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A New Climatic Periodisation of the Gold and Guinea Coasts in West Africa, 1750-1798

A Reconstruction of the Climate During the Slave Trade Era, Including an Analysis of the Climatically Facilitated Trans-Atlantic Slave Trade

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Åbo, April 2013
Stefan Norrgård

1 Introduction

On June 13th 1766, John Hippisley, the newly appointed Chief Governor of the slave trade on the Gold Coast, sat in his room on the third floor of Cape Coast Castle (Ghana) and composed a letter to his employers in London: *The Committee of Merchants Trading to Africa*.[1] Hippisley had just returned from England, and as the new Chief Governor he was now formally responsible for the day-to-day operation of all British settlements on the Gold Coast.[2] From his window, Hippisley could see the blue tropical waters of the Atlantic Ocean and the slave traders' ships that had moored at a safe distance from the hidden reefs, which lay beneath the surface. Below him, in the cellars, the slaves awaited embarkation. However, the trade was not the first thought on the governor's mind in June 1766, and little did he know that 1766 was going to be the most intense year in the slave trade. Hippisley was gazing through the window hoping to see the company's ship that he had dispatched to procure food; meanwhile, Hippisley wrote:

> There has been the greatest Dearth of Corn & consequently of all live stock that perhaps was ever known. For near these two months [May and June] I have been Witness to the most touching instances of Distress for Want of food: this Want as it always does, has brought on an epidemic Sickness. In the Castle we have escaped pretty well, but the Natives have suffered severely. Above all Your Slaves offered the most piteous examples that can be conceived Their pay in the most fruitful season is very barely a subsistence. What must it be now Gentleman when the price of Corn is raised Six times above what it is in Ordinary Years? [sic] and can with the greatest difficulty be got at all. To support the Soldiers in the Garrison I have tried the whole Coast; and, had it not been for Mr Cockburn of Tantumquerry, I realy think they must literally have been starved. He furnished me with all he could get, but their supply exhausted. We were in the Old Dilemma. I am hopefull to get Rice from Cape Appolinia, and a Fortnight ago dispatched one of Your Boats with supplies for the place & Order to let Mr Trinden to fill her with that kind of provisions. (---) in the mean time I have let the Soldiers have Flour out of the store (---) By supplying the Soldiers with what Corn I got from Tantumquerry, my Stock has suffered severely. I have sometimes had near an hundred head of Sheep & Goats besides poultry, and not a grain of Corn to give them for a fortnight together, this has reduced them so much in flesh that was it not for a French Cook whom I brought with me from Accra, and who by his art can disguise dishes, and make lean meat go down almost as well as fat (---)[3]

Hippisley was clearly surprised by the prevailing situation, and found it difficult to understand the drastic increase in the price of corn. This was not Hippisley's first time on the Gold Coast, and this was not an unusual situation in the 18th century; however, he was thoroughly amazed. A simple explanation suggests that the price of corn was raised, as the seasonal rains had not set in on time. The lack of water spelled disaster for agricultural

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1 The Royal African Company was replaced by The Committee of Merchants Trading to Africa in 1752, see for instance Albert Van Dantzig, Forts and Castles of Ghana (Accra, 1980), p. 58; or, K. G. Davies, The Royal African Company (New York, 1970) for an overview of the trading company.

2 William St Clair, *The Door of No Return. The History of Cape Coast Castle and the Atlantic Slave Trade* (New York, 2007), pp. 82, 147–148.

3 T70/31, letter dated June 14th 1766.

production. In the agricultural cycle the rains signalled the time for planting, and they supplied plants with water for the ensuing dry season.[4] However, the planting was postponed if the rains were late, which they were in 1766. As they did not have the opportunity to import food from elsewhere, the community was preparing itself for the onset of famine. Hence, as an approach to preparing for the worst, food rations became smaller, storages closed their doors, and, as a consequence, food prices incremented drastically. This is the reason for Hippisley being forced to apply for food from other forts, and this is why the French cook was a lifesaver.

However, the situation quickly changed. One month later the rains set in with great force. Hippisley described them as the "(---) most severe that were ever known in the memory of the oldest man."[5] The rains were so intense that the mud walls of the castles fell down. Sekondi fort was described as a "heap of ruins" and Cape Coast Castle was in a "most ruinous situation."[6] One disaster followed another, and it must have seemed as if the heavens were falling on Hippisley.

History repeated itself more than 200 years later in 1968. In their annual report for that year, the Ghana Meteorological Service (GMS) reported that the summer rains had destroyed several bridges and houses in the coastal district; even entire villages had been eradicated.[7]

The situation was quite the reverse more than 40 years later in 2012, when there was almost no rain between June and September, and the seasonal rains did not set in as expected in October. The lack of rain strained the farmers and the cocoa crops in the south-western areas of Ghana, north of Cape Coast. The GMS claimed that it was a bad year in terms of rainfall, and the famers who were interviewed by the news network Bloomberg were agitated.[8] The cocoa crop had been one million tons in 2010/2011, but it was expected to fall below 800,000 tons in 2012/2013. However, the cocoa industry was saved as the rains suddenly arrived in December.[9] Precisely as in 1766, the seasonal rains were only delayed.

It is unavoidable not to consider the societies' vulnerability before the forces of nature, as depicted in these excerpts. It appears as if nothing had changed between 1766 and 2012, with the lack of rains still causing agricultural distress, and the severity of the rains still reaping havoc and destruction. However, it is only the descriptions of the events that are similar, and the degree of impact cannot be compared. One should therefore be careful of becoming climatically anachronistic and applying characteristics of the 21st century climate to the 18th century. The descriptions are subjective and relative in both time and space and; furthermore, the climate is not static, it changes. The situations in 1766 and 1968 appear similar, but are the situations comparable? Were the rains really the worst 'in the memory of the oldest man' in 1766? Was the British fort at Sekondi literally in ruins? Was the destruction and havoc only caused by the severity of the rains? Was it merely the lack of rains that affected the price of corn?

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[4] Eugene M. Rasmussen, 'Global climate change and variability: effects on drought and desertification in Africa', in Michael H. Glantz (ed.), *Drought and hunger in Africa. Denying famine a future* (Cambridge, 1987), p. 8.

[5] T70/31, letter dated July 13th 1766.

[6] T70/31, letter dated July 13th 1766.

[7] See introduction of Ghana Meteorological Service, *Annual Summery of Observations in Ghana 1968*.

[8] Bloomberg, http://www.businessweek.com/news/2012-09-20/drought-in-ghana-s-cocoa-regions-curbs-farmers-outlook-for-crop (13.2.2013).

[9] Bloomberg, http://www.bloomberg.com/news/2012-12-24/ghana-cocoa-target-in-reach-as-rains-curb-dry-wind-impact.html (13.2.2013).

The primary aim of this investigation is to employ historical documents, such as John Hippisley's letters, to reconstruct the climate on the Gold Coast in West Africa between 1750 and 1798. My focus is on Cape Coast Castle, today known as Cape Coast in the Republic of Ghana. Cape Coast Castle was situated in the area widely referred to as the Gold Coast, which was part of the larger region known as the Guinea Coast. The letters are exploited to gain knowledge on the characteristics of the rainy season, its onset, intensity and duration, and also to map the demonstrated interannual and interdecadal variations. Additional sources from travellers and former servants of the slave trade are included to produce a more reliable reconstruction of the periodicity of the seasonal rains. The purpose is to determine whether or not the characteristic of the rainy season was different in comparison to its modern counterpart. A diary that was kept at Cape Coast Castle is employed to extract the monthly number of rainfall events over a period of 18 months. The compiled data are compared to those from the 20th century, with the aim of determining whether or not the monthly rainfall has changed significantly. The climatic reconstruction is facilitated by the dipole rainfall characteristics between the Guinea Coast and the Sahel region, which enables a broader climatic reconstruction of the West African climate. The investigation will also provide an insight on the plausible impact of the El Niño phenomenon on rainfall in the 18th century.

I will also analyse the reliability and validity of Royal Navy logbooks as a climatic source on the tropical waters of Cape Coast Castle, and whether or not logbooks could be employed to reconstruct the climate for the periods when there is no land based data. This includes a description of the log-board, information from which comprised core entries in the logbook. The purpose is to extract the number of monthly rainfall events and compare them to the information derived from the Cape Coast Castle diary, and to determine whether logbooks can be employed to assess the monthly rainfall pattern.

My final aim is to evaluate the impact of climatically derived events, such as famines and droughts, on the trans-Atlantic slave trade. The purpose is to determine whether or not climatic variations increased the number of slaves that embarked from Cape Coast Castle and Annamboe, which were the two main embarkation ports of the British slave trade on the Gold Coast.

The climatic reconstruction is based on a qualitative analysis on narrative descriptions found in the documents. The documents do not contain instrumental data. My analysis is based on several theoretical perspectives from a wide array of disciplinary fields. These approaches facilitate the climatic reconstruction, and are employed to diminish wrongful interpretations of climatic impact on society.

The background: a historical context

The premise of this investigation is based on the *push-effect* hypothesis. This hypothesis suggests that the trans-Atlantic slave trade was facilitated by climatic desiccation in the 18th century. Several scholars have implied the existence of a similar scenario. For instance, Joseph C. Miller suggested that desiccation facilitated the slave trade from West Central Africa; Philip D. Curtin suggested that the push-effect facilitated the slave trade from Senegambia in West Africa, and George E. Brooks suggested that climatic desiccation facilitated the slave trade from West Africa in general.[10] It is worth noting that the authors referred to different regions of Africa, and historical climates were at that time poorly charted. However, each author suggested that the climate impacted the slave trade. Hence, have they simply applied the characteristics of the modern African climate on a historical period?

The push-effect hypothesis represents a basic impact model between cause (climatic desiccation) and effect (increased slave trade).[11] Climatic variability facilitated the enslavement process as drier periods induced wars, which generated most of the slaves sold in the trans-Atlantic slave trade.[12] It is the opposite of the *pull-effect* hypothesis, which suggests that it was demand for slave labourers that generated growth of the slave trade. The difference between the push- and pull-hypotheses is that the push-effect includes the assumption of climatic impact, whereas the pull-effect perspective is mostly economic, as it is partly grounded on the fact that it was cheaper to import slaves to the Americas than to encourage a natural growth of the slave population.[13] This is why a majority of the enslaved were strong and healthy men aged between 10 and 30, and why men outnumbered women and children for most of the slave trade period.[14] The slaves were regarded as cheap labourers, a necessity to support the growth of Caribbean enterprises, mainly sugar plantations, which in turn indirectly gave rise to pre-industrial Europe. Thus, slavery was a building block of the modern world.[15] The pull and push perspectives have not been properly integrated, mainly due to the lack of annual climatic data from West Africa. However, George Brooks suggested that the European demand for slaves coincided with an increased supply of slaves, thereby implying that the slave trade system effectively fed itself.[16]

My preliminary aim was to test the hypothesis of a climatically facilitated slave trade in the 18th century. I based my approach on narratives by Willem Bosman and John Layden, who claimed to have seen people who voluntarily enslaved themselves, or sold their children, to survive famine.[17] These were humans who preferred an uncertain future as slaves rather than death by starvation. This seemed reasonable, and my aim was to provide a better understanding on the link between climatic extremes and human behaviour. I was inspired by the German historian Wolfgang Behringer's study on witch-

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[10] Joseph C. Miller, 'The Significance of Drought, Disease and Famine in the Agriculturally Marginal Zones of West-Central Africa', *Journal of African History* (vol. 23, no 1:1982), pp. 28–29; Philip D. Curtain, *Economic Change in Precolonial Africa. Senegambia in the Era of the Slave Trade* (Madison, 1975), p. 110; and, George E. Brooks, *Eurafricans in Western Africa. Commerce, Social Status, Gender, and Religious Observance from the Sixteenth to the Eighteenth century* (Athens, Ohio, 2003), p. 102.

[11] R. W. Kates, 'The interaction of climate and society', in R. W. Kates, J. H. Ausubel, and M. Berberian (eds.), *Climate Impact Assessment. Studies of the Interaction of Climate and Society* (Wiley, 1983), p. 7.

[12] Paul E. Lovejoy, *Transformation in Slavery* (Cambridge, 1995), p. 4.

[13] Curtain (1975), p. 165. Rebecca Shumway, *The Fante and the Transatlantic Slave Trade* (Rochester, 2011), p. 81; see also, Herbert S. Klein, 'The English Slave Trade to Jamaica, 1782–1808', *The Economic History Review* (vol. 31, no 1:1978).

[14] Lovejoy (1995), pp. 62−63; Johannes Postma, *The Atlantic Slave Trade* (Westport, 2003), pp. 20–46; J. R. Ward, 'The Profitability of Sugar Planting in the British West indies, 1650–1834', *The Economic History Review* (vol. 31, no 2:1978), p. 202.

[15] Patrick Manning, *Migration in World History* (New York, 2005), p. 133.

[16] George E. Brooks, 'A Provisional Historical Schema for Western Africa Based on seven Climate Periods', *Cahiers d'Etudes africaines* (vol. 26, no 1–2:1986), p. 56.

[17] Willem Bosman, *A New and Accurate Description of the Coast of Guinea, Divided into the Gold, the Slave, and the Ivory Coasts* (London, 1705), p. 391; John Layden, *A Historical & philosophical sketch of the discoveries & settlements of the Europeans in Northern and Western Africa* (Edinburgh, 1799), p. 224.

hunts in 16th century Europe. Behringer had shown that an increased number of people were accused and killed as witches during climatic aberrations.[18] This investigation has the same approach as Behringer's investigation, and it aims to understand the correlation between climate and human behaviour in 18th century West Africa. The human response to climatic aberrations is visible in the preventive measures taken to mitigate the impact of famine, or in the increase of the number of slaves who embarked from Cape Coast Castle and Annamboe. However, the climate must be reconstructed to assess its effect on the slave trade.

The availability of climatic data from the 18th century

A new excitement of investigating the climate spread amongst Europeans in the 18th century, and many tried to normalise it by conducting daily measurements.[19] However, the first British attempts were not successful as neither observational methods nor instruments were standardised.[20] This does not mean that there is a lack of instrumental data in Britain, which is the problem that has hampered climatic investigations on West Africa. Modern precipitation records for Africa barely cover a century and they are mostly located in North or South Africa.[21] Earlier temperature records, such as those provided by Thomas Winterbottom from his time in Sierra Leone in the 18th century, are rare.[22] It is therefore not possible to directly investigate long-term temperature changes via historical records. In similar situations historical climatologists usually turn to proxy data (indirect data) to fill the data gaps. Historical proxy data are attained from such records that have recorded the blossoming of flowers and trees, and grain, hay, and grape harvest dates are found in many regions of the world, although similar records for West Africa have yet to be found.[23] Other types of proxy data and dating methods, such as dendrochronology, have been widely adopted to reconstruct historical climates in Europe and North America, but it is only recently that dendrochronology has become an option in tropical West

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[18] Wolfgang Behringer, 'Climatic Change and Witch-Hunting: The Impact of the Little Ice Age on Mentalities', *Climatic Change* (vol. 43, no 1:1999).

[19] Jan Golinski, *British Weather and the Climate of Enlightenment* (Chicago, 2007), p. xii.

[20] James Rodger Fleming, *Historical Perspectives on Climate Change* (Oxford, 1998), p. 35.

[21] Sharon E. Nicholson et al, 'Spatial reconstruction of semi-quantitative precipitation fields over Africa during the nineteenth century from documentary evidence and gauge data', *Quaternary research* (vol.78, no 1:2012a), p. 13. The lack of instrumental data is a wide spread problem in the Southern Hemisphere, see P. D. Jones and R. S. Bradley, 'Climatic Variations over the last 500 years', in P. D. Jones and R. S. Bradley (eds.), *Climate Since A.D. 1500* (London 1992), p. 655.

[22] Thomas Winterbottom, *An Account of the Native Africans in the Neighbourhood up Sierra Leone* (London 1803), p. 282.

[23] See for instance, B. A. S. Davis et al., 'The temperature of Europe during the Holocene reconstructed from pollen data', *Quaternary Science Reviews* (vol. 22, no 15–17:2003); A. Tarand and P. Ø. Nordli, 'The Tallinn Temperature series reconstructed back half a millennium by use of proxy data', *Climatic Change* (vol. 48, no 1:2001); For an insight on different types of method to attain information on historical climates see for instance: Behringer Wolfgang, *A Cultural History of Climate* (Cambridge, 2010), pp. 12–13; H. H. Lamb, *Climate: Present, Past and Future vol. 2. Climatic History and the Future* (London, 1977), pp. 21–243, Colin Buckle, *Weather and Climate in Africa* (Harlow, 2004), p. 273.

Africa.[24] The dilemma is that annual growth rings are not formed in tropical trees as they are on trees in temperate and boreal zones. Tropical trees grow when and if it rains. Furthermore, the problem with similar proxy data is that they have low temporal resolution. It is, to date, not exact enough to be used in historical studies and compared to the annual number of embarked slaves, for instance.[25] The tropical environment is restrictive; however, sediments from Lake Bosumtwi and Lake Chad have proved useful in recreating the climate. This is discussed more in Chapter Two.

Consequently, the best approach to study historical climates of West Africa is through historical documents that contain subjective climatic descriptions. However, local documents are scarce. There are no written documents from the Guinea Coast before the arrival of the Europeans in the 16th century, and the oral tradition that prevailed in pre-literate societies mean that only some of their history was recorded in writing.[26] Locally produced Arabic chronicles, such as the chronicles from Timbuktu, Walat, and Tichitt, contain inland climatic information. However, chronicles are based on second-hand knowledge derived from the collective memory, and they are compiled in retrospect.[27] The information was passed by word of mouth from person to person before it was recorded many years later.[28] The chronology is therefore uncertain and, more importantly, there is the problem of causality. For instance, the author of *Tedzkiret en-Nisian* mentions starvation, but not its cause.[29] Therefore, it is unknown as to whether or not crises were caused by rainfall variations or other occurrences, such as war. The situation becomes even more problematic as there is little data for comparison, which would enhance reliability. Chronicles have, therefore, been employed with caution. Oral records *per se* have only been used in climatic investigations in East Africa, as in J. B. Webster's anthology from 1979, but J. C. McCann harshly criticised the "embarrassingly uncritical" use of oral sources 20 years later.[30]

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[24] For West Africa, see: Jochen Schöngart et al., 'Climate-growth relationships of tropical tree species in West Africa and their potential for climate reconstruction'. *Global Change Biology* (vol. 12, no 7:2006), p. 1140. Sharon E. Nicholson et al., 'A Two-Century Precipitation Dataset for The Continent of Africa', *Bulletin of American Meteorological Society* (vol. 93, no 8:2012b), p. 1226; for an example on Europe: J Guiot et al., 'Last-millennium summer-temperature variations in western Europe based on proxy data', *The Holocene* (vol. 15, no 4:2005); for North-America; Rosanne D'Arrigo et al, 'Regional climatic and North Atlantic Oscillation signatures in West Virginia red cedar over the past millennium', *Global and Planetary Change* (vol. 84, March: 2012).

[25] David Herlihy, 'Climate and Documentary Sources: A comment', *Journal of Interdisciplinary History* (vol. 10, no 4:1980), p. 713.

[26] John D. Fage, 'Some Thoughts on Migration and Urban Settlement', in Hilda Kuper (ed.), *Urbanization and Migration in West Africa* (London, 1965), p. 40.

[27] Holger Weiss, 'Västafrikanska krönikor som källor för historisk ekologisk-klimatologisk forskning om 1700-talets samhällskris. Möjligheter och begränsningar', *Historisk Tidskrift för Finland* (nr 1:2008), pp. 46-50; Nicholson et al. (2012b), p. 1223.

[28] Jan Vansina, *Oral Tradition as History* (New York, 1997), p. 29; Weiss (2008), p. 45.

[29] Weiss (2008), p. 49

[30] J. B. Webster (ed.), *Chronology, Migration and Drought in Interlacustrine Africa* (Dalhousie University Press 1979); James C. McCann, 'Causation and Climate in African History', *The International Journal of African Historical studies* (vol. 32, no 2–3:1999a), p. 264. McCann criticised the anthology for invoking "(…) embarrassingly uncritical use of oral sources to reconstruct East African climate and demographic history in a way that was at best overoptimistic and at worse grossly incompetent". McCann also criticised Herrings article in same volume for making hasty assumptions about the link between rainfall and agricultural production. However, could not find the quotation that McCann refers to. See for instance R. S. Herring, 'The view from Mount Otuke: Migrations of the Longo Omiro', in J. B. Webster (ed.), *Chronology, Migration and Drought in Interlacustrine Africa* (Dalhousie University Press, 1979).

The best source of information is therefore narrative descriptions of European origin, such as letters, reports, journals, diaries, and personal memoirs written by travellers, traders, missionaries and settlers.[31] These individuals seldom registered the weather on a daily or even monthly basis. They preferred to write general descriptions of the climate and the content varies in length and form. Some sources describe the seasonality of the rains, while others describe distressing situations such as droughts and famines. Historical documents often contain notes on climatic aberrations, meteorological extremes, and damaging weather, and West Africa is no exemption.[32] Early coastal maps have also been employed to locate changes in the environmental landscapes throughout the centuries.[33]

The growing fascination with the climate in the 18th century, as noted above, is also apparent in the sources employed in this investigation. The climate was approached more scientifically than in previous centuries, and this is also visible in remarks made by travellers and former slave traders.[34] Exotic descriptions that impacted on early European encounters with the new world, and its exotic climate, are not apparent in the sources employed in this investigation.[35] The letters are, nonetheless, different than narrative descriptions found in books that describe the Gold Coast, and even these sources have their restraints. Few sources overlap each other and most describe only the coastal climate where Europeans resided, not the inland where a majority of the Africans resided. A similar dilemma was noted by Joseph C. Miller when he employed Portuguese records on the climate in West-Central Africa.[36]

Records from voyages such as those made by Mungo Park, the first to explore the Niger River, are scarce, which is why there are almost no European sources from inland areas such as the Sahel.[37] In other parts of Africa the inland climate has been reconstructed based on missionary papers, but similar records have not yet been located in the inlands of West Africa.[38] However, the coastal sources share one dilemma with the chronicles: the cause of the claimed distress is not always mentioned. Nevertheless, the archives still contain historical documents that have not been assessed. The purpose of this investigation is, therefore, to employ previously unexplored sources, which are presented below, to reconstruct the climate. Conclusively, I emphasise that this investigation does not include any historical documents produced by the townspeople, free local populations, or slaves, who naturally felt the impact of the climate as much as the

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31 Nicholson et al.(2012b), pp. 1219–1231; Sharon E. Nicholson, 'The Methodology of Historical Climate Reconstructions and its application to Africa', *Journal of African History* (vol. 20, no 1:1979), p. 35.

32 See for instance, Helmut E. Landsberg, 'Past Climates from Unexploited Written Sources', *Journal of Interdisciplinary History* (vol. 10, no 4:1980), p. 52.

33 James L. A. Webb Jr., *Desert Frontier. Ecological and Economic Change along the Western Sahel* (London, 1995), pp. 11–13.

34 Roy Bridges, 'Exploration and travel outside Europe (1720–1914)', *The Cambridge Companion to Travel Writing* (Cambridge, 2005), pp. 56–57

35 See for instance, Stephen Greenblatt, *Marvelous Possessions: The Wonder of the New World* (Oxford, 2003).

36 Miller, pp. 17–19.

37 Mungo Park, *Travels in the Interior Districts of Africa* (London, 1816).

38 C. Vogel, 'A documentary-derived climatic chronology for South Africa, 1820–1900', *Climatic Change* (vol. 14, no 3:1989); David J. Nash and Georgina H. Endfield, 'A 19th century climate chronology for The Kalahari region of Central Southern Africa derived from Missionary Correspondence', *International Journal of Climatology* (vol. 22, no 7: 2002); David J. Nash and Stefan W. Grab, '"A sky of brass burning winds": documentary evidence of rainfall variability in the Kingdom of Lesotho, Southern Africa, 1824–1900', *Climatic Change* (vol. 101, no 3–4:2010).

Europeans. These historical actors, although often mentioned and addressed have no voice of their own in this investigation.

1.1 Sources and resources

My main source of information is the Chief Governor at Cape Coast Castle and his letters to *The Committee of Merchants Trading to Africa*. The letters are found in catalogues T70 (subcategory 29–33) at The National Archives (TNA) in Kew, London. The letters are transcriptions of original letters, although there is no reason to suspect that any issues have been omitted. The letters were entered into the booklet according to their date of arrival, which is why they are not in chronological order. However, when a letter was written, received and answered is duly noted. The letters' and their pages are unnumbered, which is why they are referred to by the date on which they were written. Some letters are noted as received from 'The Council' or signed by several governors. This makes these letters less personal, which affects the climatic descriptions, but it should not affect reliability. Many letters were written over a period of several days. This is not mentioned in the letters, but is ascertained by the climatic reflections.

The purpose of the letters was to inform the committee on the situation at the Gold Coast in West Africa. The governor of Cape Coast Castle was also the Chief Governor of the British settlements on the Gold Coast. This is why the letters also contain general descriptions of the situation at other British forts. Occasionally, the letters also contain information on the situation in rival forts and castles, in particularly on the Dutch at Elmina, which was the nearest European settlement.

The letters touch upon many and various types of subject. They discuss the general intensity of the slave trade, the personal conduct of previous governors, the price of slaves, the political situation inland, troubles with natives, the health of the company's personnel, the wants and needs of the castle and its inhabitants, the conditions of the castles, and other matters that was considered to be of interest to the investors. Occasionally, the governor also mentions the seasonal weather, especially if it was abnormal or caused havoc on the coast, but such information is scarce and sporadic. The analysis comprises approximately 200 letters; however, a letter that is 20 pages long might include only half a sentence of climatic information.

Daily weather descriptions are obtained from *The Diary of Transactions at Cape Coast Castle,* which was kept between July 10th 1777 and December 31st 1778. The governor at that time was Richard Miles, and it is possible that this was his diary, although it does not reveal the diarist. The purpose of the diary is also a mystery. While it was termed *The Diary of Transactions*, it contains no information regarding transactions of any type. The entries are often short and only weather descriptions were written on a daily basis. The weather is described in the same manner as in Royal Navy logbooks. Thus, the maritime terminology was familiar to the author.

Royal Navy logbooks

The logbooks examined in this investigation are those of the Royal Navy from 1750 to 1793, which are located at The National Archives in Kew, London. I utilise the captains' logbooks that are found according to ships' names in catalogues ADM51.[39] The logbooks found in these catalogues are most often captains' logbooks; however, in some cases a bundle can also contain lieutenants' logbooks.[40] A lieutenant occasionally acted as captain of a smaller ship, and such cases are found in this investigation. In such cases the lieutenant duly noted that he was the 'acting captain'.[41]

The logbooks are booklets and not actual books with hard covers. They were most often also termed 'journals' in the 18th century.[42] Recorded on the first page of each logbook is the name of the ship, the dates covered, and the name and rank of the person who was responsible for the logbook. The name of the officer was not always entered, and in some cases the name is difficult to interpret due to bad handwriting. However, the name is not of importance as I decided not to assess the background of each officer. The name of the captain is sometimes included in this investigation, but this is merely to improve the narrative.

All officers kept their personal logbooks, but I will constrain my investigation to those of the ships' captain. The captains were the most consistent in keeping their records, as it was only they who had had specific instructions on how to keep logbooks. This is explained in *Regulations and Instructions* from 1734. The captain was supposed to keep his journal from the day he stepped on board and he was to "(---) note therein all Occurrences, *viz.* Place where the Ship is at Noon; Changes of Wind and Weather (---).[43] The *Regulations and Instructions* pamphlet was updated several times in the 18th century, although these instructions did not change.[44] A captain kept his logbook from the commencement of the commission until completion. He then submitted his logbook to the Admiralty in order to draw his pay.

The purpose of the logbooks was to keep a record of the ships voyage. It was a method of 'mapping' the seas and voyages. Logbooks were not kept for climatological purposes although it is noted that changes in the weather should be recorded by the captains. However, theory and practice was not the same, as will be shown. Weather and wind terminology was not formally standardised and wind force had no numerical reference points in the 18th century. Francis Beaufort merely formalised the descriptions employed by officers more than a century when he standardised wind force descriptions in 1806.[45]

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[39] I will henceforth use the term *vessel* and *ship* interchangeably although the term *ship* was in restricted usage in The Age of Sail as it also identifies a certain type of ship. See for instance, Rif Winfield, *British Warships in the Age of Sail* (Barnsley, 2008), pp. xiv–xv.

[40] Most of the lieutenants' logbooks are found at Greenwich Maritime Museum.

[41] TNA, ADM51/333, *Fairy* 1790, title page. The handwriting is hard to interpret and his name is uncertain, even his rank, but it is considered to be a flamboyantly written "L". Regardless of this otherwise hard to interpret handwriting it is evident that he wrote "act. Capt". This is discussed more elaborately in Clive Wilkinson, *British Logbooks in UK Archives. A survey of the range, selection and suitability of British Logbooks for climatic research* (Draft Report, 2006), pp. 12–13.

[42] W. H. Smyth, *The Sailors Word-Book: an Alphabetical Digest of Nautical Terms* (London, 1867), p. 414.

[43] Royal Navy, *Regulations and Instructions Relating to His Majesty's Service at Sea 7th edition* (London, 1747), p. 32.

[44] There were no changes made during the investigated period and the practice remained the same in the 10th, 11th, 12th and 13th edition of the same book, see Royal Navy, *Regulations and Instructions Relating to His Majesty's Service at Sea 10th edition* (London, 1766), p. 32; *Regulations and Instructions Relating to His Majesty's Service at Sea 11th edition* (London, 1772), p. 32; Royal Navy, *Regulations and Instructions Relating to His Majesty's Service at Sea 12th edition* (London 1787), p. 32; Royal Navy, *Regulations and Instructions Relating to His Majesty's Service at Sea 11th edition* (London, 1790), p. 32.

[45] F. Singleton, 'The Beaufort scale of winds – its relevance, and its use by sailors', *Weather* (vol. 63, no 2:2008), p. 37.

Logbook content

Royal Navy logbooks have been approached as *historical documents*, but not properly analysed as *historical sources*. The 'status' of a source is of great importance when assessing its reliability. It is generally considered that a *primary* source is more reliable than a *secondary* source as these are based on second-hand knowledge.[46]

A logbook was an intelligible copy of the log-board, which was the "only authentic record of a ships transactions"[47] The log-board was a painted black board on which daily events were recorded in chalk by the hour. It was divided according to the nautical day and was kept from noon to noon. All details concerning speed (measured by a log-line, with knots at specific distances, trailing astern the vessel), wind direction and other occurrences were recorded on the log-board.[48] Officers transcribed these entries to the logbook at noon, after which the log-board was wiped clean in preparation for the next day. Hence, there is no log-board entry to analyse. More importantly, the logbook is merely a summary of everything that was entered on the log-board. The logbook was kept to make information from the log-board more "intelligible".[49] Therefore, the logbook is technically a secondary source of information, as the officer that kept the logbook (most likely) did not make the observations on the weather. This is discussed more elaborately in Chapter Four.

In general, the logbooks are neatly kept and the language is modern, which is why they are easily read and understood. Many officers employed abbreviations for their weather observations: "Moderate" (a wind force term) was often shortened to "mod", "weather" was shortened to "W", and "ditto" (indicating the same weather as the day before) was shortened to "Do". Some officers also employed their own abbreviations instead of the informally standardised versions; however, they are generally all understandable. The abbreviations probably made it easier and faster to transcribe from log-board to logbook.

The disposition of the logbook was based on the log-board, which is why all logbooks have the same arrangement of columns (see Figure 1). Columns on the left hand page (from left to right) are to record: day; date; wind direction; course; distance; latitude; longitude and finally bearings at noon. The columns are divided into rows for each day, which extends across both left and right hand pages of the logbook. The year and month was in most cases indicated in the column reserved for the day, but this was only entered when necessary. The right hand page was reserved for general remarks including weather descriptions.

There was no standardised format for recording entries, which is why the entries on the right hand page vary from ship to ship, officer to officer, and day to day. However, many entries were made according to the officers' watch, which was divided into three parts: the first part (12.00–20.00hrs); the second or middle part (20.00–04.00hrs); the third or latter part (04.00–12.00hrs). The weather was almost always the first recorded entry on the right hand page, and the descriptions were divided according to the officers' watch. This was followed by other noteworthy remarks of occurrences from the previous day.

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[46] Torsten Thurén, *Orientering i källkritik. Är det verkligen sant?* (Stockholm, 1992), p. 35.
[47] John Robertson, *The Elements of Navigation* (London, 1764), p. 674.
[48] Robertson, p. 674.
[49] James Atkinson, *Epitome of the Art of Navigation* (London, 1744), p. ix

Day January 1772	Date	Wind	Course	Latitude	Longitud e	Bearing and distance at noon		Remarks & Occurrences
Thursd ay	12	SWS				Moored at Cape Coast Castle		First part fresh gales and cloudy, middle part do, latter part light airs and Clear. People employed with…
Friday	13	NW				Do		Do

Figure 1 *A typical layout of an 18th century logbook from a ship that was moored at Cape Coast Castle. The left hand page is practically empty as the ship was stationary. General remarks are in a column on the right hand page.*

Occasionally additional information concerning the weather was included after general remarks on the day.

There are three temporal aspects that need to be addressed when examining 18th century logbooks. First, the logbook was kept according to the nautical day, which lasted from noon to noon. Therefore, the nautical day was 12 hours ahead of the civil day.[50] Secondly, the British Empire employed the Julian calendar until September 2nd 1752. This was followed by the introduction of the Gregorian calendar, which meant that 11 days were 'lost'. Wednesday September the 2nd was thereby followed by Thursday the 14th.[51] Last but not least, New Years Day was previously celebrated on the 25th of March, also known as 'Lady Day'. This is the reason that some logbooks are double dated regarding the year between January and March. For instance, the *Surprize* arrived at Cape Coast Castle on January 17th with the year being noted as "January 1749/50".[52] When adjusting the date to the Gregorian calendar, the ship is placed at Cape Coast Castle on January 28th in 1750. However, not all captains double dated; for instance, the captain of the *Humber* noted that the ship arrived at Cape Coast Castle in January 1749. It is only by referring to the captain's logbook from the *Surprize*, who noted the arrival of the *Humber*, that it can be determined that the *Humber* arrived at Cape Coast Castle in 1750, and not in 1749.[53] The adjusted dates are given in the analysis, but the footnotes refer to the dates given in the logbooks. The qualitative analysis is based on 91 logbooks.

Additional sources

This investigation employs several 18th century sources, comprising dictionaries, narratives and schoolbooks written by various authors. The books are employed to identify terms and gain a better understanding on the historical context. The general character of the climate and especially the rainy season is described in, for instance, the memoirs and descriptive narratives of Johan Adams, T. S. Ashton, Henry Meredith, and Ferdinand Rømer. Some had spent years on the Gold Coast as governors or clerks, others only visited the area. These authors' remarks are compared to the governor's letters to

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50 See for instance Henry Harries, 'Nautical Time', *Mariner's Mirror* (14:1928).

51 Her Majesty's Stationary Office, *Explanatory supplement to the astronomical ephemeris and the American Ephemeris and nautical almanac* (London, 1961), p. 417, see table 14.1.

52 TNA, ADM51/948, the *Surprize*.

53 TNA, ADM51/464, the *Humber*.

depict the climate as accurately as possible. However, these documents do not contain daily, monthly or instrumental data, and merely describe the general appearance of the climate, such as the seasonal rains and the Harmattan wind. The primary aim was to describe the exotic culture and the humans they encountered, their own observations and adventures, not the climate.

The sources are, unfortunately, spatiotemporally interspersed. For instance, Ferdinand Rømer describes the Gold Coast in the 1750s, John Adams in the 1780s and T. S. Ashton's letters describe Senegal in the 1760s. Nevertheless, together with the governors' letters, they create a climatic puzzle that needs to be solved.

The chapter that addresses the log-board contain several non-climatic sources. However, they are important in gaining insight on the relation between the log-board and logbook. William Falconer's *Universal Dictionary of the Marine* from 1769 has been an important aid to understanding the terms that were employed in the 18th century. The book was revised and published again in 1771, 1776 and 1784, which enables the tracking of semantic changes.

The log-board analysis is conducted by scrutinising the 18th century literature on navigation. J. Bettesworth's *The Seaman's Sure Guide, or, Navigator's Pocket Remembrancer* was important for the analysis. It is considered to depict a realistic version of the log-board, and how it was transcribed to the logbook. However, I also employed sources such as Thomas Haselden's *The Seaman's Daily Assistant* (published in 1781) and John Robertson's *The Element of Navigation* (published in 1764). These sources were chosen in order to include some of the most influential publications from this period. For instance, Robertson was the master of The Royal Naval Academy at Portsmouth. However, it is worth noting that he was a mathematician, not a mariner.[54] He was not an experienced sailor, he only new the principals of navigation. This is why I also take advantage of William Spaven's *The Seaman's Narrative* (1796). While this is actually a narrative biography of Spaven's life as a sailor, his descriptions provide a good insight on log-board entries. This is not explicitly included in other books on the subject, as their primary focus was to show how to transcribe navigational information. I have not found any books written by 18th century Royal Navy captains. Hence, I make full use of the Admiral W. H. Smyth's the *Sailors Word-Book,* although it was published posthumously in 1867. Smyth entered the Royal Navy early in the 19th century, and he made several charts, among others, of the African coast in the 1820s. He was also one of the founders of the Royal Geographical Society.[55] This popular dictionary is found in bookshops even today. I frequently refer to it although it was written in the 19th century.

Research literature

Historical climatology has made great strides over recent decades; however, most research has focused on Europe. There are only a few articles that address the problems created by the sources employed in investigating the West African climate. There are therefore many authors and works that have inspired me, and they have provided a frame of reference, but their input is not apparent in the thesis. Their approaches and results cannot be exploited as their investigations deal with other type of source related

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[54] Sydney Lee (ed.), *Dictionary of National Biography Vol. XLVIII* (London, 1896), p. 413.
[55] Sydney Lee (ed.), *Dictionary of National Biography Vol. LIII* (London, 1898), p. 192.

dilemmas in other areas, and various eras. However, this thesis would not have been written without their contributions.

The interdisciplinary approach of this investigation makes it impossible to highlight a particular field, discipline or author. A rather typical dilemma of the interdisciplinary investigation, as it addresses many academic fields and perspectives, but never provide an in depth perspective of one particular field of research. My methodological approach has been influenced by the works of Rudolf Brázdil, Rüdiger Glaser, Robert Kates, Hubert Lamb, Christian Pfister, Jan de Vries and Dennis Wheeler, albeit none of these have worked with the 18th century West African climate in particular.[56] It is perhaps not surprising that most of these are not historians, but natural scientists, who to some extent, and perhaps influenced and inspired by the ongoing climate change, have given climate a place in history. Nevertheless, I have also relied on the works by Philip D. Curtin, Sharon Nicholson and Holger Weiss, who are some of the few that have worked with historical documents in the West African environment.[57] Nicholson's has worked with the West African climate since the 1970s, and her most recent articles (published in 2012) address the West African climate in the 19th century, whereas P. D. Curtin has been an important influence in understanding the problem with malaria in the 18th century. Nevertheless, I have also been influenced by researchers such as George E. Brooks, James Webb, and James C. McCann, who have addressed West Africa from a different perspective, i.e. the interaction between nature and man, especially highlighting human behaviour in times of climatic change.[58]

A subcategory of historical climatology is that of climatic impact on societies. Many of the above mentioned authors have also been active contributors to this category, but it is here necessary to also include the works, to name only a few, by Cesar Caviedes, Wolfgang Behringer, Michael H. Glantz and Richard Grove.[59]

The history of West Africa, the slave trade and development of the investigated region is derived from the works of prominent researchers such as Ray Kea, Paul E. Lovejoy, William St Clair, J. K. Fynn, Rebecca Shumway and others.[60] Some of these investigations have employed the Chief Governors' letters to portray the regions history. Rather than conducting further analysis of the letters, I rely on their interpretation of historical events. When evaluating the climatic impact on the slave trade I compare the newly created climatic periodisation with the *Trans-Atlantic Slave Trade Database* (TSTD).

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[56] Rudolf Brázdil, 'Historical Climatology in Europe – State of the Art', *Climatic Change* (vol. 70, no 3:2005); Rüdiger Glaser, et al., 'The variability of European floods, since AD 1500', *Climatic Change* (vol. 101, no 1–2:2010); Kates (1983); H. H. Lamb, *Climate History and the Modern World* (Methuen, London, 1982); Christian Pfister, 'The vulnerability of past societies to climatic variation: a new focus for historical climatology in the twenty-first century', *Climatic Change* (vol. 100, no 1:2010); Jan de Vries, 'Measuring the Impact of Climate on History: The Search for Appropriate Methodologies', in Robert I. Rotberg and Theodore K. Rabb (eds.), *Climate and History. Studies in Interdisciplinary History* (Princeton, 1981); and Dennis Wheeler, 'The Weather of the European Atlantic Seaboard During October 1805: An Exercise in Historical Climatology', *Climatic Change* (vol. 48, no 2–3:2001).

[57] Curtin (1975); Nicholson (1979, 2012a); Weiss (2008).

[58] Brooks (1986); Webb (1995); James McCann, *Green Land, Brown Land, Black Land. An Environmental History of Africa, 1800–1990* (Portsmouth, 1999b).

[59] César N. Caviedes, *El Niño in History. Storming Through the Ages* (Gainesville. 2001); Behringer (2010); Michael H. Glantz, *Climate Affairs. A Primer* (Washington, 2003); Richard H. Grove and Chappell, John (eds.), *El Niño. History and Crisis* (Cambridge, 2000).

[60] Ray A. Kea, *Settlements, Trade and Polities in the Seventeenth-Century Gold Coast* (Baltimore, 1982); Paul E. Lovejoy (1995); St Clair (2007); J. K. Fynn, *Asante and Its Neighbours* (London, 1971), Shumway (2011).

The purpose of this comparison is to assess the climatic impact on the estimation of the number of embarked slaves from Cape Coast Castle and Annamboe. The database is vital to assessing the premise of a climatically facilitated slave trade. The database was originally published as a CD-Rom by David Eltis et al. However, the online database is more up to date, which is why this is preferred.[61]

1.2 Spatial and temporal demarcations

Cape Coast Castle stands majestically on a rock on Ghana's shoreline. The region was known as the Gold Coast until Ghana gained its independence in 1957. It had by then been a British colony for more than 70 years. However, the Gold Coast had originally earned its name from the gold that the Portuguese exported from the area after their arrival in the 15th century. The Gold Coast comprises an area from Cape Three Points to the Volta River estuary, surrounded by the Grain Coast on the left, and the Slave Coast, on the right. This investigation's latitudinal boundaries are confined to the area that lays between Fort Dixcove in the west and Annamboe in the east. Accra, the capital of Ghana, is not included as it is seldom mentioned in the letters.

The white walls of Cape Coast Castle today bear only slight resemblance to its appearance in the 18th century. At that time some of the walls were constructed of mud and, as will be shown, had a tendency to collapse during intense rain. The castle, or at least parts of it, was therefore constantly rebuilt, extended and strengthened.

In the 18th century, the Atlantic surf was a continual reminder that the sea was the gateway to the rest of the known world. The castle was built on a rock, although surrounded by sandy beaches. Behind and below the castle lay the town, with several thousand inhabitants, and beyond that stretched the less well-known world of West Africa. The townspeople were not engaged in agricultural activities, although the growth of these early urban economies was linked to crop production in the countryside. It was agricultural surplus that enabled the townspeople to engage themselves with other activities such as crafts, trading and personal services, and many European forts were built besides these types of African settlements.[62] The castle is depicted in Figure 2.

Elmina Castle, the headquarters of the Dutch slave trade, was the nearest European settlement to Cape Coast Castle. Almost 13 kilometres to the east of Cape Coast Castle lay Annamboe Fort, which was built in the 1750s. Annamboe quickly became the most important point of embarkation on the Gold Coast, with more slaves embarking from Annamboe than from Coast Castle or Elmina Castle. Nevertheless, Cape Coast Castle remained the headquarters of the British slave trade throughout the slave trade era.

[61] The Trans-Atlantic Slave Trade Database: http://www.slavevoyages.org. The CD-Rom; David Eltis, Stephen D. Behrendt, David Richardson and Herbert S. Klein (eds.), *The Trans-Atlantic Slave Trade. A Database on CD-ROM* (Cambridge, 1999).

[62] Kea (1982), p. 43. Henry Meredith, *An Account of the Gold Coast of Africa* (London, 1812), p. 9 Meredith described the town in 1812, and noted that it had approximately 8,000 inhabitants.

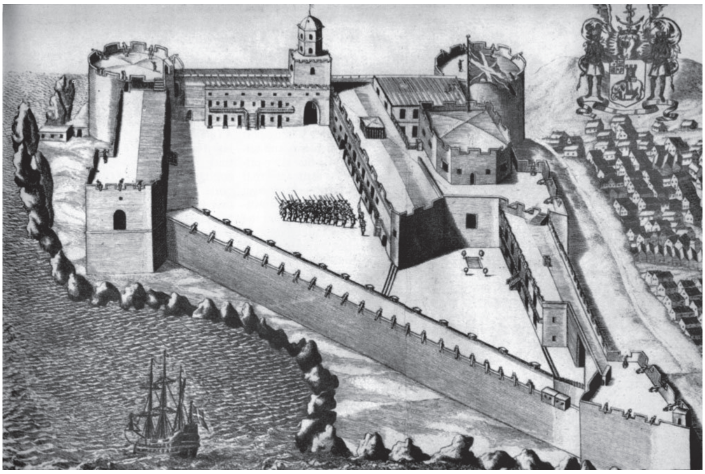

Figure 2 *Cape Coast Castle in 1682, an engraving by Henry Greenhill. Source: P. E. H. Hair et al.*[63]

It is worth noting that Cape Coast Castle had no man-made harbour. Ships that moored at Cape Coast Castle anchored off-shore, 'on the road'. The shore was too shallow to enable large ships to anchor closer to land, as there was always the fear of becoming stuck in the sand or crashing against hidden reefs.[64] The distance between the ships and the castle is not always mentioned in the Royal Navy logbooks employed in this investigation, but it is sometimes estimated at two or three nautical miles. The distance to other ships is unfortunately not mentioned in the logbooks.

The northern longitudinal boundaries cannot be precisely defined. The governors' occasionally mention the 'inland' or 'up-country', but the meaning of these concepts, and their geographical extent, are not explained. The employment of these terms suggests that they simply imply 'everything' in the hinterland of Cape Coat Castle. The 'inlands' most likely include Kumasi (roughly 200 km to the north), which was the capital of the Asante kingdom.[65] The area would thereby include the wettest south-western areas of Ghana, northwest of Cape Coast Castle. This is today an agriculturally important region, as it probably was also in the 18th century. Conclusively, the investigation includes a larger region than that which is clearly mentioned in the sources; however, it cannot be defined explicitly.

Spatiotemporal demarcation

The investigation commences in 1750. This was considered a fitting year to start the investigation as it marks the beginning of the so-called "Great Alliance" on the Gold Coast, which was an alliance between several coastal peoples such as the Fante, Abtrem, Fety, Wasa, and Denkyera.[66] The purpose of the alliance was to keep the Asante away

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[63] P.E.H. Hair, Adam Jones and Robin Law (eds.), *Barbot on Guinea: The writings of Jean Barbot on West Africa 1678–172 volume II* (London, 1992), p. 393.

[64] Meredith, p. 94; St Clair, pp. 13–14.

[65] T. C. McCaskie, *State and society in pre-colonial Asante* (Cambridge, 1995), p. 76,

[66] James Sanders, 'The Expansion of the Fante and the Emergence of Asante in the Eighteenth Century', *Journal of African History* (vol. 20, no 3:1979), p. 357.

from the coast, to where the kingdom had spread during the political instability of the 1740s. The Fante withdrew from the Alliance in the mid-1750s, and although the Asante Kingdom grew in the hinterland of the Guinea Coast, the coastal area experienced no large-scale wars during the investigated period.[67] This political development facilitates the assessment of the climatic impact on the slave trade as the impact of political instability lessened. The slave trade grew almost exponentially during the latter half of the 18th century, but it fell drastically at the beginning of the 19th century.[68] This was due to the oncoming abolishment of the British slave trade in 1807 and the fact that the Dutch trade had almost died out by the end of the 18th century.[69] The Asante armies also penetrated the coastal areas at the beginning of the 19th century, which saw British interest shifting from the slave trade to military aggression against the Asante.[70] However, the investigated period is mostly devoid of large-scale wars or political disputes on the coast.

There were many British forts along the Gold Coast, but Annamboe and Cape Coast Castle had the best coverage in the TSTD, which is why only these forts are included in the analysis.[71] Annamboe is included, as noted earlier, as it was the most important embarkation port in the British slave trade. The Senegambia was also an important area in the British slave trade, but the coastal areas of western West Africa is dominated by a different climate and rainfall pattern, which is why this area was excluded from this part of the investigation.

It is not only the political development on the Gold Coast that determined the selected timeframe. The climatic perspective rendered it necessary to stretch the investigated period to more than half a century. This is the only approach to identify climatic variability and include both 'the normal' climate and climatic aberrations. Climatic reconstructions need to be conducted over longer periods of time to distinguish normal periods from abnormal climate periods. This is explained in the following subchapter, in which the meaning of 'climate' is defined. Conclusively, neither the climatic reconstruction nor the climatic impact on the slave trade would have been meaningful if the investigated period had been shorter.

Finally, the first Royal Navy logbooks that are included in this investigation are from the 1750s, and the first letter with climatic information is from 1752. The Royal Navy reduced its presence on the Gold Coast towards the end of the 18th century, and the last registered logbook is from 1793. The last letter with climatic information is from 1798.

Defining climate and weather

'Weather' refers to the condition of the atmosphere at any particular time and location. Weather comprises air temperature, air pressure, humidity, clouds, precipitation, visibility and wind. The weather is in perpetual motion. It is always changing, from day

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[67] Shumway, p. 9

[68] See for instance, Richardson, David, 'Slave Exports from West and West-Central Africa, 1700–1810: New Estimates of Volume and Distribution' *Journal of African History* (vol. 30, no1:1989).

[69] Larry W. Yarak, *Asante and the Dutch 1744–1873* (Oxford, 2010), p. 101.

[70] Shumway, p. 11.

[71] Trans-Atlantic Slave Trade Database (TSTD):
http://slavevoyages.org/tast/database/search.faces?yearFrom=1750&yearTo=1798&natinimp=7&mjbyptimp=60404.60405.60408.60409.60410.60411.60412.60413.60415.60416.60417.60425.60427 (7.2.2013).
http://slavevoyages.org/tast/database/search.faces?yearFrom=1750&yearTo=1798&natinimp=7&mjbyptimp=60404.60405.60408.60409.60410.60411.60412.60413.60415.60416.60417.60425.60427

to day and hour to hour. The changes can be subtle and slow, but also rapid and violent. The frequency of change also varies according to season and latitude. 'Climate' is the accumulation of daily and seasonal weather over a longer period of time. Climate is often explained as 'average weather' and is, therefore, a statistical construct. It is the statistical average of all the elements that defines weather. The period over which the statistical average is created should, therefore, be long enough to include all variations, extremes and mean values of a studied region.[72] This is the best approach for distinguishing patterns and anomalies. It is worth noting that both weather and climate are dynamic, they are in constant change. Weather changes by the hour while climate changes from season to season, year to year and decade to decade, and also from millennia to millennia.

The climate can be divided according to its spatial coverage, and reduced to many different parts. The local climate, sometimes referred to as a microclimate, is the smallest unit. This defines the characteristics of a particular region or parts of it, such as woodlands or valleys. For instance, Cape Coast Castle has its own microclimate. The opposite of a microclimate is the macroclimate, which is principally the average created by several microclimates, for example parts of Ghana's coastline. Some local climate phenomena, such as sea breezes that are mentioned in the sources, are considered mesometeorology, which studies atmospheric processes and weather phenomena at the mesocscale (covering areas between 15 and 150km).[73]

There is no such thing as a 'normal' climate, but historical documents often highlight 'abnormal' climatic events. Historical documents have a tendency to record disasters, crises and extremes, but not 'normal' and daily weather. For instance, in the introduction it was noted that John Hippisley claimed the rains were the worst 'in the memory of the oldest man'. This suggests that the rains in 1766 were abnormally intense. However, Hippisley made no effort to describe the 'normal' rainy season or climate. The problem is therefore how to define all that has been omitted from the documents, for instance, an individual's subjective concept of the 'normal' weather/climate. This approach suggests that the 'normal' climate is a subconscious construction based on experience, regardless of space and time. In this sense 'normal' conditions refer to i) the type of weather that prevails most of the time, or ii) modal climate conditions, the type of climate that prevails most frequently.[74] It was based on these premises that the governors subconsciously created an average to which is referred when mentioning the anomalies. Anomalies are not included in this subconscious construct, even though they are a part of the scientific construct on climate.[75]

Generally speaking, it is the understanding of the 'normal' climate that generates expectations and hope, but weather often produces disappointment and anger. In other words, both concepts generate emotions, which then are recorded. In this manner, weather descriptions are subjective and relative. Climate is what we expect, whereas weather is what we get. This was an important aspect to remember when analysing the documents in this investigation. The climatic expectation of individual observers was based on the accumulated experience of their time in West African.

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[72] C. Donald Ahrens, *Meteorology Today. An Introduction to Weather, Climate and the Environment, 9th edition.* (Belmont, 2009), p. 18. Buckle, pp. 3, 262.
[73] Buckle, pp. 3, 272.
[74] Glantz (2003), p. 16.
[75] Joseph Tribbia, 'What Constitutes "normal"?' in Michael H. Glantz (ed.), *La Niña and Its Impacts. Facts and Speculations* (Tokyo, 2002), pp. 41–42.

Finally, this investigation aims to distinguish wetter periods from drier periods, which is why precipitation is a key word. However, the term *rainfall event* is preferred as all precipitation comes in the form of rain. I prefer to call it a rainfall event as it does not describe the intensity or distinguish between thunderstorms, convective rains or seasonal rains, but merely portrays the event *per se*.

1.3 Theory and method

This investigation can be ascribed to the interdisciplinary field of *historical climatology*, often described as a marriage between history and climatology. This discipline is mostly concerned with how climate is portrayed in historical documents, whether they contain instrumental data or descriptive information. Historical climatology has three main fields of interests, that are to: i) investigate and reconstruct previous climates, ii) study the impact and effect of historical weather and climate change on previous societies and, iii) explore discourses and the social representation of the climate.[76] Historical climatology, as an interdisciplinary field, is contemporary and acts with, and responds to, the needs and demands of society. It oscillates between the traditional disciplines as it "(…) aims at understanding the climate exactly as it is, its origins and its future, in all its complexity and vagueness."[77]

It is necessary to combine a mixture of methods and theories to properly reconstruct historical climates. This creates a disciplinary marriage in the form of tools that better fit the aims of the project. This approach enables the interdisciplinary researcher to transcend traditional disciplinary borders and reduce the possibility of misconceptions. Theories are selected from different academic fields, such as climatology and history, and include methods such as dendrochronology, palynology and source criticism.[78] The methods employed are determined by the exploited documents (journals, diaries, logbooks, personal letters, and reports), the phenomenon that is depicted in the documents (e.g. floods, droughts, rain, and storms) and the climate/area under investigation (e.g. temperate, tropical, arctic, semi-desert).[79]

Historical climatology can be considered the opposite of integrated assessment (IA), which examines the impact of future climatic changes with various models. IA is an approach that is based on the idea that causes, effects and responses to environmental change should be approached and represented by all academic perspectives: "IA's objective is to bring all disciplinary perspectives (referred to as a unifying approach) to bear on complex environmental issues."[80] IA models aim to consider all plausible solutions and fit them into one model, which aims to identify the complex relations

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[76] Brázdil et al. (2005), p. 366.
[77] Wolfgang Krohn, 'Interdisciplinary cases and disciplinary knowledge', in Robert Frodeman (ed.), *The Oxford Handbook on Interdisciplinarity* (Oxford, 2010), p. 32.
[78] Emmanuel Le Roy Ladurie, *Times of Feast, Times of Famine. A history of the climate since the year 1000* (New York, 1971)), pp. 20–21.
[79] M. J. Ingram, D. J. Underhill and G. Farmer, 'The use of documentary sources for the study of past climates', *in* T. M. L. Wigley, M. J. Ingram, G. Farmer (eds.), *Climate and History. Studies in Past Climates and Their Impact on Man* (Cambridge, 1985), p. 190. William James Burroughs, *Climate Change: A Multidisciplinary Approach* (Cambridge, 2001), p. x.
[80] Glantz (2003), p. 217.

between environmental, social and economic factors that determine future climate change, including the effectiveness of climatic policy.[81] This approach makes IA models extremely complex and the models have been accused of being too quantitative and lacking a qualitative perspective.[82] Hence, historical climatology and IA share the same dilemma: it is extremely complex to identify and assess the climatic impact on societies. It is equally difficult to predict climatic impact on future societies as it is to establish causality based on historical documents. One might even consider it easier to assess historical impact, as everything has already occurred, and everything is recorded in documents, although this is not the case, as the sources are not objective, all parties are not represented, and not all regions are covered.

However, employing multiple methods heightens the question of epistemology. It stresses the fact that various disciplines, or schools of thinking, do not share epistemology.[83] For instance, as a historian, I do not consider documents to contain climatic 'evidence'; they simply contain traces of past climates that are interpreted. As a rather typical historian, I do not consider quantification as a method to remove uncertainties. Numbers are merely a simpler and a different approach of presenting qualitative information.[84] I conduct my analysis qualitatively and not quantitatively and I stress the importance of alternative explanations to droughts and famines, than the most apparent, which would enhance my climatic reconstruction. This is not necessarily the same approach as a climatologist might adopt, and most researchers within historical climatology are natural scientists.

Historians have been careful to avoid invoking climate as a part of human history, which might explain why past societies and their relation to climatic variations have remained marginal in historical climatology.[85] However, when historians take the climate into considerations, they too readily apply modern climatic characteristics on past societies.[86] It is easily forgotten that the 18th century climate was not the same as in the 20th century. The reluctance to include climatic interpretations within the humanities might relate to the abstract and broad nature of such concepts as 'climate' and 'history', which has also been highlighted by Christian Pfister.[87] (See Table 1 for my personal interpretation) However, the aim of this investigation is to incorporate both perspectives and thus create a comprehensive interpretation of the interaction between climate and the societies on the Gold Coast in the 18th century.

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[81] Detlef P. Van Vuuren et al., 'How Well do integrated assessment models simulate climate change?', *Climatic Change* (vol. 104, no 2:2011), p. 256.

[82] J. Rotmans and M. van Asselt, 'Integrated Assessment: A growing child on its way to maturity', *Climatic Change* (vol. 34, no:3–4:1996), p. 333.

[83] Elizabeth Oughton and Louise Bracken, 'Interdisciplinary research: framing and reframing', *Area* (vol. 41, no 4:2009), p. 386.

[84] Roderick Floud, *An Introduction to Quantitative Methods for Historians* (London, 1979), p. 3.

[85] David Arnold, *The Problem of Nature. Environment, Culture and European Expansion* (Oxford, 1996), p. 39; Kenneth Hare, *The Restless Atmosphere* (New York, 1978), p. ix; Pfister (2010), p. 26.

[86] John F. Richards, *The Unending Frontier. An Environmental History of the Early Modern World* (Berkley, 2003), p. 62.

[87] Pfister (2010), p. 28.

***Table 1** An example of some components that academically are identified with the concepts of history and climate as they are unified within historical climatology. The table enhances the blanket term concept of history and climate. The table shows the complex interaction between climate and history, the actors, perspectives and sources, but also the difference between temporal and spatial distribution, it is only the sources that are the same.*

Historical climatology	
History	**Climate**
Focus: human oriented	Focus: Earth's environment
Perspectives of history: e.g. political, economic, agrarian, gender, ecological, social, ideas, technological, naval and national.	Perspectives: e.g. tropical climates, temperate, deserts (polar, subtropical), mountains, cities, valleys, land, sea and air.
Temporal distribution: e.g. hours to days to months to years and eras.	Temporal distribution: e.g. averages, months, seasons, years, decades, centuries, and millennia.
Spatial distribution: e.g. villages, towns, cities, municipalities, countries and interstate regions.	Spatial distribution: e.g. local climate, micro climate, macro climate, global and remote links (teleconnections).
Actors: e.g. nations, states, governments, companies, elites, worker, families, individuals, corporations, ethnic groups and non-governmental organizations.	Actors: e.g. sun, oceans, earth's orbit round the sun, temperature, ENSO, water, insolation, evaporation, atmosphere, weather, soils, storms, rainfall, meteorological extremes such as hurricanes, tornadoes, floods, droughts and blizzards.
Sources: e.g. narratives, journals, letters, diaries, reports, church books, chronicles, memoires, travel journal, draft reports and minutes.	Sources: e.g. narratives, journals, letters, diaries, reports, church books, chronicles, memoires, travel journal, draft reports and minutes.

1.3.1 Approaches that facilitate climatic reconstruction

This investigation is primarily based on a critical assessment of written historical data, a method that mostly is associated with historians and scholars in the humanities, but which has become an important tool for the development of historical climatology.[88] Various types of historical documents present their own particular problems of source criticism in historical climatology. In this context, source criticism becomes a tool that enables a researcher to communicate with the document, and thereby determine which questions can be answered. However, this does not mean that I employ source criticism to determine whether or not the climatic descriptions are true and/or false. Source criticism

[88] John Tosh, *The Pursuit of History. Aims, methods and new direction in the study of modern history* (London, 1984), p. 53. For historical climatology, see for instance, Ogilvie, A. E. J., 'Historical climatology, *Climatic Change,* and implications for climate science in the twenty first century', *Climatic Change* (vol. 100, no 1:2010); and Ingram (1985).

delivers the hermeneutic tool box that reduces incorrect interpretations, it takes tendentious interpretations into consideration.[89]

The source critical tool box determined the basis of my approach as the Europeans, who by origin were outsiders, visitors, and observers situated in a foreign environment, wrote the documents that are analysed. Furthermore, the data cannot be compared to other data, which highlights the uncertainty regarding the degree of impact of recorded events, such as famines. Those who actually were affected by climatic impact – the farmers, the townspeople, and the slaves – have no voice of their own. They left no records or historical documents to employ and critically assess. Hence, the evaluated famines are only witnessed at a distance. This type of information is generally considered less reliable than information recorded by a person who experienced an event.[90] William H. Green also emphasises that the impact of long-term climatic shift need to be correlated to human behaviour.[91] However, this is not possible in this investigation due to a lack of local sources.

The critical assessment emphasises that the social setting and origin of any author is of great importance.[92] Placing the document, its author and the described event in the correct context enhances critical assessment. This accentuates the age, experience, involvement, knowledge and intentions of the observer. In particular the reliability of climatic observations is dependent on the experience and intentions of the observer and the circumstances and era in which the author was living, even his education and social status becomes important tools of knowledge.[93] Hence, the optimum would be always to assess each document and its author separately, but this would be practically impossible, as the personal background and competence of each individual cannot be ascertained, especially Royal Navy captains. However, the governors were not randomly selected servants of the company. They were well educated, they were well connected and prepared to get their hands dirty, furthermore many governors had several years on the coast, starting as surgeons or writers before attaining the position of governor.[94] However, this does not preclude that each climatic event variously affected every individual on a personal and emotional level, which is an important factor, as there is a high degree of individual variability in disasters.[95]

Martha Howell and Walter Prevenier accentuate the fact that tendentious and sensational reports have greater impact on a reader than sober and careful reports.[96] This is of importance in climatic investigation as disasters affect people variously. The language that is employed to describe an event emanate from the degree of impact on the author, as Rüdiger Glaser et al. has emphasised. For instance, a chronicler will be more moderate in his choice of words when describing an event, compared to a person who suffered personal loss.[97] This is clearly visible in this investigation. The governors'

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89 Thurén, pp. 3, 17.
90 Thurén, p. 35.
91 William H. Green, *History, Historians, and the Dynamics of Change* (Westport, 1993), p. 174.
92 Martha C. Howell and Walter Prevenier, *From Reliable Sources. An Introduction to Historical Methods* (New York, 2001), p. 43.
93 Thurén, pp. 25–27; Glaser et al. (2010), pp. 239–244.
94 St Clair, pp. 83–84, 89
95 Charles E. Fritz and Eli S. Marks, 'The NORC studies of Human Behaviour in Disasters', *Journal of Social Issues* (vol. 10, no 3:2010), p. 26.
96 Howell, p. 33.
97 Glaser et al. (2010), p. 244.

descriptions are often written in affect when the castle is directly impacted, as in Hippisley's ecstatic letter from 1766 (see opening excerpt). The event is described in a manner as if the aim was to literally mediate the impact of the disastrous event to the readers in London. Hippisley even proposed a rhetorical question to the readers when wondered why the price of corn had been raised. However, in other letters the descriptions are almost laconic statements when the suffering of the slaves or local free population is mentioned. In these cases the letters become moderate reports of what they observed. However, the extent, degree and actual cause of the claimed disaster remain unknown.

Narrative climatic descriptions are an author's interpretation of an event. They are subjective and relative. The dilemma with climatic descriptions is that one has to make vague common sense assumptions on an author's ability to make reliable observations, especially when describing foreign climates and weather phenomena. This approach suggests that a person who had lived his entire life in Africa will produce more reliable observations than a visitor whose descriptions are based on two or three years' of experience of the location. In other words, the accumulated experience of the West African climate affects the reliability of each description. It is plausible to assume that a person would have needed at least two years of experience on the Gold Coast to create a meaningful and reliable description of the climatic characteristics. This was required to gain experience of the rainy season, the dry period that followed and the dry Harmattan wind in the winter, and would have been necessary to identify the erratic behaviour of the tropical environment, and produce a comprehensive picture of the normal climate.

Another important aspect of climatic reconstructions is the selectivity of the 'memory'. The majority forget most of an event's details only hours after its occurrence, and this affects subsequent descriptions.[98] Diaries and logbooks, being contemporaneous daily records, are therefore considered more reliable as the content is not distorted by memory.[99] Letters are technically less reliable as they only refer to events that occurred past, sometimes a month previously. This accentuates the purpose of the document, its meaning. Why was it written, and what was the intention of the author? A logbook was kept to record the ships' voyage, this was described in the regulations and instructions received from the Admiralty, but what was the purpose of the governors' letters? Some governors considered all events noteworthy and tried to include everything in their letters. Other governors were more selective. However, their reports to London still reflected their objectives, intentions, wishes and plans. Some events and issues were most likely intentionally omitted due to the governors' own aspirations. For instance, the governors at Cape Coast Castle often operated their own illicit business and sold gunpowder, brandy, and tobacco to increase their personal wealth and embezzle the company's money.[100] In other words, the documents might appear objective, but they might only be masking the unknown intentions of the author. However, it remains that the letters contain climatic indicators that form the basis of the climatic reconstruction.

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[98] Thurén, p. 28.

[99] Daniel L. Schacter, 'Memory Distortion: History and Current Status', in Daniel L. Schacter (ed.), *Memory Distortion. How minds, brains and societies reconstruct the past* (Cambridge, 1995), p. 1.

[100] St Clair, p. 59.

Climatic indicators

Climatic reconstructions employ climatic indicators/denominators or so-called 'exposure units' to rebuild the climate. The existence of these is dependent on the employed historical documents, but they must always be placed in their historical context, i.e. according to the period, place, culture and society that is investigated.[101] This again highlights the need to critically assess the author, his experience, age and profession, in relation to the document. The indicators are normally structures (buildings or governments), populations (human or non-human), and activities in the form of livelihoods, specific economic sectors or groups (slaves or free people), and, furthermore, activities (agriculture and cattle herding) found in a specific society, nation, or defined region.[102] The indicators in this investigation are primarily buildings, famine, drought and sickness; the exposure units are the Europeans, slaves and/or townspeople.

The fundamental approach to choosing an indicator is that there appears to be a linear relationship between the weather (cause) and the indicator/exposure unit (effect) exists. It is never fully linear, this is discussed below. However, there are particular conditions that need to be fulfilled to create meaningful indicators and linearity between *cause* and *effect*.[103] There are specific premises that need to be fulfilled for the castle to collapse due to heavy rains, and the crops to fail due to a lack of rains. Patrick Gardiner presents a striking example on how causality sometimes is simplified, and conditions forgotten:

> We say that striking a match causes it to light: but of course, this is not the *only* condition of the match's catching fire. The match must not be damp or a dummy, the sand-paper must not be worn out, the match must be struck with a certain minimum degree of force, and so forth.[104]

In other words, there are particular conditions that need to be fulfilled to see climate (the match) as a *cause* to the disastrous events that are investigated, such as crop failure or collapsed buildings, regarded as disasters. It is thereby necessary to first define a *disaster* in a meaningful manner, and break it down to less abstract parts.

Christian Pfister defined disasters as an interaction between physical, biological, and socio-cultural processes. The breakdown of one system leads to physical and psychological stress in the effected community.[105] A disaster is therefore the complex interaction of many variables; however, disasters can only occur if there is a combination of vulnerability *and* hazard. There is no risk of disaster if there are hazards but no societal

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[101] T. M. L. Wigley et al., 'Historical Climate Impact Assessments', in R. W. Kates, J. H. Ausubel, and M. Berberian (eds.), *Climate Impact Assessment. Studies of the Interaction of Climate and Society* (Wiley, 1983), pp. 532–533.

[102] Kates, p. 10.

[103] J. L. Anderson, 'History and climate: some economic models', in T. M. L Wigley, M. J. Ingram and G. Farmer (eds.), *Climate and History. Studies in past climates and their impact on Man* (Cambridge, 1981), pp. 340–341.

[104] Patrick Gardiner, *The Nature of historical Explanation* (Oxford, 1961), p. 11.

[105] Christian Pfister, 'Climatic Extremes, Recurrent Crises and Witch Hunts: Strategies of European Societies in Coping with Exogenous Shocks in the Late Sixteenth and Early Seventeenth Centuries', *The Medieval History Journal* (vol. 10, no 1–2:2007), p. 34.

vulnerability. Equally, there is no risk of disaster if a society is vulnerable but there are no hazards.[106]

There were both hazards and vulnerability on the Gold Coast in the 18th century. Interannual rainfall variability (hazard) combined with the lack of pesticides and agricultural machines (vulnerability) meant that the population was dependent on the regularity of the rainy season, or in other words, variations in the water cycle had a greater impact in the 18th century than today.[107] It is also worth noting that subsistence farmers consider rainfall the dominant climatic variable, and areas of subsistence agriculture are generally identified by high interannual rainfall variability.[108] However, vulnerability also relates to the various exposure units and how they are affected. For instance, studies have shown that the poor and marginalized in a society are more at risk from natural hazards.[109] This suggests that the slaves were more vulnerable than others, but it also implies that the personnel at Cape Coast Castle were less vulnerable. They were better equipped and had better resources to procure food from elsewhere than from the immediate surrounding of the castle, as was shown in the introductory quote. This depicts the dilemma in this investigation: the documents and accounts were written by those who were least vulnerable of all.

Societies have always attempted to mitigate against vulnerability by so called 'adjustment responses'. These are preventive measures designed to decrease the risk of disaster.[110] The preliminary adaptive measures throughout history are the preservation of food and food deposits, which are aimed at mitigating the effect of short-term disasters.[111] The existence of adjustment responses creates a dilemma: adaptive measures make it difficult to evaluate the actual degree of impact, extent, and duration of any disaster. Large and well-preserved deposits, combined with a functioning distribution system, might have prevented the onset of famine.

Finally, the existence of disasters and adjustment responses imply that there was a will to sustain *status quo*, which enables the employment of the catastrophe theory. This theory, in short, suggests that a catastrophe ends when equilibrium is reached, that equilibrium is always desired, and every action aims at equilibrium.[112] In other words, the climatic indicators identified in this investigation are situations or events in which the situation had changed from status quo into a more unstable situation that required attention, and immediate action. This is valid whether the indicator was the destruction of the castle or the threat of famine. There would always have been the will to rebuild the castle and avoid famine.

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[106] Piers Blaikie, Terry Cannon, Ian Davis and Ben Wisner, *At Risk. Natural Hazards, peoples vulnerability and disasters* (London, 1994), p. 21.

[107] Neville Brown, *History and Climate Change. A Eurocentric Perspective* (London, 2001), pp. 14–15.

[108] N. S. Jodha and A. C. Mascarenhas, 'Adjustment in Self-provisioning Societies', in R. W. Kates, J. H. Ausubel, and M. Berberian (eds.), *Climate Impact Assessment. Studies of the Interaction of Climate and Society* (Wiley, 1983), p. 439.

[109] R. C. Sidle et al., 'Interactions of natural hazards and society in Austral-Asia: evidence in past and recent records', *Quaternary International* (vol. 118–119:2004), p. 183.

[110] Kates, p. 11.

[111] The reserves in Bern (Switzerland) would feed the entire population for 117 days in 1850, see Christian Pfister, 'Food Supply in the Swiss Canton of Bern, 1850', in Lucile F. Newman (ed.), *Hunger in History. Food Shortage, Poverty and Deprivation* (Oxford, 1995), p. 287.

[112] David Z. Rich, *Order and Disorder* (Westport, 2001), p. 38.

Quantifying qualitative descriptions

Historians are traditionally reluctant quantifiers as it is considered a simplification of historical events.[113] However, the main dilemma of historical climatology is how to interpret subjective weather descriptions into something meaningful and measurable.[114] The most common approach is to label each event numerically according to intensity or degree of impact. The most appropriate method is to transform qualitative descriptions into indices on an ordinal scale. Simple monthly indices follow a three-term categorisation (-1, wet; 0, normal; 1, dry) and weighed monthly indices follow a seven-term classification. This is categorised according to intensity from -3 to 3 (-3, extremely cold; -2, very cold; -1, cold; 0, normal; 1, warm; 2, very warm; 3, extremely warm).[115]

The scaling is highly dependent on the amount and type of data. For instance, the descriptions that were employed in a study that focused on floods and droughts in China were denoted on a scale from 1 to 5 (from very wet to very dry). The documents included descriptions such as "men eating men", which was converted to the numerical value of five. This documented act of cannibalism, the assumed cause was lack of food due to climatic variations, was considered to describe "very dry" conditions.[116]

In a study on floods in Europe, a three-term classification system was employed to determine the severity of floods. The study focused on buildings as indicators. The first class (1) caused little damage in the gardens, the second class (2) damaged buildings, and the third class (3) caused severe damage.[117] These investigations utilised documents with very specific data, in which the same variable could be arranged according to the degree of impact.

Sharon E. Nicholson's most recent investigation on the historical climate of Africa included a seven-term classification system to describe rainfall intensity.[118] The data comprised historical documents and rain gauges, which enabled a construction of seven classes of wetness, ranging from -3 to +3. The highest value (+3) equalled "very wet conditions" and the lowest (-3) "severe droughts". The lowest value (-3) was allocated to famines, while zero denoted normal conditions.

The climatic information in this investigation is not exact enough to create a meaningful classification that incorporates a weighed system. There are too many years with insufficient information, and intensity is difficult to assess in a meaningful manner due to inexact descriptions. The structural damage is not specific enough to be categorised in a meaningful manner. Nevertheless, I will follow Sharon Nicholson's classification of seven wetness classes when labelling interannual information from the governor's letters. It is worth noting that the classes are based on various indicators, and not the same, as in the study of floods. The intensity of the rainfall events is not mentioned in the letters, but

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113 Floud, p. 3.

114 Nicholson, (1979), p. 35, Rüdiger Glaser and Heiko Stangl, 'Climate and Floods in Central Europe since AD 1000: Data, Methods, Results and Consequences', *Surveys in Geophysics* (vol. 25, no 5–6:2004), pp. 492–493. Glaser et al.(2010), p. 239.

115 Brázdil et al. (2005), p. 378. Rüdiger Glaser and Heiko Stangl, 'Climate and Floods in Central Europe since AD 1000: Data, Methods, Results and Consequences', *Surveys in Geophysics* (vol. 25, no 5–6:2004), p. 494.

116 Wang, Shao-Wu and Zhao Zong-Ci, 'Droughts and floods in China, 1470–1979', in *Climate and History. Studies in Past Climates and Their Impact on Man,* eds. Wigley, Ingram and Farmer (Cambridge, 1985), p. 273. Se also Table 10.1.

117 K. Sturm et al., 'Hochwasser in Mitteleuropa seit 1500 und ihre Beziehung zur atmosphärischen Zirkulation', *Petermanns Geographische Mitteilungen* (vol. 145, no 6:2001), p. 15.

118 Nicholson et al, (2012a), p. 16.

they are included in the diary. However, these are not denoted according to an ordinal scale. They are only classified qualitatively into light and abundant rains. My classification gives an indication of the amount of rain that was received in relation to the number of monthly rainfall events. This gives some indication of the amount of rain, by relation to the quantity, on a monthly basis.

I employ a different classification system in the logbook analysis. Logbook weather descriptions are presented in accordance with a two-term categorisation. This distinguishes the rainy days from the non-rainy days. The rainy days are labelled as -1 and non-rainy days as 1. Zero indicates no record. This was also the procedure in a study on summer precipitation in the lower Yangtze region of China. Descriptions of rain were transformed into 'rainy days' and 'non-rainy days' for monthly indices, which were compared to modern records.[119]

Climatic impact

The concept of *climatic impact* refers to effects caused by climatic variations or anomalies in the climatic system. This includes the havoc created by meteorological extremes or hazardous events such as, for instance, torrential rains, droughts, hurricanes, tornadoes, and floods. Meteorological extremes are often events that have always existed but are, at the time of impact, recorded due to their magnitude and short-term impact. Impacts generated from climatic changes (long-term) or climatic variability (decadal changes) occurs at a slower pace.[120]

Climatic anomalies impact on both *ecosystems* and *societies*. Ecosystems comprise natural environments that are either managed (agriculturally managed or pasture) or unmanaged (i.e. forests, wetlands, and marine environments)[121] In this investigation focus is indirectly on agriculturally managed ecosystems. This is a classical approach for the pre-industrial period. Agriculture was at that time the most important source of income and "(---) cereals the fundamental element in traditional economy".[122] The climatic impact on agriculture is visible in many aspects as it affects grain reserves, availability to food and nutrition, trade prices and balance of payments, meat prices, and ecological sustainability.[123]

Climatic impacts on societies can be subdivided into direct impact (first-order) and indirect impact (second-, third-, fourth-order and so forth). The further one moves from direct impact, the harder it becomes to determine causality.[124] The degree of impact is determined by the affected ecosystem and sensitivity of the society. The degree of impact is also dependent and how the society has adapted and prepared itself for catastrophic

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[119] P. K. Wang, and D. Zhang, 'Reconstruction of 18th century summer precipitation on Nanjing, Suzhou, and Hangzhou, China, based on the Clear and Rain Records', in *Climate Since A.D. 1500*, eds. R. S. Bradley and P. D. Jones (Routledge, London 1992), pp. 187–188.

[120] Kates, p. 9, Brázdil et al. (2005), pp. 403–404, Glantz (2003), p. 110.

[121] Glantz (2003), p. 110.

[122] Ladurie, p. 288.

[123] Jennifer Robinson, 'Global Modeling and Simulations', in R. W. Kates, J. H. Ausubel, and M. Berberian (eds.), *Climate Impact Assessment. Studies of the Interaction of Climate and Society* (Wiley, 1983), p. 481–484.

[124] Brázdil et al. (2005), p. 404.

events and meteorological extremes, which depends on whether or not the possible hazardous events are known to the society.[125]

First-order impacts are those that affect the biophysical environment. Second-order impacts are then defined according to the societal and/or economic activities that are affected. For instance, a failure of the rains leads to drought (first-order impact), which affects agricultural production (second-order impact). Food shortages may then lead to famines and rebellions (third- and fourth-order impacts respectively).[126]

Long periods of extreme weather conditions are considered to generate *climatic stress*.[127] The duration of these stress periods nullify all attempts to mitigate climatic impact by adjustment responses. Climatic stress is most visible in pre-industrial societies as they were more vulnerable to impacts on particular areas and activities, such as availability of food or fodder; population dynamics (diseases; epizootics), transport, communication, and military operations.[128] However, such impact analyses are often conducted by natural scientists, as historians generally are reluctant to incorporate climatic impact into their interpretations of history, which is unfortunate, as natural scientists are less familiar with, for example, social collapses, resource conflicts, fear, and war economies, as noted by Harald Welzer.[129]

Theories on drought and famine

It is water, more than temperature, which governs life in West Africa, and water is an essential part of the rain-fed agriculture. This is why drought has been widely investigated in West African. In 1987, Michael H. Glantz asserted that there probably are thousands of publications on drought, and this is probably the case after 2012.[130] Nevertheless, many sources often contain descriptions of droughts and famines due to the importance of water. The popular assumption is that famine is caused by a failure of the crops, and that a drought is a failure of the rains. Drought is thereby considered (as mentioned above) a first-order impact, and famine, a second- or third-order impact. However, this is not necessarily the case. A drought is not necessarily a first order impact, and a famine not necessarily a second- or third-order impact. This is all dependent on the nature of the drought and the origin of the famine.

A drought can be defined as a period with various types of hydrologic imbalance. Sharon Nicholson defined a drought as an event that has no distinct beginning or recognised end, and she suggested that the term should be "(---) reserved for protracted departures from "normal" conditions of water availability."[131]

Droughts occur under different conditions, which is why they have different characteristics. There are four types of droughts that have been distinguished. A *meteorological* drought occurs when the rains are not as intense or frequent as expected, i.e.

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[125] Nick Brooks, 'Vulnerability, risk and adaptation: A conceptual framework' *Tyndall Center for Climate Change Research, Working Paper 38* (2003), p. 4.
[126] Wigley, p. 535
[127] Jan de Vries, 'Analysis of Historical Climate-Society Interaction', in R. W. Kates, J. H. Ausubel, and M. Berberian (eds.), *Climate Impact Assessment. Studies of the Interaction of Climate and Society* (Wiley, 1983), pp. 283–285.
[128] Brázdil et al. (2005), p. 403.
[129] Harald Welzer, *Klimatkrig. Varför människor dödar varandra på 2000-talet* (Göteborg, 2009), p. 37.
[130] Ibid.
[131] Sharon E. Nicholson, *Dryland Climatology* (Cambridge, 2011), p. 407.

it portrays subnormal rainfall for a given place of time and year. The impact of meteorological droughts is direct and short in duration, but the degree of impact depends on the society and conducted mitigations. *Agricultural* droughts arise when rains are not sufficient to produce soil moisture that sustains agricultural productivity. However, adequate rains are not enough if they do not arrive in the due season, as agricultural drought is also dependent on soil type, and the cultivated crops. A *hydrological* drought occurs when the ground water level it too low to supply water for those dependent on it, and it relates to temporally and spatially extensive rainfall deficits.[132] A hydrological drought implies periods of insufficient precipitation, thereby affecting surface or subsurface water storage systems.[133] However, a hydrological drought has the same characteristics as a *socioeconomic* drought. A socioeconomic drought means that the demand for water is higher than the supply. This type of drought includes the impact of human activity.[134]

In particular, socioeconomic droughts are relevant to this investigation. The number of embarked slaves grew almost exponentially during the latter half of the 18th century. Consequently, the number of people in need of fresh water also increased at the same rate. Hence, the ground water level was affected by years of excessive consumption of fresh water. This approach might explain why ponds began to dry out at the end of the 18th century, and why there are no earlier references to similar events. The rains had not failed entirely, or enough to produce a hydrological drought, they were only insufficient and could not respond to the demand for water. This implies a Malthusian perspective on droughts as demographic increase was exponential, while the availability of water was linear.[135]

All of the above types of drought are plausible in this investigation. However, drier periods are not presented or explained by these terms in the sources. Instead, dry spells or periods of drought are usually referred to as a 'lack' or 'want' of water or rain. Hence, labelling a drought according to this categorisation is, dependent on accompanying attributes that are employed to describe the situation. The severity of the included droughts cannot be indexed by their severity as proposed by, for instance, Bailey and the Food and Agriculture Organization of the United Nations (FAO).[136] The combined index of Bailey and FAO is based on the availability of monthly rainfall data. Bailey labelled a 'very light drought' as the result of "at least four consecutive 'moderately wet' months".[137] Other drought criteria is often labelled according to the number of days without water, but the data in this investigation are not sufficient for a similar classification, as the

[132] Nicholson (2011), p. 408, Michael H. Glantz, 'Drought and economic development in sub-Saharan Africa', in Michael H. Glantz (ed.), *Drought and hunger in Africa. Denying famine a future* (Cambridge, 1987), pp. 45–47.
[133] Jan Verhagen et al., 'Climate Change and Drought Risks for Agriculture', *Environment and Policy* (vol. 39, 2004), p. 51.
[134] Michael Mortimore, *Adapting to Drought. Farmers, famines & desertification in West Africa* (Cambridge, 1989), pp. 151–152. See also Donald A. Wilhite and Margie Buchanan Smith, 'Drought as Hazard: understanding the Natural and Social Context', in Donald A. Wilhite (ed.), *Drought and Crises. Science, Technology and Management Issues* (Boca Raton, 2005), pp. 7–8.
[135] Sara Millman and Robert W. Kates, 'Toward Understanding Hunger', in Lucile F. Newman (ed.), *Hunger in History. Food Shortage, Poverty and Deprivation* (Oxford, 1995), p. 8.
[136] Bailey's and FAO's index are described in Verhagen, pp. 54–55. See Table 6.1 for a representation of the drought index.
[137] Ibid.

governors do not report the daily amount of rainfall or monthly number of rainfall events.[138]

Theories on famine are as multifaceted as those on droughts. First, famine is not considered to cause hunger, mass starvation, or death. These were at one time regarded as the only outcomes of famine, whereas these perspectives were merely the result of the debate caused by the Malthusian perspective.[139] Nonetheless, George Cox defined famine as "(…) the regional failure of food production or distribution systems, leading to sharply increased mortality due to starvation and associated disease."[140] This was later considered as a misleading definition according to Stephen Devereux, who claimed that Cox's definition made a shortage of food the prerequisite of famine.[141] However, I consider Cox's definition a good starting point in this investigation, mainly because he stated that famine is the regional failure of food production *or* distributions systems. Cox did not, as Devereux claims, make food shortage a prerequisite for famine. The problem with Cox's definition is that it does not take the cause of famine into consideration. It does not explain why there was a problem in the distribution system or why the food production failed. Hence, a more functional definition of famine is based on definitions of drought. I suggest that a *socioeconomic famine* would incorporate a situation in which famine is caused either by high prices *or* distribution problems. This definition is partly deduced from a Sahelian herder's concept of famine. The herder considered that raising the price of any necessities constitutes the situation as a famine.[142] This investigation does not focus on semi-arid grasslands, which defines the Sahel area. However, it is not the region that is important; it is the perception of famine.

This investigation needs an approach to famine that is applicable to situation that prevailed on the Gold Coast in the 18th century. This is not an easy task as the three dominating actors or exposure units – the British, the local free population and the inland slaves – had very different prerequisites for addressing famine. This is a very coarse categorisation of the exposure units as it does not include such personnel as company slaves, bricklayers, or hired canoe men, who are excluded due to lack of information on their situation. The dilemma is that the exposure units are distinguished by various degrees of vulnerability as they had differing prerequisites for obtaining food. For instance, the British bought food from the local market, but they also received necessities from Europe. However, if these alternatives failed, for some undisclosed reason, the possibility remained to send for food (by ship) from other forts or locations on the coast. However, it was not possible for the local population to travel great distances to obtain food, and the captured slaves were at the financial mercy of their traders. Hence, the local free population was immediately affected by disturbances in the production and/or distribution system, with slaves being solely dependent on the distribution system. This is why I consider a socioeconomic famine to include all three exposure units. It also highlights the fact that famine does not necessarily mean that there is no food available,

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[138] See for instance, R. R. Heim Jr., 'A review of twentieth-century drought indices used in the United States, *Bulletin of the American Meteorological Society* (vol. 83, no 8:2002), for an overview of different types of drought indices.

[139] Alex de Waal, *Famine that kills: Darfur* (Oxford, 2005), p. 10.

[140] George W. Cox, 'The Ecology of Famine: an overview', in John R. K. Robson (ed.), *Famine: Its Causes, Effects and Management* (New York, 1981), p. 5.

[141] Stephen Devereux, *Theories on Famine* (New York, 1993), p. 11.

[142] Diulde Laya, 'Interviews with Farmers and Livestock Owners in the Sahel, *African Environment* (vol.1, no2:1975), p. 88.

only that people do not have enough to eat. A famine-like situation can occur even when there are no disturbances in the distribution lines. As such, famine is caused by raised food prices that the poor cannot afford. This follows the "food entitlement decline" (FED) hypothesis by Amartya Sen.[143] High prices do not imply a shortage of food, as the Sahelian herder exemplified, only that it was more difficult to obtain.

This brings the discussion back to the idea of climatic impacts. There must be vulnerability and hazards to generate a disaster such as a famine. Extreme weather is seldom considered and accepted as the single cause for famines. This is because a group's ability to anticipate, cope with and resist disasters depends on several socioeconomic and socio-cultural factors.[144] This highlights the complexity of this investigation, as it includes slaves who, as a group, had no socioeconomic or cultural means to mitigate, prevent, or adapt to famine or drought. Consequently, claims of famine are treated cautiously, and climatic impact has no precedence in the analysis. The climatic impact is hidden or masked by several societal and political factors, such as embargoes or small-scale wars. Proceeding from first-order impacts (impact on agricultural production) to second-order impacts (impact on prices) and third-order impacts (impact ramified into larger areas – e.g. famine) only makes it more difficult to determine the origin of the distress.[145]

Migration and adaptation

Philip D. Curtin considered the trans-Atlantic slave trade the greatest intercontinental migration of the 18th century.[146] Patrick Manning has discussed the slave trade with the same terms although more clearly presenting it as involuntary.[147] The slave trade is presented as *forced* migration, thus separating it from the idea of *voluntary* migration, which Willem Boswell and John Leyden claimed to have witnessed. In the introduction I suggested that these people were fleeing from climatically induced famines. However, this cannot be properly established, as the personal motives of the people who voluntarily enslaved themselves are unknown. Survival might be an explanation, but survival from what? From what were they fleeing, climatic changes or political persecution?

Mobility is a reoccurring topic in the construction of African history, mainly because it is via the historical distribution of language patterns that current structures of society are understood and identity shaped.[148] Language creates a sense of belonging. However, George E. Brooks' climatic periodisation also includes mobility and language as a method of localizing migration in the wake of climatic desiccation.[149] The difference between Curtin and Brooks is the distance of migration: one was regional and based on voluntary migrations, the other intercontinental, and forced.

Climatically induced migrations imply that the act of migrating is directly related to climatic stress, such as droughts, famines, or meteorological extremes. Climatic migration

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143 Amartya Sen, *Poverty and Famines* (Oxford, 1981), p. 1.
144 C. Pfister and Brázdil R., 'Social vulnerability to climate in the "Little Ice Age": an example from Central Europe in the early 1770s', *Climate of the Past* (vol. 2, no 2:2006), p. 115.
145 Brázdil et al. (2005), pp. 403–404.
146 Philip D. Curtin, 'Africa and Global Patterns of Migration', in Wang Gungwu (ed.), *Global History and Migrations* (Oxford, 1997), pp. 63, 75.
147 Patrick Manning, 'Migrations of Africans to the Americas: The impact of Africans, Africa, and the New World, in Patrick Manning (ed.), *Slave Trades, 1500–1800: Globalization of Forced Labour* (Hampshire, 1996), p. 65.
148 Curtin (1997), p. 63; Manning (2005), p. 138.
149 Brooks (1986), p. 51.

is therefore considered a 'second-order impact', with its roots in directly affected processes such as water supply and/or agricultural yield.[150] However, Elisabeth Meze-Hausken highlights the problematic nature and simplified relation between migration and droughts/famines. There is no direct causality: not every drought causes a famine, and not every drought or famine causes migration. More importantly, Meze-Hausken's investigation showed that migration was an option only when every other attempt to adapt to the situation had failed.[151] John Iliffe has presented similar scenarios from a historical perspective, as some stayed to the last drop of water was employed.[152] This shows that there is no linear correlation between drought and migration. The simple impact model is undermined by the existence of adjustment responses. Migration is not an immediate result of climatic variations as people unwillingly leave their habitat. This emphasises that the decision to migrate is based on a rational decision taken by individuals, families, groups, or societies.[153] Rationality is here considered as the choice of the most appropriate means to a given end.[154]

Rationality is an important aspect of understanding migration as it facilitates a classification of historical migrations according to four basic categories as suggested by Anthony Barclay. These are, in no specific order: i) the search for personal and political security, ii) religious coercion, iii) trade, and iv) the acquisition of land for human settlement and agricultural purposes.[155] A more understandable subdivision is that people migrate due to opportunity (trade), environmental crisis/opportunity (related to agriculture) or persecution (political). These three categories all relate to survival, whether it is on a physical, metaphysical or economic level.

Barclay's categorisation suggests that migration can be approached as push- or pull-phenomena, which is similar to the mechanisms employed to explain the growth of the slave trade in the 18th century. However, the push-theory, when applied to migration, is inapt. It does not explain why some migratory destinations are selected in preference to others, even when the aim is to survive.[156] However, distance is of great importance. Most environmentally induced migrations are regional: they occur in a region, between regions, and across regions.[157] Investigations have shown that poor people migrate for short distances as they do not have the means to migrate, especially under worsening climatic conditions.[158] Modern African migration is mostly local or sub-regional as migrants do not

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150 Elisabeth Meze-Hausken, 'Migrations caused by climatic change: how vulnerable are people in dryland areas?', *Mitigation and Adaptations Strategies for Global Change* (vol. 5, no 4:2000), p. 384.
151 Meze-Hausken, pp. 398–399.
152 Johan Iliffe, *Africans. The History of a Continent* (Cambridge, 1996), pp 1, 62–63.
153 R. McLeman and B. Smith, 'Migration as an Adaptation to Climate Change', *Climatic Change* (vol. 76, no 1-2:2006), p. 38; John C. Harsanayi, *Rational Behavior and Bargaining Equilibrium in Games and Social Situations* (Cambridge, 1986), p. 10.
154 Harsanayi, p. 8.
155 Anthony Barclay, 'Regional Economic Commission and Intra-Regional Migration Potential in Africa: Taking Stock', in Aderanti Aidepoju, (ed.), *International Migration Within: To and From Africa in a Globalised World* (Legon, 2009), pp. 48–49. See also, John Iliffe, 'The Origins of African Population Growth', *Journal of African History* (vol. 30, no 1:1989), pp. 165–169.
156 S. Curran, 'Migration, social capital, and the environment: Considering migrant selectivity and networks in relation to coastal ecosystems', in W. Lutz, A. Prskawetz and W. C. Anderson (eds.), *Population and Environment: Methods of Analysis* (New York, 2002).
157 Manning (2005), p. 13.
158 Gregory White, *Climate Change and Migration. Security and borders in a Warming World* (Oxford, 2011), pp. 33, 47–48.

have the financial or cultural means to migrate great distances.[159] When drought deprives poor people of their livelihood, they are also deprived of their means to migrate, as indicated by Stephan Castle's and Mark Miller's study on Burkina Faso.[160] This is naturally not absolute. Nomadic groups are naturally mobile by nature, and long-term climatic stress can generate mass migrations.

The concepts of rich and poor are not entirely applicable in this investigation, even though slaves can be considered as 'poor' and the British as 'rich'. However, climatically induced migrations were most likely also regional in the 18th century. The people that migrated would have been fatigued by climatic stress and in need of food and water. They did not have the means to migrate long distances as there were no mass transport systems. Hence, is a climatically facilitated slave trade even a possibility? The poor and weak would not have had the means to move and, more importantly, the slave traders were not interested in buying weak and fatigued slaves, who had a higher risk of dying while crossing the Atlantic. Hence, what did Bosman and Leyden actually witness when they saw people enslaving themselves, where these people really fleeing because of climatically induced famines?

The dilemma is how to determine what led to decision to migrate. If migration is a result of an increased price of corn, caused by climatic stress, is the migratory reason economic or climatic? Olivia Dun and Francois Gemenne proposed a similar cyclical question. They concluded that within the problem of defining 'refugee' lays the problem of defining what made them refugees.[161] Arguments easily become cyclic when attempting to determine causality, but it accentuates the existence and meaning of adjustment responses. Functioning and effective adjustment responses should have delayed the decision to migrate. Migration would have been the last option and the consequence of climatic stress. Hence, are adjustment responses evidence of adaptation to climatic variations?

Anthropologists have been interested in human adaptation to environmental variability since the beginning of the 20th century. The human-induced climate change debate changed this, and many academic disciplines became interested in the subject during the 1990s.[162] Climatic adaptation has subsequently focused on adaptation options and on the costs and benefits of adaptation, which is why these are not relevant to this investigation.[163]

Climatic adaptation has been defined as all adjustments in behaviour or economic structures that reduce the vulnerability of a society to changes in the climate system.[164] Hence, climatic adaptation principally addresses with the issue of *who or what, needs to adapt to what phenomenon, and how does the adaptation occur*? This accentuates the need to

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[159] Stephen Castles and Mark J. Miller, *The Age of Migration: International Population Movements in the Modern World, 4th ed.* (New York, 2010), p. 144.

[160] See Sabine Henry et al., 'The Impact of Rainfall on the First Out-Migration: A Multi-Level Event-History Analysis in Burkina Faso', *Population and Environment* (vol. 25, no 5:2004).

[161] Olivia Dun and François Gemenne, 'Defining 'Environmental Migration', *Forced Migration Review* (no 31: October 2008), p. 10.

[162] Marco A. Jansen et al., 'Scholarly networks on resilience, vulnerability and adaptation within the human dimensions of global environmental change', *Global Environmental Change* (vol. 16, no 3:2006), p. 241.

[163] W. Neil Adger, Jouni Paavola, Saleemul Huq, 'Towards Justice in Adaptation to Climate Change', in W. Neil Adger Jouni Paavola, Saleemul Huq (eds.), *Fairness in Adaptation to Climate Change* (Cambridge, Massachusetts, 2006), p.1.

[164] J. B. Smith, 'Using a Decision Matrix to Assess Climate Change Adaptation', in J. B. Smith et al. (eds.), *Adapting to Climate Change: An International Perspective* (New York, 1996). pp. 68–79.

adapt to climatic variability on all levels, whether relating to individuals, groups, societies or activities. It refers to the process of adaptation, but also to the outcome or condition of adaptation. The adaptation process can therefore be passive, reactive, anticipatory, spontaneous, or planned.[165] Historical societies would mostly have been anticipatory in their behaviour and obtaining water and food, was the main concern in Africa. However, as already stated, most individual choices – to open or close the stores – were *ad hoc* decisions, even in cultures with subsistence farming.[166]

Conclusively, the lack of locally produced documents inhibits an extensive analysis of the preventive measures or adjustment responses in West Africa. Furthermore, the means or methods of adjusting to climatic variations are probably as varied as there are ethnic groups. There are great differences in habitats, life styles, water, land and herd management, or in the words of Henri Houérou:

> Strategies of adaptation to climatic variability and other hazards thus may be extremely different from one group to another, and therefore the impact of climate is necessarily quite variable according to the ecological conditions and the sociocultural adaptation strategies which are considered.[167]

The spatial coverage of this investigation, and the sources that are employed, do not facilitate an in-depth analysis on migration patterns and adaptation strategies further inland. The main dilemma is that Europeans wrote the sources that are employed, and they are spatially confined to the coastal region. The local population does not have its own voice on their behaviour or actions. This is why I consider the methodological and theoretic approach, presented above, to be an essential component of any climatic investigation that aims to reconstruct and analyse the climatic impact on 18th century West Africa.

1.3.2 Approaches that facilitate logbook research

The methodological approaches that determine the usage and reliability of the logbooks are different to those that apply to the governors' letters. The logbooks do not describe the inland climate or famine-like crises, and the profession is known. The logbooks should therefore be placed in their own environment and context. For instance, it was previously asserted that individuals affected by an event would generate more vivid descriptions than a chronicler. However, the logbooks contain only moderate and self-contained descriptions of the weather. Why is this?

It is the Royal Navy as an institution, its inner structure and hierarchy, which has resulted in the preservation of the logbooks.[168] The term institution can in this investigation also be employed to describe the internal rules and regulations that

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[165] Barry Smith et al., 'An Anatomy of Adaptation to Climate Change and Variability', *Climatic Change* (vol. 45, no 1:2000), p. 228.
[166] Mortimore, p. 108.
[167] Henri N. Le Houérou, 'Pastoralism', in R. W. Kates, J. H. Ausubel, and M. Berberian (eds.), *Climate Impact Assessment. Studies of the Interaction of Climate and Society* (Wiley, 1983), p. 159.
[168] Stephen Davies, *Empiricism and History* (Hampshire, 2003), p. 59.

governed the activity on board a Royal Navy vessel.[169] Approaching the logbook and the log-board as parts of a structured institution separates them from other types of historical document. This alleviates an analysis of the log-board.

The Royal Navy has evolved over several hundreds years; however the 18th century stands out in particular. The first Naval Academy was opened in 1733, officers received their uniform in 1748, and ship building technology evolved tremendously.[170] The officers responsible for keeping their logbooks represented a group and a profession, and, as a group, the officers acted and operated in a particular manner.[171] The officer core had a strong sense of collective identity that created a social role and behavioural norms.[172] This explains why the logbooks from the 1750s are almost identical to those from the 1790s. This facilitates attempts to determine their reliability, although it does not mean that logbooks are reliable. It does not exclude the fact that each individual had his own methods of making entries. The existence of an officer core and a collective identity do not mean that each individual was equally adept at observing and recording weather correctly. The reliability of an individual cannot be solely confirmed by reference to the groups which that individual belongs.

Investigating the log-board

The idea of studying an object and its purpose is anchored in an approach termed 'material culture'.[173] This approach focuses on objects as a mean to gain knowledge on past humans, ideas, and cultures.[174] The object itself reveals its purpose and function in each society, and it is assumed that there is a "(---) a strong interrelation between physical objects and human behaviour."[175] The preliminary focus is on the object within the culture or institution in which it was created and employed. It is a question concerning why artefacts matter or had a meaning.[176] Hence, the log-board is thus studied as an object that was employed in the institution known as the Royal Navy and the purpose of the object was to improve the manner in which navigational information was communicated and preserved.

The log-board analysis is an analysis of an era and the technical advancement of navigational equipment. In this sense, the log-board defines the idea of the Enlightenment, an era when progress was an important aspect of human beliefs.[177] In this historical context, the log-board transforms into an object with the purpose of improving and making navigational information understandable. The log-board helped the sailors to position themselves even though the longitude had not yet been discovered.

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169 Davies (2003), p. 60.

170 See for instance, Daniel A. Baugh, 'The eighteenth-century navy as a national institution 1690–1850', in J. R. Hill (ed.) *Oxfords illustrated history of the Royal Navy* (Oxford, 1995), pp. 120–160.

171 Tosh, p. 134.

172 Peter Burke, *History and Social Theory* (New York, 1992), pp. 47, 56.

173 Ian Hodder, 'The Interpretation of Documents and Material Culture', in Norman K. Denzin and Yvonna S. Lincoln (eds.), *Collecting and interpreting qualitative materials 2nd ed.* (London, 2003), pp. 155, 165.

174 Thomas J. Schlereth, 'Material Culture and Cultural Research', in Thomas J. Schlereth (ed.), *Material Culture. A Research Guide* (Lawrence, 1985), p. 7.

175 Hodder, p. 3.

176 Daniel Miller, 'Why some things matter', in Daniel Miller (ed.), *Material Cultures. Why some things matter* (London, 1998), pp. 10–11.

177 See for instance, Charles W. J. Withers, *Placing the Enlightenment: Thinking Geographically About the Age of Reason* (Chicago, 2008); See glossary in Davies (2003), p. 132.

There is one theoretical dilemma relating to the fact that the log-board and its content cannot be observed. There is always the possibility that words (rhetoric) are considered to represent reality if the object is analysed via contemporary documents, which is a dilemma that to some extent dominates my log-board analysis.[178] The contemporary literature is considered as evidence of the existence and usage of the log-board. The literature that is analysed had a purpose, and this is the most important aspect of the analysis: the purpose was to inform the readers on the log-board and its function.[179] Hence, the sources have to some extent been considered to represent reality. My premise is that the log-board cannot be disregarded, as it has been in previous research, due to the obvious uncertainties of studying a non-existent object. The log-board was an essential part of keeping a logbook, and its thorough analysis is therefore important. It is by understanding the purpose and employment of the log-board that the reliability of a logbook can be established and enhanced.

Finally, there is a fundamental dilemma relating to the analysis of the log-board that cannot be resolved. There is some ambiguity in the use of the terms *log*, *logbook*, *log-board* and *journal.* The dilemma is that the term *log* is employed as a homonym for a log (employed to measure speed), a log-board and a logbook. The textual analysis therefore has its own limitations because it is not always evident as to whether authors refer to the logbook or the log-board.

1.4 Previous research topics: the West African climate and logbooks

The aims of previous investigations have been to map the climate in specific regions or eras. The West African climate has been mapped from pre-historic times until the present, but logbook research has been more limited. Logbooks had not previously been employed in West Africa, and not as in this investigation, which is why I present the general development of logbook research. Understanding past climatic variations is a prerequisite for reliable projections of future climates.[180] The ongoing global climate change has raised the need to understand natural climate change and identify past climate types even further.[181] It is only by identifying climatic variations that it is possible to determine whether particular climatic characteristics appear in long-term perspectives, and if they comprise the fundamental features of a rainfall regime.[182] This has promoted and stimulated climatic research to develop tremendously in the recent decades.[183]

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[178] Carroll W. Pursell, Jr., 'The History of Technology and the Study of Material Culture', in Thomas J. Schlereth (ed.), *Material Culture. A Research Guide* (Lawrence, 1985), p. 113.

[179] Alexandra Georgakopoulou & Dionysis Goutsos, *Discourse Analysis. An Introduction* (Edinburgh, 2001), p. 14.

[180] Mike Hulme et al., 'African Climate Change: 1900–2100', *Climate Research* (vol. 17, no 2:2001), p. 146. Nicholson (2012a), p. 13.

[181] Mike Hulme, *Why We Disagree About Climate Change. Understanding Controversy, Inaction and Opportunity* (Cambridge, 2009). See for instance chapter two "The discovery of Climate Change", pp. 36–71.

[182] Sharon Nicholson, 'The nature of rainfall variability over Africa on time scales of decades to millennia', *Global and Planetary Change* (vol.26, no1–3:2000), p. 153.

[183] William F. Ruddiman, *Plows, Plagues & Petroleum. How Humans Took Control of Climate* (Princeton, 2007), p. 7.

1.4.1 Research on the historical climates of West Africa

Historical reconstructions of past climates in Europe have been diligently mapped due to the huge amount of recorded history. However, the historical climates of West Africa have not been as diligently mapped, which is mostly explained by the lack of readily attained data. In this section, I will only provide a short introduction to previous research. A detailed presentation of previous investigations is delivered in Chapter Two.

The need to know more concerning the historical climates of West Africa was prompted by the need to understand the droughts and famines in the Sahel. The first drought was registered in 1968, and this was followed by further droughts in the 1970s and 1980s.[184] The first to study this from an environmental perspective were the historians Stephen Baier and Paul E. Lovejoy. Their aim was to present and investigate societal consequences of Sahelian droughts from a political and economic perspective.[185] However, these investigations did not focus on the climate *per se*. The impact and extent of the droughts also generated a need to know if they were induced by human activity or if they were part of a cyclic phenomenon. However, it was not long before the meteorologist Sharon E. Nicholson asserted that climatic information was not readily available.[186] This hindered the reconstruction of reliable and exact climatic variations.

Most research relating to the historical climates of West Africa is found in Sharon Nicholson's unpublished doctoral thesis from 1976. This is still a comprehensive synthesis and compilation of the historical climates of Africa.[187] Based on her thesis, Nicholson subsequently published an article in 1979.[188] This still delivers the best perspective on the 18th century climate. The lack of readily available information most likely explains why West Africa has not been more diligently mapped. Six years after Nicholson's article the historian George E. Brooks presented a different climatic periodisation.[189] Some have considered their results as dichotomous, as Sharon Nicholson considered the 18th century as wetter than the previous period, while George Brooks suggested that it was drier. However, the results are merely relative interpretations of the climate based on vague evidence, which is why I think that the categorisations and dichotomy relate more to semantics than to climatic discrepancies. This is discussed further in Chapter Two. There has, since Brooks' compilation, been one attempt to create a climatic periodisation for parts of West Africa. This was by conducted by James Webb, who had a methodological approach similar to Brooks'. Both scholars based their reconstructions on human activities, while Nicholson employed a more general approach.[190] Nevertheless, the early works of Brooks and Nicholson lay out the grounds for this investigation, as these are the most influential and comprehensive investigations of the 18th century climate.

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[184] McCann (1999a), p. 261.

[185] See Paul E. Lovejoy and Stephen Baier, 'The Desert-Side Economy of the Central Sudan', *The International Journal of African Historical Studies* (vol. 8, no 4:1975) and Stephen Baier, 'Economic History and Development: Drought and the Sahellan Economies of Niger', *African Economic History* (no 1:1976).

[186] Nicholson (1979), pp. 32–33.

[187] Sharon Nicholson, *A Climatic Chronology for Africa: Synthesis of Geological, Historical, and Meteorological Information and data* (unpublished thesis, 1976).

[188] Nicholson (1979).

[189] George E. Brooks, *Western Africa to c/1860 A.D. A Provisional Historical Schema Based on Climate Periods* (Indiana University African Studies Program Working Papers Series, No. 1, Bloomington, 1985).

[190] Webb (1995).

Rainfall studies on Ghana are specialised and localised. The lack of comprehensive studies is perceptible. In particular, there is a lack of studies that focus on Cape Coast. Long-term rainfall data from Cape Coast are not easily obtained. The region is not agriculturally important which might explain why Cape Coast often is neglected.[191] Northern Ghana, for instance, is more often present in rainfall studies.[192] It has been difficult to obtain simple monthly interdecadal and interannual information that also registers the number of rainfall events, not only the amount of rainfall. I have obtained some data, but there are gaps in the records and they are not entirely coherent.

1.4.2 Previous logbook investigations

There is, to date, no climatic investigation that has employed logbook observations to study monthly rainfall patterns in West Africa in the 18th century, nor are there any studies that have focused on Royal Navy logbook weather descriptions from stationary ships in natural or man-made harbours in West Africa. The aim of this chapter is to present issues that have been addressed in previous logbook research. I focus on studies that have utilised Royal Navy and Hudson Bay Company (HBC) logbooks. Dennis Wheeler and Ricardo García-Herrera published a more comprehensive synthesis in 2008.[193] It is worth noting that previous logbook studies have not mentioned the log-board in their investigations.

H. H. Lamb was one of the front figures in historical climatology, and he was one of the first to employ and promote the investigation of logbooks. At the beginning of the 1980s, he claimed that a logbook "(---) is a vast treasure trove waiting to be used".[194] However, logbooks remained unutilised for a long time, which was why Rudolf Brázdil et al., almost two decades after Lamb's assertion, presented logbooks as a new and poorly exploited source.[195] P.D Jones and M. Salomon even claimed that logbooks prior to the 1850s have been "(---) neglected by the climatological community".[196]

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[191] This was also noted in Kwado Owusu and Peter Waylen, 'Trends in spatio-temporal variability in annual rainfall in Ghana (1951–2000)', *Weather* (vol. 64, no 5:2009), p. 115. See also Yaw Opoku-Ankomah and Ian Cordery, 'Atlantic Sea Surface Temperatures and Rainfall Variability in Ghana', *Journal of Climate* (vol. 7, no 4:1994), who used monthly rainfall data from 17 synoptic stations between 1926 and 1985, but Cape Coast was not included. P. K. Acheampong, 'Rainfall Anomaly Along the Coast of Ghana – Its Nature and Causes', *Geografiska Annaler* (vol. 64(A):1982), also excluded Cape Coast.

[192] See for instance Jeff Grischow and Holger Weiss, 'Colonial Famine Relief and Development Policies: Towards an Environmental History of Northern Ghana', *Global Environment* (vol. 4, no 7–8:2011); Dietz, Ton et al., 'Climate and Livelihood Change in North East Ghana', in A. J. Diets et al. (eds.), *The Impact of Climate Change on Drylands: With a focus on West-Africa* (New York, 2004), and E. Ofori-Sarpong, 'The Nature of rainfall and Soil Moisture in the North-eastern Part of Ghana during the 175–1977 drought' *Geografiska Annaler. Series A, Physical Geography* (vol. 67, no 3–4:1985).

[193] Dennis Wheeler and Ricardo García-Herrera, 'Ships Logbooks in Climatological Research', *Annals of the New York Academy of Science* (2008).

[194] Lamb (1982), p. 79. The statement is found on p. 89 in the second edition by Routledge; See also H. H. Lamb (1977), pp. 25–26.

[195] Brázdil et al. (2005), pp. 385–386.

[196] P. D, Jones and M. Salomon, 'Preliminary Reconstructions of the North Atlantic Oscillation and the Southern Oscillation Index from Measures of Wind Strength and Direction Taken During the Cliwoc Period', *Climatic Change* (vol. 73, no 1–2:2005), p. 132.

The lack of a digitised database might first have hampered the employment of logbooks to reconstruct past weather and climates. Michael Chenoweth considered the lack of a database a dilemma in 2000.[197] However, this changed after the EU-funded CLIWOC project ended in 2003.[198] The three year project resulted in a digitised database with logbook data from English, Spanish, Dutch, and French ships between 1750 and 1850. It was mainly wind force and wind direction from midday observations (the first entry) that were quantified and digitised.[199] The Royal Navy sub-day observations were problematic, and Clive Wilkinson later stated that "The CLIWOC UK research team found the abstraction of data from this type of logbook [masters] time consuming, therefore the benefit and usefulness of such refined data needs to be weighed against the additional time required to process it".[200] This statement might explain why many in the climatological community have neglected logbooks: they are laborious to employ, which I concur with. Dennis Wheeler even suggested that scientists do not employ logbooks due to a "(…) misplaced lack of confidence in non-instrumental, qualitative observations (…)".[201]

Nonetheless, an aim of CLIWOC was to translate the archaic 18th century vocabulary of wind terms into modern standardised terms. This resulted in the *Cliwoc Multilingual Meteorological Dictionary*, which facilitates a translation of the archaic terms into the modern Beaufort scale.[202] The first comprehensive results of the CLIWOC project were published in a special issue of the *Climatic Change* journal in 2005.[203] The CLIWOC database facilitated more complex and comprehensive investigations, which play a part in the bigger understanding on the historical climate, for example, a study that reconstructed the Atlantic Sea Level Pressure.[204] CLIWOC was then followed by the project *Recovery of Logbooks and International Marine data* (RECLAIM).[205]

Categorising previous logbook investigations

Logbook investigations have evolved through three main stages. Research has shifted from ice observations[206] (mainly in the 1980s) to small-scale naval battles [207](1980s and

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[197] Michael Chenoweth, *The 18th Century Climate of Jamaica. Derived from the Journals of Thomas Thistlewood, 1750–1785* (Philadelphia, 2003), pp. 3–4.

[198] CLIWOC is the acronym for the project "Climatological Database for the World's Oceans 1750–1850". *Climatic Change* (vol. 73, no 1–2: 2005) was a special issue for the CLIWOC project and results.

[199] R. García-Herrera et al, 'CLIWOC: A Climatological Database for the World's Oceans 1750–1854', *Climatic Change* (vol. 73, no 1–2:2005), p. 1.

[200] Wilkinson (2006), p. 9.

[201] Dennis Wheeler and Jose Suarez-Dominguez, 'Climatic reconstructions for the northeast Atlantic region AD 1685–1700: a new source of evidence from naval logbooks', *The Holocene* (vol. 16, no 1:2006), p. 39.

[202] Roberto Gustavo Herrera, *Cliwoc Multilingual Meteorological Dictionary. An English-Spanish-Dutch-French dictionary of wind force terms used by mariners from 1750 to 1850*: http://www.ucm.es/info/cliwoc/, (18.5.2010).

[203] *Climatic Change*, numbers 1–2: 2005.

[204] D. Gallego et al., 'Seasonal mean pressure reconstruction for the North Atlantic (1750–1850) based on early marine data', *Climate of the Past* (19–33:2005), p. 20.

[205] See for instance, Clive Wilkinson et al., 'Recovery of logbooks and international marine data: the RECLAIM project', *International Journal of Climatology* (vol. 31, no 7:2011).

[206] J. W. Catchpole and Marcia-Anne Faurer, 'Ships' Log-Books, Sea Ice and the Cold Summer of 1816 in Hudson Bay and Its Approaches', *Arctic* (vol. 38, no 2:1985), A. J. W. Catchpole, and Janet Halpin, 'Measuring summer sea ice severity in Eastern Hudson Bay 1751–1870´, *The Canadian Geographer* (vol. 31, no 3:1987), A. J. W. Catchpole and Irene Hanuta, 'Severe Summer Ice in Hudson Strait and Hudson Bay Following Major Volcanic Eruptions, 1751 to 1889 A.D., *Climatic Change* (vol. 14, no 1:1989).

1990s) to climatic research including land-based sources and information for comparison and reliability (2000s).[208] This categorisation is very coarse, but it facilitates a subdivision of previous research into three general categories: i) reliability and validity, ii) case studies and iii) general climatic studies. Reliability has been frequently investigated, as they are spatiotemporally confined to the era and region being studied.[209] It has been assumed that logbook inconsistency, when comparing daily entries from several logbooks, is caused by the lack of non-standardised and non-formalised wind and weather terms; inconsistency is not seen as the result of bad observations.[210] The aim to establish reliability and validity has been confined to two groups of questions: first, how reliable were the officers in their recordings, and how consistently did they describe the same weather event? Secondly, how consistently were the terms employed? Were the terms understood by all, and can they be compared to modern terms?[211] In 2010, after several investigations, it was boldly asserted that the orally spread weather and wind vocabulary was "(---) understood by all and used universally through the Service."[212]

Case studies have focused on particular events, such as weather anomalies or single historical event; for instance, naval battles. Logbooks have been employed to track the path of storms such as hurricanes.[213] In these investigations logbooks are employed, first to track a storm before it hits land and secondly, to assess the strength of the studied phenomenon. These investigations often include land-based data, when available. Studies on Naval battles focus solely on the progress of the weather during historical battles, such as the Bantry Bay incident in 1796 or the battle of Trafalgar in 1805.[214]

Finally, the third category – general climatic studies – focuses on reconstructing climate or climatic patterns. These investigations search for long-term changes or patterns of change in an attempt to better understand what creates the anomalies. These investigations are mostly studies on atmospheric circulation patterns. These investigations often cover large areas, although they are often limited to particular parts or routes, such as the English Channel, where the wind patterns is well known.[215] Sea ice studies are another type of climatic study based on HBC logbooks. There are only a small number of these studies, and most of them were conducted in the 1970s and 1980s. The

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207 Dennis Wheeler, 'The Weather at the Battle of Trafalgar', *Weather* (vol. 40, no 11:1985), Dennis, A. Wheeler, 'The Influence of the Weather during the Camperdown Campaign of 1797', *The Mariner's Mirror* (vol. 77, no 1:1991), Dennis Wheeler, 'A climatic reconstruction of the Battle of Quiberon Bay, 20 November 1759', *Weather* (vol. 50, no 7:1995), and Dennis Wheeler, 'The Destruction of the French Warship *Droits de l'Homme,* 14 January 1797: The climatic background to a famous event in English naval history', *Weather* (vol. 54, no 5:1999).

208 Dennis Wheeler, 'The Trafalgar storm 22–29 October 1805', *The Meteorological Magazine* (vol. 116, no 1380: 1987), Michael Chenoweth, 'Ships' Logbooks and "The Year Without a Summer"', *Bulletin of the American Meteorological Society*, (vol. 77, no 9:1996).

209 J. Oliver and J. A. Kington, 'The usefulness of Ships Logbooks in the Synoptic Analysis of Past Climates', *Weather* (vol. 25, no 12:1970), p. 522.

210 Dennis Wheeler, 'Sailing ships' logs as Weather Records: A test case', *Journal of Meteorology (UK)* (13:1988), p. 122.

211 Wheeler (2001), p. 364. See also Dennis Wheeler, 'An Examination of the Accuracy and Consistency of Ships' Logbook Weather Observations and Records', *Climatic Change* (vol. 73, no1–2:2005b), p. 97.

212 Dennis Wheeler et al., 'Atmospheric circulation and storminess derived from Royal Navy logbooks: 1685 to 1750, *Climatic Change* (vol. 101, no 1–2:2010), p. 263.

213 J. M. Vaquero et al., 'A Historical Analog of 2005 Hurricane Vince', *Bulletin of the American Meteorological Society* (vol. 89, no 2:2008).

214 Dennis Wheeler, 'The Bantry Bay incident, December 1796: An example of climatic influences in the age of sail', *Weather* (vol. 53, no 7:1998); Wheeler (2001).

215 See for instance, Wheeler (2010).

HBC logbooks received special attention as they were used in several, although different, investigations in the 1980s.[216] However, the ARCdoc project again focused on the investigation of logbooks in the arctic environment.[217]

Logbooks and precipitation

The aim of this study is to utilise logbooks to determine the number of monthly rainfall events and determine if they correlate with land-based sources. To date, there has been only one similar investigation conducted, which was by Dennis Wheeler in 2004.[218] I employ the same approach as Wheeler had applied in his investigation, although his focused on the rainfall events in Britain. Wheeler employed a lieutenant's logbook from the *Dunkirk* to reconstruct the monthly number of days with precipitation (hail, rain, and snow) from September 1678 to August 1679. The ship was moored at Spithead during winter months; however, it mostly cruised the English Channel in 1679. The lieutenant distinguished between the intensity and duration of rainfall events in his entries, although these entries were simply classified as "rain" in Wheeler's investigation.[219] The monthly number of days with precipitation was compared to a 30-year average (1961–1990) from Brighton. The investigation showed that the winter of 1678/9 was considerably wetter than the period between 1961 and 1990. There were 25 days of snow in 1678/9 compared the 30-year average of 13.9.[220]

Wheeler also compared the wind directions to previous investigations by H. H. Lamb and the results were consistent.[221] The conclusion was that "This single case study, although limited in time and geographic range, provides a detailed picture of daily weather over three centuries ago. In this narrow sense it reinforces and confirms what is already known of the Little Ice Age (---)".[222] However, whether a single case study is sufficient to confirm climatic conditions of the Little Ice Age (LIA), which lasted for nearly 300 years, is questionable.[223] Europe had some of its coldest winters in the last decades of the 17th century.[224] Furthermore, the period between 1675 and 1715 is also known as the Late Maunder Minimum (LMM), which delineates the coldest phase of the LIA, and wide swathes of Europe showed increased climatic variability.[225] Nevertheless, my purpose is to adopt the same approach as Dennis Wheeler and compare the number of monthly rainfall events to land-based data. The difference is that the logbooks employed in this investigation are from ships moored on the road, and not in port.

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[216] See for instance, A. J. W. Catchpole, and Janet Halpin (1987).

[217] ARCdoc homepage: http://arcdoc.wordpress.com/ (29.10.2012).

[218] Dennis Wheeler, 'Understanding seventeenth-century ships' logbooks: An exercise in historical climatology', *Journal for Maritime Research* (vol. 6, no1:2004), p. 24.

[219] Wheeler (2004), p. 26.

[220] Wheeler (2004), p. 31.

[221] H. H. Lamb, *Historic Storms of the North Sea, British Isles and Northwest Europe* (Cambridge 1991).

[222] Wheeler (2004), p. 33.

[223] Wheeler (2004), p. 34.

[224] Jürg Luterbacher et al., 'European Seasonal and Annual Temperature Variability, Trends, and Extremes Since 1500', *Science* (vol. 303, no 5563:2004), p. 1500.

[225] J. Luterbacher et al., 'The Late Maunder Minimum (1675–1715) – A key period for studying decadal scale climatic change in Europe', *Climatic Change* (vol. 49, no 4:2001), p. 441.

1.5 Outlining the chapters

Chapter Two contains a climatic overview of West Africa from a top-down perspective. It begins with a general overview of the West African climate, which is followed by an in-depth presentation of the rainfall regime in Ghana and Cape Coast Castle in particular. The first sub-chapters outline the climatic mechanism. The purpose is to demonstrate the dominant rainfall mechanism and climatic characteristics of the Guinea Coast, which includes a presentation of the El Niño Southern Oscillation (ENSO), and its affect on Guinea Coast rainfall variations. This is followed by a presentation of previous research with a particular focus on the historical climate of West Africa. The purpose is to provide a detailed presentation on the previous periodisations and some of the competing perspectives that have been presented.

Chapters Three and Four have a thematic structure as they deal with two different subjects, the climate and the weather. The internal structure of each chapter is chronological. I adopted this twofold approach in preference to including all data in one chapter. It is not only the temporal division that demands a thematic structure, but also the spatial. Chapter Three and Four address land-based sources and the logbooks respectively. The logbooks are included in the analysis at a later stage, after the climate has been reconstructed. This enables a comparison between the two locations and facilitates assessment on the reliability of the logbooks. Chapter Three concludes with a discussion on the climatic indicators that were employed to construct the climate. This is followed by an analysis of the possible ENSO impact. The results attained from the analysis in Chapter Three are then incorporated into Chapter Four.

In Chapter Five, I analyse the climatic impact on the transatlantic slave trade from Annamboe and Cape Coast Castle. This is conducted by combining slave trade data and the climatic anomalies derived from the governors' letters. The analysis assesses the impact of climatic aberrations rather than simply suggesting that a drier climate facilitated the slave trade. The last chapter comprises a presentation of the enslavement process in the 18th century. The purpose is to place the climatically induced slave trade in a spatiotemporal historical context. The final chapter also includes an analysis of whether ENSO induced droughts were a triggering factor for the slave trade.

2 The West African climate and its past

The purpose of this chapter is to present prior investigations on the West African climate. The chapter begins with a geographical presentation on West Africa and Ghana to define the general outline of the area that is termed West Africa. This is followed by an overview of the rainfall characteristics on the West African climate and, more importantly, Ghana.

It is, generally speaking, important to remember that prevalent climatic conditions in the 18th century might have been different to those of today. Those that are presented here might not apply to the 18th century; however, they act as a reference point for the climatic reconstruction.

My short synthesis of earlier investigations comprises a presentation on the methods, sources, and material employed in previous studies. The two main climatic periodisations are discussed separately after the brief introduction, and then compared prior to my reconstruction.

2.1 West Africa and Ghana

In this investigation, West Africa is defined as the region from Mauretania in the west to Chad in the east. Going south along the coast from Mauretania, West Africa stretches all the way to Nigeria in the south. Ghana is practically in the middle of this area (see Figure 2.1). This region is distinguished by similarities related to the climate, and vegetation, but also earlier investigations. This vast region, as large as or larger than the United States, has some of the most extreme climates regarding precipitation and high temperatures. In the south-western parts prevails a climate that is typical of tropical rainforests, which might receive over 4,000mm of rain annually. However, in the north, along the southern fringes of the Sahara Desert, the yearly precipitation falls below 200mm, which makes it an extremely rain dependent area.[1]

West Africa is generally referred to as part of the *tropics*. The term has no exact meaning, but is ascribed to the area between the Tropics of Cancer at 23.5˚ N and Capricorn at 23.5˚ S. The diurnal temperature range is larger than the annual range, which is why temperature is an important feature when defining the tropics. The temperature seldom drops below 18˚C and the mean annual temperature range, the difference between the mean hottest and coldest months, is less than 6˚C. However, the diurnal temperature range is much greater; while it is below 10˚C in the coastal regions, it can be over 20˚C in the Sahara. However, the mean annual temperature range shows that there are no actual seasons, as defined by temperature, in West Africa. Hence, the absence of a cold season or winter, as in the mid-latitudes, might be the best definition of the tropics.[2]

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[1] Brooks (2002), p.2; Buckle, p. 209; Mountjoy, Alan B. and Hilling, David, *Africa: Geography and Development* (London, 1988), p. 183.

[2] Glenn R. McGregor and Simon Nieuwolt, *Tropical Climatology 2:nd ed.* (Chichester,1998), pp.1–5; Andrew S. Goudie, 'Climate Past and Present', *The Physical Geography of Africa*, eds. William M. Adams, Andrew S. Goudie and Antony R. Orme (Oxford, 1996), p. 39; John F Griffiths, 'Africa: climate of' in John E. Oliver (ed.), *Encyclopedia of World Climatology* (Dordrecht, 2005), p. 7.

Figure 2.1 *Political map of West Africa.*

The most perspicuous seasons are the *rainy season*, when the majority of the annual precipitation occurs, and the *dry season*, which is predominantly dry with little expectancy of rain.[3] Hence, vegetational growth is restricted by temperature in only a few areas. It is mainly rainfall, in relation to evaporation, that is the differentiating factor for vegetational growth. However, the rainy season is known for its variability, which makes the tropics one of the most demanding environments for agricultural production.

Ghana

Ghana is located between latitude 5°N and 11°N, and longitude 1°E and 3°W. The country covers an area of 238,305km^2. Ghana's neighbouring countries are Burkina Faso in the north, Ivory Coast in the west and Togo in the east. Ghana has a length of 840km from north to south, which includes Lake Volta, the world's largest man-made lake. Lake Volta was built in the 21st century, which is why its effect on the local climate is not included in the analysis. Ghana connects to the Gulf of Guinea in the south and the coastal line is 541km long. It was the sheltered beach landing places along the so-called Elmina type coastline that provided sites for European forts such as Cape Coast Castle, in contrast to the so-called Dahomey type coastline that is found in the eastern parts of Ghana, which provided no natural shelter for ships.[4]

The Portuguese arrived at the southern coastal parts of West Africa in the late 15th century, and the coastal fringe of Ghana has been referred to as the Gold Coast for most of its history. The gold trade existed before the arrival of the Portuguese, but from a European perspective it was the Portuguese who 'discovered' the area and its resources. However, it was the British who dominated the historical development of the region. The

[3] J. O. Ayoade, *Introduction to Climatology for the Tropics* (Chichester, 1983), p. 188.
[4] Mountjoy and Hilling, p. 232.

Republic of Ghana was a British colony throughout the 19th century, after the abolishment of the slave trade, until it received independence in 1957.[5]

For a long time, gold was the main commodity exported from the region. However, human trafficking came to grow in importance, and the trans-Atlantic slave trade dominated the development of the area in the 18th century. There were nearly 60 European castles and forts along the coastline. Nevertheless, the mining industry and gold has, with other minerals such as diamonds, manganese, and bauxite, remained important for the country after the slave trade was abolished in the 19th century. The wetter south-western parts of Ghana is suited for perennial tree crops such as rubber, palm oil, coffee, cocoa, bananas, and citrus fruits; cotton and kola are important. Cocoa has become the main commodity of Ghana, which is now one of the largest cocoa exporters in the world.[6]

2.2 West African rainfall

Rainfall patterns and distributions have been intensely investigated due to their importance and impact on agricultural activity and availability of fresh water. The rain-fed agriculture that is practised largely depends on the extent of interannual rainfall variations. The duration and intensity of the rainy season largely determines agricultural production potential, which was noticeable during the rainy season in 2012 when the lack of rain affected cocoa crops in Ghana (see introduction).[7]

The field of climatology, which outdates much of the literature, is experiencing a paradigm shift, concerning our understanding on the rainfall mechanism of West Africa. Sharon E Nicholson has suggested that the classical definition of the Intertropical Convergence Zone (ITCZ) in West Africa is based on an out-dated model from the 1950s.[8] It has previously been assumed that the ITCZ dominates the rainfall mechanism of West Africa. However, the rain bearing mechanism that governs the area should be referred to as the 'tropical rain belt', and this should be distinguished from the ITCZ.[9]

The classical definition of the ITCZ depicts it as the West African rain bearer, and defines the zone where the two principal air masses, the north- and south-east trade winds, converge. The mean position of the ITCZ is slightly north of the equator in the boreal winter, but it migrates north as it follows the position of the sun in the spring, until it reaches its most northerly position in August when the sun passes the zenith at 15°N (see Figure 2.2). This is when the Sahel area receives its rain and the coastal regions experience a short dry season. The rains then follow the ITCZ as it migrates south in the autumn.[10]

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[5] Francis Agbodeka, *An Economic History of Ghana. From the Earliest Times* (Accra,1992), pp. 10–12, E. A. Boateng, *A Geography of Ghana* (Cambridge, 1960), pp. 3–11.

[6] Mountjoy and Hilling, pp. 238–245.

[7] Bloomberg, http://www.businessweek.com/news/2012-09-20/drought-in-ghana-s-cocoa-regions-curbs-farmers-outlook-for-crop (13.2.2013).

[8] Sharon E. Nicholson, 'A revised picture of the structure of the "monsoon" and land ITCZ over West Africa', *Climate Dynamics* (vol. 32, no 7–8:2009), pp. 1156–1157.

[9] Sharon E. Nicholson, 'The intensity, location and structure of the tropical rainbelt over west Africa as factors in interannual variability', *International Journal of Climatology* (vol. 28, no 13:2008), p. 1175.

[10] See for instance, Buckle, pp. 138–140; McGregor and Nieuwolt, pp. 242–243; Nicholson (2011), p. 73.

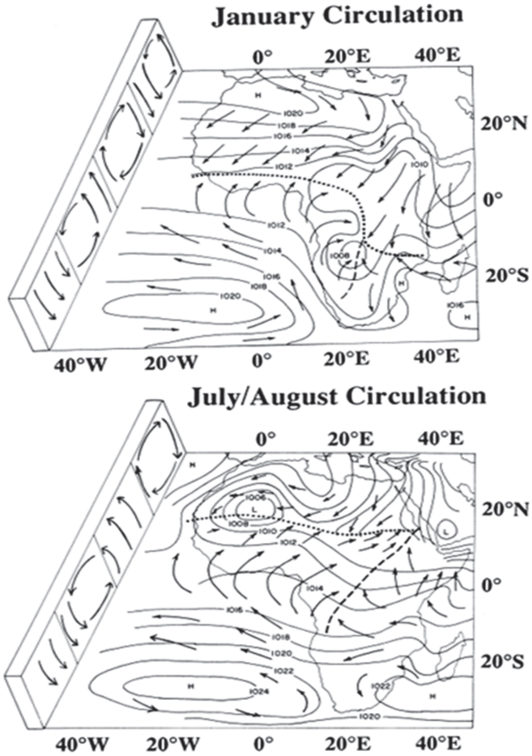

Figure 2.2 *Schematic of general wind patterns, pressure, and convergence zone over Africa in respective months. Arrows indicate wind currents, dotted lines indicate the position of the ITCZ, and dashed lines indicate other convergence zones. Source: Sharon Nicholson*[11]

When the ITCZ has reached its most southerly position in the boreal winter, and the south-easterly trades are weak, the North African high-pressure belt dominates over West Africa. When the winds strengthen they create a dry continental wind that sweeps across West Africa to the coast, the so-called *Harmattan* wind, which is characterised by low humidity and a dust haze that is created by fine sand carried on the wind. Humidity can fall below 10 percent, which parches human skin and cracks lips, and greatly reduces visibility. The dry winds also affect the temperature and prohibit the development of clouds. Daytime temperatures are high as there are no clouds to reduce the insolation; however, the reverse is the case at night as there are no clouds to trap the heat. The biggest difference to the wet season is low humidity, which widely affects both vegetation and people.[12]

The description above is the classical description of the ITCZ and its function; when the ITCZ arrives, so do the rains. However, the position of the ITCZ and location of maximum rainfall is inconsistent.[13] Nicholson has lately concluded that rainfall directly

[11] Nicholson (2000), p. 138.

[12] Buckle, pp. 85–86; R. J. Harrison Church, *West Africa. A study of the Environment and of man's use of it 8th edition* (London, 1980), p. 22.

[13] Nicholson (2008), p. 1775.

linked to the ITCZ generally affects the Southern Sahara and northern-most Sahel, and these areas alone, and only during abnormally wet years.[14]

In other words, it is not the ITCZ that governs rainfall variability; it is the position and intensity of the tropical rain belt. The causes for shifts in the position of the rain belt are addressed by Nicholson (2008) and fall beyond the purpose of this thesis. Nonetheless, the rainy season occurs as the rain belt crosses each region. This results in a bimodal rainy season along the coast and a single rainy season in the sub-tropical region.[15]

For my analysis I employ a model that is based on two basic rainfall patterns which largely describe rainfall variability in West Africa. The model distinguishes the regions below and above latitude 10˚N, henceforth referred to as the Sahel (north of 10˚N) and the Guinea Coast (south of 10˚N). The most common pattern is that of opposite rainfall anomalies in the two regions, also known as the 'dipole' perspective (see Figure 2.3). Either of these regions experiences below average rainfall when the other experience above average rainfall. The second rainfall pattern, the 'non-dipole' perspective, is characterised by the same anomalies throughout the regions.[16] Approximately 73 percent of the rainfall between 1920 and 1997 can be described by one of the four modes in figure 2.3, with occasions of the dipole perspective being recorded in 29 years.[17]

The dipole and non-dipole perspectives are also visible in Richard Wagner's and Arlindo Da Silva's study on rainfall in the Guinea Coast region. However, the dipole or non-dipole patterns between the Guinea Coast region and the Sahel are mostly only visible on an interannual scale, as the general long-term trend points to drier conditions between 1951 and 1989, which enhances the non-dipole perspective.[18]

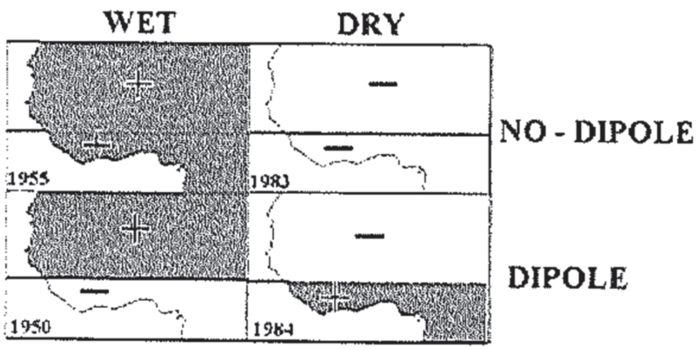

Figure 2.3 *Schematic of the most common rainfall anomaly patterns over West Africa. Light shading indicates below normal rainfall; dark shading indicates above normal rainfall. Source: Nicholson (2008)*[19]

[14] Nicholson (2009), p. 1156.
[15] Nicholson (2008), p. 1776.
[16] Nicholson (2008), pp. 1775, 1777.
[17] Nicholson (2008), p. 1777.
[18] Richard G. Wagner and Arlindo Da Silva, 'Surface Conditions Associated with Anomolous Rainfall in the Guinea Coastal Region', *International Journal of Climatology* (vol. 14, no. 2:1994), pp. 180–181, 183–184.
[19] Nicholson (2008), p. 1777.

Even though the sources only discuss the coastal regions, it is the existence of the two basic rainfall patterns that enables this investigation to deliver suggestions regarding the general characteristics of the climate of 18th century West Africa. In other words, years with abundant rainfall along the coast are also either shown as droughts or years with abundant rainfall in the Sahel. This is how the results of this investigation impact on larger perspective of West Africa.

2.2.1 Rainfall types and variability

Tropical West Africa receives most of it rains during the boreal summer and there are several types of precipitation system that have been recognised to cause rainfall during the summer monsoon season: these are mesoscale convective systems (MCSs), monsoon rains and thunderstorms or showers.[20] It has traditionally been considered that tropical convective rainfall is associated with small and isolated cumulus and cumulonimbus clouds; however, MCSs are now considered to produce most rainfall.[21]

There is no commonly accepted definition of monsoonal rains, as noted by Fink et al. who defined monsoonal rains as "(…) prolonged period of steady or intermittent, light to moderate rains (…)".[22] This is an important distinction as Peter Acheampong concluded that the Ghanaian Gold Coast receives most of it annual rains from the monsoon and local thunderstorms.[23] However, there are recorded rains also during the boreal winter in Ghana, which is predominantly dry, although these events are unusual. One of these events was registered in January 2004, when an infrared satellite noted deep moist convection from the Guinea coast that spread to the inlands, which resulted in heavy rains. This affected the harvest that was stored in the open, while it was beneficial to cattle nomads.[24]

The rainfall types that are described above do not produce a single linear type of rainfall that is evenly spread over the regions; they all differ in intensity and duration, and also in their spatiotemporal coverage. Rainfall intensity generally refers to the number of millimetres of rain received per hour. However, there are no measured values in this investigation, which is why 'intensity' merely refers to the intensity of the rains as described in the sources. It is worth noting that in West Africa the amount of rain does not correlate with the number of rainfall events. Hence, the number of rainfall events is not a good indicator of the amount of rain. A thunderstorm that lasts no longer than one hour might generate over 100mm of rain, while showers that last for several hours, or rainfall systems that generate a high number of rainfall events over a period of several days, might generate below 20mm of rain. Another temporal aspect is that of interannual rainfall variability, which expresses the extent to which the rain for a defined period differs from the long-term mean. The challenge with tropical West Africa is that interannual and interdecadal rainfall variability is large, meaning that the amount of rain

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[20] A. H. Fink, D. G. Vincent and V. Ermert, 'Rainfall Types in the West African Sudanian Zone during the Summer Monsoon 2002', *Monthly Weather Review* (vol. 134, no 8:2006), p. 2144.
[21] Nicholson (2011), p. 87.
[22] Fink et al. (2006), p. 2144.
[23] Acheampong, p. 210.
[24] Peter Knippertz and Andreas H. Fink, 'Dry-Season Precipitation in Tropical West Africa and Its Relation to Forcing from the Extratropics', *Monthly Weather Review* (vol. 136, no 9:2008), pp. 3579–3581.

shows great variations. However, it is not only the temporal aspect that shows high variation as, spatially, rainfall is also extremely erratic. Two adjoining areas might show great variations: one receiving heavy rainfall, while the other receives no rain whatsoever.[25]

This erratic behaviour is visible in the logbook analysis, especially when there are inconsistencies between two logbooks from different ships: one captain noting rainfall, while the other did not. I refer to these discrepancies as 'local' rainfall, although it depicts the erratic distribution of rainfall. The weather at the location of a ship, in relation to Cape Coast Castle, is also affected by daytime sea breezes, which are typical along the Ghanaian coast during the dry season. If the sea breeze converges with winds from different directions, which can occur at Cape Coast Castle, it might give rise to a sea breeze convergence zone, which causes precipitations onshore, that causes afternoon showers and occasionally also thunderstorms.[26] These events would not be registered in the logbooks as ships usually moored at least two miles off shore, and captains noted weather experienced at their ships' locations, not onshore.

2.2.2 Tornadoes

A *tornado* is a rainfall event that reoccurs from time to time in historical documents, although it is unclear how to interpret the event.[27] Tornado observations are indistinct and it is unclear what phenomenon the term implies, and whether or not this includes rain.

The term *tornado* is today mostly associated with dark and violent whirlwinds that sweep across the United States and destroy almost everything in their path. These violent whirlwinds can, in theory, appear anywhere in the world when the necessary conditions occur. The West Coast of Africa is not a typical location for these to appear. Nonetheless, the term *tornado* is often found in the *Diary of Transactions*, and also in some logbooks employed in this investigation. The number of tornadoes and their appearance by month in the diary are presented in Table 2.1. There is no clear continuity or consistency that reveals the actual meaning of the term, although an accurate definition is important as it affects the number of rainfall events.

The Oxford English Dictionary (OED) claims that the etymology of the term *tornado* suggests its predecessor was *ternado,* which is considered a bad version of the Spanish word *tronada*, meaning thunderstorm. Introducing the term *tornado* was an attempt to improve the original term *ternado*, and present it as a derivative of the Spanish word *tornar* (to turn) from which the turning tornado was derived.[28] The term *tornado* therefore indicates a particular type of thunderstorm that was given a specific meaning.

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[25] Buckle, pp. 188–196.

[26] Buckle, pp. 86–88; McGregor and Nieuwolt, pp. 112–113.

[27] The term "tornado" exists in many forms in the logbooks, but *tornadoes* or *travadoes* are only two variations of the same phenomenon.

[28] The Oxford English Dictionary, see tornado <http://www.oed.com/view/Entry/203575?redirectedFrom=tornado#eid>, 15.3.2012.

Table 2.1 *The frequency of tornadoes per month in the Diary of Transactions at Cape Coast Castle. The parentheses indicate the number of entries that were claimed to include rain.*

Tornadoes at Cape Coast Castle		
Month	**Frequency (1777)**	**Frequency (1778)**
October	1	
November	6 (1)	6 (3)
December	1 (1)	
January		1 (1)
February		2 (1)
March		3 (2)
April		5 (4)
∑	8 (2)	17(11)

The OED asserts that *tornado* was a term applied by 16th century *navigators* to describe *violent* thunderstorms – "with torrential rain, and often with sudden and violent gusts of wind" – in the tropical Atlantic.[29] Employing the term navigator is noteworthy as it does not automatically include naval officers. It is unclear how the OED demarcates the term *navigator* in the definition of a *tornado*, while a *navigator* is defined as "A person who navigates."[30] A more specific definition is "[a] sailor, *esp.* one skilled and experienced in navigations."[31] It is necessary to point out that the definition does not imply an experienced sailor but a navigator.

The distinction is that an experienced sailor had spent time at sea, while a navigator might have had little to no experience of sailing. The time at sea is an important indicator as the chances of correctly identifying an event depends on how frequently it has been observed or experienced. Furthermore, when it comes to navigators in the age of sail, it is evident that they were good in mathematics, although not necessarily experienced sailors. For instance, both John Robertson and Thomas Haselden were mathematicians and had written books on navigation. They knew how to navigate, at least theoretically, which is why they taught navigation to officers, but neither of them were experienced sailors.[32] Furthermore, the diary was kept at Cape Coast Castle, which was situated on land and the author is unknown. It is not known whether he had much experience of being at sea or not.

The etymology of the word *tornado* suggests that the term was employed to describe a phenomenon in the tropical Atlantic. However, combined thunder, lightning and rain are not a particular phenomenon in Africa. Furthermore, the definition in the OED is not confirmation that mariners understood the difference between a tornado-like thunderstorm and other types of thunderstorms.

The OED, however, also has a secondary definition of *tornado*, which implies that it can indicate a *very violent* storm *without* thunder.[33] This definition does not include rain,

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[29] Ibid.

[30] OED, see "navigator" <http://www.oed.com/view/Entry/125478?redirectedFrom=navigator#eid> (15.3.2012).

[31] Ibid.

[32] Lee, p. 413; Leslie Stephen and Sidney Lee (eds.), *Dictionary of National Biography. Vol. XXV* (London 1891), p. 106.

[33] OED online, see the second reference under "tornado" <http://www.oed.com/view/Entry/203575?redirectedFrom=tornado#eid> (15.3.2012).

although on some occasions this is included in the diary and also in many of the logbooks. Neither the diary nor the logbook descriptions provide any indication on how to interpret the meaning of the term *tornado* or Royal Navy officers' understanding of its meaning. The logbook descriptions might cover almost any weather condition including, for example, rain or no rain, and violent winds without thunder, if they are interpreted according to the OED's definition. This appears to make the term practically superfluous.

There is no clear definition of a *tornado* in 18th century literature. However, it is clear that the location is relevant in many descriptions. William Falconer defined the term tornado as:

> a violent squall or gust of wind rising suddenly from the shore, and afterwards veering round the compass like a hurricane. These are very frequent on the coasts of Guinea and South Barbary[34]

Falconer's definition does not mention the whirling wind, although *veer* can be employed to describe something that turns. Falconer's dictionary includes a definition of the term *waterspout*, which implies that actual whirlwinds were fairly well-known. Falconer's definition of a tornado was therefore not a description of how the term is understood today. Furthermore, in his definition of a waterspout, Falconer described a black, long, and lofty whirlwind that hit Rome in 1749.[35] This is a description of Rome being hit by a *tornado* as it is understood today. The blackness of the whirlwind originated from dust being sucked into the air. However, *Falcon*er did not employ the term *tornado* to describe the phenomenon in Rome. Instead, he suggested which it was a waterspout that had moved from sea to land.[36] Nonetheless, if mariners were familiar with waterspouts and the term *whirlwinds* existed, it implies that *tornado* was a thunderstorm. However, is it possible that tornadoes recorded in the logbooks implies something different to those in the diary, considering the discrepancy between weather onshore and off shore?

William Bosman was the Chief Factor for the Dutch Elmina, and he published a book recounting his time in West Africa during the late 17th century. He described how those in the castle sometimes were "attacked by violent Travadoes, or Storms of Thunder, Lightning and Wind".[37] This definition is very similar to the OED description of tornadoes as a violent type of thunderstorms (without rain). Nevertheless, this description does not explain nor how to identify and distinguish it from other thunderstorms.

Ludewig Ferdinand Rømer, who also stayed at Cape Coast Castle, described how tornadoes appeared when the winds came from the north-east. Black clouds arose on the horizon, "just the size of a hand", which were followed by violent rainfall accompanied by thunder and lightning.[38] Rømer explained that these storms scarcely lasted for an hour and, that European thunderstorms cannot be compared to those in West Africa.[39] The duration of the tornado indicates that this was a short-lived thunderstorm. However, the

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[34] William Falconer, *An Universal Dictionary of the Marine* (London, 1769). Unnumbered pages see the definition of the word *tornado* (unnumbered pages).

[35] Falconer, see the word *waterspout* (unnumbered pages).

[36] Falconer, see the word *waterspout* (unnumbered pages). Falconer says that the tornado which hit Rome can be traced back to Ostia.

[37] Bosman, p. 112.

[38] Ludewig Ferdinand Rømer, *A Reliable Account of the Coast of Guinea* (1760), p. 17. Translated and edited by Selena Axelrod Winsnes in 2000 and published by Oxford University Press, p. 18.

[39] Rømer, p. 18.

editor of Rømer's book implies that Rømer's tornado is the same as a *line squall*.[40] The editor refers to E. A. Boateng's book *A Geography of Ghana* where a line squall is described as:

> (---) a narrow belt of bad weather, characterized by a long line of low black cloud and a rapid rise in wind speed when the belt actually passes overhead. In addition to heavy rain there is plenty of thunder, lightning, and a rapid change in wind direction. Line squalls are not the same as tornadoes, and the latter term, which has a very special meaning, should never be employed for Ghana or any part of West Africa.[41]

Boateng might have found old documents such as Bosman's book, the Cape Coast Castle diary, or Royal Navy logbooks that mentioned tornadoes, which is why he chose to say that line squalls and (modern) tornadoes are not the same phenomenon. Boateng's statement is supported by for instance, R. J. Harrison Church, who clearly stated that a tornado is a line squall.[42] However, line squalls are not typical along the coastline, as can be seen in H. O. Walker's definition of a line squall:

> A belt of "bad" weather characterised by a long line of dark cloud and a rapid raise in wind speed. A line squall is almost invariably associated with thunder lightning, a rapid change of wind direction and heavy rain. In addition to their appearance as part of a line squall, thunderstorms may occur as isolated phenomena, particularly over the higher parts of the country and the inland areas which are subjected to the greatest afternoon temperatures. Local thunderstorms are rarest in drier south-east coastal areas and most frequent over the hilly areas of Ashanti.[43]

Walker's and Boateng's descriptions of a *line squall* are very similar to Rømer's description of a tornado. One common denominator is the heavy rainfall and blackness of the sky. Walker also describes the squall line as a belt of bad weather. This is similar to Rømer, who first described it as a cloud that could be covered by the hand, which sounds similar to that of a local thunderstorm, but then it grew to cover the entire horizon. However, Walker also stated that "rain from isolated thunderstorms and disturbance lines are usually associated with winds from between north-east and south-east".[44] Walker defines the winds as NE, which also Rømer did. This is an important observation, but it is worth noting that these descriptions are based on observations from land.

The American Meteorological Society (AMS) online glossary defines a squall line as "[a] line of active thunderstorms, either continuous or with brakes, including contiguous precipitation."[45] This implies that the storms are not continuous and, furthermore that the rains will not necessarily arrive at a particular location because they are contiguous. However, it is difficult to clearly distinguish between a local thunderstorm and a line

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[40] Rømer, see footnote 8 on p. 18.
[41] Boateng, p. 32.
[42] Harrison Church, p. 22.
[43] H. O. Walker, *Weather and Climate of Ghana. Departmental note no.5* (Ghana Meteorological Department, Accra, 1957), p. 15.
[44] Walker, p. 8.
[45] American Meteorological Society (AMS), Glossary of Meteorology: http://amsglossary.allenpress.com/glossary/search?id=squall-line1 (6.12.2011).

squall. Local thunderstorms can also provide intense rain over a very small area, outside of which there is no rainfall.[46]

Thomas Winterbottom, who was at Sierra Leone in the 18th century, claimed that tornadoes generally include rain. In other words, they do not always include rain. His description of a tornado was similar to Rømer's. Winterbottom wrote that "[a] dark cloud, not larger than "a man's hand," is first observed on the verge of the eastern horizon (---) until a great part of the heavens seems wrapped in the darkness of midnight*; (---)".[47] However, Winterbottom also differentiated between a tornado on land and one at sea. He claimed that a tornado was called a *white tornado* at sea, which occurred either with or without rain, and the wind was the first thing to be noted. Rain never fell after the wind, but a white tornado was, in general, more violent when accompanied by rain, this description did not include reference to thunder.[48] Furthermore, a white tornado is not found in any other sources, and he was thus most likely referring to a waterspout. Winterbottom also noted that tornadoes at Sierra Leone mostly occur in April, May, June, October, and November. There were no tornadoes in May and June at Cape Coast Castle (see Table 2.1). The difference is most likely due to the location in relation to the latitudes, with tornadoes appearing earlier in the year at Cape Coast Castle, due to the movement of the rain belt, or the ITCZ.

Conclusively, most modern authors have defined tornadoes as line squalls, but it is still unclear as to whether or not they include rain. A tornado cannot be categorised as indicating a line squall or a local thunderstorm in particular. The duration of the event helps to differentiate the two phenomena from each other. If the tornado is recorded as having lasted for an hour, then it was most likely a local thunderstorm. Line squalls usually last longer, which is why this is the only difference between the two phenomena.[49] However, I will employ the term tornado to avoid misleading interpretations. It remains uncertain as to whether or not a tornado included rain, which is why 'rain' has to be mentioned for inclusion in the rainfall event analysis.

2.2.3 Guinean coastal rainfall and ENSO

The mechanisms that determine rainfall variability over the Guinea Coast are very complex. Hanh Nguyen et al. recently concluded that the rainfall mechanism is not yet fully understood.[50] Nevertheless, coastal rains are predominantly governed by Sea Surface Temperature (SST) in the tropical Atlantic and coastal cold-tongue upwelling.[51] For instance, Yaw Opoku-Ankomah and Ian Cordery have established a positive correlation between SST's and monthly rainfall in Ghana, while Wagner and Da Silva concluded that

[46] McGregor and Nieuwolt, p. 145.
[47] Winterbottom, pp. 24–25.
[48] Winterbottom, p. 27.
[49] Buckle, pp. 145–146.
[50] Hanh Nguyen, Chris D. Thorncroft and Chidon Zhang, 'Guinean coastal rainfall of the West African Monsoon', *Quarterly Journal of The Royal Meteorological Society* (vol. 37, no 660:2011), pp. 1828, 1839.
[51] Guojun Gu and Robert. F. Adler, 'Seasonal evolution and variability associated with the West African Monsoon System', *Journal of Climate* (vol. 17, no 17:2004), p. 3373.

wet summers correspond with above normal SST's and dry summers to below average SST's.[52]

However, the main dilemma, relating to this investigation, is the high interannual variability that relates to the onset and duration of the springtime rainy season. In a study that investigated the onset of springtime rainfall between 1979 and 2009, the data showed that onset dates varied from April 6th to June 10th. In the same study, Hanh Nguyen et al. also concluded that the length of the rainy season varied between 3 and 14 pentads.[53]

The El Niño Southern Oscillation (ENSO) might also affect the onset, existence and duration of the rainy season, even though its influence on the Guinea Coast rainfall variation is uncertain. ENSO is a global climatic phenomenon that consists of a warm phase, i.e. El Niño (Spanish for "the boy"), and a cold phase, i.e. La Niña ("the girl"). The phenomenon is caused by above/below average cold or warm SSTs in the eastern tropical Pacific Ocean and air surface pressure variations in the western Pacific.[54] These anomalies remotely influence, via so-called teleconnections, the global climate.[55] However, the impacts are not linear; the intensity of an ENSO-event varies, as do the effects and impacts. ENSO is generally considered to generate many effects: for example, droughts in India, Indonesia and Australia; rainfall variability in northern Brazil; droughts and floods in Africa; thereby affecting the lives of millions of people across the world.[56] There are several approaches to describing El Niño and its characteristics, its onset, intensity and impacts. Some of the most common aspects of El Niño are listed in Table 2.2.

Studies on the impact of ENSO on West Africa have focused on climatic impacts after the mid 19th century, and mostly on the Sahel area. Neil Ward et al. concluded that ENSO is more associated with affects on rainfall in the Sahel than in the Guinea Coast region in

Table 2.2 *Common aspects and characteristics of El Niño.*

- Anomalous warming of surface water
- Warm south-ward flowing current of the coast of Peru
- Involves sea surface temperature increases in the eastern and central Pacific
- Appears off the coast of Ecuador and northern Peru (sometimes Chile)
- Linked to changes in pressure at sea level (the Southern Oscillation)
- Accompanies a slackening of westward-flowing equatorial trade winds
- Recurs, but not at regular intervals
- Returns around Christmas time
- Lasts between 12 and 18 months

Source: Glantz (2001)[57]

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[52] Opoku-Ankomah and Cordery, p. 557; Wagner, p. 185.
[53] Nguyen et al., p. 1839.
[54] For a complete introduction and all aspects of El Niño, see Allan J. Clarke, *Dynamics of El Niño & the Southern Oscillation* (Amsterdam, 2008).
[55] George Kiladis, 'La Niña teleconnections', *in* Michael Glantz (ed.), *La Niña and its impacts. Facts and speculations* (Tokyo, 2002), p. 44; Michael H. Glantz, *Currents of Change. Impacts of El Niño and La Niña on Climate and Society* (Cambridge, 2001), pp. 133–145.
[56] See for instance, Caviedes (2001); Grove (2000).
[57] Glantz (2001), p. 17.

the 20th century; however, there are no investigations on the effect of ENSO on the Guinea Coast region in the 18th century.[58] Nonetheless, the relationship between ENSO and West African rainfall has shown divergent results. For instance, C. F. Ropelewski and M. S. Halpert suggested that there were no large coherent areas of ENSO-related precipitation in the Sahel region after 1877, and Sharon Nicholson suggested that the 1997 El Niño did not have a strong influence on Sahel precipitation.[59] Conversely, Serge Janicot suggested that there was strong association between Sahel droughts and ENSO dynamics after 1970, while T. N. Palmer et al. suggested that ENSO events probably are associated with Sahelian droughts.[60] Another study suggested that ENSO effects upwelling in the eastern Atlantic.[61] This implies that El Niño might have an effect on the coastal climate in, for instance, Senegal.

I will assess the possible impact of ENSO on coastal rainfall along the Guinea Coast in the 18th century. The aim is to establish a correlation between rainfall variability and El Niño in the Guinea region. This is conducted by comparing the region's climatic chronology for the period from 1750 to 1798 to a corresponding El Niño chronology. The basis for this premise is the idea that ENSO might have acted in a different manner in the pre-industrial era, regardless of how presently it affects West Africa.[62] For instance, Robert J. Allan has suggested that ENSO has undergone changes in both mode and nature since the 1970s, which is why it is also plausible that its general characteristics were different in the 18th century.[63] There is an unbiased assumption in this analysis that ENSO, like most climatic elements, is dynamic and in constant change. However, this raises the dilemma of which chronology to employ for comparative purposes. There are only a few different El Niño chronologies available, and most claim to be more exact than their predecessors.

The first El Niño chronology was compiled by W. H. Quinn, who has then constructed several chronologies. Each chronology has been improved as new and better data have been included, which means that there have been some minor changes in the frequency of events and the most indistinct events have often been disregarded.[64] Quinn's chronologies have been criticised by Luc Ortlieb, who considered Quinn's chronology to be based on vague historical evidence. For instance, Ortlieb's chronology distinctly

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[58] M. Neil Ward, 'Diagnosis and Short-Lead Time Prediction of Summer Rainfall in Tropical North Africa at Interannual and Multidecadal Timescales', *Journal of Climate* (vol. 11, no 12:1998), pp. 3167–3191.

[59] C. F. Ropelewski and M. S. Halpert, 'Global and Regional Scale Precipitation Patterns Associated with the El Niño/Southern Oscillation', *Monthly Weather Review* (vol. 115, August:1987), p. 1617; S. E. Nicholson et al., 'An Analysis of Recent Rainfall Conditions in West Africa, Including the Rainy Season of the 1997 El Niño and the 1998 La Niña Years', *Journal of Climate* (vol. 13, no 14:2000), p. 2638.

[60] Serge Janicot, 'Sahel drought and ENSO dynamics', *Geophysical Research Letters* (vol. 23, no 5:1996), p. 515; T. N. Palmer et al., 'Modeling interannual variations of summer monsoons', *Journal of Climate* (vol. 5, May 1992).

[61] Claude Roy and Chris Reason, 'ENSO related modulation of coastal upwelling in the eastern Atlantic', *Progress in Oceanography* (vol. 49, no 1–4:2001).

[62] Joëlle L. Gergis and Anthony M. Fowler, 'A history of ENSO events since A.D: 1525: implications for future climatic change' *Climatic Change* (vol. 92, no3–4:2009), p. 343.

[63] Robert J. Allan, 'ENSO and Climatic Variability in the Past 150 Years', in Henry F. Diaz and Vera Markgraf (eds.), *El Niño and the Southern Oscillation. Multiscale Variability and Global and Regional Impacts* (Cambridge, 2000), p. 7.

[64] See for instance, W. H. Quinn and V. T. Neal, 'El Niño Occurrences Over the Past Four and a Half Centuries', *Journal of Geophysical Research* (vol. 92, no 13:1987); W. H. Quinn and V. T. Neal, 'The Historical Record of El Niño events', in Raymond S. Bradley and Philip D. Jones (eds.), *Climate Since A.D. 1500* (London 1992).

deviates from Quinn's chronology and the number of events is considerably lower.[65] Conclusively, Quinn's chronologies are the most debated, but also the most frequently utilised. I will employ the most recently adjusted version of Quinn's chronology, which was published by Joëlle L. Gergis and Anthony M. Fowler in 2009 (see Table 2.3).[66]

2.3 Ghanaian rainfall and rainfall variability

The southern parts of Ghana belong to a 'dry zone' that stretches from Sekondi into Benin, although the extent of this zone sometimes includes the entire Ghanaian coastline. However, this dry zone makes the eastern coastal fringe of Ghana the driest part of the country which, considering its equatorial location, is conspicuous. The rainfall generally varies between 700mm in the east and 1,200mm in the west.[67] However, Acheampong showed that the average between 1952 and 1970 was 932mm in Accra (east), 1,411mm in Takoradi (west), and 2,332mm in Axim (west of Cape Three Points), while the dry zone receives between 740mm and 890mm according to Owusu and Waylen (Zone B in Figure 2.5).[68] Nevertheless, the south-western parts of Ghana have the highest rainfall, and receive between 1,500mm and 2,000mm of rain annually. The northern parts of the country with predominant savanna grasslands are more dependent on rainfall than the more humid south-western parts that provide a good basis for different crops.[69]

Table 2.3 *El Niño events between 1750 and 1798.*

- 1754
- 1766
- 1768–1770
- 1777
- 1782–1784
- 1791–1794
- 1798

Source: Gergis and Fowler[70]

[65] See for Instance, Luc Ortlieb and José Macharé, 'Former El Niño events: records from western South America', *Global and Planetary Change* (vol.7, no 1–3:1993); Luc Ortlieb, 'The Documented Historical Record of El Niño Events in Peru: An Update of the Quinn Record (Sixteenth through Nineteenth Centuries)', in Henry F. Diaz and Vera Markgraf (eds.), *El Niño and the Southern Oscillation.Multiscale Variability and Global and Regional Impacts* (Cambridge, 2000).
[66] Joëlle L. Gergis and Anthony M. Fowler, 'A history of ENSO events since A.D. 1525: implications for future climatic change, *Climatic Change* (vol. 92, no 3–4:2009). The first ENSO chronology was published by P. Whetton and I. Rutherford, 'Historical ENSO teleconnections in the Eastern Hemisphere', *Climatic Change* (vol. 28, no 3:1994); see also P. Whetton and I. Rutherford, 'Historical ENSO teleconnections in the Eastern Hemisphere: comparisons with the latest El Niño series of Quinn', *Climatic Change* (vol. 32, no 1:1996).
[67] Buckle, p. 213; Nicholson (2011), p. 305. Buckle suggests that dry zone begins at Sekondi in Ghana, while Nicholson places its beginning at the Ivory Coast.
[68] Acheampong, see Table 2, p. 9.
[69] Mountjoy and Hilling, p. 233.
[70] Gergis and Fowler, see Table 9, p. 369.

The coastal region has two rainy seasons, and this distinguishes it from the northern parts of the country that have one rainy season. The first season runs from April to June, and the secondary season has an onset in September/October. The northern parts of the country with predominant savanna grasslands are more dependent on rainfall than the more humid south-western parts that provide a good basis for different crops.[71]

Ghana Meteorological Services Department (GMSD) has divided the country into four rainfall regions, or four types of rainfall according to their characteristics (see Figure 2.4). The first region (Type 1), north of a line running through Wa and Salaga, receives rain from March onwards, and has its maximum rainfall in August. Wa lays just above 10˚N, which is why it lays in the boundary area defined by the dipole or non-dipole rainfall patterns (see Figure 2.3). The second region (Type 2) is located south of the first region and has a southern border drawn through Kintampo and Hohoe. The rains are evenly distributed in this section, and they are received between March and October. There is no distinct maximum rainfall period. The third area (Type 3) is located below the second area, and has a southern boundary line drawn through Wiawso and Keta. Rainfall reaches its maximum in May or June, and then again in October. The division between spring and autumn indicates that the area has two separate rainfall seasons, during which the amount of rainfall is largely the same for each month. The third area is also characterised by months that are drier than normal. These are the winter months of December, January, and February, and July, August, and early September in the summer.
The areas that belong to the second and third categories also mark the most productive agricultural zones, excluding the eastern parts (see Figure 2.5). The fourth area (Type 4) and final rainfall type follows the coastal plain with the northern boarder being the line drawn from Wiawso and Keta. This includes the dry coastal zone, as previously noted. This area is dominated by two different rainfall patterns. The western part of this region has the greatest amount of rainfall in Ghana. The eastern part, conversely, is the driest area and thus has the lowest rainfall.[72] The rainfall map of Ghana is of less importance for this investigation, especially when compared to the agroecological map, which depicts the areas suitable for agricultural production (see Figure 2.5).

The agroecological map of Ghana shows the most important regions for agricultural production. For instance, the dry eastern parts in Zone B are not suitable for large-scale agricultural production, while Zones A and C are the most important areas for rain-fed crop production.[73] The importance of the south-western parts of Ghana is depicted even more closely in the Food and Agriculture Organization's (FAO) simulated land use map, which clearly shows how agricultural production is concentrated to the south-western parts of Ghana (see Figure 2.6).

The location of agriculturally important areas is an important aspect to consider when assessing the impact of large-scale famines in the 18th century. Zone A is situated north of Cape Coast Castle, and gives an indication of where crops that sustained the coastal population were derived from. I emphasise the fact that Europeans resided in coastal towns that were dependent on inland agricultural production. For instance, Ray

[71] Mountjoy and Hilling, p. 233.
[72] Ghana Meteorological Services Department's webpage: http://www.meteo.gov.gh/climatology.html (27.1.2009). For a similar description see also, E. A. Boateng, *A Geography of Ghana* (Cambridge, 1960), pp. 31–33; Walker, p. 6.
[73] Food and Agriculture Organization of United Nations, *Fertilizer Use by Crop in Ghana* (Rome, 2005), p. 4.

Figure 2.4 *Rainfall map of Ghana based on the subdivision of the GMS. Source: GMS*[74]

Ray Kea suggested famine and starvation would only have resulted from a bad harvest in the countryside, in other words, Zone A.[75] This is an important aspect of the climatic analysis, as it will be shown that there were years with famines, although coastal rains were reported as severe. This would appear contradictory if the coastal area had been an important crop-producing area.

Conclusively, Kwadwo Owusu and Peter Waylen's spatiotemporal study on rainfall in Ghana suggested that rainfall in general had diminished between 1950 and 2000. The largest decrease (20%) was found in the wetter south-western parts of Ghana.[76] This finding supported and geographically specified the pattern established by Richard G. Wagner, who had determined the correlation between the long-term trend of drier conditions in the Guinea Coast and the Sahel.[77] However, Owusu and Waylen showed that the greatest downward trend was in the agriculturally important area of the country.

[74] Ghana Meteorological Services Department's webpage, http://www.meteo.gov.gh/climatology.html (27.1.2009).
[75] Kea (1982), p. 43.
[76] Owusu and Waylen, pp. 119–120; Wagner, pp. 183–184.
[77] This was also noted by Elfatih A. B. Eltahir and Cuiling Gong, 'Dynamics of Wet and Dry Years in West Africa', *Journal of Climate* (vol. 9, no 5:1996), p. 1031.

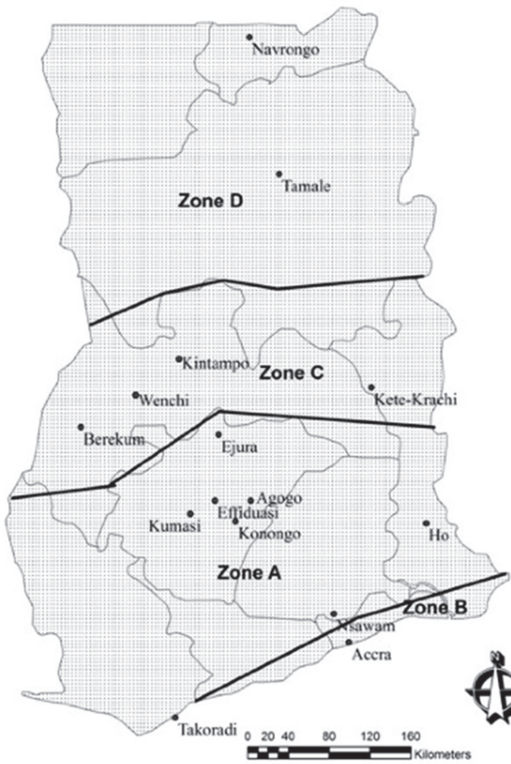

Figure 2.5 *The agroecological zones of Ghana. Source: Owusu and Waylen.*[78]

The authors concluded that "[s]uch changes [20%] are likely to have significant impact in the areas of rain-fed agriculture which is widely practiced in Ghana."[79] It is generally considered that rain-fed agriculture functions within small margins of annual rainfall variations, which makes agricultural activity both high risk and drought sensitive.[80] The question is, therefore, how would a similar trend have affected agricultural productivity in the 18th century, a period when the relation between the hydrological cycle and agricultural production was much more sensitive than in the 20th century?

Finally, it is worth noting that in some studies Cape Coast is included in the coastal dry zone, while in other investigations it lays closer to the wetter area of Takoradi. It is difficult to obtain rainfall data for Cape Coast, but as shown below, the long-term annual rainfall was marginally in excess of 900mm in the 20th century, which places it within the dry zone. This is presented more elaborately below.

[78] Owusu and Waylen, p. 116.
[79] Owusu and Waylen, p. 119.
[80] Ton Dietz and Els Veldhuizen, 'The Worlds Drylands: A Classification', *Environment and Policy* (vol. 39, 2004), p. 19.

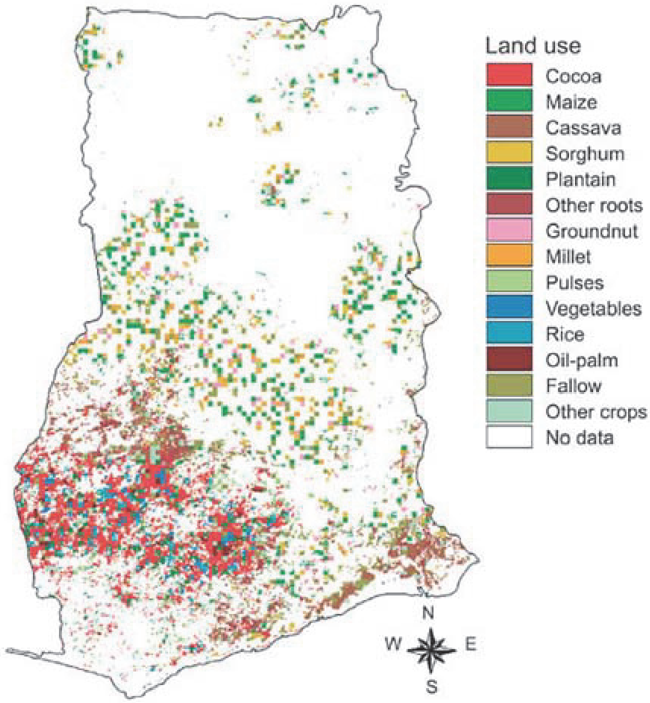

Figure 2.6 *Simulated land use map of Ghana in 2004. Cocoa and oil-palm are dominant crops in the wetter south-western parts of the country. Maize, millet, sorghum and groundnuts are more dominant in the drier parts. Source: FAO*[81]

2.4 Rainfall and rainfall variability at Cape Coast/Cape Coast Castle

The longest and most continuous data available for Cape Coast are found in the *Weather and climate of Ghana*, compiled by H. O. Walker for the Ghana Meteorological Department in 1957.[82] Although the compilation addresses most of Ghana, the period it covers is not mentioned. Table XVIII in the compilation contains the mean monthly rainfall and number of rain days per month for many Ghanaian cities. The column labelled 'years' probably refers to the number of years with collected data that were employed to establish the mean. The number of years varies from 19 to 70, and the data for Cape Coast are claimed to have been collected over 34 years. It is not mentioned, but it is probable that this covers the period from 1922 to 1956. [83]

[81] FAO: http://www.fao.org/docrep/008/y5749e/y5749e0e.htm (8.11.2012).
[82] H. O. Walker, *Weather and Climate of Ghana. Departmental note no.5*, (Ghana Meteorological Department, Accra, 1957).
[83] Walker, p. 25

Walker's long-term report is here compared to annual reports prepared by the Ghana Meteorological Service (GMS) between 1958 and 1970. However, the data for the latter period are incomplete, as the reports for 1959 and 1961 were not found, and 1966 was the only year with data for every month. For instance, the report covers only five months in 1969 (Feb-June-Oct-Nov-Dec), and the remainder of the months are left empty. This meant, according to the report, that there were no records, insufficient or unreliable records, or finally, that it was not applicable. However, there were 56 rainfall events in 1969, and Cape Coast received 984mm of rain.[84] Walker's report showed an average of 61 rainfall events for the entire year, totalling 923mm of rain, which means that the report from 1969 shows the ambiguity of employing the number of rainfall events as an indicator for the amount of rainfall.[85] This greatly affects the subdivision of dry and wet years.

The period between 1922 and 1956 was drier than the period between 1958 and 1970, when the average number of rainfall events per month exceeded Walker's 34-year average almost every month (see Figure 2.7).[86] The number of rainfall events, as already noted, is a misleading measurement. For instance, there were 18 days of rainfall days noted at Cape Coast in August 1966, but it rained only 23,88mm, which was only 0.25mm more than was recorded in Walker's report, with an average of two rainfall events.[87] However, it also rained more in the 1960s. The normal amount of rainfall at Cape Coast changed four times between Walker's report in 1957 and the GMS report in 1969. Walker's average was 923mm, which then fell to 916mm in 1958, only to rise to 932mm and 984mm in 1964 and 1969 respectively.[88]

The general trend at Cape Coast Castle for the 1960s is also visible in Nicholson's long-term mean of the Guinea Coast, where the 1960s stand out as a wetter decade with more annual extremes, although drier than the 1950s. However, Nicholson also shows that Cape Coast follows a drier general trend until the 1950s.[89]

Extremes and variability

There were several extremely wet years in between 1959 and 1970. For instance, the amount of rainfall in 1962 and 1968 was almost double the average.[90] It rained in excess of 914mm in June 1962, which was approximately the same as the recorded yearly average. The GMS asserted that this was the highest amount of rain since they began keeping records in 1915.[91] Many coastal cities also exceeded their average, almost exponentially during the heavy rains in 1968. In Ada, east of Accra in the dry zone, they received 20 times the normal amount of rain, which washed away culverts and bridges. The GMS noted that "entire transport and communication system was disrupted" and "whole

[84] Ghana Meteorological Service, *Annual Summery of Observations in Ghana 1969*, p. iv and 44, Ghana Meteorological Service, *Annual Summery of Observations in Ghana 1966*, p. 45.
[85] Walker, p. 25.
[86] This data is derived from a report prepared by the Ghana Meteorological Service between 1958 and 1970. The report for 1959 and 1961 was not found. The report is entitled, for example in 1958, Ghana Meteorological Service, *Annual Observations in Ghana 1958* (Accra).
[87] Ghana Meteorological Service, *Annual Summery of Observations in Ghana 1966*, p. 45, Walker, p. 25.
[88] This category is found in all the reports. See A*nnual Summery of Observations in Ghana* between 1958 and 1970.
[89] Nicholson et al. (2012a), see Figure 8, p. 21.
[90] Ghana Meteorological Service, *Annual Summery of Observations in Ghana 1962*, p. 37 and Ghana Meteorological Service, *Annual Summery of Observations in Ghana 1968*, p. 44.
[91] Ghana Meteorological Service, *Annual Summery of Observations in Ghana 1962*, unnumbered page, see "Introduction".

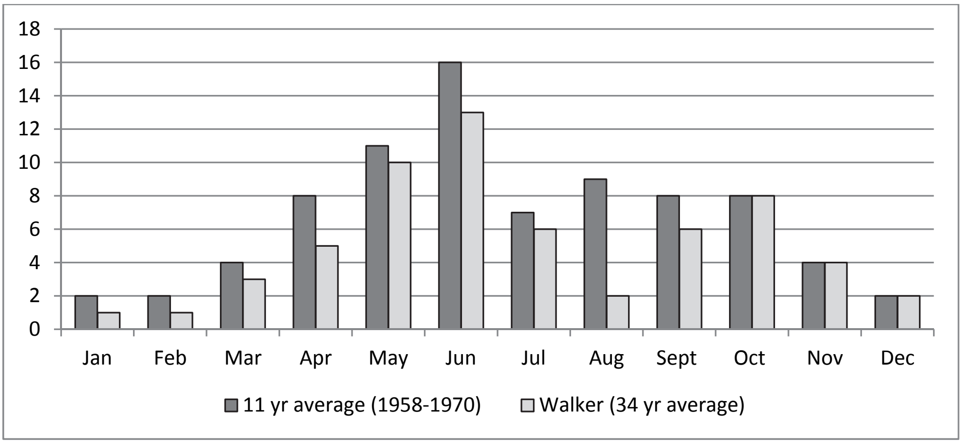

Figure 2.7 *Number of rainfall days per month at Cape Coast. A comparison between Walker's 34 year monthly mean and GMS's reports between 1958 and 1970. Source: GMS and Walker*[92]

villages were wiped out".[93] The little dry season during the boreal summer was also washed away in 1968. There was only one prolonged rainy season in 1968, when it rained it rained heavily from April to October at Cape Coast Castle.[94]

The 1960s was generally a wetter period in general in the equatorial regions, also in East Africa. This was almost the reverse of the conditions in the 1950s.[95] K. Owusu and P. Waylen, as mentioned above, showed that Sahel and parts of Ghana had diminished rainfall between 1950 and 2000, but R. G. Wagner also showed that the correlation was not as exact on an annual time-scale. This is confirmed by the GMS reports, as the Sahel experienced fairly normal weather with small rainfall anomalies in the 1960s, until the drought in 1968.[96] This is the opposite the Cape Coast, which had heavy rains in the 1960s. Most of the coastal regions of the Guinea Coast were wetter in the 1950s and 1960s, when comparing the 20th century.[97] In the Sahel, the 1950s were slightly wetter than the 1960s; however, it became increasingly drier after 1968.[98] Nevertheless, the purpose of this discussion was to demonstrate the function of the dipole and non-dipole perspective shown in Figure 2.3.

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[92] Ghana Meteorological Service, *Annual Summery of Observations in Ghana 1958–1970;* Walker, p. 25.

[93] Ghana Meteorological Service, *Annual Summery of Observations in Ghana 1968*, unnumbered page, see "Introduction".

[94] Ghana Meteorological Service, *Annual Summery of Observations in Ghana 1968*, unnumbered page, see "Introduction" and p. 44.

[95] Sharon E. Nicholson and Xungang Yin, 'Rainfall Conditions in Equatorial East Africa during the Nineteenth century as Inferred from the Record of Lake Victoria', *Climatic Change* (vol. 48, no 2–3:2001), p. 396. Nicholson (2001a), p. 128.

[96] Peter J. Lamb, 'Rainfall in Subsaharan West Africa during 1941–83', *Zeitschrift für Gletsscherkunde und Glaziealgeologie* (Band 21:1985), p. 133, Figure 1; Luc Le Barbé et al., 'Rainfall Variability in West Africa during the Years 1950–90', *Journal of Climate* (vol. 15, no2:2002), pp. 187–202, p. 187, see also Fig. 1, p. 188.

[97] J. E. Paturel, et al.,' Climatic variability in humid Africa along the Gulf of Guinea Part II: an integrated regional approach', *Journal of Hydrology* (vol. 191, no 1–4:1997), p. 34.

[98] P. J. Lamb, p. 188.

H. O. Walker was not ignorant of the great interannual variations regarding the onset and duration of the rainy season. Walker exemplified with Ho that the onset of the subsidiary rainy season varied between the first week in August and third week of September over a period of eight years, while the length of the rainy season varied from six to twelve weeks.[99] The difference between the two extremes is great. For example, the rainy season might have started in early August and lasted until the end of October (12 weeks), or it might have commenced in late September and lasted to mid November (6 weeks). Walker portrayed the same variability that was established by Hanh Nguyen et al., who concluded that the onset of the West African monsoon along the coast varied between the 6th of April and 10th of June.[100] Variation in the onset of the rainy season generates a challenge to the aim of reconstructing the climate; however, annual extremes, such as those in 1968 should be fairly easy to establish with sufficient data.

2.5 The historical climate of West Africa

The historical climate of the Guinea region and the Gold Coast has previously not been scrutinised in the same manner as in this investigation, especially not the 18th century climate. However, there are two investigations that have dealt with the West African climate in general. The most intriguing aspect of this is that the investigations are distinguished by two different results or climatic modes: one labelled the 18th century climate as drier, and the other as wetter than previous or succeeding periods. Nevertheless, I will present the general character of these investigations before presenting them more elaborately below. In presenting the earlier reconstructions, I will focus on the climate in West Africa from around the turn of the millennium until the mid 19th century. I will include other perspectives and new data from other case studies to generate a better and more comprehensive perspective. These sources are mostly included in the section that deals with Nicholson's periodisation, especially as Brooks' periodisation employed a different method in his reconstruction.

The only investigation that in particular refers to the Guinea Coast climate in the 18th century is found in Sharon E. Nicholson's unpublished thesis from 1976 and her article, based on her thesis, from 1979. However, the Guinea Coast was not the focus, mostly due to the nature of her investigation. The purpose of Nicholson's thesis was to position the African climate within a global scheme, and to locate climatic aberrations. Nicholson commenced with the climate in the late Pleistocene (35,000 BP) and worked through to the 20th century, which is why the 18th century formed only a small part of the thesis. This long-term perspective on the climate has been present also in later studies; however, the Guinea Coast climate in the 18th century has not been addressed in particular. Nicholson's thesis is a climatic synthesis based on previous research, including new interpretations and new data, but it is an impressive compilation.[101] Even H. H. Lamb, in his classical work *Climate: Present, past and future* (published one year after Nicholson's thesis)

[99] Walker, p. 6.
[100] Nguyen et al. p. 1839.
[101] Nicholson (1976), p. 1.

expressed his gratitude for Nicholson's synthesis, which shows the impact of her thesis.[102] Nevertheless, I will highlight the part of her investigation that focused on West Africa. Nicholson follows the vegetation zonation of West Africa (see Figure 2.8), which includes the Guinea Coast as a specific geographic region.

The only investigation that comes close to creating a climatic periodisation similar to Nicholson's was compiled by George E. Brooks in 1986. Brooks also had a long-term perspective, and his climatic periodisation described several climatic periods beginning in 9000 BC until the last quarter of the 19th century. However, his approach to West Africa was different to Nicholson's. Brooks defined West Africa as the area west of the inland delta of the Niger River and Bandama River, which excludes the eastern parts of the Guinea region.[103] Brooks' employment of ecozones locates the Guinea Coast in the Savanna woodland area (see Figure 2.9).

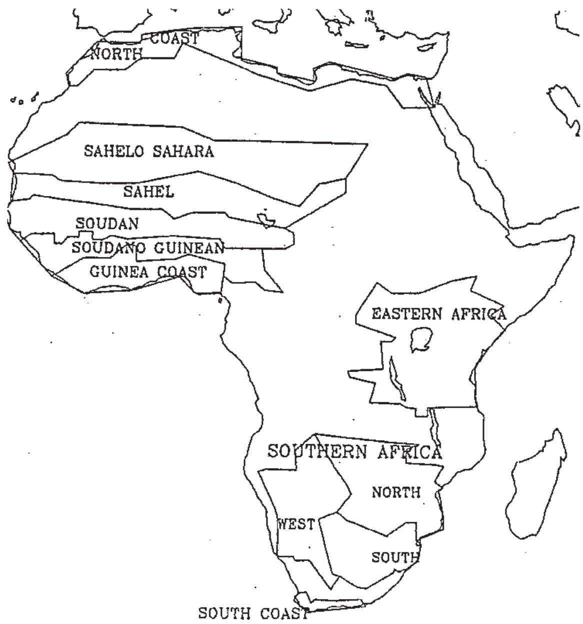

Figure 2.8 *Geographical regions and subdivision of West Africa according to the vegetation zonation as employed by Sharon E. Nicholson. Source: Nicholson (2001)*[104]

[102] Lamb (1977), p. 469. Lamb writes: "I am greatly indebted to Sharon Nicholson for the supply of this recently gathered information".
[103] Brooks (1986), p. 43.
[104] Sharon E. Nicholson, 'Climatic and environmental change in Africa during the last two centuries' *Climatic Research* (vol. 17, no 2:2001b), see Figure 5, p. 128. Similar map is depicted in Nicholson (2011), p. 304, Fig.16.18.

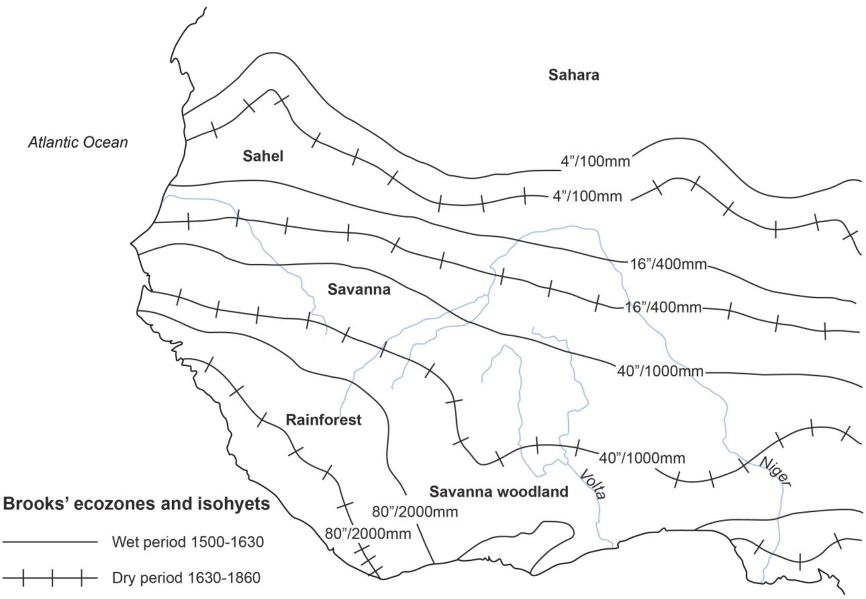

Figure 2.9 *West Africa as George E. Brooks has referred to it in his climatic periodisation. The map depicts the ecozones and placement of respective isohyets during the wet period between 1500 and 1630, and the dry period between 1630 and 1860. Source: George E. Brooks*[105]

Brooks' methodological approach is different to Nicholson's, mainly because Brooks focused on the interaction and effect of rainfall variability on historical development. This provided interdecadal and interannual rainfall variation a determining role in the explanation of historical development in West Africa.

2.5.1 Sharon Nicholson's climatic periodisation

The West African climate went through a wetter period from approximately the 8th to the 14th century. There are not much historical data from this period, but the caravan trade in Mauretania seemed to have flourished as it was possible to cross the El Djouf desert. This would not have been possible if it had been drier, and crossing the desert is nowadays prohibited by the arid environment. Sources from Senegal and Niger also indicate that the regions south of the Sahara enjoyed increased rainfall. A study on Lake Bosumtwi, situated south-east of Kumasi in Ghana, implied that the Guinea Coast was in a wetter phase until the 13th or 14th century.[106] Nicholson had employed an earlier investigation by M. Talbot and G. Delibrias, but this is also supported by more recent investigations conducted by Tim Shanahan et al. The most recent studies show that Bosumtwi

[105] Brooks (2003), p. 3 see map 2.1.

[106] Nicholson (1979), pp. 39–42; M. Talbot and G. Delibrias, 'Holocene variations in the level of Lake Bosumtwi, Ghana', *Nature* (268:1977), p. 723.

underwent progressive desiccation from the 15th century to the mid 18th century.[107] Lake level variations in Lake Bosumtwi – the data were obtained by measuring oxygen isotopes in laminated sediments in a lake core sample – also seem to correlate with rainfall variations in the Sahel. This was, at least, the case during the Sahel droughts in the 1960s and 1970s.[108] Lake level variations appear to follow the long-term trend between the Sahel and Guinea Coast in general, as noted by Wagner and Da Silva, and also Owusu and Waylen (see Chapter 2.2). However, it is worth noting the correlation between Sahel and Guinea Coast was absent on an interannual mode, if taking the dipole/non-dipole perspective into consideration.[109] Nevertheless, West Africa experienced wetter conditions until the 13th or 14th century. This was followed by drier conditions in the 14th century, which also shows correlation with Lake Bosumtwi that underwent progressive desiccation until the mid 18th century.[110]

It is worth noting that this drier period commenced at the same time that Europe entered a period identified as the Little Ice Age (LIA). The LIA is a controversial term as it was not a uniformly cold period, and its onset has been placed around or prior to the beginning of the 15th century, or the mid 16th century, when the European climate was strongly impacted and there were enhanced glacial conditions.[111] Shanahan et al. considered the drying out of Bosumtwi as evidence of a LIA drought.[112] However, it is evident that this is highly dependent on the timeframe. The connection between climatic shifts in Africa and Europe has been touched upon by many. A. T. Grove suggested that shifts in atmospheric circulation might have led to similar changes in Africa and Europe, but he also claimed that there are no correlations between Europe and the African droughts in 20th century.[113] Conversely, D. J. Schove asserted that changes in the Sahel "(---) seems to have been in sympathy" with the changes in Europe in the 16th century.[114] Be as it may, the change from a wet to a drier environment in the 14th century was only "a best guess" according to Nicholson.[115]

The drier period that commenced in the 14th century continued throughout the 15th century. The dry era was then followed by the much wetter 16th century. The amount of climatic data increases after the 16th century, which thereafter enables a more reliable climatic reconstruction. Precipitation increased primarily in the Soudano Guinean zone, but also in the Soudan and the Sahel (see Figure 2.8), and the margins of the Sahara desert

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[107] T. M. Shanahan et al., 'Atlantic Forcing of Persistent Drought in West Africa', *Science* (vol. 324, April:2009), p. 378.
[108] Shanahan et al., p. 377.
[109] Wagner and Da Silva, pp. 180–181, 183–184; Owusu and Waylen, p. 117.
[110] Shanahan et al., p. 378.
[111] Jean M. Grove, 'The Onset of the Little Ice Age', in P. D. Jones, A. E. J. Ogilvie, T. D. Davies and K. R. Briffa (eds.), *History and Climate* (New York, 2001), p. 178; Behringer (1999) has an overview of some of the different perspectives and periodisations. See also, Jean M. Grove, *Little Ice Ages. Ancient and Modern volume 1, 2nd ed.* (London, 2003), p. 3; Michael E. Mann, 'Little Ice Age' in Michael C. MacCracken and John S. Perry (eds.), *Encyclopedia of Global Environment Change vol. 1* (Chichester, 2002), p.1; Brian Fagan, *The Little Ice Age. How Climate made History 1300–1850* (New York, 2000), pp. 47–59.
[112] Shanahan et al., p. 378.
[113] A. T. Grove, 'The environmental setting' in A. T. Grove (ed.), *The Niger and its Neighbours. Environmental history and hydrobiology, human use and health hazards of the major West African rivers* (Rotterdam, 1985), p. 17.
[114] D. J. Schove, 'African Droughts and the Spectrum of time', *African Environment. Special Report* (no 6:1977), p. 41. Schove's found 'sympathy' rested on vague evidence, and his conclusions were highly speculative, even incorrect. His referred to a correlation between tree rings in North America, and a rise of the water level in Lake Chad, which he linked to his own deductions that LIA commenced in 1590.
[115] Nicholson (1979), pp. 39–42.

were wetter until the beginning of the 18th century. The situation was quite different along the Guinean coast. Nicholson suggested that the Guinea Coast was drier in the 17th and 18th centuries than in the 20th century. She concluded that the rain fell earlier in the year, that the summer was drier, and that the rains, in general, fell less frequently and in less quantity.[116]

Some sources employed by Nicholson to reconstruct the Guinea Coast climate were temporally highly interspersed and, to simply demonstrate the extent of this, and the dilemma which arises in this investigation, she referred to six sources, of which three are presented here. One of the sources was Willem Bosman's description of the Guinea Coast, written at the end of the 17th century, which was employed together with John Matthews and Thomas Winterbottom's description of Sierra Leone almost 100 years later. There was a great temporal and spatial distance between these men, and it seems highly unlikely that they would have described the same climatic conditions. For instance, Bosman claimed that:

> But the season alters so much from Year to Year that we have in a manner left off reckoning them; the Summer comes sometimes a whole Month earlier one Year than another, and the same is also observed of the Mist and Rain. In short they come so consused [sic] and uncertain, that it is impossible to make any Calculation of them. Formerly, when I first came to the Coast summer and Winter succeeded alternately, exactly at a certain time, and the latter was much severer than at present. The Rains were so violent, continuing for several Days successively as if the Country were to be drowned, and we expected a second Deluge; but at present are not either so violent nor so frequent.[117]

It is evident that Bosman considered himself to have experienced a change in the seasonality. Winter and summer had previously changed at given intervals, but Bosman claimed that the rains had changed character, and they had become less intense and less frequent. Bosman's reflection implies that the rainfall pattern had become more erratic, and that it was generally drier than it previously had been. Bosman had spent more than a decade on the coast; he had arrived at the age of 16 in 1688, and left when he was 29 years old.[118] However, his temporal reflection is ambiguous, and it is fair to question his boyish memory and his first memories of the coast, if that was his timeframe. Nonetheless, Bosman's description includes a general change from wetter to drier conditions, and also greater interannual variations at the end of the 17th century.

John Matthews was not at the Gold Coast like Bosman. Matthews was further north, and he described the weather at Cape St. Ann and River Rionoonas in Sierra Leone in 1785 and 1786.[119] This was almost 100 years after Bosman. Matthews claimed that the rainy season had been more severe and longer than was generally the case.[120] The first three days of May produced heavy rains, but the rest of the month was clear. There was some rain at the beginning of June, but from the 13th onwards it rained continuously, and this continued throughout July, only to end in September. There were frequent showers

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[116] Nicholson (1979), pp. 42–47.
[117] Bosman, p. 111.
[118] Albert Van Dantzig, 'Willem Bosman's "New and Accurate Description of the Coast of Guinea": How Accurate Is It?', *History in Africa* (vol. 1:1974), p. 102.
[119] Latitudes between 7° north and 10° north respectively, roughly Berekum and Kintampo in inland Ghana.
[120] John Matthews, *A Voyage to The River Sierra-Leone and the Coast of Africa* (London, 1788), p. 35

and a tornado every day from September 18th onwards, and there were some tornadoes in November. The last tornado on the 29th was, according to Matthews, uncommonly late. Matthews made no comparisons with previous years; however, his notes indicate that it rained more than was usual. In December the Harmattan continued for eight days between the 10th and 18th.[121]

Thomas Winterbottom was in Sierra Leone a decade after Matthews and the weather appeared to have become significantly wetter. It rained for 11 days in May, 25 days in June, and 30 days in July 1793. The Harmattan wind was felt only for a "few times and for a few hours each" between 1792 and 1795.[122] However, the Harmattan lay as a blanket over Sierra Leone by the end of 1795 and it lasted for 10 consecutive days.[123]

The general conclusion drawn from these sources was that the coastal climate had become drier at the end of the 17th century; however, it was entering a wetter phase at the end of the 18th century. The Sahel climate was at the same time wetter, which supports the dichotomy between the sub-Saharan and coastal climate.[124]

Historical records and oral traditions from Lake Bosumtwi support the development of the Sahel climate, but Nicholson also indicates that Lake Bosumtwi followed the rainfall pattern of the Guinea Savanna area.[125] Oral traditions show that the lake's level was very low from 300 to 200 years ago (mid 17th century to mid 18th century); however, the most recent investigations showed that Bosumtwi was lower into the mid 19th century.[126]

The investigation from Bosumtwi was completed after Nicholson's synthesis, which is why it is not found in the bibliography of her thesis from 1976, but the investigation from Bosumtwi was mentioned in Nicholson's article from 1979. Nonetheless, the desiccation of the lake and its synchronicity with the Sahel is not mentioned in Nicholson's article. The dry period serves as evidence of a drier period along the Guinea Coast between the 16th and 19th centuries.[127]

Droughts and famines in the 18th century

There were several droughts and famines registered in 18th century West Africa. The most important places, peoples, settlements, and regions discussed in the following chapters are shown in Figure 2.10.

P. D. Curtin had registered droughts and famines in lower and upper Senegal and the Sahel between 1738 and 1756, and again between 1770 and 1774, only to end with a famine in the 1790s.[128] However, the correlation between drought and famine is not always evident. For instance, the correlation between the famines and plausible droughts in Timbuktu in the 1740s is unclear. The author to the *Tedzkiret en-Nisian* chronicle does not specifically mention the causes of these famines, merely the effects, which is why it uncertain if they were caused by climatic aberrations.[129]

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121 Matthews, pp. 29–30, 33.
122 Winterbottom, pp. 39, 285. See also the table in the appendix for the amount of days with rain.
123 Winterbottom, p. 40
124 Nicholson (1979), p. 44.
125 Nicholson (1979), p. 41.
126 Shanahan et al., p. 378; Talbot and Delibrias, p. 723.
127 Nicholson (1979), p. 47.
128 Nicholson (1976), pp. 127–128, 132–142; Curtin (1975), p. 110.
129 Weiss (2001), pp. 48–49.

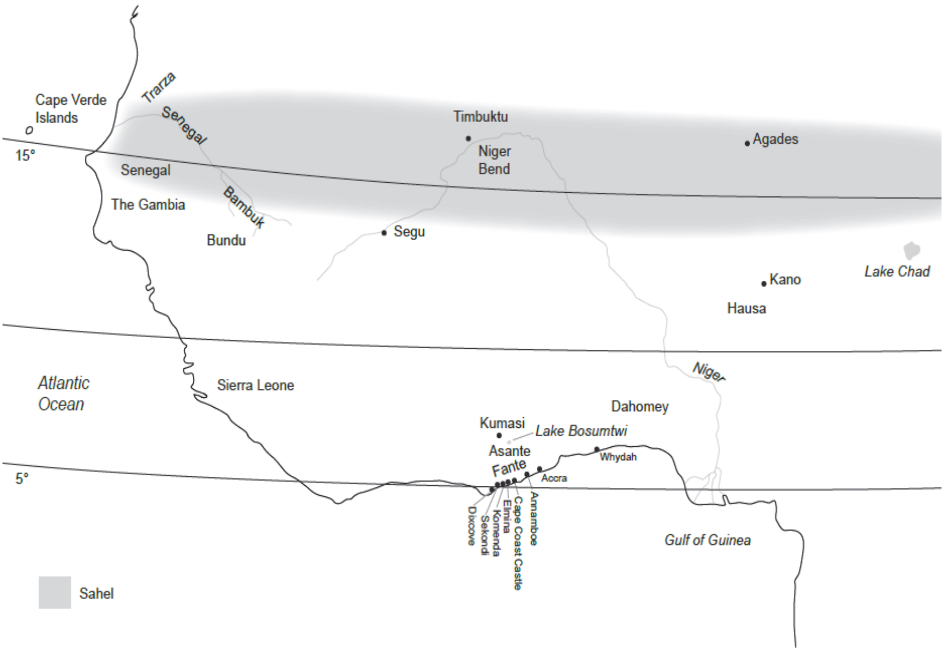

Figure 2.10 *Settlements, forts, rivers, ethnic groups, and other locations mentioned in the previous reconstructions on the West African climate in the 18th century.*

However, Sahelian droughts does not explain the elevated grain prices on the Gold Coast, and at Shama, Elmina and Accra forts in 1739, 1743, and 1748, although a raise in grain price is not an indication of drought. However, a Sahel drought in the 1740s might possibly explain the Oyo invasions of Dahomey (southern Benin) in 1739, 1740, 1742, 1743, and 1747 as "(---) such annual "migrations" from the drier Oyo country to the wetter Dahomey coast would be understandable", according to Nicholson.[130] Long term climatic stress might undoubtedly have caused such large scale migrations. Nevertheless, the 1740s was followed by a period with normalised rainfall, until famine was reported in Timbuktu in 1770 and 1771, and in Trarza from 1771 to 1775. Famine was also reported at Cape Coast Castle and Christiansborg (Accra) in 1774.[131]

The 1770s appear to have been drier, but this was again followed by several events with heavy rainfall. There was a flood in Agadez (situated in northern Sahel) in the 1780s and in Niger in 1780, when Lake Chad simultaneously had a great overflow. The coastal area experienced a famine at approximately at the same time. The conditions then seemed to have reversed in the 1790s: Agadez was evacuated due to drought, and Lake Chad began to rapidly desiccate.[132] Four years after Nicholson's article, Michael Watts claimed to have registered several droughts in Hausaland in Northern Nigeria, especially in the

[130] Nicholson (1976), p. 133.
[131] Nicholson (1976), p. 134.
[132] Nicholson (1976), pp. 139–142.

1750s and again between 1793 and 1795, the latter droughts correlate with the desiccation of Lake Chad.[133]

The change to more arid conditions in central Sahara and Sahel began in the 1790s and continued well into the 19th century. This is visible in Sharon Nicholson's most recent compilation of 19th century climate. The Guinea Coast was also predominantly dry in the beginning of the 19th century, when there were only three years with abundant rains during the first decade.[134] The climatic events from the 18th century are presented on a timeline in Figure 2.11.

Conclusively, a wetter climate prevailed in the Sahel during the 18th century, but this was followed by rapid desiccation at the end of the century. However, the coastal climate was drier than today. It is noteworthy that the coastal regions of West Africa appear to have experienced less precipitation at times when the Sahel enjoyed more precipitation. This was sporadically the case during the 13th and 14th centuries, and again in the 17th and 18th centuries. The Bosumtwi investigation is not entirely included in Nicholson's investigations, but it shows a turn to more arid conditions before the end of the 18th century.

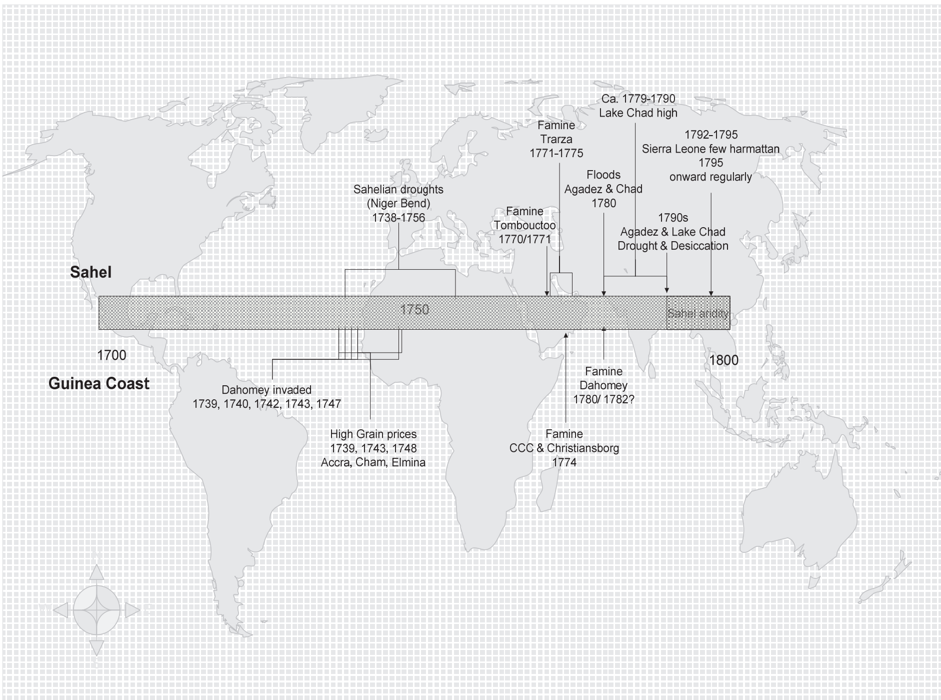

Figure 2.11 *A climatic timeline based on data from Sharon Nicholson's synthesis. Information on the top side of the time line represents climatic indicators from Sahel; information on the bottom side represents data from the Guinea/Gold Coast.*

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[133] Michael Watts, *Silent Violence. Food, Famine & Peasantry in Northern Nigeria* (Berkeley, 1983), see Table 3.3, p. 99.

[134] Nicholson et al. (2012a), see Figure 8, p. 21.

2.5.2 George E. Brooks' climatic periodisation

George E. Brooks had a very different methodological approach, when compared to Sharon Nicholson, in his investigation. It is therefore necessary to present the methodological approach before presenting the climatic reconstruction. Brooks' preliminary focus is on human reaction to rainfall variability, and the environmental impact of rainfall variations. The fundamental idea is that availability of water governs human life (both trade and agriculture) and cattle (grazing), and also the spreading of vegetation and vector born diseases such as trypanosomiases (sleeping sickness). Wetter periods made it possible for the trade routes to exist in otherwise arid regions by creating water holes. Conversely, weakened rains facilitated the use of horses in areas where they otherwise would have died due to vector borne diseases, which was an important advantage in war campaigns. Reversed conditions provided pasture for cattle in otherwise arid areas, and prohibited the use of horses as water provided breeding grounds for vector borne diseases. This explanatory model shows how the history of Africa can be divided with regard to effects of ecological and political stress factors; however, the causality is not always clear.[135] Drier and wetter periods have affected food supply, but also resulted in the migration of people and cattle, war campaigns, and the spread of diseases.[136] James Webb investigated Western Sahel ten years after Brooks, and developed Brooks' model, which is why I will exemplify Brooks' approach by referring to Webb.

The fundamental idea is that rainfall variability resulted in shifting boundaries of the ecological camel, cattle, and agricultural zones, and the delimiting zone for the spread of vector borne diseases. The zones acted as demarcation zones, each defining the economical activity within it; however, each zone was highly transitional due to rainfall variability. The boundaries of the ecological zones have a wavelike pattern that follows the isohyets. The rain does not fall evenly, neither within a zone nor between two neighbouring zones. For instance, the dry desert camel zone was too arid for agricultural activity, and cattle did not thrive there as working animals. The camels had better carrying capacity and managed better without water than cattle. Conversely, camels were not as economically lucrative in the cattle zone. Cattle gave the herders meat, milk, and hides, which the camels did not.[137] Increasing aridity in the 18th century would have meant that the ecological zones retracted towards the coast, which resulted in migration of people and animals. This meant a higher density of people in a smaller area of land. Those who remained and were determined to adapt their lifestyles to the changing environment were forced to compete over scarce resources.[138]

Webb has an elaborate discussion regarding horses in the Western Sahel. He claimed that it was the progressing aridity that pushed the tsetse fly line further south, and that this made the breeding of horses more lucrative. However, Webb accentuated the fact that

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[135] See for instance, Holger Weiss, *Banga Banga. Stress und Krisen Im Hausaland (Nord-Nigeria im 19. Jahrhundert* (unpublished Licentiate thesis, 1995). Weiss accentuates both climatological and political stress factors in 19th century Hausaland.

[136] McCann (1999b), p. 18.

[137] Webb (1995), pp. 11–13.

[138] Webb (1995), p. 132.

there might have been large variations over small areas.[139] As such, he effectively dissected the concept of West Africa as a 'uniform' region. A modern example of the impact of rainfall variability on Brooks' ecozones is the northward and southward movement of the Sahara-Sahelian 200mm isohyet. The mean position of the isohyet migrated 130km southwards between 1980 and 1990. It is evident that this impacted on agricultural productivity in the area. However, similar shifts also occur interannually, which generate more direct effects. For instance, the Sahara-Sahelian isohyet migrated 77km southwards between 1981 and 1982, only to retract (south to north) 110km between 1984 and 1985.[140]

Roderick J. McIntosh called the swing of the isohyets the *pulse*, and the pulse model explains human response to mini-pluvials. McIntosh suggested that the pulse, when applied to historical development of the environment and human history, can explain the effect on soil degradation and human migration. The soil and vegetation was effectively over-used during the northward swing, which was enough to have had an irreversible effect on the environment during the southward swing. This exhaustive use of the environment would also have facilitated desertification, the gradual degradation of vegetated land, which has been an important topic in environmental research.[141]

Conclusively, the idea behind the pulse model, the migration of people, also set out the basis of George E. Brooks' climatic periodisation of West Africa. Similar pulses have not been registered in southern parts of Ghana, and they might not have occurred on such grand scales; however, the pulse-model provides an example how rainfall variations and human behaviour interact in West Africa. In other words, water created either advantages or disadvantages, depending on whose perspective is chosen, and this was the basis for Brooks' argumentation on the climate. The consequences of rainfall variability were always felt within each ecological zone. Furthermore, everybody and everything were affected by changes in the rainfall pattern, with which they sometimes acted in conjunction.

George E. Brooks divided West Africa into zones that principally followed the characteristics of the vegetation (see Figure 2.9). The amount of annual rainfall varies from 100mm in the northern parts of the Sahel to 400mm in its southern fringes, while the rainforest receives over 2,000mm. Approximately 200–300mm of rainfall is needed to renew pasture, while 150–200mm will restrict animal husbandry.[142] Conversely, a surplus of water or wetter conditions facilitates the spread of vector born diseases, such as that carried by the tsetse fly which inhabits areas with over 1,000mm of annual rainfall (see Figure 2.9).[143] It is, however, not possible to predict transmission of vector born diseases within this vector, and sometimes it is not necessary as the environmental conditions that generate the *possibility* of infection are sufficient to determine life in Africa. In other words,

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[139] Webb (1995), pp. 69, 81, and 87. On p. 81, Webb describes how the Bundu state was able to sustain a cavalry, but in the neighbouring ecozone, which was moister, the Bambuk only had foot soldiers, while further north, in the desert area, the Hawd had nearly 7,000 horsemen and the same number of foot soldiers.

[140] Compton J. Tucker, et al., 'Expansion and Contraction of the Sahara Desert from 1980 to 1990', *Science* (vol. 253, no 5017:1991), p. 253.

[141] Roderick J. McIntosh, 'The Pulse Model: Genesis and Accommodation of Specialization in the Middle Niger', *The Journal of African History* (vol. 34, no 2:1993), pp. 200–201; See also Charles F. Hutchinson, 'The Sahelian desertification debate: a view from the American south-west', *Journal of Arid Environments* (vol. 33, no 4:1996), p. 521.

[142] Mountjoy & Hilling, p. 190; Brooks, (1986), p. 45.

[143] Brooks (1986), p. 48.

the idea of sickness hinders action, and rainfall is the most important factor in limiting the transmission and distribution of vector borne diseases such as malaria.[144] This rather abstract approach to considering climate as a limiting and determining factor, even before impact, was the basis for Brooks' periodisation. People live and act with, but also react to the climate and those elements in the environment that are partially governed by climate.

Brooks' climatic periodisation

Brooks suggested that a wetter climate increased the herds of camels, donkeys, sheep and goats in the Sahelian pasture during the first hundred years of the second millennium. The rains spread over a wide area and were greater in general. The ecological zones migrated (pulsated) north, which made more land available for pasture, thereby generating a movement of herds. There was a good supply of water in otherwise arid environments, even sufficient water to build up herds of horses in the Sahel. This development contributed to conflicts between Berbers and other groups in the Sahel and Savanna. They were, however, not able to expand further south as they were hindered by mosquito and tsetse fly infestations that spread northward due to the rains.[145]

The northward movement of the 1,000mm isohyet also forced herders in Senegal to migrate. However, they could not go north, where the horse riding Berbers ruled, which is why they went eastward to avoid political disputes.[146] The forced movement of people and their cattle provides a plausible explanation for the spreading of language groups in West Africa. It is worth noting that Brooks describes the era between 300 to 1100 A. D. as not simply wetter, but an era of "plentiful rainfall".[147] Brooks' based this historical development on synthesis compiled by E. Ann McDougall, who in 1985 investigated war, trade, and social change in south-western Sahara from the 8th to the 15th century.[148]

The wetter period up to 1100 A. D. was followed by 400 years of progressive desiccation. As the rains subsided and both the ecological and isohyetical borderlines migrated towards the equator, so did the people. Brooks concluded that the emergence of later investigated sub-group languages in the upper Niger River were a result of drought induced migrations.[149] The migration of traders and smiths provides further evidence of drought. Traders expanded their networks further south along the Senegal and Niger rivers, while the smiths, who followed the traders, created lodges in new areas along the western coast of West Africa.[150] However, it is worth noting that these might also have been opportunists in search of better lives, not simply climatic refugees. Nonetheless, the aridity contributed to the founding of the Mali Empire in the 13th century, and facilitated the use of horses, which meant that Mali horsemen could conduct raids southwards and reach areas that previously had been inaccessible due to vector born diseases. Brooks

[144] M. H. Craig, R. W. Snow and D. le Sueur, 'A Climate-based Distribution Model of Malaria Transmission in Sub-Saharan Africa', *Parasitology Today* (vol. 5, no 3:1999), p. 105.
[145] Brooks (1986), p. 50.
[146] Brooks (1986), pp. 50–51.
[147] Brooks (1986), p. 50.
[148] E. Ann McDougall, 'The view from Awdaghust: war, trade and social change in the southwestern Sahara, from the eighth to the fifteenth century', *Journal of African History* (vol. 26, 1:1985).
[149] Brooks (1986), p. 51.
[150] Brooks (1985), pp. 131–134.

claimed that the ecological zones retracted several hundred kilometres southward during this period.[151]

The dry period was interrupted by a short wetter period between 1500 and 1630. The rains increased and the ecological zones shifted northward again. Areas that had been too dry for grazing were now green enough to support cattle. The 1,000mm tsetse fly line was pushed further north and thereby commenced the decline of the Mali Empire, which had grown during the dry period. It was fortunate, for the Mali Empire that its capital now came under the influence of the tsetse fly line, which hindered the newly emerged Songhai Empire and their cavalry from occupying it. For their part, the Songhai were under stress from the Moroccans, as the wetter conditions made it possible to attack trade routes in the Sahara desert. However, just as the Mali Empire, the Songhai Empire was saved by the tsetse fly line that killed the Moroccan armies and their horsemen who pushed southwards. Brooks demonstrates a clear seesaw pattern of migration, wars, and social changes caused by the fluctuating movement of the ecological zones. However, he asserted that the wet period is "(…) as yet imperfectly charted, both as for its duration and as for its manifestations".[152]

The wet period was followed by a dry era that lasted approximately between 1630 and 1860, thereby suggesting that the 18th century was wetter. The wetter period coincides with the emergence of the LIA in Europe, although he does not address this matter. Brooks recorded several periods of drought and famine during this period, but he also noted that it was interspersed with abundant rainfall.[153] This seemingly contradictory statement of coincident droughts and abundant rains only emphasises the erratic behaviour of the rainfall mechanism. This was the period that Bosman, suggestively, described changes in the seasonality of the rains.[154] Nevertheless, Brooks suggested that the drier climate indirectly created a market for the slave trade:

> While there was no connection between the onset of the c1630–1860 dry period and the rapid development of plantation agriculture in the Americas, the coincidence had disastrous consequences for western African Societies. To the "pull" of European demand for captives there was added the "push" of droughts, famines, and deteriorating economic, social, and political circumstances in many parts of western Africa, the consequences of which made African groups more willing than otherwise to sell war captives, domestic slaves, criminals, and social deviants, however defined.[155]

Brooks claimed that there were several droughts and famines in the Niger Bend and Senegambia at the end of the 17th century. There were droughts in Senegambia in each decade from the 1710s to the 1750s, and again in the 1770s and 1780s. Furthermore, Brooks noted famines between 1790 and 1840. Brooks based this information, as did Nicholson, on studies conducted by Philip D. Curtin.[156] Brooks also asserted that many droughts doubtlessly went unrecorded during this period and that they probably contributed to the increasing slave trade. He supported his statement by referring to Curtin's and Lovejoy's

[151] Brooks (1986), pp. 52–53.
[152] Brooks (1986), cit. on p. 53, pp. 54–55.
[153] Brooks (1986), p. 55.
[154] Bosman, p. 111.
[155] Brooks (1985), pp. 201–202, Brooks (1986), p. 56.
[156] Curtin (1975).

statistics on the slave trade.[157] Brooks continued by adding that the drier climate also increased the number of captives who crossed the Sahara desert.[158] However, the trans-Saharan slave trade is based on "scanty evidence".[159] The greatest volume of captives for the trans-Saharan slave trade was noted at the beginning of the 19th century, a climatic period that Brooks and Nicholson agree had become drier – this is shown especially by Nicholson's (2012) most recent investigation. Brooks claim appears contradictory, as it suggested that trade routs can only exist in drier environments during wetter eras. Alternatively, the rise in the Saharan slave trade might have been a consequence of wars and raids during the dry period, as Brooks refers to the era as the Fula ascendancy.[160] Brooks emphasises the growth of the slave trade as a *possibility* of desiccation. His periodisation is at best an impressive interpretation of the impact of climate changes, which are based on the interaction and movement of people. Brooks' conclusion was that his focal historical period might be modified by further research.[161]

Conclusively, the demographic development of West Africa is an important factor in the migration of people, but even more so to sustain the slave trade. A southward movement of the tsetse fly during dry periods created room for the expansion of cavalry warfare, and more wars would have generated more slaves. Droughts might have resulted in wars, which produced slaves, especially in the Savanna.[162] There might be some correlation between cavalry warfare and more slaves in the Senegambia area, but not in the Gold Coast area as the climate was too wet for horses.[163] However, the slaves did not originate from the coast, which is why the Gold Coast slave trade probably was affected by droughts further inland. However, the demographic development should have been positive for a long time in order to sustain the massive export of slaves from Africa in the 18th century.

2.5.3 Comparing the two climatic periodisations

The periodisations portray two different climates in 18th century West Africa (see Figure 2.12).[164] Nicholson suggested that the Sahel was wetter, while Brooks suggested that it was drier. However, the periodisations are based on vague evidence, and the difference might be more semantic, than an absolute reference of fact. It is worth noting that Nicholson labelled it as a wetter period intermixed with droughts and famines, while Brooks

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[157] Brooks refers to p. 497 in Paul E. Lovejoy, 'The Volume of the Atlantic Slave Trade: A Synthesis', *Journal of African History* (vol. 23, 4:1982); P. D. Curtin, *The Atlantic Slave Trade. A Census* (Madison 1969), see Figure 26, p. 266.

[158] Brooks (1986), p. 56. Brooks refers to table, 2.8 on p. 66, in R. A. Austen, 'The Trans-Saharan Slave Trade: A Tentative Census' in H. A. Gemery & J. S. Hogendorn (eds.), *The Uncommon Market. Essays in the Economic History of the Atlantic Slave Trade* (New York, 1979).

[159] Paul E. Lovejoy, *Transformations in Slavery. A History of Slavery in Africa 2nd ed.* (Cambridge, 2000), p. 25.

[160] Brooks n (1986), pp. 56–57.

[161] Brooks (1986), pp. 58–59.

[162] Lovejoy (2000), p. 28.

[163] See for instance, James L. A. Webb Jr., 'Economics and Politics of Slaving in the Sahel. The Horse and Slave Trade Between the Western Sahara and Senegambia', *The Journal of African History* (vol. 34, no 2:1993).

[164] The Little Ice Age is included and the beginning is placed in the mid 16th century when the European climate was strongly impacted and enhanced glacial conditions and not mid 14th century, adapted from Mann, p.1.

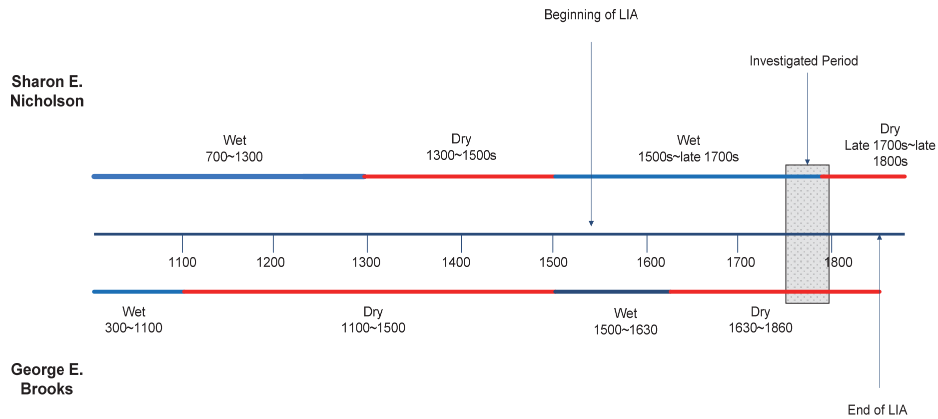

Figure 2.12 *The climatic periodisation in West African Sahel according to Brooks and Nicholson The LIA indicates the onset of the period, which is only included as a reference to the events in Europe. The shading indicate the period investigated here.*

suggested that it was a dry period interspersed with abundant rainfall. Hence, it appears that they were describing the opposite sides of the same coin. Furthermore, James Webb, who considered the 18th century a drier period, suggested that the discrepancy might be resolved by abandoning the "artificial construct" of wet and dry periods, especially as the increasing aridity was unevenly spread in the 18th century.[165] Nevertheless, the periodisations have one common factor: there was no knowledge of either the frequency or intensity of the rains at an interannual or interdecadal level. The periodisations were based on plausible causes such as drought, famines, and floods. For instance, neither Nicholson nor Brooks have any data for the 1760s, which probably was very dry. I have found evidence suggesting that the rains failed in 1768, and it was exceedingly dry in Senegal, many ships ran aground in the 1760s.[166]

It is probably the methods and the disciplinary differences that lead to the dichotomies. Brooks, as a historian, interpreted the climate by investigating historical events and highlighted causality. Brooks studied societal changes and the spreading of language groups as a consequence of diminishing rainfall. He focused on the effect of short-term climatic fluctuations, but with long-term impact, as changing languages. He emphasised the non-linear movement of the ecological zones.

It is unclear why Brooks concluded that the 18th century climate was dry, as he actually suggested that it fluctuated between "(…) periods of severe drought and famine conditions interspersed with periods of relatively abundant rainfall."[167] He did not specify what he meant by periods and whether it reflects interannual variations or interdecadal variability. Brooks concluded that droughts were exacerbated by population increase from the wet period in the 17th century. This emphasises a Malthusian perspective; however, the link between famine and climate is not discussed extensively.

[165] Webb (1995), p. 5.
[166] T. S. Ashton (ed.), *Letters of a West African Trader. Edward Grace 1767–70* (London, 1950), pp. 7, 27.
[167] Brooks (1986), p. 55.

Brooks also had more and newer investigations available for his compilation, and he employed investigations that were based on new interpretations from Arabic sources in West Africa. These were not available almost a decade earlier when Nicholson created her synthesis.

Sharon Nicholson, as a meteorologist, concentrated on the available data and specific events and did not attempt to interpret historical events in the same manner as Brooks. Nicholson pinpointed wet and dry periods through environmental data interspersed with historical information, mainly concerning famines and droughts. She differentiated the past climate from the present, suggesting that the Guinea Coast climate hade been drier in the 18th century, not necessarily dry, and wetter in the Sahel, not necessarily wet. Thus, Sharon Nicholson suggested that the coastal area was *drier* and that the Sahel was *wetter.*

Brooks did not comment on the Guinea Coast climate in particular, which is why Figure 2.11 depicts the Sahelian climate. It is evident that there is a difference between the periodisations of Nicholson's and Brooks', when portrayed in this manner. Nevertheless, the most interesting century is the 18th century and in particular the period at the end of it that is investigated here, the gray dotted area in Figure 2.12.

James Webb considered the best approach to resolving the dichotomy was to abandon the artificial construct of wet and dry periods, as noted above. First, Webb asserted that the Sahelian and Savanna climates were not more humid in the 17th and 18th centuries than in the 19th and 20th centuries. Secondly, he suggested that a long-term trend towards aridity began in the late 16th or early 17th century and continued into the mid 19th century. Furthermore, he suggested that rainfall was uneven and unpredictable over the Sahel and the savanna, which is why some sources do not correlate.[168] Webb's explanation has a structured basis, and illustrates a long-term change in the mean rainfall while taking regional variability into consideration. This might explain the dichotomous results from Nicholson and Brooks. However, it also implies that it was merely the choice of words which separates the two investigations.

The long term climate and the slave trade

Brooks suggested that there was a link between the change to more arid conditions and the increasing slave trade in the 18th century. He did not specify any period during the 18th century in particular, instead presenting it as a cumulative effect. The climatic shift created a push-effect that coincided with the demand for millions of slaves in North Africa and the Americas.[169] This has been suggested also by P. D. Curtin and Joseph Miller. In other words, the slave trade system fed itself, and the climatic development is portrayed as a prerequisite for the slave trade. However, what if the period that Brooks described as dry was actually wetter, with clusters of drier periods when the slave trade increased, as Nicholson suggested? How would this comply with the slave trade?

Brooks' hypothesis implies that uneven rainfall over the ecological zones fed the slave trade, especially from Senegambia. The hypothesis might be scrutinised if the number of exported slaves from Senegambia was known, which unfortunately it is not.[170] For

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[168] Webb (1995), p. 5.

[169] Brooks (1986), pp. 55–56.

[170] The slave trade from Senegambia is not as well covered as that from the Gold Coast, see for instance Boubacar Barry, *Senegambia and the Atlantic Slave Trade* (Cambridge,1988), pp. 61–73. For another estimation see TSTD, however, Barry's estimation exceeds those presented by the slave trade database.

instance, Boubacar Barry has also suggested that deteriorating ecological conditions, caused by lesser rainfall, was "closely" linked to the trans-Atlantic slave trading system.[171] However, both Brooks and Boubacar made general references. Neither of them searched for correlations between specific famines or droughts and the slave trade. A quick comparison with the Trans-Atlantic Slave Trade Database shows that the slave trade from The Gambia, Gorée, and Senegambia had its three top years between 1774 and 1776, which coincides with the droughts Nicholson had recorded in Trarza from 1771 to 1775. Trarza is located in southern Mauretania, just north of Senegal, and this might support a correlation between the slave trade and the desiccating climate conditions.[172] However, Brooks and Boubacar only mentioned that there were droughts in Senegambia in the 1770s.[173] The conclusion is that Nicholson's periodisation of a wetter period, intermixed with droughts and famines, actually supports Brooks' hypothesis of an increasing slave trade.

The climatic conditions depicted by Nicholson and Brooks, or Webb, for that matter, should have different outcomes when applied to the slave trade, demographic development and political situation in West Africa. Table 2.4 presents a hypothetical scenario on the various outcomes of a generally dry versus wet environment. For instance, drier conditions would have generated higher regional crop variations, while a wetter environment would have shown less variation in agricultural productivity. A dry environment might have induced migration towards wetter and more sustainable areas, resulting in political disturbances/disputes or wars, thus affecting the slave trade positively. A wetter environment would have been sustainable and caused less migration, less political instability, thereby impacting negatively on the slave trade.

Table 2.4 *Categorical subdivision of plausible socioeconomic impacts in a dry or wet environment in 18th century West Africa. The table should be read from the middle column, and the effects on the indicator, depending on the environment, are separated in the left and right hand columns.*

Drier environment	Indicator	Wetter environment
High regional variation in harvest totals	Crops	Less regional variation in harvest totals
Movement towards better crops/grazing areas	Migration of People	Greater sustainability, i.e. more area available for harvesting/grazing,
Negative effect	Demography	Positive effect

171 Barry, p. 112.
172 Nicholson (1976), p. 134.
173 Brooks (1986), p. 56.

However, it is plausible that wetter conditions would have caused opportunistic migration. There are no simple explanations for the different outcomes of a dry versus a wet environment in the 18th century. The climatic type that governs West Africa, the balance between demand and availability of resources, was susceptible to disruption more rapidly than perhaps elsewhere. Focus should, therefore, be on the carrying capacity of an environment without pesticides and fertilizers.[174] The suggested outcomes in Table 2.4 are at best speculative, but it highlights some of the uncertainties related to earlier research and employs historical explanations in climatic research in West Africa. I will return to the correlation between climate and slave trade in Chapter Five.

Demographic development and the enslavement process

Demographic development was a necessity for the slave trade to flourish. Therefore, the demographic development must have been positive to facilitate the slave trade. John Hippisley, one of the governors, wrote an essay on the population of Africa, published in 1764. He noted that the question of how Africa could continually supply the slave trade had often been considered, and also that "slaves seem quite as plenty as they were twenty or thirty years ago".[175] The slave trade might not have flourished if the demographic development had been negative prior to or during the 18th century. This suggests that the climatic conditions must have been able to sustain agricultural production. Deteriorating climatic conditions could not have supported the demographic increase if not interspersed with clusters of wet years.

Enslavement was often related to wars and violence, all of which required people. The slaves that were sold in the Atlantic slave trade were procured via wars, kidnapping, judicial enslaving (as punishment for criminals), or levying tribute; however, there was also some voluntary enslavement to avoid death by, for instance, famine.[176] Nevertheless, most slaves were prisoners of war, and wars have been considered the primary source for procuring slaves.

Wars were waged for various reasons, for instance, to gain political control, as in the case of the Ashanti expansion.[177] Wars were also fought over foreign luxury items such as brandy and rum, and wars were sometimes initiated with neighbouring groups for the purpose of procuring slaves to exchange for luxury items. The need for luxurious items was such that some traders even sold people from their own group to get a desired item.[178] Some researchers have even suggested that the gun trade to West Africa was conducted only for the purpose of procuring slaves, not for waging wars. However, this has been debated, as political intentions provide a more stable ground to explain the gun trade.[179]

The correlation between wars, the gun trade, and the slave trade is that wars were preferably fought during the dry period of the year, or during drier periods, at least in Senegambia where horses played an important role in slave raiding and trading.[180] Wars

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174 Claude Raynaut, *Societies and Nature in the Sahel* (London, 1997), p. 39.
175 John Hippisley, *Essays. I. On the Populousness of Africa* (London, 1764), pp. 1–2.
176 Shumway, pp. 58–58; Barry, p. 108; Lovejoy (2000), p. 4.
177 Metcalf, p. 384.
178 Brooks (2003), pp. 102–105.
179 J. E. Inikori, 'The import of Firearm Into West Africa 1750–1807: A Quantitative Analysis', *Journal of African History* (vol. XVIII, no 3:1977), pp. 350–351. See also, Metcalf, p. 385.
180 Webb, pp. 68–68.

were preferably fought during the dry season when crops needed little care. Therefore, the slave trade and mechanisms for waging war were connected to climatic variations, even though this seems far-fetched. This supports the idea of a climatically facilitated slave trade.

3 A climatic chronology of the Guinea coast, 1750 to 1798

The scarcity of climatic information and data is a mantra that is often employed for the African continent. However, it is evident that there are historical documents that have hitherto not been employed for climatic purposes. In this chapter, I present new evidence on the Gold Coast region and especially Cape Coast Castle. The climatic information is derived from letters sent from Cape Coast Castle to *The Committee of Merchants Trading to Africa* in London. The letters were in most cases written by the castle's governor, who was also the Chief Governor of all the forts. The same letters have been utilised by, for instance, J. K. Fynn to study the rise of the Asante during the 18th century, which is employed as the reference for political events.

The climate in general is seldom reflected upon in the letters and most climatic information relate to the rainy season, often referred to as the *bad season*. This was the preferred term as the season often caused sickness amongst the Europeans. The daily weather descriptions found in the *Diary of Transactions at Cape Coast Castle* are included in the analysis when the period is discussed. The documented descriptions are presented per decade before the climate for the period is reconstructed, which is followed by a general discussion regarding the climate for the latter half of the 18th century.

3.1 The 1750s

The letters sent from Cape Coast Castle in the 1750s contain only scarce meteorological information. There is no documented information for 1750 and the two subsequent years contain only a handful of climatic descriptions.

The governor wrote that there was tranquillity in the country in 1751.[1] This notion probably referred to the political state of the country, and the governor wanted to reassure the investors that everything was quiet since the political instability in the 1740s. The Asante had tried to gain access to the coast since 1742, which had lead to the formation of a "Great Alliance", led by the Fante, in 1750.[2] The Fante were strong along the coast, and together with some of the Asante tributary states formed an alliance to keep the Asante away from coastal trade and ensure that they did not obtain firearms.[3] This was followed by civil wars in Asante. The Fante withdrew themselves from the blockade of the Asante in 1754, as they felt that it disrupted their own trade with the inland.[4] Nevertheless, the governor probably referred to the peace brought on by the great alliance when he referred to tranquillity. However, the reference to 'the country' is ambiguous. The geographical area is not defined; however, the concept was often employed in the letters and is of great importance for the reconstruction. It most likely refers to an area

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[1] TNA, T70/29, letter dated August 9th 1751.

[2] Sanders, p. 357.

[3] R. A. Kea, 'Firearms and Warfare on the Gold and Slave Coasts from the Sixteenth to the Nineteenth Centuries, *Journal of African History* (vol. XII, no 2:1971), p. 201. Guns were important for Asante for building up their regime and maintain their political dominance, although there were many internal conflicts. The import of firearms, why they were needed, has been debated. See also Inikori (1977), p. 349.

[4] Fynn, pp. 85–87.

that included the Asante Empire. The concept of 'the country' is hence forward considered to at least cover the distance between Cape Coast Castle and central Asante, which was about 200km.[5]

The governor informed London that their representatives at the castle were in good health in January 1752. The castle was low on supplies, but this was probably the consequence of costly wars and not drought. The castle was low on money and did not have the means to procure food from the locals, which was why they were waiting for supplies from London.[6] In August, the governor described the rains to have been uncommonly great during the rainy season.[7] Diseases flourished due to the rains, and they had been devastating for the Danes at Christiansborg, where almost the entire personnel had died. The new soldiers had also been sick at Cape Coast Castle, which was quite common during the rainy season, after which many Europeans often died. The great death toll is the reason that the area was referred to as the 'white man's grave', and it has been estimated that between 25 and 75 percent of the Europeans died within one year of their arrival at the coast.[8]

It was believed that the 'unhealthy' climate caused the high mortality rates, and this is partly correct. The climatic approach appeared logical in the 18th century as the prevalence of disease altered with the climate.[9] Some thought that it was the men's own mismanagement that caused their deaths. However Willem Bosman, who had long experience on the coast, did not agree with this reasoning.[10] He was correct, although he did not know that the deaths were caused by the lack of immunity to diseases, such as malaria and yellow fever, which are spread by mosquitoes that thrive in wet conditions.

Mortality often grew during periods with severe rain, as many of the letters will demonstrate. Hence, there is a correlation between intense rainy seasons and increasing deaths among the Europeans, the most likely cause for which were vector borne diseases. However, the link between rainfall and mosquito abundance is complex, especially in areas where the disease is perennial (annual, for more than six months).[11] Increased sickness during the rainy seasons cannot be linked to vector born diseases *per se*, although some types of sickness spread more easily during wetter years. It is worth noting that nowadays there is a general tendency for heavy rainfall to have an effect on mosquito borne disease outbreaks.[12] An investigation that was conducted on the eastern parts of the Ghanaian coastline showed that the prevalence of malaria infection grew from 20 percent in the dry season to 36.6 percent in the rainy season.[13] This study was conducted in the 20th century, but the same conditions most likely prevailed in the 18th century. Furthermore, the lack of proper medical care probably increased the death toll 200 years ago. Hence, it is probable that abundant rains resulted in the spread of vector borne

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[5] McCaskie, p. 76. See map 3.
[6] TNA, T70/29, letter dated January 8th 1752.
[7] TNA, T70/29, report dated August 20th 1752.
[8] Brooks (2003), p. 16.
[9] Philip D. Curtin, *The Image of Africa: British Ideas and Action, 1780–1850* (Madison, 1964), p. 77.
[10] Philip D. Curtin, 'The End of the "White Man's Grave"? Nineteenth-Century Mortality in West Africa', *Journal of Interdisciplinary History* (vol. 21, no 1:1990), p. 63. See also Bosman, p. 106.
[11] Craig et al., pp. 106–107.
[12] J. R. McNeill, *Mosquito Empires. Ecology and War in the Greater Caribbean* (Cambridge, 2010). p. 58.
[13] K. Collins, 'Malaria-related beliefs and behaviour in southern Ghana: implication for treatment, prevention and control', *Tropical Medicine and International Health* (vol. 2, no 5:1997), p. 489.

diseases and therefore more deaths in the 18th century, which is why sickness, when mentioned, will be considered also to indicate abundant rains.

The governor wrote that he had received 20 Gambia slaves by the Royal Navy ship the *Hind* in April 1753.[14] The slaves were to remain at Cape Coast Castle until the seasonal rains were over, after which they were supposed to work as bricklayers at other forts. One month later, on May 12th, the governor noted that "the rains" had set in with great violence.[15]

The concept of 'the rains' was often employed to describe the rainy season, which was troublesome season in 1753. In a letter written in July the governor asserted that all the bricklayers were sick and that many of the company's settlements were in bad condition. The forts at Commenda, Sekondi, and Dixcove were all reported to be "down" due to the violence of the rains.[16] It is unclear whether 'down' refers to the actual buildings falling down or to the trading being down due to sickness, especially as the governor also noted that the trade was middling. However, the term most likely refers to the buildings falling down. The castles were poorly build with many having walls made out of mud that did not withstand the battering of heavy rains, which is why, from time to time, they fell down. Furthermore, the castles were under constant reconstruction during the slave trade era. The castles were originally built for storing gold, not slaves, and they offered inadequate protection against any enemies, whether from sea or land, natural or man-made.[17] They were not built for housing many people or active occupation. These are the primary reasons why castles and forts, especially the walls, collapsed during the latter half of the 18th century. Nevertheless, at the same time that rains battered the Gold Coast, the rains failed at Cape Verde Islands (west of Senegal). This resulted in a famine that struck the entire archipelago in 1754–55.[18]

Bad weather and heavy rains seemed to have repeated themselves in 1754. The letters contains no direct reflection of the rains, but everybody except Governor Thomas Melvin had been sick.[19] There were no deaths reported; however, the letter was written in August, which implies that the sickness was brought on by vector borne diseases during the seasonal rains a couple of months earlier.

There were no reports on the weather in 1755. The governor only mentions that many tradesmen and labourers at Annamboe were affected by worms in February.[20] It is not known by what type of worms they were infected, which is why this is a vague indicator. Many types of worm are prevalent in warm climates and areas with poor sanitation, which made the Gold Coast a breeding ground. These worms infest the host orally from unwashed vegetables, or anally.[21] The governor was most likely describing the Guinea worm, which had affected them also in 1753.[22] The Guinea worm spreads through

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[14] TNA, T70/29, letter dated April 24th 1753. The logbook from this ship is included in this investigation. However, the captain of the Hind makes no mention of slaves when arriving at Cape Coast Castle.
[15] TNA, T70/29, letter dated May 12th 1753.
[16] TNA, T70/29, letter dated July 1st 1753.
[17] Shumway, pp. 62–63; St Clair, p. 45.
[18] K. David Patterson, 'Epidemics, Famines, and Population in the Cape Verde Islands, 1580–1900', *The International Journal of African Historical Studies* (vol. 21, no 2:1988), p. 307.
[19] TNA, T70/30, letter dated August 7th 1754.
[20] TNA, T70/30, letter dated February 12th 1755.
[21] Richard B. Sheridan, *Doctors and Slaves. A medical and demographic history of slavery in the British West Indies 1680–1834* (Cambridge, 2009), pp. 214–217.
[22] TNA, T70/29, letter dated April 24th 1753.

stagnant water, which acted as drinking water when there was a lack of fresh water.[23] This was also noted by Bosman, who stated that "foul water" caused the "worm-disease".[24] In *The Physical and Medical Climate* from 1867, James Africanus also claimed that the Guinea worms were frequent during winter, while fevers were seldom recorded.[25] It is here assumed it was the Guinea worm that troubled the men at Annamboe, especially as the governor wrote his letter during the dry season in February, when weaker rains would have resulted in a lack of fresh water.

The rainy season, and the inland rains, was probably weak in 1755. This is derived from a letter written on May 4th 1756. The governor wrote that there was a "great scarcity of corn along the coast, occasioned by the want of rains." [26] Indian corn (maize) was preferred to Guinea corn or, especially, cassava, which was mostly fed to slaves.[27] The scarcity of corn was therefore a general problem, and not only for the slaves. The scarcity of corn implies that the onset of the rainy season was late and that the previous year's crop was running low. The governor continued his letter by adding that the "up country" people refused to send their stored provisions to the coast as there was a fear of famine if the regular crops failed.[28] In other words, the up-country people closed their stores to mitigate the effect of a complete failure of the rains. This was considered the best method of delaying the onset of famine. This preventive action relates to the crop cycle.

The planting usually commenced at the beginning of the rainy season, to be harvested months later. The scarcity of corn in early May 1756 suggests that the periodical rains had been less frequent and intense in 1755. This, combined with the late onset of the rains in 1756 caused the dire conditions described in the letter of May 1756. The late onset of the rains impacted on the entire Gold Coast, which suggests that the rains had failed over a larger area. It is noteworthy that the scarcity of corn and want of rain was noted already on May 4th. This gives an indication of when they expected the rains to commence, but it might also mean that the rains had been weak already in 1755. This depends on when the rainy season usually commenced in the 18th century.

The Danish assistant clerk, Fredrik Rømer – who stayed at the Gold Coast, and frequently visited Cape Coast Castle and Elmina between 1739 and 1745, and again between 1746 and 1749 – claimed that there was only one rainy season, and that it lasted from April until the end of May.[29] Hence, if Rømer was correct, the onset of the rains was approximately a month late in 1756. This would explain the unwillingness of the locals to sell food to the Europeans in early May; however, the situation was about to get worse. The dry weather continued, which drained the men. In a short letter dated May 8th, the governor wrote that they remained very ill, but he hoped that the approaching rains would bring "salutary weather".[30] Three days later, while continuing to wait for the rainy

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[23] Jan A. Rozendaal (prep.), *Vector Control. Methods for use by individuals and communities* (Geneva, 1997), pp. 324–326.
[24] Bosman, p. 109.
[25] James Africanus, *Physical and Medical Climate and Meteorology of the West Coast of Africa* (London, 1867), p. 245.
[26] TNA, T70/30, letter dated May 4th 1756.
[27] Agbodeka, pp. 30–31.
[28] TNA, T70/30, letter dated May 4th 1756.
[29] Rømer, p. 17.
[30] TNA, T70/30, letter dated May 8th 1756.

season to "purify the air", the governor noted that many had died of yellow fever, and that the rainy season was near.[31]

The rains had not commenced when the last letter was written on May 11th. The governor never claimed that they had received any rain before the 11th; therefore, it was very dry, even if they had received some showers. The scarcity of corn continued, and in September they were also low on fowl and other provisions.[32] There appeared to have been some sickness at Cape Coast Castle, but the Dutch at Elmina had suffered even more. In December the governor wrote that "[w]e are now in actual distress for want of supplies".[33] His choice of words stressed the seriousness of the situation, but it remains unknown how the situation evolved. The rains were never described. However, Archibald Dalzel, the governor at Cape Coast Castle in the 1790s, wrote that he remembered 1755 and 1756 as the most fatal years at Cape Coast Castle.[34]

The climatic events at the beginning of the 1750s coincide with earlier research from the Sahel area. The Western Sahel area experienced several droughts and famines prior to 1756, even though some recovery was suggested to have been made in 1753–55.[35] However, a famine continued to rage at Cape Verde Islands in 1754–55, which is an extension of the Sahel area, although not attached to the African continent.

There were no descriptions of the weather in 1757 and the next source of information is from April 1758. The governor expressed the need for surgeons as they so often had problems with "disorders".[36] This might indicate that the previous year had been troublesome, but it is evident that 1758 was a difficult year for everybody at Cape Cost Castle. In a letter dated July 5th, the governor described the rains as "excessive violent, but now almost over".[37] Charles Bell, who had been the governor since 1756, considered the weather to have been the unhealthiest he had ever known in 1758. Almost every person in the castle had been ill, yet only three or four soldiers had died of their disorders, which Bell was grateful of.[38] However, the Commenda and Sekondi forts were expected to fall down due to the severity of the rains. Later, in the same letter, the governor asserted that the SE-, NW- and NE-bastion of Sekondi had fallen down. All the roofs were leaking and Bell expressed his concerns that Sekondi was becoming uninhabitable because of the rains.[39]

The extreme weather was the most probable cause of the disintegration of the forts in 1758. It is worth noting that there had not been any reports on the condition of the castles since they had fallen down in 1753. The consequences of the circumstances in 1758 are uncertain. There were no reports on the weather, the state of the castle, or the condition of the men in 1759. The most noteworthy events during the 1750s are summarised in Table 3.1.

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[31] TNA, T70/30, letter dated May 11th 1756.
[32] TNA, T70/30, letter dated September 1st 1756.
[33] TNA, T70/30, letter dated December 12th 1756.
[34] Archibald Dalzel, *The History of Dahomy* (London, 1793), p. 143.
[35] Nicholson (1976), p. 127. Curtin (1975), p. 110.
[36] TNA, T70/30, letter dated April 16th 1758.
[37] TNA, T70/30, letter dated July 5th 1758.
[38] TNA, T70/30, letter dated July 5th 1758.
[39] TNA, T70/30, letter dated July 5th 1758.

Table 3.1 *Summary of the most noteworthy climatic indicators per year and months as they appear in letters written during the 1750s*

Year	January – March	April – July	August – October	November – December
1750				
1751				
1752	Good health; supply low		Great rains; almost all Danes dead	
1753		Violent rains in May; much sickness; castles down		
1754			Almost all ill	
1755	Worms			
1756		Scarcity of corn; dry weather	Scarcity of corn, sickness, Elmina sickly	Distress of supplies
1757				
1758		Violent rains; castles down; sickly season		
1759				

3.1.1 Concluding remarks: outlining the climate in the 1750s

The letters suggest that coastal rains were intense in 1752, 1753, and 1758. The rains mostly set in during the beginning of May and lasted until the beginning of July. However, there were exceptions, as in 1756 when the rains were extremely late, depending on when they were expected to commence. Rømer claimed that they should have started in April, as they did during his time at the coast.

The intensity of the rains was at times so intense, or frequent, that some of the castles' walls collapsed. It was also probably intense rains, by facilitating the spread of vector borne diseases, which caused much sickness and deaths on other occasions. Many also experienced 'the worms' during the winters of 1753/54 and 1755/56. This might imply that the rains had been very weak during the autumn. However, this is highly speculative as worms were, if not common throughout the year, at least more common during the winter season. Whether or not this is linked to the rains is unknown, but it is evident that lesser rains would have affected the availability to procure pure and fresh water. In any event, it seems as if the rains were concentrated to the rainy season in the spring, and there were no references to a subsidiary rainy season.

The scarcity of corn in 1756 suggests that the rains were lighter in 1755, perhaps even light enough to have caused a drought. The dry winter in 1755/56 is based on scarce evidence, and the problems caused by guinea worms, seen as a consequence of unclean water, are hypothetical. However, it can be assumed that the rains were weak in 1755. This affected the crops and generated a fear of a famine among people in agricultural regions further north. Nonetheless, there are no clear indications of widespread famines or droughts before 1756 when the rains did not set in as expected, with consequences felt along the entire coastline.

The heavy rains along the Gold Coast in 1752 and 1753 might be an indication of lesser rains in the Sahel (Niger Bend and Cap Verde Islands), which supports the early drought registered by Curtain, if applying the dipole perspective. However, it is worth noting that interannual variations did not correlate, as Richard G. Wagner argued. Nevertheless, the scarcity of corn and the threat of famine abated after 1756. There was probably no immediate threat of famine as, in the following year, the governor did not comment on the situation. This would suggest that the inland rains recovered somewhat in agricultural areas after 1756.

Conclusively, it seems as if the inland country climate was drier until the mid 1750s, with the Sahel area and the wet south-western parts experiencing lesser rains, which culminated in a serious drought in 1756. The evidence is scarce, but the records clearly show that rains were more intense during some years than others, thereby showing high interannual variability. The coastal area experienced everything from wetter to drier conditions. In between these periods there seems to have been some normal rainfall. However, wetter years exceeded drier years.

There were no remarks on the Harmattan in the winter, nor were there any indications of a secondary rainy season in the 1750s. This supports Rømer's observations, as he claimed that there was only one rainy season. However, Captain John Adams, who visited the equatorial regions ten times between 1786 and 1800, asserted that the first rainy season lasted between May and July, and that there were heavy showers again in October and November.[40] This correlates with the 20th century rainfall pattern, although it is worth noting that John Adams did not specify which area he described. He merely noted that he was describing an area north of the equator in Africa, everything east of Cape Palmas (the most eastern point of reference was The Congo River), thereby including the entire Guinea Coast region. Furthermore, he did not live there and visited the area on ten voyages. Adams visited the area after the mid 1780s, which might influence the validity and reliability of his observations, especially when making comparisons with the climate 30 years earlier. It is not known if his description of the rainy season was based on his own observations or whether he based his descriptions on hearsay.

Henry Meredith's description of the rainy season, approximately a decade after Adams, was considerably different. Meredith asserted that there were two seasons of rainfall. The first commenced at the end of May and the other at the end of October. However, Meredith claimed that the rains in October were so weak that "the last does not deserve the name wet season, in comparison to the very heavy rains which fall in the former".[41] Nevertheless, according to Walker's study, it is not unusual for months that should be rainy to have no significant rainfall.[42] It is thereby difficult, at this stage, to conclude whether or not the descriptions by Rømer, Adams, and Meredith describe anything more than the results of interannual rainfall variability.

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[40] John Adams, *Sketches Taken During Ten Voyages to Africa Between the Years 1786 and 1800* (London, 1821), p. 55.

[41] Meredith, pp. 5–6.

[42] Walker, p. 6.

3.2 The 1760s

The first letter with climatic references in the 1760s was written in June 1761. The governor noted that all bricklayers had worms but did not mention the rains, although this was in the middle of the rainy season. He only stated that they had problems with landing the goods from the supply ship. The sea was "bad", which was normal for this time of the year.[43] However, the governor commented on the slave trade. He claimed that there was no slave trade whatsoever at Cape Coast Castle and that all the slaves were at Tantumquery. Later, in a second letter from June, the governor noted that everybody at the castle had been ill, and that the surgeon died after a few days of fever.[44] The lack of more detailed descriptions might suggest that the rains were normal. It was neither wetter nor drier than during any previous season.

The first description of the rains is found in a letter dated June 21st 1762. The ship carrying provisions from Britain had arrived at the worst possible time, and there were again problems with landing the cargo safely. It was customary for the castles to hire canoe men to transport goods between the ships and the castles, but even their skills were not always sufficient to land goods safely.[45] This is the reason for goods sometimes being lost, as in 1762. The weather was described as tempestuous with rain, lightning, and thunder.[46] The letter is eight pages long, and Charles Bell continued writing as the days passed. This explains why, in a later passage, he mentions that rains 'continued' violently. There was no communication with the other castles as the weather made it impossible to travel by foot or boat. Furthermore, the Guardian's house had collapsed due to violent winds and rains, even one of the castle's walls had been swept away.[47] The governor expressed his concern regarding the condition of the other castles. However, he had not received any reports as it was impossible to sustain communication between Cape Coast Castle and the other forts. The chaotic situation was not improved by the fact that many of the men were sick and the castle lacked fresh food.

Slightly over a month later, Bell wrote that "[s]laves are plenty but in general extremely bad".[48] It is uncertain to what 'bad' refers, but it was probably the conditions and/or quality (health) of the slaves. Slave traders preferred healthy slaves as they were better workers who had a higher chance of surviving the middle passage.[49] It is therefore probable that Bell would have commented on their health. The reason that they were in such a bad state is not mentioned. There were no remarks concerning droughts, famines, scarcity of food, diseases, or wars before or after Bell's comment. However, the bad weather that started in June continued throughout the summer, or returned in the autumn. In a short letter written in September, with a reference to the letter written in August, the governor mentioned that the men *still* continued to be ill. Many of the soldiers had also

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[43] TNA, T70/30, letter dated June 5th 1761.
[44] TNA, T70/30, letter dated June 29th 1761.
[45] Emma Christopher, *Slave Ship Sailors and Their Captive Cargoes 1730–1807* (Cambridge, 2006), pp. 146–151.
[46] TNA, T70/31, letter dated June 21st 1762.
[47] At this time the castle had poorly constructed walls, and they were not plastered. The plastering of the castle (the white durable walls) was conducted at a later date. The building of the castle and its maintenance can be followed in the letters throughout the investigated period. See also van Dantzig (1980), p. 59.
[48] TNA, T70/31, letter dated August 20th 1762.
[49] See for instance, Richard H. Steckel and Richard A. Jensen, 'New Evidence on the Causes of Slave and Crew Mortality in the Atlantic Slave Trade', *Journal of Economic History* (vol. XLVI, no 1:1986).

died. There remained no communication with the other forts, and Bell wrote that "I have never known so bad a season in Africa".[50]

It is possible that it rained throughout the summer in 1762, exactly as it did in 1968.[51] Otherwise it is the first indication of a secondary rainy season. Bell claimed that he had not had regular correspondence with the other forts "for some time past".[52] The temporal reference is ambiguous and might indicate anything from weeks to months. Furthermore, his description of the season as bad was highly subjective and indistinct, as he did not elaborate or specify what this meant. It seems plausible that the governor would have commented on the rains if it had rained continuously for a period of four months, but he did not. Nonetheless, the impact of the rains in 1762 was similar to that in 1968, when entire transport and communication systems were destroyed and rendered unusable.[53]

Many were reported to be ill at the beginning of February 1763. Whether or not this relates to the previous year's rainy season is not revealed, although the governor's entry gives that impression. He wrote that "[w]e have still a sickly time of it, especially amongst the natives".[54] This might be a reference to Guinea worms, which often affected the men during the winter months, but might also refer to the sickness caused by the secondary rainy season. Two months later, the governor mentions that there was a distress of supplies.[55] There were no remarks on an inland drought or scarcity of corn, only that the supply ship was late, which concerned the governor. The main reason for the shortage of supplies was probably linked to the ship's arrival during the rainy seasons in 1761 and 1762. This had made it difficult to land the supplies safely, and it is likely that some supplies were lost in transit between the ships and the castle. The distress should, therefore, not be interpreted as an indication of a drought or a general lack of supplies in the country. The distress of supplies continued for some time, and the ship had not arrived by the end of May.[56] On July 7th, in his last letter as Chief Governor before resigning due to bad health, Bell wrote that he had never seen an unhealthier season.[57] Many had been ill, although the weather was probably not as bad as the previous year. The letter includes no references to the intensity of the rains, which might be expected from Bell as he had so vividly described the weather in June 1762. The diseases imply that the rains had been frequent and intense, or even severe. For instance, Dalzel claimed that the death toll had been high at Cape Coast Castle in 1763, although he did not mention the reason.[58]

There is no reference to the weather in 1764. It might be that the new Chief Governor (William Mutter) did not consider climatic information relevant. He arrived at Cape Coast Castle in August 1763, and in his letter from January 1764 he focused on describing the situation he had entered and had to address. It is also possible that there was nothing worth reporting as everybody was reported to be healthy.[59] Mutter also felt compelled to

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[50] TNA, T70/31, letter dated September 20th 1762.

[51] Ghana Meteorological Service, *Annual Summary of Observations in Ghana 1968*, p. 44.

[52] TNA, T70/31, letter dated September 20th 1762.

[53] Ghana Meteorological Service, *Annual Summary of Observations in Ghana 1968*, unnumbered page; see introduction for a description of the rains' impact.

[54] TNA, T70/31, February 1763. The governor forgot to date this letter; however, in the copy found in the catalogue it is added that it was written on the 6th.

[55] TNA, T70/31, letter dated April 4th 1763.

[56] TNA, T70/31, letter dated May 25th 1763.

[57] TNA, T70/31, letter dated July 7th 1763.

[58] Dalzel, p. 143.

[59] TNA, T70/31, letter dated January 10th 1764.

inform the Committee in London that the Royal Navy captains were "not sufficiently warranted" to interest themselves with the affairs of the traders.[60] The governor was clearly disappointed in not receiving more assistance from the Royal Navy in dealing with pirates and other problems.

The following year, Mutter claimed to have assisted the Asante by sending them food. This does not necessarily mean that the Asante had nothing to eat and that this was a consequence of reduced crops. It might simply mean that food was not made available to them. The situation that was unravelled shows the Asante had gone to Fante villages to buy food. This action suggests that there was food although not available to the Asante who, instead of being fed, found themselves kidnapped and enslaved by the Fante. This was a surprising action by the Fante as the Ashanti had been their victorious allies when recently defeating the Akim, Wassa, and Twifo.[61] Nonetheless, between 1,200 and 1,500 Asante had been kidnapped and enslaved by the Fante (noted in 1765), and this event would prove to be the beginning of a long dispute between the Fante and Asante.[62] The Europeans, an Anglo-Dutch coalition, acted as diplomats and tried to resolve the differences. The main concern was to prevent a war, as this would affect the trade. However, the issue went unresolved for several years.[63] I will return to the situation later, as it might have influenced the progression of the slave trade and availability of food in 1766.

In a letter signed by John Hippisley, Gilbert Petrie, and John Grosle in July 1765, the trio explained why traders should not buy people from the coast. It was considered bad for business to buy people that originated from the coast, as they had a tendency to run away as soon as they were free of their chains. The letter also contained an ambiguous entry concerning slaves from the inland, so-called Duncoes. The Duncoes were considered "very stupid & [even] weakly kind".[64] It is not explained whether this referred to the Duncoe as humans or their state of health. Employing the word 'even' might imply that 'stupid' refers to their character while 'weakly' refers to their general health. This also depends on the origin of the Duncoes, which is unclear. It is assumed that the Duncoes were from the upper parts of the Volta river area and the interior of Ashanti.[65] This would mean that they had walked over 200km before arriving at the coastline. Such a journey would most certainly have affected the health of the slaves, even healthy individuals. It is also possible that they had migrated due to lack of rains before being enslaved, or imprisoned, in 1764. This might explain the state of their physical strength, if it assumed that foes were treated, not badly, but not as well as friends. The letters from 1764 did not mention the rainy season, which might explain the weak health of the slaves in 1765. However, based on letters written in 1766, it can be assumed that the rains failed in 1764.

[60] TNA, T70/31, letter dated February 10th 1764.
[61] Fynn, p. 100.
[62] TNA, T70/31, letter dated July 20th 1765.
[63] Fynn, pp. 99–105.
[64] TNA, T70/31, letter dated July 25th 1765. The handwriting is hard to interpret, but it appears to read "even". It might also be "ever", this would then only suggest that they had always been weak. "[E]ven" is chosen as this is the first mention of Duncoes.
[65] Raya Kea, 'Plantations and labour in the south-east Gold Coast from the late eighteenth to the mid nineteenth century', in Robin Law (ed.), *From slave trade to legitimate commerce: the commercial transition in nineteenth-century West Africa* (Cambridge, 1995), see note 16, p. 140. A more narrow definition suggests that the word "Duncoe" referred to a slave sold by Ashanti, referring to any man or woman sold as a slave, see R. S. Rattray, *Ashanti Law and Constitution* (Oxford, 1929), p. 35. There is, however, no clear understanding on who the Duncoes were or from where they originated.

In a letter written on October 22nd 1766, Governor Gilbert Petrie claimed that, in 1765, he had heard that the Fante had several thousand prisoners after defeating the Akins and the Asante. At that time, the Fante needed to dispose of these prisoners "immediately" as food was "uncommonly scarce".[66] Petrie considered the surplus of slaves a perfect situation to try and lower their price. He hoped that his actions would resolve the Fante's problem of having too many slaves to feed.[67] The Asante prisoners were probably the same slaves to whom Mutter referred in 1765. It is also possible that some of the slaves were the weak Duncoes mentioned in the letter written by Hippisley, Petrie, and Grosle, as the lack of food might explain the bad state of health of the Duncoes. More importantly, Petrie's remark suggests that even the Fante were short of provisions, not only the Asante. This is why it is possible that there had been a drought in 1764. There was clearly not sufficient food for everybody, not even the victors. However, the scarcity of provisions in 1765 was not felt on the coast until 1766, which might explain why this was not mentioned earlier.

Governor John Hippisley was restlessly awaiting provisions in March 1766, and he mentions that he hoped the ship would arrive before the beginning of the rainy season six weeks later. This is the first entry that describes when the rainy season was expected to commence, at the beginning of May.[68] This claim is in sharp contrast to Rømer, who asserted that it usually commenced one month earlier.[69] However, the rainy season was not the first matter on the governor's mind in 1766. As Hippisley so vividly explained on June 14th:

> There has been the greatest Dearth of Corn & consequently of all live stock that perhaps was ever known. For near these two Months I have been Witness to the most touching instances of distrust for want of food: This Want as it always does, has brought on an epidemic sickness. In the Castle we have escaped pretty well, but the Natives have suffered severely.[70]

This is a strong indication that that the crops failed in 1765. However, the governor appeared surprised by the scarcity of food, and he was confused by the prevailing circumstances. In addressing the Committee in London, he wrote "[w]hat must it be now Gentlemen when the price of Corn is raised six times above what it is in Ordinary Years?"[71] It seems as if the governor had no clue of the events that were unravelling. At Cape Coast Castle they had only managed to survive as, two weeks earlier, they had received rice from Appolonia. However, almost all of the goats, sheep, and poultry had died as they were left without fodder. Otherwise this might have eased the situation for the castle's personnel as the animals provided the castle with meat. The personnel's survival was assisted by their new French cook. The governor praised the cook who "by his art can disguise dishes, and make lean meat go down almost as well as fat".[72]

The rains must have been late in 1766. It would otherwise seem natural for Hippisley to have commented on the rains in mid June, especially as the rains should have relieved

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[66] TNA, T70/31, letter dated October 22nd 1766.
[67] TNA, T70/31, letter dated October 22nd 1766.
[68] TNA, T70/31, letter dated March 20th 1766.
[69] Rømer, p. 17.
[70] TNA, T70/31, letter dated June 14th 1766.
[71] TNA, T70/31, letter dated June 14th 1766.
[72] TNA, T70/31, letter dated June 14th 1766.

the dire situation. However, the rains were mentioned for the first time in a letter written in mid July. The governor wrote that the rains had set in and became the "most severe that was ever known in the memory of the oldest man".[73]

The rainy season was extremely intense in 1766. Cape Coast Castle was reported to be "in a most ruinous situation" as the walls had collapsed.[74] The situation was even worse at Sekondi, which had turned into "a heap of ruins".[75] The situation was extremely troublesome, with one crisis followed by another. Gilbert Petrie took over the job as governor as Hippisley had died of "putrid" fever in September. Petrie explained that "[a] more sickly season than this was never seen by the oldest Servants you [the Committee] have, and mortality has been great amongst the natives".[76] The weather was moist and foggy and diseases ravaged along the entire coastline. The Dutch had lost many of their soldiers and officers at Elmina. Petrie also noted that there was not a slave to be seen at any neighbouring forts. However, at Annamboe the trade was "flourishing" more than ever previously known.[77] This observation was later proved correct. The number of embarked slaves peaked in 1766, and it was higher than any other year in the 18th century.[78] The extreme situation probably created a surplus of slaves, with many selling themselves as slaves to survive. However, it is also possible that the Fante continued to have a surplus of slaves since enslaving the Asante in 1765.

The forts and men were severely punished in 1766. There was a general lack of food in the country at the same time that the rains were heavy, the castles collapsed, and the men were ill and dying. However, the remainder of the year continued without problems and the castles' walls were rebuilt by the end of the year.[79] There were no remarks on the secondary rainy season in any letters from that year. However, in a letter written in March 1768, the governor described some problems relating to the castle in 1766. He wrote: "Since the month of October when the rains ceased in the year 1766".[80] This choice of words suggests that in 1766 i) it had rained until October or ii) the rainy season ended in October, thereby suggesting that it had only been prolonged, as in 1968. Be that as it may, this is the first and only remark that might imply the existence of a secondary rainy season.

In January 1767, the governor mentions a store ship that had sailed past Cape Coast Castle in December 1766.[81] The westward current and the nightly sea breeze had pushed the ship close to Cape Three Points, west of Cape Coast Castle. The ship had sailed past Cape Coast Castle as it had sailed from Appolonia (east of Cape Coast Castle) towards Cape Coast Castle in the night. This mishap was only possible while sailing at night during the Harmattan, which had turned the winds and the current westward. The same phenomenon also prevented the ship from sailing to Cape Coast Castle. When writing the letter in January, the governor explained that they were only waiting for the Harmattan to abate, and the current and the winds to turn again to leeward. He wrote "This is the

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[73] TNA, T70/31, letter dated July 13th 1766.
[74] TNA, T70/31, letter dated July 13th 1766.
[75] TNA, T70/31, letter dated July 13th 1766.
[76] TNA, T70/31, letter dated September 13th 1766.
[77] TNA, T70/31, letter dated September 13th 1766.
[78] TSTD.
[79] TNA, T70/31, letter dated March 3rd 1768.
[80] TNA, T70/31, letter dated March 3rd 1768.
[81] TNA, T70/31, letter dated January 10th 1767.

proper Hirmantan [sic] Season, when they [wind and current] generally set to the Westward".[82]

This is the first time that the Harmattan in mentioned in any of the letters. The governor noted that the winds and the current 'generally' turn westward during this time of the year. This might indicate that it was thought the Harmattan reversed the flow of the current. Nonetheless, employing the words 'proper' and 'generally' is ambiguous. It might mean that the current 'generally', but not on every occasion, turned westward during the Harmattan, which appeared annually. This might mean that they always experienced the Harmattan winds, but that the current did not always change. This would signal a variation in the southward migration of the ITCZ. However, it might also indicate that they were not affected by the Harmattan annually, but 'generally'; thus meaning most years, but not every year. The winter of 1767/68 was considered a 'proper' Harmattan season with regard to its intensity. A proper Harmattan would therefore refer to a period when the ITCZ migrated south of the coastline, or far enough to affect the direction of the current. The only difference is in the general positioning of the ITCZ. It is worth noting that the Harmattan does not go below the coastline every year, which was noted in an investigation from 2007.[83] However, this does not mean that it was not a possibility prior to 1767, although, if this was the case, why was the Harmattan not mentioned in the previous letters?

It is evident that this description of the Harmattan was written only for the Committee in London, and only because the ship sailed past Cape Coast Castle. It was not written because the Harmattan was considered an anomaly. Therefore, it is difficult to determine whether or not the ITCZ always (or often) migrated below the Guinea coastline prior to 1767. A description of the Harmattan, provided by Thomas Winterbottom in 1795, suggested that it was occasionally felt along the Guinea coastline. Winterbottom also added that the Harmattan was felt more frequently on the leeward part of the Guinea coast, which was where Cape Coast Castle was situated.[84] However, as in the case with the subsidiary rainy season, it is possible that the climate had changed between Winterbottom's statement in 1795 and Gilbert Petrie's note in 1767.

The Harmattan in January was all the information found in the letters from 1767, there was no reference of the rainy season. In a council meeting, it was suggested that an application should be made to the Lord of the Admiralty to send ships to the coast. This suggestion was proposed due to disturbances between the Asante and the Fante, and because the Dutch had invited the Asante to invade the coast.[85] This action was part of the Anglo-Dutch rivalry that had commenced in the 17th century and continued throughout the 18th century. The English merchant company with its headquarters at Cape Coast Castle collaborated with the coastal people, while the Dutch, who had their headquarters at Elmina, were closer to the Asante.[86] Nevertheless, from time to time the antagonists also helped each other, as some solidarity existed between the Europeans when far away from home, in a foreign environment, and at the mercy of the locals.

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[82] TNA, T70/31, letter dated January 10th 1767.
[83] Changling He et al., 'Mineralogy of dust deposited during the Harmattan season in Ghana', *Danish Journal of Geography* (vol. 107, no 1:2007), p. 9.
[84] Winterbottom, p. 39.
[85] TNA, T70/31, letter dated October 25th 1767. Fynn, p. 112.
[86] Shumway, pp. 64–66.

The rains either set in late or were prolonged in 1768. In late August the governor wrote that the rains had prevented the building of the castle "for some time past".[87] The meaning of 'some time past' cannot be established, but it appears that the frequency of rainfall events had been high. The rains and the winds had prevented ships from sailing from Winneba to Cape Coast Castle. Furthermore, the winds pushed two ships off anchor in the middle of June, and the ships had been pushed all the way to Whydah, situated approximately 300km east of Cape Coast Castle. The ships had not returned by the time the letter was written in August, which implies bad conditions for almost three months. It appears as if everything conspired against the British in 1768. The slave trade was reported to almost be at a standstill all along the coast as "nothing but bad Duncoe slaves can be seen, which are scarcely worth carrying of the coast".[88] As there was no disturbance in the country, Petrie could not understand why the trade had stagnated. His description of the Duncoe slaves was similar to that in 1765. The situations were also similar. There had been a scarcity of corn in 1765, and this was probably also the case in 1768. This assumption is based on a letter written in June 1769, in which the governor wrote that the famine still continues in the country.[89] Employing the word 'still' suggests that the famine had started already in 1768, thereby implying that the rains might have failed in 1767. This might explain the condition of the Duncoes in 1768. The prolonged drought then resulted in a famine in 1769. Following the hypothesis that the dry coastal region and the inland area, especially in the Sahel, experienced opposite conditions, prolonged rains along the coast in 1768 might suggest that the inland rains were weak. For example, the inland rains failed sufficiently to affect the water level at Senegal River in Western Sahel. This rendered the brig *Charming Nancy* useless as she ran aground, due to the "exceeding dry Summer", in 1768.[90]

Whatever the situation in 1768, John Grosle described the situation as critical in June 1769, a year that Dalzel remembered as a "fatal" year.[91] There had been a lot of deaths at the forts, and the British were reduced in numbers. There was a probably a famine and an utmost need of provisions.[92] This was the famine that was claimed to continue in 1769, which implies that it had begun in 1768. There is, unfortunately, no further information regarding the weather, the deaths, or the famine. However, heavy rains were a probable cause of the many deaths in 1769. The governor noted that 30 persons had died of the yellow fever by the end of October, which was considered an unusually high number.[93] Consequently, to tackle the "white mans grave" syndrome, Grosle suggested that men should be sent to the coast twice a year. He was convinced that this would minimise deaths among the Europeans. Grosle proposed that the first shipment of men should arrive at the same time as the store ship in February. He then considered it a better alternative for the second shipment of men to arrive in late August or early September, at the beginning of the "healthy season".[94]

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[87] TNA, T70/31, letter dated August 27th 1768.
[88] TNA, T70/31, letter dated August 27th 1768.
[89] TNA, T70/31, letter titled "Appointments dated Cape Coast Castle 20th June 1769", which probably suggests that it was report of a council meeting between the governors at the Gold Coast.
[90] Ashton, p. 27.
[91] TNA, T70/31, letter titled "Appointments dated Cape Coast Castle 20th June 1769"; Dalzel, p. 143.
[92] TNA, T70/31, letter dated July 6th 1769.
[93] TNA, T70/31, letter dated October 26th 1769.
[94] TNA, T70/31, letter dated October 26th 1769.

Grosle's remark of a 'healthy season' suggests that the rainy season in 1768, when heavy rains continued to prevail at the end of August, was unusual. Furthermore, Grosle's proposition indicates that there was no clear secondary rainy season in the autumn months. This was why Grosle suggested that the men should arrive before and after the rainy season, which would maintain the number of personal at Cape Coast Castle above the minimum level at all times. Grosle's suggestion appears strange if there remained an expectation of heavy rains throughout October, especially as he might have asked for the men to be sent in October. The men would, otherwise, have arrived slightly prior to the rains. However, Grosle's suggestion seems more in context if the rains were evenly spread over the autumn months. Unfortunately, there was no further information on the 'healthy season' or other types of weather related information in the 1760s. A summary of the most noteworthy events during the 1760s are presented in Table 3.2.

3.2.1 Concluding remarks: outlining the climate in the 1760s

It is worth noting that no other investigation has found documents or recorded any famines during the 1760s. Neither the coastal nor the inland climate was represented in Nicholson's or Brooks' periodisations of West Africa, or in any other investigations dealing with the same subject and geographic area. In Nicholson's appendix, there is specific information for this decade only for Northern Africa, and in particular Morocco (locust invasion, 1761–62), Algeria (plague, 1762–64), and Tunisia (little rain and bad harvest, 1762–63; droughts with expensive food, 1763–64)[95]. To this can now be added the lack of rain in Senegal in 1768 when the *Charming Nancy* to run aground.

The weather and climate at the Guinea Coast showed a great deal of variation in the 1760s. The rains were abundant and prolonged, and there were many disorders causing a lot of sickness and deaths. This was intermixed with droughts and famines, which affected not only the inland country but also the coastal regions. However, there was only a small number of reflections of the inland climate before 1764.

The rains were sufficiently violent to prevent all communication between the forts in 1762. The rainy season was later described, by the governor, as the worst season in Africa. The rains were heavy again in 1763, and the governor described the season as the unhealthiest ever. This utterance was made by Governor Charles Bell, who had a lot of experience at the coast, which further supports remarks concerning the intensity and/or severity of the rainy season in general.

There was not much climatic evidence for 1764. One hypothesis suggests that the rains failed in 1764, which led to a scarcity of provisions among the Asante in 1765. This might also explain the bad condition of the Duncoe slaves, and the fact that the Fante had to promptly dispose of their slaves. Food availability was, first, a bigger dilemma than its actual shortage, although the conditions seemed to have been desiccating. There was probably a drought in 1764, which then affected the Asante and Fante in 1765. This explains why there was no corn available in 1766. There might have been some recovery in 1767, but the inland rains then failed again in 1768, which strained the deposits from 1767. This resulted in a famine in 1769.

[95] Nicholson (1976), pp. 237, 244, and 246.

Table 3.2 *Summary of the most noteworthy climatic indicators per year and months as they appear in letters written in the 1760s.*

Year	January – March	April – July	August – October	November – December
1760				
1761	Worms	Sickness		
1762		Tempestuous weather; violent rains	Sickly season; bad weather; no communication	
1763	Still sick	Distress of supplies	Sickly season	
1764	Men healthy			
1765		Scarcity of corn		
1766		Scarcity of corn	Sickly season; bastion fell; provisions low	
1767	Proper Harmattan			
1768			Severe rains; Exceeding dry summer in Senegal	
1769		Lack of provision; famine	Yellow fever; many deaths	

The coastal climate was different to that inland. The rains were sufficiently hard to make some walls collapse in 1766. The rains were heavy again two years later, and probably also again in 1769 when there were many diseases and deaths.

Conclusively, inland rains appear to have been weak during several years starting from 1764. It is here suggested that this was the beginning of a drier inland climate, while the otherwise drier coastal regions experienced a wetter period. Some rains appear to have been prolonged in some years; however, there remained no clearly defined subsidiary rainy season.

3.3 The 1770s

The famines that swept over the Guinea Coast region in the late 1760s continued into the 1770s, and the weather conditions that dominated the 1760s continued throughout the beginning of the 1770s; however, changes were occurring. The coastal rains were devastating for Cape Coast Castle in 1770. Many were sick and 17 had died by the end of May. The epidemic-like conditions appeared to have been constrained to Cape Coast Castle as nobody was reported sick at Annamboe. The Chief Governor made a request for more men to be sent from London as "the rainy season is not near over…great reason suspect will lose many before season is over", and this proved to be true.[96] Approximately a month later a famine lingered among the natives and caused "considerable mortality"

[96] TNA, T70/31, letter dated May 24th 1770.

all along the coast.[97] The rains continued, the weather was foggy and damp, and almost everybody had fallen ill. Charles Bell, who had returned as governor, stated that the rainy season had been very severe and that they had not seen the sun for almost a week. The weather had even prevented the slaves from repairing the castle, and they had only been able to work three days a week. [98]

Diseases almost depopulated Cape Coast Castle in the summer of 1770, and it lasted until August before the governor wrote that the weather had "mended".[99] The governor did not describe what was meant by mended; for example, whether the rains had been prolonged but stopped, or whether it had been foggy and moist and was clearing up. Whether or not this had affected the slave trade is uncertain, but the trade was described as very dull all along the coast. The governor feared that all ships at Annamboe had made an "indifferent voyage if the trade does not considerably mend". [100] Two months later he explained that the sick personnel were kept in town houses, and that the smallpox was spreading amongst the slaves. [101] He claimed that half the slave trade was conducted at Annamboe. The Trans-Atlantic Slave Trade Database (TSTD) supports this notion, and shows that trading in slaves was intense at Annamboe in 1770. This was the second most intensive trade year in the 18th century, which suggests that the trade was anything but dull, as claimed by the governor in August.

Diseases took their toll in 1770. The governor at Whydah informed the Chief Governor at Cape Coast Castle that they were in very bad condition. The governor at Whydah also claimed that there was a scarcity of corn.[102] However, the governor at Cape Coast Castle made no remarks on a similar situation. Therefore, how the situation evolved at Whydah and its cause is unknown. In his last letter from 1770, the governor only mentions that they had lost many men in 1770.[103]

There are only a few remarks for 1771, and no remarks on the famine mentioned in 1770. The trade was described as indifferent, which was why the governor claimed it was going to take a long time to fill the slave ships.[104] A month later, in March, he informed the Committee in London that their servants were healthy and that the weather had been fine.[105] This is regarded as evidence that the famine had abated and the weather had mended.

The trade was described as indifferent in 1771, but it was described as "extremely dull" in June 1772. [106] There were no remarks on the weather although the letter was written in the middle of the rainy season. The trade was claimed to be almost non-existent in the middle of August.[107] The remarks on the slave trade are intriguing. Both 1771 and 1772 are among the top ten years of slaves exported from Annamboe in the TSTD. This might suggest that the governor was explicitly describing the slave trade from Cape Coast Castle or that he was describing the trade in other commodities. The governor later added

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[97] TNA, T70/31, letter dated June 20th 1770.
[98] TNA, T70/31, letter dated June 20th 1770.
[99] TNA, T70/31, letter dated August 25th 1770.
[100] TNA, T70/31, letter dated June 20th 1770.
[101] TNA, T70/31, letter dated October 9th 1770.
[102] TNA, T70/31, letter dated October 24th 1770.
[103] TNA, T70731 letter dated November 19th 1770.
[104] TNA, T70/31, letter dated February 28th 1771.
[105] TNA, T70/31, letter dated March 18th 1771.
[106] TNA, T70/31, letter dated June 20th 1772. At the end of the letter it is added that Mr Beard's meteorological diary is enclosed in the shipment of letters. The whereabouts of this book are unknown.
[107] TNA, T70/31, letter dated August 12th 1772.

that they were beginning to see the end of the rainy season. The weather was reported to be "excessive bad" and the rainy season to have been "most disagreeable".[108] The rainy season was prolonged, especially if the rains had continued half way into August, when the letter was written. However, they escaped without a great loss of men as only four had died. The health of the men, and the fact that the castles remained standing, implies that the rains had been frequent but not intense. The situation was quite the reverse at the Cap Verde Islands. The rains failed totally in 1772. This resulted in a famine that caused tremendous suffering for three years.[109] It is worth noting that the weather at Cap Verde in 1772, as in 1753, was the complete opposite to that at Cape Coast Castle.

There were troubles with pirates at the beginning of 1773. A Royal Navy vessel arrived at the Gold Coast in March, but it was moored off Cape Coast Castle for only a week before setting after pirates. This is also the first time that the pond at Annamboe was reported to have dried out, which is somewhat surprising as the rains had been severe in previous years, at least at Cape Coast Castle.[110] The pond must have dried out during the winter, which implies that there had been only weak rains following the summer. The slave trade had also been intense the previous year, which means that there had been an excessive consumption of water by slaves and slave traders. This would characterise the dry pond as being caused by socioeconomic rather than meteorological factors, which would be the case if the rains had failed. However, in the middle of July, when the rainy season was nearing its end, the governor claimed that the rains had "not" been severe.[111] This is the first remark on a less intense or less frequent rainy season. At this time, David Miller was the governor in charge, and this was his fourth rainy season as a governor. Comparing the rainy season in 1773 with the preceding year shows that it appears to have ended almost one month earlier in 1773. However, the weather had nonetheless taken its toll, as nine officers had died and 26 were ill.

There is no information on the weather in the winter of 1773/74, but the country was feeling the impact of a "general famine" in May 1774.[112] It was impossible to obtain any corn, and the castle had received bad and inedible bread from England. While the situation was bad at Cape Coast Castle, it was even worse at Elmina where everybody was dying. The governor did not speculate over the causes, but the rains had commenced and he predicted "a very severe" rainy season.[113] There are unfortunately no records for the remainder of the year. It is, therefore, unknown how severe the rains were or how the famine progressed. However, reflecting upon the effects of the famine and whether or not it had affected the slave trade is unavoidable. Especially as the governor in April 1775 wrote that "a far greater number of slaves were exported in 1774 than in any one year of the Establishment".[114] The governor also reported that the peace between the Asante and Fante was a necessity for the trade to flourish. The main reason for his remark was that the war between the Fante and Asante had closed the trading routes between the coast and the inland. In addition, it is evident that the dispute between the Fante and Asante was considered the main reason for the "exceeding dull" trade in October 1776.[115]

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[108] TNA, T70/31, letter dated August 12th 1772.
[109] Patterson, p. 307.
[110] TNA, T70/31, letter dated March 6th 1773.
[111] TNA, T70/31, letter dated July 12th 1773.
[112] TNA, T70/32, letter dated May 10th 1774.
[113] TNA, T70/32, letter dated May 10th 1774.
[114] TNA, T70/32, letter dated April 15th 1775.
[115] TNA, T70/32, letter dated October 19th 1776.

There were no letters describing the weather in the summer of 1775. The rains had an early onset as the governor claimed that they were setting in already in the middle of April.[116] There were no further remarks on the rainy season. However, the weather was reported to be bad, and many officers had fallen ill, on December 30th.[117] It would appear obvious that it was the Harmattan. However, there are reasons to assume otherwise as indicated by the weather in December 1778. I will return to this at a later stage.

Richard Miles was appointed the new Chief Governor in August 1777, and his letters mostly address the slave trade. The reason for the lack of information might be explained by a letter that was written in January 1778. The governor mentions that he was sending information on the castle and health of the men in a separate list, not in the letter as had been customary.[118] It might be that Miles had adapted this procedure from the beginning, which is why there is little reference to the weather. Nevertheless, the letters sent in 1777 provide a large amount of insight on the number of monthly rainfall events. The letters can be compared to the daily information extracted from the *Diary of Transaction at Cape Coast Castle*, which was kept from July 10th 1777 to December 31st 1778. This is therefore added to complement the discussion concerning the weather during this period, and compensates for the general lack of climatic information in 1778.

3.3.1 Daily weather at Cape Coast Castle in 1777

The rains set in as expected in May 1777, and their intensity led the governor to anticipate a severe season.[119] On July 10th, one and a half months later, the governor described the rains as having been "very severe", although the personnel remained in good health and the rainy season was nearing its end.[120]

Exactly one month later, on August 10th, the governor wrote that they had received only a little rain since July 10th. The weather was now foggy and the most "unwholesome weather ever seen".[121] Many of the officers had fallen ill although nobody was dangerously ill, and there were no reports of deaths. The Fante possessed a great number of slaves and had invited everyone to Annamboe to participate in the trading. The invitation did not surprise the governor as he noted that the country was filled with slaves "scarce of provisions, and no English ship to take them off their [The Fante] hands".[122] The scarcity of provisions indicates that the inland area had been affected by a drought in 1776 and 1777, at least to the extent that the Fante could not support their slaves, just exactly as had been the case in 1765. Nevertheless, the governor claimed that they had only received a little rain during the previous month. The meaning of little rain can be determined by reference to entries in the *Diary of Transactions at Cape Coast Castle*.

July was a very foggy month according to the diary, exactly as reported in the governor's letter from August. The weather was described as 'foggy' or 'thick foggy' on 14 out of 22 days, but it only rained on five occasions and the rainfall was, for the most

[116] TNA, T70/32, letter dated April 15th 1775.
[117] TNA, T70/32, letter dated December 30th 1775.
[118] TNA, T70/32, letter dated January 15th 1778.
[119] TNA, T70/32, letter dated May 20th 1777.
[120] TNA, T70/32, letter dated July 10th 1777.
[121] TNA, T70/32, letter dated August 10th 1777.
[122] TNA, T70/32, letter dated August 10th 1777.

part, light. The rains that were received on the 14th, 17th, and 24th were either described as "some rain" or "drizzling rain".[123] The qualifying adjectives indicate that the rains were short in duration and not abundant. The weather did not change much in August, and was noted as foggy on 22 out of 31 days. The weather was described as very unwholesome and, on one occasion, it was claimed to have been so bad that "[w]e cannot see the length of the Castle".[124] It only rained twice in August. The precipitation was described as "some drizzling rain" on the 7th and as "small drizzling rain" on the 14th.[125] These descriptions clearly indicate that they received only a little rain in August. Hence, the diary can now be employed to give an indication of what the governor meant when he wrote that they received only a 'little rain' between July 10th and August 10th.

There were six rainfall events between July 10th and August 10th 1777, with five of them documented in July. The rains were described as 'drizzling' on three occasions and as 'some' on one occasion. These rainfall events produced only a small quantity of rain. However, the rains on July 12th and 15th were more abundant. The weather was described "as yesterday [thick foggy weather] with rain" on the 12th and as "[v]ery dirty weather with rain" on the 15th.[126] These entries reflect more continuous rains when compared to the other entries, which clearly described the rains as light in intensity or short in duration. The rains on the 12th and 15th are considered continuous as the rainfall on the 15th is sandwiched between two lighter rainfall events. This entry implies that the duration was longer than rainfall events described as including 'some' rain or 'drizzling' rain. However, the rains on the 12th and 15th cannot be considered abundant simply because they were intense. The duration of the rains was not mentioned, and the description does not contain any qualifying adjectives such as 'great' or 'heavy', that are found in later descriptions.

The rains will henceforth be divided into *light* and *abundant* rains. *Light rains* refer to remarks that described the rains to be *short in duration and not intense*. If infrequent, as in July 1777, they might be regarded as *inadequate* and in general summarised as *little* over a longer period.

Abundant rains describe the opposite conditions to light rains, and were either *continuous or/and short, but intense*. There is room for a third category between these two categories. This (middle) category would refer to *normal* rains. These descriptions contain no qualifying adjectival adjectives that reflect on intensity as, in the example above, it was only entered that it rained. However, it is considered that this is an indication of some type on continuance. It 'rained' is the opposite of it was 'no rain', although the weather was never described as such. However, these entries are included in the category labelled *abundant* as they appear to be continuous, although not always intense. The categorisation and the descriptions gathered from the diary are presented in Table 3.3.

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[123] TNA, T70/1468, July 10th–31st 1777. The pages are unnumbered, and I will henceforth only refer to the dates.
[124] TNA, T70/1468, August 1st–31st 1777.
[125] TNA, T70/1468, July 7th and 14th 1777.
[126] TNA, T70/1468, July 12th and 15th 1777.

Table 3.3 *Denominators for describing light and heavy rains collected from Diary of Transactions at Cape Coast Castle (July 10th 1777 – December 31st 1778).*

Light rains	**Heavy rains**	
	Normal	Abundant
Some rain; drizzling rain; little rain; some little rain; little shower; some showers; gentile showers	*With rain; rainy weather; rain; rain in the night*	*Deal of rain; heavy fall of rain; a very great fall of rain; great fall of rain; great rain; rained almost all night; incredible fall of rain; a very rainy day; rain all night; hard shower of rain; heavy shower of rain; remarkably hard shower*

The weather in September was similar to that in August. It did not rain during the entire month and the foggy weather continued, with 15 out of 30 days being reported as foggy. However, the weather was clearing up as the fog dissipated after the forenoon.[127] This was the beginning of the healthy season, as the governor explained in 1769. The governor probably referred to the fact that the conditions were getting drier and less humid. Although it cannot be determined with certainty, there is always the possibility that it rained throughout the summer in 1769, just as in 1968. October was mostly clear. A tornado was noted on October 5th, but it did not include rain. Based on the description in the diary it appears that the keeper of the diary did not consider a tornado to necessarily include rain. This is consistent throughout the diary, as rains were occasionally noted as accompanying tornadoes, thereby implying that it might occur with or without rains. It is plausible that it was considered unnecessary to mention the rains as it always rained; however, this seems unlikely.

In total, there were six days of rain in October 1777. Five of the rainfall events produced only light rains, while the rains on the 14th were abundant.[128] There are two vague entries in October. These are from the 17th and 18th, when only "ditto weather" was entered, which refers to "[f]ine clear weather with regular Land & Sea Breezes. About noon some little rain" on the 16th.[129] The character of the entries, in general, is such that the ditto reference (Do) probably refers to the weather being mostly fine and clear, although it excludes the rain. Especially as the first entry also has a reference to the time of the event, in some cases more than others, there are fewer reasons to distrust these types of entry, although the dilemma that arises is almost always the same. However, the difference created by the *actual* rainfall events noted in the diary when compared to the *possible* quantity varies a great deal from month to month. The *actual* number of rainfall events will henceforth refer to rainfall events that are written and clearly identified in the diary (or logbook). The *possible* number of rainfall events includes the unclear *ditto* remarks. The

[127] TNA, T70/1468, September 1st–30th 1777.
[128] TNA, T70/1468, October 1st–31st 1777.
[129] TNA, T70/1468, October 16th and 17th 1777.

possible amount of rainfall events will therefore always be higher. This approach makes October appear as a dry month, although the frequency of rainfall events might, plotted on a graph, make it look like a subsidiary rainy season. However, the majority of the rainfall events were light and too weak to be identified as a secondary rainy season. It would appear that the rains were too weak to be termed a rainy season, as claimed by Henry Meredith. Nonetheless, it is worth noting that one abundant rainfall event might have generated enough rain to qualify the rains as part of a secondary rainy season. Walker's long-term average showed 13 rainfall events in June and eight in October, the amounts were 228.6mm and 101.6mm respectively.[130] In other words, the secondary rainy season generated less than half the amount of rainfall when compared to the first. It is, based on the remark in the diary that states "a deal of rain", impossible to determine the amount of rain that was received.[131] However, considering the qualifying adjectives in Table 3.3, the event appears to not have produced a considerable amount of rain.

The weather was quite different during the last two months of 1777. Three of the rainfall events were abundant, while two were light. However, there were a total of five tornadoes registered in November. Most occurred in the afternoon, but the tornado included rains (abundant) only on one occasion, and this tornado appeared in the afternoon. The two remaining abundant rainfall events might have generated a large amount of rain, sufficient to make November appear wetter than October. For instance, there was a "very great fall of rain" during the night of the 10th. This might have been a late onset of the secondary rainy season. However, this is a highly speculative suggestion. The uncertainty is increased by the fact that there were notes on five actual and eight possible rain events. The three additional possible rainfall events were noted between the 20th and 22nd, thus referring to the weather on the 19th when "little rain" was reported to have fallen around noon.[132] If the possible rainfall events and the tornadoes included rainfall, then it would probably suffice as an indication of the secondary rainy season.

The weather in December was similar to November, although it began to get foggier at the end of the month. This might also indicate the onset of the Harmattan, when sand blowing from the Sahara Desert can make it appear foggy or hazy, although the concept was not employed to describe the weather.[133] This is contradicted by the strong leeward current. It might be that the convergence zone did not go below the coastline, which is why the direction of the current was not altered, as it was speculated to have been in January 1767. However, the entries and number of rainfall events during December are problematic (see Table 3.4). There were four actual rainfall events and 17 possible. Two of the actual events were abundant and two were light. The number of possible rainfall events is problematic only because December should be dry, although it might have been a winter anomaly similar to that noted by P. Knippertz and A. Fink in 2004.[134] For instance, the average number of rain days in December was two in Walkers 34-year average, and the situation was the same in the 1960s (see Fig 2.7).[135]

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[130] Walker, p. 25.

[131] TNA, T70/1468, October 14th 1777.

[132] TNA, T70/1468, November 1st–30th 1777.

[133] The Harmattan might bring with it sand from the Sahara Desert to the coastline. However, this phenomenon was not widely known in the 18th century, and thus it was sometimes described as hazy. However, Winterbottom suggested that the haze was sand transported on the wind, pp. 40–41.

[134] Knippertz and Fink, p. 3580. See Chapter 2.

[135] Walker, p. 25 Table XVIII.

Table 3.4 *The weather entries made in the Diary of Transaction at Cape Coast Castle in December 1777. Possible rainfall events are in [brackets]; and actual events are in italics.*

Date	**Weather**
23 Nov	A fine clear day
24-30 Nov	Ditto weather
1 Dec	Ditto weather
2 Dec	Ditto weather
3 Dec	Ditto weather
4 Dec	Ditto weather: In the evening *rain*
5 Dec	Ditto weather [rain?]
6 Dec	Ditto weather [rain?]
7 Dec	Ditto weather [rain?]
8 Dec	Fine pleasant weather with land wind in the morning, in evening Sea Breeze.
9 Dec	Ditto weather with *a little rain* in the night
10 Dec	Ditto weather with strong Sea Breeze all night and lee current [a little rain?]
11 Dec	Ditto weather: Sea breeze all night with very strong Lee current [a little rain?]
12 Dec	Ditto weather: in the night *some rain*
13 Dec	Ditto weather with a strong lee current [some rain?]
14 Dec	Ditto weather [some rain?]
15 Dec	Ditto weather [some rain?]
16 Dec	Ditto weather [some rain?]
17 Dec	Ditto weather. In the night a very hard Tornado & *heavy fall of rain*
18 Dec	Ditto weather [heavy fall of rain?]
19 Dec	Ditto weather [heavy fall of rain?]
20 Dec	Ditto weather [heavy fall of rain?]
21 Dec	Ditto weather [heavy fall of rain?]
22 Dec	Fine clear weather with a strong land wind in the morning

Source: The Diary of Transactions at Cape Coast Castle[136]

Although not impossible, it is extremely unlikely that there were 17 rainfall events in December, which would have made it the wettest month of the year in 1777. Instead, the rainfall entries (when they occur) should be interpreted as daily anomalies, which is why they are added to the ditto references. In other words, the weather remained the same, although there was also some rain. The ditto entries do not suggest that the weather was exactly the same as the preceding day. It only states that the weather at a general level remained the same, which was 'fine and clear'. Some comments on the weather might also

[136] TNA, T70/1468, November 1st–30th, December 1st – 22nd 1777.

be expected if there were five tornadoes with heavy rain on five days in a row.[137] Nonetheless, even if the possible outcome is disregarded, it constitutes December as a relatively rainy month with two abundant and two light rainfall events.

The information derived from the letters and the diary constitutes 1777 as a dry year (see Figure 3.1). The rains were severe at the beginning of the rainy season, but they subsided quickly. There were a total of 21 rainfall events between July 10th and the 31st December 1777, and 13 of these events were light rains. However, it appears that the castle received some late winter rains in November and December, although the diary does not reveal whether or not this was an unusual phenomena. However, the low amount of rainfall, and number of rainfall events, can explain the events in early 1778. Conversely, the events in 1778 might also give an indication on how to interpret the quality of the rains in late 1777.

3.3.2 The weather at Cape Coast Castle in 1778

The weather was foggy in January 1778, and it was an "amazing thick foggy day &…very cold" on both the 11th and 16th. [138] There were three rainfall events and one tornado, which was accompanied by "the greatest falls of rain".[139] The Harmattan set in at approximately ten o'clock on the 20th, which made it "very cold", and lasted until the 25th.[140] The winds appeared to be abating on the 23rd, although the two subsequent entries only note *ditto weather*, which makes it difficult to determine whether the Harmattan continued to blow. However, the wind was again SW and the current leeward in the evening of the 25th, which can be seen as an end to the Harmattan season at the beginning of 1778.[141]

Cape Coast Castle received a letter from the governor of Elmina fort on December 28th. The Dutch governor "begged" the British governor to allow the Dutch ships to take water from the pond at the town beside Cape Coast Castle.[142] It appears that water reserves were low at Elmina, which implies insufficient rains for a longer time; sufficient time to generate a hydrological drought, and thereby strengthen the assumption that 1777 was a drier year. Another plausible explanation was that too many ships and slaves had drained the pond at Elmina, thereby indicating that the drought was socioeconomic. The TSTD shows that an estimated 650 slaves embarked from Elmina in 1777. This was nowhere near the peak of over 2,000 slaves, but it was twice as many as the second highest year of embarkation during the 1770s.[143] Nevertheless, the keeper of the diary did not speculate on the causes to Elmina's inquiry, and the request was granted.

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[137] TNA, T70/1468, December 1st–31st 1777.
[138] TNA, T70/1468, January 11th and 16th 1778.
[139] TNA, T70/1468, January 13th 1777.
[140] TNA, T70/1468, January 20th 1778.
[141] TNA, T70/1468, January 25th 1778.
[142] TNA, T70/1468, January 28th 1778.
[143] TSTD, slaves embarked from Elmina 1750–1798.

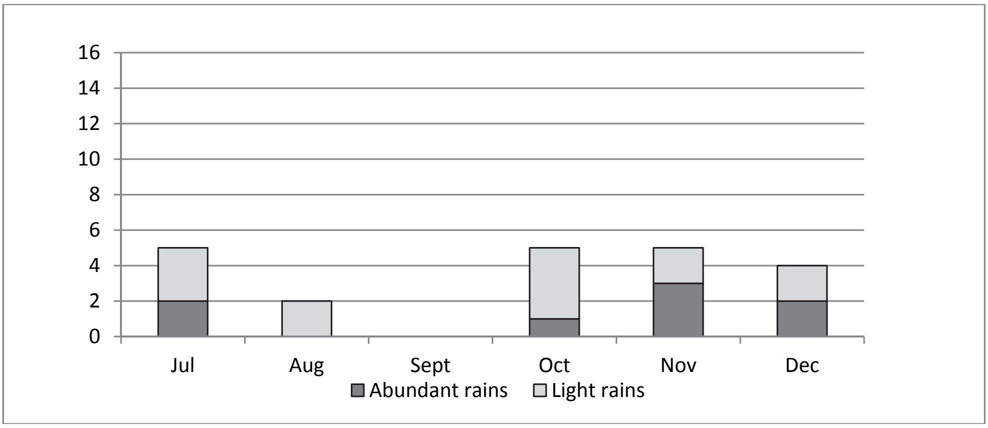

Figure 3.1 *The number of days with rainfall per month at Cape Coast Castle between July 10th and December 30th 1777. Light and abundant rainfall events are separated.*

February 1778 started with some foggy mornings; however, the weather was mostly fine during the entire month. There were two abundant rainfall and two possible rainfall events. Heavy rains accompanied a tornado on the night of the 12th and this entry is followed by ditto entries the two following days. However, tornadoes were so remarkable and short lived events that the ditto references cannot be assumed to mean the exact same weather. It is presumed that the tornadoes would have been mentioned if they had occurred. It also rained heavily on the 15th and they had a tornado on the 22nd, but no other remarkable events were noted.[144]

March was more eventful than February, and there was a total of five actual and nine possible rainfall events. Three of the actual events were considered abundant. There were three tornadoes noted, of which two included heavy rains. The two remaining rainfall events were light.[145] The Chief Governor received a letter on the 24th, probably written by Governor Captain Stubbs at Annamboe, delivered by a ship that arrived from Annamboe.[146] The letter was a request for water from the tank at Cape Coast Castle. The town pond at Annamboe was drying out, and the remaining water was considered undrinkable. Cape Coast Castle fulfilled the request, although the entry notes that they were also short of water.[147]

The castle received a second letter from Elmina four days later. Elmina requested permission to water the Dutch company ships. The reply that was sent, according to the diary, was that there was an "impossibility of supplying him".[148] The diary does not explain why, but it was probably due to low water levels in the tanks at Cape Coast Castle. There were no explanations on why the pond was low or why Elmina needed water, but this was already the second occasion in two months that Elmina had requested water. The diary showed that the rains had been reported as severe in June 1777 with a little rain in July, which might have been enough to create a water shortage, especially if there were

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144 TNA, T70/1468, February 1st–28th 1778.
145 TNA, T70/1468, March 1st–31st 1778.
146 The name is difficult to interpret, but it appears to be Captain Stubbs, which was the governor at Annamboe.
147 TNA, T70/1468, March 24th 1778.
148 TNA, T70/1468, March 28th 1778.

insufficient rains during the autumn and winter months. The rains might also have been insufficient in 1776, which would further strengthen the hypothesis of a drought, although labelling it as a hydrological drought. However, there were no letters describing the general situation from either 1776 or 1778. The drying ponds might also be the effect of an intensified slave trade or trade in general. A larger quantity of slaves and slave ships in need of water might, at least hypothetically, have created a higher demand for fresh water, as suggested above.

One can at best only speculate on why the ponds had dried out at Elmina, Annamboe, and Cape Coast Castle. However, as all three castles were low on water, the widespread phenomenon is considered a strong indication of weak rains along the coastal dry zone. A dilemma in determining the cause is that the TSTD contains no information on the number of slaves who were exported from Cape Coast Castle in 1777. It is therefore impossible to determine whether this might have been a socioeconomic drought. Nonetheless, the rains were clearly insufficient to restore the water levels in the tanks, which were often filled with rain water, during the first months in 1778.[149] It is therefore highly unlikely that all *possible* rainfall events in March produced precipitation. It is more likely that there were only five rainfall events.

In April, there were five rainfall events, of which three produced abundant rains. There were five tornadoes and four included rains. The tornadoes were important rain bearers in this month. There are no other significant or unclear remarks for the month.[150]

The rainy season had a slow start in May. There were only five rainfall events before the middle of May, and only two of the rainfall events generated abundant rains. There was a total of nine days with rain (eleven possible), and six of the rainfall events were abundant.[151] The castle received an "incredible fall of rain" from two until five in the morning on May 6th.[152] The last rainfall entry was made on the 31st and it is corroborated, although it was a so-called ditto entry. The last rainfall event is included as the entry on the 30th. "Thick foggy weather & calm with rain" does not specify the weather in particular, but instead it describes the general state of the weather for the entire day.[153] This is why the ditto entry on the 31st is considered to describe no changes. It seems highly unlikely that the entry on the 31st would have referred only to the fog on the 30th. It did not rain much in May 1778, especially when compared to some other years described in the letters. However, it seems as if the rains were sufficiently severe to affect the castle's inhabitants. The Sunday service on the 10th was cancelled due to sickness.[154]

The rainy season had a slow start; however, the rains were more intense and frequent in June. There was a total of 16 rainfall events noted (17 possible), and nine of the rainfall events were abundant.[155] The rains were both continuous and heavy. The 4th of June was noted as "[a] very rainy day", and the rains continued throughout the entire day on the 5th.[156] Roofs started leaking on the night of the 18th, which was the eleventh day of rain.[157]

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149 Winterbottom, p. 39. In the note on p. 39, it is explained that rain water was preserved in tanks. It is noted that this was done for "economical purposes", although this was not explained.
150 TNA, T70/1468, April 1st – 30th 1778.
151 TNA, T70/1468, May 1st–31st 1778.
152 TNA, T70/1468, May 6th 1778.
153 TNA, T70/1468, May 30th 1778.
154 TNA, T70/1468, May 10th 1778.
155 TNA, T70/1468, June 1st–30th 1778.
156 TNA, T70/1468, June 4th and 5th 1778.
157 TNA, T70/1468, June 18th 1778.

This is an interesting comment, especially when compared to the letters in which it was noted that walls either collapsed or roofs were leaking, as, for instance, in 1753 or 1766. The question is: was it the intensity of the rains or the frequency of rainfall events that caused the leaks in June 1778? Furthermore, when reconstruction of the castle was halted in August 1768, was it because the rains were intense or because they had been continuous? These questions cannot be answered; however, it is evident that all the different impact factors at play only make the answer, at best, speculative.

Nevertheless, the intense rains continued and the castle received "[a] deal of rain in the Morning" on June 21st.[158] The entry on the following day was "Do weather in the morning" and in this case, although nothing more is noted, it is considered to describe abundant rains.[159] There should be no ambiguity concerning the entry on the 22nd as it refers to the entry on the 21st, which referred to a specific part of the day. Hence, there were ten abundant rainfall events. The second possible rainfall event was noted on the 26th, but this is disregarded due to its inexact reference. The supply ship was moored off the castle, but the bad weather made it difficult to land the goods, as had been the case so many years earlier.

The rains quickly subsided in July. The month began with two days of abundant rainfall events. However, subsequently it rained on only three occasions, and all the rainfall events were light. There were a total of five actual and seven possible rainfall events.[160] Two possible entries are disregarded. For instance, on the 7th the weather was described as calm and cloudy with a little rain in the evening.[161] The next day only "Do weather" was entered. It is therefore unlikely that it was exactly the same as the day before.[162] Disregarding these vague entries should not have a significant impact on the quantity of rain, although it affects the quantity of rainfall events. Nonetheless, it began to get foggier in the latter part of the month, although it was far less foggy than in July 1777. Many men had fallen ill by the end of the month, although nobody seemed to have died.[163] The weather in July 1778 was very similar to the weather in July 1777. There were five rainfall events noted in both years. It is worth noting that the diary begins on July 10th 1777. Therefore, only three light rainfall events remain if the first ten days in July 1778 are excluded. This makes July 1778 drier than July 1777.

The foggy weather that started at the end of July continued throughout the whole of August. The fog was momentarily so thick that one end of the castle could barely be seen from the other. The damp weather had many men complaining of sore throats. It became even worse as the weather did not change. They were distressed "with worms & other disorders" on the 25th.[164] There were two actual rainfall events recorded, one abundant and the other light, and one possible rainfall event. The first rainfall event was noted on August 1st. However, this is disregarded as it only refers vaguely to rains received on July 31st. Although many were sick, there were no deaths. This month gives little credence to August being the 'healthy season', as it was described in 1769.

September was a quiet month, although slightly wetter than in 1777. There were two light rainfall events. The weather was foggy during the first half of the month, while the

[158] TNA, T70/1468, June 21st 1778.
[159] TNA, T70/1468, June 22nd 1778.
[160] TNA, T70/1468, July 1st–31st 1778.
[161] TNA, T70/1468, July 7th 1778.
[162] TNA, T70/1468, July 8th 1778.
[163] TNA, T70/1468, July 28th 1778.
[164] TNA, T70/1468, August 25th 1778.

second half was clearer.[165] There were no rainfall events noted in September 1777. However, the rains in September 1778 are not sufficient to consider the former much dryer than the latter.

There were three rainfall events in October, all abundant. It rained almost the entire day on the 13th, and this was followed by abundant rains during the nights of the 24th and 30th. A French captain applied for water on the 12th, which he received. He made a second request for water seven days later, but this time he was denied access to the pond. The diary does not explain why the French captain was denied water by the governor on the 19th. The entry merely notes that the castle could not grant the French more water. There are two plausible explanations for why they were not granted access to the pond. First, the French supported the rebels in The War of Independence in North America; thus, the countries were at war with one another.[166] Cape Coast Castle had given water to the French on the first occasion as solidarity thrived among the Europeans in West Africa.[167] This was also why the English had aided the Dutch earlier in the same year. All were far from home and isolated from their investors, government, and nations; they had to pull together. Secondly, it is also possible that the water level was so low that there simply was not any water to spare, which seems likely as they had received only a little rain since the pond dried out in March.

November 1st was a Sunday, and the day began with land winds and a windward current. However, six tornadoes swept over the castle in November and three of them included abundant rains. The second tornado was registered at midnight on November 6th. The tornado only lasted for an hour, which indicates that it was a local thunderstorm; however, the rains continued until daybreak. The tornadoes did not occur at any specific time of the day. The first appeared at ten o'clock in the morning, the second at midnight, the third at eight o'clock in the evening, the fourth at two o'clock in the afternoon, and the last two around noon. Later in the month there are notes on the Harmattan winds setting in. However, it is more likely that it was a strong land wind.[168] Similar mistakes had been made earlier. For instance, Winterbottom claimed that Dr Shotte probably took a strong land wind for the Harmattan in Sierra Leone in 1778.[169]

The last month was very wet in 1778. December contained nine distinguishable and 14 possible rainfall events.[170] Five of the rainfall events lasted for only a couple of hours, but they were all abundant. Four of the lighter rainfall events are easily distinguishable, while five remain disputable. They were recorded as "Do weather with a small shower in the morning", on the 14th.[171] However, the entries between the 15th and the 19th were "Do weather", which implies that it rained for seven days in row.[172] The total number of rainfall events increases to 14 if these entries are included in the analysis. They are, nonetheless, disregarded for the same reasons as earlier. The weather on the 14th is considered to be the same as the day before, but the rainfall was then simply added. Hence, the rains would have been included in the description if it had rained on the 15th

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[165] TNA, T70/1468, September 1st – 30th 1778.
[166] TNA, T70/1468, October 1st – 31st 1778.
[167] Shumway, p. 65.
[168] TNA, T70/1468, November 1st – 30th 1778.
[169] Winterbottom, p. 42. Winterbottom refers to Johann Peter Schotte, *A treatise on the synochus atrabiliosa, a contagious fever, which raged at Senegal in the year 1778* (London, 1782), p. 9.
[170] TNA, T70/1468, December 1st–31st 1778.
[171] TNA, T70/1468, December 13th and 14th 1778.
[172] TNA, T70/1468, December 15th–19th 1778.

onwards. The last entry in the diary is from December 31st. There was a strong land wind that transformed into the Harmattan at ten o'clock.[173]

December 1778 was less foggy than December 1777, but it is evident that December was wetter in 1778. It is noteworthy that December produced more rains than any other month since June, both in frequency and intensity. This might be considered an anomaly or part of the subsidiary rainy season that was now emerging, thereby indicating a change in the seasonality of the rains. However, it is more likely that they were experiencing the unusual event of winter rainfall, which was registered by Knippertz and Fink in 2004.[174] Summarising the rainfall events of 1778 shows that there was a total of 65 rainfall events, with 23 of these being light (see Figure 3.2). The primary rainy season is clearly identifiable while the subsidiary rainfall season, which was detectable on the 20th, is not detectable.

An in-depth comparison between 1777 and 1778 is conducted in the concluding remarks on the 1770s. There were unfortunately no letters with climatic information sent to London in 1778. However, the weather was fairly similar in both 1777 and 1778. This provides some indication on how to interpret the rainy season, although the heavy rains in December 1778 were probably an anomaly.

The last years of the 1770s

The first letter with climatic information in 1779 was written on April 14th. Dutch Elmina had some trouble with an epidemic disease that had lasted for two months and killed almost everybody. However, diseases did not seem to trouble the people at Cape Coast Castle as only one soldier was reported to have died during the previous 12 months. The

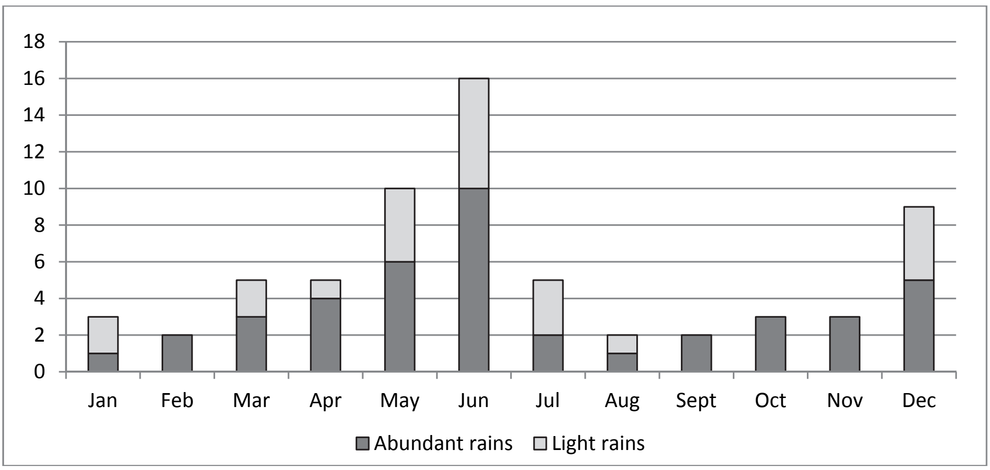

Figure 3.2 *Rainfall events per month at Cape Coast Castle 1778. Light and abundant rainfall events are separated.*

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[173] TNA, T70/1468, December 31st 1778.

[174] Knippertz and Fink, p. 3579.

governor seemed surprised by the fact that only one man had died. He wrote: "Here (altho [sic] we have had a very dry season, scarce a shower for two months) God has blessed us with an uncommon share of good Health".[175] It is as if the governor implies that they had escaped with good health although they had only received a little rain. The number of rainfall events was not mentioned, and it is therefore impossible to determine what he meant by 'scarce a shower for two months'. The governor's choice of words does not reveal anything concerning frequency or intensity. There were nine rainfall events and seven tornadoes during the same period in 1778 (from February 14th to April 14th). Furthermore, six of the rainfall events were considered abundant, and on four occasions the rains fell during a tornado.[176] This amount of rainfall had nevertheless caused the ponds to dry out in 1778. This comparison implies that the beginning of 1779 was very dry.

Five months later the governor wrote that they had lost their second European in two years.[177] This seems to contradict the letter written in April, in which the governor claimed that they had lost their first soldier in one year. However, the soldier might have been a local, which is why the European origin was noted in the letter written in September. Therefore, if he who died in September 1779 was the second in two years, then the first died during or after the rainy season in 1777. If this was the case, then it was highly unusual, as almost every person at the castle had survived two rainy seasons. This would certainly label the years 1777, 1778, and 1779 as drier than any previous years.

The governor claimed that they had not seen a Man of War for nearly two years in December. This does not seem surprising as the American War of Independence was being fought on the other side of the Atlantic Ocean. However, the governor was either purposefully exaggerating or his memory had failed. The *Weazle* had visited Cape Coast Castle in June 1778. However, Man of War was also a term that was sometimes employed to describe a first, second, or third rate ship, and the Weazle was merely a sloop.[178] It is of particular interest that the reconstruction of extensions at Cape Coast Castle and Sekondi had been prolonged due to heavy rains.[179] The letter was dated December 8th, which suggests that the rains had been abundant at the end of November or beginning of December. Intense rains might have slowed the building work by tearing down some of what had already been built. To impede the workers, it would seem more likely for the rains to have been continuous rather than short and intense. Nonetheless, it is noteworthy that this occurred in November or December, which again implies that these were unusual winter rains, as in December 1778. Another possibility is that the governor meant to state that Mr Lomax, who acted as the superintendent for both building projects, could not travel between the forts due to the rains, thereby affecting the building of the castles. This implies that the reconstruction was brought to a standstill in Mr Lomax's absence. However, the letter indicates that the end of 1779 was similar to the end of 1778. Nevertheless, everything was reported to be quiet and everybody was healthy.[180] The most noteworthy climatic events from 1770s are presented in Table 3.5.

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[175] TNA, T70/32, letter dated April 14th 1779.

[176] TNA, T70/1468, February 14th till April 14th. The rainfall events included were those entered on February 12th and 15th, March 2nd, 6th, 15th, 20th and 28th, and finally April 7th and 14th.

[177] TNA, T70/32, letter dated September 23rd 1779.

[178] Dorothy Denneen Volo and James Volo, *Daily Life in The Age of Sail* (Westport, 2002), p. 69.

[179] TNA, T70/32, letter dated December 8th 1779.

[180] TNA, T70/32, letter dated December 8th 1779.

Table 3.5 *Summary of the most noteworthy climatic indicators per year and months as they appear in letters written in the 1770s.*

Year	January – March	April – July	August – October	November – December
1770		Continuous rains; much sickness and deaths; famine	Epidemic disorder; weather and men better; scarcity of corn at Whydah	
1771	Healthy; fine weather			
1772			Disagreeable rainy season, still excessive bad; few deaths	
1773	Dry ponds at Annamboe	Not sever rains, but many men ill		
1774		Country famine (greatest export of slaves)		
1775				Bad weather (rains?), many ill
1776				
1777		Severe beginning of rainy season	Little rain in July (short rainy season), many ill; no deaths; slaves without provision	
1778	Dry ponds at Annamboe, Elmina, Cape Coast Castle		Short rainy season	Severe rains in Dec
1779		Almost all dead at Elmina; dry at CCC but good health.	Second European dead in two years	Severe rains in Dec

3.3.3 Concluding remarks: outlining the climate in the 1770s

The famine that began at the end of the 1760s continued into the 1770s. The prolonged drought and famine impacted on a large part of the region during the first half of the decade. However, this decade is not only identified by long-term droughts. There was also significant interannual variability. Years with early droughts in spring were intermixed with heavy summer rains and late winter rains in December. Previous research has suggested that there was famine and drought in Timbuktu during 1770 and 1771, and also in the Niger Bend between 1771 and 1775, which implies that the Guinea Coast and Sahel were experiencing similar weather conditions.

The coastal towns and castles were strained in 1771. The lack of provisions in 1769 was the probable cause of the famine that affected the Gold Coast in the 1770s. The mortality rate was high among the natives, and this was most likely famine-based. However, the mortality rate was also high among the Europeans. Cape Coast Castle was almost depopulated at the beginning of the decade. The reason was not the raging famine but the intense rainy season with continuous rains and fog. The famine and the diseases abated during the winter of 1770/1771. Everybody was reported to be healthy, and the weather was fine in March 1771.

The rainy season was intense in 1772. The governor wrote a letter in August in which he claimed that it was nearing its end, thereby implying a prolonged rainy season, as it usually ended before the middle of July. If the summer of 1772 was wet, the winter of 1772/73 was dry. The Annamboe pond was reported to be dry in March 1773, which was the probable consequence of weak autumn rains. The rainy season was also weak, and the governor wrote that the rains had not been severe in 1773. This is the first year when the rains seemed to have been considerably weakened.

The next famine was registered in May 1774, at the same time as the onset of the rains. Unfortunately, there was no further relevant information for 1774, and the gravity of the famine and the rains is unknown. The following piece of information was provided in December 1775 when the governor wrote that the weather was bad. It is most likely that they were feeling the effect of winter rains, as they also did in December 1778, and again in 1779, and perhaps in 1777. There was no information for 1776. This might imply normal conditions, as it was aberrations or small changes that were most often mentioned.

The rains set in on due time in May 1777, but they were intense and short, as the ended after mid July. However, the weather continued foggy and moist. The country was filled with slaves who were short of provisions, which might suggest that the inland rains had failed in 1776. The period between September and December was fairly dry, and there were only 14 rainfall events. Six of the events generated abundant rainfall.

The lack of rains explains the dry ponds that were reported in the winter of 1778/79. Elmina was the first castle to apply for water from Cape Coast Castle, which was followed by a request for water from Annamboe. However, they were also low on water at Cape Coast Castle.

The rainy season began slowly, but was intense in 1778. The roof at Cape Coast Castle started leaking in June, and this was probably the consequence of both intense and frequent rains. There were simply not enough clear and sunny days to allow the roof dry out. The rains then subsided quickly in July. The period between September and December was slightly wetter in 1778 than in 1777.

There were 17 events in 1778 and 14 events in 1777, which is not a significant difference. However, 13 of the rainfall events in 1778 were considered abundant, compared to six in 1777. A noteworthy remark is that most of the rainfall events in 1778 were in December. The importance of this knowledge cannot be sufficiently emphasised. If it was not for the diary, then it would have been assumed that it was the Harmattan haze that generated bad weather in December 1775. However, based on the events in December 1778, it is probable that it also rained in December 1775. This is a significant find, and is probably the same phenomenon noted by Knippertz and Fink. For instance, a similar event was not recorded in the 1960s. The last month of 1778 was considerably wetter than in 1777. There was not much information for 1779, but the year ended with abundant rains, as it had in 1778. The number of monthly rainfall events for 1777 and 1778 are depicted in Figure 3.3.

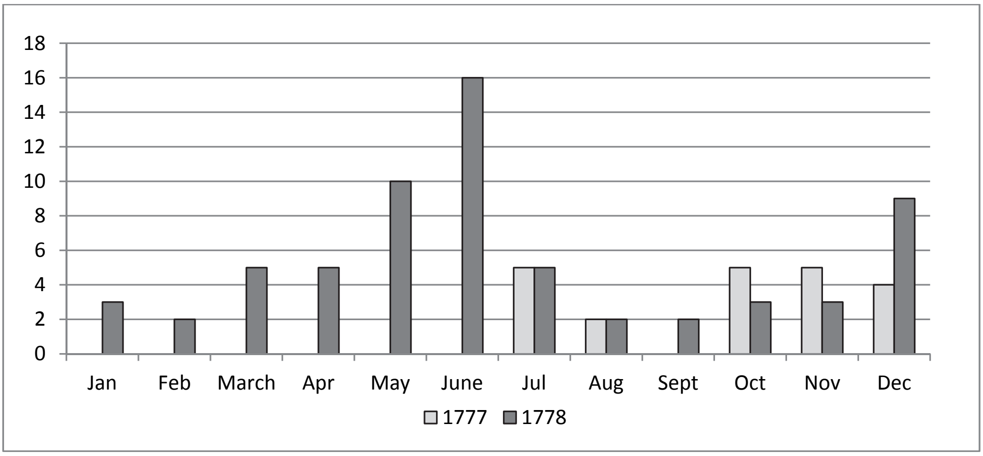

Figure 3.3 *Number of rainfall events per month in 1777 and 1778 based on the analysis of the Diary of Transactions at Cape Coast Castle.*

Conclusively, the droughts in the 1770s were induced by lack of rain. A famine ravaged the coast in 1770 and continued into the following year. For instance, the governor at Whydah stated that there was a scarcity of corn. The inland rains alleviated the situation in 1773, although famine returned to the area again in 1774 and 1777. The Gold Coast subsequently became clearly drier.

There was high interannual rainfall variability in the 1770s. The rainy season was prolonged in 1770 and 1772. This was followed by a gradual increase in drier conditions after 1773. The ponds dried out and the seasonal rains were not severe. They experienced a dry winter and summer at the castle in 1773, and these continued in 1777, 1778, and 1779, despite heavy rains in December. The Guinea Coast was affected by several droughts between the mid 1760s and the mid 1770s, although the rainfall pattern changed after 1776/77.

The latter part of the decade is considered drier than usual, which is supported by the drying out of the ponds. The Dutch applied for water in 1778, but Annamboe and Cape Coast Castle also were low on water. It is, however, not implicit that the ponds dried out due to a failure of the rains. The causality between dry ponds and failure of the rains is not straightforward. The ponds dried out at the same time that the number of people at the coastal region was higher than ever before, and this had raised the demand for fresh water. The effect might have been that of a combination of little rain and an increased slave trade. The period between 1770 and 1776 contains some of the most intensive years of the slave trade in the 18th century.[181] For instance, there were no remarks concerning the ponds in the 1760s. This might suggest that i) the rains were more abundant in the 1760s, ii) there were not as many people (fewer slaves) along the coastline in the 1760s, or finally iii) both the former and latter assumptions are correct.

[181] TSTD.

It is worth noting that there was a scarcity of food in 1765. This drought, which created famine-like conditions, prevailed at least until 1774. After this there is no mention of famine, although the letter written in August 1777 notes that the country was full of slaves who were short of provisions. However, the governors did not mention a famine or a lack of provisions, and there are no reports of famine or lack of provisions after 1777. Nonetheless, it is clear that the weather changed at the Gold Coast. It was dry throughout the 1770s, especially after 1773. The rains in the 1770s were less frequent and less abundant than during the 1760s. There were, consequently, fewer deaths during the 1770s in comparison to the 1760s.

3.4 The 1780s

There are no letters containing climatic information from the beginning of the 1780s, and the general lack of information signifies this decade. Richard Miles left the office of Chief Governor, after only three years, at the beginning of 1780. The letters are mostly signed by three governors after Miles resignation, and there are seven different signatories to the letters between 1780 and 1788. The letters were mostly noted as received from the 'Governor and Council at Cape Coast Castle' in the catalogue. This is the reason for no specific author being mentioned in the analysis.

There were plenty of slaves but no buyers present in May 1780.[182] The price of corn had also risen, which implies a scarcity. This was mentioned in a letter written at the end of July that contains unusual and reflective thoughts concerning the rainy season, especially in relation to the price of corn. The governor made a suggestion to the council in London regarding the procurement of a ship. It was considered that this would make them less dependent on expensive and locally hired canoe men. In his argument for why they needed the ship, the governor wrote:

> They [the ships] are necessary for many other purposes, and particularly when the Periodical Rains do not come in due season, it causes great Scarcity of Corn, yambs, [sic] and other country vegetable provisions, which was likely to happen this year, for Corn got so high as 3 Ackies of Gold per Chest that was used to go for 1½ and other Provisions in Proportions but we have had some Rain that has thanks to the wise Disposer of all things in some measure relieved our Wants, otherwise without Craft to have sent to the Islands or other parts of the Coast, where there was a Supply of Provisions to be got, both Europeans and Natives might have been greatly reduced and distressed, which has often happened where there has been no small vessel belonging to the fort (…) [183]

The rains had a late onset in 1780 and this immediately affected the price of corn, but Cape Coast Castle handled the situation with ease. They had sent for provisions from overseas and the situation was resolved when the rains commenced. The situation was similar to that in 1756, although not as bad. The letter implies that a great scarcity of provisions is caused when the periodical rains are late. There is no temporal reference;

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[182] TNA, T70/32, letter dated May 29th 1780.
[183] TNA, T70/32, letter dated July 20th 1780.

however, the letter was dated July 20th, after the rainy season should have ended. This is the first reflective generalisation on the rainy season, and its impact on the price of corn, when not setting in on time. It is clearly indicated that a late onset of the rainy season had an immediate effect on the price of corn. This was probably the consequence of an activated adjustment response. People began to save provisions as a precautionary action. This would have been the only method of preventing an immediate shortage of corn later in the year, and possibly a famine in the following year. It remains unclear whether the price was raised, or whether it rose in line with an increasing demand for corn.

This behaviour is explained by the crops cycle. The crops were planted at the beginning of the rainy season; however, it was assumed that they might fail if the rains did not begin when expected or were not as intense. This manner of thinking is concerned with understanding the relationship between climate and agriculture in the past, when some of the crops was always saved for planting.[184] However, a total failure of the crops might lead to consumption of the seed grain to minimise starvation. Accordingly, raising the price of corn was a precautionary act for many reasons, but it did not mean that there was a lack of food. In other words, raising the price of corn indicated a drier period but was interpreted as the approach of famine. There is a correlation between a changing climate and the price of corn, although there is no linear causality. There are also other impact factors such as, for instance, distribution and availability. However, the men at Cape Coast Caste had the opportunity to obtain provisions from overseas, which is why they were not affected by raised prices. Nonetheless, it has to be assumed that this possibility did not affect the availability of corn at the Gold Coast, only in the immediate vicinity of the castle, at least in this case.

Finally, the causality between the price of corn and a late onset of the rainy season is somewhat oversimplified. For example, the crops might have been good or successful, but the price for corn might have been high if the crops were subsequently spoiled or destroyed, thereby emphasising the want for rain. For instance, the December winter rains destroyed harvests stored in the open air in 2004.[185] A similar scenario could have had sever consequences in the 18th century. There was only a narrow margin between a normal supply of food and a scarcity of corn in the rain-fed agricultural production system in the 18th century. This made society increasingly vulnerable to even minor checks, or impact factors of unknown origin. These are not mentioned in the letters. It would otherwise be fairly simple to assess the severity of a drought by reference to the price increase. However, there needs to be much more data available to determine causality between the price of corn and drought.[186]

In October, the governors noted that the Duncoes, "a powerful people", were at war with the Ashanti.[187] This remark concerning the Duncoes, who were reported to be of "weakly kind" in 1765, clearly refers to their authority and control as a group and not their physical health.[188] Ameliorating conditions further inland might have made it easier

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184 M. L. Parry, 'Climatic change and the agricultural frontier: a research strategy', in T. M. L. Wigley, M. J. Ingram and G. Farmer (eds.), *Climate and History. Studies in past climates and their impact on Man* (Cambridge, 1981), pp. 325 and 327.
185 Knippertz and Fink, p. 3579.
186 Vries (1981), p. 21.
187 TNA, T70/32, letter dated October 8th 1780.
188 The problem with the origin of the Duncoe, as noted in 1756, is here exemplified. They are now regarded as a people. This makes Rattray's definition incorrect. However, this is a separate discussion and is not addressed in this investigation.

for the Duncoes to sustain themselves and procure nourishment that, in the long term, would have a positive effect on their society as a whole. This is principally the same idea with which G. E. Brooks worked. The Duncoes regained their strength by migrating to better areas and taking control over the environment, both individually and as a society. However, a climatic shift would not have been the only cause of their newly gained strength. It is probable that they took advantage of the internal political crisis in the Asante kingdom which was on the verge of a civil war, and that this facilitated the growth of the Duncoes.[189]

Cape Coast Castle received a letter from Governor Stubbs at Annamboe in December. Stubbs informed Cape Coast Castle that the garrison and the castle slaves had been on the verge of starvation in the summer.[190] The letter was very short and its sole purpose was to inform Cape Coast Castle that they had survived, although it clearly depicts the severity of the crisis in 1780.

Dry ponds and sickness

Everybody at Cape Coast Castle was in good health on Christmas Eve 1780. However, the weather was reported to have been bad. The governor noted that the weather "has been more unfavourable than it was ever Known to have been by the oldest person on the coast".[191] He also noted that the governor at the Danish fort in Accra had died two weeks earlier, after which more than one hundred had died due to an epidemic fever.[192] The unfavourable weather can only be interpreted to indicate either rain or the Harmattan. However, the governor probably referred to winter rains similar to those in 1775, 1778, and 1779, and in a letter slightly more than a month later, on February 3rd 1781, he wrote: "The great Drought we have had, for want of rain for a long time past intirely [sic] dried up the pond the shipping used to have their water from".[193] This was only a little more than a month after his last letter in December. It seems very unlikely that they would have experienced a drought if it recently had rained. January is nowadays the driest month of the year, and it probably also was in the 18th century. However, it is evident that the water level in the pond was not dependent on the rains between December 24th and February 3rd. The pond had dried out due to extensive precipitation deficits (hydrological drought), which was why the ground water level had fallen, or a failure of the periodical rains (meteorological drought). The former is the most probable cause to the effect. The rains had a late onset in 1780, but it was probable that the drier conditions in 1777, when the rains were 'little', had continued. The letter also reveals that the ships took water from a different pond than the one that supplied the castle. The castle probably used rain water that was stored in tanks, not water from the town or any other wells. The problem with the dry pond was resolved by digging a new well that was 16 feet deep. This boosted the company's confidence, and they were now certain that they could sustain the ships with water even in the "driest of seasons".[194] Cape Coast Castle was also affected by some disorders during the winter, after the letter written in December 1780. The men that had

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189 Fynn, pp. 124–126.
190 TNA, T70/32, letter dated December 23rd 1780.
191 TNA, T70/32, letter dated December 24th 1780.
192 TNA, T70/32, letter dated December 24th 1780.
193 TNA, T70/33, letter dated February 3rd 1781.
194 TNA, T70/33, letter dated February 3rd 1781.

been ill were reported to be recovering in February 1781. The letter does not specify why or from what sickness the men suffered.

The rainy season had a late onset in 1781, and almost all of the officers were sick at the end of July.[195] The situation did not change much over the following months. Many remained ill in October, which suggests that the rains had continued for a longer period than usual. The governor wrote that "the season still continues so very unfavourable to us that most of our officers are laid up".[196] The governor thought it was the weather that caused the sickness. He did not write that the season was unfavourable 'because' or 'as' the men were sick, which would have implied that the season was bad because of the situation at hand. This is why he probably meant to note that it had rained continuously, or that it was moist and foggy. The weather might also have been similar to that in 1968 when it rained throughout the summer.

The last letter to contain meteorological information in 1781 was written in October. This is followed by a five year gap with no climatic information whatsoever. Hence, the next letter with reference to the weather was written on February 19th 1786. At this time, the castle's water tanks were low. The periodical rains had been scarce in 1785, and they needed water from the town well.[197] There were no attempts to describe why the tank was empty and from which well they were drawing their water. It might have been the same well that was dug in 1781. However, the situation is explicitly explained only because the townspeople prevented the transportation of water from the well to the castle. This was a method of blackmailing the castle and its inhabitants. It is not known whether or not it was standard procedure to obtain water from the town or if the rains had actually been too weak to provide enough drinking water. However, it can be assumed that the rains had been too weak, and that it was not standard procedure to obtain water from the town. This would have made the castle dependent on the town, which would have been strategically bad in times of war or other crises.

Some of the council members were reported to be ill in May 1788, and this prevented the governors from keeping their regular meeting at Cape Coast Castle. It was also added that the bad weather had made it "absolutely impossible" for the council to meet.[198] There are no indications of a late onset of the rainy season, but the letter suggests that the rains fell with considerable intensity and frequency. The next letter was written only five days later, but there were no changes in either the weather or the health of the council members.[199]

The rainy season greatly impacted on the Gold Coast in 1788. The governor wrote that exceeding heavy rains had damaged the house at Sekondi, but he does not mention which or what type of house. However, it was not only the Europeans who were unfortunate. The rains had also caused many of the towns' houses along the coast to collapse. This is the first time in many years that the season was referred to as sickly. Many of the locals and also many of the officers were ill, but there were no reported deaths.[200] The Danish fort, Christiansborg, had also suffered from the heavy rains. One of

[195] TNA, T70/33, letter dated July 27th 1781.
[196] TNA, T70/33, letter dated October 1st 1781.
[197] TNA, T70/33, letter dated February 19th 1786.
[198] TNA, T70/33, letter dated May 30th 1788.
[199] TNA, T70/33, letter dated June 4th 1788.
[200] TNA, T70/33, letter dated September 15th 1788.

the flanks on the seaward battery had collapsed and a couple of cannons had fallen into the sea.[201]

Three Europeans were reported to have died and many were ill in March 1789, and the governors requested more people to be sent from England.[202] They also expected more sickness, and their prediction turned out to be correct. Approximately three months later, in the latter half of June, the rains were reported to "have been more heavy than we recollect for many years, they [the rains] have not long been set in, and already we have had Complaints from several of the Chiefs [governors] of the Damage they have done".[203] It is worth noting that the signatories to the letter were not the same as those in 1788. Therefore, it is impossible to determine the temporal aspect of the expression 'we recollect'.

Sekondi was in a bad condition in June 1789. The governor even had to stay with the locals during the rains, which appears to have been a common procedure as many of Sekondi's previous governors had done the same.[204] The letter was written in mid June, which makes the reference that the rains 'have not been long set in and already' quite remarkable. The rainy season should have been halfway through at this stage, nearing its end. However, the letter gives the impression that it was only beginning. The rains had been severe along the Gold Coast in 1788 and 1789; however, the letter from June 1789 proclaimed that "every article of Country Provision is both very scarce and excessive dear".[205] The inland rains had probably been insufficient to produce a good crop. This assumption is supported by a letter written on August 20th.

The English slave traders had tried to lower the price of slaves at Annamboe in May. This was seen as treachery among the local traders who responded by refusing to sell any slaves for six weeks. However, keeping the slaves was costly and the trade resumed "being at a great Expense, in keeping what slaves they had by them, also threatened by every appearance of Famine for Want of Rain" at a lower price.[206] This implies that they experienced a lack of rain from the end of May until almost mid June. This correlates fairly well with the letter from June, which indicated that the rainy season had recently commenced.

Cape Coast Castle was depopulated during the rainy season in 1789.[207] This was mentioned in a letter written in July. Why there had been so many deaths is not stated, but it was probably due to a combination of heavy rains and lack of inland provisions. The men were hungry, wet, and tired, which enabled the spread of diseases. The situation in the summer of 1789 remains unresolved. I have found no letters that explain how the situation continued, and these are therefore the last remarks for 1789. A summary of the most important climatic indicators in the 1780s is presented in Table 3.6.

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[201] Georg Nørregård, *Danish Settlements in West Africa 1658–1850* (Boston, 1966), p. 154.
[202] TNA, T70/33, letter dated March 31st 1789.
[203] TNA, T70/33, letter dated June 18th 1789.
[204] TNA, T70/33, letter dated June 18th 1789.
[205] TNA, T70/33, letter dated June 18th 1789.
[206] TNA, T70/33, letter dated August 20th 1789. The price of slaves was lowered only momentarily. Shortly after this incident the coast was filled with buyers, which consequently raised the prices back to their previous level.
[207] TNA, T70/33, letter dated July 28th 1789.

Table 3.6 *Summary of the most noteworthy climatic indicators per year and months as they appear in letters written in the 1780s*

Year	January – March	April – July	August – October	November – December
1780		Scarcity of corn		Unfavourable weather; good health; many deaths at Danish castle
1781	Drought; want of rain for long time; pond dry	Unfavourable season	Almost all sick	
1782				
1783				
1784				
1785		Scarcity of rains		
1786	Water tanks low			
1787				
1788		Bad weather prevents council meeting	Sickly season; castles and houses down	
1789	Some deaths	Heavy rains; castles in bad condition; country provisions scarce; castle depopulated		

3.4.1 Concluding remarks: outlining the climate in the 1780s

The annual information regarding the weather during the 1780s is scant and ambiguous. It is more difficult to reconstruct and outline the climate during this decade as many of the years lack any climatic information. Previous research had concluded that there was a drought at Dahomey in 1780, while the water level at Lake Chad seemed to have been high between 1779 and 1790. The Dahomey drought correlates with the situation at Cape Coast Castle, while increasing rains in the Sahel suggests that the coastal area might have experienced drier conditions.

Corn prices were high at the beginning of the decade. The periodical rains were late in 1780 and weak in 1779. The rainy season in 1780, when finally setting in, was short and intense, but not severe. A noteworthy event is that the coastal area probably continued to receive winter rains in December. This was already the third consecutive year in which they had received rains in December. The weak periodical rains in 1780 resulted in dry ponds early in 1781, and the rainy season had a late onset in 1781. However, there were no indications of a scarcity of corn, which implies that the agricultural areas further inland did not suffer from weak seasonal rains. Based on the governor's letter in October, the rainy season was longer than usual. The general character of the rainy season appears to have been gradually changing over the decade. The seasonal rains were probably less frequent, and this resulted in low water levels in the tanks at the beginning of 1786. There were no letters describing the situation in 1787. However, the rains in 1788 bear some resemblance to the rains in the 1760s. The rains caused great damage not only to Sekondi castle, but also to all town houses along the coast. The situation was very similar again in 1789 when there was a scarcity of provisions caused by the late onset of the rains.

Conclusively, the rainfall pattern had changed in the latter half of the 1770s, and the arid conditions prevailed throughout a large portion of the 1780s. The rains had a late onset, but there were intense winter rains in December. These might also be the first identifiable signs that suggest a secondary rainy season; however, the data is at this stage very scant. Nonetheless, the rainfall pattern was gradually changing, and the rains were more intense at the end of the decade. The coastal climate was again becoming wetter, after having been relatively dry since the beginning of the 1780s.

3.5 The 1790s

The change to wetter conditions began at the end of the 1780s, and this gradual shift is noticeable also in the 1790s. However, the change set in with force once it had started, and the coast was deluged with rain. Previous research has also suggested that the Sahel was gradually changing. There was a drought in Agadez in 1790 and Lake Chad showed signs of desiccation, which indicates opposite rainfall patterns.

The rains took their toll in 1790. In July, the governor informed London that nine persons had died and 15 were ill with fevers and other disorders. The company slaves' house were refitted to serve as a hospital; however, there were concerns that the hospital would collapse if the heavy rains continued or repeated themselves in the future. The rains had already made the fort at Tantumquery and the house at Sekondi almost uninhabitable. However, the governor's house at Sekondi remained standing, and he had not yet been forced to move in with the townspeople.[208] The situation was probably resolved as it receives no further attention.

The heavy rains that had hit the area in 1790 repeated themselves in 1791. The governor did not describe the general character of the rainy season, although it was intense and the death toll was extremely high. People were dropping dead in large numbers at the end of June in 1791. There were only three persons capable of working at Cape Coast Castle. The situation was similar at Annamboe.[209] The situation got even worse in July, when even more people were reported ill and dying at Cape Coast Castle, Accra, and Annamboe. The governor hoped that God would spare them from the "general calamity that seems to surround us".[210] The dire situation at the various castles and the number of deaths makes 1791 appear to be one of the worst seasons throughout the investigated period. The situation did not improve in 1792.

The rains had a late onset in 1792, which resulted in a great scarcity of corn at the beginning of May 1792. The governor termed the situation an emergency and hoped that the local council would be granted some latitude in addressing the situation. Annamboe, which had been augmented since the distress in 1791, was low on corn and requested help from Cape Coast Castle. The governor then noted that the price of corn had risen to 5

[208] TNA, T70/33, letter dated July 30th 1790.
[209] TNA, T70/33, letter dated June 30th 1791.
[210] TNA, T70/33, letter dated July 22nd 1791.

Akies, which reflects the stress in 1792. This was a considerable rise compared to 1780 when it was 3 Akies (at that time reported to normally be 1.5 Akies). The governor was surprised by this incredible rise in the price. However, he expected the price of corn to be even higher at the end of the rainy season.[211]

The price of corn might correlate with the political tension in the spring of 1792. The Danes had asked the Asante for assistance to fight the Popo, which the Dutch and British traders could not accept.[212] The situation was later resolved peacefully, and the Danes political coup proved to be a failure. However, the prospect of war probably raised the price of corn although, unfortunately, there were no further references to the price of corn after May. The rainy season, however, generated frequent and heavy rains that were sufficient to slow down the trading at the beginning of June.[213] Nonetheless, the employees survived the season in good condition, and most of the men were healthy again in September.[214]

There is no direct information relating to the rainy season in 1793. One of the walls at Cape Coast Castle collapsed due to "excessive" rains in May 1793, but this was mentioned in a letter written in December.[215] Many of the other forts were also reported to be in bad condition, and the building of a fort at Accra was claimed to be at a standstill.

The weather favoured the Europeans at the end of 1793 and the beginning of 1794. All officers and soldiers were reported to be in good health.[216] There were no reports of rains or unfavourable conditions in December, similar to the beginning of the 1780s. However, the locals refused to sell "country provisions" to Annamboe fort.[217] There had been some skirmishes between the Europeans and the locals, which was why the trade with provisions faltered. This emphasises the nonlinearity between the scarcity of corn and drought. It was an effective method to threaten the antagonist by denying them necessities, especially at the Gold Coast where neither food nor water were readily available. The townspeople had also refused to sell necessities to Annamboe in 1760 and 1780, at which times they had not appreciated the governor at Annamboe. It is possible that the situation had a similar background in 1793.[218]

Two Royal Navy ships arrived at Cape Coast Castle at the end of May in 1794, and the commodore was reported to have gone ashore on June 1st, where he then was forced to remain for a longer period of time. The main reason for this delay was excessive rains and high seas, which made it impossible for the commodore to return safely to his ships.[219] It is probable that five days of continuous rains deterred the commodore from returning to his ship. The rains forced the governor to predict a difficult rainy season. The onset and duration of the rains was not mentioned, but the officers were reported to be in good health.[220] Two months later the season was reported to have been a "sickly season, but the weather now begins to clear up, and the valetudinarians recover".[221] The letter was

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211 TNA, T70/33, letter dated May 5th 1792.
212 Fynn, pp. 132–136.
213 TNA, T70/33, letter dated June 2nd 1792.
214 TNA, T70/33, letter dated September 27th 1792.
215 TNA, T70/33, letter dated December 17th 1793.
216 TNA, T70/33, letter dated January 30th 1794 and letter dated February 17th 1794.
217 TNA, T70/33, letter dated December 17th 1793.
218 Shumway, p. 82
219 TNA, T70/33, letter dated June 5th 1794. The letter informs us that it was the *Dictator* and the *Fairy* that arrived on May 31st. However, these logbooks are not included in this study.
220 TNA, T70/33, letter dated June 5th 1794.
221 TNA, T70/33, letter dated August 16th 1794.

written in mid August, which suggests that 'clearing up' refers to either rains or fog. It is again possible that they had experienced similar conditions to those in 1968 when it rained all summer, which correlates with changes in the rainfall pattern since the late 1780s.

Archibald Dalzel and the winter of 1794/95

Everybody was healthy and in good condition at the beginning of 1795.[222] However, the weather was anything but normal. Archibald Dalzel claimed that they had experienced a "very uncommon Season, instead of the Tornadoes & Harmattan, which used to prevail at this time of the year, we have had much calm weather with a foggy atmosphere".[223] Dalzel then added that he thought it was the weather that had caused dysentery and colds among the men. Dalzel had much experience of being at the coast, which is why his remarks are interesting. It is probable that he made this remark of tornadoes based on and compared to earlier experiences, his subjective memory of how it had been and how it should have been. He compared the weather in 1795, at least unconsciously, to his previous experiences. However, it seems unusual that he expected Harmattan winds in February when his letter was written, as it usually swept over the coast in January.

Archibald Dalzel first stayed at the Guinea Coast as a surgeon and a slave trader at Annamboe between 1763 and 1767. He was the acting governor at Whydah between 1767 and 1770. Dalzel then left Africa, only to return later to take up the position of Chief Governor at Cape Coast Castle between 1792 and 1802.[224]

Dalzel's remark concerning the uncommon weather in the winter of 1794/95 suggests that the weather had been normal in the previous year. It is probable that he otherwise would have commented on this in the letters he wrote in January and February 1794.[225] The uncommon winter of 1794/95 was also felt at Sierra Leone. Thomas Winterbottom claimed that the Harmattan only blew for very short periods between 1792 and 1795.[226] Sierra Leone is further north, which is why the onset of the Harmattan differs at Cape Coast Castle. Nevertheless, Winterbottom asserted that the Harmattan was strong and blew for ten successive days at the end of 1795. Therefore, the Harmattan seemed to be strong at Sierra Leone while it was absent at Cape Coast Castle. Last but not least, it is worth considering Dalzel's remark as a reflection of the changes that had occurred since the 1760s. It seems evident that he would have reacted even more strongly if he had witnessed the winter rains that fell at the beginning of the 1780s. It is also evident that Dalzel would have considered the unusual weather as an anomaly, and not as a climatic change. The same applies for Winterbottom. It is, at this stage, not known which was more normal, short or long Harmattan periods.

Dalzel described the weather as "thick" in January 1796.[227] This implies that the Harmattan wind was showing its presence at the castle. The weather was not described as *foggy*, as it had been in the previous year. This correlates with Winterbottom's notes

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[222] TNA, T70/33, letter dated January 8th 1795.
[223] TNA, T70/33, letter dated February 12th 1795.
[224] I. A. Akinjogbin, 'Archibald Dalzel: Slave Trader and Historian of Dahomey', *Journal of African History* (vol. vii, no: 1:1966), pp. 69–70 and 73–74. Dalzel arrived at Cape Coast Castle in March 1792, his first letter to London (employed in this investigation) was written in May 1792.
[225] TNA, T70/33, letters dated January 30th and February 17th 1794.
[226] Winterbottom, pp. 39–40.
[227] TNA, T70/33, letter dated January 15th 1796.

concerning the strong Harmattan in Sierra Leone at the end of 1795, as it would have arrived later at Cape Coast Castle. There are unfortunately no comments on the weather during the rainy season in 1795 or 1796, which suggests that the weather was as expected and that the rains were, to some extent, at least not out of the ordinary. Dalzel noted that the officers and soldiers were in good condition in October.[228]

The rains were violent in May 1797. Many officers had caught colds and had sore eyes. There was no communication with Dutch Elmina, but Dalzel offers no reason. It is possible that it was because of the rains, as it often had been a reason in previous years, although this is merely a speculation. It is strange that he referred to Elmina and not another British fort if there was no communication due to the rains. However, Dalzel also claimed that Elmina had been without supplies for many months, which might explain his concern with Elmina.[229] The Dutch interests in West Africa also radically changed since 1795, which might provide a better explanation to the lack of communication.[230]

The rains were even more violent in 1798 than in 1797. Many of the men had now fallen ill, and the rains were described as "extremely violent" on June 17th.[231] Dalzel later wrote that almost everybody had been ill and that the season was "uncommonly severe".[232] In September he further emphasised that the "bad season this year has been very severe and permanent" with everybody being "laid up".[233] It is of particular interest that Dalzel claimed that "[t]he country has for some time been distressed by famine" and he thought that the price of corn was "enormous".[234] He does not present the price of corn in the same format as he did in May 1792. This is unfortunate as it makes it impossible to compare the prices, which otherwise would give some indication of the situations. Dalzel noted that the price of corn was the "enormous price of three Akies Gold [for/per] basket of 7 gallons, or less; and at one ounce four Akies [for/per] chest of 55 gallons."[235]

However, Cape Coast Castle had been buying their food from overseas, which eased their situation considerably. The famine did not surprise Dalzel, and it appears that it was not caused by weaker rains. It is probable that the famine was a result of a civil war in the Asante Kingdom at the end of the 1790s, or bad relations between the Fante and Asante.[236] The political situation at the end of the 18th century makes it difficult to assess the impact of the rains. The famine might be climate related, but the extremely heavy coastal rains make it difficult to identify the inland droughts. The famine came without any warnings or reflections of droughts from earlier years. This was the final letter containing climatic information. A summary of the most important climatic indicators in the 1790s is presented in Table 3.7.

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[228] TNA, T70/33, letter dated October 11th 1796.
[229] TNA, T70/33, letter dated May 30th 1797.
[230] Yarak, p. 101.
[231] TNA, T70/33, letter dated June 17th 1798.
[232] TNA, T70/33, letter dated July 9th 1798.
[233] TNA, T70/33, letter dated September 14th 1798.
[234] TNA, T70/33, letter dated July 9th 1798.
[235] TNA, T70/33, letter dated July 9th 1798.
[236] Fynn, pp. 136–139.

Table 3.7 *Summary of the most noteworthy climatic indicators per year and months as they appear in letters written in the 1790s.*

Year	January – March	April – July	August – October	November – December
1790		Sickness; many deaths; heavy rains; forts inhabitable		
1791		Calamity; many deaths at all forts		
1792		Scarcity of corn; rains frequent and heavy	Good health	
1793		Heavy rains; forts in bad condition		
1794	Good health	Heavy rains; good health	Sickly season; but weather and men improving	
1795	Good health; no Harmattan or tornado			
1796	Thick weather		Men in good condition	
1797		Violent rains; no communication with Elmina		
1798		Violent rains; much sickness	Bad season; famine, scarcity of corn	
1799				

3.5.1 Concluding remarks: outlining the climate in the 1790s

The weather was reasonably well documented in the 1790s, and a clear pattern emerges from the changes that began in the late 1780s. The rains were abundant in most years. The onset seems to have shifted to later in May, and the rains seem to have continued for a longer period of time. There are no indications of low water levels in the ponds or wells in the 1790s. The December rains that signified the beginning of the 1780s had vanished in the 1790s. The rains had become more intense and bore more resemblance to those at the beginning of the investigated period. However, there remained no clear signs of a secondary rainy period.

Heavy rainfall in May and June were the probable cause of many deaths in 1790 and 1791. The situation was bad enough to be considered a catastrophe in 1791. The intensity of the rains is clearly identified throughout most of the 1790s, and caused much sickness and problems again in 1793, 1794, 1797, and 1798.

Simultaneous with the intense and heavy rains was the scarcity of corn in early May 1792, and the famine that unfolded in 1798. The calamity in 1791 had most likely induced the scarcity of corn in 1792. The extremely heavy rains along the coast are distractive. They make the scarcity of corn appear as an anomaly, especially as the shortage was noted early in May. A plausible explanation is that the inland rains had failed, thereby emphasising high spatio-temporal variations between the coast and the agriculturally important inland between Kumasi and Cape Coast Castle. The high price of corn was a result of the political situation, and the tension that was created between the Danes and the Anglo-Dutch collaboration. The famine that was revealed in July 1798 might be explained as a situation that had its roots further inland. All efforts to determine a cause for this famine will only result in speculation. However, the famine might mirror the deteriorating climate in the Sahel region, assuming that the correlation between the wetter south-western parts of Ghana and the Sahel, as noted by Owusu and Waylen, followed the same rainfall pattern. After all, there was a "very marked fall" of the water level in Lake Chad.[237] The men were reported to be in good health in the winter of 1794/95. This was probably only mentioned as there had been much sickness in the rainy seasons that preceded the winter months. The letters reporting on the men being in good health are therefore suggested *not* to imply anything concerning the weather.

3.6 A new climatic chronology

Previous research had determined that the latter half of the 18th century was both drier and wetter in comparison to the 20th century. However, both investigations are based on scant information. Their approaches were different, the geographical areas different, and their results divergent. I consider both suggestions to be accurate, within their own limitations. They are not as dichotomous as they might appear, and the difference is probably semantic.

I concur with the suggestion that the climate was drier in the 18th century than in the 20th century. The annual average amount of rainfall was lower, but it is difficult to determine the extent without numerical data. However, the lack of substantial evidence of a bimodal rainfall pattern supports the idea of a drier environment. The rains were evenly distributed over the autumn and winter months, rather than being clustered into a clearly identifiable autumn rainy period. This would have generated a drier environment in general. Therefore, in general I consider it more appropriate to state that the climate was different in the 18th century than in the 20th century. It is less categorical than referring to it as wetter or drier than in the 20th century. The rainfall pattern has changed, and it is evident that there were considerable variations in the investigated period. The variations appeared in bigger clusters, but the seasonal rains varied from intense and frequent to less intense and less frequent. The coastal region clearly experienced wetter periods. These were followed by normalised or high variation transit periods before entering drier stages. There were not only variations in the seasonal rains; there were also unexpected rains in the winter months. In other words, there were interseasonal, interannual, and interdecadal changes. However, the interdecadal changes are most easily identified.

This chapter begins by creating a climatic timeline for the investigated period. This is followed by discussion and presentation of the climatic indicators and the possible pitfalls

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[237] Nicholson (1976), p. 294.

they create. The aim is to discuss the reliability and validity of the climatic fingerprints that have been employed to recreate the climate in this investigation. The last discussion focuses on a special dilemma that has been present throughout the investigation, which is the fact that there is no clear evidence of a secondary rainy season in autumn months.

Recreating and rebuilding the climatic puzzle is not an easy task, as both heavy rains and famines were occurring simultaneously. However, it should be remembered that these are two different types of phenomenon. The rains reflect the 'real' weather, while the famines described a situation that might have been caused by changes in the climate during the previous year(s). The famines-like conditions might also have been caused by other factors, such as wars, or political instability in general. The climatic indicators that are discussed and employed to reconstruct the climate are those that have occurred and been discussed on several occasions. They are also presented as indices on an ordinal scale in Appendix A. The figure follows the same principle as Sharon Nicholson's wetness index.[238] There are seven classes, and a dry year was classified as -3 (famine), -2 (scarcity of corn/drought), and -1 (weak rains/little rain or dry ponds). A zero is denoted as "no information", while wet years were denoted as +1 (normal), +2 (wet rainy season), and +3 (severe rainy season). The governors never described the rainy season as 'normal', which is why this category remains empty, although, it might describe all years that are not represented in the investigation. The classification "severe rainy season" indicates heavy rains (extreme wetness) and also that buildings collapsed; "wet rainy season" is primarily based on sickness, as it was assumed that much sickness indicated above normal rains. Finally, the sickness and the rains are mostly indications of the climate at the coast, particularly in the dry coastal zone, while the famines and scarcity of corn refer to the inland, the area in between the dry coastal zone and latitude 10°N. Thereby including the area presented as Zone A in Figure 2.5. The time series in the Appendix include both areas, while they are separated in Figure 3.4, which distinguishes the two areas more clearly.

3.6.1 A climatic periodisation from 1750 to 1798

The following chronology recognises two distinct areas: the inland, referred to as the country in the letters, and the dry-zone coastal climate. The inland area is categorically considered to represent the agricultural and slave-generating area; for example, this was where slaves were abducted and where food was produced. The agricultural area comprises areas north of Cape Coast Castle, or Zone A in Figure 2.5. The slave-generating area is more ambiguous and might stretch as far north as 10°N or even further. The inland area was not visited by the Europeans, which is why it only receives little attention in the letters. However, inland droughts had an impact on the availability of food at the Gold Coast. There must have been agricultural production closer to the coastal dry-zone, but it must have been on a smaller scale.

The two areas show two differing types of periodisation, and there are several distinguishable interdecadal periods that overlap each other. These are shown in Figure 3.4. The inland area shows five different periods varying between wet and dry. The

[238] Nicholson (2012a), p. 16.

coastal area shows three periods within the same categories. The letters originated from the coast, which is why this information is more reliable. There were three rainfall typologies identified. First, the most prominent category was years with abundant rains. This includes subcategories that showed i) short and intense periods with high frequency rains, ii) prolonged periods of rainfall, and iii) one interval with intense winter rains. The second category include years with normal rainfall during the rainy season. These were years that did not show intense or frequent rains, but, nonetheless, many persons were reported to be sick.[239] The third and final category includes years with a lack of rain. These were years with reports of ponds or wells that had dried out.

3.6.2 The coastal climate: from heavy rains to dry ponds and vice versa

The first period spans the beginning of the investigated period to the 1770s. There is no clear ending as the weather was gradually changing and becoming more arid at the end of the 1770s. This is the longest period of the three identified periods, and is identified as a wetter period with interannual variations. The rainfall varied from extreme, violent, and abundant, to normal rainfall. There were several reports of the castles' walls collapsing, severe rains, and much sickness at the castles. There is a cluster of years that stand out from the rest. This period spans 1752 to 1754. The rains were heavy an all occasions, although there is only scant evidence for 1754. Another year that stands out is 1762, which showed a prolonged rainy season. The rains were reported as tempestuous on June 20th, and three months later the rains continued to, or again, prevented communication between the forts.

There was no information regarding the climate or the weather in 1757, 1759, 1760, and 1764, which might indicate normal rainy seasons, making these years stand out. It is noteworthy that there was no clear indication of a subsidiary rainy period. This supports Nicholson's suggestion that the 18th century was drier than the 20th century. Nonetheless, the first period ends in the 1770s, when the climate entered a transition period. The rains gradually abated from the beginning of the 1770s. The ponds were reported to be dry at Annamboe already in 1773. However, the drier period is clearly recognisable at the end of the 1770s. The period of transition is shown as a dotted line in Figure 3.4.

The second period is identifiable at the end of the 1770s onwards. For instance, there were only three years with abundant rains between 1774 and 1787. However, the last three years were clearly drier than the previous years. They received only a little rain in the summer of 1777, and the year continued as fairly dry throughout. From this year onwards the ponds and/or wells were reported to be dry on three occasions. Mortality was also very low, which suggests that there was little opportunity for vector born diseases to spread. It is worth noting that there was only a small amount of information from the 1780s. There were no indications of a secondary rainy season, not even in the diary, which only showed that the rains were quite evenly spread throughout autumn and winter months.

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[239] Nicholson employed rings to symbolise "near average conditions". However, it was decided that these should be termed normal conditions as there is no concept of what would constitute "average" during the investigated period. Normal conditions are thus considered to situate below that which would constitute dry or wet years. See Nicholson (2000), p. 154. See Fig. 15.

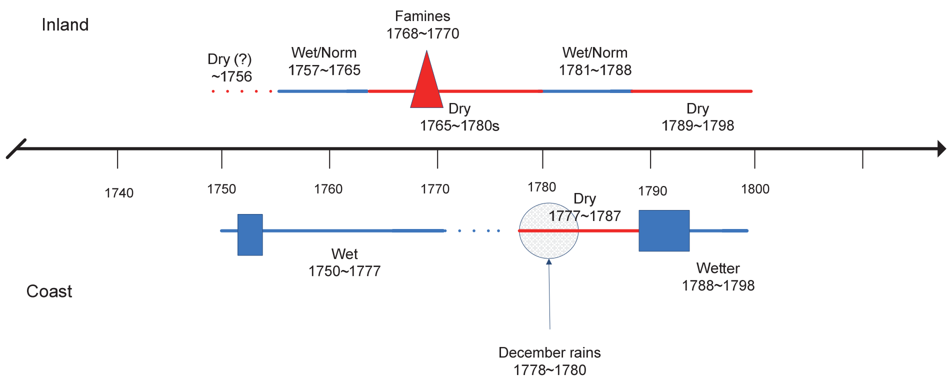

Figure 3.4 *A climatic chronology of the inland climate and the coastal climate according to the periodisation into wet and dry years. The triangle visualises prolonged famines and the rectangle clusters of wetter years. The dotted red line shows a suggested period, the blue dotted a transition period between two periods.*

However, the December winter rains that were registered for the first time in 1778 were highly unusual. These appeared to have been the same anomaly noted by Knippertz and Fink; however, there were so many consecutive years with winter rains, that it might also indicate a change in the rainfall pattern. It is plausible that it was the first sign of the secondary rainy season. This is a subject in need of further investigation.

The third and final period commenced at the end of the 1780s. The climate was rapidly changing towards wetter conditions. Additional information from the 1780s might indicate a more gradual change. However, the dry period clearly ended after the water level in the tanks at Cape Coast Castle was reported to be low in 1786. This was the last time that the tanks and wells were reported to be dry. There are seven consecutive years with abundant rainfall after 1788. The rains made the life at the coast difficult and prevented the governors from attending their meetings, castles and also houses along the coastline were washed away, the mortality rate was high, and there was much sickness. The situation was even described as catastrophic in 1791. Nonetheless, this period of clearly abundant rains abated in the middle of the 1790s. The lack of documents for the last few years leaves the rest of the period open to speculation. Nonetheless, the last period with heavy rains correlates with the marked changes of the water level in Lake Chad. Sharon Nicholson's chronology for the 19th century supports this development as both the Guinea Coast and Sahel entered a drier period. It was, nevertheless, more pronounced in the Sahel, while the variations were more pronounced on the Guinea Coast.

3.6.3 The inland climate: five periods of famine, drought, and recovery

The inland climate has a more complex chronology than the coastal climate. The rains were scarcer in the 18th century than in the 20th century, which made the agricultural production areas more sensitive to rainfall changes. Even minor adjustments in the frequency and intensity of the annual rains would have affected the output of regular crops. This is probably why there sometimes was already a scarcity of corn in early May. These agriculturally important areas appear to have been vulnerable to even the slightest delay in the onset of the rainy season. These are important climatic indicators as the impact of rainfall variations further inland was felt along the coast.

The first climatic period was also the shortest. It lasted only between 1750 and 1756/57. There was only a small amount of information for the beginning of the 1750s, which is why the suggested typology is based on scant evidence. However, previous research suggested that the Niger Bend experienced a mixture of good and bad years up to 1756, which might imply that the period was somewhat drier also in this region, if applying the correlation between the Sahel and south-western Ghana, as noted by Owusu and Waylen. The only clear drought is in the middle of the 1750s. The inland rains probably failed in 1755, which caused a scarcity of corn along the coast and the need for rains in 1756. However, the rains were late in 1756, and this caused much distress at the Gold Coast. This was the only year when the governor hoped that the rains would bring better times. Furthermore, this is also the only year in which the scarcity of corn was reported to continue into September. There was no climatic information for 1757; however, if 1756 was as dry as the letters suggests then conditions might have been even worse in 1757. Nonetheless, there emerges an interdecadal pattern that is clearly identifiable from 1756 onwards.

The undisclosed period before 1756 was followed by one of the most stable periods throughout the investigation. This lasted from 1756/57 to 1765/66. The stability only refers to the apparent lack of variation in both the inland area and at the coast. There were no reports of famines or scarcity of corn between 1756 and 1765. The coastal rains were reported as abundant on many occasions, even sufficient to prevent all communication between the castles, but there was considerable variability. The inland area probably made some recovery during these years as there were no reports of famines or droughts.

The third period is clearly the driest and is easily identifiable through a range of famines in the 1760s and 1770s (see Appendix A). The third period commenced around 1765/66 and continued until the last noted scarcity of corn in 1780. The inland began to experience drier conditions in 1765, which is why there is a transition period. However, drier conditions are clear and definite from 1766 onwards. There are several years when the inland droughts affected the coast. The years between 1768 and 1770 stand out. There was probably a drought that began in 1768, possibly even a famine as the coast was heavily affected by the lack of food in 1769 and 1770. There was only a gradual recovery until the area was affected by a general famine in 1774. The crops had probably already failed in 1773. The slaves were said to be short of corn in 1777, which is why the extent and impact of the famine is difficult to establish. However, there was a registered drought at both Dahomey and Cape Coast Castle in 1780. The third period differs from the other periods. The coastal climate became gradually drier at the same time as the inland experienced droughts. There were large-scale variations occurring, and they appear to have become more complex after the 1760s and lasted until the middle of the 1770s.

The fourth period lasted between 1780 and 1788/89. It commenced and ended with droughts. There was only a small amount of information from this period, but the inland area probably experienced some recovery regarding rainfall. This was at the same time that the coastal area experienced its first dry period. It is noteworthy that the coastal climate was not drier during the second and wetter inland period. In other words, the two areas do not clearly display bimodal conditions. The inland areas did not necessarily experience a wetter period at the same time that the coastal climate was drier.

The fifth and final period began in 1788/89. The inland rains were probably weaker in 1788, which is why it was reported that every article of country provision was both scarce and expensive in 1789. The inland rains provided some relief the next year, but they were weak again in 1791. This resulted in a scarcity of corn in 1792. The rains gained their strength over the three following years, which again provided some alleviation. The rains then failed in 1797, which caused a famine in 1798. The last dry period was not as intense as the third period. Due to its characteristics, it appears analogous to the beginning of the first period. It is noteworthy that the inland does not appear to have experienced equally radical conditions as the coastal regions or the Sahel. It is evident that the Sahel and the inland experienced a similar type of desiccation. However, the change was more prominent in the Sahel.

Finally, the climate during this period showed periods with abundant rainfall, normal rainfall, and low rainfall. The normal years should not be considered to represent an average, but merely a period of transition without any extremes. There were no droughts, although the rainfall does not appear to have been considered sufficiently extreme to be mentioned in the letters. Conclusively, the summer rains were short and intense throughout most of the investigated period. The remainder of the year was mostly dry. The climate was in general drier during the latter half of the 18th century when compared to the 20th century. The Gold Coast and the inland area were drier than in the 20th century. This supports Nicholson's theory of a wetter period in the Sahel. The Sahel and the inland area also seem to follow the same rainfall pattern, very similar to the findings of Owusu and Waylen.[240]

Conclusively, there was high interannual rainfall variability, but the most notable changes occur on interdecadal timescales. There are three periods that stand out. The first period is the third inland period, signified by several droughts between 1765/66 to 1780. The second period that needs to be highlighted is signified by the coastal droughts with winter rains, lasting from the late seventies throughout the 1780s. The final period is the extremely wet beginning of the 1790s. These three periods imply that West Africa, the Gold Coast, and the Cape Coast climate was changing after the middle of the 1760s. Nonetheless, there remains a need for further investigations.

3.6.4 Was there a secondary rainy season?

The rainy season is clearly divided between two separate periods in the 20th century, the first in springtime around May, and the second around October in the autumn. This is why it was first assumed that this should also be clearly visible in the 18th century. However, the secondary rainy season is not clearly visible in the sources employed in this investigation. Furthermore, Fredrik Rømer's description of the climate at the Gold Coast did not include a subsidiary rainy season. Is it, therefore, possible that the subsidiary rainy season was not mentioned in the letters because either it did not exist, as Rømer claimed, or that it was considerably weaker? For instance, Henry Meredith stated that there was a secondary rainy season, although he considered it too weak to be called a

[240] Owusu and Waylen, p. 119.

secondary rainy season. However, there are more than 50 years between Meredith's and Rømer's claims, and the rainfall pattern might have changed considerably during this interval. Furthermore, John Adams noted that there was a subsidiary rainy season in October/November after the middle of the 1780s. Hence, if there was a subsidiary rainy season, why is it not mentioned in any of the letters?

The Diary of Transactions showed that the October rains were weak in both 1777 and 1778. There were very few rainfall events in October 1777 and 1778. This might explain why this was a drier period at the Gold Coast, but it does not explain why the secondary rainy season is not mentioned in any letters. All references to the rains refer to the primary rainy season in springtime, thereby indicating that there was only one rainy period that lasted between May and mid July. The rains were mostly evenly spread throughout the months for the remainder of the year. It is necessary to point out that the number of rainfall events is a vague indicator, especially as one rainfall event might have generated sufficient rainfall to produce a secondary rainy season. However, if this was the case, should there not be at least some indication of the secondary rainy season in the letters?

It is it difficult to distinguish a clear trend in the intensity and frequency of the seasonal rains based on the letters, which indicate that the rains generally started in early May only to end in early July. Rømer claimed that the rains commenced in April during the 1740s, while Henry Meredith claimed that they commenced in late May during the early 19th century. This indicates that the rainy season changed character at some stage. It is also possible that the interannual changes affected the descriptions of the rainy season, and that the descriptions are too unreliable. These books were, after all, not written for meteorological purposes; they were merely biographical depictions of their experiences, and observations at the coast.

Meredith thought that it was an overstatement to consider the secondary rainy season as a wet season. His assertion supports the letters and the existence of only a primary rainy season, as does Rømer's statement. However, this is not evidence that there was not a secondary rainy season, although it might be considered such. Furthermore, in 1769, the governor recommended that the men should be sent to the Guinea Coast at the end of August or beginning of September when the healthy season began. It seems unlikely that the governor would have considered this the onset of the healthy season, especially if an expectation of a month of rains remained. However, this is only circumstantial evidence and cannot be considered an indication of the non-existence of a secondary rainy season. Nevertheless, weaker rains in general and a very weak secondary rainy season might explain why the 18th century was relatively dry.

The only letter that denoted a subsidiary rainy season in October was written in 1768. The governor claimed that the south bastion at Cape Coast Castle collapsed after the rains had ended in October 1765. However, this might also indicate a prolonged rainy season. It might have rained throughout the summer, as it did in 1968.

The winter rains might be evidence of an adjusted secondary rainy season as, for instance, when it rained heavily in December 1778. It is interesting that there were no comments on this in the diary. If the winter rains in 1778 were abnormal, why is this not reflected in the diary, or mentioned in any letters? Even if this depicts the same unusual phenomenon that Knippertz and Fink noted in 2004, why was it not commented on in the diary? In other words, most climatic information that is found in historical documents mentions climatic extremes or aberrations. Why therefore did the rains in December 1778 not receive more attention? A plausible explanation is that the rains were not an anomaly; it was more or less usual to receive this much rain in December. There were, after all, other years with rains in December. The interannual variations might also have been such that the rains did not deserve more attention. In other words, the climate and its characteristics were such that there was little regularity. This is why the rains in December 1778 and the secondary rainy season did not receive more attention.

The dilemma is also approachable by considering the other side of the coin. For instance, by disregarding the modern rainfall pattern and simply interpreting the letters from the information they provide, it becomes clear that there was no rainy season after the summer rains. In other words, the letters and the diary suggest that the rains were evenly distributed throughout the remainder of the autumn months. The existence or non-existence of the rainy season in the 18th century is in need of further investigation. However, I will return to this subject in the following chapter. Finally, the erratic nature of the tropical rains, and the rainy season in general, make it extremely difficult to conclude this matter, especially as there are, to this date, no measured data available. This matter is in need of further investigation.

3.6.5 Outro: addressing the reliability of the exposure units/climatic indicators

The most interesting season of the year was the rainy period. All the sources seem to variously place the onset of the rainy season, although the letters show some internal consistency. The primary rainy season was the only period that broke the otherwise seemingly monotonous climate in West Africa. However, it is difficult to draw general conclusions concerning the intensity and frequency of the rains without daily rainfall data. Descriptive information is much more limited than numerical data, and it is evident that rainfall descriptions are highly subjective and relative. The governors' letters sometimes described the rains to be intense, or appeared to have been intense, and/or frequent. These descriptions were sometimes made without any reference to previous rains, but sometimes the rains were also described to be worse than ever before; in other words, there was a comparative perspective. It is difficult to separate intensity from frequency, and this leaves the rainy season reasonably uncharted. Frequency sometimes had the same reference points as intensity, but this is more easily identified via droughts, famines, and/or the scarcity of corn, which sometimes was an immediate consequence of a late onset of the rainy season. Therefore, what was the role of the rains, and how correctly can the seasonal rains be employed to create the suggested periodisation above? For instance, was it intensity or frequency that made castles collapse and men fall sick? Is sickness, from this perspective, a reliable indicator? Are men reliable as exposure units? What if a castle was poorly constructed or men only suffered from poor hygiene? General mismanagement was a problem in all forts along the coastline as experienced equally by the English, Dutch, and Danish.[241]

This investigation has considered the impact of the rains on particular exposure units as a method of measuring intensity or frequency. For instance, intense and frequent rains made the castles collapse. In other words, it is suggested that there is a correlation

[241] Drunkenness, for instance, was a problem at Cape Coast Castle, although apparently a problem at all the castles, see also Bosman, p. 106; Nørregård, p. 165.

between heavy rains and the castles falling down. However, it is important to emphasise that there is no existing causality. For instance, although heavy rains ultimately caused the castles to collapse, it should be remembered that there were several undetermined factors that cannot be measured, or conditions that must be fulfilled to facilitate the event. The durability of the castle was determined by how well it was constructed and maintained. There are many factors that would have determined whether or not the castle would collapse. For instance, poor maintenance or utilising bad materials would probably have affected durability (see Figure 3.5). These factors are never thoroughly discussed in the letters, which is why it appears that the rains directly, and without doubt, caused the castle walls to collapse. Furthermore, the internal relation between these determinants is important. For instance, employing bad materials and poor maintenance (not properly checked after/during rains) would finally have led to the destruction of the walls. The location also plays its part. For example, if the castles were located and had been built in England and collapsed due to heavy rains, then the impact of rains would be easier to evaluate. This is only dependent on what we know of other buildings and building techniques from that particular period; for example, the materials that were employed. However, Cape Coast Castle was not built for the slave trade, it was a remnant of the gold trade and there were no long traditions of building sturdy structures in the investigated area.[242]

Nonetheless, the castle walls are simply one example, and the same principle is applicable to all indicators employed in this investigation. There are always some unaccountable impact factors. The remainder of this chapter aims to reflect on the climatic indicators or denominators and their validity in retrospect to this investigation. An overview of the internal relations between cause and effect is presented in Figure 3.6, which is a general flowchart that shows the impact of different intensities and onset of the rains, and the possible outcomes of these scenarios.

Collapsing mud walls

The letters contained several remarks on situations when some of the castles' mud walls collapsed during the rainy season. This was not only a problem at Cape Coast Castle, but also at Annamboe, Commenda, Sekondi, Whydah, and Christiansborg. The 1770s was the only decade without any reports of similar events. However, there was no linear causality between the castles collapsing due to the rains being more violent than usual. The rains were not the only factor determining the outcome and should not be assumed to be the only cause of the havoc, although the governor blamed the rains. The construction and materials employed when building the castles were not of the best type. Limestone and bricks were sometimes ordered from England for construction at the Guinea Coast. Local materials were also employed, which were cheap but not durable.[243]

The castles/forts were not always plastered or painted, and on some occasions the walls were constructed of mud. All of this determines whether or not the castle would collapse when it rained. For instance, on one occasion the governor hoped to get more paint for the castles as he considered this to better preserve the castle. Therefore, it cannot simply be determined that the rains were more intense and/or frequent during those years when the castle walls collapsed or the roofs leaked.

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[242] Shumway, p. 61.
[243] Danzig, p. 59.

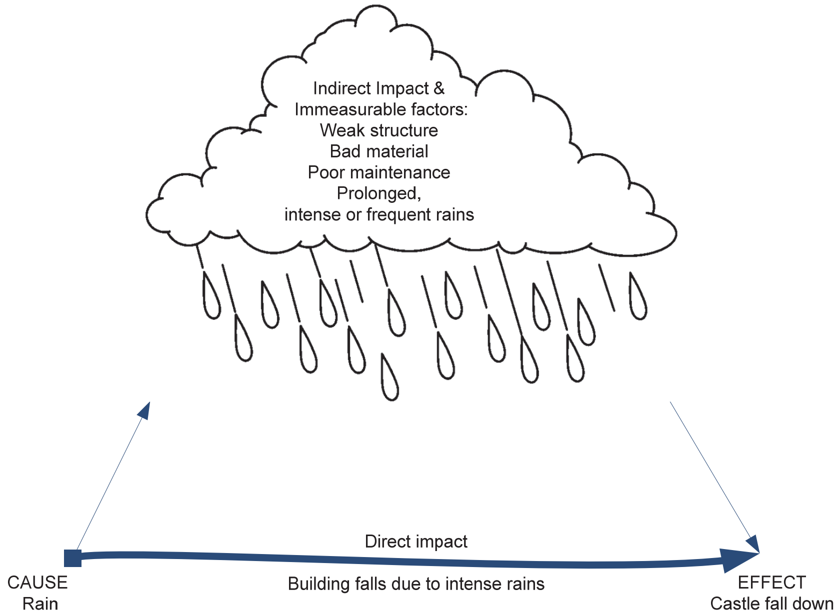

Figure 3.5 *This figure presents all factors that influenced the durability of the castle during the rainy season. The line showing "direct impact" is how the information is presented in the letters, which suggests that the castle would have collapsed regardless of all other variables.*

Nonetheless, the impact of frequent and intense rains cannot be disregarded. The rains would in the long run deteriorate the structure of the castles, slowly weakening them, until the rains were sufficiently heavy to make the walls collapse. However, the interannual difference of the intensity and frequency was probably not as great as sometimes indicated by the letters. The descriptions are both subjective and relative, and each governor had his own points of reference. From this perspective, it is astounding how remarkably similar the descriptions are throughout the investigated period. This is why it that this climatic indicator supplies reliable and valuable information on the rains. Even if the materials and the constructions were not the best possible, and even if time affects every construction differently, they are not enough to exclude the impact of the rains. The climatic impact is a construct existing in time and space. It is no more a determining factor than any other, but neither is it a factor with less impact than any other.

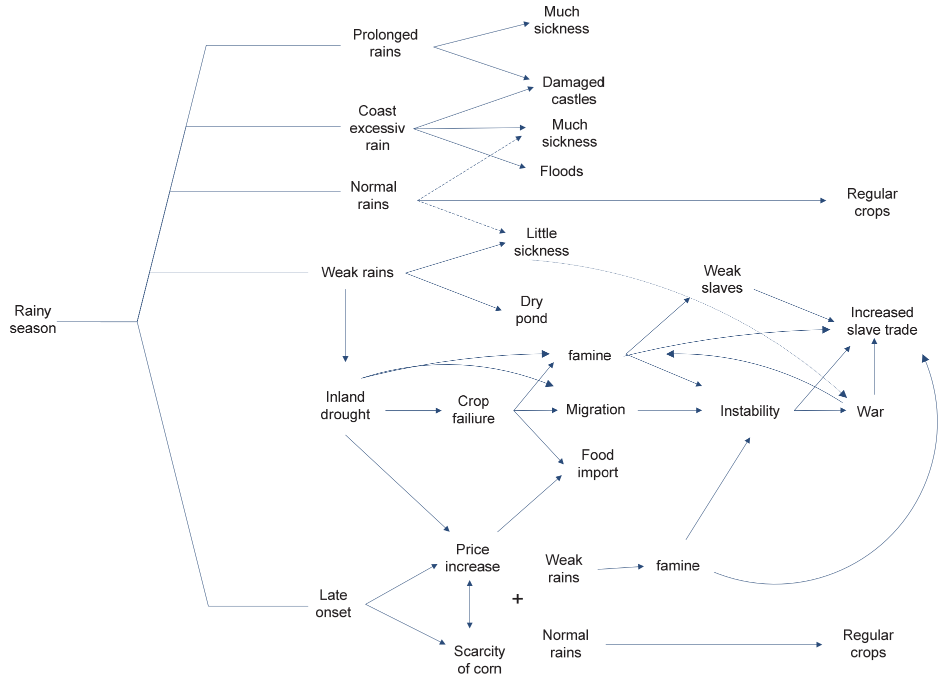

Figure 3.6 *A flowchart on the causality between different types of rains and its impact on the climatic denominators, under certain circumstances, which have been employed in this investigation. This schema shows the possible scenarios arising from different types of rains and the consequences regarding the castle, health, availability of corn, famine and wars.*

In sickness and health

Another important indicator was the health of personnel at the castle, those who exposed themselves to the dangers of the climate. The health of personnel is a more complex climatic indicator than the condition of the castle. First, the person who was sick was not always noted. The rank and origin of the individual is often unknown. Whether it was an English (European) soldier, officer, gentleman, tradesman, or surgeon who was sick, or whether it was one of the local soldiers, bricklayers, or carpenters, was not recorded. Secondly, there are many factors that determined whether or not an individual would survive at the Guinea Coast: for example, a leaky rooftop, the spreading of vector born diseases, stagnant waters, and dirty vegetables affected the health of the men. But, this was not all. An individual's health and strength determined whether or not he would survive in the African climate and recover from diseases. Even sheer luck might decide whether or not a person survived. For instance, there appeared to have been more sick men at Elmina than at Cape Coast Castle in 1756. There was a similar situation in 1779. However, there were no explanations concerning the marked difference between the two neighbouring castles.

It is impossible to distinguish who became sick, or of what and why. Nevertheless, there was a correlation between the health of the men and years with heavy rainfall. This has also been established in other investigations. The governors also took notice of this correlation. For instance, one governor suggested that new personnel should be sent to the coast twice a year to reduce the number of deaths. He thought that this would reduce the number of deaths while sustaining the minimum required personnel. Furthermore, Africa and the Guinea Coast were known as "the white mans grave", and this was not without reason. Many went to Africa only to die within a month of their arrival, and there were years in which the death toll was clearly higher than normal. For instance, 17 men had died in May 1770, and only three men were able to work in June 1791. Therefore, it was suggested that years with high mortality or much sickness were years with abundant rains or normal rainfall, even though this is not explicitly noted in the letters. However, it should be clearly stated that it is impossible to determine interannual rainfall variations based on sickness.

Low intensity rainfall or droughts?

There were few remarks concerning droughts at the Gold Coast. There were only a very few years when the rains were noted as insufficient. For instance, Governor David Mills reported that the rains had *not* been severe in 1773. Four years later he stated that they had received only a little rain since the beginning of July. Equally interesting are the small number of years when there are reports of very few deaths. In September 1779, the governor claimed that they had lost only two Europeans in two years. This suggests that only one person died in the period after the rainy season in 1777 and another in the period after the rainy season in 1779. The lack of rain and low death toll is a strong indication of little rains.

The years when the well or pond was dry, or when other castles or ships applied for water are of particular interest. There were several plausible explanations for these events. The difficulty lays in determining the typology of the drought. Was the drought caused by a failure of the rains in the previous months (meteorological drought), or had the rains failed sufficiently to affect fresh water resources (hydrological drought)? Or, was it the increasing number of slaves and ships at the Gold Coast that led to the drought (socioeconomic drought)?

It is duly noted that these events were all clustered around the drier period on the Gold Coast. This implies that it was the failure of the rains that caused the drought, not excessive usage of the ponds and wells. The wells, ponds, and tanks were not reported to have been dry or have dried out before March 1773, when the ponds at Annamboe were dry. However, this was followed by similar events at other castles. Elmina was low on water in March 1778 and Cape Coast Castle's own pond dried out in 1781. This resulted in a new well being dug, but the water level in the tanks remained low in 1786. There are no further reports of similar, subsequent events occurring. This suggests that the droughts were generated by water deficiencies and changes in the rainfall pattern. Thus, these events signify a dry period along the coastline.

Scarcity of corn and famines

The two final climatic indicators to be considered are situations in which the governor claimed that there was a scarcity of corn or a famine in the country. Famine was a climatic indicator although the exposure units were the people, whether slaves, Europeans, or free local inhabitants. No relation between famines and droughts was drawn in the letters.

There were reports of famines even in years with abundant rains. A famine was never clearly asserted to have been caused by diminished rainfall. The lack of apparent causality between insufficient rains and famine was explained by the fact that it was the inland areas that provided coastal areas with food. Hence, a famine was induced by rainfall variability further inland. The sources were distanced from the coast, which is why famines often appeared suddenly, or unexpectedly, in the letters. The famines were not preceded by claims of weakened rains or desiccating conditions. For instance, the governor suddenly noted that the famine 'still' continued in 1769. The famine appeared suddenly and without any further reflections, and the causes were never mentioned.

The quantity of recorded famines might be lower than the actual number of events. This is because the castles survived by other means than merely on provisions from the countryside. British forts received provisions from Britain, which meant that they were not immediately affected by a lack of food from the countryside. There was a famine "amongst the natives all over the coast" in 1770, but it did not seem to have an effect on the life at the castle.[244] The British also had the opportunity to procure provisions from other places than the inland areas, as in 1798 when they procured provisions from overseas. This downplayed the role of the rains, and increases the possibility of unregistered famines. Furthermore, famines were not always a consequence of a failure of the rains. The letters indicated that, in some cases, it was the quantity of people (slaves) that was the reason for a famine, which occurred as there were too many to feed. For instance, the possibility of a famine among the slaves made traders sell their slaves after a six week intermission in the trade in 1789. This shows that famine was caused by socioeconomic factors, and was not related to the slaves and their means to procure food.

There was also some ambiguity in the interpretation of 'a scarcity of corn' as an indication of a drought or famine. The adjustment response prolonged the chain of impact: corn could not be procured due to the famine in 1774; there was a great scarcity of corn because there was the threat of a famine in 1756; there was a scarcity of corn because the periodical rains had not set in when they were expected in 1780; finally, the slaves were reported to be short of provisions in 1777. These situations are described similarly although they all had different origins. There are different exposure units and time perspectives, but they all feared the same consequences; for example, a famine. The real and actual cause of these events cannot be determined with certainty. A famine might have been induced by weak rains, but also by political disturbances. Famines, and situations when there was a scarcity of corn, can be both vague and strong indicators of weakened rains. Each situation should be evaluated within its historical context.

3.6.6 El Niño and rainfall variability at the Guinea Coast

The aim of this chapter is to determine if rainfall variations, which caused famines and droughts, correlate with El Niño events registered by Joëlle L. Gergis and Anthony M. Fowler in 2009.[245] This approach is based on results from previous research, which

[244] TNA, T70/31, letter dated June 20th 1770.

[245] Joëlle L. Gergis and Anthony M. Fowler, 'A history of ENSO events since A.D. 1525: implications for future climatic change, *Climatic Change* (vol. 92, no 3–4:2009).

concluded that El Niño was associated with Sahel rainfall deficits.[246] In turn, weakened rains in the Sahel coincide with wetter or drier years along the equatorial latitudes in the tropical Atlantic.[247] Furthermore, this investigation concluded that the coastal weather was opposite to that of the crop-providing area in the inlands. In other words, wetter years at the coast coincided with famines and droughts in the inland, which has shown correlation with the Sahel. All three geographical reference points facilitate the employment of El Niño as a plausible explanation of climatic aberrations.

The El Niño chronology identifies 14 registered El Niño events in the latter half of the 18th century. This compares to 12 droughts/famines, and 15 heavy rainfall events that have been identified in this investigation. This includes the plausible famine in 1768. All events are included in Table 3.8 with years that show a correlation between El Niño and famines/droughts and heavy rainfall events being highlighted in bold.

The correlations in Table 3.8 are intriguing. It is first of all noteworthy that seven of the 14 El Niño events correlate with registered famines and droughts at the Gold Coast, including the assumed famine in 1768. There is also a cluster of events that clearly stands out from the rest. The most pronounced correlation is found during the second dry inland period, which covers the years 1766, 1768, 1769, and 1770. The events in 1765 might also have been connected to the oncoming El Niño event the following year. There was unfortunately no climatic information from 1782 to 1784, which is the reason that correlation cannot be established. However, the rainy season was intense in 1781, which might show the onset of El Niño, as in 1765. The most salient famine was in 1774 when there was a "famine in the country", even though there is no registered El Niño event.[248] The question is: can this be considered confirmation that the famine was not caused by a drought? The rains had also failed at Cape Coast Castle in 1773, which implies a normal rainy season in the inland. It seems most likely that the inland rains had been sufficient, and that the famine was caused by something other than a failure of the rains. It is also worth noting that seven of the 15 heavy rainfall events correlate with El Niño events. The heavy rainfall at the end of the century clearly stands out. There were not many recorded famines, but the heavy rainfall events and the consecutive El Niño events correlate throughout almost the entire decade.

Sharon Nicholson suggested a 75 percent consistency to confirm a robust signal between El Niño-Southern Oscillation (ENSO) and rainfall variations.[249] It is evident that this investigations falls short of suggesting a robust signal with regard to Nicholson's requirement. Only 50 percent of the droughts or famines correlate with El Niño chronology, and only 46 percent of the heavy rainfall events.

Conclusively, the comparison indicates some correlation between the climatic anomalies and El Niño events during the latter half of the 18th century. The most noteworthy correlations are the droughts and famines noted in 1766, 1768, 1769, and 1770 that all correlate with the suggested El Niño episodes, as do the rainfall events in 1792, 1793, 1794, and 1798.

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[246] See for instance, S. Janicot, S. Trzska, I. Poccard, 'Summer Sahel-ENSO teleconnection and decadal time scale SST variations', *Climate Dynamic* (vol.18, no 3-4:2001), p. 301.
[247] S. E. Nicholson and Jeeyoung Kim, 'The Relationship of the El Niño-Southern Oscillation to African Rainfall', *International Journal of Climatology* (vol. 17, no 2:1997), p. 126.
[248] TNA, T70/32, letter dated May 10th 1774.
[249] Nicholson and Jeeyoung Kim (1997), p. 126.

Table 3.8 *El Niño events between 1750 and 1798 in comparison to the famines/droughts and heavy rainfall events identified at the Gold Coast from 1750 to 1798. The question mark indicates uncertainty in the data.*

El Niño	**Famines/Droughts**	**Heavy rains**
		1752/1753
1754		
	1756	
		1758/1762
	1765	
1766	**1766**	**1766**
1768	**1768(?)**	**1768**
1769	**1769**	
1770	**1770**	**1770**
	1774	
1777	**1777**	
	1780	
		1781 (?)
1782 –1783		
1784		
		1788
	1789	1789
1791		
1792	**1792**	**1792**
1793		**1793**
1794		**1794**
		1797
1798	**1798**	**1798**

Source: Gergis and Fowler (2009)[250]

[250] Gergis and Fowler, see Table 9, p. 369.

3.6.7 El Niño and the West African climate: an overview

The droughts and famines from this investigation show a vague correlation with El Niño. However, the dates and events also correlate with events in the Sahel. There were droughts in the Niger Bend at the beginning of the 1750s, which might signify El Niño in 1754. The investigation also showed that the rains failed in Western Sahel in 1768 during El Niño in the same year. This is followed by a gap in the records until the famines in Timbuktu in 1770/71, which also correlate with events on the Gold Coast. Finally, there were four consecutive years with El Niño events between 1791 and 1794. All of these correlate with remarks concerning a marked fall of the water level in Lake Chad.[251] It seems that the rainfall deficit was caused by El Niño.

The intensity of the events imply that El Niño changed mode and character in the 1790s, as it also did in the 1970s, as suggested by Robert J. Allan.[252] The only drought that was registered in the Guinea region occurred in 1792, but the coastal climate was very chaotic overall. The frequency and intensity of the rain were not mentioned, although the situation was described as catastrophic in 1791. Many died, probably due to heavy rains.[253] The following year they had "frequent and heavy" rains at the same time that there was a scarcity of corn.[254] The rains then continued as "excessive" in both 1793 and 1794.[255] The intense rainy seasons, combined with the marked fall of Lake Chad, support the hypothesis of opposite rainfall patterns between the Sahel and the equatorial region. Most of the events in the 18th century confirm that El Niño, to some extent, had an impact on the rainfall pattern, which then resulted in socioeconomic disasters such as famines and scarcities of corn.

3.6.8 Global climatic turbulence in the 1760s

The most pronounced correlation between El Niño events and climatic aberrations occurred in 1766, 1768, 1769, and 1770, when there were several drought and famines intermixed with heavy rainfall. However, the effects of El Niño were felt globally. Richard H. Grove has provided a similar suggestion, as presented here, for the cluster of El Niño events in the 1790s.[256] Nevertheless, the second inland dry period at the Gold Coast correlates with Christian Pfister's climatic periodisation of the Swiss Alps. He asserted that the Swiss lowlands were generally colder, and that there was more snow on Alps between 1764 and1778. Especially 1769 and 1770 were eventful in both Switzerland and the Czech Lands.[257] Hubert Lamb also noted that it was abnormally wet in England between 1763 and 1772.[258] The peat-bogs became so swollen with moisture that they burst

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[251] Nicholson (1976), p. 259.
[252] Allan (2000), p. 7.
[253] TNA, T70/33, letter dated June 30th and July 22nd 1791.
[254] TNA, T70/33, letter dated May 5th and June 2nd 1792.
[255] TNA, T70/33, letter dated December 17th 1793 and June 5th 1794.
[256] Richard H. Grove, 'Global Impact of the 1789–93 El Niño', *Nature* (vol. 393, no 6683), pp. 318–319. Grove's investigation was not based on the same chronology employed in the present investigation.
[257] See for instance, Pfister (2006); Christian Pfister, *Agrarkonjunktur und Witterungsverlauf im westlichen Schweizer Mittelland, 1755–1797* (Bern, 1975).
[258] Lamb (1995), p. 246.

in 1771 and 1772. This had only previously occurred in 1697, and subsequently in 1824.[259] A study that investigated droughts in Western Sicily (Italy) registered three droughts (1764, 1768, and 1776) within the period identified as the second inland dry period at the Gold Coast.[260] The investigation mentions only six droughts in Western Sicily between 1750 and 1800. The only cluster of events is found between the mid 1760s and mid 1770s.

If these events were triggered by ENSO, then it would downplay the meaning of the Little Ice Age (LIA) period, and especially the so called 'Little Ice Age-type Impacts' (LIATIMP).[261] The chain of events across Europe vaguely implies that they were triggered by El Niño, and were not in particular a phenomenon of the LIA period. The chain of events in Africa and Europe also possibly all relate to a sequence of intense ENSO events. However, it was not only West Africa and Europe that was turbulent in the 1760s, something was clearly occurring on a global scale. L. Hoberman noted that Mexico City experienced a dry period between the 1750s and 1820s, although it was wet in the 1760s.[262] Furthermore, Michael Chenoweth registered severe droughts in Jamaica between 1768 and 1770.[263] Finally, the grain crops failed in Russia in the 1760s.[264] All of these events might have been related to El Niño events in 1766, 1768, 1769, and 1770.

Conclusively, something occurred in the global climate in the 1760s. Whether or not this was triggered by the string of El Niño events is uncertain. El Niño might be the link between climatic anomalies in Europe and West Africa in the 18th century. It might also explain the global event in the 1760s. There were also drought in India in 1768/69, but as Richard Grove and John Chappell noted; the core problem with El Niño footprints prior to the instrumental period is the gaps and the mismatches between the records, while the forerunner events, which imply that the onset of an El Niño event caused climatic aberrations, also makes it easy to prejudge all events as El Niño events.[265] This is a subject that is very much in need of further research.

3.7 Concluding remarks

The letters that were employed to reconstruct the climate at the Gold Coast during the latter half of the 18th century contain several climatic indicators, which have both advantages and disadvantages. However, the sources are considered reliable and valid for similar investigations. The information is not easily obtained, although it would be wrong to state that there is a general lack of information.

The analysis shows that the climate was drier due to a different rainfall pattern. The secondary rainy season was not clearly defined and it was clearly weaker, when

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[259] Lamb (1995), p. 242, Robert Doe, *Extreme Floods. A history in a changing climate* (Sparkford, 2006), pp. 128–129.
[260] E. Piervitaly and M. Colacino, 'Evidence of Drought in Western Sicily during the period 1565–1915 from Liturgical Offices', *Climatic Change* (vol. 39, no 1–2:2001), p. 230.
[261] Pfister (2006), p. 115.
[262] L. Hoberman, 'Bureaucracy and Disaster: Mexico City and the Flood of 1629', *Journal of Latin American Studies* (vol. 6, no 2:1974).
[263] Chenoweth (2003), p. 47.
[264] Lamb (1995), p. 245.
[265] Richard H. Grove and John Chappell, 'El Niño Chronology and the History of Global Crises During the Little Ice Age', in Richard H. Grove and John Chappell (eds.), *El Niño. History and Crisis* (Cambridge, 2000), pp. 6, 11. The India droughts are presented in Table 1, pp. 8–9.

compared to its presence in the 20th century. This might be a source-related dilemma, accentuated by the lack of instrumental data, but it would explain why the climate along the coastline was drier in the 18th century. It was more likely that the secondary event was evenly spread over the autumn months. *The Diary of Transactions* strengthened this hypothesis. However, this remarkable finding is in need of further research.

There was only one clearly drier period identified along the Gold Coast and at the location of the castle, but there were three drier periods identified in the inland. The climate was drier in the 18th century than its counterpart in the 20th century. Minimal changes in the amount of rainfall might easily have created drought-like conditions. It was therefore important that the periodical rains commenced on time, or when they were expected to begin. A minor adjustment in the timing of the onset of the rainy season led to precautionary actions and preparations for famine. These adjustment responses became important climatic indicators in the analysis.

Another important finding was the clusters of famines during the 1760s and 1770s, combined with the clusters of rainfall events at the beginning of the 1790s. The rainfall events at the end of the investigated period imply that the climate and rainfall pattern were changing. This change correlates with previous research, which suggested that the Sahel area entered a drier period. This analysis, therefore, supports the hypothesis which indicates that the Sahel and the Gold Coast experienced opposite climatic conditions, at least from a historical perspective. However, the correlation is not linear.

The correlation between El Niño and climatic aberrations during the investigated period was pronounced in the late 1760s and the early 1790s. Approximately 50 percent of the El Niño events correlated with the registered droughts/famines and heavy rainfall events. However, this need to be refined and the correlation should be dealt with more elaborately. Another interesting finding was the global anomalies that coincided with the El Niño events in the 1760s. This is also a matter that is in need of further investigations.

4 The Royal Navy at Cape Coast Castle

The rainy season at the Guinea Coast lasted throughout May and June, only to quickly subside in July. Furthermore, there were only vague traces of the subsidiary rainy season in October. This depicts the general character of the rainy season in the 18th century, based on the analysis in the previous chapter. The purpose of this chapter is to study monthly rainfall events at Cape Coast Castle in particular. The results are then included and discussed within the framework of the general climatic conditions and results from the previous chapter.

The main sources of information are Royal Navy logbooks, which are first analysed per decade in the same manner as the letters, and then compared per month. The letters from Cape Coast Castle made it possible to analyse the climate in general, but the logbooks provide an opportunity to study the coastal climate in particular. The division into light and heavy rains, Table 3.3 in the previous chapter, is also employed to distinguish between the intensity of the rains registered in the logbooks.

The logbooks cover only 97 out of 588 months. It is, therefore, not possible to conduct any long-term analysis. Some months are also better represented than others. The Royal Navy visited the area sporadically, and mostly between January and April before the onset of the rainy season. The ships did not visit the castle as frequently during the rainy season between May and July, although August and September show the lowest frequency of ships. Only one vessel visited Cape Coast Castle in September. The last three months of the calendar year again show a higher frequency of ships visiting the castle, although not as many as at the beginning of the year. The number of logbooks employed in this investigation, per month, is presented in Table 4.1. The table also shows how frequently each month is represented in the investigation, followed by the actual number of entries per month. It is worth noting that the last column represents the number of entries, not the number of observations per entry. The number of observations would rise to 3,462 if all captains had noted the weather for all three watches of the day. However, each captain had his own method of reporting the state of the weather. This might have been dependent on the captain himself, but also on whether or not the so-called log-board was utilised, which is why this will be discussed before conducting the analysis.

4.1 Logbook reliability

The Royal Navy logbook is a secondary source and not a primary source, which is why its reliability is dependent on the primary source. The content of a logbook is actually that which was copied from another source of information; namely, the log-board. However, the log-board has not been presented in other logbook-related research, which is why I considered it necessary to briefly introduce its purpose and function before continuing with the climatic analysis. One of the few books that even mentions the log-board was written in the 1960s, but after this I have found no further reference to the log-board in any of the contemporary literature.[1] The next section does not nullify previous research or

[1] G. R. Taylor and M. W. Richey, *The geometrical seaman: a book of early nautical instruments* (London, 1962), p. 66.

Table 4.1 *The number of logbooks, per month, from ships that visited Cape Coast Castle between 1750 and 1793.*

Month	**Total number of logbooks per month**	**Number of months represented out of 50 possible**	**Number of entries per month**
January	8	6	83
February	20	12	207
March	22	15	295
April	13	9	153
May	4	3	47
June	4	3	40
July	3	3	68
August	3	2	47
September	1	1	12
October	5	4	78
November	4	3	71
December	4	3	53
Σ	91	64	1,154

the results; the aim is merely to place the logbook in its proper historical context, a matter which has not been addressed to date.

The log-board is relevant to determining a logbook's reliability as it describes how information was denoted and conveyed. This has not been studied in previous investigations. Instead, reliability has mainly been established by focusing on the meaning, usage, and understanding of non-standardised and non-formalised weather terms that were employed by officers.[2] By comparing different logbooks and establishing consistency, it has been possible to ascertain the orally-spread weather and wind vocabulary that was "understood by all and used universally through the Service."[3] However, I argue that it cannot be asserted that all officers understood non-standardised and non-formalised terms equally in the 18th century. The fact that the meaning of terms change with time (termed diachronic perspective) has been duly noted.[4] I argue that previous investigations have been anachronistic in establishing the reliability of logbooks by referring to the competence of modern observers. For instance, an experiment that was conducted during the Tall Ships Race in 1986 has been considered evidence that 18th and 19th century officers were able to make reliable observations of the wind.[5] The reliability of 17th and 18th century officers has also been established by vague references to the practices of estimation that are nowadays employed on Voluntary Observing Ships (VOS).[6]

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[2] Wheeler (1988), p. 122; Wheeler (2001), p. 364; Wheeler (2005b), p. 97.

[3] Wheeler et al. (2010), p. 263.

[4] B. Ziemann and M. Dobson, 'Introduction', in Miriam Dobson and Benjamin Ziemann (eds.), *The interpretation of text from nineteenth and twentieth century history* (Oxon, 2010), p. 6. Wheeler, Dennis, 'The weather vocabulary of an eighteenth-century mariner: The log-books of Nicholas Pocock, 1740–1821', *Weather* (vol. 50:1995), p. 298.

[5] Wheeler (2001); pp. 364–366

[6] Wheeler (2008); p. 26; Wheeler et al. (2010), p. 263.

The VOS principle is based on an international agreement of 1853. It is thus based on the system that was created by 19th century officers.[7] Modern day VOS participants receive training and meteorological supplies from Port Meteorological Officers.[8] Therefore, VOS participants receive training for the sole *purpose* of observing the weather. However, there was no such formal training in the 18th century. It has been concluded that seamanship was orally taught on board, and it has been assumed that it was actually through this practice that officers became good observers.[9] Reliability has therefore been established by focusing on the professionalism of the officers' corps, not the individual. However, the prerequisites are different when comparing the competence of 18th century naval officers and 20th century VOS participants. For instance, the meteorological language and terminology is now standardised and formalised. Furthermore, school literature, TV, internet, technical supplies (i.e. radars; computers) influence our capacity to observe weather and identify anomalies. We are practically surrounded by weather information on a daily basis. It is even possible to study a foreign climate without ever experiencing it in real life. A mariner in the Age of Sail had no opportunity to rehearse his observational skills, and this is a decisive difference when comparing the two eras. An 18th century officer might have been an experienced sailor, but he might have sailed for years without experiencing a tropical storm in West Africa. This prevented him from learning by repeated exposure to the wind force that he was supposed to understand, and this was the only method of learning the meaning of weather and wind terminology.

Hence, I consider it misleading to establish the competence and observational skills of an 18th century officer by referring to 20th or 21st century mariners or methods. The skills and competence of any 18th century profession cannot be established by referring to their modern counterparts. It is necessary to be mindful of generalisations and anachronistic interpretations concerning individuals or professions.

A logbook has also been described as a book wherein the officer recorded his personal non-instrumental observations, which were "based on the judgement of the officer in question" and his "skill and experience". [10] However, whether this refers to the officer whose name is on the title page of the logbook or the person who noted the observations on the log-board is not explicated. There is an essential difference, as it has been stated that the "original observations were made by the officers of the watch and noted in the working day logbook".[11] This is probably a reference to the log-board, although it was termed the 'working day logbook'. In other words, I argue that the person who actually made the observations found in the logbooks has not been properly established. Was it was the 'mate of the watch' or the 'keeper' of the logbook? Which officer's reliability should actually be evaluated, and which officer's reliability has been established? These questions have not been addressed.

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[7] National Oceanic and Atmospheric Administration (NOAA): http://www.vos.noaa.gov/vos_scheme.shtml (28.01.2013), or at World Meteorological Organisation (WMO): http://www.wmo.int/pages/prog/amp/mmop/JCOMM/OPA/SOT/vos.html (28.01.2013).

[8] VOS brochure: WMO/Intergovernmental Oceanographic Commission of UNESCO, *The WMO Voluntary Observing Ship Programme*: *An Enduring Partnership*, p. 3. The VOS brochure can be obtained from: http://www.bom.gov.au/jcomm/vos/information.html#info02 (28.01.2013).

[9] Wheeler et al. (2010), p. 263.

[10] Wheeler and Suarez-Dominguez, p. 40. The second quotation is from Dennis Wheeler, 'Sailors and Storms' *Ocean Challenge* (vol. 15, no 3:2008), p. 25.

[11] Wheeler, (2005b), p. 100.

Furthermore, it has often been claimed that logbook entries were made at each of the day's three watches and as conditions changed.[12] It has also been claimed that a "Particular note was made of phenomena as rain."[13] These assertions cannot be made or validated, as it is impossible to determine the time of an entry or the actual weather by analysing a logbook. A logbook does not reveal if all daily changes in the weather were included. Short lived rainfall events might have been omitted from the logbook as they might have been the 'modal weather' that was transcribed from the log-board.

Finally, in an article from 2008, the concept "the day's work" is described as "[a] valuable insight into the keeping of such logbooks [English logbooks from the pre-instrumental period]".[14] It is *not* mentioned that 'doing a day's work' was part of the process of transcription from the log-board to the logbook. The log-board is not mentioned although the authors referred to John Robertson's *The Elements of Navigation*, which not only describes the log-board and its purpose but also contains more than 20 pages in which it is shown how to transcribe navigational data from log-board to logbook.[15] The log-board has for some reason been disregarded. However, the best method to establish a document's reliability, when it is known that it is a copy of another document (or artefact), is to establish the internal correlation between the primary and secondary source.

4.2 The log-board

W. H. Smyth defined the log-board as:

> Two boards shutting together like a book, and divided into several columns, in which to record, through the hours of the day and night, the direction of the wind and the course of the ship, with all the material occurrences, together with the latitude by observation. From this table the officers work the ship's way, and compile their journals [logbooks]. The whole being written by the mate of the watch with chalk, is rubbed out every day at noon. Now a slake is more generally used.[16]

Similar descriptions are found in all employed sources in this investigation. This definition describes the log-board as the most important tool for keeping records on board a Royal Navy ship. It was the ship's official logbook for one day, a daily prototype of the logbook. It was probably also a small object, as John Hamilton Moore noted that it should hang "[i]n the Steerage, or some convenient Place in the Ship (---)".[17]

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[12] See for instance, Wheeler (2001), p. 364; Wheeler (2004), p. 23; Dennis Wheeler and Clive Wilkinson, 'The determination of Logbook wind force and weather terms: The English case', *Climatic Change* (vol. 73, no1–2:2005a), p. 57.

[13] Wheeler et al. (2010), p. 262.

[14] Wheeler (2008), p. 3.

[15] Wheeler (2008), p. 3; Robertson, pp. 674–694. Wheeler claimed to have used the version published in 1785, which I did not locate. However, the book was published in 1764, 1780, 1786, and 1796. All versions of the book contain a description of the log-board.

[16] Smyth, p. 452.

[17] John Hamilton Moore, *The Seaman's Complete Daily Assistant* (London, 1782), p. 11.

There is little information regarding the daily usage of the log-board in the 18th century, if disregarding the literature employed here, and no captain has left a detailed description concerning daily procedures on board a Royal Navy ship. This probably relates to the changes that the Royal Navy experienced in the 18th century, when it was only beginning to develop as a structured institution.[18] For instance, the education of British officers commenced in 1733 at the Portsmouth Naval Academy (later the Royal Naval Academy), and the officers' naval uniform was first introduced in 1748.[19] Initially, the academy was not widely approved, especially by more traditional mariners who considered the ship the best place to learn seamanship. Another reason for the lack of approval was that naval cadets received prerogatives (i.e. more rapid promotion) that were introduced to make the profession and academy more lucrative.[20] Hence, the lack of a functioning, structured, and widely approved naval academy explains why there are no formalised or standardised instructions to follow. There was an on-board teacher, termed the 'schoolmaster', who first appears in official documents around the 1700s; however, he was not widely appreciated.[21] Nevertheless, the lack of formalised instructions is visible in the terminology throughout the 18th century. For instance, in William Falconer's *An Universal Dictionary of the Marine* from 1769, the log-board is defined as:

> a sort of table, divided into several columns, containing the hours of the day and night, the direction of the winds, the course of the ship, and all the material occurrences that happen during the twenty-four hours, or from noon to noon; together with the latitude by observation. From this table the different officers of the ship are furnished with materials to compile their journals, wherein they likewise insert whatever may have been omitted; or reject what may appear superfluous in the log-board. See the article JOURNAL[22]

The term journal was widely employed when referred to the logbook, or as W. H. Smyth defined the logbook: "a journal into which the log-board is transcribed".[23] However, Falconer's definition clearly indicates that it was up to the officer to personally select what to transcribe when compiling the logbook.

Many 18th century authors emphasised that the logbook was ruled in the same manner as the log-board, thereby facilitating transcription.[24] John Hamilton Moore even asserted that the logbook was ruled "exactly" like the log-board.[25] However, the logbooks in this investigation are not similar to any log-boards presented in the 18th century literature. Any reference to exact similarity is misleading. It is always possibility that the authors came into contact with other types of logbook, and that these were similar to the log-boards. However, this seems highly unlikely as the logbooks in this investigation

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18See for instance, Daniel A. Baugh, 'The eighteenth-century navy as a national institution 1690–1850', in J. R. Hill (ed.) *Oxfords illustrated history of the Royal Navy* (Oxford, 1995), pp. 120–160.

19 Baugh, p. 157; H. W. Dickinson, *Educating the Royal Navy. Eighteenth- and nineteenth-century education for officers* (London, 2007), pp. 33–34.

20 Margarette Lincoln, *Representing the Royal Navy: British Sea Power1750–1815* (Burlington, 2002), pp. 9, 21–23.

21 Dickinson, pp. 12–13.

22 Falconer, unnumbered pages see *log-board*. The definition remained unchanged in the new editions of Falconer's dictionary, which were published in 1771, 1776 and 1784.

23 Smyth, p. 452.

24 Robertson, p. 674.

25 Moore (1772), p. 42.

cover a period of 49 years, the same period during which the authors' books were published.

The definitions present the logbook as a copy, summary, and compilation of the log-board. Nonetheless, the log-board probably contained too much information to be entered into the logbook. Only the most important information on position, wind, weather, and general remarks were transcribed into the logbook. It is worth noting that the log-board had an hourly division, while the logbook, if it was diligently maintained, followed the officers' watch (three parts: first, 12.00–20.00hrs; middle, 20.00–04.00hrs; latter, 04.00–12.00hrs). Hence, any changes in the weather were probably entered on the log-board at the time of occurrence, which means that the logbook was not compiled based on the officers memory. The log-board thereby lessens the effects of an officer's subjective memory and strengthens the reliability of the observations. The governors' letters, for instance, merely depict how they, in most cases, remembered the rains. Nevertheless, the type and quality of information found in a logbook depends on matters considered important by the officers. This leads to a most important question: what aspects of the weather were transcribed? Was it the most frequent observation or an anomaly, such as a shower of rain?

4.2.1 Responsibility and 'reckoning'

Based on 18th century literature, it is difficult to determine who was responsible for keeping the log-board. Smyth claimed that it was the mate of the watch, while Haselden and Robertson claimed that it was either the officer of the watch, the captain, or the mate that made the entries.[26] It is possible that the person with responsibility for the log-board, or who supervised its usage, was not the person who made the observations and the entries. This is probably the case, as one person was not able to supervise the employment of the log-board around the clock.

It was always an officer who commanded the watch on a Royal Navy ship. Smyth claimed it was the officer who was responsible for the log-board entries, and that the officer also checked and confirmed all entries by signing off at the end of his watch.[27] As the officers' watch divided the nautical day into three parts in the same manner as the captain sometimes reports on the weather in his logbook, there were three different officers who would have supervised the keeping of the log-board and who also bore responsibility for the entries. This creates a circular argument regarding the correlation between a log-board and logbook: one person entered his observations on the log-board; however, when it was transcribed, the officer was able to select what to transcribe. This explains why John Robertson, the master at the Royal Naval Academy between 1755 and 1766, claimed that the log-board was the "only authentic record of the ship's transactions".[28] Nevertheless, it remains unclear whether or not the log-board was

[26] Smyth, p. 473, the word-book defines mate as generally implying adjunct or assistant. This system was later transferred to the keeping of the ships logbook, although it was kept by the officer of the watch; Wilkinson (2006), p. 9; Robertson, p. 674; Thomas Haselden, *The Seaman's Daily Assistant* (London, 1761), p. 126.

[27] Smyth, p. 474.

[28] Robertson, p. 674; Lee, p. 413.

employed when the ship was moored – there was, after all, no reason the heave the log when the ship was anchored.

Doing a day's work

Knots and fathoms were entered for every hour (or every second hour) on the log-board to position the ship, termed a ship's *reckoning*, while other information was entered when necessary.[29] The officers then transcribed this information from the log-board to the logbook at the end of each day to position the ship. This method of calculating the position of the ship was termed *dead reckoning*, and the procedure was termed *doing a day's work*.[30] The act of doing a day's work was conducted in the so-called *traverse table* before the result was entered in the logbook.[31] The purpose of the transcription was to make the log-board understandable, as described by James Atkinson:

> And how each Days Sailing is managed, in taking it from the Log-Board, casting it up, and bringing it into one Course and Distance…and setting it in the Journal: So that by this the Whole is made more intelligible.[32]

An example of how to do a day's work is found in almost every book employed here. The procedure had one important aim: to store data to enable "necessary deductions relative to the ship's place".[33]

Doing a day's work played an important part in what was entered in the logbook, and it is evident that all had to learn how to calculate the position correctly. However, I have found no examples that explain which other details might have preferably been transcribed to the logbook, or how to compile weather descriptions. William Spavens provides a comprehensive list on what to enter on the log-board, and it is better than the schoolbook. However, Spavens' book was a biography and, more or less, a vivid description of his adventures as a mariner, and he was not an officer.[34] His descriptions are therefore not entirely reliable and, more importantly, he does not signify what was transcribed, only what was entered. This accentuates three dilemmas: it cannot be established who made the weather observations that were entered on the log-board; it is not known what information was omitted; it is not known which weather conditions were transcribed. For instance, was it the modal weather conditions or the mean that was transcribed? Previous investigations have avoided this dilemma by only extracting the first entry from the logbook on the assumption that this was the principal description, and that it was made at noon.[35] But, how reliable are the other weather entries?

In J. Bettesworth's, *The Seaman's Sure Guide, or, Navigator's Pocket Remembrancer* the author employed a copy of a log-board and logbook to show how to conduct the

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[29] Robertson, p. 674.

[30] Moore (1782), p. 11.

[31] Moore (1782), p. 12. Moore shows how to calculate the given positions on the log-board before being entered in the logbook. All entries concerning course, speed, and distance from one day were collected, and based on this information the real course and distance was calculated. See also, Moore (1772), pp. 145–149. Moore gives several examples on how to keep the journal, from log-board to traverse table.

[32] James Atkinson, *Epitome of the Art of Navigation* (London, 1744), p. ix.

[33] Robertson, p. 674.

[34] William Spavens, *The Seaman's Narrative* (Louth, 1796), p. 184

[35] Wheeler et al. (2010), p. 261

transcription. The author implies that he employs a real example, taken from on board the Royal Navy ship *Cumberland* in August 1782, but this is not correct.[36] The ship actually existed and sailed during the given dates, and the logbooks were found in the archives. However, both the master's and the captain's logbook, place the ship at a location other than that claimed by Bettesworth. The dates match, and in both cases August 13th was shown as a Tuesday in 1782; however, the weather does not match, nor does any other information.[37]

Nonetheless, it is remarkable that the master's logbook from the *Cumberland* is almost identical to the log-boards in the contemporary literature.[38] It has a column for hours, knots, fathoms, wind direction, and remarks, and it contains several remarks on both weather and wind, throughout the day. The weather is noted every fourth hour, beginning at one o'clock. For instance, there were four descriptions of the weather between noon and midnight on August 15th. The wind and weather conditions were described as light breezes and clear at one o'clock; moderate breezes and cloudy at four o'clock; light breezes and cloudy at eight o'clock; ditto breezes with squalls and rain at midnight. The wind and the weather were then described three times after midnight. At four and eight o'clock they had moderate winds and clouds, and at noon the following day, light breezes and clear.[39] The most important issues noted is the number of entries, and the note that identified a rainfall event.

The captain's logbook from the *Cumberland*, however, resembles any other logbook employed in this investigation. The captain only noted "ditto weather", meaning light breezes and clear, on August 15th.[40] Hence, it is evident that the captain's logbook falls short on describing the real weather conditions. The rains, which the master described, are not included. Furthermore, the winds were mostly *moderate* and not *light*, in the master's logbook, and it was mostly *cloudy*, and not *clear* on August 15th 1782. Hence, the captain employed the preliminary entry (which was consistent with the masters' logbook) to describe the weather for the entire day. The most noteworthy comment is that he omitted the rainfall event. Hence, there would have been one rainfall event less in this investigation if the captain's logbook from the *Cumberland* had been employed.

The purpose of this short example is to show that logbook weather descriptions might have differed considerably to those found on the log-board. The logbooks from the *Cumberland* show that there is much information that might have been omitted during transcription. I will provide further examples of this in the analysis below. Conclusively, this short analysis of early schoolbooks on navigations, combined with an actual example, shows that there are many uncertainties that relate to weather entries, especially if there is only one observation for the entire day. One should always bear in mind that observations might not have been made by the captain, but by the officer of the watch. Be that as it may, in the following analysis I will refer to the logbooks as if the observations were made by the captains.

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[36] J. Bettesworth, *The Seaman's Sure Guide, or, Navigator's Pocket Remembrancer* (London, 1783), pp. 134–153

[37] This has been checked with the logbooks found at TNA in Kew London, ADM51/220 and ADM52/2238.

[38] I am thankful for the help provided by Dr Catharine Ward, who also noted that the master's logbook is unusual given its detail (personal communication).

[39] TNA, ADM52/2238, *Cumberland*, August 15th 1782.

[40] TNA, ADM51/2290, *Cumberland*, August 15th 1782.

4.3 Logbooks from the 1750s

The first two logbooks to be included in this analysis are those kept by the captains on board the *Surprize* and the *Humber* in January 1750 (see Figure 4.1). The *Surprize* arrived at Cape Coast Castle on the 17th, which when adjusted to the Gregorian (all dates are hereafter follow the Gregorian calendar) calendar was January 28th, and stayed until February 12th. There was only one rainfall event at night noted, and this was on the day of arrival. This rainfall event was also noted in the logbook on board the *Humber*. The captain on the *Humber* noted that it rained during the second watch (8 p.m. to 4 a.m.), and the captain on board the *Surprize* noted that it rained during the night. [41] It is therefore probable that they were describing the same rainfall event, although their references are different. The captain on board the *Surprize* also described the intensity as he entered "much" rain in his logbook.[42] The *Humber* stayed until February 24th, and there was thunder, lightning, and rain during the middle watch on the 21st. However, the weather was only described as squally, and the intensity of the rains was not described.[43] The rainfall frequency appears normal as both January and February are the driest months at Cape Coast Castle.

The information for 1751 is much more comprehensive than for 1750. The logbook from the *Prince Henry* places the ship at the Cape Coast road between March 26th and April 8th 1751. There were "some showers" of rain on April 4th and 6th.[44] The *Surprize* also visited Cape Coast Castle between April 5th and 7th, but there were no rainfall entries.[45] Hence, is the observation from the *Prince Henry* valid for this investigation, and why are the rains not noted in both logbooks? It is probable that the distance between the ships was such that the discrepancy only reflects the erratic behaviour of tropical rainfall. Whether or not these would have fallen on the castle is undeterminable. The dilemma is that is difficult to establish whether or not the inconsistency relates to the entry, the observation, the transcription, or the erratic rainfall pattern. This perspective is discussed later when there are more ships moored off Cape Coast Castle.

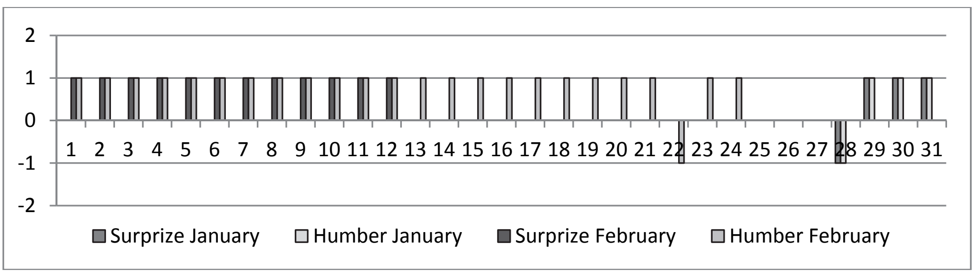

Figure 4.1 *The graph shows the weather during each day in January and February as registered in the captains' logbooks on board the Humber and the Surprize in 1750. A negative value indicates a rainfall entry.*

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41 TNA, ADM51/464, *Humber*, January 17th 1749.
42 TNA, ADM51/948, *Surprize*, January 17th 1749.
43 TNA, ADM51/464, *Humber*, January 17th – February 13th 1749.
44 TNA, ADM51/4299, *Prince Henry*, March 15th – 28th 1750/51.
45 TNA, ADM51/949, *Surprize*, March 25th –27th 1750/51.

The autumn months of 1751 are well represented. The *Swan* and the *Glory* moored off Cape Coast Castle between October and November. There are two ships registered as the *Swan* in the ADM 51 catalogue, although one was found under the name *Swann*.[46] However, both logbooks are from the same ship as Captain Dudley Digges had, for some reason, termed the ship the *Swann*, while the lieutenant termed it the *Swan*.[47] The *Swan* visited Cape Coast Castle in October and November, but sailed to other castles between October 16th and 22nd. The captain's and lieutenant's logbooks are almost identical throughout this period, and only disagree on occasions when it rained. This is peculiar as the logbooks otherwise describe every situation in *exactly* the same manner, as if one was a word by word copy of the other. The lieutenant noted four rainfall events in October, but the captain noted only two (see Figure 4.2a). The situation repeats itself in the next month. The lieutenant entered two rainfall events, and the captain only one (see Figure 4.2b). The discrepancy is intriguing. For instance, the lieutenant noted rainfall in his logbook on October the 23rd and 24th, but the captain did not. However, the wind columns contain exactly the same remarks: "W, SW, and SSW".[48]

The reason for this bizarre discrepancy might be that the transcription from the log-board to the logbook varied. The captain probably decided not to transcribe all rainfall events. This dichotomy signifies one of the most evident dilemmas when addressing logbooks in this type of investigation, especially if from the same ship: contradictory evidence. Earlier investigations have focused on the dichotomy and reliability, but not in relation to the transcription. However, there is no correct method to deal with this dilemma. The lieutenant did not imagine the additional rainfall events. As such, one logbook is no more correct than the other. It is more likely that the captain forgot, ignored, or determined not to focus on describing the weather correctly than that the lieutenant fabricated his entries. Fabricating rainfall events would not serve any purpose from the lieutenant's perspective. This reasoning – that all entries are correct – suggests that the best approach to employing logbooks in studies similar to this is to find the logbook with the highest frequency of rainfall events, and employ only that. This demands a diligent analysis and comparison of all logbooks found on any ship before they are employed in any investigation.

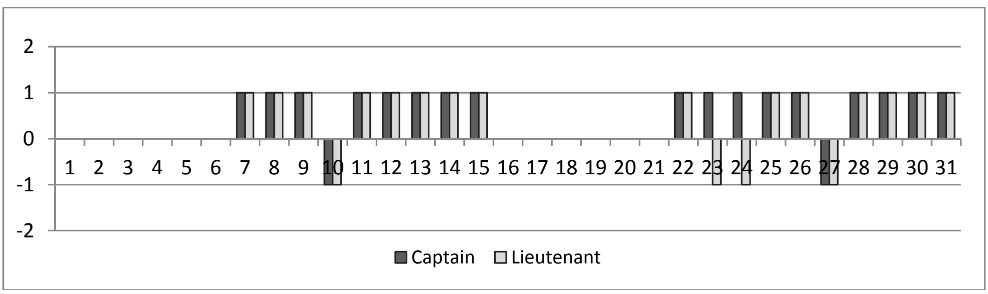

Figure 4.2a *This graph shows the weather during each day as registered in the captain's and lieutenant's logbooks on board the Swan in October 1751. A negative value indicates rainfall entry.*

[46] TNA, catalogue number ADM51/4362 contains a logbook from the *Swan* and ADM51/3988 from the *Swann*.
[47] Winfield, p. 304.
[48] TNA, ADM51/3988, *Swann*, October 12th and 13th 1751 and same dates found in ADM51/4362.

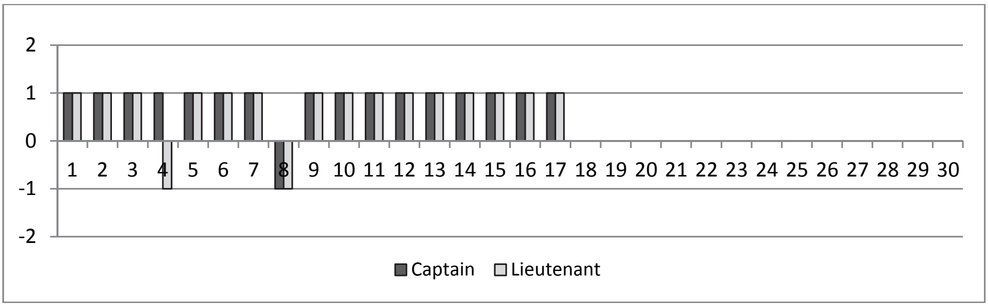

Figure 4.2b This graph shows the weather during each day as registered in the captain's and lieutenant's logbooks on board the Swan in November 1751. A negative value indicates rainfall entry.

It is, in this case, interesting that the logbooks from the *Swan* have poor descriptions of the weather for the days when the ships were not at Cape Coast Castle. There are even days for which there are no descriptions at all. However, both logbooks agree that it rained on October 18th (not included in Figure 4.2a).[49] In other words, the actual number of rainfall events between Cape Coast Castle and Elmina was three according to the captain's logbook, and five according to the lieutenant's logbook. There were, according to *The Diary of Transactions*, five rainfall events at Cape Coast Castle in October 1777 and three rainfall events in October 1778. The number of rainfall events in the logbooks from the *Swan* can therefore not be considered to project any anomalies, although they show internal discrepancies.

The *Glory* moored off the castle at the same time as the *Swan*; however, the captain on the *Glory* kept his logbook as a personal diary between September 19th and November 3rd. There are no dates, and the logbook is a report-like reflection on hostilities between the Dutch and the English. The weather for the entire period is described as "Moderate Breezes of Wind for the most part and fair Weather".[50] It is only by scrutinising the logbooks from the *Swan* that it becomes evident that the *Glory* was not even at Cape Coast Castle during this period.

The next ships to anchor off Cape Coast Castle arrived after September 1752, which was after the introduction of the Gregorian calendar. It is uncertain whether or not the captains were aware of the change, as it might have been proclaimed while the ship was at sea. It is, however, possible that they had received information regarding the change from other ships. Nonetheless, the logbooks are here considered to have been adjusted to the Gregorian calendar after September 1752.

There are no logbooks for the rainy period in 1752, although November and December can be almost entirely reconstructed based on the logbooks from the *Badger* and the *Glory*. However, again there are some discrepancies. For instance, the logbook on the *Glory* commences on October 28th and continues until December 16th. However, an undated letter in catalogue T70/29 states that the *Glory* arrived on October 22nd, and that it sailed to Annamboe on the 26th.[51]

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[49] TNA, ADM51/3988, *Swann*, October 18th 1751, and the same date found in ADM51/4362.

[50] TNA, ADM51/412, *Glory*, September 19th – November 3rd 1751.

[51] TNA, T70/29, undated letter, year uncertain, but in the catalogue it is found between a letter dated September 1752 and a letter dated January 1753.

The logbook has no information concerning the position of the ship on the 26th, but on the 27th it is moored off Annamboe.[52] The ship then returned to Cape Coast Castle and remained there from October 28th to December 16th. The captain noted one rainfall event in October, four in November, and two in December.[53]

The logbook from the *Badger* commences on November 16th and continues until December 24th, but the whereabouts of the *Badger* are uncertain before the 16th. The column for the position of the ship is empty until the 16th. It was only entered that the ship arrived at Cape Coast Castle and encountered the *Glory*, which was also noted in the logbook on board the *Glory*.[54] There were two rainfall events noted in the *Glory's* logbook before its arrival at Cape Coast Castle, of which one agrees with the *Badger*. The captain on board the *Badger* noted three rainfall events between November 16th and 30th.[55] There were two actual rainfall events and one possible between December 1st and Christmas Eve.[56] All rainfall events are presented in Figure 4.3. The rains before November 16th are included in the graph, although the *Badger* arrived at Cape Coast Castle on the 16th.

Figure 4.3 shows that there are some discrepancies concerning the rains in November. The whereabouts of the *Badger* before November 16th makes the rains on the 13th inadequate for investigation. The rains on the 12th are noted in both logbooks, but the captain on board the *Badger* noted rains on the 20th, which the captain on board the *Glory* did not.[57] The rains on the 20th were either erratic, local, or disregarded during transcription. This was a similar situation to that in April 1751. The inconsistency does imply that the sources are unreliable or that the officers were bad observers. The inconsistency accentuates the distance between the ships and the dynamics of the weather. Captain John Gale on board the *Badger* noted that the rains were "hard" on the 20th and that it rained during a tornado on the 22nd.[58] The captain made the following entry: "At 3 pm had a Tornado with Thunder Lightning & hard Rain".[59]

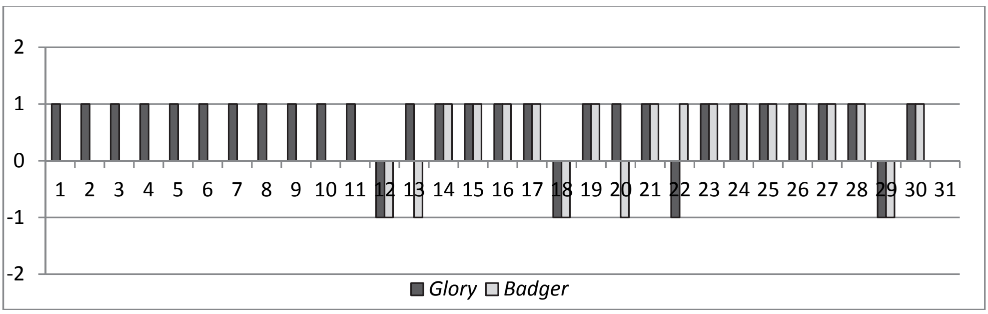

Figure 4.3 *The graph shows the weather during each day as registered in the captains' logbooks on board the Glory and the Badger in November 1752. A negative value indicates rainfall entry.*

52 TNA, ADM51/388, *Glory*, October 26th – 28th 1752.
53 TNA, ADM51/388, *Glory*, October 28th – December 16th 1752
54 TNA, ADM51/388, *Glory*, November 16th 1752, TNA, ADM51/77, *Badger*, November 16th 1752.
55 TNA, ADM51/77, *Badger*, November 16th – 30th 1752.
56 TNA, ADM51/77, *Badger*, December 1st – 24th 1752.
57 TNA, ADM51/388, *Glory*, November 19th and 20th 1752.
58 TNA, ADM51/77, *Badger*, November 20th 1752.
59 TNA, ADM51/388, *Glory*, November 22nd 1752.

The tornado was also noted in Captain John Gale's logbook on board the *Badger*. However, Gale's entry was different to that of Captain Cokburne on board the *Glory*. After Cokburne had described the weather for the day he added: "at 5 Pm Came on a Trenadoe the wind being mostly at SE" (see Table 4.2); however, he made no reference to rain.[60] Is it, therefore, possible that they described two different events or phenomena? Secondly, and furthermore, there was a two hour difference between the tornadoes. Might this explain why Cokburne did not mention the rains? What did these mariners mean when they noted tornado?

4.3.1 The mariners' perspective of a tornado

It was previously established that it is unclear what was meant by a tornado, and whether or not it included rain. This is exemplified in the case above. However, one reason for the temporal difference between the noted tornados was that there were at least two miles separating the ships. The captain on the *Badger* claimed that the castle was one mile to the NW, while the captain on the *Glory* positioned the castle three miles to N½W.[61] The distance between the ships is one plausible explanation of why the tornado was noted at 3 p.m. in one logbook and at 5 p.m. in the other. Furthermore, the logbook from the *Badger* is more indistinct. The wind directions were (top down) WSW, NW, SE and NNW, however, in the remarks column he noted that the winds were mostly SE. This implies that the winds were variable between noon and 5 p.m., and that the third entry (SE) was made at the time of the tornado.[62] A similar discrepancy is found at the beginning of December. On December 6th, Captain Cokburne described the weather for the middle part as "black and Squally with Lightning & Hard Rain" and the wind column shows variable winds (top down) SW, SSW, SE, NW, WBN (see Table 4.3).[63]

Table 4.2 *Entries describing a tornado from on board the Glory and the Badger on November 22nd 1752.*

Ship	Month	Date	Wind direction	Weather
Glory (Cokburne)	November	22	SW, SE, NW, SW	At 3 pm had a Tornado with Thunder Lightning & hard Rain, middle and latter parts moderate and fair Weather
***Badger* (Gale)**	November	22	WSW, NW, SE, NNW	First Part little Wind and Cloudy, mid variable, latter Fair, at 5 Pm Came on a Trenadoe the wind being mostly at SE

[60] TNA, ADM51/77, *Badger*, November 22nd 1752. This catalogue contains two logbooks by John Gale. The first ends on the 21 of November 1752, so this entry is the first entry in a new logbook. The second logbook appears to have been written by somebody other than John Gale as the handwriting is much easier to interpret.
[61] TNA, ADM51/77, *Badger*, November 16th 1752, TNA, ADM51/388, *Glory*, October 28th 1752.
[62] TNA, ADM51/77, *Badger*, November 22nd 1752.
[63] TNA, ADM51/388, *Glory*, December 6th 1752.

In his logbook on board the *Badger*, Captain Gale entered: "at 11 Came on a Trenado which lasted about an hour in which it Blew Hard", but he made no entry in the wind direction column.[64] Cokburne, for some undisclosed reason, did not classify this event as a tornado. He considered it to bear no resemblance to the event on November 22nd. Gale mentioned the *tornado,* but he decided not to describe its accompanying attributes. The inconsistency in usage of terms suggests that the captains understood the meaning of the term differently. However, Captain Gale on board the *Badger* noted the duration of the event, which suggests that he was describing a local thunderstorm. This was consistent with Rømer's description, who stated that tornadoes were short lived, and might imply that Captain Gale considered the notion of rain to be superfluous information as a tornado always included rain. However, it is more problematic when there is only one logbook available for analysis, as it is more difficult to understand how the term was employed.

There are several, although not many, similar cases in the logbooks. A similar entry to captain Gale's was made on board the *Weazle* on March 15th 1777. In this case it was Captain Hope who shortly noted: "Mod[erate] Breezes and fine W[eather]…at 6 pm Came on a Tornado".[65] A more descriptive entry is found in Captain Cornwallis's logbook from the *Pallas* on March 22nd 1775:

> First part Do Wea[ther], middle Fresh Gales and Squally with rain, latter Little Wind and rain, PM set up the main and mizon top mast rigging. Employed watering and stowing the Hold, ½ past 6 am in a Tornado the Ship dragged the Stream anchor, at 8 weighed it, cut 2½ fathoms off the middle of it being much rubb'd and spliced(---)[66]

Captain Hope mentioned the tornado only because the stream anchor was dragged. The entry contains no description of violent winds or rain, although it is clear that the wind force was considerable. It would otherwise not have dragged the anchor. However, this was also a short storm and the damage minimal. The anchor was weighed and fixed at eight o'clock, only two hours after the tornado had commenced.

Table 4.3 *Entries describing a tornado from on board the Glory and the Badger on December 6th 1752.*

Ship	Month	Date	Wind direction	Weather
Glory (Cokburne)	December	6	SW, SSW, SE, NW, WBN	First part moderate and Hazey middle black and Squally with Lightning & Hard Rain, latter part light airs & Cloudy
***Badger* (Gale)**	December	6	[no entries]	The first and latter parts Little wind and fair the middle [?] at 11 Came on a Trenado which lasted about an hour in which it Blew Hard

[64] TNA, ADM51/77, *Badger*, December 6th 1752.
[65] TNA, ADM51/1055, *Weazle,* March 1777. The dates between 1st and 14th are entered as February and from the 15th forward as March. It is assumed to be March as the month has over 29 days.
[66] TNA, ADM51/667, *Pallas*, March 22nd 1775.

The term tornado is found on 11 occasions in the logbooks (see Table 4.4). All entries, excluding two, appear in different years and thus represent 11 out of 97 months. Only one tornado was noted in January (1753), three in February (1767, 1777, and 1793), two in March (1762 and 1775), two in April (1770 and 1783), two in November (1752), and one in December (1752). Six of these entries do not describe the tornado as accompanied by thunder, lightning, and rain. The tornado in 1793 was recorded on the *Scorpion*, but not on the *Charon*.[67] All of the tornadoes appeared in late autumn, winter, and early spring, and their timing correlates with the tornadoes noted in the *Diary of Transactions* (see Table 2.1). The frequency is considerably lower in the logbooks due to the low quantity of logbooks. There are, however, no indications of the wind ever being exactly NE in the logbooks, as was suggested in Chapter 2. However, the winds were often easterly, although they were as expected at the beginning of the day; for instance, between S and W.

The entries in Table 4.4 are included because the term tornado was used. However, there are many entries were the term tornado is not employed, although the described event appears to be a tornado. In these cases it is the usage of qualifying adjectives that imply that it might have been a tornado. For instance, Captain Lewis Robertson entered "Middle, wind round the compass with much rain" in his logbook on June 10th 1778.[68] This description and the characteristics of the event might indicate a tornado. It was similar to Cokburne's entry on board the *Glory* in 1752, and also contains elements of Falconer's description of a tornado; for instance, the veering wind. The entry made by Robertson also included the same characteristics as those that were employed to describe a tornado. However, Robertson's entry was made in June, which was not a typical period in which tornadoes occur.

Another example is from the *Phoenix* in April 1769, when the captain entered "middle, Squally with thunder lightning and rain".[69] The captain on board the *Badger* also employed *squally* to describe the same phenomenon that the captain on board the *Glory* considered a tornado. It seems certain that the captain on board the *Phoenix* meant to describe a tornado.

Table 4.4 *The use of the term tornado in logbooks from this investigation.*

Ship	**Date**	**Year**	**Wind**	**Time of day**
Badger	November 22nd	1752	WSW, NW, SE, NNW	5 p.m.
Glory	November 22nd	1752	SW, SE, NW, SW	3 p.m.
Badger	December 6th	1752	[no entry]	11 [p.m./a.m.?]
Glory	January 30th	1753	SW, Eb, ENE, EbE	10.30–11.30 a.m.
Winchester	March 23rd	1762	SW, SSW	Middle [20.00–04.00]
Phoenix	February 22nd	1767	WSW, NW, ESE	10 till Noon [a.m.]
Hound	April 22nd	1770	Variable	3 p.m.
Pallas	March 22nd	1775	WbS, EbN, Variable	6 a.m.
Weazle	February 15th	1777	SW, SSW, NNE	6 p.m.
Rotterdam	April 19th	1783	WSW, E	Latter [04.00–12.00]
Scorpion	February 21st	1793	SSE to EbN, Variable, SW	4 a.m.

[67] TNA, ADM51/853, *Scorpion*, February 21st 1793, TNA, ADM51/189; *Charon*, February 21st 1793.
[68] TNA, ADM51/1055, *Weazle*, June 10th 1778.
[69] TNA, ADM51/693, *Phoenix*, April 22nd 1769.

It is also probable that captain Rich Edwards was describing a tornado when he entered "First & middle Parts hard Squales of wind with Rain, Thunder & Lightning" on board the *Falcon* in April 1753.[70]

These are but a few examples; however, it appears that the captains understood the term *tornado* differently. It was employed to describe a thunderstorm, but there was no uniform understanding on this. However, it is also possible that the usage of concepts relates to the employment of the log-board. Therefore, the person who made the entry on the log-board was unfamiliar with the concept, which is why there are so many descriptions that seem to imply tornadoes, even though not noted as such. Whether or not the descriptions refer to the same phenomenon is also dependent on how terms such as *squally* are understood in a tropical environment.

Squally

Squally was a popular term without a uniform meaning. Squally was employed as a qualifying adjective and described the state of the weather, its behaviour, and characteristics, not the force of the wind. Nevertheless, to be described as squally, the force of the wind should at least be strong and variable. This is based on a comparison of entries made by the captain and the master on board the *Phoenix* in April 1769. The master entered "Fresh gales & squally with thunder lightning and rain" in his logbook.[71] Fresh gales were, in the CLIWOC (climatological database for the world's oceans) dictionary, considered equivalent to gale force winds.[72] Hence, the wind was sufficiently strong to portray the same phenomenon that led to the *Pallas* dragging its anchor in 1775. A similar entry to that from the *Phoenix* is found in the captain's logbook from the *Humber*. On Sunday, February 11th 1750 the captain entered "First part fresh Gales and squalley with Thunder Lightning and Rain".[73]

Entries similar to those on board the *Humber* in 1750 and *Phoenix* in April 1769 are abundant. If all entries that describe the weather as *squally with thunder, lightning, and rain*; *fresh gales with thunder, lightning, and rain*; *black and squally with thunder, lightning, and rain*, were considered as *tornadoes*, it would more than triple the number of registered tornadoes at Cape Coast Castle. However, this categorisation is unreliable. There are many entries that are similar to these mentioned above, but they are not identical in their usage of terms. They also are not consistent in their descriptions. In some cases the wind is described as *moderate*, in other descriptions no *rain* or *lightning* is mentioned. For instance, the captain on board the *Rotterdam* noted a tornado on April 19th 1783.[74] Ten days earlier, the weather was recorded as "Squally with thunder lightning and rain"; however, this was not considered a tornado.[75] The wind direction column has three entries of which the middle is *variable*, which is in line with the description of a tornado based on the contemporary literature. However, it was not considered a tornado even though it rained,

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[70] TNA, ADM51/335, *Falcon*, April 12th 1753.
[71] TNA, ADM52/1402, *Phoenix*, April 22nd 1769.
[72] CLIWOC multilingual meteorological dictionary, p. 32. The scale ranges from 0 to 12 (12 being the strongest and equivalent to a hurricane). Gale force winds are considered equivalent to an 8.
[73] TNA, ADM51/464, *Humber*, February 11th 1750.
[74] TNA, ADM51/777, *Rotterdam*, April 19th 1783.
[75] TNA, ADM51/777, *Rotterdam*, April 9th 1783.

the weather was squally, and the winds variable.[76] This implies that there was an immeasurable element that made the event appear as a tornado on April 19th in 1783.

It is due to similar entries that it is difficult to determine what qualified as a tornado or what was meant by the term; there was clearly no consensus on its meaning. There are no common denominators such as variable winds, wind force, rains, thunder, and lightning, which can be employed to identify a tornado. It can only be concluded that the term tornado was employed to describe a thunderstorm, although it did not automatically include rain. It is also possible that it always included rain, which is why captains with long experience considered it superfluous information and unnecessary to include in an entry.

There was a rainless tornado registered on board the *Badger* in December 1752; however, the rains were noted on board the *Glory*. The entire month of December is presented in Figure 4.4.[77] The rains on December 1st, noted by the captain on board the *Glory,* are not included in Figure 4.4 as these were noted at a distance. This highlights a spatial dilemma, and touches upon one of the core questions of the investigation: are logbooks' weather descriptions sufficiently reliable to reflect the weather at Cape Coast Castle?

The rains on December 1st were observed in the north-western quarter and not at the location of the ship.[78] The entry might imply that it rained on land and at Cape Coast Castle if the castle was NW of the ship. This indicates that logbooks do not portray the same weather as that on land. It also highlights another dilemma: it is not evident that logbooks always describe the weather at the location of the ship, although this example is probably an exception.

However, why did the captain make this entry? While it is possible that he simply copied it from the log-board, was there something special concerning this event? It is impossible to provide answers to these questions, but this show the erratic nature of the rainfall in the tropics, and that there might be a problem relating to the correlation between sea and land in this environment.

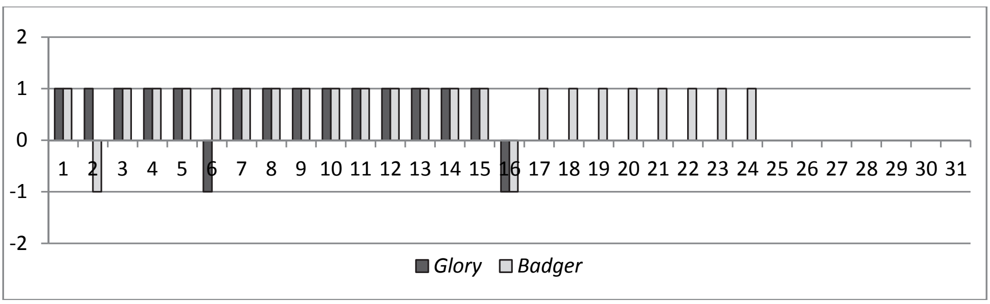

Figure 4.4 The graph shows the weather during each day, as registered in the captains' logbooks on board the Glory and the Badger in December 1752. A negative value indicates a rainfall entry.

[76] TNA, ADM51/777, *Rotterdam*, April 18th 1783.
[77] TNA, ADM51/388, *Glory*, December 1st – 16th 1752 and ADM51/77, *Badger*, December 1st – 24th 1752.
[78] TNA, ADM51/388, *Glory*, December 1st 1752.

There are three types of 'microclimate': the first is that observed at the location of the castle, and the second and third microclimates are those at the location of the two ships, which were at a distance of approximately two miles from each other.

The *Glory* returned to Cape Coast Castle in January 1753 after departing for Annamboe on December 16th. The *Glory* was the only Royal Navy vessel at Cape Coast Castle between January 1st and mid-February, after which it was joined by the *Assistance*, the *Falcon*, and the *Hind*. Both the *Assistance* and the *Falcon* stayed until May, although only sporadically during the last two months. The captain on board the *Glory* noted four rainfall events in January. Three were accompanied by thunder, lightning, and rain, while the fourth was noted as a tornado.[79] The rains were abundant at all times, and even described as "excessive hard" during the tornado on the 31st.[80] Four abundant rainfall events can be considered significant during the month that nowadays is the driest of the year, especially if the same rains fell over the castle. The captain entered only one rainfall event between February 1st and 14th.[81] The ship then sailed to Annamboe, and returned to Cape Coast Castle on the 23rd to join both the *Assistance* and the *Falcon*.

The *Assistance:* a case-study

The catalogue ADM 51 contains two logbooks from the *Assistance*, and both cover the same period. The title page also confirms that both were written by Captain George Stepney. The books are not numbered and can only be differentiated by their physical appearance and style. The first logbook has a simple title page and layout; the entries are short and simple, at least when compared to its counterpart. I will refer to this as the 'minimalistic' logbook. The second logbook has an ornamented and elegant title page, and the wind direction and remarks column are often elaborately filled. This more diligently kept logbook places the ship at Cape Coast Castle on February 20th, while the minimalistic logbook claims that the ship arrived at Cape Coast Castle on the 23rd. Furthermore, the minimalistic logbook has no entry on March 12th (Monday), which for some reason was skipped, with Sunday the 11th being followed by Tuesday the 13th.[82]

A significant difference is that there were more rainfall events noted in the more diligently kept logbook. For instance, there were two more rainfall events registered per month in March, April, and May. The minimalistic logbook contains a total of nine rainfall events for the entire period, compared to 14 in the more diligently kept logbook.

The more diligently kept logbook is employed in this investigation for several reasons. First, it is more consistent with the logbooks from other ships. Secondly, the dating creates an obvious dilemma as there can be no certainty that the dates are either correct or corrected accurately. For instance, the *Falcon* arrived at Cape Coast Castle at approximately 8 a.m. on the 27th (at the end of the nautical day), but according to the captain on the *Assistance* it was the 28th.[83] Furthermore, the captain on the *Hind* noted that the *Falcon* departed on the 24th, which agrees with the logbook on the *Falcon*.[84] In other words, the dates from the other ships are consistent with each other, but not with the

[79] TNA, ADM51/388, *Glory*, January 1st – 31st 1753.
[80] TNA, ADM51/388, *Glory*, January 31st 1753.
[81] TNA, ADM51/388, *Glory*, February 1st–14th 1753.
[82] TNA, ADM51/7, *Assistance*, March 11th – 13th 1753.
[83] TNA, ADM51/335, *Falcon*, March 27th 1753; ADM51/7, *Assistance*, March 28th 1753.
[84] TNA, ADM51/335, *Falcon*, March 24th 1753; ADM51/455, *Hind*, March 24th 1753.

dates from the *Assistance*. This is the main reason why the more diligently kept logbook is preferred.

The *Assistance* had been at Cape Coast Castle for three days when the *Glory* returned from Annamboe in February. The *Falcon* arrived at Cape Coast Castle on the same day as the *Glory*, although earlier in the day. The captains' logbooks from these ships are very consistent over the last days of February. All captains described the weather as moderate and cloudy/hazy until the 28th, when it rained.[85] The logbooks are also consistent in their descriptions on the day when it rained. The captain on board the *Assistance* noted: "Do W with thunder lightning & rain".[86] The captain on board the *Glory* noted thunder, lightning, and rain, while the captain on the *Falcon* noted rain and lightning.[87] In the 'minimalistic' logbook from the *Assistance*, the entry was 'some rain', which again shows how logbooks from the same ship might variously describe the weather.

March is the only month when all the ships are present during almost the entire month. The previously mentioned ships were also accompanied by a fourth ship, the *Hind*. There are some dates missing in March as there were some days when the weather was not described. For instance, the *Hind's* captain, Timothy Nucella, did not comment on the weather on the 20th and 22nd.[88] Nevertheless, there were ten rainfall events in March, all of which were registered after the 15th. Approximately half of the events were noted in only one logbook, but the rainfall events on the 18th, 23rd, 27th, and 29th were registered on board all ships (see Figure 4.5). The rainfall event on the 21st was registered on only two of the four ships. The remainder of the rainfall events were only registered on one ship.

There is nothing typical about the dichotomies concerning the rainfall events. There is no common denominator that might explain the differences. For instance, the figure shows that the captain on board the *Glory* was the only one to claim that it rained on Friday March 17th. It is evident, when comparing the entries from each ship, that the captains on board the *Glory* and the *Falcon* made the most descriptive entries (see Table 4.5).

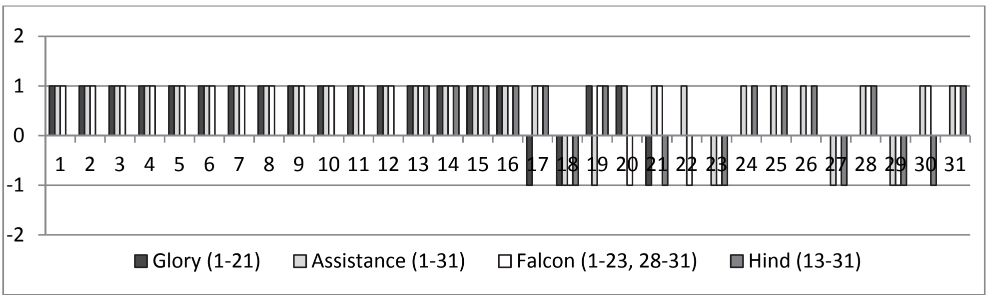

Figure 4.5 *This graph shows the weather during each day as registered in the captains' logbooks on board the Glory, the Assistance, the Falcon, and the Hind in March 1753. A negative value indicates rainfall entry. The parentheses indicate the period when each ship was present at Cape Coast Castle.*

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[85] TNA, ADM51/388, *Glory*, February 23rd – 28th 1753; ADM51/7, *Assistance*, February 22nd – 28th 1753; ADM51/335; *Falcon*, February 23rd – 28th 1753.

[86] ADM51/7, *Assistance*, February 28th 1753.

[87] TNA, ADM51/388, *Glory*, February 28th 1753; ADM51/335, *Falcon*, February 28th 1753.

[88] TNA, ADM51/455, *Hind*, March 20th and 22nd 1753; Winfield, p. 257.

Table 4.5 *Logbook entries for March 17th 1753, derived from the logbooks on the Glory, the Hind, the Assistance, and the Falcon.*

Ship	Entry
Glory	The first and latter parts little Wind and Cloudy, the middle squally with rain (---)
Assistance	Light airs and hazey (---)
Falcon	First & middle parts: moderate and hazey; The latter Cloudy Weather (---)
Hind	The same weather [moderate and cloudy] (---)

Both followed the officers' watch and divided the nautical day into three parts. George Stepney, captain of the *Assistance*, made a short entry on the 17th, which was a typical example of the entries in his logbook. He was not consistent in dividing the day according to the officers' watch. Stepney mostly described the wind and weather for one entire day in one short sentence. The captain of the *Hind* also made ambiguous entries. Nevertheless, only the captain on board the *Glory* entered rain on the 17th. The only explanation for the discrepancy is the erratic rainfall pattern. This situation is similar to that in 1751 when two logbooks showed different types of weather. The rains were noted in only one of the four logbooks. The best method to address these entries would be to exclude them from the climatic analysis. They are unreliable as observations for the purpose of this investigation. However, the tropical climate is such that excluding certain observations is equally problematic as including them all. Nevertheless, for the remainder of the investigation I will include only rainfall events that were noted in several logbooks.

I base my premise on the assumption that these rainfall types were large enough to cover a wider area. These are the only entries that might portray the weather on land. Applying this method reduces the number of rainfall events from ten to five in March 1753. This portrays a more realistic picture of the precipitation in March, especially if the expected number of rainfall events follows the diary. This dilemma is discussed further at the end of the chapter when the suitability of logbooks, as sources for similar types of investigation in this area, is considered.

There were a total of seven rainfall events in April (see Figure 4.6).[89] The rains on the 17th, 22nd, and 23rd were all part of a thunderstorm, and noted on both the *Assistance* and the Falcon. The remaining rainfall events were only registered in one of the logbooks.

[89] TNA, ADM51/335, *Falcon*, April 1st – 25th; ADM51/71, *Assistance* 1st – 27th 1753; ADM51/455, *Hind*, April 1st – 4th 1753.

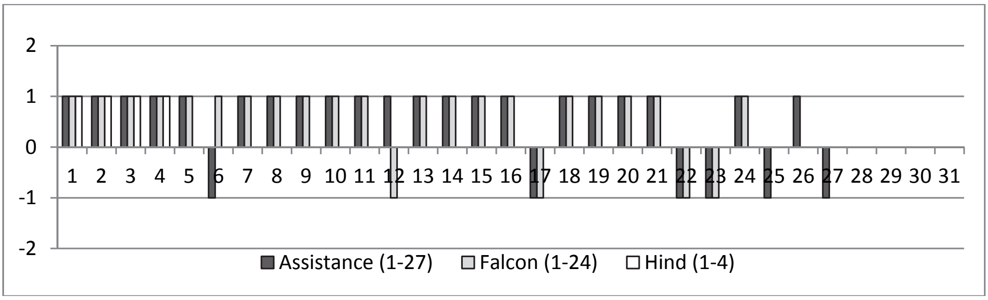

Figure 4.6 *This graph shows the weather during each day, as registered in the captains' logbooks on board the Assistance, the Falcon, and the Hind in April 1753. A negative value indicates rainfall entry. The parentheses indicate the period when each ship was present at Cape Coast Castle.*

The captain on board the *Falcon* noted hard squalls with rain, thunder, and lightning on the 12th, but the captain of the *Assistance* only noted thunder and lightning. The captain of the *Assistance* claimed that it rained on the 25th and 27th; however, these cannot be compared to the entries on the *Falcon*. The rains fell in the afternoon on the 27th, after the *Falcon* had weighed anchor and sailed for Annamboe at 2 a.m. By combining those that overlap, the actual number of rainfall events included in the analysis drops from seven to five, including the rains on the 25th and 27th. This is the same number of rainfall events as portrayed in the diary.

One of governor's letters reveals that the *Hind* had brought 20 Gambia slaves to Cape Coast Castle. This is the only occasion when it was noted that a Royal Navy ship carried slaves, although it was not mentioned in the logbook. 12 slaves were to be utilised as bricklayers and sent to other castles, but not before the rains were over.[90]

The logbooks from May show the onset of the rainy season. There were eight rainfall events noted out of 15 entries, which shows how the seasonal rains enter the Gold Coast area (see Figure 4.7).[91] The events that occurred at the end of the month were thunderstorms. The *Assistance* arrived at 4 p.m. on the 17th, and it rained during the third watch; therefore, although they were not, the rains should have been mentioned in the logbook.

It is possible that the captain on the *Assistance* only noted the weather for the first 12 hours of the day (from noon until midnight), which is why the nightly rains are not.[92] This method of making entries would have been similar to the example from the *Cumberland* in 1782. The governor had noted violent rains in 1753 that had brought down many of the forts.[93] If these are the same rains mentioned in the *Falcon's* logbook then it indicates a late onset of the rainy season.

There is not as much information for 1754 as there was in 1753. The *Crown* was moored off Cape Coast Castle for 11 days in January, but nothing remarkable occurred. The weather was mostly described as moderate and hazy.[94]

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[90] TNA, T70/29, letter dated April 24th 1753.

[91] TNA, ADM51/335, *Falcon*, May 14th – 17th and 23rd – 30th 1753; ADM51/71, *Assistance*, May 17th – 21st 1753.

[92] TNA, ADM51/71, *Assistance*, May 17th 1753.

[93] TNA, T70/29, letter dated July 1st 1753.

[94] TNA, ADM51/215, *Crown*, January 12th – 16th and 21st – 26th 1754.

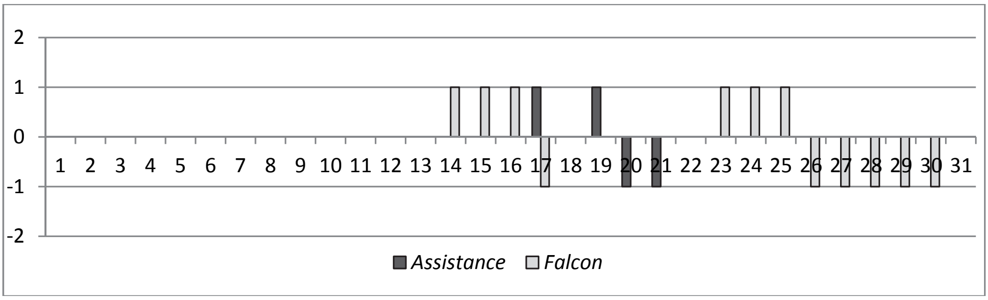

Figure 4.7 *This graph shows the weather during the latter part of May as registered in the captains' logbooks on board the Assistance and the Falcon in 1753. A negative value indicates rainfall entry.*

The next ship to visit Cape Coast Castle was the *Jason*, which was moored at Cape Coast road between July 6th and 26th. It is remarkable that there were no rainfall events noted in the logbook.[95] However, the lack of rainfall events might relate to the captain's laconic style of keeping his logbook. The captain wrote *ditto* in all columns for almost the entire period. Even though the rains should have subsided in July, it seems unlikely that there were no rainfall events at all and that the winds remained the same throughout the period.

4.3.2 The latter half of the 1750s

Gosport was the only ship that visited Cape Coast Castle in 1755. This was between March 30th and April 8th. It rained twice, on both occasions in April.[96] This is similar to the beginning of April 1753 and the diary in 1778, which both showed only a few rainfall events.

The *Humber* arrived at Cape Coast Castle on the last day in February in 1756 and remained there until March 17th. The ship then sailed to Elmina before it returned to Cape Coast Castle on the 24th, where it stayed until April 2nd. There were two rainfall events between February 29th and April 2nd. The first was on March 14th and the second during the middle watch on the 17th, slightly before the ship departed for Elmina at four o'clock in the morning.[97] It is noteworthy that the weather was described as *hot and sultry*. It was only in March that the weather was described as hot and sultry in the *Diary of Transactions*.[98] 'Sultry' is a subjective description, which is why it does not describe the weather in particular, merely how it was considered by the captain.

The *Assistance* was anchored off Cape Coast Castle between November 26th and December 10th in 1756. There were no rainfall events in November and three abundant events in December.[99] This might indicate winter rains, as in December 1778.

[95] TNA, ADM51/487, *Jason*, July 6th – 26th 1754.
[96] TNA, ADM51/406, *Gosport*, March 30th until April 8th 1755.
[97] TNA, ADM51/4221, *Humber*, February 29th – April 2nd 1756.
[98] TNA, T70/1468, *Diary of Transactions at Cape Coast Castle,* March 1778.
[99] TNA, ADM51/71, *Assistance*, November 26th – December 10th 1756

Two ships visited Cape Coast Castle in 1757. These were the *Lichfield* and the *Centaur*, and both ships visited Cape Coast Castle in October. The *Lichfield* was anchored off the castle between October 7th and 29th, and the *Centaur* between the 8th and 19th.[100] The captains had similar methods of keeping their logbooks, and they show great consistency. The weather was noted as *fair* throughout almost the entire period. There is only one rainfall event, which was on the 26th. The extent of these rains cannot be cross-referenced as the *Centaur* had already sailed from Cape Coast Castle. The *Lichfield* remained for almost an entire month, which is why it is remarkable that there is only one rainfall event noted in the logbook. There are no indications to support the existence of a secondary rainy season. It is also questionable whether or not the logbooks would portray the secondary rainy season as the rains arrived from the inland.

The *Lichfield* visited the Guinea coast again in April 1758. It is unclear if it sailed to Cape Coast Castle as the logbook has not been found, but the ship is mentioned in a letter written in April. The governor noted that he was sending money with the *Lichfield*.[101] it is also possible that the logbooks were lost as the ship was wrecked on the coast of Morocco seven months later.[102] Nonetheless, the logbook from the *Rye* has survived. The *Rye* moored off Cape Coast Castle only for a few days at the end of August. There were no rainfall events noted in the logbook.[103] With no other logbooks for comparison, these short periods provide information of only little value.

4.4 Logbooks from the 1760s

The *Chesterfield* was moored at the road off Cape Coast Castle between January 24th and February 5th in 1760.[104] There were no rainfall events or anything else of climatic value entered in the logbook. The next ship to visit the castle was the *Centurion*, which stayed between December 15th and 19th, but the logbook contains no rainfall entries.[105]

The *Woolwich* was anchored off Cape Coast Castle for almost the entire month in March 1761. The ship had been at Senegal and Goree before arriving at Cape Coast Castle on the 8th, where it stayed until the 29th. There were five rainfall events entered in the logbook (see Figure 4.8).[106] There are some discrepancies in Captain William Bayne's logbook. Some of these ambiguities are similar to those found in the *Diary of Transactions*. First, it rained in the middle watch on the 22nd, and the following day the weather is simply described as 'the same'. The frequency of rainfall events for March is dependent on how the entry on the 23rd is interpreted. If it is decided that the weather was exactly the same, then it has to be assumed that it rained. However, the captain always explicitly noted when it rained, which is why the entry from the 23rd is best disregarded.

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[100] TNA, ADM51/542, *Lichfield*, October 7th – 29th; ADM51/171, *Centaur* 8th – 19th 1757.
[101] TNA, T70/30, letter dated April 16th 1758.
[102] Winfield, p. 151.
[103] TNA, ADM51/825, *Rye*, August 27th – 31st 1758.
[104] TNA, ADM51/196, *Chesterfield*, January 24th – February 6th 1760.
[105] TNA, ADM51/176, *Centurion*, December 15th – 19th 1760.
[106] TNA, ADM51/1083, *Woolwich*, March 8th – 29th 1761.

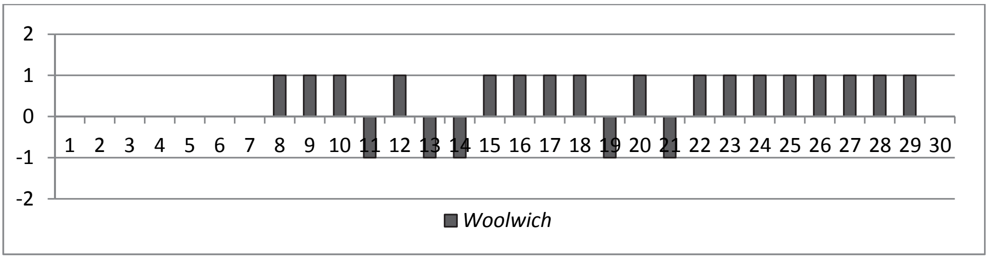

Figure 4.8 *This graph shows the weather during each day as registered in the captain's logbook on board the Woolwich in March 1761. A negative value indicates rainfall entry.*

Secondly, Thursday the 26th is followed by Friday the 28th, and Saturday the 29th is followed by Monday the 30th. This does not affect the result of the investigation, but it points to some of the dilemmas in employing logbooks as sources. There was a similar problem when dealing with the logbook from the *Assistance*. This shows that logbooks, from time to time, contain errors of various types. It is not only weather entries that are ambiguous, but also the dating and the positioning of the ships need to be scrutinized.

The *Winchester* was moored at Cape Coast road in March 1762, but the weather in 1762 bears little resemblance to that in March 1761. The *Winchester* was moored at Cape Coast road between March 17th and 27th and there were no rainfall events noted in the logbook.[107] There was a tornado noted on the middle watch during the 23rd, but the entry contains no description of rain.

The *Assistance* was moored off Cape Coast Castle between April 7th and 12th 1763. The captain noted only one rainfall event during this period.[108] The ship was mentioned in a letter a few days after it had departed. The governor informed London that he was sending gold with the *Assistance,* but he also stated that there was a shortage of supplies.[109] This is not mentioned in the logbook.

The *Ludlow Castle* arrived at Cape Coast Castle on June 23rd and stayed until August 28th, thereby covering almost two thirds of the summer in 1763 (see Figure 4.9).[110] There were only five rainfall events noted in the captain's logbook: one in June, two in July, and two in August. The frequency of rainfall events is extremely low, especially for June, which was the principal month of the rainy season. The governor asserted that he had never seen an unhealthier rainy season. He did not describe the rains, but his assertion suggests heavy rains, which should be visible in the logbook.[111] The *Ludlow Castle* arrived on June 23rd, which was approximately two weeks before the governor wrote his letter.

There were only two rainfall events in the logbook between June 23rd and July 7th, which implies that it was dry.[112] The amount of rainfall events are lower than might be expected at this time of the year. August was mostly foggy and hazy, and the two rainfall

107 TNA, ADM51/4396, *Winchester*, March 17th – 27th 1762.
108 TNA, ADM51/71, *Assistance*, April 7th – 12th 1763.
109 TNA, T70/31, letter dated April 14th 1763.
110 TNA, ADM51/559, *Ludlow Castle*, June 23rd – August 28th 1763.
111 TNA, T70/31, letter dated July 7th 1763.
112 TNA, ADM51/559, *Ludlow Castle*, June 28th and July 6th 1763.

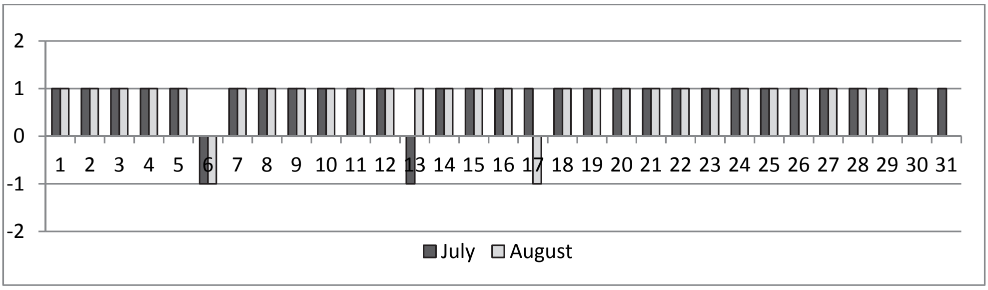

Figure 4.9 *This graph shows the weather during each day, as registered in the captains' logbooks on board Ludlow Castle in July and August 1763. A negative value indicates a rainfall entry.*

events did little to ease the drought. The first rainfall event produced 'some rain', while the second generated more continuous rains.[113]

The frequency of rainfall events noted in the logbook in August is reasonably consistent with the rainfall events noted in the diary in 1777 and 1778, although June and July are under-represented. However, the logbook on *Ludlow Castle* portrays similar conditions to those recorded in the logbook on the *Jason* in 1754, which had no rainfall events. it seems unlikely that it would only have rained twice between June 23rd and July 7th, especially as the governor considered it to be an unhealthy season. This would imply that the rainy season ended before June 23rd in 1763, which was very early, although it might also be an indication that the logbooks are more reliable at the beginning of the rainy season than at its end.

The *Martin* was moored at Cape Coast road between January 25th and February 8th 1764, excluding a short visit to Annamboe between February 4th and 6th.[114] There were no rainfall events noted during this period and the weather was mostly hazy. The *Shannon* had also sailed to Cape Coast Castle, but the ship only stayed there for one day, which is why it is not included in this investigation.[115] However, the *Shannon* returned to Cape Coast Castle in 1765, and remained there from June 25th to July 16th.[116] It did not rain in June, but the captain noted three rainfall events at the beginning of July.

The *Shannon* was at the castle until the middle of July and the logbook covers only half the month, but the rain fell at the beginning of the month, as it had in July 1763. The rest of July was hazy, and only two of 16 days were clear. The rainfall event frequency was again lower than expected. This might again show the discrepancy between sea and land.

The governor noted a great dearth of corn in June 1766. There were unfortunately no logbooks to corroborate the distress. The *Hound* was the only ship that was moored off Cape Coast Castle in 1766.[117] The *Hound* had arrived with the *Phoenix* to hunt for pirates, as noted in a letter written in April, but *Phoenix's* logbook was not found.[118] The ships sailed for Dixcove after only four days, and their captains made no entries of rain.

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113 TNA, ADM51/559, *Ludlow Castle*, August 6th and 17th 1763.
114 TNA, ADM51/580, *Martin*, January 25th – February 8th 1764.
115 TNA, ADM51/891, *Shannon*, February 1764.
116 TNA, ADM51/852, *Shannon*, June 25th – July 16th 1765.
117 TNA, ADM51/462, *Hound*, April 9th – 12th 1766.
118 TNA, T70/31, letter dated April 25th 1766.

Both the *Hound* and the *Phoenix* returned to the Gold Coast at the beginning of 1767. The *Phoenix* arrived at Cape Coast Castle on February 20th, and remained there until March 10th.[119] The *Hound* arrived in the afternoon on February 26th and remained there until March 6th.[120] There were four rainfall events noted, two in February and two in March. All were noted on board the *Phoenix* at a time when the *Hound* was not present. Three of the rainfall events were thunderstorms and one was defined as a tornado.

The same ships returned to Cape Coast Castle in 1768. *Phoenix* was moored off Cape Coast Castle for seven days at the end of February, and it rained on two occasions.[121] The rainfall event on the 22nd was a tornado, and the next day they only received 'some' rain. The *Hound* arrived at Cape Coast Castle approximately one month later and stayed between March 20th and 28th.[122] It did not rain during its visit.

The *Phoenix* was again moored off the castle between April 21st and May 12th 1769 (see Figure 4.10).[123] The captain mentioned four rainfall events in April, with only one being light. The beginning of May continued as April had ended. There were eight rainfall events, and the rains were abundant on all occasions but two. It rained for the entire day on the 3rd, which would, if transformed to the civil calendar, imply that it also rained on the 4th, thereby increasing the number of rainfall events. These entries clearly depict the rainy season in 1769. The logbooks from the 1760s seem to predict the onset of the rainy season in May.

The *Merlin* was the last ship to visit Cape Coast Castle in the 1760s, this was between October 5th and 26th in 1769(see Figure 4.11).[124] There were three rainfall events noted in the captain's logbook. This agrees with the number of rainfall events noted in the diary in December 1778. There are nine days missing and thus the data are not complete; however, to some extent, the information from the *Merlin* supports the hypothesis which suggests that the subsidiary rainy season was weak in the 18th century.

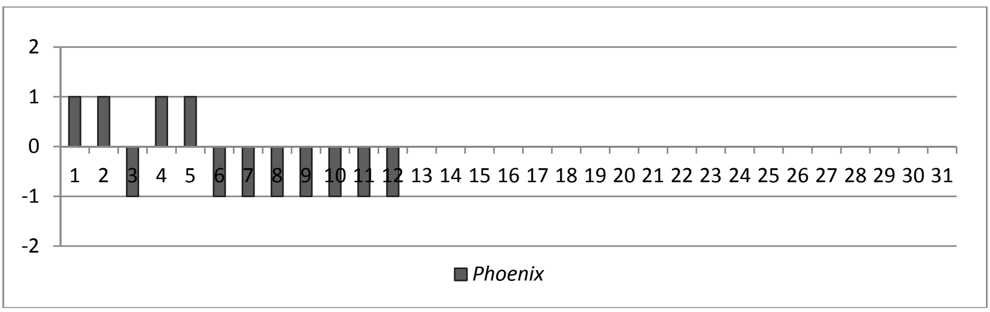

Figure 4.10 *This graph shows the weather as registered in the captain's logbook on board the Phoenix at the beginning of May 1769. A negative value indicates rainfall entry.*

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119 TNA, ADM51/693, *Phoenix*, February 20th – March 10th 1767.
120 TNA, ADM51/462, *Hound*, February 26th – March 6th 1767.
121 TNA, ADM51/693, *Phoenix*, February 22nd – 28th 1768.
122 TNA, ADM51/462, *Hound*, March 20th – 28th 1768.
123 TNA, ADM51/693, *Phoenix*, April 21st – May 12th 1769.
124 TNA, ADM51/603, *Merlin*, October 5th – 26th 1769.

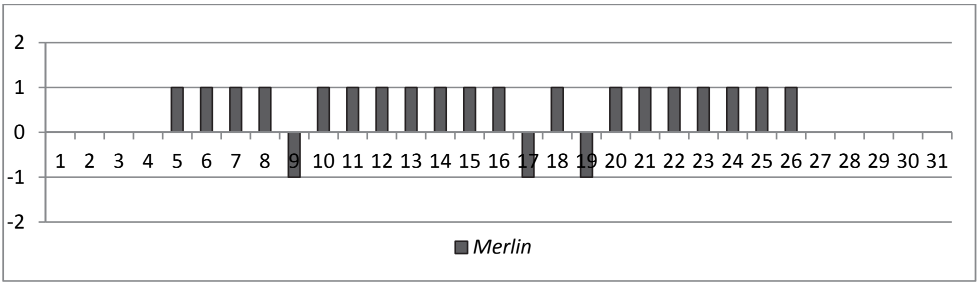

Figure 4.11 *This graph shows the weather in October 1769 as registered in the captain's logbook on board the Merlin. A negative value indicates rainfall entry.*

4.5 Logbooks from the 1770s

The first logbooks to be analysed from the 1770s are those from the *Phoenix* and the *Hound* (see Figure 4.12). The logbooks portray April 1770 as a wet month with seven rainfall events in twenty days of entries.[125] Most of the rainfall events were thunderstorms, but only one of the thunderstorms was considered a tornado, which was on the 22nd. The logbooks are consistent, and four of the rainfall events are noted in both logbooks. The last three events are only noted in the logbook on the *Hound* as the *Phoenix* had already departed from Cape Coast Castle.

The *Rainbow* visited Cape Coast Castle in March two years later. On this occasion it was joined by the *Weazle* for a short period of time. The *Rainbow* was anchored off the castle between the 14th and 27th, and there was one rainfall event noted in the logbook as they received "some showers" on the 19th.[126] The same shower of rain was noted as a rainless tornado on board the *Weazle*, although the ship had not yet arrived at the castle.

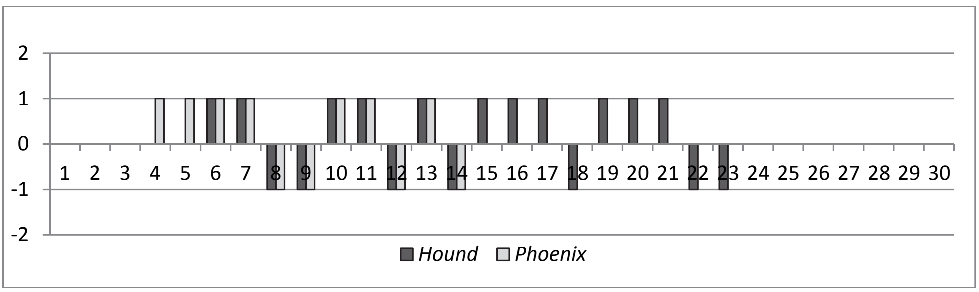

Figure 4.12 *This graph shows the weather as registered in the captains' logbooks on board the Hound and the Phoenix in April 1770. A negative value indicates rainfall entry.*

[125] TNA, ADM51/693, *Phoenix*, April 4th – 14th 1770; ADM51/4220, *Hound*, April 6th – 23rd 1770.
[126] TNA, ADM51/761, *Rainbow*, March 14th – 27th 1772.

The tornado carried away the *Weazle*'s steering sails; however, it reached Cape Coast Castle where some repairs were carried out before its departure five days later. There were no rainfall events noted in the captain's logbook on board the *Weazle*.[127]

The *Rainbow* visited Cape Coast Castle again in February 1773, on this occasion with the *Dispatch*. The ships moored off Cape Coast Castle for a week before setting after pirates. The logbooks cover a period between March 18th and 24th. It rained on the 19th but this was only noted on the *Rainbow*. This was the same day that the *Dispatch* arrived, which might explain why the rains were not registered in its logbook.[128] The *Rainbow* visited the castle again in March 1774. On this occasion the *Rainbow* stayed for only a week, and the captain noted one rainfall event.[129]

The *Pallas* made a short visit to Cape Coast Castle in March 1775. The ship was anchored for a week and there was a rainfall event noted on the last day.[130] The *Pallas* visited Cape Coast Castle again on March 8th and 17th in 1776.[131] The captain made one rainfall entry in his logbook.

The *Weazle* also visited the castle in 1776. The ship was at Cape Coast Castle for a period of seven days in February 1776, but there were no rainfall events noted in the logbook.[132]

The same ships frequently visited the Gold Coast during the 1770s. The *Weazle*, which had been there in 1776, returned to Cape Coast Castle on March 8th 1777. The ship remained there until March 24th, when it departed before returning on April 17th, after which it moored off the castle until the 25th.[133] There were two rainfall events in March and a tornado on the 15th, but the tornado was not reported to have included any rains. It did not rain in April.

The *Pallas* returned to the castle in 1777. The ship arrived at the beginning of June and stayed for only four days, during which it rained every day.[134] These rains were part of the seasonal rains as expected in June. The governor described the rainy season as "very severe" only one month later.[135] It is unfortunate that the *Pallas* had set sail before the commencement of the diary, which begins on July 10th. Nevertheless, the rains registered in the logbook certainly imply that the rains were severe. The logbook and the letters are consistent, and describe similar conditions. If the rains continued in the same manner for the rest of the month it would have been a very severe season. However, the letter that followed noted that they had only a little rain in July, which was confirmed by the diary.

4.5.1 June 1778: A comparison between the diary and the *Weazle's* logbook

The *Weazle* visited Cape Coast Castle in June 1778, which enables a comparison with the entries in the *Diary of Transactions at Cape Coast Castle*. The *Weazle* was moored off Cape

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[127] TNA, ADM51/1065, *Weazle*, March 19th – 25th 1772.
[128] TNA, ADM51/761, *Rainbow*, February 18th – 24th 1773; ADM51/253, *Dispatch*, 19th – 24th 1773.
[129] TNA, ADM51/761, *Rainbow*, March 17th – 23rd 1774
[130] TNA, ADM51/667, *Pallas*, March 20th – 26th 1775.
[131] TNA, ADM51/667, Pallas, March 8th – 17th 1776.
[132] TNA, ADM51/1055, *Weazle*, February 17th – 23rd 1776.
[133] TNA, ADM51/1055, *Weazle*, March 8th – 24th and April 17th – 25th 1777.
[134] TNA, ADM51/667, *Pallas*, June 5th – 8th 1777.
[135] TNA, T70/32, letter dated July 10th 1777.

Coast Castle between the 6th and 27th.[136] There were six rainfall events according to the captain's logbook, whereas there were 16 rainfall events in the entire month according to the diary.[137] The logbook and the diary overlap each other for 22 days of which 12 entries agree, resulting in 55 percent consistency. The rainfall events are presented in Figure 4.13. There were four rainfall events on the same date but not on the same day, due to the difference between the nautical and civil days. These are the rainfall events on the 10th, 14th, 19th, and finally the 21st.

However, the logbook was kept according to the nautical day, which started at noon, 12 hours ahead of the civil day. This will have an effect on the division of the rainfall events as the observations on the 10th, 14th, 16th and 19th were made during the middle watch between 8 p.m. and 4 a.m. For instance, the rains on the 10th, fell on the evening of the 9th and morning of the 10th. This affects the outcome of the consistency, especially as the diary describes the rains on the 9th to have fallen in the evening, and the rains on the 10th in the morning.[138] One entry on the 26th did not specify the time of the rainfall event, which is why it cannot be determined when the rains fell.[139] This entry was not divided according to the officers' watch, in contrast to almost all other entries. In this sense the *Weazle* is a good example of the importance that a captain kept his logbook in accordance with the officers' watch.

Some rainfall events in the logbook transform into two different rainfall events on two different dates when adjusted to the civil calendar, which is consistent with the diary. The adjustment improves concordance, as there now are seven rainfall events instead of four that occur on the same date. There were 12 rainfall events noted in the diary and seven are consistent with the logbook. The adjusted version of the logbook entries results in 64 percent consistency (see Figure 4.14).

There were three rainfall events noted in the logbook, but not in the diary. There were, *vice versa*, five rainfall events noted in the diary, but not in the logbook. However, the rainfall events on the 4th and 5th were both noted in the logbook, although the ship was not at Cape Coast Castle but at sea off Commenda and Elmina. Including these would raise the number of observations to 24 and entries that agree to 16,

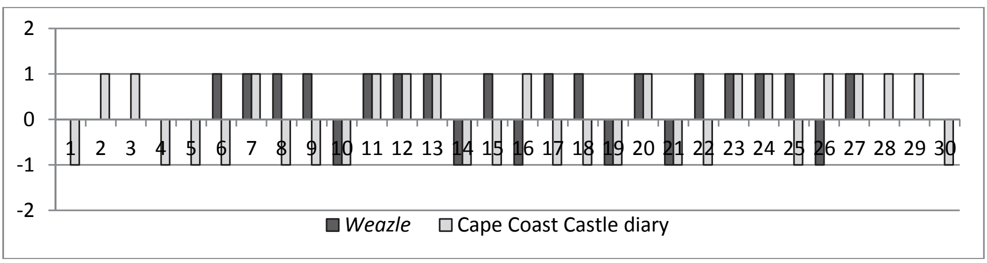

Figure 4.13 *This graph shows the weather during each day, as registered in the captain's logbook on board the Weazle (according to the nautical day) and in the Diary of Transactions at Cape Coast Castle in June 1778. A negative value indicates rainfall entry.*

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[136] TNA, ADM51/1055, *Weazle*, June 6th – 27th 1778.
[137] TNA, T70/1468, June 1st – 30th 1778.
[138] TNA, T70/1468, June 9th and 10th 1778.
[139] TNA, ADM51/1055, *Weazle*, June 26th 1778.

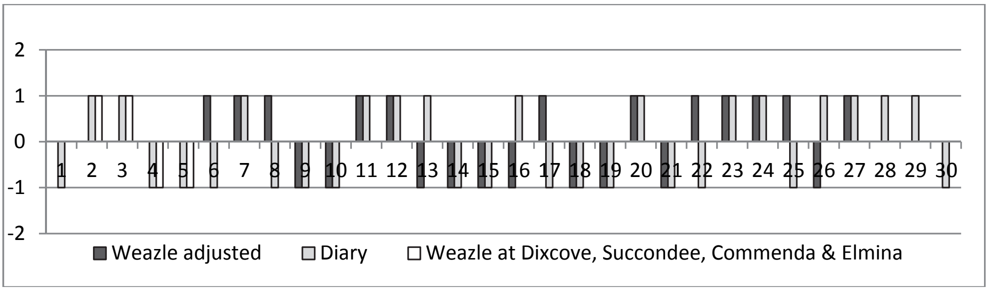

Figure 4.14 *This graph shows the weather during each day, as registered in the captain's logbook on board The Weazle (adjusted to the civil day) and in the Diary of Transactions at Cape Coast Castle in June 1778. A negative value indicates rainfall entry.*

thus showing 66 percent consistency. The inclusion of observations from the 2nd and 3rd, when the *Weazle* was at Dixcove and Sekondi, strengthens the hypothesis that sea based observations reflect on land weather during the rainy period. These are added to the data in Figure 4.14, mostly to show that larger rainfall events might produce higher reliability. It is worth noting that none of the rainfall events was a tornado. The discrepancies created between the logbook and the diary confirm the assumption made earlier that some of the rains noted in the logbooks are too erratic to be registered on land. The distance between the ship and the castle created two different types of setting and two perspectives. The rains that fell at the location of the castle did not cover a sufficiently wide area to be noted in the logbook and *vice versa*. There is also the possibility that the rains were not transcribed. Nonetheless, 64 percent is a respectable correlation. It should also be noted that there was a total of 12 rainfall events recorded in the diary during the period when the *Weazle* was moored off the castle, and that were ten rainfall events when the logbook was adjusted to follow the civil calendar. The sources are very consistent when regarded from this perspective. There is 70 percent consistency between the logbook and the diary when all days are included, but is worth noting that this might give the wrong impression on their consistency; especially as some of the rainfall entries are not in agreement.

4.6 Logbooks from the 1780s

There are only a small number of logbooks from the 1780s. There were very few Royal Navy vessels that visited Cape Coast Castle, and this was possibly due to the American War of Independence. There was no specific African Fleet, which is why a crisis would have affected the number of ships that were available to Africa. The American Revolutionary War also meant that Britain was at war with France (since February 1777), Spain (since June 1779), and finally the Dutch (December 1780). There was undoubtedly lot of tension on the high seas in this period.[140]

[140] Winfield, p. x.

The governor claimed, in October 1780, that it was two years since the last Man of War had visited the Gold Coast.[141] This might explain the lack of logbooks, although the smaller ships, such as the *Weazle*, visited the area, as shown above.[142] However, the American Revolutionary War concluded in 1783, which is why the war is not an entirely satisfactory explanation for the lack of ships at the Gold Coast. However, the slave trade was also becoming a politically sensitive subject in the political arena in Britain. The British Parliament had agreed to consider proposals to ameliorate conditions in the slave trade, which led to Dolben's Act in 1788.[143] The Admiralty might therefore have considered it best to reduce their presence in Africa during this period.

The first logbook from the 1780s was kept by the captain on board the *Rotterdam* in 1783, which was moored at Cape Coast Castle between April 9th and May 19th.[144] The captain noted five rainfall events in April and four of these brought with them abundant rains. There was a tornado on April 19th, but it did not include rain. The logbook from this month show the same number of rainfall events as the diary did in April 1778. The diary noted five rainfall events of which one was light, but it is worth noting that the *Rotterdam* did not stay at Cape Coast Castle for the entire month.

May does not show the same consistency. The captain noted only three rainfall events although the *Rotterdam* moored off the castle for 18 days.[145] Only one of the rainfall events occurred during the second watch. According to the civil calendar, this can be transformed into two different rainfall events if it rained throughout the entire watch. This is very different from the logbooks in May 1769. There are unfortunately no letters with climatic information from 1780.

The next vessel to visit Cape Coast Castle was the *Termagant*, which was moored off Cape Coast Castle between August 18th and September 12th 1784.[146] This was the first ship to visit the castle in these months. It did not rain for a period of 30 days. This period is nowadays considered the little dry period as it is located between the preliminary and secondary rainy seasons. It appears that, even in the 18th century, the coastal area received little rain during these months. This was also supposed to be the beginning of the healthy season, as suggested by the governor in 1769.[147] The *Termagant* was the last ship to visit Cape Coast Castle for a long period of time. The *Grampus* was moored off the castle for only two days in January 1786 and is therefore not included in this investigation.[148] The *Scorpion* was the next ship to visit the castle for a period longer than a couple of days, and it arrived at Cape Coast Castle in March 1788. There was one rainfall event mentioned between March 10th and 18th.[149]

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[141] TNA, T70/32, letter dated October 8th 1780.
[142] TNA, T70/32, letter dated December 8th 1779
[143] For an overview on parts of the discussion on slavery in Britain during this period, see, Steckel, p. 57; M. H. McCahill, 'The house of the Lords in the Age of George III (1760–1811)', *Parliamentary History* (vol. 28, issue supplement s1:2009), p. 281; Seymore Drescher, *Abolition. A History of Slavery and Antislavery* (Cambridge, 2009), pp. 118–124; Kenneth Morgan, *Slavery and the British Empire* (Oxford, 2007), pp. 149–152.
[144] TNA, ADM51/777, *Rotterdam*, April 8th – May 19th 1783.
[145] TNA, ADM51/777, *Rotterdam*, May 1st – May 19th 1783.
[146] TNA, ADM51/976, *Termagant*, August 18th – September 12th 1784.
[147] TNA, T70/31, letter dated October 26th 1769.
[148] TNA, ADM51/382, *Grampus*, January 1786.
[149] TNA, ADM51/873, *Scorpion*, March 10th – 18th 1788.

The *Adventure* was the last ship to visit the Gold Coast in the 1780s. The ship was moored one mile off Cape Coast Castle between February 9th and 22nd 1789, and it rained twice.[150]

4.7 Logbooks from the 1790s

The first two ships to visit Cape Coast Castle were the *Adventure* and the *Fairy*. Both ships anchored off Cape Coast Castle in February. The *Adventure* was anchored at the road between the 9th and 21st, while the *Fairy* remained at anchor between the 10th and the 21st.[151] The captain on board the *Adventure* mostly noted the wind force in the remarks column of the logbook, but not the weather. The captain on the *Fairy* was more comprehensive and also made remarks concerning the weather. It was 'clear and fine' over the first six days and cloudy over the next six days. It did not rain throughout the entire period. This is the first occasion that there are no rainfall events in February.

The *Scorpion* returned to Cape Coast Castle in 1791, and the captain noted one rainfall event between February 7th and 21st. The rains accompanied a tornado that lasted for two hours.[152] The tornado was, however, not mentioned in the captain's logbook on board the *Medusa*, which moored off Cape Coast Castle between February 8th and 21st.[153] These two logbooks show a high degree of inconsistency in general. The captain on the *Medusa* described the weather as *cloudy* or *hazy* on ten out of 14 days. The captain on the *Scorpion*, however, described the weather as *hazy* on only one occasion, otherwise it was considered *clear*, *fine* or *fine and pleasant*. This does not impact on this investigation, but reflects the dilemma of relativity and subjectivity. It is likely that the captain considered the weather to be *pleasant* when it was cloudy. The ships then returned to Cape Coast Castle in January 1792, but none of the captains mentioned any rainfall events between January 20th and 28th.[154]

The last logbooks to be included in this investigation are from 1793. The *Scorpion*, which had visited the area for several successive years, moored off Cape Coast Castle for the final time between February 18th and March 5th.[155] On this occasion the *Scorpion* was in company with the *Charon*.[156] A morning tornado and heavy rain were noted on board the *Scorpion* on the 21st. However, this was not noted in the logbook on board the *Charon*. Apart from the tornado, the logbooks contain no noteworthy entries.

[150] TNA, ADM51/9, *Adventure*, February 9th – 22nd 1789.
[151] TNA, ADM51/9, *Adventure*, February 9th – 21st 1790; ADM51/333, *Fairy*, 10th – 21st 1790.
[152] TNA, ADM51/853, *Scorpion*, February 7th – 21st 1791.
[153] TNA, ADM51/590, *Medusa*, February 8th – 21st 1791.
[154] TNA, ADM51/853, *Scorpion*, January 20th – 28th 1792; ADM51/4473, *Medusa*, January 20th – 28th 1792.
[155] TNA, ADM51/853, *Scorpion*, February 18th – March 5th 1793.
[156] TNA, ADM51/189, *Charon*, February 18th – March 5th 1793.

4.8 Outlining the monthly weather and the validity of the logbooks

The aim is to determine whether or not logbooks are suitable for an analysis of the weather at the location of Cape Coast Castle. There are therefore two questions that need to be addressed. First, are the logbook descriptions valid and reliable for the purpose of this investigation? Can the rainfall events be employed to depict the weather at Cape Coast Castle? Secondly, is there any recognisable pattern in the logbooks? Are the logbooks more reliable and more valid during some periods or months than others?

These questions are intertwined and cannot be entirely separated. There are also some delimiting factors that need to be considered. It is evident that some years and some months are better represented than others. For instance, few ships visited the Gold Coast in the rainy season between May and July. This prevents the reconstruction of a continuous climatic series for this period. Furthermore, the interannual and interdecadal climatic variations make it difficult to suggest a trend line, partly due to the absence of land-based sources with daily observations. The frequency of rainfall events, their duration, and, to some extent, the intensity of the rainfall events, is comparable to those in the diary. However, high interannual variability makes the comparison indistinct, especially when comparing the same months from different years.

The logbooks reveal that some of the ships visited several of the forts, sometimes even remaining for longer periods than at Cape Coast Castle, and the duration of the visit is of great importance when assessing their reliability and validity as climatic sources. Cape Coast Castle was in many cases neither the first nor the final destination, nor the purpose of the voyage. For instance, the letters sent from Cape Coast Castle indicate that many ships sailed to and moored off Annamboe as the slave trade was more intense from there. The number of slaves embarked from Annamboe was almost double that from Cape Coast Castle.[157] Nevertheless, the aim is now to compile and analyse the weather observations provided by the logbooks, month by month.

4.8.1 From dry to wet: January – April:

January was poorly covered and only six of 50 possible months were included in the investigation. The number of observations per month was low, and there was no information for the period between 1765 and 1791. January is considered to be the driest month on the coast with only sporadic rainfall. This would make this month almost irrelevant from a climatic perspective, especially if it cannot be proved that the climate was considerably different during the 18th century.

The number of rainfall events varied from zero to four. There were four rainfall events noted on board the *Glory* in 1753. This was the only occasion when there was a ship at the castle for the entire month. A comparison with, for instance, January 1750, which showed one rainfall event based on four observations, or January 1754, during which there were 11 observations and no rainfall events registered, only reflects normal variations. For instance, there were three rainfall events noted in the *Diary of Transactions*

[157] According to the TSTD database the number of slaves embarked from Annamboe was 99,633 between 1750 and 1798. The number of slaves embarked from Cape Coast Castle was 48,912.

in 1778, while Walker had noted an average of one rainfall event in January. The long term average was 1.5 rainfall events, which makes it comparable to other data. However, this is not a reliable average as the number of observations is very low and represents only a fraction of all the months and days in this period. It cannot be considered to reflect actual conditions.

The frequency of observations was considerably higher in February than in January. February is represented in 12 out of 50 possible months. The longest gap between the observations was between 1777 and 1788. The observations were reasonably consistent and the number of rainfall events varied from zero to three, resulting in an average of 1.1 rainfall events per month. This correlates with the data derived from Walker's report and the *Diary of Transactions.*

March and April

March showed an even higher representation than February as the logbooks cover 15 out of 50 possible months. The number of rainfall events varied between zero and five. However, there were 11 possible rainfall events noted in March 1753, and this month clearly stands out from the other. This high number of rainfall events was merely the result of four different ships mooring off the castle. It was suggested that only overlapping observations should be employed, a method employed to identify larger rainfall types, and this resulted in five observations instead of 11. However, all observations should be regarded as correct and it is merely the lack of land-based sources that make it impossible to estimate the number of rainfall events, which might be everything from five to 11.

March showed great variability. There was only one rainfall event noted on board the *Humber* in 1756, although there were over 15 observations. This is a significant difference when compared to 1753, but it also represents some apparent problems with logbooks. It might be that the rainfall event in 1756 only covered a small area, thus suggesting that the event would not have been registered in other logbooks, even if there had been more ships present. The opposite is also possible, meaning that the rains at the castle were not noted on board the *Humber*. Hence, the number of rainfall events is dependent on the number of ships moored off the castle. However, this is also dependent on how diligently the captain kept his logbook, or how diligently he *transcribed* from the log-board.

One of the main dilemmas is that the validity of the logbook is dependent on many delimiting factors that cannot be determined or evaluated. The frequency of rainfall events might be higher as a consequence of the number of ships mooring off the castle, but the erratic behaviour of the rains does not guarantee that increasing the number of ships would produce a different result. However, a higher number of ships make it easier to identify rainfall events that were wide enough to also generate rain on land. In other cases, it must be assumed that the logbook describes the weather in the vicinity of the ship, and only that.

April showed the same discrepancy as March. The number of rainfall events varied from zero to seven. This is consistent with Walker's investigation and *The Diary of Transactions*. It is, however, evident that a higher frequency of observations can result in a higher frequency of rainfall events, especially in April. The onset of the rainy season was generally in April, especially over sea, which is why observations might provide a timeframe for the onset of the rainy season. Unfortunately, the data are not sufficient for a similar analysis.

4.8.2 The rainy season: May – July

May was the first month of the rainy season, which is probably why there were only three logbooks available. This was the worst time of year to arrive at the coast, as often mentioned in the governors' letters. It was difficult to land both men and goods safely, which is why ships preferred not to arrive at the coast at this time of year.

There were only three ships that visited Cape Coast Castle in May, and the number of observations was low. There were 47 entries spread over three different years, which were 1753, 1769, and 1783, thereby showing a huge gap in the records. There was a total of 19 rainfall events registered. The most noteworthy entries were from May 1783: the logbook from that year contained 19 observations, but only three rainfall events. For comparison, there were 15 entries in May 1753 and over half of these were rainfall events. It is evident that these are part of the rains that belong to the rainy season, and the information correlates with that from the governor's letter, which indicated that it rained heavily in 1753.

The logbooks depicted May 1753 as a wet month, but it was even wetter in May 1769. There were only 12 entries in May 1769, with eight being rainfall events. Transforming the logbook to follow the civil division of the day increases the rainfall events to nine. The governor's letter indicated that this was a difficult season. Vector borne diseases thrived in the moist conditions, and 30 persons had died due to yellow fever. The logbooks can certainly be employed to identify the early part of the rainy season, and its onset in April. The problem is that the logbook sample, in this case, is too low.

June was in the middle of the rainy season, which explains why the frequency of daily observations was low. Only four ships visited Cape Coast Castle in June. Excluding the *Weazle's* visit in 1778, there was a maximum of eight entries in three out of four years. This resulted in 18 observations, but only one rainfall event. The captain on board the Ludlow Castle entered "variable with showers" on the day that it rained.[158] Therefore, both frequency and intensity were low.

The logbook and position of the *Weazle* is the most valuable in this investigation. There were six rainfall events noted in Captain Robertson's logbook on board the *Weazle* in 1778. The diary kept at Cape Coast Castle contained 12 rainfall events during the time when the *Weazle* was present. The rainfall events correlated on only four occasions, which resulted in eight unregistered rainfall events in the logbook. However, the rainfall events rose to ten when the logbook was adjusted according to the civil division of the day. Only five of the rainfall events in the diary went unregistered on board the *Weazle*, while seven of the entries correlated. The number of registered rainfall events was ten in the logbook and 12 in the diary, which is a noteworthy correlations. However, the diary had a total of 16 rainfall events for the entire month. It rose to 12 on board the *Weazle*, when the first few days were included. This resulted in 75 percent consistency with the diary, which is considered a significant correlation.

July was the last month of the rainy season and, during normal years, the rains usually subsided quickly at the beginning of the month. This month was only represented

[158] TNA, ADM51/559, *Ludlow Castle*, June 28th 1763.

on three occasions throughout the entire investigation. The first was when the *Jason* visited Cape Coast Castle for a period of 21 days in 1754, although there were no rainfall events noted in the logbook. The *Ludlow Castle* was at the castle for the entire month in 1763, and the captain entered two rainfall events. This was remarkably low, especially as the governor at Cape Coast Castle described the rains as extremely violent and tempestuous. However, this might also mean that it was intense in May and June, not necessarily that it was frequent thereafter.

The *Shannon* was moored off Cape Coast Castle in July 1765 and remained for a period of 16 days, during which the captain noted three rainfall events. These were clustered together, and therefore the number of rainfall events increases if they are transformed to follow the civil calendar. However, the captain noted "with rain at times", which is considered too ambiguous to indicate rain during the last watch.[159] This is why the logbook was not transformed to follow the civil calendar. There were five rainfall events noted in the diary in July 1777 while Walker's 34-year average registered six rainfall events. Again, if the logbooks are considered to mirror correctly the weather at the castle, then these years can be regarded as drier.

In his letter written on July 10th 1777, the governor noted that the rains had been severe but were nearly over. In his next letter, written on August 10th, the governor noted that they had only a little rain since his last letter. A comparison with the diary (see previous chapter) concluded that *little*, in this case, indicated five rainfall events; four of which produced light rains. One of the rains in the captain's logbook from the *Ludlow Castle* was reported to be heavy and the other light. The rainfall events and the number of observations per year are presented in Figure 4.15. The trend line is clearly visible as the number of rainfall events increase towards the end of the century. However, there is a great margin for error as it is always possible that rains occurred during days which are not covered.

Conclusively, according to the logbooks, the rainy period was intense and short. It normally began in May and continued throughout June, only to quickly subside at the beginning of July, which is why there is only a small amount of evidence on rainfall in July. This is in accord with the information obtained from the letters. The weather would then remain humid and "unhealthy" for the Europeans until the end of August.

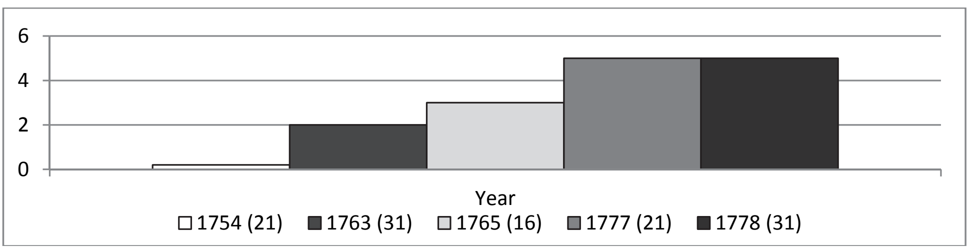

Figure 4.15 *The frequency of rainfall events in July during selected years. The parenthesis indicates the number of entries. There were no rainfall events in 1754.*

[159] TNA, ADM51/852, *Shannon*, July 4th 1765.

4.8.3 Concomitantly dry: August – December

The only logbook to have noted any rains in August was that of the captain on board the *Ludlow Castle*, who noted two rainfall events. The *Ludlow Castle* moored off Cape Coast Castle for 28 days, and both rainfall events were noted before the 18th. Two other ships moored off the castle for a considerably shorter period – the *Rye* in 1758 and the *Termagant* in 1784 – and after the 18th on both occasions, which might be why neither captains noted any rainfall events.

There is a possible causality between the ships that visited the castle after the 18th and the lack of registered rainfall events. Many men died in the aftermath of the rainy season in 1769. This was why the governor suggested that London should send men to the coast in late August or September, as this was the beginning of the healthy season.[160] The governor's letter might explain why the captain on board the *Ludlow Castle* noted rain in his logbook at the beginning of the August, and also why the captains of the *Termagant* and the *Rye*, who kept their logbooks at the end of the month, did not. The *Termagant* was the only ship to anchor off Cape Coast Castle in September. The vessel was anchored off the castle during the first 12 days of September and the captain made no rainfall entries, which is consistent with the little dry period.

October

October is represented in six separate logbooks, although only four years are represented in the analysis. The maximum number of rainfall events was three, and these were noted on board the *Merlin* which was moored off the castle for a period of 21 days in 1769. The *Lichfield* was moored off the castle for 22 days in 1757, but the captain noted only one rainfall event. The *Lichfield* was accompanied by the *Centaur* for a period of ten days, but there were no rainfall events noted in the captain's logbook on board the *Centaur*. This supports and strengthens the observations obtained from the *Lichfield*, as it at least to the extent that not many rainfall events passed unnoticed on the *Lichfield*. This does not rule out the possibility of rains at the location of the castle. The captain on board the *Glory* noted one rainfall event in October 1752, although this only covers four days. The number of entries is considered too low to draw any conclusions regarding the secondary rainy season at the location of the castle. The rains might have fallen outside the given period. Furthermore, if the rains arrived from the inland, not the sea, then these would not be noted in the logbooks.

The *Swan* moored off Cape Coast Castle in October 1751. It was the first ship to visit the castle but the last ship that is analysed. The *Swan* was elaborately discussed earlier as both the captain's and the lieutenant's logbooks were archived under different ship names (*Swann* and *Swan*). More importantly, the captain noted two rainfall events while the lieutenant noted four. Both officers were on the same ship, and as suggested earlier, it can be assumed that they were correct in their observations. They did not imagine a rainfall event only to make an erroneous entry. Few logbooks contain as much information as these do, which is why the similarity between them is astounding, and the discrepancy even more astounding. However, none of the logbooks contained the same number of rainfall events as the diary in October 1777. None of the logbooks come close to the 21st

[160] TNA, T70/31, letter dated October 26th 1769.

century average. Nevertheless, most logbooks are from the 1750s, which is why it is difficult to reflect over long-term changes. The average number of rainfall events was 1.4 but, again, there are insufficient data to create a fruitful comparison.

November and December

Walker's report presented November as a month when the rains subsided. The average number of rainfall events was four, according to Walker's compilation, and the frequency was the same in the 1960s. This is also consistent with the average from the diary.

Four ships moored off Cape Coast Castle in November. These were the *Swan* in 1751, the *Glory* and the *Badger* in 1752, and the *Assistance* in 1756. The dilemma with the captain's and lieutenant's logbook on board the *Swan* is the same for November as it was for October. The captain noted one day with rainfall in his logbook, while two were noted by the lieutenant. A similar dilemma appeared in 1752, when the captain on board the *Glory,* moored off the castle for the entire month, noted four rainfall events. However, the captain on board the *Badger*, moored from the 16th until the end of the month, noted three rainfall events. This was resolved by including only overlapping entries, which resulted in three rainfall events. The *Assistance* moored off Cape Coast Castle for only five days, and the captain noted only one rainfall event.

By only employing the captains' logbooks and overlapping entries, conclusively, the average number of rainfall events for November is 1.7. This is lower than the average of four that is obtained from Walker's report and the diary. However, the number of observations is too low and interspersed to create a valid average.

December should be clearly drier than the three previous months, at least if the 18th century climate is considered to be similar to that during the 20th century. Walker's compilation and the 1960s average show a total of two rainfall events. However, the logbooks and the diary showed a more mixed rainfall pattern and considerably higher variability.

The captain on board the *Glory* noted two rainfall events in December 1752. This was the same number of events that was noted on board the *Badger*, resulting in a total of four rainfall events. However, only one of the rainfall events was entered on the same day. The captain on board the *Assistance* noted four rainfall events in December 1756. This is noteworthy as the ship was moored for only ten days. The *Centurion*, which moored off the castle for five days in December 1760, noted only one rainfall event. The frequency of observations was low and the average number of rainfall events was 1.5, which approximates to Walker's average. However, the diary depicted a completely different rainfall pattern. There were four rainfall events in December 1777 and a total of nine rainfall events in 1778. This results in an average of 6.5 rainfall events, which is clearly higher than Walker's long-term average.

4.9 Concluding remarks

The preliminary and general conclusions derived from the analysis above are: first, it is not possible to make any suggestions regarding the climate for West Africa and the investigated period based on the logbook data. The data are too interspersed and there are insufficient logbooks for a long-term analysis. Interannual and interdecadal changes are not traceable, even though it is certain that these would have affected the logbook descriptions, and appear in them. The number of rainfall events from the logbooks seems to correlate with those extracted from the diary. However, with so little data, no meaningful comparisons can be conducted. For example, there might have been even more rainfall at the location of the ship. Furthermore, on one occasion the captain noted heavy thunderstorms in the north-western corner. This might indicate heavy rainfall at Cape Coast Castle, although similar events were not usually registered in any logbooks. Hence, the amount and quality of the data are too dependent on external factors such as the position of the ship, the distance between the ships, the distance to the castle, the duration of the visit, and the availability of land-based sources. Logbooks might generate a more realistic picture of the climate if data from ships that sailed under other flags were included. Books and letters from, for instance, Danish, Dutch, and Portuguese forts would also enable a more comprehensive analysis.

Secondly, the analysis also demonstrated that it is impossible to reconstruct the long-term climate at Cape Coast Castle. Again, the logbooks are too interspersed, both temporally and spatially. Furthermore, it appears that the climatic mechanism, the erratic rains, coastal upwelling, and the Guinea current, combined with the possible occurrence of sea-breeze fronts, render the logbooks unsuitable for this period and this location. The logbooks can clearly be employed to anticipate the rainy season, its onset, duration, and seasonality. However, for this, several logbooks from several ships need to be available. In an ideal situation, they would also have to position themselves at the coast sometime in March, before the onset of the rainy season. They would, furthermore, need to remain moored at the same location until the end of the rainy season. There was not one such logbook in this investigation.

The logbooks in this investigation also showed great variability in their entries. Some captains only noted the wind force, others diligently noted their variability. Some captains made elaborate notes three times a day, some captains made sub-daily entries concerning the weather, some disregarded the weather altogether, one even employed his logbook as a diary, merely reflecting the situation on land. The elaborate presentation on the logbooks shows that they are not particularly suitable for similar investigations in this region. The variety of entries that were noted implies that the log-board was not employed coherently when the ships were moored. The presentation also shows that, even though weather terms were employed consistently, the method of keeping the logbook was inconsistent. This clearly effects the effective employment of logbooks, at this location, and for the purpose of this investigation.

5 A climatically facilitated slave trade

Prominent scholars such as Philip D. Curtin, Joseph C. Miller, and George E. Brooks have claimed that deteriorating climatic conditions in Africa expedited the transatlantic slave trade in the 18th century.[1] This hypothesis has never been tested or analysed due to a lack of exact (annual) climatic information and annual estimations on the number of embarked slaves. These two elements are fundamentally necessary to avoid baseless speculations on the climatic impact, and to act as a counterbalance to other plausible explanations on the growing slave trade.[2]

The purpose of this chapter is to assess the correlation between climatic anomalies (famine and drought) and an increase in the number of slaves who embarked from Annamboe and Cape Coast Castle. It is necessary to mention that diminished rainfall (a first-order impact) did not directly increase the number of slaves that embarked (third- or fourth-order impact). The relation between cause and effect is masked by an indeterminate list of unknown and indirect impact factors, the internal order between which is extremely complex and unpredictable. Aspects such as disputes concerning the heir to a throne, civil wars, or an advantage in firepower might have affected the slave trade either positively or negatively. How then might a correlation between the slave trade and climatic anomalies be defined? What constitutes a clear and significant impact, when the commodity was human lives?

The purpose of this chapter is not to reinvent the wheel or revolutionise the methods for explaining historical events. The purpose is neither to be climatically deterministic nor to explain the complexity of the multifaceted slave trade by one impact factor alone. However, the impact of the climate must not be downplayed. Daily weather intermixed with seasonality and interannual variations played an important role in the daily life of all in West Africa, it also influenced the transatlantic slave trade. For instance, slave traders preferred not to set sail during the rainy season, and they preferred to arrive in time for the harvest in the Caribbean, both of which relate to the climatic cycle.[3]

Furthermore, the impact of hurricanes cannot be diminished as, for instance, in 1780 when over 2,000 slaves died at Barbados.[4] Nevertheless, the transatlantic slave trade has been diligently addressed by many researches, which is the reason that the slave trade system will not be addressed here.[5] It will only be noted that trading with slaves reached its height during the 18th century. Curtain termed this period the "plateau" of the slave trade.[6]

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[1] Miller, pp. 28–29; Curtin (1976), p. 110; Brooks, (2003), p. 102.

[2] See for instance George Metcalf, 'A Microcosm of Why Africans Sold Slaves: Akan Consumption Patterns in the 1770', *Journal of African History* (vol. 28, no 3:1987).

[3] See for instance Stephen D. Behrendt, 'Ecology, Seasonality, and the Transatlantic Slave Trade', in Bernard Bailyn and Patricia L. Denault (eds.), *Soundings in Atlantic History. Latent structures and Intellectual Currents, 1500–1830* (Cambridge, 2009), pp. 44–85; David W. Galenson, *Traders, Planters, and Slaves. Market Behaviour in Early English America* (London, 2002)

[4] Richard B. Sheridan, *Doctors and Slaves. A medical and demographic history of slavery in the British West Indies 1680–1834* (Cambridge, 1985), pp. 158–162; Matthew Mulcahy, *Hurricanes and Society in the British Greater Caribbean, 1624–1783* (Baltimore, 2008), pp. 108–109.

The following analysis begins by comparing the top 11 years of the slave trade from Cape Coast Castle and Annamboe (see Table 5.1) with the climatic events identified in Chapter Three. The purpose is to determine whether or not the top 11 years of the slave trade correlate with the identified climatic anomalies. My premise is that famines and droughts intensified the enslavement process, and thereby increased the slave trade. The number of years that are investigated is derived from the number of identified and climatically induced droughts and famines (11).

Finally, there are two important aspects that need to be emphasised. First, the governor commented on the trade, but he did not comment on the relation or correlation between the climate and the trade. No governor even speculated on the climatic impact on the supply of slaves, and they never claimed that famine had a positive impact on the trade. Secondly, the slaves' origin is unknown, although it is certain that the slaves were not captured by the Europeans or in the vicinity of the castle. Hence, the enslavement process was affected by climatic aberrations in the inland, not along the coastal dry-zone. For instance, the Asante participated in the slave trade and occasionally supplied the Europeans with so-called Duncoes, who originated from hundreds of kilometres further inland.[7] Thirdly, Annamboe clearly dominated the trade during the investigated period. 99,633 slaves embarked on their voyage across the Atlantic from Annamboe, which is more than double the total number of 48,912 slaves from Cape Coast Castle. The annual averages at Annamboe and Cape Coast Castle were 2,033 and 1,165 respectively, from 1750 to 1798. There are seven years for which there is no information for Cape Coast Castle in the database.

5.1 Assessing climatic influence

Governor David Mill claimed that the company exported more slaves than during "any one year of the establishment [Cape Coast Castle]" in 1774.[8] Unfortunately, this assertion cannot be confirmed as there is no information in the TSTD on Cape Coast Castle in 1774. However, the governor was partially correct as the number of slaves that embarked from Annamboe was the third highest year on record (see Table 5.1). It is particularly interesting to note that there was a "general famine in the country" in 1774, but this was not the first famine during the investigated period.[9]

The trade had peaked eight years earlier in 1766. However, the slave trade was slow at the beginning of 1766. The governor informed London that there was a great scarcity of slaves during the first three months.[10] He did not mention why there was a

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[5] See for instance, Philip D. Curtin, *The Atlantic Slave Trade. A Census* (Madison, 1969); Paul E. Lovejoy, *Transformations in slavery. A history of slavery in Africa* (Cambridge, 1995); Robin Law, *The Slave Coast of West Africa 1550–1750. The impact of the Atlantic Slave Trade on an African Society* (Oxford, 2002); Johannes Postma, *The Atlantic Slave Trade* (Westport, 2003); Robin Blackburn, *The Making of the New World Slavery. From the Baroque to the Modern 1492–1800* (London, 1998), pp. 76–83; Paul E. Lovejoy (ed.), *Slavery on the Frontiers of Islam* (Princeton, 2004).

[6] Curtin (1969), p. 265.

[7] Benedict G. Der, *The Slave Trade in Northern Ghana* (Accra, 1998), pp. 10–12.

[8] TNA, T70/32, letter dated April 15th 1775.

[9] TNA, T70/32, letter dated May 10th 1774.

[10] TNA, T70/31, letter dated March 20th 1766.

Table 5.1 *Years with the highest number of embarked slaves from Cape Coast Castle and Annamboe between 1750 and 1798. The indicated average is calculated over a 49 year period from 1750 to 1798.*

Rank	Year	Sum of embarked slaves	Annamboe	Cape Coast Castle
1	1766	6,692	6,292	400
2	1770	5,607	5,255	352
3	1774	5,223	5,223	(no data)
4	1784	5,144	3,266	1,878
5	1798	4,777	1,643	3,134
6	1754	4,621	4,141	480
7	1785	4,555	570	3,985
8	1772	4,358	4,006	352
9	1771	4,330	4,057	273
10	1776	4,133	3,672	461
11	1792	4,093	3,359	734
Average		3,031	2,033	1,165

Source: TSTD[11]

scarcity of slaves, although one month later he claimed that the trade would increase if the Asante, who were at war with the Fante, had a route to the coast.[12] Whether or not he meant to suggest a route for the transportation of slaves (to the coast) or guns (to the inland) is uncertain.

However, if his assertion is regarded in the context of his earlier reference concerning the slow trade, he was probably referring to slaves. In June, the governor claimed that there was the "greatest dearth of corn", and in September he noted that the slave trade flourished at Annamboe.[13] The situation had changed radically since the first letter in March. The question is: what had made the situation turn around so quickly, from almost no slaves in March to the most flourishing trade ever recorded by September?

It is tempting to state that the dearth of corn resulted in 1766 being the most voluminous year of the slave trade. The lack of food increased the number of embarked slaves. There is a correlation, but the causality is not linear. The Fante needed to dispose of several thousand prisoners quickly, due to the scarcity of provisions already in 1765.[14] The Fante had at that time kidnapped Asante who were searching for food, which implied that the inlands had been hit by a drought. It is probable that not all the slaves were sold in 1765, which is why the surplus of slaves and the dearth of corn intensified the trade in 1766. The governor never employed the word famine to describe the situation in 1766, but the price of corn, which was six times higher than normal, indicates famine-like conditions. This occurred simultaneously with John Hippisley's claim that the rainy season was the worst in the memory of the oldest man.[15]

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[11] The Slave Trade Database: http://www.slavevoyages.org/tast/index.faces

[12] TNA, T70/31, letter dated April 25th 1766.

[13] TNA, T70/31, letter dated June 14th 1766 and from the same catalogue a letter dated September 13th 1766.

[14] TNA, T70/31, letter dated October 22nd 1766.

[15] TNA, T70/31, letter dated July 13th 1766.

The rainy season was also intense in 1770, which is the year with the second highest number of embarked slaves. In June, the governor claimed that the sun had not been seen for almost a week and, while the rains battered the castle, that a famine caused "considerable mortality amongst the natives".[16] Notwithstanding this mayhem, 5,607 slaves embarked from Cape Coast Castle and Annamboe. It is worth noting that the famine in 1770 had continued for quite some time. One year earlier, the governor stated that there was a continuing famine, thereby implying that there was famine that had lasted from 1768 until 1770.[17] Conclusively, the three top years of slave embarkation indicate a correlation between the climate and the number of embarked slaves. However, is this evidence of a climatically induced transatlantic slave trade?

5.1.1 Common denominators to the top three years

The top three years (1766, 1770, and 1774) in the slave trade have several common denominators. The first, and most intriguing, is that they are confined to the second inland dry period between 1765 and 1780. This was at the same time that the coastal regions experienced a wetter period (see Chapter Three).

The two top years show some similarities that distinguish them from 1774. First, the number of embarked slaves was higher in 1766 and 1770 than in any other year of the 18th century. Secondly, there was a famine or scarcity of provisions prior to these years, which indicates prolonged droughts. Thirdly, the rains were severe at Cape Coast Castle in both 1766 and 1770.

It should be noted that there are some ambiguities concerning the relevance of the climatic evidence in 1766. This is the dispute between the Fante and the Asante in 1765, when the Fante took food-seeking Asante as their prisoners.[18] It is not certain that there was a drought simply because the Asante lacked food. The Asante were in Fante land and did not have their own supply system, which would have affected their means of procuring food. Therefore, it cannot be determined whether or not it was the skirmishes or the scarcity of provisions that increased the supply of slaves. However, it is noteworthy that the Fante wanted to dispose of their prisoners due to a scarcity of food. Hence, even if the kidnapping of the Asante led to an increased supply of slaves, it was the scarcity of food that compelled the Fante to sell their slaves.

The third year in question is similar to the above in that there was a famine. However, the famine was the only clearly identifiable common denominator. The rainy season was only predicted to be severe in 1774, but whether or not this prediction came true is unknown. Furthermore, the year preceding 1774 was very different from those that preceded 1766 and 1770. In 1773, the ponds were dry at Annamboe and the rainy season was not intense.[19] Nonetheless, each of the top three years portrays similar climatic conditions. The number of slaves who embarked from Cape Coast Castle and Annamboe peaked in years with a reported famine or scarcity of provisions. The two top years also showed prolonged droughts further inland, which indicated that the rains had failed or

[16] TNA, T70/31, letter dated June 20th 1770.
[17] TNA, T70/31, letter dated June 20th 1769.
[18] TNA, T70/31, letter dated July 20th 1765.
[19] TNA, T70/31, letter dated March 6th 1773; T70/31, letter dated July 12th 1773.

been weak for several years in a row. These indications are merely circumstantial evidence of the climate's impact on the trade, although the common denominators are noteworthy.

There are some important aspects that need to be accentuated before continuing with the analysis. First, the famine or famine-like conditions surrounding the 1766 (1765), 1770 (1769) and 1774 high slave embarkation numbers represent 45 percent (five of 11) of all the years with climatically induced droughts and famines. Hence, it is worth noting that the two top years emerged after prolonged droughts, and not when the drought set in. Secondly, the three top years occurred during the second inland dry period between 1765 and 1780. Thirdly, the total number of embarked slaves was not extraordinarily high in the years preceding the peaks: 2,665 slaves embarked in 1765 and 2,948 in 1769, which is far lower than the peaks of the following years. This situation was corroborated by the trade at Cape Coast Castle from where 280 slaves embarked in 1765 and 601 in 1769, which falls well below the average of 1,165 slaves. Fourthly, there were no regional wars as had occurred in 1764 or 1765, when the combined Asante and Fante forces defeated their adversaries. Conclusively, the common denominators imply the possibility of a climatically regulated slave trade.

However, there is more to this assertion than is apparent. For instance, several hurricanes swept over the Caribbean in 1766, 1768, 1771, and 1772.[20] A high death toll as caused by the hurricanes might have caused an increase in the demand for more slave laborers from West Africa in 1770 and 1774. It is also worth noting that there several consecutive droughts in West Africa occurred at the same time as frequent and intense hurricane seasons in the Caribbean, thereby implying that the demand for and supply of slaves occurred simultaneously. Nevertheless, there remain two famines that have not been addressed. Therefore, if the common denominators that so far have been identified are found in the remainder of the sample, it would certainly imply that the climate facilitated the transatlantic slave trade in the 18th century.

5.1.2 The middle years: intermixed uncertainties

The fourth highest year on record occurred in 1784, when 5,144 slaves were embarked. Unfortunately, there is no climatic information from 1784; however, this year is situated in the middle of the dry period along the coast. This was identified as a wetter period further inland, which casts some doubt on the hypothesis of a climatically induced slave trade. Further investigations might reveal more on this year. It is worth noting that 1784 was the third consecutive El Niño year at the beginning of the 1780s. This might have generated currently unregistered climatic anomalies that affected the slave trade in the same manner as in 1766 and 1770. Furthermore, the fifth most voluminous year in the slave trade occurred in 1798, which was also an El Niño year.

The events in 1798 resemble the conditions during the top three years of the slave trade. The rainy season was described as "extremely violent" and "uncommonly severe"

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[20] Sherry Johnson, pp. 370, 379, 387–388. See also Table 1 in César Caviedes, 'Five Hundred Years of Hurricanes in the Caribbean: Their Relationship with Global Climatic Variabilities', *GeoJournal* (vol. 23, no 4:1991).

while, at the same time, the country was distressed by a famine.[21] However, most slaves embarked from Cape Coast Castle in 1798, and not from Annamboe (see Table 5.1).

The number of exported slaves had reached an early peak in 1754, but unfortunately there is no climatic evidence from this period. However, there was a registered El Niño event in 1754, and this might have caused unregistered rainfall variations. It was also suggested that this was a drier period further inland, which connected with the drought in the Niger Bend, all of which supports the El Niño approach. The number of slaves that embarked from Annamboe was high in 1754 and 1753, and these years are the seventh and fourth most intense years respectively in the slave trade at Annamboe. The letters did not contain any reference to famines, however, the "violence" of the rains in 1753 left many sick, and Kommenda, Dixcove, and Sekondi were reported to be "down".[22] The trade was middling and the slaves cheap, but the governor claimed that no buyers were present.[23] In other words, the supply of slaves and extremely violent rains along the Gold Coast imply that there might have been an inland drought. This is in line with the events in 1766 and 1770, when the preceding years impacted on more intense trading in the following year.

The seventh peak was reached in 1785, when a total of 4,555 slaves embarked from Annamboe and Cape Coast Castle, the majority of the slaves departing from Cape Coast Castle. This was an exceptional year in comparison to the other years. It was the second year (the first was 1784) that corresponds to the coastal dry period, which might imply that the trade flourished at Cape Coast Castle because of the drought. This is a speculative suggestion, but it is worth noting that the trade was extremely high on only three occasions at Cape Coast Castle, which was in 1784, 1785, and 1798 (see Table 5.1). There was an El Niño event in 1784, and the trade in 1785 might have been a delayed effect of this phenomenon.

5.1.3 The last four of the top 11 years

1772 and 1771 are the eighth and ninth years respectively in Table 5.1. There were no famines reported in these years. However, the governor described the trade as "indifferent" in February 1771 and "extremely dull" in June 1772, which might explain the low number of embarked slaves from Cape Coast Castle.[24] The rainy period was intense and prolonged in 1772, which suggests that the inland had experienced drier conditions. It is possible that the prolonged droughts at the end of the 1760s and the beginning of the 1770s continued into 1771 and 1772, especially as there was an El Niño event in 1770. The rains might only momentarily have increased and eased the situation after 1770 until the region was again hit by a famine in 1774.

These years also fall in the second inland dry period, and there might be several unregistered famines during this period. The increase slave trade might be an indication of an inland drought, although this was not mentioned in the letters. However, this is

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[21] TNA, T70/33, letter dated June 17th 1798 and letter dated July 9th 1798.
[22] TNA, T70/29, letter dated July 1st 1753.
[23] TNA, T70/29, letter dated July 1st 1753.
[24] TNA, T70/31, letter dated February 28th 1771; letter dated June 22nd 1772.

only suggested because six of the top years are found in clusters during the inland dry period.

The two last years are 1776 and 1792. The trade was reported to be dull in 1776, which was caused by disputes between the Asante and Fante.[25] The governor assumed that wars possibly hindered the trade at Cape Coast Castle, but this contradicts the hypothesis that wars generated a supply of slaves. However, the number of slaves who embarked in 1776 suggests that the governor's perspective was narrow. Instead, the war might explain why 1776 was the year with the tenth highest number of embarked slaves. There is no climatic information for 1776, although it is noteworthy that this year falls between the registered famine in 1774 and the drought in 1777.

The final and 11th year to be included in this analysis is also the fifth year when there was a scarcity of corn and an intense rainy season. In other words, the conditions in 1792 were very similar to those in 1766 and 1770.[26] Most of the slaves embarked from Annamboe, which also reinforces the trend that the trade at Annamboe increased during inland droughts. The final peak was reached during the last period of drought in the inlands. It was also the ninth most intensive trading year at Annamboe. It is again worth noting that there was also a recorded El Niño event in this year. Figure 5.1 is a schematic of the climatic impact's inclusion in the analysis. The model shows the causation chain that was employed to evaluate impact. For instance, rainfall deficiency caused a scarcity of corn, which led to famine/political instability, which generated the push-effect that was necessary to supply the slave trade with slaves. The causality between other impact factors and the slave trade are not as linear as portrayed in the figure, and this is merely a simplified model of how the slave trade thrived.

5.1.4 Concluding remarks

The number of embarked slaves peaked during three distinct famines. In addition, four of six famines correlate with years that had a high number of embarked slaves. This is a noteworthy correlation which seems to imply that the second drier inland period, intermixed with famines, had an impact on the number of slaves who embarked from Cape Coast Castle and Annamboe.

The dry inland period between 1765 and 1780 is the only climatic period that clearly affected the slave trade, and the remaining periods had a considerably lower impact factor. I am thereby inclined to suggest that the increase in the slave trade further strengthens the climatic periodisation and the probability of a dry period occurring further inland from the mid 1760s to the mid 1770s. The investigated period and the number of embarked slaves are presented in Appendix B. The figure in the appendix also shows the correlation between the number of embarked slaves and the droughts and famines. The figure accentuates the correlation between the second inland dry period and the slave trade.

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[25] TNA, T70/32, letter dated October 19th 1776.

[26] TNA, T70/33, letter dated June 2nd 1792.

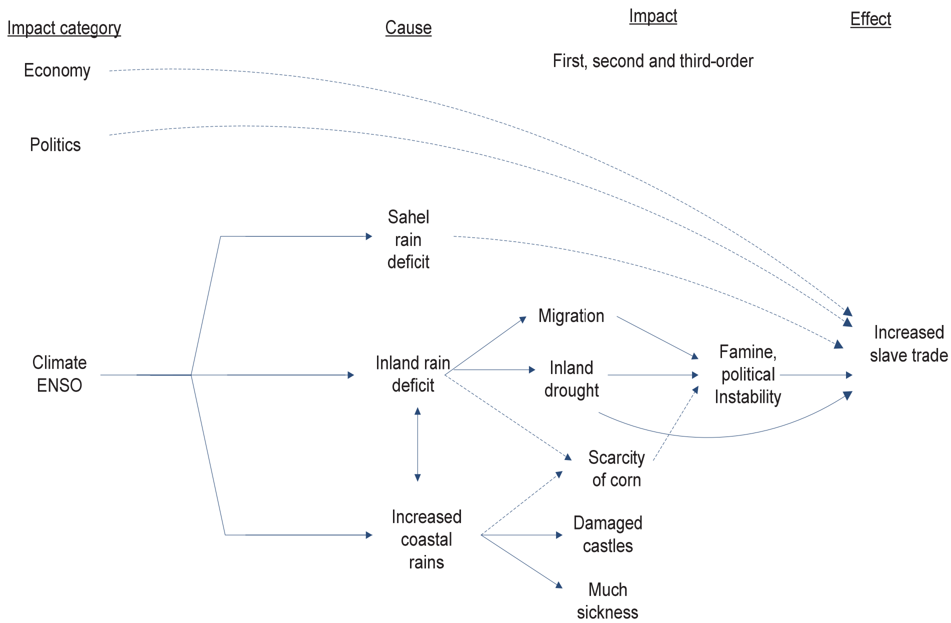

Figure 5.1 *A schematic on implications for various impact factors on the slave trade, from cause to effect. Dotted lines suggest indirect implications.*

5.2 From drought to slave trade

The analysis above began with the number of embarked slaves. However, not all peaks in the slave trade occurred during a drought, which means that some droughts and famines remain unrepresented in the comparison. In the following section I will compare the climatic aberrations with the number of embarked slaves (see Table 5.2). For instance, the first famine was registered in 1756, although the number of embarked slaves fell drastically in this year. This was a particularly difficult year at Cape Coast Castle, as the country people refused to sell their stored provisions to the Europeans. The governor even expressed his fear of a famine, which was an extraordinary uttering.[27] In most other cases it was the locals or natives who were noted as suffering from the famine. However, the slave trade was slow, and only an estimated 672 slaves embarked in sum, all from Annamboe. The trade from Annamboe fell from 2,740 slaves in 1755 to 672 in 1756, only to increase to 2,414 in 1757. Unfortunately, there are no estimations for Cape Coast Castle. However, 1756 falls between two years with an above average trade, which suggests that there has been some difficulty in obtaining data for this year. For instance, the average only falls below 1,000 on three occasions throughout the period, and 1756 is one of those years.

[27] TNA, T70/30, letter dated May 4th 1756.

Table 5.2 *Climatic aberrations in comparison to the number of embarked slaves respectively. The indicated average is calculated over a 49 year period from 1750 to 1798.*

Year with climatic aberration	Sum of embarked slaves	Annamboe	Cape Coast Castle
1756	672	672	(no data)
1765	2,945	2,665	280
1768	3,507	2,552	955
1769	3,549	2,948	601
1777	2,978	2,978	(no data)
1780	1,035	1,035	(no data)
1789	2,802	1,273	1,529
Average	3,031	2,033	1,165

Source: TSTD[28]

The two next droughts occurred in 1765 and 1769. These years were partly addressed in the previous section, especially as they were constituents of the prolonged famines from 1765 to 1766 and from 1769 to 1770. There was very little climatic information for 1765. The drought in 1765 was based on the governor's claim that the Fante wanted to dispose of their prisoners due to a scarcity of provisions and many inferior Duncoe slaves.[29] Whatever the situation, it did not affect the trade and the number of embarked slaves was low in 1765, even below the average number of embarked slaves.

It rained heavily at Cape Coast Castle in 1768. This suggests that the inland rains were weaker, which might explain why the governor claimed that the famine 'still' continued in the country in 1769.[30] However, the time frame is unknown, and the governor's claim concerning the famine is ambiguous. It might refer to situations from the previous year or the last six months. 3,549 slaves embarked in 1769, which was far less than during the top year in which more than 6,000 slaves were exported. Therefore, the famine did not seem to have had a direct impact on the trade. However, the long-term effect of conditions in 1768 and 1769 might explain why the three subsequent years (1770, 1771, and 1772) were among the top eleven.

The next drought occurred in 1777, although this was registered at the coast, and not in the inland. The governor claimed that the country was full of slaves without provisions and the rains were "very severe" at the beginning of the rainy season. However, in July he claimed that they had received only a little rain.[31] All components that on earlier occasions increased the slave trade are represented in 1777; however, the number of embarked slaves remained low. 2,978 slaves embarked from Annamboe, but there were no data for Cape Coast Castle. The conditions were very similar three years later in 1780. The price of corn was high; they had barely escaped a disastrous famine at the castles, and there were plenty of slaves available.[32] The governor claimed that the trading paths had been closed

[28] The Slave Trade Database: http://www.slavevoyages.org/tast/index.faces
[29] TNA, T70/31, letter dated July 25th 1765.
[30] TNA, T70/31, letter dated June 20th 1769.
[31] TNA, T70/32, letter dated July 10th 1777.
[32] TNA, T70/32, letter dated July 20th 1780.

and the "Duncoes a powerful people" had revolted against the Asante.[33] This might explain the low number of embarked slaves. Furthermore, there are no data available for Cape Coast Castle and only 1,035 slaves embarked from Annamboe, which makes it the fourth year from the bottom. The trade was lower only in 1756, 1779, and 1795. However, the trade tripled in 1781, which made it the fifth most intensive year of trading at Cape Coast Castle. Thus, the question is: is it possible that the coastal drought impacted the trade in 1777 and 1780?

It seems remarkable that the trade was so low in 1756, 1777, and 1780, especially as the governors claimed that there were plenty of slaves available in 1777 and 1780. However, the stagnant trade is not the only common denominator for these years; they also have something else in common: there are no data for the number of slaves that embarked at Cape Coast Castle.

There are seven years with no data for Cape Coast Castle in the Trans-Atlantic Slave Trade Database (TSTD), and four of these have registered climatic anomalies. The only year that does not fall into this category is 1789, which is the last year analysed.

There was a great scarcity of country provisions and many slaves to feed in 1789, and this made the local traders fear the onslaught of a famine. However, trading was slow, and it was only slightly higher from Cape Coast Castle than from Annamboe. This suggests that neither the famine nor conditions that created the situation impacted on the slave trade, even though many denominators that should have intensified the trade are identified; the rains were heavy, there was a scarcity of provisions, and fear of a famine.[34] However, the realistic threat of an actual famine is unknown.

Conclusively, there was a correlation between the climatic aberrations and an increased slave trade during the second dry period in the inland. However, the remaining droughts do not support a climatically induced slave trade. None of the six remaining years show any correlation between the climate and the slave trade. However, many of the years lack data in the TSTD, and it is evident that this greatly impacts on the analysis.

5.3 Annamboe vs. Cape Coast Castle

A pattern emerges when climatic impacts are placed in context and compared with Annamboe and Cape Coast Castle. The trade was seldom intensive at both castles in the same year. There are seven years with no information for the number of embarked slaves from Cape Coast Castle, four of which occurred during famines and droughts. For instance, it is noteworthy that there is no information for 1774, which was the same year that the governor claimed the trade to be the best in the history of the establishment. Furthermore, it only occurred once that a famine coincided with a high number of embarked slaves from Cape Coast Castle, which was in 1798.

Annamboe clearly dominated the trade during the investigated period, and most of the peaks at Annamboe are also the most intensive years in the slave trade as a whole. Seven of the top eleven years at Annamboe fall between 1766 and 1776, six of which are among the top eleven from the investigated period (see Figure 5.2).

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[33] TNA, T70/32, letter dated October 8th 1780.

[34] TNA, T70/33, letter dated June 17th 1789.

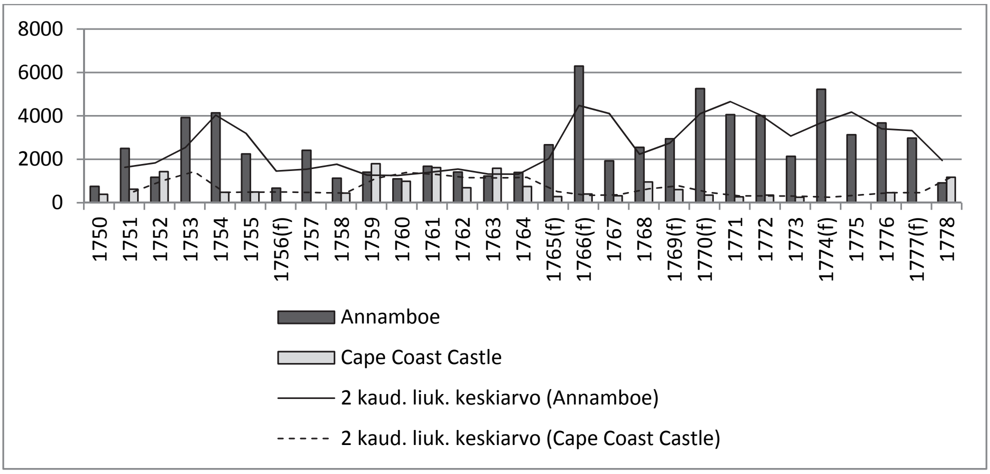

***Figure* 5.2** *The sum of embarked slaves from Annamboe and Cape Coast Castle from 1750 to 1778. (f) indicates a famine/drought. The trend line follows the moving average of embarked slaves. Source: TSTD*[35]

The period between 1765 and 1777 stands out from other periods, especially when examining the long-term development of the slave trade. There is a clear increase in the slave trade during the dry inland period. The number of slaves that embarked between 1765 and 1777, the first and the last recorded famine during the second inland dry period, accounts for almost half of the slaves who embarked between 1750 and 1798.

Also visible in Figure 5.2 and Figure 5.3 (the Figures are combined in Appendix B) is the internal correlation between Annamboe and Cape Coast Castle. The embarkation of slaves often decreased at Cape Coast Castle when it increased at Annamboe, especially during the second inland dry period. The average fluctuates considerably more after the dry period ended at the end of the 1770s (see Figure 5.3). The slave trade from Cape Coast Castle grew in importance after 1778. This might relate to the Asante invasion of Appolonia, west of Annamboe in the 1780s.[36]

Finally, there are some years that clearly stand out with regard to Annamboe and Cape Coast Castle. These are the years with no climatic information but a high number of exported slaves; during the former period, it was the years 1753 and 1754 (see Figure 5.2) and during the latter period 1784 and 1785 (see Figure 5.3). These years have two common denominators: there is almost no climatic information and the number of embarked slaves was high. This is discussed in the chapter below.

Conclusively, inland droughts and famines affected the slave trade from Annamboe. This is mainly visible during the inland dry period between the mid 1760s until the end of the 1770s. The climatic impact is less distinct after 1778. The trade fluctuated more after this period, and it appears more irrational in comparison to the dry inland period. The last dry period of the century is probably masked by global political tension, such as the Napoleonic Wars and the abolition of the slave trade.

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[35] The Slave Trade Database: http://www.slavevoyages.org/tast/index.faces
[36] Shumway, pp. 84–85.

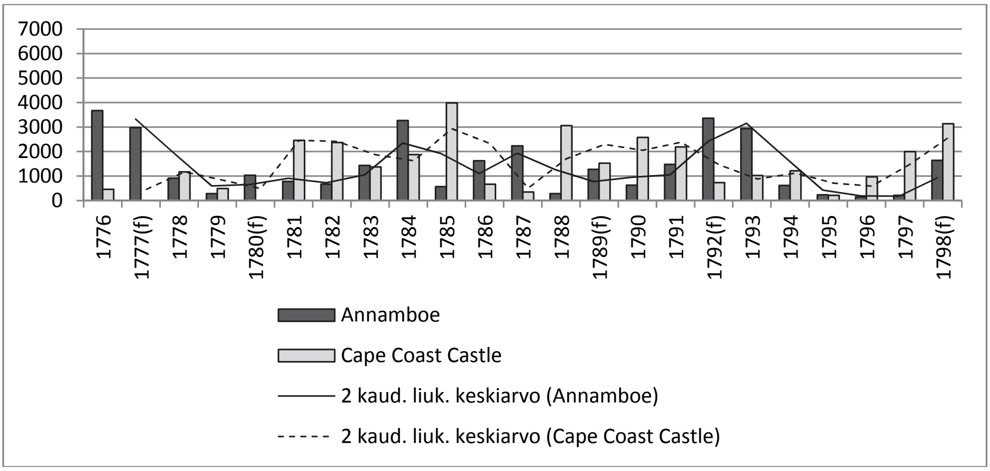


Figure 5.3 *The sum of embarked slaves from Annamboe and Cape Coast Castle from 1776 to 1798. (f) indicates a famine/drought. The trend line follows the moving average of embarked slaves. Source: TSTD*[37]

For instance, 4,300 British merchant ships were captured between 1793 and 1800.[38] This was mostly attributable to the French as their merchant shipping had disappeared from the high seas after 1793, which released both men and ships to wage war against the British trade.[39] Political interests might also have included economic restraints on particular products, such as flour and slaves in the Caribbean.[40] These events are more probable causes than the climate to fluctuations in the slave trade in the last decades of the 18th century.

5.4 El Niño and the slave trade

The purpose of this chapter is to compare El Niño chronology with years that lacked climatic information but showed an increase in the slave trade, mainly 1753, 1754, 1784, and 1785. This comparison is based on the idea that an increased slave trade might be employed as a climatic indicator. The years that now are investigated show an increased slave trade; however, there was little to no climatic information in the letters. Hence, the following analysis is based on the hypothesis that El Niño caused rainfall variations at the Guinea Coast (see Chapter 3.6.7), which caused droughts that resulted in famines or famine-like conditions. The rainfall deficiency caused by El Niño therefore indirectly and positively influenced the number of slaves that embarked from Annamboe and Cape

[37] The Slave Trade Database: http://www.slavevoyages.org/tast/index.faces

[38] T. S. Ashton, *An Economic History of England. The 18th century* (London, 1972), p. 146

[39] G. J. Marcus, *A Naval History of England. The Age of Nelson* (London, 1971), p. 102.

[40] See for instance Sherry Johnson, 'El Niño, Environmental Crisis and the Emergence of Alternative Markets in the Hispanic Caribbean, 1760s–70s', *The William and Mary Quarterly* (vol. LXII, no 3:2005). Johnson provides an interesting perspective on how wars, climate, and protectionism were combined in the 18th century.

Coast Castle. The purpose is not to blame the slave trade on El Niño; however, the idea of a correlation between human behaviour and climatic stress, facilitates this as an attempt to identify droughts/famines that were not registered in the governors' letters.

There were 14 registered El Niño events in the latter half of the 18th century. These El Niño events and famines/droughts, including years with an increased number of embarked slaves, are presented in Table 5.3. Years that show a correlation between El Niño and/or the slave trade and drought/famine are highlighted in bold. The same data are visualised in Appendix B.

Six of the 14 El Niño events correlate with years in which the slave trade reached its highest intensity. Four of the years that show a clear increase in the slave trade were also preceded by an El Niño event. These were in 1766, 1771, 1785, and 1792. Finally, four of the 14 El Niño events correlate with years that included either famine or drought, and a high number of embarked slaves. These comprise the two top years in the slave trade, 1766 and 1770 (famines), and 1792 and 1798 (droughts). Conclusively, the overall consistency is remarkable. Nine of 14 El Niño events correlate with either of the columns. This results in 64 percent consistency, which is historically, not statistically, significant.

It is of special interest that the years which lacked climatic information, but had a high number of embarked slaves (1754 and 1784), are registered as El Niño years. This might imply that there were droughts that increased the slave trade during these years. The former also coincide with the droughts in the Niger Bend, as registered by P. D. Curtin. Hence, the data in Table 5.3 indicate the possibility of and El Niño induced drought, which then affected the slave trade, in 1754. There is at least a strong possibility that the rainy season in either 1753 and/or 1754 was affected by the onset and duration of El Niño. The letters contained no information on the weather in 1782 and 1783. However, it is possible that there was a prolonged drought caused by El Niño, which subsequently increased the slave trade in 1784 and 1785. However, there are several years when El Niño events do *not* correlate with the high number of embarked slaves, as in 1771, 1772, 1774, and 1776. However, as mentioned, the increased slave trade in 1771 and 1772 might have been a delayed effect of an El Niño event.

5.5 Concluding remarks

The slave trade was not governed or determined by interannual rainfall variations. However, the analysis indicated that there, on occasions, was a correlation between climatic aberrations and an increase in the number of slaves who embarked from Cape Coast Castle and Annamboe. There was also correlation between El Niño events and droughts/famines that led to an increased slave trade. This was especially clear during the consecutive droughts and famines between the mid 1760s and mid 1770s. This implies that there was a climate oriented push-effect in West Africa, especially during climatic anomalies. However, the correlation between the climate and the possible socio-economic impact was irregular after the 1770s. Nevertheless, how is a correlation between the climate and an increased slave trade defined? What constitutes a *clear* and significant impact? How many slaves needed to embark to be considered an impact? Is an increase of 1,000 slaves a year sufficient? What is a human life worth, when discussing one of the grimmest eras in human history?

Table 5.3 *El Niño events between 1750 and 1798 compared to famines and droughts, and the top 11 years of embarked slaves.*

El Niño	Famines/Droughts	Embarked slaves
1754		**1754**
	1756	
	1765	
1766	**1766**	**1766**
1768	1768	
1769	1769	
1770	**1770**	**1770**
		1771–1772
	1774	1774
		1776
1777	**1777**	
	1780	
1782 –1783		
1784		**1784**
		1785
	1789	
1791		
1792	**1792**	**1792**
1793		
1794		
1798	**1798**	**1798**

Source: Gergis and Fowler, TSTD (2009)[41]

I chose not to conduct a statistical analysis as the number of factors and their internal and nonlinear causality are considered too many to be measured in a meaningful manner. There is no clear causality in the events, and all conditions that need to be known to facilitate an assessment of the climatic impact are not known.

It is clear that the causality is not as straightforward as it might appear. Drought might be regarded as a first-order impact, but that would identify an increase in the slave trade as a third- or fourth-order impact. For instance, less rainfall led to a drought, which was exploited to wage wars, which resulted in a famine, which provided the slaves that increased the number of embarked slaves from Cape Coast Castle or Annamboe. Hence, was it the climate or the wars that impacted the number of embarked slaves? One noted method of procuring slaves was by kidnapping as, for example, when the Fante

[41] Gergis and Fowler, see Table 9, p. 369, TSTD.

kidnapped Asante people while they were searching for food at Fante villages in 1765.[42] Therefore, was it the kidnapping or the lack of food, caused by a drought, which generated more slaves? The order of impact can be masked by many impact factors, and is not as straightforward as depicted here. However, it is my final conclusion that the climate played such a large role in West Africa that it must have had a profound effect on the trans-Atlantic slave trade in the 18th century. Furthermore, the pull- and push-effect played an equally important role in the slave trade mechanism.

The idea of a climatically facilitated slave trade has been analysed, but the subject is in need of further investigation. The correlation between the number of embarked slaves, the impact of droughts and famines, the wars, and the political history of West Africa in relation to climatic events are in need of further and more extensive investigations.

[42] Fynn, p. 100.

6 Conclusions

This investigation is the first study to place special emphasis on the climate along the Gold Coast (Ghana) in the 18th century. It is one of the first studies to investigate 18th century climatic variations in West Africa, not only on an annual basis but also on a monthly and even daily basis. This study has shown the existence of historical documents that have not been employed in climatic studies on West Africa, thereby refuting the myth that has been maintained for several years, which suggests that there are very few historical documents with meteorological information on 18th century West Africa. To date, this has hindered the development of a good understanding on pre-industrial climatic variations in this part of the world. This study has shown that the archives are rich in documentary material, and that there are sources which remain unemployed for large parts of West African coastal areas. A broader comparison might include and combine an even wider array of sources than employed in this investigation. The spatiotemporal frames might also be widened. The logbooks and their usability in this regard should be investigated further as they might prove to be more useful in other parts of West Africa. This investigation has merely scratched the surface of possibilities, and has only opened the door to a corridor filled with doors that lead to new investigations on climatic studies with a focus on West Africa. The historical climate of West Africa remains poorly charted and, considering the coming climatic changes, there remains a need to better understand climatic variations from a historical perspective, and also in relation to the El Niño-Southern Oscillation (ENSO) phenomenon. El Niño events caused rainfall variations at the Guinea Coast area in the 18th century; however, there were also years that did not correlate with rainfall variations.

The sources employed in this investigation are documents with descriptive information and without measured data. The governors' letters were the most informative source of information in this investigation. The logbooks were considered reliable in their descriptions, but they are ambiguous and not particularly useful for assessing the quality of the rainy season in the investigated area. However, it must be noted that this is a case-study on the conditions at Cape Coast Castle, and it did not include the western coastline of West Africa, where logbooks might prove more useful.

The climate

The West African 18th century climate has previously received little attention, and the lack of readily obtainable sources has rendered most research speculative and suggestive. Suggestive because earlier investigations have addressed scarce meteorological and climatological proxy data, and/or speculative as the constructions has been based on socioeconomic impacts. This investigation has shed new light on the latter half of the 18th century climate, but it has also indicated the need for further investigations. This investigation only focused on a period of 48 years, leaving a larger part of the 18th century open for further research.

The results from this investigation conclude that the West African climate was predominantly dry during the latter half of the 18th century. Interdecadal variations stand out more clearly, in the long-term perspective, than interannual variations. The best method with which to address the period in question is to approach it as one that is drier than today, although with notable fluctuations between wetter and drier decades. This was the method employed to reconstruct the periodisation. The conducted analysis supports Sharon Nicholson's suggestions concerning some climatic changes towards the end of the century. The climate was more unstable and erratic, and this is (perhaps) related and caused by the cluster of ENSO events in the 1790s. A cluster of ENSO events also seems to have caused global climatic disturbances during the 1760s, especially in West Africa.

It is also concluded that there was a clear dichotomy between the coastal dry zone and the inland climate, often referred to as the south-western parts of Ghana. The coastal area often experienced abundant rains during periods when the inland rains failed, which resulted in either droughts or even famines. There were also years when the coastal area experienced drought-like conditions, when the inland did not, which further strengthen the dichotomy. Much of the evidence also supports the dipole rainfall pattern between the Sahel and the Guinea Coast.

The investigation also came to the conclusion that the rainy period began earlier in the year and was shorter in comparison to 20th century rainfall patterns, generally lasting from the beginning of May until mid July. The rains fell more unevenly and less frequently. However, there were great variations in the onset and duration of the rainy season. The secondary rainfall season, which today occurs around October, is suggested to have been weak in the 18th century. The documents employed in this investigation showed almost no trace of a secondary rainy, which supports and explains why this region, in the 18th century, was drier than in the 20th century. However, this subject is in need of further investigation.

The climatic periodisation

There were three registered periods for the coastal climate, and five registered periods for the inland climate. The coastal climate enjoyed a wetter interval that lasted from the beginning of the period until the 1770s, and it was identified by intense rainfall events interspersed with normal rainfall in the rainy season. The second period was drier than the first, and the climate started to gradually transform from wet to dry at the beginning of the 1770s. However, the wetter period lasted until the end of the 1770s when the drier period was clearly visible and identifiable in the sources. The end of the 1770s and beginning of the 1780s is also differentiated due to abundant winter rains in December. Subsequently, the rains were weak throughout the dry period in the 1780s, which is an assertion, in general, based on only vague references. The third and final period began at the end of the 1780s as the climate rapidly grew wetter along the coastline.

The inland area showed larger variations than the coastal area. It was suggested that the first climatic period of the inlands spanned from the beginning of the 1750s to the middle of the same decade. This period is suggested, although on scant evidence, to be drier than the second period, which lasted from the middle of the 1750s to the mid 1760s. This was a wetter period during which the rains seemed to have regained sufficient strength to sustain the regularity of the crops, and no famines were registered. The third period, which lasted from the middle of the 1760s to the end of the 1770s, was clearly drier than any other period. There were several famines and droughts registered, and several climatic disturbances. This period shows a significant correlation with El Niño and other climatic aberrations on other continents. The third period was followed by a wetter period comprising nine years of recovery of the rains. There were no reports of droughts or famines during this period, although, as with the coastal regions, there was little evidence in general. The last period that was identified was a drier period. This started at the same time as the coastal climate grew wetter. However, the inland climate did not experience an equally rapid and absolute transformation as the coast.

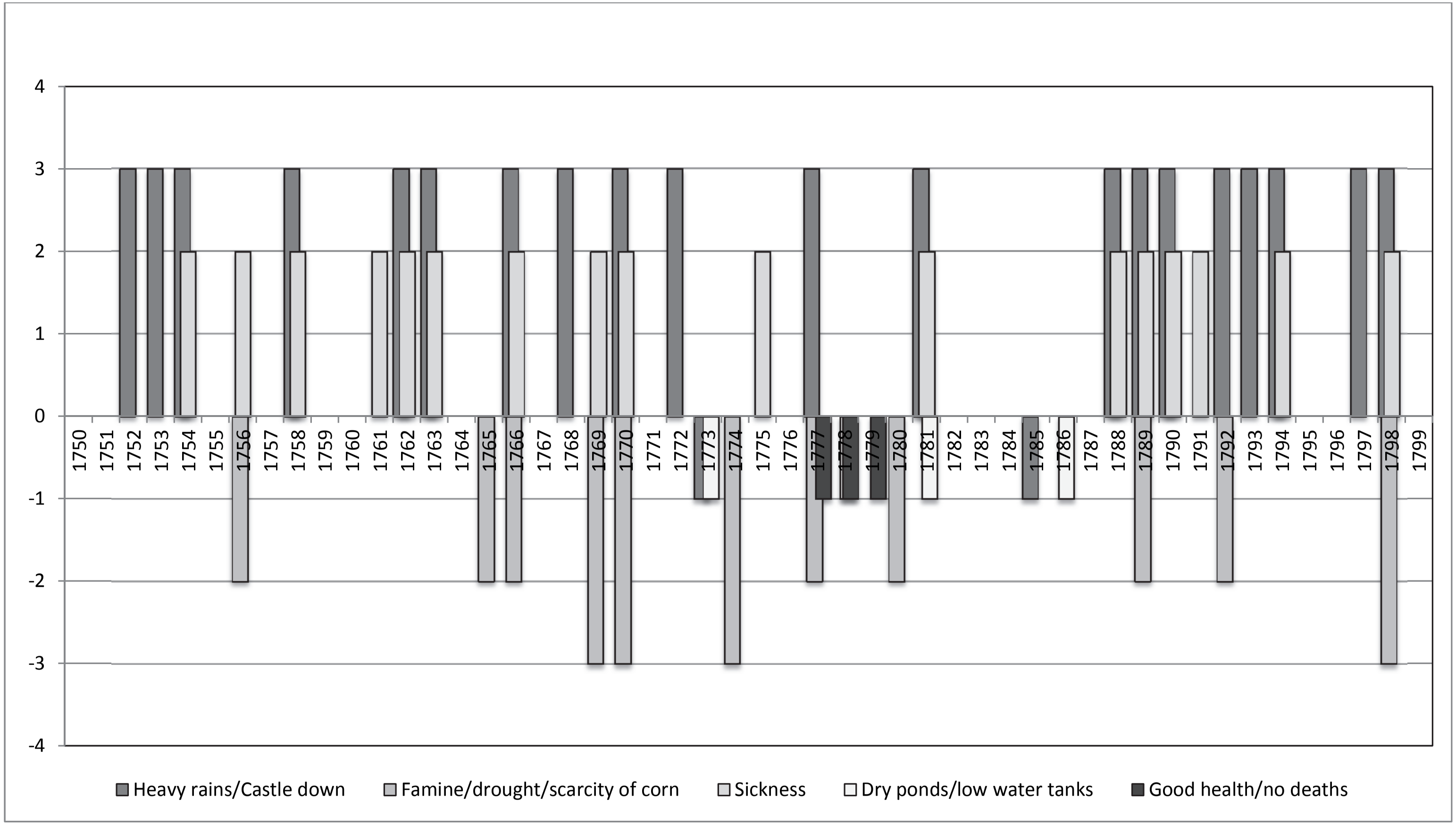
There are some apparent dilemmas with these periodisations. Naturally, the most prominent is the sources and their reliability, which are confined to the dry coastal zone. However, this period is in need of further research for improved exactness. However, most of all, it is in need of continuance and to be placed in a wider context. Thus, in other words, there is a need to gain better knowledge on the climate before 1750.

The climatic impact

It is evident that the climate governed daily life and had an impact on those who resided in West Africa during the 18th century. The rains sometimes battered the castles to unrecognisable heaps of mud, forcing the administration to constantly rebuild their castles. This proved to be an important source of information for determining the intensity of the rains and the effect of the weather.

It has also been determined that the climate, especially the cluster of droughts between the mid 1760s and mid 1770s, had an impact on the slave trade. There is a remarkable correlation between the droughts and the number of embarked slaves from Cape Coast Castle and Annamboe during this period. However, it was also judged that there are many dilemmas related to this subject, as the dry periods also induced wars, thereby masking the relation between cause and impact.

Appendix: Figures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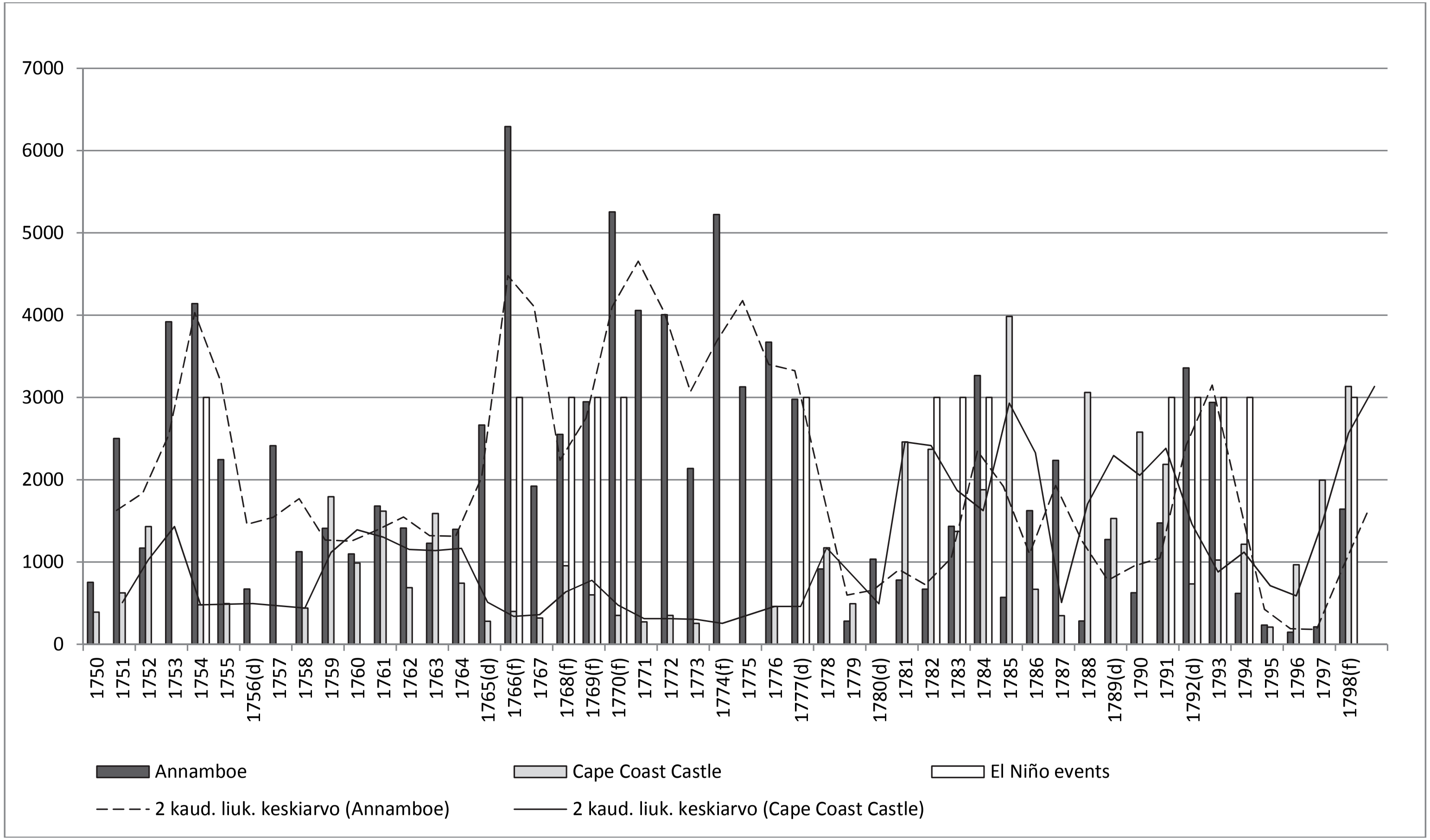
Heavy rains/Castle down
Famine/drought/scarcity of corn
Sickness
Dry ponds/low water tanks
Good health/no deaths

Appendix B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Annamboe
Cape Coast Castle
El Niño events
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Swedish Summary – Sammanfattning

Avsikten med den här undersökningen är att rekonstruera klimatet i västra Afrika. Rekonstruktionen görs på basis av klimat- och väderbeskrivningar, samt omnämnande av klimatrelaterade katastrofsituationer (t.ex. torka, hungersnöd, brist på dricksvatten) vid det engelska slavhandelsfortet Cape Coast Castle (Cape Coast i Ghana) vid Guldkusten mellan åren 1750 och 1798. Målet med avhandlingen är att tillgodose forskarsamfundet med en bättre förståelse av det historiska klimatet i västra Afrika under 1700-talets andra hälft. Avsikten är också att, med hjälp av den nya klimatiska periodiseringen, analysera klimatets inverkan på den transatlantiska slavhandeln från Cape Coast Castle och Annamboe vid Guldkusten.

Kartläggningen av det historiska klimatet i västafrikanska har till dags dato varit bristfällig och regionen har inte studerats lika flitigt som andra delar av världen. Temperaturdata täcker nästan enbart 1900-talet, och 1800-talets klimat blev kartlagt för första gången 2012. Till dags dato baseras kunskapen om västra Afrikas klimat på 1700-talet på studier från 1970- och 1980-talet. Den första studien var en klimatisk syntes sammanfattad av meteorologen Sharon E. Nicholson, vilket efterföljdes av historikern George E. Brooks klimatiska rekonstruktion tio år senare. Dessa studier fokuserade däremot på klimatets långsiktiga utveckling under holocenen och således fick 1700-talet bara begränsad uppmärksamhet. Klimatrekonstruktionerna hade olika angreppssätt, och emedan Brooks fokuserade sig på historisk utveckling sammanflätad med klimatets inverkan på samhället, fokuserade Nicholson på uppsamlingen av nedtecknade naturkatastrofer. Resultaten var en indelning av klimatet i fuktigare och torrare perioder, vilka sträckte sig över flera århundraden. Årliga, eller långsiktigare nederbördsvariationer o perioder om tiotals år, lokaliserades inte. Således har forskarsamfundet, fram tills nu, haft föga kunskap om kortvariga klimatvariationer eller fluktuationer i Västra Afrika på 1700-talet.

Fokuseringen på västra Afrikas historiska klimat stagnerade delvis efter 1980-talet, emedan forskningen kring klimatets mekanismer tilltog kraftigt. Den har utvecklingen var ett led i försöket att förstå orsakerna till de extrema torkor som drabbade Sahelområdet efter 1968 (den senaste drabbade området (2012). En orsak till stagneringen i studien av historiska klimat var det dåliga källäget. Det rådde (och råder) en brist på användbar instrumentell data (temperatur, regnmängd och luftryck), men även så kallad proxydata (indirekt eller approximativ data) från naturens eget arkiv. Dendrokronologi, till exempel, är vanligtvis en användbar metod för att identifiera klimatets årliga variationer, men det är inte en användbar dateringsmetod i västra Afrika. De tropiska trädarterna genererar inte årsringar på samma sätt som trädarterna i tempererade zoner. Träden i västra Afrika växer när och om de får vatten, inte alltid under våren, som i till exempel Norra Europa. Sedimentlager från sjöarna Bosumtwi och Chad har däremot studerats för att särskilja variationer i vattenhöjden, som i ett led särskilja mellan torrare och våtare perioder. Det är nämligen vatten som är den viktigaste variabeln och mätinstrumentet för fastställande av klimatvariationer i västra Afrika: tillgången till vatten bestämmer vem som överlever och vem som inte. Temperaturväxlingar är ett minde viktigt mätinstrument för fastställande av klimatvariationer i jämförelse med nederbörd, eftersom tillgängligheten till vatten avgör den agrara produktionskapaciteten och upprätthållandet av boskap, inte temperatur. Det är av den här orsaken som denna studie har fokuserat på variationer i monsunregnen, inte på temperaturförändringar. De årliga nederbördsvariationerna i tropiska Afrika är dock kraftiga, vilket gör det svårare att återskapa en korrekt bild av klimatet. Det är dock nederbördsmönstret mellan Sahel och Guineakusten som gör det möjligt att diskutera klimatet i hela regionen, trots att analysen utgörs av en fallstudie vid Cape Coast Castle.

En annan orsak till att klimatforskningen i västra Afrika släpat efter utvecklingen in övriga världen är att det råder en brist på lokala källor. Det här var delvis förankrat i de orala traditioner som dominerat i västra Afrika. Få händelser har dokumenterats och fåtal kulturer har lämnat skriftligt material efter sig. Undantaget utgörs av lokal krönikör, men dessa kan inte användas utan förbehåll eftersom innehållet i dessa förorsakar många typer av källkritiska problem. Krönikorna är oftast nedtecknade i efterhand, ibland flera år i efterskott. De är ibland baserade på myter, legender och hörsägen, skapade för ett visst syfte, och syftet har inte varit att nedteckna förekomsten av förändringar i klimatet. Väderleks- och naturkatastrofuppgifter anges inte exakt och dateringen är inte tillförlitlig. Orsakerna till olika typer av kriser, som till exempel hungersnöd, anges endast undantagsvis. Således är det omöjligt att bestämma om en hungersnöd orsakades av minskad nederbörd eller det var följderna av politisk oro. Källorna i den här undersökningen förorsakar delvis liknande spatiotemporala problem, speciellt eftersom den lokala befolkningen inte är representerad. Omfånget av problemen som uppstår är däremot betydligt mindre än de som uppstår i samband med användningen av krönikor, delvis därför att reflektionerna omfattar en kortare tidsram.

Således, den bästa informationskällan för att rekonstruera västra Afrikas klimat är Europeiska dokument av olika slag, så som reseberättelser, memoarer, officiella rapporter och brev från personer som besökte regionen. Dilemmat med dessa är att de är spatialt begränsade. Få européer begav sig till de innersta delarna av västra Afrika under 1700-talet och därför härrör de flesta dokumenten från kusten där slavhandeln pågick. Dokumentinnehållet är till natur narrativt och klimatet/vädret beskrivs oftast översiktligt, emedan de sällan innehåller instrumentell data för temperatur eller nederbörd. Det här i motsats till exempel Europa där 1700-talet förde med sig ett nyutvecklat intresse för klimatets regelbundenheter, varefter många började föra väderdagböcker däri man nedtecknade vädret dag för dag. Dylika källor är högts ovanliga i västra Afrika och tills dags dato har inte en dylik källa registrerats vid Guldkusten.

Den här undersökningen påvisar däremot att kalläget inte är så dåligt som man tidigare hade konstaterat. Det finns samtida europeiska källor från västra Afrika och de är lättillgängliga, även om det kräver en del arbete för att få tag på klimat- och/eller väderbeskrivningar. Den här undersökningen har såldes också ett underbetonat mål. Det primära målet är att rekonstruera klimatet, men samtidigt att lyfta fram det faktum att det finns outnyttjade källor och att det således är möjligt att rekonstruera 1700-tals klimatet även för västra Afrika. Det vore oerhört viktigt, med tanke på framtida klimatförändringar att kartlägga det historiska klimatet ännu mera noggrant, således har denna undersökning bara en första ytskrapning.

Diskussionen kring historiska dokument, deras användbarhet och relevans har varit ett ofta återkommande ämne inom klimathistoria, speciellt bland de naturvetare som använt sig av historiska dokument för att rekonstruera klimat. Forskarsamfundet har ofta betonat behovet av kvalitativa analysmetoder för att bäst utnyttja den subjektiva och relativa information som källorna innehåller. Om källorna inte primärt beskriver vädret eller klimatet, behövs källkritik och den historiska kontexten för att särskilja mellan klimatets primära och sekundära inverkan på samhället. Det är enbart genom en skrupulös analys av de primära (t.ex. torka), sekundära (t.ex. hungersnöd) och tertiära (t.ex. hungersnöd) händelserna som klimatet kan rekonstrueras. Beskrivningarna indexeras, graderas och kategoriseras enligt intensitet och inverkan för att sedan sammanställas klimatologiskt. Det är inom ramen för tolkningen av klimatets inverkan och händelsernas inbördes kausalitet, som klimatet rekonstrueras. Ett vanligt antagande är att hungersnöd uppstår som en följd av minskad agrar produktion, vilket antyder att regnmängden varit bristfällig, men det är inte alltid är klart att hungersnöd var förorsakad av nederbördsvariationer, vilket däri understryker vikten av att placera studien i sin korrekta historiska kontext.

Västra Afrika var på 1700-talet var en knytpunkt i den transatlantiska slavhandeln under 1700-talet. Antalet slavar som transporterades från västra Afrika till Amerika kan räknas i miljoner. Den senare halvan av 1700-talet utmärks av en nästan exponentiell ökning av slavhandeln från Guldkusten. Orsaken till denna ökning har länge ansetts vara efterfrågan på slavarbetare till plantagerna i Amerika. Flera prominenta historiker har föreslagit att klimatutvecklingen i Afrika bidrog till att tillgodose slavmarknaden med ett större utbud av slavar, det vill säga klimatet genererade en situation som producerade mer slavar. Denna så kallade *push-effect*, i motsats till *pull-effekten* i Amerika, har däremot inte kunnat undersökas eller påvisas i brist på exakt klimatdata. Man har därmed inte kunnat jämföra relationen mellan klimatanomalier och fluktuationer i slavhandeln. De tidiga klimatrekonstruktionerna har inte varit exakta nog för att kunna bidra till en analys av klimatets inverkan på slavhandeln.

Förhållandet mellan en ökad slavhandel och klimatet är komplex och det bör påpekas att det inte kan finnas ett linjärt samband eller direkt kausal effekt mellan slavhandeln och klimatet. Den starkaste kopplingen är att slavarna främst förvärvades som fångar i samband med krig, som vanligtvis utkämpades under torrperioden, eller i samband med torrperioder. Det finns också antydningar på att vissa frivilligt sålde sig själv som slavar för att undgå förföljelse eller hungersnöd. Dylika fall – där folk sålt sig själv som slavar som en följd av förändrade väder- eller klimatförhållanden – kan däremot inte påvisas. Problemet är att det är svårt att påvisa om en person sålde sig själv som slav för att ungdå hungersnöd, eller om den gjorde det för att den inte hade den ekonomiska förmågan att undgå svältdöd. Vidare, de flesta slavar som såldes var vanligtvis pojkar och unga män mellan 10 och 30, vilket gör det svårt att direkt påvisa klimatets inverkan, speciellt eftersom nöden inte borde skilja på slavens kön eller ålder. Slutligen, det är värt att notera att slavarnas ursprung är okänt, vilket gör det ännu svårare att klargöra klimatets inverkan på slavhandeln. Det enda som kan sägas med säkerhet om deras härkomst är att majoriteten av slavarna kom från inlandet och inte från kustområdet.

En diger analys av källorna som användes i samband med denna rekonstruktion resulterade i följande klimatiska rekonstruktion: I jämförelse med idag så började monsunregnen tidigare under 1700-talet och deras varaktighet var kortare. Den sekundära regnsäsongen var även betydligt svagare, om även icke-existerande, vilket skulle förklara det torrare klimatet. De årliga variationerna i regnsäsongen (början, intensitet och varaktighet) var de samma som under 1900-talet, men klimatet var överlag torrare. De mest framträdande klimatvariationerna förekom i perioder på en längd upp till 15 år, och skiftade mellan torrare och blötare kluster. Det förekom däremot även kraftiga nederbördsvariationer från år till år. Periodiseringen åtskiljde även mellan det torrare kustklimatet och det blötare klimat som rådde längre inåt land. Kustklimatet indelades i tre olika perioder, där en torrare period under 1780-talet omgärdades av två fuktigare perioder. Inlandsklimatet var mera komplext och indelades i fem torrare och blötare perioder som konsekvent avlöste varandra. Den mest framträdande perioden var den andra torrperioden i inlandet, vilken fick sin början under 1760 och sträckte sig till den senare delen av 1770-talet. Under den här perioden registrerades bland annat flera hungersnödssituationer. En komparation med antalet slavar som embarkerade under denna period, från Cape Coast Castle och Annamboe, de två viktigaste engelska platserna i den engelska slavhandeln, visade att slavhandeln tilltog i samband med de registrerade nödåren. Flera av de registrerade klimatanomalier mellan 1750 och 1798, korrelerade med ett ökat antal embarkerade slavar, men det är svårt att klart påvisa att det är klimatet som orsakade den ökade slavhandeln. Det är även svårt att definiera en signifikant inverkan, dvs. hur många människor mer som måste exporteras för klimatets inverkan skall anses betydande. Det här bör studeras mera ingående och det finns fog för mera närgående analyser i förhållande till den interna politiska utvecklingen i regionen, samt dess påverkan på slavhandeln.

Analysen påvisade också att El Niño till en viss grad påverkade nederbörden i den studerade regionen. Flera av de år när det registrerades häftiga regn vid kusten korrelerade med El Niño, samtidigt som även dessa år resulterade i torka längre inåt land. Bristen på data och mera exakta beskrivningar gör det klart svårare att fastbestämma till exakt vilken grad El Niño korrelerar med nederbördsvariationerna, således påvisar undersökningen samma osäkerhet i korrelationen som tidigare undersökningar: ibland korrelerar datan, ibland inte. Mera specifik data och information behövs för att klarar fastbestämma El Niños inverkan på nederbördsmönstret.

I undersökningen prövades även den engelska flottans loggböckers lämplighet som källor för klimatrekonstruktioner vid Guldkusten. Analysen visade att loggböckerna, som fördes ombord skepp ankrade vid Cape Coast Castle, inte var användbara för att rekonstruera klimatet på land. Början av monsunregnen registrerades med stor sannolikhet korrekt i loggböckerna, dessvärre undvek man som oftast att besöka Guldkusten vid den här tidpunkten, varefter mängden data var minimal. Loggböckerna ansågs för övrigt inte användbara för att rekonstruera klimatet vid Cape Coast Castle. De lokala förhållandena är sådana att loggböckerna inte nödvändigtvis återspeglar samma väder som på land, bland annat möjligheten för sjöbrisfronter gör att det kan regna på land men inte över havet. Sjöbrisfronterna är ett specifikt fenomen för den här delen av västra Afrika, varför det finns skäl att undersöka loggböckernas användbarhet på andra delar av kustområdet.

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