

Factors affecting climate in Africa

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ABSTRACT

The study is focused on the background of climate. It also aimed to discuss the factors affecting climate in Africa. It is also wanted to describe the location of Africa, the physical features of Africa such as climate, soil, and natural vegetation. In the same time, the paper concentrate on population of Africa, their countries in Africa. Moreover, the study cover the size and shape of the Africa's continent. The study used primary and secondary source to obtain data collection. Also, the qualitative and quantitative descriptive methods was employed for a finding of factors affecting climate in Africa. On the same way, the study recommended to the researchers to emphasis on availing complete information about the factors affecting climate in Africa.

Key wards: Factors, affecting, climate, Africa.

1. INTRODUCTION

Climate is the average condition of the atmosphere observed over a long period of time. It is considered as the average weather condition of a given place. The weather conditions considered mainly include rainfall, temperature, humidity and cloud cover (Nathan.K.T. 2017).

Climate is the long-term pattern of weather in an area, typically averaged over a period of 30 years. More rigorously, it is the mean and variability of meteorological variables over a time spanning from months to millions of years. Some of the meteorological variables that are commonly measured are temperature, humidity, atmospheric pressure, wind and precipitation. In a broader sense, climate is the state of the components of the climate system, which includes the ocean, land, and ice of Earth. The climate of a location is affected by its latitude/longitude, terrain and altitude, as well as nearby water bodies and their currents. Climates can be classified according to the average and the typical ranges of different variables, most commonly temperature and precipitation. The most commonly used classification scheme was the Koppen climate classification (en.m.wikipedia.org).

The climate of Africa is average of climates of equatorial climate, the tropical wet, dry climate, the semi-arid climate and desert, as well as subtropical highland climate. Temperate climates are rare across the continent except at very high elevations and along the fringes. In fact, the climate of Africa is more variable by rainfall a mount than by temperature which are consistently (Todd Mitchell, 2001).

2. STATEMENT OF THE PROBLEM

This study focused on factors affecting climate in Africa. The research or study is conducted to answer the following questions:

- 2.1. What is climate?
- 2.2. What are factors affecting climate in Africa?
- 2.3. Explore the background of Africa in term of location, size and the shape?
- 2.4. What are the physical features of Africa in term of climate, soil and vegetation?

3. OBJECTIVES OF THE STUDY

The main objective is to examine the factors affecting the climate in Africa.

Moreover, the specific objectives are:

- 3.1. To explore the background of Africa in term of location.
- 3.2. To define the climate of Africa.
- 3.3. To determine the factors affecting climate in Africa.
- 3.3. To examine the physical features of Africa such as climate, soil and vegetation.
- 3.4. To discuss the size and shape of Africa.
- 3.5. To explain the population and their countries.
- 3.6. To suggest the solutions to the factors affecting climate in Africa.

4. MATERIALS

Materials involve the following:

Figure 1: showing map of Africa



Legend: 0 100 200

5. AREA OF THE STUDY

Africa is one of the continents of the world. The continent is surrounded by large expanses of water known as oceans and seas. To the west is the Atlantic Ocean, to the north is the Mediterranean Sea, to the east is the Indian Ocean while to the south is the Antarctic Ocean. The Red Sea and Suez Canal border Africa in the northeast effectively separating the continent from the Arabian landmass. In term of latitude and longitude, the continent extends from about 34° south to 37° north and about 17° west to 51° east. The continent have three latitudes, the equator, the tropics of cancer and Capricorn, cross the continent.

6. Physical Features

Physical features include:

6.1. CLIMATE

Different parts of Africa experience different climates. Africa's climate can be broadly into equatorial climate and this type of climate experienced by the areas lying close to the equator, especially within 5° north or south of equator. These areas include much of Congo Basin, the West Africa coast, parts of Gabon, Equatorial Guinea and Cameroon. Equatorial climate is characterized by high mean annual temperature of about 27°C, and small annual temperature range of about 3° to 5°C, high relative humidity of about 80 percent, abundant rainfall of about 2000 mm on average, beside two peaks of rainfall occur around May and October of each year, with thunder and lightning accompanied rainfall, and absence of a distinct dry season. In addition to Savannah climate which are found south of the Sahara and Sahel region in West Africa, east and central Africa outside the Congo Basin as well as highlands. This type of climate characterized by moderate rain fall between 760-1500 mm. North of the equator, the rainfall received in the middle of the year, and the southern hemisphere it is received during the first and last months of the year. The rainfall is seasonal characterized by one wet season and dry period, high temperature throughout the year, but during the dry season, day time temperatures are much higher than night time temperature and low relative humidity. It also involve the desert climate, this extends across North Africa from the Red Sea in the east, westwards to the Atlantic Ocean. It borders the Mediterranean climate. Such deserts as the Namibia desert which is found in southwest Africa along the Atlantic Ocean. The Kalahari semi-desert in the eastward, occupies part of Botswana and the

northwestern part of the Republic of South Africa. The climate is characterized by very low or no rainfall at all, very clear sky or no cloud cover, very low or no humidity, and very high temperatures above 30°C as well as very strong winds over the Sahara causing sand storms (Climate p. center, 1997).

Nevertheless, the continent also involve the semi-desert climate in which it is experienced on the fringes of the desert, and characterized by low relative humidity less than 25 percent, limited cloud or even clear skies, very low rainfall usually less than 760 mm and high day- time temperatures, low temperatures at night and high evaporation rate. On the same way, it include the Mediterranean climate it is known as warm temperate western margin. This type of climate found in southwest of the Republic of South Africa (Cape Town area), the coast of Morocco, Algeria and the Benghazi area of Libya. It characterized by wet winters (rainfall is received in winter due to onshore winds in that season and offshore winds in summer), dry summers, warm to hot summers and cool to mild winters. On the other hand, the physical features of Africa include montane climate which experienced in the high mountains. The high grounds of Africa such as Atlas, Drakensberg, Adamawa and Ethiopian highlands. This type of climate characterized by low temperature near and at the tops of the mountains, decrease in atmospheric pressure as altitude increases, and relief rainfall is received mainly on the windward side, as well as dry leeward side because of rain shadow effect.

6.2. SOIL

Africa is generally a plateau land with different levels ranging between 1000 and 2000 meters above sea level. The plateau is highest in the east, gradually sloping down to the west. The plateau is interrupted by mountains, highlands and basins of different modes or means of formation. Notable examples are The Ethiopian highlands, Tibesti and Atlas mountains. Some of these mountains were formed by Vulcanicity while the others were formed by faulting and folding.

6.3. VEGETATION

Vegetation is the natural plant cover of the earth's surface. Vegetation can grow naturally or it can be planted by man. There are millions of plant species which depend on grow in the soils. Natural vegetation refers to plants whose origins by natural processes and factors. In Africa there are many different plant communities and can be classify into seven types. These types are:

6.3.1. Equatorial / Tropical rainforest vegetation

These forests are the thick impenetrable forests that grow within the tropics. This vegetation is found where the tropical and equatorial climate is experienced. Such include the equatorial forest in the Congo Basin, coastlands of West Africa such as Sierra Leone, Ivory Coast, Equatorial Guinea and Gabon. This forest characterized by closely packed tall trees rising to an average height of 50 meters. The trees occur in mixed stands, with different tree species grow next to each other in the same area. Also, different species shed their leaves at different times giving the forest an evergreen characteristic. Beside, climbing plants, lianas and epiphytes grow amidst the bigger trees. Some of these depend on the bigger trees for support, while others have a parasitic relationship with the bigger trees as they feed on them. The forests have very little undergrowth because of limited light. The existing undergrowth is mainly of ferns and parasitic plants such as mosses and fungi. The trees are mainly broad-leaved and evergreen. The trees retain their branches and leaves throughout the year in a green state. The trees in rainforests grow buttress roots. Because buttress help to hold firm the tall trees. This forests have umbrella- shaped branches that form thick cover.

6.3.2. Savannah vegetation

It lies between tropical rainforest and desert vegetation. It is categorized into savanna woodland and savanna grassland. Savannah woodland borders tropical rainforests, while savanna grassland borders desert vegetation. Savannah woodland grows in wet savanna areas such as the Miombo Woodland of eastern and central Africa as well as northern Zambia and central Tanzania. It is characterize by more or less continuous cover of trees that are 8-16 meters tall with brushy spreading tops. Trees have compound leaves to produce the rate of water loss through transpiration, and most plants have fleshy barks to store water or use during the dry season. Also trees have tap roots to suck water from deeper layers of the soil. There is dense undergrowth of shorter trees, bushes, and grasses between taller trees. While, savanna grassland is the most widespread type of natural vegetation in Africa. It is found in West, Central, East and South Africa. The type is characterize by relative tall grass of about 1 meter on wet margins, and short grass dominates on the dry margins. Short and widely scattered trees are most plants in the area. Trees have compound leaves to reduce the rate of transpiration. In addition to that, most plants except grasses have tap roots to help them get water from deeper layers of the soil.

6.3.3. Semi- desert vegetation

This vegetation is found in the semi-arid areas of the continent. It is widespread over the Sahara and Namibia deserts and the Kalahari semi- desert. The semi- desert vegetation is characterized by very short and widely

spaced bushes as well as short grass and bare surface or very dry margins. The forests have also drought resistant plants such as cactus and euphorbia. Moreover, the vegetation contain plants with long and spreading roots to tap scarce water, with plants of few leaves which minimize water loss through transpiration. It also have shiny leaves to reflect insolation. Some plants have a short maturing period to utilize the little water received to grow quickly maturity.

6.3.4. Desert vegetation

Deserts are predominately bare without vegetation most of the time. Palm trees and cactus vegetation grow only around oases where underground water appears near the surface. Quick maturing seasonal plants grow only after rain shower has appeared. These plants grow very quickly to maturing and their seeds become dormant when there is no rain. They come back to life when another rain is received. The xerophytes fleshy trunks and usually have no leaves to reduce water loss.

6.3.5. Mediterranean vegetation

The Mediterranean vegetation is found along the Algerian, Tunisian and Moroccan coasts. It is also found around Misratan in Libya and Cape Town in South Africa. The plants which grow here have developed certain adaptations in response to hostile drought environmental conditions. The trees have shiny and waxy leaves to reduce transpiration and conserve limited water supply. Moreover, trees such as cork and oak have thick barks to store water for use during drought time. In this vegetation, plants grow long tap roots that extend to great depths in the soil in search of water, and other plants with fleshy bulbous roots are able to store water for some time.

6.3.6. Montane vegetation

This is the vegetation found on high mountains and highlands which include the Ruwenzori, Drakensburg, Atlas ranges, Adamawa and Ethiopian highlands. There is a dominance of plants that have adapted to cold climatic conditions. The common plants species in montane vegetation are heath and moor plants species, lobelia and tursel plants, short grasses, scattered low shrubs and occasional sprouting flowering plants.

6.3.7. Wetland (swamp vegetation)

This vegetation is found along the continent's coastal strip as well as along river valleys such as the Congo, Zambezi, and the shores of lakes of Victoria, Edward, Albert, Kyoga and Tanganyika. Wetland vegetation in general is characterized by papyrus plants, the tall grass and plants that tend to have relatively short roots since water is readily available at or near the earth's surface.

7. METHODS

Methods of the study involved:

7.1. Primary Data Collection

This study used a personal interview method for the purposes of data collection. Data was collected from all eligible people who are usually eligible after giving them a brief description of the purposes and procedures of the study and ensuring that they had properly understood, before beginning of an interview.

7.2. Secondary Data Collection

The methods of secondary data collection are vary and include: information from references, public records, organizational records, census data, previous studies and surveys.

7.3. Ethical Considerations

This study used a primary data analysis of survey. In order to protect the anonymity and confidentiality of the information regarding respondents, names and house numbers were not identified in the Questionnaire and in the data set. Permission to carry out the study was obtained from the various scholars in the public universities, department of geographies in the country.

7.4. Data Analysis Methods

In analysis of data sets, descriptive statistical method was employed for the purpose of obtaining the information required for the study. Also the data were displayed by using percentages distribution Tables. The qualitative and quantities methods were employed in the study.

8. DISCUSSION AND RESULTS

The discussion comprise of the following questions:

8.1. Discuss the factors affecting the climate in Africa?

The factors are:

8.1.1. Latitude

Latitude is the angular distance of a point north or south of the Equator. Places near the equator and between the tropics usually experience high temperature throughout the year those near the equator have similar temperature throughout the year. Those near the tropics have a hot season and a cooler season. Because of high temperatures, tropical areas receive mainly convectional rainfall.

8.1.2. Apparent movement of the overhead sun

Because the earth's axis is tilted, as the earth moves around the sun during the year, the sun is overhead at different places at different times of the year. It is overhead north of the equator from March to September and South of the Equator from September to March. This is called apparent movement of the sun, because the sun appears to move although it is the earth that is actually moving. The overhead sun moves between the Tropic of Cancer and the Tropic of Capricorn. The sun heats most where it is overhead causing convectional rainfall as it moves north and south. This results in rainy and dry seasons alternating in the northern hemispheres. The sun is overhead in northern hemisphere from April to September causing wet conditions there. It is overhead in the southern hemisphere from October to March causing wet conditions also there. The sun is overhead at the equator twice a year in March and September. This explain why the equatorial regions receive two peaks of rainfall in a year.

8.1.3. The Inter-Tropical Convergence Zone (ITCZ)

The Inter-Tropical Convergence Zone (ITCZ) is the area around the earth near the Equator, where winds originating from the northern and southern hemisphere meet. The winds that meet at the ITCZ are referred to as trade winds. Because the winds meet and rise up along the ITCZ it is an area of convectional rainfall. In the northern hemisphere, the trade winds blow from the northeast, while in the southern hemisphere, they move northwestward from the southeast. When the ITCZ is in the North of the equator there is a rainy season there, and when it is in the South of the equator there is a rainy season there also. The ITCZ appear where there is high heat from the sun which causes hot air to rise. The rising air leaves behind a vacuum which causes cool air to move in very fast to fill the vacuum or space. When the trade winds meet, the cooler one forces the warmer one to rise further leading to formation of heavy rainfall that is characterized by strong wind, lightning and thunder. The location of ITCZ varies over time. It moves back and forth across the equator following the overhead sun. The migration of the ITCZ in Africa affects seasonal rainfall patterns across the continent, resulting in the wet and dry seasons in the tropical region.

8.1.4. Altitude

Altitude is height above the sea level. It affects mainly temperature and atmospheric pressure. The higher the altitude, the lower the temperature. This means that as height increase, temperature tends to decrease. Within Africa, the slopes and tops of high mountains have cold climates. Mountain Ruwenzori, for example is right of equator, experiences a very cold climate at the top and is permanently ice-capped. The Atlas and Ethiopian highlands experience cool climate because of altitude. Altitude also affects atmospheric pressure. This is the force exerted by the weight of air on the earth's surface. Atmospheric pressure decreases when altitude increases implying that the tops of mountains have lower pressure than the foothills.

8.1.5. Relief

Mountains are the relief features which significantly influence climate. Rain-bearing winds are forced to rise when they blow towards mountains. The moisture they contain condenses into clouds and rain; giving rainfall on the windward side of the mountains. The leeward side of mountains in the rain shadow and remains dry. Because the winds lose their moisture on the windward side. This explains why the eastern slopes Drakensberg Mountains are wetter than the western slopes.

8.1.6. Distance from the Sea

Coastal areas tend to be wetter than areas in continental interior. This is because areas close to the sea, the major of moisture, intercept moisture-bearing winds. In contrast, land areas farther away from the coast tend to have dry conditions since the prevailing winds lose their moisture the farther away they blow from the coast. By the time they reach continental interior, they are dry. This partly explains the drier conditions in central Africa as compared to the coastal lands.

8.1.7. Vegetation

Forests and wetland vegetation contribute rainfall formation through evapotranspiration. A lot of moisture is released to atmosphere from vegetation which later condenses into rainfall. The existence of dense equatorial forest of West Africa and the Congo Basin have partially accounted for the relatively high rainfall amounts received in the respective places.

8.1.8. Ocean Currents

When oceans basins, water slowly but steadily moves towards certain directions. This movement is known as ocean currents. Warm and cold ocean currents are two broad types of ocean currents. Coastal lands near warm ocean currents tend to be warm and wet. The East Africa coast is close to the warm south equatorial current and its southward extension of the warm Mozambique Current. This situation explains why the East African coast and the adjacent coastlands are hot and wet. In contrast, coastlands near cold ocean currents

have lower temperature. Such coastlands also have lower rainfall compared to those close to warm ocean currents. The southwest coast of Africa is washed by the cold Benguela Currents. While the cold Canary Current washed northwest Africa. These coastlands are dry and have desert conditions. The cold current creates cold conditions around it and this makes condensation take place near the surface. This results in fog rather than rain.

8.1.9. Influence of large water bodies

The Indian and the Atlantic oceans are great sources of moisture, and Lake Victoria is a prominent large inland water body that affects the climate of parts of Africa. The water bodies influence the formation and movement of land and sea or lake breezes. These breezes are local winds around the sea coast or lake shore. A sea breeze is a local wind which blows from the sea to the land. As a result air over land rises and low pressure develops over the land, while a higher pressure develops over the water surface. Since wind blows from high to low pressure, air moves from the sea to the land. This is in the form of wind which is laden with moisture picked from the sea or lake. The moisture condenses on the coast or lake shore resulting in heavy or torrential rainfall especially in the afternoon hours. During the night, both land and sea surfaces lose heat and increasingly get cool. However, the rate of loss of heat is higher over the land surface than over the sea or lake surface. Consequently, higher pressure develops over the land surface owing to the lower temperature, while the pressure over the sea remains relatively lower owing to the warmer water at the higher temperature. The outcome of this pressure difference is the movement of air from land towards the sea in form of a land breeze. As this air blows towards the sea or lake, it displaces warm light air upwards. As the moist air rises, it gradually cools down until at a condensation level, clouds and rainfall form. The rainfall is usually received on the surface of the earth in the early morning hours in moderate to light amounts. Apart from the mechanism of land and sea breeze, large water bodies are sources of moisture which is picked up and transported by winds towards the land. Lake Victoria, for example, re-charges the otherwise dry southeast trade winds as they blow over the water surface. This implies that these winds become moisture-laden again and later gradually cool and the moisture contained in them condenses leading to cloud and rainfall formation. This partly explains the relatively high rainfall amounts over the Lake Victoria Crescent.

8.1.10. Human activities

The people of Africa, like in other parts of the world, have tampered with the natural environment. In the process, they have caused changes in the atmospheric behaviour. Deforestation, swamp reclamation, sinking of boreholes, bush burning and industrialization are some of the activities that have intensified drought conditions in many parts of Africa.

8.2. Explain the size and the shape of Africa?

In terms of size, Africa is one of the earth's largest landmasses. It is covering an area of about 30,335,000 square kilometers. Africa is the second largest continent after Asia. The Equator almost divides Africa into two halves; the northern half extends for about 3800 km northwards, while the southern half extends for about 3800 km south from the equator. While the shape of Africa, the continent has an unbalanced shape. The northern half is wide; spreading out westwards as West Africa and eastwards as the Horn of Africa in the Somalia area. In contrast, the continent is thinner and narrower south of the equator compared to many other landmasses, it is the only continent with a more or less straight coastline. Unlike Europe, North America or South America which have numerous capes and bays, Africa is not as endowed with such coastal indentations.

8.3. Demonstrate the population of Africa?

The people of Africa are black constituted the largest category and effectively dominate Sub-Saharan Africa. They include all the groups of Africa continent. Among them, the Negro people with different languages and they were divided into groups with related languages of Bantu. The Arabs are the dominant population group in North Africa. These related groups of the Afro-Asiatic as they are related to people of which in Middle East part of Asia. There are many non-indigenous people of which European and Asians are perhaps the most numerous. In the past, these immigrants have continued to immigrate into the continent for various administrative, political, economic and social reasons. The size of Africa's population has been steadily increasing, reaching an estimated 1.150 billion people in 2015. However, the continent has the highest birth rate in the world of 37 per 1000. It also has the highest fertility rate, average number of children per women of about 4-9.

8.4. How many independent countries Africa consisted of?

Africa continent consisted of 55 independent countries after South was born in 2011. The countries and territories vary in size. Some of the largest countries on the continent are Algeria and Congo.

8.5. Determine some countries and their areas?

Table8.5: show some countries and their areas (km2):

Country	Area(km2)
Algeria	2.381.741
Democratic Republic of Congo	2.344.885
Sudan	1.886.068
South Sudan	619.745

9. CONCLUSION

In conclusion, factors affecting the climate in Africa to be addressed to the entire learners of the world to equip them with the knowledge of these factors. On the other hand, to explain the size, the shape of Africa Continent. It is also tried to discuss the physical features of Africa such as climate, soil and vegetation. Moreover, the study demonstrated the population and the countries based on their sizes. Also its tries to examine the classification of Africa’s climate in general. Similarly, a lake breeze is a local wind which blows from a lake to adjacent land. This is happens during day time and influenced by the sun’s insolation and the unequal rates of heating to water and land. During the day, the sun’s heat strikes the surface of the earth and both land and sea heat up but land heats up at a faster rate than water.

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