# AKWA IBOM STATE

# A GEOGRAPHICAL PERSPECTIVE

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# 6 CLIMATE CHARACTERISTICS

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## INTRODUCTION

Climate is one of the many factors that impinge upon the life of man in the environment and man reacts or responds to these impingements. The impact of weather and climate on man has always been of enormous significance. All around us, everyday and in almost all that man does, climate plays a part, often the part is an important one. Many of the activities of man and his behaviours are influenced by one or more elements of climate. Today, in spite of increased knowledge and technology, man's dependence on weather is not reduced. Climate is relevant to agriculture, water resources, aviation, road transport, shipping, building design and construction, industries, sport and health. If man is to respond intelligently to the complex environment he has found himself a knowledge of climate is necessary. A thorough understanding of climatic processes will allow for accurate planning, and little can be planned for the future with success if the climatic environment is neglected.

Climate should also be regarded as a resource like water, and soil, gold, diamond oil and cocoa or people (Oguntoyinbo 1987). This chapter therefore tries to explore the climate characteristics of Akwa Ibom State. Attempts will be made to assess the various climate parameters of which relevant records are available, their variation in time and season and their effects on the environment in general.

**RAINFALL:** In the tropics, it is the rainfall parameter that is most frequently discussed of all the climatic variables. The reason for this may not be far fetched. Rainfall is the most important single climatic variable in a situation of near uniformity in temperature within this environment. The presence or absence of rainfall, its reliability and seasonality, its scarcity all affects not only crop production but also most, if not all of the other activities in the natural environment.

Rainfall comes as a result of an uplift of air, where condensation takes

place producing clouds with subsequent rainfall. The cause of the uplift has been used in the classification of rainfall into three major categories as follows.

(a) **Convectional Rainfall:** This is caused by the heating of the ground and the rising of moist tropical air. It is common in the afternoons. This type of rainfall varies with season. In Akwa Ibom, this is common during the dry season, when the intensity of isolations is high. The rainfall here will be intense but of short duration.

(b) **Orographic or Relief Rainfall**: This is the type of rainfall resulting from the forced uplift of air as a result of its contacts with a highland. The forced air rises and cools as a result of the loss of heat. In Akwa Ibom State, this type of rainfall is not common since the elevation of the area is almost flat with little elevation in the northern part.

(c) **Frontal Rainfall:** There are three major air masses which interact with one another in Akwa Ibom State. They are the Warm Dry Tropical Continental (WDTCA). Airmass from the Northern part of the country and the Warm Wet Tropical Maritime Airmass (WTMA) from the Atlantic Ocean south of the country. The third is the Cool Dry Equatorial Easterlies which blows in the upper layer from East to West. The meeting of the two contrasting WDTCA and WWTMA airmasses will result in a front popularly known as the Inter Tropical Zone of convergent (ITZC). An uplift of one usually the lighter will result in condensation and then subsequently rainfall. In Akwa Ibom State, a significant proportion of the rainfall is as a result of this. Frontal rains are associated with lightening and thunders and usually occur late in the afternoon, at the beginning and end of the raining seasoning when the maritime air mass is less deep.

**Seasonal Distribution of Rainfall in Akwa Ibom State:** Rainfall in Akwa Ibom is dependent on the location of the ITZC. In January when the Front (ITZC) is at about $8^{\circ}$ N of the Equator, Akwa Ibom experiences frontal rainfall. This is the period when the Warm Dry Tropical Continental Airmass usually referred to as the North Easterly winds flow into most of the country. Due to the reduced quantity and distribution of rainfall during this period, it is often referred to as the Dry Season. There is no time (month) of the year that Akwa Ibom State does not receive this frontal rainfall on the average. The only variation is in the quantity.

**Table 6.1: MEAN MONTHLY RAINFALL FOR UYO (mm)**

| Month | J | F | M | A | M | J | J | A | S | O | N | D | ANN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean monthly rainfall | 35 | 71 | 136 | 230 | 277 | 323 | 347 | 290 | 392 | 270 | 169 | 38 | 2581 |
| No of days of Rainfall | 3 | 4 | 12 | 13 | 15 | 19 | 22 | 21 | 22 | 20 | 10 | 4 | 165 |

***Source: computed from Data of Agro-met slate UNIUYO***

From table 1, it is clear that there is no month in a year that Akwa Ibom State does not receive rainfall on the average. The only variation is in the quantity of rainfall received. The period around January is predominated by Warm Dry Tropical Air mass. However, convectional rainfall still occurs in this area. In July, the ITZC moves to around 21° N. This is farther north of Akwa Ibom resulting in the influx of the Warm Wet Tropical Airmass commonly called the South West Trade winds. This moist airmass produces a lot of rainfall. This is the period usually referred to as the rainy season, a period of about eight months.which comes between March and October. It is worth noting here that there is a gradual steady increase in rainfall from January until the peak in the month of July and September. Thereafter, there is a drastic and rapid drop in the quantity and frequency of rain till December (Table 1).

The seasonality index computed for Uyo using rainfall figures of ten years (1978 – 1987) indicates that the rainfall regime in Uyo is rather seasonal with a short dry season. Table 2 shows seasonality and variability indices computed for ten years after Walsh and Lawler (1981).

**Table 6.2: Rainfall Seasonality and variability indicates**

| Year | Seasonality | Variability Indices |
|---|---|---|
| 1978 | 0.51 | -0.2 |
| 1979 | 0.60 | 0.2 |
| 1980 | 0.55 | 0.2 |
| 1981 | 0.60 | +0.0 |
| 1982 | 0.60 | -0.3 |
| 1983 | 0.52 | -0.2 |
| 1984 | 0.61 | -0.2 |
| 1985 | 0.61 | -0.2 |
| 1986 | 0.61 | -0.3 |
| 1987 | 0.71 | 0.6 |

***Source: After Walsh and Lawler (1981).***

Scale of rainfall in Akwa Ibom can be described as rather seasonal with a short dry season. There has been a marked increase in the seasonality of rainfall over the years as the figure above indicates. In other words it appears that rainfall has a tendency of getting more seasonal over the years. The last seven years, except 1983, indicates a highly seasonal pattern of rainfall. This could be taken to mean that there is a changing pattern in rainfall regime over Akwa Ibom State. This may be attributed to increased urbanization of the state and other anthropogenic factors.

However the period under consideration is so short to merit a solid conclusion. This situation requires more research and continuous observation over the years to come.

The monthly rainfall indicates that in Akwa Ibom State, the wet season is from March to October interrupted by the "little dry season" in August usually referred to as "August break".

This little dry period is as a result of inversion in Tropical maritime which does not allow the rise of moist air (Monanu 1975). However it is worth noting that in Akwa Ibom State there is no dry August rather a slight decrease in the already heavy rainfalls.

## VARIATION OF RAINFALL REGIME IN AKWA IBOM

Rainfall variability has been accepted as a good parameter to estimate the reliability of rainfall over any area within a specific time. Rainfall variation refers to the change that occurs in rainfall totals received in any location. In other words the differences that occur in time over the total amount of rainfall in a given environment. Using daily rainfall records collected over a Twenty year period (1978 – 1998) the average variability of rainfall was computed for Uyo using the average variability index (AVI). The values are as show in Table 2.

From the table, rainfall variability in Uyo is as low as -2. In other words, rainfall in Uyo does not deviate much from the mean amount that is usually received. In practical terms, therefore, rainfall in Uyo and in Akwa Ibom State is reliable.

**TOTAL ANNUAL RAINFALL:** The total annual rainfall of Akwa Ibom is high. This emphasizes the effect of the all year round influence of the South West Winds. The average annual rainfall total is about 2500 mm.

It is worth noting that rainfall records are available for a consistent period for only one station in the State. The mean monthly rainfall and the average number of rainy days per month are given in the Table 1.

**TEMPERATURE:** Temperature is a relative term implying the degree of molecular activity, or heat, of a substance or object. Due to its locational disposition, Akwa Ibom State receives abundance of isolation. There is constant and abundant insolation. The sun's ray is received at an angle that is almost vertical, so the intensity is high. The mean monthly sunshine hours is almost constant throughout the year. The only variation being the intense cloud cover which affects the direct sunshine hours. It is worth mentioning, that despite the near constant isolation there are factors that modify the actual temperature of the environment. Among them are cloud cover, high rainfall and high humidity.

**AIR TEMPERATURE:** Atmosphere temperatures within the State are continually high and only changes slightly within the year. The mean daily maximum temperature is about 27° C all through the year. The highest temperatures are recorded between February and April but they do not usually exceed 37° C. Within the State, the variation in temperature is not much but the coastal regions experience lower temperatures generally because of the moderating effects of the ocean. The mean annual maximum temperature for Uyo is about 28°c.

The mean daily minimum temperatures decrease from the coastal areas towards the interior of the state. Generally the mean annual temperature is above 23°c and does not exceed 29°c. Over the entire region the mean annual temperature ranges between 27°c and 28°C.

**DAILY MARCH OF TEMPERATURE:** The daily march of temperature is a direct result of the balance between incoming solar radiation and the outgoing long wave radiations in the twenty four hour of the day. Daily and seasonal march of temperatures show more significant variation than the annual temperature mean. In Akwa Ibom it is cold in the morning especially in the harmattan months of December and January. It is hottest in the early afternoon, warm in late afternoon and cold in the night.

**SEASONAL MARCH OF TEMPERATURES:** The temperature pattern over Akwa Ibom exhibits some seasonal pattern. The transition months between the wet and dry seasons are the hottest of the months. February through April, by records, is the hottest months especially in years that rainfall commencements are delayed. This is because the full impact of the South West Winds are not yet felt within these months and the cloudless skies allow for the full impact of insolation to reach the surface at this point in time. April through October is colder. This is

as a result of the rains. The effect of the S. W. Wind is strong at this time producing enormous rainfall in this zone. This, with the heavy cloud covers reduces the temperature during this time. The coldest month is August and despite the reduced amount of rainfall, the heavy cloudiness makes this rainy season the coldest.

**TABLE 6.3: MEANS MONTHLY TEMPERATURE IN UYO**

| | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max | 31.7 | 33.5 | 33.1 | 32.1 | 31.1 | 30.2 | 28.6 | 28.3 | 29.0 | 29.9 | 30.7 | 31.3 |
| Min | 22.4 | 23.7 | 24.1 | 23.9 | 23.6 | 23.3 | 23.2 | 22.7 | 22.4 | 23.0 | 23.1 | 22.6 |

***Source: Agrometeorological station – University of Uyo***

In conclusion, it is worth remarking that due to the influence of the sea (proximity to ocean), the seasonal March of temperatures is not so conspicuous in the coastal environment. The effects and import of the hamattan winds are not long enough in the coastal areas to make any serious impact. The sea breeze helps to moderate seriously the high temperatures at other times.

The daily temperature range is higher than the annual range or seasonal variation. The average daily range of temperature is about 5°C while the annual range is about 1°C. However the interior region has higher temperatures and therefore has higher annual ranges of temperature.

**RELATIVE HUMIDITY (RH):** Relative Humidity is the commonest way to express the water contents of the air. In other words, it is a measure of the dampness of the atmosphere. The proportion of water vapour in the air compared with the maximum it can hold at the same temperature and pressure is known as Relative Humidity. It is always expressed in the form of a ratio, fraction or percentage.

**DAILY VARIATION IN R.H:** In Akwa Ibom State Relative Humidity, as indicated by records, fluctuates through a wide daily range. This is generally a reverse of that of temperature since hourly Relative Humidity is largely a function of temperature. The highest values of Relative Humidity are recorded in the morning when temperature is low, usually between 90 – 95%. In the afternoon when temperature increases, the relative humidity decreases and reaches a minimum of 50 – 60% by 4.00pm. Thereafter it begins to rise gradually.

**SEASONAL VARIATION IN RELATIVE HUMIDITY:** Seasonal variation in R.H is strongly influenced by the humidity characteristics of the major airmasses affecting this area. In January, when temperature is high, relative humidity is low because the wind affecting this region during this time is the Dry Continental Airmass. As from April Temperature decreases while Relative Humidity rises steadily and reaches maximum in June and September. During this time Temperature reaches minimum. The high Relative Humidity at this time is due to the influence of the humid maritime Airmass (the South Westerly Winds).

From the months of September to November, the Relative Humidity decreases and by December the low Relative Humidities are again accompanied by high temperatures. However it is worth mentioning that the coastal areas have a higher Relative Humidity of well over 90%. The mean annual Relative Humidity therefore decreases from the coast towards the interior reflecting the effects of the maritime. In the coastal areas the Relative Humidity is high throughout the year because of influences of the large body of water which increases evaporation.

**TABLE 6.4: MEANS MONTHLY RELATIVE HUMIDITY**

| Month | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RH | 60 | 68 | 67 | 70 | 74 | 75 | 79 | 83 | 81 | 78 | 72 | 62 |

***Source: Agro meteorological station – University of Uyo.***

The mean annual Relative Humidity decreases steadily form the coasts towards the in land as a result of the influence of the ocean.

**WIND:** Akwa Ibom State lies between equator 0° and latitude 6° N it is also significant that the Inter Tropical Discontinuity (ITD) always remains above the coastline. This fact helps to explain the general distribution of Wind over the area. The movement of the ITD helps in determine the months of rainfall over the area at a particular time of year. In January the ITD lies South and the influence of North East Trade winds are felt even to the coastline. This is what is referred to as the harmattan period. This situation changes in July when the ITD moves northward in response to the apparent movement of the sun. The south west wind becomes dominant and because it is maritime, it is vapour laden. This results in the heavy rainfalls of this period. These are the two important airmasses or Wind system that are predominant in this region. However, it is worth mentioning that because of its closeness to the equator there is this upper airmass called Equatorial Easterlies which occasionally reaches down to the surface. It is this Wind that is

responsible for line squall which predominates this area during the transition months, from dry to wet season and from wet to dry season. This wind system is responsible for most of the destructions that usually decure at the onsets and cessation of the rains.

1. The long dry season
2. The long wet season
3. The short dry period
4. The short wet season.

The long dry season lasts from November till early March. The long wet season begin in late march till early August. The short dry period which last for at must two weeks is within August. The short wet season then begin in late August to October.

It is worth mentioning that the onset of the rains is always gradual but the cessation is sharper. The most prominent factor in the climate of Akwa Ibom State is therefore the rainfall pattern. This is determined by the predorminant airmass characteristic of the region. Therefore the predominant airmass characteristic determines the weather and climatic characteristics.
Akwa Ibom State can therefore be classed under Tropical Humid climates.

**Climate and Flooding**

Akwa Ibom State falls within the sub-equatorial climate belt with an annual rainfall of about 2500mm (Uniuyo, 1999). The rainy season usually begins from March to November and is characterized by heavy flooding and severe erosion.

The topography of Akwa Ibom State presents a characteristically flat to gently sloping terrain with poor drainage system. With a near flat land surface in the State, rain-water easily collects on the surface to depths of over 30cm in several parts, thus rendering those areas impassable. Some of the rain water percolates through the soil; some dries up through evapotranspiration while some drains into the valley of water courses in form of run-off which causes street erosion. Uyo currently experiences severe cases of flooding in almost all part, in the rainy season.

**Effects of Climate on Leaching**

Akwa Ibom State is characterized with 9 months (March – November) rainy period in a year. The intense rainfall events and increases leaching rate in well drained soils with high infiltration rate. This causes flooding and water salination,

hence reduces organic matter decomposition in the soil. Leaching gives rise to greater amount and frequency of runoff on soils in sloping terrain with sedimentation down slope and worse downstream. It also increases chances of mass movement in the form of landslide or mudflow in certain soft sedimentary rocks.

Increase leaching aid the rapid process of chemical mineralogical change under changing external condition which leads to loss of salt and nutrient. Hydrolysis and cheluviation may be accelerated by increased leaching rates.

**Effects of Climate on Vegetation**

Variation in vegetation exists mainly due to variability in climate, geomorphology and soil. These factors interact to influence the distribution of vegetation in Akwa Ibom State. The vegetation of the State falls within tropical evergreen forest. Climate is perhaps the most critical factor in vegetation. Individual plants species require specific climate conditions for their survival. Some plants and trees can only grow in certain climate condition. This is an indication that both precipitation and temperature regime are important factors in the development of vegetation regimes. The spatial pattern of climate and the spatial pattern of vegetation are very close to one another. Akwa Ibom State is in the region that has rainforest climate. Rainfall surpasses 80 inches per year (200cm), relative humidity exceeds 75 percent throughout the years and temperatures are warm enough to promote rapid growth of vegetation. The distribution of agricultural crops in Akwa Ibom State is high influenced by climate. Tubers like cassava and yam are well grown in the State because precipitation is sufficient to support these crops.

**Effects of Climate on Erosion**

The heavy rainfall in Akwa Ibom State influence the way that agriculture is conducted, and of all the climate elements, rainfall appears to be of greatest significance. Torrential rains also create challenges for other areas of life. The most pervasive problem related to heavy rainfall is erosion. Erosion not only affects farmers, it also impacts the built environments of humans. For example, many roads are seriously impacted by the heavy rainfall experienced in Akwa Ibom State. It is difficult to maintain road because of the ravages of the rainy season. Roadways with poor drainage/low carrying capacity often experience erosion and surface damage. This occurs when water socks and erodes the soil underneath paved roads. After the lower soil layer is eroded, pavement collapses and crumbles away.

Erosion has affected many building and residences in cities and rural areas, especially areas without adequate drainage infrastructure, water can quickly erode a household's front yard or building foundation. In University of Uyo for example, erosion has damaged a very reasonable area of land, because it is more vulnerable to heavy rains. In Nigeria it has been estimated that millions of hectares of cultivated land are lost to erosion.

**Evaporation**

Evaporation is a critical component for the water cycle, which is responsible for clouds and rain. Solar energy drives evaporation of water from oceans, lakes, moisture in the soil, and other sources of water. Evaporation is one of the two forms of vaporization. It proceeds more quickly at higher temperature, at higher flow rate between the gaseous and liquid phases and in liquid with lower surface tension (i.e. higher vapor pressure). In Akwa Ibom State, the location is well disposed to receiving abundant of insolation hence, the thermal motion of molecule of liquid is sufficient to overcome the surface tension to evaporate, that is, its kinetic energy exceed the work function of cohesion at the surface.

Evaporation and evaportranspiration constitute a major factor in hydrology and climatology as well as in such diverse fields as agriculture, foresting and reservoir management. The rate of evaportranspiration is subject to two major contents: the availability of moisture at the evaporating surface and the ability of the atmosphere to vapoarize the water and remove the vapour. When there is an increased of evaportranspiration, net upward movement will be increased resulting in salination.

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