

NIGERIA CLIMATE REVIEW BULLETIN 2010



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FOREWORD

Climate change is global phenomenon. Its impacts in form of extreme and unusual weather phenomenon are evident in every country. The increasing frequency and intensity of these extreme weather events, and the associated natural disasters are a challenge to mankind. They constitute a major threat to socio-economic development programmes in every country. The United Nations Development Programme (UNDP) now recognizes that the attainment of the Millennium Development Goals (MDGs) by the target date of 2015 is endangered by climate change. According to the UN Secretary-General Ban Ki-Moon, "it is clear that improvements in the lives of the poor have been unacceptably slow, and some hard-won gains are being eroded by the climate, food and economic crises, "in particular the UNDP is concerned that agricultural production and food security, access to clean and abundant water resources and gainful employment that underpin the solution to extreme poverty and hunger are vulnerable to climate change.

Nigeria is part of the global community and therefore not immune to the impacts of climate change. Just like the MDGs, our Vision 20: 2020 may also be at risk if Climate Change adaptation and mitigation strategies are not put in place. Therefore, there is need for adequate understanding of past, present and future climate trends to enable policy makers manage our changing climate and mainstream climate information into our national and global development plans. This implies that climate risk information derived from analyses of Nigerian climate data need to be integrated into our national planning and decision-making. Such integration should encompass both the challenges that climate extremes pose and the opportunities climate change presents, especially those associated with the green economy, as a pathway for sustainable development. It is in the light of this concept that NIMET publishes the ***Nigeria Climate Review Bulletin*** annually to assess the climate of the previous year and also to bridge the gap between climate and socio-economic development. The publication compliments the ***Seasonal Rainfall Prediction*** which NIMET also presents to the public at the beginning of each year.

The review of the climate over Nigeria in 2010 has shown that warmer than normal conditions prevailed over greater parts of the country especially in the north and central states. The outbreak of Cerebrospinal meningitis that was reported in states like Kaduna, Bauchi, Jigawa Gombe, Zamfara, etc, may have been associated with the above normal temperatures in those parts of the country.

Rainfall amounts in the year over the country were generally higher than long term mean values except in places in and around Kwara State, leading to floods and opening of dams. These extreme events led to dislocation of families, destruction of farmlands, infrastructure and loss of lives. In particular, the above normal rainfall in the northwest areas of Sokoto and Jigawa states was quite significant because it occurred at critical stages of crop development.

If the present trend of Climate variability continues, it is likely that the frequency and intensity of weather related disasters may increase in the years ahead. It is therefore critical that extreme weather/climate events such as storms, floods and droughts are predicted as accurately as possible in a timely manner. It is equally important that climate trends are monitored closely and necessary disaster risk reduction strategies put in place to safeguard lives and property of Nigerians.

The Nigeria Climate Review Bulletin is an authoritative source of information on contemporary climate over Nigeria. It is based on empirical observations and data collected from NIMET's network of meteorological stations spread across Nigeria. Climate scientists and policy makers will no doubt find it useful for research as well as policy formulation and implementation for socio-economic development of the country and the benefit of the Nigerian public.

Dr. Anthony C. Anuforum

Director General/CEO & Permanent Representative of Nigeria with WMO

1.0 INTRODUCTION

Extreme weather and climate events have constituted serious threat to global economic growth over the past few years, especially to the socio-economy of developing nations. In Nigeria, severe floods, windstorms, heat waves and several other extreme weather and climate events have impacted negatively on its socio-economy and many people have been affected physically and psychologically. However, in fulfillment of its mandate in monitoring weather and climate and providing early warning advisories, NIMET is taking far reaching steps in contributing to the mitigation of these harsh weather impacts on the ordinary people and lending support to the sustainable development of the country.

The seasonal northward and southward oscillatory movement of the Inter-Tropical Discontinuity (ITD) largely dictates the weather pattern of Nigeria. The moist southwesterly winds from the South Atlantic Ocean, which is the source of moisture needed for rainfall and thunderstorms to occur, prevail over the country during the rainy season (April – October). In reverse, northeasterly winds which raise and transport dust particles from the Sahara Desert prevail all over the country during the harmattan period (November – March). The overall changes in temperature, rainfall and other meteorological parameters determine the changes in climate in the country each year.

The 2010 Climate Review bulletin presents scientific information on the magnitude, departures from long term conditions and trends in maximum and minimum temperatures, incident solar radiation, dust haze, rainfall amount and distribution. This edition also gives insight into some abnormal and extreme weather occurrences in the country in the year.

A good number of places in the country, especially in the north, experienced record flooding due to a combination of above normal rainfall during the year and the collapse of some dams. The “August Break’ (Little Dry Season) usually experienced in the southwest was less pronounced unlike in recent years. The temperature analysis also revealed that almost the entire country was warmer than normal during the year under review.

This bulletin would be useful to scientist, climate risk managers, policy makers and the general public.

2.0 SYNOPTIC FEATURES

2.1 SURFACE PRESSURE

The characteristics of weather systems over West Africa are usually driven by the pressure and wind systems whose dynamics depends on the surface pressure systems over North Africa and over the South Atlantic Ocean.

During the first quarter of the year, the surface pressure over North Africa remained high most of the time as it fluctuated between 1024 - 1032hPa which caused the surface pressure values over the country to remain between 1012 and 1015hPa. This pressure build up resulted in the lifting of dust particles into the atmosphere over the Sahara Desert and the Sahel regions and the subsequent southward transport of the lifted dust particles into the country. The resultant effect was the occasional reduction in horizontal visibility to less than 1000m in parts of the country.

At 1,500m above the earth's surface, the northeasterly winds dominated the flow pattern but moist southwest winds with speeds of 10-20m/s (20-40knots) influenced the flow at lower levels except during periods when spells of dust haze prevailed.

The second quarter witnessed the beginning of the seasonal weakening of the Saharan high and this resulted in further northward incursion of moist southwest winds from the South Atlantic Ocean into the northern parts of the country. The increase in the depth of moisture at 1,500m continued into the third quarter. By the end of September, the winds at this height penetrated inland to reach an average position of latitude 15.3⁰N.

Strengthening of the Saharan high pressure system began at the beginning of the fourth quarter. This led to the prevalence of northeasterly winds over the country and the subsequent onset of the harmattan dust haze season in the country.

2.2. INTER-TROPICAL DISCONTINUITY (ITD)

The Inter-Tropical Discontinuity (ITD) in 2010 was located at an average position of latitude 7.9°N in January. It then oscillated northwards to reach a northernmost position of latitude 20.9°N in August. Thereafter, the ITD began its seasonal southward movement to reach latitude 7.8°N in December (Fig. 1).

The decadal movements and average monthly positions of the ITD were, in most cases, above normal but lagged behind long term conditions in April and December (Fig. 2) but were near normal in May and November. The higher than normal ITD positions accounted for the high rainfall in many cities across the country, particularly in the north.

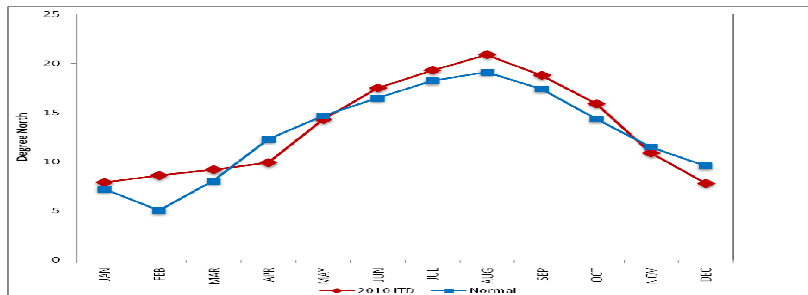


Fig. 1: ITD Positions in 2010 and normal

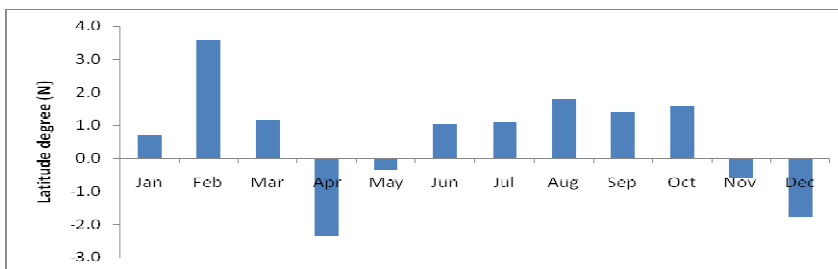


Fig. 2: ITD Position Anomaly in 2010

2.3 EL NINO AND GLOBAL CIRCULATION

The moderate to strong El Niño conditions at the beginning of the year (Table 1) was a continuation of the El Niño conditions that started in June 2009. The conditions quickly developed into La Niña conditions in June/July 2010, following the dissipation of the 2009/2010 El Niño in May. These La Niña conditions strengthened till the end of the year.

Unlike many El Niño or La Niña events that have unequal contributions from the oceanic and atmospheric components during onset, this event featured strong ocean-atmosphere coupling since its initial development in June, following a strong initial spell of enhanced trade winds in the western equatorial Pacific in May. By August the event had become moderate to strong and became slightly stronger by December.

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Anomaly (°C)	1.7	1.5	1.2	0.8	0.3	-0.2	-0.6	-1.0	-1.3	-1.4	-1.4	-1.7

Table 1: 2010 Sea Surface Temperature (SST) Anomalies

3.0 TEMPERATURES

3.1 MAXIMUM TEMPERATURE

Mean maximum temperatures across the country ranged between 31.1 – 42.6°C during the hot season (Fig.3). The highest temperature range of 40.0 – 45.0°C was recorded over the northeast and northwest zones of the country. The hottest areas included Maiduguri, Potiskum, Sokoto, Nguru and Yola. The extreme coastal areas, and Jos and its environs recorded the lowest temperatures in the range of 30.0 – 32.0°C, while other areas recorded 35.0 – 40.0°C maximum temperature in the season.

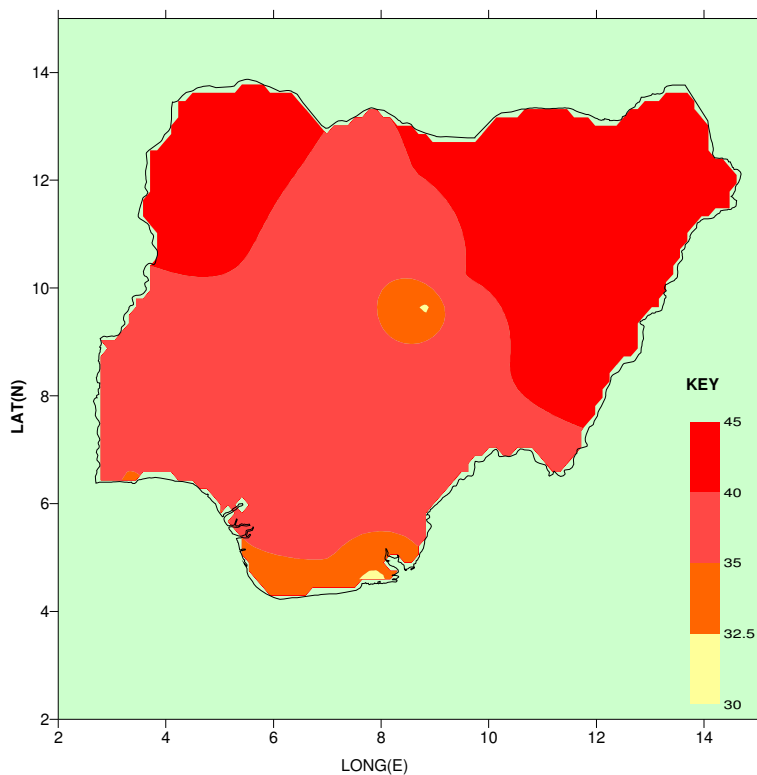


Fig.3: Maximum Temperature

3.2 MAXIMUM TEMPERATURE DEPARTURES

Warmer than normal maximum temperatures prevailed over most places in the country with high positive values between 1.9 – 2.9°C over Yelwa, Bauchi, Maiduguri, Potiskum and Ogoja (Fig.4). However, colder than normal weather conditions were experienced in a few places especially over Eket that recorded negative maximum temperature departures as low as 2.4°C.

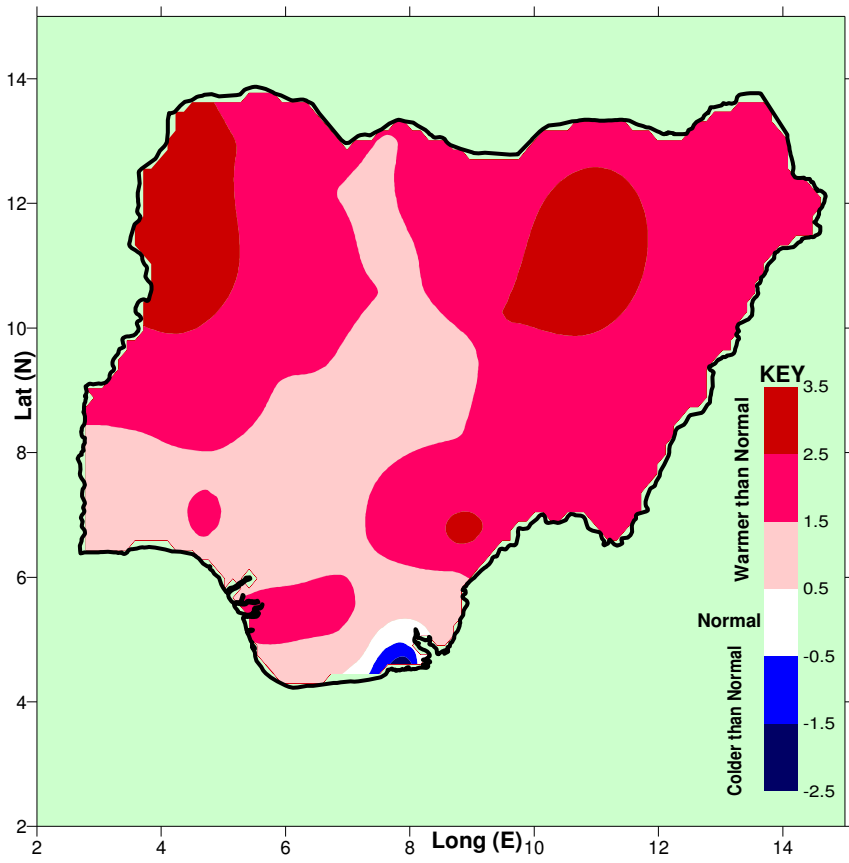


Fig.4: Maximum temperature departures from 1971 – 2000 normal

3.3 MINIMUM TEMPERATURE

Monthly minimum temperatures ranged from 11.1 - 19.2°C over the north and central areas of the country, with the coldest areas located around Postiskum, Jos, Maiduguri, Kano and Kaduna. The southern region recorded minimum temperatures ranging from 20.0 to 24.1°C (Fig. 5).

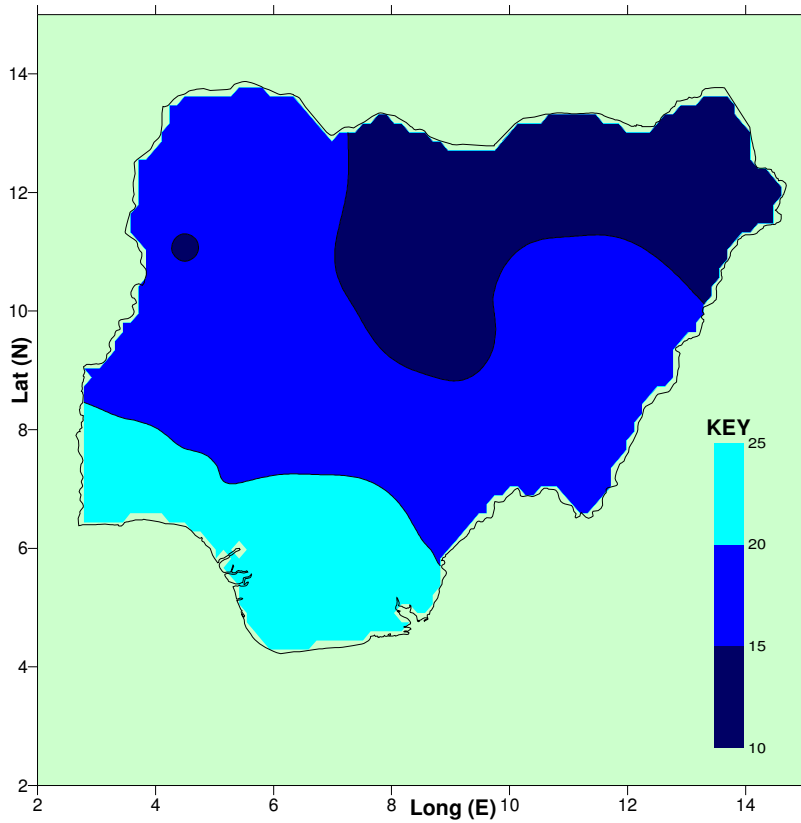


Fig.5: Minimum Temperature

3.4 MINIMUM TEMPERATURE DEPARTURES

Minimum temperatures during the cold season (January) were 0.5 – 1.5°C warmer than normal over most parts of the country with places such as Eket, Enugu, Gusau, Ibadan, Oshogbo, Owerri and Ikeja recording values which were 2.0 – 3.1°C warmer. On the other hand, Ibi, Yelwa, Jos and Kaduna were 0.8-1.8°C colder than normal (Fig.6).

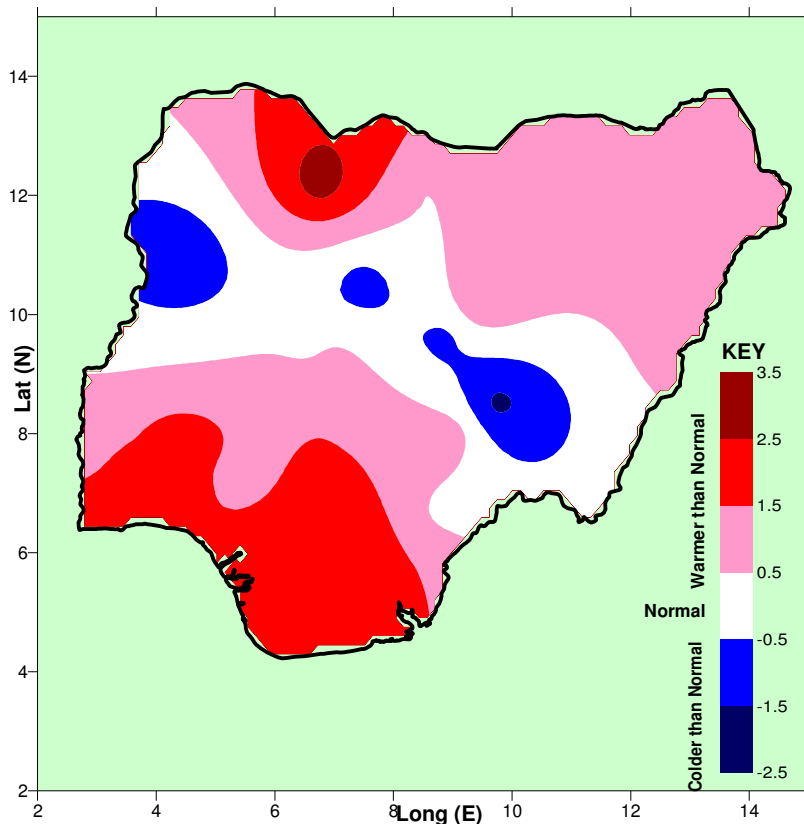
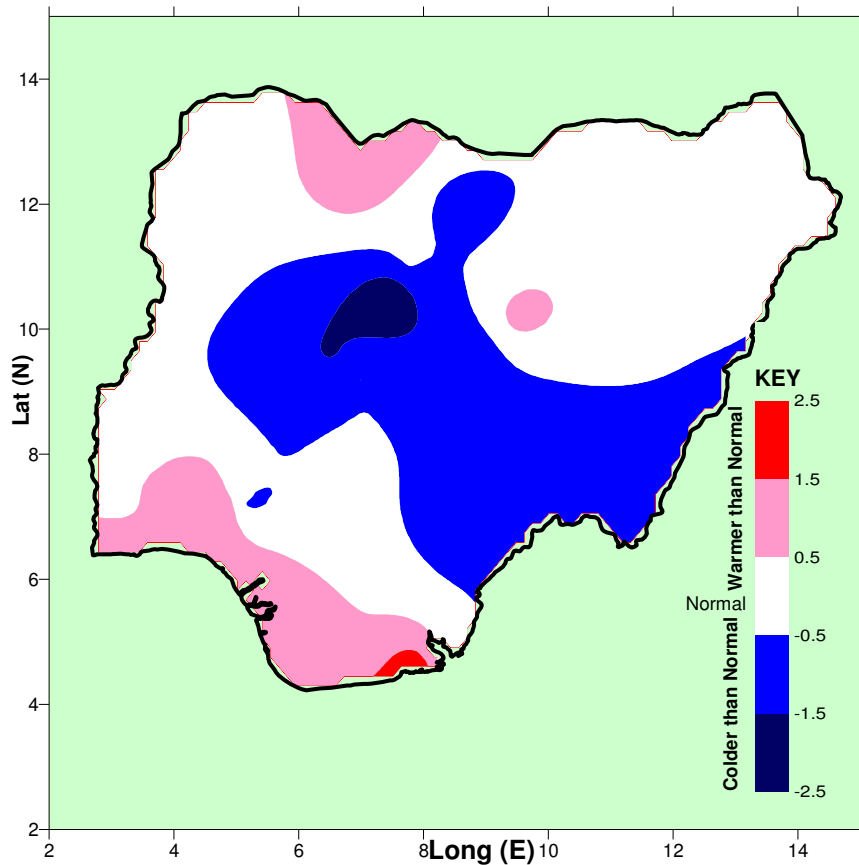


Fig. 6: Minimum temperature (January 2010) departure from normal (1971 – 2000)

Also, the minimum temperatures in December (cold season) indicated colder than normal conditions over most parts of the central states with Kaduna recording 2.2°C colder than normal temperature (Fig.7). However, temperatures in the extreme southern cities and Katsina were 0.5 – 2.7°C warmer than normal conditions. Elsewhere, minimum temperatures during the cold season were normal.



**Fig.7: Minimum temperature departure (December 2010)
from 1971 – 2000 normal**

3.6 MEAN TEMPERATURE

Mean temperature analysis over Nigeria showed that the year was warmer than the 1971-2000 normal and slightly warmer than year 2009 (Fig.8). Almost all parts of the country had mean temperatures higher than the 1971-2000 normal except along the Abuja-Kaduna-Jos axis in the central area and Owerri-Eket axis in the southeast area which had normal mean temperatures.

Mean temperature departures between 1.0 – 1.5° C were observed over the northeast, coastal areas of the southwest extending up to Yenagoa and around Lokoja in the central area.

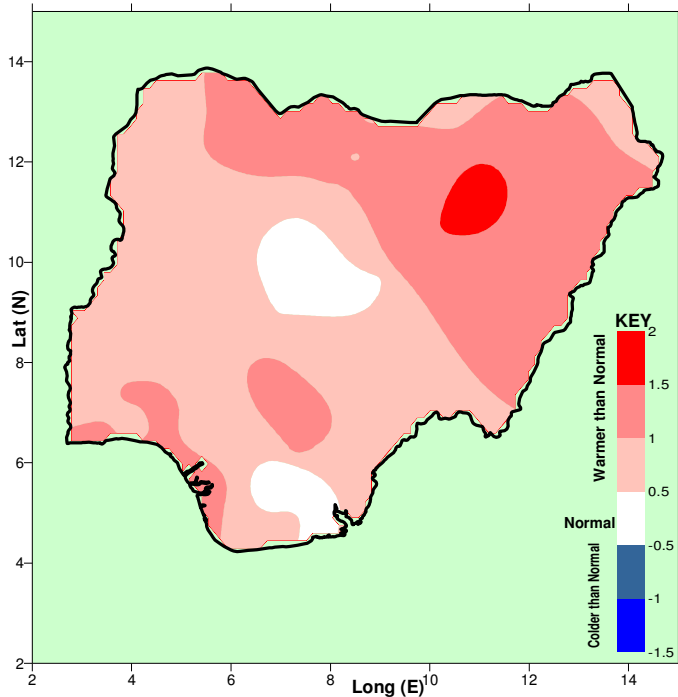


Fig. 8: Mean temperature departure from 1971-2000 normal

The first half of the year was found to be generally warmer with average monthly mean temperature departures ranging between 1.0 – 1.6°C. February had the highest departure of 1.8°C followed by January (1.5° C). The extreme north and northeastern parts of the country were observed to be warmer than other parts of the country with departures ranging from 1.0 – 1.5°C. Potiskum had the highest departure of 1.6° C followed by Bauchi (1.4° C).

4.0 SOLAR RADIATION

The mean incident solar radiation in February across the country varied from 15.0-18.0Wm⁻²day⁻¹ over the coastal area to between 25.0-30.0Wm⁻²day⁻¹ over the north (Fig. 9). It ranged between 20.0-25.0Wm⁻²day⁻¹ in the inland of the south and the central region.

The lowest incident solar radiation of 18.2Wm⁻²day⁻¹ was recorded over Ondo while Gusau had the highest value of 27.9Wm⁻²day⁻¹. The central states, southwest and parts of the southeast recorded values between 20.0- 25.0Wm⁻²day⁻¹. The coastal areas and the inland of the southeast recorded incident solar radiation between 18.2- 20.0Wm⁻²day⁻¹.

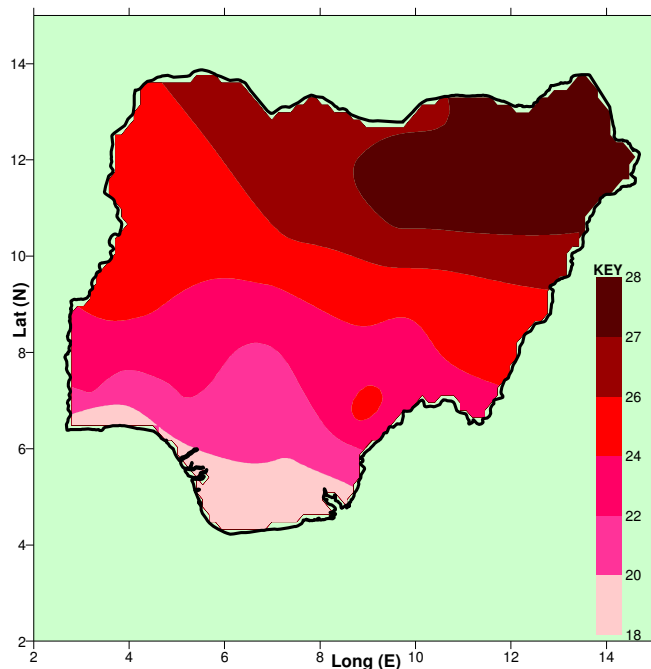


Fig. 9: Incident Solar Radiation in February 2010

5.0 RAINFALL

5.1 CUMULATIVE RAINFALL

The annual cumulative rainfall is shown below (Fig. 10). Rainfall amounts of 300 – 1000mm were recorded in the northeast, parts of Katsina and Kano in the northwest and Ilorin in the central region. The entire southeast and parts of Akure, Benin, Ijebu Ode and Oshogbo in the southwest had 2000 – 3000mm of rainfall in the year. The rest of the country experienced rainfall between 3000 – 4500mm. The highest cumulative rainfall amount of 4224.0mm recorded at Eket is about

269.3mm less than the 2009 record high at the same station. Nguru, like in the year past, recorded the lowest rainfall of 447.8mm.

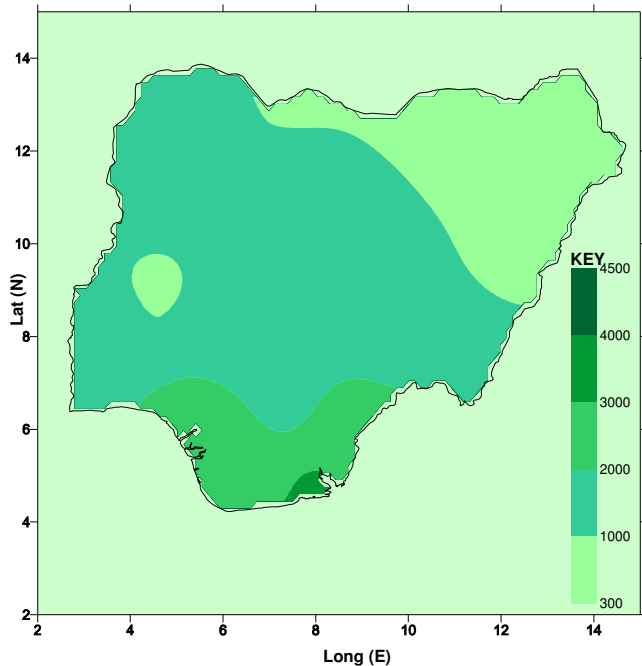


Fig. 10: 2010 Cumulative Annual Rainfall

5.2 RAINFALL ANOMALY

Wetter than normal conditions were experienced in the extreme northeast, northwest and cities such as Bauchi, Jos and part of Minna in the central states (Fig. 11). Other areas that recorded wetter than normal rainfall conditions included southwest and Ogoja, Calabar and Eket in the southeast. Isolated case of drier than normal rainfall was recorded at Ilorin. The rest of the country had normal rainfall.

In the last three years, the extreme northwest had experienced drier than normal rainfall condition but became wetter than normal in year 2010

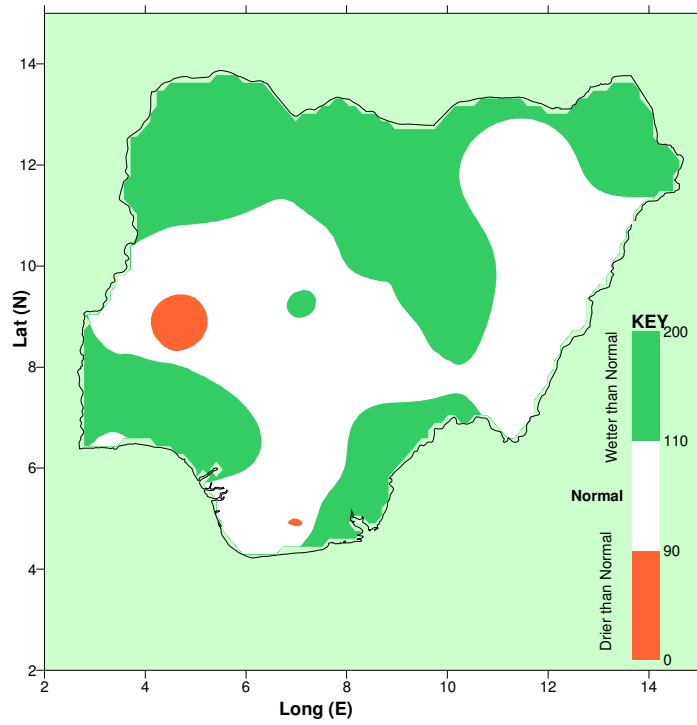


Fig. 11: 2010 Rainfall Anomaly

5.3 AUGUST RAINFALL ANOMALY

August is usually the peak of rainfall in the north with the ITD reaching its northmost position. Wetter than normal rainfalls were recorded over the eastern half of the country and parts of the central states (Fig.12). Ikeja, Ondo and Ibadan in the southwest recorded between 200 – 300 percent above normal rainfall which was the highest in the year.

Drier than normal rainfall was experienced over places such as Maiduguri, Yola, Bauchi, Abuja, Lokoja, Makurdi, Enugu and Port-Hacourt . The rest of the country had normal rainfall in August.

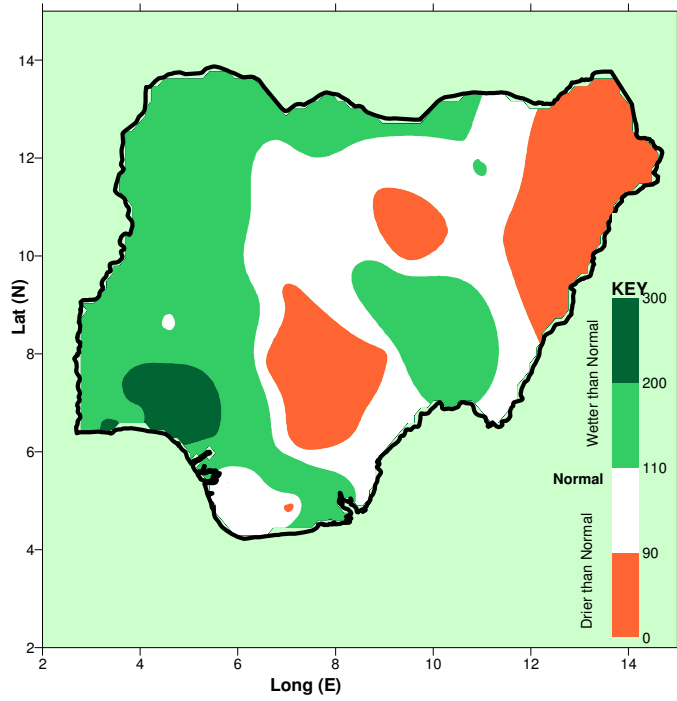


Fig. 12: September Rainfall Anomaly

5.4 RAINFALL MONTHS

Analysis of the months which had total rainfall not less than 50.0mm showed a generally near normal condition across the country. The departures of rainfall months from the 1971-2000 normals as shown below in Fig. 13 however depicts upto 2 months longer rainfall months in 2010 over the extreme northern part of the country and isolated inland of the southwest. On the other hand, a few places in the eastern sector of the central region had about 2 months shorter rainfall.

The higher rainfall months noted above, coupled with flash floods and weak infrastructures greatly contributed to the reported wide spread flooding experienced in the region during the year.

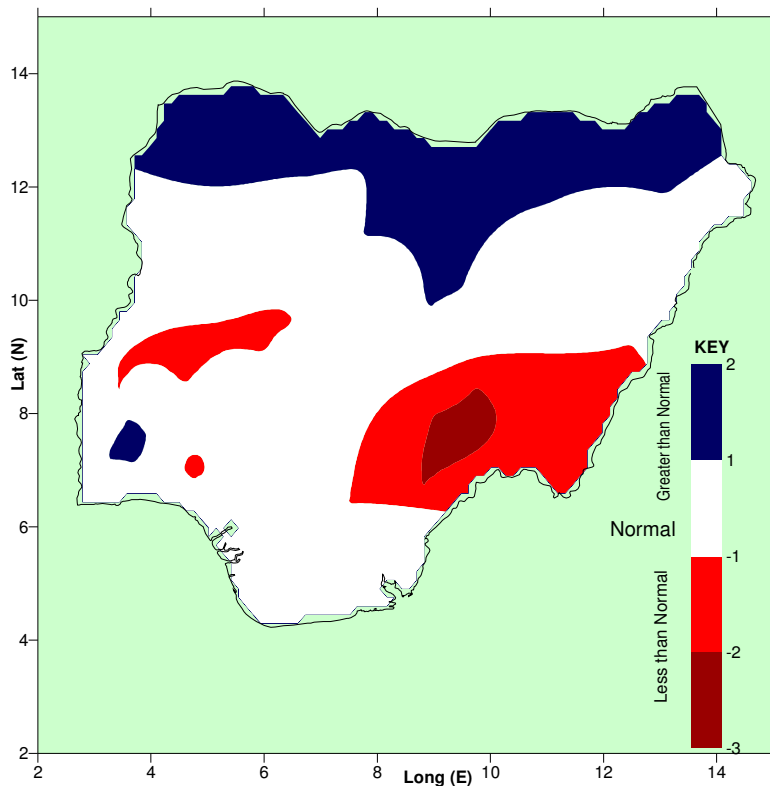


Fig. 13: 2010 Rainfall month departure from 1971-2000 normal

5.5 LITTLE DRY SEASON (LDS)

The Little Dry Season (LDS) concept refers to a period of pronounced rainfall deficit midway in the rainy season over the South, particularly over the southwest of the country. Although the LDS occurs mostly between July ending and early August as illustrated in Fig. 14.

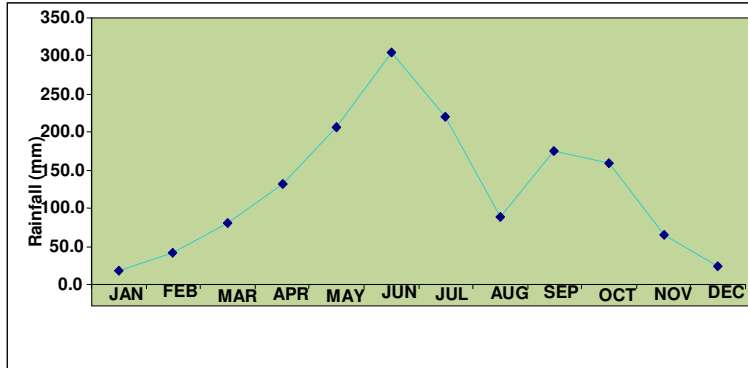


Fig. 14: Mean monthly Rainfall in Ikeja: 1971-2000

Monthly rainfall distribution in the southwest in 2010 as represented by Ikeja rainfall data suggests a higher than normal rainfall from June to September (Fig. 15). The Little Dry Season was therefore not well defined as in recent years and in addition, it impacted on the July rainfall rather than the usual August rainfall due to the period of its occurrence. This pattern of occurrence of the LDS was last observed in 2007.

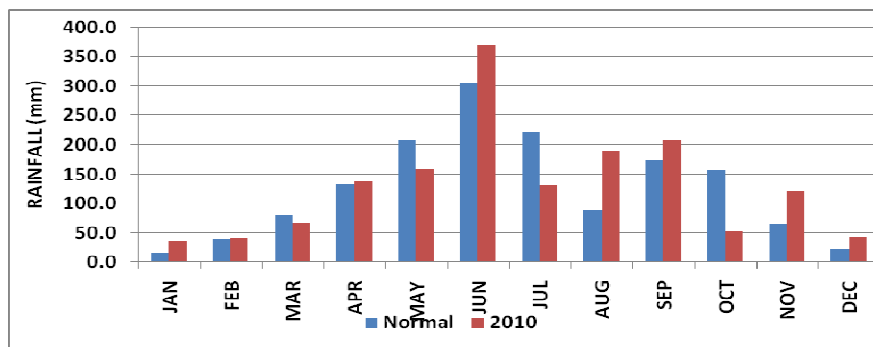


Fig. 15: Comparison of monthly Rainfall in Ikeja: 2010 with 1971-2000 normal

The severity of the Little Dry Season in the Southwest in 2009 and 2010 varied both spatially and temporary. While the LDS phenomenon was well pronounced in the previous years, its effect in the year under review was minimal (ie. 16).

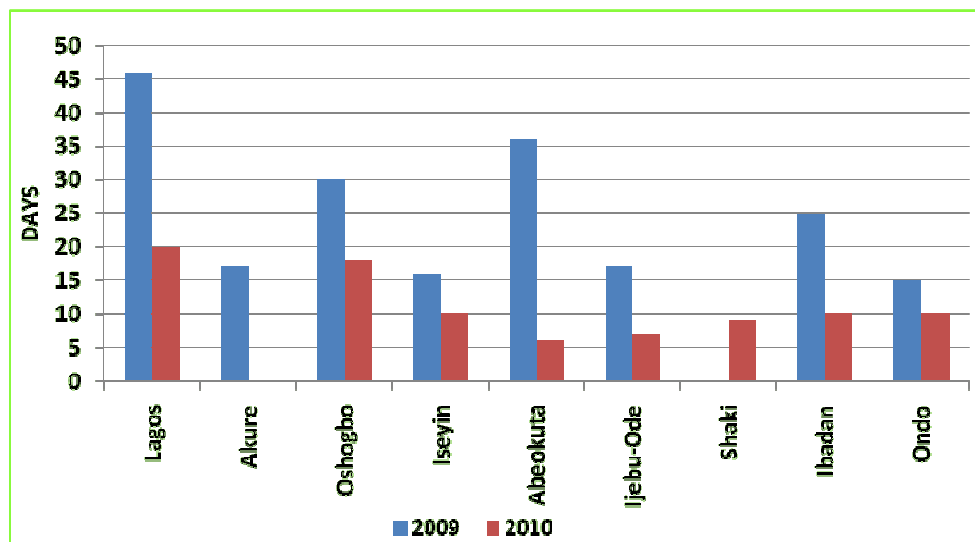


Fig. 16: Comparison of LDS intensities in 2009 and 2010

Table 2 contains a summary of the duration and number of days the LDS lasted in 2009 and 2010 in the southwest region of the country. The duration in 2010 was far shorter than it was in 2009; whereas the period lasted from the 3rd week in July to the end of August in 2009, it was witnessed between the 3rd week in July and the 1st week in August in 2010.

S/N	City	Period (2010)	2010 Duration(days)	2009 Duration(days)
1	Lagos	July 17 - 5 August	20	46
2	Akure	Nil	Nil	17
3	Osogbo	Jul 20 – 5 August	18	30
4	Iseyin	July 27 – 5 August	10	16
5	Abeokuta	July 18 – 2 August	6	36
6	Ijebu-Ode	August 1 - 7	7	17
7	Shaki	July 28 – 5 August	9	Nil
8	Ibadan	July 27 – 5 August	10	25
9	Ondo	July 28 – 6 August	10	15

Table 2: Little Dry Season (LDS) in the Southwest in 2010

5.7 DRY SPELL

Dry spell is regarded here as a period of abnormally dry weather during the months of July, August and September in the north and from May to September in the south. Table 3 below shows the number, period and duration of dry spells recorded in some cities across the country.

STN.	NO. OF SPELL	PERIOD	DURATION (DAYS)
POT	1	AUG 18 - 26	9
SHA	1	JUN 21 – 29	9
YEL	1	JUL 11 – 17	7
ASA	1	JUL 16 – 23	8
AWK	1	JUL 16 – 24	9
BNI	1	JUL 17 – 24	8
IKJ	1	JUL 17 – 31	15
OGO	1	JUL 15 – 21	7
UMU	1	JUL 16 - 23	8
YOL	1	JUL 11 – 20	11
OBU	1	JUL 15 – 21	7
OSH	1	JUL 17 – 26	10
AKU	1	AUG 1 -7	7
BAU	1	AUG 13 – 19	7
ENU	1	AUG 25 – 31	7
GOM	1	AUG 14 – 22	9

Table 3: Dry Spells in 2010

Shaki in the southwest was the only area which reported one dry spell in which lasted for 9 days in June.

In July, 7-9 days of dry spells were observed mainly in the southern part of the country, except for Yola in the northeast and Yelwa in the northwest which recorded 7-11 days of a single dry spell each in the month. The observed dry spells in the south during the month, most likely could be associated with the Little Dry Season (LDS) phenomenon.

In August, dry spells were observed in Bauchi, Gombe and Potiskum in the north had 7-9 days dry spells while Enugu and Akure in the south experienced 7-10 days of dry spells.

6.0 DUST HAZE

During the months of January-March and November - December, dry north easterly winds prevailed over parts of West Africa as a result of surface pressure build up over the Sahara desert and Sahel region. This development transported air borne dust particles southwards and reduced horizontal visibility to less than 1000m. February and March 2010 witnessed one of the most intense harmattan dust haze episodes that ever occurred in the country in recent years.

A total number of 9 significant dust haze spells were experienced in the country in the year; one spell each in January, April, October, November and December while two dust haze spells were experienced each in February and March.

In January, horizontal visibility was reduced to less than 3000m in most parts of the country while places in the north reported visibility between 700m-800m. The spells in February reduced visibility to less than 800m in the north and central region while some places in the south reported visibility as low as 1000m.

The first major and nationwide dust haze started on the 18th and lasted till 24th. During this period the northern and central parts experienced visibility between 100-800m, Kano reported visibility of zero meter on the 19th for almost 6hrs while the southern part reported visibility between 200-900m.

October, November and December saw the last phase of dust haze in the country which reduced to between 1000-800m in parts of the north and central regions of the country including other places such as Akure and Oshogbo in the south.

Table 4 gives a summary of the intensity of harmattan dust haze in the country in 2010.

DATE	NO OF DUST SPELLS	EFFECT
January 15-17	1	Visibility reduced to 700-800m in the north (Potiskum, Maiduguri)
February 4-10; 24-27	2	Visibility reduced to 400-800m in the north , central (Kano, Nguru, Maiduguri, Abuja, Ilorin, Minna) and some southern parts (Lagos)
March 3-5	1	Visibility reduced to less 800 over Kano and isolated places in the north
March 18-24	1	Visibility reduced to 100-900m all over the country
April 7-9	1	Visibility reduced to 1000-800m in the north (Gusau, Kano, Maiduguri) and isolated southern cities
October 27-30	1	Visibility reduced to less than 800m over isolated places in the north
November 20-24	1	Visibility reduced to less than 100m over isolated places (Yola, Oshogbo)
December 25-30	1	Visibility reduced to less than 900m in the central states and Akure

Table 4: Summary of Dust Haze Spells and Effects

7.0 EXTREME WEATHER EVENTS

7.1 TEMPERATURES

Extremely high daily temperatures in the range of 40.0°C and above were recorded in the northern part of the country for consecutive days beginning from the third week in February to the end of May (Table 5). Potiskum and Maiduguri in the northeast recorded the highest daily temperatures of 46.1°C and 45.5°C respectively. Few of the cities with extremely high daily temperatures, the duration of such high values and the highest recorded temperatures during the period are provided in the table below.

S/N	City	Period	Highest Value(°C)
1	Bida	Feb 17 - 8 March	41.0
2	Maiduguri	Feb 16- 31 May	45.5
3	Potiskum	Feb 15-31 May	46.1
4	Nguru	Feb 17- 31 May	43.9
5	Sokoto	Feb 14-31 May	44.2
6	Yola	Feb 12- 31 May	44.5
7	Yelwa	Feb 16- 31 May	44.2

Table 5: Daily high temperatures

7.2 RAINFALL

Daily heavy rainfalls ranging from 100.00mm and higher are presented in Table 5 below. Highest daily rainfalls of 199.5mm, 184.6mm and 183.8mm were recorded at Uyo (June), Benin (September) and Umuahia (June) respectively (Table 6).

STATIONS	RAINFALL(mm)	MONTH
Asaba	108.7	August
Bauchi	125.8	July
Benin	184.6	September
Calabar	128.4	September
Eket	132.3	May
Enugu	103.0	July
Ibadan	108.4	August
Ijebu Ode	144.6	September
Ikom	122	June
Lafia	119.6	July
Ondo	110.0	August
Owerri	124.5	June
Port-Harcourt	111.3	July
Potiskum	107.7	August
Umuahia	183.8	June
Uyo	199.5	June
Warri	126.5	September
Zaria	115.6	May

Table 6: Daily rainfalls of 100.0mm and higher in 2010

8.0 SOCIO-ECONOMIC IMPACTS

The weather of the year under review had serious impact on rain-fed agriculture, hydrology, construction, Education, Health etc as briefly discussed.

8.1 AGRICULTURE

The northern states of Borno and Yobe experienced a reduction in rainfall amount in August which led to a drop in millet, sorghum and cowpea production by about 10% as reported. Reports also indicated that Sokoto, Kebbi and Jigawa states had a reduction in rice production by 50% due to excessive flooding in September as compared to the same period in 2009 (FEWSNET 2010 report). In the south, higher crop harvest was reported particularly in crops such as yam, maize and cassava. However, high relative humidity in September and October delayed maize and cassava drying which led to losses. Fishing activities were affected particularly in the coastal states of Bayelsa and Rivers due to rise in water levels and flooding caused by above normal rainfall.



Pix 1: Flooding of farmland in Sokoto state

8.2 HEALTH

Incidences of flood related diseases such as cholera were reported to have infected nearly 40,000 people and killed more than 1,500 in some parts of the country in October. This was the worst outbreak of cholera in the country for nearly two decades. The highest death tolls were in

the north (Borno, Katsina and Bauchi) that experienced heavy rain falls. There were also cases of cholera outbreak in the south, including Rivers and Cross River states in the Niger Delta.

8.3 EDUCATION

The educational sector also felt the effect of the floods in the country with the closure of the Usman Danfodio University Sokoto as a result of the collapse of the bridge leading to the institution in September. The Lagos State University was also cut off as a result of the collapse of the bridge leading to the school in June. A number of schools at the primary and secondary levels were also forced to close down or relocate due to the ravaging flood.

8.4 HYDROLOGY

The wet season started normally in the March/April in the south and in late May/June in the north. Excessive flooding was reported in most parts of the country between August and September, particularly, occurring along major rivers in Jigawa, Sokoto and Ogun, and coastal flooding in states such as Delta, Rivers and Bayelsa states. Communities along the Lagos/Ogun borders also suffered spillover effect of the Ogun flooding (Pix 2). The high impact flooding in the country could be assessed, for example, from the recorded flow volume of about 17.27billion m³ of water between June 1- September 30, 2010 at Jiderebode (gauged station in Nigeria) which was the highest ever recorded during the period in recent years and about twice the total mean flow of the five-year return period.



Pix 2: Flooding in Lagos due to spillover Effect

The River Niger which flows into Nigeria from the northwest along the Benin-Niger border was substantially swollen in 2010 and flowed downstream to swell the Sokoto River, Rima River Basin and Goronyo dam. The reported Goronyo dam failure in Sokoto state combined with the decision to open its flood gates sent violent floodwaters across croplands, pasturelands and settlements. The flooding caused the washing away of bridges and the inundation of a number of adjoining villages with the reported attendant loss of lives and properties, adding to worries about food security and rise in the prices of grains. Besides displacing residents there were media reports that about 50,000 families had been left homeless in northern Nigeria.

Satellite observation (Pix 3) also clearly shows the high volume of water which passed through the country during the period under consideration.



Pix 3: Satellite Image on October 8, 2010 from the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra after floods swept through the region. This image uses a combination of infrared and visible light to increase the contrast between water and land. Water ranges in color from electric blue to navy.

8.5 AVIATION

The year witnessed a few instances of flight disruptions due to severe weather conditions. The month of March recorded a severe dust hazy spell which reduced horizontal visibility to between 200m-800m for several days and this caused a lot of disruptions in flight operations across the country. These disruptions affected flight operations in Lagos, Abuja, Kano, Kaduna, Minna, Maiduguri, Sokoto, Enugu, Owerri, Port Harcourt and Calabar airports. There were cases of outright cancellations.

In January and December, early morning fog was reported in; Lagos, Port Harcourt, Owerri and Jos which reduced horizontal visibility to between 200-800m. This resulted in flight delays at these airports. Also thousand of Europe-bound Nigerians were stranded at the Murtala Mohammed International Airport (MMIA) Lagos, as heavy snow pounded European airports in December. These harsh weather conditions affected the number of inbound and outbound flights at the Murtala Mohammed International Airport during the period. (Table 7)

DATE	WEATHER	EFFECTS
January - March	Dust haze and fog	Rescheduling and delays of most local flights which lasted for several days.
April - September	Volcanic eruption of Mt. Eyjafjallajoekull (Iceland)	Most international flights were cancelled due to the closure of European airports.
	Severe thunderstorm and squalls	Flight delays were experienced in severe thunderstorms and squalls.
December	Snow in America and Europe,	Most international flights were cancelled due to the closure of European airports
	Fog in Nigeria	Local flight delays

Table 7: Summary of Weather Effect on Aviation at Lagos airport in 2010

Flight delays, cancellations and/or diversions due to adverse weather conditions were reported during the year 2010. Preliminary analysis of air traffic at the Nnamdi Azikiwe International Airport shows March with the highest number of flight disruptions largely due to the harmattan dust haze. The prevailing dust haze during the period (March) resulted in very low horizontal visibility at most of the nation's airports. Also flight disruptions were reported during the wet season mainly due to heavy downpours, severe thunderstorms and squally weather.

Analysis of air traffic at the airport suggests a sharp increase of flight delays and cancellations in 2010 when compared with the previous two years (Table 8).

Month	2008	2009	2010
Jan	2	5	13
Feb	0	9	12
Mar	0	8	55
Apr	0	3	3
May	0	2	6
Jun	6	0	0
Jul	1	1	0
Aug	1	0	5
Sep	5	1	1
Oct	2	1	3
Nov	0	5	3
Dec	12	5	12
Total	27	40	113

Table 8: Comparison of flight disruptions at Abuja airport in 2008, 2009 & 2010

9.0 SUMMARY

The Inter-Tropical Discontinuity moved northwards from latitude 7.9°N in January to reach latitude 20.9°N in August. Its positions from June through October were 1-2 degrees of latitude higher than normal positions but its positions were below normal in April, November and December.

Maximum temperatures during the hot season were 1.5-2.9°C warmer than normal over a greater part of the north and central regions. Extremely high daily temperatures between 41.0 – 46.0°C persisted from mid February to May ending in these regions. The incident solar radiation also indicated highest values over the north, particularly over the northeast in February. The cold season minimum temperatures were generally 0.5-3.1°C warmer than normal in January but 0.5-2.2°C colder than normal in parts of the central states in December.

Total rainfall in the year varied from 300.0-1000.0mm in the northeast, 2,000.0-3,000.0mm in the northwest, central states, southwest and the southeast. The extreme east coast recorded

the highest rainfall of over 3,000.0mm. The recorded rainfall in the year was mostly higher (110-200%) than long term mean rainfall except at Ilorin and environs where it was less than normal. Also the length of the rainy season was 1-2 months longer than normal over the extreme north. The heavy rainfall within and outside the country coupled with human interventions led to the 8