

2023
SEASONAL CLIMATE PREDICTION
(SCP)



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Foreword



Global temperatures despite being on an upward trajectory were tapered down due to the triple dip La Niña event that has sustained cooler ocean water over the tropical Pacific. However, even with 2022 not setting a record, it is likely to be only the fifth or sixth warmest year on record¹. 2022 flood in Nigeria is one of the worst floods experienced in decades. This led to the death of over 600 people and displaced over 2.4 million people in the country. Millions of dollars (NEMA, 2022) worth of investment in agriculture have been destroyed by the flood. There were also destruction of infrastructure and economic

losses by the extreme weather event.

Severe weather events such as cold and warm temperatures, increase in coastal surge as well as increase in the frequency of heavy precipitation events in different parts of the country have been observed in recent decades.

It is now known that global warming which drives the extreme weather events experienced worldwide is caused by the emission of carbon dioxide and other greenhouse gases by human activities. It is also evident that unless the emission of greenhouse gases is reduced in every country, the global temperature rise may get to a catastrophic and irreversible level that will endanger human existence on Earth. In response to this challenge, the global community is taking coordinated action to reduce greenhouse gas emissions.

Nigeria is playing her own part in this global effort to combat climate change. In this regard, the country, in compliance with the Paris Climate Change Agreement, submitted the updated Nationally Determined Contribution (NDC) to the United Nations Climate Change Convention (UNFCCC) secretariat in July 2021². The updated NDC, re-stated the actions the country is committed to taking to limit global warming and climate change. The Federal Government is implementing the mitigation

¹ Provisional State of the Global Climate in 2022 | World Meteorological Organization (wmo.int)

² Nationally Determined Contributions Registry | UNFCCC

measures outlined in the NDC document. These measures include greenhouse gas emission reduction as well as measures to remove carbon dioxide from the atmosphere such as reforestation. Recently, President Muhammadu Buhari also signed the Climate Change bill into law, unveiled Nigeria's Net Zero Emission plan (targeting 2060 for Nigeria to achieve net zero emission) and the Energy Transition Plan (designed to decarbonize the energy sector). It is also important to note that the Federal Government is also implementing adaptation measures to reduce the impact of climate change on vulnerable Nigerians. NiMet is contributing to the adaptation measures by providing timely meteorological information regularly. The Seasonal Climate Prediction (SCP) is an essential early warning tool for planning against the effect of climate change and variability in all weather-sensitive sectors of the economy. The information also helps in taking advantage of favourable climatic conditions to improve performance, especially in agriculture. The SCP provides vital meteorological information on temperature, rainfall pattern, onset of the season, end of season, length of season and their impacts on socio-economic activities in the country. Experience over the years has proved that the application of these early warning information helps in increasing resilience and reducing vulnerability to extreme weather events.

Over the years NiMet has progressively improved on the coverage and quality of data collection and predictions. The Agency has also incorporated the interpretation of the forecast into three major languages of Hausa, Igbo and Yoruba as well as improved downscaling of the forecast all over the country.

The Nigerian Meteorological Agency with the support of the Federal Ministry of Aviation will continue to demonstrate its capacity and commitment to provide quality and timely services in line with its mandate. Nigeria is an active member of the World Meteorological Organization, and therefore the Agency is also committed to fulfill its international obligations. Our stakeholders in all-weather sensitive sectors like agriculture, aviation, maritime, environment, water resources, energy, engineering, tourism, and the public will find the information in SCP very vital in their various operational and decision-making activities. I therefore strongly recommend this 2023 NiMet's Seasonal Climate Prediction (SCP) to all Nigerians.

Senator Hadi A. Sirika
Hon. Minister of Aviation

January, 2023



Executive Summary



The Nigerian Meteorological Agency (NiMet) has produced the 2023 Seasonal Climate Prediction (SCP). The SCP provides a snapshot of some essential climate parameters and their behaviour within the season. NiMet produces this publication annually in fulfilment of its mandate to provide accurate, timely, and quality weather and climate information to advise the Federal, State, and Local Government of Nigeria and the public on weather and climate-related issues. The information provided in the SCP is tailored mainly to boost economic growth and prevent losses due to severe

weather phenomena. The production process of the SCP involves scientific use of long-term meteorological data with state-of-the-art prediction models. Furthermore, a co-production process involving relevant stakeholders such as agriculture, aviation, construction, water resources, health, trade, and tourism, amongst others was implemented to achieve these remarkable user-tailored forecasts.

The ENSO has a major influence on climate patterns globally. This edition of the SCP is based on a projected La Niña phase of the El Niño Southern Oscillation (ENSO) in the first quarter of 2023, and the projection that the Neutral phase will most likely persist for the greater part of the year. The La Niña (cold) phase was used for the onset of rains, while the neutral phase was the basis for parameters such as the length of the season, end of the season, and total seasonal rainfall amount. Moreover, rainfall, temperature, soil moisture data, water balance, farm management practices, and other phenological and soil type information were also factored into this forecast. The results of the forecasts are summarized below.

Rainfall Onset Dates

The rainfall onset date is predicted to be **earlier than the long-term average** in most parts of the country. However, parts of Katsina, Zamfara, Kano, Jigawa, and Yobe in the north and Cross River, Ebonyi, Imo, and Rivers in the south are likely to experience a delayed onset. The onset dates for parts of Adamawa, Bauchi, Gombe,

Kwara, Oyo, Ogun, and Lagos are likely to be near their long-term averages. The Onset is expected to start from the coastal states of Bayelsa, Rivers, and Akwa Ibom in early March and around June/July in the northern states such as Sokoto, Kebbi, Zamfara, Kano, Katsina, Jigawa, Yobe, and Borno.

Rainfall Cessation Dates

An early End of Season (EoS) is predicted over parts of the south comprising of Osun, Ondo, Edo, Delta, Imo, Bayelsa, Rivers, Akwa Ibom, and the Eastern parts of Ogun and Lagos States. Parts of Yobe, Adamawa, Niger, Nasarawa, and Kogi States are also predicted to have early end of season when compared to long-term average conditions. However, an extended rainfall season is predicted over parts of Gombe, Kaduna, Kwara, Enugu, Anambra, western Ogun, and Lagos State. The cessation is anticipated earliest in September over parts of Sokoto and Katsina States, while it would occur much later in December over most parts of the coastal region.

Rainfall Amounts

Rainfall amount over the country in 2023 is predicted to be average to above average in most parts of Nigeria. However, the prediction shows that parts of Yobe, Jigawa, Kano, Bauchi, Jigawa, Kaduna States and the FCT are likely to observe below-average annual rainfall amount. Nasarawa, Taraba, Kogi, Benue, Ekiti, Osun, and Oyo State as well as the FCT, are expected to have 1190 mm to 1590 mm of rainfall while Bayelsa, Akwa-Ibom, Delta, and Cross River State are predicted to record annual rainfall amounts of 2700 mm and above.

Length of Growing Season

The length of growing season in most places in the country is likely to be near the long-term average, except for some parts of the northern states such as Katsina, Jigawa, and Kano where shorter than the long-term average length of the growing season is anticipated. Parts of Lagos, Ondo, Delta, Bayelsa, Rivers, and Cross River are also likely to have shorter length of growing season.

Temperature

Temperatures are expected to be generally above the long-term average across the country. Both daytime and night temperatures are predicted to be warmer than the

long-term average over most parts of the country in January, March, and May. However, February day and night-time temperatures are predicted to be cooler than the long-term average. Additionally, most of the north is also anticipated to be cooler in March 2023.

Dry Spells

Mild to moderate (8-16 days) dry spell is predicted to occur in April 2023 in the south after the Onset is established. Furthermore, following the establishment of onset in the north, a severe dry spell that is likely to last between 15 to 21 days or longer is predicted in June to early July in parts of the northern (Sokoto, Zamfara, Kebbi, Jigawa, Katsina, Yobe Borno, Kano) and central states. A moderate dry spell is predicted over Niger, Nasarawa, Gombe, Bauchi, Benue, Kogi, and the FCT. A mild dry spell is predicted over Ekiti, Edo, Ondo, Anambra, Ebonyi, Ogun, and Imo states in July.

Little Dry Season (LDS)

In 2023, the LDS is expected to be less severe when compared with that of the last three years. It is likely to begin between the 21st and 26th of July in parts of Oyo, Osun, Ogun, and Lagos. The length of the little dry season in these areas is expected to last between 14 to 20 days. Parts of Kogi, Ekiti, and Ondo are likely to feel a low effect of the LDS season with a length of 10 to 14 days.

Malaria Vigilance

High Vigilance for malaria is anticipated in the coastal zone of the country as early as January 2023. This level of vigilance for malaria spreads inland (northwards) as the year progresses and covers up to parts of Taraba, Benue, Kogi, Kwara and Nasarawa states in north central zone of the country. The area under high and low vigilance for malaria reaches the northernmost extent covering up to Niger, Plateau, and Adamawa states in May 2023.

Meningitis Vigilance

High vigilance for meningitis is anticipated over the extreme northeast of the country, covering most of Borno, Yobe and parts of Jigawa states, as early as January 2023. As the year progresses the area under high vigilance threshold extends southwards and reaches the maximum extent in March 2023. The area under high and moderate vigilance for meningitis reaches the southernmost extent, covering

up to Benue, Kogi, Kwara and parts of Oyo states in January 2023.

In 2021, the World Health Organization (WHO) launched an initiative known as Defeating Meningitis By 2030: A Global Roadmap, for eradication of meningitis globally³. Nigeria is participating in the implementation of this programme. The meningitis vigilance forecast is NiMet's contribution to the successful execution of this programme.

The Seasonal Climate Prediction serves as an early warning tool to stakeholders and the public for timely preparedness and anticipatory action against weather and climate-related hazards in urban and rural, down to remote and hard-to-reach communities in Nigeria.

Professor Mansur Bako Matazu
Director General/CEO
Nigerian Meteorological Agency (NiMet)

January, 2023

³ Defeating Meningitis by 2030 (who.int)

Chapter One

The Scientific Basis for the Prediction

1.0 Climate Drivers

1.1 ENSO Synopsis

El Niño Southern Oscillation (ENSO) describes the state of the sea surface temperature over the tropical Pacific Ocean in relation to atmospheric characteristics such as winds, temperature, radiation, humidity, rainfall etc. ENSO has therefore been found to impact weather in different ways over different regions of the world including Nigeria (National Oceanic and Atmospheric Administration (NOAA). ENSO in Niño 3.4 region of the tropical Central Pacific Ocean (120W-170W, 5N -5S) significantly impacts rainfall over Nigeria. This makes the ENSO phase in Niño 3.4 region a major driving force of the seasonal rainfall characteristics within the country and the region⁴.

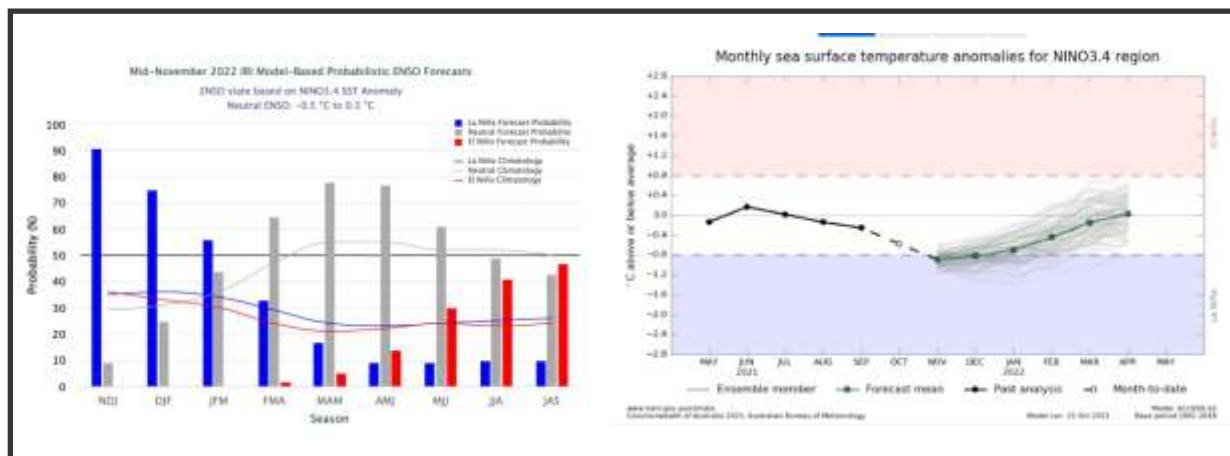


Figure 1a: IRI/CPC Consensus ENSO Forecast 1b: Bureau of Meteorology Australia ENSO forecast

The ENSO ensemble prediction for 2023 by the Institute of Research for Climate and Society (IRI)/Climate prediction Centre (CPC) and the Bureau of Meteorology (BoM) of Australia (Figures 1a & 1b) favours a Neutral ENSO

⁴ <https://research.noaa.gov/article/ArtMID/587/ArticleID/2685/New-research-volume-explores-future-of-ENSO-under-influence-of-climate-change>

condition for a greater part of 2023. The year is however expected to begin with a La Niña ENSO phase and transit into a neutral phase after March.

The 2023 rainfall season is therefore predicted based on two ENSO phases: a La Niña (cold) phase for the onset of rains, and a neutral phase which is expected to impact the length of season, end of season and total seasonal rainfall amount. There is 75 - 90% probability that the length of season, end of season and total rainfall amount will be normal while the onset is predicted to be earlier than normal. There is 75 - 90% the weak cold phase will continue from December 2022 to February 2023 and decrease to 56% by March after which a neutral phase will begin with a probability of about 65%, and increase to 74% by April-May-June season, persisting till the June-July-August season with a lower probability. The season is therefore likely to end in an El-Nino (warm) phase by December 2023.

The impact of a La Niña phase during onset and a neutral phase for the rest of the season within our region is: Early to Normal onset dates, and Normal cessation dates, length of season, and precipitation amount across the country.

Updates on the 2023 Seasonal Climate Prediction will be released by NiMet regularly to provide the people with the latest information on the state of the atmosphere and related issues to enable prompt and decisive action during the season. Stakeholders are therefore advised to visit NiMet's website (www.nimet.gov.ng) and social media handles (Facebook (@NIMETNIGERIA), Twitter(@nimetnigeria), YouTube(@nimetng), Instagram (@officialnimetng)) for daily, weekly, and monthly updates.

1.2 Pre-Onset Activities (False Onset)

Before the establishment of the rainy season each year there are usually rainfall events. This pre-onset rainfall can come very early in the year. They could also be heavy and fairly regular in such a way that could mislead the public, especially farmers, who tend to rush to their farms, believing that such

rains indicates early commencement of the rainy season. The occurrence of these rains, with varying intensity and frequency from year to year is quite normal. In 2023, more frequent high intensity rainfall before the establishment of the onset of the planting season is expected. The two main forcing functions which should play a role in the early rains in 2023 include the Mid Latitude Wave (MLW) and the Madden Julian Oscillation (MJO).

The Mid Latitude Wave (MLW)

This is an eastward propagating Rossby wave, found mainly over the temperate region and has made its presence felt over the West African region. During its propagation, when it is over the Mediterranean region and fringes of North Africa, the edge of its trough dips down into West Africa, coming in phase with the monsoon trough. This leads to a pull up of the ITD and northward surge in moisture inland, thus bringing about an enhancement of rainfall over Nigeria and parts of West Africa. Its influence was notable in 2022 and it is expected to play a dominant role in the behavior of our weather systems in 2023. The expected strengthening of its influence over Nigeria and West African climate by extension is as a result of the increase in global temperatures which has also increased its frequency of occurrence in recent times.

The Madden Julian Oscillation (MJO)

The Madden Julian Oscillation is a tropical disturbance that propagates from west to east around the global tropics. It has been known over time to enhance as well as suppress rainfall wherever it is in time. Its enhanced phase is expected to play a role in the intense rainfall events that may be experienced within the early months of 2023. The MJO was noticed to have hovered longer each time it made an appearance over West Africa in 2022. This is not unconnected with warmer global temperatures that is affecting the normal pattern of atmospheric circulation. So, it is projected that the MJO may tarry longer each time it appears and likely enhance rainfall over West Africa and Nigeria in 2023.

Chapter Two

2023 Seasonal Climate Predictions

The 2023 rainfall season is predicted based on two ENSO phases: a **La Niña (cold)** phase for the onset of rains, and a neutral phase which is expected to impact the length of season, end of season and total seasonal rainfall amount. These conditions are expected to lead to an early onset, normal cessation, normal length of season and normal to above normal rainfall patterns in the country.

2.1 Rainfall Predictions

2.1.1 Onset Dates of Rainy Season & Departure from Normal (Long-term Average)

The 2023 onset is predicted to be earlier than normal in most parts of the country except for some parts of Katsina, Zamfara, Kano, Jigawa, Yobe in the north and Cross River, Ebonyi, Imo and Rivers in the south that are likely to experience a delayed onset when compared to the long-term averages in the areas. The onset dates in parts of Adamawa, Bauchi, Gombe, Kwara, Oyo, Ogun, and Lagos are likely to be near normal (*Figure 2*).

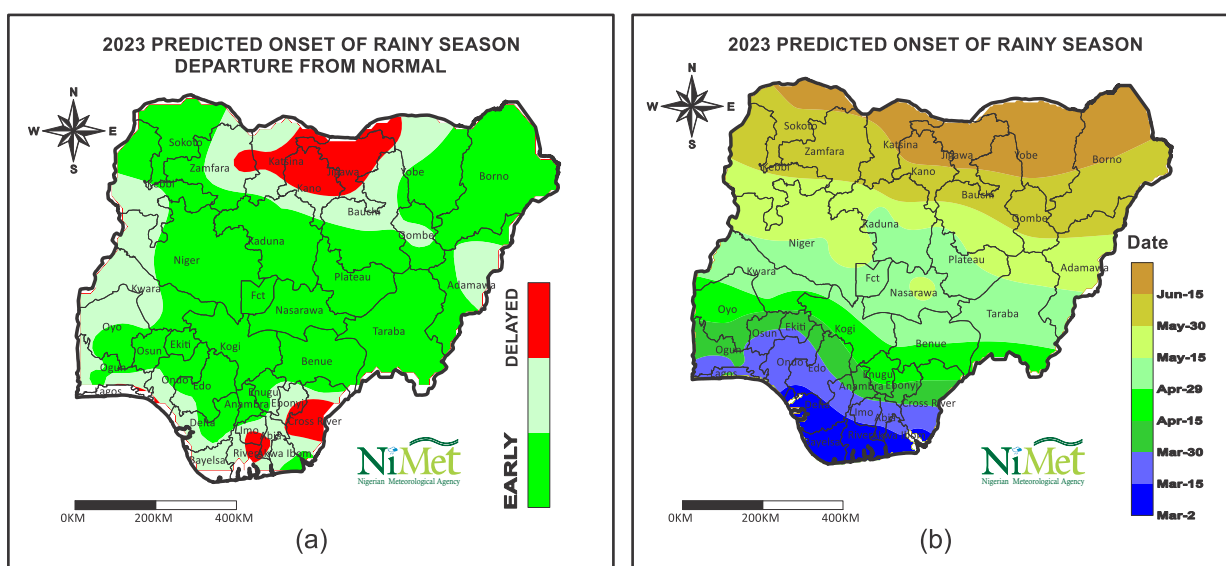


Figure 2: Departure from Normal (a) and Predicted Onset Dates of Rainy Season (b)

The prediction shows that the earliest onset will likely occur on or around the 2nd of March 2023 in the coastal zone of the south-south states of Bayelsa, Rivers, Akwa Ibom and environs. The onset dates are expected to increase latitudinally with the ITD northward oscillation as the year progresses. The inland cities of the south are therefore likely to have their onset in April while areas around the central states are likely to have onset in May. The extreme northern states are predicted to have onset between June and July, with the northern fringes of Sokoto, Kebbi, Zamfara, Kano, Katsina, Jigawa, Yobe and Borno states predicted to likely have onset between 20th June and 7th of July 2023.

It is important to note that strong windstorms across the country and sandstorms in the extreme northern states can occur prior to the onset period.

2.1.2 Cessation Dates of Rainy Season & Departure from Normal (Long-term Average)

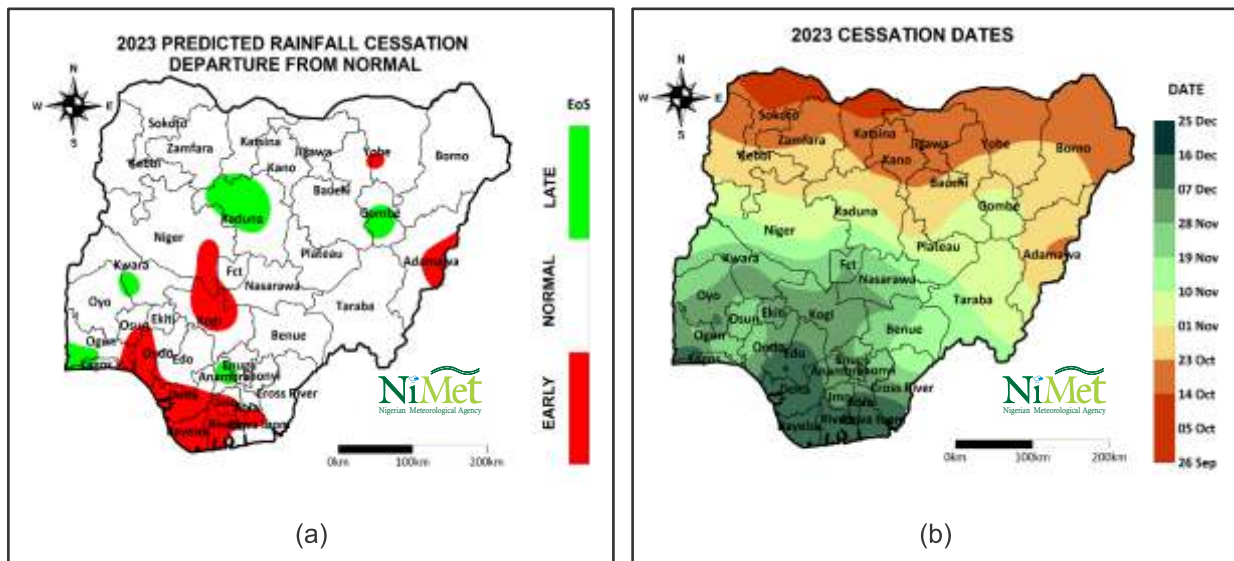


Figure 3: Departure from Normal (a) and Predicted Cessation dates (b)

The distribution of 2023 predicted cessation dates and the departure from normal (long term average) over Nigeria are shown in Figure 3. Early End of Season (EoS) is predicted over parts of the south comprising Osun, Ondo, Edo, Delta, Imo, Bayelsa, Rivers, Akwa Ibom, eastern parts of Ogun and Lagos states. Parts of Yobe, Adamawa, Niger, Nasarawa and Kogi states are also

predicted to have early EoS. On the other hand, an extended rainfall season is predicted over parts of Gombe, Kaduna, Kwara, Enugu, Anambra, western Ogun, and Lagos. The earliest cessation in 2023 is anticipated to be around 26th September over parts of Sokoto and Katsina, while it would occur much later between 16th and 25th December over most parts of the coastal region.

2.1.3 Predicted Length of Rainy Season (LoS) & the Departure from Normal (Long-term Average)

As depicted in Figure 4, in 2023, most places in the country are likely to experience normal length of season in comparison with the climatological averages except parts of Katsina, Jigawa and Kano states where shorter than normal length of season is expected. A difference of about 10 days below the climatological normal is expected in this scenario. Parts of Lagos, Ondo, Delta, Bayelsa, Rivers and Cross-rivers are also likely to have shorter length of growing season.

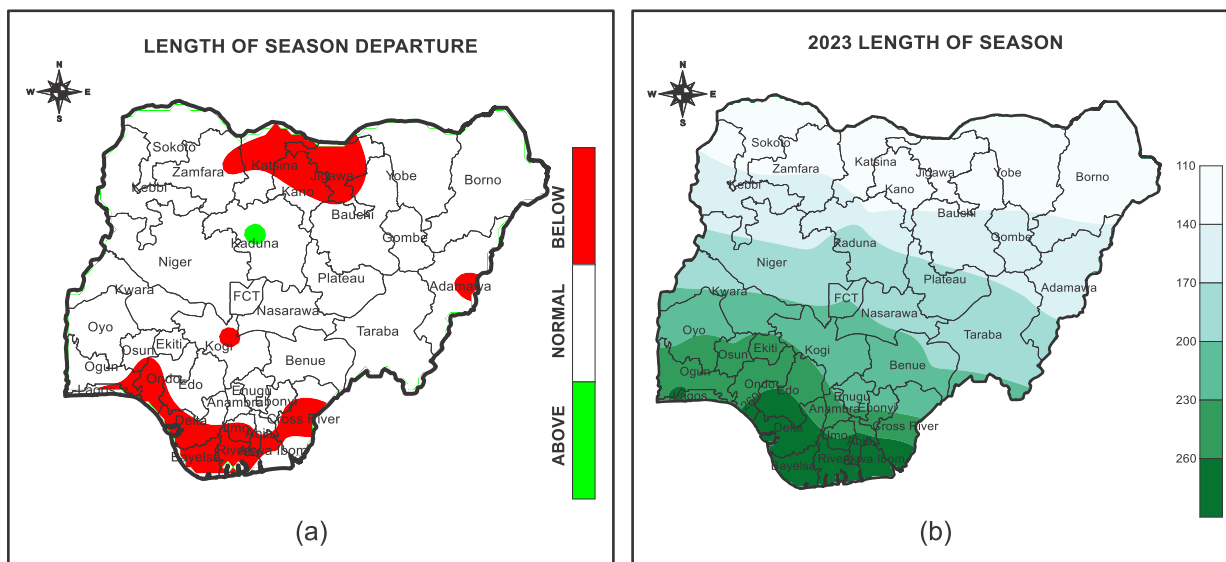


Figure 4: Departure from Normal (a) and Predicted length of growing season (b)

The frontier states of the north are likely to have an average length of growing season of about 84 days while Bayelsa in the South-South region is expected to have the longest length of season of about 283 days. The Federal Capital Territory along with adjoining states like Niger, Nasarawa, and Southern Kaduna may likely have length of growing season varying from 170 to 230 days.

2.1.4 Predicted Annual rainfall Amounts & the Departure from Normal (Long-term Average)

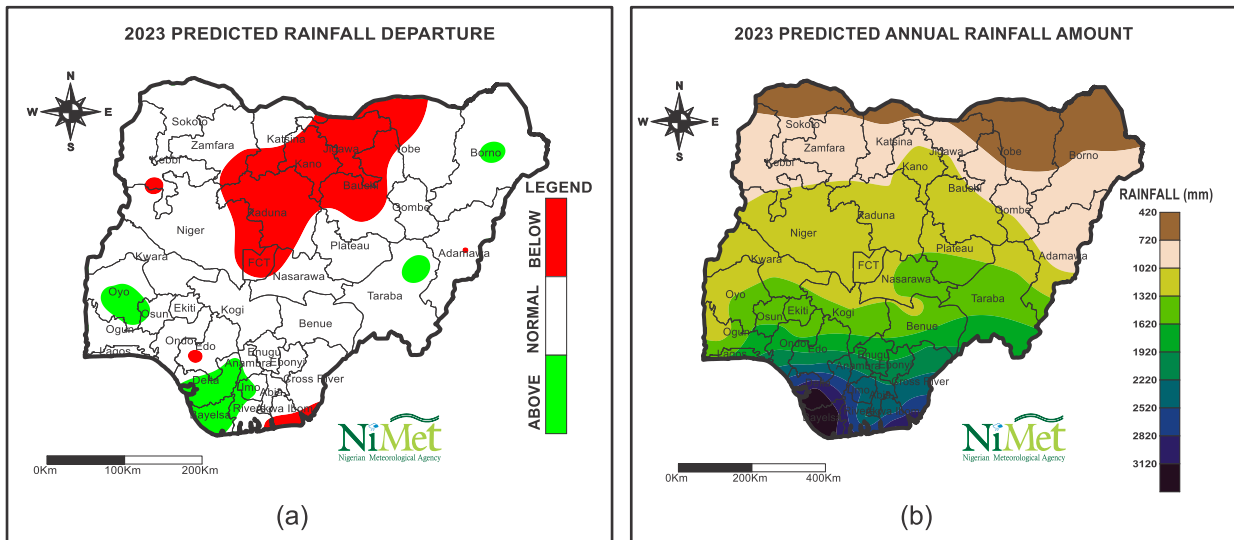


Figure 5: Departure from Normal (a) and predicted annual rainfall Amounts (b)

The predicted 2023 rainfall amounts and the departure from normal (long term average) are shown in Figure 5. Normal to above-normal annual rainfall amounts are expected over most parts of the country except in parts of Yobe, Jigawa, Kano, Bauchi, Kaduna and FCT that are likely to observe below normal to near normal annual rainfall amounts. Other states such as Nasarawa, Taraba, Kogi, Benue, Ekiti, Osun and Oyo as well as the FCT, are likely to have between 1190 mm and 1590 mm of rainfall in 2023. However, the southernmost states, namely: Bayelsa, Akwa-Ibom, Delta, and Cross River are predicted to record annual rainfall amounts of 2700 mm and above.

In 2023, annual rainfall amount across Nigeria is anticipated to vary from 420 mm in the far northernmost parts to 3120 mm in the coastal areas as shown in Figure 5. Parts of Yobe, Borno, Katsina, Sokoto, Adamawa, Gombe, Kano, Kaduna, Bauchi, and Niger states rainfall amounts are expected to be between the range of 420 mm to 1200 mm. States such as Kogi, Kwara, Osun, Lagos, Ondo, and Enugu states, will likely record 1300 mm to 2000 mm of rainfall. The coastal states of Cross River, Akwa Ibom, Delta, and Bayelsa as well as Imo state, are likely to receive annual rainfall amounts ranging from 2350 mm to 3253 mm.

Detailed periodic updates and advisories will be available on the Agency's website.

2.1.5 Dry Spell 2023 Prediction

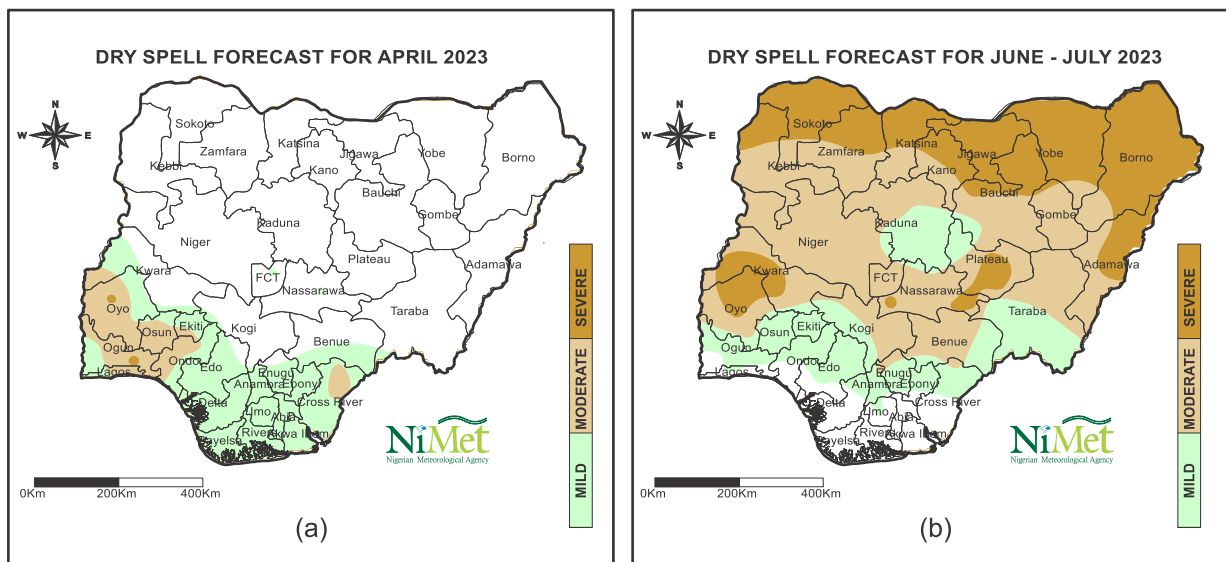


Figure 6: Predicted areas of occurrence of dry spell in April and June-July 2023 respectively

The 2023 Prediction shows that in April there is likelihood of a mild (8 days) to moderate (16 days) dry spell after the establishment of rainfall in Southern Nigeria. Moderate dry spell of 14 to 16 days is predicted over Ogun (Ijebu-Ode, Abeokuta), Oyo (Ibadan, Iseyin, Shaki, Atisbo, Ogbomosho), Osun (Osogbo), Ekiti (Ado-Ekiti), Ondo, Lagos, Cross River (Ikrom, and Ogoja).

In the month of June to early July 2023, a severe dry spell that is likely to last above 16 days is predicted over the following states:

- Kebbi state:** Arewa Dandi, Aleiro, Kalgo, Bunza, Birnin Kebbi, Argungu, Augie, Jega, Maiyana
- Katsina State:** Baure, Batsari, Bindawa, Batagarawa, Daura, Charanchi, Kankia, Jibia, Rimi, Mani, Mashi, Mai'Adua, Katsina, Dutsi, Sandamu, Ingawa, Zango
- Jigawa State:** Babura, Birniwa, Gwiwa, Garki, Roni, Kazaure, Gumel, Guri, Yankwashi, Kirkasama, Maigatari, Kaugama, Sule-Tankarkar, Malam Madori
- Yobe State:** Barde, Bursari, Geidam, Machina, Nguru, Karasuwa, Yunusari, Yusufari, Jakusko, Tarmuwa
- Adamawa State:** Furfure, Girei, Gombi, Madagali, Maiha, Michika, Mubi, Hong, Song, Yola

- Borno State:** Abadam, Mobbar, Kukawa, Guzamala, Gubio, Nganzai, Monguno, Marte, Ngala, Bama, Gwoza, Kala-Balge
- Kwara State:** Baruten, Kaiama, Ilorin, Moro, Pategi, Edu, Ifelofun
- Oyo State:** Atisbo, Irepo, Olorunsogo, Ori ire, Orelope, Ogbomosho, Saki, Iwajowa, Kajola, Itesiwaju, Iseyin, Oyo
- Nasarawa State:** Akwanga, Lafia, Awe, Kokona, and Keana
- Plateau State:** Langtang North, Langtang South Wase, and Kanke

A moderate dry spell is predicted over Niger, Nasarawa, Gombe, Bauchi, Benue, Kogi and the FCT. Mild dry spell is predicted over Ekiti, Edo, Ondo, Anambra, Ebonyi, Ogun and Imo state in the month of July.

2.1.6 Little Dry Season Prediction for 2023

THE LITTLE DRY SEASON FORECAST 2023 (LDS)

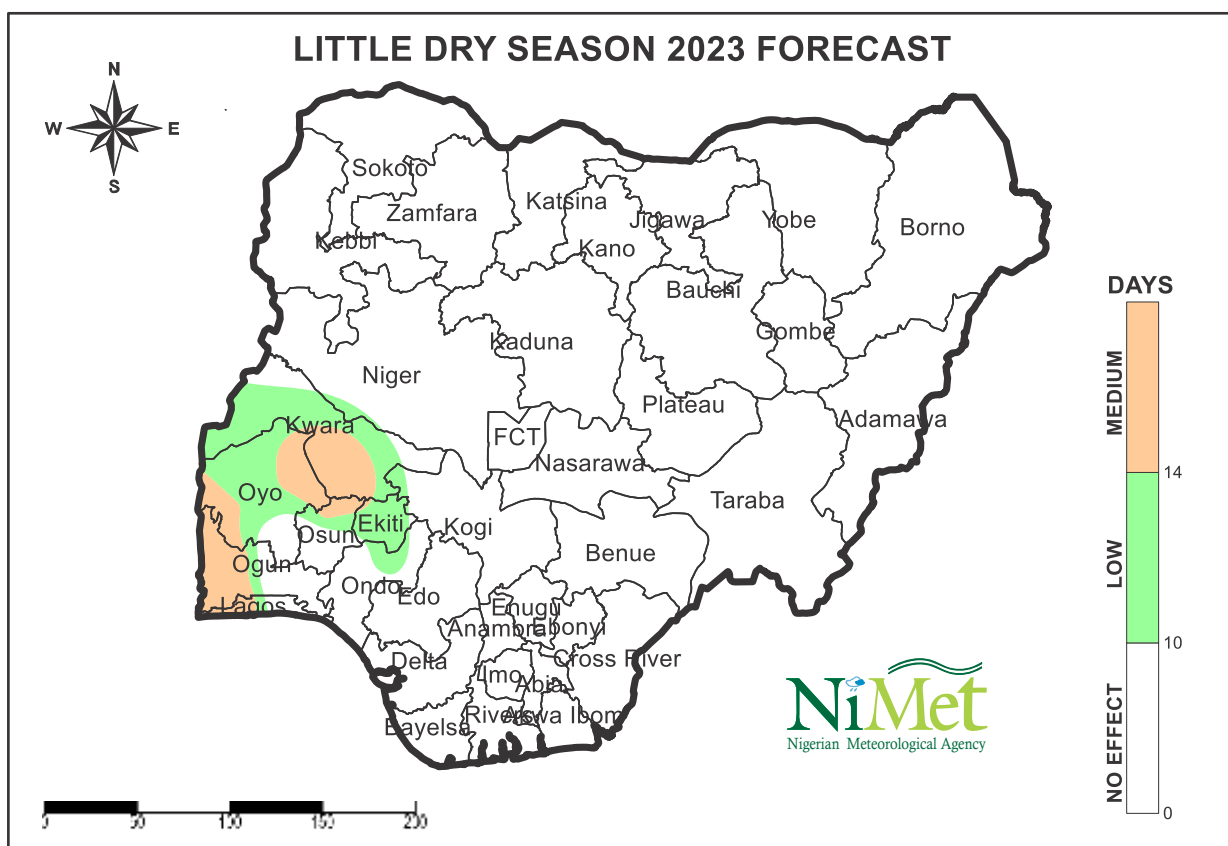


Figure 7: 2023 Little Dry Season Forecast (LDS)

The Prediction shows that in 2023, the little dry season is expected to be less severe. The LDS season of 2023 is likely to begin between 21st – 26th July 2023 in parts of Ekiti, Kwara, Ogun, Osun, Oyo and Lagos states (See Figure 7). The length of the little dry season in these areas is expected to last an average length of 14 - to 20 days. The areas in green in Figure 7 are likely to have a low effect of the LDS season with average length of 10 to 14 days.

The anticipated onset dates and lengths of little dry season at various places in 2023 are summarized in Table 1.

Table 1: Likely onset dates and duration of LDS at various locations in 2023

Location	Ave.2023(days)	Start day
ABEOKUTA	16	21st July
ADO EKITI	12	21st July
AKURE	14	21st July
BENIN	7	16th July
IBADAN	13	1st Aug
IJEBU-ODE	14	2nd Aug
IKEJA	19	30th July
ILORIN	20	21st July
ISEYIN	14	21st July
LAGOS ISLAND	18	23rd July
OSOGBO	15	30th July
SHAKI	12	25th July

2.2 Temperature Predictions for 2023

The predicted day and night-time temperatures, and the departures from long-term averages for the five critical months – January, February, March, April, and May are presented in this section. The impact of temperature is mostly felt in the country during these months, i.e., the cold season during the month of January while the hot season occurs in March, April and May, depending on location within the country. Temperatures in parts of the country are expected to be near the long-term average during these months. However, some other areas will experience temperature anomalies that are about 2°C above normal (i.e., hotter than the average seasonal temperature).

2.2.1 Predicted January 2023 Day and Night-time Temperature Forecast and Anomalies (Deviations from Long-term Average)

The predicted daytime temperatures for January 2023 and the departure from the long-term average across Nigeria are shown in Figure 8. The forecast shows that most parts of the country are likely to experience warmer than normal daytime temperatures. However, normal daytime temperature conditions are anticipated around Taraba, southern Benue, Cross-River, Akwa-Ibom, Abia, Ebonyi, Enugu, as well as parts of Rivers and Imo states. Daytime temperatures in January 2023 over Oyo, Lagos, parts of Ogun, Osun, and Ondo are also not expected to vary from long-term averages.

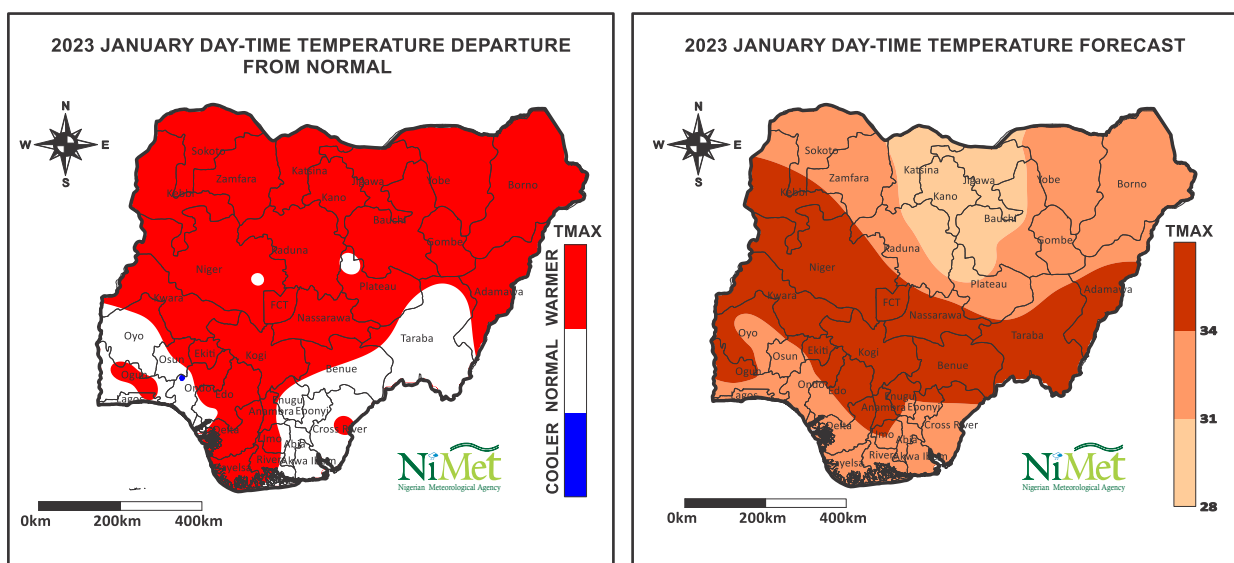


Figure 8: Predicted Daytime Temperatures for January 2023

The predicted mean maximum temperatures for January 2023 ranges from 28.1°C to 36.1°C across Nigeria. The lowest temperature value of 28.1°C is expected over Plateau state while the highest value is likely to be observed over Nasarawa state. However, most places within the north-central and southern states are expected to have daytime temperature values in the range of 34°C to 36°C and 32°C to 34°C respectively, while the north-west and north-eastern states are likely to record slightly lower temperature values in the range of 29°C to 32°C, except for Kebbi, Taraba and Adamawa states.

2023 PREDICTED JANUARY NIGHT-TIME TEMPERATURE

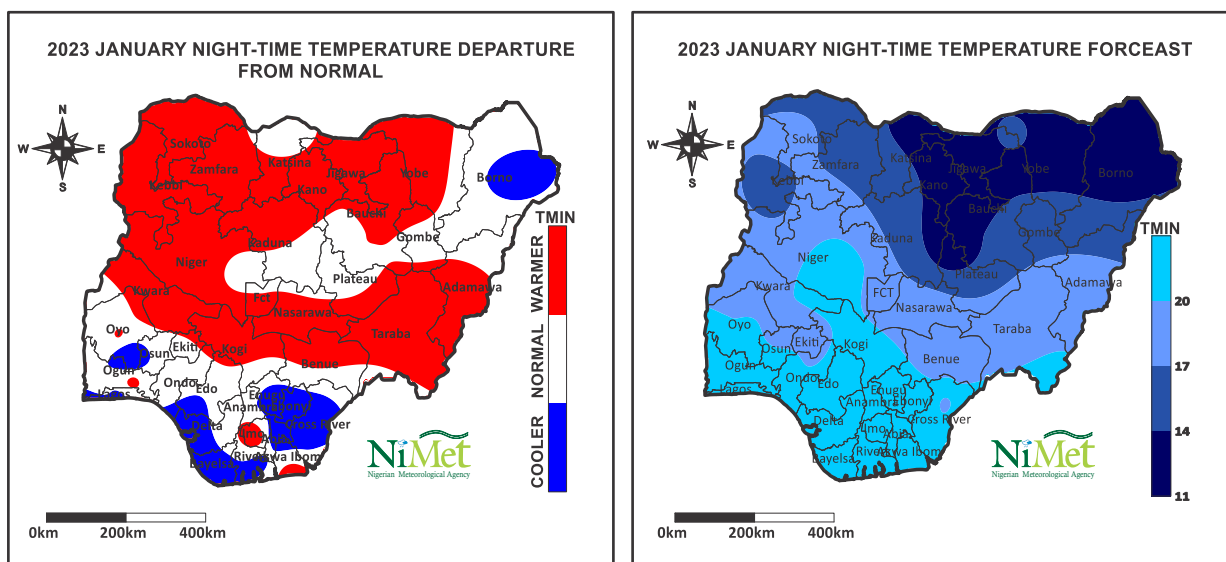


Figure 9: Predicted Nighttime Temperature for January 2023

Compared to the thirty-year long-term average, normal nighttime temperatures are expected in January in parts of the northern and central states, such as Borno, Gombe, Adamawa, Plateau, Kaduna, and Nasarawa including the FCT. The same condition is expected in the south, over places like Oyo, Ekiti, Ogun, Ondo, Edo, Rivers, Akwa Ibom and Cross River states. Areas around Enugu, Ebonyi, Bayelsa, Delta, Osun, Ogun, Cross rivers, and Borno will likely experience cooler night-time temperature conditions. Warmer than normal night-time temperatures are anticipated over Sokoto, Zamfara, Kebbi, Niger, Katsina, Kano, Jigawa, Yobe, Kwara, Bauchi, Kogi,

Taraba, Adamawa, parts of Benue, Oyo, Ogun, and Imo states.

The forecast values for night-time temperatures in January 2023 show that temperatures will range between 12°C over Plateau state and 24°C over Lagos state areas respectively. Borno, Yobe, Jigawa, Bauchi, Gombe, Kano, Katsina, parts of Kaduna, Plateau, Gombe and Zamfara state are anticipated to experience nighttime temperatures in the range of 12°C and 16°C. Temperatures between 22°C and 24°C are projected for some southern states such as Lagos, Ogun, Imo, Delta, Bayelsa, and Akwa Ibom state.

2.2.2 Predicted February 2023 Day and Night-time Temperature Forecast and Anomalies (Deviations from Long-term Average)

2023 PREDICTED FEBRUARY DAY-TIME TEMPERATURE

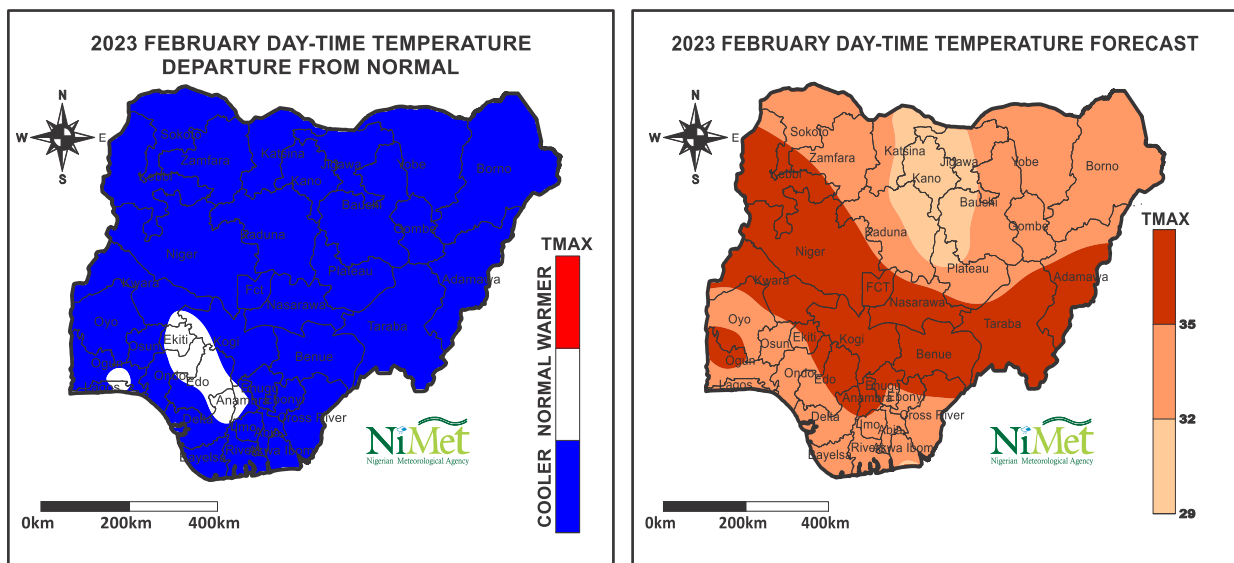


Figure 10: Predicted Daytime Temperature for February 2023

The Prediction shows that in February 2023, daytime temperatures are generally expected to be slightly cooler than the normal (or long-term average) for the month of February. For most parts of Ekiti, Ondo, Delta, Anambra, Ogun and Lagos states, daytime temperatures are expected to be about the same as the long-term average (Figure 10). For other places however, daytime temperatures are anticipated to be lower than normal.

Areas where this is likely to be more pronounced are parts of Kaduna, Adamawa, Sokoto, Yobe, Kano, Taraba, Gombe, Zamfara and Jigawa states where daytime temperatures are predicted to be as much as 1°C lower than long term normal.

Maximum temperatures in the month of February are projected to range from 29°C to 38°C. The month should have the lowest day time temperatures of 29°C to 32°C over Katsina, Kano, Jigawa and parts of Plateau states. The coastal states of Lagos, parts of Ogun, Ondo, Bayelsa, Delta, parts of Edo, Rivers, Akwa Ibom and Cross River states should experience maximum daytime temperatures between 32°C and 35°C. The highest day time temperatures of 34°C to 38°C are predicted for the rest of the southern and central states, including parts of Adamawa, Borno, Sokoto, Zamfara and Kebbi states in the north.

2023 PREDICTED FEBRUARY NIGHT-TIME TEMPERATURE

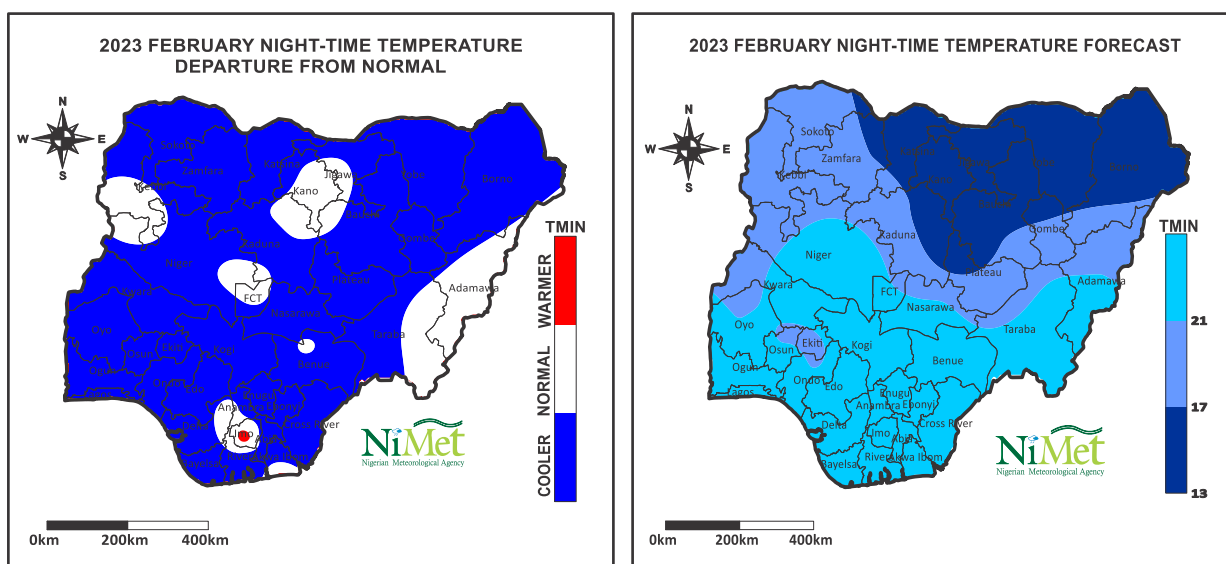


Figure 11: Predicted Nighttime Temperature for February 2023

The distribution of predicted night-time temperatures over Nigeria for February 2023 is shown in Figure 11. The projection shows that during the month, cooler than normal long-term average temperature is expected to be experienced over most parts of the country except Imo state which is

projected to be warmer than normal. Parts of Anambra, Kano, Jigawa, Kebbi and FCT are predicted to be under normal temperature conditions during the period.

For the February nighttime temperature, the Northern states, Plateau and parts of Niger, Nasarawa, Ekiti and Osun states are projected to record values between 13°C and 21°C, while the southern states are predicted to have nighttime temperatures higher than 21°C.

2.2.3 Predicted March 2023 Day and Night-time Temperature and the Anomalies (Deviations from Long-term Average) over Nigeria

2023 PREDICTED MARCH DAY-TIME TEMPERATURE

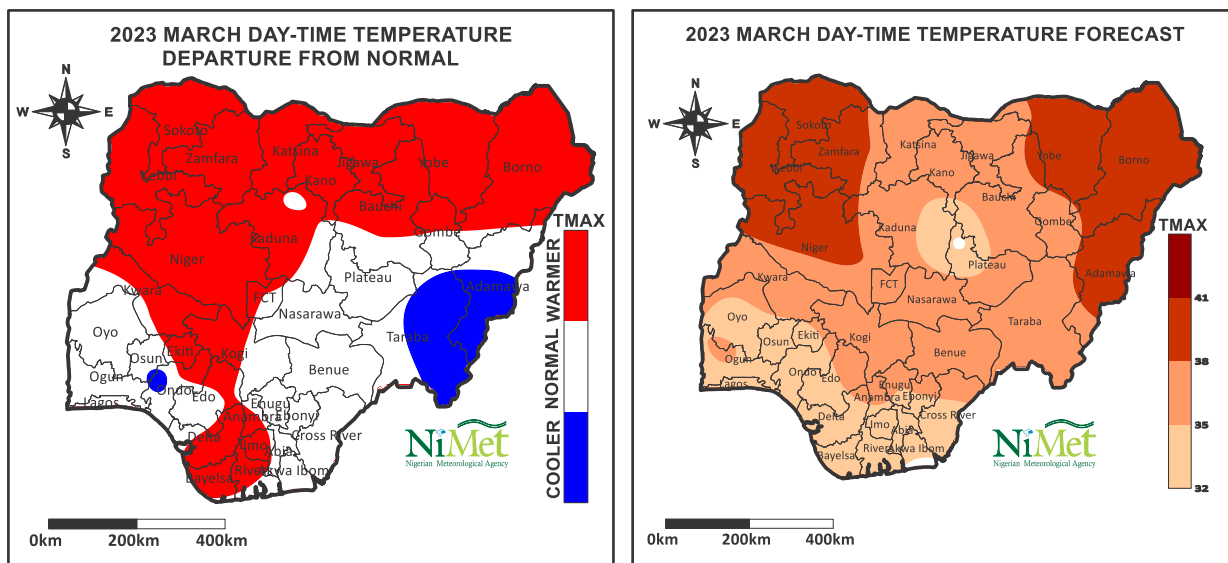


Figure 12: Predicted Daytime Temperature for March 2023

A comparison of the 2023 predicted day-time temperature values with the 1991-2020 average reveals that most places in the North and parts of Ekiti, Kogi, Anambra, Imo, Delta, Rivers and Bayelsa states will be slightly warmer than the long term normal conditions, while part of Adamawa, Taraba, and Ondo States will record values slightly lower than long term average temperature are expected to be cooler than usual at this time of the year. Other States such as Oyo, Ogun, Ondo, Lagos, Nasarawa, Benue, Plateau, Cross River, Enugu and Ebonyi state are predicted to experience normal

conditions.

Day-time temperature values in the month are predicted to range between 31.0 - 41.0°C (Fig. 12). The highest range of 39 -41°C is expected over Borno, Adamawa, Sokoto, Zamfara and Kebbi States. Other states in the North and Central Nigeria are to experience temperatures in the range of 36-39°C, except Plateau and southern States where temperature values of 31-36°C are likely.

2023 PREDICTED MARCH NIGHT-TIME TEMPERATURE

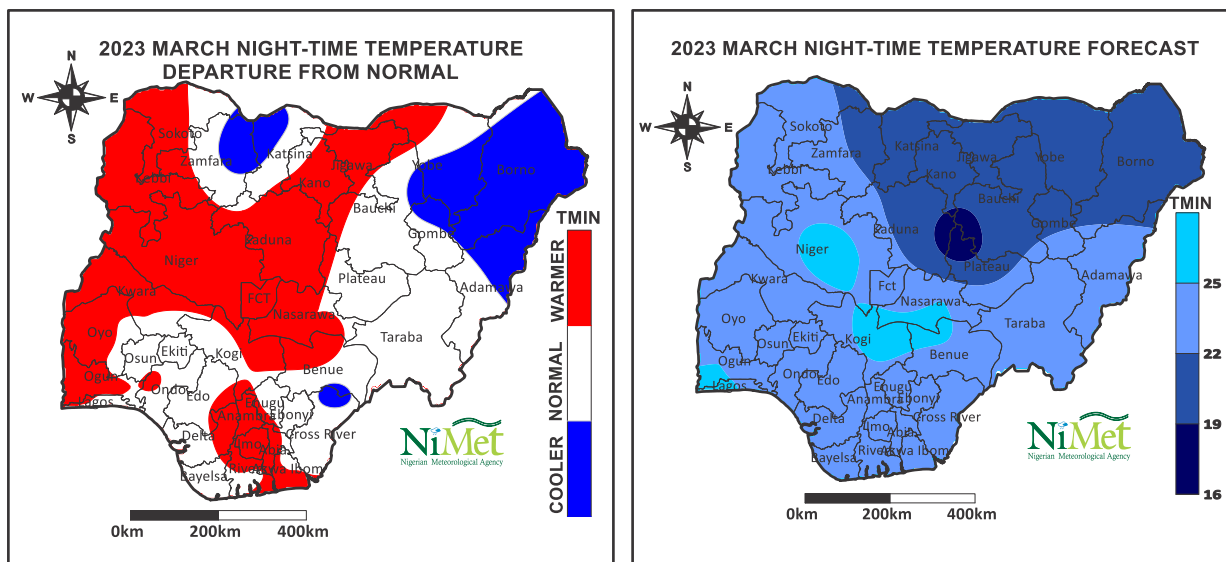


Figure 13: Predicted Nighttime Temperature for March 2023

Night-time temperature in March 2023 is anticipated to be warmer than usual for this period of the year over most parts of the country. However, there are signals of the occurrence of cooler-than-usual conditions over Zamfara, Katsina, Bauchi, Gombe, Borno, Yobe, Adamawa, Benue, and Cross River. Furthermore, the lowest minimum temperature in the range of 16-18°C is expected over parts of Plateau, Kaduna, Kano, Katsina, Yobe, Borno, and Bauchi. While the central, and southern states, Taraba, and parts of Adamawa would experience temperatures between 22 to 26°C.

2.2.4 Predicted April 2023 Day and Night-time Temperature Forecast and the Anomalies (Deviations from Long-term Average)

PREDICTED APRIL 2023 DAY-TIME TEMPERATURE

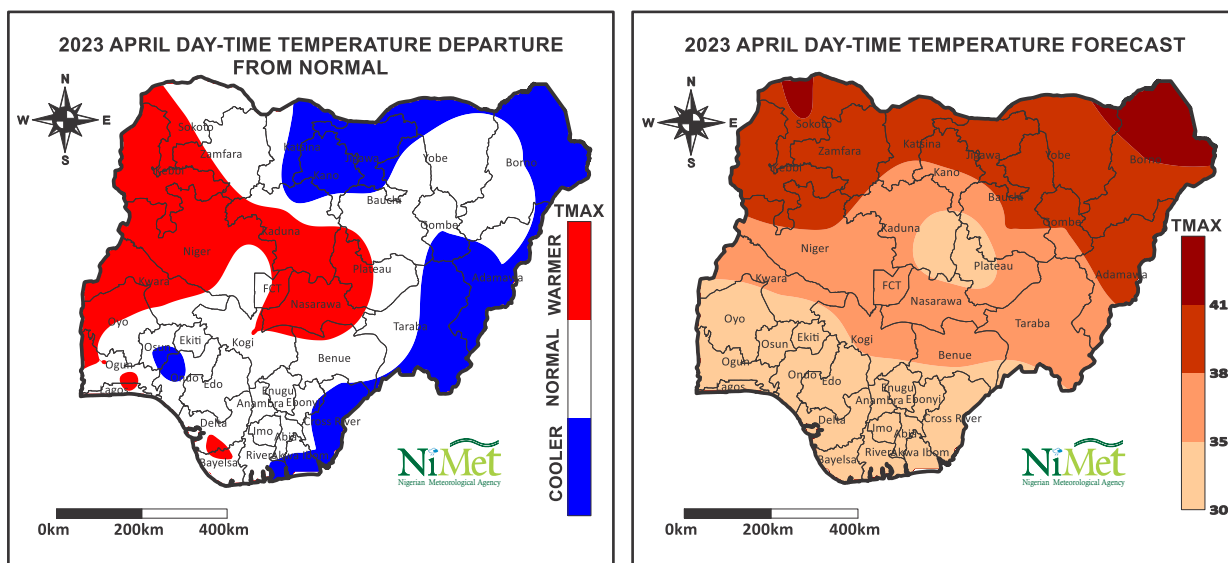


Figure 14: Predicted Daytime Temperature for April 2023

For the daytime temperatures in April 2023, the southern states are projected to experience temperatures of between 31^o C and 35^o C, while temperatures above 39^o C are anticipated for states in the northern fringes of the country (Figure 14). The Central states are however to expect temperatures ranging 35^o C and 39^o C.

This implies that parts of Katsina, Kano, Jigawa, Yobe, Borno, Adamawa, Gombe, Taraba, Cross river, Akwa Ibom, Rivers, Ondo and Osun states are predicted to be cooler than usual while warmer than usual is expected over Kebbi, Nasarawa and parts of Sokoto, Zamfara, Kaduna, Niger, Plateau, Kwara, Oyo, Ogun, Lagos and Delta states including the FCT. However, other places in white like Ekiti, Ondo, Edo, Enugu, Imo, Bauchi, Gombe among others are to experience day time temperatures associated with April in those states.

PREDICTED APRIL 2023 NIGHT-TIME TEMPERATURE

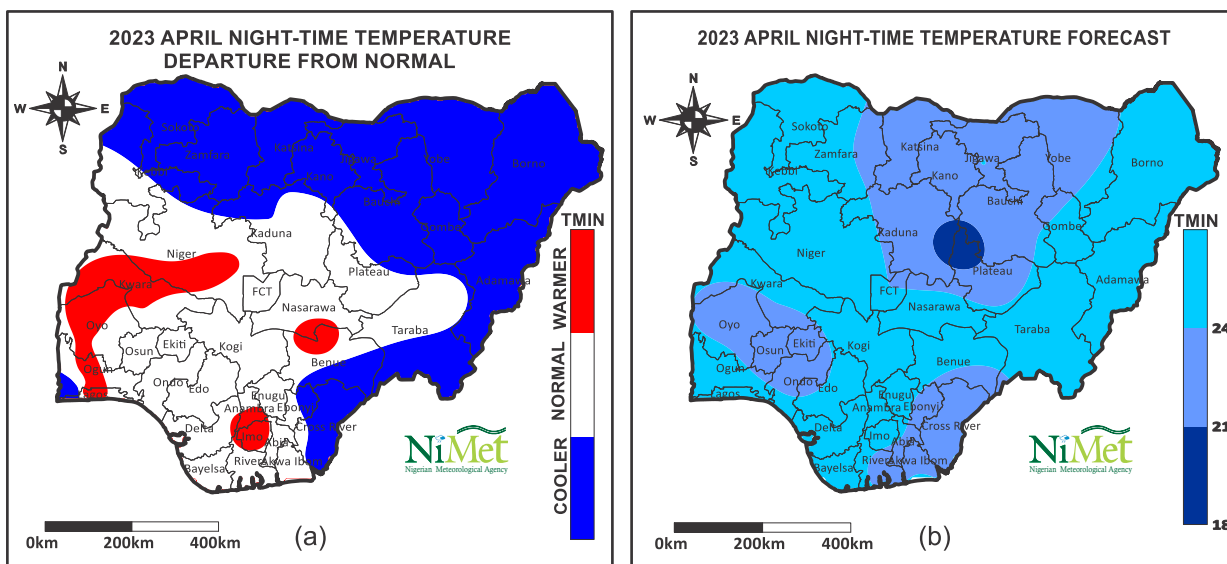


Figure 15: Predicted Nighttime Temperature for April 2023

The northern states at the fringes, parts of Taraba, Cross River and Benue states are expected to experience lower than normal night-time temperatures in April 2023. In these places, the nights are likely to be cooler than usual for the month of April. These areas are shown in blue on the map (Figure 15(a)). On the other hand, parts of Nasarawa, Imo, Anambra, Niger, Kwara, Oyo and Ogun states are expected to experience warmer than normal nights in April 2023. These areas are shaded in red on the map (Figure 15 (b)). The other states like Kogi, Osun, Ondo Ekiti, Edo, Delta, Rivers, Bayelsa, Akwa Ibom, Enugu, FCT and parts of Niger, Kaduna, Nasarawa, Plateau, Taraba, Benue, Oyo, Ogun, and Lagos states should experience normal night-time temperatures associated with this period of the year.

2.2.5 May 2023 Day and Night-time Temperature Forecasts and the Anomalies (Deviations from Long-term Average)

PREDICTED MAY 2023 DAY-TIME TEMPERATURE

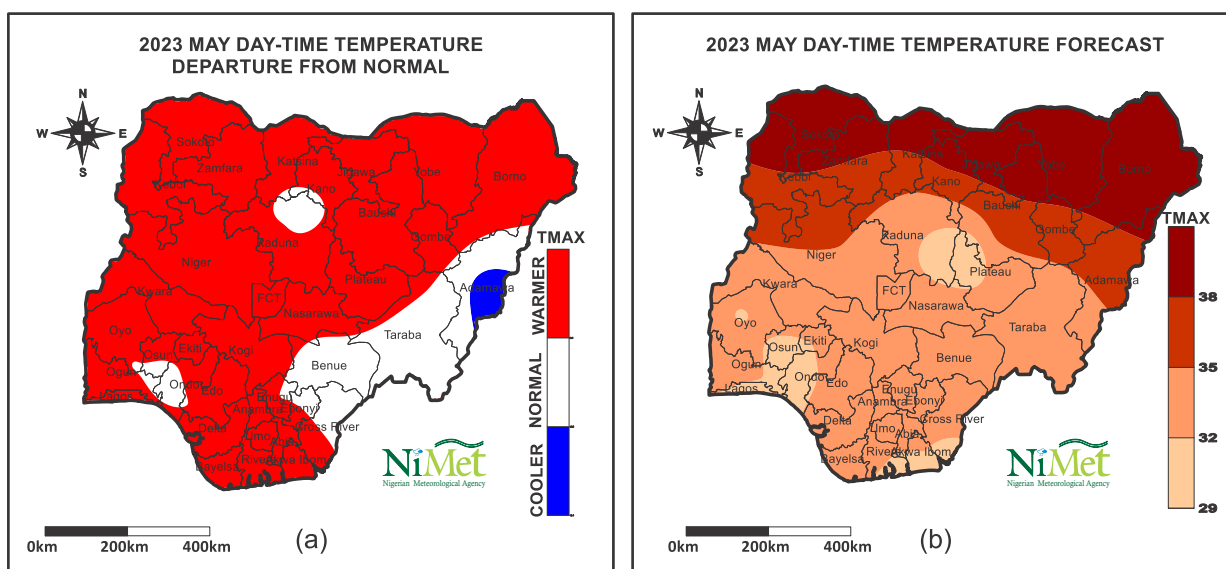


Figure 16: Predicted Daytime Temperature for May 2023

Figure 16 shows the predicted night-time temperature and the deviation from the long-term average over Nigeria for the month of May 2023. The expected temperature forecast for the month ranges from 29°C to above 40°C across the country, while the temperature in the South and most parts of the North Central, parts of Kaduna and Bauchi states are expected to be within the range, 29°C to 34°C. States like Niger, from the middle to southern parts of Kebbi, Zamfara, Katsina, Kano, Bauchi, Gombe, Southern Borno, Northern Taraba, and a major part of Adamawa state will record daytime temperatures ranging from 34°C to 38°C. The extreme northern states of the country are likely to record daytime temperatures ranging from 38°C to above 40°C. Figure 16 (a) shows the deviation of the forecast daytime temperature for May 2030 from the 30-year average. Warmer daytime temperatures are anticipated over a larger part of the country during the month, while the daytime temperature in parts of Kaduna, and few areas in the Southwest, Adamawa, Taraba, Benue, parts of Ebonyi and Enugu states are expected to be about the same as the long-term average. While a little portion of Adamawa will witness colder than normal day time temperature in the Month of May 2023. See Figure 16 (a).

2023 PREDICTED MAY NIGHT-TIME TEMPERATURE

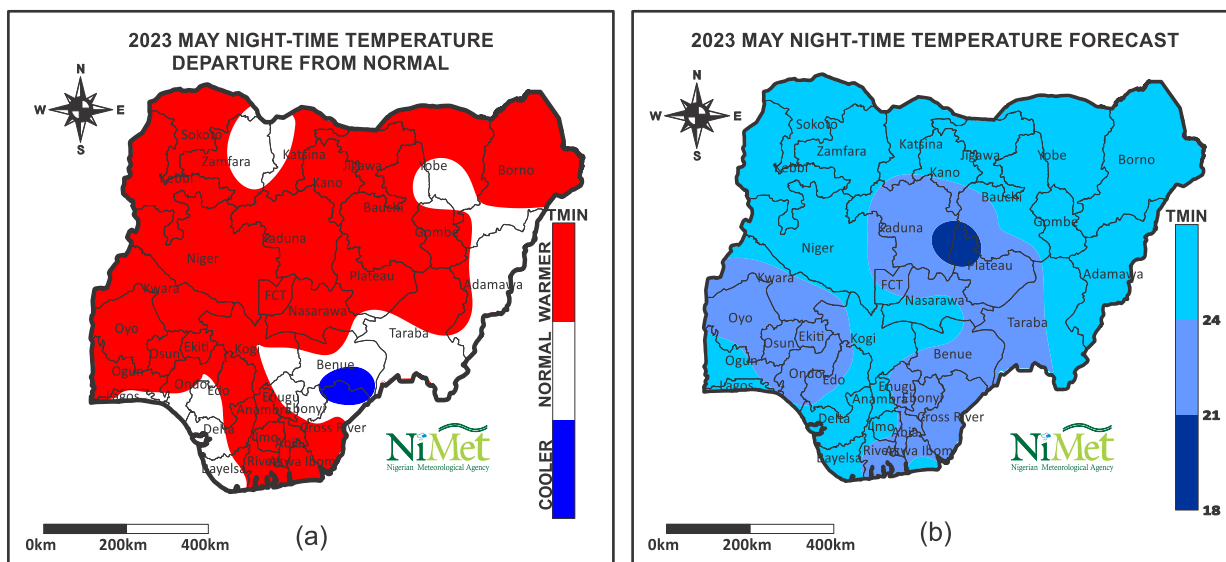


Figure 17: Predicted Nighttime Temperature for May 2023

The predicted night-time temperatures over Nigeria for May 2023 and their departure from the 30-year average are shown in Figure 17. As depicted in Figure 17 (a), warmer than normal nighttime temperatures are anticipated in May 2023 in most parts. However, parts of Cross River and Benue states are expected to experience cooler than normal nighttime temperatures during the period. Normal nighttime temperatures are anticipated over parts of Zamfara, Katsina, Bauchi, Yobe, Borno, Adamawa, Taraba, Kogi, Enugu, Ebonyi, Bayelsa, Delta, Lagos, Ondo, and Edo states.

The predicted night-time minimum temperature values for May 2023 across the country are expected to range between 18°C and 28°C. The lowest temperature range of 18°C to 21°C are expected over Jos and its environs while values in the range of 21°C to 24°C are anticipated in Cross River, Ebonyi, Kaduna, Enugu, Abia, Rivers, Ondo, Osun, Ekiti, parts of Benue, Nasarawa, Plateau, Taraba, Ogun, Edo, Kwara, Niger, Bauchi states and the FCT. Lagos, Delta, Anambra, Kebbi, Sokoto, Zamfara, Katsina, Kano, Jigawa, Yobe, Borno, Adamawa, and Gombe states are anticipated to record temperature values between 24°C and 28°C.

2.3 Climate and Health

Human health and well-being are directly and indirectly affected by weather conditions and climatic variables. The prevalence of some diseases and illnesses are seasonal. This could be attributed to the fact that disease vectors (such as mosquitoes) and micro-organisms breed and reproduce faster under certain climatic conditions. Malaria and meningitis are two main public health challenges in Nigeria. The World Health Organization (WHO) reported that in 2020, Nigeria accounted for 26.8% of malaria cases and 31.9% of deaths due to malaria globally⁵. According to the Nigeria Centre for Disease Control (NCDC), malaria is a risk for 97% of Nigerians. It affects up to 100 million people in Nigeria and causes about 300,000 deaths annually in the country.

Temperature and relative humidity (associated with the rainy season) are two climatic factors that influence the occurrence and spread of malaria, while the outbreak and spread of meningitis are also influenced by temperature, relative humidity, and atmospheric dust concentration. Based on the predicted temperature, relative humidity, and dust concentration in the atmosphere, NiMet predicts the probability of occurrence malaria and meningitis across Nigeria and that determines the vigilance level. The criteria for high, medium, and low vigilance thresholds are outlined in Section 2.3.2 for malaria and Section 2.4.1 for meningitis.

2.3.1 Malaria Vigilance Forecast

Background: Malaria is a widespread mosquito-borne disease, especially in the tropics where the climate is conducive for the spread of the illness. Experts have noted that global warming and ongoing changes in the weather favor pathogenic parasite reproduction, survival, and spread. A female Anopheles mosquito bite from an infected person to an uninfected person transmits malaria, a potentially fatal infectious disease, which is brought on by a single cell parasite (Plasmodium). Many studies linked variations in meteorological parameters to the steady transmission in Sub-Saharan Africa.

⁵ World malaria report 2021. Geneva: World Health Organization; 2021.

Malaria Vigilance Forecast: The predicted temperature and relative humidity are used in determining the degree of vigilance for malaria. When the temperature is between 25°C and 32°C and relative humidity > 80%, the region is placed under high vigilance. When the temperature is between 20°C and 25°C and relative humidity is between 70 and 80%, the area is recommended for moderate vigilance. Low vigilance for malaria is issued when the temperature is in the range of 18 °C-20°C and relative humidity is between 60 and 70%. No vigilance is required when the temperature is less than 18°C and relative humidity less than 60%.



Figure 18: Anopheles Mosquito

Criteria for Malaria Vigilance Thresholds

The predicted temperature and relative humidity are used in determining the degree of vigilance for malaria. When the temperature is between 25°C and 32°C and relative humidity is greater than 80%, the region is placed under high vigilance. When the temperature is between 20°C and 25°C and relative humidity is between 70 and 80%, the area is recommended for moderate vigilance. Low vigilance for malaria is issued when the temperature is in the range of 18 °C to 20°C and relative humidity is between 60% and 70%. No vigilance is required when the temperature is less than 18°C and relative humidity less than 60%. Temperature and relative humidity vary

geographically from month to month across Nigeria. Consequently, the prevalence of malaria also changes with climatic conditions and is not uniform all over the country. The level of malaria vigilance changes with geographical location and season as presented below. The predicted vigilance is useful guide for public health planning.

2.3.2 Malaria Vigilance Maps for January to May 2023

The levels of vigilance for January, February, March, April and May 2023 have been predicted using the forecast temperature and relative humidity across the country for each of the months. The results are presented in Figures 19 to 23.

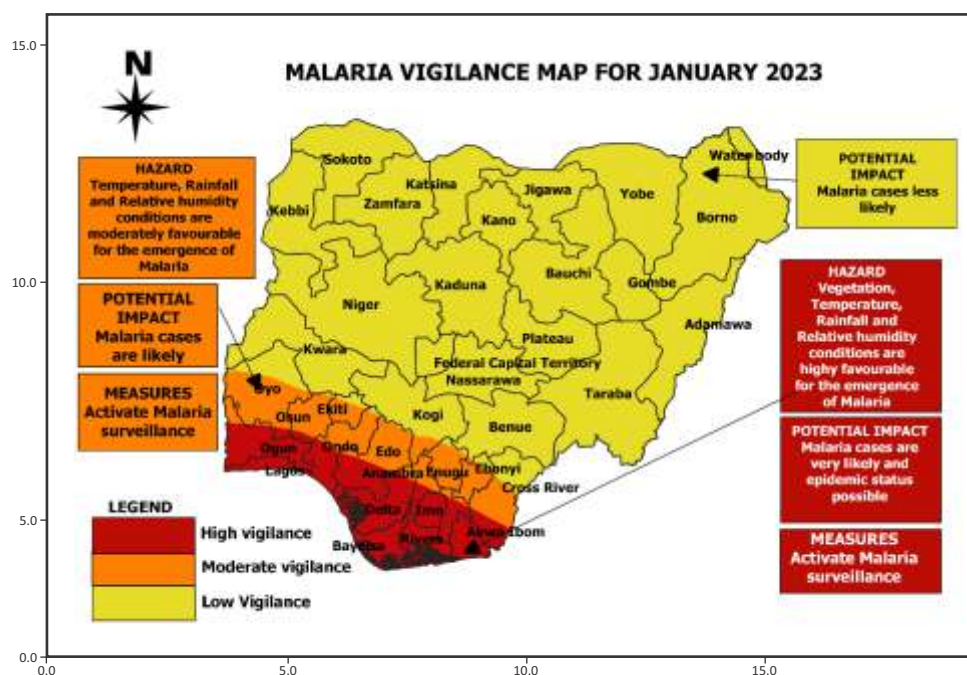


Figure 19: January 2023 Malaria Vigilance Map

The following vigilance for Malaria is expected over the country in January 2023 as shown in Figure 19

- **High Vigilance:** the coastal states, namely: Lagos, Ondo, Delta, Bayelsa, Rivers, Akwa Ibom, River states as well as some inland states in the south such as Ogun, Imo and parts of Cross River

- **Moderate Vigilance:** major part of Oyo, Ogun, Ondo, Enugu, Ebonyi, and part of Cross River state.
- **Low Vigilance:** The entire north comprising the North Central and the extreme North are expected to observe Low Vigilance.

2.3.2.1 February 2023 Malaria Vigilance Map

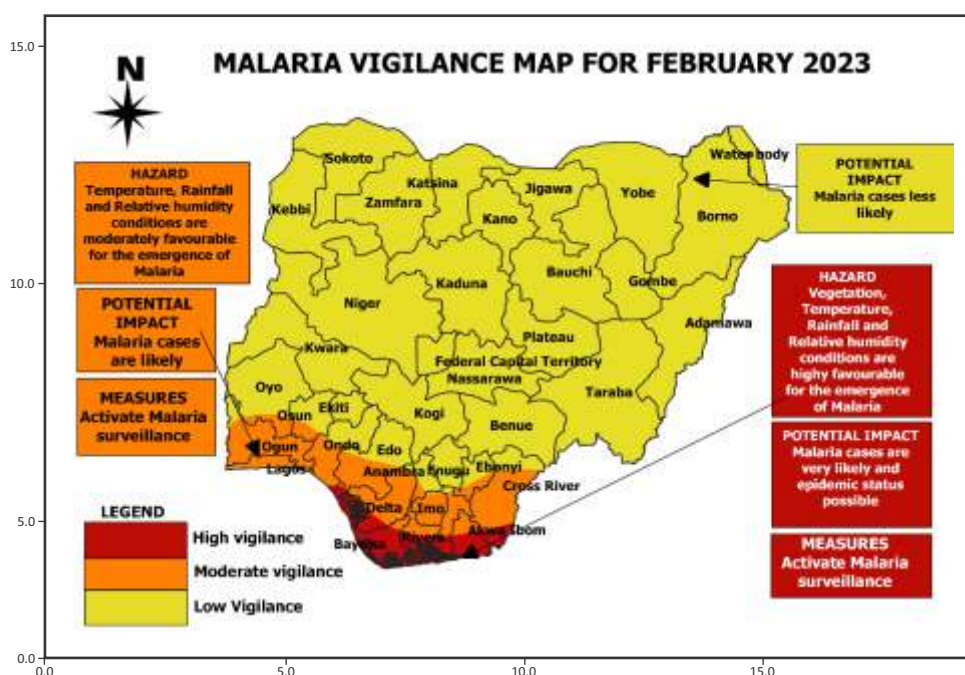


Figure 20: February 2023 Malaria Vigilance Map

The following vigilance for Malaria is expected over the country in February 2023 (Figure 20):

- **High Vigilance:** the coastal area of the south such as Delta, Bayelsa, Rivers, Akwa Ibom and Cross River states.
- **Moderate Vigilance:** Lagos, Ogun, Ondo, Edo, Imo, Anambra, Ebonyi, Oyo, and Osun.
- **Low Vigilance:** entire north, central region, Ekiti, Enugu, Benue, and Taraba states.

2.3.2.2 March 2023 Malaria Vigilance Map

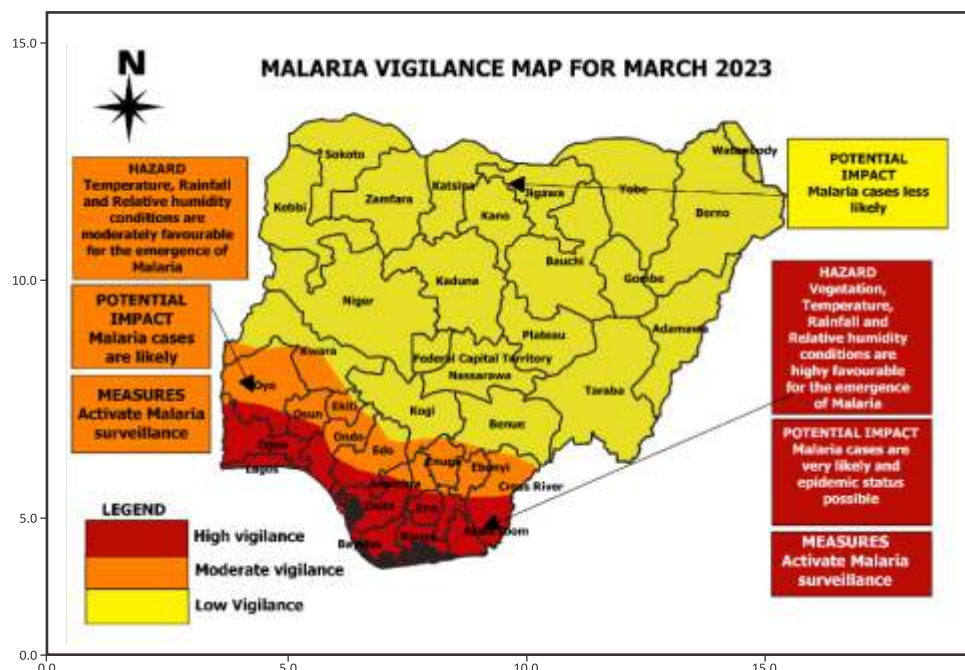


Figure 21: March 2023 Malaria Vigilance Map

The following vigilance for Malaria is expected over the country in March 2023 (Figure 21)

- **High Vigilance:** Lagos, Ogun, Anambra, Imo, Rivers, Delta, Akwa Ibom, and Bayelsa. States.
- **Moderate Vigilance:** Ondo, Edo, Ekiti, Oyo, Ebonyi and Cross Rivers state.
- **Low Vigilance:** From North Central to the extreme.

2.3.2.3 April 2023 Malaria Vigilance Map

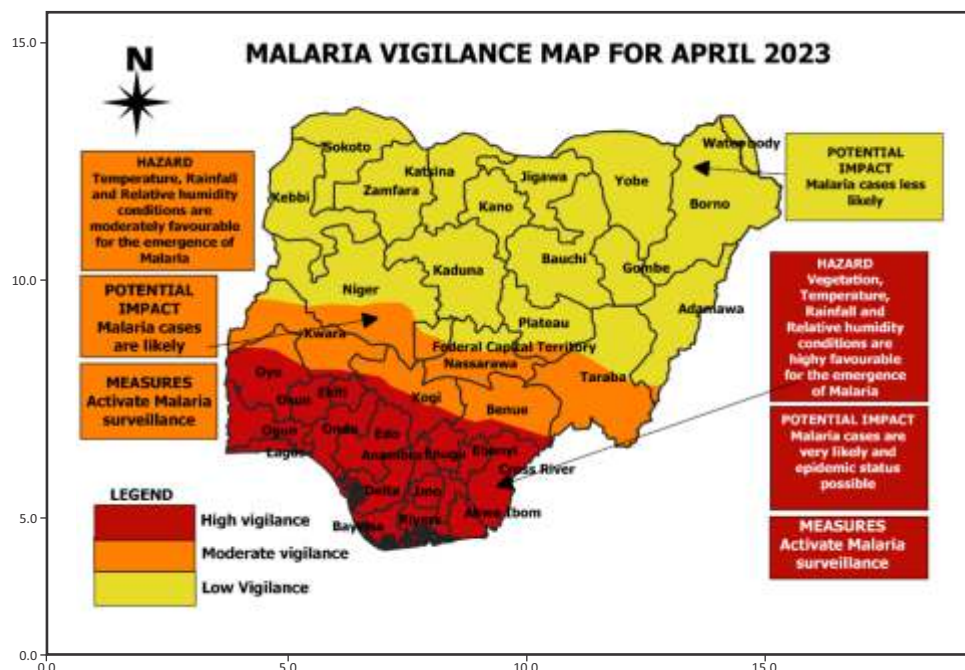


Figure 22: April 2023 Malaria Vigilance Map

The following vigilance for Malaria is expected over the country in April as shown in Figure 22.

- **High Vigilance:** The entire southern region of the country extending to the southern parts of some central states such as Kwara, Kogi, and Benue states.
- **Moderate Vigilance:** Niger, FCT, Nasarawa, Plateau, Taraba, and Adamawa states.
- **Low Vigilance:** The whole of the northern states.

2.3.2.4 May 2023 Malaria Vigilance Map

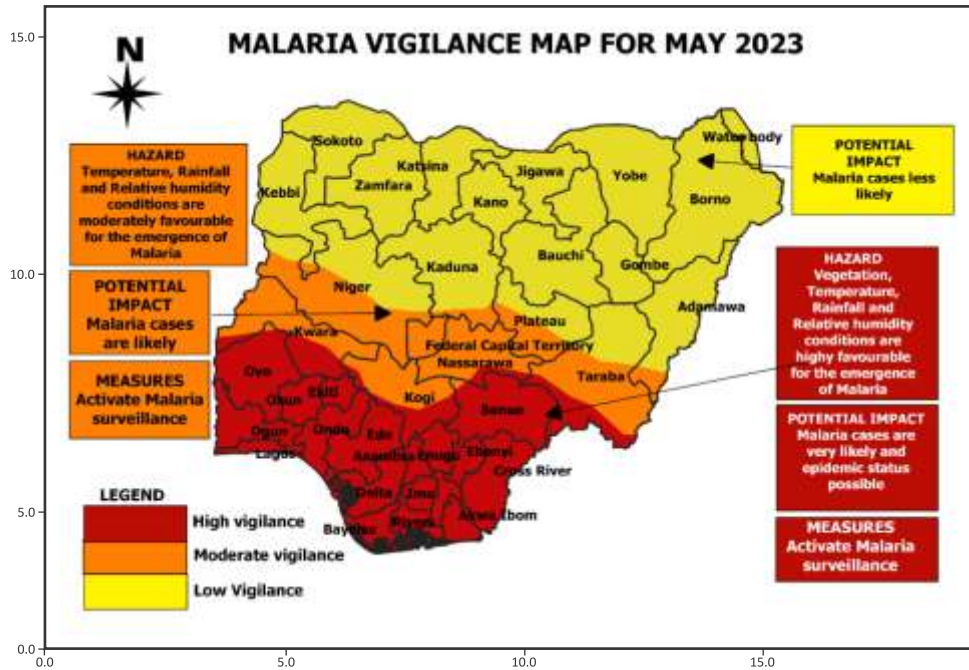


Figure 23: May 2023 Malaria Vigilance Map

The following vigilance for Malaria is expected over the country in May as shown in figure 23:

- **High Vigilance:** The entire southern region of the country extending to the southern parts of some central states such as Kwara, Taraba, Kogi, Benue, Nasarawa states.
- **Moderate Vigilance:** FCT, Parts of some central states like Niger, Plateau, and Adamawa states.
- **Low Vigilance:** Most of the northern states

2.4 Meningitis

Nigeria lies within the Meningitis Belt of sub-Saharan Africa which stretches from Ethiopia in the East to Senegal/Gambia in the West. (See Figure 24). This region is known for frequent outbreak of meningitis. In Nigeria, this region is prone to both meningitis and malaria in alternating seasonality. Meningitis poses a significant public health challenge in Nigeria. Citing the NCDC, The Punch Newspaper reported that in 2022 Nigeria recorded 961 suspected cases and 51 deaths due to meningitis in 32 and the FCT across 159 Local Governments as of October⁶. Even though 19 states of Nigeria and the FCT lie within the African Meningitis Belt, the disease occurs all over the country. However, the occurrences is higher in the northern region, especially the Sahel and Sudan savannah region⁷. Its outbreak is seasonal and is strongly influenced by temperature, relative humidity and concentration of dust in the atmosphere. These three climatic parameters are used by NiMet to forecast the likelihood of meningitis and the spatial distribution over Nigeria. The outlook is issued as meningitis vigilance which is categorized as (i) high vigilance, (ii) moderate vigilance, and (iii) low vigilance, depending on the predicted probability of occurrence. This section presents the meningitis vigilance for January to May 2023.

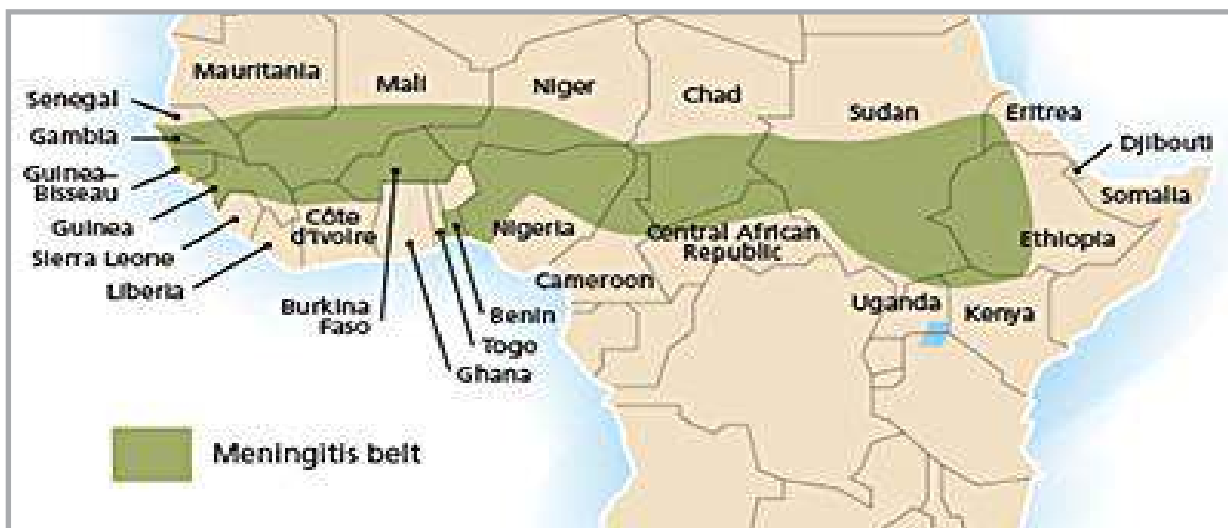


Figure 24: African meningitis belt comprising Twenty-six (26) countries⁸.

⁶ <https://punchng.com/nigeria-records-961-meningitis-cases-56-deaths/>

⁷ Ayanlade, A., Nwayor, I.J., Sergi, C. et al. Early warning climate indices for malaria and meningitis in tropical ecological zones. *Sci Rep* 10, 14303 (2020). <https://doi.org/10.1038/s41598-020-71094-8>.

⁸ https://www.who.int/health-topics/meningitis#tab=tab_1

Criteria for Meningitis Vigilance Thresholds

Relative humidity, concentration of dust in the atmosphere and mean air temperatures are the predictors used in determining the vigilance thresholds for meningitis. For high vigilance, relative humidity of less than 20%, the temperature within the range of 25°C-32°C, and atmospheric dust concentration of 500 to 2000 µg/m³ are considered. For moderate vigilance, relative humidity within the range of 20-40%, the temperature of 20°C - 25°C, and dust concentration of 200 to 500 µg/m³ are used. Low vigilance is said to prevail when relative humidity is above 40%, temperature below 25°C, and dust concentration is within the range of 50 to 200 µg/m³ while no vigilance prevails if there is a significant amount of rainfall⁹.

2.4.1 January 2023 Meningitis Vigilance

In January 2023, the climatic parameters such as low Relative Humidity below 40%, no rainfall, high temperatures, prevalence of dry north-easterly wind and surface dust conditions which favour the outbreak of meningitis, are expected in the Northeast of Nigeria.

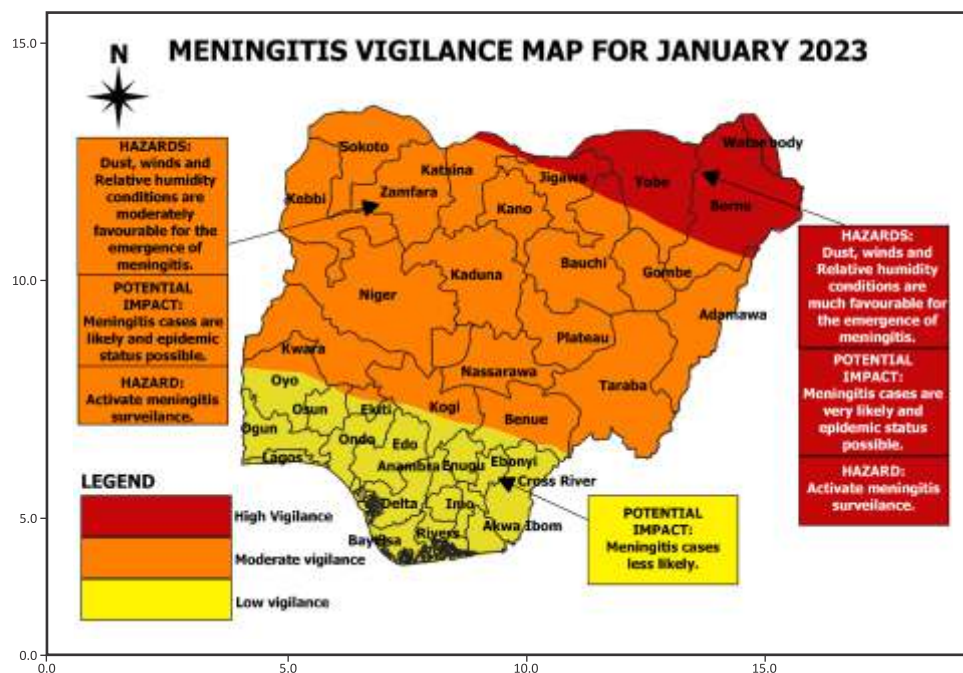


Figure 25: January 2023 Meningitis Vigilance Map

⁹ Seefeldt MW, Hopson TM, Warner TT: A Characterization of the Variation in Relative Humidity across West Africa during the Dry Season. J Appl Meteorol Climatol 2012, 51(12):2077–2089. 10.1175/JAMC-D-11-0196.1

The following vigilance for Meningitis is expected over the country in January as shown in Figure 25:

- **High Vigilance:** This is anticipated within the Northeastern part of the country; namely Borno, Yobe part of Jigawa and small portion of Katsina.
- **Moderate Vigilance:** The entire north central region parts of South and the extreme North except for the few northeastern states will witness Moderate Vigilance.
- **Low Vigilance:** The entire South fall within low Vigilance, except for Northern parts of Oyo, Ekiti and Osun.

2.4.2 February 2023 Meningitis Vigilance

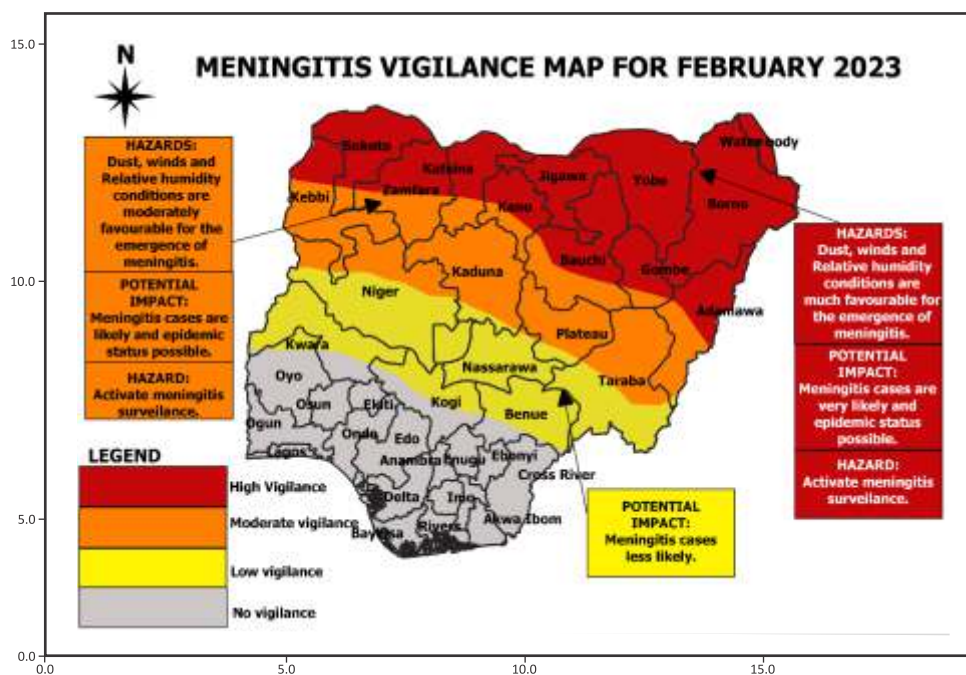


Figure 26: February 2023 Meningitis Vigilance Map

The following vigilance for Meningitis is expected over the country in February as shown in Figure 26:

- **High Vigilance:** Kebbi, Sokoto, Zamfara, Katsina, Jigawa, Bauchi,

Gombe, Adamawa, and Borno states.

- **Moderate Vigilance:** Niger, Kaduna, Plateau, and Taraba states.
- **Low Vigilance:** Kwara, Kogi, Nasarawa, and Benue states.
- **No vigilance:** The southern part of the country.

2.4.3 March 2023 Meningitis Vigilance

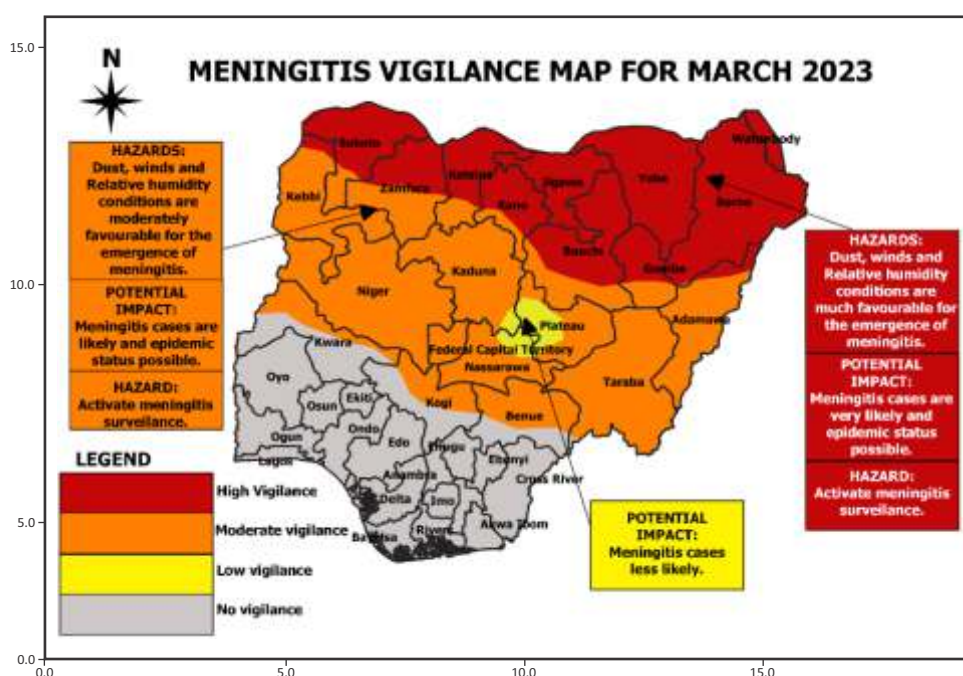


Figure 27: March 2023 Meningitis Vigilance Map

The following vigilance for Meningitis is expected over the country in March

- **High Vigilance:** Borno, Yobe, Jigawa, parts of Gombe, Bauchi, Zamfara, Katsina, Kano, Sokoto, and the northern fringes of Adamawa.
- **Moderate Vigilance:** Kebbi, Niger, Kaduna, Taraba, Nasarawa, parts of Benue, Plateau, Kogi, Kwara and the FCT.
- **Low Vigilance:** parts of plateau, Nasarawa and parts of southern Kaduna.
- **No Vigilance:** southern parts of the country.

2.4.4 April 2023 Meningitis Vigilance

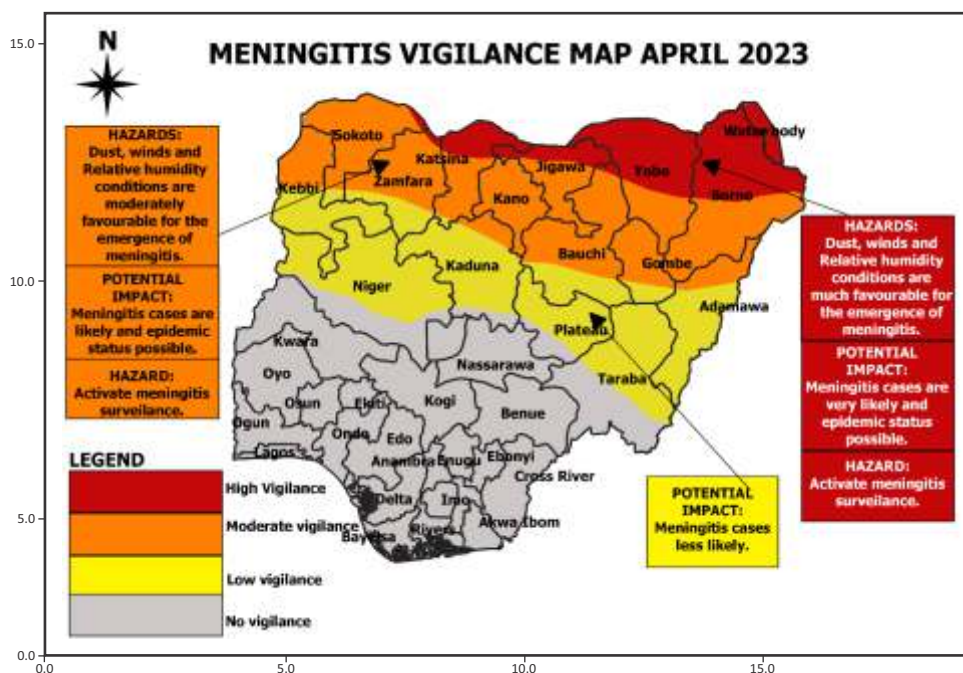


Figure 28: April 2023 Meningitis Vigilance Map

The following vigilance for Meningitis is expected over the country in April as shown in Figure 28:

- **High Vigilance:** The northern fringes of Sokoto, Zamfara, Jigawa, Yobe, and Borno states.
- **Moderate Vigilance:** Parts of Kebbi, Kano, Kaduna, Bauchi, Gombe, and Adamawa states.
- **Low Vigilance:** Niger, Plateau, and Taraba state.
- **No vigilance:** The South and the southern part of the central states.

2.4.5 May 2023 Meningitis Vigilance

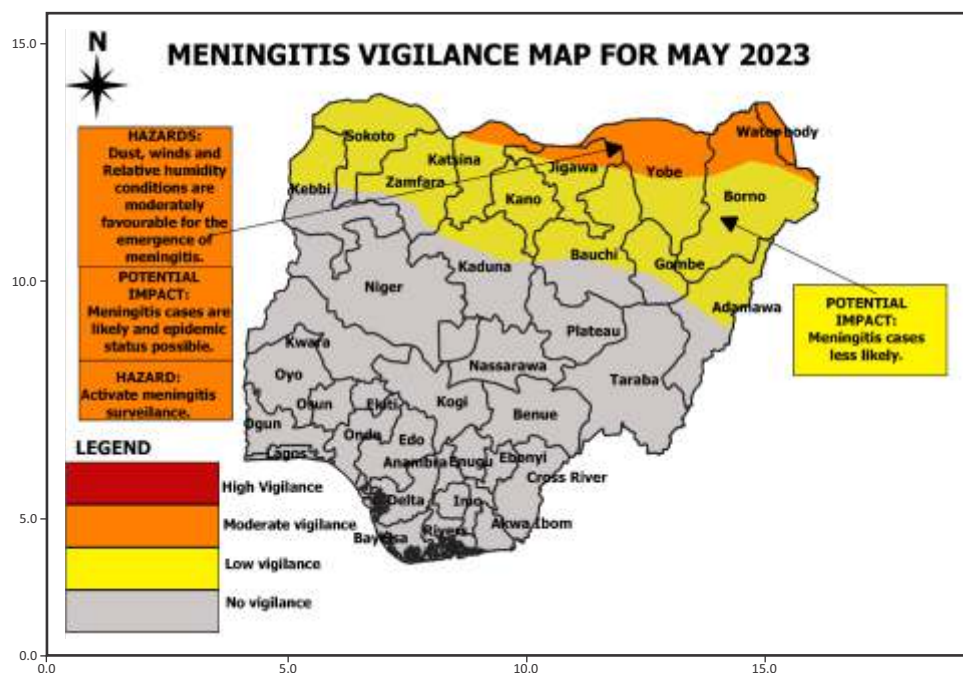


Figure 29: May 2023 Meningitis Vigilance Map

The following vigilance for Meningitis is expected over the country in May as shown in figure 29:

- **Moderate Vigilance:** The northern fringes of Katsina, Jigawa, Yobe, and Borno states.
- **Low Vigilance:** Most parts of the northern states including Sokoto, Zamfara, Kano, parts of Kebbi, Kaduna, Bauchi, Gombe, and Adamawa states.
- **No vigilance:** The south and central states.

Chapter Three

3.0 Implications of the 2023 Seasonal Climate Prediction for Some Key Economic Sectors

Weather affects every sector of the economy and aspect of human activities. The predicted conditions of the climate in Nigeria for 2023 will affect various sectors of the economy in different ways, and the appropriate response by operators will vary from one sector to another. The key sectors of the economy that are particularly sensitive to climate include agriculture, water resources, power generation and distribution, transportation (air, land, and sea), health, telecommunication.

3.1 Agriculture

The prediction for 2023 shows that the onset of the growing season is likely to range from early to normal in most parts of the country. However, later than normal onset dates are expected over parts of northern Borno, Bauchi, Jigawa, Kano, Katsina, Zamfara, and Yobe in the north as well as Abia, Imo, River, Cross-River, and Lagos states in the south of Nigeria. However below-normal rainfall amount (420-720mm) is predicted in some places over the extreme North such as Borno, Yobe, Kebbi, Katsina, Sokoto, and Jigawa and this is likely to create water stress in those areas. Farmers around this area are therefore advised to apply the following adaptation measures:

1. Crop

- a) Preserve soil moisture, ensure frequent weeds control, and encourage the increase of soil biota that promotes soil health and crop performance.
- b) Build breaks in between rows and beds before the growing season to check soil erosion.
- c) Practice Zero or limited tillage (disturbance of the soil).
- d) Avoid applying fertilizers just before it rains, to prevent leaching and runoff of the applied nutrient.
- e) Use of supplementary irrigation during dry spells
- f) Encourage the use of small-scale water harvesting systems such as



- ditches.
- g) Relevant authorities are advised to use the information in this SCP as a guide in choosing and providing early maturing and drought-resistant crop varieties and irrigation options to improve crop productivity.
 - h) Preparation for farming should start early (Jan -Feb. in the southern part of Nigeria),
 - i) Areas predicted to have a normal length of the growing season are advised to use long-maturing varieties
 - j) Given the anticipated, early onset farmers and state govt should start early preparation in terms of early mobilization of resources such as seeds, fertilizers, pesticide
 - k) Synchronization of crop - weather calendar



Figure 30: Typical Maize Farm

2. Livestock Production

i. Poultry

The 2023 prediction shows that daytime temperatures all over the country is are likely to be above normal when compared to the thirty-year (1991-2020)

average in the months of January, March, April, and May. This could have adverse impact on domestic animals and result to economic losses. The following measures are therefore recommended.

- a) Poultry pens should be ventilated, and birds should be rehydrated frequently.
- b) Farmers should reduce stocking densities during the stress period and ensure good farm management practices.
- c) During the anticipated high temperatures body temperature of young birds (chicks) should be regulated and clean water provided frequently for the birds.
- d) Poultry pens should be sanitized during the raining season to avoid breeding of fungi, bacteria, and other pathogens.
- e) To increase and enhance feed intake and reduce selective feeding, feed may be given in pelleted forms.
- f) Poultry floor should be kept dry always to prevent manifestation the growth and spread of bacteria and fungi.



Figure 31: Poultry Farm



ii. Ruminant

Ruminants (such as cattle, sheep, and goat) are susceptible to sickness and diseases during the wet and cold seasons. They are more prone to diseases when they are being fed with grasses or other feeds that are already mouldy due to warm and humid weather. Also increase in moisture during raining season can lead to increased breeding of bacteria pests (ticks), etc. The following advisories are recommended.

- a) Farmers should de-worm their animals regularly.
- b) Pest (such as ticks) control measures should be applied frequently during the raining season because pests spread faster during this season.
- c) Dairy cows should be treated with antibiotics to avoid udder mastitis (swelling of the udder) that could stop production of milk)
- d) Animal feeds should be kept in clean and dry place during the rainy season to avoid moulds.
- e) Clean water should be given frequently during the anticipated high temperatures.



Figure 32: Cattle Ranch

3.1.3 Aquaculture

Weather parameters, specifically rainfall, relative humidity, winds, temperature, and light intensity and sunshine hours affect agricultural production systems, including aquaculture. The Prediction for the year 2023 indicates normal to above normal rainfall over the country, ranging from 420mm in the north to over 3120 mm in the coastal states. The following measures are therefore recommended:

- a) Farmers should build earth ponds one to two months before the start of rain to achieve the best depth.
- b) Dredge the pond to make it deeper so that it can hold a lot of water during the season.
- c) Avoid collecting or stocking fingerlings during high rainfall and temperatures
- d) To avoid fishponds failure, earth pond should be built at least one month before onset and should be away from waterway



Figure 33: Typical Fishpond in Bayelsa, Nigeria

3.2 Water Resources Management

Water resources management involves planning, developing, distributing and management for the optimum use of water resources. Natural sources of water are sensitive to climate and the activities involved in the management, such as the construction of new facilities, restructuring and maintenance of the old, proper management of flood (including mitigation), droughts monitoring, etc., are therefore sensitive to the effects of climate change and variability. Accurate forecasting of rainfall has been one of the most important issues in hydrological research and operations because early warnings of severe weather can help prevent damages caused by weather-related natural disasters, and provide advance information for groundwater, surface water and many water quality problems. For these and many more reasons, NiMet' Seasonal Climate Prediction is a relevant tool for achieving improved water resources management practices in Nigeria.

According to the NiMet' 2023 prediction, most parts of the country would experience early start of rains, from about 2nd March in the coastal states to around 7th July the northernmost boundaries of the country. The predicted total amounts of rainfall in 2023 for Bayelsa and Delta states are over 3000mm, while between 1900mm and 2800mm is expected in the other southern states. Between 1300mm and 1600mm is predicted for the Central states, while 400mm to 1000mm total amount of rainfall is expected for the northern states in the year.

With the early onset and ample amount of rains expected and the experiences of the year 2022, it would be good to know that the water table has not gone too low and the aquifers still very much active across the country and as such there could be chances of flash floods over many places largely due to poor sanitation practices, looseness of the soil resulting to poor percolation and subsequently increasing the volume of water that get to the tributaries of major rivers, streams and dams. These are likely to cause damages along their course of flow. It would therefore be important that adequate mitigation and response measures be put in place where such do

not exist and strengthened where the need be to forestall the reoccurrence of the flood disaster experience of the previous year.

Measures such as the under listed should be taken by the responsible Agencies such as NEMA, SEMAs, RUWASSAs etc.:

- i. Checking and putting up appropriate contingency plans by the Management personnel of Hydrological areas I, II, V and VIII in the eventuality of extreme situations.
- ii. Strengthening of campaigns on clearing of drainages, better waste disposals and evacuation plans where necessary.
- iii. Preparing effective water budget plans commensurate with the 2022 rainfall forecasts.
- iv. Employing, improving and strengthening of integrated water resources management techniques.
- v. Identifying and preparing suitable sites for relocating evacuees communities who might be affected in the event of large scale flooding, while also improving on the search and rescue techniques.
- vi. Strengthening collaboration with supporting donors at the National and International levels (philanthropists, NGOs, Government, etc.).
- vii. Maintaining regular contacts with the health authorities to adequately contain any outbreak of water borne diseases.
- viii. Evaluating roles and synergizing efforts through Regional Water Planning agencies like the Niger Basin Authority (NBA) with countries comprising of Guinea, Côte d'Ivoire, Mali, Burkina Faso, Algeria, Benin, Niger, Chad, Cameroon, and Nigeria.
- ix. Discouraging the use of non-permeable surfaces like pavements and concretization in buildings and constructions but instead promote the use of environment-friendly construction materials and improve planting of trees.



Figure 34: Water Treatment plant

3.3 Power Generation and Distribution



Figure 35: Power Distribution in Nigeria

Energy production in Nigeria remains highly skewed with the non-clean (thermal) sources accounting for about 80% of the total power generated in the country. However, renewable energy-based production is gaining more attraction in Nigeria, as the Federal Government continues to promote clean energy production by supporting local communities in setting up renewable energy production plants and ensuring that all components needed to generate renewable energy are readily available and affordable. Such initiative is in line with achieving the Sustainable Development Goal 7 (SDG-7) – Affordable and Clean Energy to cut carbon emissions to net zero by 2060. The predicted normal rainfall amount over most parts of the country would sustain hydro-power generation if the opportunity is properly harnessed by the Hydro power generating Dams and plant managers should complement the non-renewable energy sources to meet up with the high



demand for power during the hot season for cooling systems. Accordingly, the following advisories are offered:

- **Alternative power generation sources should be embraced to compliment the Hydro-Power sources** to cope with the high demand for power. This will also help to hedge the power sector against the vulnerability of hydropower systems to climate variability and change.
- **Higher capacity distribution Sub-stations should be provided** to compensate for eventual breakdown of existing transformers due to high load and demand especially in high density areas.
- Electricity Distribution Companies should ensure that cables, electric poles and other installations used in transmitting power to users are properly installed so as to withstand strong winds, heavy rains and other severe weather phenomena
- Continuous investment in renewable energy systems powered by Solar and Wind to supplement the non-renewable energy production deficit,
- Offices, buildings, and households should be well ventilated to allow effective and efficient air circulation during the hot season, and thereby reduce demand for power for air-conditioning.
- Regular monitoring and de-silting of hydro-power dams to maximize water storage, prevent dam collapse and minimize risk of water shortage.
- Maintenance and cleaning of solar panels and windmills to enhance energy production and withstand rainstorms common at the beginning of the rainy season
- Power storage battery bank shelters (especially outdoors) for renewable energy sources should be built using non-conductor materials and should be well ventilated to minimize high temperature effects
- Risk of fire incident is also high during the period and therefore, **bushes should be trimmed, and fire breaks provided around power substations and wooden poles.**

3.4 Transportation

Transportation as a sector that is also vulnerable to the vagaries of weather, it is affected greatly by the different weather elements - heavy rainfall, thick dust haze, a long rainy season, fog and mist, extreme temperatures, etc. All these weather conditions interplay in one way or another to affect the various means of transport. The transportation system in Nigeria which we shall be looking at include road, rail, air, coastal and inland water way transport.



Figure 36: Transportation in Nigeria

3.4.1 Road Transport.



Figure 37: Road Network in Nigeria

The 2023 seasonal outlook projects a long rainy season, with prospects of near normal to above normal rainfall amount. This means that there may be more convective rains which are usually of high intensity and accompanied with strong winds. These can affect road transport as travel times will be longer. Heavy rains can lead to flash flooding and temporal closure of roads. It can lead to collapse of weak roads and bridges cutting off passage from one location to another. Strong winds can pull down huge trees, communication mast which can block roads temporarily. The 2023 prediction indicate that temperatures are expected to be generally warmer than normal. This will have implications for the road transport. The tarred roads will be more prone to warping when temperatures are extremely high. Motor

vehicles tyres could also be affected by high temperatures especially during the hot season. This can increase the likelihood of tyre burst and vehicular accidents.

Advisory:

1. The federal ministry of works in conjunction with the state ministry of works should carry out a needs assessment of the state of the highways and fortify weak roads and bridges
2. The federal government is advised to embark on dualization of all major expressways to reduce the prospects of hold up arising from heavy rains, reduced visibility, and road congestion.
3. Motorist are advised to avoid using expired tyres as these are susceptible to bursting under high pressure when heated by road surface during the hot season.
4. Warmer temperatures coupled with heavy rains will affect bituminous and concrete road surfaces as they would crack, allowing rains into the cracks which can cause fast accelerate deterioration of road surfaces.

3.4.2 Air Transport

Air transport is known to be the safest, fastest and most preferred means of transport over both short and long distances. Its efficiency lies both in its safety and speed. However, it is also greatly affected by weather. and casualty can be very high in such cases. The projected rainfall pattern in 2023 implies that there would be frequent heavy rains during the long rainy season. The convective rains accompanied by strong winds will lead to more cases of flight disruption. The increased chances of aquaplaning following rainfalls on the runway have significant safety implications. Aquaplaning could cause aircraft skidding off the runway. The projected high temperatures will increase the prospects of wind shear and air turbulence. The prospects of increased mid latitude wave activity will also increase the spate of raised dust and dust haze conditions which can increase chances of flight delays and cancellations due to the attendant poor horizontal visibility. There will be more disruptions to flight operations because of more convective activities (wind shear, microburst, poor visibility due to heavy rain).



Figure 38: Nigerian Air Force

Recommendations

1. Airline operators are advised to adhere strictly to safety guidelines for flight operations in poor weather conditions.
2. Pilots are strongly advised to ensure they go for preflight briefing at NiMet's forecast offices and flight briefing rooms at the airports across the nation.
3. Flight operators should put safety of their passengers ahead of profit maximization.
4. Continuous monitoring and clearing the runway of runoffs and other debris.
5. Provision of remote sensing equipment to ensure the provision of early warning and real time observation of the weather (eg LLWAS, weather radar and MIDAS).

2.4.3 Rail Transport



Figure 39: Nigeria Railway Corporation

In recent years, the Federal Government of Nigeria has renewed its focus on the railway sector, a critical part of the transportation sector with huge potential of boosting Nigeria's economy. However, to guarantee the safety of operations and ensure promising returns on investments worth billions of Naira, it is essential to apply certain measures in operational planning and maintenance of the railway system. Weather affects rail tracks therefore access to, and use of weather and climate information are essential for ensuring safety of train movement. Some of the effects of weather on the rail system include:

- 1. Rail track buckling:** Rail tracks are made of steel, and they expand in hot weather. Without adequate expansion gaps in between tracks the thermal expansion could result in buckling of the tracks. Therefore, there are chances of rail line buckling with the warmer temperatures predicted over most parts of the country, especially in March, April, and May.
- 2. Rail Track Flooding and Washout:** As in every rainy season, high-intensity rainfall is common which usually results in surface runoff that could flood rain lines and disrupt services.
- 3. Obstruction of Rail Lines:** Chances of increased high temperatures increase the possibility of violent storms. This typically breaks down power lines and dismantles trees affecting the rail tracks and other infrastructure
- 4. Cooling in Train Stations:** With predicted above-normal daytime temperature, there could be increased demand for cooling in trains and train stations to reduce passenger and staff discomfort

Advisory for Rail Transport Operators

- The Nigerian Railway Corporation (NRC) and other relevant stakeholders are advised to adhere to this advisory from NiMet, as well as other updates for planning and operations to reduce risks and increase efficiency.
- Periodic monitoring of rail tracks for possible damages during hot

weather.

- Periodic monitoring, and clearing of falling trees/ objects on rail tracks during rainstorms
- Reducing train speed on hot days, especially when temperatures are predicted to rise above 30°C to reduce chances of buckling
- Passengers are advised to prepare for increased travel time as a result of reduced speed restrictions
- Provision of additional passive and active cooling facilities in train stations and trains to reduce discomfort

Coastal Marine Transportation and Inland Waterways



Figure 40: Nigeria Port Authority

With the predicted normal to above normal rainfall season expected in 2023 and with over 3120mm of annual rainfall expected in the coastal states, the flow of inland waters is likely to be normal to above normal also. This will be a favorable situation for inland transportation in the country as it will enhance accessibility to the inland river ports in the country and facilitate free movement of passenger and cargo vessels. However, with the normal to above normal rains there may be increase in siltation and contamination of the waterways. Silts and other debris (mostly garbage) that are washed into the rivers can impede smooth navigation by boats and other vessels on the waterways.

Reports on accidents on Nigeria's inland water ways reveal that low visibility due to bad weather is a major cause of accidents on the inland waterways. The predicted above normal temperatures and normal to above normal rainfall in most parts of the country will increase the chances of stormy

weather. This implies that increased weather hazards for boats and other vessels on the inland waterways should not be ruled out.

Advisory for Inland Waterways

- The responsible authorities should ensure regular desilting and clearing of debris washed into the waterways. Regulations against dumping refuse and waste in waterways should be strictly enforced.
- The National Inland Water Way Authority (NIWA) and the Nigerian Maritime Administration and Safety Agency (NIMASA) should regularly obtain daily marine weather forecast (Inshore and Shipping Forecast) and marine bulletins issued by NiMet, and ensure they are properly disseminated to stakeholders in the marine sector and operators on Nigeria's rivers and inland waterways to help mitigate their exposure to weather hazards during their navigation.
- NIWA and NIMASA should collaborate with NiMet to provide regular stakeholders forums to get proper feedbacks from stakeholders and inland water way operators on how marine services to them can be improved and regular proper enlightenment on weather hazards to operators and stakeholders in the marine sector.



Figure 41: Water Transport Lagos, Nigeria



3.5 Health

Weather parameters and atmospheric conditions such as rainfall, temperature, relative humidity, dust concentration, wind, all have direct and indirect impacts on human health. Pathogens and disease vectors grow and multiply faster under certain weather conditions. For instance, high dust concentration, low relative humidity and warm temperature are associated with incidence of meningitis. Also, a combination of accumulated rainfall of 80mm, air temperature of 25°C to 32 °C and relative humidity up to 80% are conducive for fast breeding of mosquitoes and hence, transmission of malaria. High air temperature and relative humidity directly affect personal comfort of humans. Heat stress can occur when these two weather parameters are high. Furthermore, high air temperature and relative humidity also affect human health indirectly because they affect the stability and efficacy of some drugs.

Warmer atmospheric conditions have been observed globally in recent time when compared with Climatology of the regions. Nigeria as a country in West Africa is also affected by global warming. As a result of this, extreme weather events such as devastating storms, flash flood, coastal flooding and major flood have become more frequent lately. The 2023 Climate Prediction has shown that warm conditions are very likely to occur across the country, both in the day and night. During the year, rainfall is expected to be above normal in some parts of the country and normal in other parts.

Immediate Health effects include Diarrhea outbreak: this predominantly waterborne disease is associated with flood disasters. Drowning is also a leading cause of death from floods especially due to flash floods. Injuries: this usually occurs in an attempt to escape danger, such injuries may result from electrical burns, explosions and also animal bites within the rural areas.

Heat stroke can be caused by a combination of external heat from the environment and internal body heat generated from metabolic processes. Rapid rises in body temperature due to exposure to hotter than average conditions compromise the body's ability to regulate temperature and can

result in a cascade of illnesses, including heat cramps, heat exhaustion, heatstroke, and hyperthermia.

Deaths and hospitalizations from heat can occur extremely rapidly (same day) or have a lagged effect (several days later) and may result in accelerating death or illness in the already weak persons during heat waves. Even small differences from seasonal average temperatures are associated with increased illness and death. Temperature extremes can also worsen chronic conditions, including cardiovascular, respiratory, and cerebrovascular disease and diabetes-related conditions. Heat also has important indirect health effects: Heat conditions can alter human behaviour, transmission of diseases, health service delivery, and critical social infrastructure such as energy, transport, and water. The measure and nature of the health impacts of heat depend on the timing, intensity and duration of a temperature event, the level of acclimatization, and the adaptability of the local population, infrastructure, and institutions to the prevailing climate. The exact threshold at which temperature represents a hazardous condition varies by region alongside factors such as humidity and wind, local levels of human acclimatization and preparedness for heat conditions.

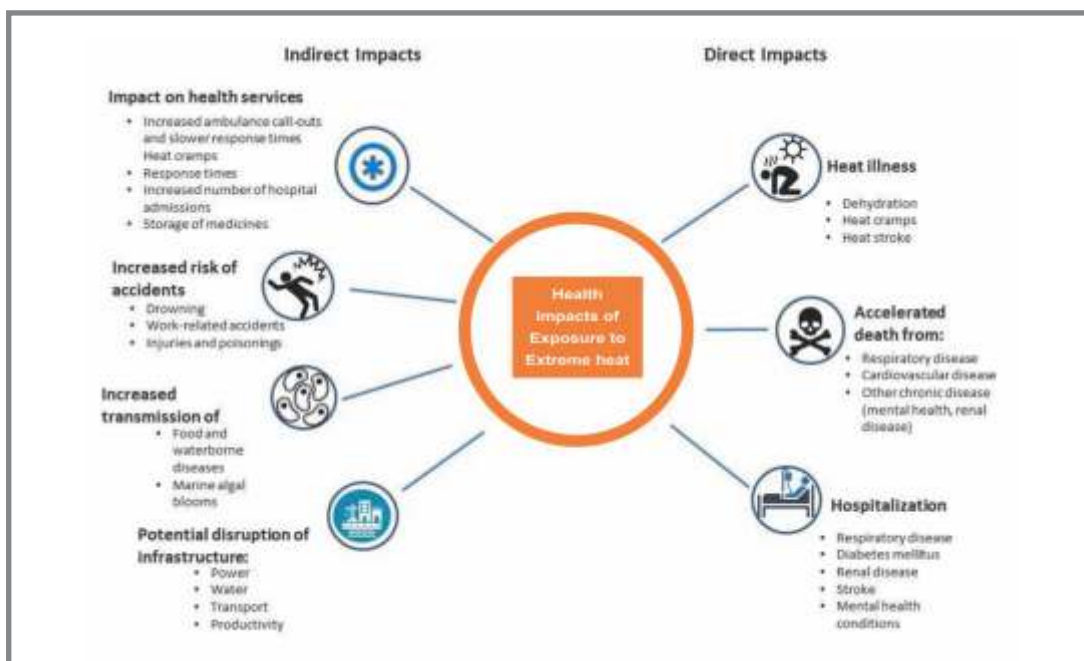


Figure 42: Health impact of severe Heat



Research have shown that the increased breeding of mosquitoes is related to climate. The key weather elements that affect the breeding of mosquitoes and the associated prevalence of malaria are temperature, relative humidity, and precipitation¹⁰. From the larva stages in the aquatic environment and as adults of mosquitoes are very sensitive to these weather conditions. The time for the development of mosquitoes from larval to maturity is shorter during warm weather. adult female mosquitoes are feed on blood more frequently, thus increase pathogen transmission. The primary pathway via which rainfall directly affects the malaria vector is by altering the number, quality, and location of breeding sites for oviposition (egg-laying). Adequate humidity is essential to mosquito survival as the insects are highly susceptible to desiccation. High humidity may precede heavy rainfall when temperatures are high, since moisture evaporating from the land surface in warm conditions is prevented from escaping by the arrival of clouds. Near the land surface, high relative humidity leads to an increase in mosquito survival, flight activity and host-seeking behaviour¹¹. These changes favour malaria transmission within an optimum relative humidity range of approximately 60–80%¹².

Advisory: Heat Period

Maintain a cool environment during heat period.

- Room temperatures should be kept lower than 32 °C during the day and 24 °C during the night hour.
- Open all windows and shutters during the night and the early morning, when the temperature outside is lower.
- Reduce the heat load inside the apartment or house.
- If your residence is air conditioned, close the doors and windows and save energy not needed to keep you cool.
- Electric fans may provide relief, but when the temperature is greater than 35 °C, may not prevent heat-related illness. It is important to drink fluids.

¹⁰ <https://www.who.int/publications/i/item/WHO-CDS-GMP-2019.10>.

¹¹ Garg A, Dhiman RC, Bhattacharya S, Shukla PR. Development, malaria and adaptation to climate change: a case study from India. *Environ Manage*. 2009;43:779–89.

¹² Haque U, Hashizume M, Glass GE, Dewan AM, Overgaard HJ, Yamamoto T. The role of climate variability in the spread of malaria in Bangladeshi Highlands. *PLoS ONE*. 2010;5:e14341.

Avoid hot locations.

- Move to the coolest room in the home, especially at night.
- If it is not possible to keep your home cool, spend 2–3 hours of the day in a cool place (such as an air-conditioned public building).
- Avoid going outside during the hottest time of the day.
- Avoid strenuous physical activity if you can.
- Stay in the shade.



Figure 43: Water balance

- Take cool showers or baths.
- Wear light, loose-fitting clothes of cotton fabrics, hat, cap, and sunglasses could be helpful too.
- Drink fluid regularly but avoid too much caffeine and sugar.
- Quality and moderate meals will add more value.

Help others

- Susceptible individuals might need support during the hot season.
- Discuss with your family on the need to keep their environment well ventilated.



- Get trained, take a first-aid course to learn how to treat heat emergencies and other emergencies. Everyone should know how to respond.

In event of health challenge

- Keep medicines in a cool and dry place.
- Consult your doctor.

Advisory: Malaria

- Avoid exposure to mosquitoes as much as possible
- Endeavour to see the doctor in the event of any illness and take medication as prescribed.
- Drainages should be cleared frequently, and the environment kept clean.
- Use insecticide-treated mosquito nets.
- Fumigate the environment frequently.
- Focus on early diagnosis and prompt treatment.
- Pregnant women are advised to take necessary measures to prevent being infected with malaria, such as sleeping under insecticide-treated mosquito nets and taking anti-malaria prophylaxis

3.6 Telecommunications

The telecommunication industry plays a pivotal role in global and national economic growth and development in the 21st century. Telecommunication relies on the propagation of electromagnetic waves to transmit signals (voice, video, data) from one point to another. Electromagnetic wave propagation is directly affected by weather conditions. The presence of water in the form of rain, water vapour, snow/ice in the atmosphere, and electrical discharge (lightning) are two atmospheric conditions that have direct impact on telecommunication because of their interference with electromagnetic wave propagation. They affect signal quality and may cause deterioration and distortion of cell phone reception. Telecommunication installations such as masts and antennae are also susceptible to storms. These installations could be pulled down by violent winds and squalls, resulting in disruption of telecommunication services and huge economic losses. Weather forecasts are therefore useful for planning, installation, and operation of telecommunication services.



Figure 44: Telecommunication in Nigeria



The 2023 Seasonal Climate Prediction shows that the onset of the rainfall season is likely to be earlier than normal in most parts of the country. However, Katsina, Zamfara, Kano, Jigawa, Yobe in the north and Cross River, Ebonyi, Imo and Rivers in the south, may experience delayed onset.

The high intensity rainstorms and windstorms which happen as precursors to the season itself can pose some challenges to telecommunication pulling down some installations and thereby disrupt service delivery.

The high temperatures expected in March, April and May 2022 could cause discomfort for engineers and technicians in the industry who work outdoors. Electronic equipment used in the telecommunication sector could also be affected by above-normal temperatures predicted for some parts of the country. Furthermore, such high temperatures often cause frequent malfunctioning and breakdown leading to equipment downtime if adequate temperature control measures are not applied. Provision of extra cooling systems should therefore be made for available for telecommunication equipment that are vulnerable to high ambient temperatures.

Advisory to Telecommunication Industry Operators

- Telecommunication installation managers are advised to ensure proper thunder and lightning protection of masts and other installation.
- All telecommunication facilities must be serviced to minimize service disruptions because of high temperatures and poor visibilities in January, March, April and May.
- Extra cooling systems should be made for available for telecommunication equipment that may be vulnerable to high ambient temperatures.
- Managers and operators in the industry are advised to follow closely the Seasonal Climate Prediction, the Monthly and Weekly High Impact Weather Forecast (HIW) issued regularly by NiMet.
- People are advised to keep away from telecommunication masts in during stormy and thundery weather.

3.7 Disaster Management



Figure 45: A Typical Scene of the 2022 Flood in Nigeria

The prediction for this year indicates normal rainfall across most parts the country. However, emergency managers are advised to help prepare disaster-prone communities for possible flooding in the aftermath of excessive rainfall predicted over parts of Borno, Taraba, Oyo, Osun, Imo, Rivers and much of Delta and Bayelsa states which may cause flooding. Low-lying areas of Niger, Benue, Kogi, Port Harcourt, Anambra and the coastal areas are at higher risk of flooding, despite the predicted normal to below-normal conditions in 2023.

Wet spells and flash floods can also occur in areas with normal to below-normal rainfall. Other disasters may occur as well because of strong and gusty winds, particularly during the onset and cessation phases of the rainy season. During these two periods, the southernmost parts of the country will be characterized by violent thunderstorms.

Domestic fires are also possible in the north, where dry, windy conditions and high temperatures are typical in March and April. The predicted warmer-than-normal conditions could well result in drier-than-normal conditions and may likely create the necessary conditions for the occurrence of bushfires, domestic, and industrial fires across the country.

Though a normal to an earlier-than-normal onset dates and a normal length of the season is predicted to occur in 2023. Competition for pasture and farmland could result in people being displaced and herdsmen migrating to a more suitable environment, as a result of communal conflict between herdsmen and farmers.

All the challenges listed above are issues for disaster risk management and preparedness. Emergency managers should therefore use this early warning advisory to educate communities to reduce their vulnerability and possible losses to severe weather.

Advisory:

- Relevant authorities such as NEMA, SEMA and LEMA should ensure all drainages are cleared to avoid blockage and ensure free water flow.
- Discourage building along waterways.
- Environmental authorities are to ensure proper waste management.
- State governments are advised to identify safe areas to relocate potential victims in the event of flooding.
- The relevant authorities such as the Fire Service should ensure that people are sensitised on measures to prevent fire disasters
- States, LGAs, Media, Community Leaders and NGOs should carry out aggressive sensitization in identified risk locations.
- Federal, state, and local authorities should take note of the above recommendations and ensure that funds are available and released on time for proactive measures.



Figure 46: Flood victims being transported in Bayelsa State



Figure 47: Frontline Worker in the Flood affected community



Figure 48: Properties Destroyed by Fire in 2022

Chapter Four

4.0 Evaluation of 2022 Seasonal Climate Prediction

At the beginning of every year, the Nigerian Meteorological Agency (NiMet) presents the Seasonal Climate Prediction (SCP) for the year to stakeholders including environmentalists, water resources managers, farmers, policy makers in all sectors of the economy, emergency managers, engineers, NGOs and indeed, the Nigerian public. The SCP has proved to be a very useful tool for planning, policy making, decision making and adaptation to climate change.

4.1 Evaluation of Onset Date, Length of Season and Annual Rainfall Amounts

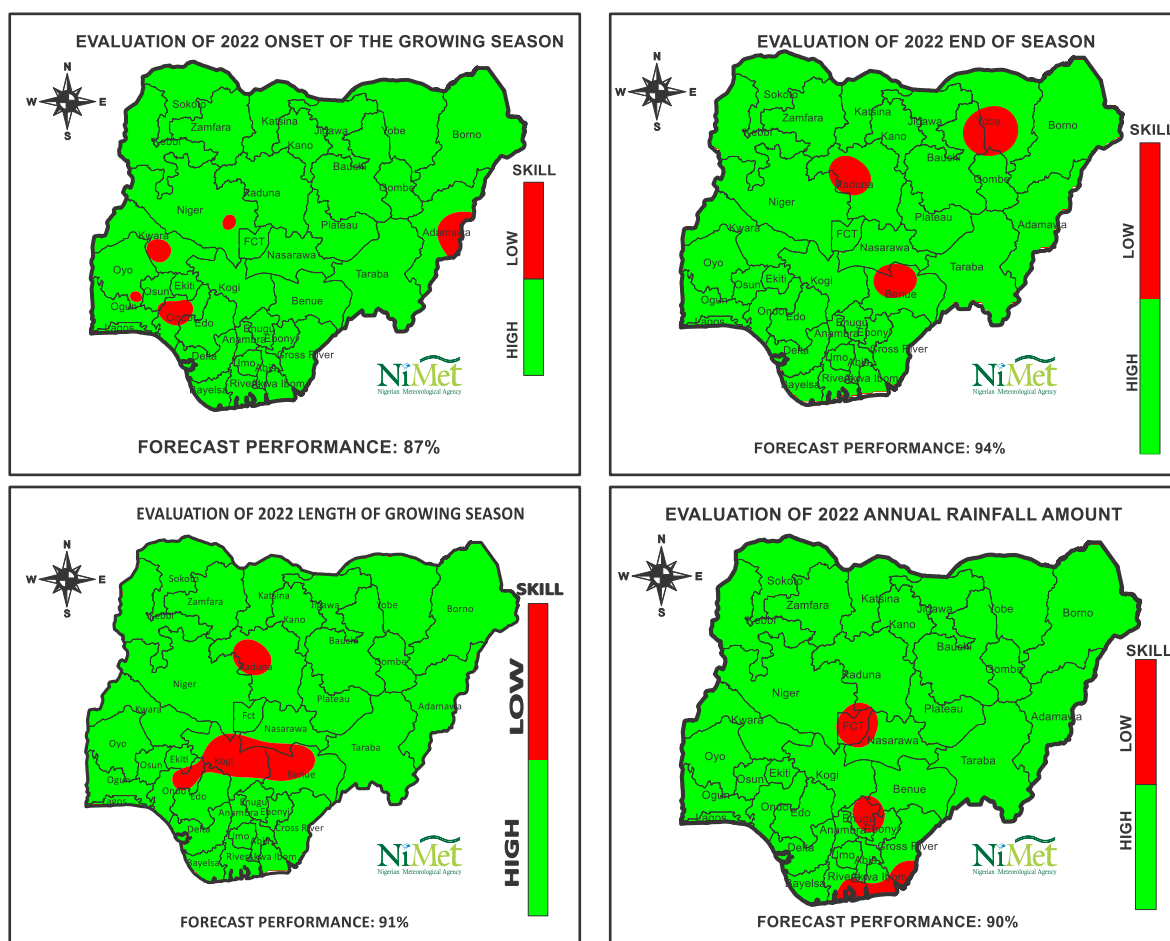


Figure 49: Evaluation of Performance of 2022 Rainfall Prediction

The use of the early warning information provided in the SCP has tremendously helped to reduce disaster risks in weather-sensitive sectors in Nigeria.

Figure 49 summarizes the performance of NiMet's predictions of the 2022 onset date of growing season (a), end of growing season (b), length of season (c), and annual rainfall amount (d). The areas shaded green on the map indicate parts of the country where the model recorded high performance (i.e., the observed parameters fell within the predicted range of the predicted dates and values of rainfall amount). On the other hand, the areas shaded red on the maps indicate parts of the country where low model skills were recorded (i.e., the observed values were not in agreement with the predicted).

A high-performance skill above 75% was attained in the forecast made for onset of growing season, end of season, length of growing season, and rainfall amount (Table 2). The highest skill of 94% was recorded in prediction of onset and length of the growing season. The overall average performance of the SCP model in predicting the 2022 Rainfall Season is therefore estimated to be 91.3%

Table 2: PERFORMANCE OF 2022 RAINFALL FORECAST

RAINFALL FORECAST PARAMETERS	PERFORMANCE (in %)
ONSET OF GROWING SEASON	87
LENGTH OF GROWING SEASON	94
END OF GROWING SEASON	91
ANNUAL RAINFALL AMOUNT	90
AVERAGE PERFORMANCE	91.3

4.2 Evaluation of 2022 Temperature Forecasts

From NiMet's observation, the year 2022 is the 10th warmest in the last forty years in Nigeria. On the global scale, the World Meteorological Organization,

WMO confirmed that 2022 is set to be the 6th warmest year¹³ (NOAA) on record and therefore among the most recent seven years, 2015 to 2022 are the seven warmest years on record¹⁴. Analysis of global temperatures from January to September 2021 by WMO also shows that the temperature of the Earth has increased by about 1.09°C above the 1850–1900 pre-industrial average temperature. This accelerating rate of increase of global temperature which is a manifestation of climate change has been making temperature predictions more difficult. As a result of this most Climate Prediction Models, including the NiMet SCP Temperature Prediction model, show low skills (that is limited accuracy).

The evaluation of the performance of 2022 Temperature Prediction was also carried out prior to the production of the 2023 forecasts to review the previous forecast and to improve the accuracy of future editions, taking into cognizance the present rate of warming. The Daytime and Nighttime temperature forecast evaluation results for January – April 2022 is presented below in Figures 24 - 27. The parts of the country where the forecast skills are high (i.e., the observed temperatures agree with the predicted) are shaded in green on the maps. Areas shaded in red indicate parts of the country where the forecast performance skills are low.

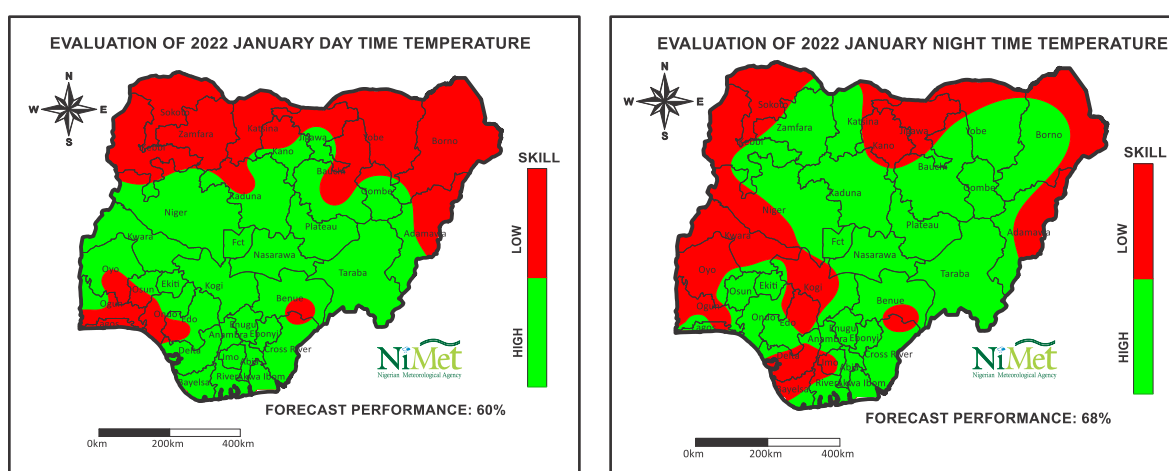


Figure 50: Evaluation of January Day time and Nighttime Temperature Forecast Skills

¹³Provisional State of the Global Climate in 2022 | World Meteorological Organization (wmo.int)

¹⁴WMO, 2021: State of the Global Climate 2021

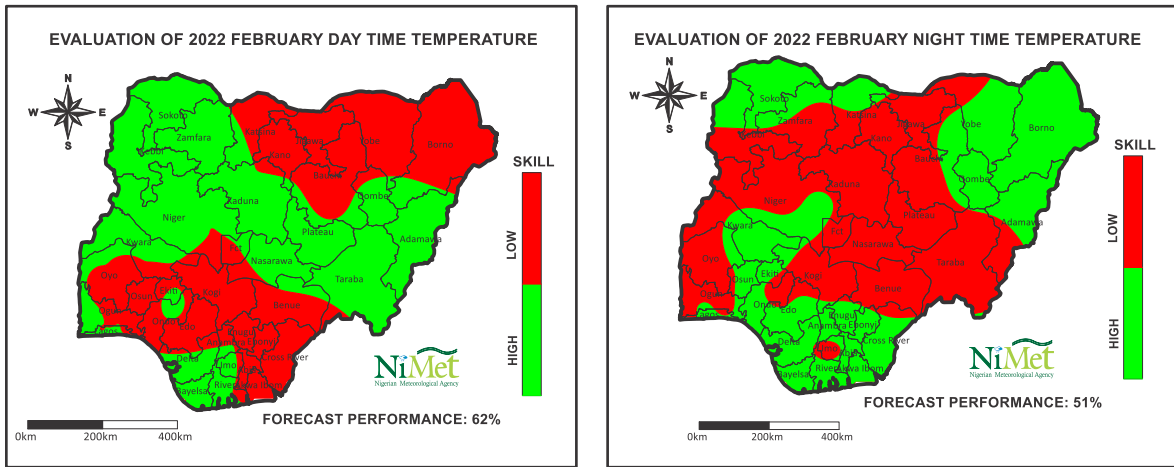


Figure 51: Evaluation of February Day time and Nighttime Temperature Forecast Skills

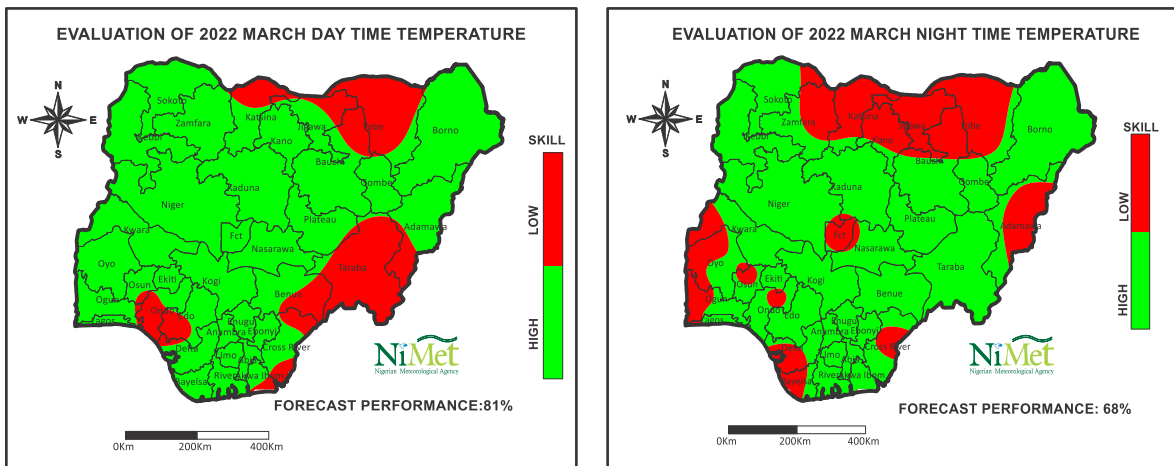


Figure 52: Evaluation of March Day time and Nighttime Temperature Forecast Skills

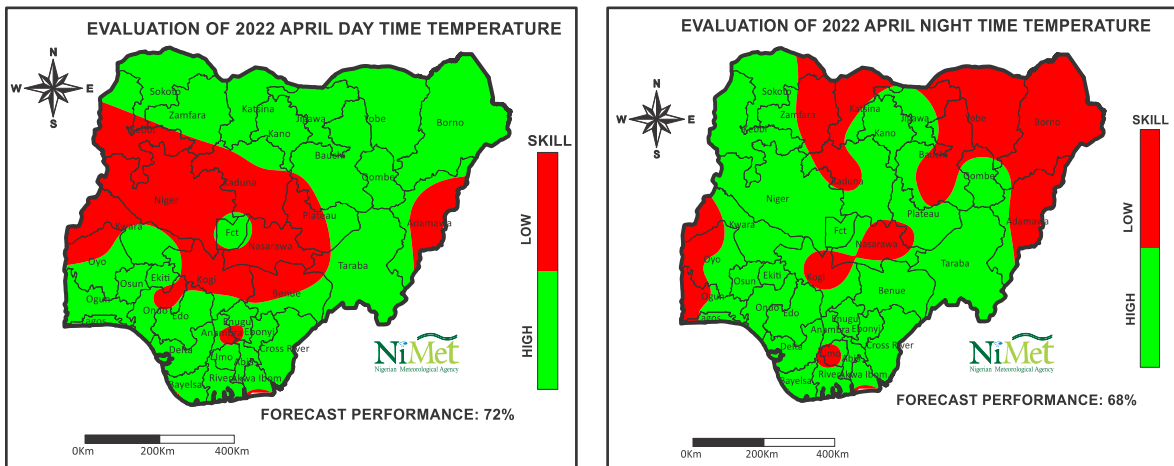


Figure 53: Evaluation of April Day time and Nighttime Temperature Forecast Skills

Table 3: PERFORMANCE OF 2022 TEMPERATURE FORECASTS

S/N	Temperature	Forecast Performance (%)
1	January Day	60
2	January Night	68
3	February Day	62
4	February Night	51
5	March Day	81
6	March Night	68
7	April Day	72
8	April Night	68

The highest performance skills of 81% and 68% (or accuracies) were observed in prediction of March Day and Night temperatures respectively. The lowest skills of 51% was recorded in February night temperature as the observed 2022. (Table 3).

Chapter Five

5.0 Temperatures Prediction

This chapter highlights the predicted day and night temperature from January to April for the 36 states of the country including FCT and their selected locations (4 locations from each state) based on geopolitical zones of each state. Temperatures from January to April are important because of their critical nature, these are the months where you have highest and lowest temperatures of the year.

5.1 Predicted 2023 Day time Temperatures

State	Location	January	February	March	April	May
Abia	Arochukwu	29.7	30.6	30.4	30.0	29.4
	Ukwa West	29.9	30.4	29.9	29.4	29.0
	Umuahia	32.9	34.1	34.3	33.2	32.0
	Umunneochi	29.8	30.7	30.5	30.1	29.5
Adamawa	Ganye	31.9	34.5	35.8	33.8	30.7
	Madagali	33.3	35.7	38.3	38.7	36.3
	Numan	33.4	35.9	37.1	35.0	32.4
	Yola	34.6	35.9	39.5	39.6	35.6
Akwa-ibom	Eket	30.6	31.3	31.4	30.9	30.3
	Oni	29.8	30.5	30.1	29.8	29.3
	Oron	29.2	29.6	29.2	28.8	28.4
	Oruk	29.7	30.1	29.6	29.3	28.9
	Uyo	32.6	34.0	33.6	32.5	31.6
Anambra	Anambara West	33.7	36.1	36.3	34.1	33.2
	Awka	33.9	35.4	35.5	33.9	32.1
	Idemi South	34.9	33.8	35.1	34.5	33.4
Bauchi	Ogbaru	34.1	34.9	34.6	32.9	32.9
	Bauchi	30.8	32.8	37.2	38.1	35.8
	Bogoro	32.3	34.5	36.2	35.7	32.9
	Darazo	32.3	35.0	38.1	39.4	36.9
Bayelsa	Zaki	31.9	34.6	38.3	40.7	39.3
	Brass	28.6	29.1	28.8	28.5	28.0
	Ekeremor	29.1	29.6	29.3	29.0	28.5
	Southern Ijaw	29.7	30.2	29.8	29.2	28.8
Benue	Yenegoa	30.3	31.0	30.7	30.2	29.7
	Katsina Ala	30.3	32.2	32.5	31.3	30.0
	Makurdi	34.9	36.3	37.5	36.0	32.7
	Oturkpo	31.0	32.7	33.0	31.9	30.6
Borno	Vandeikya	30.2	31.7	31.2	30.1	29.1
	Abadam	32.0	34.8	38.7	41.8	41.4
	Dikwa	34.6	37.1	40.3	41.9	40.2
	Maiduguri	31.5	33.7	39.1	41.0	40.2

	Nganzai	32.7	35.4	39.1	41.6	40.7
Cross-river	Abi	30.0	31.0	30.4	29.9	29.2
	Calabar	31.9	33.1	32.8	31.8	31.1
	Ikom	32.9	34.5	34.9	33.0	32.0
	Obudu	30.1	31.7	31.0	29.9	28.9
	Ogoja	34.1	35.9	36.7	34.6	32.6
Delta	Asaba	34.1	35.6	35.7	34.3	32.6
	Ndoka East	30.5	31.4	31.1	30.7	30.2
	Patani	30.3	31.0	30.7	30.2	29.7
	Warri	32.8	33.7	34.2	33.5	32.3
	Warri North	29.2	29.9	29.7	29.2	28.6
Ebonyi	Abakaliki	30.5	31.7	31.1	30.5	29.6
	Afikposi South	29.8	30.7	30.4	30.0	29.4
	Ishielu	30.4	31.5	31.0	30.5	29.6
Edo	Akoko Edo	31.0	32.2	32.1	31.1	30.1
	Benin	33.2	34.6	34.3	33.3	32.0
	Esan East	30.1	31.0	30.7	30.1	29.4
	Ovia Southwest	29.6	30.3	30.0	29.4	28.7
Ekiti	Ado Ekiti	33.9	34.8	34.3	32.4	31.5
	Ide Orun	30.4	31.5	31.2	30.2	29.3
	Ijero	31.1	32.5	32.4	31.0	29.8
	Ikole	31.6	33.1	33.2	31.9	30.4
Enugu	Aninri	29.9	31.0	30.8	30.3	29.5
	Enugu	33.5	34.9	35.3	33.5	31.8
	Igboeze North	30.7	32.2	31.9	31.0	29.9
	Uzo Uwani	30.0	31.1	30.9	30.4	29.6
FCT	Abaji	32.8	34.1	34.7	33.3	31.3
	Abuja	34.9	36.1	37.1	35.8	32.8
	Bwari	32.2	34.0	34.5	32.4	30.3
	Kuje	32.6	34.1	34.6	32.7	30.8
Gombe	Balanga	34.3	36.9	38.3	36.2	33.2
	Dukku	32.5	35.1	38.0	38.5	35.7
	Gombe	30.8	32.7	37.3	38.0	35.7
	Shomgom	33.4	36.2	37.7	35.8	32.8
Imo	Ideato North	29.7	30.6	30.4	30.1	29.4
	Ngorokpala	29.9	30.7	30.4	30.0	29.5
	Obowo	29.7	30.6	30.4	30.0	29.5
	Owerri	33.5	34.7	34.7	33.5	32.1
Jigawa	Dutse	29.1	31.7	37.3	39.0	38.2
	Gwaram	31.8	34.5	37.6	39.1	36.9
	Gwiwa	30.4	33.3	37.1	39.4	38.3
	Suletankarkar	30.9	33.8	37.8	40.4	39.2
Kaduna	Birnin Gwari	30.5	33.3	35.5	34.4	31.7

	Kachia	32.1	34.5	35.3	32.9	30.1
	Kaduna	31.4	33.0	36.6	36.3	32.9
	Lere	31.5	33.4	34.9	34.5	31.6
	Zaria	29.3	31.2	35.9	36.2	33.6
Kano	Dambatta	30.8	33.7	37.5	39.7	38.3
	Gwarzo	29.7	32.5	35.9	37.1	35.2
	Kano	29.1	31.7	37.3	39.0	38.2
	Sumaila	30.6	33.2	36.3	37.4	35.1
Katsina	Danmusa	30.7	33.5	36.8	38.0	36.2
	Katsina	29.3	31.9	37.2	39.0	38.8
	Sabuwa	29.6	32.5	35.4	35.5	33.0
	Zango	30.6	33.5	37.5	40.1	39.0
Kebbi	Arewa	33.6	36.3	39.3	40.8	38.7
	Dokonwasagu	32.6	35.4	37.5	36.6	33.8
	Suru	33.9	36.6	39.0	39.3	36.5
	Yelwa	32.8	33.7	40.2	33.5	32.3
Kogi	Ibaji	30.3	31.3	31.1	30.5	29.8
	Lokoja	35.0	36.6	37.7	36.1	33.3
	Yagba West	32.8	34.4	34.9	33.6	31.7
Kwara	Baruten	33.8	35.6	35.6	33.9	32.0
	Ekiti	32.5	34.1	34.3	32.9	31.1
	Ilorin	33.9	35.4	36.1	34.6	32.5
	Pategi	33.5	35.1	35.9	34.9	32.7
Lagos	Badagry	33.0	34.1	32.9	32.9	32.1
	Ikeja	32.3	33.7	33.8	33.1	31.5
	Ikorodu	31.9	32.9	33.5	33.6	32.5
	Lagos Island	30.7	31.5	32.0	31.5	30.8
Nasarawa	Akwanga	33.5	35.6	35.9	33.3	30.5
	Awe	32.7	34.9	35.3	33.3	31.3
	Doma	32.8	34.7	35.2	33.4	31.4
	Lafia	35.6	36.9	38.0	36.6	33.2
Niger	Bida	35.3	37.1	38.7	37.6	34.3
	Borgu	33.0	35.4	37.2	36.8	34.3
	Lapai	32.8	34.1	34.7	33.3	31.3
	Magama	32.8	35.2	36.8	36.2	33.5
	Mashigi	33.7	35.8	36.9	36.1	33.7
	Minna	34.5	36.1	38.4	36.7	33.5
	Rijaw	33.2	36.0	38.0	37.2	34.1
Ogun	Abeokuta	35.0	36.0	35.8	34.7	32.7
	Ijebu Ode	33.3	34.6	34.4	33.4	31.6
	Imeko Afon	32.0	33.2	32.6	31.3	30.3
	Ipokia	30.8	31.3	30.7	29.9	29.2
	Ogun Waterside	28.6	29.2	29.1	28.7	28.1

Ondo	Akoko Northwest	31.4	32.9	32.8	31.5	30.1
	Akure	33.9	34.8	34.3	32.4	31.5
	Ilaje Eseodo	29.1	29.7	29.5	29.0	28.3
	Ondo	32.2	33.7	33.2	31.7	30.5
	Ose	30.4	31.4	31.1	30.1	29.2
Osun	Atakumosa East	30.1	31.2	30.7	29.6	28.8
	Ifedayo	30.9	32.2	31.8	30.4	29.4
	Ife North	30.5	31.6	30.9	29.8	29.0
	Oshogbo	33.4	34.4	34.7	32.8	31.5
Oyo	Ibadan	33.1	34.6	34.7	33.1	31.6
	Iseyin	33.3	34.8	34.7	33.1	31.7
	Iwajowa	31.5	32.6	32.1	30.8	29.9
	Oluyole	30.6	31.3	30.7	29.8	29.2
	Shaki	33.3	34.4	34.8	33.6	31.3
Plateau	Bokkos	32.8	34.7	35.0	32.8	30.0
	Jos	27.6	29.4	31.6	31.3	28.4
	Langtang South	34.2	36.4	36.7	34.3	31.7
	Wase	34.7	36.8	37.7	35.6	32.6
Rivers	Akukutor	29.8	30.3	29.9	29.3	28.9
	Ogba Egbe	30.0	30.7	30.5	30.1	29.6
	Opobo Nkoro	29.5	29.9	29.4	29.1	28.6
	Port Harcourt	32.7	33.8	33.5	32.4	31.5
Sokoto	Gudu North	32.4	35.3	38.8	41.1	39.8
	Illela	32.1	35.0	38.7	41.0	39.6
	Isa	32.0	34.9	38.5	40.3	38.6
	Kebbe	33.7	36.4	38.8	38.7	35.9
	Sokoto	32.4	34.2	39.6	41.1	39.6
Taraba	Bali	32.6	34.9	34.9	32.7	30.1
	Jalingo	34.3	36.0	38.1	36.5	33.5
	Sardauna	28.9	30.9	30.9	28.6	26.6
Yobe	Gulani	34.0	36.3	38.8	38.6	35.6
	Nguru	30.6	32.4	38.2	40.2	40.5
	Potiskum	31.1	33.1	38.9	40.3	38.9
	Tarmuwa	31.7	34.5	38.3	40.6	39.3
	Yunusari	30.7	33.5	37.7	41.0	40.5
Zamfara	Gummi	33.4	36.2	38.5	38.2	35.4
	Gusau	31.6	33.2	38.3	39.1	37.3
	Maru	32.2	35.0	37.5	37.3	34.7
	Shinkafi	32.0	34.9	38.5	40.3	38.6

5.2 Predicted 2023 Nighttime Temperatures.

State	Location	January	February	March	April	May
Abia	Arochukwu	19.9	21.5	23.4	23.7	23.5
	Ukwa West	22.2	23.4	24.6	24.6	24.4
	Umuahia	21.7	23.3	24.0	24.0	23.4
Adamawa	Umunneochi	19.9	21.5	23.3	23.6	23.5
	Ganye	16.8	18.8	21.8	22.9	22.1
	Madagali	15.4	17.6	21.6	24.5	24.4
	Numan	16.5	18.9	22.9	24.7	24.0
Akwa-ibom	Yola	18.3	21.2	24.3	26.7	25.3
	Eket	23.4	24.1	24.4	24.4	23.9
	Oni	20.7	22.1	23.6	23.8	23.7
	Oron	23.9	24.9	25.7	25.7	25.5
	Oruk	22.8	23.9	25.0	25.1	24.9
Anambra	Uyo	22.0	23.2	23.6	23.7	23.3
	Anambara West	20.9	23.9	25.1	25.1	24.1
	Awka	21.7	23.7	24.8	24.7	23.8
	Idemi South	20.8	22.6	23.5	25.0	24.1
	Ogbaru	22.0	21.5	23.8	24.1	23.5
Bauchi	Bauchi	14.3	16.6	20.6	23.6	23.8
	Bogoro	15.8	18.0	21.2	23.1	22.6
	Darazo	14.4	16.8	21.1	24.6	24.7
	Zaki	13.9	16.2	20.5	24.3	25.5
Bayelsa	Brass	24.7	25.5	26.1	26.1	25.8
	Ekeremor	23.9	25.0	25.7	25.7	25.5
	Southern Ijaw	22.5	23.7	24.5	24.6	24.4
	Yenegoa	22.8	19.5	24.3	26.4	25.5
Benue	Katsina Ala	18.3	20.2	22.7	23.4	23.1
	Makurdi	19.2	22.1	25.3	25.6	23.8
	Oturkpo	18.1	20.4	23.2	23.9	23.6
	Vandeikya	18.6	20.3	22.4	23.0	22.8
Borno	Abadam	14.5	16.7	21.4	25.8	27.6
	Dikwa	15.8	18.1	22.4	26.1	27.0
	Maiduguri	12.6	15.4	19.4	24.4	26.3
	Nganzai	14.9	17.2	21.8	25.7	27.2
Cross-river	Abi	20.1	21.6	23.4	23.7	23.5
	Calabar	22.7	23.4	23.6	23.5	23.2
	Ikom	19.9	21.9	23.2	23.1	22.7
	Obudu	18.7	20.3	22.4	23.0	22.8
	Ogoja	20.1	21.2	23.0	22.9	21.9
Delta	Asaba	22.1	24.0	24.5	24.6	23.7
	Ndoka East	20.4	22.1	23.6	23.9	23.7

	Patani	21.4	22.8	24.0	24.2	24.0
	Warri	22.8	23.8	24.3	24.5	23.6
	Warri North	22.9	24.3	25.4	25.5	25.2
Ebonyi	Abakaliki	19.3	21.1	23.3	23.8	23.6
	Afikposi South	19.8	21.4	23.3	23.7	23.5
	Ishielu	19.2	21.1	23.2	23.7	23.5
Edo	Akoko Edo	18.9	20.9	23.0	23.3	23.0
	Benin	22.6	23.8	24.3	24.3	23.5
	Esan East	19.2	21.0	23.0	23.4	23.1
	Ovia Southwest	21.1	22.8	24.2	24.4	24.1
Ekiti	Ado Ekiti	19.4	20.5	22.4	22.7	22.0
	Ide Orun	18.9	20.7	22.6	23.0	22.7
	Ijero	18.5	20.5	22.5	22.9	22.5
	Ikole	18.6	20.6	22.8	23.1	22.7
Enugu	Aninri	19.2	21.0	23.2	23.6	23.5
	Enugu	20.6	22.8	24.2	24.0	22.9
	Igboeze North	18.4	20.5	22.9	23.5	23.2
	Uzo Uwani	18.8	20.7	23.0	23.5	23.3
FCT	Abaji	17.9	20.2	23.4	24.4	23.8
	Abuja	18.6	21.2	23.7	24.0	23.2
	Bwari	16.7	18.9	21.9	23.1	22.7
	Kuje	17.8	20.1	23.0	23.9	23.4
Gombe	Balanga	16.5	19.3	23.1	24.9	24.2
	Dukku	14.7	17.1	21.4	24.6	24.3
	Gombe	15.7	17.7	21.8	24.2	23.8
	Shomgom	15.7	18.5	22.5	24.4	23.7
Imo	Ideato North	19.9	21.5	23.3	23.7	23.5
	Ngorokpala	20.6	22.1	23.6	23.8	23.6
	Obowo	20.0	21.6	23.3	23.6	23.5
	Owerri	22.6	24.0	24.3	24.3	23.7
Jigawa	Dutse	13.5	16.1	20.4	24.0	25.2
	Gwaram	13.8	16.1	20.4	24.2	24.5
	Gwiwa	13.2	15.5	19.8	23.6	24.9
	Suletankarkar	13.5	15.8	20.3	24.3	25.7
Kaduna	Birnin Gwari	14.2	16.5	20.1	22.6	22.5
	Kachia	15.5	18.0	20.7	21.9	21.6
	Kaduna	15.8	17.7	21.1	22.7	21.9
	Lere	14.0	16.1	19.1	21.1	20.8
	Zaria	14.9	16.9	21.0	23.0	22.6
Kano	Dambatta	12.8	15.0	19.4	23.4	24.7
	Gwarzo	12.8	15.0	19.2	22.7	23.2
	Kano	13.5	16.1	20.4	24.0	25.2

	Sumaila	13.0	15.3	19.4	22.9	23.3
Katsina	Danmusa	13.8	16.0	20.1	23.3	23.8
	Katsina	13.3	15.0	19.4	22.9	25.4
	Sabuwa	13.3	15.6	19.4	22.3	22.4
	Zango	13.3	15.6	20.1	24.0	25.5
Kebbi	Arewa	16.3	18.7	22.7	26.7	27.1
	Dokonwasagu	15.3	17.8	21.6	24.1	23.7
	Suru	16.2	18.7	23.0	26.4	25.8
	Yelwa	16.4	23.8	24.3	24.5	23.6
Kogi	Ibaji	19.1	21.0	23.2	23.7	23.4
	Lokoja	20.4	23.0	25.7	25.8	24.2
	Yagba West	18.8	21.0	23.4	23.9	23.3
Kwara	Baruten	18.0	20.4	22.7	23.3	22.9
	Ekiti	18.5	20.8	23.0	23.4	23.0
	Ilorin	20.0	21.4	23.4	23.8	22.8
	Pategi	18.4	20.9	24.0	24.8	24.2
Lagos	Badagry	23.6	24.5	26.2	26.1	25.0
	Ikeja	23.4	24.4	25.2	25.4	24.3
	Ikorodu	24.1	25.1	26.0	26.1	24.8
	Lagos Island	24.0	24.8	25.4	25.2	24.2
Nasarawa	Akwanga	17.3	19.6	21.9	22.6	22.1
	Awe	18.3	20.6	23.7	24.5	24.0
	Doma	18.3	20.7	23.7	24.4	23.8
	Lafia	19.2	21.9	25.2	25.8	24.1
Niger	Bida	21.5	23.6	26.2	26.3	24.6
	Borgu	17.2	19.7	23.8	25.6	24.8
	Lapai	17.9	20.2	23.3	24.3	23.8
	Magama	16.4	19.0	23.0	25.2	24.4
	Mashigi	17.2	19.8	23.5	25.0	24.4
	Minna	20.6	23.0	25.0	25.4	23.6
	Rijaw	15.8	18.3	22.3	25.0	24.3
Ogun	Abeokuta	22.0	23.3	24.9	25.2	24.3
	Ijebu Ode	22.4	23.3	24.2	24.4	23.5
	Imeko Afon	19.8	21.9	23.3	23.5	23.1
	Ipokia	22.7	24.1	24.9	24.9	24.6
	Ogun Waterside	24.3	25.4	26.3	26.4	26.1
Ondo	Akoko Northwest	18.7	20.7	22.7	23.1	22.7
	Akure	19.4	20.5	22.4	22.7	22.0
	Ilaje Eseodo	22.8	24.2	25.4	25.5	25.2
	Ondo	21.9	22.9	23.6	23.5	22.9
	Ose	19.0	20.9	22.7	23.0	22.8
Osun	Atakumosa East	19.3	21.1	22.7	23.0	22.7

	Ifedayo	18.5	20.6	22.5	22.8	22.4
	Ife North	19.8	21.7	23.1	23.4	23.1
	Oshogbo	18.9	20.7	22.3	22.8	22.1
Oyo	Ibadan	21.5	22.8	23.6	23.7	22.9
	Iseyin	21.2	22.1	23.3	23.3	22.7
	Iwajowa	19.4	21.4	23.0	23.2	22.9
	Oluyole	20.3	22.1	23.4	23.6	23.3
	Shaki	19.7	20.8	22.6	22.9	21.8
Plateau	Bokkos	16.8	18.9	20.9	21.6	21.2
	Jos	11.6	13.6	16.5	18.4	18.1
	Langtang South	18.5	20.9	23.8	24.5	23.8
	Wase	17.9	20.3	23.5	24.6	23.8
Rivers	Akukutor	22.2	23.4	24.4	24.5	24.4
	Ogba Egbe	20.9	22.3	23.7	23.9	23.8
	Opobo Nkoro	23.2	24.4	25.3	25.4	25.2
	Port Harcourt	21.0	22.4	23.2	23.4	23.0
Sokoto	Gudu North	15.5	17.8	21.8	26.0	27.6
	Illela	15.0	17.3	21.4	25.5	26.9
	Isa	14.7	17.0	21.3	25.1	26.2
	Kebbe	16.1	18.6	22.7	25.9	25.4
	Sokoto	17.4	19.1	23.6	26.5	27.3
Taraba	Bali	18.2	20.2	22.7	23.4	22.8
	Jalingo	19.4	22.0	24.7	25.6	24.1
	Sardauna	15.6	17.0	18.7	19.2	18.9
Yobe	Gulani	16.2	18.4	22.2	24.6	24.2
	Nguru	14.3	15.8	20.4	23.6	25.5
	Potiskum	13.7	15.1	19.5	23.5	25.2
	Tarmuwa	14.3	16.6	21.2	25.1	26.2
	Yunusari	13.5	15.8	20.6	24.9	26.7
Zamfara	Gummi	15.8	18.3	22.2	25.3	24.9
	Gusau	15.8	16.9	21.0	23.2	24.4
	Maru	15.0	17.4	21.2	23.9	23.8
	Shinkafi	14.7	17.0	21.3	25.1	26.2

Chapter Six

6.1 Detailed 774 Local Government Area Seasonal Rainfall Prediction

Nigeria is a country with vast expanse of land, with different climatic and ecological zones. A single state could cut across about 2 or 3 agroecological zones, and this has implications for the onset, cessation, length of season and rainfall amount over each state. Below is a detailed breakdown of the forecast over the 744 local government areas of the country.

State	City	Onset date Error 1 to 9 days	Season end Error 1 to 12 days	Season Length Days Error 2 – 15	Annual Rainfall mm Error 25 to 470mm
Abia	Aba North	14-Mar	14-Dec	276	2556
	Aba South	14-Mar	14-Dec	276	2569
	Arochukw	20-Mar	10-Dec	267	2354
	Bende	21-Mar	10-Dec	265	2309
	Ikwuano	18-Mar	12-Dec	270	2427
	Isiala Ngwa North	17-Mar	12-Dec	271	2439
	Isiala Ngwa South	16-Mar	12-Dec	272	2475
	Isuikwua	23-Mar	9-Dec	262	2247
	Oboma Ngwa	14-Mar	14-Dec	275	2544
	Ohafia Abia	21-Mar	10-Dec	264	2301
	Osioma Ngwa	15-Mar	13-Dec	274	2519
	Ugwunagbo	13-Mar	14-Dec	278	2596
	Ukwa East	12-Mar	15-Dec	279	2632
	Ukwa West	12-Mar	15-Dec	278	2619
	Umuahia North	20-Mar	10-Dec	266	2343
	Umuahia South	19-Mar	11-Dec	268	2388
Umu-Nneochi	25-Mar	7-Dec	258	2173	
Adamawa	Demsa	22-May	22-Oct	153	1097
	Fufore	7-May	24-Oct	170	1143
	Ganye	27-Apr	30-Oct	185	1320
	Girei	21-May	17-Oct	149	965
	Gombi	11-May	22-Oct	165	1095
	Guyuk	16-May	19-Oct	156	1020
	Hong	22-May	16-Oct	147	951
	Jada	1-May	28-Oct	180	1258
	Jimeta	9-May	24-Oct	168	1127
	Lamurde	13-May	21-Oct	162	1068
Madagali	30-May	12-Oct	135	881	

	Maiha	16-May	19-Oct	156	1016
	Mayo-Belwa	3-May	27-Oct	177	1220
	Michika	26-May	13-Oct	140	909
	Mubi North	23-May	16-Oct	146	943
	Mubi South	21-May	16-Oct	148	961
	Numan	11-May	22-Oct	164	1084
	Shelleng	18-May	18-Oct	154	1001
	Song	16-May	19-Oct	156	1021
	Toungo	5-May	26-Oct	174	1188
	Yola South	23-May	29-Sep	149	1124
	Yola North	22-May	2-Oct	153	1138
Akwa Ibom	Abak	13-Mar	14-Dec	278	2605
	Eastern Obolo	6-Mar	18-Dec	288	2853
	Eket	8-Mar	17-Dec	286	2792
	Esit - Eket	8-Mar	17-Dec	285	2783
	Essien Udim	14-Mar	14-Dec	276	2558
	Etim Ekpo	12-Mar	15-Dec	279	2620
	Etinan	10-Mar	16-Dec	282	2695
	Ibeno	7-Mar	18-Dec	287	2831
	Ibesikpo Asutan	11-Mar	15-Dec	280	2648
	Ibiono Ibom	15-Mar	13-Dec	274	2507
	Ika	13-Mar	14-Dec	278	2597
	Ikono	15-Mar	13-Dec	274	2507
	Ikot Abasi	7-Mar	18-Dec	287	2830
	Ikot Ekpene	15-Mar	13-Dec	274	2511
	Ini	17-Mar	12-Dec	270	2431
	Itu	14-Mar	14-Dec	275	2544
	Mbo	7-Mar	17-Dec	286	2795
	Mkpat Enin	7-Mar	18-Dec	286	2809
	Nsit Atai	10-Mar	16-Dec	281	2689
	Nsit Ibom	11-Mar	15-Dec	280	2658
	Nsit Ubium	9-Mar	16-Dec	283	2726
	Obot Akara	16-Mar	13-Dec	273	2488
	Okobo	10-Mar	16-Dec	282	2702
	Onna	8-Mar	17-Dec	286	2792
	Oron	9-Mar	16-Dec	283	2738
	Oruk Anam	10-Mar	16-Dec	282	2691
	Udung Uko	9-Mar	16-Dec	283	2729
	Ukanafun	11-Mar	15-Dec	280	2649
	Uruan	12-Mar	15-Dec	278	2612
	Urue-Offong/Oruko	9-Mar	17-Dec	284	2750
	Uyo	13-Mar	14-Dec	278	2604

Anambra	Aguata	26-Mar	7-Dec	257	2158
	Anambra East	30-Mar	5-Dec	251	2028
	Anambra West	2-Apr	3-Dec	246	1947
	Anaocha	27-Mar	6-Dec	255	2115
	Awka North	30-Mar	5-Dec	250	2016
	Awka South	28-Mar	6-Dec	253	2074
	Ayamelum	2-Apr	3-Dec	246	1933
	Njikoka	29-Mar	5-Dec	252	2059
	Ekwusigo	26-Mar	7-Dec	257	2155
	Idemili North	27-Mar	6-Dec	255	2101
	Idemili South	27-Mar	6-Dec	256	2124
	Ihiala	24-Mar	8-Dec	260	2214
	Dunukofia	28-Mar	6-Dec	253	2074
	Nnewi North	26-Mar	7-Dec	257	2154
	Nnewi South	25-Mar	7-Dec	258	2177
	Ogbaru	24-Mar	8-Dec	260	2202
	Onitsha North	27-Mar	6-Dec	255	2102
	Onitsha South	27-Mar	6-Dec	255	2114
	Orumba North	27-Mar	6-Dec	255	2111
	Orumba South	26-Mar	7-Dec	257	2153
	Oyi	29-Mar	5-Dec	253	2062
Bauchi	Alkaleri	17-May	29-Oct	164	904
	Bauchi	22-May	26-Oct	157	851
	Bogoro	14-May	31-Oct	170	950
	Damban	9-Jun	16-Oct	129	674
	Darazo	3-Jun	19-Oct	139	705
	Dass	19-May	28-Oct	162	890
	Gamawa	14-Jun	13-Oct	120	657
	Ganjuwa	29-May	22-Oct	146	786
	Giade	7-Jun	17-Oct	132	681
	Itas/Gadau	12-Jun	14-Oct	124	662
	Jama'are	10-Jun	15-Oct	127	669
	Katagum	9-Jun	16-Oct	129	672
	Kirfi	24-May	25-Oct	154	780
	Misau	7-Jun	17-Oct	133	683
	Ningi	1-Jun	20-Oct	141	713
	Shira	7-Jun	17-Oct	131	680
	Tafawa-Balewa	17-May	28-Oct	164	903
	Toro	23-May	25-Oct	155	839
	Warji	3-Jun	19-Oct	139	704
	Zaki	18-Jun	11-Oct	115	603
Bayelsa	Brass	5-Mar	19-Dec	290	2890

	Ekeremor	11-Mar	15-Dec	281	2668
	Kolokuma/Opokuma	13-Mar	14-Dec	277	2575
	Nembe	6-Mar	18-Dec	288	2860
	Ogbia	9-Mar	17-Dec	284	2740
	Sagbama	14-Mar	13-Dec	275	2535
	Southern Ijaw	7-Mar	18-Dec	287	2818
	Yenegoa	14-Mar	14-Dec	276	2562
Benue	Ado	26-Apr	1-Nov	189	1824
	Agatu	10-May	24-Oct	168	1487
	Apa	7-May	26-Oct	172	1549
	Buruku	3-May	28-Oct	177	1630
	Gboko	3-May	28-Oct	178	1646
	Guma	10-May	24-Oct	167	1482
	Gwer East	3-May	28-Oct	177	1629
	Gwer West	7-May	26-Oct	172	1546
	Katsina-Ala	3-May	28-Oct	178	1639
	Konshisha	29-Apr	30-Oct	185	1752
	Kwande	26-Apr	1-Nov	189	1822
	Logo	8-May	25-Oct	170	1521
	Makurdi	3-May	26-Oct	176	1234
	Obi	28-Apr	31-Oct	185	1764
	Ogbadibo	28-Apr	30-Oct	185	1760
	Ohimini	1-May	29-Oct	181	1684
	Oju	27-Apr	31-Oct	188	1806
	Okpokwu	28-Apr	30-Oct	185	1760
	Oturkpo	2-May	28-Oct	180	1669
	Tarka	6-May	26-Oct	173	1559
	Ukum	7-May	26-Oct	172	1551
	Ushongo	29-Apr	30-Oct	184	1748
	Vandeikya	26-Apr	1-Nov	188	1817
Borno	Abadam	5-Jul	30-Sep	87	495
	Askira/Uba	28-May	21-Oct	146	848
	Bama	8-Jun	14-Oct	128	477
	Bayo	25-May	22-Oct	150	873
	Biu	28-May	20-Oct	145	842
	Chibok	30-May	20-Oct	143	733
	Dambo	3-Jun	17-Oct	136	703
	Dikwa	14-Jun	11-Oct	120	459
	Gubio	24-Jun	6-Oct	104	456
	Guzamala	26-Jun	4-Oct	100	461
	Gwoza	3-Jun	17-Oct	136	702

	Hawul	25-May	22-Oct	150	771
	Jere	13-Jun	12-Oct	121	462
	Kaga	9-Jun	14-Oct	127	473
	Kala/Balge	16-Jun	10-Oct	116	455
	Konduga	10-Jun	13-Oct	125	469
	Kukawa	28-Jun	3-Oct	98	466
	Kwaya Kusar	24-May	23-Oct	152	779
	Mafa	15-Jun	11-Oct	118	457
	Magumeri	17-Jun	9-Oct	115	454
	Maiduguri	13-Jun	12-Oct	121	461
	Marte	20-Jun	8-Oct	110	453
	Mobbar	30-Jun	2-Oct	93	475
	Monguno	22-Jun	7-Oct	107	454
	Ngala	18-Jun	9-Oct	112	453
	Nganzai	21-Jun	7-Oct	108	453
	Shani	22-May	24-Oct	156	806
Cross River	Abi	25-Mar	8-Dec	259	2191
	Akamkpa	17-Mar	12-Dec	271	2439
	Akpabuyo	10-Mar	16-Dec	282	2705
	Bakassi	9-Mar	16-Dec	283	2737
	Bekwarra	4-Apr	2-Dec	243	1881
	Biase	20-Mar	10-Dec	266	2347
	Boki	30-Mar	5-Dec	251	2035
	Calabar	12-Mar	15-Dec	278	2611
	Calabar South	10-Mar	16-Dec	282	2702
	Etung	24-Mar	8-Dec	260	2219
	Ikom	27-Mar	6-Dec	256	2123
	Obanliku	1-Apr	3-Dec	247	1953
	Obubra	26-Mar	7-Dec	257	2151
	Obudu	3-Apr	3-Dec	245	1916
	Odukpani	15-Mar	13-Dec	274	2521
	Ogoja	2-Apr	3-Dec	246	1944
	Yakurr	24-Mar	8-Dec	261	2225
	Yala Cross	2-Apr	3-Dec	245	1928
Delta	Aniocha North	30-Mar	4-Dec	250	2015
	Aniocha South	28-Mar	6-Dec	254	2094
	Bomadi	15-Mar	13-Dec	273	2499
	Burutu	17-Mar	12-Dec	271	2457
	Ethiope East	25-Mar	8-Dec	259	2187
	Ethiope West	22-Mar	9-Dec	263	2284
	Ika Northeast	29-Mar	5-Dec	252	2057
	Ika South	28-Mar	6-Dec	253	2074

	Isoko North	19-Mar	11-Dec	267	2367
	Isoko South	18-Mar	11-Dec	269	2412
	Ndokwa East	21-Mar	10-Dec	265	2311
	Ndokwa West	23-Mar	8-Dec	261	2231
	Okpe	21-Mar	9-Dec	264	2295
	Oshimili North	30-Mar	5-Dec	251	2028
	Oshimili South	27-Mar	6-Dec	255	2113
	Patani	15-Mar	13-Dec	274	2506
	Sapele	24-Mar	8-Dec	260	2213
	Udu	19-Mar	11-Dec	268	2377
	Ughelli North	19-Mar	11-Dec	267	2360
	Ughelli South	18-Mar	12-Dec	270	2426
	Ukwuani	23-Mar	8-Dec	261	2228
	Uvwie	20-Mar	10-Dec	266	2339
	Warri North	23-Mar	8-Dec	261	2232
	Warri South	21-Mar	10-Dec	265	2317
	Warri Southwest	20-Mar	10-Dec	266	2343
Ebonyi	Abakaliki	29-Mar	5-Dec	252	2044
	Afikpo North	24-Mar	8-Dec	259	2201
	Afikpo South	24-Mar	8-Dec	260	2209
	Ebonyi	1-Apr	3-Dec	247	1959
	Ezza North	29-Mar	5-Dec	252	2049
	Ezza South	28-Mar	6-Dec	254	2099
	Ikwo	27-Mar	6-Dec	255	2118
	Ishielu	31-Mar	4-Dec	249	1989
	Ivo	25-Mar	8-Dec	259	2191
	Izzi	1-Apr	3-Dec	247	1952
	Ohaozara	26-Mar	7-Dec	258	2161
	Ohaukwu	1-Apr	4-Dec	248	1966
	Onicha	27-Mar	6-Dec	255	2117
Edo	Akoko-Edo	13-Apr	27-Nov	228	1633
	Egor	31-Mar	4-Dec	250	2007
	Esan Central	4-Apr	2-Dec	242	1866
	Esan Northeast	5-Apr	1-Dec	241	1847
	Esan Southeast	3-Apr	3-Dec	245	1916
	Esan West	4-Apr	2-Dec	243	1885
	Etsako Central	8-Apr	30-Nov	237	1775
	Etsako East	11-Apr	28-Nov	231	1684
	Etsako West	8-Apr	30-Nov	236	1767
	Igueben	2-Apr	3-Dec	247	1950
	Ikpoba-Okha	28-Mar	6-Dec	253	2071

	Oredo	29-Mar	5-Dec	252	2051
	Orhionmwon	28-Mar	6-Dec	254	2090
	Ovia North East	1-Apr	4-Dec	248	1971
	Ovia South West	1-Apr	4-Dec	248	1972
	Owan East	9-Apr	29-Nov	235	1738
	Owan West	7-Apr	30-Nov	238	1795
	Uhunmwonde	1-Apr	3-Dec	247	1954
Ekiti	Ado-Ekiti	16-Apr	25-Nov	223	1556
	Efon	17-Apr	24-Nov	222	1539
	EkitiEas	18-Apr	24-Nov	220	1513
	EkitiSouth-West	16-Apr	25-Nov	225	1579
	EkitiWest	18-Apr	24-Nov	222	1531
	Emure/Ise/Orun	14-Apr	26-Nov	227	1607
	Gboyin	17-Apr	25-Nov	223	1553
	Ido/Osi	20-Apr	23-Nov	218	1476
	Ijero	19-Apr	23-Nov	219	1493
	Ikere	15-Apr	26-Nov	226	1593
	Ikole	20-Apr	23-Nov	218	1472
	Ilejemeje	21-Apr	22-Nov	216	1456
	Irepodun/Ifelodun	18-Apr	24-Nov	221	1528
	Ise/Orun	14-Apr	26-Nov	227	1607
	Moba	21-Apr	22-Nov	216	1445
	Oye	20-Apr	23-Nov	218	1477
Enugu	Aninri	26-Mar	7-Dec	256	2132
	Awgu	28-Mar	6-Dec	254	2083
	Enugu East	2-Apr	3-Dec	245	1922
	Enugu North	1-Apr	4-Dec	247	1965
	Enugu South	31-Mar	4-Dec	248	1983
	Ezeagu	31-Mar	4-Dec	249	1986
	Igbo-Etiti	4-Apr	2-Dec	243	1880
	Igbo-Eze North	9-Apr	29-Nov	235	1751
	Igbo-Eze South	8-Apr	30-Nov	237	1776
	Isi-Uzo	5-Apr	1-Dec	242	1860
	Nkanu East	30-Mar	5-Dec	251	2034
	Nkanu West	30-Mar	4-Dec	250	2013
	Nsukka	6-Apr	1-Dec	239	1815
	Oji-River	28-Mar	6-Dec	253	2076
	Udenu	6-Apr	30-Nov	239	1811
	Udi	1-Apr	4-Dec	248	1966
	Uzo-Uwani	4-Apr	2-Dec	242	1868
FCT	Abaji	12-May	1-Nov	198	1220

	Abuja Municipal	14-May	31-Oct	195	1186
	Bwari	17-May	29-Oct	190	1141
	Gwagwalada	15-May	30-Oct	193	1169
	Kuje	10-May	2-Nov	201	1258
	Kwali	11-May	1-Nov	200	1242
Gombe	Akko	31-May	11-Oct	133	717
	Balanga	27-May	13-Oct	139	761
	Billiri	27-May	13-Oct	138	755
	Dukku	9-Jun	6-Oct	119	632
	Funakaye	9-Jun	6-Oct	119	633
	Gombe	2-Jun	9-Oct	130	693
	Kaltungo	27-May	13-Oct	138	755
	Kwami	5-Jun	8-Oct	125	663
	Nafada	12-Jun	4-Oct	113	606
	Shomgom	25-May	14-Oct	142	789
	Yamaltu/Deba	2-Jun	24-Oct	144	696
Imo	Aboh-Mbaise	18-Mar	11-Dec	269	2396
	Ahiazu-Mbaise	20-Mar	10-Dec	266	2348
	Ehime-Mbano	22-Mar	9-Dec	264	2289
	Ezinihitte	19-Mar	11-Dec	268	2380
	Ideato North	24-Mar	8-Dec	260	2212
	Ideato South	23-Mar	8-Dec	261	2238
	Ihitte/Uboma	21-Mar	10-Dec	264	2305
	Ikeduru	20-Mar	10-Dec	266	2347
	Isiala Mbano	22-Mar	9-Dec	264	2289
	Isu	22-Mar	9-Dec	264	2287
	Mbaitoli	20-Mar	10-Dec	266	2329
	Ngor-Okpala	17-Mar	12-Dec	271	2449
	Njaba	22-Mar	9-Dec	263	2273
	Nkwerre	22-Mar	9-Dec	262	2264
	Nwangele	22-Mar	9-Dec	263	2276
	Obowo	20-Mar	10-Dec	267	2350
	Oguta	21-Mar	10-Dec	264	2305
	Ohaji/Egbema	18-Mar	11-Dec	269	2407
	Okigwe	23-Mar	8-Dec	261	2233
	Orlu	23-Mar	8-Dec	261	2234
	Orsu	24-Mar	8-Dec	260	2208
	Oru East	22-Mar	9-Dec	263	2264
	Oru West	23-Mar	9-Dec	262	2254
	Owerri-Municipal	19-Mar	11-Dec	268	2377
	Owerri North	19-Mar	11-Dec	269	2393
	Owerri West	18-Mar	11-Dec	269	2403

	Unuimo	23-Mar	9-Dec	262	2247
Jigawa	Auyo	19-Jun	2-Oct	106	603
	Babura	23-Jun	30-Sep	99	605
	Biriniwa	25-Jun	29-Sep	97	608
	Birni Kudu	8-Jun	9-Oct	123	828
	Buji	8-Jun	8-Oct	122	827
	Dutse	12-Jun	6-Oct	117	814
	Gagarawa	21-Jun	1-Oct	102	603
	Garki	20-Jun	2-Oct	104	603
	Gumel	22-Jun	30-Sep	100	605
	Guri	23-Jun	30-Sep	99	605
	Gwaram	4-Jun	10-Oct	128	745
	Gwiwa	24-Jun	30-Sep	98	606
	Hadejia	20-Jun	2-Oct	103	603
	Jahun	15-Jun	4-Oct	111	606
	Kafin Hausa	17-Jun	4-Oct	109	604
	Kaugama	21-Jun	1-Oct	103	603
	Kazaure	23-Jun	30-Sep	99	605
	Kiri Kasamma	22-Jun	1-Oct	101	604
	Kiyawa	12-Jun	6-Oct	116	712
	Maigatari	24-Jun	29-Sep	97	607
	Malam Madori	22-Jun	1-Oct	101	604
	Miga	17-Jun	3-Oct	108	604
	Ringim	16-Jun	4-Oct	109	605
	Roni	23-Jun	30-Sep	100	605
	Sule-Tankarkar	23-Jun	30-Sep	99	606
	Taura	18-Jun	3-Oct	107	604
	Yankwashi	24-Jun	29-Sep	97	607
Kaduna	Birnin-Gwari	30-May	23-Oct	146	879
	Chikun	24-May	27-Oct	165	931
	Giwa	2-Jun	22-Oct	150	856
	Igabi	27-May	25-Oct	159	901
	Ikara	4-Jun	20-Oct	147	844
	Jaba	11-May	3-Nov	185	1086
	Jema'a	9-May	4-Nov	188	1116
	Kachia	16-May	31-Oct	177	1022
	Kaduna North	26-May	26-Oct	161	912
	Kaduna South	25-May	26-Oct	163	919
	Kagarko	11-May	3-Nov	186	1097
	Kajuru	22-May	28-Oct	167	947
	Kaura	13-May	2-Nov	181	1055
	Kauru	21-May	29-Oct	170	964

	Kubau	31-May	23-Oct	154	875
	Kudan	4-Jun	21-Oct	147	846
	Lere	23-May	28-Oct	167	945
	Markafi	5-Jun	20-Oct	146	841
	Sabon-Gari	3-Jun	21-Oct	149	852
	Sanga	7-May	5-Nov	190	1143
	Soba	1-Jun	22-Oct	152	867
	Zango-Kataf	16-May	31-Oct	178	1024
	Zaria	2-Jun	22-Oct	151	860
Kano	Ajingi	14-Jun	11-Oct	120	709
	Albasu	10-Jun	14-Oct	126	720
	Bagwai	16-Jun	10-Oct	117	506
	Bebeji	8-Jun	14-Oct	128	726
	Bichi	18-Jun	9-Oct	113	503
	Bunkure	10-Jun	13-Oct	126	720
	Dala	15-Jun	11-Oct	118	607
	Dambatta	20-Jun	8-Oct	110	503
	Dawakin Kudu	12-Jun	12-Oct	123	714
	Dawakin Tofa	16-Jun	10-Oct	116	505
	Doguwa	31-May	19-Oct	140	840
	Fagge	14-Jun	11-Oct	119	708
	Gabasawa	16-Jun	10-Oct	116	505
	Garko	9-Jun	14-Oct	127	624
	Garum Mallam	10-Jun	13-Oct	126	620
	Gaya	12-Jun	12-Oct	123	614
	Gezawa	15-Jun	11-Oct	118	507
	Gwale	14-Jun	11-Oct	119	608
	Gwarzo	13-Jun	12-Oct	120	610
	Kabo	13-Jun	12-Oct	121	611
	Kano Municipal	14-Jun	11-Oct	119	609
	Karaye	11-Jun	13-Oct	123	615
	Kibiya	8-Jun	15-Oct	129	628
	Kiru	9-Jun	14-Oct	127	622
	Kumbotso	13-Jun	11-Oct	120	610
	Kunchi	20-Jun	8-Oct	110	503
	Kura	11-Jun	13-Oct	123	615
	Madobi	12-Jun	12-Oct	122	613
	Makoda	20-Jun	8-Oct	110	503
	Minjibir	17-Jun	9-Oct	114	504
	Nasarawa	15-Jun	11-Oct	118	507
	Rano	8-Jun	15-Oct	129	628
	Rimin Gado	13-Jun	11-Oct	120	610

	Rogo	8-Jun	14-Oct	128	626
	Shanono	15-Jun	10-Oct	117	506
	Sumaila	6-Jun	15-Oct	131	635
	Takai	7-Jun	15-Oct	130	631
	Tarauni	14-Jun	11-Oct	119	608
	Tofa	14-Jun	11-Oct	118	607
	Tsanyawa	18-Jun	9-Oct	113	503
	Tudun Wada	5-Jun	16-Oct	133	642
	Ungogo	15-Jun	11-Oct	118	507
	Warawa	13-Jun	11-Oct	120	610
	Wudil	11-Jun	13-Oct	124	616
Katsina	Bakori	9-Jun	12-Oct	124	722
	Batagarawa	26-Jun	2-Oct	98	512
	Batsari	25-Jun	3-Oct	100	509
	Baure	25-Jun	3-Oct	99	509
	Bindawa	24-Jun	4-Oct	102	507
	Charanchi	23-Jun	4-Oct	104	505
	Dandume	7-Jun	13-Oct	129	733
	Danja	7-Jun	13-Oct	129	734
	Dan Musa	17-Jun	7-Oct	112	554
	Daura	28-Jun	1-Oct	95	466
	Dutsi	27-Jun	2-Oct	97	463
	Dutsin-Ma	20-Jun	6-Oct	108	553
	Faskari	10-Jun	11-Oct	124	670
	Funtua	7-Jun	13-Oct	128	820
	Ingawa	23-Jun	4-Oct	103	455
	Jibia	28-Jun	1-Oct	95	466
	Kafur	10-Jun	12-Oct	124	721
	Kaita	30-Jun	30-Sep	92	474
	Kankara	14-Jun	9-Oct	117	558
	Kankia	21-Jun	5-Oct	107	453
	Katsina	28-Jun	1-Oct	95	466
	Kurfi	24-Jun	3-Oct	101	457
	Kusada	21-Jun	5-Oct	106	553
	Mai'adua	30-Jun	30-Sep	92	473
	Malumfashi	12-Jun	10-Oct	120	562
	Mani	26-Jun	2-Oct	98	462
	Mashi	30-Jun	30-Sep	92	473
	Matazu	18-Jun	7-Oct	111	453
	Musawa	15-Jun	8-Oct	115	456
	Rimi	26-Jun	2-Oct	99	460
	Sabuwa	6-Jun	14-Oct	130	588

	Safana	21-Jun	5-Oct	106	454
	Sandamu	27-Jun	2-Oct	97	463
	Zango	28-Jun	1-Oct	96	465
Kebbi	Aleiro	26-Jun	1-Oct	97	603
	Arewa	1-Jul	28-Sep	89	605
	Argungu	1-Jul	28-Sep	89	605
	Augie	5-Jul	26-Sep	83	613
	Bagudo	6-Jun	8-Oct	124	636
	BirninKe	28-Jun	30-Sep	94	603
	Bunza	24-Jun	2-Oct	100	605
	Dandi	12-Jun	4-Oct	114	613
	Danko Wasagu	7-Jun	7-Oct	122	630
	Fakai	8-Jun	7-Oct	121	628
	Gwandu	29-Jun	29-Sep	93	603
	Jega	24-Jun	2-Oct	100	605
	Kalgo	18-Jun	1-Oct	105	603
	Koko/Bes	7-Jun	7-Oct	122	633
	Maiyama	14-Jun	3-Oct	111	609
	Ngaski	27-May	13-Oct	139	706
	Sakaba	3-Jun	9-Oct	127	650
	Shanga	4-Jun	8-Oct	126	645
	Suru	11-Jun	5-Oct	116	617
	Yauri	31-May	11-Oct	132	669
	Zuru	8-Jun	6-Oct	120	627
Kogi	Adavi	25-Apr	31-Oct	189	1547
	Ajaokuta	22-Apr	1-Nov	193	1607
	Ankpa	22-Apr	1-Nov	193	1618
	Bassa	26-Apr	30-Oct	187	1516
	Dekina	23-Apr	31-Oct	191	1582
	Ibaji	14-Apr	6-Nov	206	1834
	Idah	17-Apr	4-Nov	201	1739
	Igalamela-Odolu	17-Apr	4-Nov	201	1741
	Ijumu	27-Apr	29-Oct	185	1491
	Kabba/Bu	30-Apr	28-Oct	181	1429
	Kotonkar	2-May	26-Oct	177	1380
	Lokoja	2-May	26-Oct	177	1382
	Mopa-Muro	1-May	27-Oct	179	1402
	Ofu	21-Apr	2-Nov	195	1647
	Ogori/Magongo	23-Apr	1-Nov	192	1600
	Okehi	26-Apr	30-Oct	188	1529
	Okene	22-Apr	1-Nov	193	1605
	Olamabor	19-Apr	3-Nov	198	1700

	Omala	27-Apr	30-Oct	186	1509
	Yagba East	2-May	27-Oct	178	1399
	Yagba West	3-May	26-Oct	176	1368
Kwara	Asa	6-May	25-Oct	172	1317
	Baruten	16-May	19-Oct	156	1136
	Edu	12-May	21-Oct	162	1202
	Ekiti	1-May	27-Oct	180	1416
	Ifelodun	8-May	23-Oct	169	1276
	Ilorin East	7-May	24-Oct	169	1285
	Ilorin South	6-May	25-Oct	172	1314
	Ilorin West	6-May	24-Oct	171	1307
	Irepodun	2-May	27-Oct	178	1388
	Isin	3-May	26-Oct	176	1368
	Kaiama	18-May	18-Oct	152	1102
	Moro	11-May	21-Oct	163	1211
	Offa	2-May	27-Oct	178	1394
	Oke-Ero	2-May	27-Oct	178	1397
	Oyun	2-May	27-Oct	178	1392
	Pategi	9-May	23-Oct	167	1260
Lagos	Agege	4-Apr	2-Dec	243	1891
	Ajeromi-Ifelodun	1-Apr	3-Dec	247	1959
	Alimosho	3-Apr	2-Dec	244	1905
	Amuwo-Odofin	1-Apr	4-Dec	248	1975
	Apapa	1-Apr	4-Dec	248	1977
	Badagry	1-Apr	4-Dec	248	1978
	Epe	1-Apr	3-Dec	247	1952
	Eti-Osa	1-Apr	4-Dec	248	1970
	Ibeju/Lekki	1-Apr	4-Dec	248	1973
	Ifako-Ijaye	4-Apr	2-Dec	243	1876
	Ikeja	3-Apr	2-Dec	244	1900
	Ikorodu	3-Apr	2-Dec	244	1903
	Kosofe	3-Apr	2-Dec	244	1906
	Lagos Island	2-Apr	3-Dec	246	1936
	Lagos Mainland	2-Apr	3-Dec	246	1942
	Mushin	2-Apr	3-Dec	245	1925
	Ojo	1-Apr	4-Dec	248	1967
	Oshodi-Isolo	3-Apr	3-Dec	245	1920
	Shomolu	2-Apr	3-Dec	245	1924
	Surulere	2-Apr	3-Dec	246	1944
Nasarawa	Akwanga	14-May	20-Oct	184	1171
	Awe	3-May	26-Oct	201	1368
	Doma	2-May	27-Oct	203	1392

	Karu	15-May	19-Oct	183	1152
	Keana	2-May	26-Oct	202	1382
	Keffi	11-May	22-Oct	189	1218
	Kokona	12-May	21-Oct	186	1193
	Lafia	9-May	23-Oct	192	1251
	Nasarawa	5-May	25-Oct	199	1338
	Nassarawa Egon	10-May	22-Oct	191	1241
	Obi	4-May	25-Oct	199	1340
	Toto	4-May	26-Oct	200	1354
	Wamba	14-May	20-Oct	185	1174
Niger	Agaié	12-May	16-Oct	182	1200
	Agwara	6-Jun	2-Oct	143	889
	Bida	14-May	15-Oct	178	1161
	Borgu	1-Jun	5-Oct	151	934
	Bosso	21-May	11-Oct	168	1060
	Chanchaga	21-May	11-Oct	167	1055
	Edati	13-May	15-Oct	180	1177
	Gbako	17-May	13-Oct	175	1122
	Gurara	17-May	13-Oct	174	1115
	Katcha	14-May	15-Oct	178	1161
	Kontagora	1-Jun	5-Oct	150	929
	Lapai	12-May	16-Oct	183	1208
	Lavun	15-May	14-Oct	177	1146
	Magama	31-May	5-Oct	152	937
	Mariga	5-Jun	3-Oct	145	899
	Mashegu	24-May	10-Oct	164	1026
	Mokwa	15-May	14-Oct	177	1147
	Muya	24-May	9-Oct	164	1025
	Paikoro	20-May	12-Oct	170	1081
	Rafi	29-May	7-Oct	156	965
	Rijau	9-Jun	30-Sep	138	863
	Shiroro	26-May	8-Oct	160	992
	Suleja	16-May	14-Oct	176	1139
	Tafa	17-May	13-Oct	175	1124
	Wushishi	22-May	11-Oct	167	1049
Ogun	Abeokuta South	12-Apr	28-Nov	231	1675
	Abeokuta North	11-Apr	28-Nov	232	1699
	AdoOdo/Ota	3-Apr	2-Dec	244	1901
	EgbadoNorth	10-Apr	28-Nov	233	1713
	EgbadoSouth	6-Apr	1-Dec	240	1829
	Ewekoro	8-Apr	30-Nov	237	1774
	Ifo	5-Apr	1-Dec	241	1845

	Ijebu North-East	7-Apr	30-Nov	238	1802
	IjebuEast	5-Apr	1-Dec	241	1843
	IjebuNorth	9-Apr	29-Nov	236	1755
	IjebuOde	6-Apr	1-Dec	240	1837
	Ikenne	7-Apr	30-Nov	238	1786
	Imeko-Afon	17-Apr	25-Nov	222	1541
	Ipokia	3-Apr	2-Dec	244	1901
	Obafemi-Owode	8-Apr	30-Nov	237	1775
	Odeda	12-Apr	27-Nov	230	1658
	Odogbolu	6-Apr	1-Dec	240	1824
	OgunWaterside	31-Mar	4-Dec	249	1988
	Remo-North	8-Apr	29-Nov	236	1759
	Shagamu	6-Apr	1-Dec	240	1825
Ondo	Akoko North-East	16-Apr	25-Nov	224	1571
	Akoko South-East	14-Apr	26-Nov	226	1605
	Akoko South-West	14-Apr	26-Nov	228	1621
	AkokoNorthWest	17-Apr	24-Nov	222	1534
	Akure North	12-Apr	28-Nov	231	1678
	Akure South	11-Apr	28-Nov	232	1687
	Ese-Odo	30-Mar	5-Dec	251	2035
	Idanre	8-Apr	30-Nov	236	1768
	Ifedore	13-Apr	27-Nov	229	1639
	IlajeEseodo	27-Mar	6-Dec	255	2113
	IleOluji/Okeigbo	12-Apr	27-Nov	230	1662
	Irele	2-Apr	3-Dec	246	1931
	Odigbo	5-Apr	2-Dec	242	1862
	Okitipupa	3-Apr	3-Dec	245	1921
	Ondo East	9-Apr	29-Nov	235	1736
	Ondo West	8-Apr	29-Nov	236	1756
	Ose	9-Apr	29-Nov	234	1735
	Owo	10-Apr	28-Nov	233	1714
Osun	Atakumosa East	13-Apr	27-Nov	229	1642
	Atakumosa West	16-Apr	25-Nov	225	1577
	Ayedaade	13-Apr	27-Nov	229	1644
	Ayedire	16-Apr	25-Nov	224	1571
	Boluwaduro	21-Apr	22-Nov	217	1458
	Boripe	20-Apr	23-Nov	218	1481
	Ede North	18-Apr	24-Nov	221	1522
	Ede South	17-Apr	25-Nov	222	1542
	Egbedore	19-Apr	24-Nov	220	1503
	Ejigbo	19-Apr	23-Nov	219	1500
	Ife East	13-Apr	27-Nov	229	1641

	Ife North	12-Apr	28-Nov	231	1675
	Ife South	12-Apr	28-Nov	231	1676
	IfeCentral	15-Apr	26-Nov	226	1601
	Ifedayo	21-Apr	22-Nov	216	1450
	Ifelodun	21-Apr	23-Nov	217	1462
	Ila	21-Apr	22-Nov	216	1451
	Ilesha East	16-Apr	25-Nov	224	1560
	Ilesha West	17-Apr	25-Nov	223	1545
	Irepodun	20-Apr	23-Nov	218	1478
	Irewole	14-Apr	26-Nov	228	1625
	Isokan	12-Apr	27-Nov	230	1663
	Iwo	17-Apr	25-Nov	223	1545
	Obokun	19-Apr	24-Nov	220	1505
	OdoOtin	22-Apr	22-Nov	215	1442
	Ola-Oluwa	18-Apr	24-Nov	220	1515
	Olorunda	20-Apr	23-Nov	218	1483
	Oriade	15-Apr	25-Nov	225	1580
	Orolu	20-Apr	23-Nov	217	1470
	Osogbo	19-Apr	24-Nov	220	1509
Oyo	Afijio	19-Apr	24-Nov	219	1508
	Akinyele	16-Apr	25-Nov	224	1578
	Atiba	25-Apr	20-Nov	209	1365
	Atigbo	26-Apr	19-Nov	207	1339
	Egbeda	14-Apr	27-Nov	227	1627
	Ibadan North	14-Apr	26-Nov	226	1617
	Ibadan North East	13-Apr	27-Nov	227	1630
	Ibadan North West	14-Apr	26-Nov	227	1620
	Ibadan South East	13-Apr	27-Nov	228	1642
	Ibadan South West	13-Apr	27-Nov	227	1635
	Ibarapa Central	14-Apr	26-Nov	226	1607
	Ibarapa East	17-Apr	25-Nov	222	1551
	Ibarapa North	17-Apr	25-Nov	222	1543
	Ido	15-Apr	26-Nov	225	1589
	Irepo	5-May	14-Nov	193	1178
	Iseyin	20-Apr	23-Nov	218	1484
	Itesiwaju	24-Apr	20-Nov	210	1383
	Iwajowa	21-Apr	22-Nov	215	1443
	Kajola	22-Apr	22-Nov	213	1424
	Lagelu	15-Apr	26-Nov	225	1595
	Ogbomosho North	24-Apr	21-Nov	211	1392
	Ogbomosho South	23-Apr	21-Nov	212	1412
	Ogo Oluwa	21-Apr	22-Nov	215	1450

	Olorunsogo	2-May	16-Nov	198	1228
	Oluyole	11-Apr	28-Nov	231	1690
	Ona-Ara	12-Apr	27-Nov	229	1666
	Orelope	3-May	16-Nov	197	1221
	Ori Ire	26-Apr	19-Nov	207	1345
	Oyo East	20-Apr	23-Nov	217	1472
	Oyo West	21-Apr	23-Nov	216	1464
	Saki East	1-May	17-Nov	199	1248
	Saki West	30-Apr	17-Nov	202	1275
	Surulere	23-Apr	21-Nov	212	1414
Plateau	Barikin Ladi	18-May	13-Oct	168	861
	Bassa	24-May	10-Oct	159	788
	Bokkos	13-May	16-Oct	176	936
	Jos East	21-May	11-Oct	163	818
	Jos North	22-May	11-Oct	161	806
	Jos South	20-May	12-Oct	164	829
	Kanam	17-May	14-Oct	170	878
	Kanke	15-May	14-Oct	172	897
	Langtang North	11-May	17-Oct	179	969
	Langtang South	5-May	20-Oct	188	1070
	Mangu	16-May	14-Oct	172	896
	Mikang	11-May	17-Oct	180	973
	Pankshin	14-May	15-Oct	175	926
	Qua'an Pan	8-May	19-Oct	184	1018
	Riyom	18-May	13-Oct	169	866
	Shendam	8-May	19-Oct	184	1021
	Wase	11-May	17-Oct	179	965
Rivers	Abua/Odual	11-Mar	16-Dec	280	2678
	Ahoada East	13-Mar	14-Dec	276	2585
	Ahoada West	13-Mar	14-Dec	277	2597
	Akuku Toru	6-Mar	18-Dec	287	2841
	Andoni	6-Mar	18-Dec	287	2840
	Asari-Toru	9-Mar	16-Dec	282	2735
	Bonny	6-Mar	18-Dec	287	2845
	Degema	7-Mar	18-Dec	286	2811
	Eleme	9-Mar	17-Dec	283	2740
	Emohua	10-Mar	16-Dec	281	2689
	Etche	13-Mar	14-Dec	276	2582
	Gokana	8-Mar	17-Dec	284	2778
	Ikwerre	13-Mar	14-Dec	276	2584
	Khana	8-Mar	17-Dec	285	2789
	Obia/Akpor	10-Mar	16-Dec	281	2704

	Ogba/Egbema/Ndoni	18-Mar	12-Dec	269	2422
	Ogu/Bolo	8-Mar	17-Dec	284	2778
	Okrika	8-Mar	17-Dec	284	2780
	Omumma	14-Mar	14-Dec	275	2564
	Opobo/Nkoro	6-Mar	18-Dec	287	2846
	Oyigbo	10-Mar	16-Dec	280	2681
	Port-Harcourt	9-Mar	16-Dec	282	2729
	Tai	9-Mar	16-Dec	282	2736
Sokoto	Binji	30-Jun	19-Sep	81	525
	Bodinga	26-Jun	21-Sep	88	510
	Dange-Shuni	26-Jun	21-Sep	87	511
	Gada	7-Jul	15-Sep	71	558
	Goronyo	3-Jul	18-Sep	77	535
	Gudu	4-Jul	17-Sep	75	543
	Gwadabawa	4-Jul	17-Sep	75	541
	Illela	7-Jul	15-Sep	71	557
	Isa	1-Jul	19-Sep	80	527
	Kebbe	14-Jun	28-Sep	107	509
	Kware	30-Jun	19-Sep	82	522
	Rabah	29-Jun	20-Sep	83	518
	Sabon Birni	5-Jul	17-Sep	74	546
	Shagari	22-Jun	24-Sep	94	504
	Silame	28-Jun	20-Sep	85	516
	Sokoto North	29-Jun	20-Sep	83	519
	Sokoto South	28-Jun	20-Sep	84	518
	Tambuwal	20-Jun	25-Sep	97	503
	Tangaza	5-Jul	17-Sep	74	545
	Tureta	22-Jun	24-Sep	94	504
	Wamako	28-Jun	20-Sep	83	518
	Wurno	1-Jul	18-Sep	79	530
	Yabo	25-Jun	22-Sep	89	508
Taraba	Ardo-Kola	3-May	24-Oct	174	966
	Bali	23-Apr	29-Oct	190	1165
	Donga	17-Apr	2-Nov	198	1291
	Gashaka	14-Apr	3-Nov	203	1360
	Gassol	27-Apr	27-Oct	183	1083
	Ibi	26-Apr	28-Oct	184	1098
	Jalingo	4-May	23-Oct	172	950
	Karim-La	8-May	21-Oct	166	891
	Kurmi	10-Apr	5-Nov	209	1459
	Lau	7-May	21-Oct	167	897
	Sardauna	6-Apr	8-Nov	215	1564

	Takum	14-Apr	3-Nov	203	1363
	Ussa	7-Apr	7-Nov	214	1540
	Wukari	22-Apr	30-Oct	191	1186
	Yorro	4-May	23-Oct	172	955
	Zing	4-May	23-Oct	172	952
Yobe	Bade	24-Jun	19-Sep	87	507
	Bursari	24-Jun	20-Sep	88	506
	Damaturu	12-Jun	26-Sep	106	512
	Fika	7-Jun	29-Sep	114	532
	Fune	12-Jun	26-Sep	106	512
	Geidam	23-Jun	20-Sep	89	506
	Gujba	6-Jun	30-Sep	116	537
	Gulani	1-Jun	3-Oct	124	568
	Jakusko	21-Jun	21-Sep	93	503
	Karasuwa	27-Jun	18-Sep	83	513
	Machina	29-Jun	17-Sep	80	519
	Nangere	12-Jun	26-Sep	106	513
	Nguru	27-Jun	18-Sep	83	514
	Potiskum	11-Jun	27-Sep	108	517
	Tarmua	18-Jun	23-Sep	97	503
	Yunusari	30-Jun	16-Sep	78	523
	Yusufari	1-Jul	16-Sep	77	527
Zamfara	Anka	15-Jun	25-Sep	102	607
	Bakura	22-Jun	21-Sep	91	604
	Birnin Magaji	21-Jun	21-Sep	92	603
	Bukkuyum	14-Jun	25-Sep	103	608
	Bungudu	17-Jun	24-Sep	99	604
	Gummi	14-Jun	25-Sep	103	708
	Gusau	13-Jun	25-Sep	104	710
	Kaura Namoda	21-Jun	21-Sep	92	604
	Maradun	25-Jun	19-Sep	87	608
	Maru	11-Jun	27-Sep	108	717
	Shinkafi	28-Jun	17-Sep	81	616
	Talata Mafara	20-Jun	22-Sep	94	603
	Tsafe	13-Jun	25-Sep	104	610
	Zurmi	26-Jun	18-Sep	84	612

GLOSSARY

1. **Anti-microbial resistance:** The WHO defines antimicrobial **resistance** as a microorganism's **resistance** to an antimicrobial drug that was once able to treat an infection by that microorganism
2. **Antibiotic:** any of a large group of chemical substances, as penicillin or streptomycin, produced by various microorganisms and fungi, having the capacity in dilute solutions to inhibit the growth of or to destroy bacteria and other microorganisms, used chiefly in the treatment of infectious diseases.
3. **Aquaculture:** The rearing of aquatic animals or cultivation of aquatic plants for food.
4. **Agro-meteorological information:** Weather and climate information that, if applied to guide agricultural activities, improves yields, and enhances coping strategies against adverse impact of climate-related hazards in the sector.
5. **Annual rainfall amount** is the total amount of rainfall observed and recorded in the year under reference.
6. **Cessation-date of rainy season:** Cessation date is determined when the available water content at the root zone has dropped to 50%.
7. **Cessation date:** Postulated period when conditions such as soil moisture availability is below 50% requirements of plants need.
8. **Cooler than normal:** Mostly associated with temperatures below long-term average.
9. **Climate change:** Is a non-random change in climate that is measured over several decades or longer, which may be due to natural or human-induced causes.
10. **Climate variability:** refers to variations in the mean state and other statistics such as standard deviations, the occurrence of extremes, climate on all spatial and temporal scales beyond that of the individual events. Variability may be due to natural internal processes within the climate system or anthropogenic external forcing.
11. **Comfort Index:** An index of air temperature that provides daily satisfaction



with the thermal environment or an index, which combines air temperature and relative humidity to determine satisfaction with the thermal environment.

12. **Decision Support System for Agro Technology Transfer (DSSAT):** Simulation model
13. **Dehydration:** is lack of fluid in the body
14. **Departure:** Difference from long term average.
15. **Diarrhoea:** Is the passage of 3 or more loose or liquid stools per day, or more frequently than is normal for the individual
16. **Dry season farming-** Farming practices sustained by irrigation during period of little or no rainfall.
17. **Ecological zones:** They are dependent on and defined by precipitation intensity, variability and annual amounts.
18. **Escherichia coli:** Gram-negative, facultative anaerobic, rod-shaped, coliform bacterium of the genus **Escherichia** that is commonly found in the lower intestine of warm-blooded organisms
19. **El- Nino:** A warming of the Pacific Ocean water near the equator, off the coast of Peru, that typically occurs every 3 – 7 years, and which dictates a shift in normal weather patterns.
20. **ENSO (El- Nino – Southern Oscillation):** a combination of El-Niño features and strength of surface air pressure between the tropical eastern and western Pacific Ocean waters, which is usually computed from fluctuation in the surface air pressures between Tahiti and Darwin in Australia.
21. **ENSO – Neutral:** normal temperature conditions in the ocean water of the equator off the coast of Peru in South America.
22. **Extreme weather:** is an event that is rare at a particular place and time of the year. Extreme weather event would normally be as rare as or rarer than the 10 or 90 percentiles of the observed probability density function.
23. **Flash floods:** Flooding that begins within 6 hours, and often within 3 hours, of the heavy rainfall (or other cause).

24. **Global warming:** An overall increase in the world temperatures, which is often caused by additional heat being trapped by greenhouse gases mostly because of human activities.
25. **Green House Effect:** The warming generated by the trapping of long-wave radiation (heat) by Green House Gases in the atmosphere.
26. **Harmattan:** Cold, dry, dusty north easterly wind from the Sahara predominant during the winter season over West Africa.
27. **Heat stress:** can occur when you are exposed to extreme **heat** and your body is unable to cool itself properly.
28. **Heat stroke:** is a life-threatening condition with symptoms of high body temperature, rapid pulse, difficulty breathing, confusion, and coma.
29. **Heat waves:** is generally defined as a period of several days to weeks of abnormally hot weather.
30. **High-intensity rainfall:** Rainfall that is characterised by high amount of precipitation and often time last more 10 hours and may be accompanied by strong winds above 20 knots.
31. **Hydroelectricity: Hydroelectric** power, electricity produced from generators driven by turbines that convert the potential energy of falling or fast-flowing water into mechanical energy.
32. **IPCC:** Inter-Governmental Panel on Climate Change.
33. **Indian Ocean Dipole (IOD):** Indian Ocean **Dipole** (IOD) refers to the **temperature** difference between the eastern and western parts of the Indian ocean.
34. **Intra-seasonal rainfall patterns:** Variation in rainfall intensity and duration within the rainy season itself.
35. **Klebsiella pneumonia** is a bacterial organism that is responsible for causing **pneumonia**, sepsis, and urinary tract infection (UTI). The organism resides in the upper respiratory tract and gastrointestinal tract of healthy individuals.
36. **La- Nina:** An extensive cooling of the waters in the upper section of the tropical eastern Pacific Ocean.



37. **Length of rainy season:** is the number of days between the onset and cessation dates of the rainy season.
38. **Madden Julian Oscillation (MJO):** The **MJO** can be **defined** as an eastward moving 'pulse' of clouds, rainfall, winds and pressure near the equator that typically recurs every 30 to 60 days.
39. **Meningitis:** is an inflammation of the membranes (meninges) surrounding your brain and spinal cord. The swelling from **meningitis** typically triggers symptoms such as headache, fever and a stiff neck.
40. **Mid-Latitude Wave:** This wave is usually embedded in the passage of frontal systems over the mid-latitude region. It occurs along a frontal belt traversing from East to West. It is associated with deep level convection in form of atmospheric convergent force which pulls moisture to itself from as far West Africa.
41. **Modulators:** These are atmospheric forcing functions.
42. **SDG:** Sustainable Development Goals.
43. **North-easterly winds:** Winds from the Sahara Desert from a north-easterly direction
44. **Normal:** A long term average calculated over a minimum of thirty years.
45. **Near Normal:** Values of parameters under observation in the tolerance neighbourhood of Normal values.
46. **Neutral signal:** When El-Nino Southern Oscillation signal emanating from sea surface temperature over the pacific vary between +/- 0.5°C.
47. **Onset-date of rainy season** is the date at which the available water content of the root zone at the beginning of the cropping season reaches 50%.
48. **Pathogens:** are disease-causing viruses, bacteria, fungi, or protists, which can infect animals and plants.
49. **Pre-season rainfall:** Rainfall events prior to the seasonal events. They are usually short-lived and could come because of periodic incursion of extra-tropical modulators.

50. **Perishable goods:** Agricultural goods that lose considerable value if delayed in conveyance from the produce point to the desired place of sale. They are goods that go bad rapidly if a weather-controlled preservation technique is not employed
51. **Ruminant animal:** Animals with four compartmentalized stomachs
52. **Sea Surface Temperature (SST) anomalies** refers to the deviations from long-term averages in the mean temperature of the ocean in the upper few metres.
53. **Seasonal Rainfall Prediction (SRP):** Forecast of weather or climate condition for a period or season ranging from about three months to one year.
54. **Short-duration rainfall:** Rainfall events within 30minutes duration.
55. **Staphylococcus aureus:** is a Gram-positive, round-shaped bacterium that is frequently found in the upper respiratory tract and on the skin
56. **Tele-connection:** describes statistical correlations between weather events that occur at different parts of the world.
57. **Vision 20:20:20:** Nigeria's Vision to become one of the top twenty (20) advanced Nations' economies by the year 2020.
58. **Warmer than normal:** Mostly pertaining to temperature values higher than the long-term average.

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