


Overview of the 2020 Seasonal Rainfall Prediction

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WITH WORLD METEOROLOGICAL ORGANISATION (WMO)

21st January, 2020

Introduction

The Seasonal Rainfall Prediction (SRP) is produced by NiMet in fulfilment of one of our core mandates to monitor weather and climate in Nigeria and provide authoritative meteorological information for sustainable development and safety of life and property in the country.

Introduction

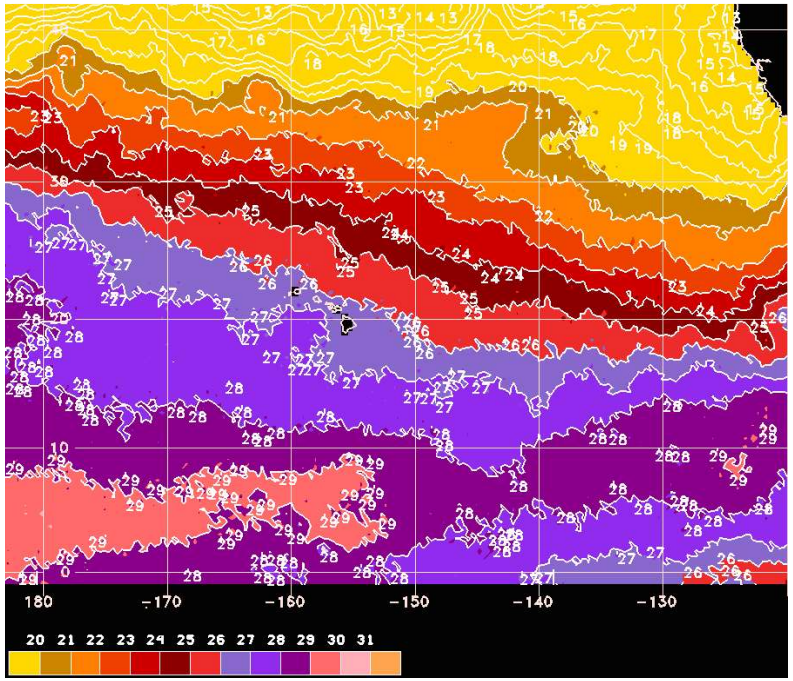
The SRP provides essential weather advisories and early warnings to planners, decision-makers and operators in the various rainfall-sensitive socio-economic sectors. These are agriculture, water resources, environment, transportation, health, construction etc.

Introduction

The SRP is therefore an invaluable tool that is capable of ameliorating the unpleasant consequences of extreme weather and climate events.

The proper application of the SRP reduces climate-related risks, enhances production, security and revenue generation.

The use of ENSO phase is adopted because of the strong teleconnection existing between the different phases (warm, cold, or neutral) that defines the state of sea surface temperature in the central Pacific Ocean and rainfall pattern in the country



Methodology

SRPs are statements about the probability of occurrence of stated onset, cessation, length of season, wetter – than, normal, or drier – than normal or average longterm (using the World Meteorological Organization (WMO)-approved 1981 – 2010) conditions over a given period

These statements or predictions are based on the statistics of probability of good correlation of our rainfall and temperature pattern with sea surface temperature anomalies over the Tropical Pacific

Methodology

In 2020 a neutral ENSO phase has been predicted for the NINO 3.4 region of the tropical Pacific Ocean by the international Research Institute for climate and Society (IRI)/Climate Prediction Centre (CPC) and the Bureau of Australian Meteorology (BoM) using both statistical and dynamical models involving hundreds of ensemble forecast members.

The confidence level in the ENSO prediction from these centers has continued to increase yearly because of how accurate the predictions have been, particularly in the last 10 years

DSAAT Model

The DSAAT crop model also incorporates phenological and soil information as well as historical daily weather data from 155-meteorological stations spatially distributed over Nigeria for calculation of onset, cessation and length of rainy season for the different areas in the country

The predictions provide information about:

(i) Onset and cessation dates of rainy season;

(ii) Length of the rainy season;

(iii) Annual Total amount of rainfall;

(iv) Dry Spell Occurence

(v) Socio-economic implications of the predictions

Pre- Onset Activities (False Onset)

Before the full establishment of the onset of the planting season over the various ecological zones, a couple of rainfall events are expected to occur which could be enormous and tend to give a false start of the season. Such rainfall events are not uncommon, however, their frequency seems to be on the rise. Some forcing functions have been observed to be likely responsible and will be monitored carefully, amongst these are;

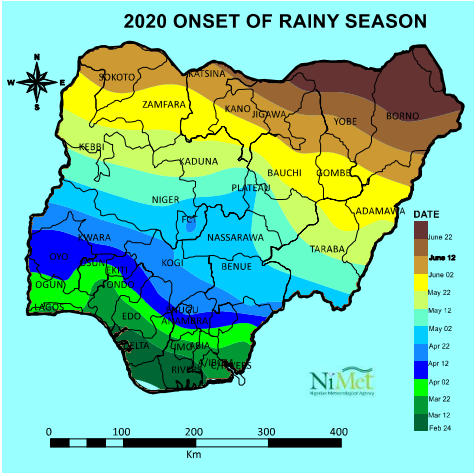
The Mid-Latitude Wave. This wave activity was very active in 2019. As we move into 2020, the effect of this may likely bring about rainstorms in the first quarter of 2020 over parts of the central and northern cities

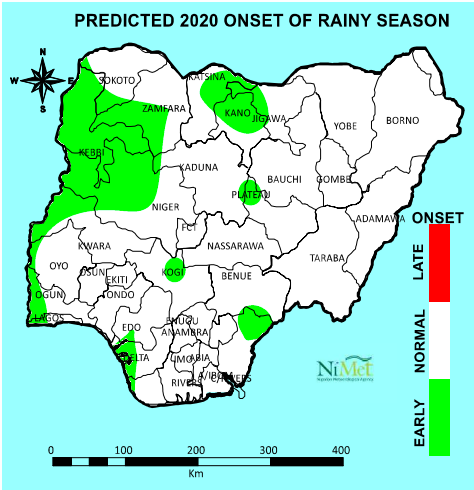
2020 Seasonal Rainfall Prediction

As the year 2020 is anticipated to be an ENSO neutral year, near-normal to above normal rainfall varying magnitude is expected for most part of the country. This is expected to have an impact on the timing of the onset and cessation of the growing season:

A near-normal length of season is expected with chances of above normal rainfall to near-normal amounts. Therefore, weather and climate information is necessary for planning as an adaptation option across the climate services value chain.

2020 Predicted Onset

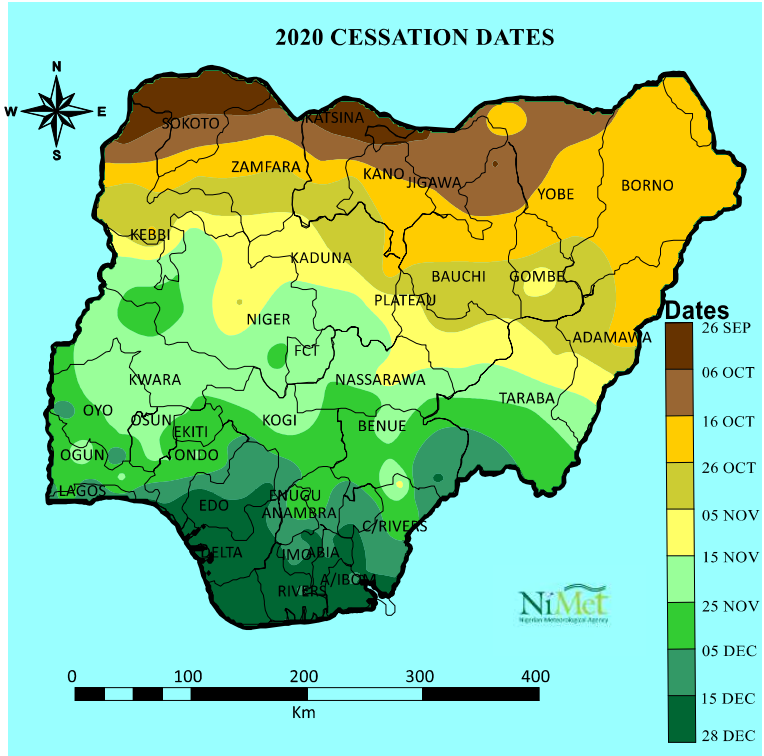


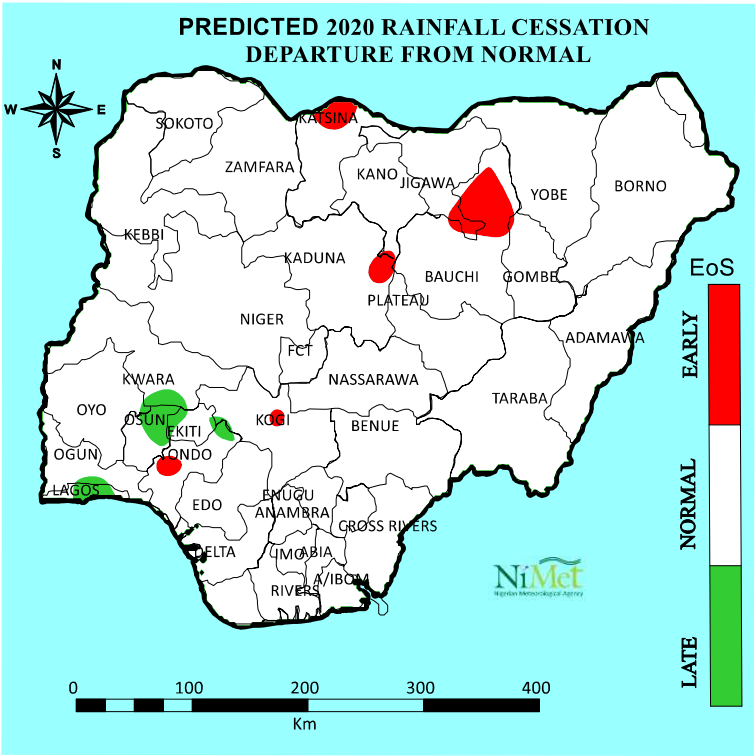


The Predicted 2020 onset of the growing season is expected to be near-normal to earlier than normal in most parts of the country as a result of the ENSO Neutral signal over the Niño 3.4 region. The maps shows that the earliest onset date is likely to occur on the 24th of February, 2020 around coast of the south-south states. The onset dates are expected to change as the ITD gradually continues its northwards oscillation with areas in and around ***Sokoto, Kebbi, Zamfara, Katsina, Jigawa, Yobe and Borno states predicted to likely have their onset from 2nd June, 2020***.

It is important to note that strong winds across the country and sand storms in the extreme northern states are precursor to the onset period

2020 Predicted Cessation





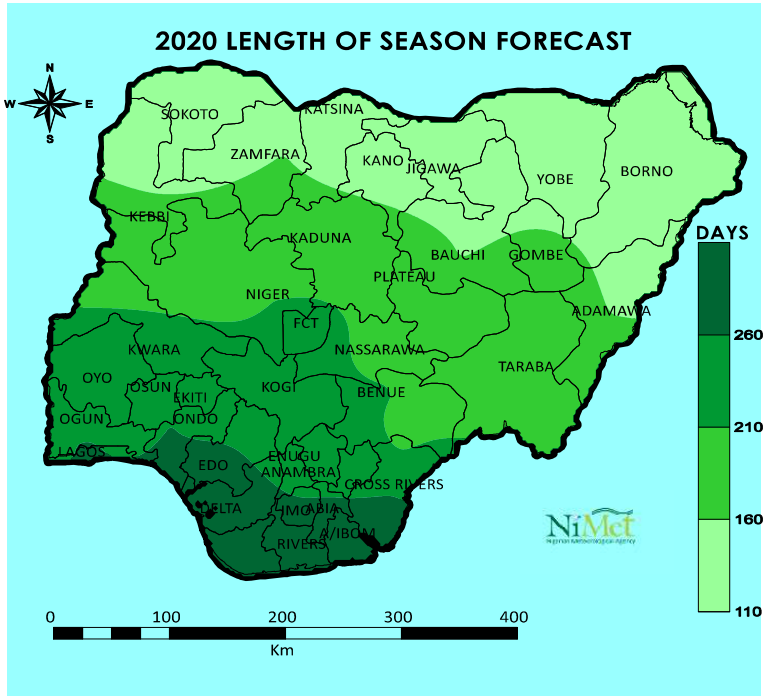
The above maps represent the expected cessation dates (i.e. the end of the growing season) and its departure from normal in Nigeria for the year 2020. In line with the annual rainfall retreat from the northern part of Nigeria to the coastal part of the South, the cessation dates are expected to begin from the North and end in the South.

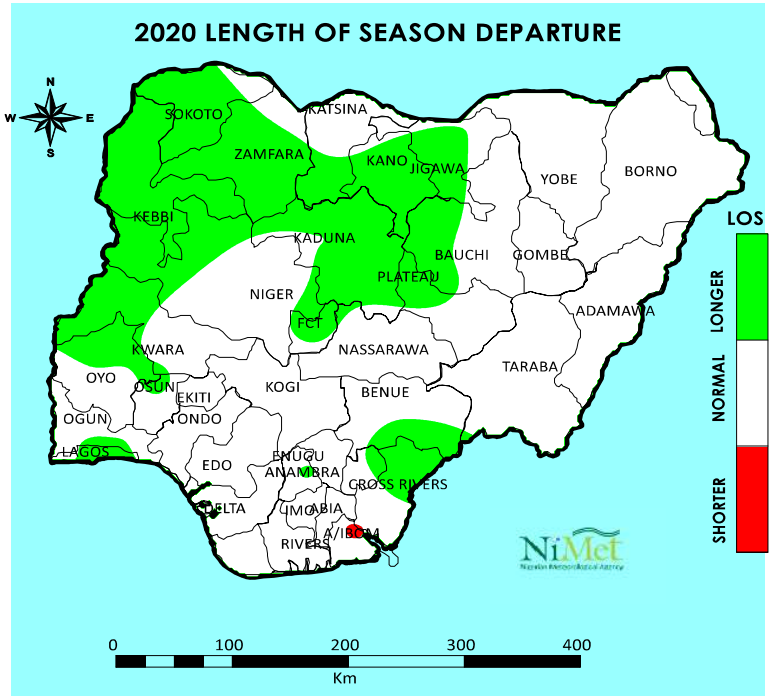
2020 Cessation Dates of Growing Season

The earliest cessation date, 26th September 2020, is expected around Katsina and the northern part of Sokoto while the latest cessation date is expected on the 28th December, 2020 over the Niger-Delta region. Generally, Cessation dates in other parts of the North are expected to be in October through 5th November extending to 15th November in Gombe, Jos and Kaduna. In the Central and inland parts of the South, cessation dates are expected in November while the South-east, Lagos and the Niger-delta are to have cessation dates in December.

These cessation dates, in comparison with observed normal over the country, show that most locations are expected to be near-normal. However, in few places around Katsina, Jigawa, Plateau, Kogi and Ondo, cessations dates are expected to be earlier. In Osun, parts of Lagos and Ekiti, cessation dates are expected to be later. The chances of occurrence of earlier and later cessation dates are relatively modest .

2020 Predicted Length of Season





In the year 2020, the length of growing season is expected to span 110-160 days in the Sahelian region of the north. As we progress southwards, 160-200 days are predicted for the central cities of Plateau, Niger and Adamawa states. The inland cities of the south such as Enugu, Anambra, Ekiti, and Oyo states will expect a growing season between 210-280 days.

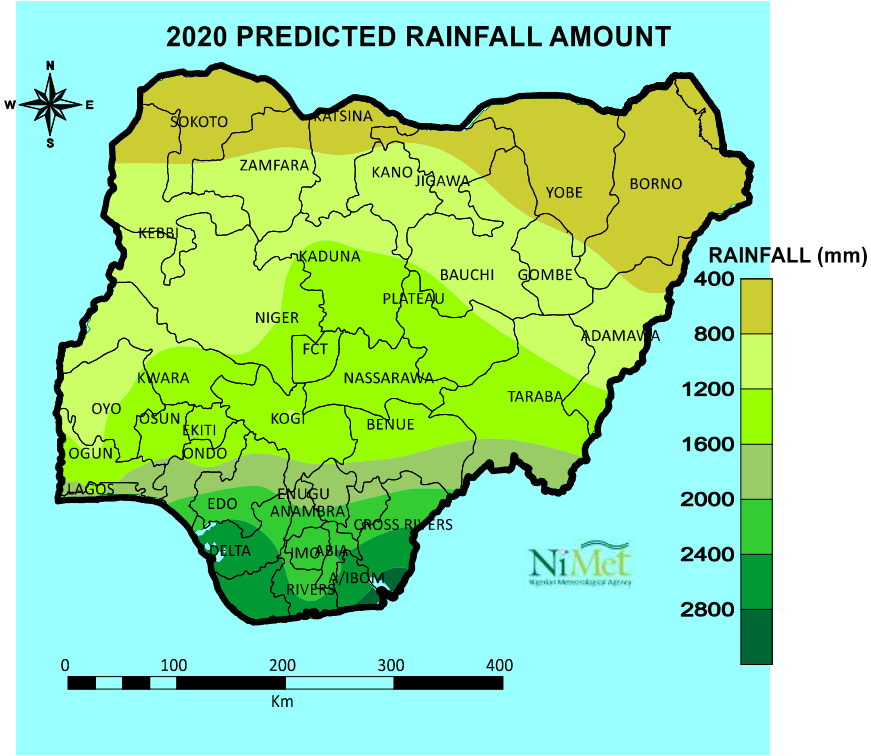
2020 Predicted Length of Season

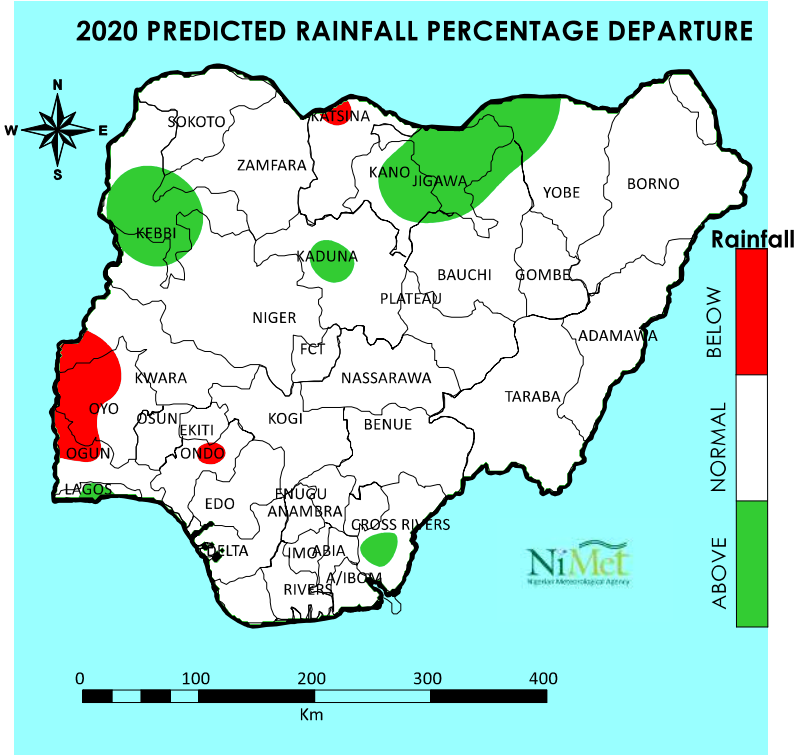
Meanwhile, farmers in Abuja, Kogi, and Makurdi should also expect the length of season with the range of 200-250 days.
The coastal areas will have length of season that may likely extend to about 310 days. The growing pattern throughout the season is not expected to vary much from the normal across the country

The variation expected in the length of growing season for year 2020 is likely to affect a large section of the north-west where places like Sokoto, Kebbi, Gusau, Kaduna, Zaria and Kano are possibly going to experience an extended length of growing season which may extend beyond 7 days. In the central states, Abuja and Plateau could also experience an extended length of growing season

In the south, parts of Lagos state and northern Cross River (Ikom and Ogoja) could also experience a longer length of season when compared to the normal trend. However, Uyo in Akwa Ibom state reflects a slight reduction in length of growing season but this signal is quite insignificant. But most places in the country will have a near-normal length of growing season.

2020 Predicted Rainfall Amount



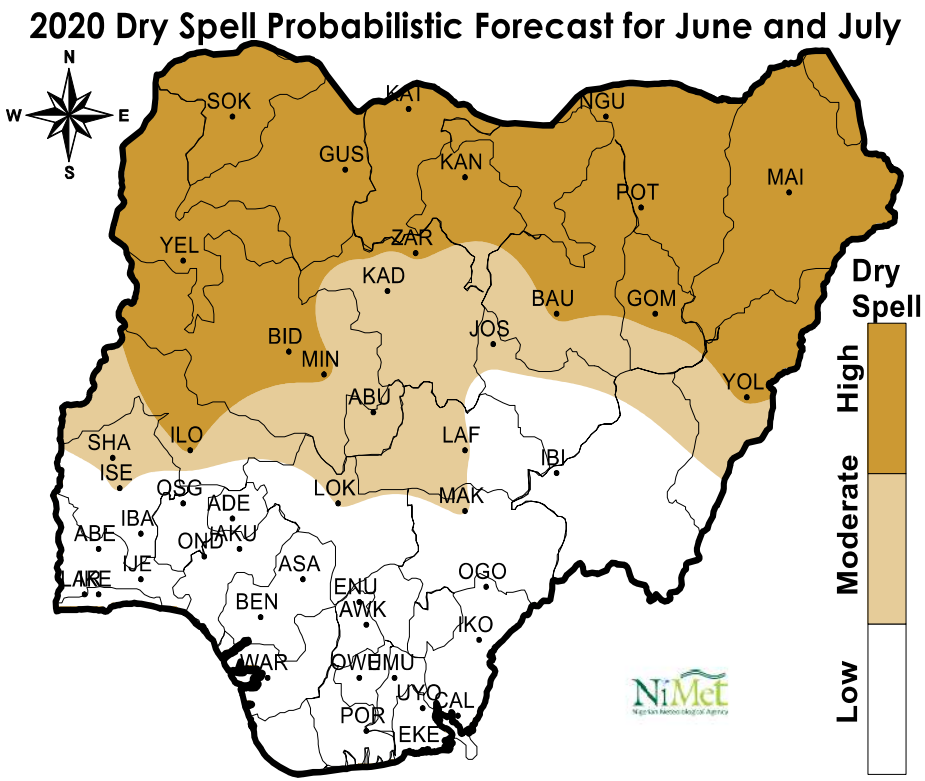


2020 Predicted Rainfall Amount

In 2020, the country is expected to have rainfall amounts ranging from 400mm in the north to over 3000mm in the south. Places in the extreme north such as Sokoto, Katsina, Yobe and Borno are expected to have the least rainfall amounts within the range of 400-800mm. Rainfall amounts in the range of 800-1200mm have been predicted for places around Yelwa, Zaria, Dutse, Gombe and Yola. The central cities comprising Abuja, Lafia, Jos, Benue and most southwestern states are expected to have between 1200 and1600mm. Places along the coastline of the country such as Delta, Port Harcourt, Benin, Calabar and Uyo are expected to have total rainfall amounts exceeding 2400 mm.

The rainfall departure map shows most places are likely to have near-normal annual rainfall amount. However, places around Shaki, Iseyin, Abeokuta and Katsina are expected to have below normal rainfall as denoted in red colour. However, above normal rainfall is expected over Kebbi, Kaduna, Kano and Uyo denoted in green.

2020 Dry Spell Prediction

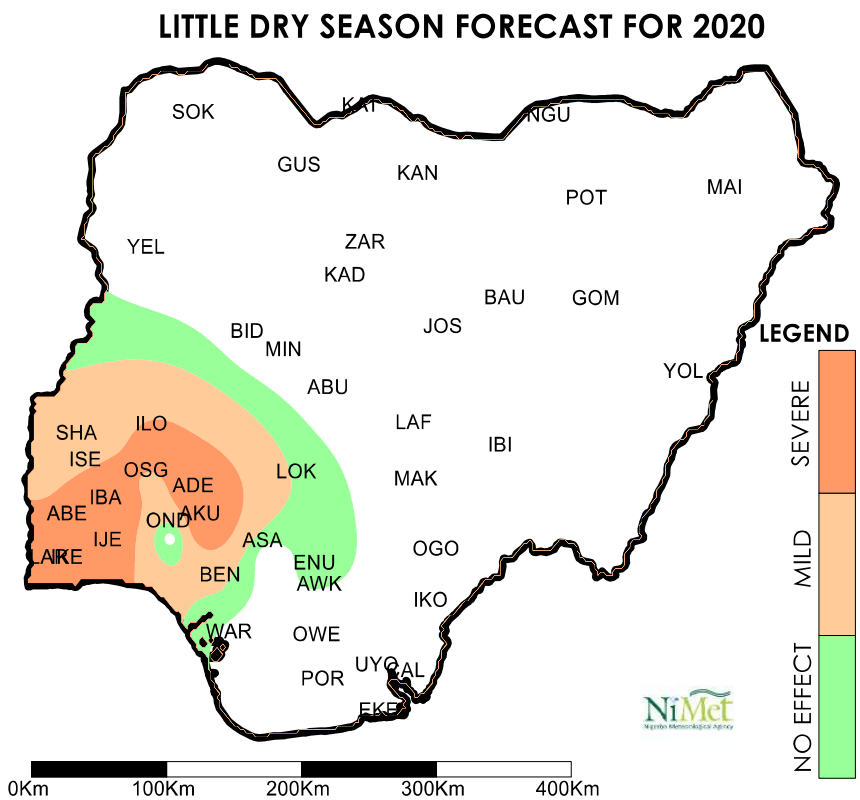


Severe dry spell that may last 10 to 21 days is predicted over Niger, Bauchi, Jigawa, Sokoto, Zamfara, Katsina, Kano, Kebbi, Yobe and Borno in the month of June. This may last 10 to 21 days after the onset spilling into July. Moderate dry spell that may last 8 to 15 days is expected around Yelwa, Bida, Minna, Zaria, Funtua, Lafia, Bauchi, Abuja, Gombe and Yola in June, 2020.

2020 Dry Spell Prediction

There is a moderate to high probability for dry spell in and around Ilorin, Baruten, Shaki, Iseyin, Yola and parts of Gombe in the month of July that may last between 15 to 21 days. While, areas around Borno (Jere, Mobbar, Abadam, Kukawan, Guzamala, Gubio, Nganzai, Mongono), Jigawa (Birniwa, Dutse, Hadejia, Guri, Sule Tankarkar, Maigatari, Babura), Sokoto (Illela, Gada, Tangaza, Isa, Gudu), Katsina (Jibia, Kaita, Matazu, Funtua, Mai'Adua, Daura, Mashi, Dutsi), Yobe (Damaturur, Gashua, Yusufari, Yunusari, Machina, Karasuwa), Kebbi (Augie, Arewa Dandi, Birnin kebbi, Argungu) and Zanfara (Shinkafi, Zurmi, Maradun, Talata Mafara, Bakura, Kaura Namoda) will experience dry spell in the June spilling into July that may last up to 15 days.

2020 Little Dry Season Forecast

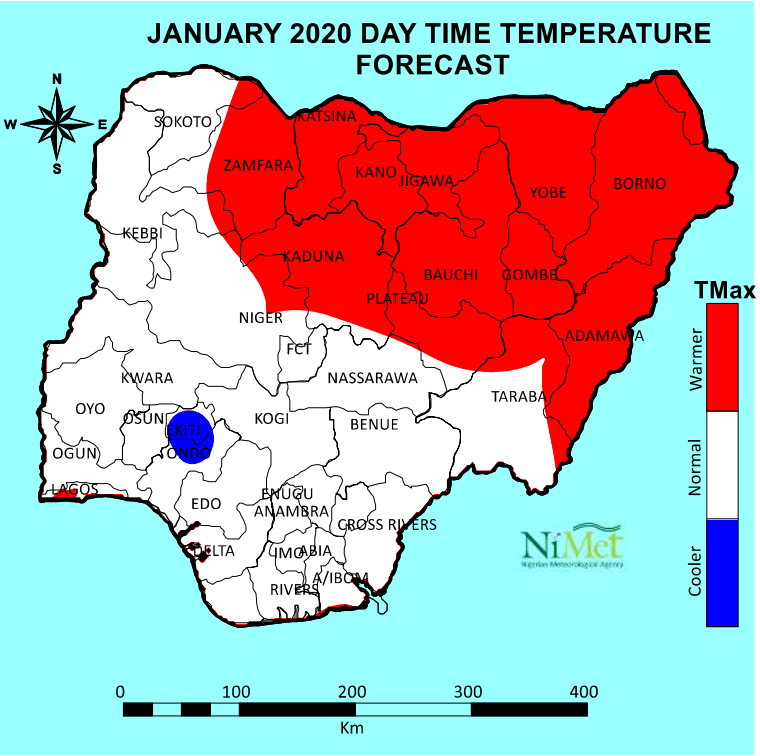


In the year 2020, severe of effect of little dry season is expected over the coast of Lagos, Ijebu Ode, Ibadan, Akure, Shaki, Iseyin, Ilorin and Ado Ekiti. The length of days with relatively dry spells is expected to last between 10 to 25 days in places like Abeokuta, Osogbo, Shaki, Iseyin, and Ilorin with more than 50% chance of occurrence while the coast of Lagos, Ikeja, Ibadan, Ijebu Ode and Akure could have dry spells above 30 consecutive days in a worst case scenario

2020 Little Dry Season(LDS) Forecast

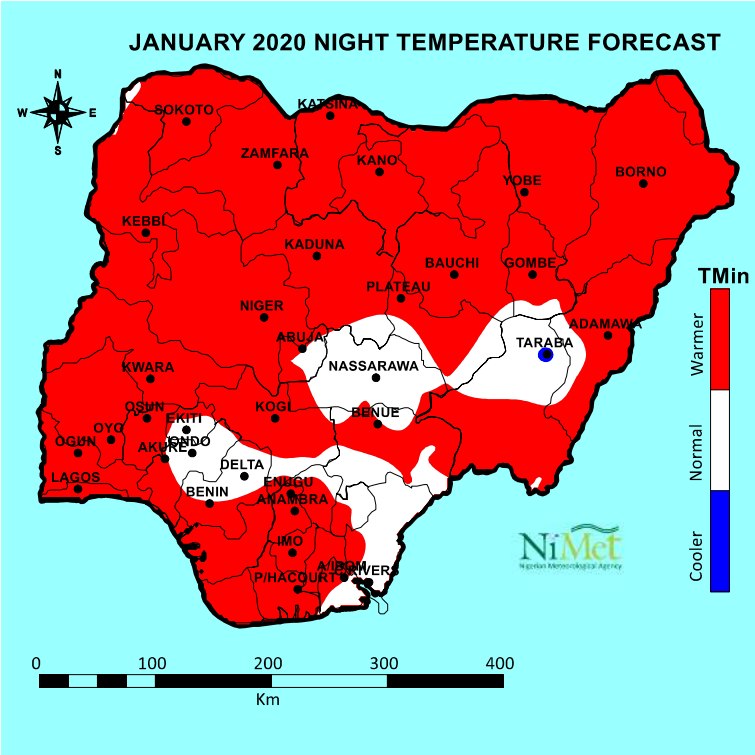
The 2020 LDS season is likely to start as early as 18th of July in Abeokuta and as late as 4th of August along the coast of the southwest. However, we expect very mild effect over places like Benin, Lokoja and Enugu.
Prior to the beginning of the LDS season, 'false starts' of dry spells that could last about 7-8 days cannot be ruled out.

Predicted January 2020 Day Temperatures



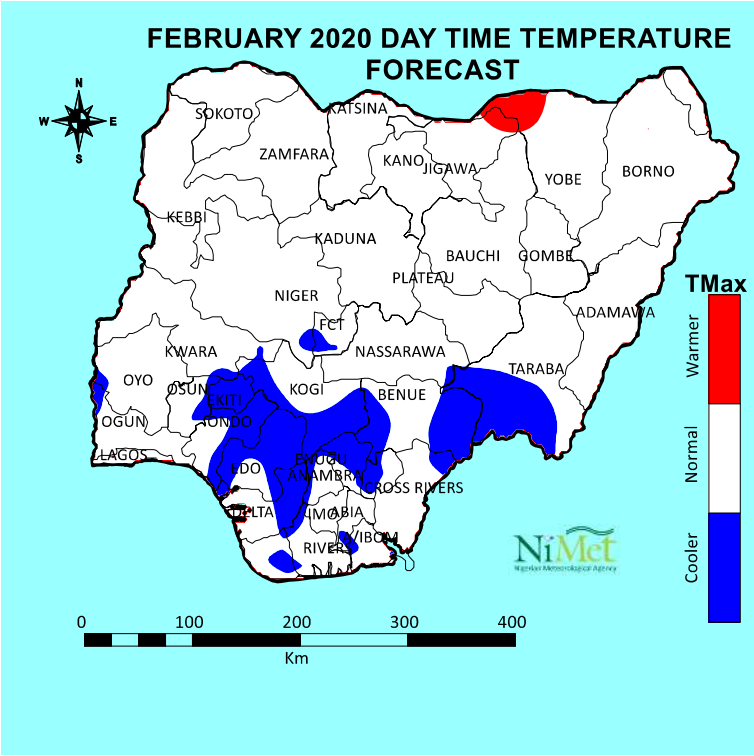
In *January*, the day-time temperature forecast for 2020 indicates that most parts of the country are likely to experience near-normal temperature condition. However, warmer-than-normal conditions are predicted around the north-east and north-western states including Jos and Minna in the central states. Areas around Akure are predicted to be cooler-than-normal.

Predicted January 2020 Night Time Temperatures



Night time temperatures over most parts of the country are expected to be warmer than normal. However, cooler than normal night temperatures are likely over Jalingo in Taraba state while near normal temperatures are predicted for Cross River, Akwa Ibom and Nasarawa states as well as northern parts of Ondo and Edo states.

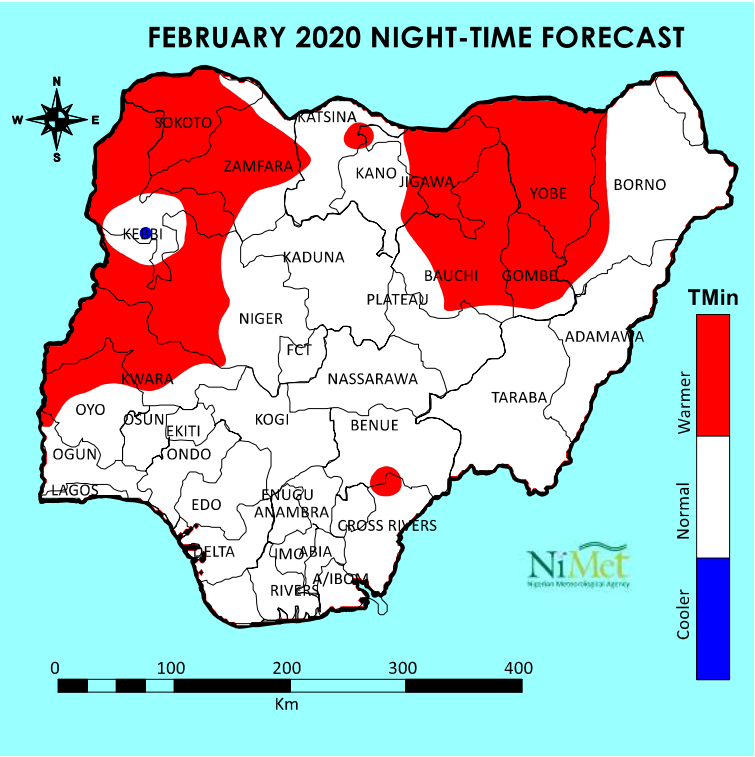
Predicted February 2020 Day Temperatures



Day time temperatures for February 2020 are projected to be mostly within the normal temperature distribution range. There are also projections for cooler than normal cases in south western parts of the FCT (Abaji, Kwali and Gwagwalada areas), South western parts of Taraba, Eastern and western parts of Benue, parts of Cross River, Kogi, Enugu, Delta, Ekiti, Ondo, Edo, Osun, Ogun and Oyo

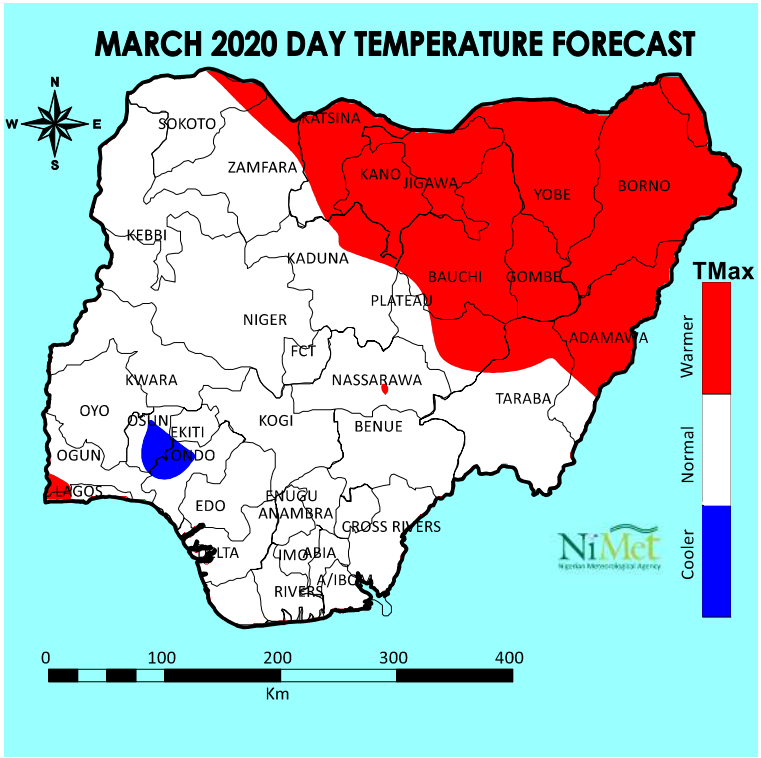
The only projection for above normal day temperatures is over northeastern Yobe. However, the odds of cooler than normal temperatures are more modest

Predicted February 2020 Night Temperatures



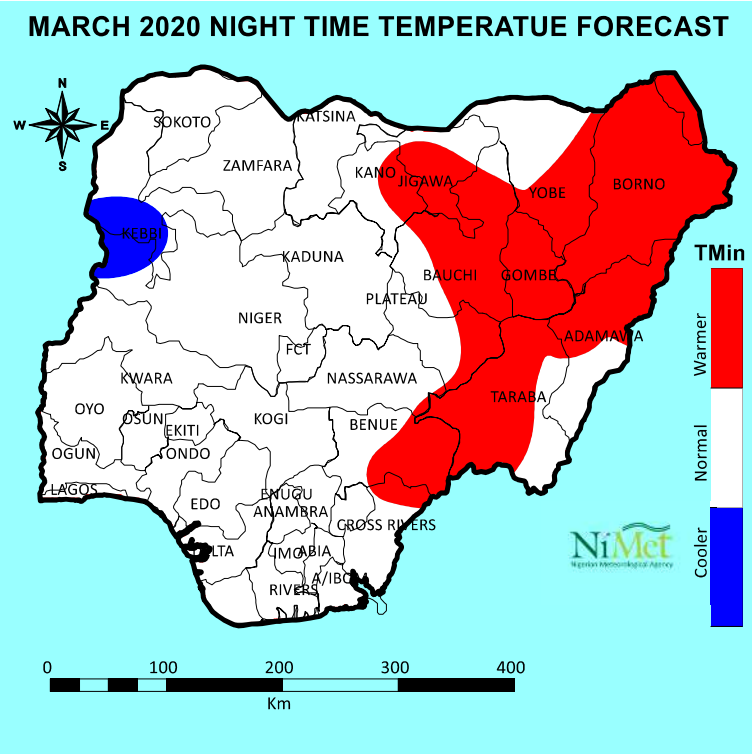
February 2020 night-time temperature forecast is predicted to be likely near-normal in most parts of the country. However, warmer-than-normal conditions are predicted in some parts of northwest, northeast, Shaki and Ogoja while Yelwa is predicted to be cooler-than-normal

Predicted March 2020 Day Temperatures



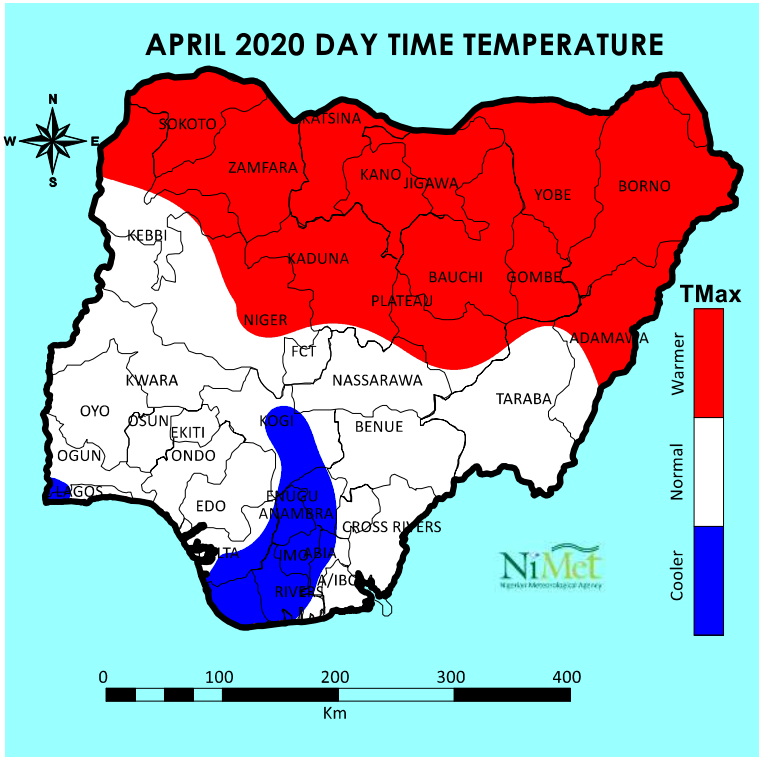
Day time temperature is predicted to be generally normal in March across the country except Katsina, Kano, Nguru, Dutse, Potiskum, Maiduguri, Gombe, Yola, Jalingo, Bauchi, Zaria and Ikeja where slightly warmer-than-normal maximum temperature conditions are expected. However, Ondo and environs is predicted to be cooler than normal in the month.

Predicted March 2020 Night Temperatures



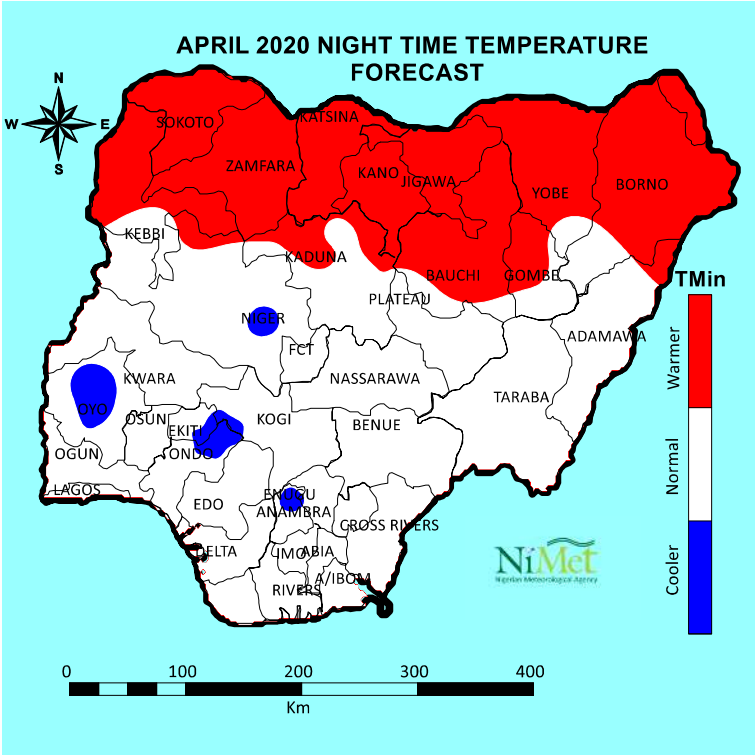
In March 2020, night time temperature over most places in Nigeria is predicted to be near normal. However, a significant part of the eastern flank of the country could experience some warming. In contrast, an evidence of cooling is shown around Yelwa in the northwestern part of the country.

Predicted April 2020 Day Temperatures



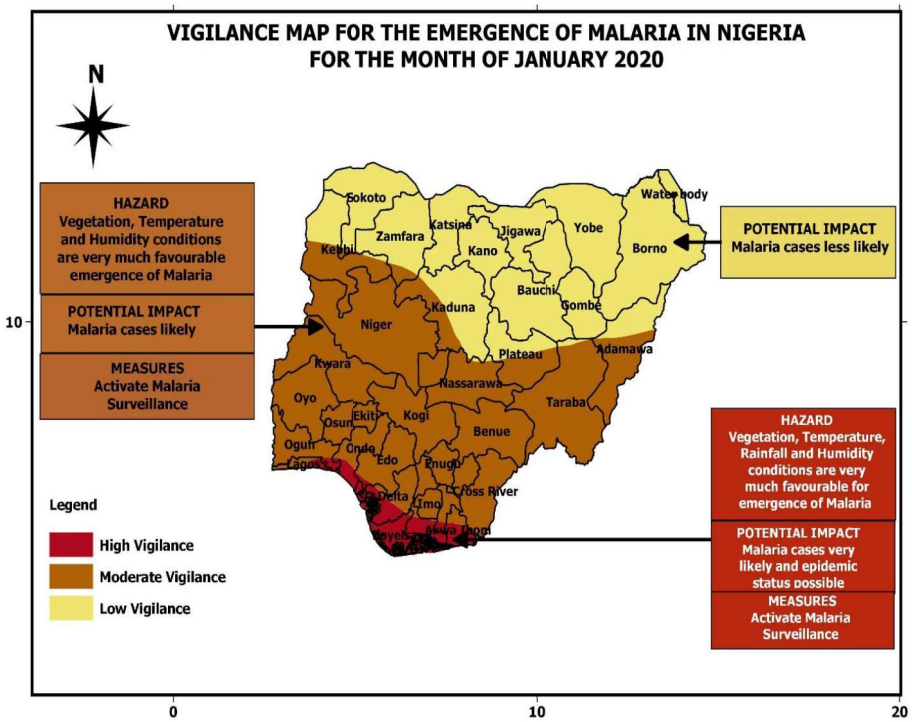
April day time temperatures have been predicted to be warmer- than-normal over the entire far north and Niger state in the north central. However, Anambra, Imo, Abia, Rivers, Kogi and parts of Lagos states are likely to experience cooler day temperatures. For the rest of the country, near normal condition is likely to prevail.

Predicted April 2020 Night Time Temperatures



Night-time temperature in April portends a warmer-than-normal temperature over the northern part of the country. Hot nights are expected in this month and this could bring with it high discomfort. Some parts of Oyo, Niger, Ondo and Ekiti States are likely to experience cooler than normal conditions. The rest of the country is expected to have near-normal temperature conditions

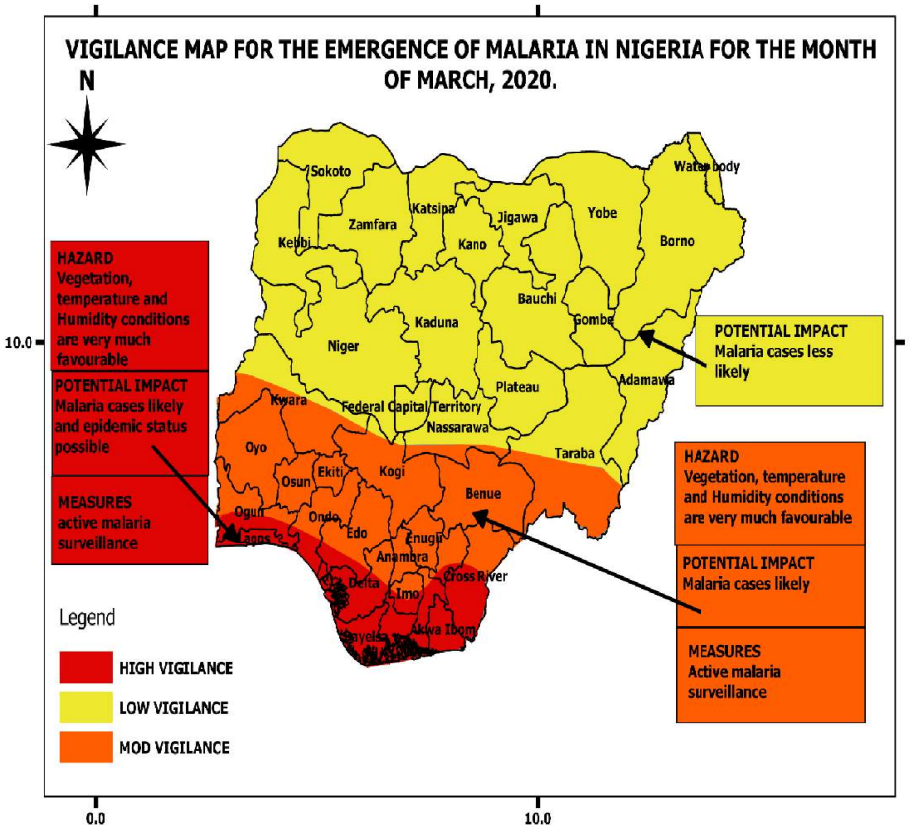
January Malaria Vigilance



High vigilance is required over Delta, Bayelsa, Lagos and River states. The inland areas of the south and central states are likely to be in moderate vigilance while the North West and greater part of the North East are projected to be in Low vigilance.

No part of the country is without watch for Malaria in January because air temperatures and other environmental factors favour the emergence of the disease

February Malaria Vigilance Map, 2020



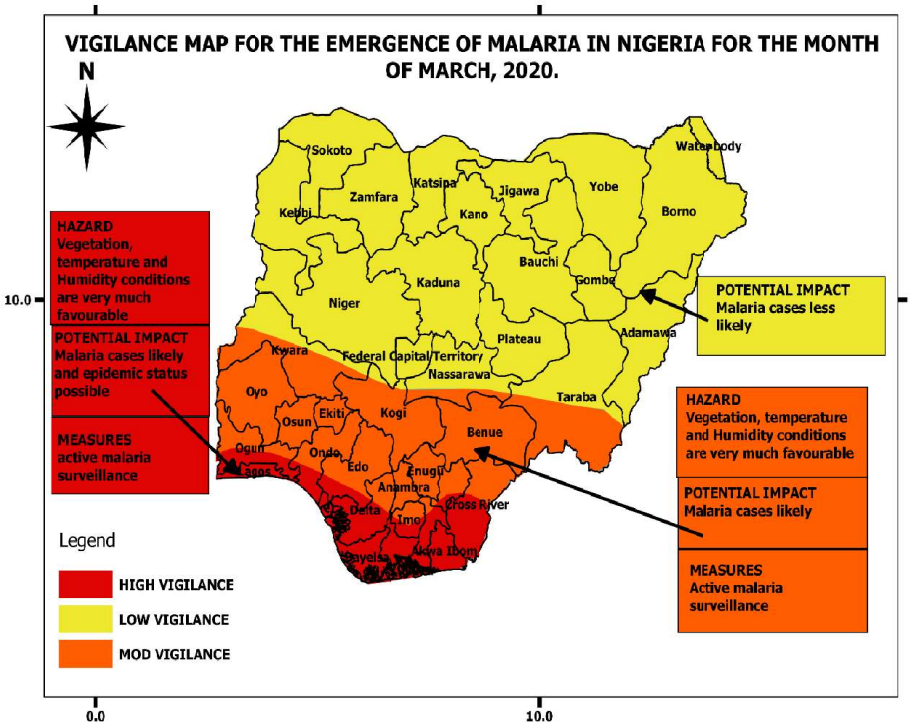
High vigilance for malaria is expected for Akwa Ibom, Cross rivers, Bayela, parts of Rivers state and Bayelsa.

Moderate vigilance is required over Abuja, Nassarawa, Benue, Kogi, Osun, Ekiti, Oyo, parts of Niger and Kebbi states, Anambra, Enugu, Abia,

Low vigilance over the North East and North West is required

No part of the country is without watch for Malaria

March Malaria Vigilance Map, 2020



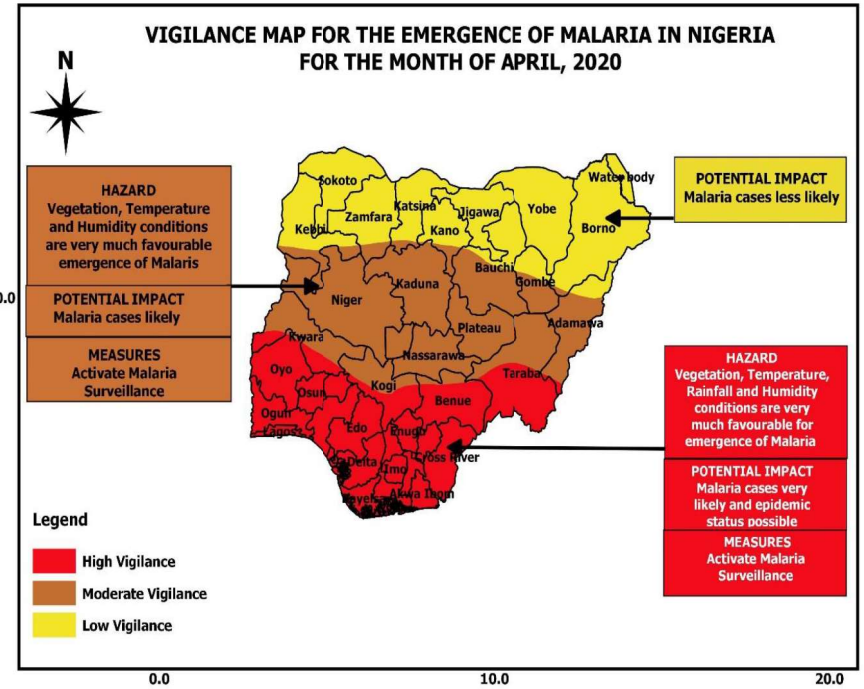
High vigilance for malaria is expected over Bayela, Lagos, River, Bayelsa and parts of Delta state.

Moderate watch is required over Benue, Kogi, Osun, Ekiti, Enugu, ebony, Anambra, Ekiti, Osun, Ondo and Oyo,

Low vigilance over the North East and North West and some central states

No part of the country is without watch for Malaria

April Malaria Vigilance Map, 2020

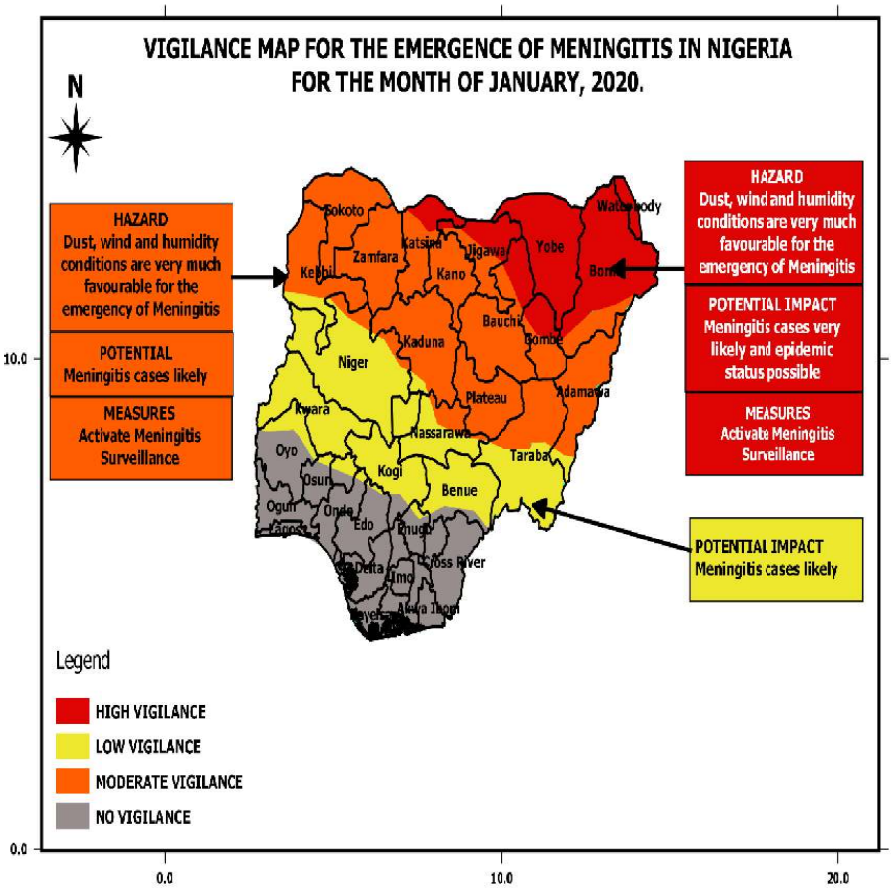


High vigilance is expected over the coast of the south, inland areas including Taraba, Benue and Kogi states

Moderate Vigilance over the central region

Low vigilance for Malaria is required in the northern parts of the country

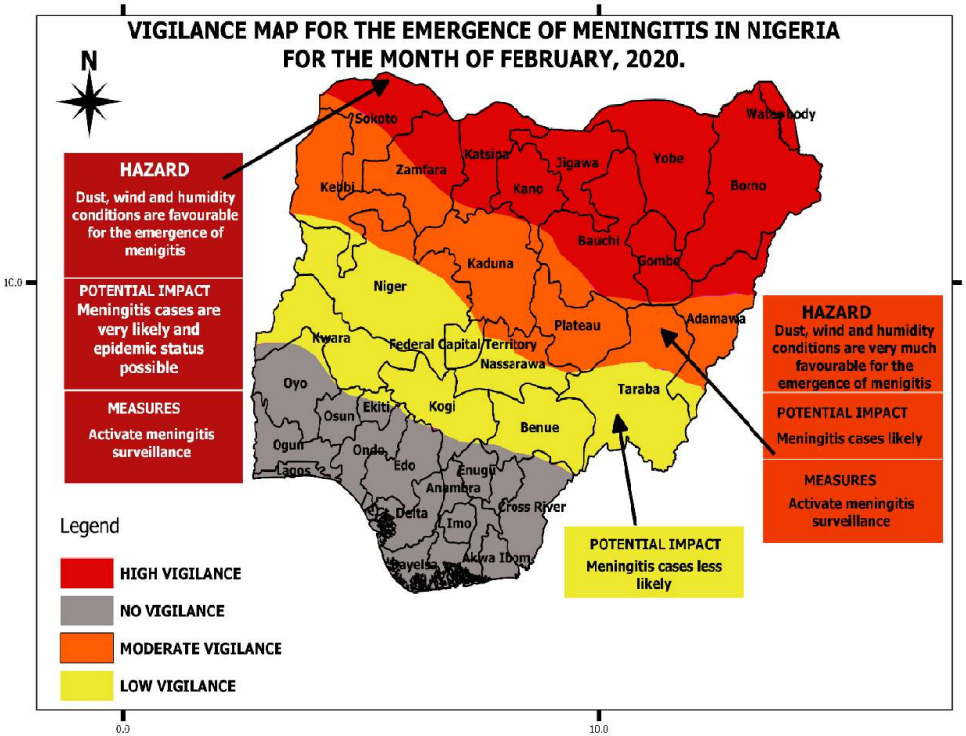
January Meningitis Vigilance Map, 2020



Over the extreme north in January 2020, places like Borno, Yobe, parts of Gombe, Bauchi, Jigawa and Katsina are expected to have a high vigilance for Meningitis

Sokoto, Zamfara, Kano, Kaduna, Adamawa and Plateau including parts of Katsina, Bauchi, Kebbi, Taraba and northern fringes of Nasarawa states are projected to be in moderate vigilance for meningitis. The southern half of the central region will likely be in low vigilance while for the coast, no threat is anticipated.

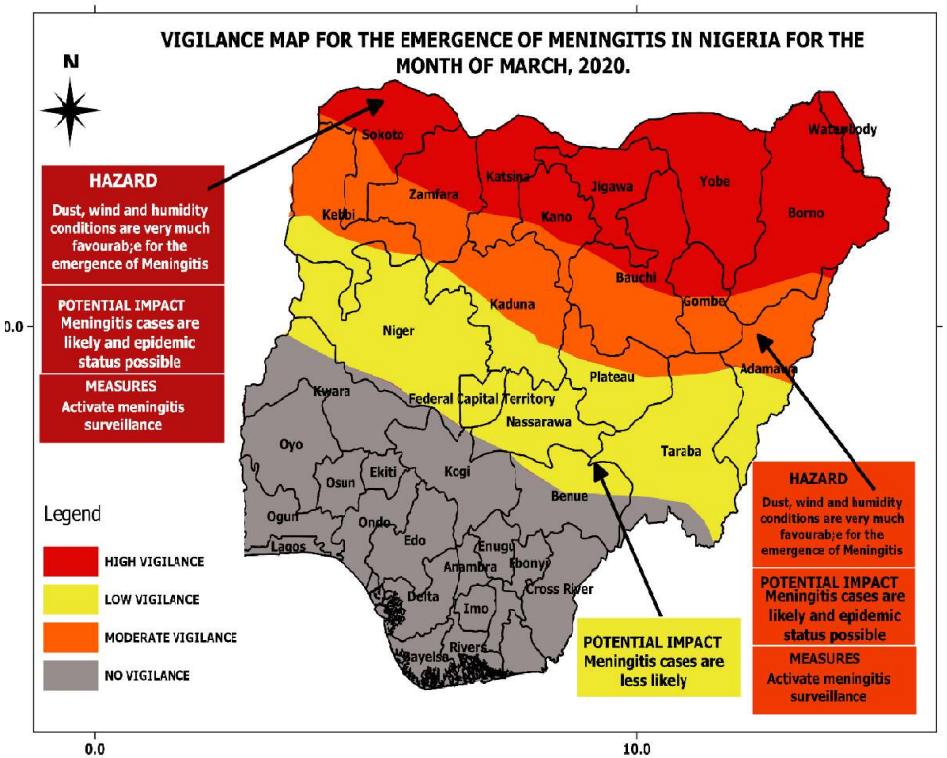
February Meningitis Vigilance Map, 2020



By the month of February, more states are expected to be in high vigilance for Meningitis, states to include Sokoto, Zamfara, Borno, Yobe, parts of Gombe, Bauchi, Jigawa and Katsina

For low vigilance, the coast to inland cities of the south are predicted to be in low vigilance

March Meningitis Vigilance Map, 2020



In the month of March, the epidemic preparedness drops toward the central region of the country, particularly over Kogi, Kwara and Benue states.

High vigilance is required over Sokoto, Zamfara, Katsina, Kano, Jigawa, Yobe and Borno states

Socio Economic Implications Of The 2020 Forecast: Agric

The growing season is expected to be 'near-normal to earlier than normal with near normal rainfall amount' in most parts of the country. Therefore farmers are advised to:

- Avoid planting during pre-onset period, farmers should take advantage of this period for land preparation and procure inputs
- Adopt risk management techniques i.e. Insurance
- Farmers are encouraged to use weather and climate information throughout the agricultural value chain.

Socio Economic Implications Of The 2020 Forecast

- Adopt climate smart agriculture (improve productivity, build resilience and reduce emission) such as;

Soil and water conservation

Water harvesting techniques

Supplementary irrigation during the dry spell

The use of drought and stress tolerant seed varieties

The use of early-maturing varieties f. Agroforestry is highly recommended

Socio Economic Implications Of The 2020 Forecast

Authorities concerned are advised to facilitate the provision of early maturing and drought resistant varieties to guard against the risk of crop failure and poor yield. The use of weather and climate information is encouraged throughout the agricultural value chain

Soil and water management is essential for maintaining the production of food crops and fodder under conditions with high water stress. Soil erosion may be controlled through the reduction of surface water run – off by improving soil surface cover or physical structures.

Socio Economic Implications Of The 2020 Forecast

Cropping pattern adjustments can also help farmers adapt to changing weather patterns. ***Plants can be planted further apart so that more moisture i***s available for each row, increasing the likelihood that they survive a period of dryspell

Socio Economic Implications Of The 2020 Forecast

Livestock

Poultry: The predicted warmer than normal temperatures in January to April over the northern states will affect their feed conversion ratio, shell quality and egg weight in layers may likely be affected

Therefore, heat stress prevention strategies and improving the general environmental conditions will go a long way in boosting their efficiency

Socio Economic Implications Of The 2020 Forecast

Livestock

Ruminant animal: The predicted warmer than normal temperatures across the country is likely to affect ruminant animal (e.g cattle, sheep and goat) feed intake, milk production, and reproductive efficiency

Heat stress prevention strategies through providing water constantly and cooling of the animals is advised

Livestock feed supplementation should be enhanced as an adaptation measure

Socio Economic Implications Of The 2020 Forecast

Livestock

The following strategies are recommended:

- Provision of pastures
- Provision adequate water and shed for animals
- Production of conservative feed resources such as silage, hay

Socio Economic Implications Of The 2020 Forecast

Aquaculture

The anticipated warmer than normal temperatures across the country is expected to affect oxygen solubility in water, favors the survival of parasites & bacteria, growth and development

Changing of pond water as at when due and other management practices should be encouraged to avoid heat stress

Socio Economic Implications Of The 2020 Forecast

Water Resources Management

The 2020 Seasonal Rainfall Prediction based on the ENSO- neutral phase projects **near normal rainfall condition for most parts of the country**

The rainfall amount is expected within ***400-300mm across the Coastal belts***. But then, there is need for caution to avoid disasters as excesses and deficits are normal for some areas and as such, best practices of operation be maintained to manage disasters

Socio Economic Implications Of The 2020 Forecast

Water Resources Management

Above normal rainfall amount (800-1200mm) expected over Kebbi, Kano, Kaduna and Jigawa states with Yobe (Nguru) (400-800mm)

This may impact on the domestic, irrigational and industrial activities of the Hadejia - Jama?re (HA-8) - upper Niger River (HA-1) basins. The predicted above 2800mm over Cross River and Lagos (1600-2000mm) states is likely going to result to high aquifer recharge and flooding which could lead to pollution of water bodies both surface and underground. More so, with the changing climate, inherent runoff effects may be exacerbated

Socio Economic Implications Of The 2020 Forecast

Water Resources Management

Authorities in charge of dam management should take proactive measures in dams optimization, urban storm water management and regulation to avoid ***dam breakage*** that could lead to flooding

Socio Economic Implications Of The 2020 Forecast

Water Resources Management

On the other hand, the below-normal rainfall amount expected over ***Ogun, Oyo (Shaki and Iseyin) and Ondo states*** portends depletion of groundwater, therefore over dependency on the extraction of underground water for domestic, industrial and Agricultural uses should be limited

However, for the temperature projections, areas where warmer-than-normal temperatures are anticipated especially around the **northeast including Jos and Minna.** This may lead to higher evapotranspiration with impacts on reservoir water losses and increased frequency of irrigation, therefore, effective water use efficiency would be required for sustainable agriculture and domestic water supply

Socio Economic Implications Of The 2020 Forecast

Water Resources Management

Relevant MDAs and stakeholders are consequently advised to make adequate preparations against annual peculiar occurrences over the country

Need for a proper Integrated Water Resources management and aggressive sensitization programmes in order to inform the citizenry on the danger of building on flood plains or the corridors of the river system

Socio Economic Implications Of The 2020 Forecast

Power Generation and Distribution

The seasonal outlook of weather patterns in the year 2020 is likely to enhance ***hydroelectricity power generation*** as copious rainfall activities are expected throughout the rainfall season

Socio Economic Implications Of The 2020 Forecast

Power Generation and Distribution

High day time temperature common to the first quarter of the year is **likely to impact electrical installation used for thermal energy generation**. There is the need for proper and timely maintenance of these facilities must be carried out in anticipation of these conditions

Meanwhile dam managers linked to processes of hydro power generation have to be wary of heavy precipitation in the months of July, August and September that could increase threshold levels. Windstorms and severe thunderstorms in the months of February, March and April may affect electrical installation nationwide

Socio Economic Implications Of The 2020 Forecast

Transportation

Weather events influence the daily and seasonal operation of transport systems. Transport plays a key role in the economy of any nation. Essential products and services like energy, food, manufacturing, and trade all depend on interrelated ways in the reliable functioning of the transportation system

Disruptions to transportation systems, therefore, can cause large economic and personal losses

Socio Economic Implications Of The 2020 Forecast

Road Transportation

Though the rainy season is expected to be near normal, possibilities of heavy rainfall events may result in flooding, which could disrupt traffic, delay construction activities, and weaken or wash out the soil and culverts that support roads, tunnels, and bridges. Additionally, during onset of the season, strong Winds can knock down trees on to roadways, and can tear down bridges. Warmer temperatures will accelerate asphalt deterioration and cause buckling of pavements, it could also cause vehicle overheat, and tires will deteriorate more quickly

Socio Economic Implications Of The 2020 Forecast

Road Transportation

Higher temperatures can cause pavement to soften and expand. This can **create pot-holes, particularly in high-traffic areas and can place stress on bridge joints**. Therefore, drivers are advised to drive carefully, especially during onset and cessation as this period is characterized by heavy downpour that can impede visibility

Socio Economic Implications Of The 2020 Forecast

Rail Transportation

Climate trends affect the design of transport infrastructure, which is expensive and designed to last for long. Warmer temperatures will cause rail tracks to expand and buckle. More frequent and severe heat waves may require track repairs or speed restrictions to avoid derailments

Heavy precipitation could also lead to delays and disruption, and rainstorms can also flood or leave debris on railways, disrupting rail travel and freight transport

Socio Economic Implications Of The 2020 Forecast

Coastal Marine Transportation & Inland Waterways

Changes in precipitation can affect shipping in many ways. ***Above normal total rainfall amount predicted over Lagos could affect port infrastructures.*** This could cause increase in downtime due to shut down and delays in port and terminal operations. Activities such as loading and unloading of cargo would be disrupted

Flooding could ***close shipping channels***, and an increase runoff from extreme precipitation events could cause silt and debris to build up, leading to shallower and less accessible channels

Socio Economic Implications Of The 2020 Forecast

Air Transportation

Extreme weather events have a significant impact on flight and airport operations. ***Severe weather such as thunderstorm and line squall contribute significantly to flight delays***, diversion and cancellations.

Socio Economic Implications Of The 2020 Forecast

Air Transportation

While near-normal rainfall is predicted for 2020 over most part of the country, activities accompanied with **onset and cessation of the rainy season such as squall lines, thunderstorms, wind shear, microburst, flash floods can flood runways, disrupt landing and takeoff,** cause delays in flights and affect the sensors along the runways.

Additionally, dust haze during the Harmattan season could result in poor visibility which also leads to disruption of flight operations. Therefore, aviation stakeholders should take precautionary measures especially during the onset and cessation of rainfall for smooth and safe operations.

Socio Economic Implications Of The 2020 Forecast

Health

According to the forecast, the year 2020 is projected to be a neutral year with normal to above normal rainfall. Temperatures from January to April (night and day) on the other hand, are expected to be warmer than normal in the north, extending down to parts of the central axis. This situation is expected to have a great impact on health

High temperatures are a great burden to health as it results in heat stress and eventually heat stroke

During the harmattan period from January to mid-March, dry and dusty conditions favourable for the emergence of Cerebrospinal Meningitis (CSM) are expected to prevail.

Socio Economic Implications Of The 2020 Forecast

Disaster Management

Above normal rainfall poses a threat to the environment due to its associated excess runoff. However, normal to below normal rainfall could still pose a threat due to natural factors like high-intensity short-duration rainfall resulting in flash floods and environmental factors such as drainage and water channels blockages

Socio Economic Implications Of The 2020 Forecast

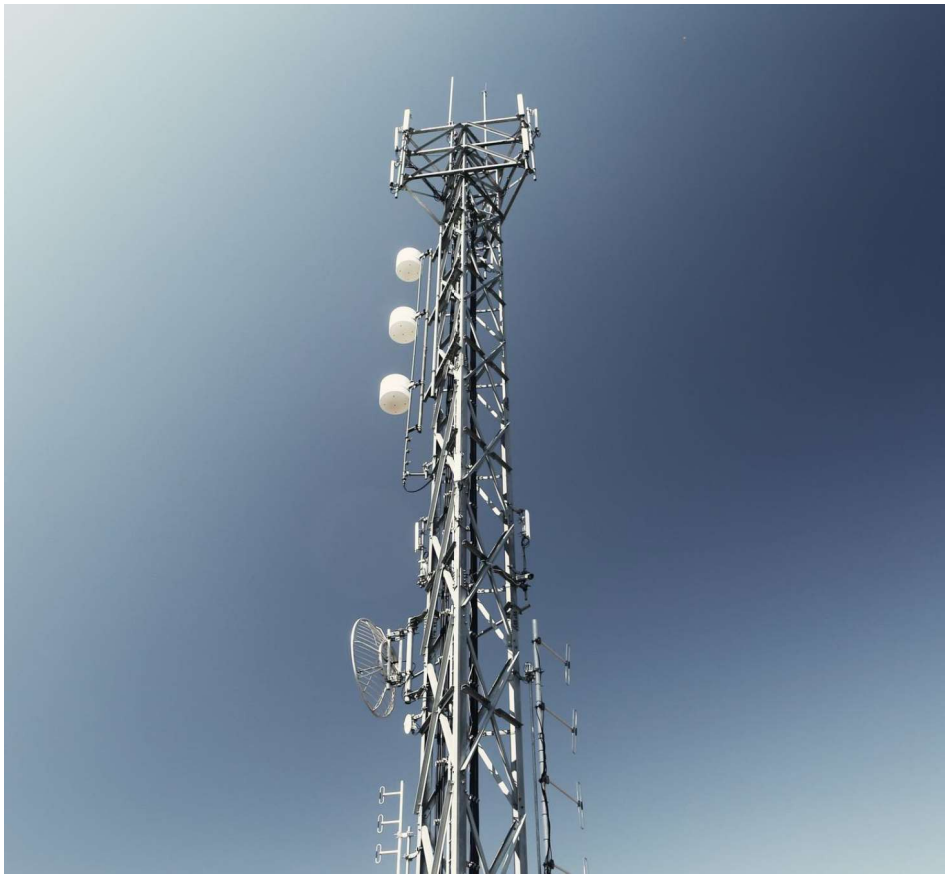
Disaster Management

In the year 2020, a normal rainfall amount is anticipated over most parts of the country. It is therefore essential for the disaster managers to prepare for possible excess run-off that may arise from a high amount of rainfall

Socio Economic Implications Of The 2020 Forecast

Telecommunications

Severe weather poses a great risk to the personnel, operations and assets of the telecommunication industry. Threats such as destruction of telecom towers and interruption of transmission of signals by strong winds and heavy rainfall are among the most common hazards associated with severe storms. The effect of this on transmission of signals is worst in remote areas where there is limited number of telecom masts installations



Socio Economic Implications Of The 2020 Forecast

Telecommunications

Despite near-normal rainfall predicted over most parts of the country in 2020, heavy rainfall events highly probable within the season could interfere with signals and negatively impact infrastructures such as cables, masts and antennas especially **during the peak rainfall periods between June and September.**

In 2020, a significant part, especially over the northern region is predicted to record above normal night and day time temperatures between January and April.

Socio Economic Implications Of The 2020 Forecast

Telecommunications

The effect of this is expected to be highly felt during the hot season (March-April) when temperatures reach peak values that could affect telecom equipment.

Consequently, there is need for the managers of Telecom installation to ensure provision of adequate cooling systems in order to prevent equipment failure, hence, saving overhead cost and preventing unnecessary interruption of signals.

Conclusion

The SRP is aimed at providing early warning signs to help policy makers and end users to plan adequately as they carryout their socio economic activities. The 2020 Seasonal Rainfall Prediction will therefore serve as a huge resource material for planning so as to reduce weather-related risks and serve as a tool for sustainable development.

THANK YOU!

Any Questions?