Air Quality Bulletin

October- December 2025

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To observe Nigerian Weather and Climate and provide Meteorological, Hydrological, and Oceanographic Services in support of National needs and International Obligations

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Preface

Air quality remains a crucial component of environmental health and public safety, especially in the face of increasing urbanization, industrialization, and changing climate across Nigeria. The Nigerian Meteorological Agency (NiMet), through its Air Quality Quarterly Bulletin, provides detailed analysis of observed air pollutants, their concentrations, and trends to inform and equip stakeholders and the general public with correct and up-to-date information about the state of air quality in the country.

In this edition of the bulletin, the concentrations, distribution patterns and influences on air quality of the key air pollutants - $PM_{2.5}$, NO_2, CO, and SO_2 - in October, November and December, 2025 are discussed. The influence of meteorological parameters such as wind mean sea level pressure, rainfall and the movement of the Inter-Tropical Discontinuity (ITD), which significantly affect the dispersion and concentration of pollutants across the country is also discussed.

All analyses are based on satellite data from the Copernicus Atmospheric Monitoring System (CAMS), complemented by data from NiMet's surface observations. This publication is expected to serve as a vital resource for policymakers, health practitioners, researchers, environmentalists, and regulatory agencies, to support informed decision-making and promote practices that safeguard public health and environmental sustainability.

Through this bulletin, NiMet reaffirms its commitment to providing timely, science-based information that enhances national development and fosters a cleaner, healthier atmosphere for all Nigerians.

Professor Charles Anosike
Director General/CEO NiMet & Permanent Representative of Nigeria with WMO

Introduction

Air pollution is now recognized as the largest environmental risk to human health worldwide, with impacts that extend beyond public health to ecosystems, biodiversity, and climate (UNEP 2025)[1]. While climate change unfolds over decades to centuries, air pollution occurs on shorter timescales of days to weeks, yet both are deeply interconnected. Short-lived pollutants such as ozone, nitrogen oxides, and sulfur compounds not only degrade air quality but also intensify the greenhouse effect, thereby exacerbating climate change (WMO, 2024)[2]. The World Health Organization (WHO) updated its Global Air Quality Guidelines in 2021, setting stricter limits for pollutants such as $PM_{2.5}$ and NO_2, reflecting new evidence that even low concentrations can cause serious health effects. WHO estimates that 99% of the world's population live in places where these guidelines are not met (WHO, 2021)[3]. The United Nations Environment Programme (UNEP) further confirm that air pollution accounts for more than 8 million premature deaths annually (UNEP, 2025)[4]. The Lancet Commission on Pollution and Health affirmed that pollution is responsible for 1 in 6 deaths worldwide, making it the single largest environmental cause of disease and early mortality (Lancet, 2022)[5].

These figures highlight the urgent need for continuous monitoring, accurate forecasting, and effective

In Nigeria, the Nigerian Meteorological Agency (NiMet) produces the Air Quality Bulletin quarterly to provide science-based insights into atmospheric conditions and pollutant levels. Month-by-month analyses of pollutant concentrations, visibility trends, and meteorological influences are captured in this bulletin. The emergence of the Harmattan season, retreat of rainfall and the beginning of deterioration of air quality in the northern states in October are key phenomena that occurred during the fourth quarter of 2025.

The evolving pollutant profiles in November and December are discussed in chapters two and three, emphasizing regional disparities and the cessation of rainfall accompanied by strong northeasterly winds which aided pollutant uplift and dispersion across the country. Quarterly trends across cities and regions are presented in chapter four while summary of key events and conclusion are presented in chapter five. NiMet is committed to continuous monitoring, awareness creation, and evidence-based guidance for policymakers, health professionals, researchers, and the public through this routine publication. The ultimate goal is to safeguard human health, support sustainable development, and reduce Nigeria's vulnerability to the adverse effects of air pollution and climate change.

Air Quality

Air quality is a measure of how clean or polluted the air, at a given place is. It is determined by the concentrations of pollutants such as particulate matter ($PM_{2.5}$ and PM_{10}), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), and ground-level ozone. These pollutants originate from both natural processes like dust storms and wildfires and also through human activities that release emissions from vehicles, industrial operations, and open burning.

Poor air quality poses serious health risks by increasing the prevalence of respiratory conditions such as asthma and chronic obstructive pulmonary disease (COPD), while also elevating the risk of lung cancer. Vulnerable groups, including children, the elderly, and individuals with pre-existing respiratory or cardiovascular illnesses who are particularly at greater risk[1]. Beyond human health, poor air quality disrupts ecosystems, reduces visibility, and contributes to climate change[2]. Consistent monitoring of air quality is therefore essential to identify pollution sources, support accurate health risk assessments, and help in the development of effective policies aimed at protecting the environment, improving public health, and overall well-being.

Particulate Matter (PM)

Particulate matter refers to a complex mixture of microscopic solid particles and liquid droplets suspended in the atmosphere[1]. It originates from both natural processes, and human activities. These particles differ in size, composition, and source, and are commonly classified by their diameter. PM_{10}: particles have diameters less than 10 micrometers while $PM_{2.5}$: fine particles have diameters less than 2.5 micrometers. As a result of their size and persistence in the air, particulate matter plays a major role in air quality deterioration and poses significant risks to human health and the environment. Particulate matter ($PM_{2.5}$) remains the most harmful pollutant to human health. With diameters less than 2.5 micrometers, $PM_{2.5}$ penetrates deep into the lungs and bloodstream, causing respiratory irritation, aggravating asthma, and increasing risks of cardiovascular diseases, strokes, and lung cancer. Globally, $PM_{2.5}$ exposure has been linked to 2.9 million premature deaths in 2017, including approximately 80,000 in West Africa (WMO, 2024)[1]. Other pollutants such as ground-level ozone, nitrogen oxides, carbon monoxide, and sulfur oxides are also of major concern, as they act as precursors to secondary PM formation. The acceptable limits of PM and other pollutants in the atmosphere are clearly spelt out in the World Health Organization Air Quality guidelines shown in Table 1.

Table 1: World Health Organization Guidelines

Pollutant	Averaging Time	2005 AQGs	2021 AQGs
$PM_{2.5}$, $\mu g/m^3$	Annual	10	5
	24-hour[a]	25	15
PM_{10}, $\mu g/m^3$	Annual	20	15
	24-hour[a]	50	45
O_3, $\mu g/m^3$	Peak season[b]	-	60
	8-hour[a]	100	100
NO_2, $\mu g/m^3$	Annual	40	10
	24-hour[a]	-	25
SO_2, $\mu g/m^3$	24-hour[a]	20	40
CO, mg/m^3	24-hour[a]	-	4

Air Quality Index (AQI)

The Air Quality Index (AQI) is a standardized tool used to assess and communicate the state of air quality and its potential health implications. It represents a ratio of pollutant concentrations expressed as an index. AQI values range from 0 to 500, with lower indices (0–50) reflecting clean air and minimal health risks, while higher indices (above 150) indicate unhealthy to hazardous conditions. The AQI (Table 2) therefore enables individuals, communities, and governments to take timely and informed actions to safeguard public health and reduce exposure to harmful pollutants.

Table 2: AQI Categories and Health Implications

Air Quality Index Range	Class/ Category	Health Advisory
1-50	Good	The quality of the air is good; it presents no threat to health.
51-100	Moderate	The air quality is acceptable, except for unusually sensitive individuals.
101-150	Unhealthy for Sensitive group	Outdoor activity should be minimized for sensitive groups such as the elderly, children, and individuals with heart and lung diseases.
151-200	Unhealthy	Everyone should avoid prolonged exposure to prevent breathing difficulties, which may be more severe in sensitive populations.
201-250	Very Unhealthy	Minimize time spent outdoors. The entire populace is likely to be affected.
251-500	Hazardous	Hazardous for everyone and may prompt emergency condition alerts.

CHAPTER ONE
1.0 HIGHLIGHTS OF OCTOBER 2025 WEATHER

1.1: Position of the Inter-Tropical Discontinuity (ITD) and Rainfall Distribution across Nigeria in October 2025

In October 2025, the Inter-Tropical Discontinuity (ITD) retreated southward oscillating from latitude 16.3°N in the first dekad to 13.6°N in the second dekad and further southward to latitude 12.1°N during the 3rd dekad of the month. It maintained an average position of latitude 14.0°N during the month. The consistent southward retreat in October signalled the transition from rainy to dry Harmattan season. The observed ITD position was slightly southward of the normal position in the month with significant rainfall variability and distribution across Nigeria. The southern and coastal regions recorded high rainfall amounts of 240 to 892.6 mm while the northern cities experienced minimal rainfall as shown in Figure 1.1. These transitional conditions and moderate rainfall helped maintain an overall moderate air quality in most parts of the country.

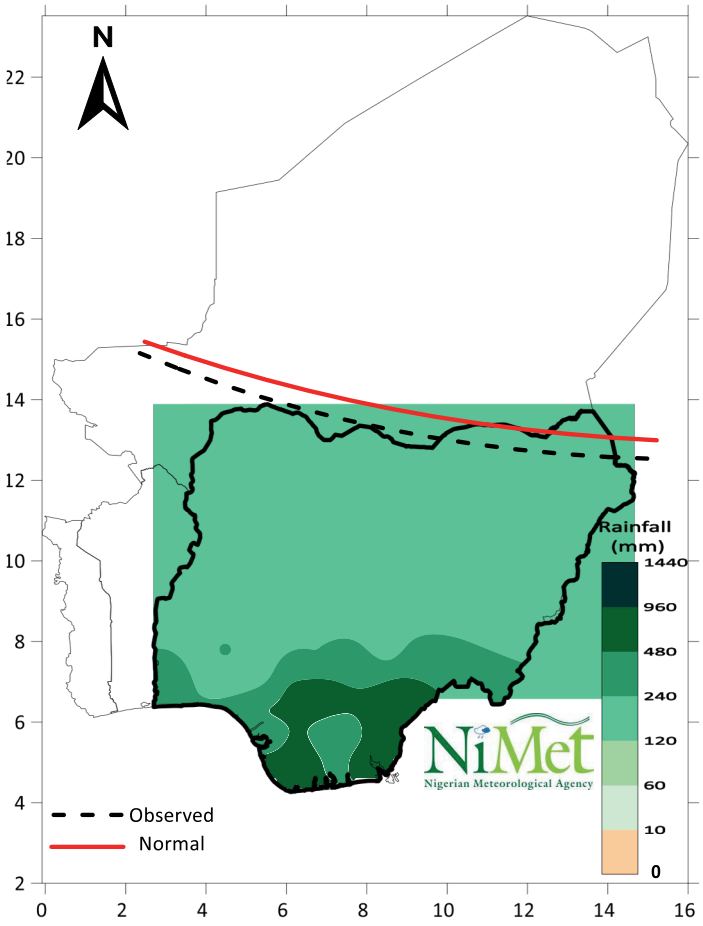

Figure 1.1: Mean Position of ITD and Rainfall Amounts across Nigeria in October 2025.

1.2 Mean Sea Level Pressure (Azores and St. Helena Highs) in October 2025

Two of the high-pressure systems that modulate weather over Africa are the Azores and St. Helena high-pressure areas located around 30°N and 30°S respectively. The average Mean Sea Level Pressure (MSLP) at the centre of the Azores high-pressure cell was 1018hPa. It weakened by an appreciable 4.0hPa from MSLP of 1022hPa in September to 1018hPa in October 2025. The monthly average centre pressure of the St. Helena high-pressure cell intensified appreciably from 1024 hPa in September to 1026.8hPa in October (Figure 1.2). Although, no heat lows were observed on the MSLP chart in October 2025, there was evidence of good influx of moisture-laden winds from the Atlantic Ocean to the coastal and inland states of the south where rains were recorded. The 1015 hPa Isobar maintained a mean position of latitude 8°S which was still favorable for rainfall over the coastal states in October 2025.

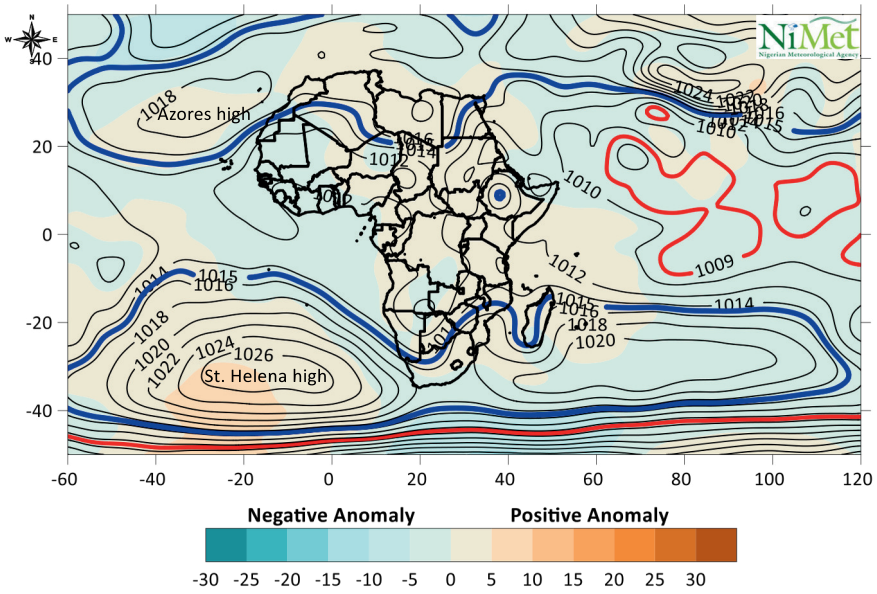

Figure 1.2: Mean Sea Level Pressure in October 2025

1.3 Winds

1.3.1 Wind at 925 hPa Level (900m above Ground) in October 2025

At the 925 hPa pressure level, early October was dominated by south-westerly (SW) winds with speeds of 5 to 25 kts. These moist maritime winds enhanced rainfall and suppressed dust transport, keeping air quality relatively good across southern and central Nigeria. The winds became predominantly north-easterly (NE) especially in northern Nigeria with speeds up to 30 kts on 19th October.

These strong winds favoured dust uplift and transportation from the Sahara Desert into northern Nigeria. SW flows persisted over the southern states where enhanced humidity, rainfall and improved air quality was observed. Over the northern states however, NE winds reduced visibility and increased Particulate Matter concentrations thereby reducing the air quality to unhealthy levels for sensitive groups in the month.

1.3.2 Winds at 850 hPa Level (1500m above the ground) in October 2025

In October 2025 the 850 hPa pressure level was dominated by NE trade winds with resulting dust outbreaks observed over the northern and central states while SW winds intrusions kept the air in southern Nigeria relatively clean and wet with rainfall in October. Wind speeds ranged from 5 to 25 kts, especially from mid to late October. The dominance of NE winds in northern Nigeria reflected the southward retreat of the ITD, signaling the onset of Harmattan conditions. The transition set the stage for deteriorating air quality especially in northern Nigeria as Harmattan intensifies in subsequent months.

1.4 Particulate Matter (PM2.5) Concentration Across Nigeria in October 2025

The observed mean $PM_{2.5}$ concentrations across the country in October 2025 generally ranged between 15 and 75 µg/m³. The lowest range of concentrations between 15 and 30 µg/m³ was recorded in parts of Niger, Kwara, Oyo, Osun, Ekiti, Ondo, Kogi, Edo, Delta, southern Ogun, Lagos, Bayelsa, Rivers, Akwa Ibom, Cross River, eastern Benue, Taraba, Adamawa, Borno, and eastern Yobe states (See Figure 1.3). Concentrations ranging between 30 and 45 µg/m³ were observed, over parts of Niger, Kebbi, Kwara, Kogi, including Plateau, Bauchi, western Gombe, western Yobe, the Federal Capital Territory (FCT), Nasarawa, Benue, as well as Enugu, Anambra, Ebonyi, Imo, Abia, southern Oyo, and northern Ogun States. Higher concentrations ranging from 45 to 60 µg/m³ were recorded in eastern Sokoto, eastern Zamfara, western Katsina, northern Kaduna, northern Bauchi, and western Jigawa states, while the highest concentrations between 60 and 75 µg/m³ were observed in parts of Katsina, Kano, and Jigawa states. Overall, the mean $PM_{2.5}$ concentrations across the country in October exceeded the World Health Organization (WHO) 2021 updated Air Quality Guideline (AQG) threshold of 15 µg/m³ in 24 hours.

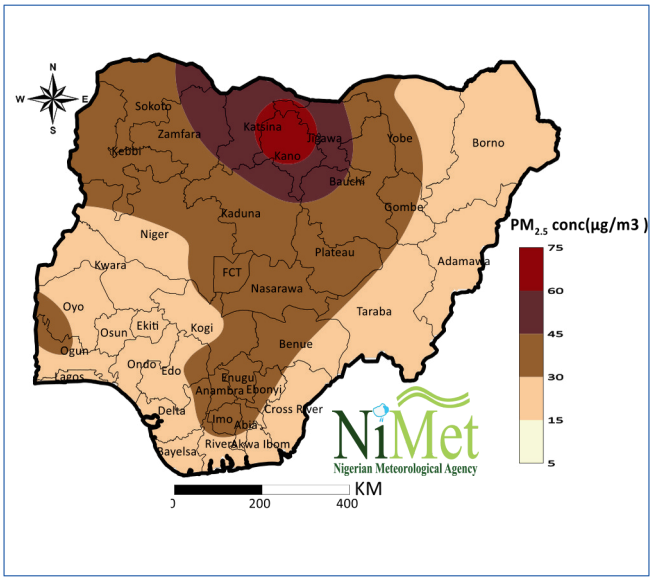

Figure 1.3: Mean Monthly Concentration of Particulate Matter ($PM_{2.5}$) over Nigeria in October 2025

1.5 Horizontal Visibility Across Nigeria in October 2025

In October 2025, horizontal visibility over most cities in the country were generally good, with values mostly above 5 km. (Figure 1.4). However, a few short-lived deteriorations in horizontal visibilities were observed over the southern states but caused mainly by mist. Calabar recorded a visibility of 2,000 m on 5th October, while Uyo reported the lowest visibility of 1,500 m on 28th October, as a result of haziness caused by mist conditions.

Most northern states recorded visibility of 10km and above while Kaduna, Kano, Borno and Kebbi states recorded visibilities less than 5000 m on a few days of the month as a result of dust transported into the country from neighbouring Niger and Chad. Despite these isolated events of reduced visbility, the observed visbilty in October was predominantly good across the Country.

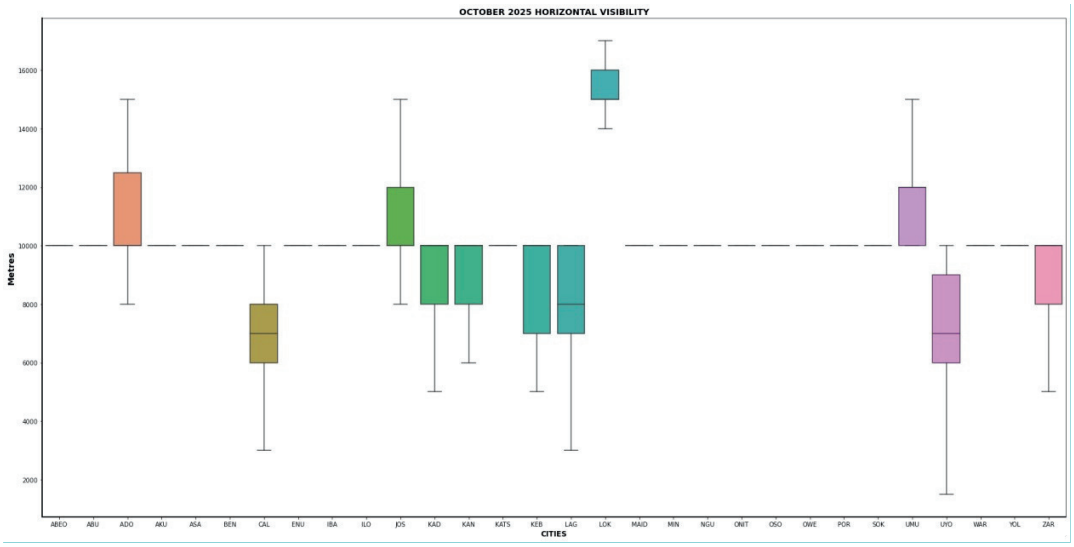

Figure 1.4: Mean Daily Horizontal Visibility Over Cities in Nigeria in October 2025

1.6: Nitrogen Dioxide (NO_2) Concentration across Nigeria in October, 2025

The observed spatial distribution of NO_2 concentrations across Nigeria in October 2025 (Figure 1.5) shows elevated concentrations exceeding 8.0 µg/m³over Katsina, Kano, Jigawa, Bauchi, Kaduna, the Federal Capital Territory (FCT), Nasarawa, Ogun, Oyo, Lagos and part of Abia, Imo and Ebonyi states, suggesting likely influence from anthropogenic activities in these areas. In contrast, parts of Taraba, Benue, Cross River, Akwa Ibom, Niger, and Kebbi states recorded lower NO_2 concentrations between 2.0 and 4.0 µg/m³ while most states recorded concentrations of 4.0 to 8.0µg/m³, reflecting moderate NO_2 emissions. Despite the elevated levels in some states, concentrations generally remained below the World Health Organization (WHO) limit (Table 1)

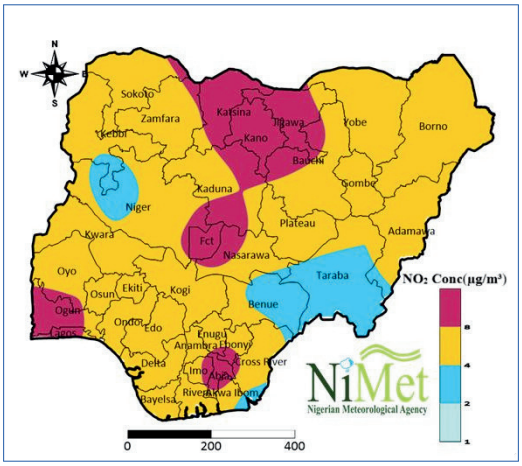

Figure 1.5; Mean Concentration of Nitrogen Dioxide (NO_2) across Nigeria in January 2025.

1.7 Carbon Monoxide (CO) Concentration Across Nigeria in October 2025

The average concentration of CO across Nigeria in October 2025 varied between 311 and 510ppbv (0.35 and 0.59mg/m^3). The lowest CO concentration in the range of 300 to 350ppbv (0.35 to 0.40 mg/m^3) was observed over parts of Benue, Ebonyi, Delta, Edo, Cross River, Bayelsa, Enugu and the FCT (Figure 1.6). The highest range of 500ppbv to 550ppbv (0.58 to 0.63 mg/m^3) was recorded over part of Yobe state. Concentrations of 350 to 450ppbv (0.40 to 0.46mg/m3) were recorded over Kano, Plateau, and parts of Katsina, Zamfara, Bauchi, Kaduna, Nasarawa, Benue, Anambra, Imo, Abia, Akwa Ibom, Rivers, Cross River, Bayelsa, Delta, Edo, Ondo, Ekiti, Osun, Ogun, Oyo and Kwara states. Concentrations of 400 to 450ppbv (0.46 to 0.52mg/m3) were observed over Lagos, Kogi, Niger states and the northeastern and northwestern states. The observed CO concentrations across the country in October 2025 were generally below the WHO standard threshold (Table 1)

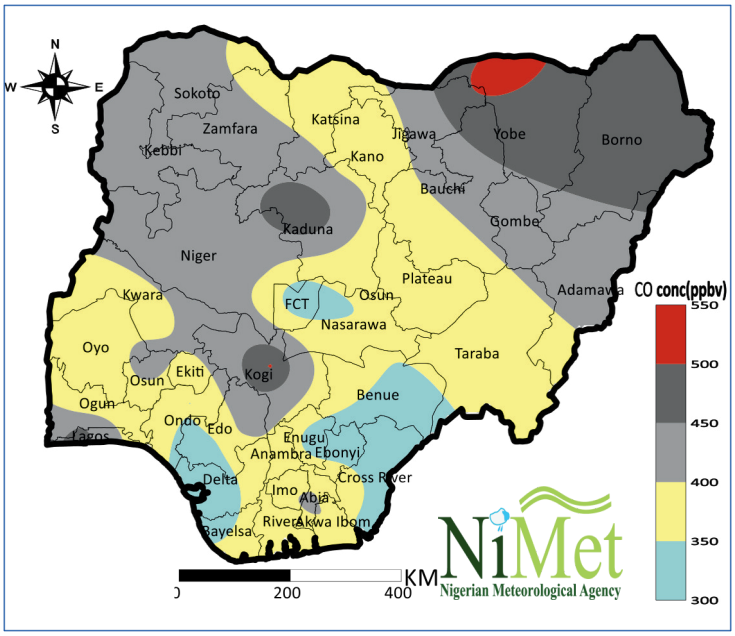

Figure 1.6: Mean Monthly Concentration of Carbon Monoxide Over Nigerian Cities in October 2025

1.8 Sulphur Dioxide (SO_2) Concentration across Nigeria In October 2025

As shown in Figure 1.7 most states recorded mean SO_2 concentrations between 1.6 and 3.0 µg/m^3 in October 2025. The highest concentrations ranging between 2.0 and 3.0 µg/m^3 were recorded over Ebonyi, Abia, Enugu, Kano, Kaduna, Katsina, Jigawa, Bauchi, Gombe, Yobe, Borno, FCT, Plateau, Adamawa and most parts of Zamfara, Enugu, Niger, Nasarawa, Benue, Taraba, Kogi, Kebbi, Rivers, Imo, Anambra, Akwa-Ibom and Cross River States. The lowest SO_2 concentrations between 1.0 to 2.0 µg/m^3 were recorded over parts of Kebbi, Niger, Kogi, Imo, and Rivers, Zamfara, Anambra, Taraba, Akwa-Ibom, Benue, Cross River State, Sokoto, Kwara, Oyo, Ogun, Lagos, Osun, Ekiti, Ondo, Edo, Delta, and Bayelsa States. The observed monthly mean SO_2 concentrations across the country in October 2025 were below the WHO 2021 recommended standard of 40 µg/m^3 in 24 hours (Table 1)[1].

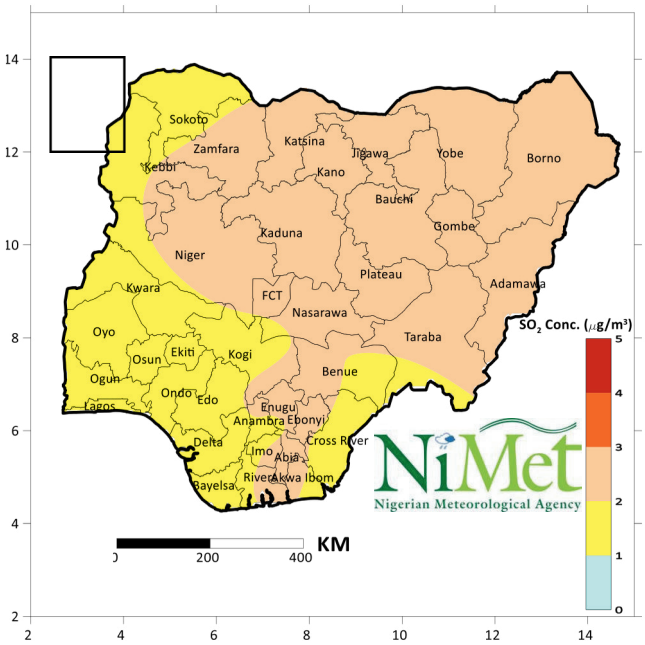

Figure 1.7: Mean Monthly Concentration of Sulphur Dioxide (SO_2) over Nigeria in October 2025.

1.9: Air Quality Index across Nigeria in October 2025

In October 2025, most parts of the country experienced moderate air quality with Air Quality Index (AQI) of 51 to 100. (See Figure 1.8). This implies that there was no serious risk of human exposure to the air quality that prevailed in October. The air quality over Sokoto, Zamfara, Katsina, Kano, Kaduna, and parts of Kebbi, Niger, Bauchi, Jigawa states and the FCT was poor, with AQI of 101 to 150 which suggests that the air quality was unhealthy for sensitive group of persons especially children and the aged living in these places

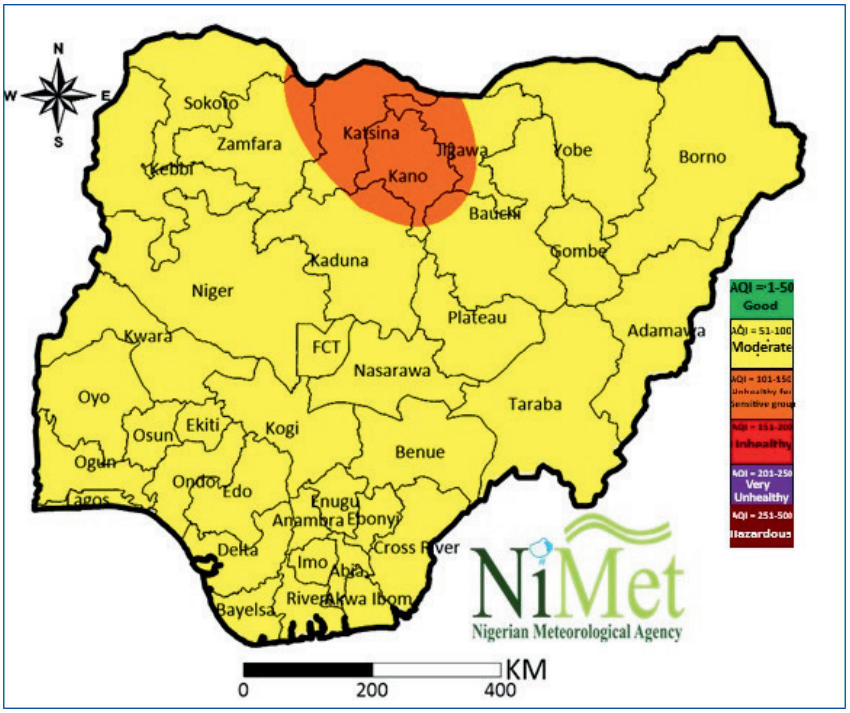

Fig 1.8: Air Quality Index Across Nigeria in October 2025

CHAPTER TWO
2.0 HIGHLIGHTS OF NOVEMBER 2025 WEATHER

2.1 Position of the Inter-Tropical Discontinuity (ITD) and Rainfall Distribution across Nigeria in November 2025

In November 2025, the Intertropical Discontinuity (ITD) moved further southward from latitude 9.6°N in the first dekad to 8.2^{0}N by the end of the end of the third dekad of the month, maintaining an average position of latitude 8.8°N during the month. This southward displacement of the ITD enabled the flow of the Saharan dust-bearing northeasterly winds into the northern and central parts of the country. As a result, the weather in the northern and central states of the country during the month was generally dry and hazy, with strong surface winds and poor visibility. The southern states still experienced thunderstorms with occasional haziness and weather changes associated with the cessation of the rainy season. Meanwhile, the coastal areas still recorded significant rainfall amounts ranging from 10 mm to 240 mm during the month as shown in Figure 2.1.

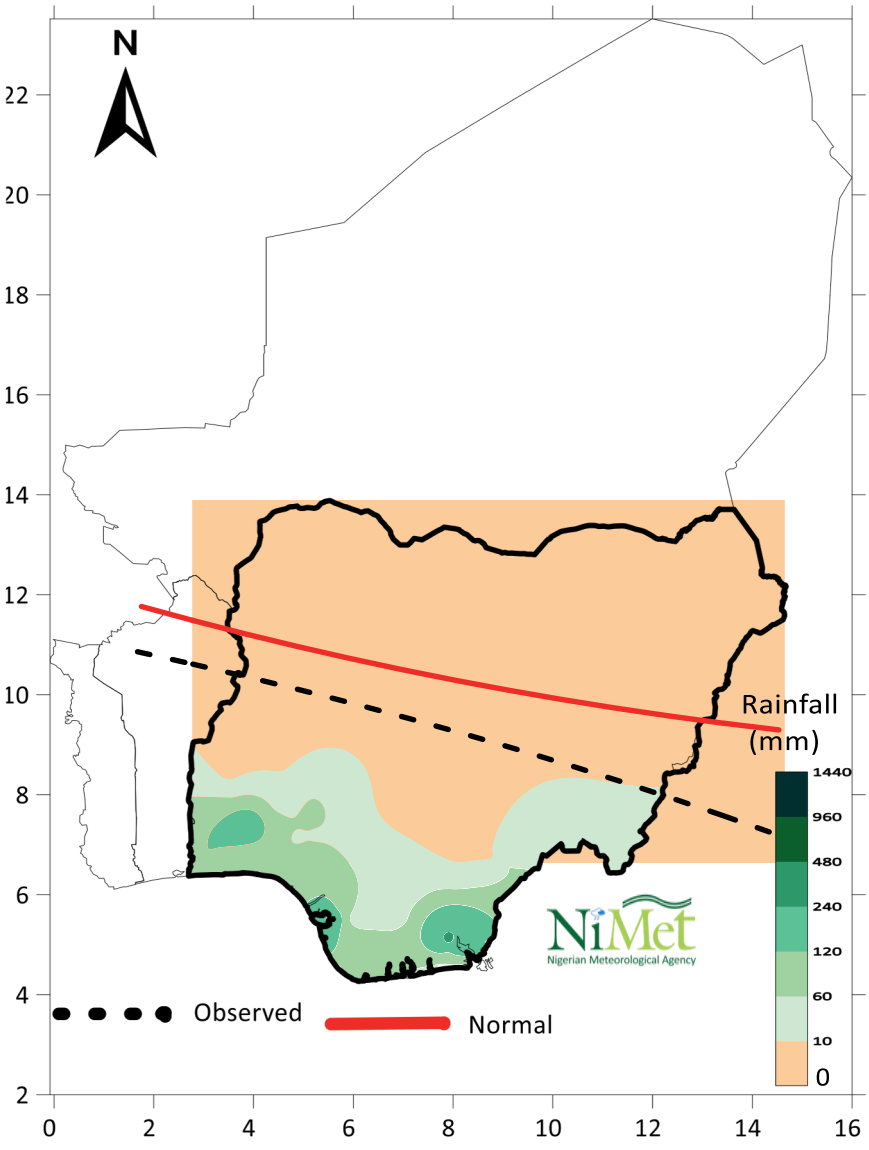

Figure. 2.1: Mean Position of ITD and Rainfall amounts across Nigeria in February 2025

2.2: Mean Sea Level Pressure (Azores and St. Helena Highs) across Nigeria in November 2025

In November 2025, the Azores high-pressure system intensified from 1018hPa in October to 1022hPa while the St. Helena high pressure core weakened from 1026hPa in October to 1022hPa in November. Both Azores and St Helena pressure cells maintained a mean pressure core of 1022hPa in the month (see figure 2.2). Heat lows were also absent on the MSLP charts in November as the rainy season ended over Northern Nigeria. The 1015hPa Isobar retreated further southwards and maintained a mean position of latitude 12°S. The observed MSLP in November further suppressed rainfall in different parts of the country (Figure 2.2)

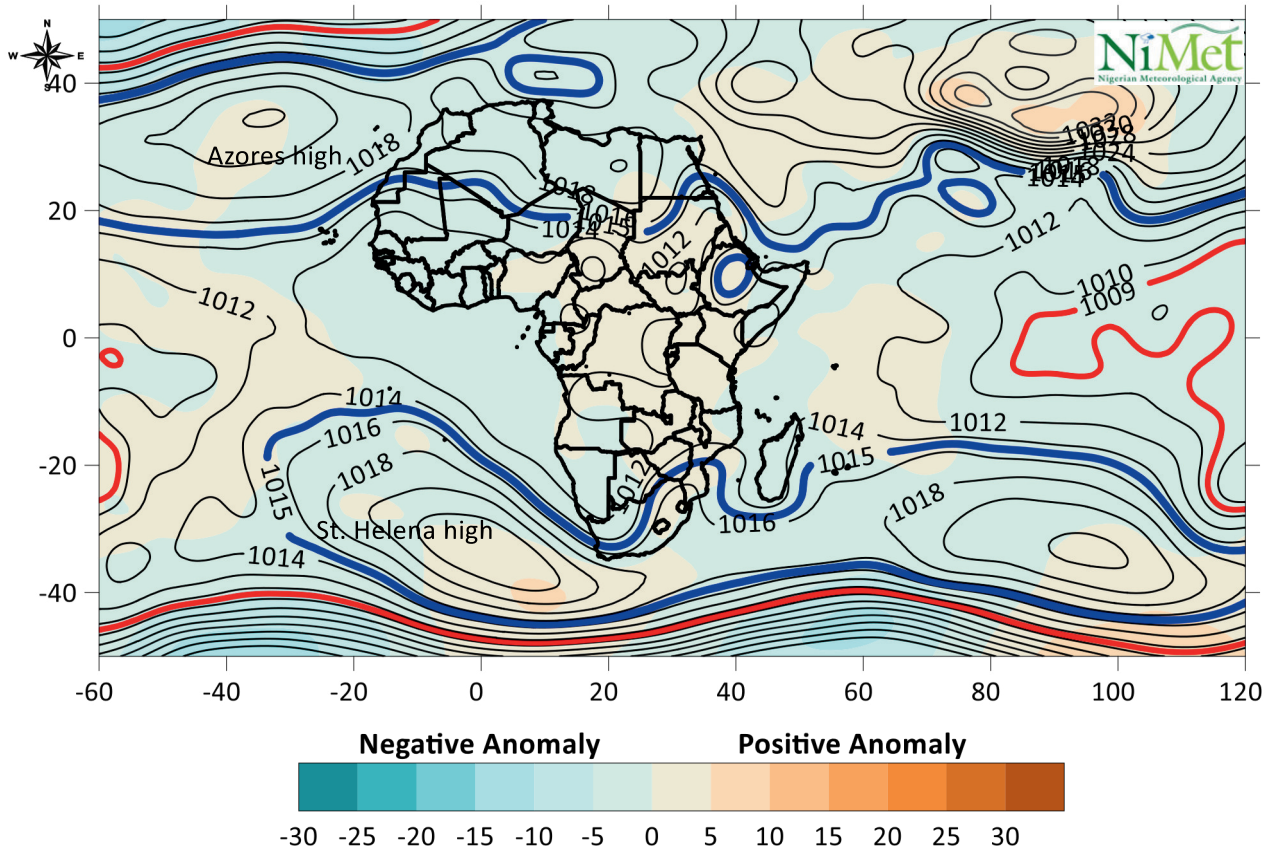

Figure 2.2: Mean Sea Level Pressure in November 2025

2.3 Winds

2.3.1 Winds at 925hPa Level (900m above the Ground) in November 2025

At 900m above the ground, dry north-easterly winds carrying large amounts of dust dominated the country in November, with speeds ranging from 5 to 35 knots. Moist maritime winds prevailed over the southwest and northcentral states, with speeds between 5 and 20 knots.

The influx of large amounts of dust led to a noticeable deterioration of air quality all over the country. Visibility was significantly reduced as a result of thick dust haze reported in some parts of northern Nigeria during the month.

2.3.2 Winds at 850hPa Level (1500m above the ground) in November 2025

At 850hPa level of the atmosphere, continental trade winds (mainly north-easterly winds) dominated the country in November 2025, with speeds ranging from 5 to 30 knots. These persistent winds were the primary drivers of dust during the dry, hazy, harmattan season, especially across the northern states. Stronger winds were recorded on 6th, 7th, and 11th November, while calm conditions occurred on 3rd, 9th, and 25th.

Such strong continental air mass aided transportation of particulate matter to higher levels of the atmosphere, and contributed to widespread dusty conditions, reduced vertical and horizontal visibilities, and the characteristic cool, dry atmosphere experienced across the country during this period.

2.4 Mean Particulate Matter ($PM_{2.5}$) Concentration across Nigeria in November 2025

The spatial distribution of $PM_{2.5}$ concentration over the country in November shown in Figure 2.3 reveals that most parts of the country recorded mean $PM_{2.5}$ concentrations ranging between 15 and 79 µg/m³. Concentrations within the 15 to 30 µg/m³ range were observed over the southwest, extending through Kogi, Edo, Delta, Bayelsa, Rivers, Akwa Ibom, Cross River states, to southern Taraba, southern Adamawa, Borno, and northern Yobe states. Higher concentrations between 45 and 60 µg/m³ were observed across most parts of the northwest, including parts of Katsina, Kano, northern Bauchi, and Jigawa.

The highest concentrations between 60 and 79 µg/m³ were recorded in parts of northern Kaduna, Katsina, and Kano. The rest of the country recorded $PM_{2.5}$ concentrations in the range of 30 to 45 µg/m³. The average $PM_{2.5}$ concentration for the month exceeded the World Health Organization (WHO) guideline standard limit (Table 1).

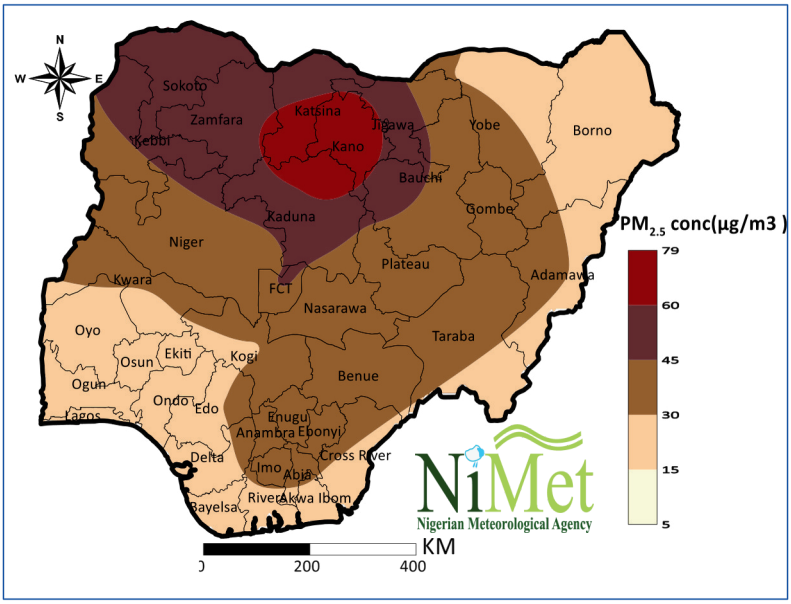

Figure 2.3: Mean Monthly Concentration of Particulate Matter ($PM_{2.5}$) over Nigeria in November, 2025

2.5: Horizontal Visibility Across Nigeria in November 2025

The horizontal visibility across Nigeria in November 2025 was generally moderate to good, with most cities recording between 6,000 m and 10,000 m visibility, as shown in Figure 2.4. Several stations, however, observed noticeable variability, and intermittent visibility deterioration during the month. Ado Ekiti, Akure, Jos, Kano, Katsina, Kebbi, Umuahia and Uyo showed frequent fluctuations and poor visibilities on some days of the month (See Table 2). In contrast, the visibilities in Enugu, Calabar, and Minna were less variable visibilities in November 2025.

Very good visibilities (above 15,000 m) were observed over Lokoja, while visibility deteriorated to 1000-2000m at Abuja, Kano, Maiduguri, Kaduna, Katsina, and Nguru (Table 2) due to dust haze. Only few cities experienced visibility below 1,000 m, and these events were short lived over Kaduna and Nguru in the month.

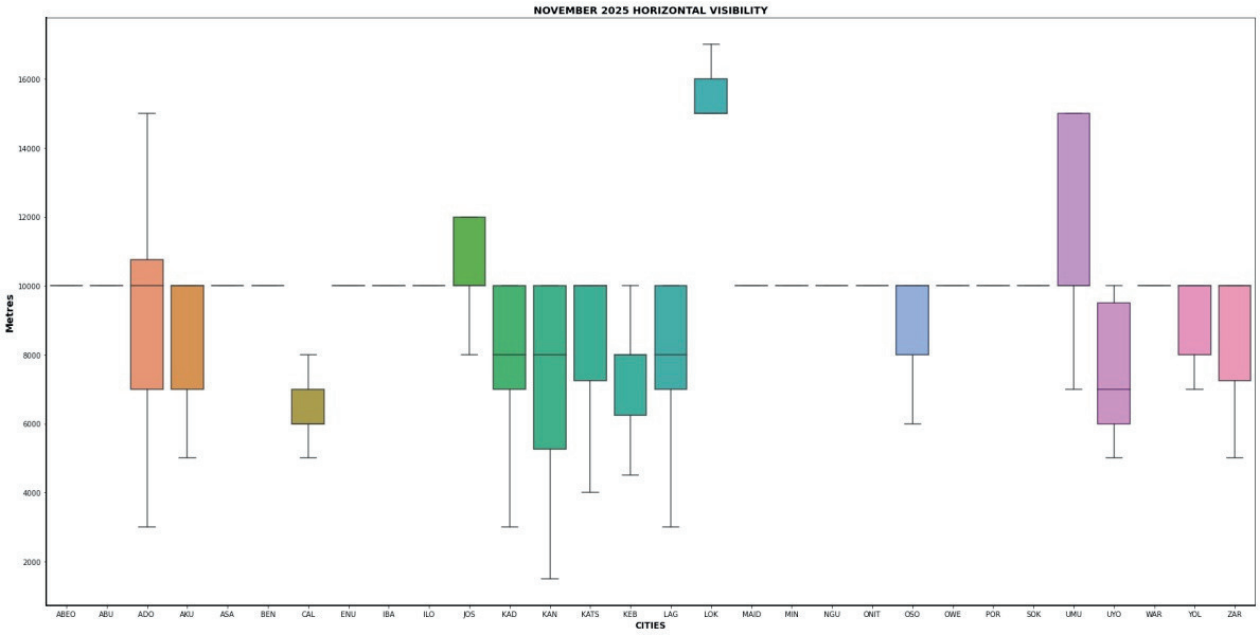

Figure 2.4: Mean Daily Horizontal Visibility Over Cities Over Nigeria in November 2025

Generally, horizontal visibility in November was better over the southern cities compared to the northern cities where thick dust haze caused serious deterioration of visibility and air quality especially over Kaduna and Nguru.

TABLE 2: CITIES THAT RECORDED HORIZONTAL VISIBILITY BETWEEN 400 AND 2000M IN NOVEMBER, 2025

VISIBILITY (m)	LOCATIONS	DATE	TOTAL NUMBER OF DAYS
100-200	-	-	-
201-400	-	-	-
401-600	Kaduna	26th	1
601-1000	Nguru	15th, 25th	2
1001-2000	Abuja, Kano, Katsina, Maiduguri, Minna, Nguru.	6th, 14th, 15th, 16th, 25th, 26th, 27th	7

2.6: Nitrogen Dioxide (NO_2) Concentration Across Nigeria in November 2025

Increased NO_2 concentrations exceeding 8.0 µg/m³ were sustained over some parts of Katsina, Kano, Jigawa, Kaduna, Nasarawa, Ogun, Lagos states and the FCT, similar to what was observed in October (Figure 2.5). However conditions improved in November over Abia, Imo and Ebonyi compared to the increased concentrations recorded in October over these states.

The lowest observed NO_2 concentrations, ranging between 2.0 and 4.0 µg/m³, were recorded over Taraba, Benue, Cross River, and some parts of Kwara, Niger, Plateau, Adamawa, Kebbi, Yobe and Borno states. The NO_2 concentrations in most parts of the country was between 4.0 and 8.0 µg/m³ during the month (See Figure 2.5). The observed concentrations across the country remained below the WHO thresholds (Table 1).

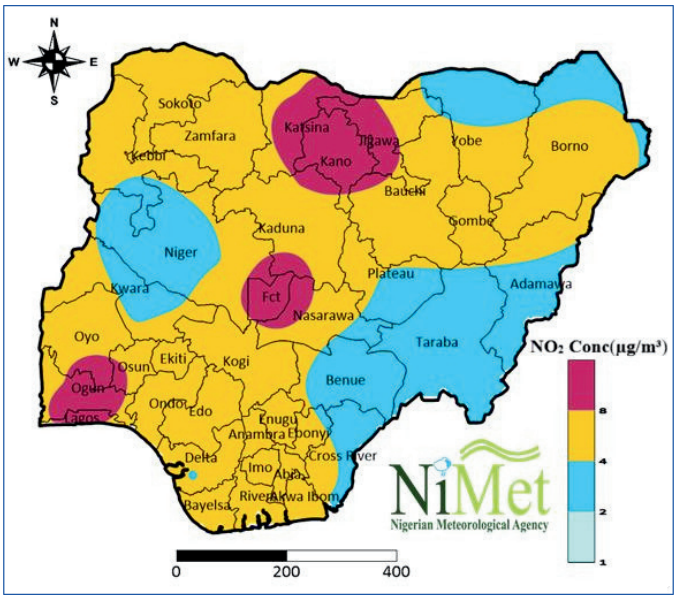

Figure 2.5: Mean Monthly Concentration of Nitrogen Dioxide (NO_2) over Nigeria in November, 2025

2.7: Carbon Monoxide (CO) Concentration Across Nigeria in November 2025

The mean concentration of CO in November 2025 was between 339 and 450ppbv (0.39 and 0.52mg/m^3). CO emissions reduced significantly in November over the northern parts of the country compared to October. Most of the states in the country recorded concentrations in the range of 400 to 450ppbv (0.46 to 0.52mg/m^3) while Sokoto, Kebbi, Niger, Kwara, Oyo, Osun, Lagos, Ondo, Edo, Delta, Plateau, Enugu, Imo, Bayelsa, and part of Zamfara, Ogun, Rivers, Ebonyi, Kaduna, and Nasarawa states recorded concentrations of 350 to 400ppbv (0.40 to 0.46mg/m^3), see Figure 2.6. The observed CO concentrations in November were lower the WHO standard limit (Table 1)

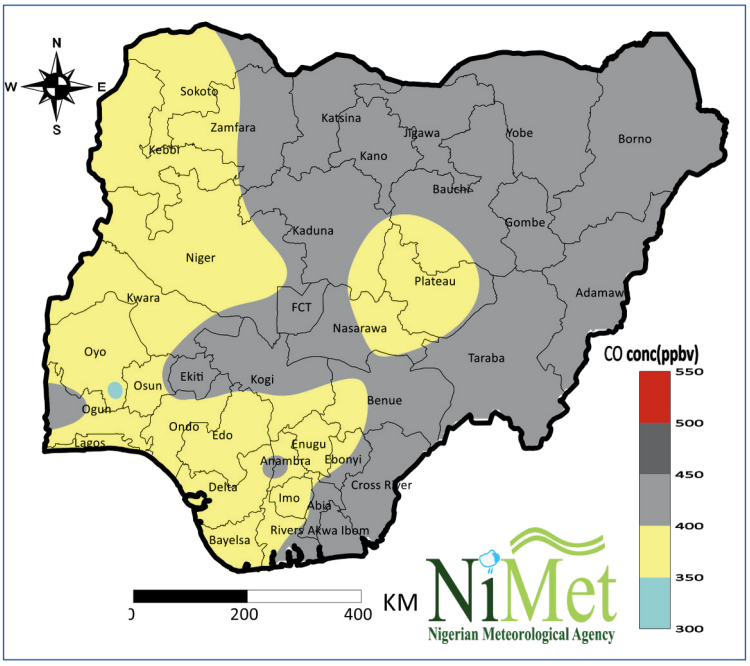

Figure 2.8: Air Quality Index Across Nigeria in February 2025

2.8: Sulphur Dioxide (SO_2) Concentration Across Nigeria in November 2025

The observed mean concentration of SO_2 in November generally ranged from 2.32 to 4.51 (µg/m^3) across the country (See Figure 2.7). The lowest concentrations between 2.0 to 3.0 µg/m^3 were observed over Sokoto, Osun, Ogun, Lagos, Bayelsa, western Zamfara, Niger, Kwara, Imo, Edo, and parts of Kebbi, Ekiti, Oyo, Ondo, Delta, Rivers, Cross River and Abia States. Concentrations between 3.0 and 4.0 µg/m^3 were recorded over Katsina, Kaduna, FCT, Kogi, Enugu, Benue, Anambra, Imo, and Ebonyi, parts of Zamfara, Kebbi, Kwara, Ekiti, Ondo, Edo, Delta, Niger, Bauchi, Jigawa, Taraba, Yobe, Plateau, Abia, and Cross River states. The highest SO_2 concentrations of 4.0 to 4.51 µg/m^3 were observed over most of the northeastern states. The observed monthly mean concentrations across most states in the country were remarkably below the World Health Organization (WHO) recommended standard (Table 1).

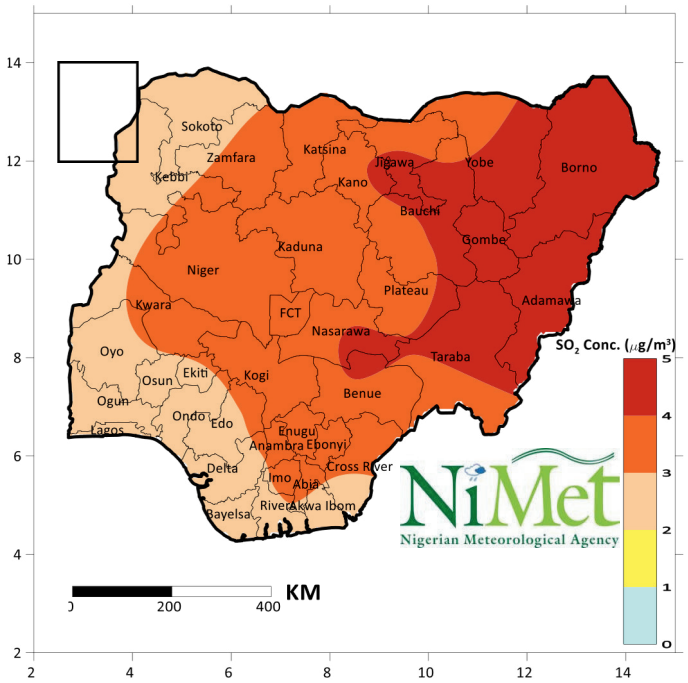

Figure 2.7: Mean Monthly Concentration of Sulphur Dioxide (SO_2) over Nigeria in November 2025.

2.9: Air Quality Index Across Nigeria in November 2025

Air Quality Index across the country in November shows there was an improvement. In November 2025, the air quality improved from moderate to good over the coastal states compared to October. Moderate air quality with index of 51 to 100 prevailed over the northeastern, central and southern states (Figure 2.8).

Localized pollution of the atmosphere mainly due to dust haze persisted over Sokoto, Kebbi, Zamfara, Katsina ,Kano, Kaduna, Jigawa and some parts of Bauchi, Niger as well as the FCT with air quality index of 101 to 150. The coastal states however, experienced good air quality due to proximity to the Atlantic ocean and high rainfall frequency which washed out pollutants from the atmosphere.

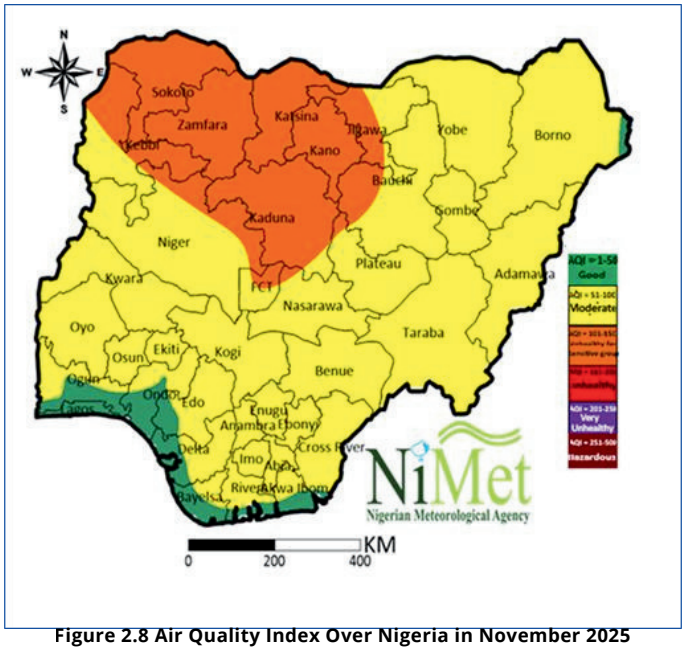

Figure 2.8 Air Quality Index Over Nigeria in November 2025

CHAPTER THREE

3.0 HIGHLIGHTS OF DECEMBER 2025 WEATHER

3.1 Position of the Inter-Tropical Discontinuity (ITD) and Rainfall Across Nigeria in December 2025

In December 2025, the Intertropical Discontinuity (ITD) moved southwards from latitude 7.6°N in the first dekad to 7.2°N in the third dekad of the month. Its mean position was 7.3°N during the month. (Figure 3.1). As a result of this ITD position, most parts of the country was under the influence of the northeasterly winds and experienced dry, dusty, weather conditions during the month. The coastal states of the country still experienced some rainfall which helped in removing dust particles from the atmosphere and improving the air quality.

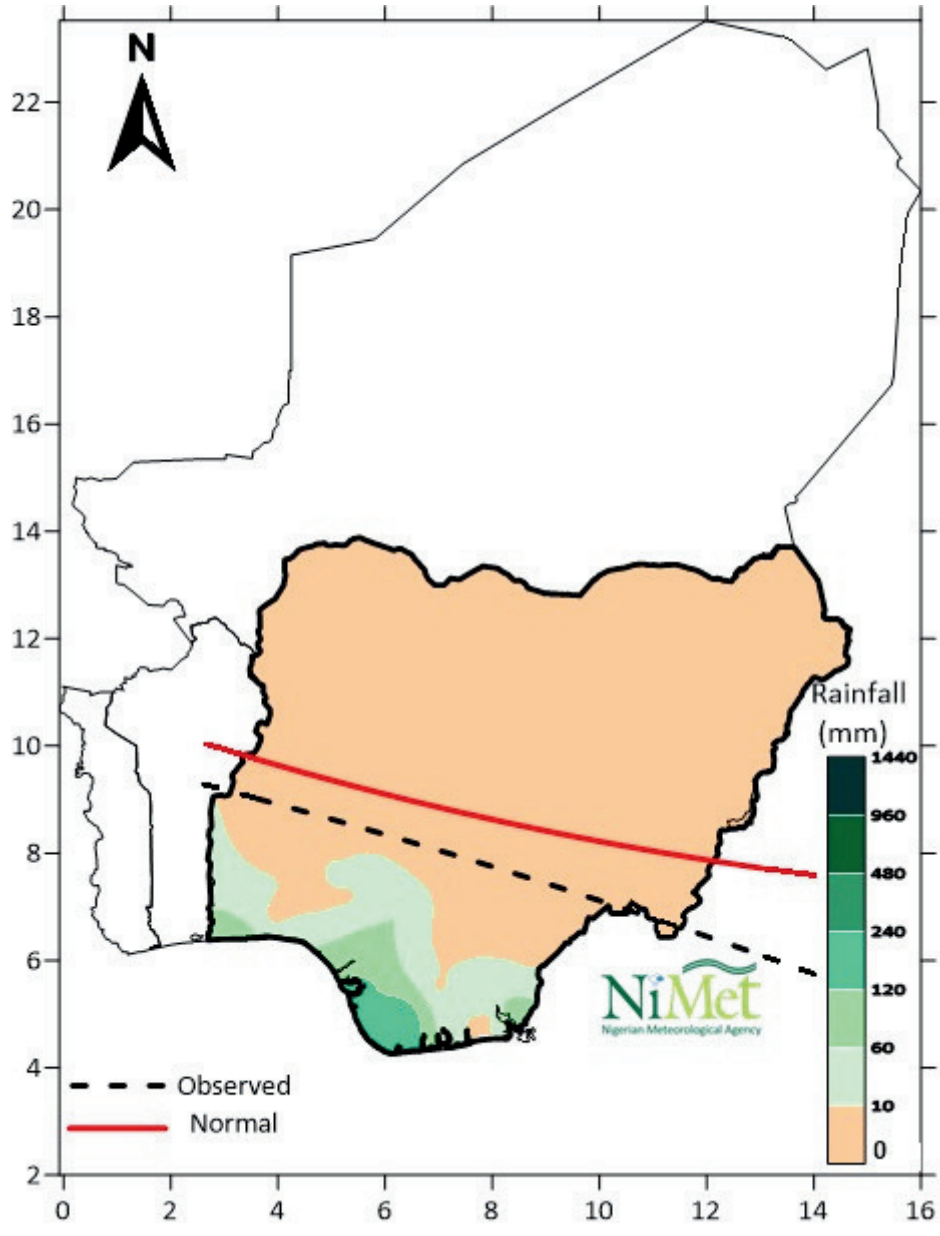

Figure 3.1: Mean ITD Position and Rainfall Amounts across Nigeria in March 2025

3.2 Mean Sea Level Pressure (Azores and St. Helena Highs) Across Nigeria in December 2025

The Azores high pressure core remained quasi stationary at 1022hPa, however, it pushed the 1015hPa Isobar in the northern hemisphere southwards to enhance dust uplift over the desert region. Its southern counterpart, the St. Helena high pressure core weakened from 1022hPa in November to 1020hPa in December 2025 (see figure 3.2). The 1015hPa Isobar continued its southward retreat to a mean position of 15°S and further depleted moisture and rainfall over the coastal states. Generally, the pressure conditions that prevailed in December favored drier conditions, strong surface winds and dust transport into the country.

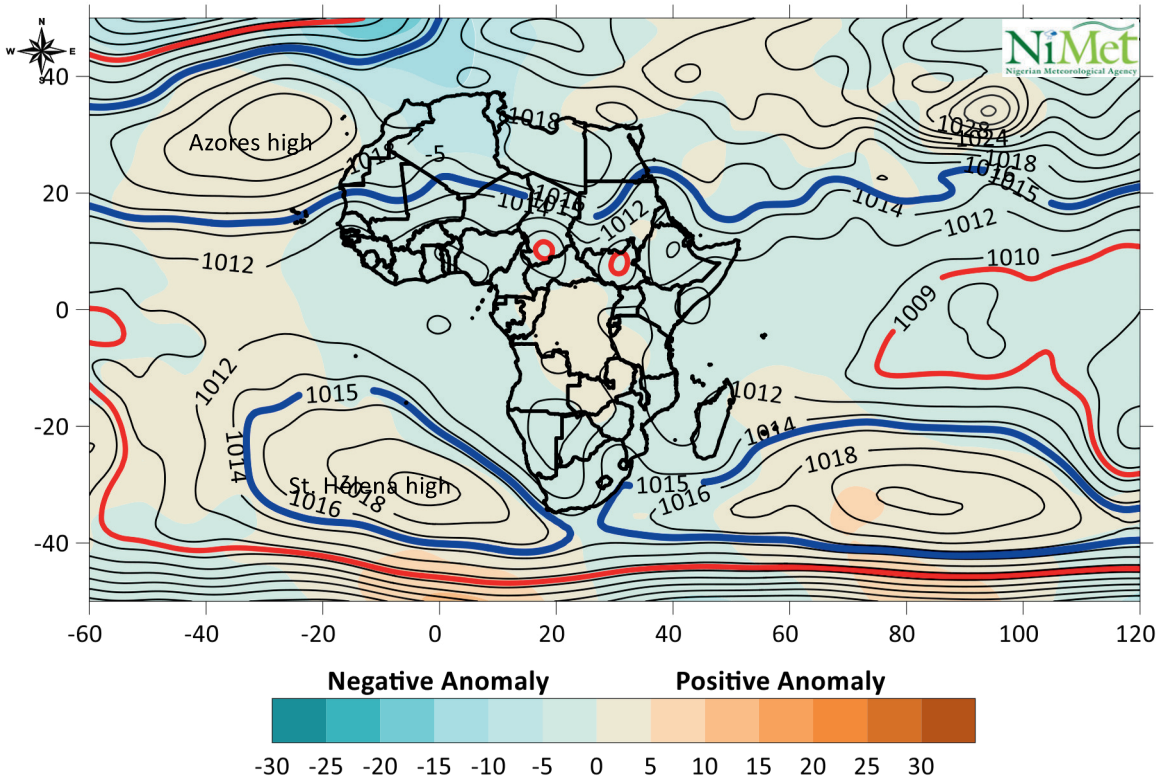

Figure 3.2: Mean Sea Level Pressure in December, 2025

3.3: Winds

3.3.1: Winds at 925hPa Level (900m Above Ground) in December, 2025

At the 925 hPa level, dry and dusty northeasterly trade winds dominated the country with speeds of 5 to 35kts, particularly strong during the first half of the month, while occasional southwesterly winds with speeds of 5 to 20kts were observed over southern and coastal states. Anti-cyclonic vortices were observed over the northcentral and northeastern regions on several days, which enhanced wind divergence, uplift and the transport of Saharan dust into the country, that resulted in reduced visibility and poor air quality considered unhealthy for all persons mainly in the northern parts of the country.

3.3.2: Winds at 850hPa Level (1500m above the ground) in December 2025

Northeasterly winds with speeds ranging from 5 to 30kts were predominant at the 850hPa level across the country. Wind speeds varied throughout the month, with notable intensifications to 25 and 30kts between the 14th and 16th December. Cyclonic vortices were observed on 21st and 25th further influencing circulation patterns that were favourable for convective events over the southern parts of the country. These prevailing conditions over the northern states facilitated the uplift and dispersion of dust and fine particulate matter ($PM_{2.5}$) into the upper atmosphere, contributing to the suppression of rainfall nationwide.

3.4: Particulate Matter (PM2.5) Concentration Across Nigeria in December 2025

The mean $PM_{2.5}$ concentrations across the country in December 2025 generally ranged from 15 to 130 µg/m³ (See Figure 3.3). The lowest concentrations ranging between 15 and 30 µg/m³ were recorded over Bayelsa, Rivers, Akwa Ibom, Delta, Ondo, southern Edo, Ogun, Lagos, and southern Cross River states. Mean $PM_{2.5}$ concentrations ranging between 30 and 45 µg/m³ were observed across Oyo, Osun, Ekiti, northern Edo, Kogi, Anambra, Imo, Abia, Ebonyi, northern Cross River, Enugu, southern Benue, and southern Taraba. Higher concentrations ranging ranging between 45 and 60 µg/m³ were recorded over some parts of Kwara, , southern Niger, northern Kogi, the southern Federal Capital Territory (FCT), southern Nasarawa, northern Benue, northern Taraba, Adamawa, and Borno states.

The highest $PM_{2.5}$ concentrations of 60 to 130 µg/m³ were observed over most parts of northern Nigeria and the FCT. The observed concentrations over the northern states in December were highest concentrations ever recorded in 2025. This can be attributed to early rainfall cessation in 2025 and dry conditions which facilitated transportation of high volume of dust from the Sahara Desert into the country. Overall, $PM_{2.5}$ levels across the country exceeded the WHO 2021 Air Quality standard limit, indicating increased health risks to the Nigerian population during December 2025, worse than the conditions observed in October and November 2025.

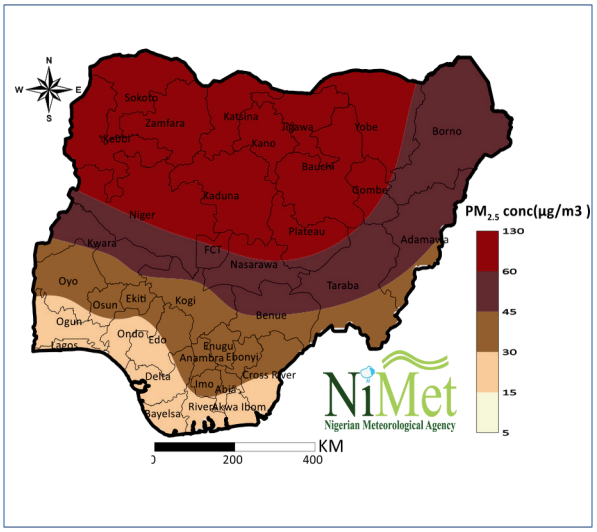

Figure 3.3: Mean Monthly Concentration of Particulate Matter ($PM_{2.5}$) over Nigeria in December 2025

3.5: Horizontal Visibility Across Nigeria in December 2025

As a result of the increased concentration of Saharan dust in the atmosphere, horizontal visibility in most Nigerian cities were lower in December 2025 compared to November. Cities in northern Nigeria, such as Kano, Katsina, Kebbi, Kaduna, Maiduguri, Minna, and Nguru recorded horizontal visibility as low as 400 to 1000, on some days of the month. (See Figure 3.4 and Table 3).

The highest horizontal visibility of 6000m to 17000m during the month were recorded in Lokoja and Umuahia.

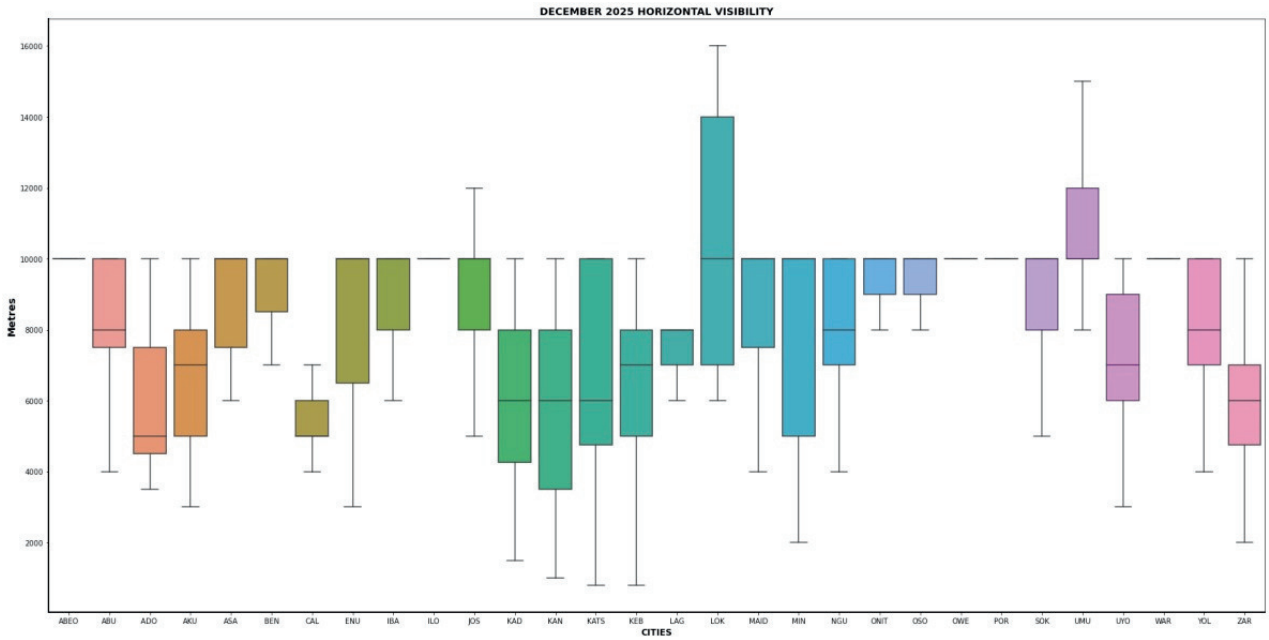

Figure 3.4: Mean Daily Horizontal Visibility for Nigerian Cities in December 2025

TABLE 3: CITIES WITH HORIZONTAL VISIBILITY BETWEEN 400 and 2000m IN DECEMBER, 2025

VISIBILITY (m)	LOCATIONS	DATE	TOTAL NUMBER OF DAYS
100-200	-	-	-
201-400	-	-	-
401-600	Nguru	1st	1
601-1000	Kano, Katsina, Kebbi, Maiduguri.	1st, 2nd, 9th, 15th, 16th	5
1001-2000	Kaduna, Kano, Katsina, Kebbi, Maiduguri, Minna, Sokoto, Zaria.	1st, 2nd, 3rd, 10th, 11th, 12th, 15th, 16th, 17th	9

3.6: Concentration of Nitrogen Dioxide (NO_2) Across Nigeria in December 2025

NO_2 concentration remained consistently above 8µg/m³ from October to December over Katsina, Kano, Jigawa, Nasarawa states and the FCT. Unlike the previous month, this high concentration hotspots extended to Zamfara and Imo states in December (Figure 3.5) A larger portion of the country recorded concentrations between 4.0 to 8.0 µg/m³. The lowest range of concentrations between 2.0 and 4.0 µg/m³ were observed over Taraba, Benue, Cross River, Kwara, Niger, Plateau, Adamawa, Yobe, Borno, Bayelsa, Rivers, Ebonyi, and Kebbi states reflecting reduced NO_2 emissions in December over these states. Overall, observation in December confirmed the persistence of NO_2 hotspots in some states. However, both the concentrations observed over the hotspots and those recorded across other states remained below the WHO standard threshold, indicating a low health risk for individuals exposed to NO_2 emissions during December 2025.

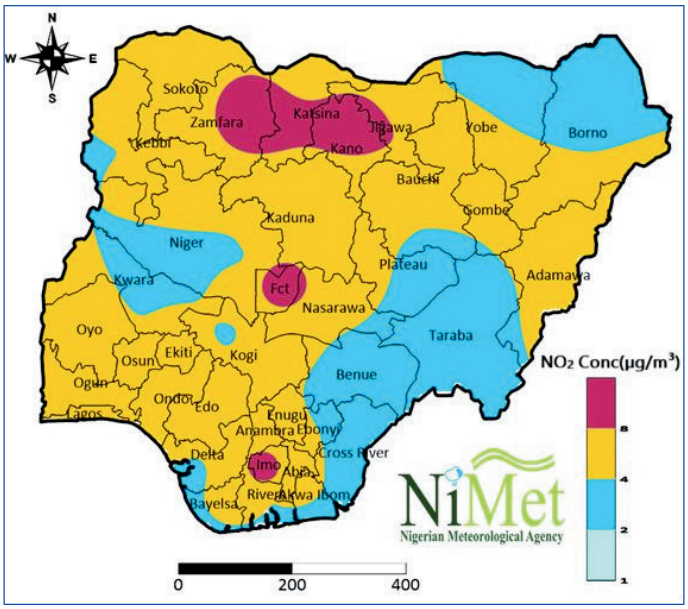

Figure 3.5: Mean Monthly Concentration of Nitrogen Dioxide (NO_2) over Nigeria in December 2025

3.7: Carbon Monoxide (CO) Concentration Across Nigeria in December 2025

In December 2025, the mean CO concentration recorded over Nigeria was between 312 and 462 ppbv (0.36 and 0.53 mg/m³) as shown in Figure 3.6 . Most states recorded concentrations ranging from 350 to 400 ppbv (0.40 to 0.46 mg/ m³) while some parts of Cross River, Benue, Kogi Taraba, Adamawa, Katsina, Jigawa, Kano, Kebbi, Niger, Kwara, Oyo, Ogun, and Lagos states, recorded between 300 and 350 ppbv (0.345 and 0.403 mg/ m³) of CO.

The highest range of concentrations from 400 to 500 were recorded over Imo, Rivers, Ekiti, and some parts ofAnambra, Osun, Ondo, Anambra, Plateau, Borno and Sokoto states. Just as observed in previous months. CO concentrations in December over Nigeria were below the WHO 2021 standard (Table 1)

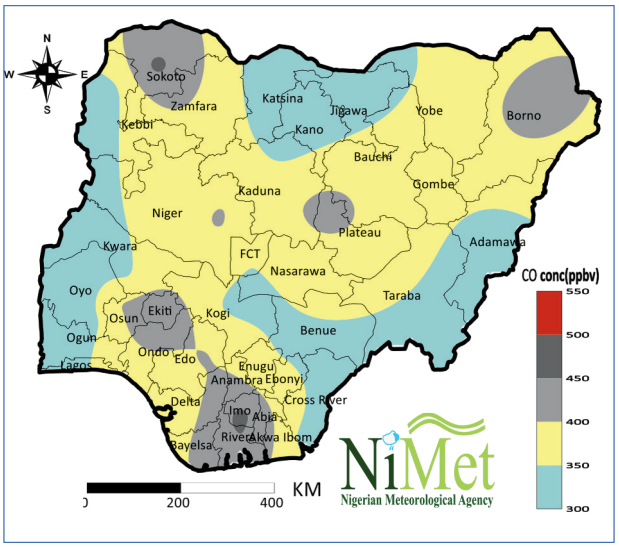

Figure 3.6: Mean Monthly Concentration of Carbon Monoxide Over Nigerian Cities in December 2025

3.8: Sulphur Dioxide (SO_2) Concentration Across Nigeria in December 2025

In December 2025, sulfur dioxide (SO_2) concentrations across Nigeria ranged from approximately 2 to 5µg/m³(See Figure 3.7). Some parts of the northern states of Sokoto, Zamfara, Katsina, and Yobe, recorded lower concentrations between 2.0 and 3.0 µg/m. In contrast, , most of Yobe, Gombe, Bauchi, Jigawa, Kano, Katsina, Zamfara, Kebbi, Sokoto, Niger, Kwara, Oyo, Osun, Ekiti, Ogun, Lagos, Ondo, Edo, Delta and Bayelsa states recorded SO_2 concentrations of 3 to 4 µg/m³, while the FCT, Nasarawa, Kogi, eastern Niger and the northeastern and southeastern parts of the countryrecorded the highest concentrations in the range of 4.0 to 5.0 µg/m³. Overall, SO_2 pollution remained within safe limits nationwide but showed regional variation, with higher concentrations clustered in the central and eastern states.

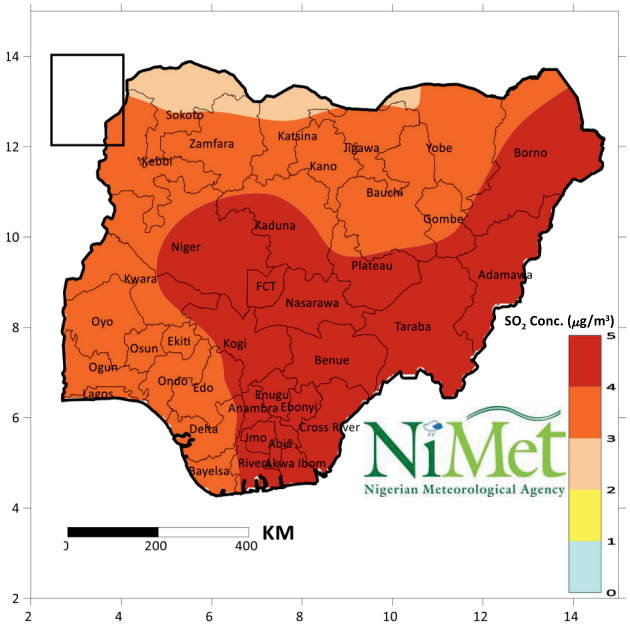

Figure 3.7: Mean Monthly Sulphur Dioxide (SO_2) Concentration over Nigeria in December 2025.

3.9: Air Quality Index Across Nigeria in December 2025

A further deterioration of air quality was observed in December over most northern and central states compared to November.These conditions could be attributed to the influx of Saharan dust advected into the country from the dust source regions. Parts of Katsina, Kano, Kaduna and Bauchi recorded the poorest air quality with AQI of 151 to 200 considered unhealthy for the populace (Figure 3.8). Other states in the north and central states recorded poor air quality with AQI of 101 to 150 which was unhealthy for sensitive groups. Air quality over the Niger Delta was good while the rest of the southern states and some part of Adamawa, Taraba, Benue Kogi and Kwara states recorded moderate air quality in December with minimal health risks.

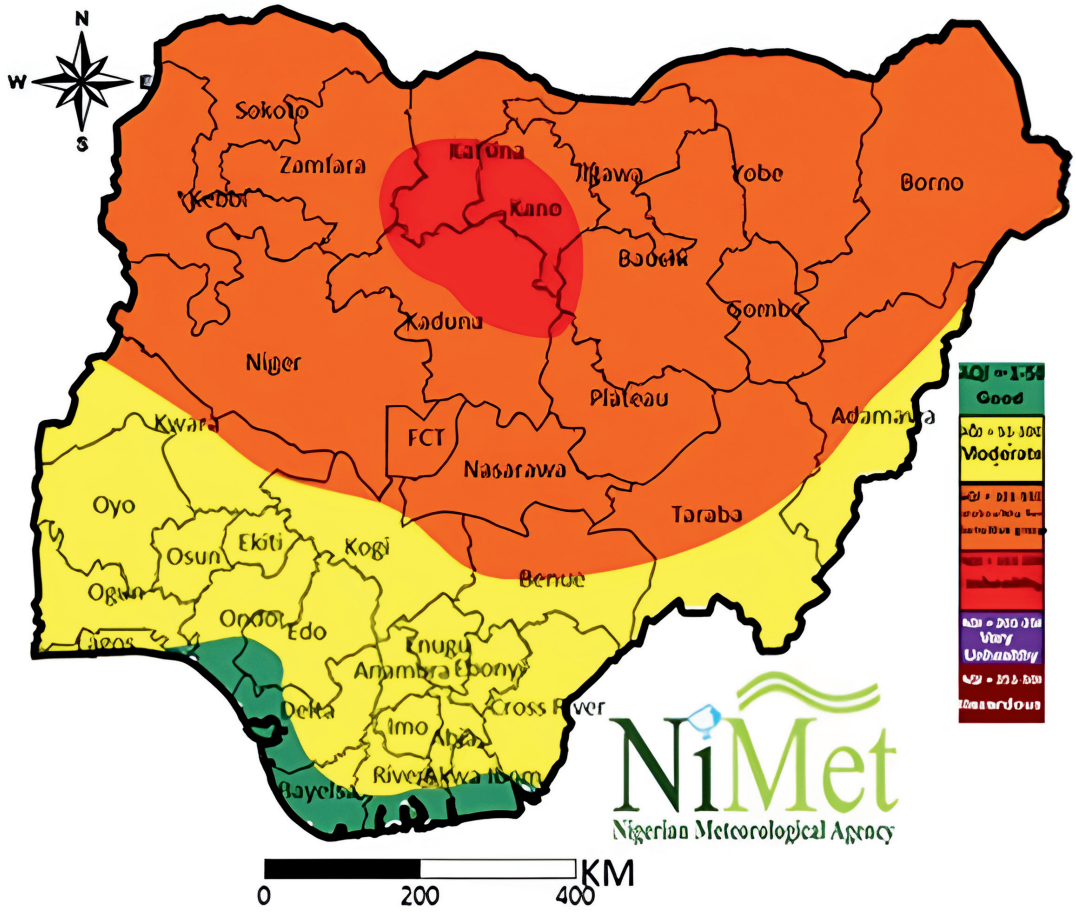

Figure 3.8. Air Quality Index over Nigeria in December 2025

CHAPTER FOUR
4.0: Quarterly Trends: Fourth Quarter October-November-December (OND) 2025

4.1: Observed ITD Positions – Fourth Quarter 2025

During the Fourth Quarter of 2025 (October to December), the Inter-Tropical Discontinuity (ITD retreated southward from latitude 16.3°N in the 1st dekad of October to latitude 7.2°N by the 3rd dekad of December. The ITD maintained average positions of 14.0°N, 8.8°N and 7.3°N in October, November, and December respectively, with the most northward position observed in early October. The observed southward retreat is in line with the climatological pattern of faster southward oscillation rate of about 3.5 degrees latitude per month compared to its northward advance of 3.0 degrees per month.

The ITD remained north of its climatological mean only during the 1st dekad of October, after which it consistently maintained positions south of the normal position from the 2nd dekad of October through December. The observed mean position of the ITD during the Fourth Quarter of 2025 accounts for the suppressed rainfall across the country particularly over the coastal states, and sustained dust incursion across the country. This led to reduced horizontal visibility and deteriorated air quality across most states. These conditions were further aggravated by persistent northeasterly winds at both 925hPa and 850hPa levels which facilitated the widespread dispersion of dust and fine particulate matter ($PM_{2.5}$) during the period.

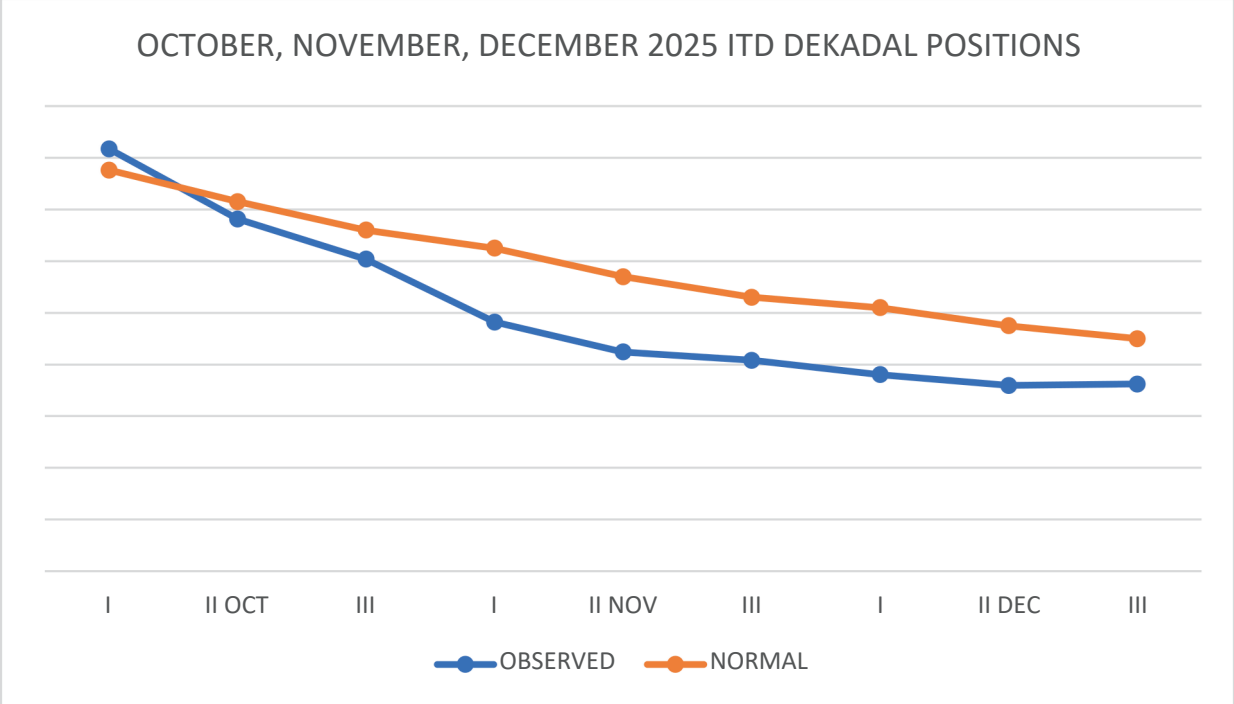

Figure 4.1: Fourth Quarter (October to December) 2025 ITD Positions.

4.2: Mean Concentration of Particulate Matter ($PM_{2.5}$) in the Fourth Quarter of 2025

As shown in Figure 4.2, the $PM_{2.5}$ concentration in most parts of Nigeria in the fourth quarter of 2025 ranged between 30 and 45 µg/m³. The lowest concentrations in the range of 15 to 30 µg/m³ were observed across the southwestern states extending to Edo, Delta, Bayelsa, Rivers, Akwa Ibom, and Cross River States. Concentrations ranging between 45 and 60 µg/m³ were recorded over Sokoto, Kebbi, western Zamfara, northern Niger, southern Kaduna, the Federal Capital Territory (FCT), and parts of Nasarawa, Plateau, and Bauchi. The highest quarterly $PM_{2.5}$ concentrations of 60 to 87 µg/m³ were observed over parts of Katsina, Kano, Jigawa, Zamfara, Bauchi, and Kaduna states.

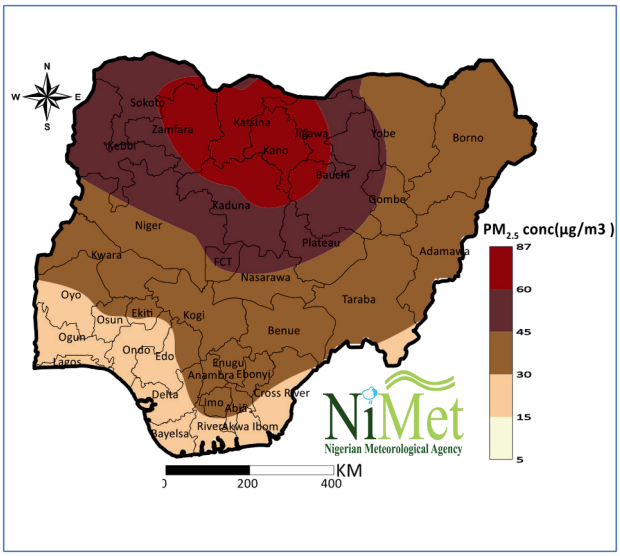

Figure 4.2: Mean Concentration of Particulate Matter ($PM_{2.5}$) over Nigeria in the Fourth Quarter of 2025.

4.3: Daily Mean Concentration of Particulate Matter ($PM_{2.5}$) Over Northern Nigeria in the Fourth Quarter of 2025

During the fourth quarter of 2025, there was pronounced day-to-day variability of $PM_{2.5}$ in all the cities in northern Nigeria with increasing trend from October into December. (See figure 4.3). In October, $PM_{2.5}$ concentration levels were generally lower and relatively stable, mostly ranging between about 20 and 70 µg/m³ across the cities. From November onward, concentrations began to increase steadily, with more frequent concentrations above 60 µg/m³. This increase became more pronounced in December, when several cities recorded high concentrations with sporadic peaks. Notably, extreme $PM_{2.5}$ pollution was recorded in Zaria in December, with daily concentrations exceeding 200 µg/m³, indicating severe short term air quality deterioration. Peaks concentrations above 100 µg/m³ also occurred in Kano and Sokoto during the same period, suggesting region-wide particulate matter pollution, mainly from Harmattan dust sources, and also from biomass burning which is common practice during the season over the norther cities. The lowest PM2.5 concentration throughout the period under review was recorded at Nguru. The fitted trendline for all cities indicate a consistent positive trend during October, November and December, confirming a gradual and steady deterioration of air quality towards the end of the year.

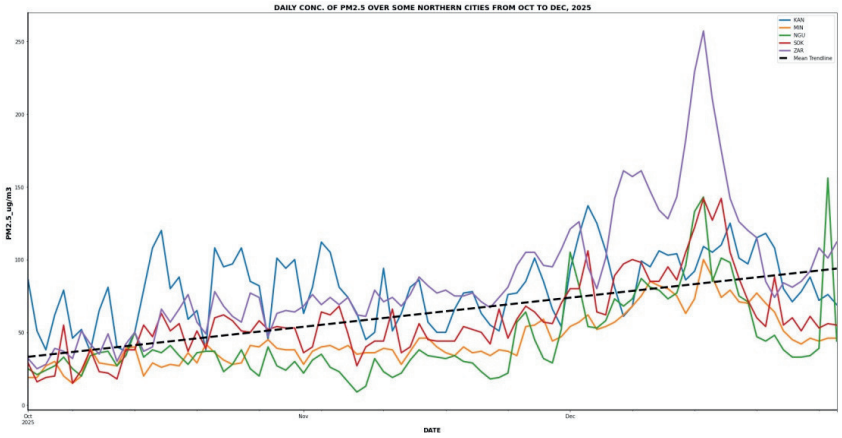

Figure 4.3: Daily Mean Concentration of Particulate Matter ($PM_{2.5}$) over Cities in Northern Nigeria in Fourth Quarter of 2025

4.4 Daily Mean Concentration of Particulate Matter ($PM_{2.5}$) Over Southern Nigeria in the Fourth Quarter 2025

Figure 4.4 shows the daily $PM_{2.5}$ concentrations over selected southern Nigerian cities from October to December 2025. The observed $PM_{2.5}$ concentrations in the south were generally lower in comparison to the north, but exhibited noticeable day-to-day variability and increasing trend similar to the northern cities throughout the period. During October, concentrations were mostly within the range of 15 to 35 µg/m³, with occasional short-lived spikes above 40 µg/m³. The highest daily concentration was observed in October over Onitsha. From November to December, a steady increase in $PM_{2.5}$concentration was evident across most cities, as reflected by the positive slopes of the trendline.

Ado-Ekiti, Oshogbo and Ibadan recorded more frequent and the highest $PM_{2.5}$ pollution episodes in December compared to other southern cities, with several peaks of concentration reaching 60 to 75 µg/m³.

Despite the relatively lower magnitudes compared to the northern cities, $PM_{2.5}$ concentrations in the southern cities consistently exceeded the WHO 2021 Air Quality Guideline daily limit of 15 µg/m³ on many days. The observed upward trends toward the end of the year suggest the influence of seasonal factors, such as the onset of the dry season and increased regional pollutant transport. Overall, the plot (See Figure 4.4) indicates a progressive deterioration of air quality over southern Nigerian cities from October to December 2025.

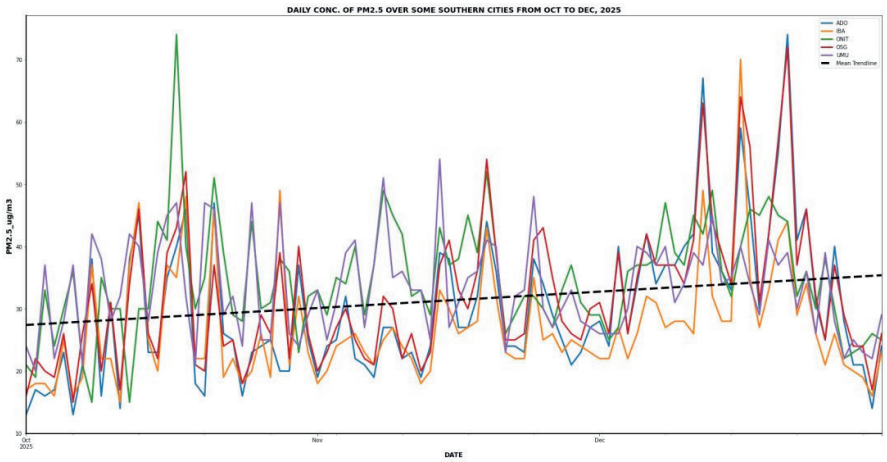

Figure 4.4: Daily Mean Concentration of Particulate Matter ($PM_{2.5}$) over cities in Southern Nigeria in Fourth quarter of 2025

4.5: Daily Mean Concentration of Particulate Matter ($PM_{2.5}$) in the Fourth Quarter of 2025

The boxplot (See Figure 4.5) illustrates the range of distribution of $PM_{2.5}$ concentrations from October to December, 2025 over different cities across the country. Substantial variability in $PM_{2.5}$ concentration was observed, with marked differences in, mean and extreme concentrations in the cities.

Most of the cities recorded $PM_{2.5}$ concentrations ranging from 8 to 50 µg/m³ while few cities such as Jos, Kaduna, Kano, Katsina, Kebbi, and Sokoto recorded concentrations which ranged from 10 to 138 µg/m³. Zaria recorded exceptionally the highest average and range of concentration between 30 to 257 µg/m³ during the period under review (See Figure 4.5). Generally, the observed $PM_{2.5}$ concentrations during the third quarter of 2025 reflected sustained exposure of Nigerians to elevated levels of particulate matter far above the WHO recommended standard thresholds with high air quality concerns and health risks.

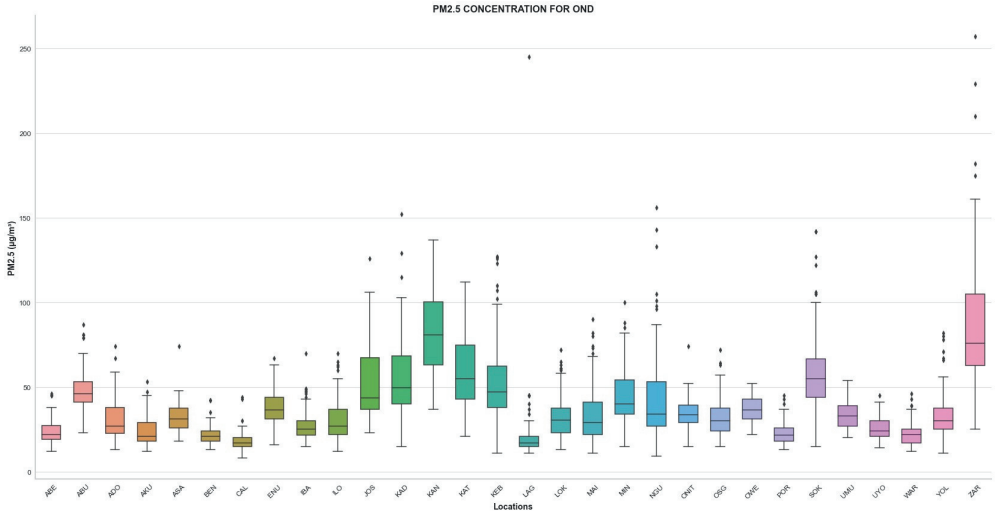

Figure 4.5: Average Daily Particulate Matter ($PM_{2.5}$) Concentration across Nigerian cities in Fourth Quarter of 2025

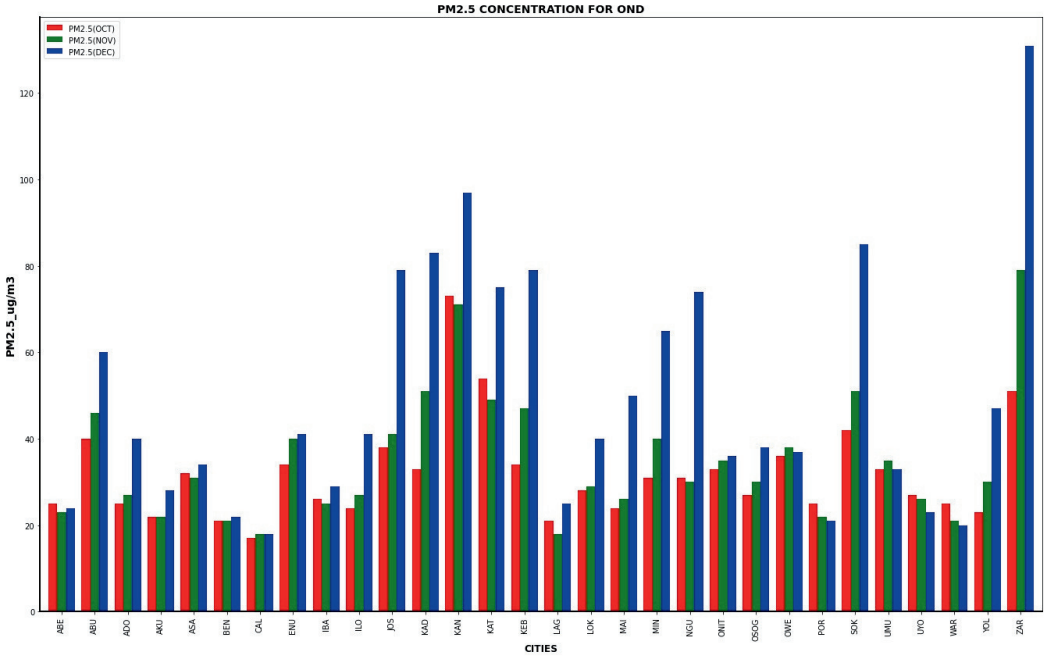

Figure 4.6: Average $PM_{2.5}$ Concentration over Nigeria cities in Fourth Quarter of December 2025

recorded concentrations which ranged from 10 to 138 µg/m³. Zaria recorded exceptionally the highest average and range of concentration between 30 to 257 µg/m³ during the period under review (See Figure 4.5). Generally, the observed $PM_{2.5}$ concentrations during the third quarter of 2025 reflected sustained exposure of Nigerians to elevated levels of particulate matter far above the WHO recommended standard thresholds with high air quality concerns and health risks.

Table 4: Maximum, Minimum and Mean Concentration of Particulate Matter $PM_{2.5}$ (µg/m³) in Fourth Quarter 2025

	OCTOBER			NOVEMBER			DECEMBER		
CITY	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean
ABEOKUTA	46	12	25	33	16	23	37	16	24
ABUJA	53	23	40	59	38	46	87	42	60
ADO EKITI	47	13	25	44	19	27	141	14	40
AKURE	45	12	22	34	15	22	53	13	28
ASABA	74	18	32	48	21	31	47	22	34
BENIN	42	13	21	31	16	21	32	13	22
CALABAR	44	8	17	27	12	18	27	11	18
ENUGU	67	16	34	54	31	40	63	24	41
IBADAN	49	15	26	43	18	25	70	16	29
ILORIN	45	12	24	39	18	27	70	18	41
JOS	53	23	38	69	28	41	126	51	79
KADUNA	56	15	33	74	39	51	152	50	83
KANO	120	37	73	112	45	71	137	61	97
KATSINA	97	21	54	86	26	49	112	39	75
KEBBI	64	11	34	72	32	47	127	39	79
LAGOS	45	11	21	26	12	18	245	12	25
LOKOJA	46	13	28	42	20	29	72	17	40
MAIDUGURI	48	12	24	48	11	26	90	20	50
MINNA	45	15	31	59	28	40	100	42	65
NGURU	50	20	31	64	9	30	156	33	74
ONITSHA	74	15	33	52	26	35	49	22	36
OSOGBO	52	15	27	54	20	30	72	17	38
OWERRI	52	22	36	52	25	38	50	24	37
PORT HARCOURT	45	14	25	40	13	22	29	13	21
SOKOTO	63	15	42	70	27	51	142	51	85
UMUAHIA	47	20	33	94	23	35	45	22	33
UYO	45	15	27	37	19	26	33	14	23
WARRI	46	12	25	33	14	21	29	12	20
YOLA	43	11	23	43	25	30	82	24	47
ZARIA	78	25	51	107	61	79	257	74	131

4.6: Mean Air Quality Index (AQI) - Fourth Quarter 2025

During the Fourth Quarter (October to December), the southern and central states of Nigeria experienced moderate air quality with AQI of 51 to 100 which posed no significant health risk to individuals in those states. Air quality Index in the range of 101 to 150 classified as unhealthy air quality for sensitive group of persons was recorded over Sokoto, Zamfara, Kebbi, Kaduna, Kastina, Kano, Jigawa, Bauchi, FCT, and some parts of part of Plateau. Good air quality was consistently maintained throughout the fourth quarter of 2025 over the coastal states of Ondo, Delta, Bayelsa and Rivers states (Figure 4.7).

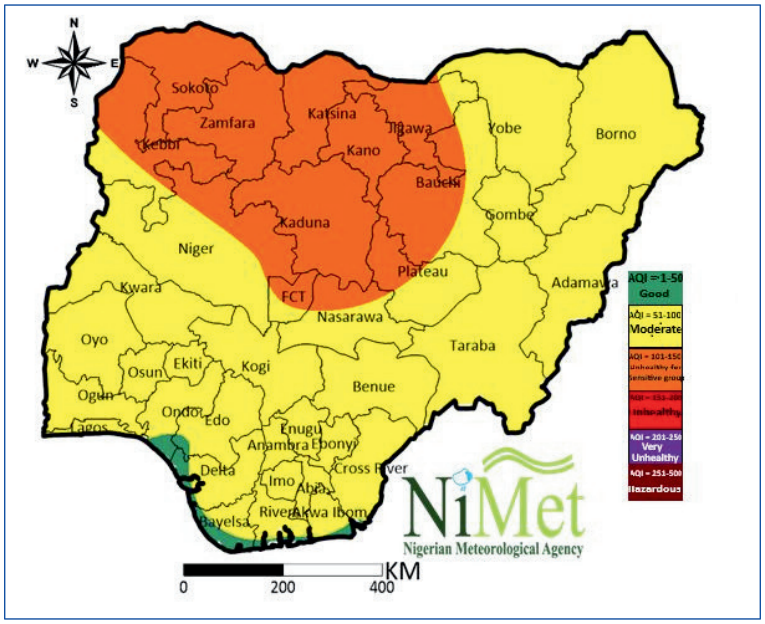

Figure 4.7: Mean Air Quality Index over Nigeria in Fourth Quarter of 2025

4.7: Spatial Distribution of Mean Nitrogen Dioxide (NO_2) Concentration in the Fourth Quarter 2025

During the Fourth Quarter of 2025 (Figure 4.8), a consistent spatial intensification of NO_2 concentrations was observed across Nigeria, particularly over several hotspot regions. Concentrations exceeding 8.0 µg/m³ were recorded between October and December in Katsina, Kano, Jigawa,the FCT, some parts of Nasarawa, Kaduna, Imo, and Abia, reflecting possible influences from urbanization, traffic density, and industrial activities. Most states reported moderate concentrations ranging from 4.0 to 8.0 µg/m³, while Taraba, Benue, Cross River, Kwara, Niger, Plateau, Adamawa, Yobe, Borno, and Kebbi consistently remained within the 2.0 to 4.0 µg/m³ range, indicative of reduced NO_2 emissions. Although quarterly averages remained below the WHO 24-hour guideline of 25 µg/m³, occasional daily averages exceeded the WMO threshold in certain periods and locations. These findings highlight the need for sustained air quality monitoring and targeted mitigation strategies in states where NO_2 hotspots persist.

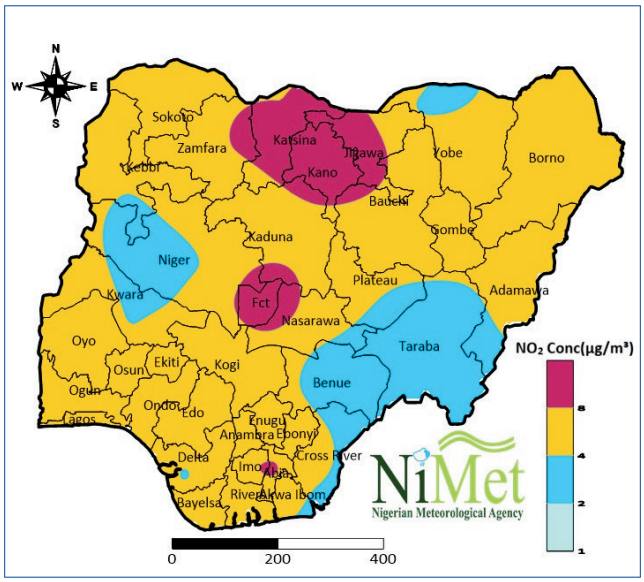

Figure 4.8: Mean Concentration of Nitrogen Dioxide (NO_2) over Nigeria in Fourth Quarter of 2025

4.8: Daily Concentration of Nitrogen Dioxide (NO_2) Over Northern Nigeria in the Fourth Quarter of 2025

Daily average concentrations of Nitrogen dioxide (NO_2) across several northern cities in the Fourth Quarter of 2025 decreased progressively during the quarter (See Figure 4.9). The highest daily peak NO_2 concentration of 25.17 µg/m³ was recorded in Kano on 16 October 2025. This slightly exceeded the World Health Organization (WHO) threshold of 25 µg/m³ in 24 hours. NO_2 concentrations over Abuja, Kano, Dutse were consistently higher compared to other cities throughout the period, varying between 5.0 and 24.16 µg/m³. Yola, Nguru, and Maiduguri maintained moderate concentrations between 8.44 and 11.63 µg/m³, while the lowest daily average of 1.47 µg/m³ was recorded over Nguru on 15 November 2025. Although NO_2 concentrations were generally higher in October than in December, the elevated concentrations in October were below WHO standard threshold on most of the days, but exceeded the threshold only in one day over Kano and as a result, the residents were exposed to a temporal health risk of exposure to NO_2 emissions during the Fourth Quarter of 2025.

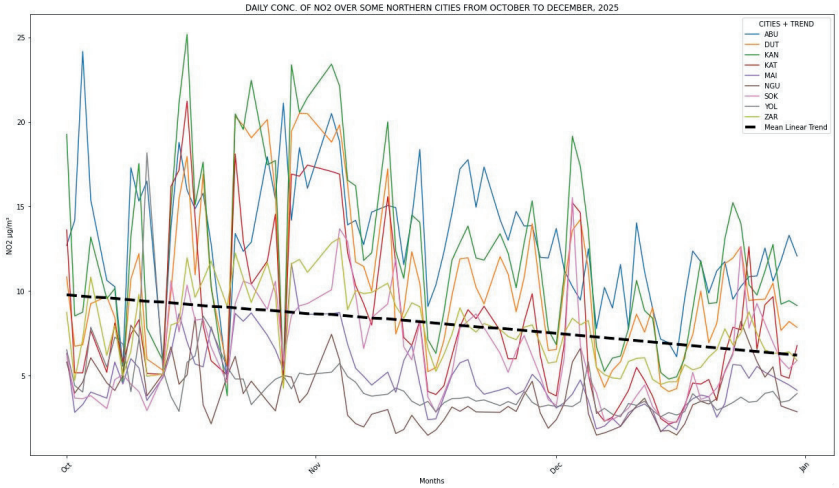

Figure 4.9: Daily Mean Concentration of Nitrogen Dioxide (NO_2) over Northern Nigeria in Fourth Quarter of 2025

4.9: Daily Concentration of Nitrogen Dioxide (NO_2) Over Southern Nigeria in the Fourth Quarter of 2025

NO_2 concentrations across several southern cities varied from 1.83 to 18.72 µg/m³ (Figure 4.10). Both northern and southern regions exhibited similar seasonal trend, with higher concentrations in October compared to December 2025. However, daily concentrations in the south were generally lower than those recorded in the north during the same period. Ikeja, Ibadan, Benin and Ado-Ekiti consistently reported elevated daily concentrations (≥10 µg/m³) than other southern cities during the Fourth Quarter of 2025. The highest daily concentration of 18.72 µg/³ was recorded in October over Ikeja in Lagos state while the lowest daily concentrations between 1.8 and 6.0µg/m³ were observed throughout the period over Yenagoa in Bayelsa state. Although several southern cities recorded recurrent NO_2 concentration spikes above 10.0 µg/m³, all observed values from October to December 2025 remained below the WMO 24 hour threshold of 25 µg/m³. This indicates a relatively low risk of exposure to NO_2 emissions in southern cities, consistent with compliance to international air quality standards.

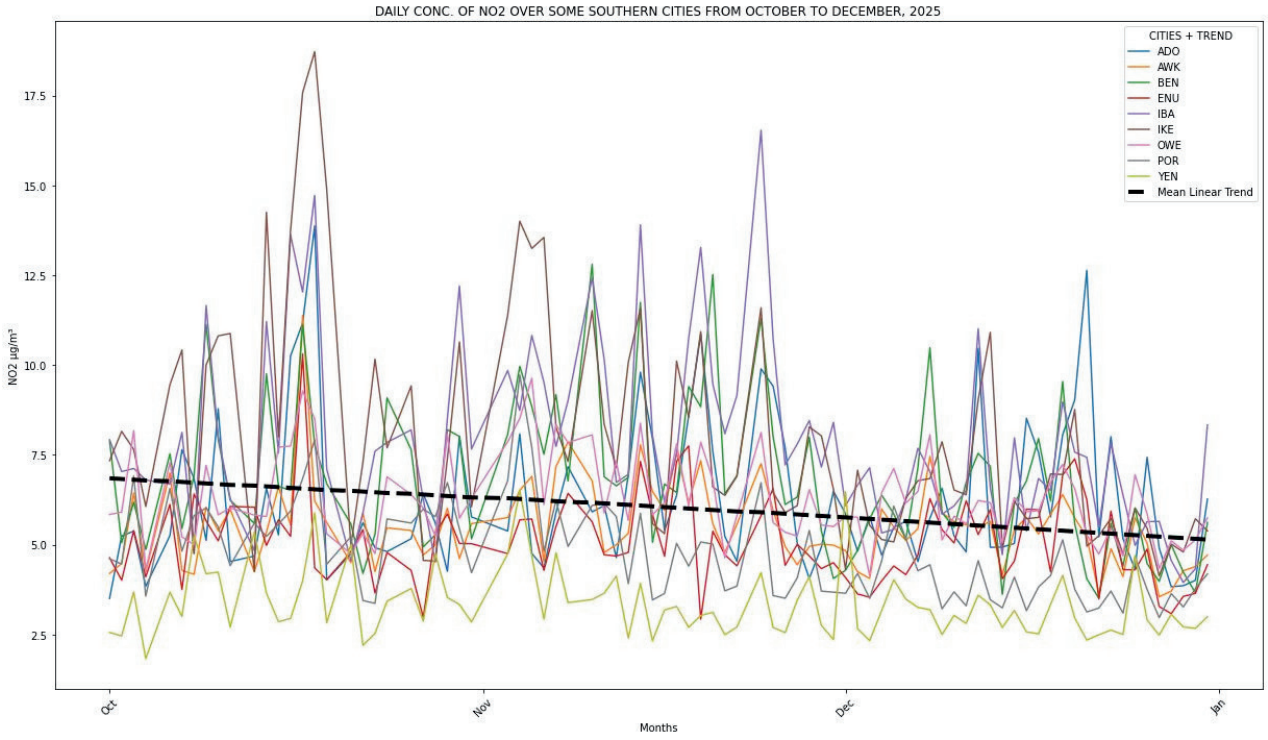

Figure 4.10: Daily Mean Concentration of Nitrogen Dioxide (NO_2) over Southern Nigeria in Fourth Quarter of 2025

Table 4: Maximum, Minimum and Mean Concentration of Particulate Matter $PM_{2.5}$ ($\mu g/m^3$) in Fourth Quarter 2025

	OCTOBER			NOVEMBER			DECEMBER		
CITY	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean
ABUJA	24.16	4.75	14.31	20.49	9.08	14.04	14.03	6.11	10.52
ADO EKITI	6.84	3.84	6.97	10.86	4.06	6.73	12.63	3.83	6.10
AKURE	11.76	2.48	4.81	8.02	3.18	4.75	8.19	2.46	4.05
ASABA	11.37	3.66	5.56	8.14	4.53	5.92	7.48	3.59	5.09
BENIN	11.13	4.20	6.91	12.80	4.06	7.82	10.48	3.51	5.77
CALABAR	5.58	2.07	3.55	5.55	2.72	3.97	4.79	2.22	3.41
ENUGU	10.31	2.97	5.15	7.75	2.93	5.29	7.39	3.08	4.81
IBADAN	14.72	4.51	8.10	16.53	6.18	9.36	11.01	3.95	6.46
ILORIN	8.33	2.86	4.35	5.10	2.36	3.56	5.25	2.53	3.65
JOS	9.72	3.85	6.48	7.55	3.03	4.22	6.80	2.64	4.50
KADUNA	10.00	3.37	6.02	11.13	3.40	5.14	7.89	2.85	4.44
KANO	25.17	3.81	14.61	23.41	6.31	12.16	19.15	4.79	9.75
KATSINA	21.23	4.75	10.67	17.07	3.88	7.73	15.22	2.13	5.76
KEBBI	9.92	2.57	5.62	9.82	3.12	5.14	7.96	2.21	4.00
LAGOS	18.72	4.25	9.25	14.00	5.30	8.30	10.91	4.13	6.14
LOKOJA	9.59	3.33	5.77	6.68	3.42	5.14	6.66	3.18	5.19
MAIDUGURI	11.63	2.82	6.30	8.73	2.39	4.55	5.65	1.67	3.55
MINNA	7.87	3.85	5.45	6.46	3.08	4.44	4.77	2.52	3.70
NGURU	8.44	2.15	4.87	7.44	1.47	2.63	8.21	1.48	3.64
ONITSHA	11.38	4.18	5.50	7.86	4.44	5.92	7.46	3.55	5.12
OSOGBO	13.51	4.75	6.57	11.93	4.80	7.21	11.51	3.88	6.15
OWERRI	9.28	4.29	6.31	9.63	4.63	6.54	8.06	4.14	5.83
PORT HARCOURT	7.92	3.37	5.40	9.72	3.46	4.72	6.07	2.97	3.90
SOKOTO	10.61	2.93	6.88	13.69	2.82	6.73	15.53	2.23	5.25
UMUAHIA	5.45	3.68	5.75	8.06	4.52	5.89	6.92	3.76	5.14
UYO	8.03	3.49	5.31	7.84	3.97	5.40	6.40	2.90	4.32
WARRI	6.21	2.38	4.27	6.31	2.78	3.83	6.02	2.43	3.37
YOLA	18.16	2.88	5.88	5.72	2.85	3.60	4.06	2.56	3.28
ZARIA	12.24	4.25	8.84	13.14	5.25	8.04	8.77	4.47	6.24

4.10: Spatial Distribution of Mean Carbon Monoxide (CO) Concentration in the Fourth Quarter of 2025

The average concentration of CO across Nigeria varied from 300 to over 425 ppbv (0.35 to 0.49 mg/m^3) in the fourth quarter of 2025. CO concentrations of 300 to 400 ppbv (0.35 to 0.46 mg/m^3) were recorded in most states of the country, while higher concentrations in the range of 400 to 450ppbv (0.46 to 0.52mg/m^3 were observed in Borno, Yobe, Ekiti and parts of Gombe, Bauchi, Jigawa, Sokoto, Zamfara, Kaduna, Niger, Kaduna, Kogi, Abia, Imo, Rivers, and Akwa Ibom states during the period. Generally, the concentrations of CO observed during the 4^{th} quarter of 2025 were below the WHO standard thresholds (Table 1), which implies lower health risks from exposure of the people to CO emissions during the fourth quarter of 2025.

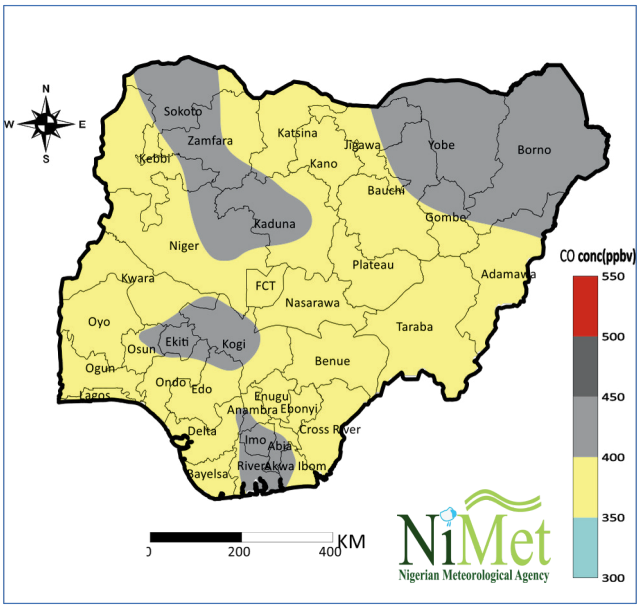

Figure 4.11: Mean Carbon Monoxide (CO) Concentration Over Nigeria in the Fourth Quarter of 2025

4.11: Daily Mean Concentration of Carbon Monoxide (CO) Over Northern Nigeria Fourth Quarter 2025

There was a decreasing trend in CO concentration from October to December with the highest daily CO concentration recorded over Kano and Zaria compared to other northern cities throughout the period under review. The highest daily concentration of 1250 ppbv (1.44 mg/m^3) was recorded in Kano on the 18th of October, while Kaduna and Katsina also show notable peaks (700 to 900 ppbv). These spikes are short-lived, indicating acute pollution events, not sustained background levels. The mean linear trend is almost flat, with a slight downward slope toward December (See Figure 4.12). This suggests no strong seasonal increase, and possibly a minor reduction in CO levels as the season progresses.

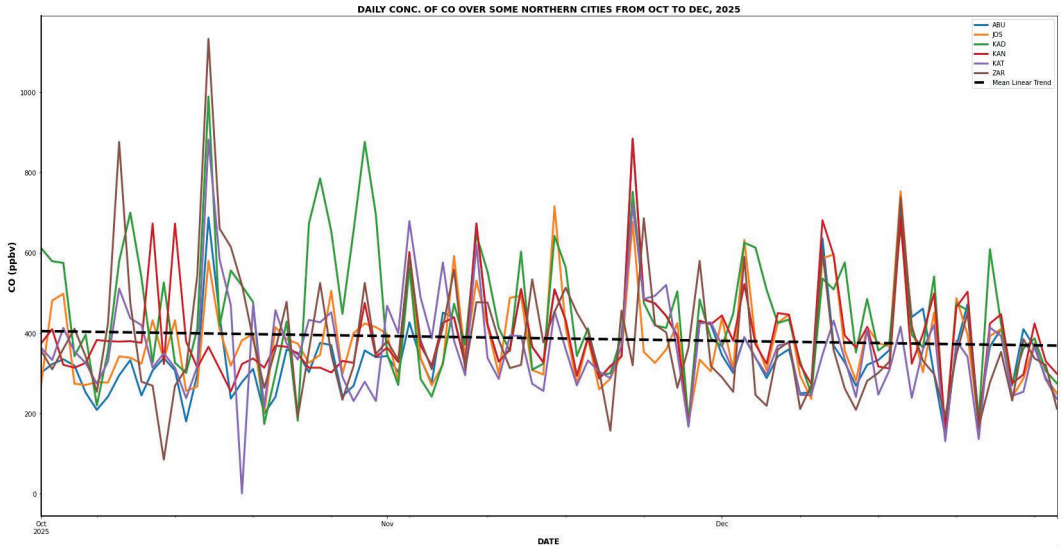

Figure 4.12: Daily Mean Concentration of Carbon Monoxide (CO) over Northern Nigeria in Fourth Quarter of 2025

4.12: Daily Mean Concentration of Carbon Monoxide (CO) Over Southern Nigeria in the Fourth Quarter 2025

The southern cities recorded slightly higher concentrations of CO than the northern cities with the highest daily concentration of 1445ppbv (1.66mg/m^3) on 24th October over Lagos (Figure 4.13). Most of the cities recorded concentrations in the range of 200 to 600ppbv with few daily peaks observed over Lagos and Ado Ekiti during the period. The peak concentrations reflect days with elevated levels of CO likely from vehicular emissions.

The lowest concentration of 135ppbv (0.156mg/m^3) was recorded in Ado-Ekiti on the 28th of November, 2025. The concentrations of CO observed during the fourth quarter 2025 were below the WHO threshold and indicated that the presence of carbon monoxide in the atmosphere on daily basis despite elevated levels on certain days, did not pose serious threat to the health of persons in the southern cities.

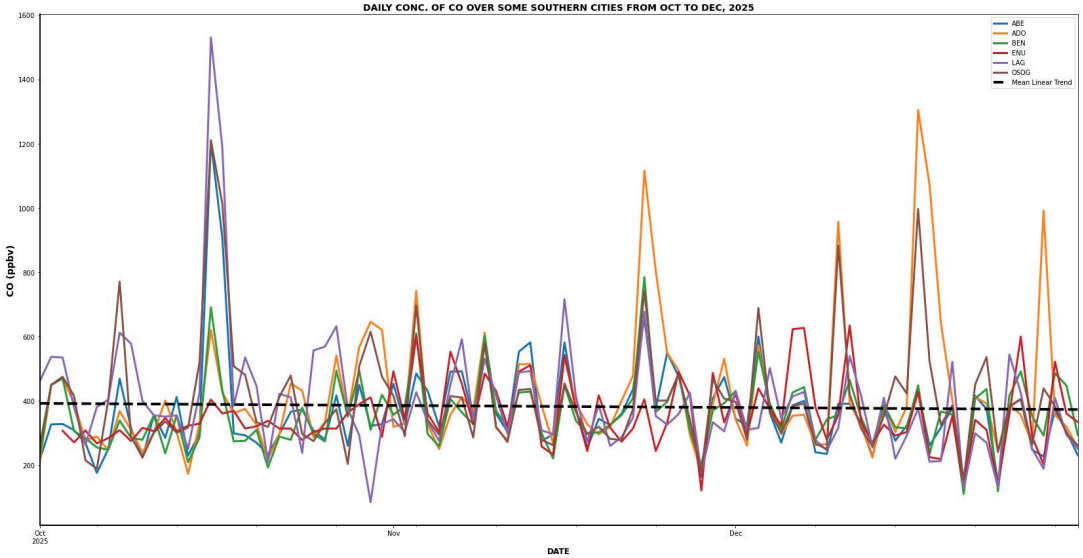

Figure 4.13: Daily Mean Concentration of Carbon Monoxide (CO) over Southern Nigeria in Fourth Quarter of 2025

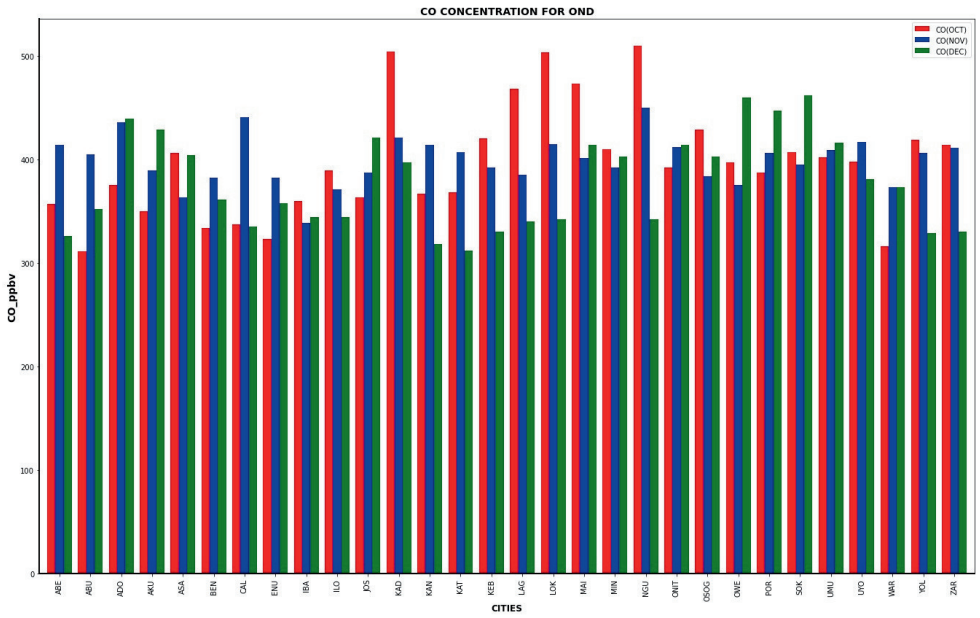

Figure 4.14: Average CO Concentration over Nigeria cities in the Fourth Quarter of 2025

CO concentration was highest over most of the cities in October (See Figure 4.14). Few cities such as Abeokuta, Abuja, Benin, Calabar, Enugu, and Uyo recorded highest mean concentrations in November, while Ado-Ekiti, Akure, Jos, Owerri, Port Harcourt, Sokoto and Umuahia recorded the highest mean concentrations in December. The varying concentrations observed over different cities from October to December suggests the varying degree of emissions from vehicles from one month to another.

Nguru, Lokoja and Kaduna recorded the highest concentrations above 480ppbv in October, while the lowest average concentration (323ppbv) was recorded over Katsina in December. The observed monthly mean concentrations over most cities were lower than the WHO 2021 recommended standard (Table 1). The maximum, minim and mean concentration of CO in October, November and December 2025 is shown in Table 6.

Table 7: Maximum, Minimum and Mean Concentration of Sulphur Dioxide SO_2 ($\mu g/m^3$)in the Second Quarter of 2025

	OCTOBER			NOVEMBER			DECEMBER		
CITY	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean
ABEOKUTA	1205	176	255	657	169	410	600	135	367
ABUJA	688	180	419	884	271	527	712	144	428
ADO EKITI	646	173	284	1116	176	647	1304	146	726
AKURE	929	184	249	703	147	408	1229	165	697
ASABA	1148	243	420	642	250	405	940	151	545
BENIN	691	193	232	785	150	493	552	111	331
CALABAR	688	207	347	766	156	463	525	119	322
ENUGU	411	268	464	600	269	360	635	133	384
IBADAN	882	223	295	673	190	398	521	133	327
ILORIN	1097	221	275	622	177	382	522	134	343
JOS	580	203	347	716	258	446	753	144	448
KADUNA	989	174	259	752	218	527	668	146	407
KANO	673	255	595	884	268	443	688	162	425
KATSINA	882	175	516	720	274	424	431	131	281
KEBBI	1148	251	291	720	196	446	450	132	291
LAGOS	1530	185	252	704	142	478	544	129	336
LOKOJA	1007	226	357	716	192	448	545	140	342
MAIDUGURI	989	174	249	796	195	410	615	141	378
MINNA	673	140	290	725	228	1031	918	163	541
NGURU	1342	231	250	646	301	586	695	137	431
ONITSHA	981	242	423	1884	249	460	689	139	414
OSOGBO	1211	189	313	961	199	375	997	154	575
OWERRI	1134	115	419	742	254	547	1231	201	716
PORT HARCOURT	1260	229	312	592	167	413	1162	204	683
SOKOTO	1148	251	282	626	222	427	1302	206	754
UMUAHIA	957	148	407	697	250	474	805	217	511
UYO	696	139	367	812	193	535	893	207	550
WARRI	415	176	267	872	156	577	982	192	587
YOLA	1342	231	236	672	207	452	689	168	428
ZARIA	1133	185	356	689	258	422	738	168	453

4.13: Spatial Distribution of Mean Sulphur Dioxide (SO_2) Concentration in the Fourth Quarter of 2025

During the Fourth Quarter of 2025 (October, November, December), the concentration of SO_2 across Nigeria ranged between 2.0 and 4.0 µg/m³. Most of the northern, central and southeastern states recorded the highest range of concentrations between 3.0 and 4.0 µg/m³, while Sokoto, Kebbi, Edo, Delta, Bayelsa, some parts of Akwa Ibom, Zamfara, Katsina, Niger, Yobe, Cross River and the southwestern states recorded lower concentrations in the range of 2.0 to 3.0 µg/m³ (See Figure 4.15).

The observed SO_2 concentrations during the period under review remained below WHO thresholds (Table 1). Generally, the eastern and central parts of the country consistently recorded higher mean concentrations than the western states reflecting regional differences in SO_2 emissions and atmospheric dispersion during the fourth quarter of 2025

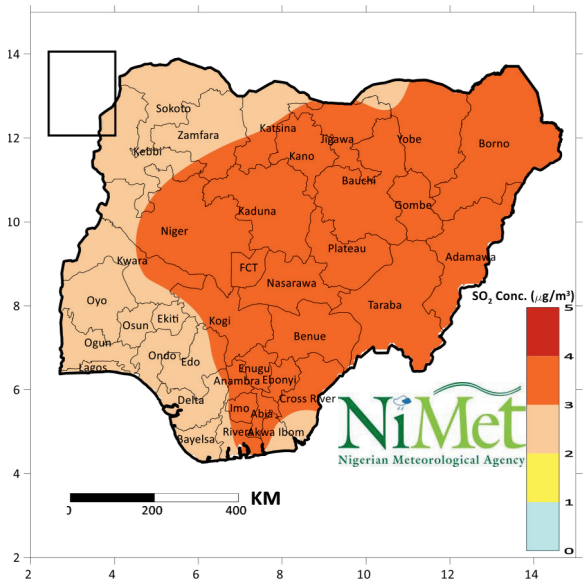

Figure 4.15 Mean Concentration of SO_2 Over Nigeria in the Fourth Quarter of 2025

4.14: Daily Mean of Sulphur Dioxide (SO_2) Concentration Over Northern Nigeria in the Fourth Quarter 2025

In the northern region, there was a progressive increase in SO_2 concentrations from October through early December 2025, with pronounced spikes observed towards the end of November particularly over Maiduguri, Nguru and Kano where daily concentrations exceeded 20 µg/m³. The analyses indicate that concentrations generally remained below the WHO 24-hour standard limit of 40 µg/m³ across all selected cities even with the spikes observed in November. From early December 2025 SO_2 concentrations decreased and stabilized toward the end of the month. Overall, there was significant temporal variation and increasing trend during the period, with Maiduguri, Nguru and Kano experiencing the highest SO_2 pollution, while some northern Nigerian cities such as Katsina and Gusau maintained relatively moderate levels throughout the fourth quarter (Figure 4.16).

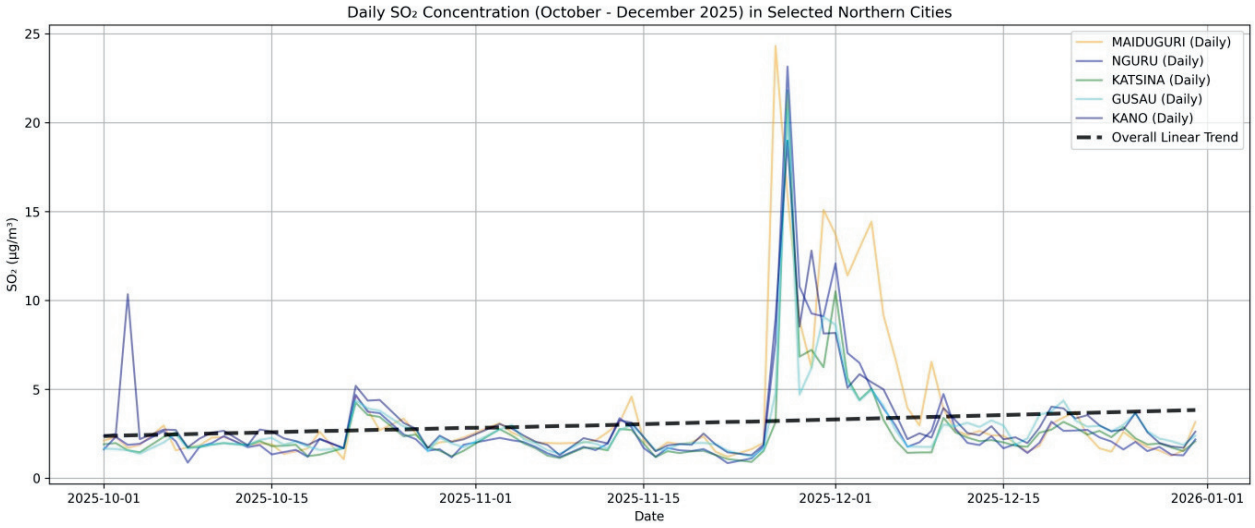

Figure 4.16: Daily Mean Concentration of Sulphur Dioxide (SO_2) across Northern Nigeria in Fourth Quarter of 2025

4.15: Daily Mean Sulphur Dioxide (SO_2) Concentration Over Southern Nigeria in the Fourth Quarter of 2025

In the fourth quarter of 2025, Calabar, Uyo and Port Harcourt consistently recorded the highest daily SO_2 concentrations among the cities in southern Nigeria. These were followed by Warri, with notable peaks around mid-October. An increasing trend was observed from October to December with the highest concentrations above 12 µg/m³ recorded in December.

The SO_2 concentrations recorded during the period under review were higher over the northern cities compared to the southern cities. However, the concentrations in both the northern and southern cities were lower than the WHO 24-hour standard limit of 40 µg/m³. The maximum, minimum, and mean SO_2 concentrations for major cities in Nigeria during this period are shown in Table 7.

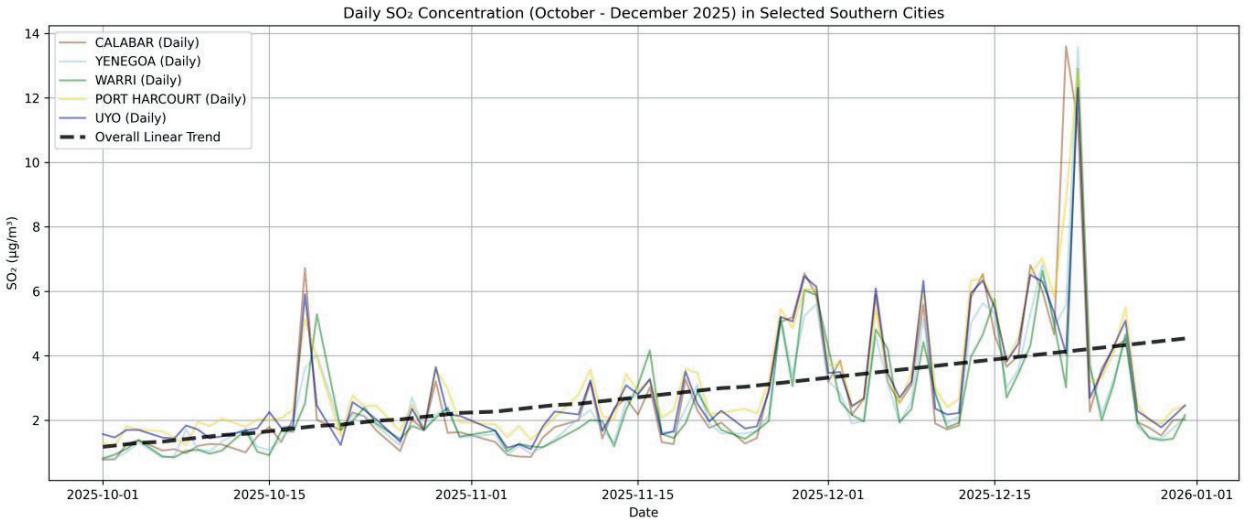

Figure 4.17 Daily Mean Concentration of Sulphur Dioxide (SO_2) across Southern Nigeria in the Fourth Quarter of 2025

Table 7: Maximum, Minimum and Mean Concentration of Sulfur DioxideSO_2 (µg/m^3) in the Fourth Quarter of 2025

	OCTOBER			NOVEMBER			DECEMBER		
CITY	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean
ABEOKUTA	3.06	0.99	1.75	8.73	1.48	2.61	5.26	1.75	3.46
ABUJA	3.72	1.17	2.09	13.32	1.98	3.76	7.60	2.28	4.49
ADO EKITI	2.83	0.81	1.62	10.85	1.33	2.81	6.43	1.46	3.68
AKURE	2.71	0.77	1.57	9.95	1.18	2.66	5.83	1.36	3.52
ASABA	4.20	1.00	1.88	8.72	1.33	2.97	8.38	1.74	3.96
BENIN	4.52	0.80	1.59	7.21	1.19	2.57	6.69	1.36	3.46
CALABAR	6.73	0.78	1.72	6.56	0.86	2.47	13.60	1.53	4.14
DUTSE	5.44	1.01	2.47	17.41	1.29	4.15	7.72	1.63	3.45
ENUGU	6.80	1.09	2.18	9.89	1.77	3.51	7.63	1.83	4.28
IBADAN	2.92	0.91	1.69	9.16	1.37	2.65	6.04	1.66	3.50
ILORIN	3.15	0.93	1.79	11.57	1.74	3.19	6.67	1.94	3.89
JOS	4.13	1.33	2.10	14.50	1.39	3.49	7.35	1.49	3.82
KADUNA	4.64	1.58	2.47	11.04	1.59	3.62	7.79	1.83	4.20
KANO	10.36	1.69	2.88	18.99	1.30	3.93	8.18	1.71	3.30
KATSINA	4.25	1.24	2.04	21.83	0.92	3.11	10.52	1.43	2.79
KEBBI	4.05	1.16	1.94	10.11	1.08	2.61	10.51	1.62	3.17
LAGOS	3.36	1.00	1.74	7.45	1.21	2.38	5.30	1.40	3.32
LOKOJA	3.34	0.97	1.86	14.18	1.54	3.49	6.68	1.75	4.20
MAIDUGURI	4.61	1.07	2.22	24.33	1.21	4.51	14.44	1.26	4.31
MINNA	4.88	1.28	2.31	11.48	2.08	3.64	8.09	2.34	4.60
NGURU	4.69	0.88	2.06	23.16	0.85	3.72	12.09	1.29	2.97
ONITSHA	4.13	0.99	1.89	8.82	1.55	3.13	8.01	1.76	4.03
OSOGBO	2.97	0.85	1.67	10.41	1.42	2.83	6.28	1.64	3.65
OWERRI	4.84	1.06	2.00	7.42	1.61	3.14	12.14	1.94	4.41
PORT HARCOURT	5.15	1.19	2.18	6.07	1.39	2.95	12.86	1.90	4.40
SOKOTO	3.74	1.04	1.89	14.55	0.86	2.60	9.42	1.36	2.94
UMUAHIA	5.39	1.10	2.09	7.79	1.64	3.22	11.26	2.08	4.56
UYO	5.91	1.23	2.04	6.46	1.11	2.72	12.31	1.78	4.11
WARRI	5.29	0.82	1.62	6.04	1.04	2.35	12.89	1.38	3.53
YOLA	4.09	0.89	2.25	14.20	1.78	4.45	12.90	1.93	4.68
ZARIA	4.84	0.97	2.38	12.49	1.37	3.71	6.49	1.73	3.71

5.0 Summary and Conclusion

During the fourth quarter of 2025, Nigeria's air quality consistently deteriorated as the ITD steadily retreated southwards moving from 16.3°N in the 1st dekad of October to 7.2°N in the 3rd dekad of December. The average monthly positions of the ITD were 14.0°N in October, 8.8°N in November, and 7.3°N in December. This progressive southward shift suppressed rainfall and enhanced dry northeasterly Harmattan winds that facilitated widespread Saharan dust transport into the country. Persistent northeasterly flows at the 925 hPa and 850 hPa pressure levels further enhanced the dispersion of dust and fine particulate matter ($PM_{2.5}$), leading to reduced visibility and deterioration of air quality all over the country, particularly across northern states.

The observed three-month mean $PM_{2.5}$ concentrations generally ranged from 15.0 to 87.0µg/m³ while daily concentrations ranged from 12 to 270 µg/m³ across the country with most of the northern and central states recording between 30 and 60 µg/m³ while concentrations exceeding 60 µg/m³ were recorded over Katsina, Kano, and parts of Jigawa, Bauchi, Kaduna, and Zamfara states during the fourth quarter of 2025. Daily concentrations reached very high levels in December with Zaria recording the highest concentrations of 270 µg/m³ while Kano, Yobe and Sokoto states recorded daily concentrations between 20 to 130 µg/m³.

Most of the southwestern states also recorded daily concentrations above 70 µg/m³. The observed $PM_{2.5}$ daily concentrations across the country consistently exceeded the World Health Organization (WHO) guideline limits of 15.0 µg/m³ per day, from October to December, and posed significant health risks to persons especially in northern Nigeria.

Nitrogen dioxide (NO_2) concentrations ranged from 4.0 to 8.0 µg/m³ over most of the states with increased concentrations recorded over Kano, Katsina, Jigawa and the FCT, suggesting increased urban anthropogenic emissions during the period under review. Despite the localized daily spikes in concentration over some northern states, the mean concentrations generally remained below the World Health Organization (WHO) 24hour threshold of 25 µg/m³.

Most of the states recorded CO concentrations of 300 to 400ppbv (0.35 to 0.46 mg/m³) while Yobe, Borno, Kogi, Ekiti, Imo, Rivers, Abia, Sokoto and part of Zamfara, Kaduna and Niger states recorded increased concentrations of 400 to 425 ppbv (0.46 to 0.48 mg/m³) during the 4th quarter. Daily concentrations reached 1000ppbv (1.15 mg/m³) over Kaduna, Kano, Katsina, Plateau, Ekiti, Ogun and Lagos states during the period under review with a general decreasing trend from October to December 2025.

The observed CO concentrations over the northern states were generally higher than those in the southern states, likely due to biomass burning, and localized vehicular emission. The observed concentrations during the fourth quarter of 2025 remained below WHO recommended threshold of 4mg/m^3.

Sulphur dioxide (SO_2) concentrations across Nigeria during the fourth quarter ranged between 2.0 and 4.0 µg/m^3. Daily concentrations reached 20 µg/m^3 in November over Borno, Yobe and Zamfara states while concentrations over the southern cities reached 12.0 µg/m^3 in December. Generally, SO_2 concentration showed increasing trend from October to December and were below WHO recommended daily limit of 20 µg/m^3 over most states except Yobe, Borno and Zamfara where daily concentrations were above WHO threshold towards the end of November 2025.

Moderate air quality generally prevailed over most states of the country with Air Quality Index (AQI) of 50 to 100 while good air quality prevailed over Ondo, Delta, Bayelsa and Rivers states. However, the quality of air was obviously poor with AQI of 101 to 150 over Sokoto, Kebbi, Zamfara, Katsina, Kano, Jigawa, Kaduna and parts of Bauchi, Plateau, Niger and the FCT during the fourth quarter of 2025, posing significant health risks especially to sensitive group of persons in these states. On daily basis, air quality was poor across Nigeria on most of the days especially in December when concentration of $PM_{2.5}$ increased in the atmosphere with peaks recorded in December due to dust transport into the country from the Sahara Desert.

Conclusion

The air quality in Nigeria consistently deteriorated from October to December 2025 due to rainfall cessation in most parts of the country especially over the northern and central states. This created dry conditions which were favourable for transportation of pollutants into the atmosphere especially particulate matter from Desert dust sources. The steady transport continuous advection of dust into the country in December increased $PM_{2.5}$ concentrations across the country. This had significant health implications on people living in the country especially children, the aged and people with respiratory related ailments. The influx of dust into the country during the period also caused reduced visibility. Economically, the aviation sector was significantly affected as flight operations were disrupted on days with very poor horizontal visibility during the period under review especially in December. Daily concentrations of $PM_{2.5}$ were above WHO thresholds across the country. The effect from other pollutants: CO, NO_2 and SO_2 were minimal as concentrations remained below WHO thresholds during the last quarter of 2025. Nigerians are therefore discouraged from unprotected exposure to the effects of particulate matter common during such periods especially during outdoor activities. Collectively, these findings highlight the need for sustained air quality monitoring, timely air quality forecast and public health advisories.

Acronyms

AQGs	Air Quality Guidelines
CAMS	Copernicus Atmospheric Monitoring System
CO	Carbon monoxide
hPa	Hectopascal
ITD	Inter-Tropical Discontinuity
kt	Knot
MSLP	Mean Sea Level Pressure
mg/m^3	Milligram per cubic meter
NO	Nitrogen dioxide 2
O_3	Ozone
PM	Particulate Matter
ppbv	Part per billion by volume
ppm	Part per million
SO_2	Sulphur dioxide
WHO	World Health Organization
µg/m^3	Microgram per cubic meter
µm	Micrometre