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STATE OF THE CLIMATE

GHANA

2024

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State of the Climate Report Ghana

2024

At the frontline of climate action

A publication of Ghana Meteorological Agency

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ABBREVIATIONS

GMet	Ghana Meteorological Agency
LTM	Long Term Mean
MAM	March April May
AMJ	April May June
MJJ	May June July
JJA	June July August
JAS	July August September
SON	September October November
ENSO	El Nino Southern Oscillation
IaTCZ	Intertropical Tropical Convergence Zone
ITD	Intertropical Discontinuity
SST	Sea Surface Temperature
TSRA	Thunderstorm with Rain

PREFACE

The state of the climate report for Ghana 2024 encompasses a comprehensive analysis of the climate conditions, climate trends and its impact in the country, focusing on the interplay between climatic changes and socio-economic factors.

Ghana's vulnerability to the effects of climate change such as erratic rainfall, rising temperatures, and extreme weather events (floods and drought) highlights the urgent need for climate monitoring. This is essential for raising awareness about climate challenges, informing policy decisions, and guiding adaptation and mitigation strategies. These weather phenomena (Rainfall and temperature) are crucial drivers of sustainable development, food security, and public health, as many infectious diseases are linked to these climatic conditions.

The Ghana Meteorological Agency, established by the Government of Ghana under the World Meteorological Organization (WMO) is mandated to monitor and analyse weather and climate information to provide expert interpretation and give advisories to support economic development and public safety. This annual report on the state of the climate aims to support collaborative efforts among policymakers, scientific institutions, stakeholders, and the general public. Since weather and climate significantly impact key sectors such as agriculture, health, water resources, energy, disaster risk reduction, environment, maritime and local government, it is crucial to emphasize the socio-economic consequences for the vulnerable populations and implement appropriate measures.

The 2024 state of the climate showcased series of extreme events stated in this report which entails the severe dry spells experienced in the Northern part of Ghana in JJA, the flood that occurred as a result of the heavy rains in the Central region and some parts of Northern Ghana causing severe havoc to lives and properties, and other relevant information with regards to the trends of various weather phenomena such as rainfall, temperature, etc. across the years. The report also delves into the behaviour of the Inter-Tropical Convergence Zone (ITCZ) and the El Niño-Southern Oscillation (ENSO), two climate drivers that significantly influence Ghana's weather patterns.

The authors hope that the information presented in this report will not only inform policy and guide research but also promote climate-resilient practices across various sectors. By

understanding the complexities of Ghana's changing climate, stakeholders can develop and implement effective adaptation and mitigation strategies to safeguard the nation's future.

This report would not have been possible without the able leadership and direction of the Director General of the Ghana Meteorological Agency, Dr Eric Asuman, and contributions of multiple individuals in the agency. The lead author, Mrs. Francisca Martey (Deputy Director, Research and Applied Meteorology Department), for her expertise and dedication in compiling and analysing the data, as well as to the contributing authors of the entire Research and Applied Meteorology Department. Their collective efforts have resulted in a comprehensive and insightful assessment of the State of the climate. We are also grateful to the various stakeholders who provided valuable feedback and support throughout the development of this report. The insights and perspectives shared by these individuals have enhanced the quality and relevance of this assessment. Finally, we acknowledge the support of GMet for providing the resources and infrastructure necessary to conduct this important work. Their commitment to advancing climate science and informing policy is essential for ensuring a sustainable and resilient future for Ghana.

FOREWORD

Dr. Eric Asuman

The climate of Ghana, a West African nation known for its diverse ecosystems and rich agricultural heritage, is shaped by an interaction of global and regional weather patterns. Over recent decades, climate change has become a subject of growing concern, with significant implications for the country's development, agriculture, and everyday life. Understanding the current state of Ghana's climate requires a multi-faceted approach, drawing insights from authoritative institutions such as the Ghana Meteorological Agency (GMet), AGRHYMET Regional Centre for West Africa and the Sahel, Centre Climatique Régional (CCR), the African Centre for Meteorological Applications for Development (ACMAD), and the World Meteorological Organization (WMO).

According to the Ghana Meteorological Agency (GMet), the climate of Ghana is characterized by a tropical climate distinct with rainfall and harmattan seasons, influenced by the West African Monsoon and the Intertropical Convergence Zone (ITCZ). However, over recent years, there has been an increasing trend of climatic variability. According to GMet's 2024 seasonal forecast, Ghana experienced different rainfall patterns, with distinct regional variations. The prolonged dry spells in the northern and transition highlight the increasing vulnerability of water resources, which is critical in a country where agriculture is largely rain-fed. This signaled a potential shift in agricultural cycles, necessitating strategic adjustments from farmers and local authorities.

The state of the climate for Ghana highlighted 2024 as the year ranked with the highest average temperature of 28.5°C since 1981, which was above the normal average temperature (27.6°C). The impact of this temperature increase is a growing concern for the public, health, energy and other sectors. Prolonged dry spells had the potential to affect crop yields, pest infestation, water availability, and even the comfort and productivity of urban populations.

One of the key findings from the 2024 state of the climate was the increased urgency for resilience building across sectors such as agriculture, water management, and urban planning, Ghana must adapt to its changing climate by improving early warning systems, diversifying agricultural practices, and adopting climate-smart technologies. The role of the Meteorological Agency in providing accurate and timely forecasts becomes even more significant as the country navigates this evolving climate landscape.

In its climate outlooks, the African Centre for Meteorological Applications for Development (ACMAD), GMet's continental body has highlighted the growing frequency of extreme weather events in the region, including droughts and floods, which have worsened vulnerability in Ghana. According to GMet, the 2024 rainfall season saw an extreme in the dry spell days with some places in Northern Ghana recording 37 and 38 days. These conditions further underscore the need for adaptive strategies in agriculture, water management, and infrastructure to build resilience against climate-related disasters. ACMAD's assessments also note that the northern part of Ghana, where temperatures have been rising steadily, faces increased risks of desertification and water scarcity, which could destabilize local communities and livelihoods. The assertion echoed by GMet and EPA led the government of Ghana to develop a project called green Ghana project to combat desertification and mitigate the effects of climate change in Ghana.

As we move forward, the collaboration between the Ghana Meteorological Agency, other government agencies, NGOs, and citizens is crucial. It is only through collective action that Ghana can mitigate the adverse effects of climate change and create a sustainable future for its people. Only through concerted effort can Ghana navigate the complexities of its changing climate, ensuring that the country remains resilient in the face of environmental challenges, and its people continue to thrive amidst change.

EXECUTIVE SUMMARY

Mrs. Francisca Martey

The Ghana Meteorological Agency produces the State of Climate Report annually in fulfillment of its statutory responsibility to inform the government and the people of Ghana on how weather and climate variables such as temperature, rainfall, and extreme weather performed in the year. This information is relevant for decision-making, planning, and policy formulation as it gives an idea of the weather in the past year and the actions and measures to adapt to the coming years. The report is particularly useful for individuals in both private and public sectors, such as agriculture, aviation, construction, water resources, health, tourism, trade, and others.

In 2024, Ghana faced significant climate-related challenges, including temperature increase, below-normal average annual rainfall, prolonged dry spells, and floods, underscoring the urgent need for comprehensive adaptation and mitigation strategies for socio-economic development. Below are the highlights of the 2024 State of Climate Report.

Temperature

Generally, Ghana experienced warmer conditions with an average temperature of **28.5°C** in the year 2024 with a standardized anomaly of **+2.1**, which marked the highest average temperature anomaly since 1981. Wa and its environs recorded below-normal to moderate-average temperatures, whereas areas such as Accra, Ho, and Akim Oda recorded significantly increased temperatures.

Rainfall Amount

Seasonally, rainfall was generally normal to below normal. The AMJ season was slightly above normal. However, the MJJ, JJA, and JAS seasons were below normal rainfall. The rainfall deficit was particularly pronounced during the JJA and JAS seasons. Additionally, the SON season in 2024 was within the normal range but marked the lowest since 2017. The annual average rainfall was below normal, with evidence from the Northern and Transition zones, which experienced below-normal rainfall, particularly between June and September.

The prolonged dry spell conditions from June to August (JJA) and July to September (JAS) caused significant rainfall deficits.

Onset Dates

The 2024 major rainfall season in Southern Ghana began early in the forest zone, with Abetifi recording its onset on February 19. Asamankese experienced a significantly delayed onset in mid-April, while the west coast areas which include Saltpond, Takoradi, and Axim, had a late onset in May.

The transition zones experienced an early onset. In the Northern Sector, Tamale experienced an early onset while Navrongo, Vea, Zuarungu, Bole, and Bui recorded a late onset.

Dry Spell Days

The longest dry spell days within the Southern sector for 2024 were experienced at Mim, which recorded 14 dry days, 7 days longer than its long-term mean (LTM). Areas along the Coast such as Accra, Takoradi, Saltpond, and Axim experienced shorter dry spell days. In the late dry spell of the season, Mim recorded 9 days, making it the shortest, while Bui had the longest, with an average of 17 days.

In the northern sector, Salaga recorded the longest dry spell period in the sector, experiencing a maximum of 14 days. Bolga, Vea, Garu, and Zuarungu recorded the shortest early dry spell period of 4 days.

Cessation

The 2024 major rainfall cessation for the southern Sector indicated an early cessation in the transition zones. Dormaa Ahenkro, Cape Coast, and Saltpond recorded exceptionally late cessation. The Northern Sector generally had a late cessation except for Salaga, which had an early cessation. Wenchi observed an extremely late cessation.

Length of Season

During the 2024 season, Wenchi and Kintampo experienced the longest season of 249 days, while Kade in the forest recorded the shortest season of 70 days. Considering the Northern Sector in 2024, Bolgatanga also experienced a longer season of 244 days whereas Vea had a shorter season of 135 days.

Extreme Weather Events

In 2024, a heavy downpour in June and October resulted in severe flooding in the Central and Northern Regions, damaging infrastructure, and wiping out several acres of farmland. Prolonged dry spells experienced in July and August led to withered crops and disruption in crop production. Farmers who depend heavily on rain-fed agriculture found themselves facing uncertainty as their crops failed to thrive.

1.0 INTRODUCTION

1.1 General Weather and Climate Features of the Country

The climate of Ghana exhibits significant variability, both temporally and spatially. Like other regions in West Africa and tropical areas worldwide, Ghana is prone to a range of climate extremes, including floods, prolonged dry spells, and droughts, amongst others. Over the past decade, there has been a noticeable increase in the frequency and intensity of these extreme weather events, a trend attributed to ongoing global warming and climate change (IPCC, 2021; Lott et al., 2013)

Situated on the southern coast of West Africa, Ghana is bordered by Togo to the east, La Cote d'Ivoire to the west, Burkina Faso to the north, and the Atlantic Ocean (referred to as the Gulf of Guinea) to the south. Geographically, Ghana spans latitudes 4°N to 12°N and longitudes 1.5°E to 3.5°W. Major weather phenomena in Ghana include rainfall, fog, mist, haze, thunderstorms, lightning, gusty winds, and hail, contributing to the country's diverse climate conditions (Ampofo et al, 2023). The main driver of weather and climate conditions in Ghana is the bi-annual northward and southward movement of the overhead sun across the equator. Rainfall in the region is mostly influenced by the migration of the Inter-Tropical Discontinuity (ITD). The ITD oscillates south to north and back and so modulates the pressure system of the West African Monsoon (Michael Baidu et al. 2017).

The country is demarcated into four distinct climatic zones, namely Northern, Transition, Forest and Coastal zones characterized by variations in seasons, temperatures, rainfall patterns, onset, cessation, and duration. It has mainly humid tropical climatic conditions. Rainfall in Ghana is characterized by its seasonal nature, following a bimodal distribution in the South and unimodal rainfall in the Northern zone.

1.2 Rainy Season

In Ghana, the major rainy season in the Southern region, below 8° latitude, typically spans from March to June, followed by a minor rainy season from September to November, creating a bimodal rainfall pattern. Conversely, the Northern region, situated at 8° latitude and above, experiences a single rainy season from April to October. August marks a break in the rainy season for the south, known as the ‘little dry season’. During this period, there is a temporary decrease in rainfall activity.

1.3 Dry Season

The dry season, known as Harmattan, prevails from December to February, characterized by dry north-easterly winds carrying dust into the country. Harmattan adversely affects visibility and air quality. Temperature patterns in Ghana are significantly influenced by its geographic location and topographical features. The highest temperatures are typically recorded in the extreme northern regions, especially in March, where temperatures can soar between 35°C to 40°C or even higher during peak heat periods. These areas, closer to the Sahelian zone, face intense heat due to its proximity to the Sahara Desert and the dry harmattan winds blowing from the north. The southern parts of Ghana, particularly areas within the forest zone and along the coast, generally experience milder temperatures. The lowest temperatures are often recorded, notably in August, when cooler air mass causes a drop in temperatures, resulting in daily averages ranging between 22°C and 27°C.

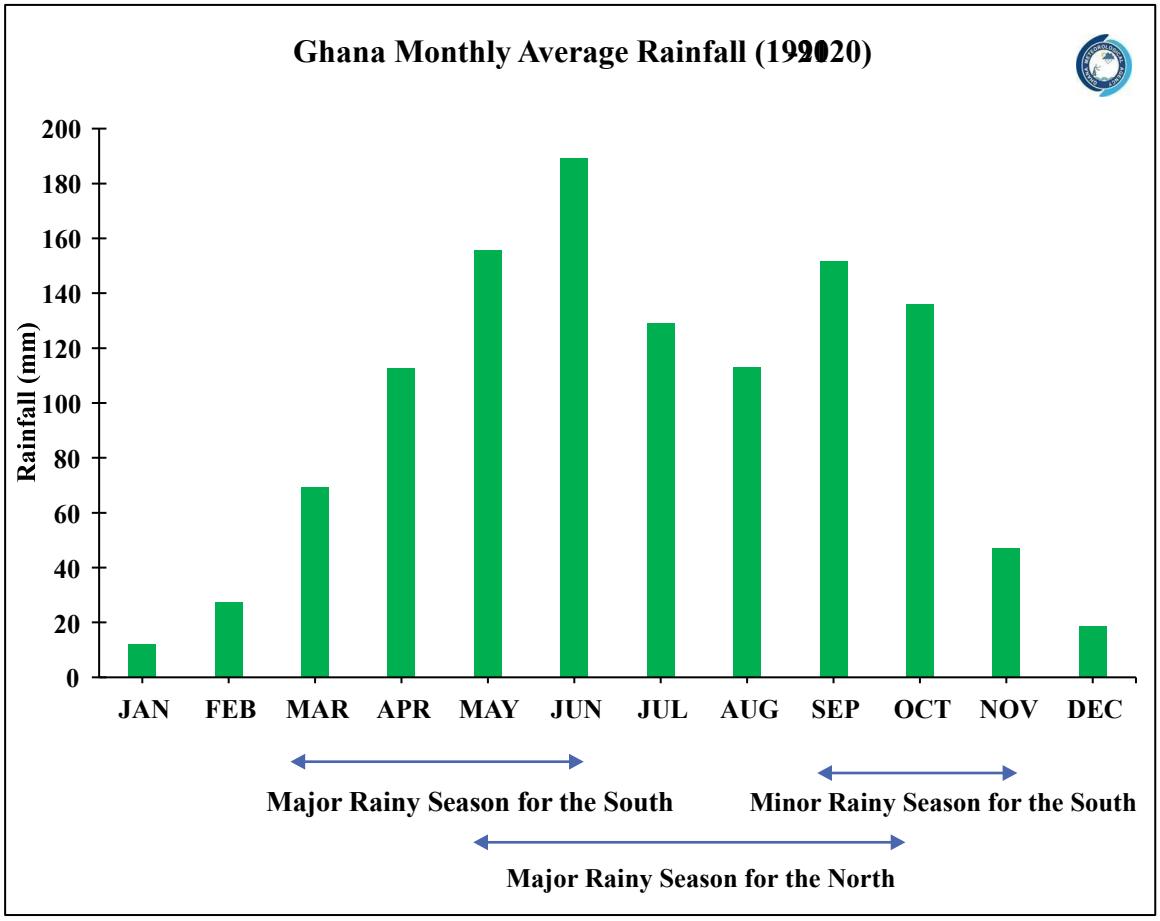


Figure 1.1. Average monthly distribution of rainfall across Ghana (1991_2020).

1.4 Winds

The surface wind patterns in Ghana are predominantly characterized by south-westerly winds during the wet season from March to November. For the dry season, from December

to February, the north easterlies are the predominant winds. They are particularly intense in the northern regions but also affect the southern areas to a lesser degree, causing lower humidity and sometimes hazy conditions.

1.5 Climate Change Impact

Climate change in Ghana causes significant damage to humans, infrastructure, and natural resources. Ghana's growing population faces high risks from floods and droughts, deforestation and land degradation, poor air and water quality, rising heat stress, and depletion of natural resources. Between 1968 and 2021, 32 major natural disasters were reported, mostly in the past two decades and mostly on account of floods, followed by droughts. On average, flooding affects about 45,000 Ghanaians every year and half of Ghana's 550-kilometer coastline is vulnerable to erosion and flooding as a result of sea-level rise. Meanwhile, droughts and dry periods have caused significant agricultural losses over the past decade, resulting in food insecurity or famines and lost working days and livelihoods. Under present climate conditions, 13 percent of the population is estimated to be affected by drought, particularly in the Northern belt.

Ghana's road network is still inadequate to provide rural-urban connectivity for all people in the country and faces high exposure and vulnerability to climate change. Despite the significant expansion of Ghana's road infrastructure, some rural communities remain disconnected. Most of these disconnected communities are in the Volta basin or Northern region. Many others are connected by roads that are threatened by changes in temperature, precipitation, and climate-induced natural hazards, facing increasing risks of economic and social isolation. Flooding and landslides are the most frequent and damaging for Ghana's roads, with around 117 kilometres affected by flooding each year. (World Bank Group., 2022).

Heat conditions can lead to flare-ups in chronic conditions and diseases, worsen mental health, increase one's chances of having a heart attack, getting an infection, or being injured at work. Extreme heat also impacts labour productivity; at a 3-degree Celsius increase from 1990 levels, Ghanaians' manual labour capacity is projected to drop by 11%. Climate change's impact on the migratory patterns of herders and increased competition for resources among food producers can exacerbate social tensions and lead to violence. Farmer-herder conflict over arable land, water, and crop damage caused by trespassing

livestock can lead to destruction of property, armed robbery, ethnic marginalization, and violence. (The Climate Reality Project, June 2023).

For the evaluation of the state of the climate for 2024, forty-seven (47) meteorological stations across the country with rainfall data and twenty-one (21) meteorological stations with maximum and minimum temperature data were used.

2.0 OBSERVED KEY CLIMATIC PARAMETERS IN 2024

2.1 Temperature

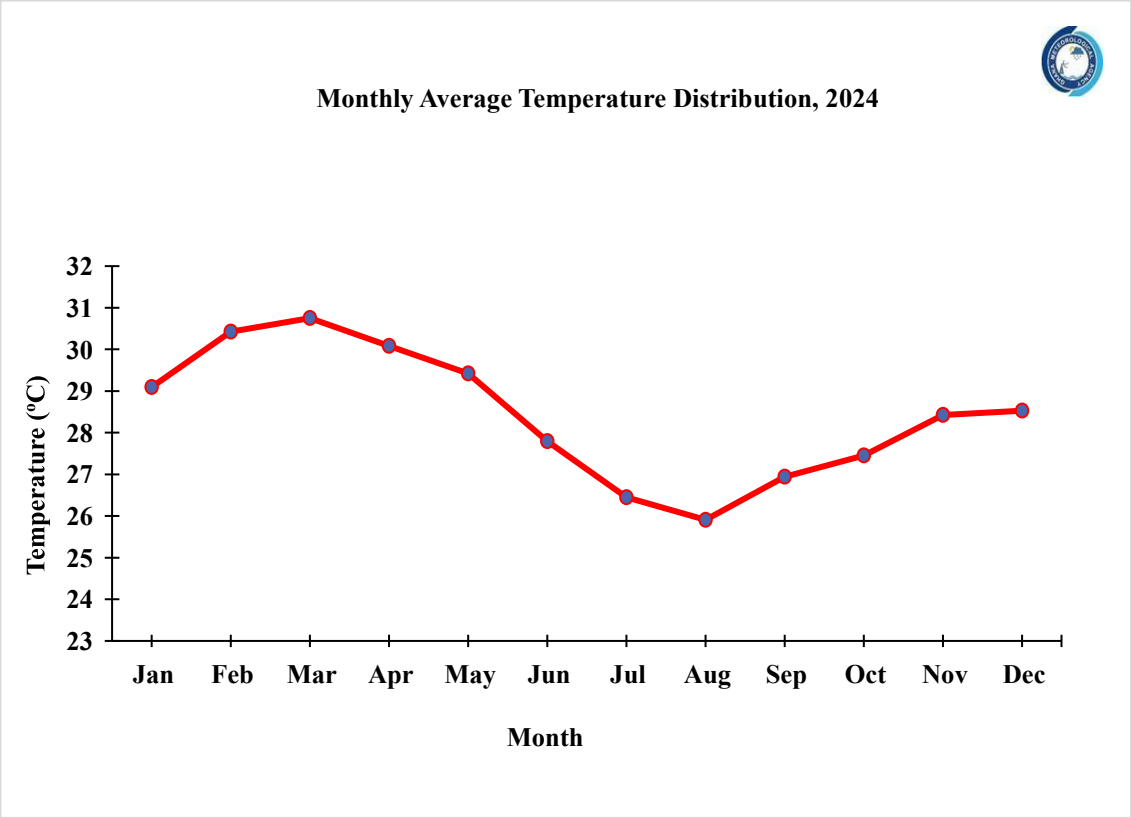
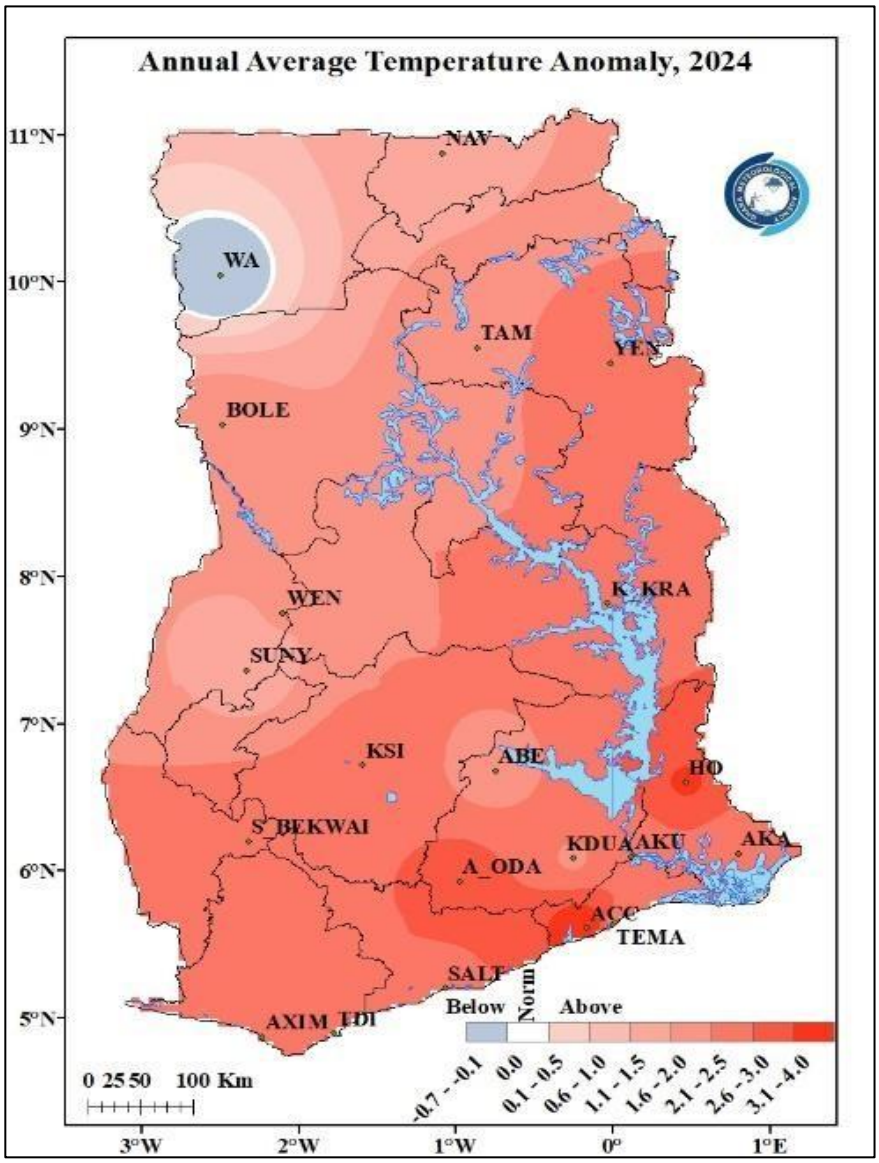


Figure 2.1. Monthly average temperature distribution across Ghana, 2024.

The graph above shows Ghana's monthly average temperature distribution in 2024, with a rise in temperatures from January to March, peaking at 31°C. After March, the temperature gradually declined, reaching 28°C by May, likely due to the onset of the rainy season. The most significant drop occurred between May and August, when the average temperature decreased to 26°C, indicating the cooler, wetter conditions of the rainy season. The average annual temperature for Ghana was 28.5°C with an LTM of 27.5°C. The 2024 temperature anomaly map for Ghana reveals a noticeable warming trend throughout most of the country. Coastal areas, such as Accra, and Tema experienced significant temperature increases. In the Forest zone, cities like Kumasi, Ho, and Koforidua also show moderate to

high-temperature changes. Meanwhile, Northern Ghana displays a mixed pattern, with most areas warming, while parts of the Upper West Region showed slight cooling.



Map 2.1. Annual Average Temperature Anomaly in Ghana 2024.

The annual average temperature anomalies show a clear warming trend from 1991 to 2024, with recent years showing increasingly significant deviations above the baseline. The 1990s were dominated by cooler-than-average years, as indicated by negative anomalies. However, starting in the 2000s, positive anomalies became more frequent and larger, signifying a shift toward consistently warmer conditions. This trend accelerated in the 2020s, which are dominated by positive anomalies, reflecting the impact of global

warming. Notably, 2024 stands out as an extreme outlier with the highest recorded anomaly of +2.1, aligning with the global state of the climate report.

Annual Temperature Anomaly

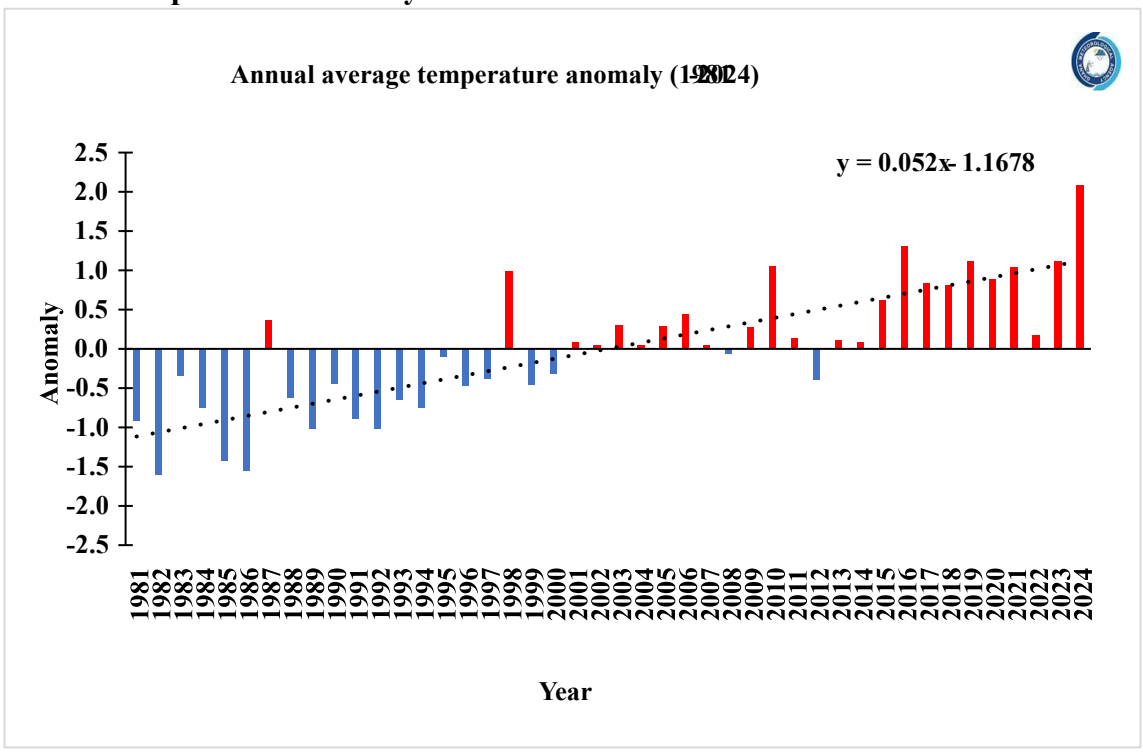


Figure 2.2. Annual Average Temperature Anomaly in Ghana, 1981-2024.

Annual Temperature Rankings (1981-2024)

***NB**: Temperatures recorded from 2020 to 2023 are shown in green and temperatures for 2024 are shown in red.*

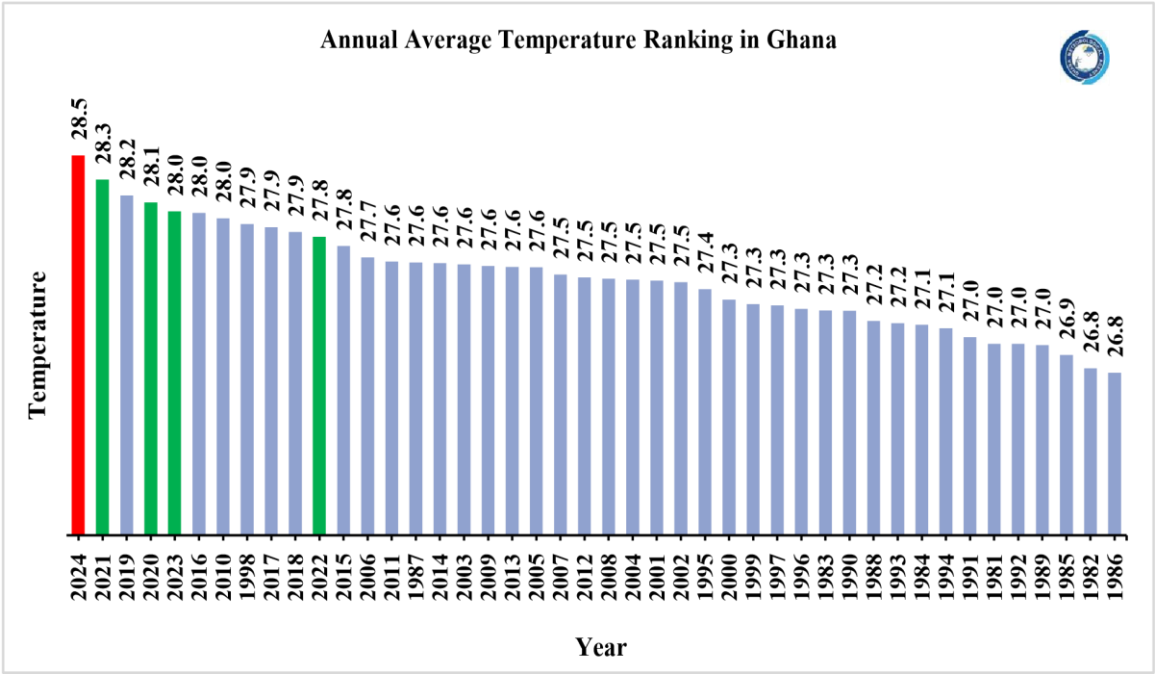
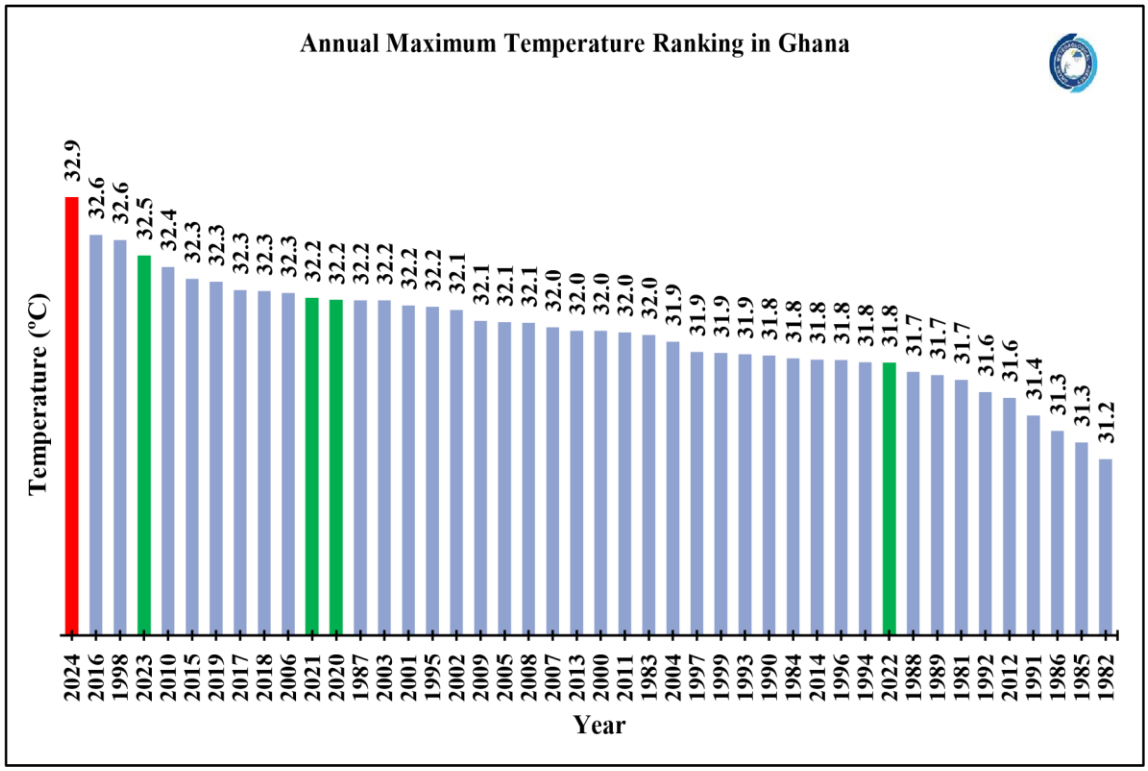


Figure 2.3. Annual Average Temperature Ranking, (1981-2024)



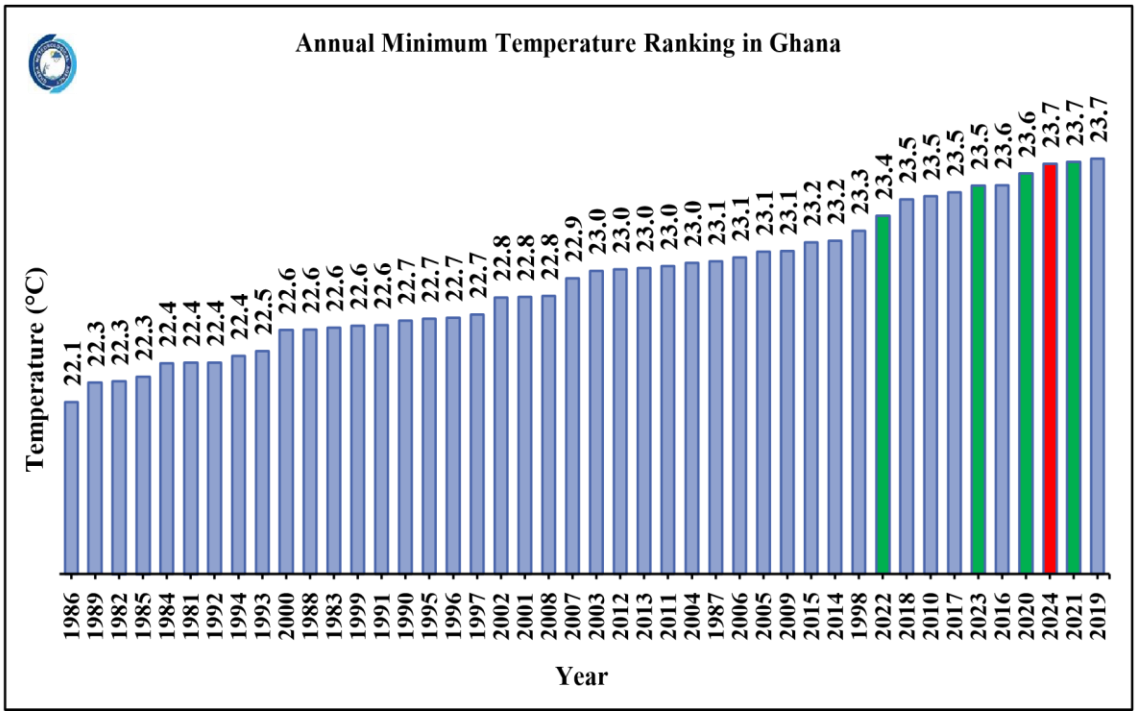


Figure 2.4. Annual Maximum, Minimum Temperature Ranking in Ghana, 1981-2024

2.1.1 Annual Average Temperature

The average temperature ranking shows a consistent rise in Ghana's annual average temperature, with 2024 being the highest on record (28.5°C). The warmest years are concentrated in the most recent decade, with 2023, 2021, 2020, and 2019 also among the

top. In contrast, earlier years, particularly before 2000, had significantly lower average temperatures, with 1986 (26.8°C) being the lowest.

2.1.2 Annual Average Maximum Temperature

Ghana in recent years has recorded record highs, of which 2024 is a record, being 32.9°C. This is closely followed by 2016, which is 32.5°C, supporting a clear trend of an increase in temperature. The other years, 2023, 2015, and 2010 were all in the first ten, with an average temperature of 32.3°C.

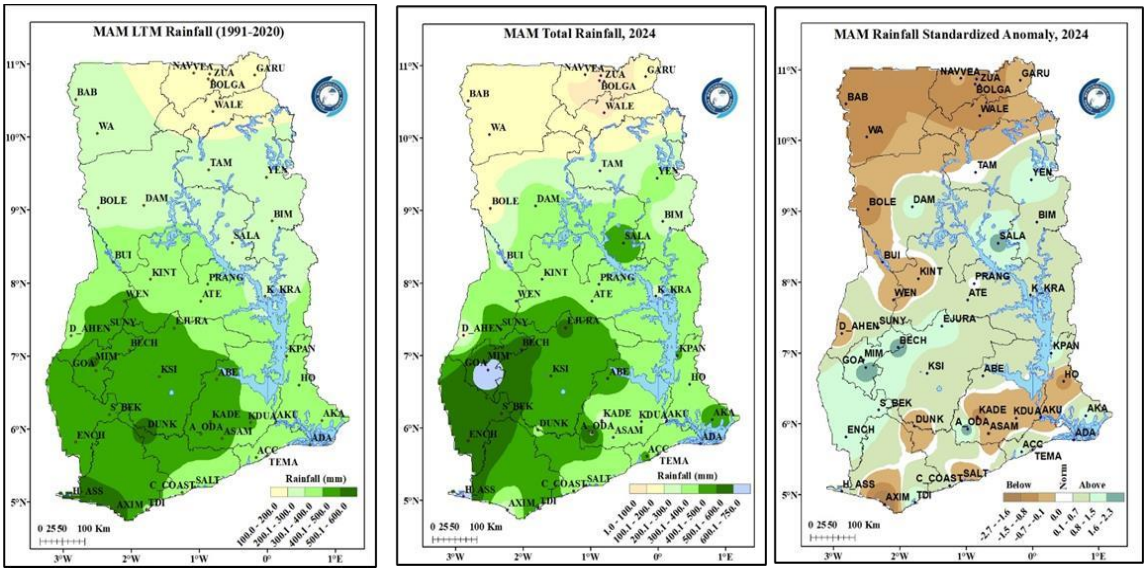
2.2.3 Annual Average Minimum Temperature

The ranking of minimum temperature shows a steady rise in Ghana's annual minimum temperatures from 22.1°C in 1986 to 23.7°C in 2019, indicating a long-term warming trend. 2024, 2021, and 2019 rank the warmest minimum temperatures in recent years with 23.7°C

2.2 Rainfall

2.2.1 Review of the Major Rainy Season for the South 2024 (March - June)

March April May (MAM)



Map 2.2. Spatial distribution of LTM, Total rainfall, and anomalies for MAM 2024.

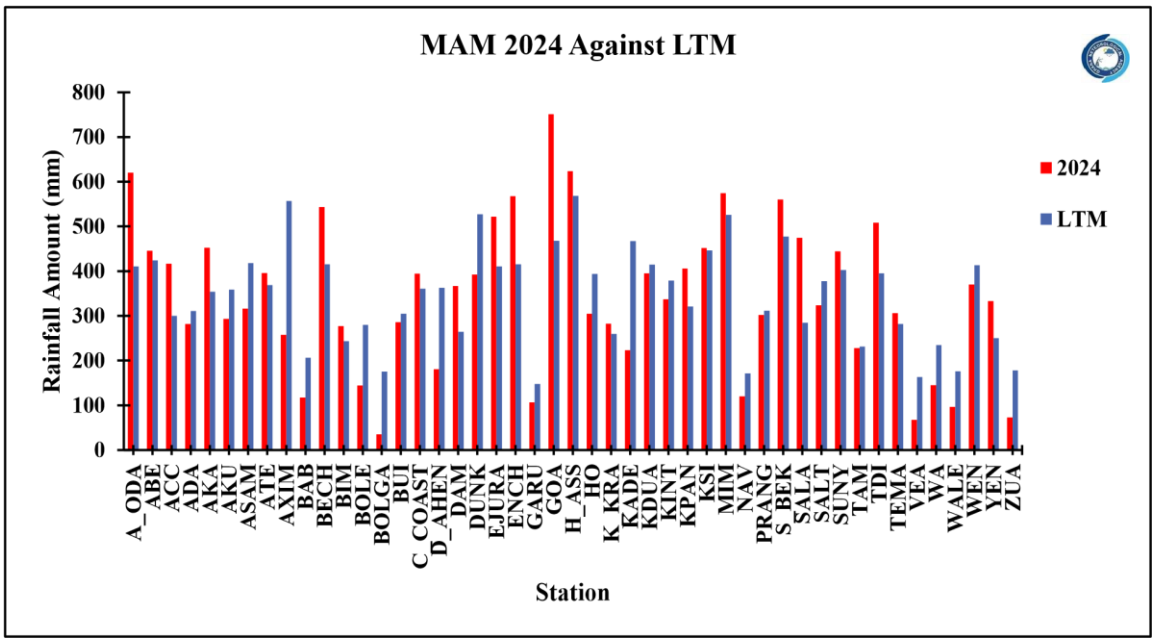
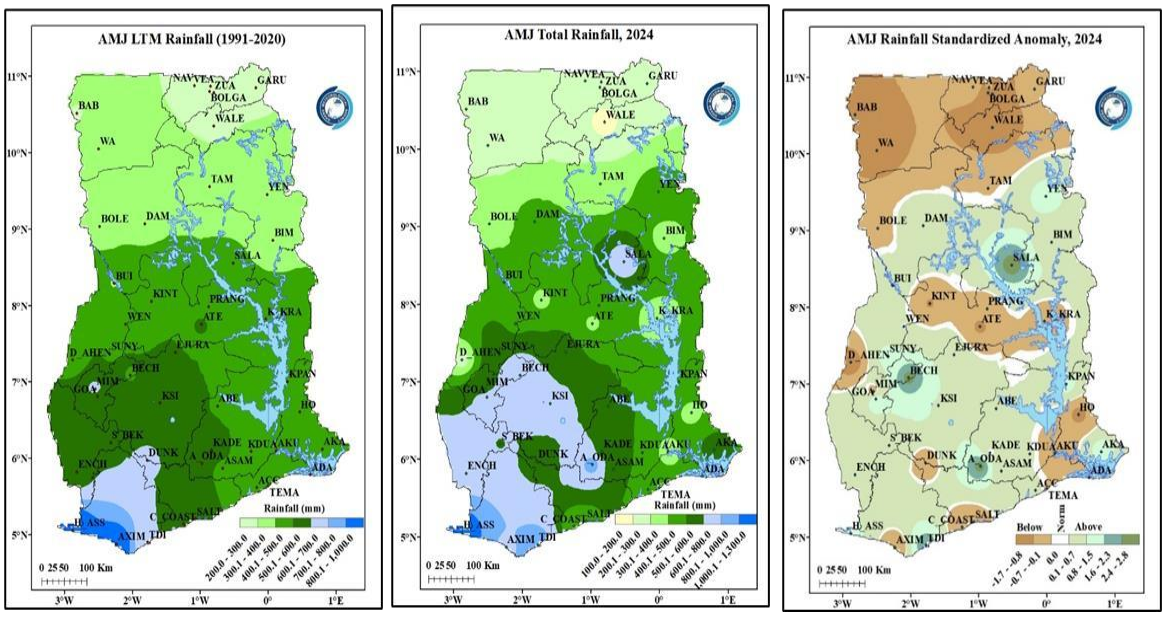


Figure 2.5. MAM 2024 Rainfall Totals against LTM (1991-2020).

The MAM 2024 season in Ghana exhibited notable differences in rainfall across the regions. The south-western part of the country saw above average rainfall, with totals ranging from **500 to 750mm**. Goaso recorded the highest rainfall amount of **750 mm**. In contrast, the transition zone and the east coast experienced moderate rainfall between 300 and 400 mm. The Northern sector received less than **300mm** of rainfall with some locations

such as Zuarungu, Bolgatanga, and Walewale recording the least amounts below 100mm. Normal to above normal rainfall was observed in most areas in the south and transition zone. Areas such as Bui(6% below its normal), Kintampo(11% below its normal) and Wenchi(10% below its normal) in the Transition zone, Dormaa Ahenkro (50% below its normal), Dunkwa Offin (26% below its normal), Axim (54% below its normal), Saltpond (15% below its normal), Kade(52% below its normal), Asamankese (24% below its normal), Koforidua (5% below its normal), Akuse (18% below its normal) and Ho (23% below its normal) in the South experienced below normal rainfall. The north generally experienced normal to below normal rainfall except for areas such as Damongo (38% above its normal), Salaga (67% above its normal), Bimbila (14% above its normal) and Yendi (33% above its normal) that recorded above normal rainfall.

April May June (AMJ)



Map 2.3. Spatial distribution of LTM, Total rainfall, and anomalies for AMJ 2024.

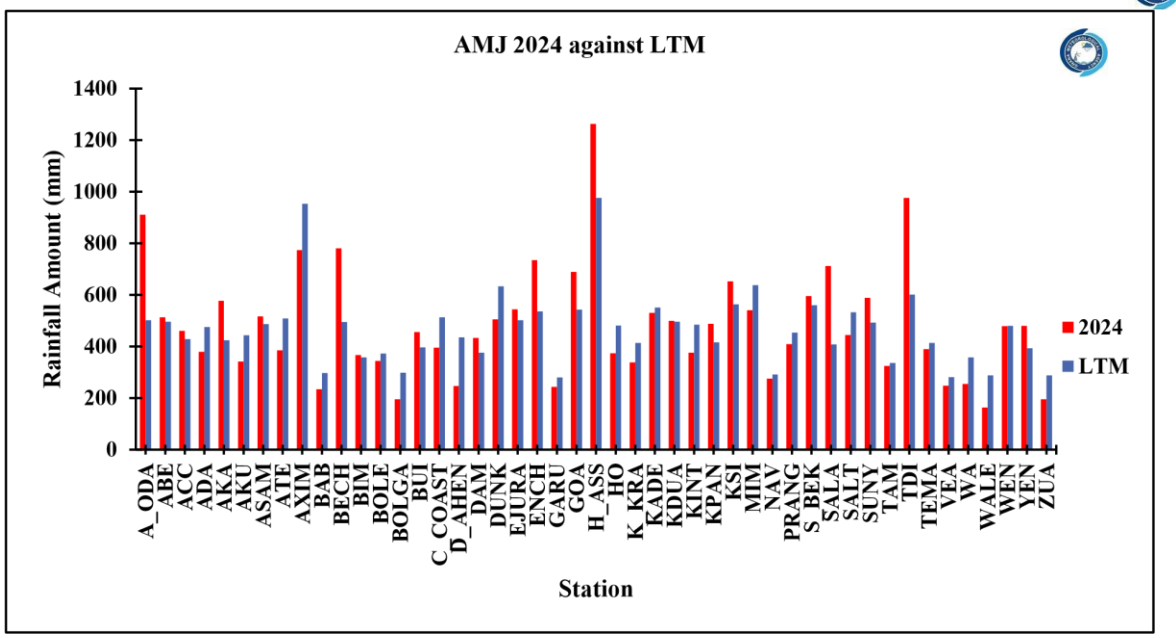


Figure 2.6. AMJ 2024 Rainfall Totals against LTM (1991-2020).

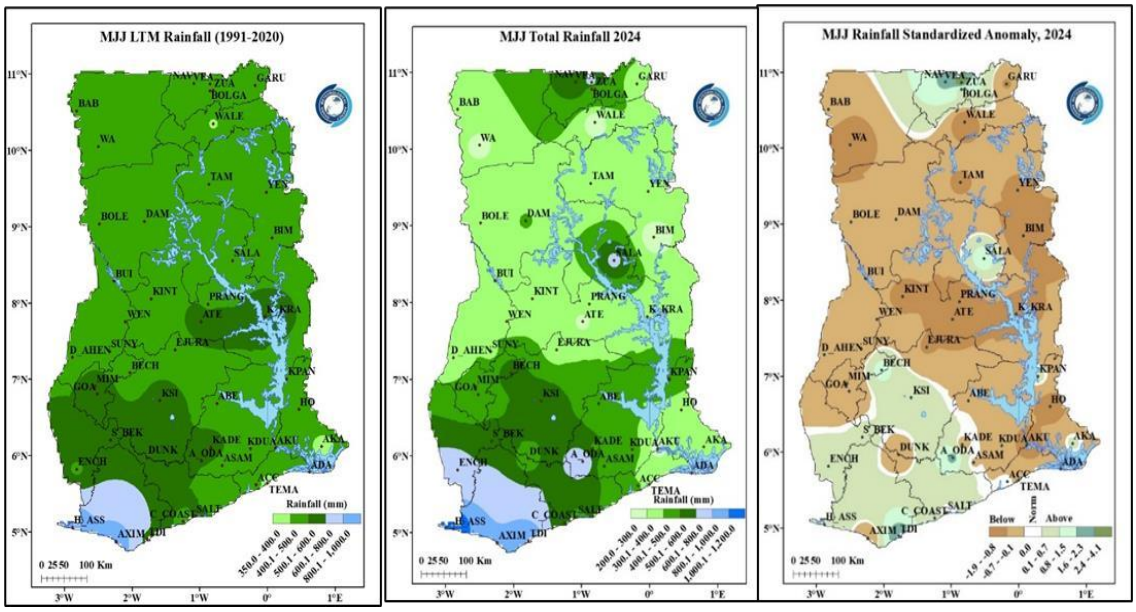
The AMJ climatology map of Ghana highlights that rainfall typically exceeds 600 mm in the southwestern region, gradually decreasing toward the northeast, where rainfall is generally the lowest. Northern regions, Transition zones, and the East Coast usually receive less than 600 mm on average. During AMJ 2024, rainfall was significantly higher than normal, especially in the southwest. Areas such as Half-Assini, Axim, Takoradi, Sefwi-Bekwai, Enchi, Akim Oda, Salaga, Bechem, and Kumasi experienced rainfall between 800 mm and 1300 mm. Southeastern and

Transition areas recorded 500–600 mm, with exceptions like Kintampo, Atebubu, DormaaAhenkro, Ho, and Akuse receiving between 300–400 mm. Rainfall in the Northern regions ranged from 200–400 mm, with the lowest levels (100–200 mm) recorded in Walewale. Rainfall anomalies showed normal to above average in locations such as Yendi (22% above its normal), Salaga (74% above its normal), Bechem (57% above its normal), Akim Oda (81% above its normal), Akatsi (36% above its normal), and Takoradi (62% above its normal). However, below average rainfall occurred in Northern regions like Babile (22% below its normal), Wa (29% below its normal), Zuarungu (33% below its normal), Bolgatanga (35% below its normal), and Walewale (44% below its normal), as well as other parts of the country including Kintampo (22% below its normal), Atebubu (24% below its normal), Kete-Krachi (18% below its normal), and Dormaa-

Ahenkro (43% below its normal).

2.2.2 Review of the Major rainy season for the North 2024 (May-September)

May June July (MJJ)



Map 2.4. Spatial distribution of LTM, Total rainfall and anomalies for MJJ 2024.

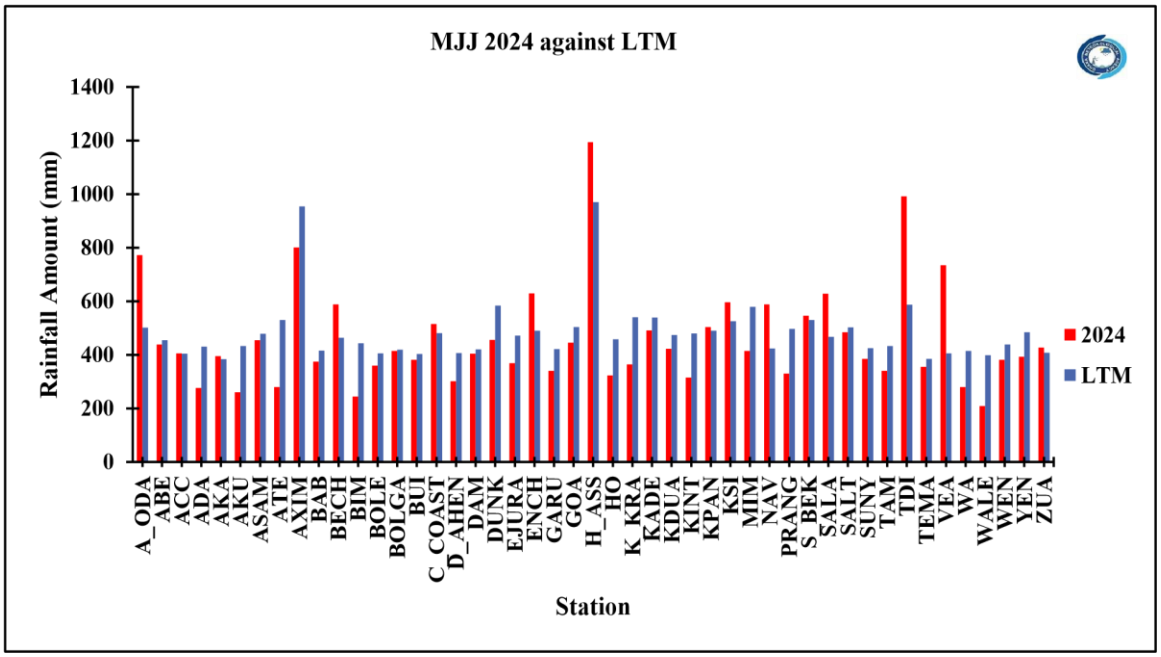


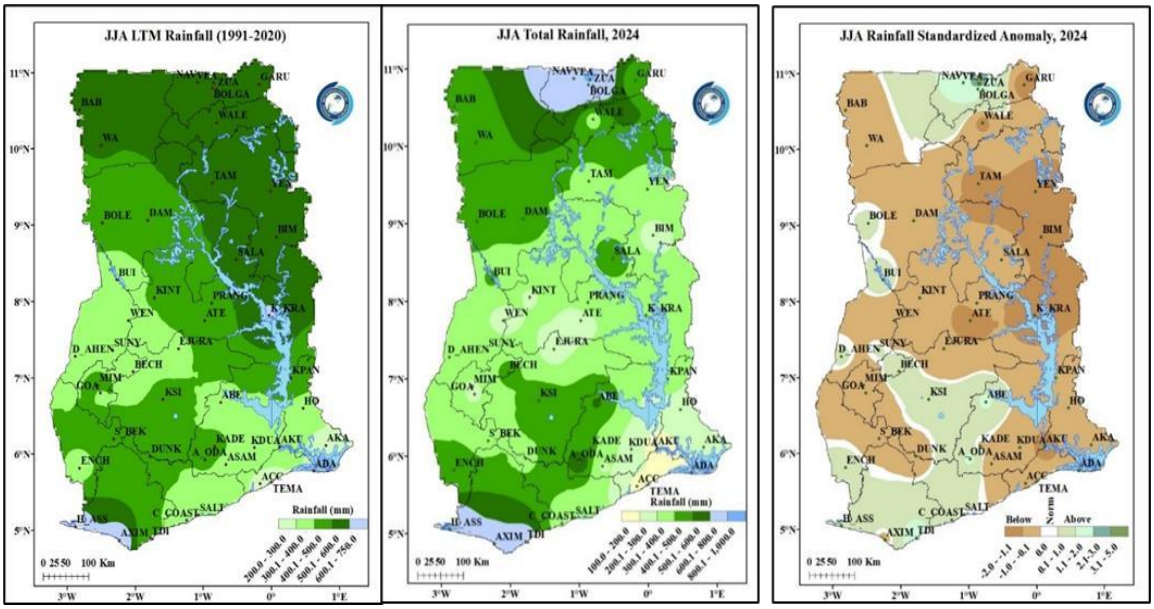
Figure 2.7. MJJ 2024 Rainfall Totals against LTM (1991-2020).

The rainfall distribution for the MJJ period in 2024, compared to the long-term mean (1991-2020), shows that large parts of Ghana experienced below-average rainfall. The LTM indicates that historical rainfall during this period typically ranges from 400 to over 1000 mm, with higher amounts in the Southwest and Coastal areas. However, the 2024

total rainfall map reveals a notable reduction in rainfall across the country, especially in the Northern and Forest zones, where totals were significantly low. The Southwestern and Coastal regions, including places like Axim and Half Assini, maintained a higher rainfall compared to other areas.

Total rainfall MJJ 2024 further highlights these below-average conditions, with most of northern, central, and eastern Ghana showing negative anomalies, indicating a rainfall deficit. Few areas of the country, especially around Salaga (34% above its normal) and parts of the Upper East such as Navrongo (36% above its normal), Vea (81% above its normal) and Zuarungu (5% above its normal) received above average rainfall. Overall, the spatial distribution of rainfall was uneven, reflecting a deficient performance during this period.

June July August (JJA)



Map 2.5. Spatial distribution of LTM, Total rainfall and anomalies for JJA 2024

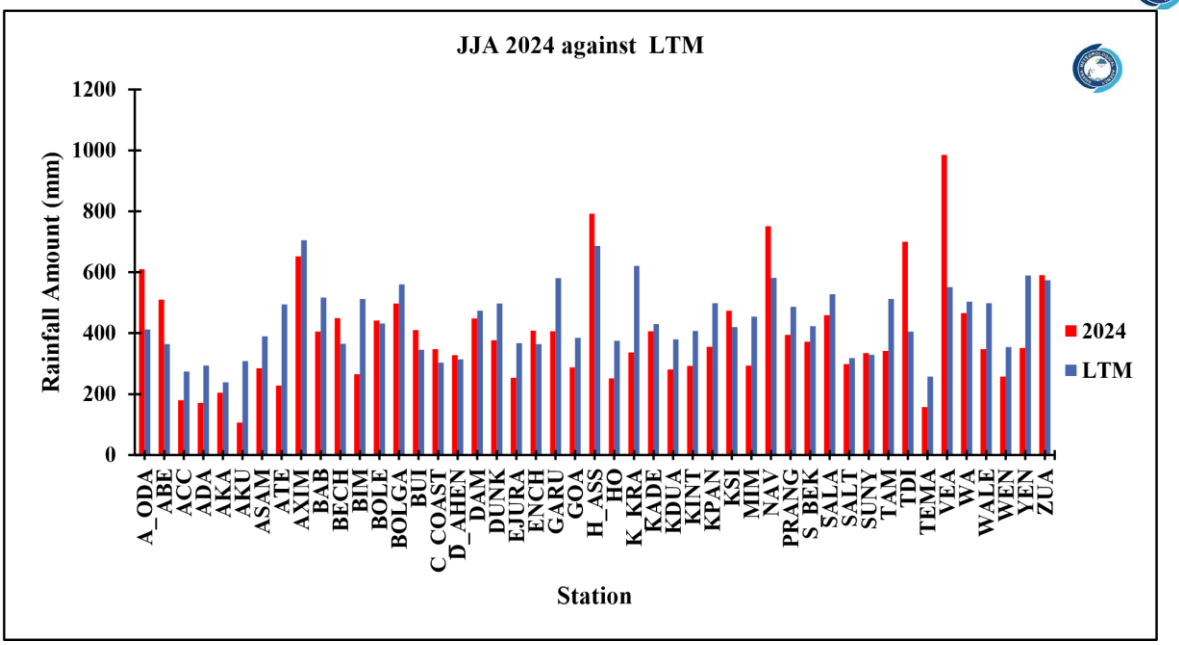
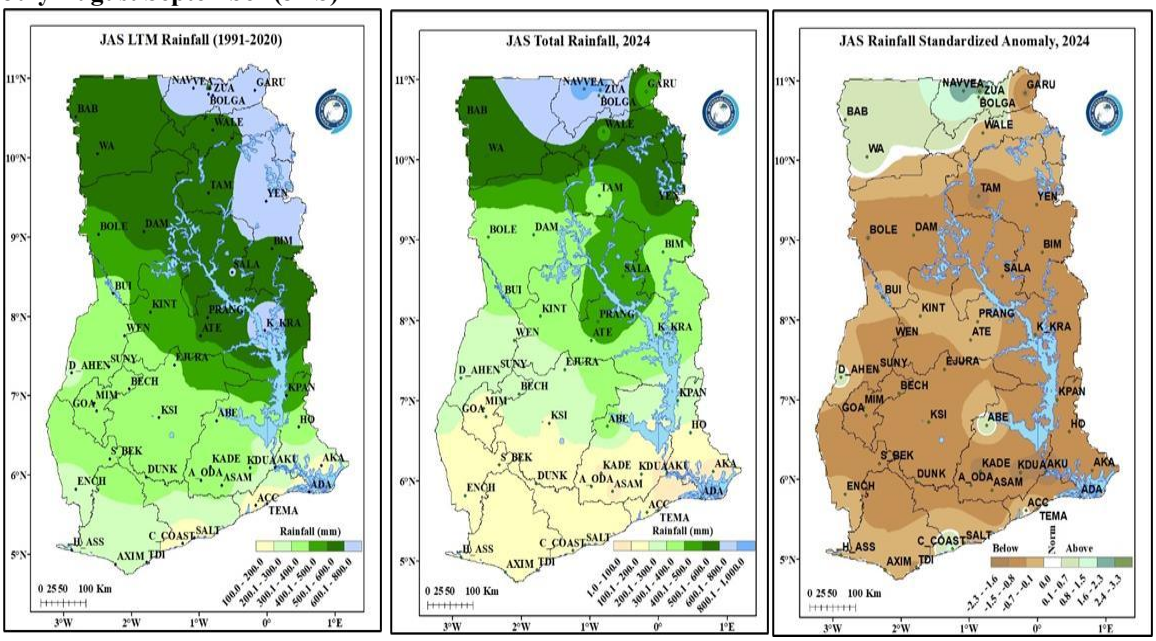


Figure 2.8. JJA 2024 Rainfall Totals against LTM (1991-2020).

During the JJA season, most parts of the country received deficit rainfall, while only a few areas received surplus rainfall. The highest amounts of rainfall were recorded at Vea, Half Assini, and Navrongo, with 985.1, 792.4, and 751.5 mm, respectively. In contrast, Akuse, Tema, and Ada received low rainfall amounts of 106.4, 157.5, and 171.2 mm respectively. In the North and Transition zone, stations like Vea (79% above its normal), Navrongo (29% above its normal), Bole (2% above its normal), and Bui (19% above its normal) had slightly above normal rains. The remaining areas experienced below-normal rainfall. This season was mainly characterized by longer than normal dry spells.

July August September (JAS)



Map 2.6. Spatial distribution of LTM, Total rainfall and anomalies for JAS 2024.

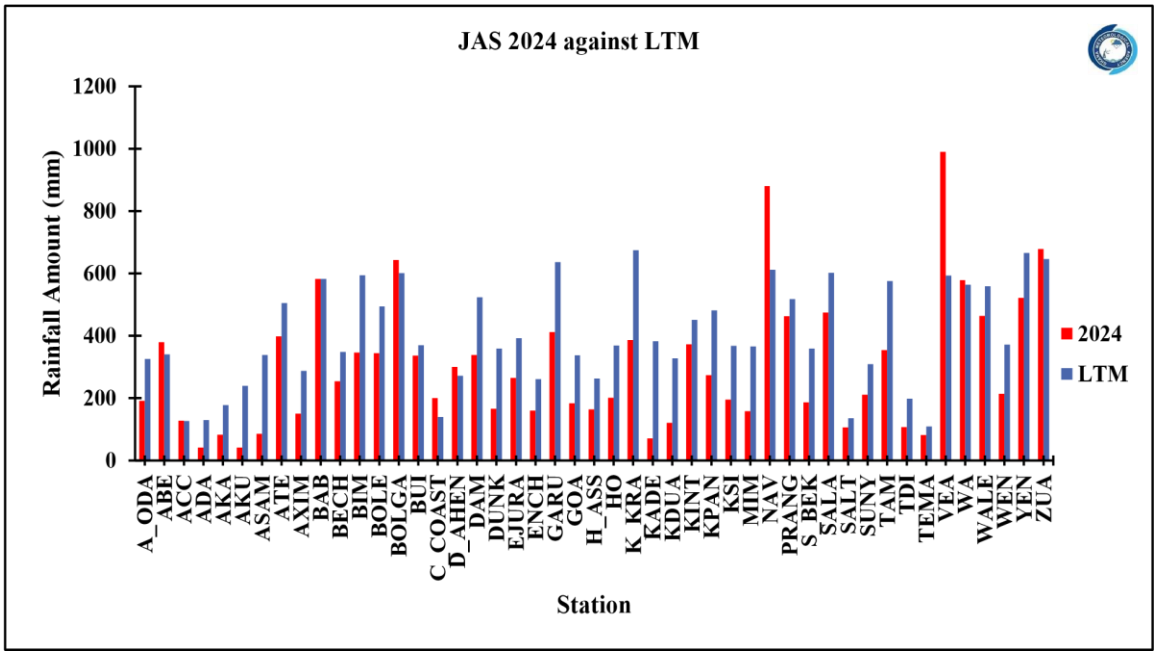
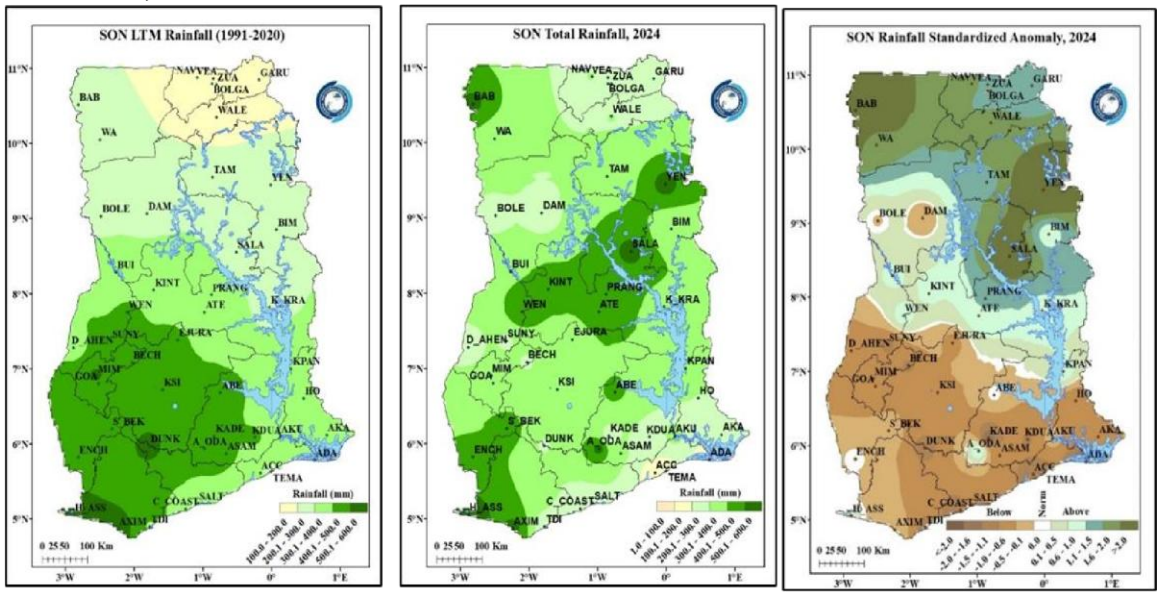


Figure 2.9. JAS 2024 Rainfall Totals against LTM (1991-2020).

A review of rainfall during the JAS 2024 season showed below-normal rainfall over most parts of the country. The rainfall distribution both in time and space was poor because of a prolonged dry spell in July extending into August. In September, the distribution of rainfall was good over several parts of the country, especially over the extreme Northern sector. The seasonal rainfall analysis from 1st July to 31st September shows a deficit rainfall over parts of the Northern sector, Transition, Forest, and Coastal zones, apart from Dormaa Ahenkro (11% above its normal), Abetifi (12% above its normal) and Cape Coast (43%

above its normal) as well as the extreme northern sector in areas such as Wa (3% above its normal), Navrongo (44% above its normal), Vea (67% above its normal), Zuarungu (5% above its normal) and Bolgatanga (7% above its normal) that experienced above normal rainfall.

2.2.3 Review of the Minor rainy season for the South 2024 (September -October-November)



Map 2.7. Spatial distribution of LTM, Total rainfall and anomalies for SON 2024.

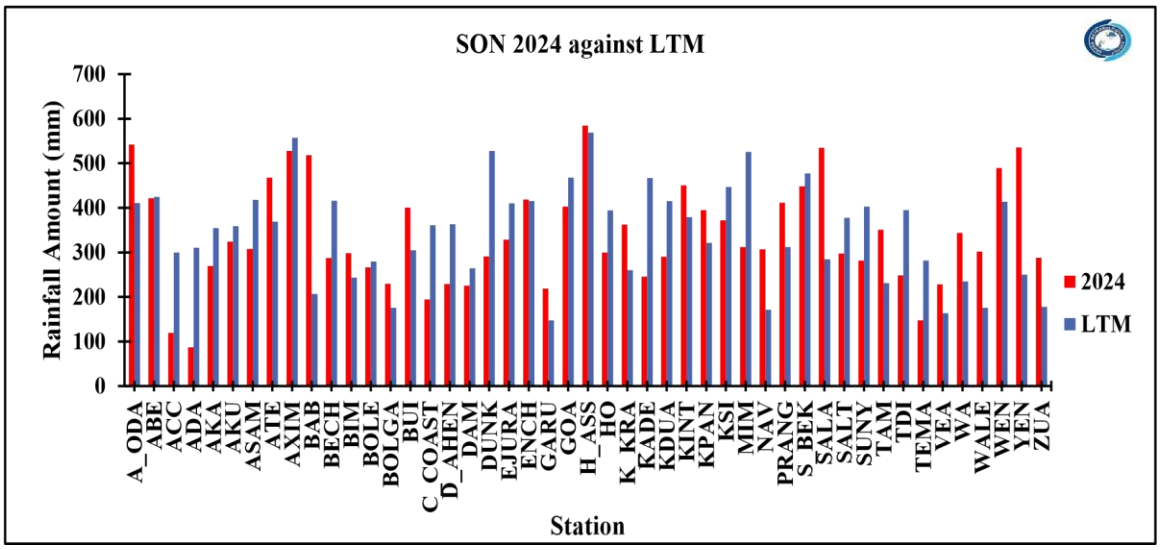


Figure 2.10. SON 2024 Rainfall Totals against LTM (1991-2020).

Southern Ghana receives high rainfall during the SON season, whilst the Northern zone records lower rainfall amounts. In 2024, Northern Ghana recorded an above-average rainfall against the long-term mean, whilst the South recorded below-average rainfall except Akim Oda (3% above its normal) and Half Assini (3% above its normal). The above-average rainfall experienced in the North could be attributed to the late southward

movement of the ITD. This late southward movement of the ITD could have contributed to the below-average rainfall recorded in the South. Enchi had normal rainfall during the season.

3.0 TRENDS

This section assesses the trends in rainfall and temperatures from 1991 to 2024 and highlights the performance for 2024.

3.1 Rainfall Trends

The total annual and seasonal (MAM, AMJ, MJJ, JJA, JAS, and SON) rainfall trends across climatic zones have been analysed for selected stations representing the four zones. The analysis is based on GMet station data for Tamale, Sunyani, Kumasi, and Accra, representing the Northern, Transition, Forest, and Coastal zones respectively. The results reveal a high variability of rainfall in Ghana.

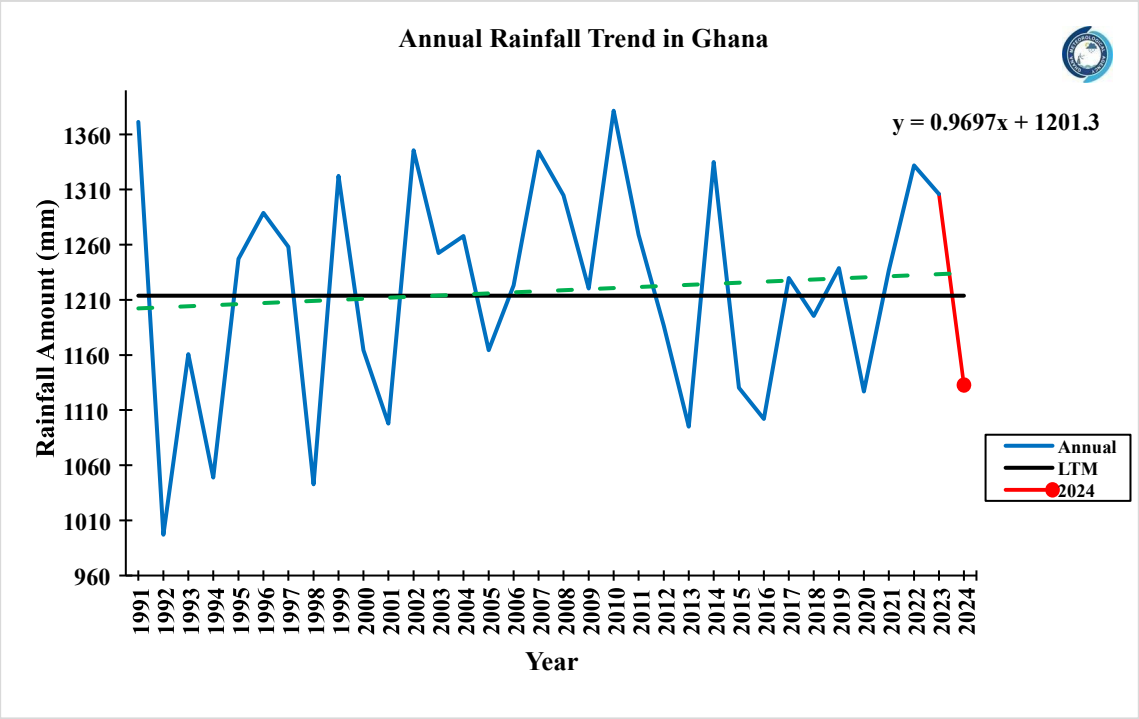


Figure3.1. Trends in annual rainfall for Ghana.

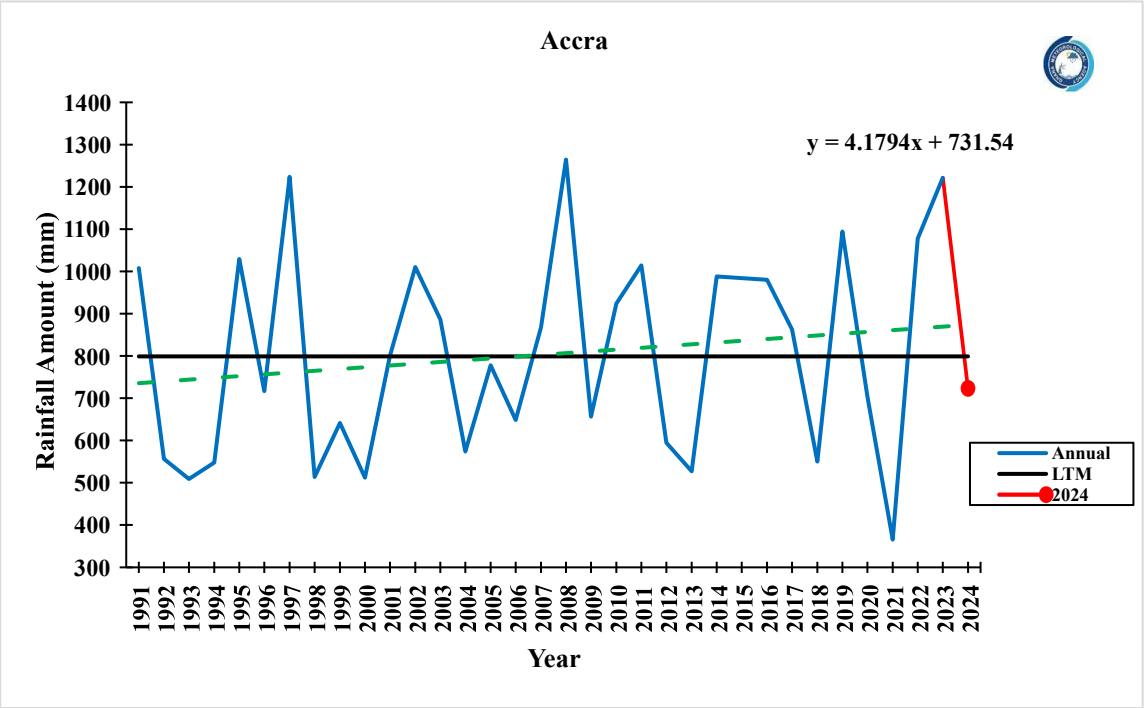


Figure3.2. Trends in annual rainfall for Accra.

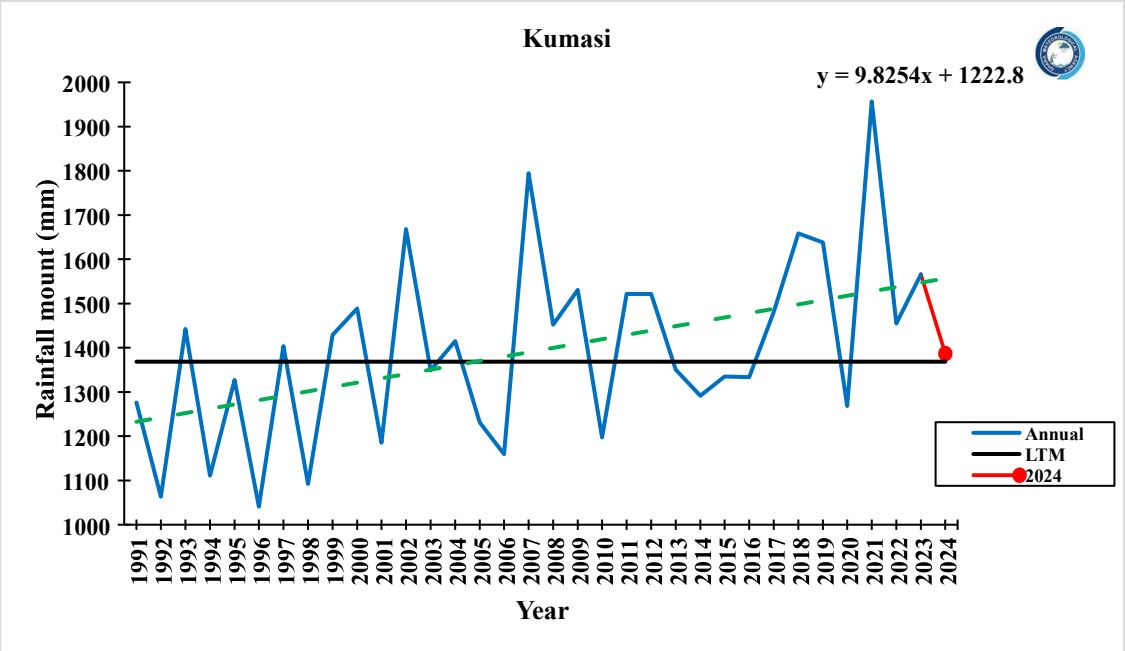


Figure3.3. Trends in annual rainfall for Kumasi

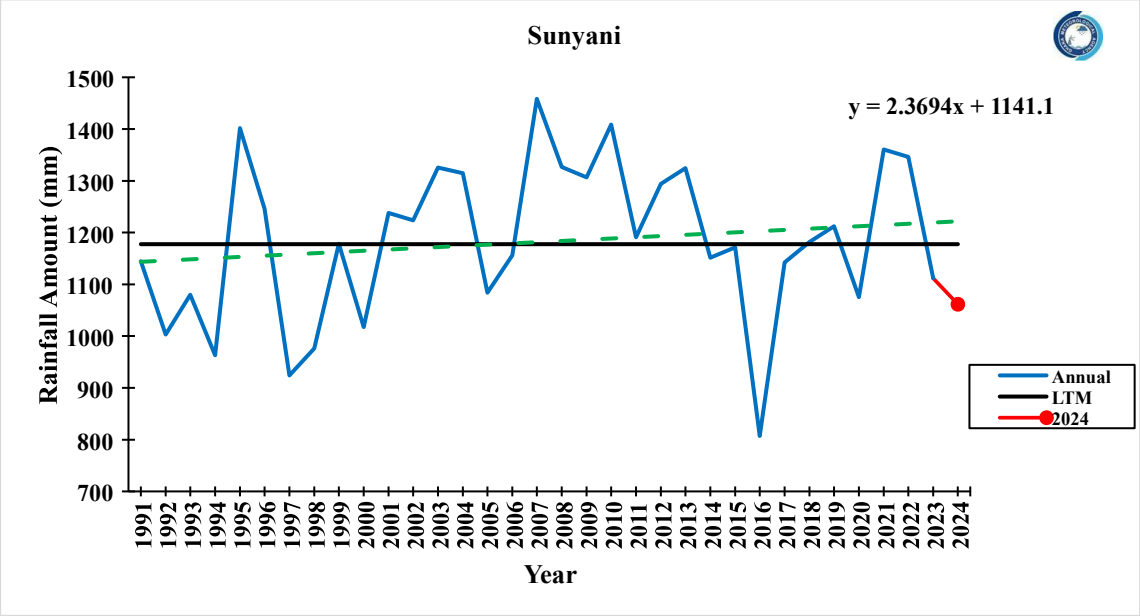


Figure3.4. Trends in annual rainfall for Sunyani

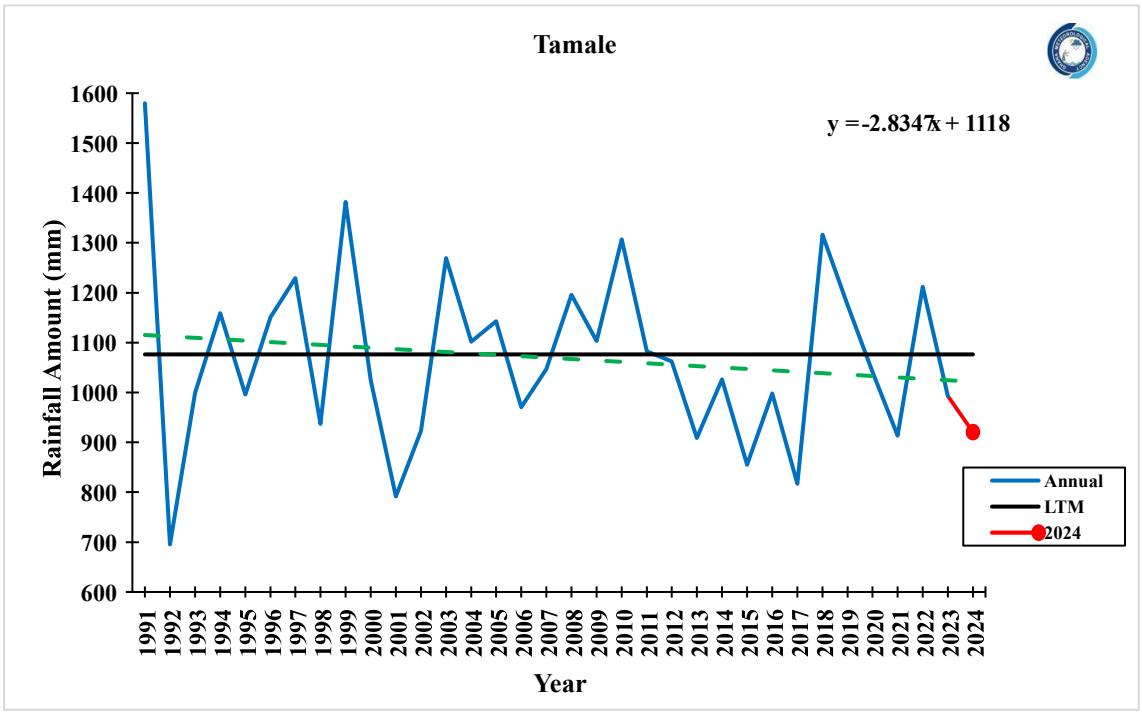


Figure3.5. Trends in annual rainfall for Tamale

In 2024, rainfall was predominantly normal to below-normal across the country. The annual rainfall recorded in Accra was 723 mm, Kumasi (1387 mm), Sunyani (1062 mm), and Tamale (920 mm), as compared to their LTMs of 800 mm, 1369 mm, 1077 mm, and 1076 mm respectively. The total annual rainfall for 2024 was 1133 mm, the lowest since 2020 and below its LTM of 1214 mm.

Seasonal Rainfall Trend

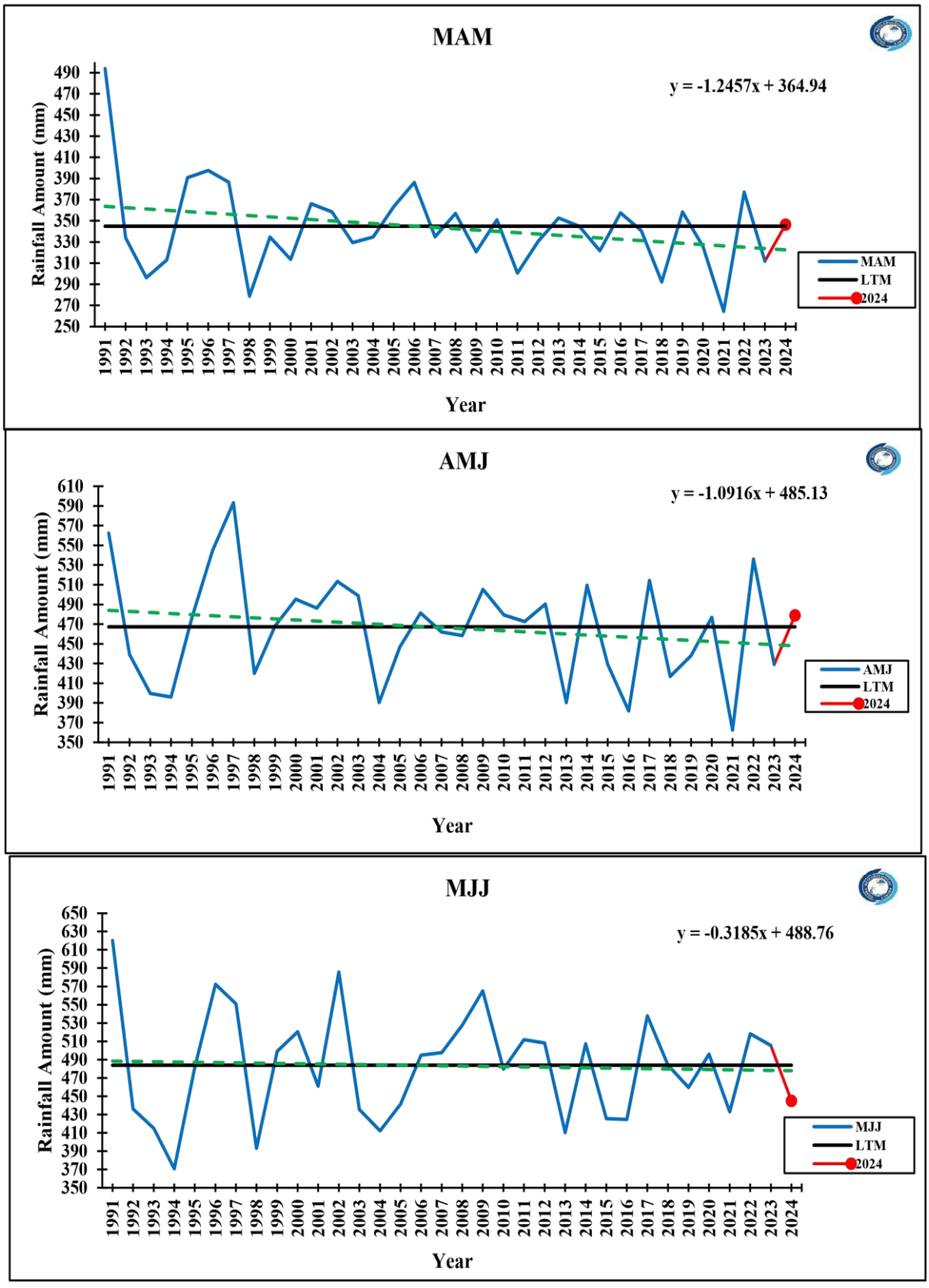


Figure 3.6 Trends in Rainfall for MAM, AMJ and MJJ (1991–2024).

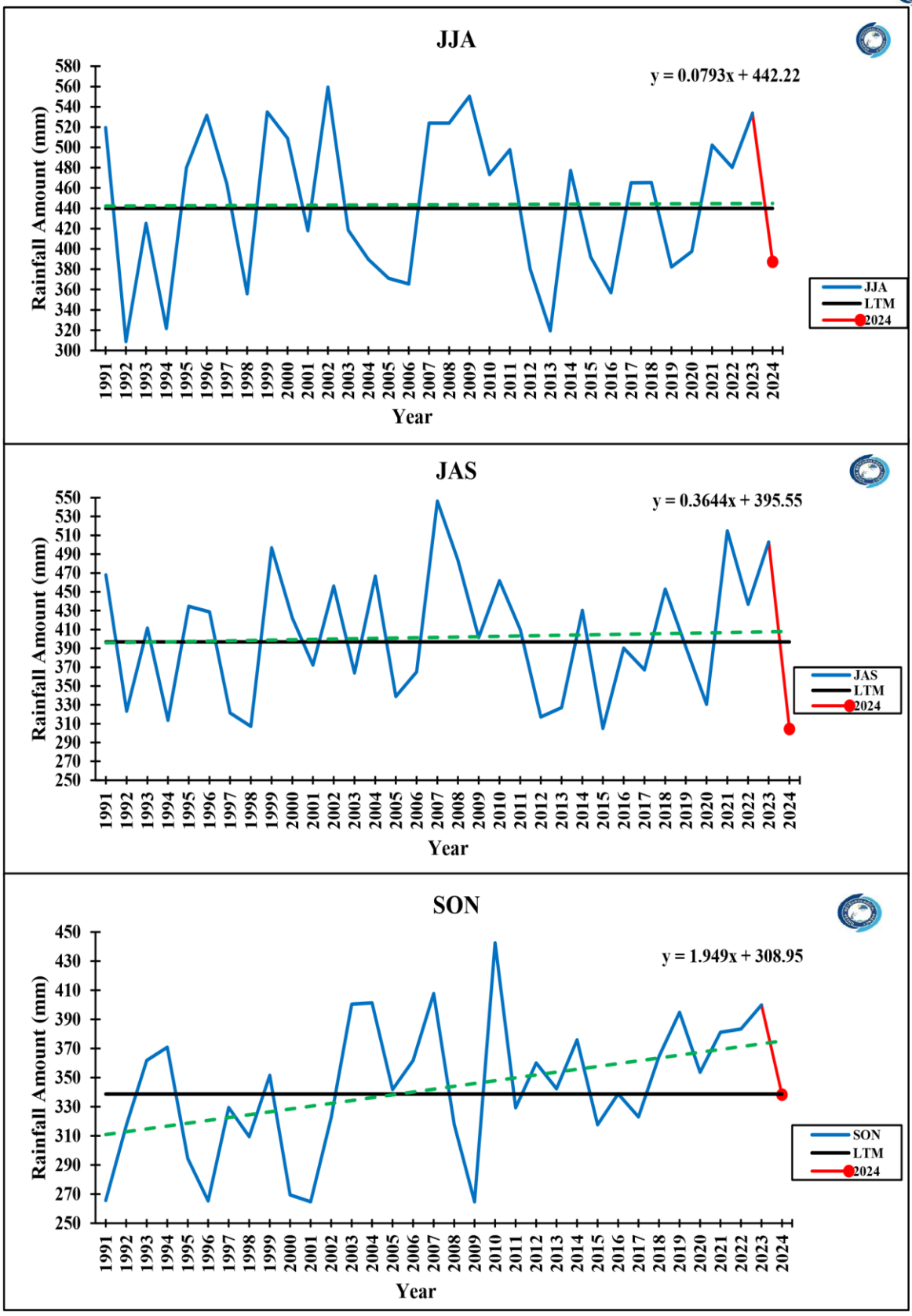
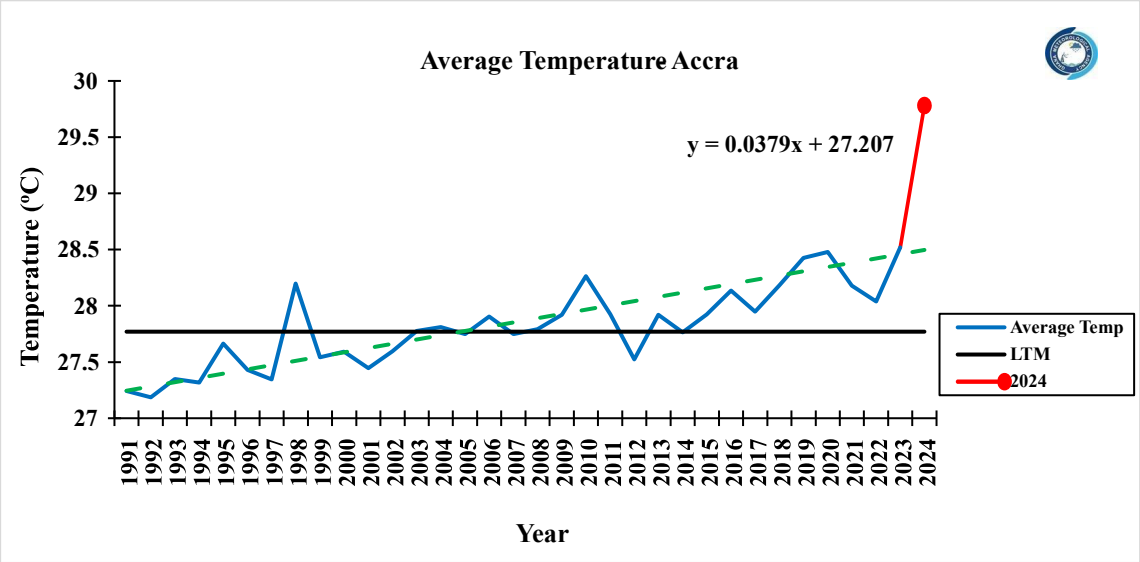
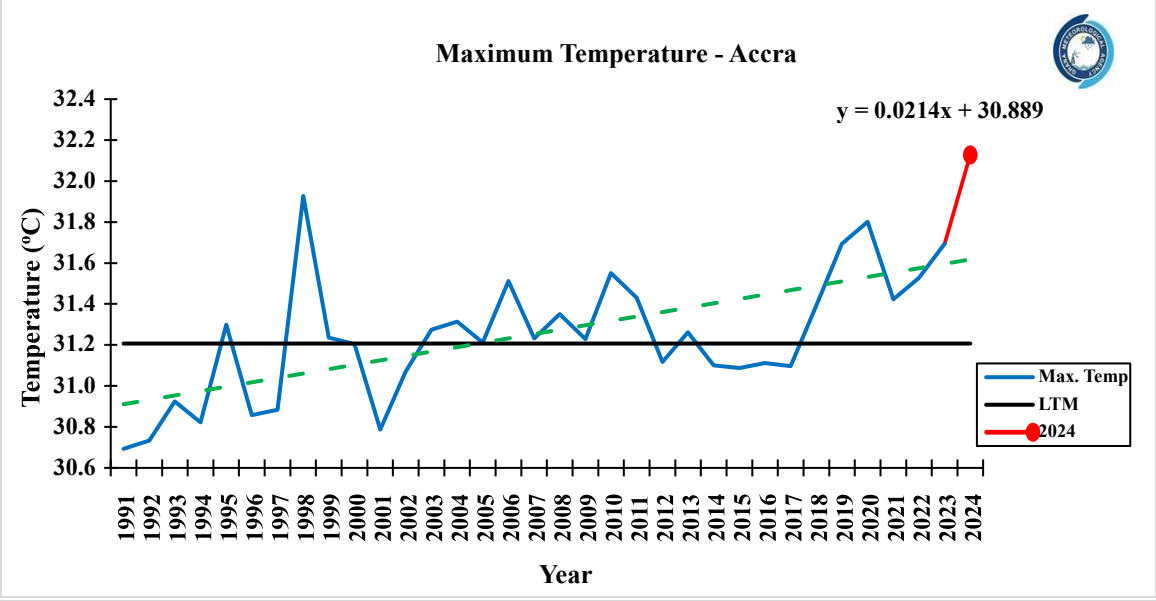


Figure 3.7. Trends in Rainfall for JJA, JAS and SON 1991–2024

Seasonally, rainfall was generally normal to below-normal. The AMJ season recorded 479 mm, slightly above its LTM of 467 mm. However, the MJJ, JJA, and JAS seasons recorded rainfall totals of 445 mm, 387 mm, and 304 mm, respectively, compared to their LTMs of 484 mm, 440 mm, and 397 mm, indicating below-normal rainfall. The rainfall deficit was particularly pronounced during the JJA and JAS seasons. Additionally, the SON season in 2024 recorded 338 mm of rainfall, which was within the normal range but marked the lowest total since 2017.

3.2 Temperature Trends





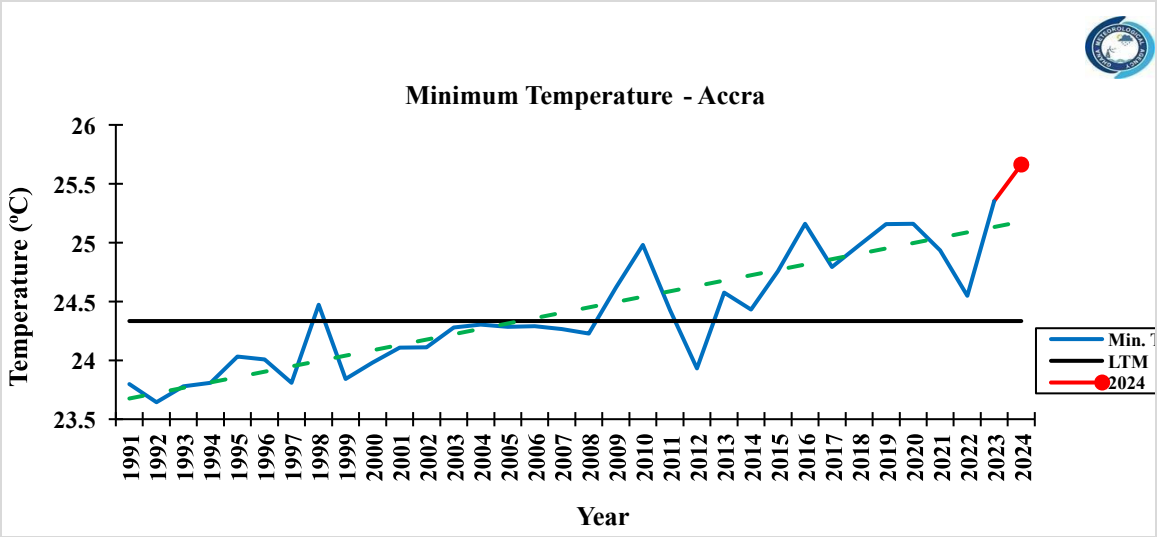
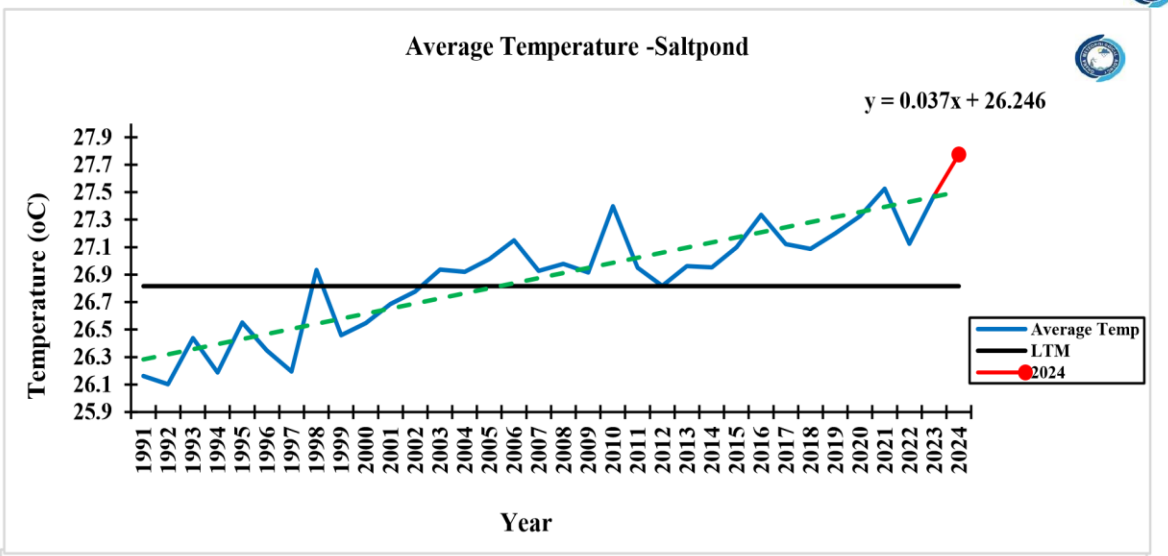
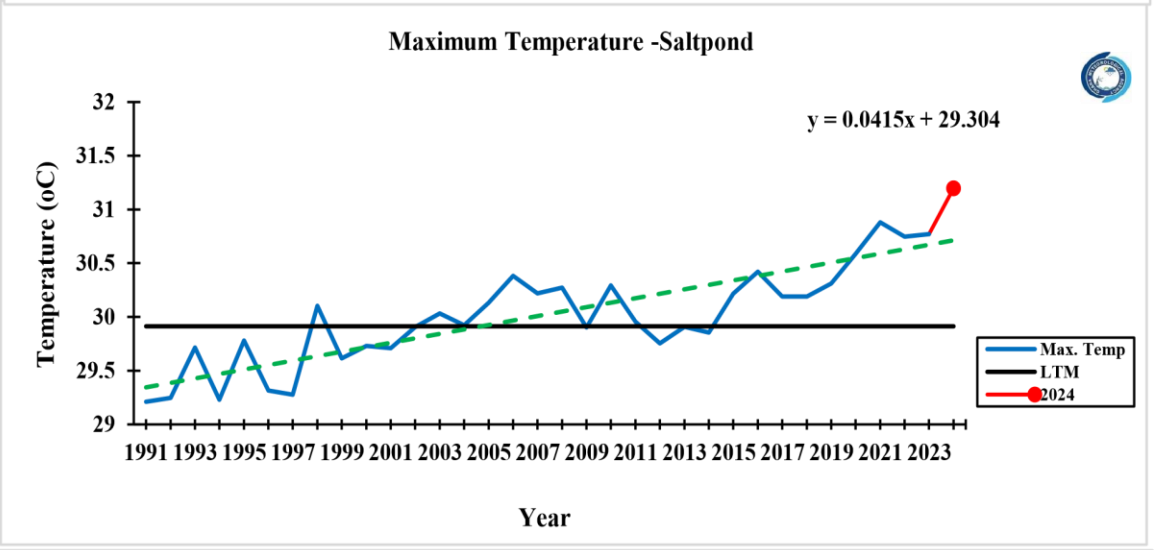


Figure 3.8. Trends in Maximum, Average and Minimum temperatures in the Coastal Zone, Accra. The red marker shows the 2024 temperature record





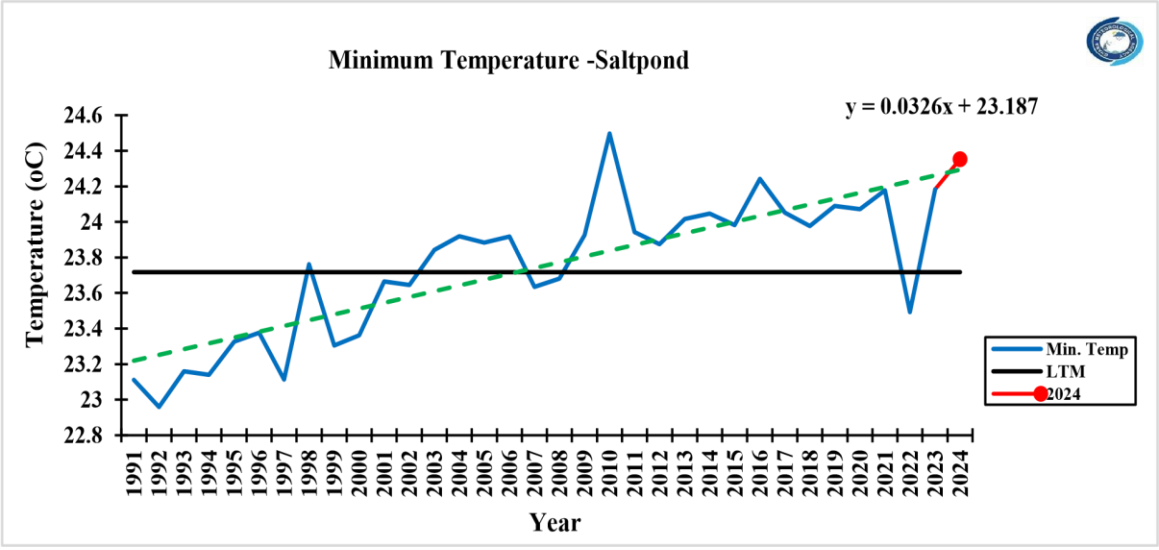


Figure 3.9. Trends in Maximum, Average and Minimum temperatures in the Coastal Zone, Saltpond The red marker shows the 2024 temperature record.

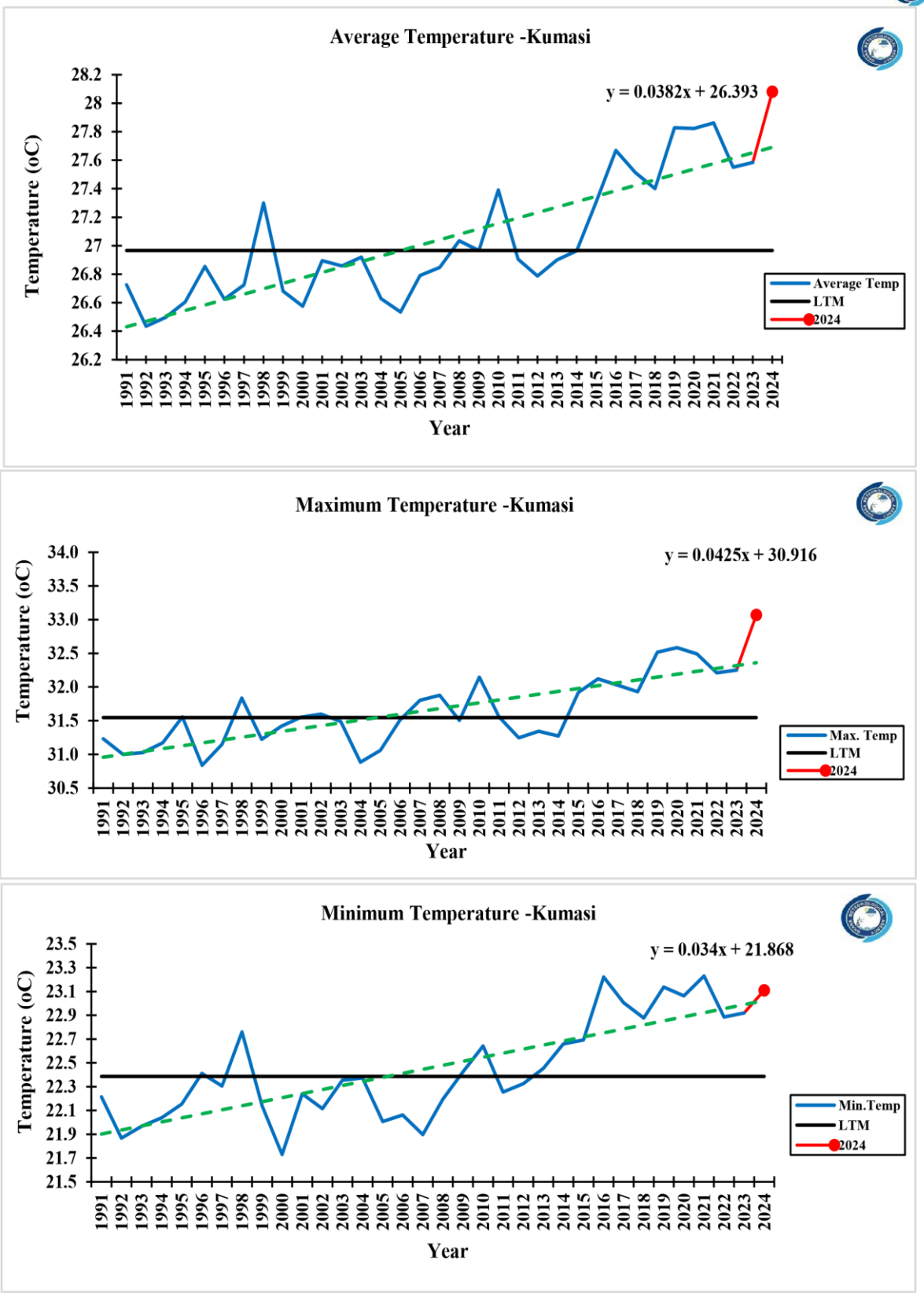


Figure 3.10. Trends in Average temperatures in the forest zone; Kumasi. The red marker shows the 2024 temperature record

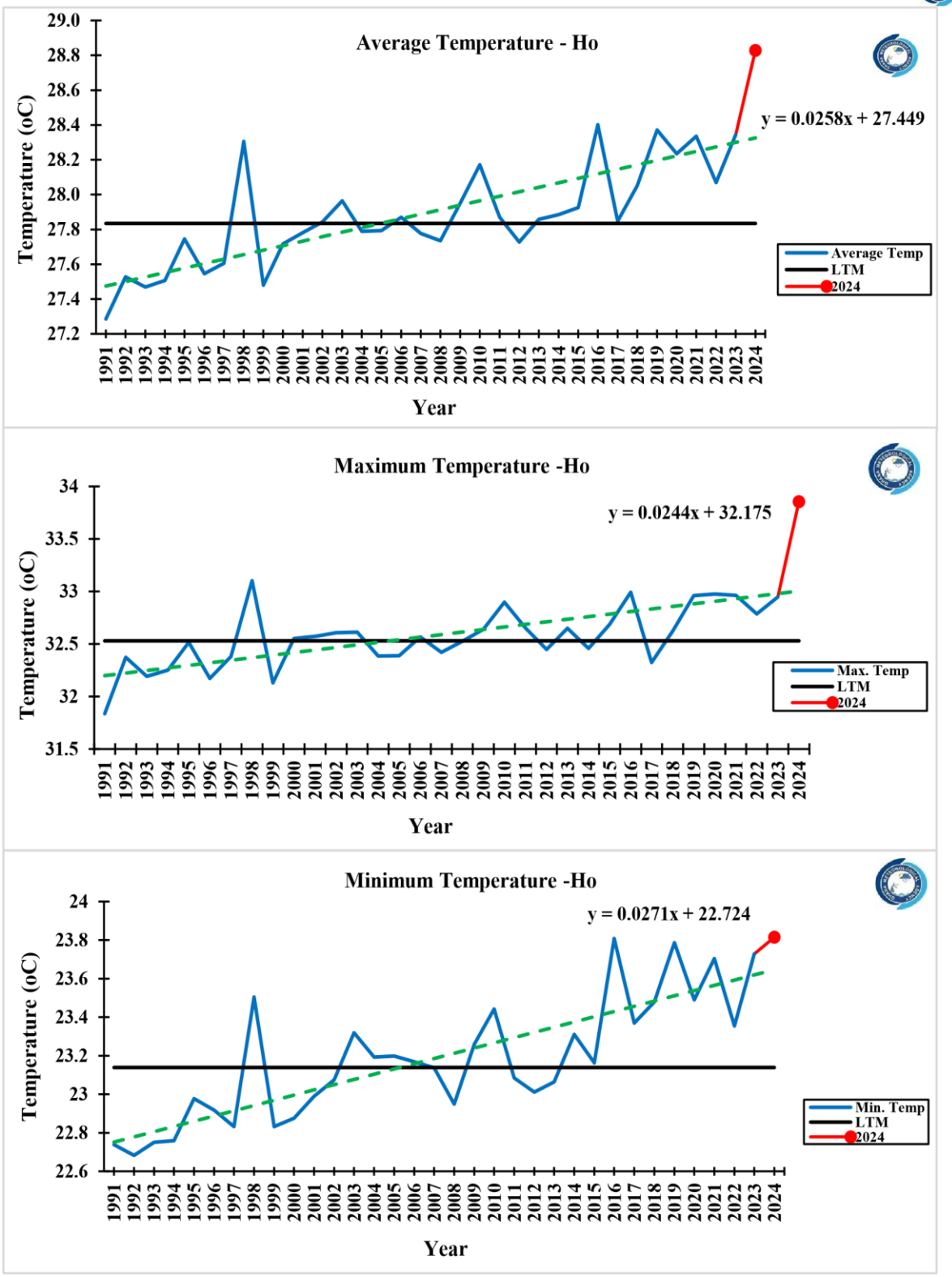
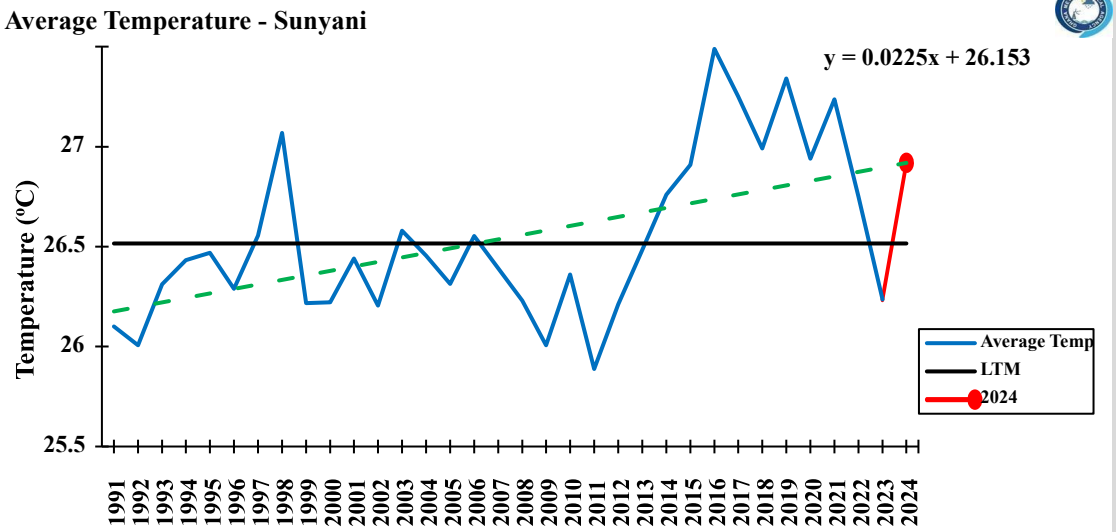
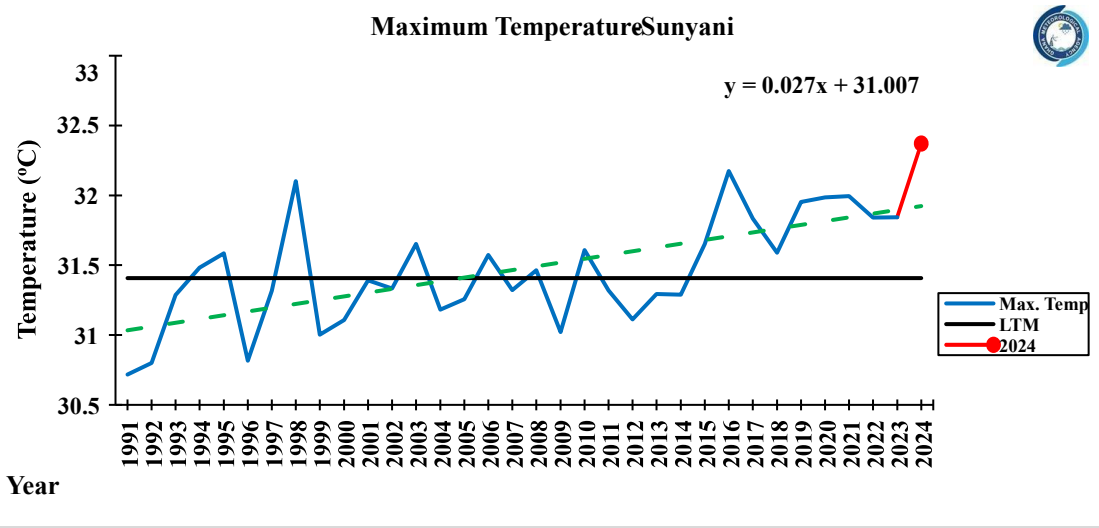


Figure 3.13. Trends in Average temperatures in the Transition Zone; Ho. The red marker shows the 2024 temperature record


Average Temperature - Sunyani
y = 0.0225x + 26.153
Temperature (ºC)
27
26.5
26
25.5
Average Temp
LTM
2024
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year


Maximum TemperatureSunyani
y = 0.027x + 31.007
Temperature (ºC)
33
32.5
32
31.5
31
30.5
Max. Temp
LTM
2024
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Year

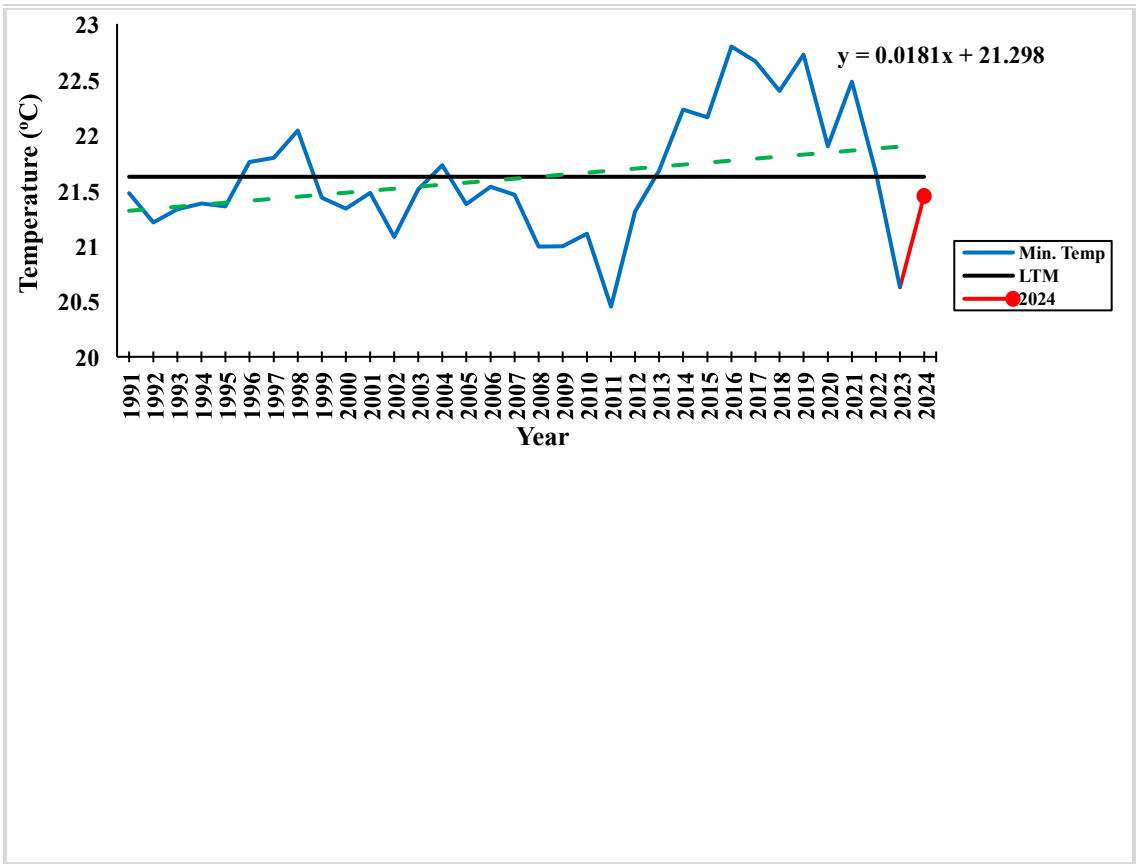


Figure 3.11. Trends in Average, Maximum and Minimum temperatures in the Transition Zone; Sunyani The red marker shows the 2024 temperature record

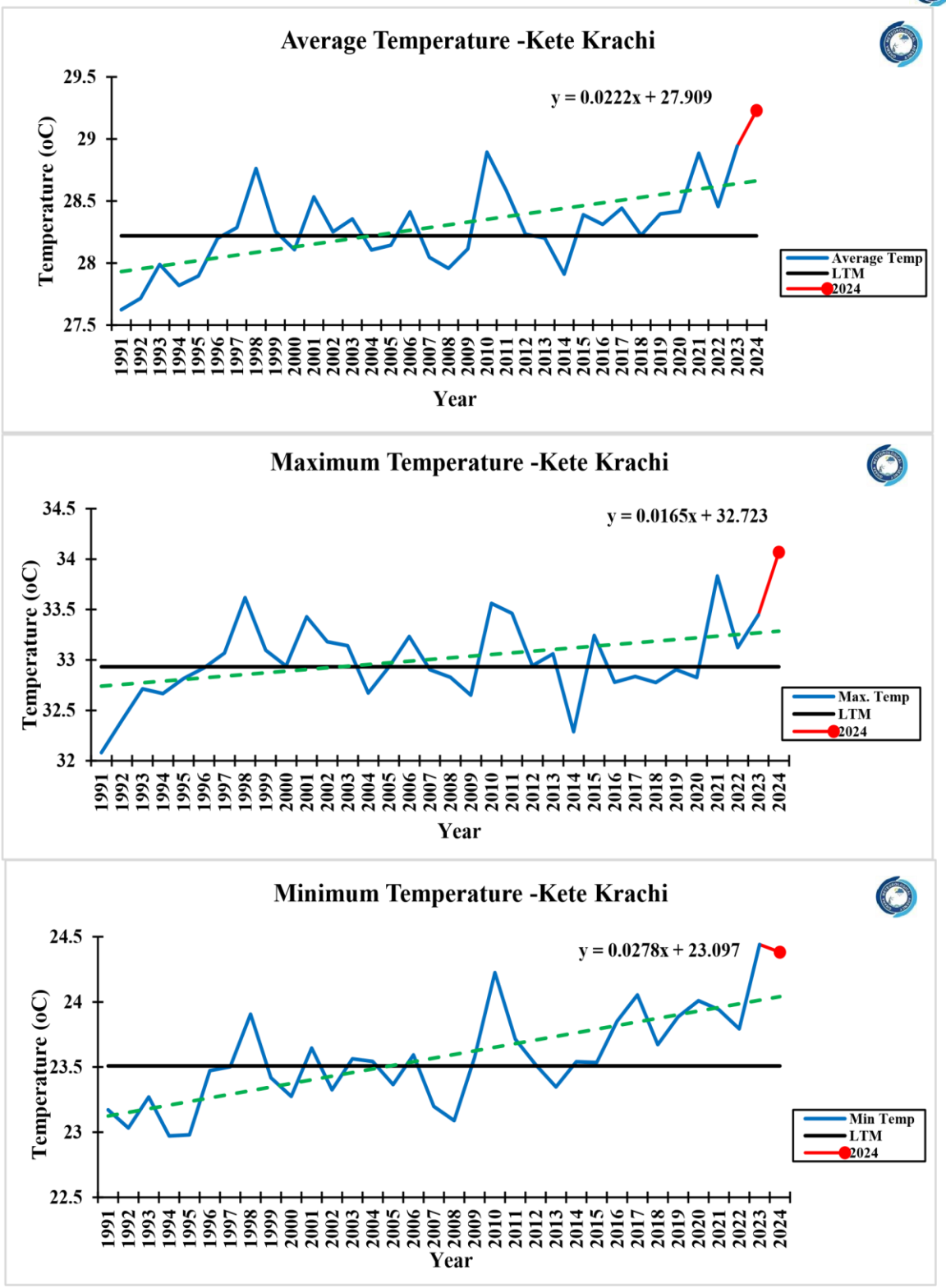


Figure 3.12. Trends in Average, Maximum and Minimum temperatures in the Transition Zone; Kete Krachi. The red marker shows the 2024 temperature record

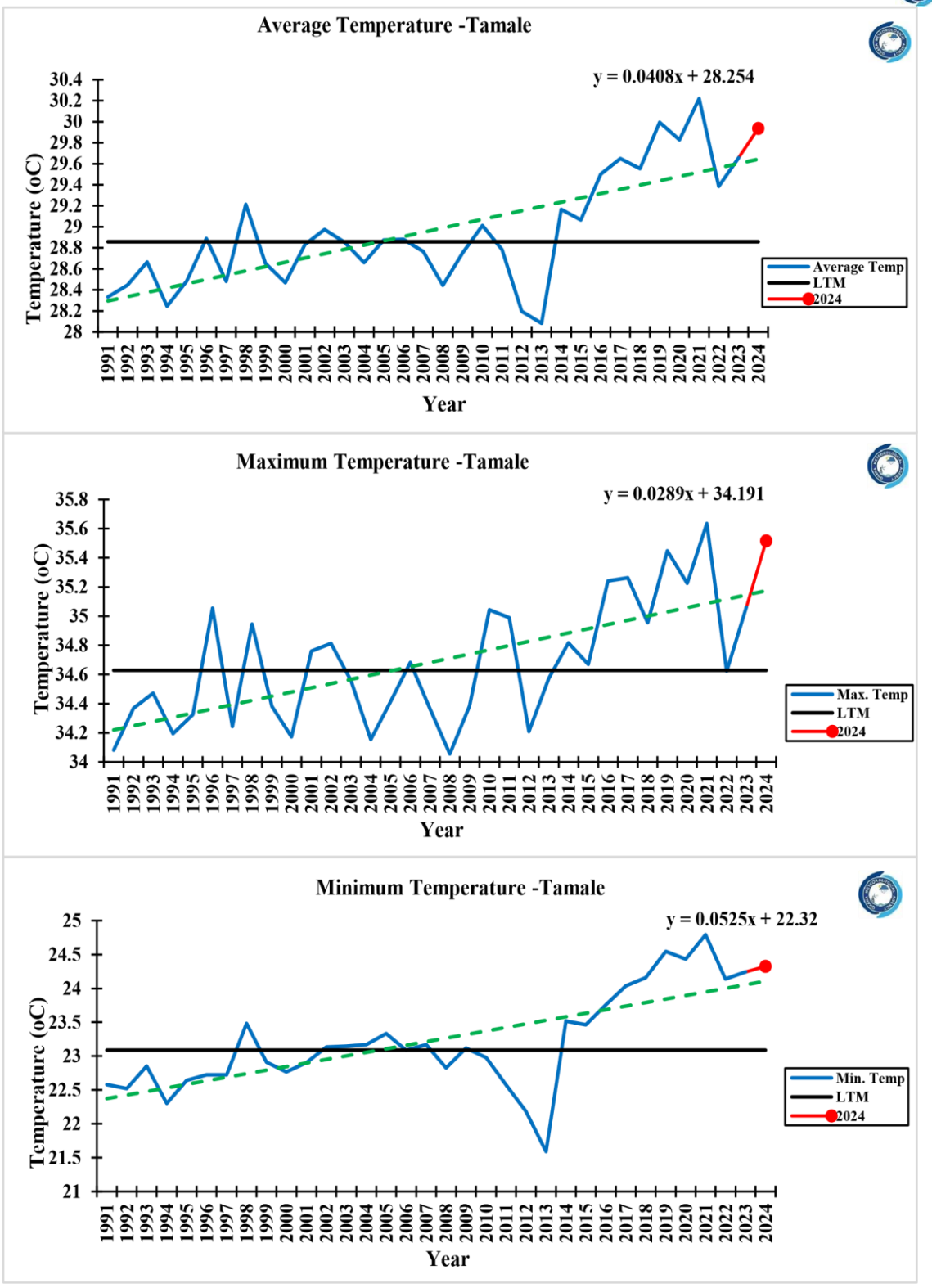


Figure 3.14. Trends in Average, Maximum, and Minimum temperatures in the Northern Ghana; Tamale. The red marker shows the 2024 temperature record

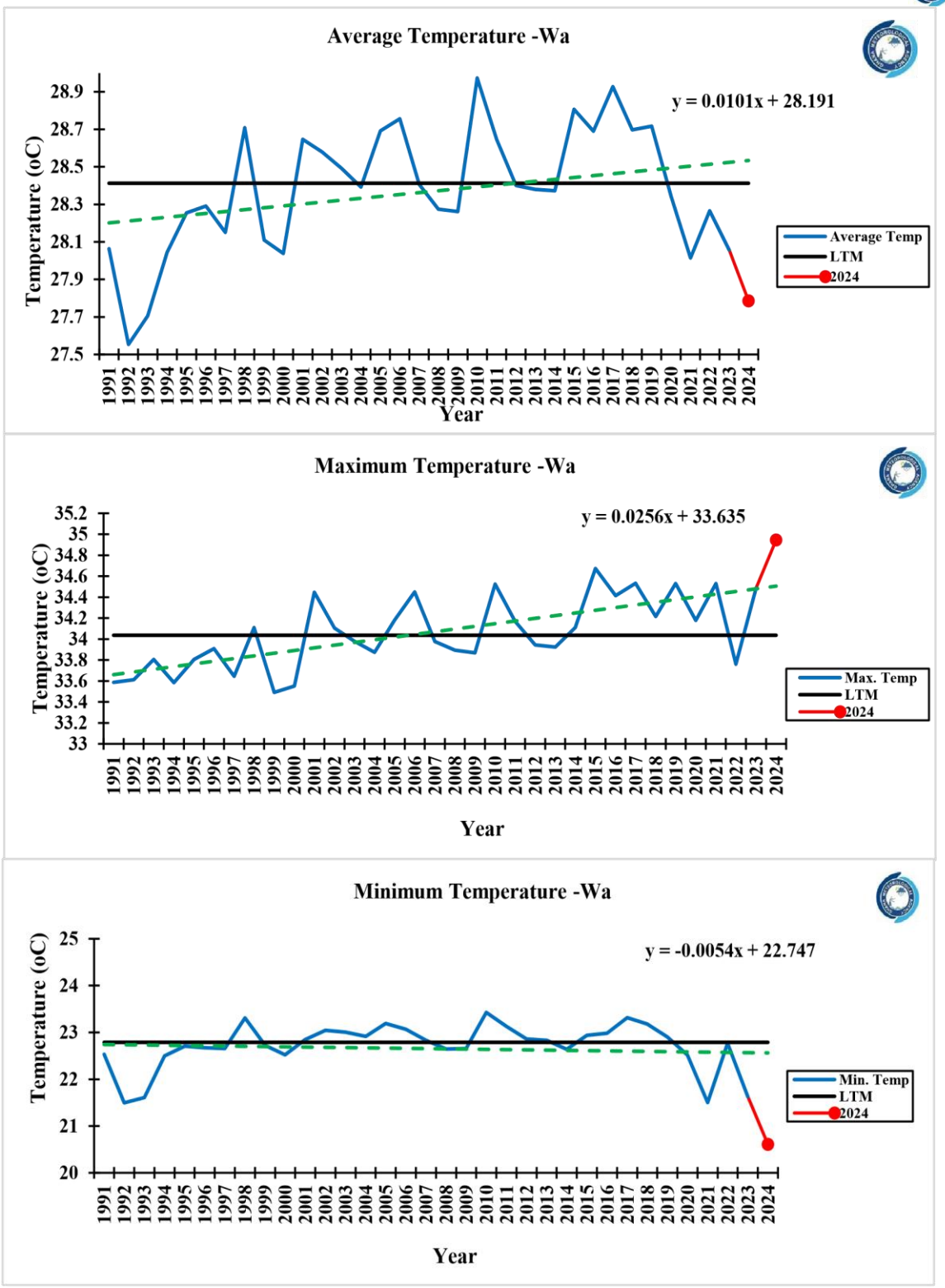


Figure 3.15. Trends in Average, Maximum, and Minimum temperatures in the Northern Ghana; Wa. The red marker shows the 2024 temperature record

This section presents annual trends in temperature at selected stations (maximum, average, and minimum) and country-wide average. The stations are representative of the four agroecological zones, like rainfall trends, the station analysis is based on GMet data. In

2024, maximum, minimum, and average temperatures generally showed an upward trend, except for Wa, where both average and minimum temperatures declined. The highest maximum temperature was recorded in Tamale at 35.5°C, followed by Wa at 34.9°C. The highest average temperature was observed in Tamale at 29.9°C, with Accra following closely at 29.8°C. Wa recorded the lowest minimum temperature at 20.6°C, reflecting a decrease of 1°C compared to 2023.

Temperature for Southern Ghana

The Average Temperature for Accra shows an increasing trend above its LTM (27.8º) for the past 10 years, thus from 2015 to 2024 (27.9ºC to 29.8ºC). Maximum temperature shows an increasing trend from 2018 to 2024.whilst the minimum temperature shows an increasing trend above its LTM (31.2ºC) from 2018 to 2024 (31.4 ºC to 32.1 ºC). Minimum temperature shows an increasing trend above its LTM (24.3 ºC) from 2013 to 2024 (24.6 ºC to 25.7 ºC).

The Average Temperature for Saltpond shows an increasing trend above its LTM (26.8 ºC) for the past 10 years thus from 2012 to 2024 (26.8 ºC to 27.8 ºC). Maximum temperature shows an increasing trend from 2015 to 2024 (30.2 ºC to 31.2 ºC) above its LTM (29.9 ºC) whilst the minimum temperature shows an increasing trend above its LTM (23.7 ºC) from 2009 to 2024(23.9 ºC to 24.4 ºC) except for 2023 which had a decreased temperature (23.5 ºC) below its LTM.

Kumasi also showed an increasing temperature trend from above its LTM (27.0 ºC) 2014 to 2024 (27.3 ºC to 28.1 ºC) for the average temperature. Maximum temperature shows increasing trend above its LTM (31.5 ºC) from 2015 to 2024 (31.9 ºC to 33.1 ºC). Minimum temperatures show an increasing trend from 2013 to 2024 (22.5 ºC to 23.1 ºC) above its LTM (22.4 ºC).

Ho shows an increasing temperature trend from above its LTM (27.8 ºC) 2018 to 2024 (28.1 ºC to 28.8ºC) for the average temperature. Maximum temperature shows increasing trend above its LTM (32.5ºC) from 2018 to 2024 (32.6 ºC to 33.9ºC). Minimum temperatures show an increasing trend from 2016 to 2024 (23.1ºC to 28.8ºC) above its LTM (23.1 ºC).

Average Temperature over Sunyani recorded an increasing trend from 2014 to 2024 (26.8 ºC to 26.9ºC) above its LTM (26.5 ºC) except for 2023 which had a decreased temperature (26.2 ºC) below its LTM. Maximum temperature had an increasing trend from 2015 to 2024

(31.7ºC to 32.4ºC) whilst the minimum temperature had a decreasing trend from 2022 to 2023. 2024 had temperature below its LTM (31.4 ºC).

Kete Krachi shows an increasing temperature trend from above its LTM (27.2 ºC) from 2019 to 2024 (27.4 ºC to 29.2ºC) for the average temperature. Maximum temperature shows an increasing trend above its LTM (32.9ºC) from 2021 to 2024 (33.8 ºC to 34.1 ºC). Minimum temperatures show an increasing trend from 2016 to 2024 (23.8ºC to 24.4ºC) above its LTM (23.5 ºC).

Temperature for Northern Ghana

Tamale also showed an increasing temperature trend above its LTM (28.9ºC) from 2014 to 2024 (29.2ºC to 29.9ºC) for the average temperature. Maximum temperature shows an increasing trend above its LTM (34.6ºC) from 2014 to 2024 (34.8 ºC to 35.5 ºC). Minimum temperatures show an increasing trend from 2014 to 2024 (23.5ºC to 24.3 ºC) above its LTM (23.1 ºC).

The average temperature for Wa shows a decreasing trend below its LTM (28.4 ºC) from 2020 to

2024 (28ºC to 27.8ºC). Maximum temperature shows an increase in temperature from 2023 to

2024 (34.5ºC to 34.9ºC) above its LTM. Minimum temperature shows a decrease in temperature

below its LTM (22.8 ºC) from 2020 to 2024 (22.5ºC to 20.6ºC).

4.0 Observed Climate Drivers

Rainfall seasons in Ghana are mainly influenced by the bi-annual northward and southward movement of the overhead sun across the equator, causing the migration of the ITD which oscillates south to north and so modulates the pressure system of the West African Monsoon. The Sea Surface Temperature (SST) along the Gulf of Guinea and the North Atlantic Ocean also influences rainfall over Ghana. The El Niño/La Niña Southern Oscillation, ENSO, is a significant driver of climate variability globally. It is a naturally occurring cycle that involves fluctuating ocean temperatures in the central and eastern equatorial Pacific and changes in the atmosphere.

4.1 Intertropical Convergence Zone (ITCZ)

The Inter-Tropical Convergence Zone (ITCZ) plays a crucial role in shaping Ghana's climate. This low-pressure belt near the equator is where the trade winds from the Northern and Southern Hemispheres meet. As a result of this convergence, the atmosphere becomes unstable, leading to the formation of clouds and significant rainfall. The ITCZ spans between 15W and 35E, Ghana is situated between 5°W and 5°E. Between January and February 2024, it was closer to the equator (around 6.5°N–8.7°N). From June through August, it reached its northernmost point (15.5°N– 20.3°N) before retreating southward between September and November (10.2°N–13.9°N). In December, it returned near the equator (7°N–8°N). The further climb of the ITCZ into the Sahelian region, especially during the JJA and JAS season, particularly in August, resulted in little to no rainfall in most areas around the Transition and the Northern zone. This led to a prolonged dry spell, affecting crop yield during the season.

Dekad	Jul-01	Jul-02	Jul-03	Aug-01	Aug-02	Aug-03	Sept-01	Sept-02	Sept-03	Oct-01	Oct-02	Oct-03	Nov-01	Nov-02	Nov-03	Dec-01	Dec-02	Dec-03
5W	18.7	19.2	20.3	20.1	21.1	20.3	20.4	21.5	20.3	19.1	17.6	13.5	9.8	9.1	7.7	7.4	7.6	6.9
0	18.6	19.1	20	19.7	21.1	19.8	20.7	21	18.7	17.8	16.2	12.6	9.3	8.6	8.2	8	7.8	7.5
5E	18.1	18.8	19.3	18.7	20.4	19.1	20.4	20.8	17.9	16.7	15.1	12.3	8.9	8.3	7.7	7.2	7.5	7.1

Dekad	Jan-01	Jan-02	Jan-03	Feb-01	Feb-02	Feb-03	Mar-01	Mar-02	Mar-03	Apr-01	Apr-02	Apr-03	May-01	May-02	May-03	Jun-01	Jun-02	Jun-03
5W	8.2	6.7	6.8	7	8.1	8.6	10	10.3	11.5	12.8	11.3	12.8	12.7	14.6	15	15.1	15	17.2
0	8.7	6.7	6.7	6.8	8.5	9.2	10.2	10.4	11.5	12.7	11.6	14	13.9	15.2	15.8	16.5	14.3	17.2
5E	8.6	6.5	6.5	6.3	8.3	8.4	10	10.3	10.5	12.9	11.7	14.3	13.9	14.4	16	16.6	14.5	16.6

Table 4.1. Decadal ITD locations for 2024. Source NOAA

4.2 El Niño Southern Oscillation (ENSO)

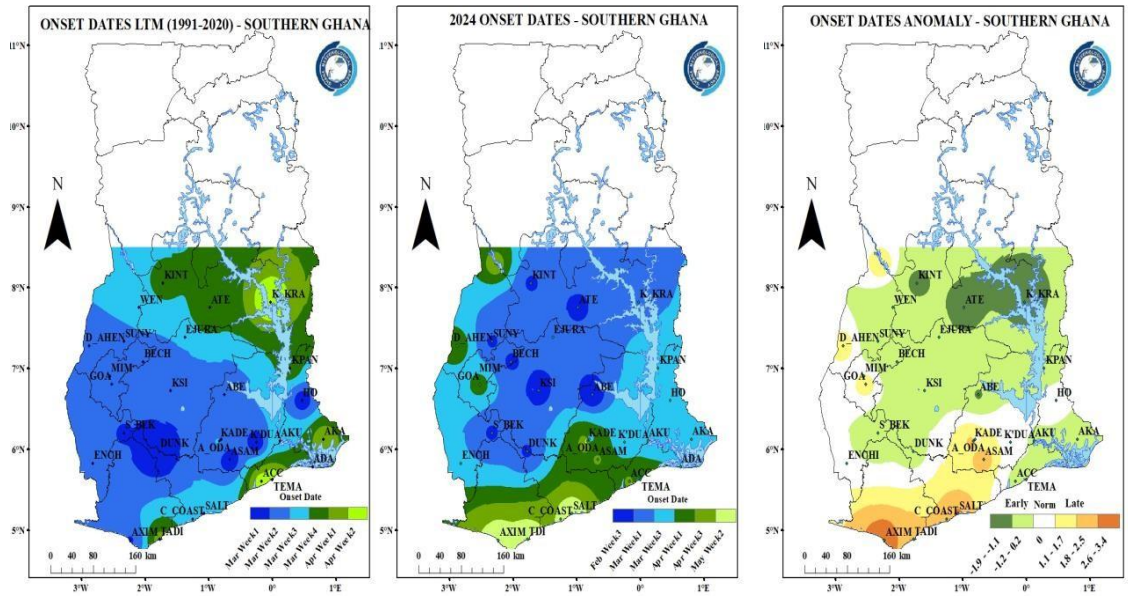
During the year 2024, ENSO was positive (El Nino was present) for the first five months, which gradually reduced as the year progressed leading to a neutral state. Rainfall this year has been suppressed especially in the MJJ, JJA and JAS season, where below-average rainfall was recorded for most parts of the country. Red colour represents EL Nino phase, blue color represents La Nina phase and black represent Neutral phase.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2020	0.5	0.5	0.4	0.2	-0.1	-0.3	-0.4	-0.6	-0.9	-1.2	-1.3	-1.2
2021	-1.0	-0.9	-0.8	-0.7	-0.5	-0.4	-0.4	-0.5	-0.7	-0.8	-1.0	-1.0
2022	-1.0	-0.9	-1.0	-1.1	-1.0	-0.9	-0.8	-0.9	-1.0	-1.0	-0.9	-0.8
2023	-0.7	-0.4	-0.1	0.2	0.5	0.8	1.1	1.3	1.6	1.8	1.9	2.0
2024	1.8	1.5	1.1	0.7	0.4	0.2	0.0	-0.1	-0.2	-0.3	-0.4	-0.5

Table 4.2. Indicates the varied ENSO indices in 2024.

5.0 REVIEW OF ONSET AND CESSATION FOR SOUTHERN GHANA (MAJOR SEASON)

5.1 Onset



Map 5.1. Spatial distribution of LTM, 2024 and anomalies for onset dates.

The 2024 major rainfall season for southern Ghana commenced from the forest zone at Abetifi, with the onset recorded on February 19, corresponding to the third week of February. Analyzing the long-term mean from 1991 to 2020, it is evident that most regions within the forest areas, including Abetifi, Kumasi, and Bechem, experienced an early onset between the first and second weeks of March. In contrast, Asamankese recorded a significantly delayed onset which occurred in the third week of April.

In the coastal region, rainfall began in Tema during the first week of April, marking the onset along the eastern coast. Coastal locations such as Saltpond on the east coast, and Takoradi and Axim on the west coast experienced a late onset of rainfall which occurred in the first and second weeks of May. The standardized anomaly map illustrates the disparity between regions in the south, highlighting areas with very early rainfall onset compared to those with a considerably delayed start.

5.1.1 Onset Dates Trend Analysis for Southern Ghana

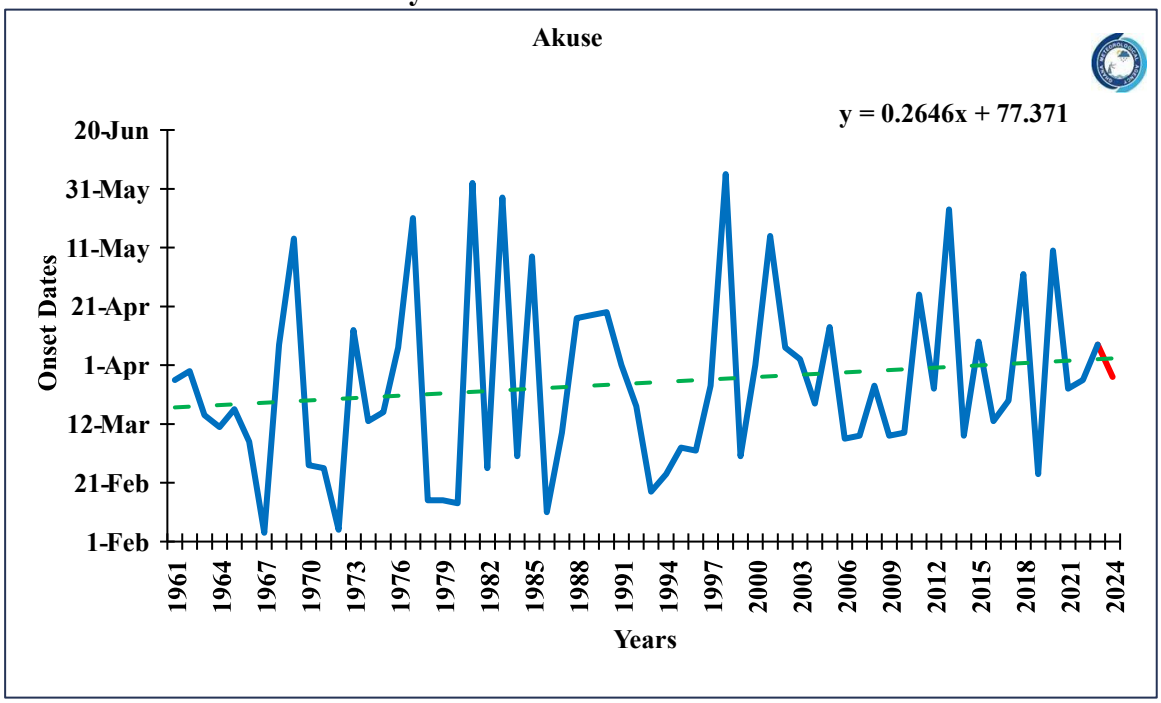


Figure 5.1. Trends in Onset Dates for Southern Ghana; Akuse

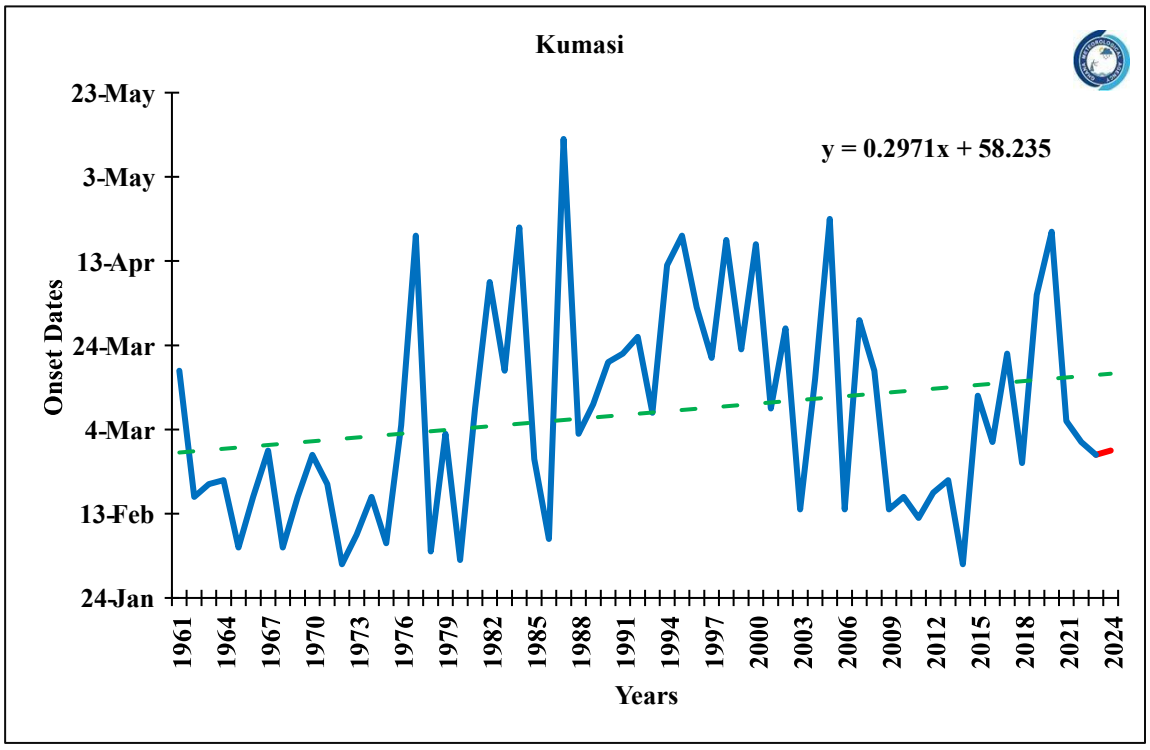


Figure 5.2. Trends in Onset Dates for Southern Ghana; Kumasi.

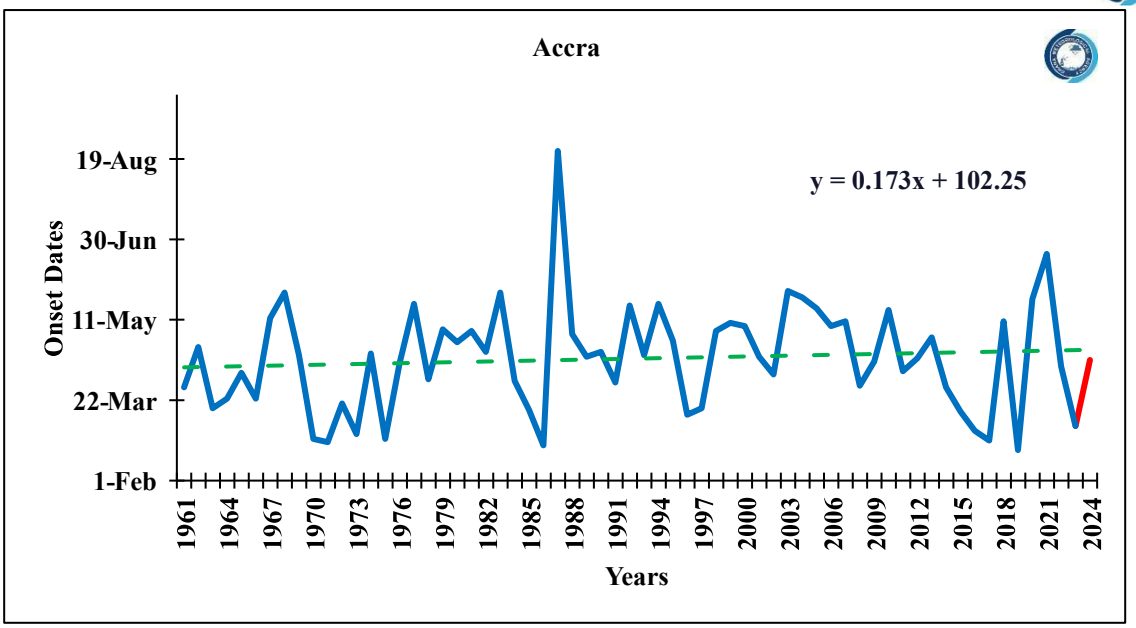


Figure 5.3. Trends in Onset Dates for Southern Ghana; Accra

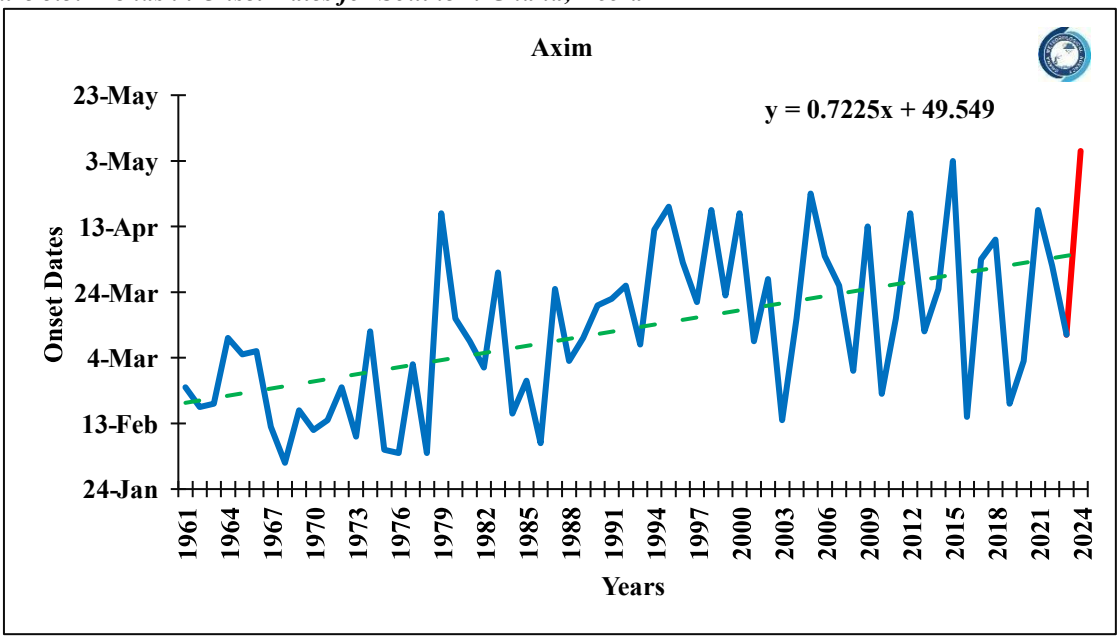
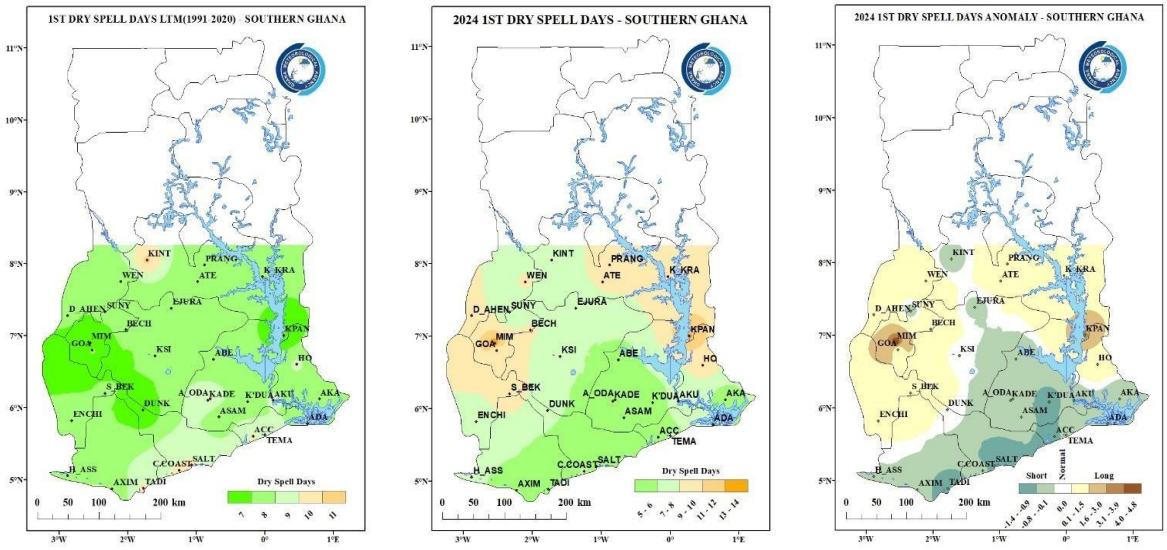


Figure 5.4. Trends in Onset Dates for Southern Ghana; Axim

The trendlines of the graphs indicate an upward trend which shows that the onset dates are being pushed back over the past years. This corresponds to delays at the start of the season. Accra in the coastal area of the country is showing a significant upward trend which indicates a delay in onset/ start of the season

5.1.2 Early/1st Dry Spell



Map 5.2. Spatial distribution of LTM, 2024 and anomalies for 1st/early dry spell days.

From the onset date to the 50th day of the season, the longest consecutive number of dry days is termed as 1st/Early Dry Spell.

Generally, most parts of the country experienced between 5-10 dry spell days with an average of 8 days within the early parts of the season. The longest dry spell days within the Southern sector for 2024 were experienced at Mim. It recorded 14 consecutive dry days, 7 days longer than its long-term mean (LTM). Areas along the Coast such as Accra, Takoradi, Saltpond, and Axim experienced more rainy days resulting in shorter dry spell days as compared to their respective LTMs.

Within the forest zone, Dunkwa, Akuse, Abetifi, and Kumasi and their environs experienced a similar scenario as that of the coast with 7,8,6 and 7 consecutive dry days which were below their respective LTMs. Most areas within the Transition experienced relatively longer dry spells (9 - 10) days except for Kintampo and its surroundings, which recorded 8 days.

5.1.3 Early/ 1st Dry Spell Trend Analysis for Southern Ghana

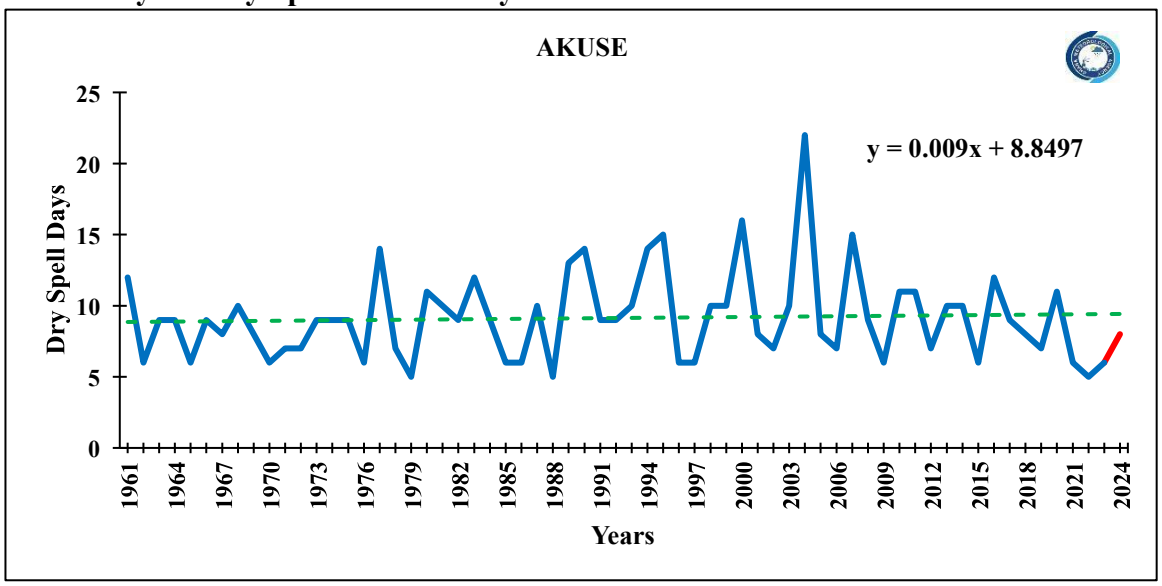


Figure 5.5. Trends in 1st /Early Dry Spell Days for Southern Ghana in Akuse

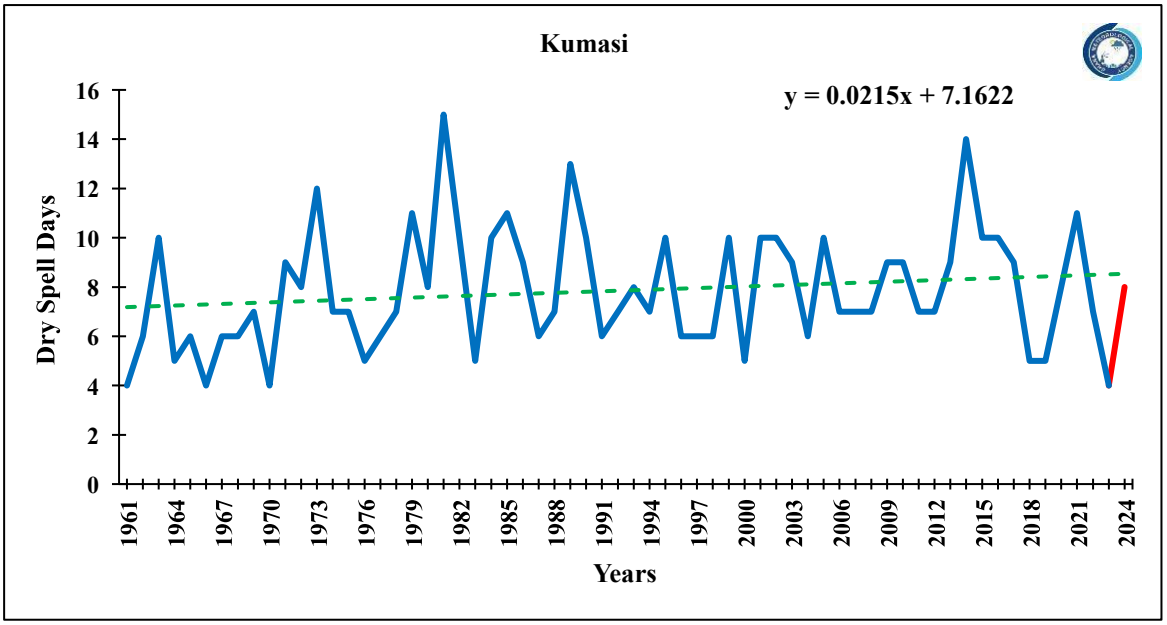


Figure 5.6. Trends in 1st /Early Dry Spell Days for Southern Ghana in Kumasi

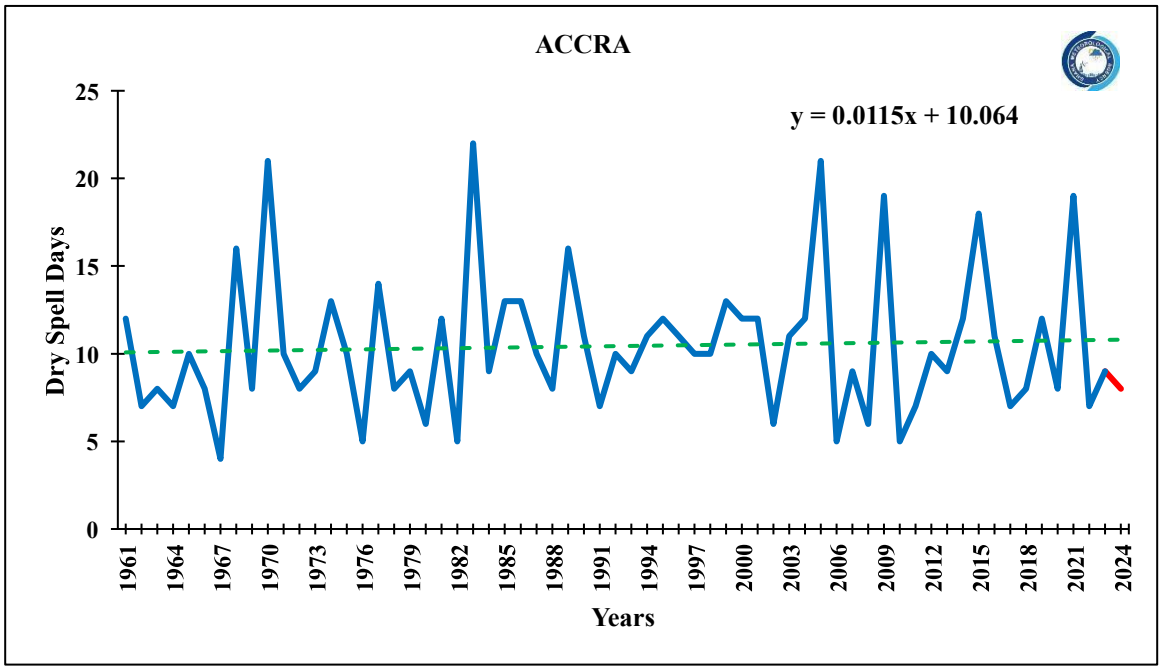


Figure 5.7. Trends in 1st /Early Dry Spell Days for Southern Ghana in Accrra

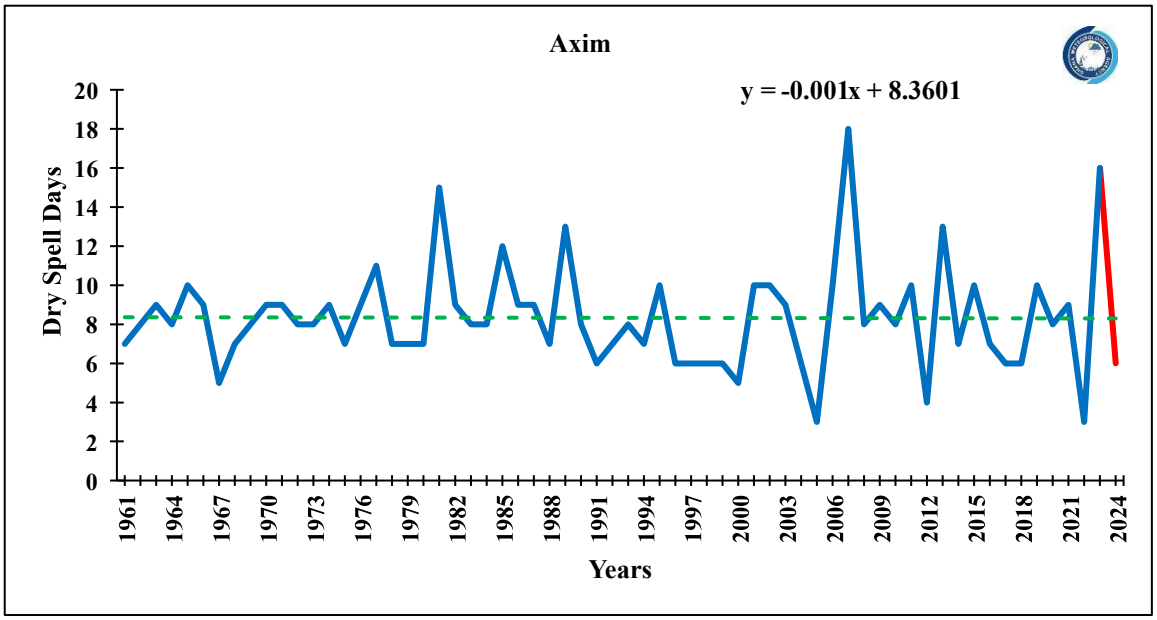
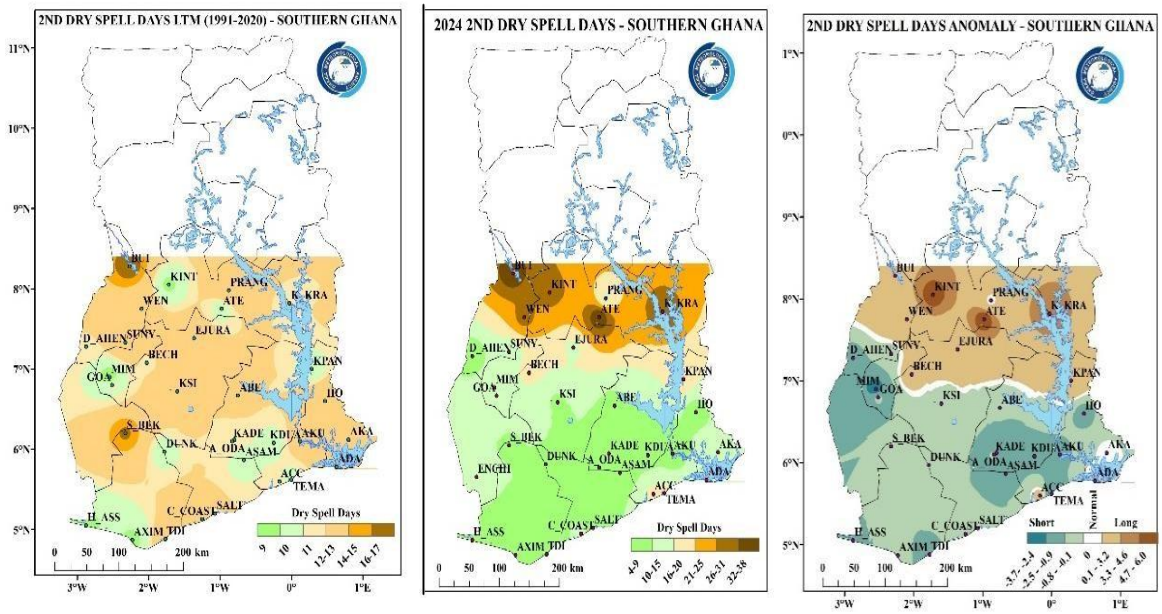


Figure 5.8. Trends in 1st /Early Dry Spell Days for Southern Ghana in Axim

Kumasi and Akuse show an upward trend in the length of the dry spell days along the period.

Conversely, Accra and Axim show a neutral trend which implies that the dry spell days have not changed significantly over the years.

5.1.4 Late/2nd Dry Spell



Map 5.3. Spatial distribution of LTM, 2024 and anomalies for 2nd/late dry spell days.

From the 51st day of the season to the cessation date, the longest consecutive number of dry days is termed as Late Dry Spell. Climatological data for Southern Ghana (below 8ºN) from 1991-2020 shows that most parts of the country record an average late dry spell length ranging from a minimum of 9 to a maximum of 17 days. Climatologically, the average late dry spell spans just 9 days in Mim, making it the shortest, while Bui has the longest, with an average of 17 days. In 2024, places in the Forest and Coastal Zones such as Kade, Asamankese, Koforidua, Mim recorded shorter-than-normal dry spell days. However, Accra recorded a longer-than-normal dry spell length and Akuse recorded normal dry spell lengths of 17 and 13 days respectively. The transition zone generally recorded longer-than-average dry spell days in 2024 except for Prang and its surroundings which recorded a normal dry spell length. Atebubu and Bui recorded the longest dry spell days with 37 and 38 days respectively.

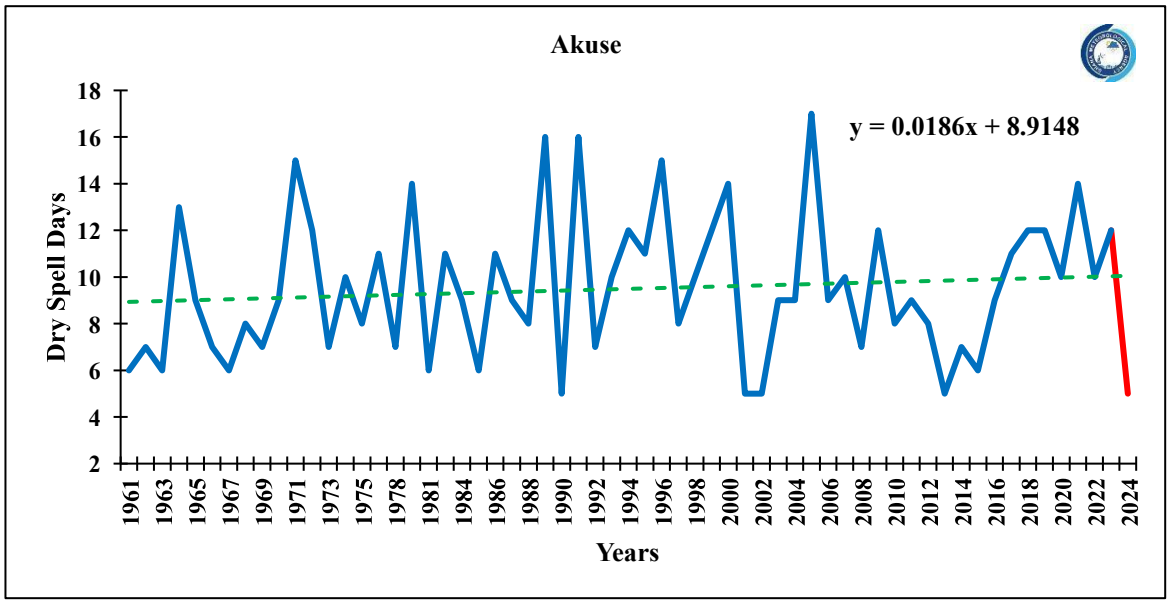


Figure 5.9. Trends in 2nd /late Dry Spell Days for Southern Ghana in Akuse

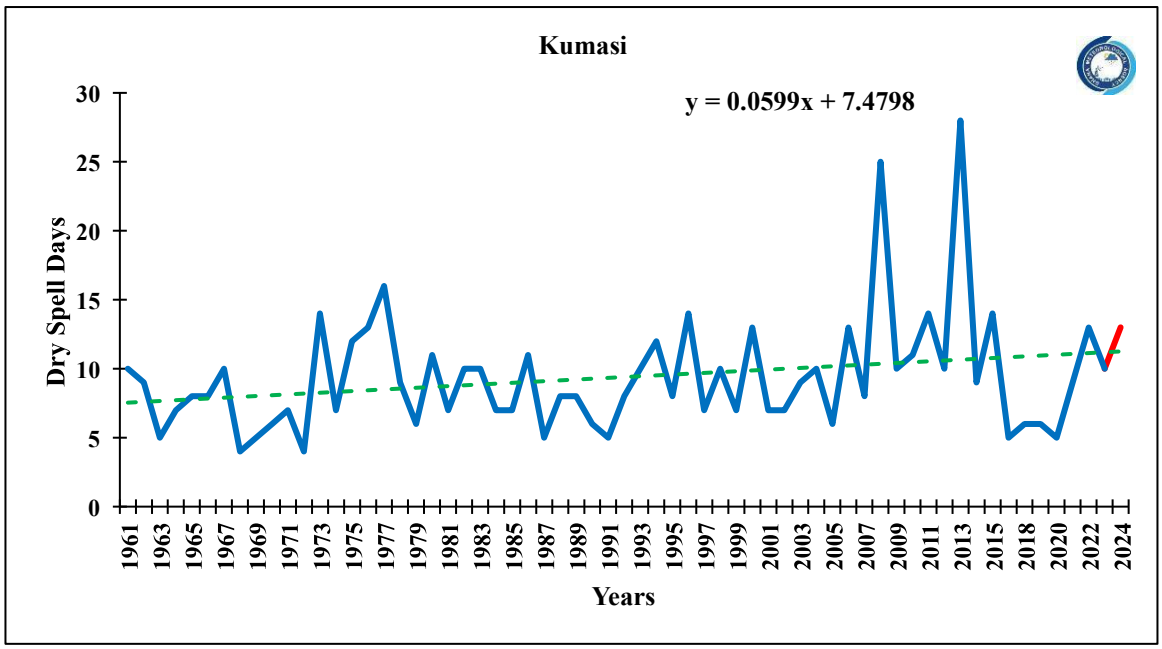


Figure 5.10. Trends in 2nd /late Dry Spell Days for Southern Ghana in Kumasi

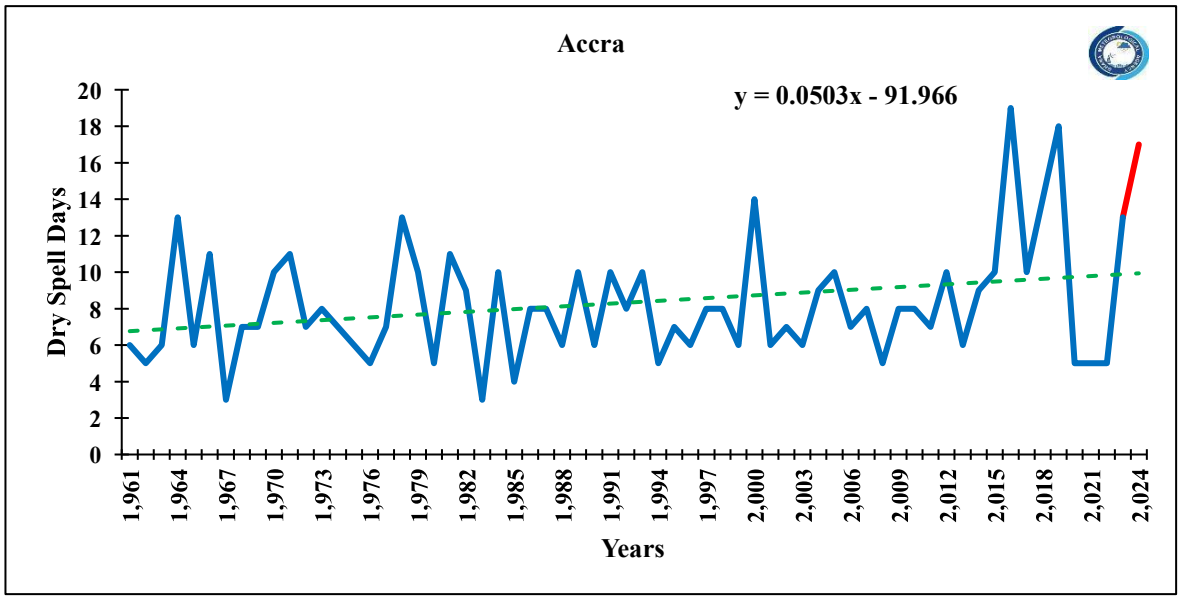


Figure 5.11. Trends in 2nd /late Dry Spell Days for Southern Ghana in Accra.

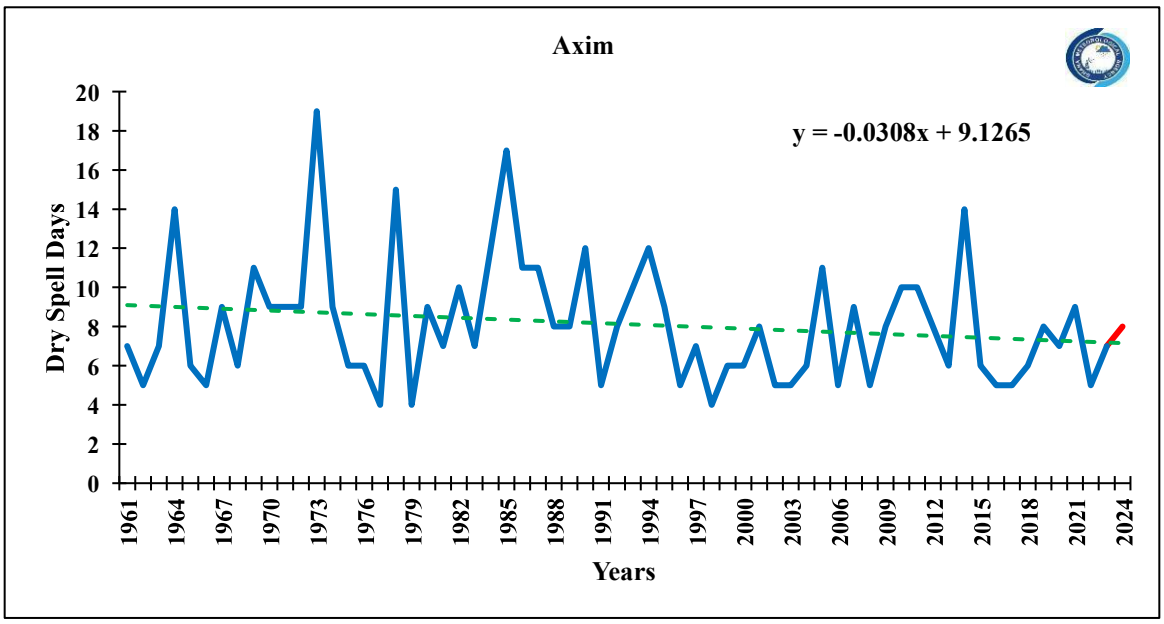
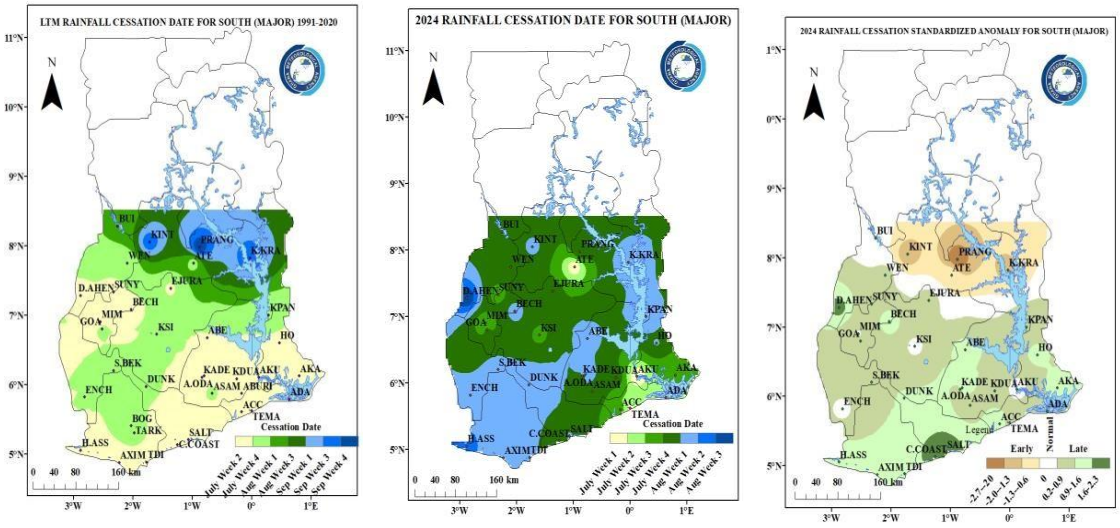


Figure 5.12. Trends in 2nd /late Dry Spell Days for Southern Ghana in Axim.

The graphs for Kumasi, Akuse, and Accra show an upward trend. This indicates an increase in the average number of dry spell days. However, Axim shows a downward trend which suggests a decrease in the average number of dry spell days.



Map 5.4. Spatial distribution of LTM, 2024 and anomalies for cessation dates.

Based on an analysis of the long-term mean (1991–2020), Ghana's rainfall cessation begins in the north and gradually moves southward. This climatological assertion was noted in Ghana during the rainfall cessation in 2024.

The major rainfall cessation map for Southern Ghana indicates an early cessation in most Transition zones. Kumasi, Akuse, Bui, Enchi, and Goaso had a normal cessation, while the remaining areas had a late cessation. Dormaa Ahenkro, Cape Coast, and Saltpond saw exceptionally late cessation. In contrast to its climatological dates, which fall between the 2nd Week of July and the 4th Week of September, the cessation dates in 2024 span from the 1st Week of July to the 3rd Week of August.

5.2.1 Cessation Dates Trend for Southern Ghana

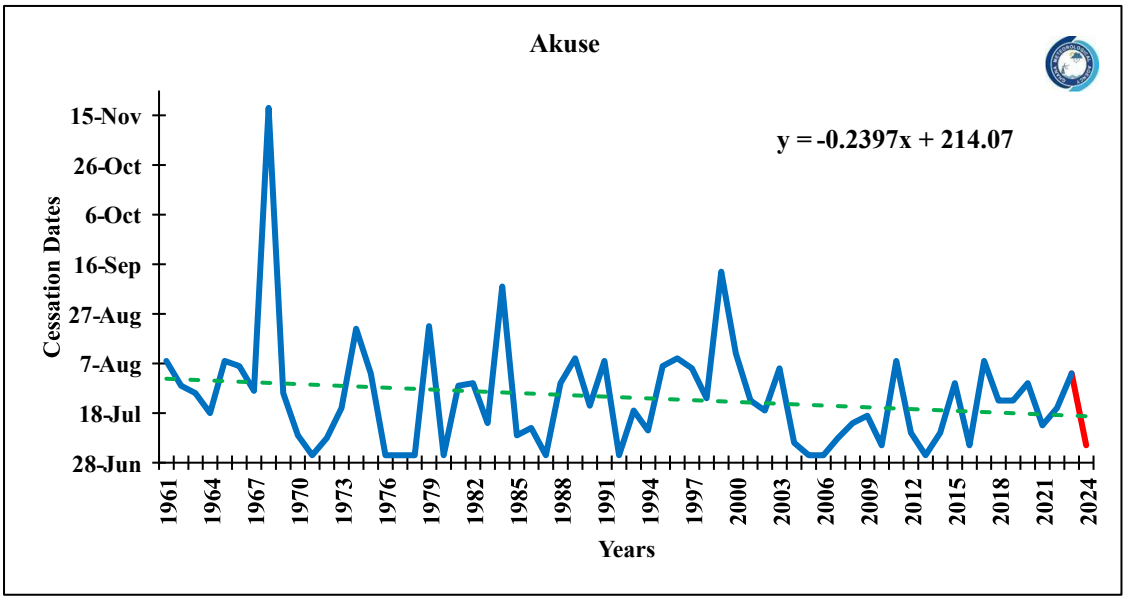


Figure 5.13. Trends in Cessation Dates for Southern Ghana in Akuse.

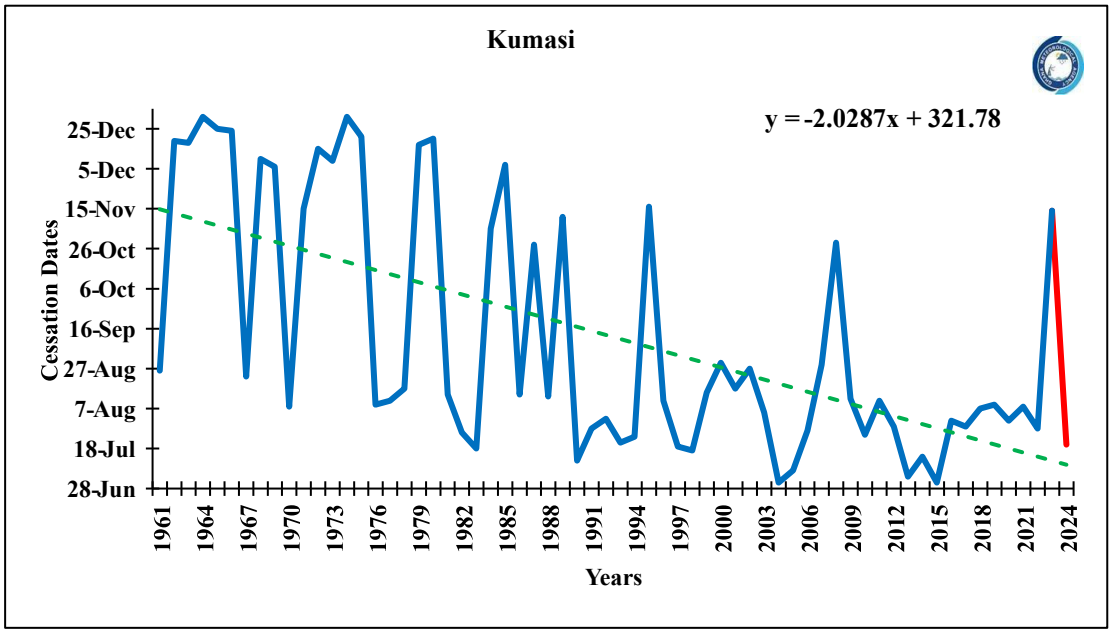


Figure 5.14. Trends in Cessation Dates for Southern Ghana in Kumasi.

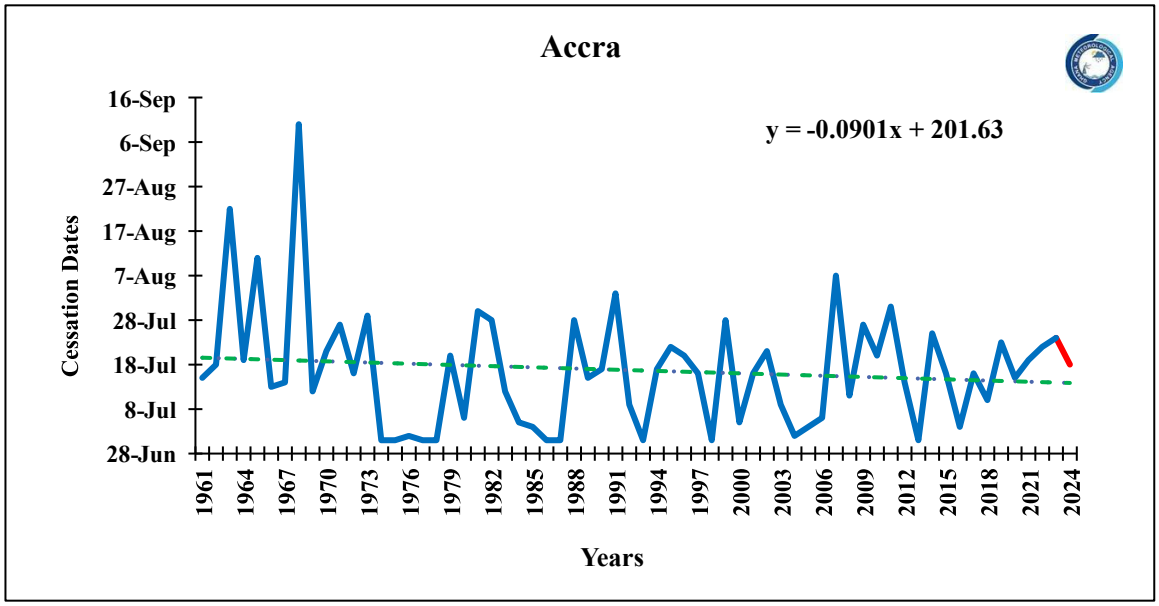


Figure 5.15. Trends in Cessation Dates for Southern Ghana in, Accra.

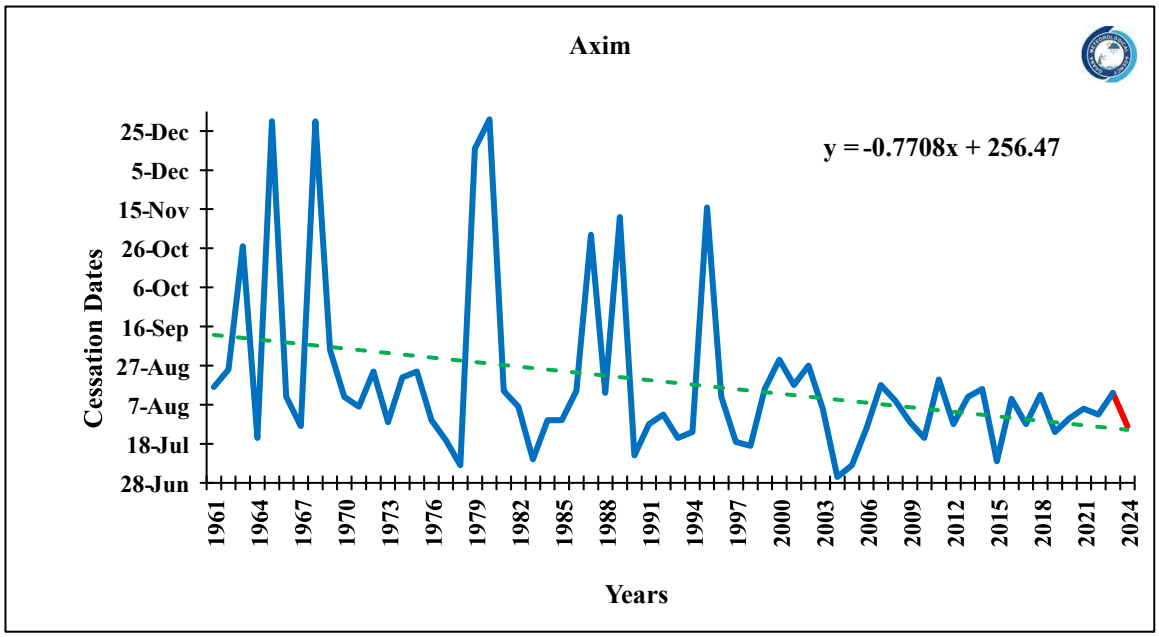
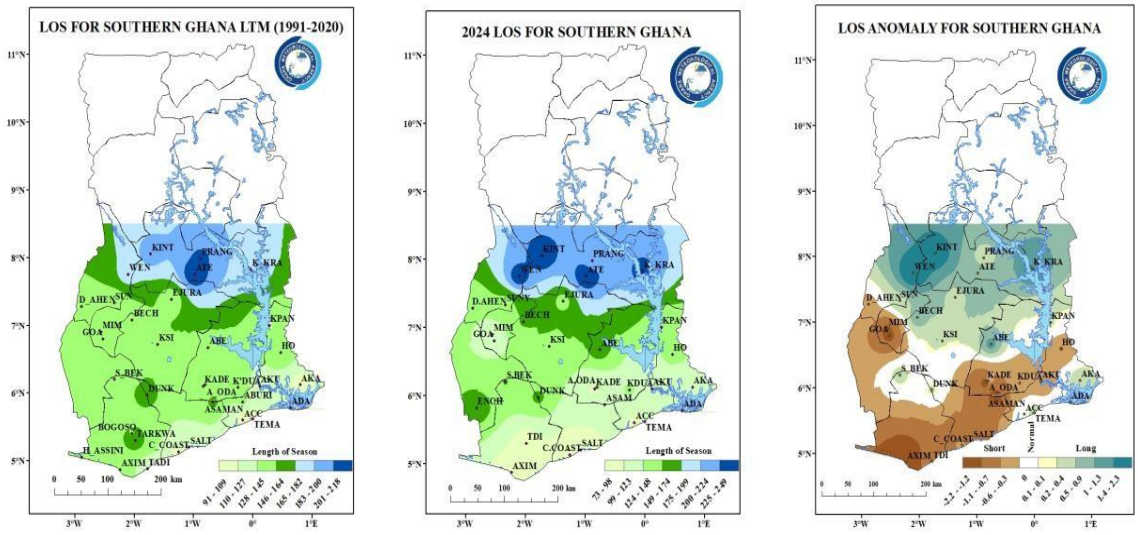


Figure 5.16. Trends in Cessation Dates for Southern Ghana in Axim.

Over the years, there has been a slight decrease for Akuse and Accra while Axim and Kumasi had a sharp decrease for the cessation dates. This suggests that the event ended earlier compared to previous years.



Map 5.5. Spatial distribution of LTM, 2024 and anomalies for length of season.

In Southern Ghana during the 2024 major rainy season, different regions experienced varying lengths of rainfall. Areas like Atebubu, Kete Krachi, Kintampo, and Wenchi in the transition zone had long seasons, ranging from 225 to 249 days, with Kintampo and Atebubu tying for the longest at 249 days. Prang had a slightly shorter season of 213 days. In the forest zone, Enchi had the longest season at 164 days, while Enchi, Abetifi, Dunkwa, Sefwi Bekwai, and Bechem recorded lengths between 149 and 174 days. Areas like Mim, Akuse,Takoradi, and Kade experienced shorter seasons under 100 days, with Kade recording the shortest at 70 days. In the Coastal Sector, Ada had a season lasting 113 days, whereas other coastal regions saw significantly shorter seasons, typically under 100 days, with Saltpond having the shortest at 79 days.

For 2024, the southern sector predominantly experienced longer-than-normal seasonal lengths compared to the long-term mean, especially in the transition zone. However, in the forest zone, areas like Goaso, Mim, Dormaa-Ahenkro, Kade, Koforidua, Akuse, and Ho had shorter-than normal seasons. On the West Coast (Axim, Takoradi, Cape Coast, and Saltpond), seasonal lengths were also shorter, while the East Coast (Ada and Tema) saw longer-than-normal seasons. Accra and nearby areas remained at normal seasonal lengths. Overall, the transition zone and middle belt had normal to longer seasons, with Wenchi and Kintampo experiencing the longest seasons of the year.

5.2.3 Length of Season Trend Analysis for Southern Ghana

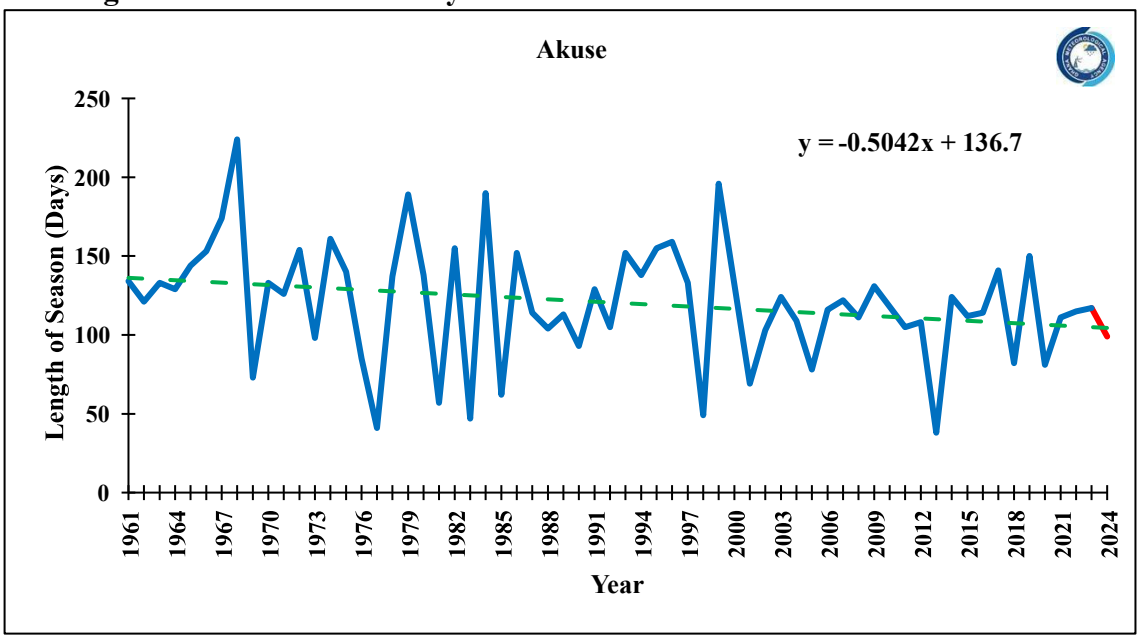


Figure 5.17. Trends in length of Season for Southern Ghana in Akuse,

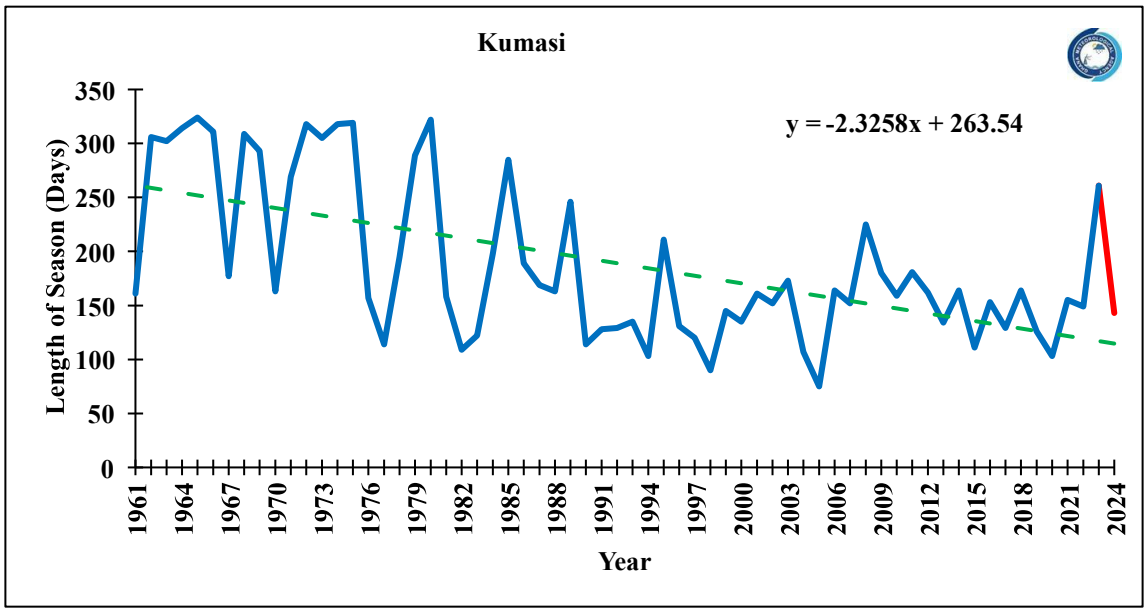


Figure 5.18. Trends in length of Season for Southern Ghana in Kumasi

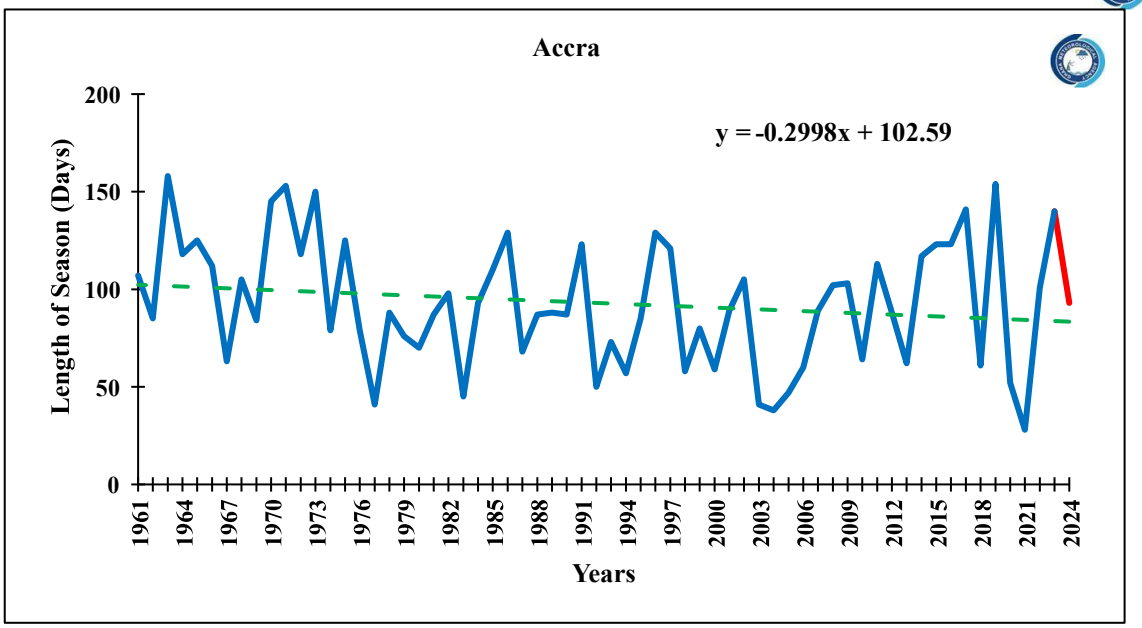


Figure 5.19. Trends in length of Season for Southern Ghana in Accra

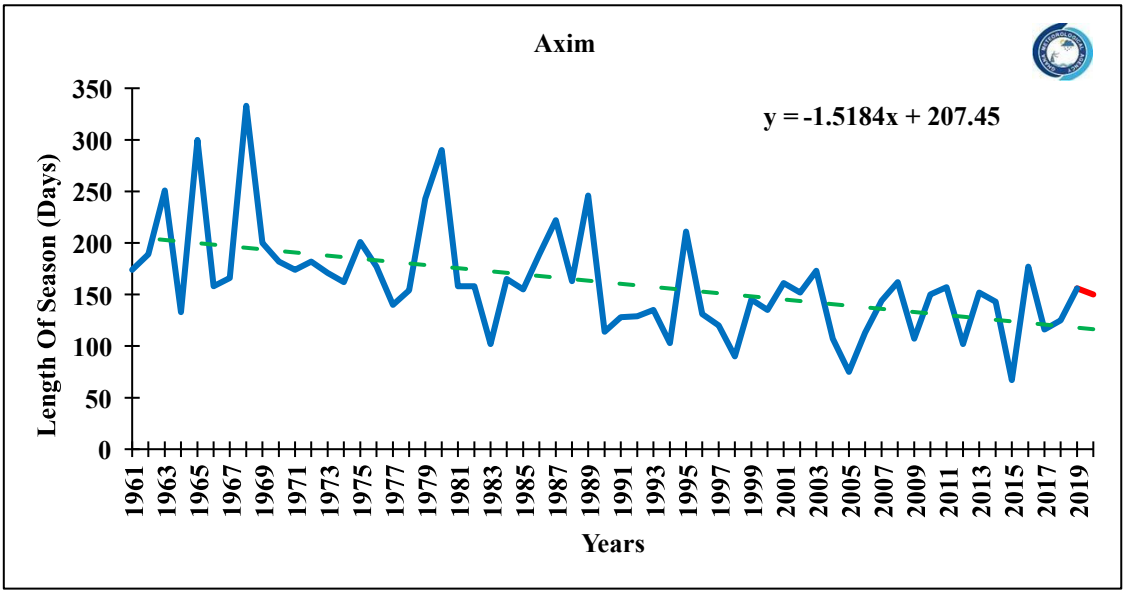
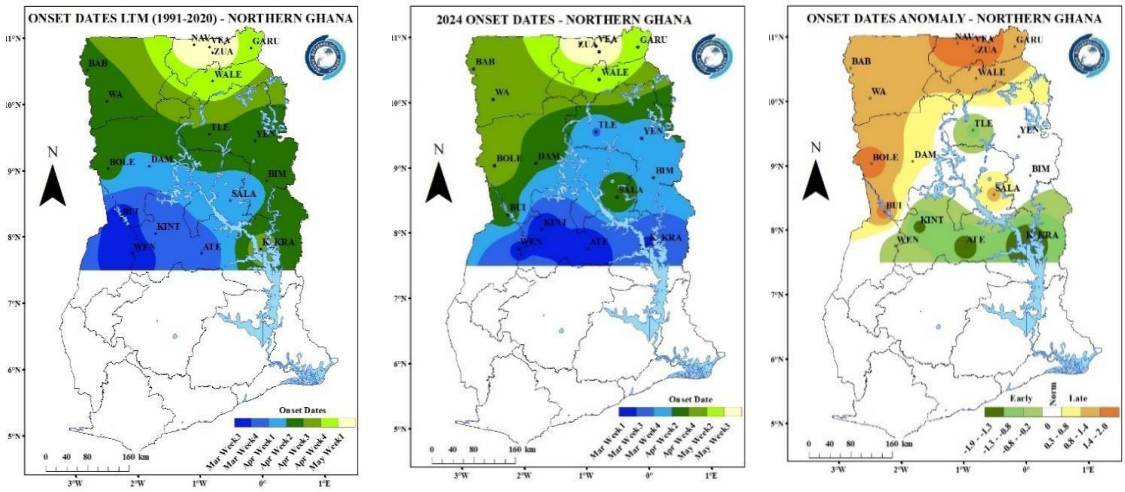


Figure 5.20. Trends in length of Season for Southern Ghana in Axim.

In the Forest zone, overall trends indicate a decrease, with Kumasi experiencing a rapid decline and Akuse showing a more gradual decrease in Figure 28. Along the coast, there has been a consistent decline in season length, with Axim showing a continuous drop and Accra experiencing a gradual decrease.

6.0 REVIEW OF ONSET AND CESSATION FOR NORTHERN GHANA

6.1 Onset



Map 6.1. Spatial distribution of LTM, 2024 and anomalies for onset dates.

The transition and northern zones also witnessed early rainfall onset, predominantly beginning in the transitional zone. When compared with the long-term mean, all areas within the transition zone experienced an early onset, except for Bui and its surrounding areas. Notably, Atebubu, Wenchi, and Kintampo recorded the earliest onset dates of the season.

In the northern zone, the onset of the season was observed in the fourth week of March in Tamale, Bimbila, and their environments, followed by Yendi in the first week of April. Navrongo and Zuarungu, located in the Upper East region, experienced the latest onset of the rainfall season, occurring in the third and last weeks of May respectively. The standardized anomaly map indicates that the extreme northern and eastern parts of the northern zone experienced a delayed onset of rainfall.

6.1.1 Onset Dates Trend Analysis for Northern Ghana

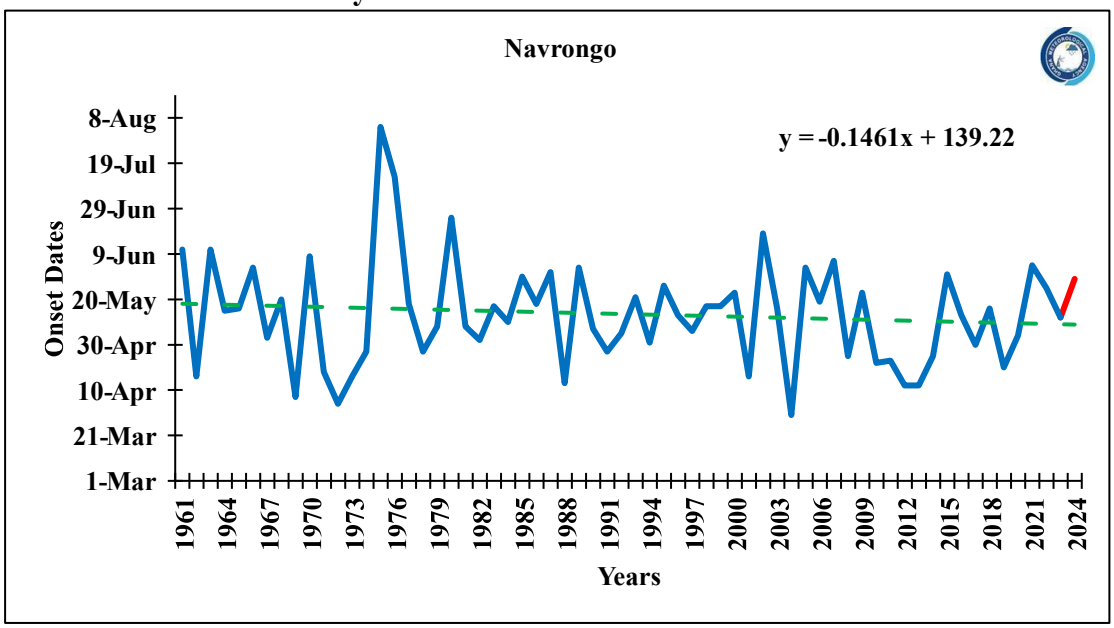


Figure 6.1. Trends in Onset Dates for Northern Ghana in Navrongo

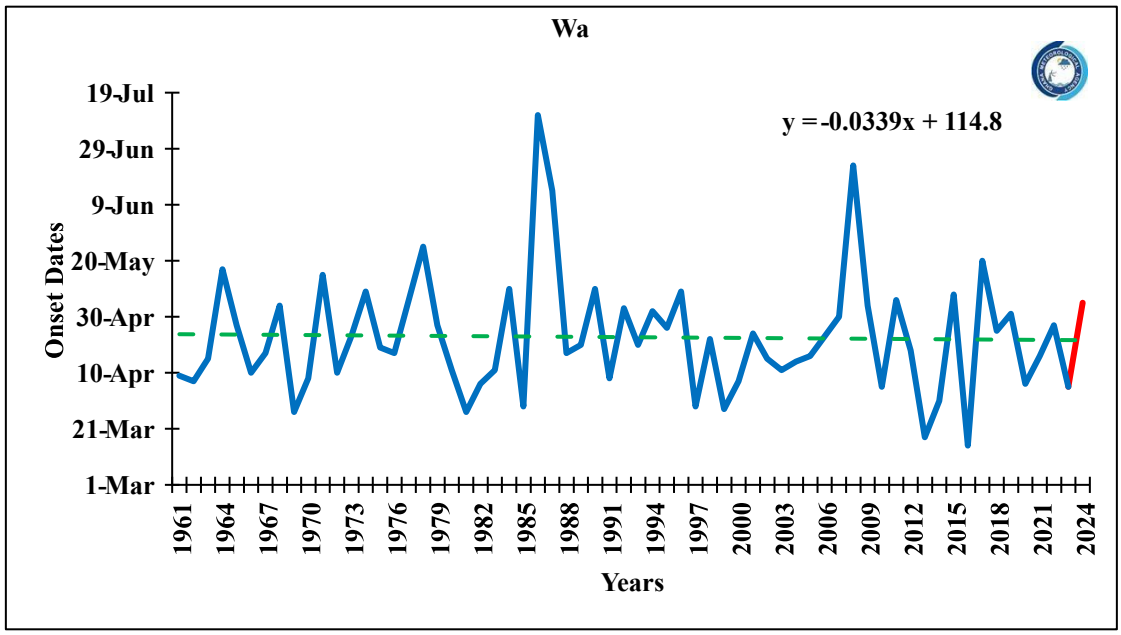


Figure 6.2. Trends in Onset Dates for Northern Ghana in Wa

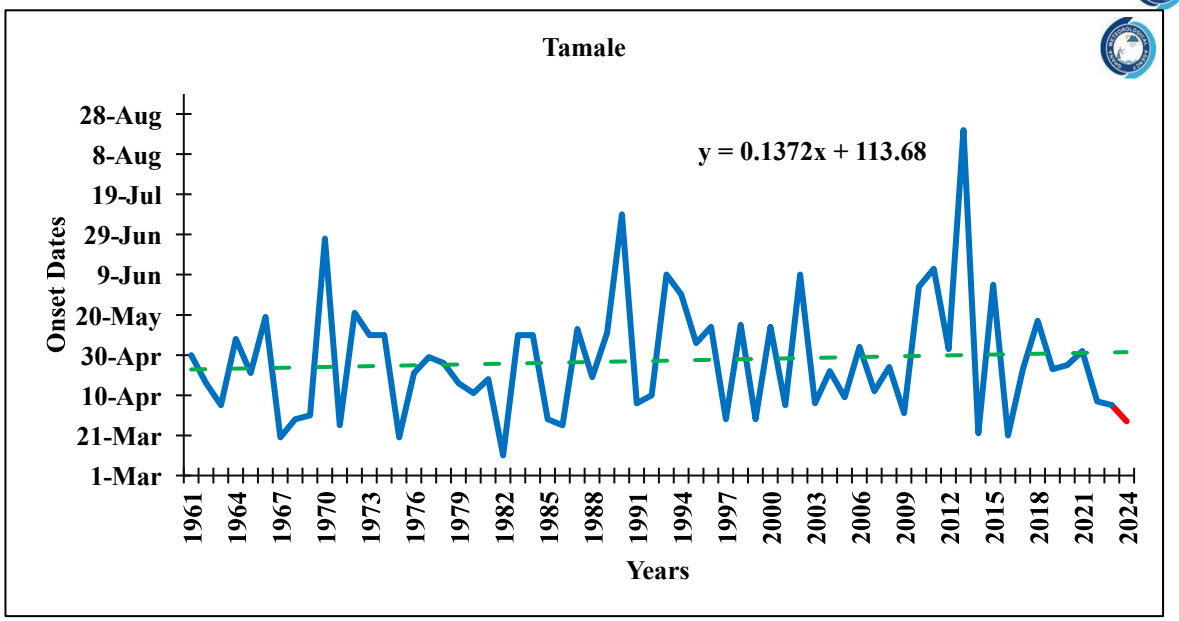


Figure 6.3. Trends in Onset Dates for Northern Ghana in Tamale

The northernmost parts of the country (Wa and Navrongo) show descending trendlines which indicate an early start of season for these areas. Tamale, on the other hand, shows a push-back in onset dates. This indicates a late start of season.

6.1.2 Onset Dates Trend Analysis for Transition Zone

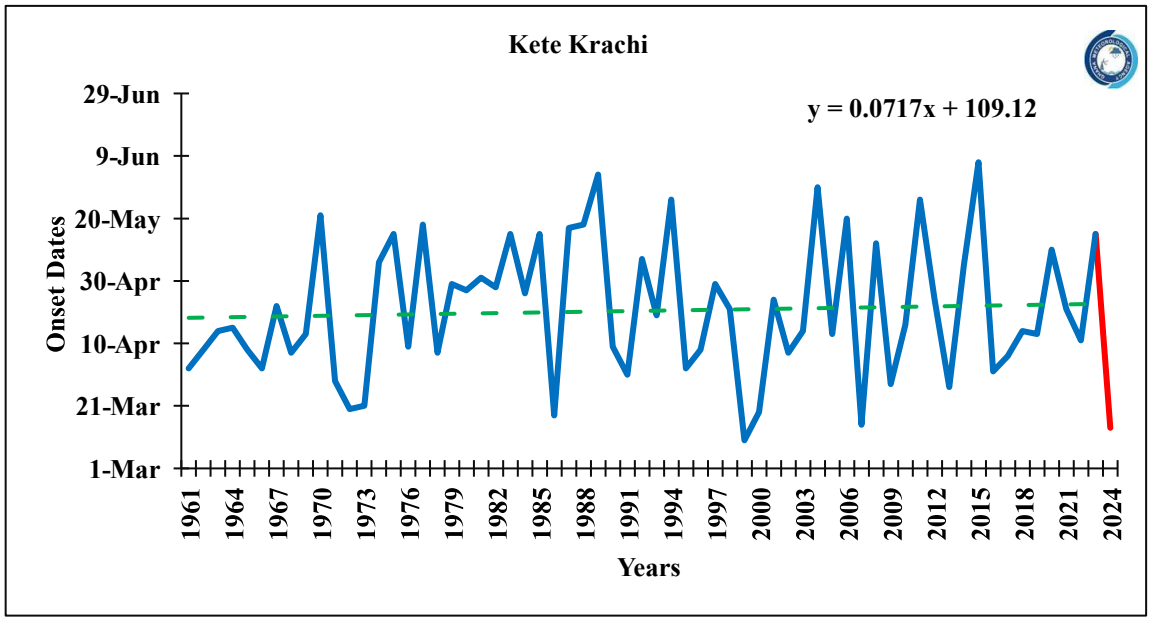


Figure 6.4. Trends in Onset Dates for Transitional zone for Kete Krachi

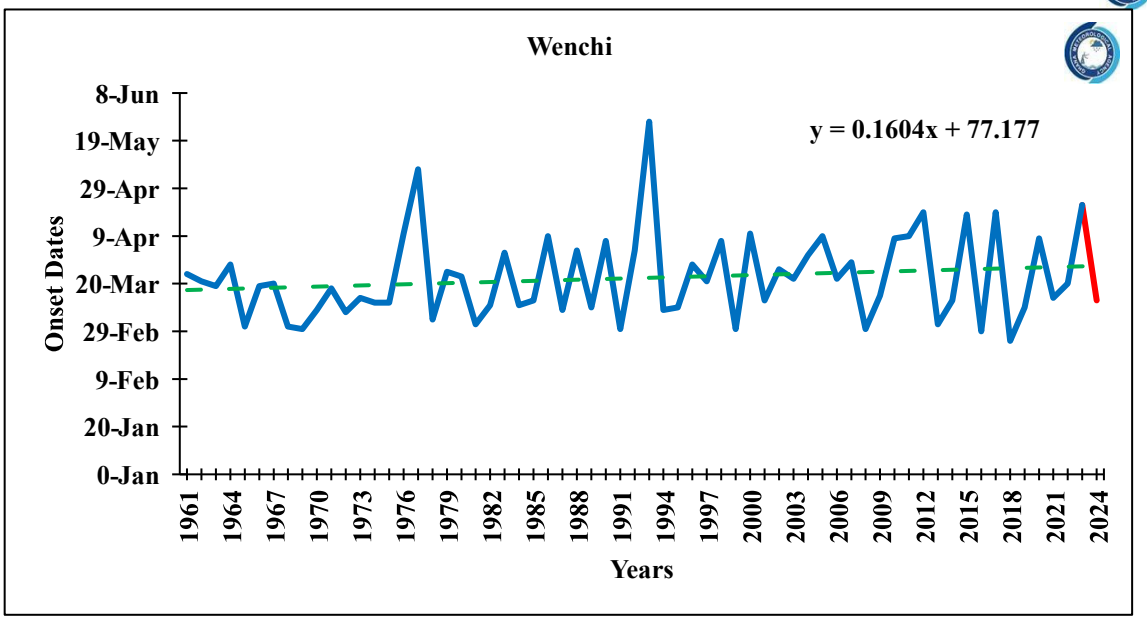
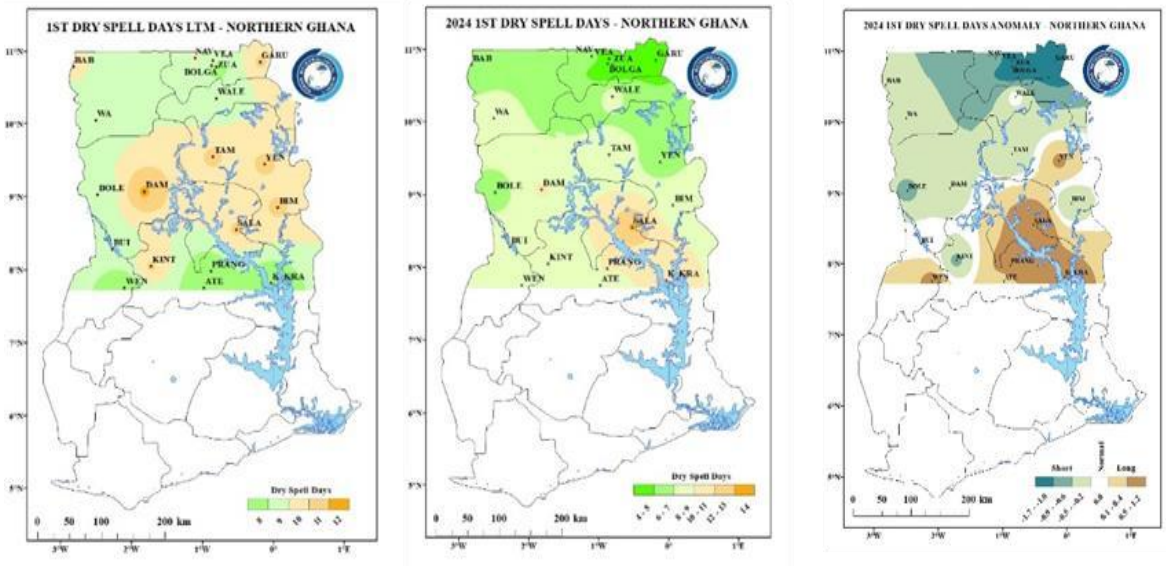


Figure 6.5. Trends in Onset Dates for Transitional zone for Wenchi

The transition zone (precisely Kete Krachi and Wenchi) records a slight upward trend which shows delays in onset dates for the past years according to the graphs.

6.2 Early/1st Dry Spell



Map 6.2. Spatial distribution of LTM, 2024, and anomalies for 1st/early dry spell days.

From the onset date to the 50th day of the season, the longest consecutive number of dry days is termed as Early/1st Dry Spell.

In the Northern sector, Salaga recorded the longest dry spells period in the sector, experiencing a maximum of 14 days without rain (3 days longer than its LTM) after the season had begun. Yendi recorded 13 dry days, 2 days longer than its LTM.

As compared to their LTMs, Bui, Wa and Walewale, together with their respective surroundings recorded normal dry spell periods of 9 days. Across the entire country, Bolga and Vea, together with their respective environs recorded the shortest early dry spell period of 4 days.

The rest of the Northern sector recorded dry spells shorter than their LTMs.

6.2.1 Early/1st Dry Spell Trend Analysis for Northern Ghana

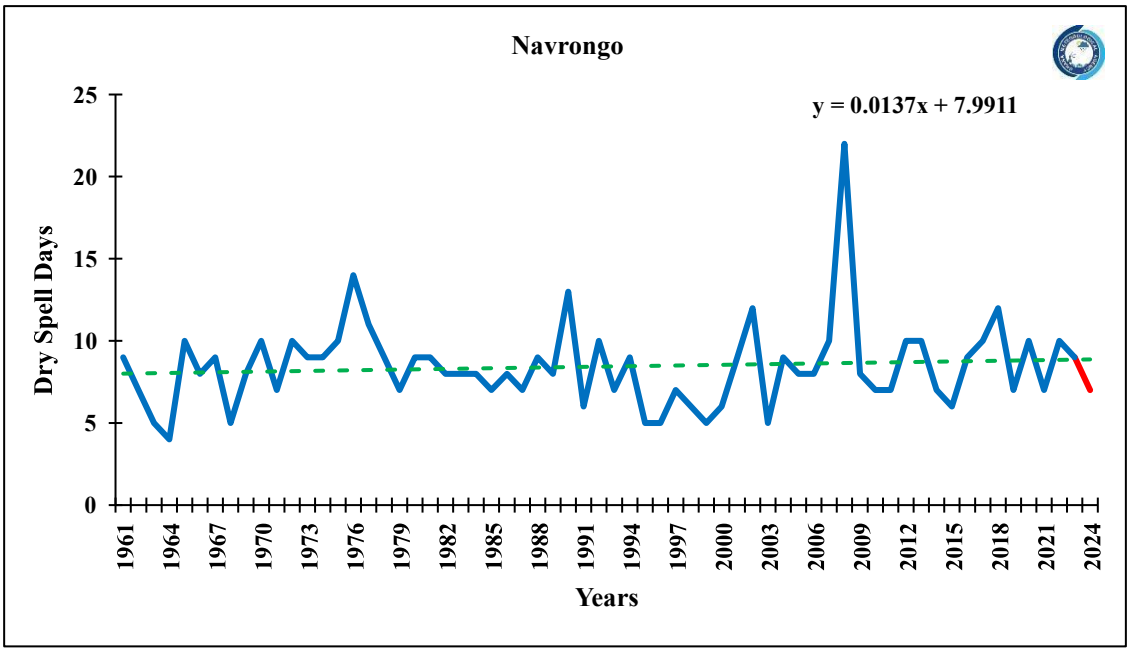


Figure 6.6. Trends in 1st /Early Dry Spell Days for Northern Ghana in Navrongo

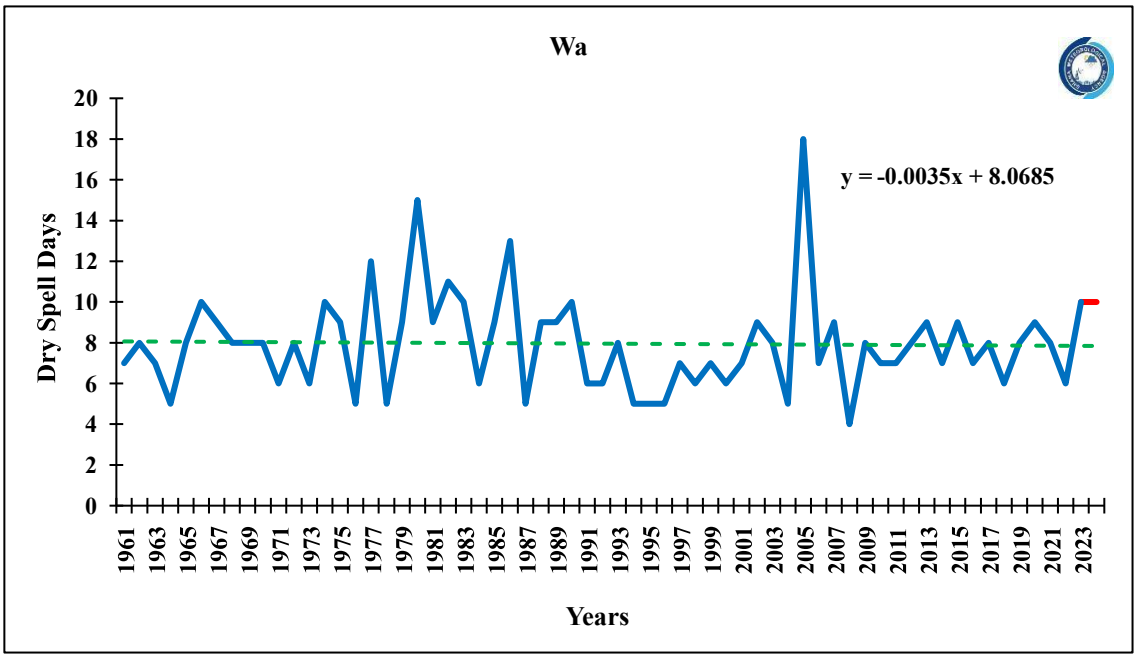


Figure 6.7. Trends in 1st /Early Dry Spell Days for Northern Ghana in Wa

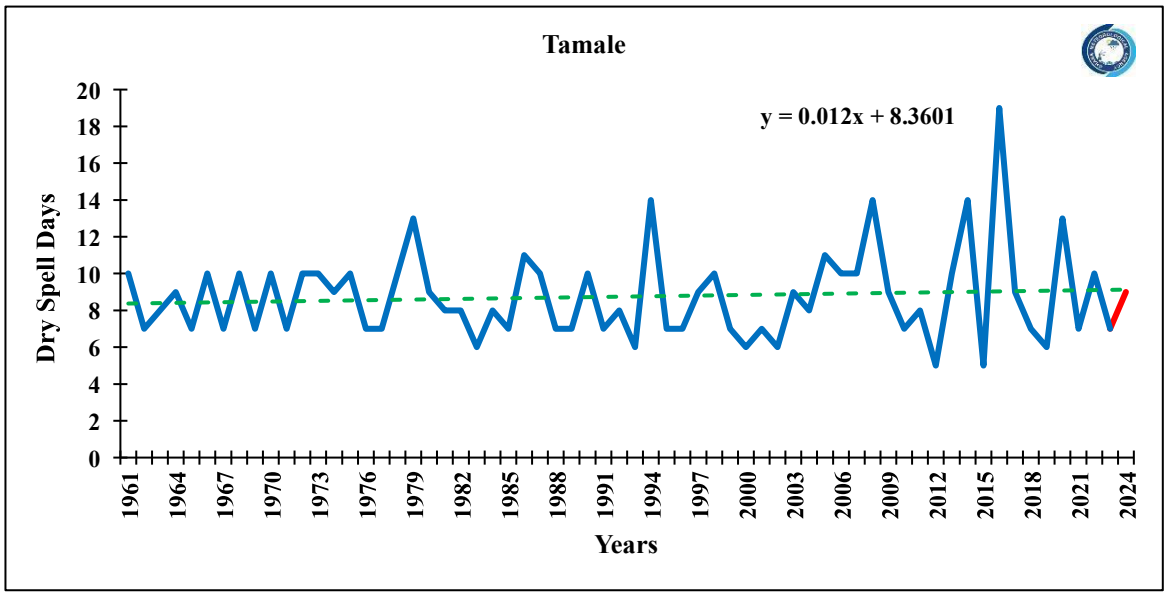


Figure 6.8. Trends in 1st /Early Dry Spell Days for Northern Ghana in Tamale

Navrongo and Tamale show an upward trend over the years (1961-2020). This indicates that there was an increase in the number of dry spells days along the period. However, Wa shows a neutral trend even though there are inter-seasonal variabilities.

6.2.2 Early/1st Dry Spell Trend Analysis for Transition zone

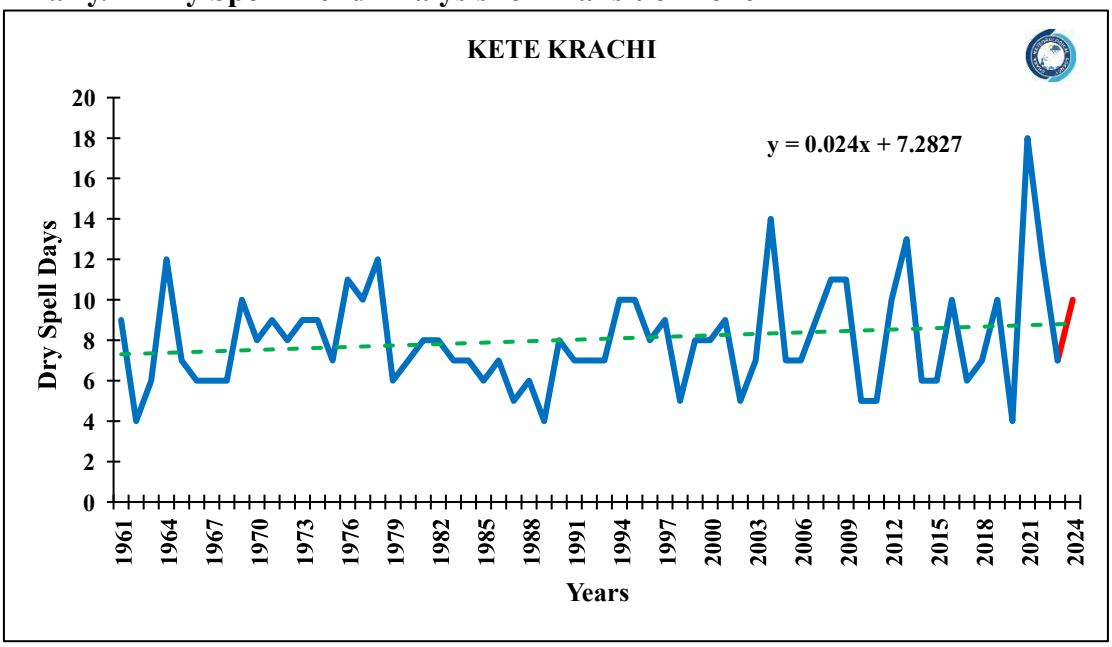


Figure 6.9 Trends in 1st /Early Dry Spell Days for Northern Ghana in Kete Krachi

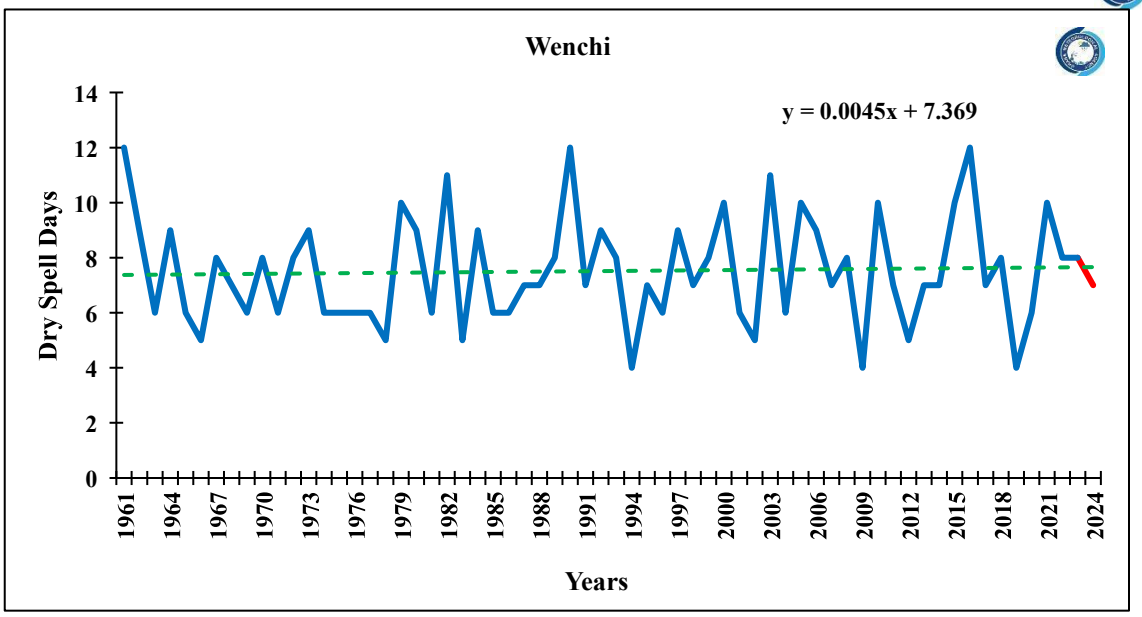
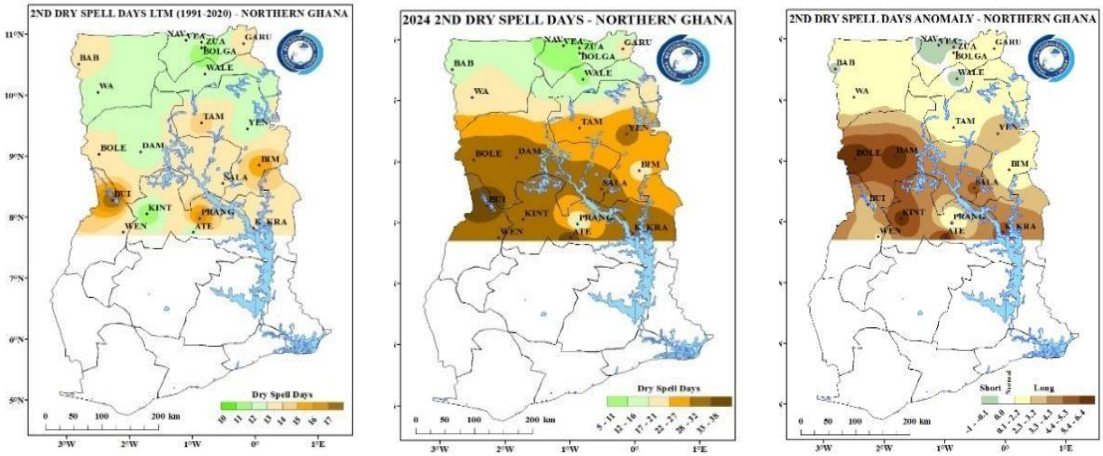


Figure 6.10 Trends in 1st /Early Dry Spell Days for Northern Ghana in Wenchi

The trends for Kete Krachi and Wenchi, in the transition zone have remained largely unchanged over the years.

6.3 Late/2nd Dry Spell



Map 6.3. Spatial distribution of LTM, 2024 and anomalies for 2nd/late dry spell days.

From the 51st day of the season to the cessation date, the longest consecutive number of dry days is termed as Late Dry Spell. Climatological data for Northern Ghana (above 8ºN) for 1991-2020 has revealed that late dry spell days normally span from 10 to 17 days.

In 2024, Northern Ghana experienced significantly prolonged second dry spell days, with deviations from the climatological normal reaching 173% in Damongo, 164% in Yendi, 158% in Bole, and 146% in Salaga. Conversely, locations such as Vea, Navrongo,

Walewale, and Babile in the Northern Zone recorded shorter-than-normal durations of the second dry spell. These reductions in dry spell days contrast sharply with the extended durations observed in other areas in Northern Ghana.

6.3.1 Late/2nd Dry Spell Trend Analysis for Northern Ghana

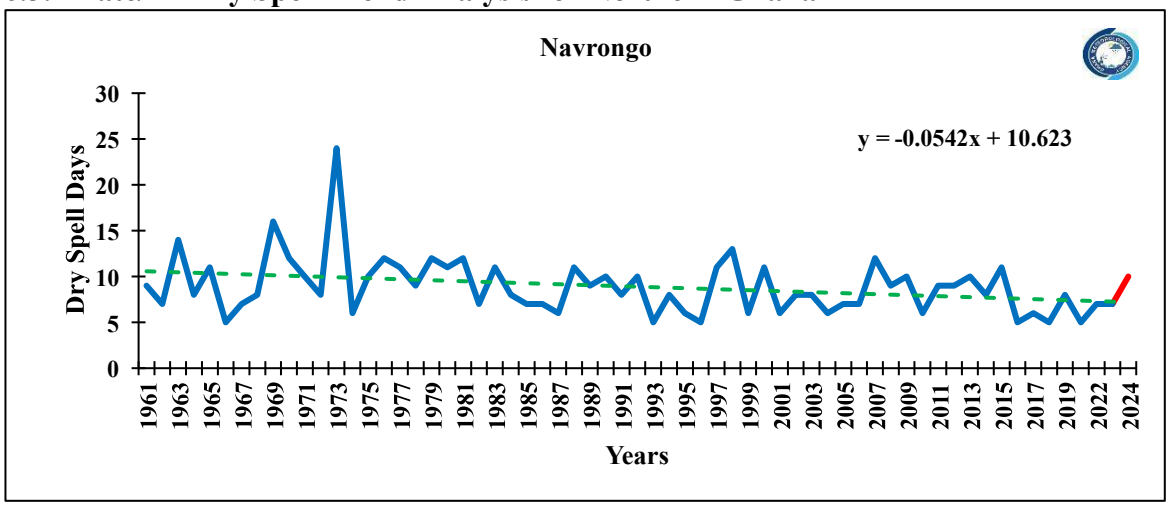


Figure 6.11. Trends in 2nd /Late Dry Spell Days for Northern Ghana in Navrongo

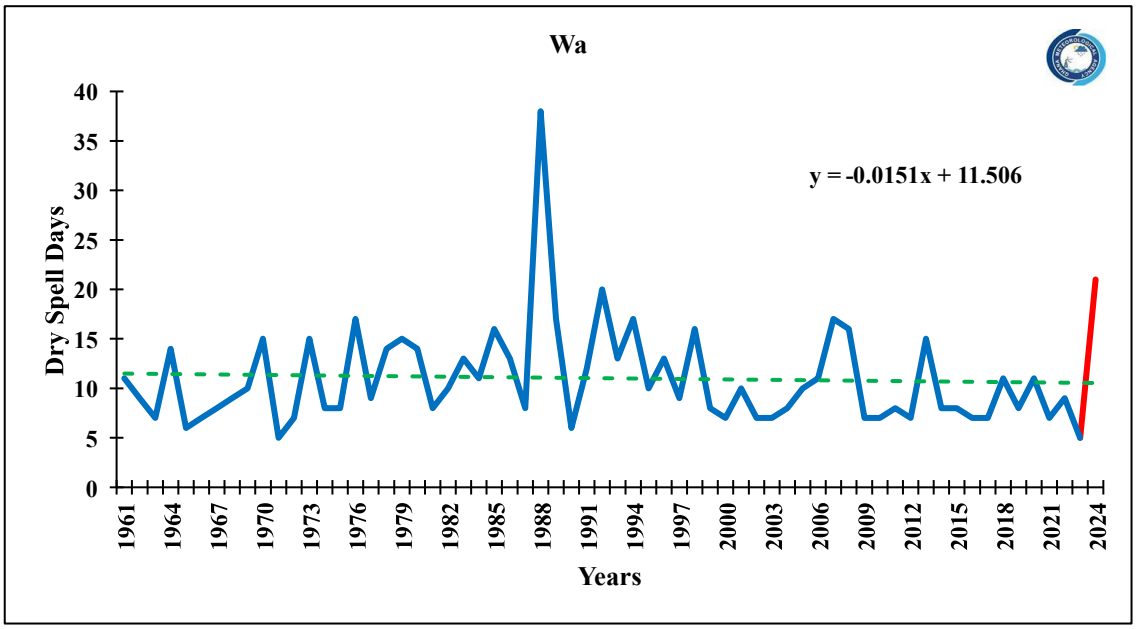


Figure 6.12. Trends in 2nd /Late Dry Spell Days for Northern Ghana in Wa

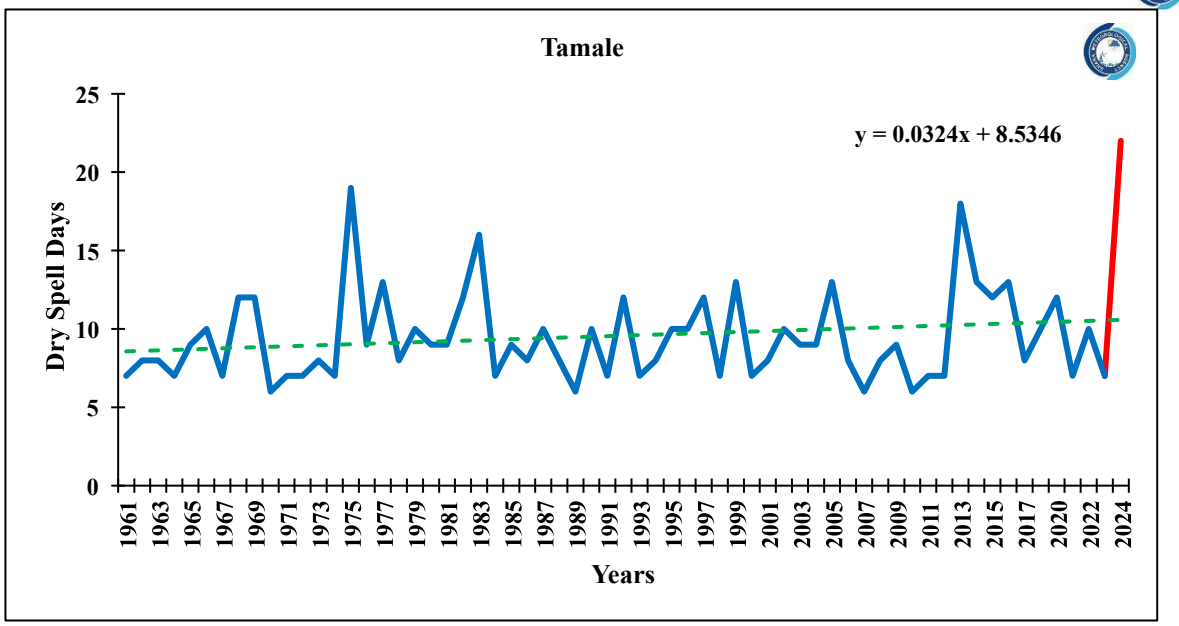


Figure 6.13. Trends in 2nd /Late Dry Spell Days for Northern Ghana in Tamale

6.3.2 Late/2nd Dry Spell Trend Analysis for Transition zone Ghana

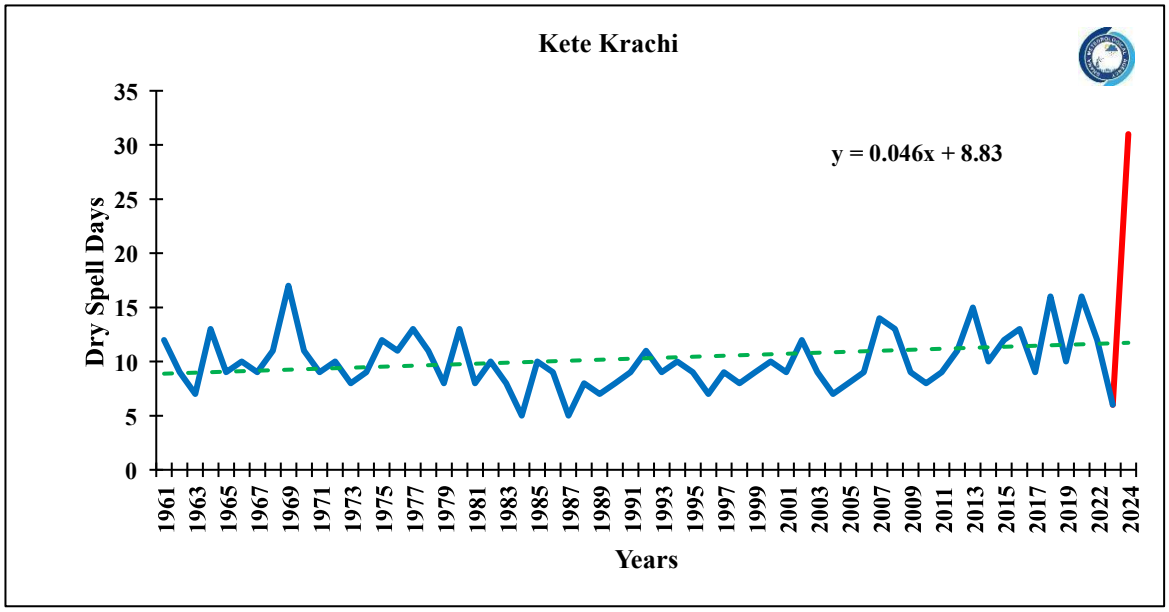


Figure 6.14. Trends in 2nd /Late Dry Spell Days for Northern Ghana in Kete Krachi

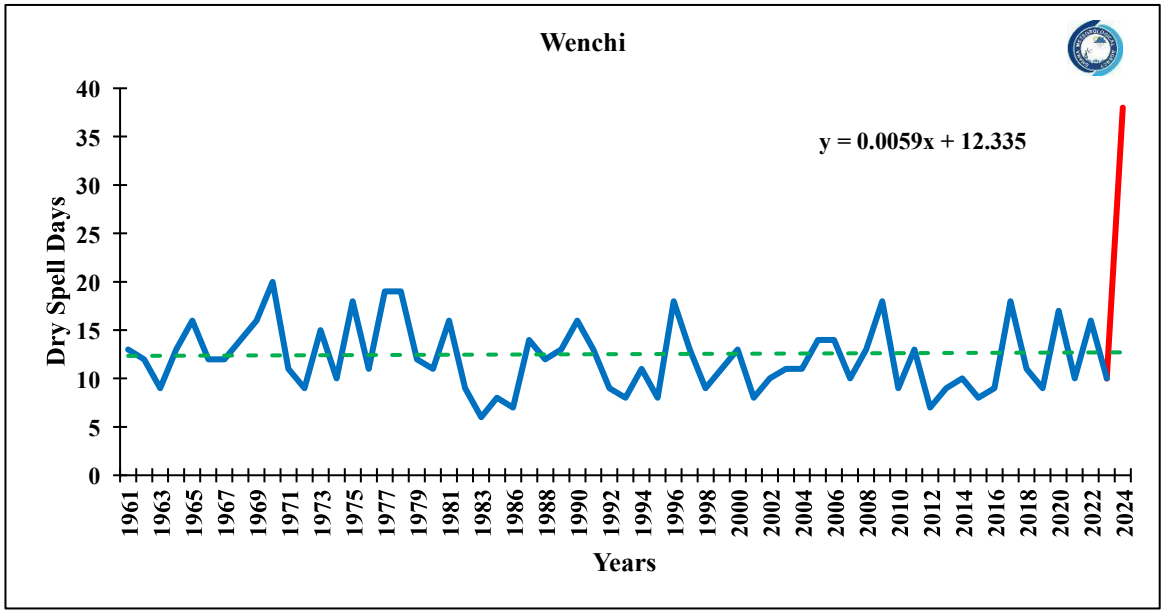
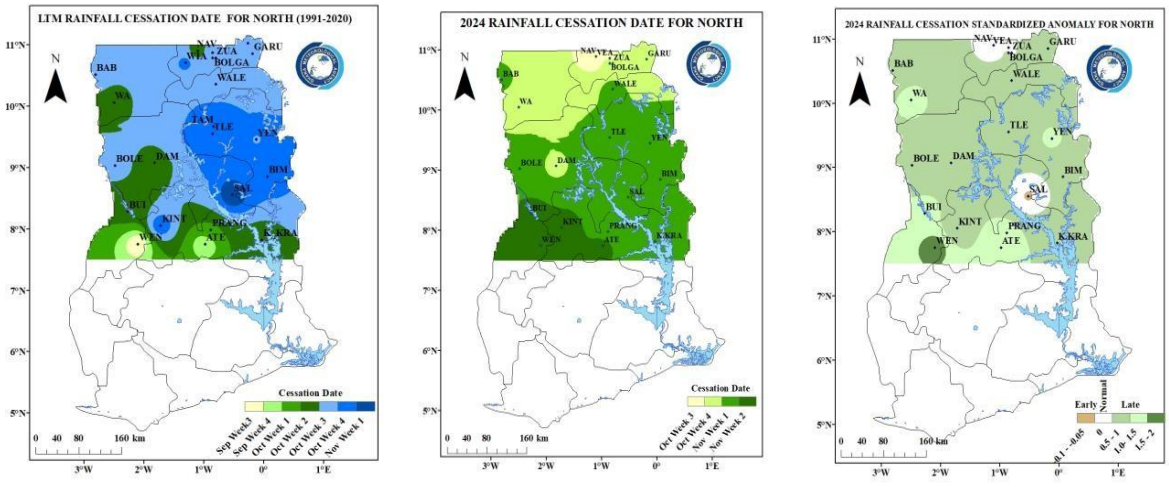


Figure 6.15. Trends in 2nd /Late Dry Spell Days for Northern Ghana in Wenchi.

Over the years, Navrongo has had a downward trend which suggests a decrease in the average length of dry spell days. The graph for Tamale shows an upward trend, indicating an increase in the average number of dry spell days. Wa, on other hand, shows a neutral trend meaning, there is no significant change in the number of dry spell days along the period.

Kete Krachi shows an upward trend indicating an increase in the average number of dry spell days. On the contrary, Wenchi has a downward trend which suggests a decrease in the average number of dry spell days.

6.4. Cessation



Map 6.4. Spatial distribution of LTM, 2024 and anomalies for cessation dates.

The major rainfall cessation for Northern Ghana generally had a late cessation except for Salaga, which had an early cessation. Navrongo, Vea, and Zuarungu experienced a normal cessation. Wenchi observed an extremely late cessation. With the climatological cessation dates spanning from the 3rd Week of September to the 1st Week of November, the cessation dates for this year were between the 3rd Week of October and the 2nd Week of November.

6.4.1 Cessation Dates Trend for Northern Ghana

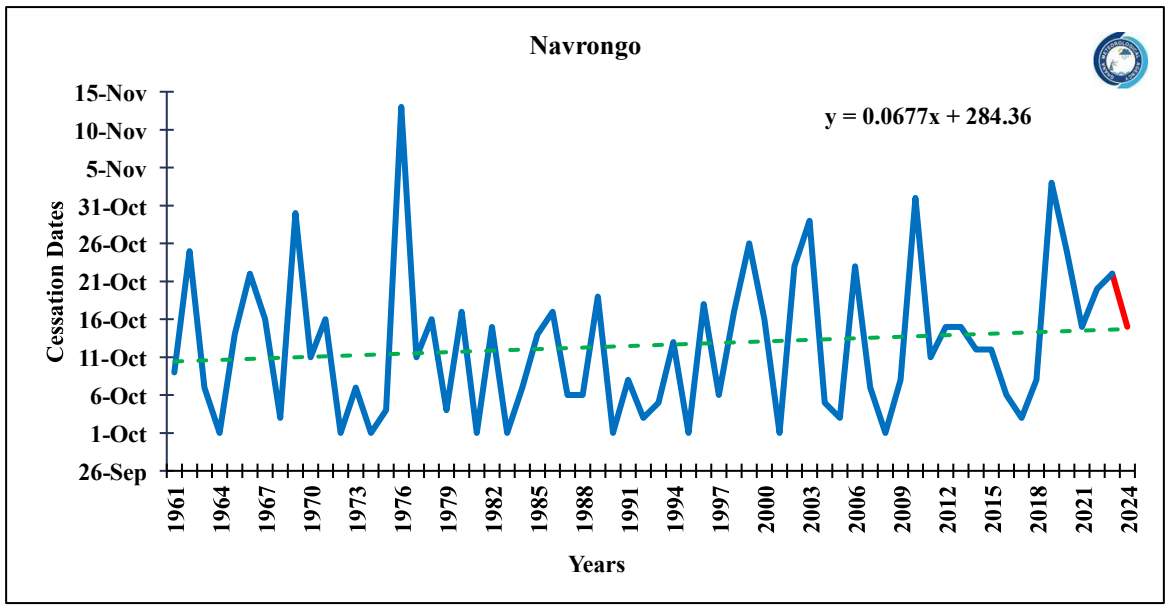


Figure 6.16. Trends in Cessation Dates for Northern Ghana in Navrongo

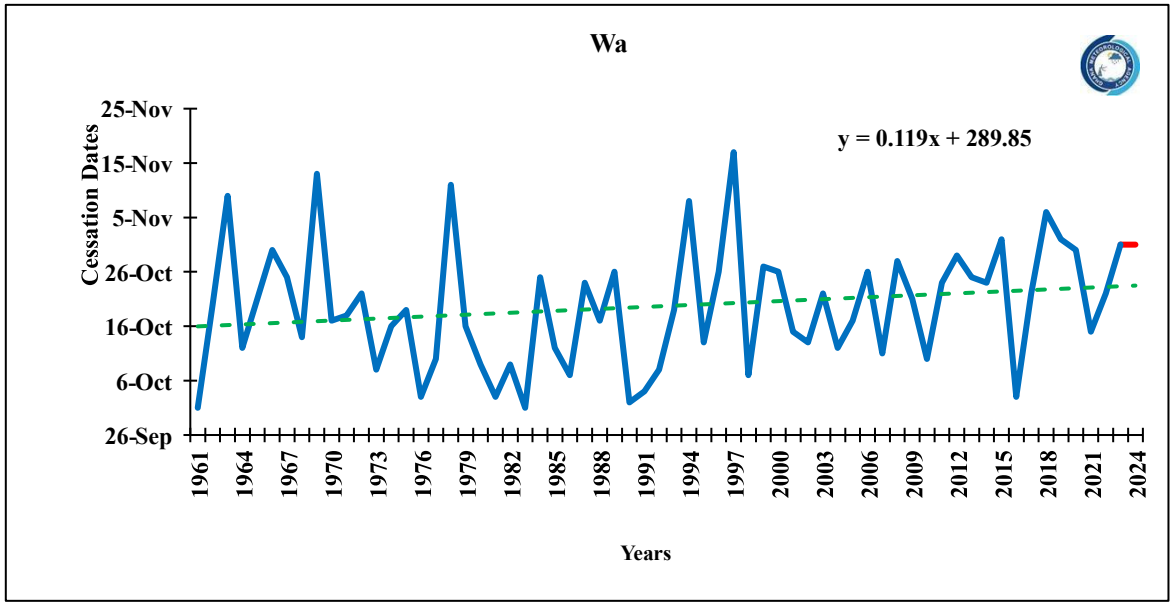


Figure 6.17. Trends in Cessation Dates for Northern Ghana in Wa

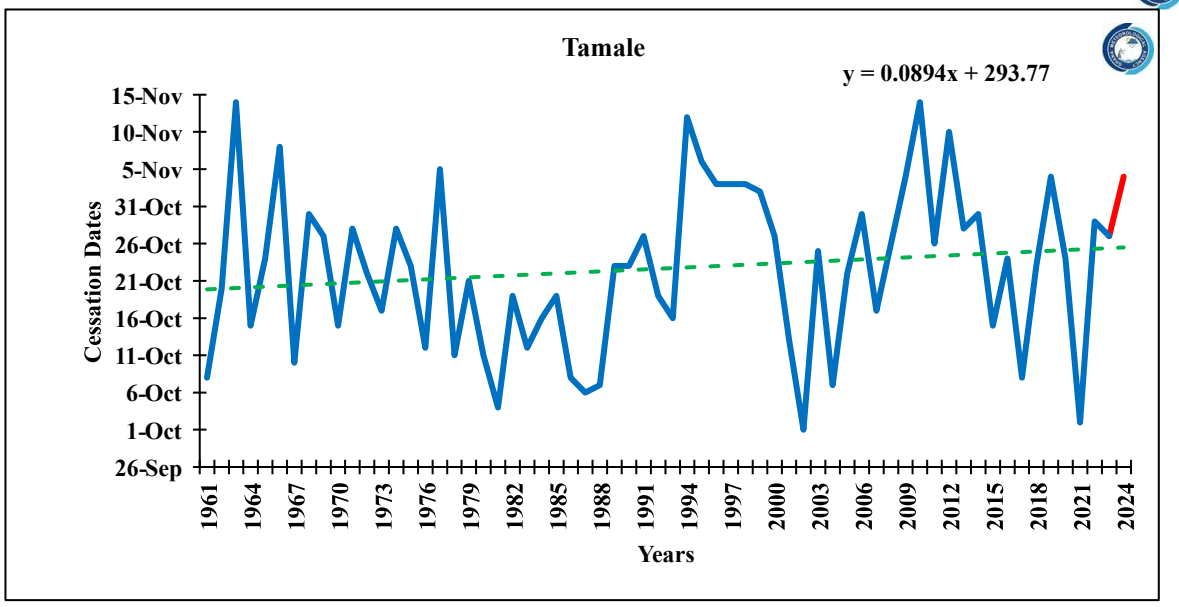


Figure 6.18. Trends in Cessation Dates for Northern Ghana in Tamale

6.4.2 Cessation Dates Trend for Transitional Zone

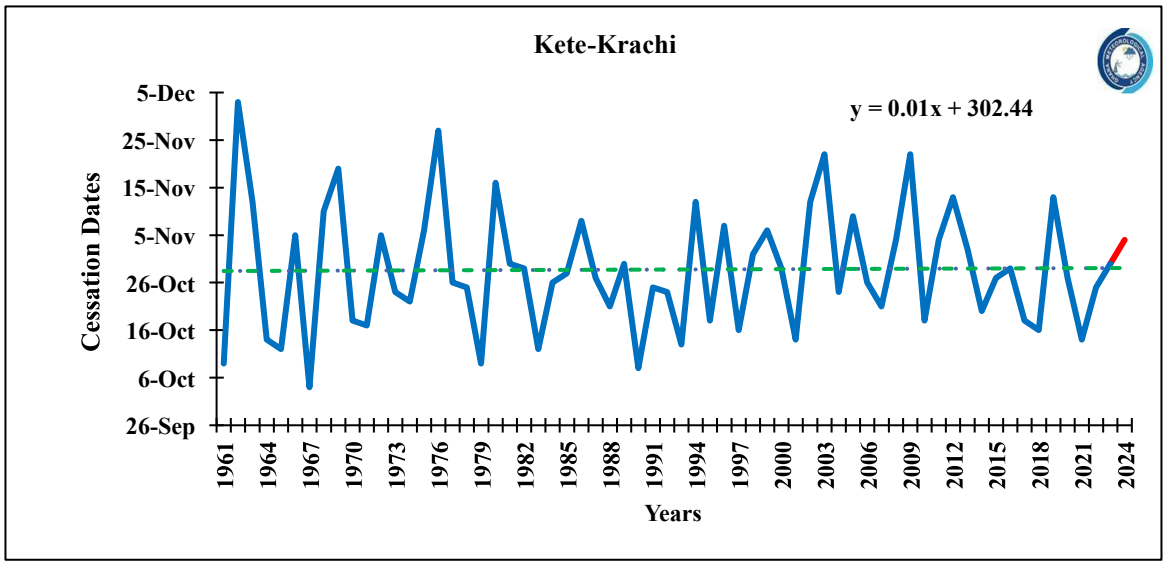


Figure 6.19. Trends in Cessation Dates for Transitional Zone in Kete Krachi.

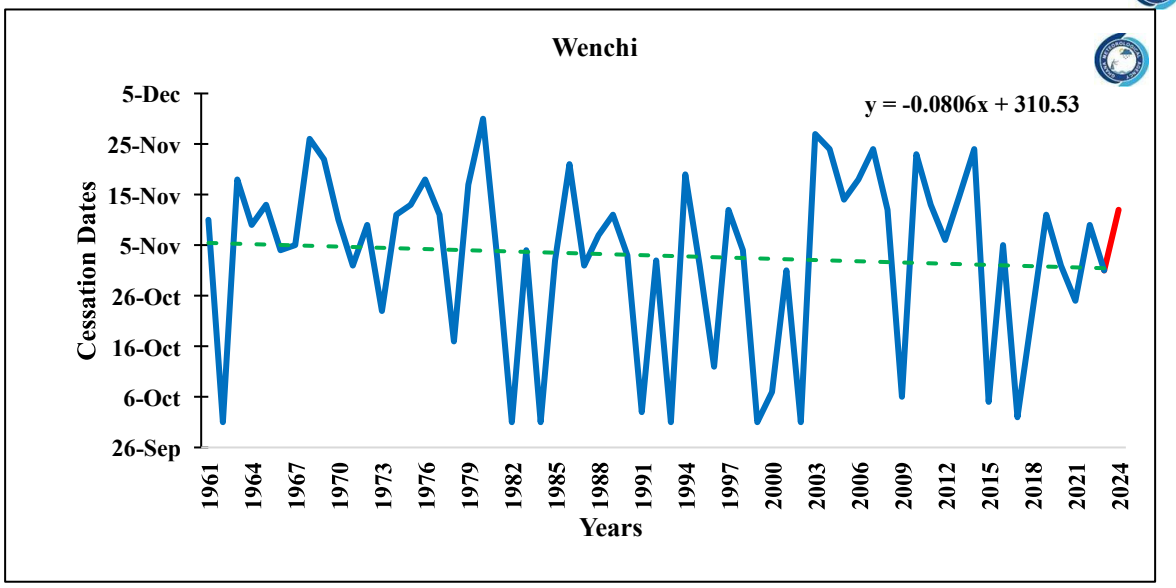
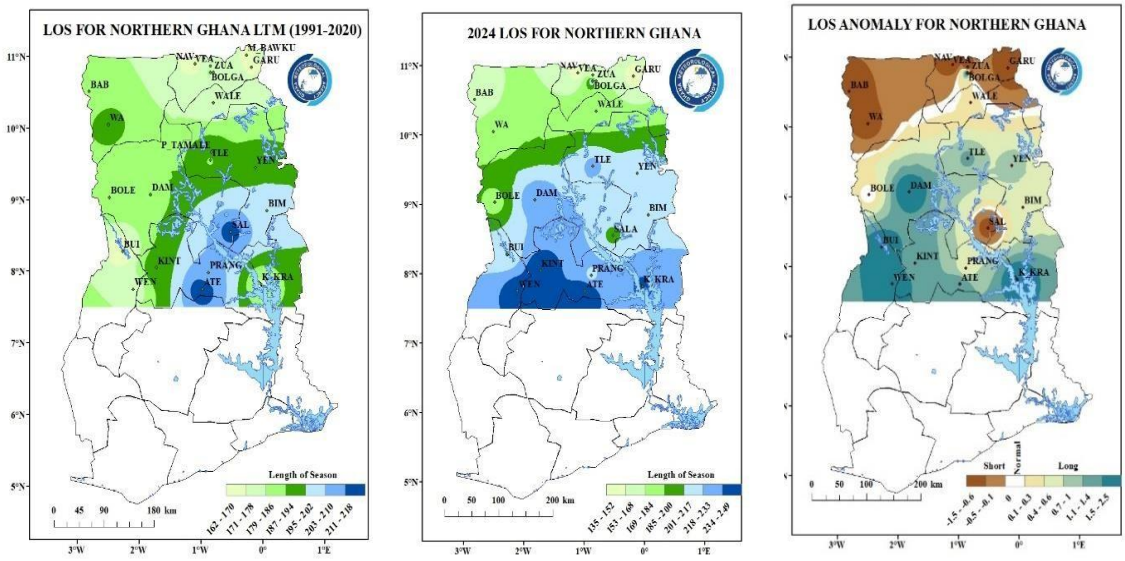


Figure 6.20. Trends in Cessation Dates for Transitional Zone in Wenchi

The plot shows significant variation in the cessation dates from year to year. The trendline indicates that Kete Krachi increased considerably over time, while Wenchi had a decreasing trendline over the years. The cessation dates vary significantly, from the first week of October to the first week of December.

The cessation dates indicate a general increasing tendency in the Northern parts of the country. Despite the increasing pattern, there is a significant variation in the years. Most cessation dates occur from the first week of October to the Second week of November.

6.5. Length of Season



Map 6.5. Spatial distribution of LTM, 2024 and anomalies for length of season.

Considering the Northern Sector in 2024, Navrongo, Vea, Zuarungu, and Garu in the Upper-East Region experienced a length of season between 135 to 152 days except for Bolgatanga which recorded a long length of Season of 244 days. Walewale in the North-East and Wa in the Upper West region also experienced a season length between 169 to 184 days, whiles Babile in the Upper West Region recorded 155 days.

In the areas of the Northern, Savannah, and the transition belt, apart from Bole which recorded a length of season 177 days and Salaga 197 days. All the other areas experienced a seasonal length above 200 days. Atebubu and Kintampo recorded the areas with the longest season length of 249 days followed by Wenchi and Bolgatanga (244 days), and Kete Krachi (235 days) while Vea (135 days) was the area with the shortest length of season in Northern Ghana.

In comparison to the Normal length of season for each area in the Northern Sector, the extreme northern part, areas such as Wa, Babile, Navrongo, Zuarungu, Vea and Garu except for Bolgatanga experienced shorter than normal length. Salaga also experienced a shorter length of season. The rest of the places experienced normal to longer length of season.

6.5.1 Length of Season Trend Analysis for Northern Ghana

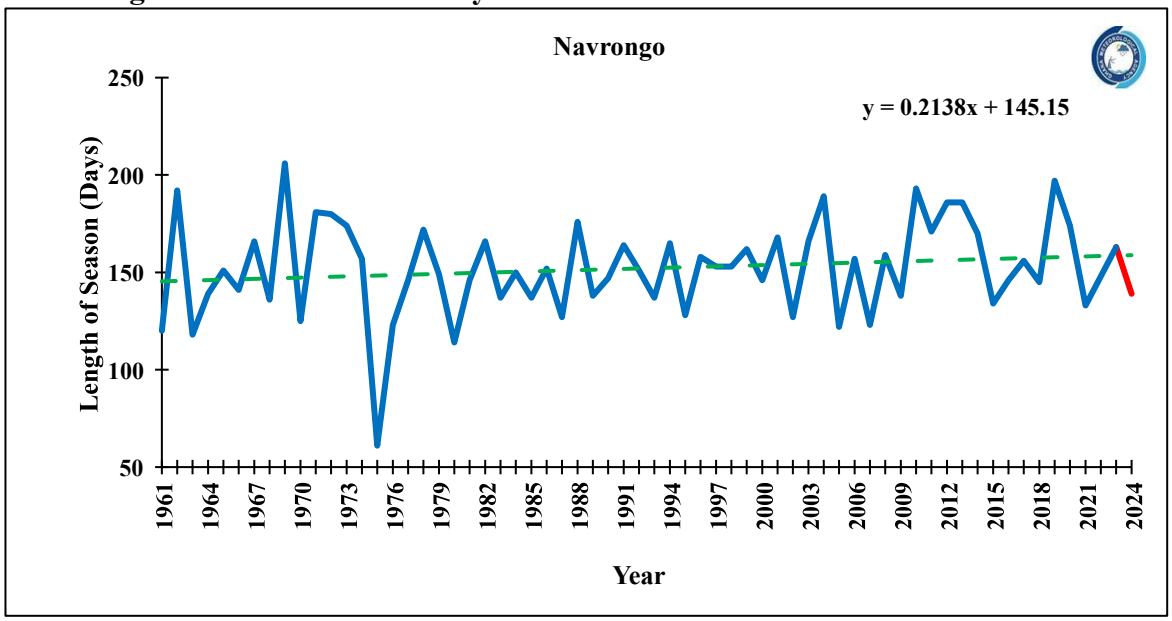


Figure 6.21. Trends in Length of Season for Northern Ghana in Navrongo

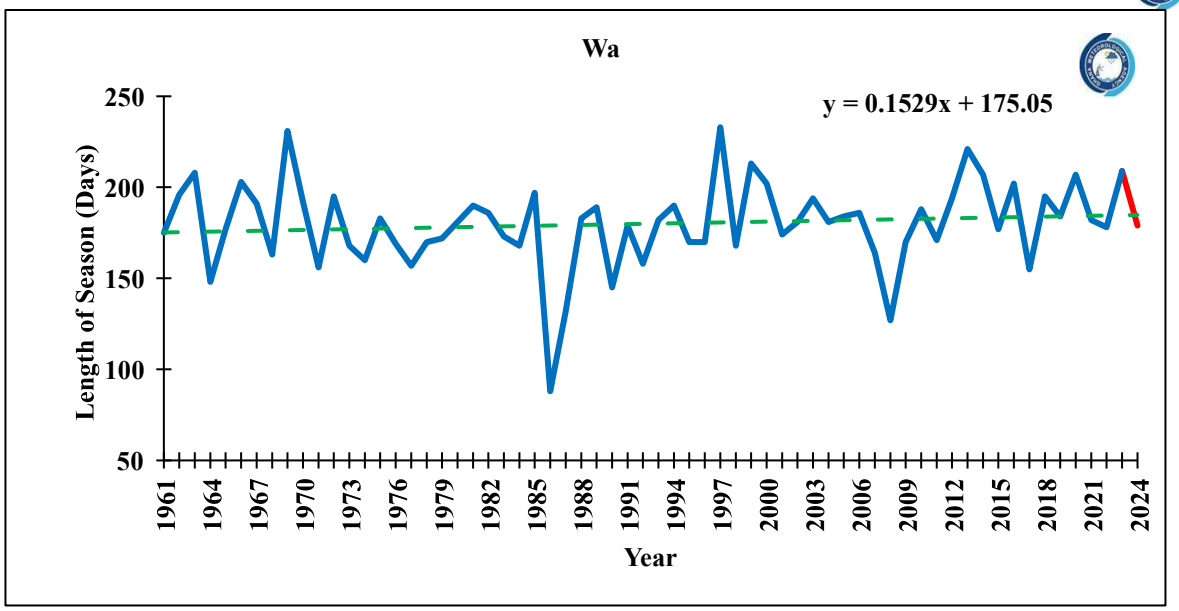


Figure 6.22.Trends in Length of Season for Northern Ghana in Wa

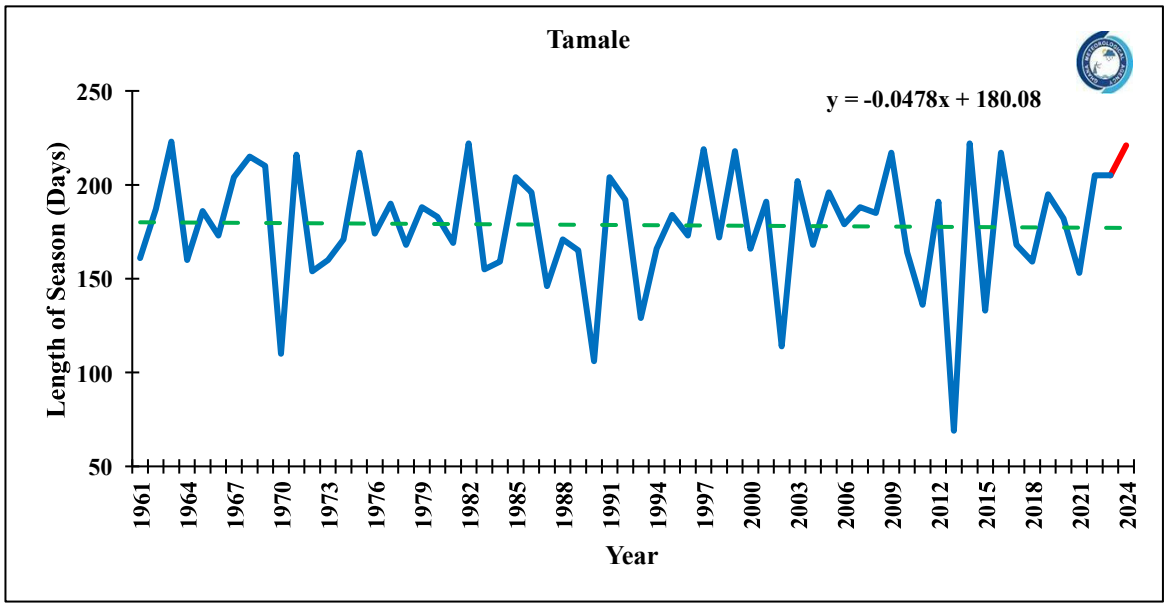


Figure 6.23. Trends in Length of Season for Northern Ghana in Tamale

Since the 1960s, season lengths in the northern sector have displayed differing trends. Wa and Navrongo had an increase in season length. However, Tamale has experienced a slight decrease.

6.5.2 Length of Season Trend Analysis for Transitional Zone

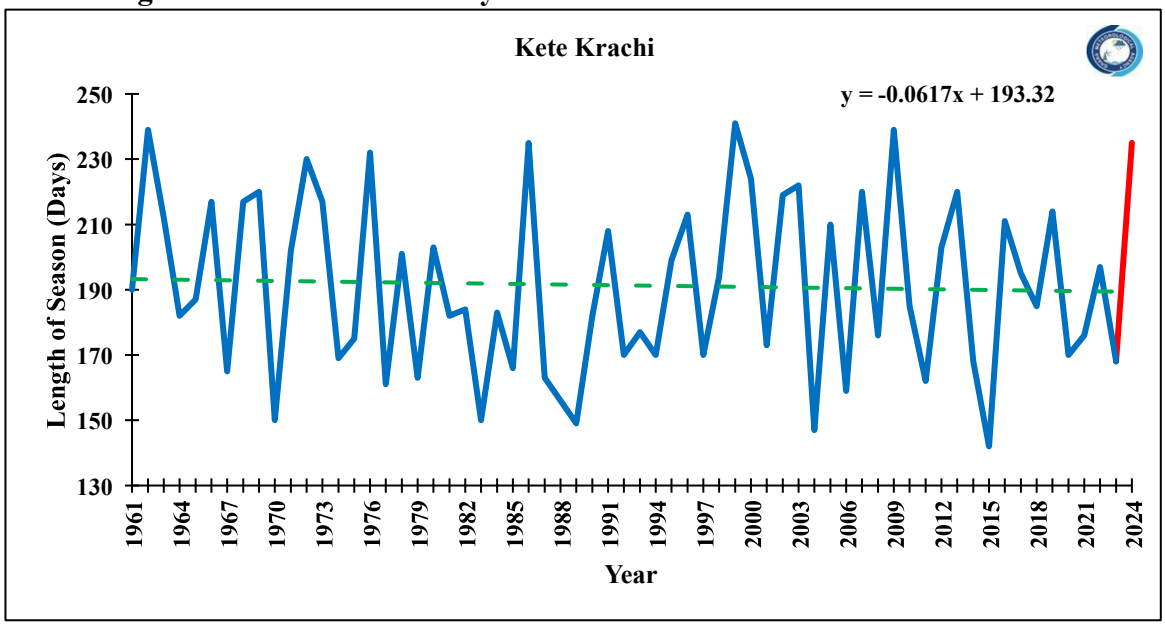


Figure 6.24. Trends in Length of Season for Transitional Zone in Kete Krachi

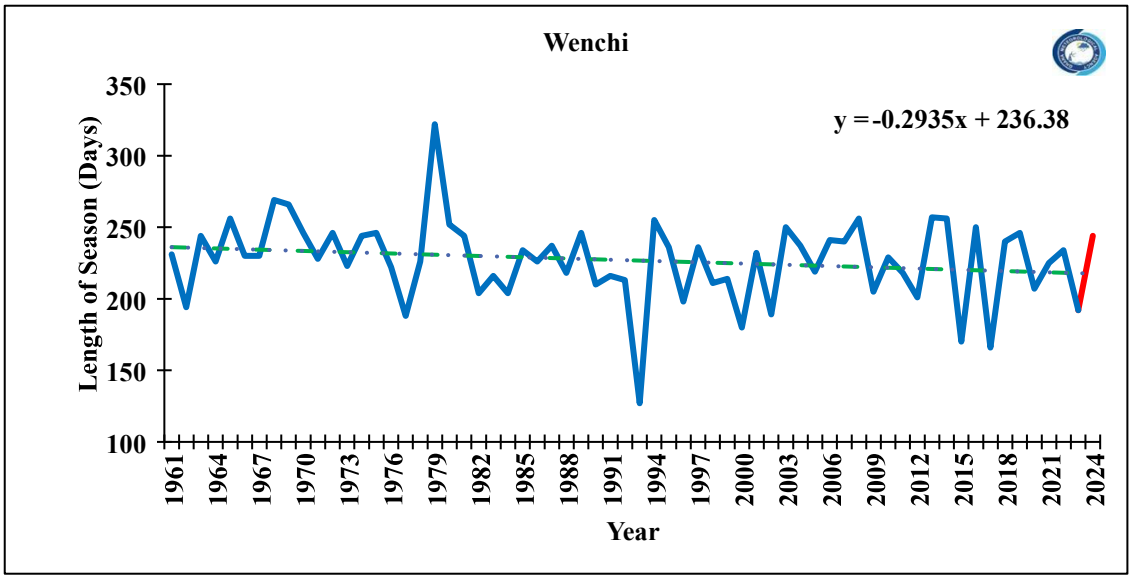
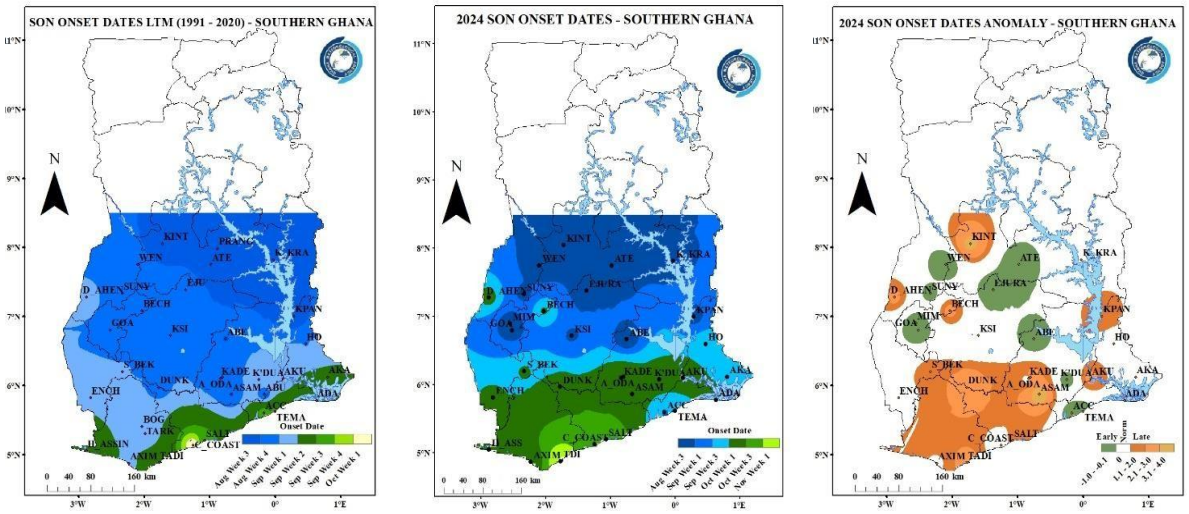


Figure 6.25. Trends in Cessation Dates for Transitional Zone in Wenchi.

In the transition, Wenchi and Kete Krachi show a declining trend in season length.

7.0 REVIEW OF ONSET AND CESSATION FOR SOUTHERN GHANA (MINOR SEASON)

7.1 Onset



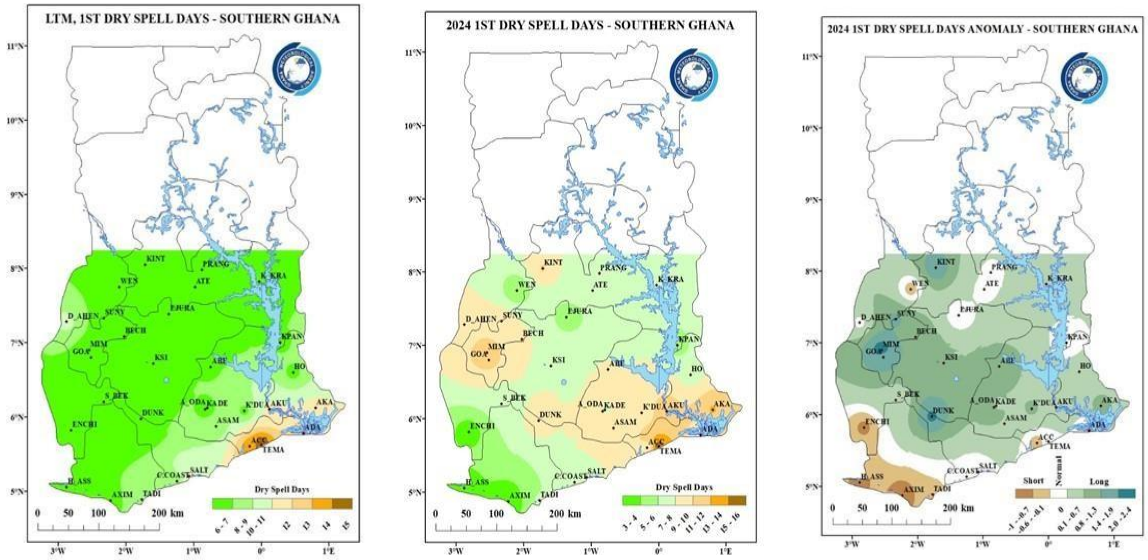
Map 7.1. Spatial distribution of LTM, 2024 and anomalies for onset dates.

The transition zone of Ghana for the 2024 year exhibited a bimodal rainfall pattern, hence we saw a minor rainfall season (SON). The SON season had rains starting in areas like Kintampo, Wenchi, and Atebubu, as well as Sunyani and Kete Krachi in the 3rd week of August. Despite the rains starting in the transition zone, the anomaly map indicates a late onset for Kintampo and its surroundings.

Most parts of the forest zone including Sunyani, Goaso, Kumasi, and Abetifi experienced an early onset occurring in the 3rd week of August. On the contrary, Dormaa Ahenkro experienced a late onset occurring in the 1st week of October.

For the Coastal sector, Accra, Tema, Ada, and Akatsi experienced an early onset which occurred in the 3rd week of September, whereas most parts of the West Coast experienced a late onset between the 1st and 3rd weeks of October. Takoradi also experienced a late onset which occurred in the 1st week of November. As per the anomaly map, most parts of the West Coast experienced a delayed onset, with Asamankese experiencing the latest.

7.2 Early/1st Dry Spell



Map 7.2. Spatial distribution of LTM, 2024 and anomalies for 1st/early dry spell days.

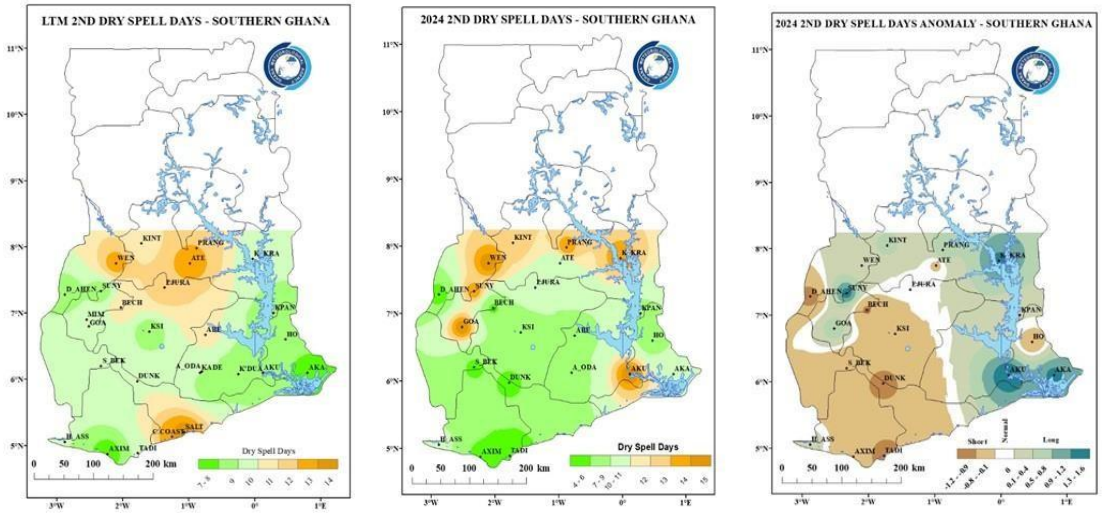
From the onset date to the 50th day of the season, the longest consecutive number of dry days is termed as Early/1st Dry Spell.

Most areas along the coast such as Axim, Accra, Ada, and Takoradi all experienced shorter dry spell days as compared to their long-term means. Prang and Atebubu together with their surroundings recorded 7 dry spell days. Cape Coast and Dormaa Ahenkro with their environs recorded 8 and 9 dry days respectively.

However, Tema and its close environs experienced the longest spell within the period with 16 consecutive days of dryness which is normal taking into consideration its long-term mean.

The rest of the stations across the country recorded longer dry spell days compared to their long-term means. Mim and its surroundings recorded the highest surplus within the country as it experienced 6 days of dryness longer than its long-term mean.

7.3 Late/2nd Dry Spell



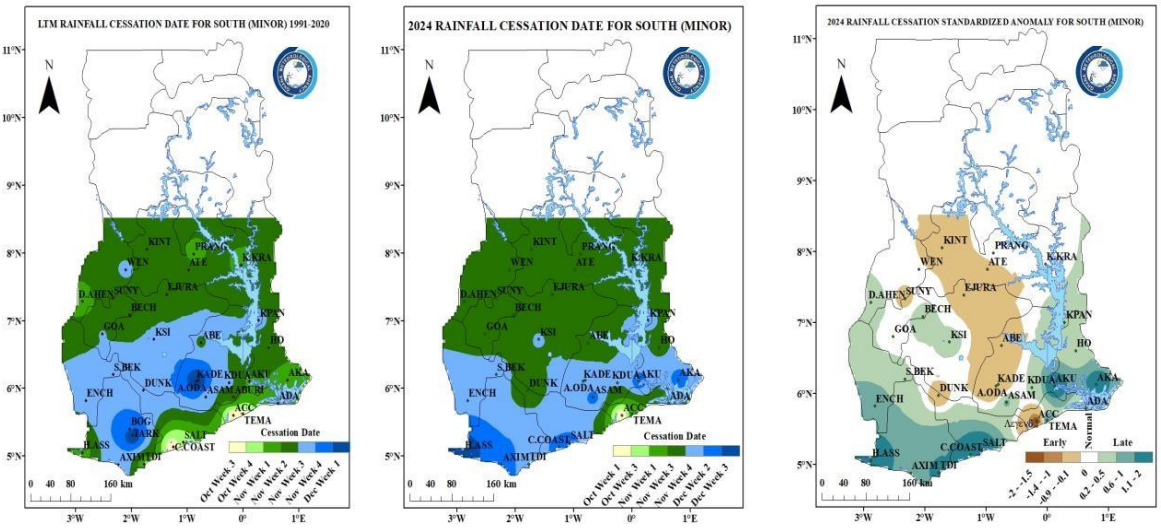
Map 7.3. Spatial distribution of LTM, 2024 and anomalies for 2nd/late dry spell days.

From the 51st day of the season to the cessation date, the longest consecutive number of dry days is termed as Late Dry Spell.

Dormaa Ahenkro, Takoradi, Dunkwa, Axim and Bechem together with their surroundings experienced shorter dry spell days (4-5 days) as compared with their LTMs. Areas Ho, Kumasi, Atebubu, and Ejura also experienced shorter dry days (6-10 days). The rest of the country experienced longer dry spell days except for Kpando and its surroundings which recorded about the same as its LTM.

For areas like Accra, Tema, Koforidua, Cape Coast, Saltpond, and Kade, 2nd dry spell days were not recorded as their seasons were shorter than 50 days.

7.4 Cessation



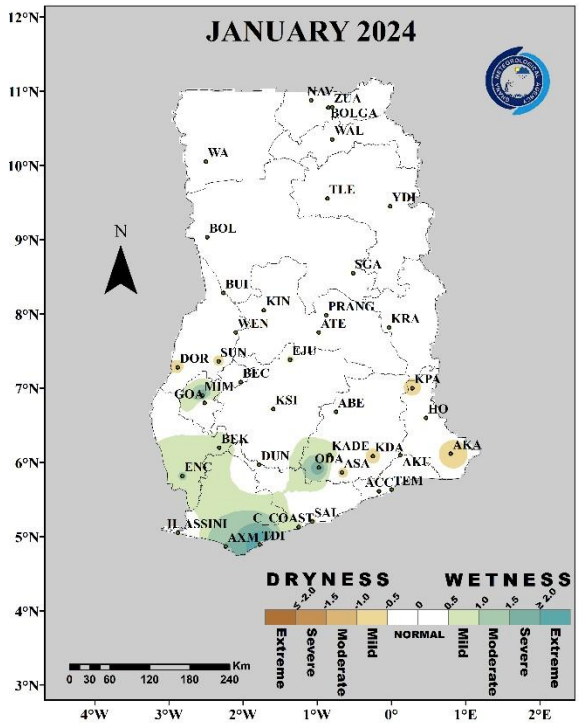
Map 7.4. Spatial distribution of LTM, 2024 and anomalies for cessation dates.

Cessation – The end of the season takes place; when from 1 Oct, a soil capable of holding 70 mm of available water is exhausted by daily evapotranspiration loss of 4 mm.

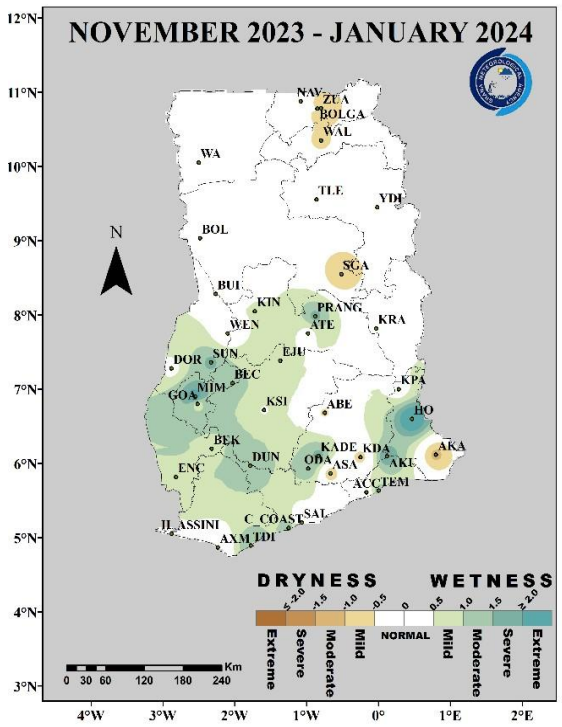
In the southern part of the country, minor rainfall cessation occurred late in most areas. Kintampo, Atebubu, Sunyani, Ejura, Abetifi, Dunkwa, Kade, Akim Oda, and Accra experienced an early cessation, whereas Prang, Kete Krachi, Wenchi, and Goaso, had normal cessation. Compared to the climatology, which ranged from the 3rd Week of October to the 1st Week of December, the cessation dates for 2024 spanned from October Week 1 to December Week 3.

8.0 STANDARDIZED PRECIPITATION INDEX

8.1 January 2024



Map 8.1(a): 1-Month SPI (for meteorological drought): January 2024



Map 8.1(b): 3-Month SPI (for agricultural drought): November 2023 – January 2024

8.1.1 1-Month SPI (January 2024)

The 1-Month Standardized Precipitation Index (SPI) for January is shown in Fig. 1(a). Normal condition dominates most parts of the country with mild to severe wetness shown in areas such as Goaso, Axim, Takoradi and Akim Oda within the Forest zone. Dormaa, Sunyani, Ejura, Kpando, Akatsi, Asamankese and Koforidua exhibited mild dryness.

8.1.2 3-month SPI (November 2023 - January 2024)

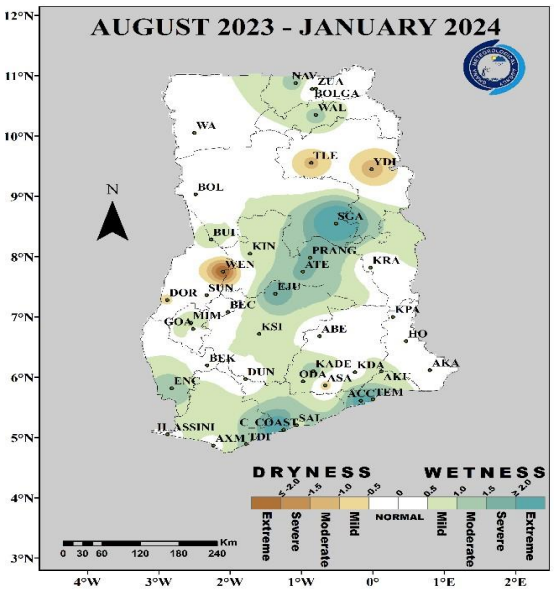
The 3-month SPI in Fig.1(b) shows normal conditions dominating most areas in the Savanna zone with patches of mild dryness in Walewale, Bolgatanga and Zuarungu. The Transition zone witnessed mild to moderate wetness in areas such as Prang, Kintampo, Sunyani and Bechem with Salaga showing mild dryness. Areas such as Mim, Ejura Sefwi Bekwai, Enchi, Akim Oda, Akuse and Takoradi recorded mild to severe wetness with Ho showing extreme wetness whereas Asamankese and Koforidua had mild dry condition. The Coastal zone shows mild to moderate wet conditions in Cape Coast and Tema while Akatsi depicts mild dry conditions.

8.1.3 6-month SPI (August 2023 - January 2024)

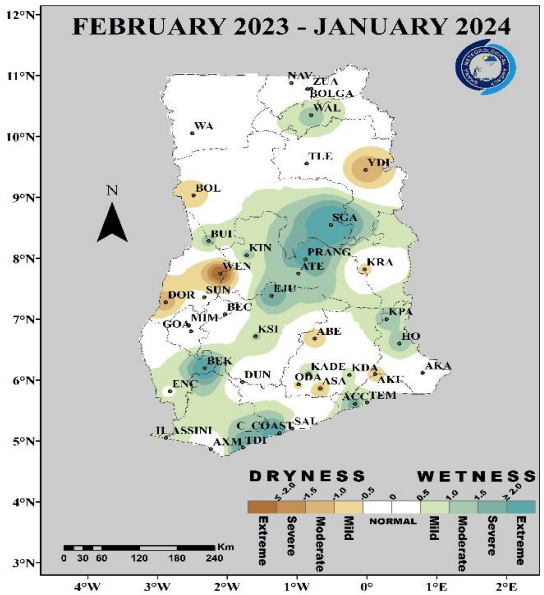
The 6-month SPI shown Fig. 1(c) reveals mild to moderate wet conditions in Walewale and Navrongo within the Savanna zone with moderate dryness in Yendi and Tamale. The Transition zone shows extreme wetness in Salaga with mild to moderate wet conditions in areas such as Bui, Kintampo, Atebubu and Prang whereas mild dryness is seen in Dormaa with extreme dryness in Wenchi. Ejura, Kumasi, Akim Oda, Kade and Akuse in the Forest zone recorded mild to severe wetness while Asamankese showed mild dryness. The Coastal zone depicts severe to extreme wetness in Cape Coast, Accra and Tema.

8.1.4 12-month SPI (February 2023 - January 2024)

The 12-month SPI shown in Fig. 1(d) indicates mainly normal conditions in the Savanna zone with Walewale showing moderate wet conditions while Bole and Yendi showed mild to moderate dry conditions. Extreme wet condition is seen in Salaga and Prang within the Transition zone with moderate wetness in Bui, Kintampo and Atebubu whereas extreme dry condition is depicted in Wenchi with mild to moderate dryness in Dormaa and Kete Krachi. In the Forest zone, Sefwi Bekwai recorded extreme wet conditions with mild to severe wetness in areas including Ejura, Kumasi, Half Assini, Takoradi, Kade, Koforidua, Ho and Kpando whilst mild dry condition is seen in Abetifi, Dunkwa, Asamakese and Akuse. The Coastal zone shows extreme wet condition in Cape Coast with Accra and Tema exhibiting mild to severe wetness.



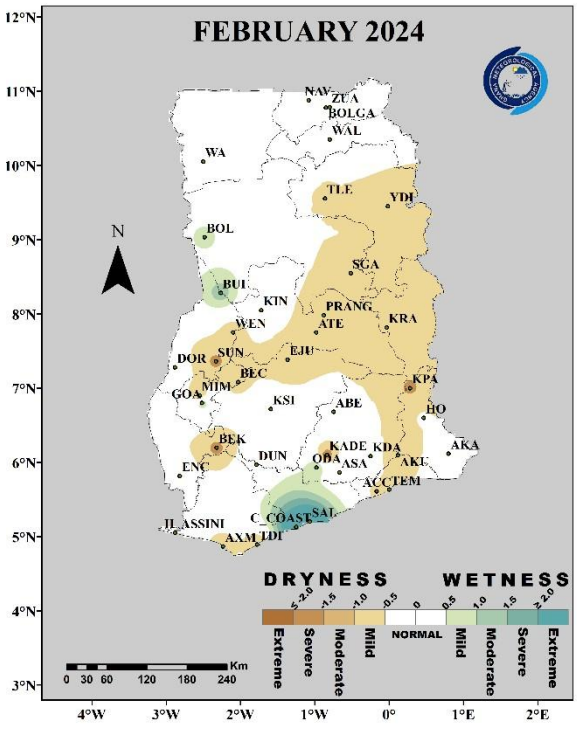
Map 8.1(c): 6-Month SPI (for streamflow and lake storage drought): August 2023 – January 2024



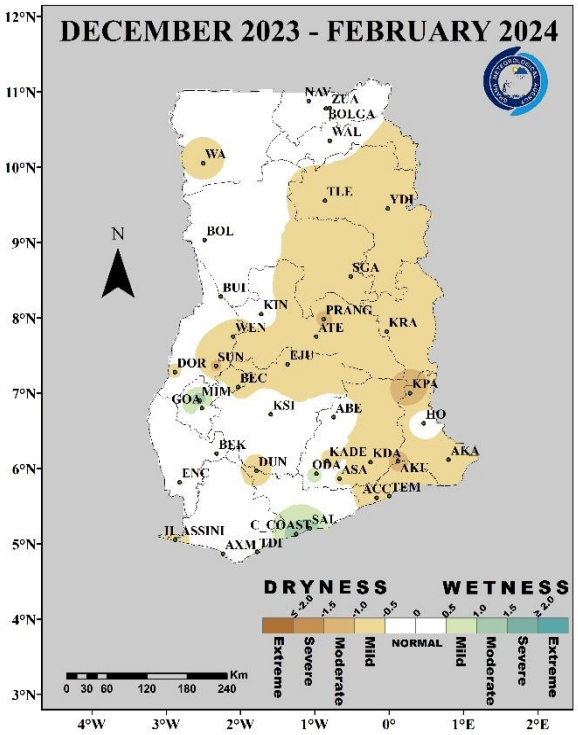
8.1(d): 12-Month SPI (for streamflow and lake storage drought): February 2023 – January 2024

8.2 February 2024

8.2.1 1-Month SPI (February 2024)



Map 8.2(a): 1-Month SPI (for meteorological drought): February 2024



Map 8.2(b): 3-Month SPI (for agricultural drought): December 2023 – February 2024

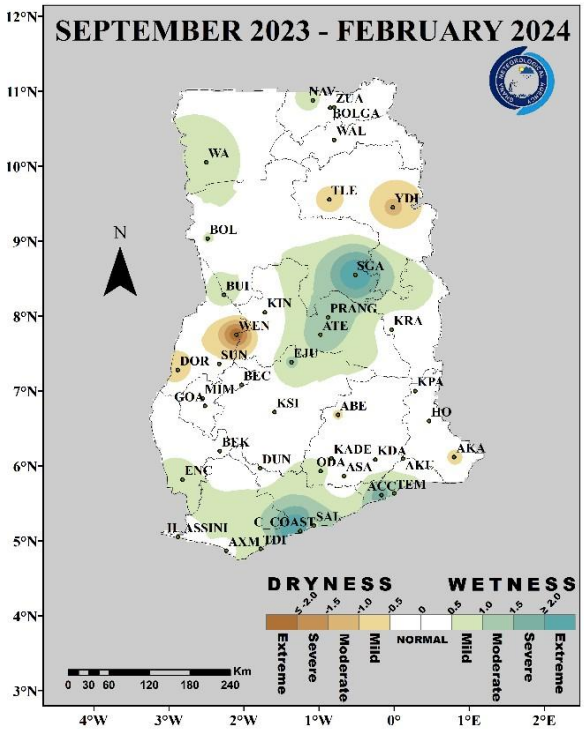
The 1-month SPI for February 2024 shown in Fig.2(a) indicates predominantly normal condition in the Savanna zone with mild wet condition in Bole and mild dry condition in Tamale and Yendi. The Transition zone is characterized mainly by mild to moderate dry conditions in areas such as Salaga, Kete Krachi, Atebubu, Bechem, Sunyani and Wenchi with Bui showing moderate wet condition. Mild to moderate dry conditions are shown in Mim, Ejura, Sefwi Bekwai, Kade, Axim, Akuse and Kpando in Forest zone. Cape Coast and Saltpond in the Coastal zone recorded extreme wetness while Accra and Tema display mild dry condition.

8.2.2 3-month SPI (December 2023 - February 2024)

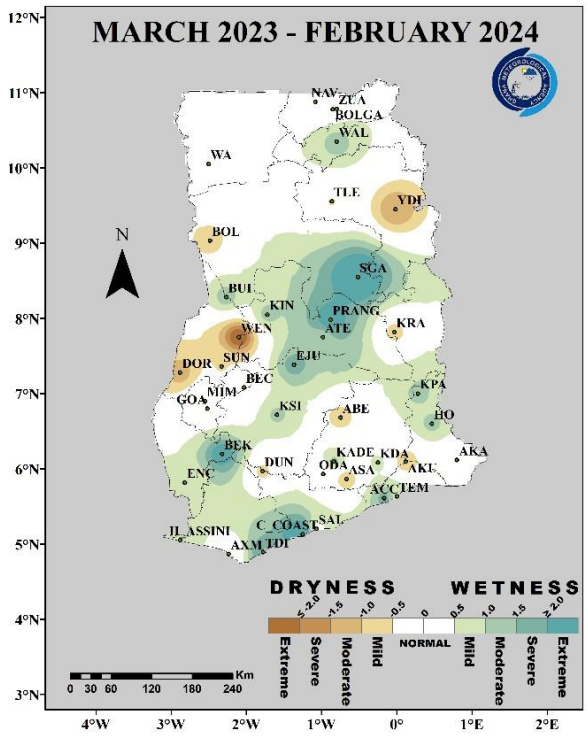
The 3-month SPI shown in Fig. 2(b) reveals mostly normal condition in the Savanna zone with mild dry condition in Wa, Tamale and Yendi. The Transition zone is characterized mainly by mild to moderate dry conditions in areas such as Salaga, Kete Krachi, Prang, Atebubu, Bechem, Wenchi, Sunyani and Dormaa. In the Forest zone, mild to moderate dry conditions are shown in Ejura, Dunkwa, Half Assini, Kade, Asamankese, Koforidua, Akuse and Kpando.

Cape Coast and Saltpond in the Coastal zone recorded moderate wetness while Accra, Tema and Akatsi display mild dry condition.

8.2.3 6-month SPI (September 2023 - February 2024)



Map 8.2(c): 6-Month SPI (for hydrological drought): September 2023 – February 2024



Map 8.2(d): 12-Month SPI (for streamflow and lake storage drought): March 2023 – February 2024

The 6-month SPI shown Fig. 2(c) reveals mild to moderate wet conditions in Walewale and Navrongo within the Savanna zone with moderate dryness in Yendi and Tamale. The Transition zone shows extreme wetness in Salaga with mild to moderate wet conditions in areas such as Bui, Kintampo, Atebubu and Prang whereas mild dryness is seen in Dormaa with extreme dryness in Wenchi. Ejura, Kumasi, Akim Oda, Kade and Akuse in the Forest zone recorded mild to severe wetness while Asamankese showed mild dryness. The Coastal zone depicts severe to extreme wetness in Cape Coast, Accra and Tema.

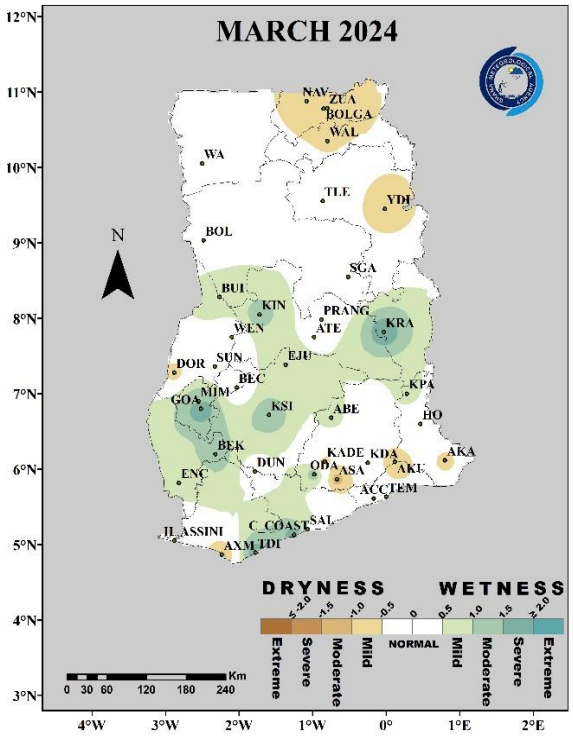
8.2.4 12-month SPI (March 2023 - February 2024)

The 12-month SPI shown in Fig. 2(d) indicates mainly normal condition in the Savanna zone with Walewale showing moderate wet condition while Bole, Tamale and Yendi showed mild to moderate dry conditions. Extreme wet condition is seen in Salaga and Prang within the

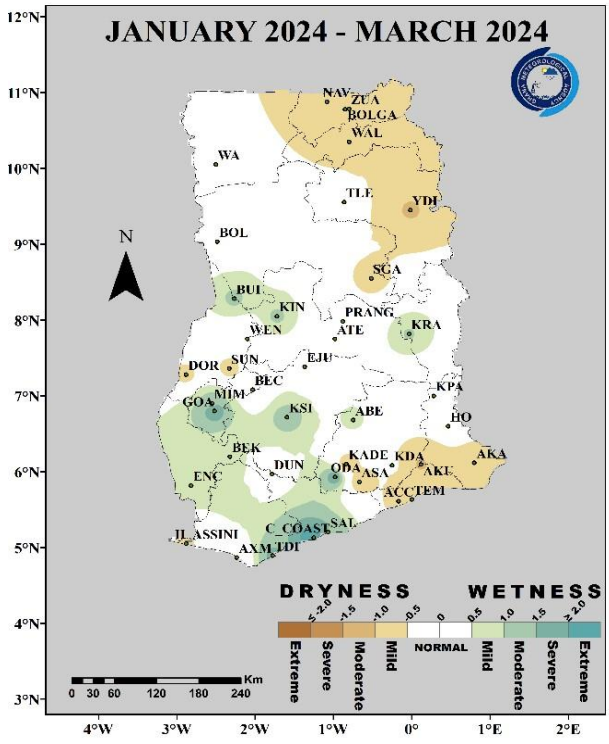
Transition zone with moderate wetness in Bui and Kintampo whereas extreme dry condition is depicted in Wenchi with mild to moderate dryness in Dormaa, Sunyani and Kete Krachi. In the Forest zone, Sefwi Bekwai recorded extreme wet condition with mild to severe wetness in areas including Ejura, Kumasi, Enchi, Half Assini, Takoradi, Kade, Koforidua, Ho and Kpando whilst mild dry condition is seen in Abetifi, Dunkwa, Asamakese and Akuse. The Coastal zone shows an extreme wet condition in Cape Coast with Accra and Tema exhibiting mild to moderate wetness.

8.3 March 2024

8.3.1 1-Month SPI (March 2024)



Map 8.3(a): 1-Month SPI (for meteorological drought): March 2024



Map 8.3(b): 3-Month SPI (for agricultural drought): January 2024 – March 2024

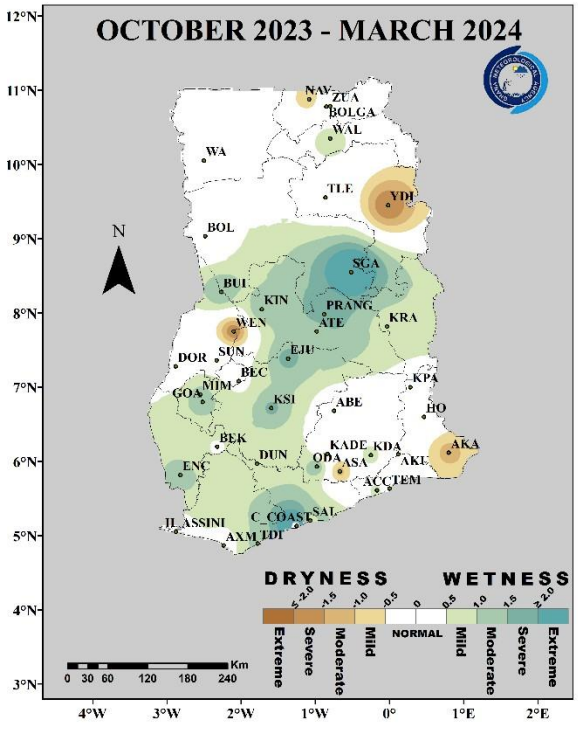
The 1-Month SPI shown in Fig. 3(a) indicates that mostly normal condition in the Savanna zone with Walewale, Bolgatanga, Zuarungu, Navrongo and Yendi showing mild dry condition. The Transition zone had mild to severe wet conditions in places like Kete Krachi, Bui and Kintampo with Dormaa showing mild dryness. Mild to severe wet conditions are seen in the Forest zone in areas such as Kumasi, Goaso, Mim, Sefwi Bekwai, Enchi, Takoradi,

Akim Oda, Abetifi and Kpando while Asamankese, Kade, Axim and Akuse showed mild to moderate dry conditions. The Coastal zone displayed moderate wet condition in Cape Coast while Akatsi had mild dry condition.

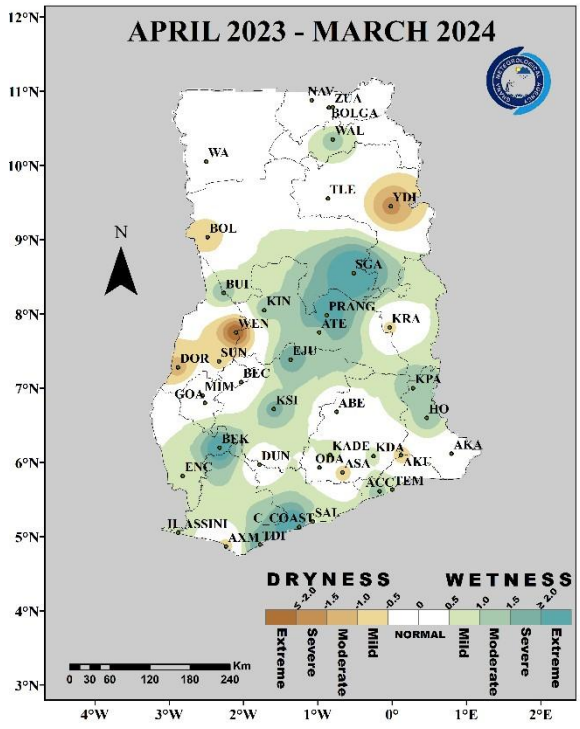
8.3.2 3-month SPI (January 2024 - March 2024)

The 3-Month SPI in Fig 3(b) shows normal condition in the Savanna zone with mild to moderate dry conditions in areas such as Navrongo, Walewale, Bolgatanga, Zuarungu and Yendi. In the Transition zone, Bui, Kintampo and Kete Krachi had moderate wet condition while mild dryness is seen in Salaga, Dormaa and Sunyani. The Forest zone recorded mild to severe wet conditions in areas such as Mim, Goaso, Enchi, Kumasi, Takoradi, Akim Oda and Abetifi while mild to moderate dryness is shown in Half Assini, Kade, Asamankese and Akuse. The Coastal zone showed moderate to extreme wet conditions in Cape Coast and Saltpond with Accra, Tema and Akatsi displaying mild dry condition.

8.3.3 6-month SPI (October 2023 - March 2024)



Map 8.3(c): 6-Month SPI (for hydrological drought): October 2023 – March 2024



Map 8.3(d): 12-Month SPI (for streamflow and lake storage drought): April 2023 – March 2024

The 6-month SPI shown Fig. 3(c) reveals predominantly normal conditions in the Savanna zone with mild wet conditions in Walewale while Navrongo and Yendi showed mild to moderate dryness. The Transition zone shows severe to extreme wetness in Salaga and Prang with mild to moderate wet conditions in areas such as Bui, Kintampo, Atebubu and Kete Krachi while severe dryness is seen in Wenchi. Ejura, Goaso, Mim, Enchi, Takoradi, Dunkwa and Koforidua in the Forest zone recorded mild to severe wetness while Asamankese showed moderate dryness. The Coastal zone shows severe to extreme wetness in Cape Coast and Saltpond with Accra depicting mild wet condition while Akatsi had moderate dry condition.

8.3.4 12-month SPI (April 2023 - March 2024)

The 12-Month SPI reveals that the Savanna zone experienced mostly normal conditions with mild to moderate wet condition in Walewale and mild to severe dry dryness in Yendi and Bole. The Transition zone recorded extreme wet condition in Salaga and Prang with moderate wetness in Atebubu, Kintampo and Bui while Dormaa, Sunyani and Kete Krachi registered mild to moderate dry conditions with Wenchi having extreme dry condition. Severe to extreme wet conditions are shown in areas such as Ejura, Kumasi, Sefwi Bekwai and Takoradi with mild to moderate wetness in Kpando, Ho, Koforidua, Kade, Enchi and Half Assini while mild dry condition is seen in Axim, Asamankese and Akuse. The Coastal zone had moderate to extreme wet conditions in Cape Coast and Accra

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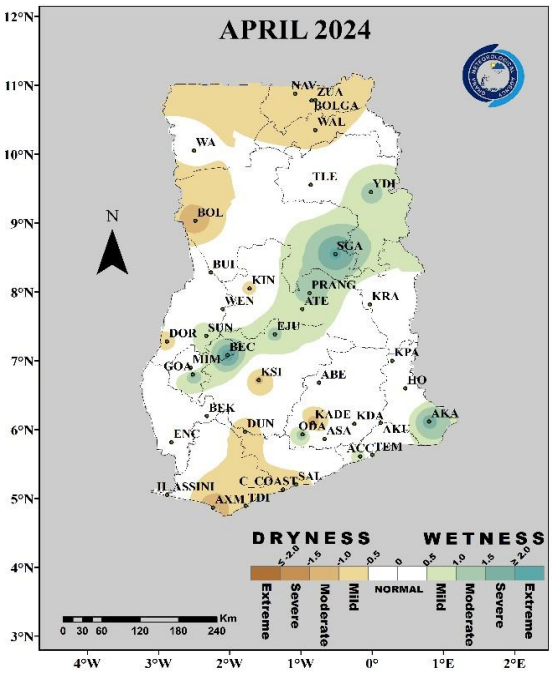
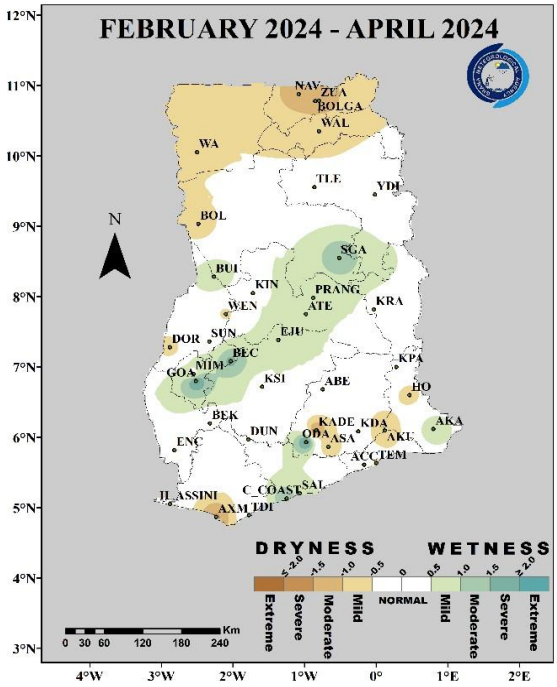
8.4 April 2024

8.4.1 1-Month SPI (April 2024)



Map 8.3(c): 6-Month SPI (for hydrological drought): October 2023 – March 2024



Map 8.4(b): 3-Month SPI (for agricultural drought): February 2024 – April 2024

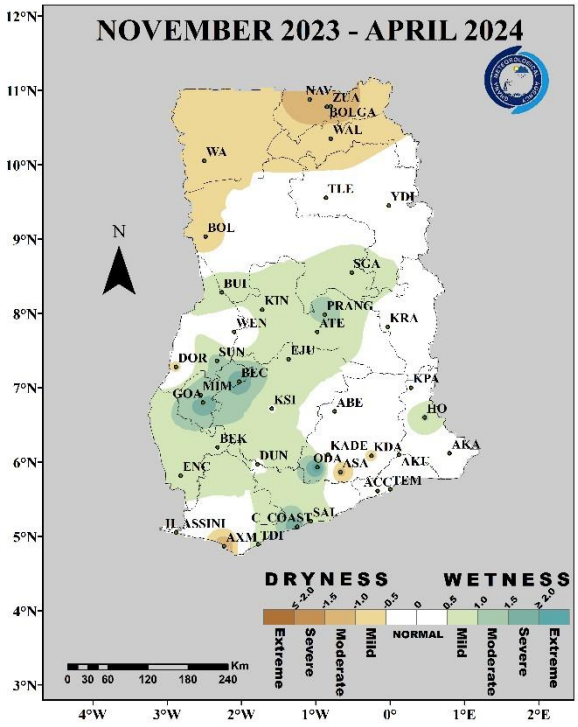
The 1-Month SPI in Fig. 4(a) shows mild to moderate dry conditions in areas such as Navrongo, Bolgatanga, Zuarungu, Walewale and Bole in the Savanna zone Yendi experienced moderate wet condition. Extreme wet condition is seen in Salaga and Bechem in the Transition zone with Prang, Atebubu and Sunyani showing mild to moderate wetness while mild dry condition is depicted in Dormaa and Kintampo. Mostly normal condition dominates the Forest zone moderate wet condition in areas such as Ejura, Goaso and Akim Oda while Kumasi, Dunkwa, Axim, Takoradi and Kade showing mild to moderate dry conditions. The Coastal zone shows mild dry condition in Cape Coast and Saltpond with Accra and Akatsi displaying mild to severe wet conditions.

8.4.2 3-month SPI (February 2024 - April 2024)

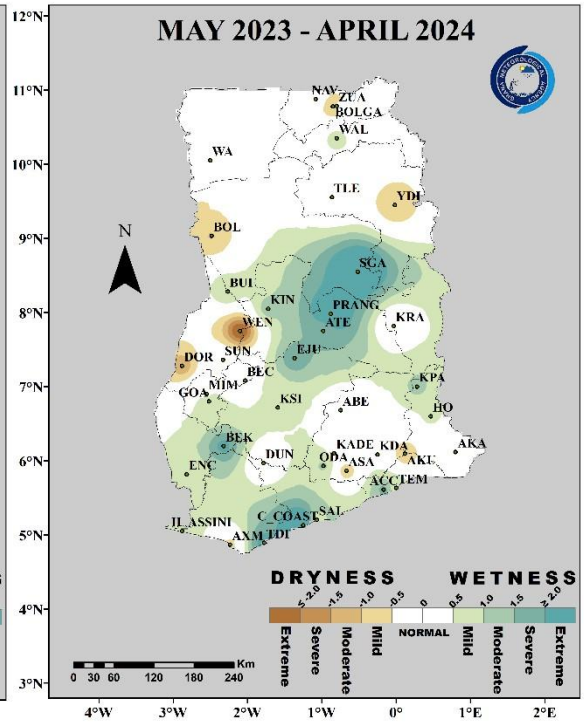
The 3-Month SPI as shown Fig. 4(b) reveals mild to moderate dry conditions dominating areas such as Bole, Wa, Walewale, Bolgatanga, Zuarungu and Navrongo. The Transition zone shows mild to moderate wet conditions in areas such as Salaga, Bui, Prang, Atebubu and Bechem with mild dryness in Dormaa and Wenchi. Normal condition dominates the Forest zone with moderate wet condition in areas such as Goaso and Akim Oda while Axim, Asamankese,

Kade, Akuse and depict mild to moderate dry conditions. Cape Coast, Saltpond and Akuse show mild to moderate wet conditions over the Coastal zone with Tema showing mild dry condition.

8.4.3 6-month SPI (November 2023 - April 2024)



Map 8.4(c): 6-Month SPI (for hydrological drought): November 2023 – April 2024



Map 8.4(d): 12-Month SPI (for streamflow and lake storage drought): May 2023 – April 2024

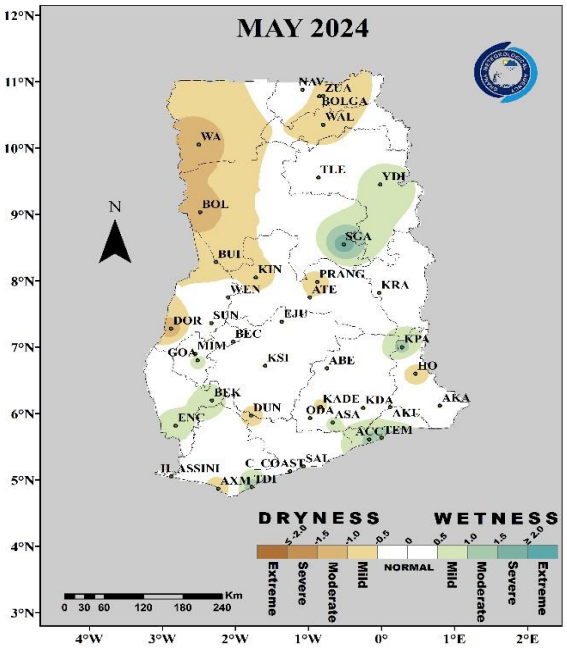
The 6-Month SPI in Fig. 4(c) shows mild to moderate dry conditions dominating areas such as Bole, Wa, Walewale, Bolgatanga, Zuarungu and Navrongo. The Transition zone shows mild to moderate wet conditions in areas such as Salaga, Bui, Prang, Atebubu, Sunyani and Bechem with mild dryness in Dormaa. The Forest zone exhibits mild to severe wet conditions in areas such as Ejura, Goaso, Mim, Sefwi Bekwai, Enchi, Takoradi, Akim Oda and Ho while Axim, Asamankese, and Koforidua depict mild to moderate dry conditions. Normal condition dominates the Coastal zone with Cape Coast and Saltpond showing mild to severe wet conditions.

8.4.3 12-month SPI (May 2023 - April 2024)

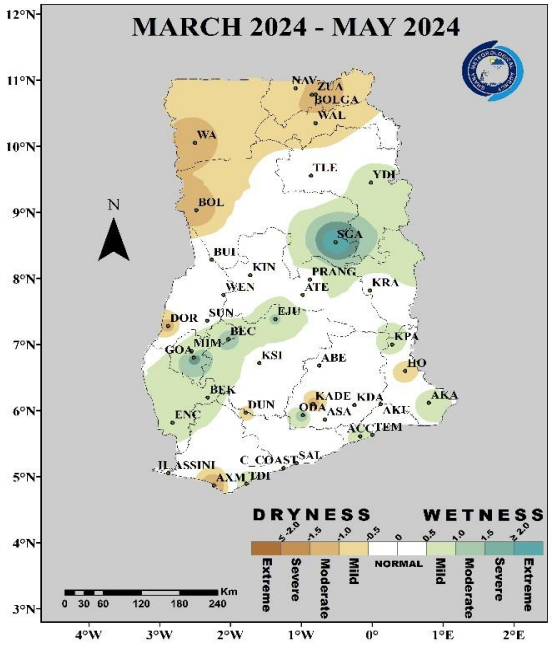
The 12-Month SPI as shown in Fig. 4(d) indicates mostly normal condition over the Savanna zone with mild wet condition in Walewale and mild dryness in Yendi, Bole and Zuarungu. The Transition zone recorded extreme wet condition in Salaga and Prang with mild to severe wetness in Atebubu, Kintampo and Bui while Dormaa and Wenchi registered moderate to extreme dry conditions. Severe to extreme wet conditions are shown in areas such as Ejura, Sefwi Bekwai and Takoradi with mild to moderate wetness in Kpando, Ho, Akim Oda, Kumasi, Goaso, Enchi and Half Assini while mild dry condition is seen in Axim, Asamankese and Akuse. The Coastal zone experienced severe to extreme wet conditions in Cape Coast and Accra with Saltpond and Tema showing mild wet conditions.

8.5. May 2024

8.5.1 1-Month SPI (May 2024)



Map 8.5(a): 1-Month SPI (for meteorological drought): May 2024



Map 8.5(b): 3-Month SPI (for agricultural drought): March 2024 – May 2024

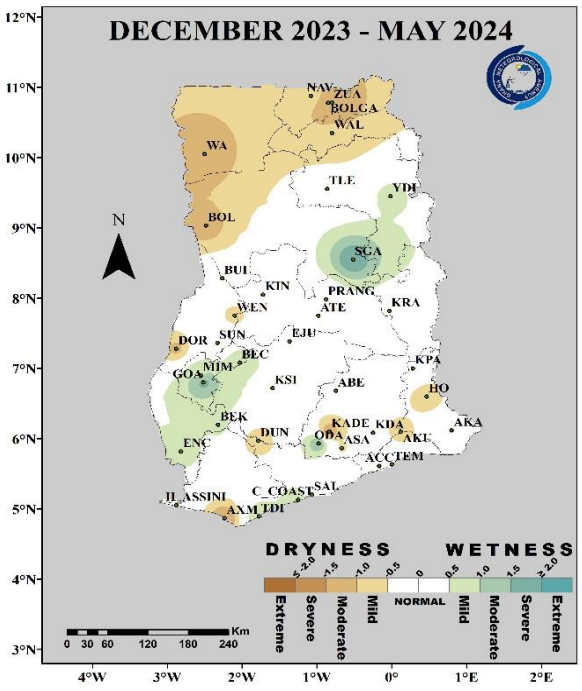
The 1-Month SPI as shown in Fig. 5(a) indicates mild to moderate dry conditions over the Savanna zone in areas such as Wa, Bole, Walewale, Bolgatanga and Zuarungu with Yendi recording mild wet condition. Normal condition dominates the Transition zone with mild to moderate dry conditions in areas such as Dormaa, Bui, Prang and Kintampo while Salaga

displayed severe wetness. The Forest zone is predominantly dominated by normal condition with mild to moderate wet conditions in areas such as Takoradi, Enchi, Sefwi Bekwai, Goaso, Asamankese and Kpando while mild dry condition is seen in Axim, Dunkwa, Kade and Ho. The Coastal zone depict mild to moderate wet conditions in Tema and Accra.

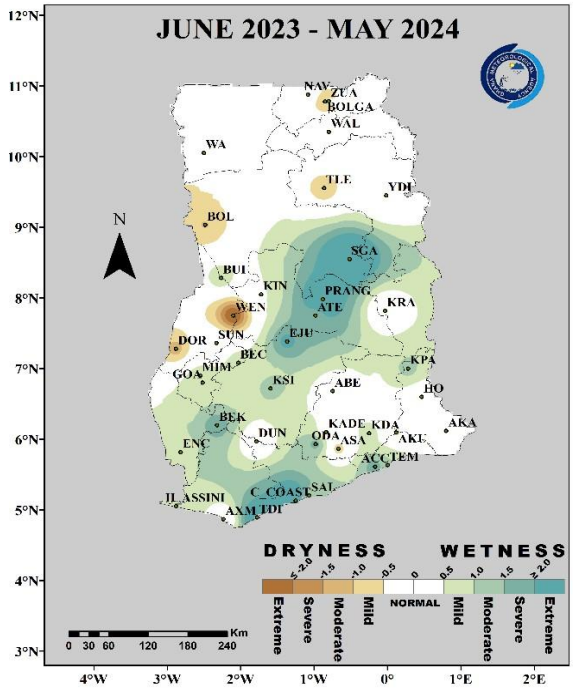
8.5.2 3-month SPI (March 2024 - May 2024)

The 3-Month SPI in Fig. 5(b) reveals mild to moderate dry conditions in areas such as Wa, Bole, Walewale, Bolgatanga, Zuarungu and Navrongo within the Savanna zone with Yendi showing mild wet condition. The Transition zone is dominated by normal condition with Salaga showing extreme wet condition with Bechem showing moderate wetness while Dormaa displayed moderate dry condition. Normal condition is mostly seen in the Forest zone with areas such as Goaso, Ejura Enchi, Sefwi Bekwai, Takoradi, Akim Oda and Kpando showing mild to severe wet conditions while Axim, Dunkwa, Kade and Ho display mild to moderate dry condition. The Coastal zone is dominated by normal condition with mild wet condition in Tema, Accra and Akatsi.

8.5.3 6-month SPI (December 2023 - May 2024)



Map 8.5(c): 6-Month SPI (for hydrological drought): December 2023 – May 2024



Map 8.5(d): 12-Month SPI (for streamflow and lake storage drought): June 2023 – May 2024

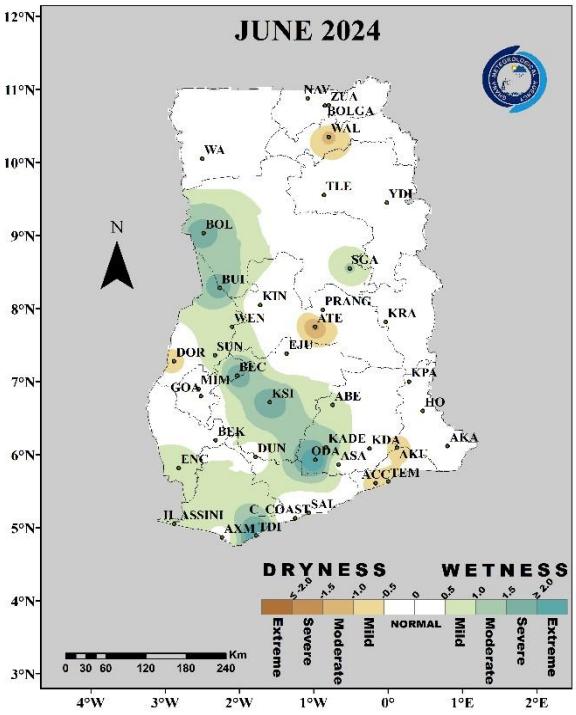
The 6-Month SPI displayed in Fig. 5(c) shows mild to moderate dry conditions over the Savanna zone in areas such as Wa, Bole, Walewale, Bolgatanga, Navrongo and Zuarungu with Yendi showing mild wet condition. The Transition zone is dominated by normal condition with Bechem and Salaga showing mild to severe wet conditions while Dormaa and Wenchi exhibited mild to moderate dryness. Normal condition dominates the Forest zone with mild to severe wet conditions in areas such as Takoradi, Enchi, Goaso, Mim, Sefwi Bekwai and Akim Oda while Axim, Dunkwa, Asamankese, Kade, Akuse and Ho displayed mild to moderate dry conditions. The Coastal zone is predominantly normal with mild wet condition in Cape Coast.

8.5.4 12-month SPI (June 2023 - May 2024)

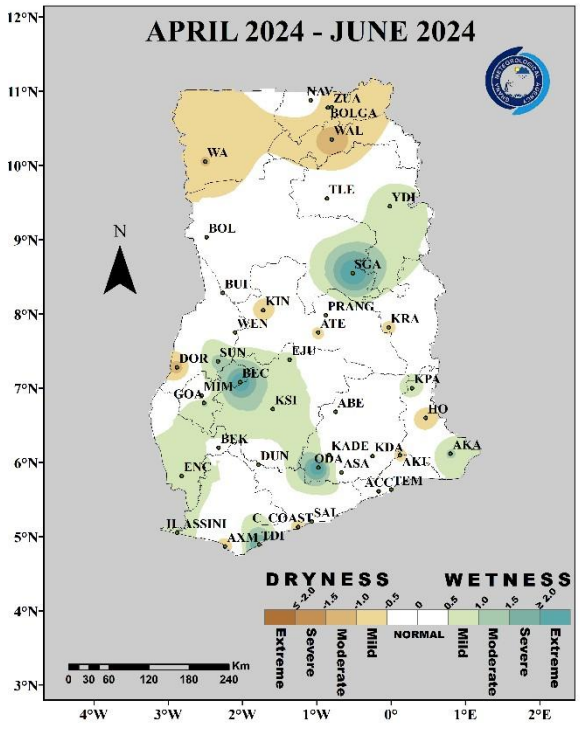
The 12-Month SPI as displayed in Fig. 5(d) shows predominantly normal condition over the Savanna zone with mild to moderate dry conditions in areas such as Tamale, Bole, and Zuarungu). Severe to extreme wet conditions are seen in Salaga, Prang and Atebubu in the Transition zone with mild wetness in Bui and Bechem while moderate to extreme dry condition persisted over Dormaa and Wenchi. The Forest zone recorded mostly normal to mild wet conditions with moderate to extreme wet conditions in areas such as Ejura, Kumasi, Sefwi Bekwai, Takoradi, Kumasi, Akim Oda and Kpando, while Asamankese is shows mild dry condition. Moderate to severe wet conditions are shown in the Coastal zone in areas such as Cape Coast, Saltpond, Accra, Tema.

8.5. June 2024

8.6.1 1-Month SPI (June 2024)



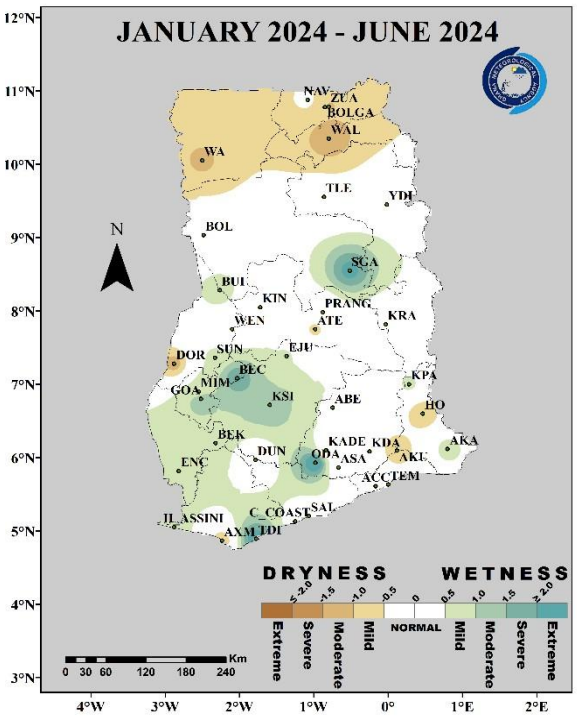
Map 8.6(a): 1-Month SPI (for meteorological drought): June 2024



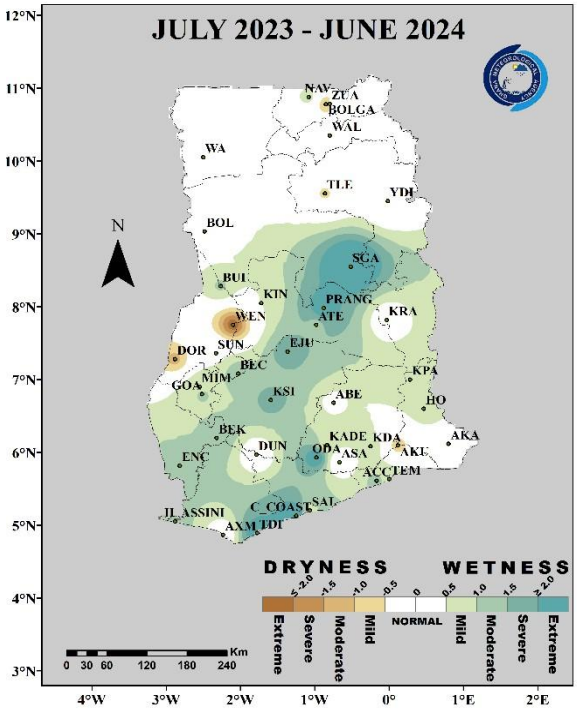
Map 8.6(b): 3-Month SPI (for agricultural drought): April 2024 – June 2024

8.6.2 3-month SPI (April 2024 - June 2024)

The 3-Month SPI in Fig. 6(b) reveals mild to moderate dry conditions over the Savanna zone in areas such as Walewale, Bolgatanga, Zuarungu, and Wa with Yendi showing mild wetness. Moderate to severe wetness is seen Salaga, Bechem and Sunyani with mild to moderate dry conditions in areas such as Dormaa, Kintampo, Atebubu, and Kete Krachi. The Forest zone is dominated by normal condition with severe to extreme wet conditions in areas such as Takoradi and Akim Oda as well as mild wet condition in Half Assini, Enchi, Goaso, Kumasi and Kpando while Axim, Akuse and Ho experienced mild dry condition. The Coastal zone shows mainly normal condition with moderate wet condition in Akuse and Cape Coast displaying mild dryness.



Map 8.6(c): 6-Month SPI (for hydrological drought): January 2024 – June 2024



Map 8.6(d): 12-Month SPI (for streamflow and lake storage drought): July 2023 – June 2024

8.6.3 6-month SPI (January 2024 - June 2024)

The 6-Month SPI in Fig. 6(c) shows mild to moderate dry conditions over Savanna zone in areas such as Wa, Walewale, Bolgatanga, and Zuarungu. The Transition zone shows severe to extreme wet conditions in Salaga and Bechem with mild wet condition in Bui and Sunyani while Dormaa and Atebubu display mild to moderate dry conditions. Extreme wet condition is depicted in Akim Oda and Takoradi in the Forest zone with mild to moderate wetness in areas such as Goaso, Kumasi, Enchi, Half Assini and Kpando while mild dryness is seen in Axim, Akuse and Ho. The Coastal zone is dominated by normal condition with mild wet condition in Akatsi.

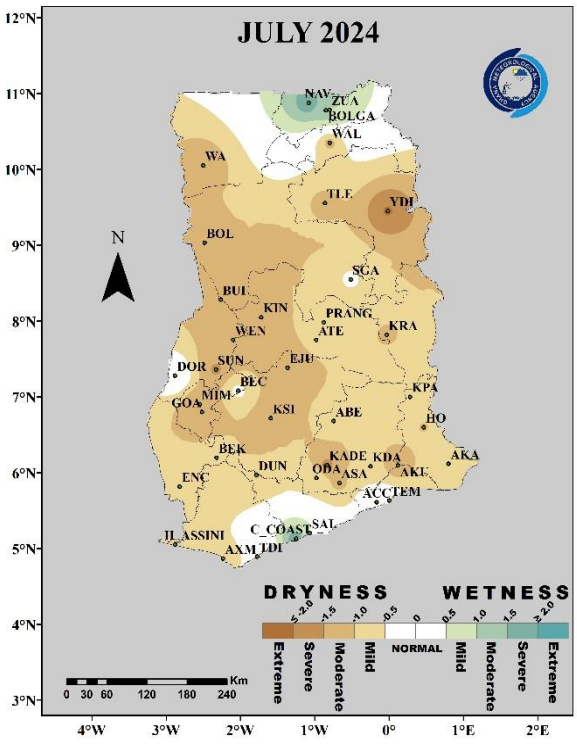
8.6.4 12-month SPI (July 2023 - June 2024)

The 12-Month SPI shown in Fig. 6(d) depicts mostly normal condition over the Savanna zone with spots of mild wet condition in Navrongo while mild dry condition is shown in Zuarungu

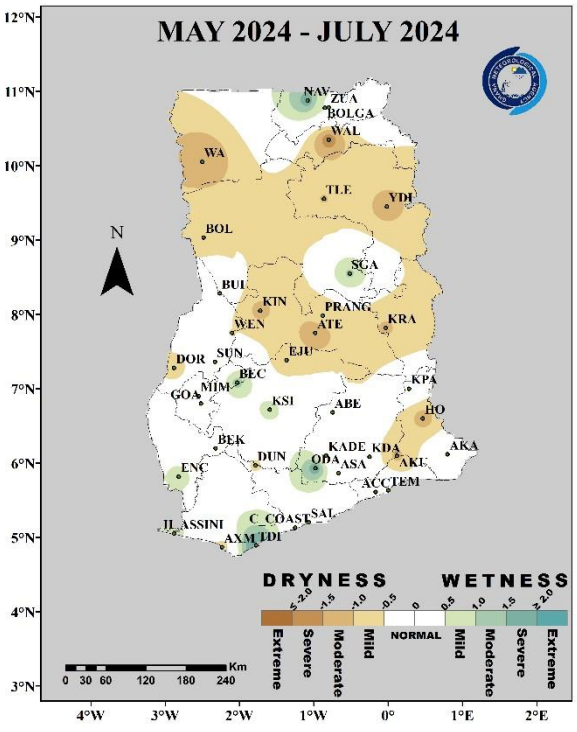
and Tamale. Moderate to extreme wet conditions are shown in Salaga, Prang, Atebubu, Bechem and Bui with moderate to extreme dry conditions in Dormaa and Wenchi. Predominantly mild to moderate wet conditions are depicted in Mim, Goaso, Sefwi Bekwai, Enchi, Half Assini, Koforidua, Ho and Kpando with severe to extreme wet conditions in Ejura, Kumasi, Takoradi and Akim Oda while Akuse showed mild dry condition. The Coastal zone shows extreme wet condition in Cape Coast with Saltpond, Accra, and Tema recording mild to moderate wet conditions.

8.7 July 2024

8.7.1 1-Month SPI (July 2024)



Map 8.7(a): 1-Month SPI (for meteorological drought): July 2024



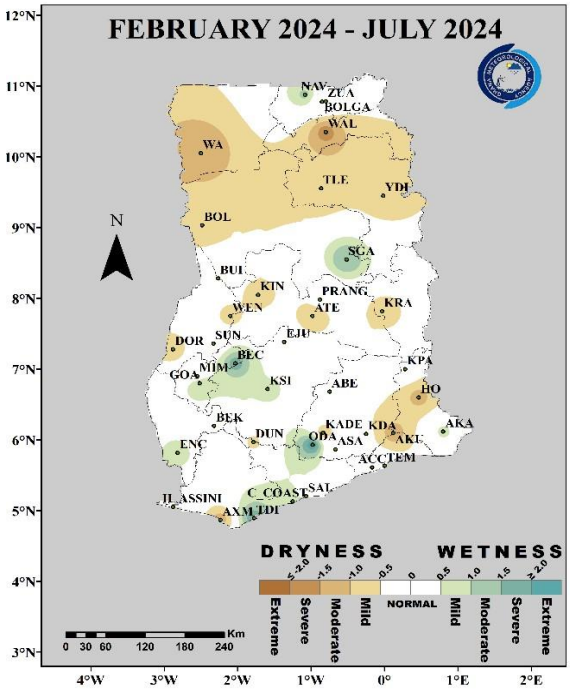
Map 8.7(b): 3-Month SPI (for agricultural drought): May 2024 – July 2024

The 1-Month SPI shown in Fig. 7(a) indicates mostly moderate to severe dry conditions in the Savanna zone in areas including Wa, Bole, Walewale, Tamale and Yendi with Navrongo, Zuarungu and Bolgatanga showing mild to severe wet conditions. Mild dry condition dominates the Transition zone with moderate to severe dryness in areas such as Bui, Kintampo, Wenchi, Sunyani and Kete Krachi while Salaga, Dormaa and Bechem showed normal condition. Most parts of the Forest zone depict mild dry condition with moderate to severe dryness in areas such as Goaso, Mim, Ejura, Kumasi, Dunkwa, Kade, Asamankese, Akuse and Ho while Takoradi showed normal condition. Cape Coast witnessed severe wet condition in the Coastal zone with Saltpond, Accra and Tema showing normal condition while Akatsi recorded mild dry condition.

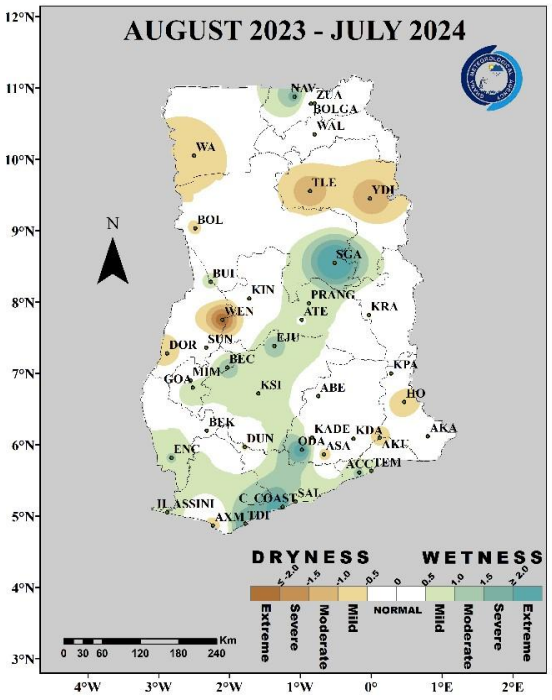
8.7.2 3-month SPI (May 2024 - July 2024)

The 3-Month SPI in Fig. 7(b) reveals displays mostly mild to moderate dry conditions in the Savanna zone in areas including Wa, Bole, Walewale, Tamale and Yendi with Navrongo showing severe wet condition. The Transition zone shows mild to moderate dryness in areas such as Kintampo, Wenchi, Dormaa, Atebubu, Prang and Kete Krachi while Salaga and Bechem showed moderate wet condition. Most parts of the Forest zone depict normal condition with mild to severe wet conditions in areas such as Kumasi, Enchi, Half Assini, Takoradi, and Akim Oda while mild to moderate dry conditions are shown in Dunkwa, Axim, Ejura, Akuse and Ho. The Coastal zone displayed normal condition.

8.7.3 6-month SPI (February 2024 - July 2024)



Map 8.7(c): 6-Month SPI (for hydrological drought): February 2024 – July 2024



Map 8.7(d): 12-Month SPI (for streamflow and lake storage drought): August 2023 – July 2024

The 6-Month SPI shown in Fig. 7(c) depicts predominantly mild to severe dry conditions in the Savanna zone in areas such as Wa, Bole, Walewale, Tamale and Yendi with Navrongo showing moderate wet condition. The Transition zone is dominated by normal condition and shows moderate to severe wet conditions in Salaga and Bechem while Kintampo, Wenchi, Dormaa, Atebubu and Kete Krachi showed mild dry condition. Normal conditions are seen in most parts of the Forest zone with severe to extreme wet conditions in Takoradi and Akim Oda and mild wet conditions are seen in Kumasi, Goaso and Enchi. Mild to moderate dry conditions are displayed in Axim, Dunkwa, Kade, Akuse and Ho. The Coastal zone shows mainly normal conditions with mild wet conditions in Cape Coast and Akatsi.

8.7.4 12-month SPI (August 2023 - July 2024)

The 12-Month SPI in Fig. 7(d) indicates mostly mild to severe dry conditions in areas such as Wa, Bole, Tamale and Yendi within the Savanna zone while moderate wet condition is seen in Navrongo. The Transition zone shows extreme wet condition in Salaga with mild to moderate wetness in Bechem, Prang and Bui while Wenchi registered extreme dry condition

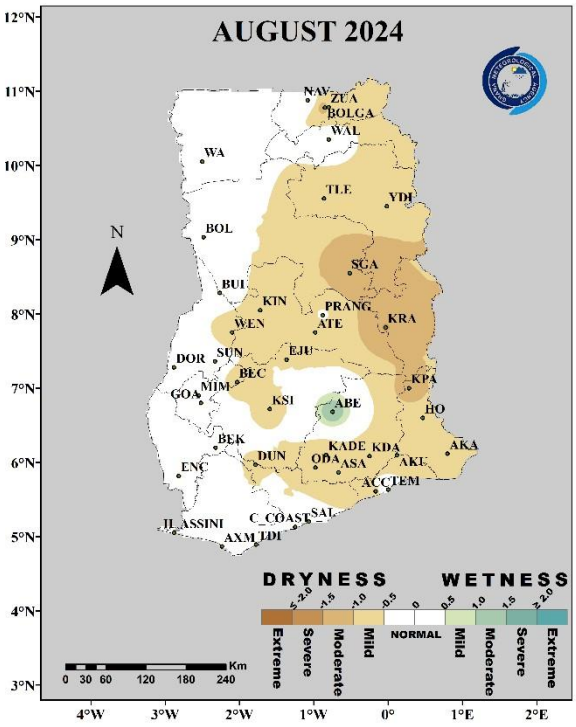
with Dormaa showing mild dry condition. Mild to Severe wet conditions are shown in areas such as Ejura,

Kumasi, Goaso, Enchi, Half Assini, Takoradi and Akim Oda in the Forest zone with mild dry condition in Axim, Asamankese, Akuse and Ho. The Coastal zone shows extreme wet condition in Cape Coast with Accra, Tema and Saltpond depicting mild to moderate wetness

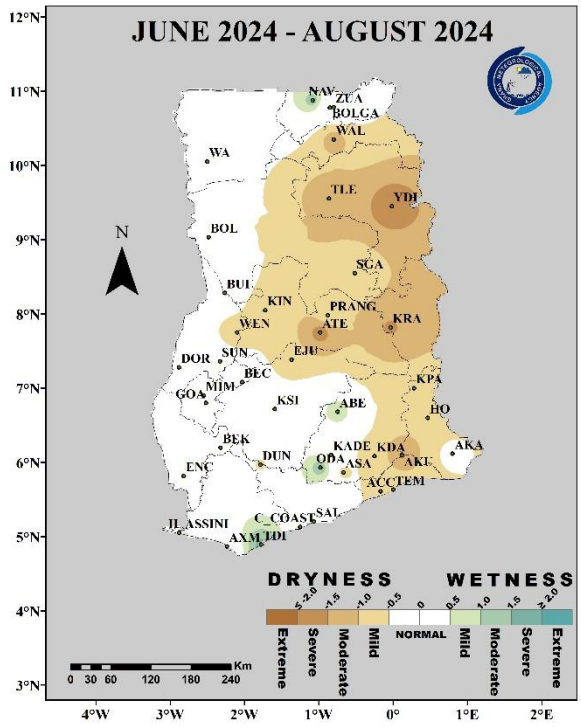
8.8 August 2024

8.8.1 1-Month SPI (August 2024)

The 1-Month SPI shown in Fig. 8(a) indicates mild to moderate dry conditions in the Savanna zone in areas such as Bolgatanga, Zuarungu, Tamale and Yendi. Mild to moderate dry conditions dominate the Transition zone in areas such as Kintampo, Wenchi, Bechem, Atebubu, Salaga and Kete Krachi. Some parts of the Forest zone depict normal condition with mild to severe dryness in areas such as Ejura, Kumasi, Dunkwa, Akim Oda, Kade, Asamankese, Koforidua, Akuse, Ho and Kpando. The Coastal zone shows mild dry condition in Accra and Akatsi.



Map 8.8(a): 1-Month SPI (for meteorological drought): August 2024

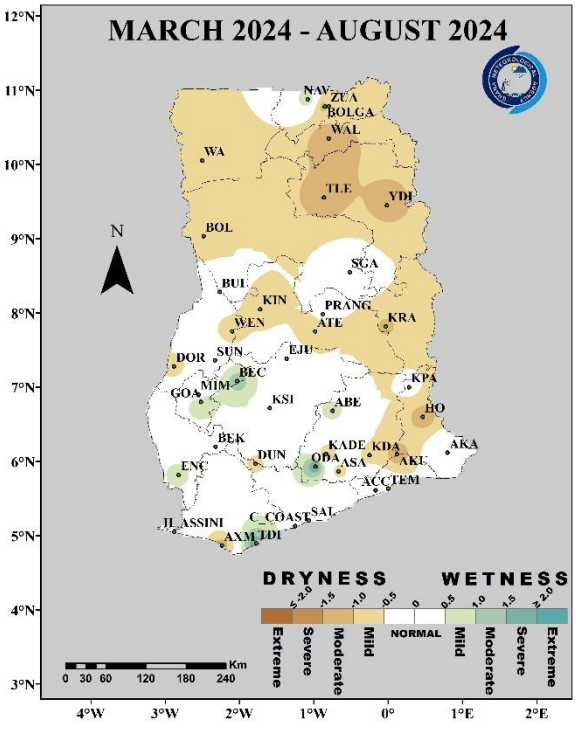


Map 8.8(b): 3-Month SPI (for agricultural drought): June 2024 – August 2024

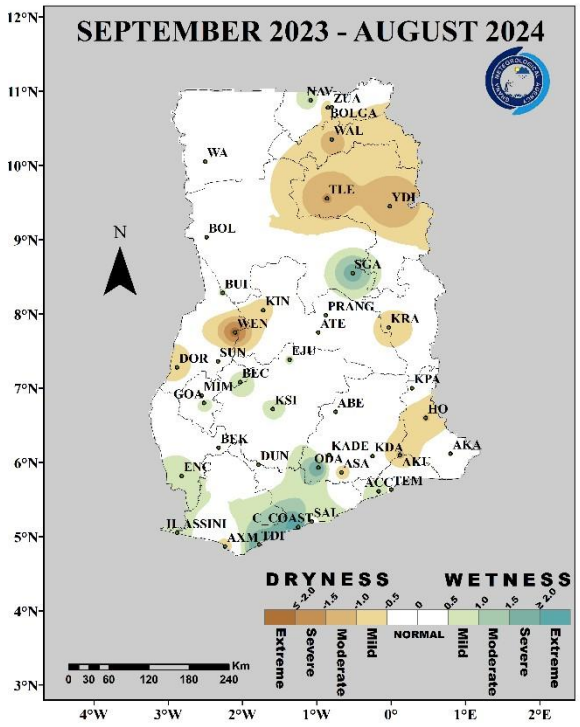
8.8.2 3-Month SPI (August 2024)

The 3-Month SPI in Fig. 8(b) reveals mostly moderate to severe dry conditions in the Savanna zone in areas such as Walewale, Tamale and Yendi with Navrongo showing moderate wet condition. Mild to severe dry conditions dominate the Transition zone in areas such as Kintampo, Wenchi, Atebubu, Prang, Salaga and Kete Krachi. Most parts of the Forest zone depict normal condition with mild to moderate dryness in areas such as Ejura, Dunkwa, Asamankese, Koforidua, Akuse, Ho and Kpando while mild to severe wet conditions are shown in Takoradi, Akim Oda and Abetifi. The Coastal zone shows mild dry condition in Accra and Tema.

8.8.3 6-month SPI (March 2023 - August 2024)



Map 8.8(c): 6-Month SPI (for hydrological drought): March 2024 – August 2024



Map 8.8(d): 12-Month SPI (for streamflow and lake storage drought): September 2023 – August 2024

The 6-Month SPI displayed in Fig. 8(c) shows mild to moderate dry conditions dominating the Savanna zone in areas such as Wa, Bole, Bolgatanga, Zuarungu, Walewale, Tamale and Yendi with Navrongo depicting mild wet conditions. Some parts of the Transition zone show

normal condition with mild to moderate dry conditions in areas such as Kintampo, Wenchi, Dormaa, Atebubu and Kete Krachi while Bechem exhibited moderate wet condition. The Forest zone mostly depict normal condition with mild to moderate dryness in areas such as Dunkwa, Axim, Kade, Asamankese, Koforidua, Akuse and Ho while Goaso, Enchi, Takoradi, Akim Oda and Abetifi depict mild to severe wet conditions. The Coastal zone shows mainly normal conditions.

8.8.4 12-month SPI (September 2023 - August 2024)

The 12-Month SPI in Fig. 8(d) reveals normal conditions in most parts of the country. Mild to moderate dry conditions are shown in areas such as Bolgatanga, Zuarungu, Walewale and Yendi within the Savanna zone with Tamale exhibiting severe dryness while Navrongo showed mild wet condition. The Transition zone shows mild dry condition in Kete Krachi and Dormaa with Wenchi depicting extreme dryness while Salaga and Bechem showed mild to severe wet conditions. Ejura, Goaso, Kumasi, Enchi, Half Assini display mild wet condition in the Forest zone with Takoradi and Akim Oda showing severe wet condition while Asamankese, Akuse and Ho recording mild to moderate dry condition. Cape Coast in the Coastal zone recorded extreme wet condition with Accra showing mild wet conditions.

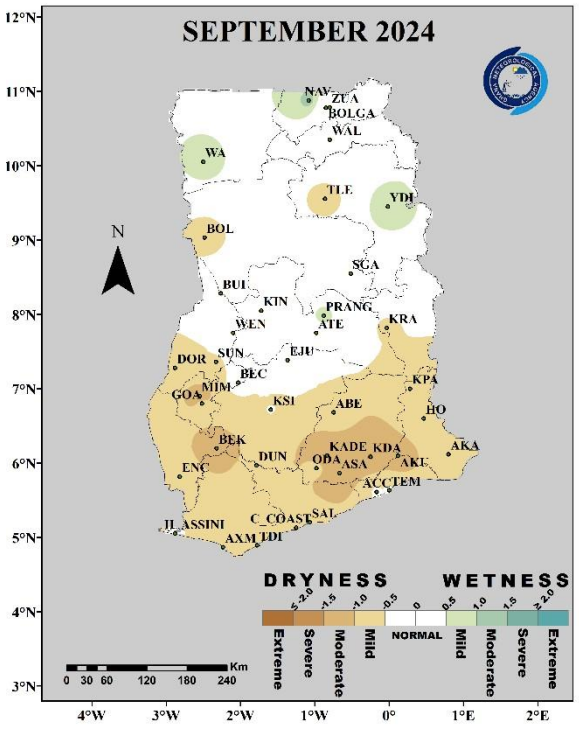
8.9 September 2024

8.9.1 1-Month SPI (September 2024)

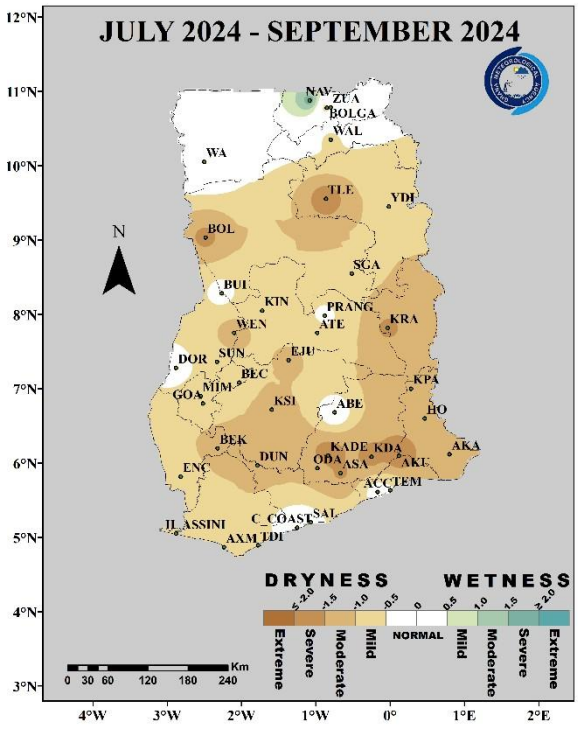
The 1-Month SPI as shown in Fig. 9(a) displays normal condition dominating the Savanna zone with Yendi, Wa and Navrongo showing mild to moderate wet conditions while Tamale and Bole depict mild dry condition. The Transition zone shows mostly normal condition with Kete Krachi, Dormaa and Sunyani recording mild dry condition while Prang show mild wetness. Mild to moderate dry conditions dominate the Forest and Coastal zones especially Mim, Sefwi Bekwai, Kade, Asamankese and Akuse.

8.9.2 3-month SPI (July 2024 - September 2024)

The 3-Month SPI in Fig. 9(b) shows almost the entire country engulfed in mild to moderate dry conditions. Particularly, the Savanna zone shows severe dry condition in Bole and Tamale with Navrongo showing severe wet condition. Also, severe dry condition is seen in Kete Krachi in the Transition zone while Kade, Asamankese, Koforidua and Akuse in the Forest zone.



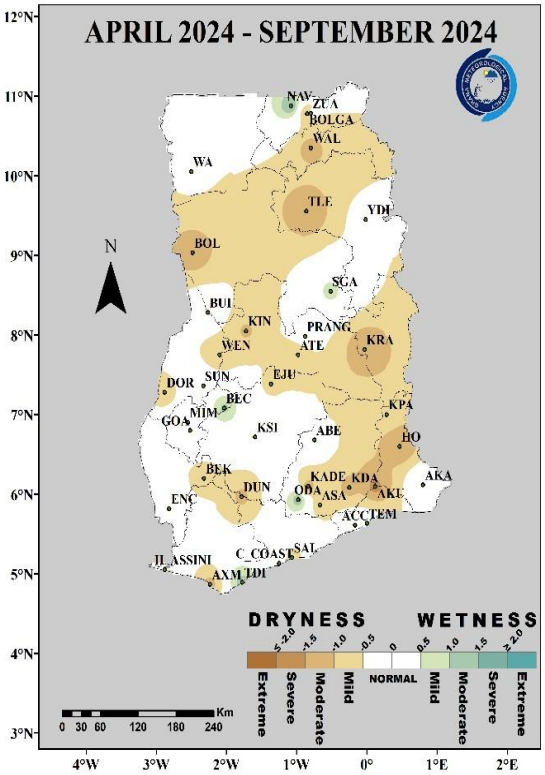
Map 8.9(a): 1-Month SPI (for meteorological drought): September 2024



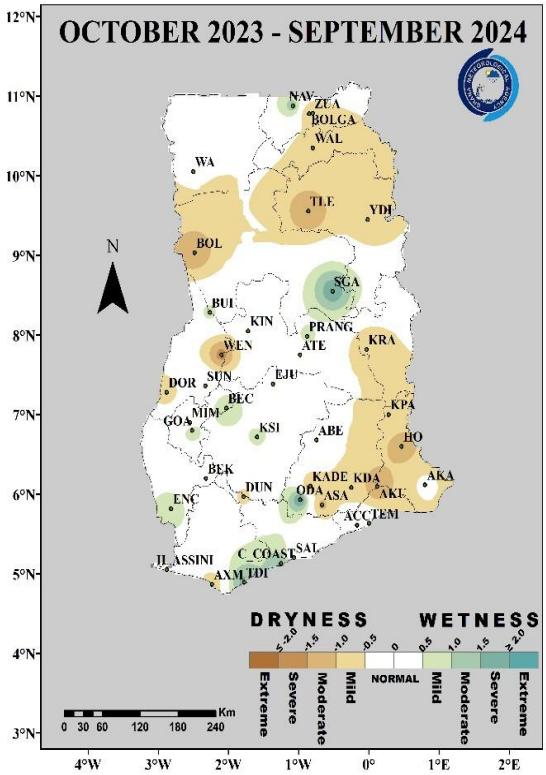
Map 8.9(b): 3-Month SPI (for agricultural drought): July 2024 – September 2024

8.9.3 6-month SPI (April 2024 - September 2024)

The 6-Month SPI shown in Fig. 9(c) shows mild to moderate dry conditions in the Savanna zone in areas such as Bole, Tamale, Walewale, Bolgatanga and Zuarungu while Navrongo depicted moderate wet conditions. The Transition zone displays mostly mild to moderate dry conditions in Kete Krachi, Atebubu, Kintampo, Wenchi and Dormaa while Bechem and Salaga show mild wet condition. Ejura, Sefwi Bekwai, Dunkwa, Axim, Kade, Asamankese, Koforidua, Ho and Kpando depict mild to moderate dryness with Akuse showing severe dry condition while Takoradi and Akim Oda exhibit moderate wet condition. The Coastal zone displays mostly normal conditions with Saltpond showing mild dryness.



Map ***8.9(c): 6-Month SPI (for hydrological drought : April 2024 – September 2024***



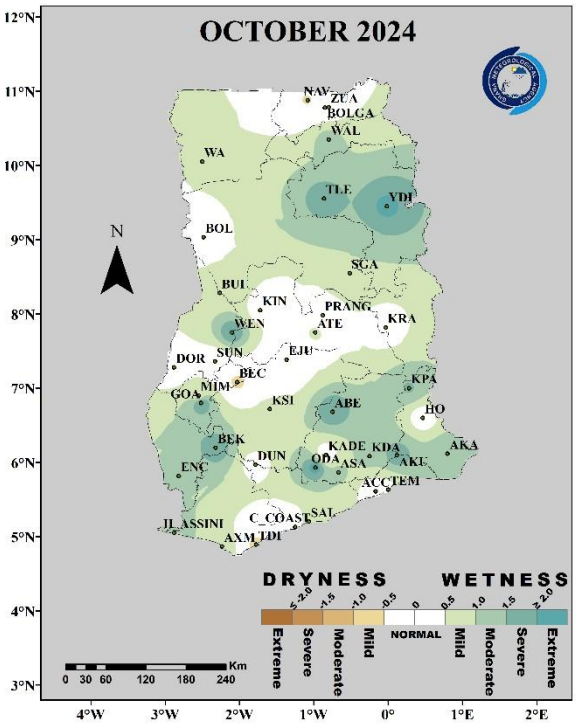
Map ***8.9(d): 12-Month SPI (for streamflow and lake storage drought): October 2023 – September 2024***

8.9.4 12-month SPI (October 2023 - September 2024)

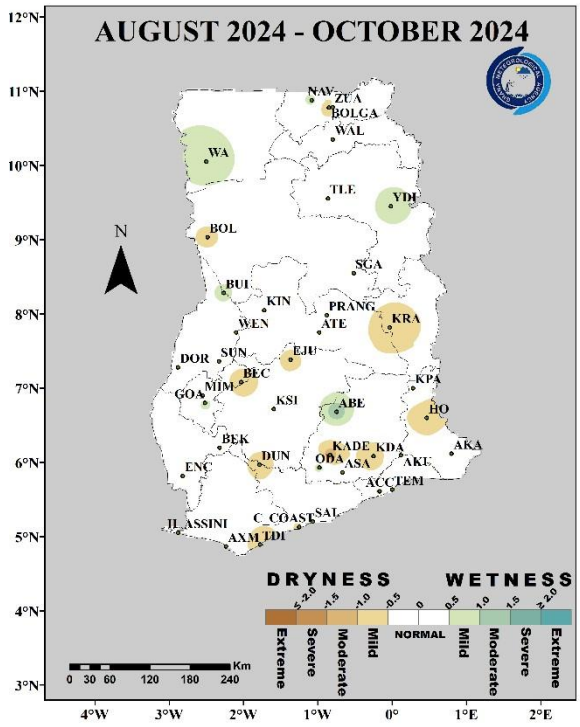
The 12-Month SPI in Fig. 9(d) reveals mild to moderate dry conditions persisting in the Savanna zone in areas such as Bole, Tamale, Yendi, Walewale, Bolgatanga and Zuarungu while Navrongo depicts moderate wet condition. The Transition zone displays mostly normal condition with mild to severe dryness in Kete Krachi, Wenchi and Dormaa while Bechem, Bui, Prang and Salaga show mild to severe wet condition. Normal condition dominates the Forest zone with Sefwi Bekwai, Goaso, Enchi, Kumasi, Takoradi and Akim Oda showing mild to severe wet condition while

Dunkwa, Axim, Asamankese, Kade, Koforidua, Akuse, Ho and Kpando exhibit mild to moderate dry conditions. The Coastal zone displays mostly normal condition with Cape Coast showing severe wetness.

8.10 October 2024



Map 8.10(a): 1-Month SPI (for meteorological drought): October 2024



Map 8.10(b): 3-Month SPI (for agricultural drought): August 2024 – October 2024

8.10.1 1-Month SPI (October 2024)

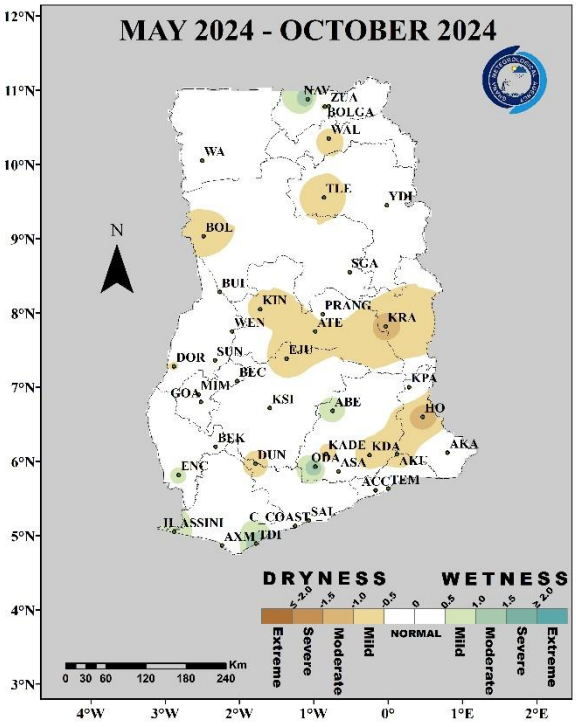
The 1-Month SPI as illustrated in Fig. 10(a), indicates mild to severe wet conditions in areas such as Wa, Walewale, and Tamale with Yendi showing extreme wetness while Navrongo exhibits mild dry condition. The transition zone display mainly normal condition with mild to severe wetness in Wenchi, Bui, Atebubu and Salaga while Bechem showed mild dry condition. The Forest zone depicts predominantly mild conditions with moderate to severe wet conditions in areas such as Goaso, Sefwi Bekwai, Enchi, Half Assini, Akim Oda, Koforidua, Akuse, Abetifi and Kpando while Takoradi showed mild dry condition. Saltpond and Akatsi in the Coastal zone recorded mild to moderate wet conditions.

8.10.2 3-month SPI (August 2024 - October 2024)

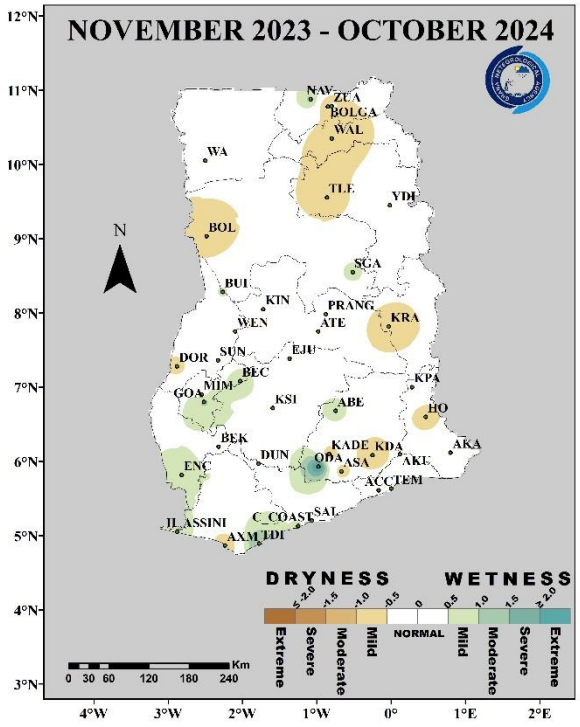
The 3-month SPI shown in Fig. 10(b) displays predominantly normal condition over the entire country. Wa, Navrongo and Yendi in the Savanna zone shows mild wet condition while

Zuarungu and Bole depict mild dryness. In the Transition zone, Bechem and Kete Krachi recorded mild dry condition. The Forest zone shows mild to moderate dry conditions in areas such as Ejura, Dunkwa, Takoradi, Kade, Koforidua and Akim Oda while mild to moderate wet conditions are displayed over Goaso and Abetifi.

8.10.3 6-month SPI (May 2024 - October 2024)



Map 8.10(c): 6-Month SPI (for hydrological drought): May 2024 – October 2024



Map 8.10(d): 12-Month SPI (for streamflow and lake storage drought): November 2023 –

The 6-month SPI illustrated in Fig. 10(c) shows normal condition dominating the country. Bole, Walewale and Tamale in the Savanna zone show mild dry condition while Navrongo and depict moderate dryness. In the Transition zone, mild dry condition is shown in Dormaa, Kintampo, Atebubu and Kete Krachi. The Forest zone shows mild to moderate wet conditions in areas such as Enchi, Half Assini, Abetifi, Takoradi and Akim Oda while Ejura, Dunkwa, Kade, Koforidua, Akuse and Ho display mild to moderate dry condition. The Coastal zone showed mainly normal conditions.

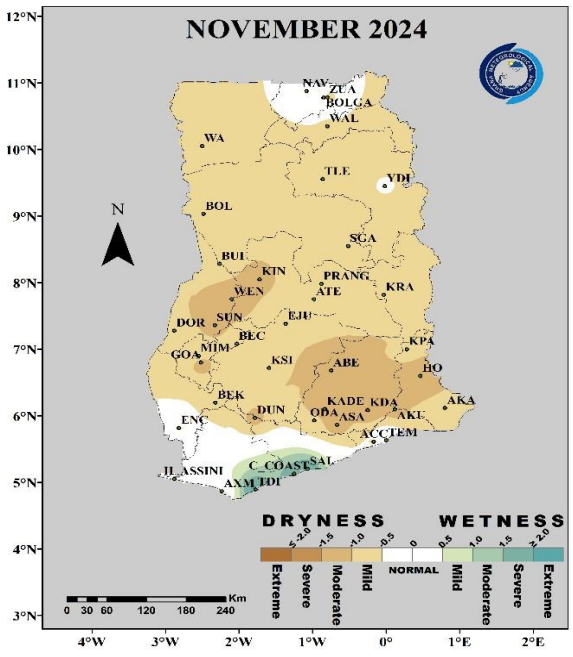
8.10.4 12-month SPI (November 2023 - October 2024)

The 12-month SPI as shown in Fig. 10(d) indicates normal condition dominating the country. Bole and Zuarungu in the Savanna zone show mild dry condition while Navrongo, Wa and Yendi depict mild dryness. In the Transition zone, mild dry condition is shown in Bechem and Kete Krachi. The Forest zone shows mild to moderate wet conditions in areas such as Ejura, Dunkwa, Takoradi, Kade, Koforidua and Ho while Abetifi display moderate dry condition. The Coastal zone exhibited mainly normal conditions

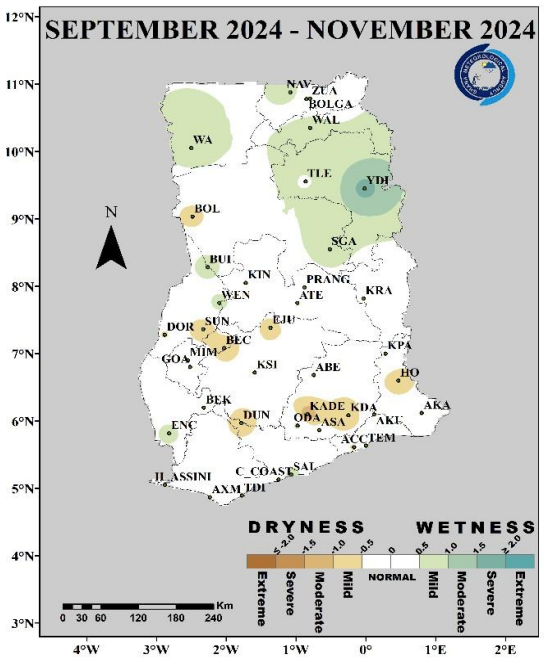
8.11 November 2024

8.11.1 1-Month SPI (November 2024)

The 1-Month SPI shown in Fig. 11(a) depicts widespread mild dry condition over most parts of the country. Normal condition is seen in areas such as Yendi, Bolgatanga, Zuarungu and Navrongo. Mild dry condition dominates the Transition with moderate dryness shown in Kintampo, Wenchi and Sunyani. The Forest zone is mainly characterized by normal and mild dry conditions with moderate dryness in Goaso, Dunkwa, Abetifi, Kade, Asamankese, Koforidua, Akuse and Ho while Takoradi shows extreme wet condition. Saltpond and Cape Coast in the Coastal zone display severe wet condition with Akatsi showing mild dryness.



Map 8.11(a): 1-Month SPI (for meteorological drought): November 2024

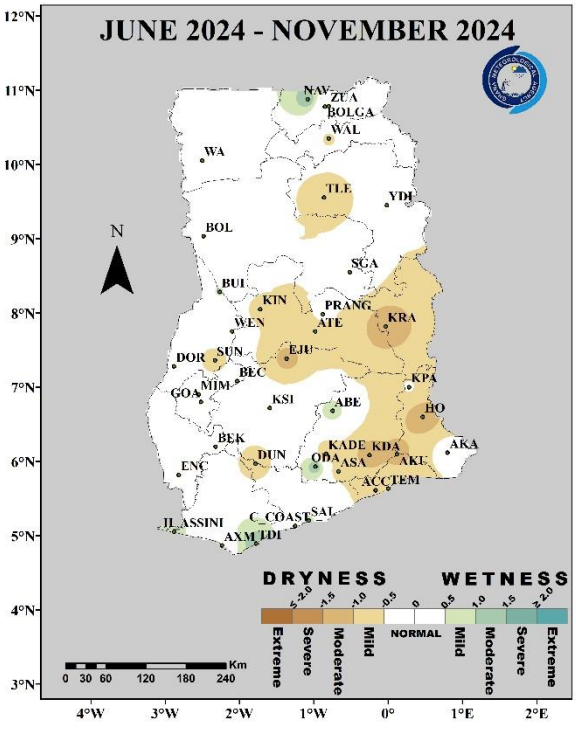


Map 8.11(b): 3-Month SPI (for agricultural drought): September 2024 – November 2024

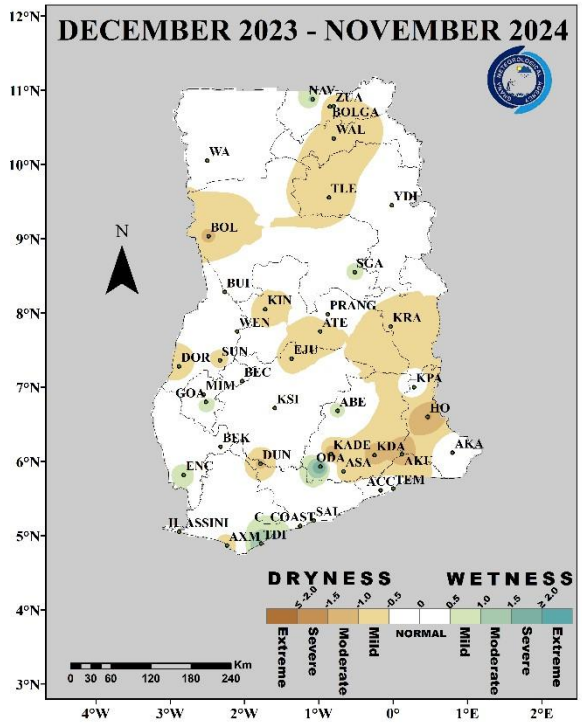
8.11.2 3-month SPI (September 2024 - November 2024)

The 3-month SPI in Fig. 11(b) reveals mild to severe wetness in the Savanna zone in areas such as Yendi, Walewale, Navrongo and Wa with Bole depicting mild dry condition. The Transition zone shows predominantly normal condition with spots of mild wet condition in Salaga, Bui and Wenchi while mild dryness is shown in areas such as Sunyani and Bechem. Normal condition dominates the Forest zone with Ejura, Dunkwa, Kade, Koforidua and Ho showing mild to moderate dry conditions while Enchi exhibits mild dry condition. The Coastal zone displays mostly normal condition with Saltpond shows mild wet condition.

8.11.3 6-month SPI (June 2024 - November 2024)



Map 8.11(c): 6-Month SPI (for hydrological drought): June 2024 – November 2024



Map 8.11(d): 12-Month SPI (for streamflow and lake storage drought): December 2023 –

The 6-Month SPI as illustrated in Fig. 11(c) reveals normal condition dominating the country with Navrongo showing moderate wet condition within the Savanna zone while Walewale and Tamale display mild dry conditions. In the Transition zone, mild to moderate dryness is seen over areas such as Kintampo, Sunyani, Atebubu and Kete Krachi. Areas such as Ejura, Ho, Kade, Koforidua, Akuse, Asamankese and Dunkwa in the Forest zone show mild to moderate

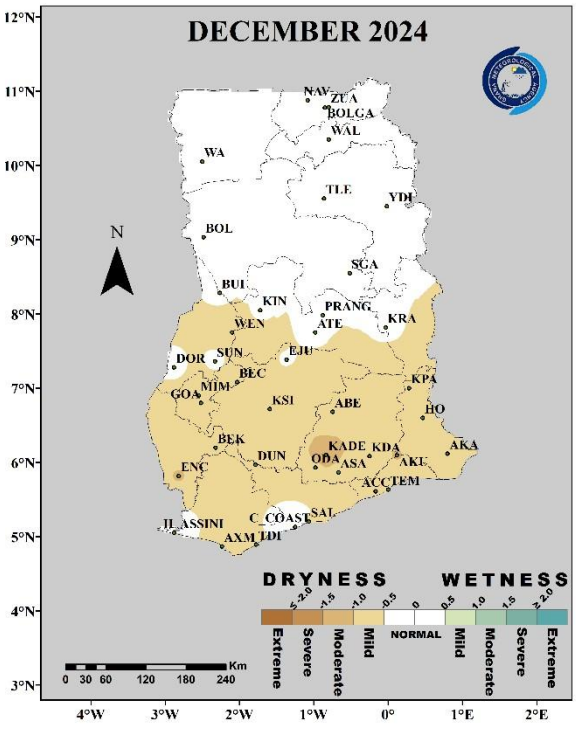
condition while mild to moderate is seen in Abetifi, Akim Oda, Axim and Takoradi. The Coastal zone depicts mild dryness in Accra and Tema.

8.11.4 12-month SPI (December 2023 - November 2024)

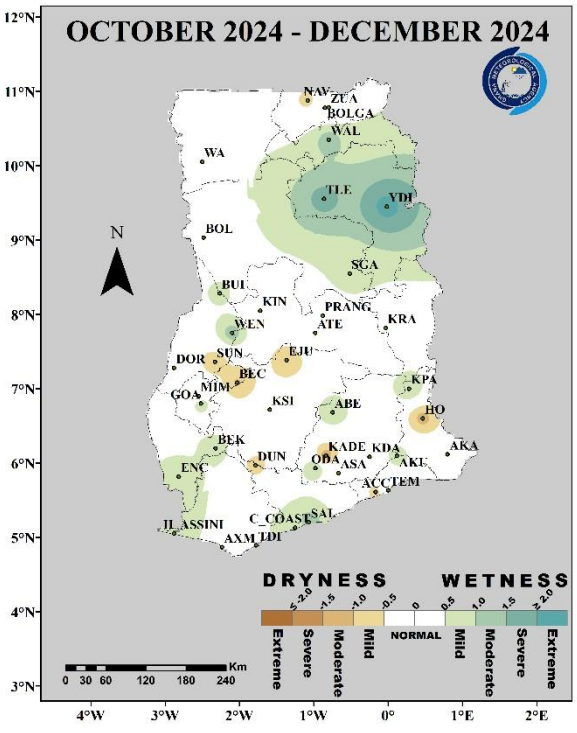
The 12-Month SPI displayed in Fig. 11(d) indicates normal condition over most parts of the country. Mild to moderate dry conditions are seen in Bolgatanga, Zuarungu, Walewale, Tamale and Bole within the Savanna zone with Navrongo showing mild wet condition. The Transition zone shows mild dry condition in areas such as Dormaa, Sunyani, Kintampo, Atebubu and Kete Krachi with Salaga showing mild wet condition. In the Forest zone, areas such as Ejura, Dunkwa, Ho, Kade, Koforidua, Akuse, Asamankese and Axim depict mild to moderate dry conditions with Goaso, Enchi, Takoradi and Abetifi show mild to moderate wetness while Akim Oda shows severe wet condition.

8.12 December 2024

8.12.1 1-Month SPI (December 2024)



Map *8.12(a):* ***1-Month SPI (for meteorological drought): December 2024***



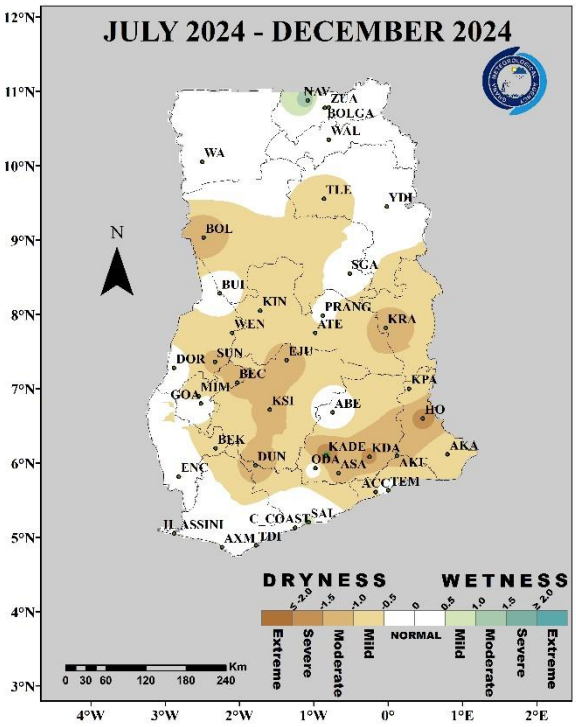
Map 8.12(b): 3-***Month SPI (for agricultural drought): October 2024 – December 2024***

The 1-Month SPI as shown in Fig. 12(a) depicts mainly normal condition over the Savanna zone. The Transition zone shows partly normal condition and mild dry condition. Mild dry condition dominates the Forest zone with moderate dryness in areas such as Enchi, Kade and Akuse while the Coastal zone is predominantly characterized by mild dry condition.

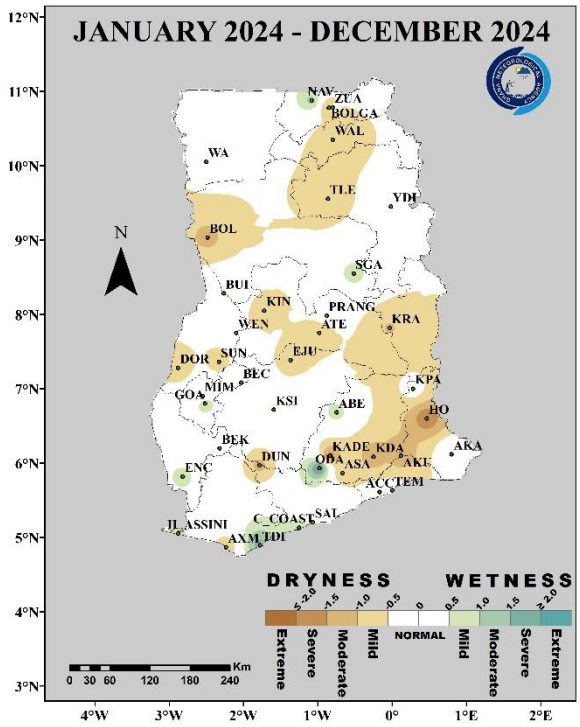
8.12.2 3-month SPI (October 2024 - December 2024)

The 3-month SPI in Fig. 12(b) reveals mild to severe wet conditions in areas such as Walewale, Tamale and Yendi in the Savanna zone with Navrongo showing mild dry condition. Bui and Wenchi in the Transition zone had mild to moderate wet condition while Sunyani and Bechem showed mild dryness. In the Forest zone, Goaso, Enchi, Sefwi Bekwai, Half Assini, Abetifi, Akim Oda, Akuse and Kpando display mild wet condition with Ejura, Dunkwa, Kade and Ho showing mild to moderate dry condition. Cape Coast and Saltpond within the Coastal zone show mild to moderate wet conditions while Accra display mild dry condition.

8.12.3 6-month SPI (July 2024 - December 2024)



Map 8.12(c): 6-Month SPI (for hydrological drought): July 2024 – December 2024



Map 8.12(d): 12-Month SPI (for streamflow and lake storage drought): January 2024 – December 2024

The 6-Month SPI in Fig. 12(c) shows moderate wet condition in Navrongo within the Savanna zone with Tamale and Bole displaying mild to moderate dry conditions. Mild dry condition dominates the Transition zone with Sunyani, Bechem and Kete Krachi recording moderate dry condition. The Forest zone shows mostly mild dry condition with moderate to severe dry conditions seen in areas such as, Ejura, Kumasi, Dunkwa, Kade, Asamankese, Akuse, Koforidua and Ho. The Coastal zone is characterized mild dry condition in Accra and Akatsi.

8.12.4 12-month SPI (January 2024 - December 2024)

The 12-Month SPI as shown in Fig. 12(d) reveals normal condition dominating the country. Mild wet condition is shown in Navrongo within the Savanna zone with Tamale and Bole showing mild to moderate dry condition. Salaga in the Transition zone show mild wet condition while Dormaa, Sunyani, Kintampo, Atebubu and Kete Krachi display mild to moderate dry conditions. In the

Forest zone, mild to moderate wet conditions are seen in Goaso, Enchi, Akim Oda, Abetifi and Takoradi with mild to moderate dry conditions shown in areas including Ejura, Dunkwa, Axim, Kade, Asamankese, Koforidua, Akuse and Ho. The Coastal zone exhibits mainly normal conditions.

9. EXTREME EVENTS IN 2024

This section outlines extreme events that happened during 2024.

9.1 Flood Events

In June and October 2024, communities in Ghana's Central and Northern Regions were severely affected by flooding caused by heavy rainfall and human activities. In the Central Region, the Ayensu River overflowed its banks, a situation made worse by the river's diversion to accommodate the expansion of the Kasoa-Winneba highway. As a result, over 2,000 people were displaced, with more than 200 homes submerged, three of which completely collapsed. The floods also wiped out several acres of farmland, intensifying the hardships faced by residents in the area. Similarly, in the Northern region, communities with poorly developed road networks were hit hard by flooding during the SON rainy season. The inundated roads disrupted daily life, destroyed businesses, and led to delays and absenteeism from work and school. The flooding also hindered residents' access to emergency services, underscoring the region's vulnerability to such disasters.

Picture 1 & 2. River Ayensu floods displace over 2000 people at Gomoa Adwawukwa, other communities, 6th June 2024.

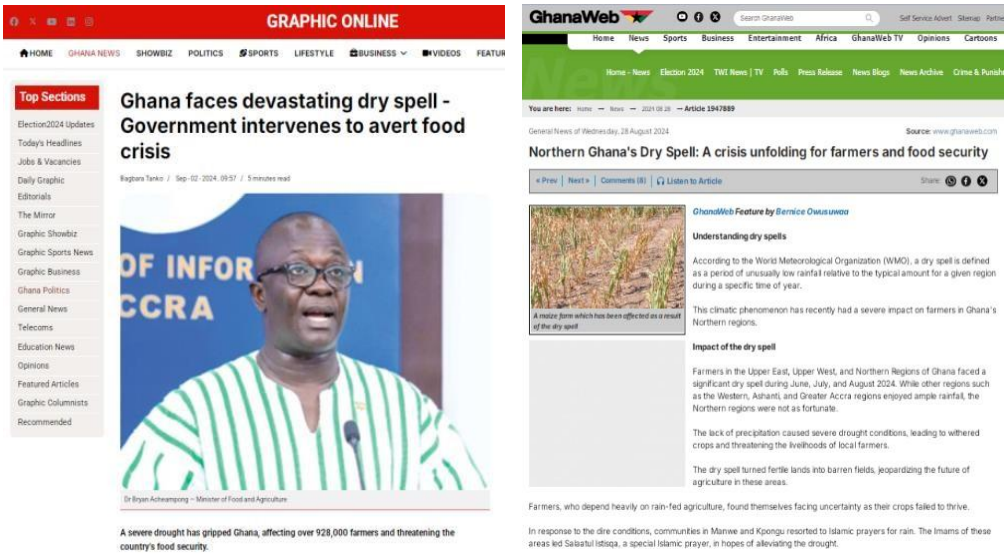
Picture 3 & 4. Flooded roads disrupt lives and businesses in Sagnerigu, Northern Ghana October 3, 2024.

REGION	CAUSE OF FLOOD	NUMBER OF EVENT	DEATH TOLL
GREATER ACCRA	TSRA	20	4
WESTERN REGION	TSRA	1	0
VOLTA REGION	TSRA	1	0
CENTRAL REGION	TSRA	1	0

Dry conditions were generally recorded in 2024 over most parts of Ghana leading to less extreme rainfall hazards compared to the previous year (2023). As displayed in the table above, Greater Accra recorded the highest number of flood incidents with only one death toll compared to last year which had floods contributing to more damages to both life and infrastructure. Other regions such as the Volta, Western, and Central recorded single flood events, leaving the remaining fourteen regions not recording maximum impact of this hazard in 2024.

9.2 Dry Spells Events

Dry Spell Days Occurrence In Transition And Northern Ghana



Source: Graphic online and Ghana Web

In 2024, Ghana experienced a dry spell in the months of July and August that caused crop failures and food insecurity, threatening the livelihoods of over 980,000 farmers (according to Daily Guide Network).

The dry spell affected about five regions in Ghana, which include the Northern, Savannah, Upper West, Bono, Bono East, and Oti regions. The affected regions, experienced continuous dry spell days, leading to conditions that significantly disrupted crop production.

The situation intensified by the lack of consistent rainfall over the past two months, which led to withered crops due to the absence of moisture. Farmers who depend heavily on rain-fed agriculture, found themselves facing uncertainty as their crops failed to thrive.

The dry spell turned fertile lands into barren fields, threatening the future of agriculture in thes areas.

Picture 5: A maize farm which has been affected because of the dry spell

Picture 6: An affected farm in Tumu in the Upper West Region of Ghana

Picture 7: Dry spell crisis captured the Northern part of Ghana.

June August September (Jas) Season – Dry Spell Days Analysis

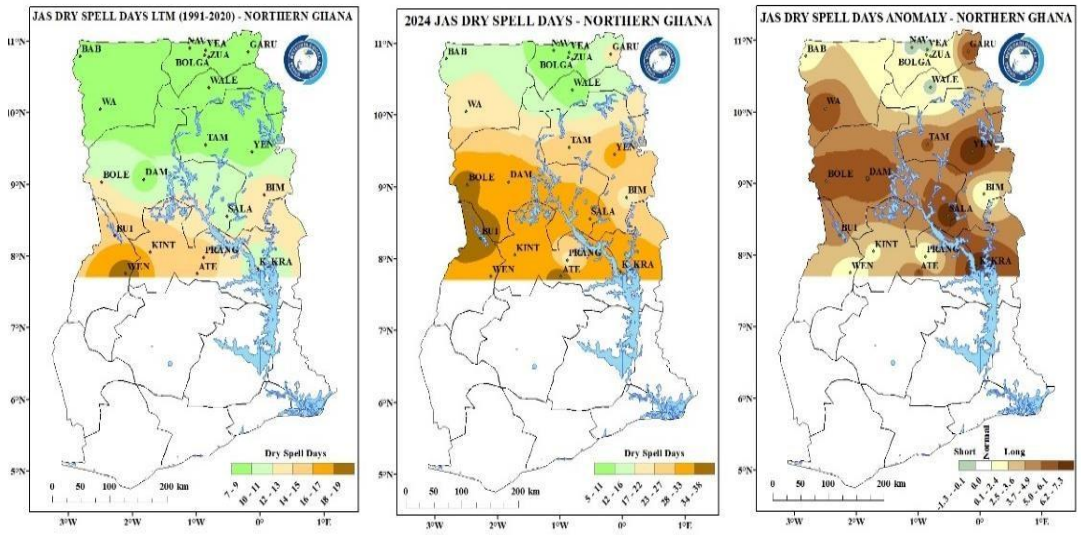


Figure 22. Spatial distribution of LTM, 2024 and anomalies for JAS dry spell days.

Annual average climatological data (1991-2020) shows that the upper part of Northern Ghana, areas such as Babile, Wa, Navrongo, Vea, Garu, Zuarungu, Tamale and Damango have shorter dry spell days spanning from (7-9 days). Moreover, areas such as Bole, Salaga, and Kete-Krachi found in the middle part of Northern Ghana mostly experience 10 - 11 dry spells days over the 30-year period (1991-2020). Wenchi has the longest climatological average of 16 dry spell days.

In 2024, Bui and Atebubu recorded the longest dry spell days of 38. Whereas, upper east and its surroundings (Vea, Navrongo, Walewale and Bolgatanga) recorded dry spell days spanning from 5 – 11 days.

The analysis of the dry spell anomalies for the June-August-September season indicated both negative and positive anomalies spanning from -1.3 to 7.3 days. The stations within the transition zone were predominately positive showing an increase in dry spell days against the climatological average (1991-2020) except for Walewale, Navrongo, and Vea with a negative anomaly value of 0.5, -0.4, and -1.3 respectively. Generally, the dry spell anomaly increased moving from the middle part of Northern Ghana through to the transition areas.

CONCLUSION

The Ghana Meteorological Agency plays a vital role in providing the government and citizens with timely climate information and reliable advisories, helping to carry out its core mission. This effort is not only key to managing risks but also supports the United Nations Sustainable Development Goal 13, which calls for urgent action to combat climate change and its impacts. As the climate continues to change, the Agency's work is crucial in protecting lives and property.

Between January and March, temperatures in Ghana recorded an increase, reaching highs of 31°C. The 2024 temperature forecast shows that most parts of the country experienced a significant increase in temperature. Coastal areas like Takoradi, Tema, and Accra felt the heat, with temperatures rising notably. In the Forest zone, including stations like Kumasi and Koforidua, there were moderate to high temperature fluctuations. In the north, most areas observed a warming impact, though some parts of the Upper West Region remained cooler.

In southern Ghana, the 2024 rainy season started on February 19, marking the beginning of the third week of February. Areas in the Forest zone, such as Abetifi, Kumasi, and Bechem, experienced an early onset, beginning between the first and second weeks of March, compared to the long term mean. In contrast, Asamankese observed a late onset, with the rains arriving in the third week of April.

Along the coast, rainfall began in Tema in the first week of April, with the eastern coastal areas experiencing early onset for the season. However, the western coastal regions like Takoradi, Axim, and Saltpond saw a delayed onset. In both the transitional and northern zones, the rains came earlier than expected, especially in the transitional zone, where Atebubu, Wenchi, and Kintampo recorded the season's earliest rainfall.

In northern Ghana, the monsoon season began in the fourth week of March in Tamale, Bimbila, and nearby areas, with Yendi following in the first week of April. However, there was a delayed onset in the Upper East region, with Navrongo and Zuarungu experiencing a delayed onset in late May. The northernmost and eastern parts of the northern zone saw the latest starts to the season.

A prolonged dry spell which was forecasted by the Ghana Meteorological Agency, spanning from June through to August was also experienced which impacted famers and food security over Ghana.

The SPI for 1, 3, 6, and 12 months indicated similar characteristics across the entire country in 2024. Positive indices were recorded in some parts of the country indicating tendencies of normal conditions. However, most places reported negative indices, indicating a drier condition for the whole country, also showing the variabilities in rainfall patterns experienced. This diversity emphasizes the need for region-specific adaptation strategies to address the unique challenges posed by these patterns.

In conclusion, the comprehensive review of Ghana's 2024 climate patterns highlights the intricate nature of the effects of climate change. The data highlights the need for coordinated efforts to address and adapt to these changes, varying from temperature fluctuation to rainfall patterns and extreme events. For government and the public to make well-informed decisions, the Ghana Meteorological Agency's ability to deliver fast and reliable information is becoming more and more important. Building resilience and ensuring a sustainable future for all depend on cooperative national and international efforts as Ghana confronts the challenges of a changing climate.

REFERENCES

Abram, N. J., Gagan, M. K., Liu, Z., Hantoro, W. S., McCulloch, M. T., & Suwargadi, B. W. (2007). Seasonal characteristics of the Indian Ocean Dipole during the Holocene epoch. *Nature*, *445*(7125), 299-302.

Ampofo, S., Annor, T., Aryee, J. N., Atiah, W. A., & Amekudzi, L. K. (2023). Long-term spatiotemporal variability and change in rainfall over Ghana (1960–2015). *Scientific African*, *19*, e01588.

Baidu, M., Amekudzi, L. K., Aryee, J. N., & Annor, T. (2017). Assessment of long-term spatiotemporal rainfall variability over Ghana using wavelet analysis. *Climate*, *5*(2), 30.

Dinko, D. H., & Bahati, I. (2023). A review of the impact of climate change on water security and livelihoods in semiarid Africa: Cases from Kenya, Malawi, and Ghana. *Journal of Climate*
Resilience and Climate Justice, *1*, 107-118.

Dufresne, J. L., Foujols, M. A., Denvil, S., Caubel, A., Marti, O., Aumont, O., ... & Vuichard, N. (2013). Climate change projections using the IPSL-CM5 Earth System Model: from CMIP3 to CMIP5. *Climate dynamics*, *40*, 2123-2165.

Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S. L., Péan, C., Berger, S., ... & Zhou, B. (2021). Climate change 2021: the physical science basis. *Contribution of working group I to the sixth assessment report of the intergovernmental panel on climate change*, *2*(1), 2391.

Nyamekye, A. P., Tian, Z., & Cheng, F. (2021). Analysis on the contribution of agricultural sector on the economic development of Ghana. *Open Journal of Business and*
Management, *9*(3), 1297-1311.

World Bank Group. 2022. Ghana Country Climate and Development Report. CCDR Series;.

© World Bank, Washington, DC. http://hdl.handle.net/10986/38209 License: CC BY-NC-ND. https://www.climaterealityproject.org/blog/how-climate-crisis-impacting-ghana.

https://www.graphic.com.gh/news/general-news/flooded-roads-disrupt-lives-and-businessesin-sagnarigu.html.

https://www.modernghana.com/news/1318020/cr-river-ayensu-floods-displace-over-2000people.html#google_vignette.

Station	Abbreviation	Station	Abbreviation
Akim Oda	A_ODA	Ho	HO
Abetifi	ABE	Kete Krachi	K_KRA
Accra	ACC	Kade	KADE
Ada	ADA	Koforidua	KDUA
Akatsi	AKA	Kintampo	KINT
Akuse	AKU	Kpando	KPAN
Asamankese	ASAM	Kumasi	KSI
Atebubu	ATE	Mim	MIM
Axim	AXIM	Navrongo	NAV
Babile	BAB	Prang	PRANG
Bechem	BECH	Sefwi Bekwai	S_BEK
Bimbila	BIM	Salaga	SALA
Bole	BOLE	Saltpond	SALT
Bolga	BOLGA	Sunyani	SUNY
Bui	BUI	Tamale	TAM
Cape Coast	C_COAST	Takoradi	TDI
Dormaa Ahenkro	D_AHEN	Tema	TEMA
Damongo	DAM	Vea	VEA
Dunkwa Offin	DUNK	Wa	WA
Ejura	EJURA	Walewale	WALE
Enchi	ENCH	Wenchi	WEN
Garu	GARU	Yendi	YEN
Goa	GOA	Zuarungu	ZUA
Half Assini	H_ASS		

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