FLOOD & DROUGHT BULLETIN

JANUARY 2024

GHANA METEOROLOGICAL AGENCY

Table of Contents

INTRODUCTION

The Flood and Drought bulletin is a monthly analysis of rainfall in Ghana prepared and released by the Ghana Meteorological Agency (GMet). The bulletin provides an authoritative and scientific understanding of rainfall variability which is essential for accurate hydrological modeling, climate change assessments, and effective water resource planning to mitigate risks associated with extreme events like droughts and floods.

Among other services and products, the Flood and Drought bulletin complements the objectives of GMet in line with the National Framework for Climate Services (NFCS) to improve co-production, tailoring, delivery and use of science-based climate predictions and services focused on the five pillars of the Global Framework for Climate Services (GFCS) by the World Meteorological Organization (WMO): agriculture and food security, disaster risk reduction, energy, health and water.

The analysis in the Flood and Drought bulletin is based on the Standardized Precipitation Index (SPI) developed by McKee et al. (1993) for the purpose of *defining and monitoring drought*. Drought is an insidious natural hazard that results from lower levels of precipitation than what is considered normal. When this phenomenon extends over a season or a longer period of time, water becomes increasingly insufficient to meet the demands of human activities and the environment. Drought must be considered a relative, rather than absolute, condition. Drought means different things to different users such as water managers, agricultural producers, hydroelectric power plant operators and wildlife biologists. Even within sectors, there are many different perspectives of drought because impacts may differ markedly. Droughts are commonly classified by type as meteorological, agricultural and hydrological, and differ from one another in intensity, duration and spatial coverage (WMO, 2012).

THE STANDARDIZED PRECIPITATION INDEX (SPI)

SPI indicator, which was developed by McKee et al. (1993), and described in detail by Edwards and McKee (1997), measures precipitation anomalies at a given location, based on a comparison of observed total precipitation amounts for an accumulation period of interest (e.g. 1, 3, 12, 48 months), with the long-term historic rainfall record for that period. This indicator measures anomalies of accumulated precipitation during a given period. In calculating SPI, precipitation is the only required input parameter (McKee and others, 1993, 1995). The SPI calculation for any location is based on the long-term precipitation record for a desired period. This long-term record is fitted to a probability distribution, which is then transformed into a normal distribution so that the mean SPI for the location and desired period is zero (Edwards and McKee, 1997).

The SPI is designed to quantify the precipitation deficit for multiple timescales and can be calculated from 1 month up to 72 months. Statistically, 1–24 months is the best practical range of

application (Guttman, 1994, 1999). The Flood and Drought bulletin of Ghana considers only the 1-month, 3-month, 6-month and 12-month SPI.

1-month SPI
The 1-month SPI compares the precipitation of a specific month with the precipitation totals from the same month for all the years included in the historical record.

3-month SPI
The 3-month SPI provides a comparison of the precipitation over a specific 3 consecutive month period with the precipitation totals from the same 3-month period for all the years included in the historical record.

6-month SPI
The 6-month SPI compares the precipitation for a specific 6 consecutive months with the same 6-month period over the historical record.

12-month SPI
The 12-month SPI is a comparison of the precipitation for 12 consecutive months with that recorded in the same 12 months in all previous years of available data.

These timescales reflect the impact of drought on the availability of the different water resources. Meteorological and soil moisture conditions (agriculture) respond to precipitation anomalies on relatively short timescales, for example 1 to 3 months (SPI-1 to SPI-3), whereas streamflow, reservoirs, and groundwater respond to longer-term precipitation anomalies, for example 3 months to 12 months (SPI-3 to SPI-12) or longer (EDO, 2020).

A real strength of the SPI is its ability to be calculated for many timescales, which makes it possible to deal with many of the drought types described above. The ability to compute the SPI on multiple timescales allows for temporal flexibility in the evaluation of precipitation conditions in relation to water supply.

In the Flood and Drought bulletin, the SPI values for any given location and accumulation period, are classified into nine different precipitation regimes (from dry to wet), as shown in Table 1. As can be seen, increasingly severe rainfall deficits (i.e., meteorological droughts) are indicated as SPI decreases below -0.5, while increasingly severe excess rainfall is indicated as SPI increases above 0.5.

ANOMALY	*RANGE OF SPI VALUES*	*PRECIPITATION REGIME*	*COLOUR*
Negative	Min <= SPI <= -2.0	Extreme dry	
	-2.0 < SPI <= -1.5	Severe dry	
	-1.5 < SPI <= -1.0	Moderate dry	
	-1.0 < SPI <= -0.5	Mild dry	
None	-0.5 < SPI <= 0.5	Normal precipitation	
Positive	0.5 < SPI <= 1.0	Mild wet	
	1.0 < SPI <= 1.5	Moderate wet	
	1.5 < SPI <= 2.0	Severe wet	
	2.0 < SPI <= Max	Extreme wet	

Table 1: SPI classification scheme used in the Flood and Drought bulletin

SPI ANALYSIS FOR JANUARY 2024

The SPI analysis for rainfall in January 2024 has been generated in multiple timescales of 1-month (January 2024), 3-month (November 2023 – January 2024), 6-month (August 2023 – January 2024) and 12-month (February 2023 – January 2024). The maps generated depict the severity (positive or negative) of rainfall anomalies for the period under review.

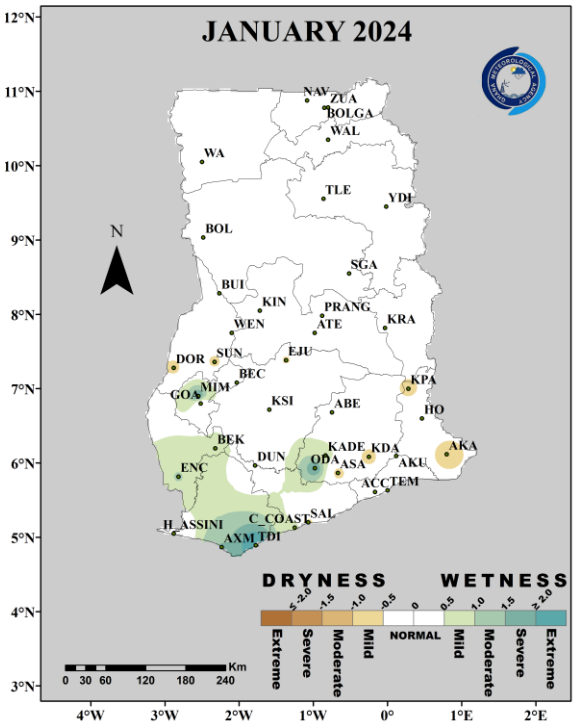

Fig. 1(a): 1-Month SPI *(for meteorological drought)*: January 2024

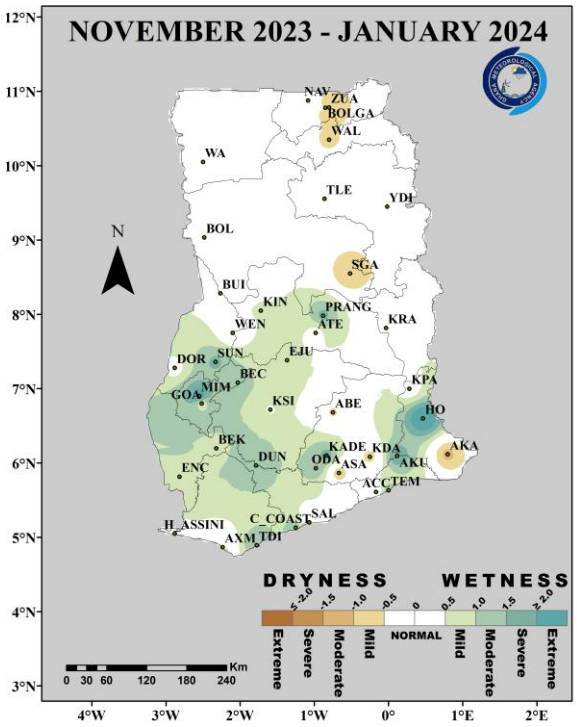

Fig. 1(b): 3-Month SPI *(for agricultural drought)*: November 2023 – January 2024

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.

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 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 condition.

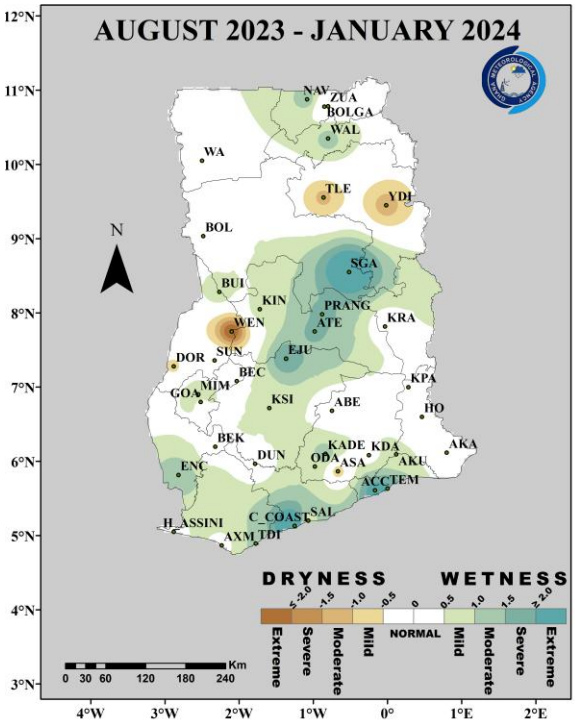

Fig. 1(c): 6-Month SPI *(for hydrological drought)*: August 2023 – January 2024

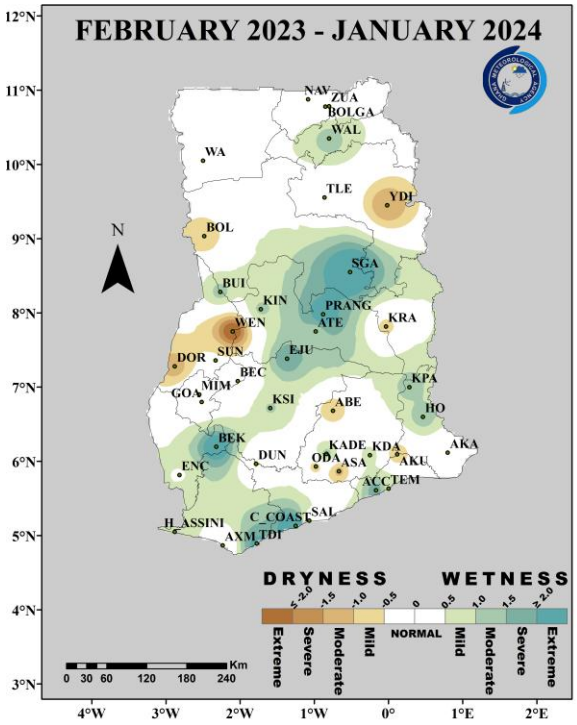

Fig. 1(d): 12-Month SPI *(for streamflow and lake storage drought)*: February 2023 – January 2024

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.

12-month SPI (February 2023 - January 2024)

The 12-month SPI shown in Fig. 1(d) indicates mainly normal condition in the Savanna zone with Walewale showing moderate wet condition 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 condition 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, Asamankese and Akuse. The Coastal zone shows extreme wet condition in Cape Coast with Accra and Tema exhibiting mild to severe wetness.

STATIONS

Station	Abbreviation	Station	Abbreviation	Station	Abbreviation
Abetifi	ABE	Enchi	ENC	Sunyani	SUN
Accra	ACC	Goaso	GOA	Takoradi	TDI
Akatsi	AKA	Half Assini	H_ASSINI	Tamale	TLE
Akim Oda	ODA	Ho	HO	Tema	TEM
Akuse	AKU	Kade	KADE	Wa	WA
Asamankese	ASA	Kete Krachi	KRA	Walewale	WAL
Atebubu	ATE	Kintampo	KIN	Wenchi	WEN
Axim	AXM	Koforidua	KDA	Yendi	YDI
Bechem	BEC	Kpandu	KPA	Zuarungu	ZUA
Bole	BOL	Kumasi	KSI		
Bolga	BOLGA	Mim	MIM		
Bui	BUI	Navrongo	NAV		
Cape Coast	C_COAST	Prang	PRANG		
Dormaa	DOR	Salaga	SGA		
Dunkwa	DUN	Saltpond	SAL		
Ejura	EJU	Sefwi Bekwai	BEK		

REFERENCE

Copernicus European Drought Observatory (EDO): https://edo.jrc.ec.europa.eu/ © European Commission, 2020.

Edwards, D. C. and T. B. McKee, 1997: Characteristics of 20th century drought in the United States at multiple time scales. Climatology Report 97-2, Department of Atmospheric Science, Colorado State University, Fort Collins, Colorado.

Guttman, N.B., 1994: On the sensitivity of sample L moments to sample size. Journal of Climate, 7(6):1026–1029.

———, 1999: Accepting the Standardized Precipitation Index: a calculation algorithm. Journal of the American Water Resources Association, 35(2):311–322.

McKee, T.B., N.J. Doesken and J. Kleist, 1993: The relationship of drought frequency and duration to time scale. In: Proceedings of the Eighth Conference on Applied Climatology, Anaheim, California, 17–22 January 1993. Boston, American Meteorological Society, 179–184.

———, 1995: Drought monitoring with multiple timescales. In: Proceedings of the Ninth Conference on Applied Climatology, Dallas, Texas, 15–20 January 1995. Boston American Meteorological Society, 233–236.

World Meteorological Organization, 2012: *Standardized Precipitation Index User Guide* (M. Svoboda, M. Hayes and D. Wood). (WMO-No. 1090), Geneva.

Kindly send feedback to:
The Director-General
Ghana Meteorological Agency
P. O. Box Lg 87, Legon, Accra-Ghana
Email: info@meteo.gov.gh
Phone: 0302764926 / 0302777172