24. INVESTIGATION OF EXTREME RAINFALL EVENTS OVER ZARIA AND ITS ENVIRONS, KADUNA STATE, NIGERIA

Ibrahim Ishiaku[1], Usman M. T[2], Emigilati M.A[2], Abdulkadir A.[2], and Salawu Ezekiel[2]
[1]Department of Geography Federal University Birnin Kebbi
[2]Department of Geography Federal University of Technology Minna
Email: ishiaku.ibrahim@fubk.edu.ng

ABSTRACT
The study investigates extreme rainfall events over Zaria and its environs. The major objective was to identify trends in the extreme event over historical records. A 50-year (1966-2015) monthly gridded rainfall data were acquired from the high-resolution 0.5°x0.5° gridded rainfall data downloaded from the Global Gridded Climatology CRU TS4.00 of the Climate Research Unit at the University of East Anglia in the (http://badc.nerc.ac.uk). The data analysis adopted standardized precipitation index (SPI) developed by McKee, et al (1993) to classify the extreme rainfall events. The results revealed that the months of May and October within the study periods have witness moderate drought (−1.00 to −1.49). The year of 1972, 1983, 2003, 2007 and 2009, was found to have shown sign of severe drought (−1.50 to −1.99) in the month of October. Rainfall was found to have been received most consistently over the month of June to September in each year of 1966 to 2015. Generally, the months of July and August in each year were found to have alternate extremely wet (2.00 and above), severely wet (1.50–1.99) and moderately wet (1.00–1.49). The study recommends that planting of agricultural crops should be done within the near-normal rainfall periods of June to September if the scenario of rainfall events continue.

Key words: Rainfall, Variability, Extreme events, Zaria, Nigeria

INTRODUCTION
One of the most significant consequences of global warming due to increase in greenhouse gases would be an increase in magnitude and frequency of extreme precipitation events (Alexander, et al. 2006). Semi-arid and dry sub-humid areas of tropics are generally said to be characterized by high inter-annual and intra-seasonal rainfall variability (Usman & Abdulkadir 2013). Northern Nigeria is a region of significant rainfall variability on a range of temporal and spatial scales (e.g. Usman & Abdulkadir (2013), Ifabiyi, & Ojoye, (2013), Ismail & Oke (2010)) and is prone to serious drought and flood events. In either case of drought or flood, it is understood to have impact on agriculture. It is noted that the bulk of the population within this study area are engaged in agriculture. Usman & Abdulkadir (2013) reported that agriculture, which employs the bulk of the rapidly increasing populations, is largely rain-fed, low-input based and highly resource dependent. As important as agriculture is within the study area, it is reported that a key impediment to its success has remained largely the erratic rainfall regime, especially since the great Sahelian drought of 1969–1973 (Usman *et al* 2005). This creates a great need for continued monitoring, provision of accurate and timely report on the rainfall phenomenon. A finding from this nature of study may serve as a basis to project the likely scenario of the future event of rainfall.

METHODOLOGY

Monthly rainfall data of Zaria on longitude 7.68^{0}E and Latitude 11.10^{0}N for a 50-year period (1966-2015) were acquired from the high-resolution 0.5°x0.5° gridded rainfall data downloaded from the Global Gridded Climatology CRU TS4.00 of the Climate Research Unit at the University of East Anglia in the UK (http://badc.nerc.ac.uk).

The data were analysed with means of Standardized Precipitation Index (SPI), developed by (McKee, Doesken, and Kleist, 1993). The SPI track dry and wet events on different time-scales, i.e. 1, 3, 9, 12, and 24 months, and is flexible with respect to the period chosen. Generally:

$$SPI = \frac{(R_{ij} - \bar{r}_i)}{\delta_i} \quad (1)$$

$$\delta_i = \sqrt{\frac{\sum_1^n (R_{ij} - \bar{r}_i)^2}{N}} \quad (2)$$

Where:

SPI = standard precipitation index for station i and year j

R_{ij} = Annual rainfall at station i

δ_i = standard deviation of the annual rainfall for station i

N = number of specific years for sample station

RESULT AND DISCUSSION

The wet and dry spell periods of Zaria within the Guinea Ecological Zone of Nigeria for the periods of 1966 to 2015 are depicted in figure 3. The months 1, 2, 3, 4, 5, and 6 represent the months in the hydrological growing season of May, June, July, August, September and October each year. The dry spells occur most often over the first month of May and the last months of October within the hydrological growing season of each year in the consider periods of this study

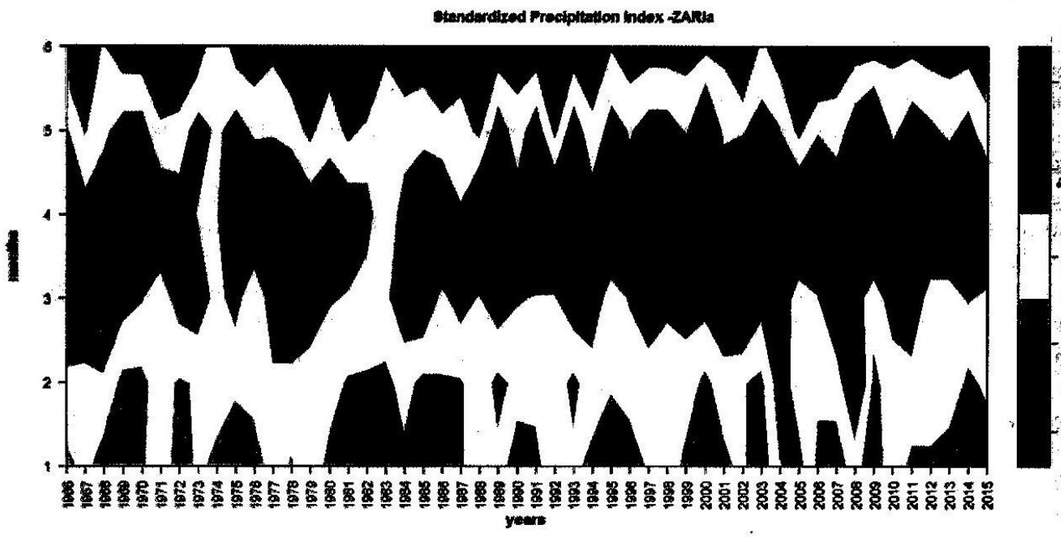

Figure 1. Standardized precipitation index of Zaria

Though it is observed generally that the first month of May with exception of 2005 and the last month of October in each year have shown sign of moisture deficient considered to be Moderate

drought (−1.00 to −1.49), the month of October which marks the end of hydrological growing season have revealed years of critical moisture deficit. The years 1972, 1983, 2003, 2007 and 2009, have shown sign of severe drought (−1.50 to −1.99) to Extreme drought (−2.00 and less).

The wet periods on the other hand occurred most often over June to September each year within the periods of 1966 to 2015. Rainfall is received most consistently over the month of June to September in each year of 1966 to 2015. The months of June and September each year are considered as near normal rainfall (−0.99–0.99). Generally within the months of July and August in each year there have been an alternate extremely wet (2.00 and above), severely wet (1.50–1.99) and moderately wet (1.00–1.49). Of significance in the years of extremely wet periods are 1969, 1976, 1999, 2002, 2008 and 2010.

CONCLUSION

Rainfall efficacy is very important for agricultural activities and an important factor for determining the potential for success in rain-fed agriculture is the effective of the growing season. In the entire study area findings revealed that drought situation were prevalence in the months of May and October for the study periods. The drought events correspond to onset and cessation months of hydrological growing season. Though moisture deficit exist in the above identified months, it severity were mostly noticed around October. On the other hand a near normal rainfall was found to exist between the months of June to September within the study period. Though rainfall were generally near normal, flood event have been noted around mostly August within the periods investigated.

The implication of this findings are twofold. If the rainfall events continue, the farmers may be advised to adopt new agricultural practice that yield harvest within the four months near- normal rainfall periods. On the alternative, normal six month hydrological growing season may continue while farmers are adviced to look for an alternative source of water to complement those months with moisture deficit.

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