Decadal Trend Analysis of August Break in Selected States of Southern Region of Nigeria

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Abstract

This study considered decadal trend analysis of August break of some selected states--Asaba, Awka, Benin, Calabar and Enugu in the Southern region of Nigeria, using secondary data of the daily values of rainfall acquired from the archives of the Nigerian Meteorological Agency(NIMET). These data covered a period of 42 years (1971-2013). From the data analysis, the decadal trend in August break shows that August break is not consistent. We observed a drift in the normal August break from August to June and also to October. This is in an agreement with the result of a similar study that showed a 0.25 probability that August break could occur in the month of June. This shift in August break could be attributed to the reality of climate change. More so, a sudden shift in seasons whether short or long dry season could promote the outbreak of certain diseases, provide suitable conditions for pests to thrive, and pose a considerable economic loss to farmers. Hence the need to checkmate any anthropogenic activity that constitutes a driver of climate change.

Keywords: Decadal Trend, Rainfall Variability, August break, Climate change, Southern Nigeria

Introduction

Human activities have greatly impacted the global climate, Earth's surface temperature and the amount of rainfall. Shifting seasons have been attributed to global warming temperatures(Land Trust Alliance, 2021)."Trend detection in temperature and precipitation time series is one of the interesting research areas in climatology"(Zarenistanak et al, 2014). Okorie (2015) posited that different locations in Nigeria experience variations in rainfall with associated destruction. For instance, rainfall decreases progressively away from the coast in the south; the far north receives no more than 500 mm a year, but with abrupt cessation of rainfall in the month of August,

resulting in a short dry season in the south, commonly called 'August break' (Nigeria - Climate, n.d). August break is also referred to as the little dry season (LDS). It is a cessation of rainfall in-between the two main rainy seasons of the year (Wopakings, 2021). According to Okorie (2015), "rainfall is one of the atmospheric driving forces responsible for climate variation and its effects in Nigeria as in other parts of the world". Rainfall has also been reported by (Anoruo et al., 2016; Ayoade, 2004) as one of the climatic factors that indicate climate variation. Nigeria, because of its location north of the equator, has a tropical climate that is characterized by dry and rainy seasons (National Weather Service, n.d). Inter Governmental Panel on Climate Change(IPCC) report has revealed that since the late 19th Century, the mean surface temperature of the globe have increased by 0.74 ^{o}C, and is projected to rise to 1.4^{o}C by 2100 with marked regional variations (Mahato, 2014). This scinario, no doubt, will greatly impact the global climate with far reaching consequences. As rightly pointed out by Arora (2019) that global food security has been threatened by abrupt changes in climatic conditions. Amadi et al. (2014) also posited that " temperature and its changes impact a number of hydrological processes including rainfall, and these processes in turn impact temperature e.g cooling due to rain or snow". Climate change has a number effects, ranging from severe precipitation patterns, recurrent forest fires. Coates & Norton (2020) study identified and classified climate-sensitive infectious diseases as "vector-borne infectious diseases, infectious diseases associated with extreme weather events, and infectious diseases linked to human migration". Mongi et al. (2010) revealed "strong evidence

demonstrating the vulnerability of rain fed agriculture to negative impacts of climate change

and variability". In 2020, August break started early July and lasted till the end of August and spanned over four geopolitical zones of Nigeria contrary to Nigerian Meteorological Agency (NIMET) predictions, a situation Agricultural scientists and Economists attributed to climate change (Ibirogba, 2020). According to IsaacUnlimited (2020), August "break is likened to the Summer when there are cloudy skies, fair and sunny weather in the morning, and noon respectively, but due to climate change, the periods for August break may differ".

Study Area
Five states in the Southern region of Nigeria were chosen for the study. The five states with their geographic coordinates are Asaba (Lat 6.23^{o}N, Long 6.82^{o}E), Awka (Lat 6.2^{o}N, Long 7.07^{o}E), Benin (Lat 6.33^{o}N, Long 5.6^{o}E), Calabar (Lat 4.97^{o}N, Long 8.35^{o}E), Enugu (Lat 6.5^{o}N, Long 7.0^{o}E). Their elevations above sea level are 46.0m, 136.0m, 88.0m, 53.0m and 180m respectively. Asaba maintains an average tropical temperature of 32°C during the dry season and an average fertile rainfall of 2,700 millimetres (106 in) during the rainy season (Amadi et al. 2014). The state had a population of 4,112,445, according to 2006 census (Federal Republic of Nigeria Official Gazette, 2009). The average temperature of Awka is generally between "27 and 30 degrees Celsius between June and December but rises to 32-34 degrees between January and April, with the last few months of the dry season marked by intense heat". The population of the state from 2006 census was 4177828 (Federal Republic of Nigeria Official Gazette, 2009). Benin City is the capital of Edo state in southern Nigeria and the state had an estimated population of 3,233,366 at the 2006 census(Federal Republic of Nigeria Official Gazette, 2009), and has an average annual temperature of 26.1°C (Amadi et al. 2014). Calabar had a population of 2,892,980 at the 2006 census(Federal Republic of Nigeria Official Gazette, 2009) and an average annual temperature of 26.1^{o}C (Ewoma and Udo, 2008). Enugu has an estimated population of about 3,268,837 at the 2006 census figures(Federal Republic of Nigeria Official

Gazette, 2009). It accounts for 2.3 percent of Nigeria's population density 262 people per square kilometer. The average annual temperature is $26.3^{o}C$ (Amadi et al. 2014).

Method of Data Analysis

In order to investigate the decadal trends in August break of some selected locations in the Southern region of Nigeria, secondary data of the daily values of rainfall for five locations (Asaba, Awka, Benin, Calabar and Enugu) for the period, 1971-2013 were acquired from the archives of the Nigerian Meteorological Agency(NIMET). These secondary data were processed into Seasonal to Decadal format. Time series plot were further used to indicate the variability of the regions.

Results and Discussion

Daily rainfall values were plotted against the months. The monthly plots emphasize the drift in August break.

Figures 1(a) , 1(b), 1(c), and 1(d) are monthly variations of rainfall across Asaba from 1975-1985, 1986-1996, 1997-2007, and 2008-2013 respectively.
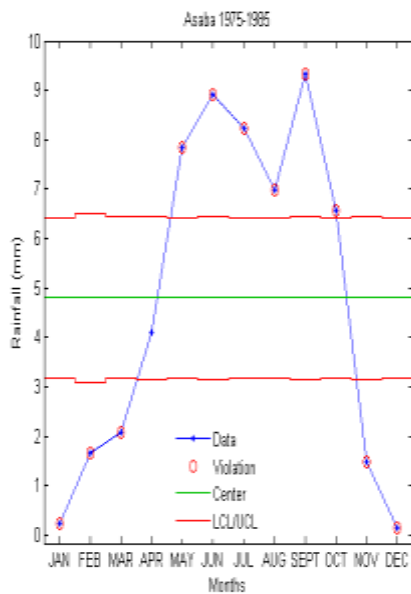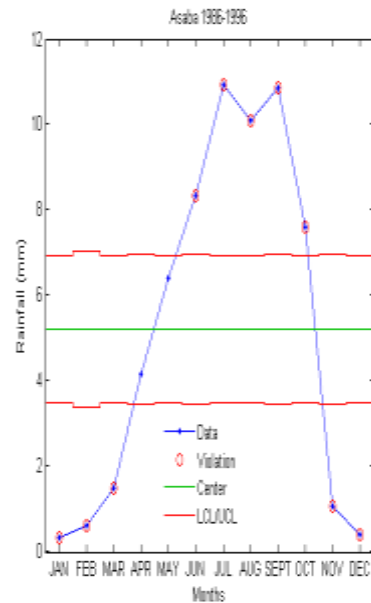

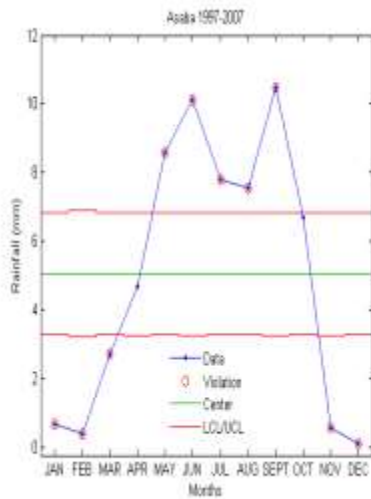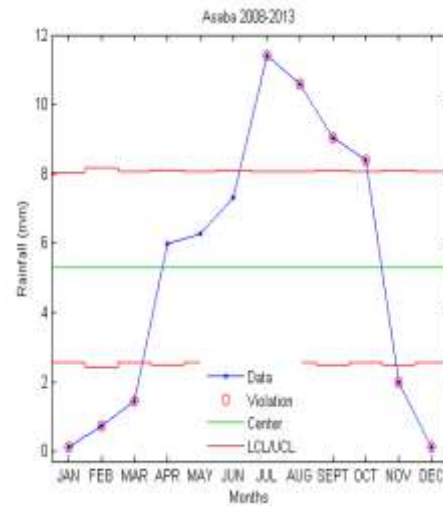**Figure1 (a)**

Figure 1 (b)

Figure 1(c)

Figure 1(d)

In figure 1(a), monthly variation of rainfall was observed from the year 1975-1985. Minimum rainfall was observed at the months of January and December. This clearly indicates Nigeria seasonal rainfall pattern. Towards the months of June, July, August and September, there was a drift from the normal August break to October. Similarly, in figure 1(b), monthly variation of rainfall was observed from the year 1986-1996. Minimum rainfall was observed at the months of January and December. This clearly indicates Nigeria seasonal rainfall pattern. Towards the month September, there was a drift from the normal August break to October. In figure 1(c), monthly variation of rainfall was observed from the year 1997-2007. Minimum rainfall was observed at the months of December. January indicated a significant amount of rainfall, which could be classified as unusual. Towards the month of June, there was a drift from the normal August break to October. In figure 1 (d), monthly variation of rainfall was observed from the year 2008-2013. Minimum rainfall was observed at the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall at the month of February and March, which could be classified as unusual. Towards the month July and August, there was heavy amount of rainfall and a drift from the normal August break to June.

Figures 2(a) , 2(b), 2(c), and 2(d) are monthly variations of rainfall across Awka from 1975-1985, 1986-1996, 1997-2007, and 2008-2013 respectively.
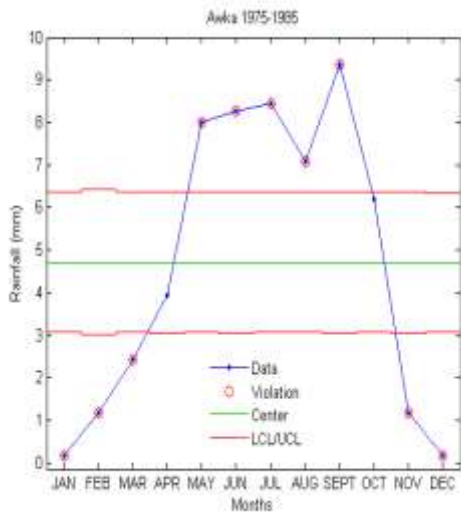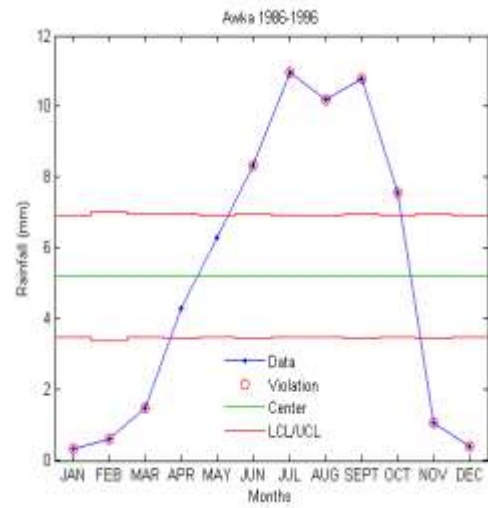
Figure 2(a)
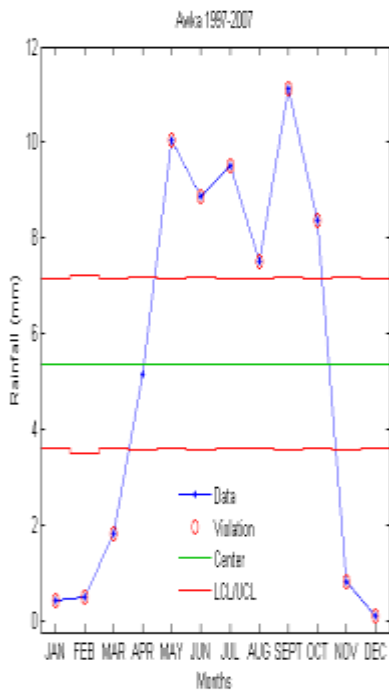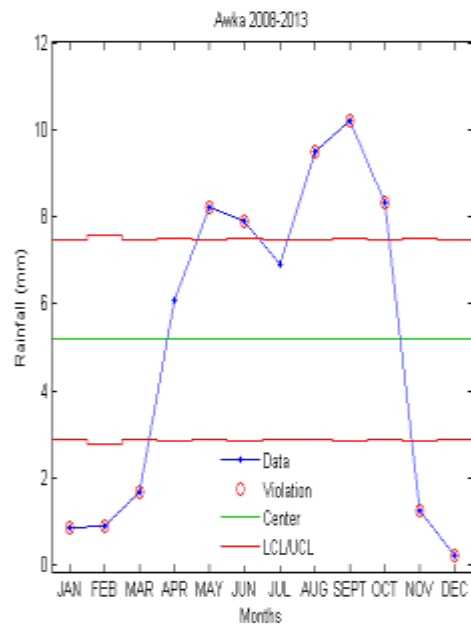

Figure 2 (b)

Figure 2(c)

Figure 2(d)

In figure 2(a), monthly variation of rainfall was observed from the year 1975-1985. Minimum rainfall was observed at the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall at the month of February and March, which could be classified as unusual. Awka experienced August break because October falls into the lower control. In figure 2 (b), monthly variation of rainfall was observed from the year 1986-1996. Minimum rainfall was observed in the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall at the month of February and March, minimal though, but could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. Towards the month of September, there was a drift from the normal August break to October. In figure 2 (c), monthly variation of rainfall was observed from the year 1997-2007. Minimum rainfall was observed at the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall at the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was sign of August break from this decade. This clearly indicates the decadal to seasonal change, and confirmation of Awka experiencing high level of August break despite its location. In figure 2 (d), monthly variation of rainfall was observed from the year 2008-2013. Minimum rainfall was observed at the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall at the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was sign of August break from this decade to the month of June. This clearly indicates the decadal to seasonal change, and the breaking of August break.

Figures 3(a) , 3(b), 3(c), and 3(d) are monthly variations of rainfall across Benin from 1971-1981, 1982-1992, 1993-2003, and 2004-2013 respectively.
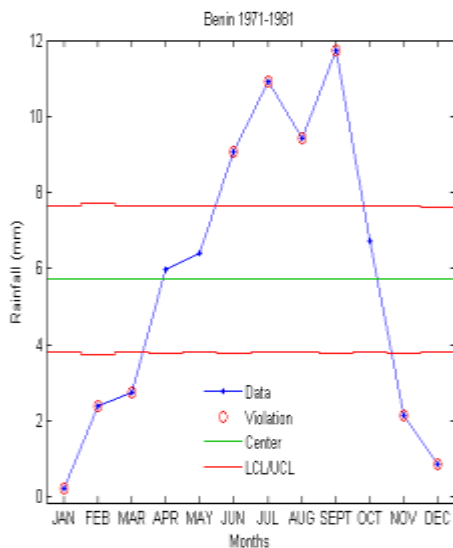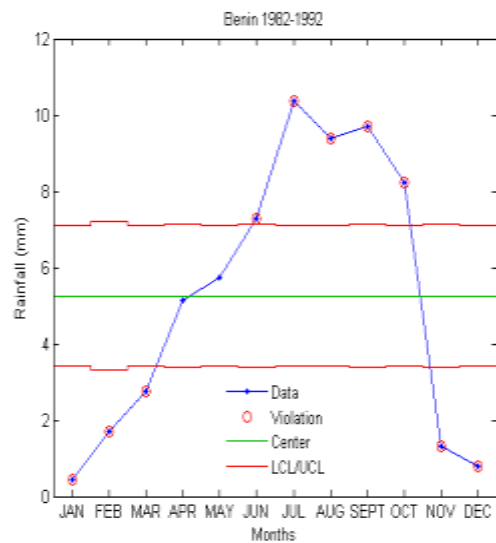

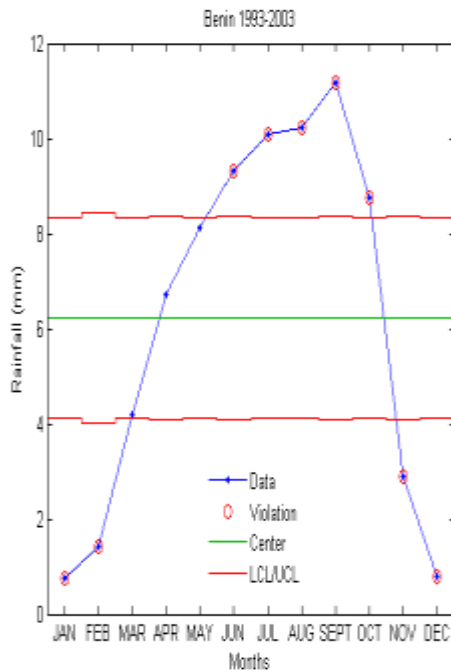**Figure 3(a)**

Figure 3(b)
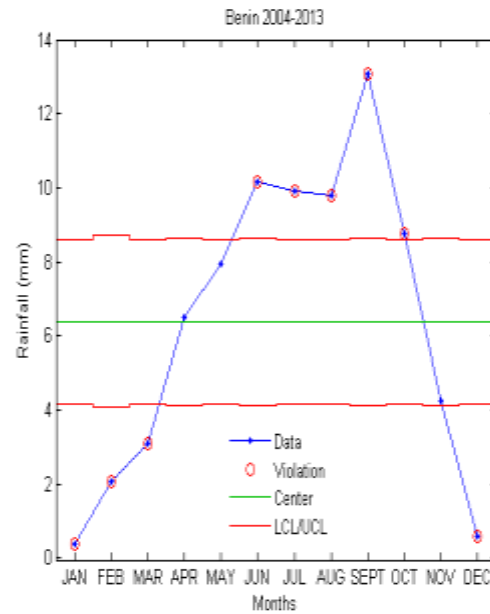
Figure 3(c)

Figure 3(d)

In figure 3 (a), monthly variation of rainfall was observed from the year 1971-1981. Minimum rainfall was observed at the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall at the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was sign of August break to the month of June. In figure 3(b), monthly variation of rainfall was observed from the year 1992-1982. Minimum rainfall was observed at the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall at the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was some break of rainfall at the month of June. This clearly indicates drift in August break. In figure 3(c), monthly variation of rainfall over Benin was observed from the year 1993-2003. Minimum rainfall was observed at the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall in the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was sign of August break to the month of October from this decade. In figure (d), monthly variations of rainfall was observed from the year 2004-2013. Minimum rainfall was observed at the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall at the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was a drift of August break to the month of October.

Figures 4(a), 4(b), 4(c), and 4(d) are monthly variations of rainfall across Calabar, from 1971-1981, 1982-1992, 1993-2003, and 2004-2013 respectively.
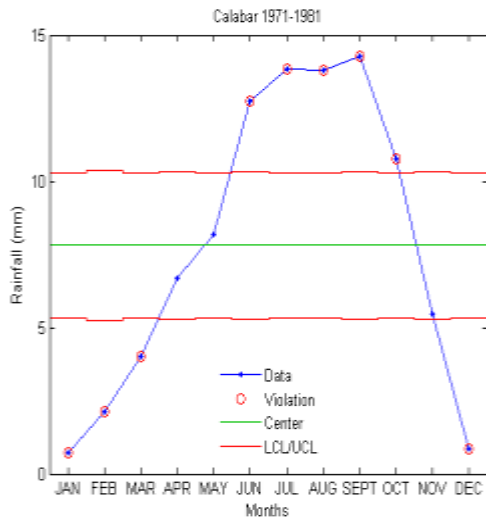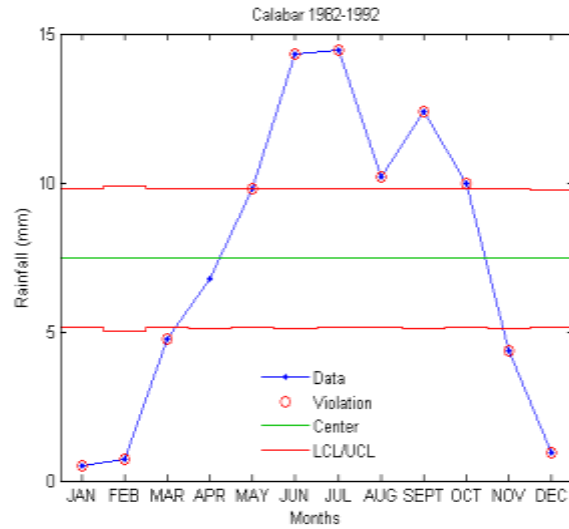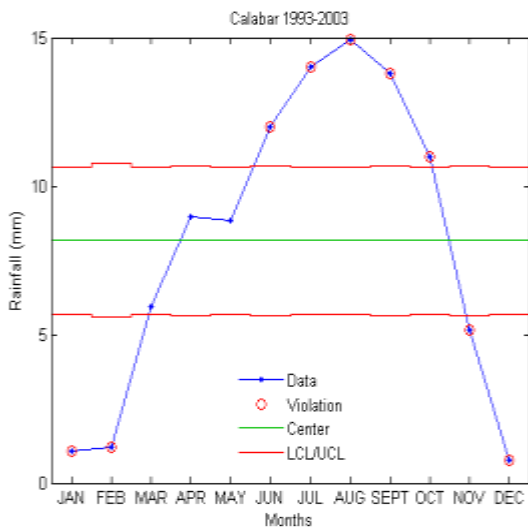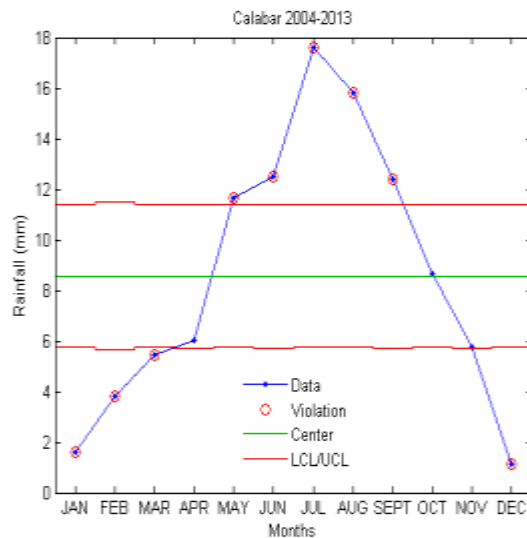
Figure 4 (a)

Figure 4(b)

Figure 4(c)

Figure 4(d)

 In figure 4(a), monthly variation of rainfall was observed from the year 1971-1981. Minimum rainfall was observed at the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall in the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was no sign of August break until the month of October from this decade. This clearly indicates the decadal to seasonal change, and the drift of August break. In figure 4(b), monthly variation of rainfall was observed from the year 1982-1992. Minimum rainfall was observed in the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall in the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was sign of August break towards the months of May and October of this decade. This clearly indicates the decadal to seasonal change, and the

drift of August break. In figure 4(c), monthly variation of rainfall was observed from the year 1993-2003. Minimum rainfall was observed in the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall in the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was no sign of August break. This clearly indicates the decadal to seasonal change, and the breaking of August. In figure 4(d), monthly variation of rainfall was observed from the year 2004-2013. Minimum rainfall was observed in the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall in the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was no sign of August break.

Figures 5(a) , 5(b), 4(c), and 5(d) are monthly variations of rainfall across Enugu from 1971-1981, 1982-1992, 1993-2003, and 2004-2013 respectively.
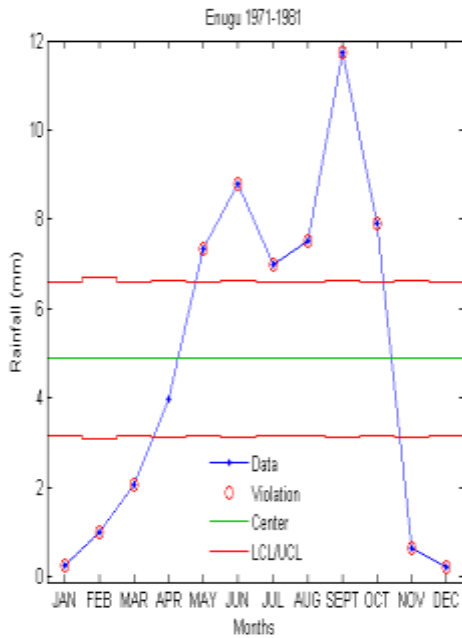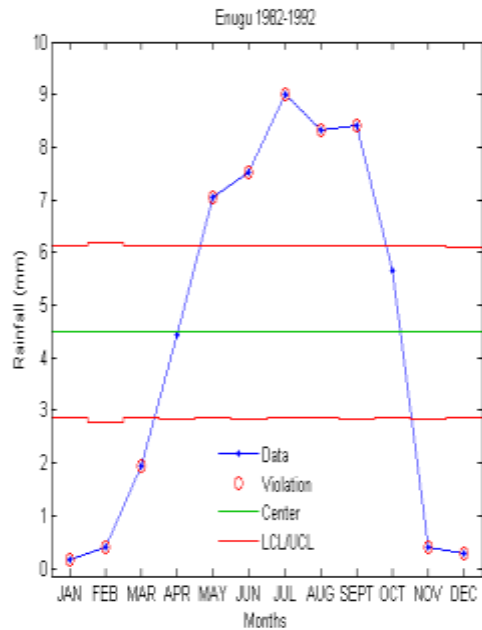

Figure 5(a)   **Figure 5(b)**
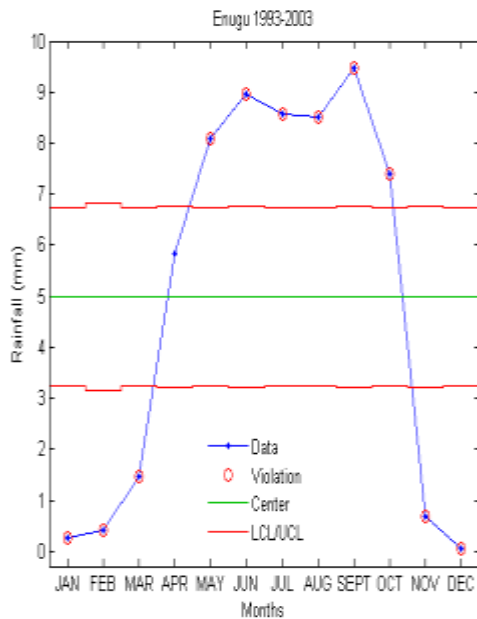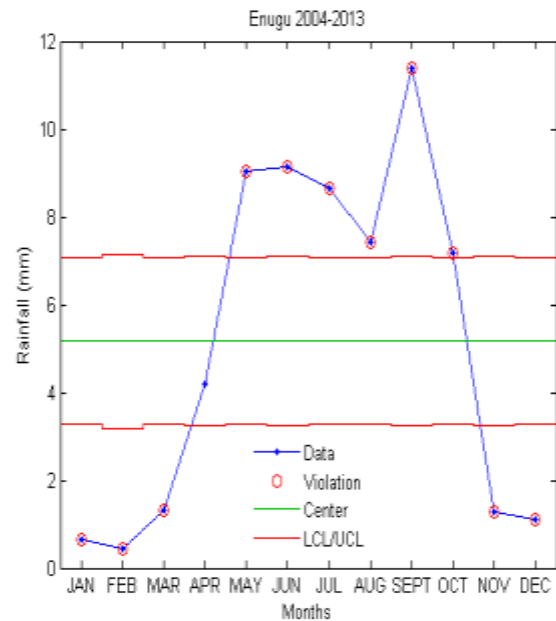
Figure 5(c)

Figure 5(d)

In figure 5(a), monthly variation of rainfall was observed from the year 1971-1981. Minimum rainfall was observed in the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall in the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was sign of August break towards the month of June. In figure 5(b), monthly variation of rainfall was observed from the year 1982-1992. Minimum rainfall was observed in the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall in the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was no sign of August break. In figure 5 (c), monthly variation of rainfall was observed from the year 1993-2003. Minimum rainfall was observed in the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall in the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was no sign of August break.

In figure 5(d), monthly variation of rainfall was observed from the year 2004-2013. Minimum rainfall was observed in the months of January and December. January indicated a significant amount of minimal rainfall. There was rainfall in the month of February and March, which could be classified as unusual. This clearly indicates Nigeria seasonal rainfall pattern. There was a sign of August break towards the months of October of this decade. This clearly indicates the decadal to seasonal change, and the drift of August break.

Conclusion

From the data analysis, the decadal trend in August break shows that August break is not consistent. We observed a drift in the normal August break from August to June and also to October. This is in agreement with a study conducted by Asadu (2002) that revealed a 0.25

probability that August Break could occur in the month of June. This shift in August break could be attributed to the reality of climate change. More so, a sudden shift in seasons whether short or long dry seasons could promote the outbreak of diseases, provides a suitable conditions for pests and mosquitoes to thrive, and pose a considerable economic loss to farmers. Hence the need to checkmate any anthropogenic activity that constitutes a driver of climate change.

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