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Variation of Rainfall and Humidity in Nigeria

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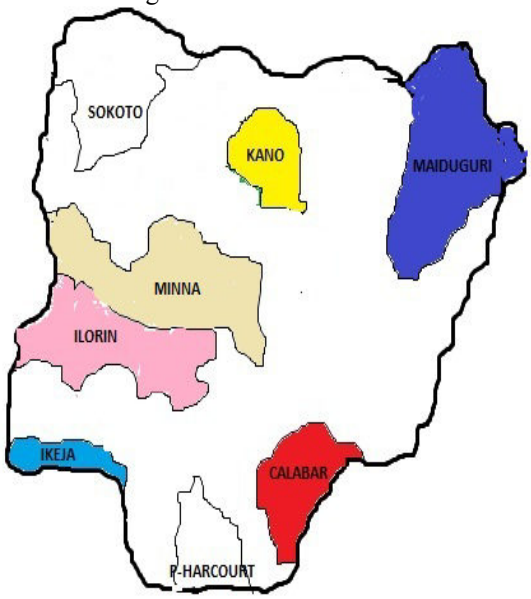
Abstract
Thirty-one year (1979-2010) annual rainfall and relative humidity for eight stations scattered over Nigeria have been analysed. Rainfall is highly variable in both time and space, particularly in sub-humid tropical regions like West-Africa. The analysis was done using statistical package. The mean, standard deviation and coefficient of variation for both relative humidity and rainfall for the study area were calculated. The results shows that the range of the standard deviation for relative humidity for the study areas lie between7.0 and10.5 while its range of the coefficient of variation is between 0.02 and0.35.Coefficient of variation for the rainfall for the period of study is between 0.25and5.65, increasing from the coastal areas into the hinterland. The monthly analysis also show that period of highest rainfall falls between June or July and August or September for the locations nearest to the coast and those closer to the Sahara desert respectively. The trend of the rainfall in Nigeria within the study period is 0 .654per annum.
Keywords: Trend, rainfall, humidity analysis, coefficient of variation, distributional pattern

INTRODUCTION

The relative humidity is maximum (100 %) when the air becomes saturated. If the air becomes saturated, condensation of water vapour (present in the air) occurs leading to the formation of tiny water droplets. Millions of such water droplets come together to form clouds. Under certain conditions such water droplets combine to form big rain drops which fall as Rain due to gravity.(Arthurn Strahler,1965) So, if the humidity is more (or relative humidity becomes maximum), it leads to the formation of clouds and subsequent precipitation. Usually condensation of water vapour into water droplets takes place only in the presence of what is called condensation nuclei .These are dust ,smoke, particles of salt, droplets of sulphuric acid. Among these, salt and sulphuric acid have affinity for water and are therefore called hygroscopic nuclei. If these hygroscopic nuclei are abundant in the atmosphere, condensation can take place even when the relative humidity is as low as 70 %.To gain an insight into the nature of climatic variability within the climate system, it is necessary to study its components in a systematic way. For instance, records of rainfall, temperature, humidity, winds, clouds, pressure or sunshine will typically consist of a complex mixture of variations. Such variations can be separated or filtered out and identified as long-term trends, annual and semi-annual cycles, quasi-cyclical discontinuities, inter- and intra-annual variability's. Previous studies have shown that among all the climatic elements, rainfall is the most variable element in Nigeria, both temporally and spatially and such variations can have significant impacts on economic activity (Kowal and Kanabe, 1972; Kowal and Kassam, 1978; Adefolalu, 1986,Ayoade,1986;Toho,2008;Williams,Lizzi2008). Thus, in this study, emphasis is placed on rainfall and humidity which is analysed in terms of changes in the statistical distribution of the local rainfall and humidity.



STUDY AREA

Figure 1: MAP OF NIGERIA SHOWING THE STUDY AREA

METHODOLOGY

Mean monthly data(1979-2000) used was acquired from the Nigerian meteorological agency (NIMET), Oshodi, Lagos, Nigeria. In this study rainfall and relative humidity for Sokoto, 5° 13' 53" E, 13° 3' 5" N Kano 08° 30' E, 12° 02' N Minna 06° 30' E, 09° 37' N Maiduguri11° 20' 0" E, 10° 48' 0" N Lagos 3° 23' 24" E, 6° 27' 11" N Port-harcourt 6° 59' 54" E, 4° 47' 21" N ,Calabar 8° 19' 05" E, 4° 59' 36" N and Ilorin 30' 0" E, 8° 11' 0" N) The data was analysed using statistical package.

The variation of rainfall and relative humidity for the study areas were determined by obtaining the yearly mean of rainfall and relative humidity.

The monthly trend was obtained by plotting the mean rainfall and relative humidity for each month through the 31 years of study (1979-2010) as shown in figures 2 to 9.

RESULTS AND DISCUSSIONS

Figures 6, 7and9 for Lagos, Port-Harcourt and Calabar respectively shows a long rainy season that begins in March and lasts to the end of July, with a peak period in June or July. It is a period of thick clouds and is excessively wet particularly in the Niger Delta and the coastal lowlands. It is marked by humidity with average values hardly below 82 per cent in these stations. It is also observed that there is a short dry season experienced in August in these locations and is Commonly refers to as the 'August Spell'. This is followed by wet period from early September to mid-October, with a peak period at the end of September. The rains are not usually as heavy as those in the long rainy season, although the spatial coverage over these stations is similar. The two periods of rainfall intensity give the double maxima phenomenon of the rainy season characteristic of southern Nigeria. A fairly long period of dry season starts as from toward the end of Octobers till early March with peak dry conditions in December and February. This period witnesses the prevailing influences of the dry and dusty north-east winds, as well as the 'harmattan' conditions.

Figures 2,3,4,5&7 for Sokoto,Ilorin,Kano,Maiduguri,Minna shows that the climatic conditions in the northern part of Nigeria which is responsible for two different seasons, namely, a short wet season and a prolonged dry season. Humidity is relatively low throughout the year, with average relative humidity values varying between40% to 70%. The dry period extends from October to mid-May. With the Intertropical Continental Zone (ITCZ)in the Southern Hemisphere, the north-east winds and their associated easterlies over the Sahara prevail over the country which is responsible for the dry conditions. The harmattan period during December- January is more intense and longer in the north than in the south. Wet season in this part of Nigeria covers a relatively short period, from June to September. Both the number of rain days and total annual rainfall also decrease progressively from the south to the north. The rains are generally convectional, heavy and short in duration, often characterised by frequent storm.

Figures 2, 3, 4, 5, 6, 7, 8&9 signifies that there is a direct relationship between rainfall and relative humidity throughout the months of the year. The rainfall increases as the relative humidity increases. Figures 10,11,12,13,14,15,16&17 show the yearly correlation between the rainfall and relative humidity of the study area from (1979-2010), indicating the year with the highest rainfall and relative humidity(refer to a table containing this information)

Figure 18 show the average yearly rainfall for all the study areas which shows that rainfall is increasing generally in Nigeria. From the equation of the trend line drawn, the rainfall for the future years could be predicted.

It was also observed that the figure had two peaks with a hill between the two peaks this marks the little dry season and it occurs in August.

From December to March tropical continental air mass dominates the whole of Nigeria and it originates from the North Africa and crosses the Sahara desert into West Africa to Nigeria making the wind dusty and dry bringing about the dry season known as harmattan. The reason why there is virtually no month when it does not rain in Portharcourt ,Calabar and Lagos is due to the fact that these stations are located along the coast and are also at a lower latitude compared to other stations in this study.

From May to September the Tropical maritime air mass dominates the whole of Nigeria and it originates from south Atlantic.

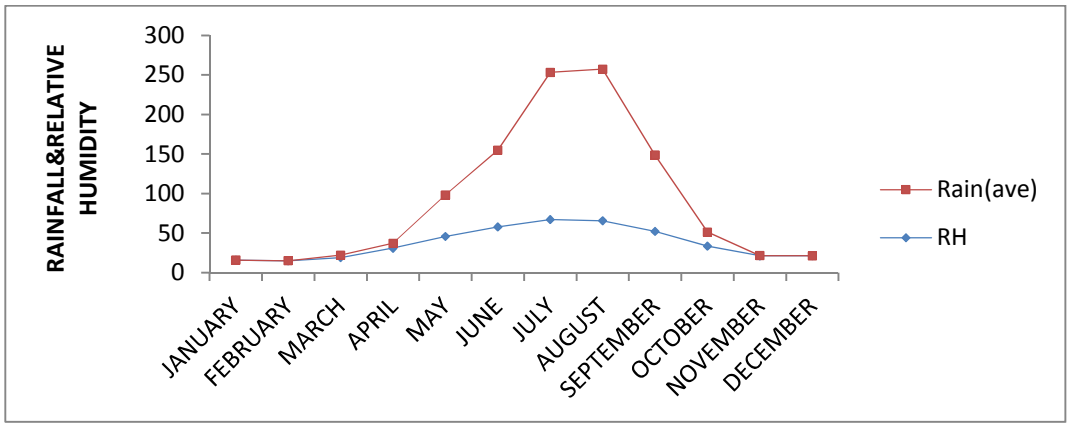


Figure 2: MONTHLY VARIATION OF RAINFALL AND RELATIVE HUMIDITY FOR SOKOTO

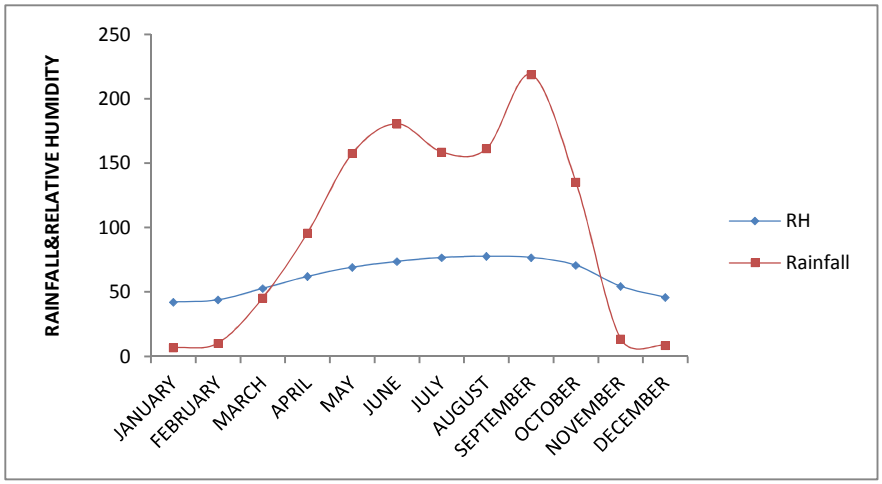


Figure3: **MONTHLY VARIATION OF RAINFALL AND RELATIVE HUMIDITY FOR ILORIN**

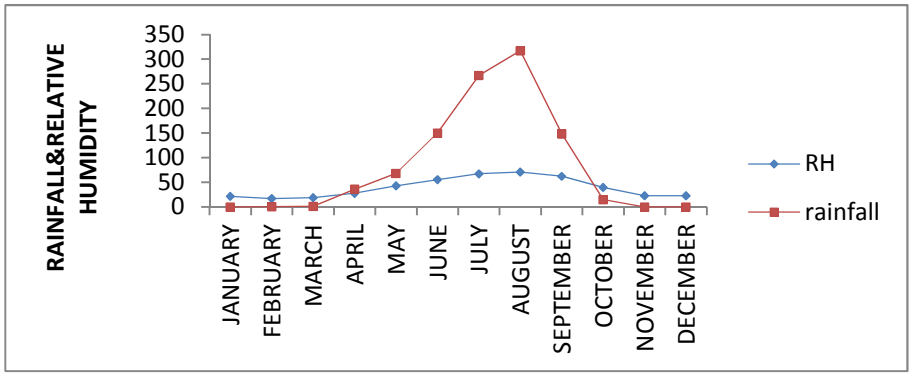


Figure4: MONTHLY VARIATION OF RAINFALL AND RELATIVE HUMIDITY FOR KANO

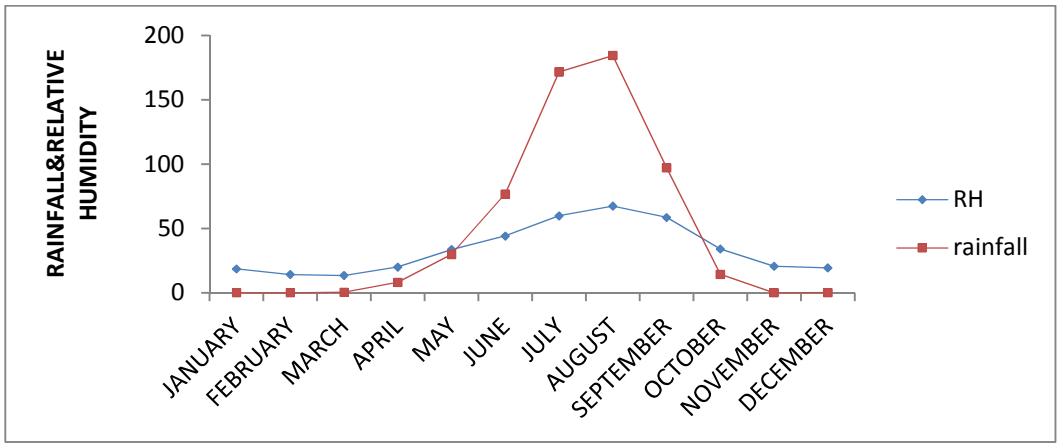


Figure5: **MONTHLY VARIATION OF RAINFALL AND RELATIVE HUMIDITY FOR MAIDUGURI**

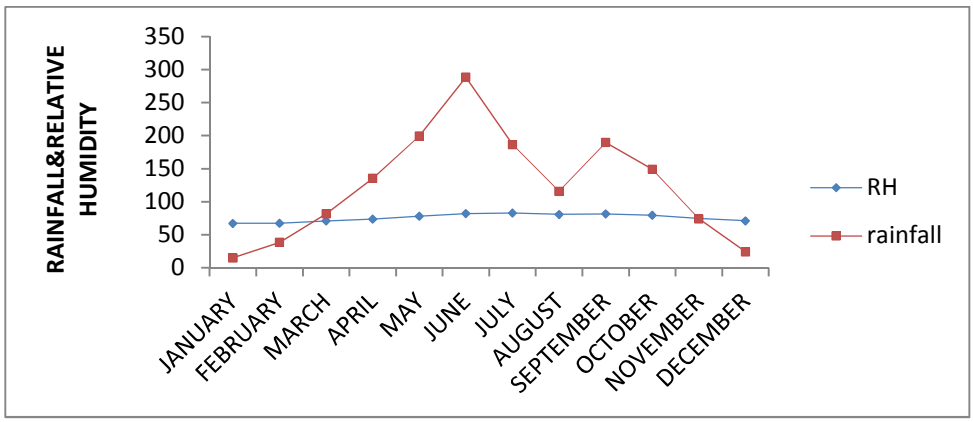


Figure6: **MONTHLY VARIATION OF RAINFALL AND RELATIVE HUMIDITY FOR LAGOS**

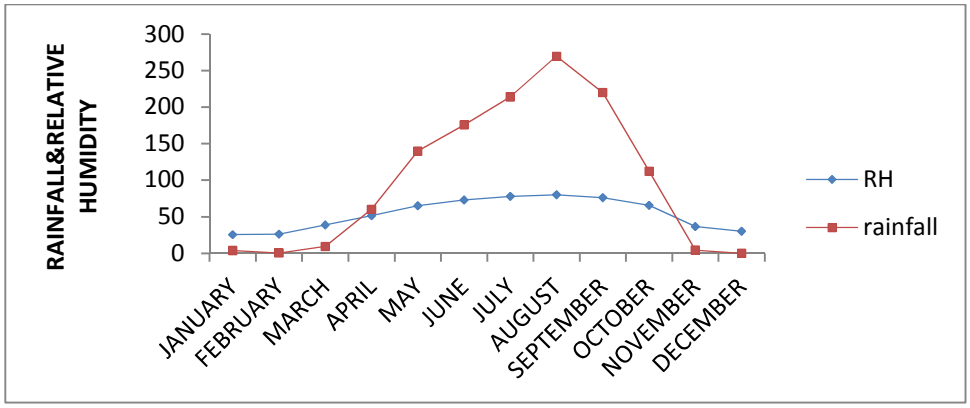


Figure 7: **MONTHLY VARIATION OF RAINFALL AND RELATIVE HUMIDITY FOR MINNA**

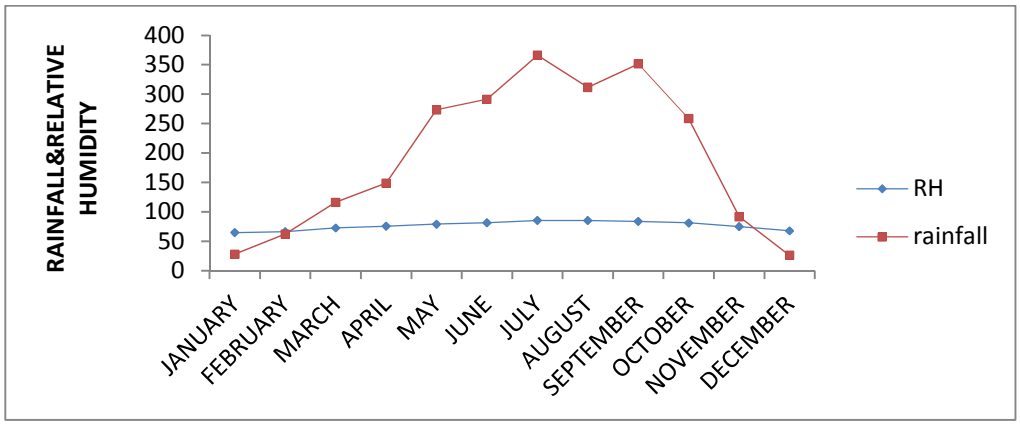


Figure 8: **MONTHLY VARIATION OF RAINFALL AND RELATIVE HUMIDITY FOR PORT-HARCOURT**

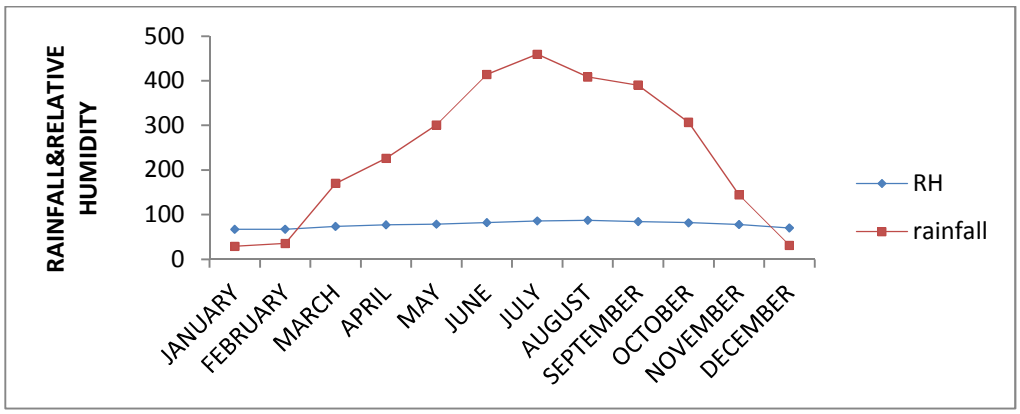


Figure 9: **MONTHLY VARIATION OF RAINFALL AND RELATIVE HUMIDITY FOR CALABAR**

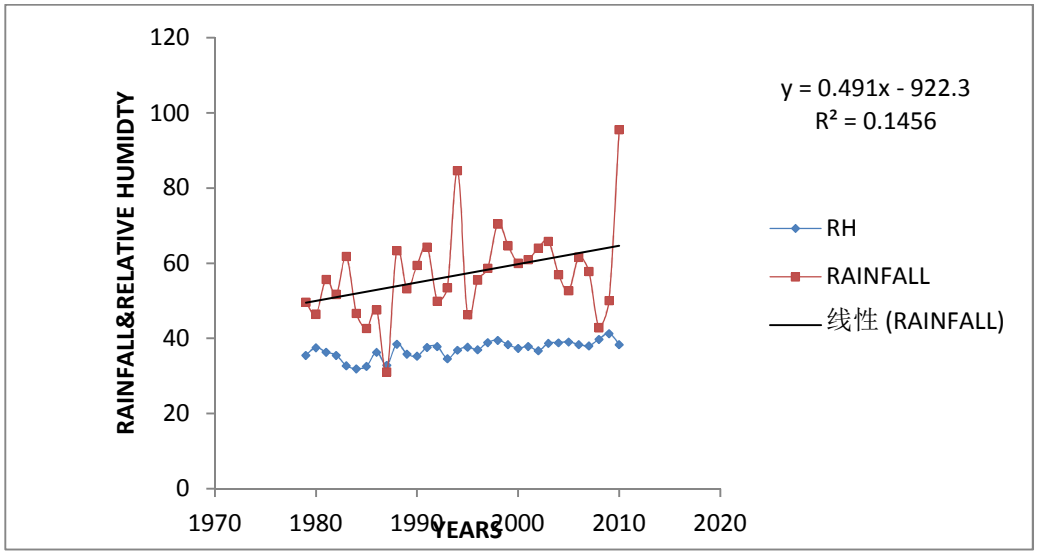


Figure 10: **VARIATION OF MEAN YEARLY RAINFALL & RELATIVE HUMIDITY IN SOKOTO (1979-2010)**

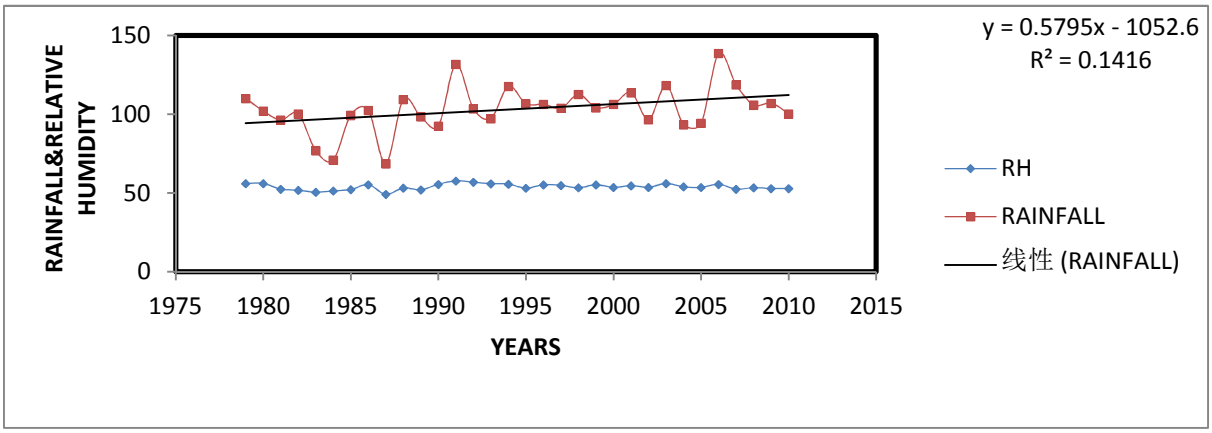


Figure11: **VARIATION OF MEAN YEARLYRAINFALL & RELATIVE HUMIDITY IN MINNA (1979-2010)**

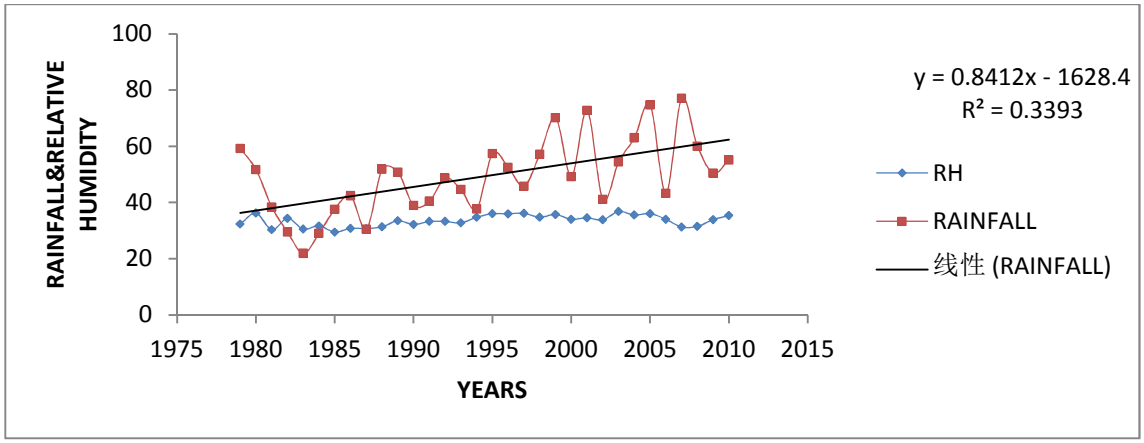


Figure 12: **VARIATION OF MEAN YEARLY RAINFALL & RELATIVE HUMIDITY IN MAIDUGURI (1979-2010)**

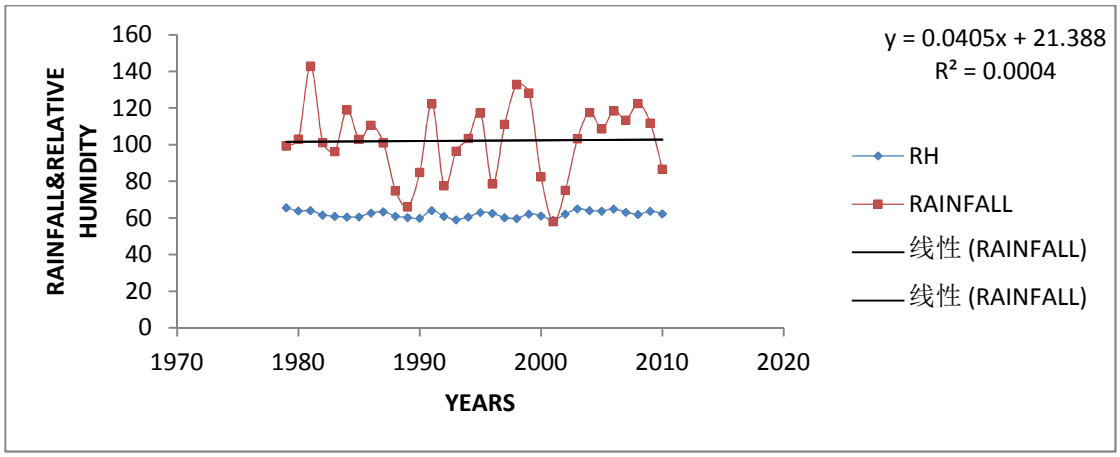


Figure13: **VARIATION OF MEAN YEARLY RAINFALL & RELATIVE HUMIDITY IN ILORIN (1979-2010)**

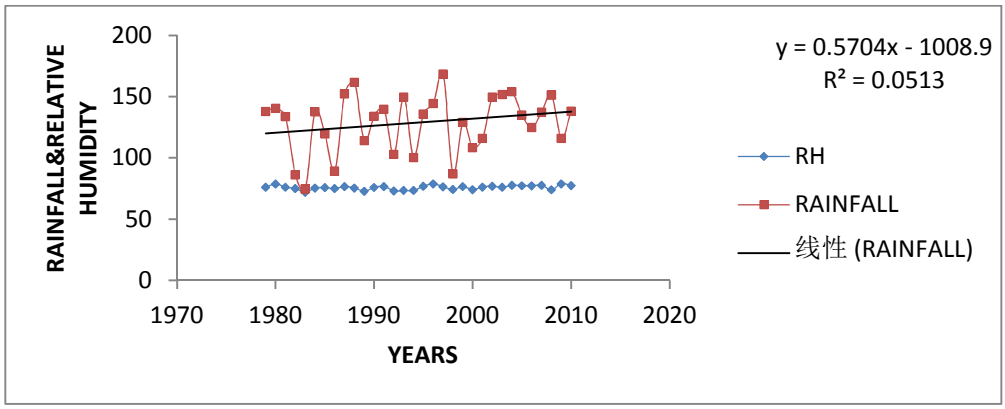


Figure 14: **VARIATION OF MEAN YEARLY RAINFALL & RELATIVE HUMIDITY IN LAGOS (1979-2010)**

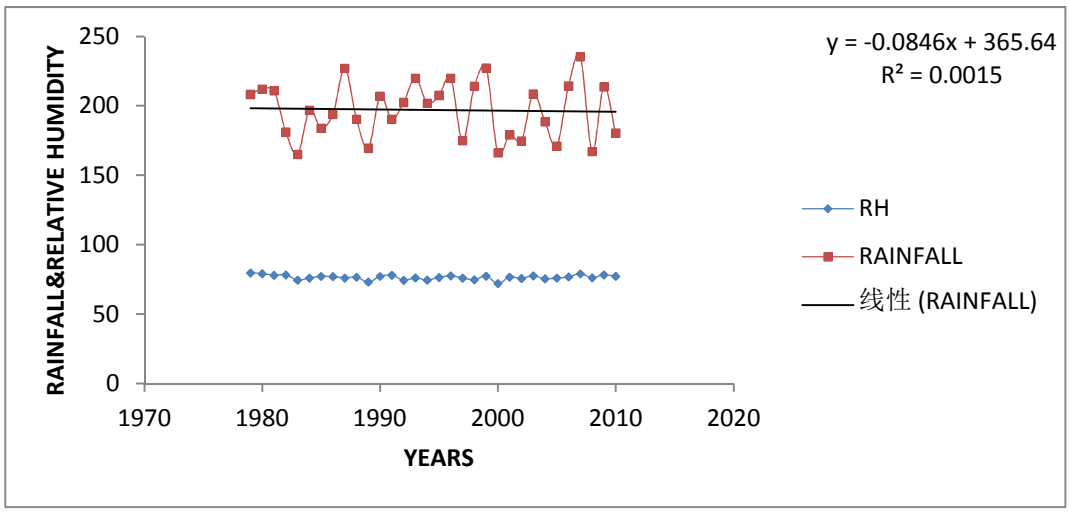


Figure15: **VARIATION OF MEAN YEARLY RAINFALL & RELATIVE HUMIDITY IN PORT-HARCOURT (1979-2010)**

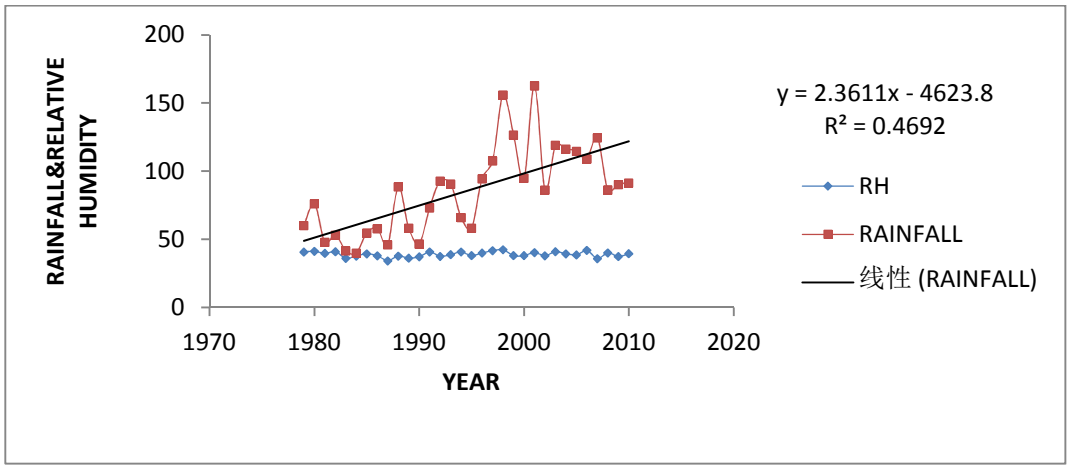


Figure 16: **VARIATION OF MEAN YEARLY RAINFALL & RELATIVE HUMIDITY IN KANO (1979-2010)**

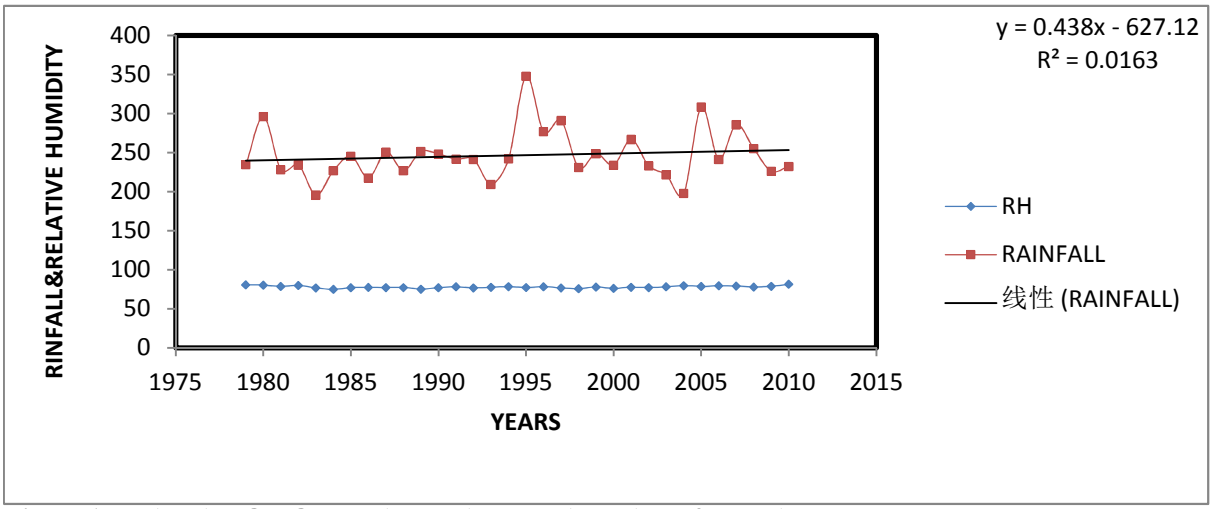


Figure 17: **VARIATION OF MEAN YEARLY RAINFALL & RELATIVE HUMIDITY IN CALABAR (1979-2010)**

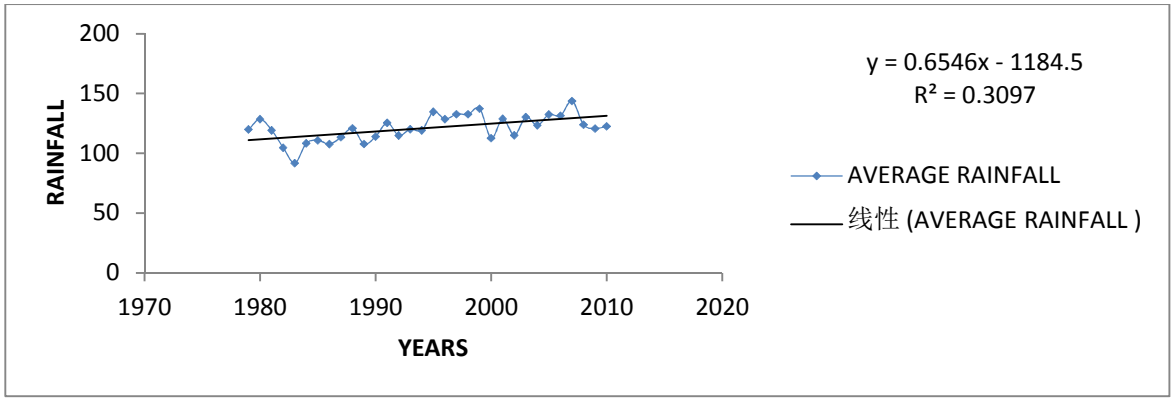


Figure 18: **MEAN YEARLY RAINFALL FOR ALL STATIONS (1979-2010)**

CONCLUSION

Relative humidity is in the line of the rainfall trend in Nigeria. The months with the highest and lowest rainfall occurs mostly in August, June and July for all stations. Consider the yearly trend for Sokoto the driest year was(1987) while the wettest year was (2010), for Kano the driest year was(1984)while the wettest years was (2001), for Minna the driest year(1987) while the wettest year was (2001), for Maiduguri the driest year was (1983) while the wettest year was (2007) , for Ilorin the driest year was (2001) while the wettest is (1981), for Lagos the driest year was(1983) while the wettest was (1997) , for Port- Harcourt the driest year was (1983) while the wettest year was (2007), for Calabar the driest year is (1983) while the wettest is (1995).The study revealed a significantly high value of mean annual rainfall within the period of study (1979 –2010) for all areas considered. The rainfall trend in Nigeria is generally increasing at the rate of 0.6546 per year.

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