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Monthly Variation of Relative Humidity and Its Response to Temperature in Zamfara State

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ABSTRACT

This research paper investigates the monthly variability of relative humidity, and possible effect of temperature on the variability in Zamfara state North-west Nigeria. Ten years data (2005-2014) of measured monthly mean relative humidity and temperature obtained from NIMET was averaged to an annual scale data which was used in plotting graphs for studying the variations using Minitab software. It was observed that, relative humidity varies across the Months over the periods, with a positive quadratic trend from the month of March to August. The peak relative humidity was observed in the month of August and the minimum was in the month of February, but decreasing trend was observed in the corresponding temperature from April to August with the peak in April and lowest in August, this affirms that as temperature increases relative humidity decreases. For response of relative humidity to temperature, linear regression was carried out with the relative humidity as response while temperature as predictor and coefficient of determination $R^2 = 18.25\%$ was determined, which showed a fair correlation between relative humidity and temperature.

Keywords: monthly variations, temperature, relative, humidity, trends, coefficient of determination

1.0 INTRODUCTION

The variations in climate are increasingly attracting the attention of many researchers due to the impact of climate variations or changes on human and environment in the present and the future. This work is aimed to analyze the variations and the pattern of changes of Relative humidity and temperature as some of the climatic change parameters in order to know the characteristics and trends or pattern of changes of these climatic parameters for the study area, which can be used to give an initial overview for future analysis and forecast of relative humidity, temperature and climate in general. To study climate and its variability, it is necessary to study its components (such as temperature, humidity, winds, clouds pressure and sunshine (Oyewole, et al 2014). Relative humidity is potentially a very important tool for climate research (Eludoyin, et al 2013). Several works have been carried out using various parameters to study variations in climate over the years. In Benin City, mean monthly Temperature and relative humidity varies across the months over the period of study and

test for temperature indicate a positive increasing trend while relative humidity shows a decreasing trend with negative slope (Ogbonmawan, et al 2016). Similarly, climatic study within Lagos, also showed Variability in temperature and relative humidity with an increasing trend in relative humidity while for temperature decreasing trend was observed, which is an inverse relationship (Salau, 2016).

Humidity is defined as some measure of the water vapor content of air (or other gas). (Rotronic, 2005).

The capacity of air to retain moisture increases with temperature (Shelton, 2008). But, one should not be in confusion that in summer air should be more humid compared to other seasons. This is because air may have more capacity to hold water, but we require source of water as well. Also, even if air has high water content at higher temperature, but it may not be saturated or have higher relative humidity compared to air having low water vapor content but more relative humidity at lesser

temperature. This is because relative humidity is not only governed by temperature of air or atmosphere (dry bulb temperature) but also wet bulb temperature.

Relative humidity is a measure of how much moisture is present compared to how much moisture the air could hold at that temperature.

2.0 MATERIALS AND METHOD

Zamfara state is located in the North Western part of Nigeria, Latitude 12.10⁰ N and Longitude 6.15⁰ E and altitude of 442m above the sea level

The input data of measured monthly mean daily maximum temperature and relative humidity of

3.0 RESULT AND DISCUSSION

3.1 Monthly variation of Relative humidity.

From Figure 1: Relative humidity was observed to have increased from the month of March to July. The peak relative humidity was observed in the month of August when the rainfall is high with a value of 70 and the minimum relative humidity was observed in the

In an open space, at constant moisture level and pressure, %RH decreases strongly as temperature increases. In a closed container of fixed volume, %RH decreases as temperature increases, however not quite as strongly as in the situation of the open space (Rotronic, 2005).

the location were collected from Nigerian Meteorological Agency (NIMET) Gusau, under the Nigerian Federal Ministry of Aviation. The data obtained covered a period of 10 years (2005-2014). These daily monthly mean data for ten years was averaged in to annual time scale for the purpose of this study. Minitab statistical software was used for plots, linear regression and trend analysis.

month of February with a value of 11. From September to December decreased trend was observed when the rainfall is becoming low, which is in good agreement with the result obtained by (Eludoyin, *et al* 2013).

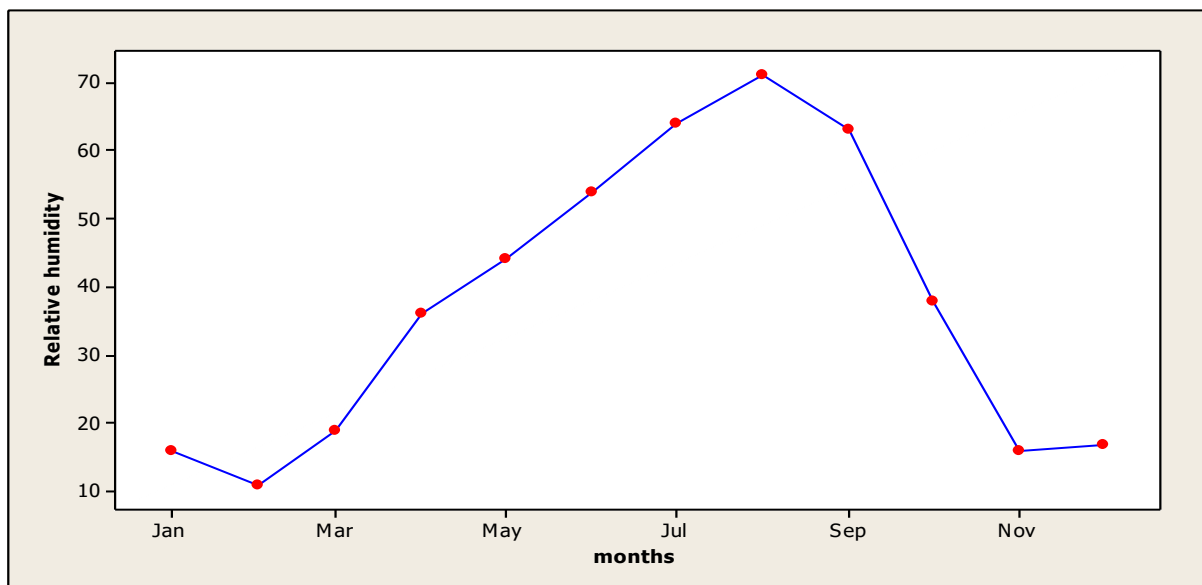


Figure1. Monthly Variation of Relative Humidity

3.2 Trend Analysis of Relative Humidity

Table 1: Accuracy Measure of The Trend Analysis Of Relative Humidity

Trend	MAPE	MAD	MSD
Linear trend	72.172	17.975	406.652
Quadratic trend	35.826	8.886	104.363
Exponential trend	62.399	18.439	453.371

From table 1: it can be observed that Quadratic trend has the least values of accuracy measures which indicate goodness of fit of quadratic trend for the data of relative humidity over linear and exponential trend.

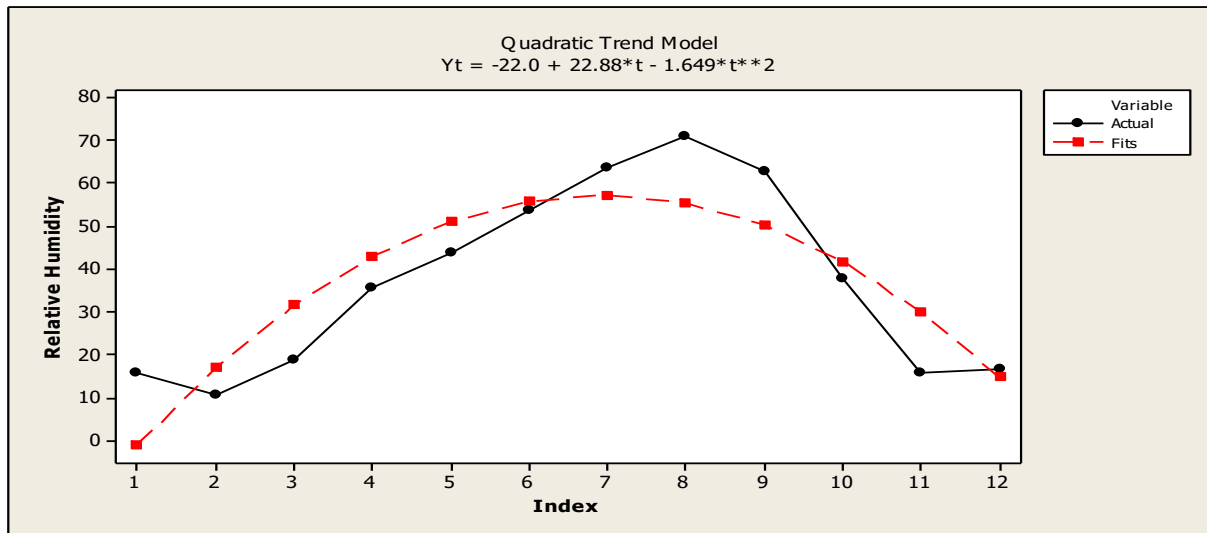


Figure 2: Positive quadratic Trend Analysis Plot of Relative humidity

3.3 Monthly variation of Maximum Temperatures

From Figure 2: it was observed that the highest temperatures occurred in March and April while the lowest temperature occurred in December and January respectively. This is

expected, since the month of March and April are characterized by heavy sunshine and dry atmosphere, while the month of December and January are characterized by harmattan and dust particles which greatly reduces the intensity of solar radiation.

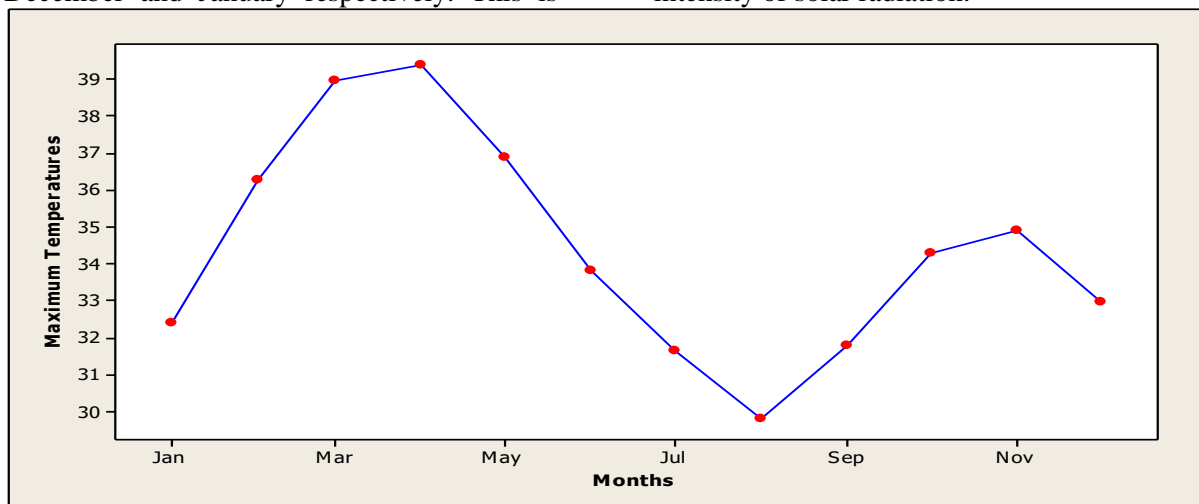


Figure 3: Monthly variation Plot of Maximum Temperature

3.4 Trend Analysis of Maximum Temperature

Table 2: Accuracy measure of the trend analysis of Maximum Temperature

Trend	MAPE	MAD	MSD
Linear trend	6.39311	2.18334	6.62093
Quadratic trend	6.69278	2.26937	7.04103
Exponential trend	6.65056	2.25072	7.04274

From table 2: it can be observed that linear trend has the least values of accuracy measures which indicate goodness of fit of quadratic

trend for the data of maximum temperature over quadratic and exponential trends.

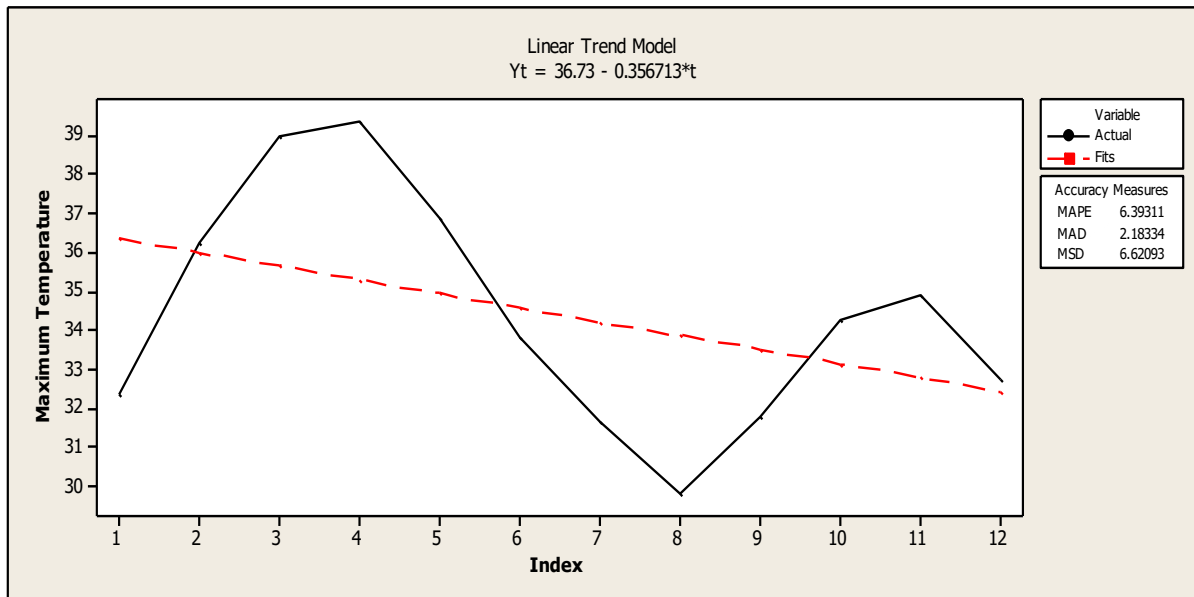


Figure 4: Trend analysis Plot of Maximum Temperature

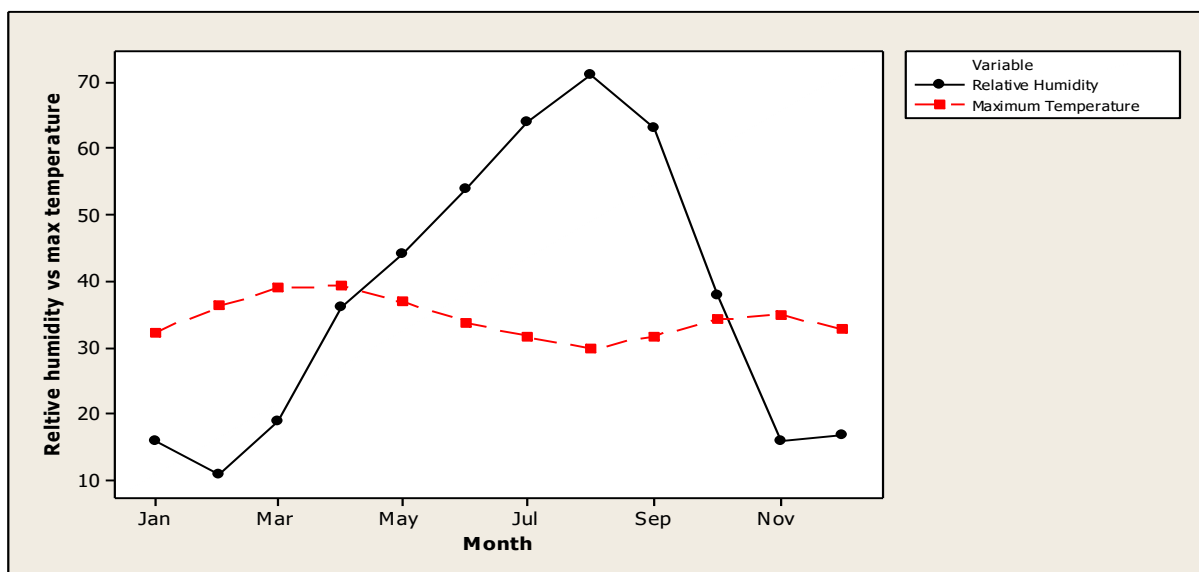


Figure 5: Comparison of Relative humidity and Maximum Temperature

From figure 5: The peak relative humidity was observed in the month of August when the rainfall is high but least temperature was recorded in the same month of August. While the minimum relative humidity was observed in the month of February but high temperature was recorded in the same month, this shows that relative humidity is inversely proportional to Temperature, and this is in good agreement with the result obtained by Gwani *et al* 2013.

4.0 CONCLUSION

In the cause of this study the following conclusion were reached

1. Relative humidity Varies across the months over the years and with a positive quadratic trend.
2. Temperature varies in the same way but has negative linear trend
3. The value of coefficient of determination from result of linear regression shows that temperature has fair influence on relative humidity, that is relative humidity decreases less strongly as temperature increases.

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