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Evidence Of Global Warming In Nigeria

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Abstract: The paper shows evidence of global warming in Nigeria with special consideration on temperature; both maximum and minimum, rainfall, relative humidity and speed of wind. In the study, descriptive statistics were used which include mean, standard error, and variance. For the test of significant variation in the factors considered, One-Way Analysis of Variance was used. The tool is one of the parameteric tools in Statistics which implies it has underline assumptions. All the assumptions associated with the Statistical tool were tested using the most appropriate technique. The modeling of temperature and rainfall in the region was done using linear regression approach. The study reveals that temperature of the region has increased in recent time with significant increase in volume of rainfall. The observations and the future values of environmental factors considered is an implication of existence of global warming in the eastern part of Nigeria.

Keywords: *Global Warming, Modeling, Hypothesis Testing, Greenhouse*

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1. INTRODUCTION

Earth is one of the nine commonly known planets with personal satellite as moon. The earth as well as other planets revolves round the sun which is a heavenly body that radiates heat. It is a known fact that heat leads to increase in temperature, therefore, heat from sun warm up the earth and other planets around it.

Earth is spherical in shape and it rotates along its course timely which leads to evenly distribution of energy (heat energy). Heat energy is important to every living thing on earth but could be harmful if not properly control. One of the great disadvantages of heat as source of energy is total burn of the substance affected. This implies direct rays of the sun are harmful to living things.

Nature is perfect as it provides a guide called the Ozone layer which prevents direct sunlight from radiating on the earth surface. The ozone layer is a layer in earth's atmosphere which absorbs most of the Sun's UV radiation. It contains relatively high concentrations of Ozone (O_3), although it is still very small with regards to ordinary oxygen and is less than ten parts per million, the average ozone concentration in Earth's atmosphere being only about 0.6 parts per million. The ozone layer is mainly found in the lower portion of the stratosphere from approximately 20 to 30 kilometers above Earth surface, though the thickness varies seasonally and geographically (NOAA, 2008). Man, due to curiosity and creativity, tends to manipulate things provided by nature to their own taste which led to alteration of the thickness of Ozone layer. As a result of reduction in thickness of Ozone layer, greater part of the Ultra Violent (UV) rays radiate directly on earth surface which causes green house effect.

By definition, green house effect is a process by which thermal radiation from a planetary surface is absorbed by atmospheric greenhouse gases and is re-radiated in all directions. Since part of this re-radiation is back towards the surface and the lower atmosphere, it results in an elevation of the average surface temperature above what it would be in the absence of the gases (Mitchell, 1989).

1.1. Causes of Depletion of Ozone Layer

The depletion in the ozone layer is caused by the increasing concentrations of ozone-depleting chemicals in the stratosphere. These chemicals come from spray cans and refrigerants and they include chemical compounds with chlorine and/or fluorine attached to carbon otherwise known as CFCs. The depletion in the Ozone layer is mainly caused by ChloroFluoroCarbons CFC's and by nitrogen oxides chemicals. They are very important chemicals but once they are released into the atmosphere they are a serious pollutant. A small amount of CFC destroys a lot of ozone. Global warming has been considered to be the reason behind the supposed depletion in the ozone layer as carbon emissions bond with the tri-oxygen and release carbon dioxide and carbon monoxide leaving humans with no chance for life in the future.

1.2. Adverse Effects of Global Warming on Earth Surface

Global warming is a universal threat to living beings on earth. Scientists have proven beyond reasonable doubt that human activity is a significant cause of global warming. According to Matt (2010), the United Nations released a

scientific report in February 2007 that concludes that global warming is happening and will continue to happen for centuries. The report also stated with 90% certainty that the activity of humans has been the primary cause of increasing temperatures over the past few decades. According to Shaffril et al (2011), the temperature, the rainfall season and the coastal areas of Malaysia have changed, the sea are no longer easy to predict as the water current, wind velocity and waves actions can easily change their pattern and endanger them while they are at the sea.

2. REVIEW OF RELATED LITERATURE

In developed world, much was done in the determination of effect of green house effect on the populace and the future events were adequately studied. In developing nation such as Nigeria, many are still doubt the existence of global warming by attributing the signs to nature. The flooding experienced in some part of the country was as a result of rise in water level of the water bodies and according to literature, it is one of the signs of global warming (Matt, 2010).

Global warming is the rise in the average temperature of Earth's atmosphere and oceans since the late 19th century and its projected continuation. Since the early 20th century, Earth's mean surface temperature has increased by about 0.8°C (1.4°F), with about two-thirds of the increase occurring since 1980 (CACC, NRC, 2011).

Recent estimates by NASA's Goddard Institute for Space Studies (GISS) and the National Climatic Data Centre show that 2005 and 2010 tied for the planet's warmest year since reliable, widespread instrumental measurements became available in the late 19th century, exceeding 1998 by a few hundredths of a degree (IPCC, 2007). Estimates by the Climatic Research Unit (CRU) show 2005 as the second warmest year, behind 1998 with 2003 and 2010 tied for third warmest year, however, "the error estimate for individual years is at least ten times larger than the differences between these three years (IPCC, 2007). The World Meteorological Organization (WMO) statement on the status of the global climate in 2010 explains that the 2010 nominal value of 0.53°C ranks just ahead of those of 2005 (0.52°C) and 1998 (0.51°C), although the differences between the three years are not statistically significant. Every year from 1986 to the present has seen world annual mean temperatures above the 1961-1990 average (IPCC Report, 2007).

According to Tung *et al*. (2008) various observations favour climate sensitivity value of about 3°C, with a likely range of about 2.0°C to 4.5°C. However, the physics of the response and uncertainties in forcing lead to difficulties in ruling out higher values. This statement can be credited to climate change and increase in the temperature of earth surface. The issue of global warming, uncertainty of global weather and the climate change effect indirectly creating the coastal area with much more expose to extreme condition (Talib and Sulieman, 2011).

According to Saifuddin and Hussain (2011), environmental issues such as global warming and recent events throughout the world, including the shortage of petroleum crude oil, the sharp increase in the cost of oil and the political instability of some crude oil producing countries, have demonstrated the vulnerability of the present sources for liquid fuel. This shows the great threat of global warming encompanses every aspect of human endeavour. Every sector feels the impact of global warming as more energy is demanded by the populace to supress heat in homes, more energy demanded from farmers for the survival of their crops etc.

Annan and Hargreaves (2006) presented an estimate that resulted from combining prior estimates based on analyses of paleoclimate, responses to volcanic eruptions and the temperature change in response to forcing over the twentieth century. They also introduced a triad notation (L.C.H) to convey the probability distribution function (pdf) of the sensitivity, where the central value C indicates the maximum likelihood estimate in degrees Celsius and the outer values L and H represent the limits of the 95% confidence interval for a pdf, or 95% of the area under the curve for a likelihood function. In this notation their estimate of sensitivity was (1.7, 2.9, 4.9) °C.

Forster and Gregory (2006) presented a new independent estimate based on the slope of a plot of calculated greenhouse gas forcing minus top-of-atmosphere energy imbalance, as measured by satellite borne radiometers, versus global mean surface temperature. In the triad notation of Annan and Hargreaves (2006) their estimate of sensitivity was (1.0, 1.6, 4.1)°C.

Royer *et al*. (2007) determined climate sensitivity within a major part of the Phanerozoic. The range of values 1.5°C minimum, 2.8°C best estimate and 6.2°C maximum, is given various uncertainties, consistent with sensitivities of current climate models and with other determinations.

Fasullo and Trenberth (2012) tested model estimates of climate sensitivity based on their ability to reproduce observed relative humidity in the tropics and subtropics. According to the researchers, the best performing models tended to project relatively high climate sensitivities of around 4°C.

Kuswanto and Rahmatia (2013) generated a model for the forecast of climatic factor from a class of time series model as an alternative of EPS. The models are calibrated using Bayesian Model Averaging (BMA) where the parameters are estimated by Markov Chain Monte Carlo (MCMC). The results show that the proposed procedure is capable to increase the reliability of the forecast.

Lobell and Burke (2010) in related study investigated on the impact of climatic change on crop yield. Climatic factors considered include temperature and rainfall. Among the findings, crop yield was drastically affected by the significant increase in temperature of earth surface and uncontrollable increase in volume of rainfall has affected the yield significantly in Africa.

3. METHODOLOGY

In this section, statistical tools used for the achievement of purpose of the research were explained which include Analysis of Variance (One-Way ANOVA), Descriptive Statistics (Mean, Range and Chart), Ordinary Least Square Regression (OLS), Multiple Regression, as well as Jaque-Bera Normality test approach.

3.1. Descriptive Statistics (Mean, Range and Chart)

Mean $(\bar{x})$ can be referred to as average which is computed using ratio of sum of required information and the number of occurrence. Mathematically, it is expressed as:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \quad (1)$$

where, n is number of years considered. In this study, mean was used to determine average occurrence of variable of interest such as average volume of rainfall in the location.

Range (R) is the difference between maximum value and the minimum value of variable of interest. Mathematically:

$$\text{Range} = \text{MaximumValue-MinimumValue}$$

Charts are used in data presentation for better understanding of the fluctuation of the observations. In this study, line charts were used to present data collected for the variables of interest from 1970 to 2010.

3.2. Analysis of Variance (One-Way ANOVA)

The tool is used to determine if there exists significance difference among factors or treatments. It involves more than one factor with replicates. In this research, it was used to test for significance difference among the observations of temperature over four decades with the years in each decade as replicates.

3.3. Sum of Squares (SS)

Sum of Square Total (SST) is the total variation in the data. Sum of Square Factor/Treatment is the deviation of the estimated factor level mean around the overall mean and Sum of Square Error is the deviation of an observation from its corresponding factor level mean. It is also known as error within treatments. The calculations are:

$$SS_{Factor} = \sum_{i=1}^{n} n_i \left(\bar{y}_i - \bar{y}..\right)^2 \quad (2)$$

$$SS_{Error} = \sum_{i=1}^{n}\sum_{j=1}^{n}\left(\bar{y}_{ij} - \bar{y}_{i.}\right)^2 \quad (3)$$

$$SS_{Total} = \sum_{i=1}^{n}\sum_{j=1}^{n}\left(\bar{y}_{ij} - \bar{y}_{..}\right)^2 \quad (4)$$

Where:

$\bar{y}_{i.}$ = Mean of the observations at the ith factor level

$\bar{y}_{..}$ = Mean of all observations and

y_{ij} = Value of the jth observation at the i^{th} factor level

3.4. Mean Squares (MS)

The calculations for the mean square for the factor and error are:

$$MS_{Factor} = \frac{SS_{Factor}}{\text{Degree Freedom}} \quad (5)$$

$$MS_{Error} = \frac{SS_{Error}}{\text{Degree Freedom}} \quad (6)$$

The degrees of freedom for each component are:

$$D_{ffactor} = r - 1,\ Df_{error} = n_T - r \text{ and Total } = n_T - 1$$

Where:

n_T = The total number of observations

r = The number of factor levels.

Basic assumptions of analysis of variance are normality, independent and constant variance. All these were tested using appropriate techniques.

3.5. Ordinary Least Square Regression (OLS)

In fitting trend values, several methods were proposed by researchers but in this study, OLS was used in fitting the trend of the variables of interest. The dependency of climate change factors were tested on time using OLS and future occurrence were predicted using the models formulated. The model can be expressed thus:

$$y = b_0 + b_1 t + e_i \quad (7)$$

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where, y is the dependent variable and t (time) is independent variable.

b_0 and b_1 are the parameters in the model. The first parameter is the intercept on y-axis and the latter is the slope or rate of change of the dependent variable with respect to independent variable. Both can be computed using the formular:

$$b_0 = \bar{y} - b_1\bar{x} \tag{8}$$

$$b_1 = \frac{n\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x \sum_{i=1}^{n} y}{\left[n\sum_{i=1}^{n} x^2 - \left(\sum_{i=1}^{n} x \right)^2 \right]} \tag{9}$$

Simple regression analysis becomes multiple regression when the independent variables increase more than 1, that is, multiple regression involves more than one independent variable. The model is expressed thus:

$$y = b_0 + b_i x_i + e_i \tag{10}$$

3.6. Jaque-Bera Normality Test

Among the assumptions of regression analysis is normality of error term in the model. In this study, the normality of the error term or the residual was checked using Jaque-Bera normality test approach:

$$JB = \frac{n}{6}\left(S^2 + \frac{1}{4}(k-3)^2 \right) \tag{11}$$

Where:

n = The number of observations (or degrees of freedom in general)

S = The sample skewness

K = The sample kurtosis:

$$S = \frac{\mu_3}{\sigma^3} = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^3}{\left(\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2 \right)^{3/2}} \tag{12}$$

And:

$$K = \frac{\mu_4}{\sigma^4} = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^4}{\left(\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2 \right)^2} \tag{13}$$

where, μ_3 and μ_4 are the estimates of third and fourth central moments respectively, $\bar{x}$ is the sample mean and σ^2 is the estimate of the second central moment, the variance.

4. ANALYSIS OF DATA

Graphical Representation of Available Data **Fig. 4** shows the movement of the observation of the variables considered from 1971 to 2012. From the graph, it can be observed that most of the factors increased drastically, though with intermittent decrease in some years. Considering the temperature of the location, it can be observed that the temperature stated on a low value but rose significantly over the stipulated period. Volume of rainfall has steady increase from 1971 to 2012. The chart shows arithmetic increase over the period with the last year considered having higher volume of rainfall.

Moreover, relative humidity increased also but from the chart, wind speed decreased steadily with slight increase towards the end of the period.

The fluctuation of value of variables considered would be investigated using appropriate statistical tools for proper conclusion based on the aim of the research.

4.1. Descriptive Statistics Variables: Temperature, Rainfall, Relative Humidity and Windspeed

Table 2 shows descriptive statistics of variables. From the table, it can be observed that average temperature of the region for the period of 42 years is 27.6°C, average volume of rainfall as 138 mm, average relative humidity as 58.11 and average wind speed as 5.16.

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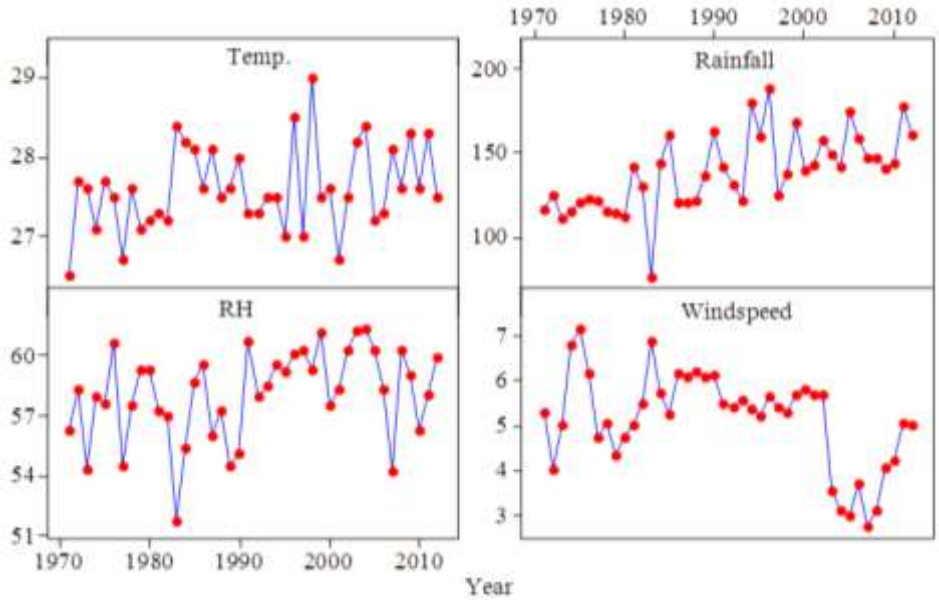

Fig. 1. Chart of temperature, volume of rainfall, relative humidity and Windspeed in Nigeria

Table 1. Climate variability, extreme climate events and possible impacts

Projected changes during the 21st century in extreme climate phenomena and their likelihood	Possible impacts
Higher maximum temperatures, more hot days and heat waves over nearly all land	1. Increased incidence of death and serious illness in older age groups and urban poor 2. Increased heat stress in livestock and wildlife 3. Shift in tourist destinations 4. Increased risk of damage to a number of crops 5. Increased electric cooling demand and reduced energy supply reliability
Increased summer drying over most mid latitude continental interiors and associated risk of drought (likely)	1. Decreased crop yields 2. Increased damage to building foundations 3. Decreased water resource quantity
Intensified droughts and floods in many different regions (likely)	1. Decreased agricultural and rangeland productivity in drought- and flood-prone regions 2. Decreased hydro-power potential in drought-prone regions
Increased intensity of mid-latitude storms (little agreement between current models)	1. Increased risks to human life and health 2. Increased property and infrastructure losses 3. Increased damage to coastal ecosystems

Source: Intergovernmental Panel on Climate Change (2007)

Figure 1 shows trend line of available data on climatic factors of the location of interest. Also, Table 1 shows summary of adverse effect of global warming which include threat to human survival and ill health. Confidence interval can be computed for the average of the variables using both mean value and the standard error of mean with lower class as the difference between mean and the standard error of mean and the upper class boundary as the addition of the two.

For the period of 42 years, the minimum and maximum average temperature was 26.5°C and 29°C respectively. This does not imply the temperature did not rise beyond 29°C but on the average, this was the maximum value observed. Also, maximum volume of rainfall was 188 mm.

4.2. Analysis of Variation Among Variables per Decade

In this section, One-Way Analysis of variance was used to test for the existence of significant difference in the observations of the variables of interest. The observations were segmented into four, namely; 70's, 80's, 90's and 20's. These served as the factors in the One-way ANOVA. The test

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was conducted at 5% level of significance which implies the p-value of 0.05 would serve as the point for decision making, determination of acceptance or rejection of the test hypothesis which is often referred to as the null hypothesis.

4.3. The Null Hypothesis

The observations are not significantly different in the past four decades. Basic assumptions of Analysis of Variance were tested using Jaque-Bera test for normality, chi-square dependency for test of independence and bartlett's test for constant variance.

The results of One-Way ANOVA for the variables are as follows:

Variable: Temperature

Table 2: One-way ANOVA: obs. versus factors

Source	DF	SS	MS	F	P
Factors	3	1.921	0.640	2.73	0.058
Error	36	8.450	0.235		
Total	39	10.371			

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev	
1	10	27.300	0.306	(---*--------)
2	10	27.810	0.396	(-----*------)
3	10	27.580	0.694	(----*-------)
4	10	27.850	0.455	(------*-----)

The p-value of 0.058 is greater than 0.05 which implies there is no significance difference among the mean temperature of the decades. Therefore, there exists enough evidence to accept the null hypothesis and conclude that temperature of the region has not changed significantly in the last four decade. This is an indication that temperature of the region has not increased significantly in recent time.

Variable: Rainfall

Table 3: One-way ANOVA: obs. versus factors

Source	DF	SS	MS	F	P
Factors	3	8013	2671	7.57	0.000
Error	36	12705	353		
Total	39	20719			

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev	
1	10	120.47	9.63	(----*-----)
2	10	131.84	24.86	(------*---)
3	10	152.22	22.80	(-------*--)
4	10	154.30	13.47	(-------*--)

The p-value less than 0.01 implies the test is significant at 1%. Therefore, at 1% level of significant, there exists enough evidence to reject the null hypothesis and conclude that volume of rainfall in the region changed significantly in the last four decade. It can be observed that the last two decades have higher value than the first two decades which is an indication of recent increase in volume of rainfall. As noted from the literature, increase in volume of rainfall is an indication of global warming in a region which could give rise to flood is both water lodge area and swampy regions.

Variable: Relative Humidity

Table 4: One-way ANOVA: obs. versus factors

Source	DF	SS	MS	F	P
Factors	3	46.80	15.60	3.50	0.025
Error	36	160.42	4.46		
Total	39	207.22			

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev	
1	10	57.550	2.013	(-----*------)
2	10	56.710	2.705	(----*-------)
3	10	59.430	1.109	(------*-----)
4	10	58.930	2.286	(-----*------)

The p-value less than 0.05 implies the test is significant at 5%. Therefore, at 5% level of significant, there exists enough evidence to reject the null hypothesis and conclude that relative humidity in the region changed significantly in the last four decade. It can be observed that the last two decades have higher value than the first two decades which is an indication of recent increase in relative humidity. According to Matt (2010), increase in relative humidity is an indication of global warming in a region.

Variable: Wind-speed

Table 5: One-way ANOVA: obs. versus factors

Source	DF	SS	MS	F	P
Factors	3	28.607	9.536	20.44	0.000

Error	36	16.794	0.466
Total	39	45.401	

Individual 95% CIs For Mean Based on
Pooled StDev

Level	N	Mean	StDev
1	10	5.4600	0.9517 (----*-----)
2	10	5.9590	0.4853 (----*-----)
3	10	5.5530	0.2063 (----*-----)
4	10	3.7530	0.8259 (-----*----)

The p-value less than 0.05 implies the test is significant at 5%. Therefore, there exists enough evidence to reject the null hypothesis and conclude that wind-speed in the region changed significantly in the last four decade and the difference can be observed that the last decades which has value less than the first three decades. This is an indication of recent decrease in wind-speed in the region considered.

Generally, considering temperature, rainfall relative humidity and wind-speed, there is enough evidence to conclude that global warming exists in some locations in Nigeria including Enugu state, Eastern part of Nigeria.

4.4. Correlation Analysis of Variables

	Temp.	Rainfall
RH	-0.180	0.255
Rainfall	0.406	1.000
Wind-speed	-0.720	-0.052

Correlation is significant if the value is greater than 0.5, otherwise, it is insignificant. The Mathematical notation (sign; + or -) of correlation value is an indication of nature of relationship between variables. Negative correlation indicates inverse relationship and positive correlation implies direct proportion between the variables.

Based on this fact, there exists positive relationship between volume of rainfall and temperature in the region considered which implies increase in volume of rainfall was as a result of increase in temperature, although, insignificant. Also, temperature has negative impact on relative humidity and wind-speed.

However, rainfall has positive effect on relative humidity but negative effect on wind-speed as observed in the region in the four decades.

4.5. Modeling Future Occurrence of the Variables Using OLS

The independent variable was time and the temperature, rainfall, relative humidity and windspeed all served as dependent variable respectively. the models are:

4.6. Fitted Trend Equation

$$Yt(temp.) = 27.3350 + 0.0127704*t \ldots (*)$$

$$Yt\ (RF) = 113.221 + 1.18872*t \ldots (**)$$

$$Yt(RH) = 56.7202 + 0.0648408*t \ldots (***)$$

$$Yt(Wp) = 6.04006 - 0.0411101*t \ldots (****)$$

Table 3 shows possibility of increase in observations of the variables except wind-speed which has lower future observations. This is an indication of future increase in both temperature and volume of rainfall.

4.7. Summary of Findings

The figures/charts show fluctuation in the variables considered over the period of 42 years. In the region considered, average temperature was found to be 27.6°C and average volume of rainfall was 138.78mm. The maximum observation of both temperature and rainfall shows the possibility of average temperature rising to 29°C and volume of rainfall to be 188.60mm.

In the determination of significant variation of variables per decade, One-way Analysis of Variance was used after test of all the necessary assumptions for the research tool using the available data. Rainfall and relative humidity have significant variation but temperature and wind-speed have insignificant variation which could be interpreted as global warming existing in the region long ago.

Correlation Analysis was used to determine strength and nature of relationship between variables in pair.

Table 6. Descriptive statistics of variables of interest

Variable	Count	Percent	Mean	SE Mean	StDev	Minimum	Median	Maximum	Maximum
Temp.	42	100	27.610	0.0822	0.533	26.500	27.550	29.000	2.500
Rainfall	42	100	138.780	3.5300	22.890	76.100	140.200	188.600	112.500
RH	42	100	58.114	0.3500	2.266	51.700	58.300	61.400	9.700
Windspeed	42	100	5.156	0.1650	1.068	2.730	5.340	7.180	4.450

Table 7. Forecast values

Period	Temp.	Rainfall	RH	Wp
2013	27.8841	164.336	59.5084	4.27232
2014	27.8969	165.525	59.5732	4.23121
2015	27.9096	166.713	59.6380	4.19010

As shows in correlation analysis section of the paper, there exists positive relationship between volume of rainfall and temperature in the region and temperature has negative impact on relative humidity and wind-speed. Rainfall has positive effect on relative humidity but negative effect on wind-speed as observed in the region in the four decades.

In the prediction of future values of the variables, ordinary least square regression was used in which the variables were tested again time. The trends were fitted and future values were computed as shown in **Table 7**.

5. CONCLUSION

Many developed countries have proven beyond reasonable doubt the existence of global warming in their region and many have planned for unforeseen future occurrence of hardship of the green house effect which include food shortage, deforestation, increase in diseases among human and animals, increase in death rate as a result of heat wave, as well as increase in energy consumption. In developing nations such as ours, research is still ongoing to convince the populace the existence of global warming and the necessary actions to take or put in place for proper planning to prevent loss of life and properties. Flooding is one of the negative effects of global warming which could lead to loss of life and properties and could be prevented with proper planning. This research acts as an evidence of global warming in the Eastern part of Nigeria, Enugu State to be precise. Variables considered include: temperature of the region, volume of rainfall, relative humidity and wind-speed.

Among the findings, it was discovered that the temperature of the region has increased in the last two decades which eventually led to increase in volume of rainfall. Also, the relative humidity has increased in the region in the last decade. Nature of relationship between the variables shows the existence of positive relationship between volume of rainfall and temperature in the region considered; this is an indication that increase in volume of rainfall was as a result of increase in temperature. Also, temperature has negative impact on relative humidity and wind-speed. However, rainfall has positive effect on relative humidity but negative effect on wind-speed as observed in the region in the last four decades.

Considering the literature and the report of IPCC on global warming, there exists enough evidence to conclude that global warming is not a mirage, it is a real demon that must be controlled to prevent destruction of valuable and precious things in our society, including life of the people.

According to the report of Matt (2010), increase in some of the climatic factors, as well as decrease in others is an indication of global warming in the region which is in agreement with the findings of this research. In a related study, Lobell and Burke (2010) concluded that climate change in Africa is as a result of global warming which is affecting the farming activities of farmers in the region. This is in line with the report on temperature changes and the drastic increase in volume of rainfall as too much rainfall could affect the survival of some crops.

5.1. Research Limitation and Future Research Prospect

The study was limited to eastern part of Nigeria considering the years 1971 to 2012. Increase in number of years could yield different result and inclusion of a new variable in the study could lead to similar or different findings.

Moreover, in the country, there exist six geo-political zones with vary climatic observations that are independent. Therefore, the result or observations from one region may not produce significant evidence about other regions. Therefore, there is need for similar study in other geo-political zones to generalize the study in Nigeria as a whole.

Finally, this study produces evidence of global warming in Nigeria using a particular region in the country based on the flood experienced in the country in recent time to alert the populace the tendency of future reoccurrence of similar event.

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