

Assessment of the Influence of Relative Humidity on Rainfall generation, in the tropical region of Imo State, South Eastern Nigeria.

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ABSTRACT –This report assesses the influence of the climatic factor of Relative humidity on rainfall generation for a period of eleven years (2006-2016) in the tropical region of Imo State, South Eastern Nigeria. The region has continually been noted for intense heat waves and the rains that fall are considerably erosive leading to destruction of lives and properties). In the study, the monthly rainfall amounts, as dependable variable were correlated and regressed with the monthly relative humidity values, using the IBM SPSS Statistics Software. The rainfall amounts correlated positively with the relative humidity values in all the years (2006-2016), with an average R² value of 52.90%. In the light of these observations, the relative humidity has been unfolded to contribute to about 53% to changes in the rainfall amounts through the years, (2006-2016). In the light of this, relative humidity could possibly be seen as an index for the evaporation of moisture into the atmosphere that periodically fall as rains. The more the relative humidity, the more the likeliness of rainfall and vice versa. The best single parameter predictor model for the rainfall amounts was a non linear, exponential model: $8.87E-6 + 202 \text{ Rel. humidity}$ 2006, with a standard error of estimate, SE, value of 0.534. According to the model, a change in the Relative humidity contributes about 68.6% to changes in the Rainfall amounts.

Keywords: climatic factor, relative humidity, influence, rainfall, generation.

I. INTRODUCTION

The influence of changes in the climatic condition has continued to demand global attention, as experiences of heat waves in the tropics by humans, soil and environment strikes alarming proportions.[1];[2] It is in the light of this that the vulnerability of the tropics is being considered. As a result of this heat waves in the area under study, erosion and flooding remain common phenomena and the people have sleepless nights. The zone has the fifth highest concentration of active gullies in the country, Nigeria.[3];[4];[5] The erosion experienced in the zone has often been attributed to the predominant soil types in the zone which consists of 40% to 60% silt contents.[6] Nevertheless, the heat waves in the zone cannot be overemphasized and ought to be given considerable attention, as the greater the heat waves, the more likely the evaporation of moisture into the atmosphere and also the more likely an ensuing rainfall.[7];[8];[9];[10] It is really on this wise that the study was chosen.

The study will attempt to unfold the role played by relative humidity in the evaporation of moisture into the atmosphere, which latter fall as rain. This stands out as the main objective of the study. It is being envisaged the result of the findings will unravel the need to embrace policies that will humidify the atmosphere rather than heating it up. Heating up of the atmosphere has been alarmed upon because of heat related damages to the environment, soil and ecosystems[11] The danger of losing soil has also been greatly

stressed, as it takes about a thousand years to form a soil profile.[12]

The study area lies between Latitude $4^{\circ}45^1$ and $6^{\circ}15^1$ N and Longitude $6^{\circ}30^1$ and $8^{\circ}9^1$ E. The area is bounded in the East by Cross River State, in the West by River State, in the South by Akwa Ibom State and in the North by Anambra and Enugu States.

II. MATERIALS AND METHODS

2.1 The Study Area

Table 1: The Monthly Relative humidity (%) of Imo State

Year	January	February	March	April	May	June	July	August	September	October	November	December
2006	82	80	78	78	82	84	87	87	88	85	79	68
2007	44	77	74	79	77	83	85	87	87	85	83	79
2008	52	55	75	78	80	83	85	86	84	80	78	71
2009	77	78	61	77	79	81	87	88	85	81	72	73
2010	75	79	78	79	84	86	86	88	88	85	83	74
2011	60	82	82	78	81	85	86	89	86	84	80	66
2012	62	81	77	80	79	85	88	86	87	84	82	70
2013	-	77	82	81	84	86	89	90	88	85	83	74
2014	78	78	80	80	82	83	87	89	88	84	83	69
2015	58	82	80	78	81	86	87	89	86	82	80	39
2016	56	70	82	77	81	84	87	87	86	82	79	69

[13]

Table 2: The Monthly Rainfall Amounts (mm) of Imo State

Year	January	February	March	April	May	June	July	August	September	October	November	December
2006	78.5	48.4	108.1	104.1	157.3	349.9	397.6	232.1	537.6	303.3	33.3	0.0
2007	TR	7.4	57.7	62.1	260.9	397.3	485.4	509.0	303.0	180.2	42.7	9.6
2008	13.6	0.0	117.5	215.4	209.7	473.9	630.2	289.6	449.8	382.9	9.2	26.2
2009	38.6	71.4	71.2	242.8	441.5	239.0	497.9	539.2	485.3	236.8	115.4	0.0
2010	0.0	62.6	34.1	164.2	297.5	255.2	252.0	453.8	258.4	306.6	184.0	1.6
2011	0.0	133.7	84.4	114.8	528.3	192.0	305.2	506.7	366.0	241.2	49.7	24.8
2012	TR	74.1	22.1	158.0	249.2	284.2	430.2	316.0	483.1	178.9	113.2	0.0
2013	-	40.0	130.9	190.5	253.2	188.7	254.1	409.1	279.0	101.1	48.6	132.4
2014	0.0	21.4	110.2	157.0	289.4	236.2	139.3	336.3	355.6	220.7	91.3	30.0
2015	12.4	72.2	61.0	61.4	236.6	364.7	325.8	359.2	352.9	324.3	78.1	0.0
2016	0.0	29.4	192.5	143.9	157.4	272.6	378.1	409.4	423.8	144.7	12.2	TR

[13]

2.2 Method of Data Analysis

The analysis was done using the IBM SPSS Statistics software[14]. The Rainfall

Amounts (mm), as dependable variables were correlated with the Relative humidity values (%), as independent variables. The strength and nature

of relationships were noted. Then the correlations that were significant at 0.05 (1-tailed) were selected and regressed upon using both linear and non-linear (curve estimation) methods. Also noted were the strength and nature of the relationship. The

respective model equations were gathered. The model equations were then observed to identify the model equation that comparatively predicted the Rainfall Amounts, with least error of estimate (SE).

III. RESULTS AND DISCUSSIONS

3.1 Results

Table 3: Results of Correlation analysis of the Relative humidity (%) and Rainfall amounts (mm)

Year	Correlation	P-Value*
2006	0.856	0.000
2007	0.673	0.012
2008	0.682	0.010
2009	0.754	0.004
2010	0.894	0.000
2011	0.607	0.024
2012	0.835	0.001
2013	0.693	0.009
2014	0.739	0.005
2015	0.701	0.008
2016	0.852	0.001

*Correlation is significant at 0.05 level (1-tailed)
 Threshold value of the Relative humidity was 78%.

Table 4: Strength and nature of relationship between Rainfall Amounts (mm) and Relative humidity(%)

Year	R	Nature of the Relationship	R ²	Strength of the Relationship
2006	0.856	Positive	73.27	Very Good
2007	0.673	Positive	45.29	Almost Average
2008	0.682	Positive	46.51	Almost Average
2009	0.754	Positive	56.85	Average
2010	0.894	Positive	79.92	Very Good
2011	0.607	Positive	36.84	Moderate
2012	0.835	Positive	69.72	Good
2013	0.693	Positive	48.02	Almost Average
2014	0.739	positive	54.61	Average
2015	0.701	positive	49.14	Almost Average
2016	0.852	positive	72.59	Very Good

Table 5 : Model Gathering (Relative humidity versus Rainfall amounts)

Year	Model Equations	R ²	Standard error of estimation
2006	Exponential: Rainfall amount=8.87E-6 +202Rel. humidity 2006	0.686	0.534
2007	Exponential: Rainfall amount=3.434E-6 + Rel. humidity 2007	0.386	1.254
2008	Exponential: Rainfall amount=0.018 +0.115 Rel. humidity 2008	0.532	1.086

2009	Exponential: Rainfall amount=0.242 + 0.085 Rel. humidity	0.489	0.693
2010	Power: Rainfall amount=6.524E-47 + 25.176 In(Rel. humidity 2010)	0.771	0.816
2011	Exponential: Rainfall amount=0.004 + 0.129 Rel. humidity 2011	0.650	0.606*
2012	Power: Rainfall amount=4.497E-31 + 16.964 In (Rel. humidity 2012)	0.657	0.577
2013	Exponential: Rainfall amount=0.067 + 0.092 Rel. humidity 2013	0.393	0.596
2014	Exponential: Rainfall amount=0.003 + 0.131 Rel. humidity 2014	0.606	0.620
2015	Exponential: Rainfall amount=0.011 + 0.116 Rel. humidity 2015	0.783	0.535
2016	Exponential: Rainfall amount=0.000 + 0.171 Rel. humidity	0.583	0.801

* Rain Amount=8.87E-6 + 202 Rel. humidity 2006 is hereby selected.

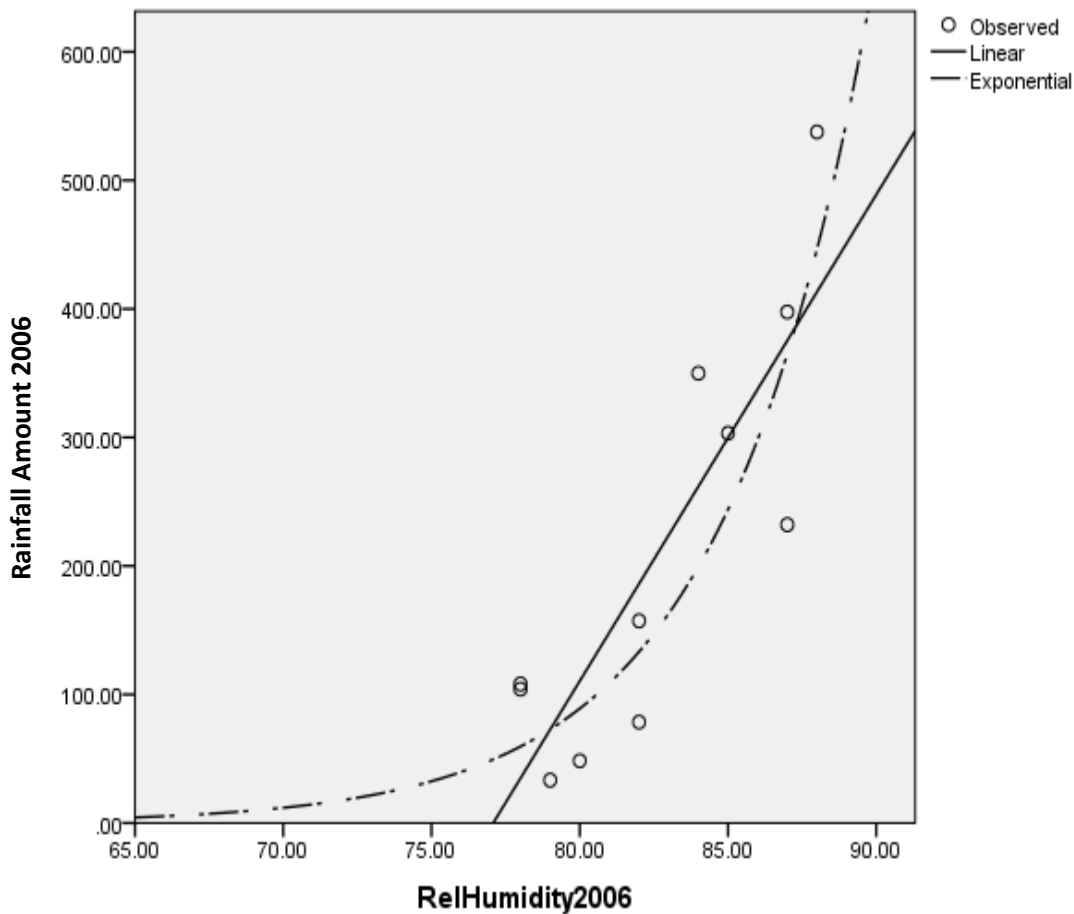


Figure 1: Rainfall amounts (observed and predicted) versus Relative humidity.

3.2 Discussions

Tables 1 and 2 showed that the study had been carried out within the following ranges of the climatic factors: Relative humidity (44% to 90%) and Rainfall amounts (7.8mm to 630.2mm). The results from the correlation analysis carried out, as indicated in Tables 3 showed that the Rainfall amount correlated positively with the Relative humidity in all the years of study. Another notable observation as postulated in Table 4 was that the strength and nature of the relationship between the Rainfall amounts and the Relative humidity throughout the period (2006 to 2016) reviewed was more than 80% above average. Even in the few cases where the relationship appeared to be less, the relative humidity contributed about 50% changes in the rainfall amount.

Through the regression analyses carried out using linear and non-linear (Curve fit) methods as could be seen in figure 1 as well as in the appendices 1 to 10, it was noticed that increases in the relative humidity brought about increases in the rainfall amounts. Nevertheless the increase in the rainfall amounts became quite profound after a threshold value of 78% Relative humidity was reached. The best single parameter predictor model for the rainfall amounts was a non linear, exponential model: $8.87E-6 + 202 \text{ Rel. humidity}$ 2006, with a standard error of estimate ,SE, value of 0.534. It predicted the range for the rainfall amounts to be 5.88mm to 629.41mm while the observed rainfall amounts ranged from 7.8mm to 630.2mm.

IV. CONCLUSIONS

The influence of relative humidity on rainfall generation was stressed. Relative humidity has been seen like an intermediary that attracts, gather and send moisture from seas and land masses into the atmosphere, which periodically fall as rain. In this study, relative humidity has not only correlated positively with the rainfall amount but has also contributed to not less than 53% changes in the rainfall amounts.

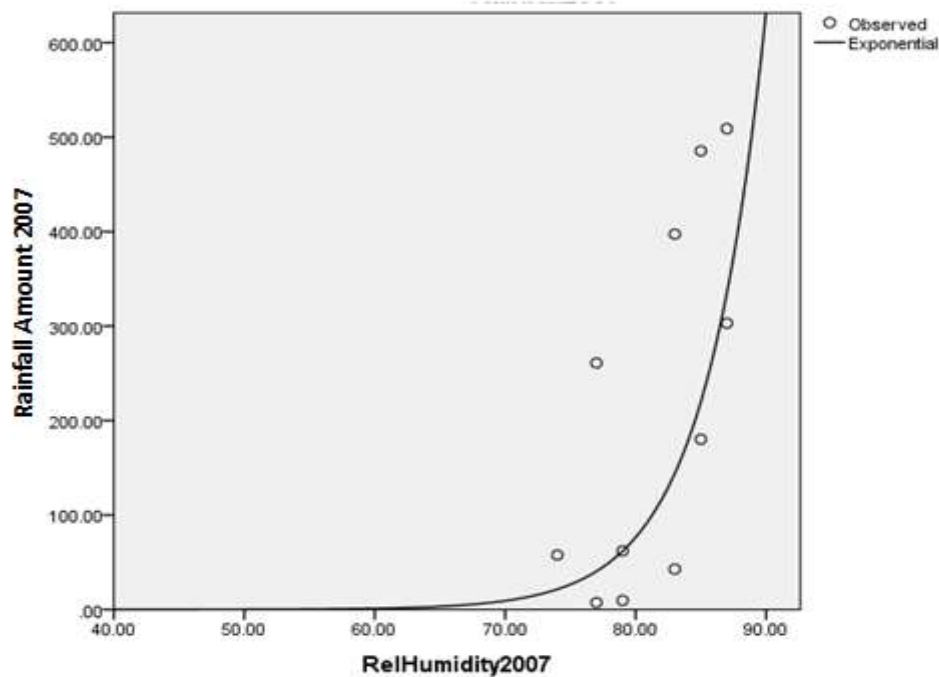
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APPENDICES

APPENDICES



Appendix 1: Rainfall amount 2007 versus Relative humidity 2007

