

CLIMATE CHANGE AND HUMAN WELLBEING

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1. INTRODUCTION

There is no gainsaying that we are living in a world of dynamism. Thus change is the order of the day. In fact, climate change is one of the most important phenomena in our contemporary world. To this end, both scientists and non-scientists alike are akin to seek for solutions on the negative impacts of climate change on human wellbeing which some authorities call maleficial effects. The aim of the paper is to investigate the causes and impacts of climate change in Warri while the objective is to examine impact of climate change with respect to rising temperatures using the Discomfort or Comfort Index statistics. Climate change has been defined as variations in climate over a long period which helps to discern a shift in the climatic characteristics of a place for about 100 years without reversing to former climatic characteristics (Ayoade, 2003 and Tamuno, 2004 & 2007). It was discovered that Warri has a Comfort Index of 77 instead of the average of 70.

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2. IMPACTS OF CLIMATE CHANGE

Evidence abound testifying that many changes have taken place in the earth-atmosphere system. Most of these changes have resulted from the effects of climate change some of which include:

- Increase in global and local temperatures ($0.6 \pm 0.2^{\circ}\text{C}$) over the 20th century
- Sea level rise in coastal areas; biodiversity loss; Spread of diseases(Malaria);
- Decrease in snow cover and ice extent; Increase in precipitation and other extreme events, etc

3. CAUSES OF CLIMATE CHANGE

Causes of climate change had been investigated by many scholars including: Ayoade (1988, 2003), Faniran and Ojo 1983) Binbol and Uzochukwu, (2007) as well as Odjugo (2008).

Ojo, Ojo and Oni (2001), Ayoade (1988 and 2003) in their texts fully discussed the causes of climate change while Faniran and Ojo (1983) dealt more on the effects of climate change. Mainwhile Binbol and Uzochukwu (2007) explained the climate effect of urbanization in Abuja. On the other hand Odjugo(2008) discussed the cost of climate change on Nigeria wherein he worked upon wind and rainstorms. There is no doubt that the most important climate elements are precipitation and temperature and in this respect humidity, directly or indirectly.

All the same, everyone knows that there are two major causes of climate change, namely: anthropogenic and natural..These have been seriously dealt with in the texts of Ayoade (1988 and 2003) as well as Ojo Ojo and Oni (2001). Thus only very brief summaries of these need to be mentioned here.

Anthropogenic causes relate to those activities of man which help to change the chemical composition of the atmosphere as they relate to increasing the volume of greenhouse gases like carbon dioxide (CO₂), Methane (CH₄), Sulphur dioxide (SO₂) etc. The emission of Chlorofluro Carbon (CFC_s) and halogens help to deplete the ozone layer which leads to global warming that partly accounts for climate change. It had been noted on global basis that CO₂ concentration had been rising steadily since pre-industrial period from about 260ppm to the present level of about 340ppm (Hekstra, 1985). It is said that CO₂ has accounted for (1.5 to 4.5)⁰C as noted by Hekstra (1985) and Eja, (2003). In Warri in particular the greenhouse gases are further enhanced by gas flaring in addition to other human economic and industrial activities.

Climate changes that are **induced by nature** are known as **natural causes of climate change** and they have been explained in several theories. Some of these are the three major theories of climate change which are:

(a) Terrestrial (Earth) causes which are effected through

- Changes in the distribution of land and water surface
- Change in the earth's topography
- Change in atmospheric chemistry and
- Changes in the cryosphere

(b) Astronomical causes (Milankovitch theories) which are effected through:

- Changes in the eccentricity of the earth's orbit
- Changes in the precession of the equinoxes

- Changes in the obliquity of the plane of ecliptic
- (c) Extra terrestrial causes effected through:
- Variations in the solar radiation amount
 - Variation in the absorption of solar radiation outside the earth's atmosphere.

The combined effects of the anthropogenic and natural causes actually bring about climate change in the ratio of about 60:40 respectively.

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4. STUDY AREA

The study area is a tropical coastal city- Warri in Nigeria. It lies on latitude 05.31° N and Longitude 05.44° E and on an altitude of 6.10m above sea level. It has a 99 years mean temperature of 27.1°C . It enjoys a typical equatorial climate and a rainfall average of 2787.22mm. Its coastal and relative low-level location no doubt affects its climatic characteristics. Warri is the commercial nerve centre of Delta State, Nigeria. Warri's size is about $31,668\text{km}^2$ while population was 500,000 as at 1991(NPC,1991) and estimated at 730,000 by 2009. Oil exploration/exploitation activities are common as well as industrial activities. Average RH is about 70-80% and above.

5. MATERIALS AND METHODS

Precipitation and temperature parameters were obtained from Nigerian Meteorological Agency (NIMET), Lagos. They were harmonized and subjected to time series analysis. The parameters were also subjected to the discomfort index and decadal statistics. Secondary data of average rainfall and temperature figures were used.

DATA ANALYSIS AND RESULTS/DISCUSSION

Thorn (1959) discomfort index which is also applicable with further modification to TH_1 was used and discovered that "D1" with formula = $td (0.55 - 0.0055u\%) (t - 14.59)$

Where DI = discomfort index

Td = dry bulb Air temperature in DC, U% = Relative Humidity.

The results show that Warri has a $Di = 26.2^{\circ}\text{C}$. Maximum index value as suggested by Thorn is 26.5°C while minimum value is 18.9°C , below which some form of **cold stress** may result. This implies that Warri is getting close to its maximum discomfort index. When the data were subjected to the Comfort Index using the formula:

$$CI = DBT(^{\circ}\text{F}) + WBT(^{\circ}\text{F}) \times 40\% + 15 \dots \dots \dots \text{Microsoft Encarta}(2008)$$

Where: DBT and WBT represent Dry and Wet bulb temperatures respectively. The temperature figures were then converted to $^{\circ}\text{F}$ and the formula applied wherein we had 77.256 being $[(82.04+75.6)\times 0.4 + 15]$ for Warri. Therefore, using either formula, increasing trend in temperature does put Warri in a disfavoured position as the average CI is 70 while a CI of 75 means just half the number can be comfortable but Warri's CI is 77.

If the trend of global warming or increasing temperature continues, as is shown in the trend which had been on the increase since 1982 (Table 1 & Fig. 1), the station will soon suffer from *heat stress which is not good for human well being*. Ayoade (1978) had already put Warri in the Hot Physiological zone. The rainfall data shown in Table 2 and Fig. 2 are more or less the indirect measure of the high relative humidity (RH) of the station (Warri), a coastal city with high temperatures.

Table:1 DECADAL TEMPERATURE STATISTICS FOR WARRI

Decadal means

Station	Year annual	1943 – 1952	1953 – 1963	1963 – 1972	1973 – 1982	1983 – 1992	1993 – 2002	2003 – 2004
Warri	Temperature($^{\circ}\text{C}$)	26.7	26.8	27.1	23.1	27.3	27.7	27.8

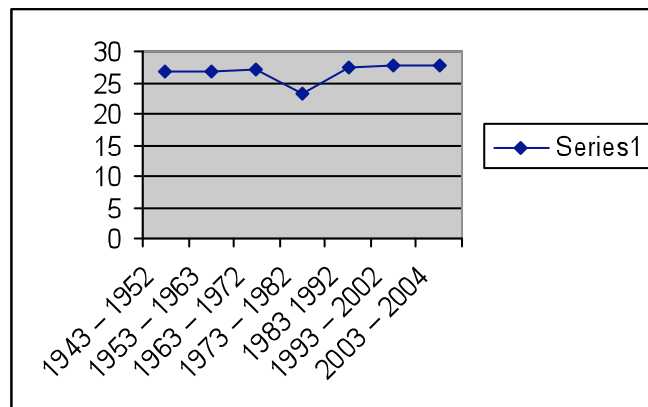


Fig. 1 DECADAL TEMPERATURE STATISTICS FOR WARRI (1943 – 2004)

Table:2 DECADAL RAINFALL STATISTICS FOR WARRI

Decadal means

Station	Mean Annual	1908– 1917	1918 – 1927	1928 – 1937	1938 – 1947	1948 – 1957	1958 – 1967	1968 – 1977	1978 – 1987	1988 -1997	1998 -2007
Warri	2787	2814.03	2641.56	2723.65	2756.39	2960.72	2893.09	2702.64	2706.18	2921.42	2746.50

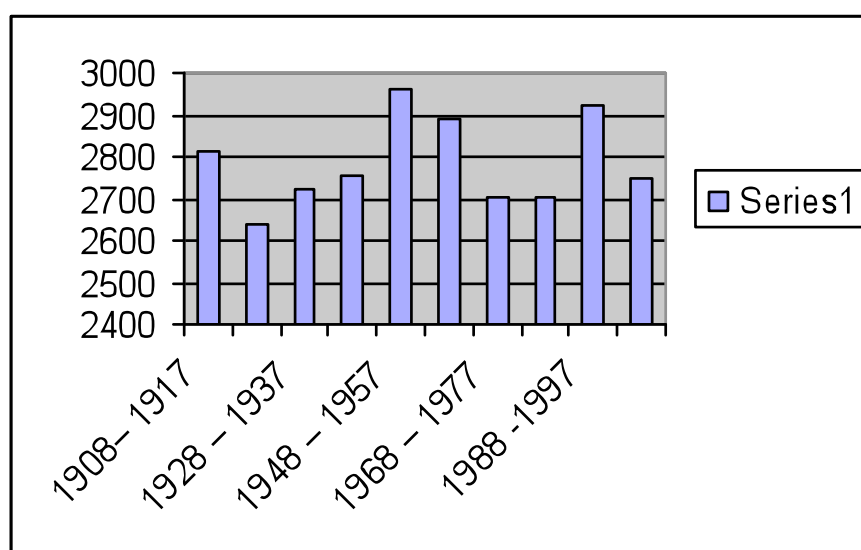


Fig: 2 DECADAL RAINFALL STATISTICS FOR WARRI 1908 – 2007

6. CONCLUSION AND RECOMMENDATION

The study shows that Warri has a general increase in temperature owing to global warming and climate change which is impacting maleficially on human well-being. The causes are **partly attributed to the gas flaring activities** in the area because a lot of gas flaring is taking place there which help worsen the effect of global warming. It is recommended that the gases flared should be stopped forthwith and re-injected to generate more money for the Nigerian economy and to help boost the energy sector in terms of electricity.

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