Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol.4, No.8, 2014
www.iiste.org

Temporal and Spatial Temperature Trends and Their Implications on Health Conditions in Port Harcourt and Warri in Niger Delta

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ABSTRACT:
In recent times climate change; global warming or rising temperature have taken centre stage in international concerns and several fora and treaties have been observed with a view of stemming trend, in rising temperatures. This study evaluated 36 (thirty-six) years maximum and minimum annual temperature of Port Harcourt and Warri in Niger Delta (1971 – 2006) to determine trends and identified extreme fluctuation in temperature and their possible implications on health condition of the people. Data used for this study were historical data on temperature of Port Harcourt and Warri sourced from the Nigerian Meteorological Agency's Archive, Lagos and data on health conditions sourced from the Braithwaite Memorial Specialist Hospital Port Harcourt and Warri Central Hospital Warri. Temperature data was analyzed for long term of thirty six (36) years and short term of 6 years series using Pearson's Product Moment Correlation Coefficient (r). Other analysis tool used include standardized temperature anomaly index, mean temperature deviation, graphical model of mean annual temperature, five year moving averages etc. Frequencies of health cases were correlated with extreme temperature fluctuation values to determine relationship between temperature trends and health conditions in Port Harcourt and Warri. The result of data analysis showed a direct relationship between temperature of Port Harcourt and Warri (r = 0.79) for the series 1971 – 2006. Mean annual temperature has varied remarkably in Port Harcourt and Warri during the period. The study also established an inverse relationship between extreme temperature and health condition in Warri (r = - 0.55). Specifically inverse relationship was establish between temperature and malaria (r= - 0.04), typhoid (r = - 0.55), measles (r = - 0.01), hypertension (r = - 0.02), hepatitis (r = - 0.75), gastro enteritis (r = - 0.36) and pneumonia (r = - 0.13). Asthma (r = 0.28) and bronchitis (r = 0.02) directly relate with temperature. Observed trends in temperature of Port Harcourt and Warri is in conformity with rising trend of global temperature as revealed by trend models. However, high and low extreme temperature have some influences on human health condition in Port Harcourt and Warri.
Keywords: Temporal, Spatial, Temperature Trends, Health condition, Port Harcourt, Warri.

Introduction

Temperature is an important element of climate and its trend in the Niger Delta should be studied temporally and spatially. Rising temperature or global warming has indeed been a worrisome meteorological problem of global concern and several fora and treaties have been observed to find solutions to this problem. Hansen (2006) noted that global warming is at least in parts a consequence of increasing anthropogenic greenhouse gases. Afangideh *et al*. (2005) noted that annual averages for rainfall and temperature in Uyo, Akwa Ibom State in Nigeria are not just fluctuating, being primary characteristics of natural system, but steadily and slowly changing due to human inadvertent incursion into nature by way of socio-economic development initiatives, population growth, agricultural activities as well as growth in science and technology. The projected impact of rising temperature on environmental stability and life on earth can rather be imagined and some of these include:- changes in global climate and consequent disruption of temperature, precipitation, cloud, evapo-transpiration, shift in vegetation belt, rise in sea level, melting of polar ice-cap etc. all these are believed to have implications on fresh water resources, agriculture and food supply, natural ecosystem and human health among others. Port Harcourt and Warri in the Niger Delta of Nigeria are still part of the global environment and given increase industrial activities, population growth, transportation activities and all other activities that will accelerate the build up of Carbon dioxide (CO_2) and other Greenhouse gases (GHGs), it is necessary to study temperature trends of Port Harcourt and Warri and the health implications with a view to sensitizing relevant authorities in Nigeria and the international community to rise up to the challenges of the realities of current temperature trend.

The Problem

Gobo (2005) noted that, changes in global climate may best be characterized by the surface global mean temperature which is estimated to rise between 1.5^0C to 4.5^0C by the year 2030. However industrial processes will continue to release large amount of carbon dioxide into the atmosphere with probable effect of warming on earth's atmosphere (Gerald, 1978)

According to the Greenfacts Digest (2007), global average of temperature is expected to increase by 0.2^0C per decade and continuing greenhouse gases emission will cause further increase in global temperature and many other climatic changes during the 21st century. Rising temperature can lead to worsen air pollution which causes diseases and death (Teme, 2005; *Susan et al.*, 2008). The poor will be most vulnerable to the impact of rising temperature, since they have less capacity to adapt and their livelihood's are dependent on resources linked to climate. A report on Nigeria under the United Nation Framework Convention on Climate Change (UNFCCC) has it that 35% of the Niger Delta region would be lost with a sea rise of 0.5mm and also a projected relocation of 27million people with a sea level rise of about 0.5mm may come to be if no mitigation plan is put in place (Okolie and Ahiadu, 2008)

The Niger Delta region of Nigeria host several oil industries with over 600 oil fields (Odu, 1983) population of about 31,224 587 persons (National Population Commission, 2006), increase transportation activities, long years of gas flair which Efe (2003) noted to have incubated a precarious heat island around gas flames and high heat stress in the environment., etc. What will be the state of temperature in Port Harcourt? Would temperature trends in Port Harcourt and Warri in any way conform to global trend of temperature? what are the likely implications of temperature trends on health conditions in port-Harcourt and Warri in Niger Delta?

Study Objectives

The main objectives of the study include:

1) Evaluate 36years (minimum and maximum) temperature of Port Harcourt and Warri in the Niger Delta and to determine the trends.

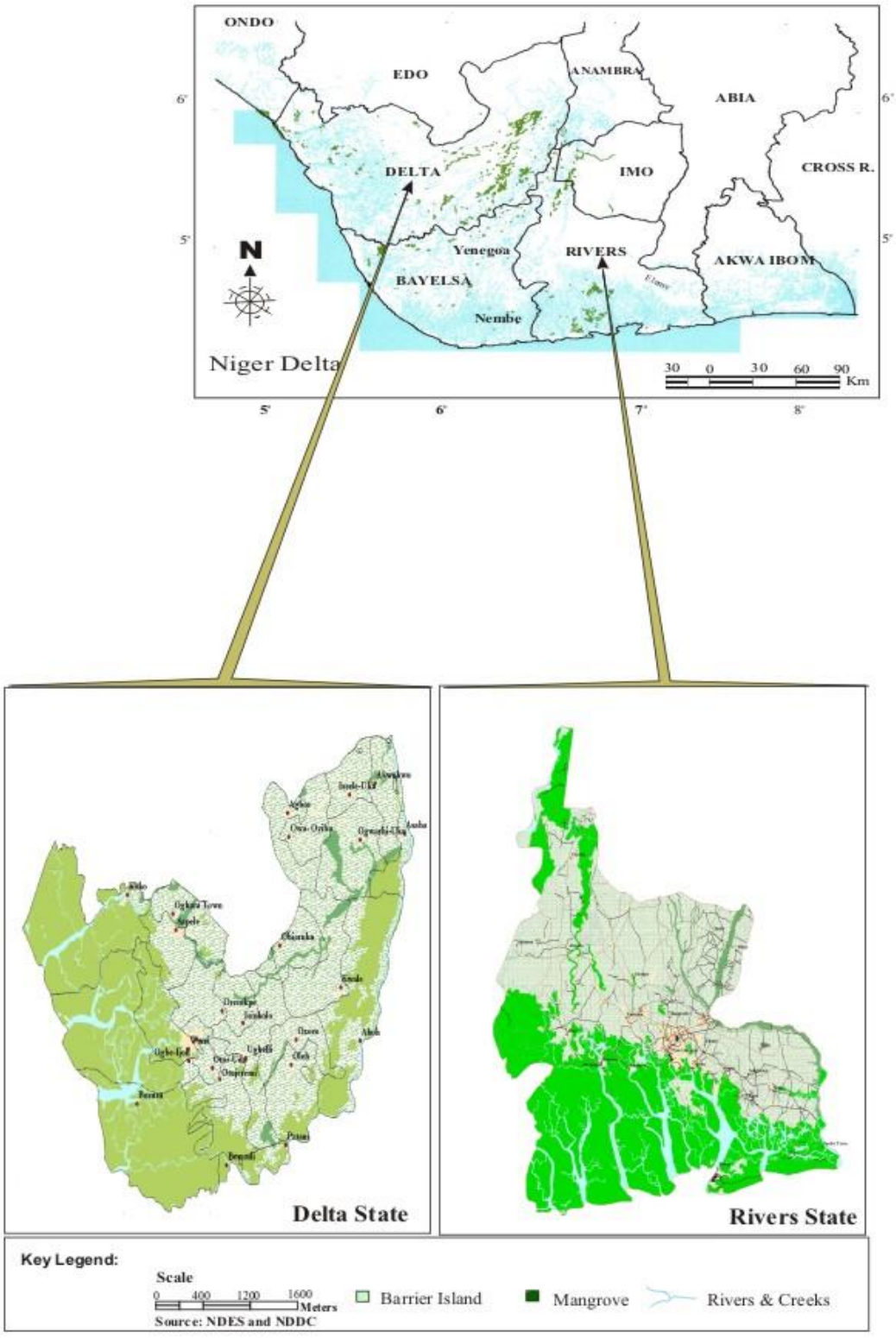
2) Compare temperature trends in Port Harcourt and Warri with trends in global temperature as to find relationships.

3) Determine how variation in mean annual temperature has occurred in Port Harcourt and Warri from 1971 to 2006.

4) Investigate medical records in the study area and see how temperature trends may have influenced human health.

Study Area

The study involved Port Harcourt (07^o01^1E, 45^o1^1N) and Warri (6^oE, 5^oN) which are typical Niger Delta Areas. Port Harcourt is the capital of Rivers State and Warri is a major City in Delta State. Port Harcourt and Warri share similar climate characteristics. As noted by Areola *et al.* (1999), the climate of the region is hot wet equatorial with temperature ranging from 24^oC to 32^oC and mean annual rainfall from 2000mm to 4000mm. Temperature is uniformly high all through, the year with a mean of about 27^oC and 3^oC annual rainfall. Port Harcourt station has annual temperature of 28^oC with a daily range of 7.5^oC (Oyegun and Ologunorisa, 2002). The general height of the area stands from 0 – 200m and the vegetation here is the typical Niger Delta which consist of lowland rainforest, fresh water swamp, mangrove swamp, etc. (Odu, 1983).


ONDO
EDO
ANAMBRA
ABIA
DELTA
IMO
CROSS R.
Yenegoa
RIVERS
AKWA IBOM
BAYELSA
Nembe
N
Niger Delta
30 0 30 60 90
Km
5'
6'
7'
8'
Delta State
Rivers State
Key Legend:
Scale
0 400 1200 1600
Meters
Barrier Island
Mangrove
Rivers & Creeks
Source: NDES and NDDC

LITERATURE REVIEW

Theoretical Framework

This study is related to climate change, anthropogenic hypothesis, radiative forcing, green house effect and global warming. The sun provides about 99.97% of the heat energy needed for the physical processes taking place on the earth's atmosphere system (Gobo, 2002). The heating of the atmosphere system is done by short wave radiation (solar radiation) and long wave radiation (terrestrial radiation) short wave radiation is the radiation from the sun and is governed by the sun's temperature. The earth receives the sun`s radiation, gets heated and release the heat as long wave radiation. This process is necessary to maintain heat balance in the earth atmosphere system as this prevent the atmosphere from cooling excessively and the earth surface from warming excessively. There has been cries of 'climate change' and 'global warming' all over the world. The "**anthropogenic hypothesis**" of global warming has it that; the burning of fossil fuels by humanity has released enough green house gases of various type (especially carbon dioxide and methane) into the atmosphere as to have caused a rise in global mean temperature. The implication of the "anthropogenic hypothesis" is that the ever-increasing use of fossil fuels will destabilize the temperature balance of the planet, with dramatic and extremely dangerous potential consequences for all life on earth (Loren, 2007). **Radiative forcing** on the other hand is a measure of the influence a factor has in altering the balance of incoming and out going energy in the earth atmosphere system. It is usually express in Watts per square meter (Wm^{-2})(IPCC,2007).

Climate Change

It is the changes in mean annual temperature and other aspects of climate over period of time ranging from decade to hundred of year to several million years (Botkins and Keller, 1998).

Teme (2005) viewed global warming or rising temperature as a major aspect of climate change which has received great attention from both scientist and the public. The problem of global warming reached a climax in Kyoto, Japan, in December 1997, with the establishment of an International Protocol to limit the emission of greenhouse gases (WMO, 1998). The *green house effects* is a term which describes the trapping of heat from the earth radiation by the atmosphere. Water vapour, and other gases – carbon dioxide (CO_2), Methane (CH_4) and CFCs perform the heat trapping (greenhouse effect) and warms the earth's atmosphere because they absorb and re-emit radiation. (Botkins and Keller, 1998). There are anthropogenic and natural factors for rising temperature or global warming and climate change.

Factors for Rising Temperature

Anthropogenic greenhouse gases are very important in global warming (rising temperature) Among the anthropogenic factors held responsible for greenhouse gases concentration are; increase industrial activities, increase fossil fuel consumption, deforestation, agriculture and land use.

Fig 2 below shows trend of global mean temperature with fossil fuel consumption for the period 1850-2010 with sustained rise between 1950-2010 (Loren, 2007).

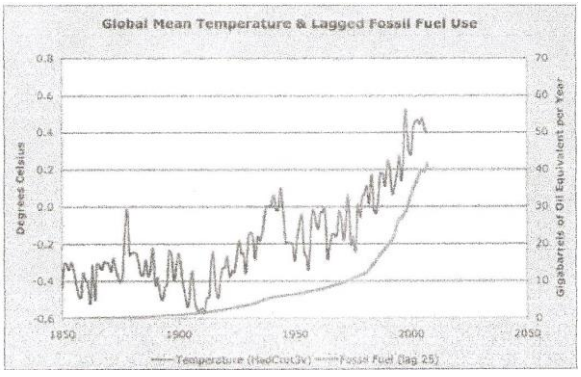


Fig.2: Global mean temperature and fossil fuel consumption
Source: Loren C., 2007

Natural factors (Non-anthropogenic factors) according to Teme (2005) include: The sun cycle and solar wind, El Nino and La Nina and volcanic activities. El Nino is a term used to describe an extensive warming of the upper

ocean in tropical eastern pacific while La Nina refers to the cooling phase of El Nino. Sea surface temperature exceeded 28^{o}C across the east central equatorial pacific beginning in May 1997, this was linked to El Nino and it contributed to a recorded high global temperature in 1997. Loren (2007) stated that changes in global mean temperature is partly caused by fluctuations in solar activity which changes the total amount of radiant energy received on earth and also the amount of cosmic radiation absorbed by the atmosphere. The correlation between smoothed solar activity and global mean temperature over the time span from1850 to 2007 is 0.61, indicating that solar activity alone may account for as much as 37% of the variance in global mean temperature. Carbon dioxide (CO_2) is a major anthropogenic green housegas in the history of global warming. IPCC (2007) noted that increase in atmospheric CO_2 since pre-industrial times are responsible for radiative forcing of $+1.66 \pm 0.17$ wm^{-2}, a contribution which dominates all other radiative forcing agents considered in the IPCC 4th assessment report.

Trends in (Global) Temperature

IPCC (2007)noted that 2005 and 1998 are the warmest two year in the instrumental global surface air temperature record since 1850 and eleven of the last 12years (1995-2006) ranked among the 12 warmest years on record since 1850 except 1996. Hansen *et al*. (2005) described the year 2005 as a "dead heat" with a temperature anomaly of 0.62^{0}_{C}.

Graphical Models of Global Temperature Trend

Rising trend in global temperature has been revealed by the following models in Figures 3, 4 and 5 below:

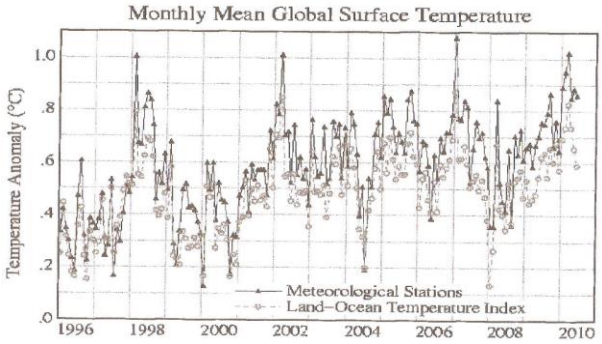


Fig 3: Monthly mean global surface temperature, 1996 - 2010
Source: **NASA GISS Surface temperature analysis**

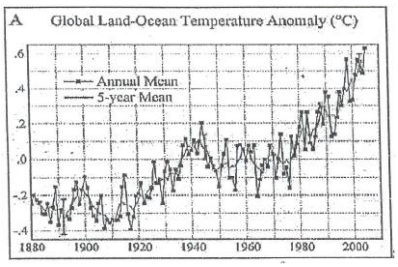


Fig 4: Global land- ocean temperature anomaly (°C) from 1880-2000.
Source: Hansen et al. 2006, NASA GISS.

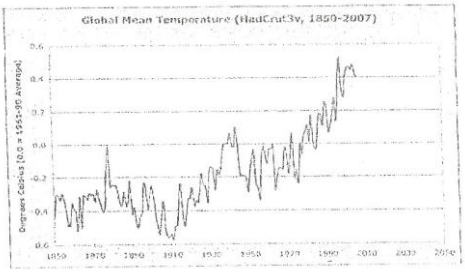


Fig 5: Trend in global temperature, 1850-2010.
Source: Loren, C. 2007

Effect of Global Warming (Global Temperature Rise)

The observed and projected effects of rising temperature are overwhelming. Gobo (2009) noted some of the effects to include: droughts and increase in desertification with reduction in arable land. Changing rainfall patterns leading to marginal food production areas and reduction in food production system etc. Heat waves and human health, air pollution, has been linked to increase death and illness from respiratory diseases such as asthma. Melting of polar ice leading to rise in sea level, which will claim millions acres of coastal and low-land areas. Threat to inhabitant of coastal lands and port facilities due to frequent storms and hurricanes, etc. IPCC (2007) noted that observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases.

Epidemiology of Rising Temperature

Changes in temperature can stimulate other components of the environment capable of arousing human health problem. Adelaja (1991) linked weather parameter such as solar radiation, temperature wind etc to human health; that exposure to high air temperature accompanied by intense radiation may result in heat stroke; and other health problems linked to meteorological factor by Adelaja include- eclampsia, pneumonia legionnaire etc. It is also expected that the geographical range of vector will be expanded as temperature rises. *Susan et al* (2008) stated that mosquitoes, tick, rodents and other vectors are expanding their geographic range altering long established patterns of diseases as a result of global warming. Temperature affects pathogenic replication, maturation and period of infectivity (Patz *et al*, 1998) and hence indirectly, human health. West Nile encephalitis, lung cancer, heart diseases, asthma and allergies and other health problem are linked to global warming (Susan *et al*., 2008) Rising temperature, could lead to worsen air pollution which brings about disease and death, global warming has dramatically affected the quality and safety of the air we breath (Teme 2005, Susan *et al*., 2008). It should be noted that there are also some indirect health problems associated with some environmental impact of rising temperature such as flooding which can cause upsurge of rodent-borne illness (Leptospirosis, Tulare mina plague, viral hemonhagic diseases and cholera) and the impact of flooding on human health continues long after the water, with mental health problems (Post-traumatic stress disorder and depression), (Susan *et al* 2008).

From the foregoing, climate change as in rising trends of temperature globally or global warming is creating serious problem with food and water supplies, increasing mental health concern and exacerbating air pollution which elevate chronic diseases risk among others.

Data Analysis Technique

The data used for this study are historical data of observed daily maximum and minimum air temperatures of Port Harcourt and Warri for the period 1971-2006 (thirty six years inclusive) and medical records of observed health cases in Port Harcourt and Warri.

Temperature data for Port Harcourt and Warri were sourced from the Nigeria Meteorological Agency's archive in Lagos and medical data were sourced from the Braithwaite Memorial Specialist Hospital (BMSH), Port Harcourt and Warri Central Hospital, Warri.

Medical data were sought for years of extreme fluctuations of temperature in Port Harcourt and Warri.

Preliminary treatment of temperature data was done by the use of totals, mean, standard deviation standardize temperature deviation, mean deviations and frequencies. Further analysis of temperature data was done by using Pearsons Product Moment Correlation (r) graphical models of mean temperature and 5year-moving average. Frequency total were used for medical data analysis. Extreme temperature values were correlated with medical data using the person product moment correlation to determine temperature implications on health condition.

The Pearson's Product Moment Correlation Coefficient was use in this study to; establish relationship in trends between temperature of Port Harcourt and Warri for the years 1991-2006 (36 years inclusive) and to establish relationship between temperature trend, and health condition of people in Port Harcourt and Warri. The 5-year moving average was use in modeling trend because it helps to minimize the smoothening of the graph so that relevant information will not lost.

Temperature data were analyzed for long term correlation (36 years) 1971-2006 coefficient (r) and short tem correlation coefficient (r) (six year series)

DISCUSSION OF RESULT

Temperature Trend in Port-Harcourt and Warri

(i) Longs Term Trend (1971-2006)

An analysis of mean annual temperature trend for Port-Harcourt and Warri from 1971-2006 (36 years series) using graphical model of mean annual temperature and 5-Years moving average and Pearson Product Moment Correlation (r) showed that: there is a direct relationship between temperature of Port-Harcourt and Warri (r=0.79). thus a rising trend in temperature of Port-Harcourt and Warri is confirmed.

(ii) Short term trend (6years series) Port-Harcourt & Warri 1971-1976 (r = 0.53), 1977-1982 (r = 0.32), 1983-1988 (r=0.67), 1989-1994 (r = 0.37), 1995-2000 (r = 0.92), 2001-2006 (r = -0.09) the correlation coefficients (r) reveals direct relationship between temperature values of Port-Harcourt and Warri except for the last series 2001-2006 with a negative relationship (inverse relationship). This is evident in the Tables 1, 2, and 3 and figures 6 and 7 below.

Table 1: Temperature Data Summary Sheet for Port Harcourt 1971 – 2006 (36 years inclusive)

Year	oC Mean Temp.	5 Yr. Moving Aver.	Deviation from Mean	SAI	Mean Max Temp. oC	Mean Min Temp. oC
1971	26.4		-0.4	-0.7	30.5	22.4
1972	26.5		-0.3	-0.5	30.3	22.7
1973	26.9		0.1	-0.2	30.8	23.0
1974	26.3		-0.5	-0.8	30.2	24.4
1975	26.1	26.4	-0.7	-1.2	30.2	22.0
1976	26.2	26.4	-0.6	-1.0	30.0	22.4
1977	26.7	26.4	-0.1	-0.2	30.4	22.9
1978	26.5	26.4	-0.3	-0.5	30.3	22.6
1979	26.6	26.4	-0.2	-0.3	30.4	22.8
1980	26.7	26.5	-0.1	-0.2	30.4	23.0
1981	26.5	26.6	-0.3	-0.5	30.6	22.3
1982	26.5	26.6	-0.3	-0.5	30.4	22.6
1983	26.9	26.6	0.1	0.2	31.2	22.7
1984	26.7	26.7	-0.1	-0.2	30.9	22.4
1985	26.8	26.7	0	0.0	30.7	22.7
1986	26.7	26.7	-0.1	-0.2	30.4	22.9
1987	27.4	26.9	0.4	0.7	31.3	23.3
1988	26.9	26.9	0.1	0.2	31.0	23.0
1989	26.7	26.9	-0.1	-0.2	31.0	22.4
1990	27.1	27	0.3	0.5	31.0	23.2
1991	26.8	27	0	0.0	30.6	22.9
1992	26.8	26.9	0	0.0	30.9	22.7
1993	26.8	26.8	0	0.0	30.9	21.0
1994	26.9	26.9	0.1	0.2	30.8	22.9
1995	27.1	26.9	0.3	0.5	31.3	22.8
1996	26.8	26.9	0	0.0	30.7	22.7
1997	27	26.9	0.2	0.3	30.9	23.0
1998	27.6	27.1	0.8	1.3	31.5	23.0
1999	26.8	27.1	0	0.0	30.8	22.8
2000	27	27	0.2	0.3	31.2	22.8
2001	26.9	27.1	0.1	0.2	30.9	22.9
2002	27	27.1	0.2	0.3	31.0	23.0
2003	27.2	27	0.4	0.7	31.3	23.2
2004	27.2	27.1	0.4	0.7	31.1	23.2
2005	27.3	27.1	0.5	0.8	31.1	23.3
2006	27.5	27.2	0.7	1.2	31.5	23.5

Table 2: Temperature Data Summary Sheet for Warri 1971-2006 (36 years Inclusive)

Year	oC Mean Temp.	5 Yr. Moving Aver.	Deviation from Mean	SAI	Mean Max Temp. oC	Mean Min Temp. oC
1971	28.9		-0.6	1.00	31.30	22.60
1972	27.4		-0.1	-0.20	31.60	23.20
1973	27.7		0.2	-0.30	32.00	23.30
1974	27		-0.5	-0.80	31.20	22.80
1975	20.8	27.2	-0.7	1.20	31.10	22.80
1976	26.6	27.1	-1.0	-1.70	30.00	22.70
1977	27.4	27.1	-0.1	-0.20	31.30	23.40
1978	27.1	27	-0.4	-0.70	31.10	23.10
1979	27.2	27	-0.3	-0.50	31.20	23.20
1980	27.1	27.1	-0.4	-0.70	30.60	23.30
1981	27.3	27.2	-0.2	0.30	30.10	23.30
1982	27.1	27.2	-0.4	-0.40	30.00	23.50
1983	27.3	27.2	-0.2	-0.30	31.40	23.50
1984	27.2	27.2	-0.3	-0.50	31.20	23.00
1985	27.3	27.2	-0.2	-0.30	31.20	23.00
1986	26.9	27.2	-0.6	-0.80	31.00	22.70
1987	27.8	27.3	0.1	0.20	32.00	23.30
1988	27.7	27.3	0.2	0.30	31.40	23.90
1989	27.4	27.4	-0.1	0.20	31.40	23.40
1990	27.7	27.5	0.2	0.30	31.50	23.90
1991	27.7	27.6	0.2	0.30	31.40	24.00
1992	27.5	27.6	0	0.00	31.40	23.10
1993	27.9	27.6	0.4	0.70	32.10	23.00
1994	27.7	27.7	0.2	0.30	32.00	23.50
1995	27.9	27.7	0.4	0.70	31.50	24.10
1996	27.7	27.7	0.2	0.30	31.50	23.80
1997	27.7	27.8	0.2	0.30	31.80	23.60
1998	28.4	27.9	0.9	1.50	32.30	24.10
1999	27.5	27.8	0	0.00	31.60	23.50
2000	27.5	27.7	0	0.00	31.50	23.50
2001	27.7	27.8	0.2	0.30	31.70	23.70
2002	27.6	27.7	0.1	0.20	31.70	23.60
2003	28	27.7	0.5	0.80	32.00	24.00
2004	27.8	27.7	0.3	0.50	31.80	23.80
2005	27.3	27.5	-0.2	0.30	31.80	22.80
2006	27.7	27.7	0.2	0.30	32.30	23.20

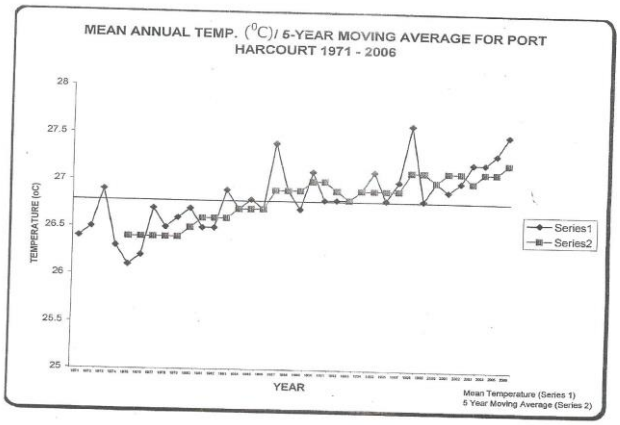


Fig. 6: Graphical model of trend in mean annual temperature (°C) and 5 years moving average for Port Harcourt

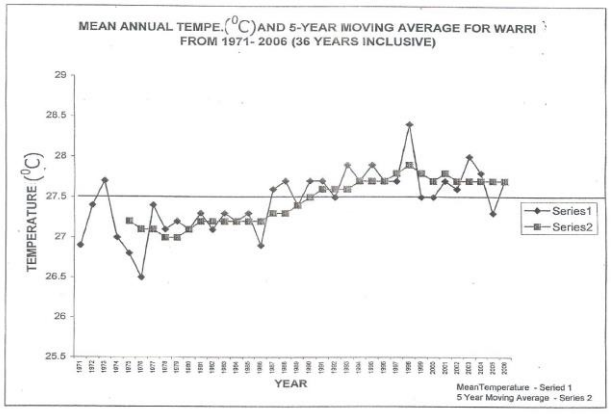


Fig. 7: Graphical model of trend in mean annual temperature (°C) and 5 years moving average for Warri.

Table 3: Showing 6 years series Pearson's Product Moment Correlation Coefficient value for mean Annual Temperature of Port Harcourt and Warri.

PERIOD	CORRELATION COEFFICIENT	REMARK
1971 – 1976	0.53	Positive correlation
1977 – 1782	0.32	Positive correlation
1983 – 1988	0.64	Positive correlation
1989 – 1994	0.37	Positive correlation
1995 – 2000	0.92	Very high positive correlation
2001 – 2006	-0.09	Negative correlation

Mean Annual Temperature Variability for Port Harcourt and Warri

Mean annual temperature varied gradually during the period 1971-2006 in Port-Harcourt and Warri. Note the extreme deviation shown on tables 1 & 2. Negative deviation indicates a fall in temperature while positive deviation was reach in Port-Harcourt in 1998 (0.8°C), 1975 (-0.7°C) was the highest negative deviation. Temperature rose for 16 (sixteen) years and fell for 14 (fourteen) years but remained at mean level (0-line) for 6(six) years during the period 1971-2006.

See figures 8, 9, 10 & 11 below.

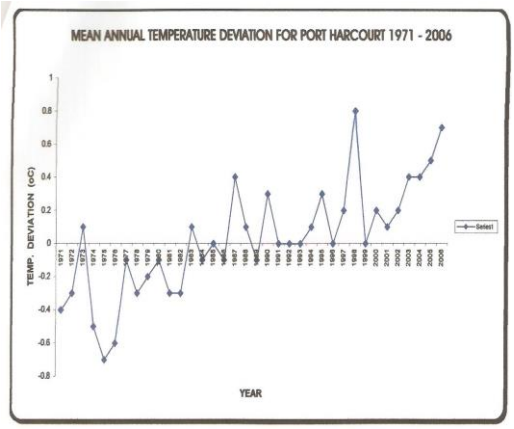


Fig. 8: Graphical model of mean annual temperature deviation for Port Harcourt (1971-2006).

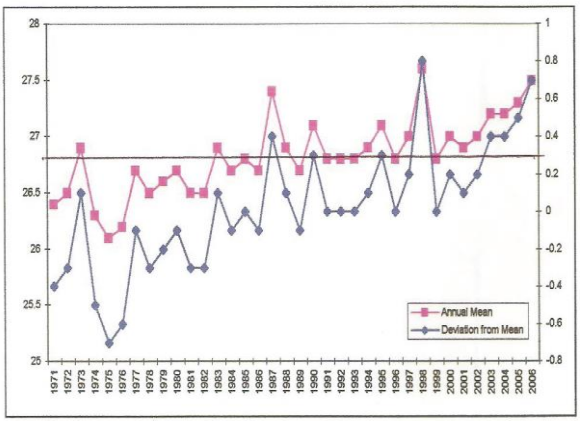


Fig. 9: Graphical model of mean annual temperature and deviation for Port Harcourt. (1971-2006).

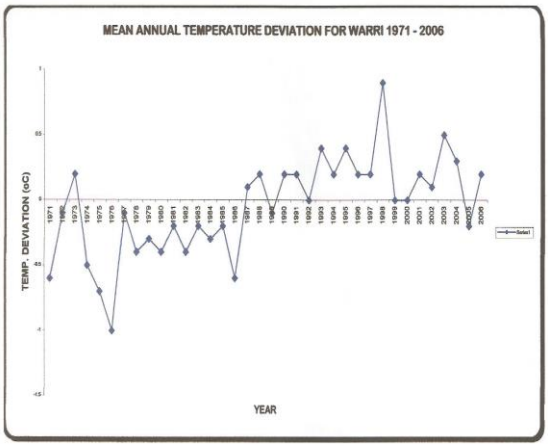


Fig.10: Graphical model of mean annual temperature deviation for Warri (1971-2006).

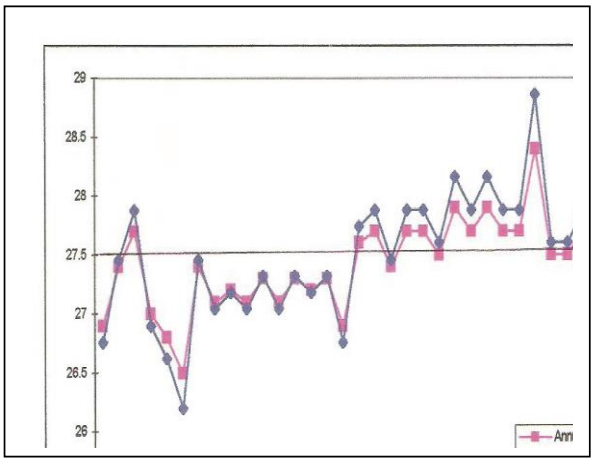


Fig.11: Graphical model of mean annual temperature and annual temperature deviations for Warri (1971-2006).

Relationship between Temperature and Health Conditions in Port-Harcourt and Warri.

An inverse relationship is defined in temperature and health conditions in Warri (r=-0.55). Thus as temperature increases, cases of health conditions decrease in Warri. Note that 1998 with the highest extreme temperature of 28.4^0_C has lower health cases compared to 1986 with 26.9^0_C. Reasons may be; increase health awareness and regular immunization exercises against certain diseases; restricted geographic ranges of pathogenic vectors at increasing temperature etc.

Specifically the relationship between temperature and malaria, typhoid fever, measles, hypertension, eclampsia, hepatitis, gastro enteritis, pneumonia is inverse (in Warri). A positive relationship is shown between asthma, bronchitis and temperature in Warri.

See the tables 4, 5, 6 and 7 below for further details.

Table 4: Data on Health Condition for Port Harcourt and Warri.

Clinical cases observed	**Port Harcourt**		**Warri**					**Total**	**Worse Case observed**
	2004	**2006**	**1986**	**1995**	**1998**	**2003**	**2005**		
Malaria	-	253	-	2942	773	1572	1262	8451	1986, 1995 (Warri)
Yellow fever*	-	-	06	-	-	02	-	08*	1986(Warri)
Typhoid fever	245	2	634	396	80	246	47	1404	1986, 1995 (Warri)
Dengue	-	-	-	-	-	-	-	-	-
Measles*	-	7	224	642	76	48	64	1054 *	1995, 1998 (Warri)
Chicken pox*	9	1	163	53	-	-	-	215*	1986 (Warri)
Cholera*	-	-	17	-	-	-	-	17*	1986 (Warri)
Whooping cough	-	-	01	-	-	-	-	01	-
Lungs Cancer	-	-	-	-	-	-	-	-	-
Asthmas	-	11	51	299	74	65	49	538	1995, 1998 (Warri)
Bronchitis	-	14	51	164	20	18	21	249	1995
Hypertension	-	131	650	418	392	394	86	1940	1986, 1995 (Warri)
Elcampsia	-	7	28	23	8	18	4	79	1986, 1995 (Warri)
Hepatitis	-	10	97	27	10	15	12	161	1986, 1995 (Warri)
Gastro enteritis	49	74	140	87	107	45	64	443	1986, 1998 (Warri)
Pneumonia	-	103	162	69	124	25	25	455	1986, 1998 (Warri)
TOTAL	**303**	**713**	**5141**	**4080**	**1661**	**2496**	**1634**	**15015**	1986, 1995, 2003, 1998

Note : Warri = 1973, 1976 data untraceable
Port Harcourt = 1974, 1975, 1976, 1998, 1999 Data untraceable
Health Hazard of National Emergency (*)

Table 5: Showing Extreme Temperature Fluctuation and Health Condition in Port Harcourt and Warri.

Location/year	Total clinical cases	Temperature ^{0}C	Standardize Temperature Anomaly Index (SAI)
Port Harcourt			
1974		26.4	-0.8
1975		26.1	-1.2
1976		26.2	-1
1998		27.6	1.3
1999		26.8	0
2004	303	27.2	0.7
2006	713	27.5	1.2
Warri			
1973		27.7	-0.3
1976		26.5	-1.7
1986	5141	26.9	-1
1995	4080	27.9	0.7
1998	1664	28.4	1.5
2003	2486	28	0.8
2005	1634	27.3	0.3

Table 6: Pearson's Product Moment Correlation Coefficient Value for Mean Annual Temperature and Specific Health Case Observed in Warri.

Health case	Correlation Coefficient	Remark
Malaria	-0.04	Very low negative correlation
Typhoid fever	-0.55	High negative correlation
Measles	-0.01	Very low negative
Asthma	0.28	Low positive correlation
Bronchitis	0.02	Very low positive correlation
Hypertension	-0.02	Very low negative correlation
Eclampsia	-0.38	Low negative correlation
Hepatitis	-0.75	Very high negative correlation
Gastro enteritis	-0.36	Low negative correlation
Pneumonia	-0.13	Low negative correlation

Table 7: Pearson's Product Moment Correlation Coefficient Value for Extreme Temperature and Total Health Cases (Above and Below Temperature Average) in Warri.

Year	Total Health Cases	Temperature (^{0}C)	Correlation Coefficient(r)
1986	5141	26.9	
1996	4080	27.9	
1998	1661	28.4	
2003	2486	28	**-0.55**
2005	1634	27.3	

Relationship Between Temperature Trend in Port-Harcourt and Warri and Global Temperature Trend

Attempt is made here to compare temperature trend of Port-Harcourt and Warri and global temperature trends. The trend models agreeably show upward fluctuations in temperatures. This clearly indicates that mean annual temperature trends for Port-Harcourt and Warri are consistent with global mean temperature trend.

Conclusions

Port-Harcourt and Warri are typical Niger Delta areas and are part of the global environment. Port-Harcourt and Warri has the potential for sustained anthropogenic green house gases blamed for global temperature rise. From the results of data analysis, it is apparent that; trends in temperature of Port-Harcourt and Warri conform with global trend and mean annual temperature has varied remarkably in Port-Harcourt and Warri. Positive and negative extreme fluctuations in temperature have influenced human health condition in Warri The relationship between temperature and health condition in Warri is inverse, hence as temperature increases cases of health condition decrease. There is a gradual rising (upward) fluctuation in temperature trends of Port-Harcourt and Warri.

Recommendations

The current trend of rising temperature can be checked through effective legislations and enforcement of policies and laws aimed at reducing greenhouse gas emission by the government, population control and environmental education programme, international co-operation in endorsing and domestication of international treaties and laws on environmental protection. Mitigation measure such as provision of sustainable, efficient and affordable health care delivery system be put in place to meet the health need of the people since they cannot run from the environment. Deliberate plan be made to monitor trends in temperature and other climatic parameters and their implications on health, agriculture, wildlife and the economy.

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