



RESEARCH ARTICLE

GLOBAL WARMING AND CLIMATE CHANGE: IMPACTS AND IMPLICATIONS
IN NIGERIA

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ABSTRACT

Within the last two decades, Global Warming and Climate Change has been one of the most important discussed topics in many scientific colloquia and workshops. As the topic connotes it is a world-wide phenomenon in which the Earth's surface is gradually being heated up due to some natural and man-made actions. The gradual temperature rise that ensued warms up the earth and causes vital climatic variations across the globe. This paper reviews the climatic changes and conditions with their impacts and implications in Nigeria. Possible remedies as panaceas to minimize further warming have been suggested.

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INTRODUCTION

Global warming and Climate change has been one of the current topics in popular discourse within the scientific circle in recent time. No day passes without any commentary, reference, inference, implication or illustration on this all important subject, both locally and globally. Global warming refers to an overall increase in the temperature of the Earth's atmosphere and oceans caused by emission of certain gases. Several scientists nurse the belief that human activities here on Earth are some of the primary causes of global warming which may have devastating consequences on the climate and the environment. Apart from man-made influences, there are some geophysical processes that underlie global climate systems which are complex and not fully understood. In the same vein, climate change of global extent would require a considerable raising and lowering of temperature sustained over many years (Shaw, 1994). Such dramatic changes would have a range of effects on existing climatic regions. Experience of the past changes suggests the middle and high latitudes (Nieuwolt, 1977) suffer the greatest modifications in general climatic conditions. The recent concern over man-made changes in the composition and structure of the Earth's atmosphere (Scheidegger, 1976; Shaw, 1994) (Fig.1) and the increasing ability to model changes in climate has led scientists to study the dynamic components or factors contributing to climate as distinct from current weather.

Consideration of these factors has helped in making climatic projections of atmospheric, hydrological, agricultural, vegetative and other useful models that could have practical applications for developing countries like Nigeria (ICTP, 2009). It has been established by researchers and scientists using instrumental records that there has been global warming and climatic variation/fluctuation in the past few decades. The variability of this world climatic system can be observed from Figures 2-4. Also, as a global phenomenon, evidences do abound within the West African sub-region vis-à-vis Nigeria – a typical third world country. Thus, it is a general notion that the earth is warming which may give rise to some unpleasant consequences to man in future if nothing is done (Awake, 2008; Houghton, 1984). The main aim of this short treatise is to highlight the causative factors that enhance global warming and its consequent climate variation with some suggested panaceas for possible remedies.

WHAT CAUSES GLOBAL WARMING?

The Greenhouse effect

Scientifically, one of the major reasons adduced for these changes is the intensification of the greenhouse effect. The greenhouse gases (GHG) is the problem emanating from gradual rise in temperature of the Earth's atmosphere caused by an increase of gases such as carbon dioxide in the air surrounding the Earth which trap the radiant heat of the sun. It is a natural phenomenon very vital for life on our planet earth. When the radiant energy from the sun falls upon the Earth,

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about 70% of it is absorbed which heats up the air, land and sea. But for this mechanism, the average surface temperature of the earth would be much lower than what it is. Eventually, the absorbed heat is released back into space as infra-red (IR) radiation, thus preventing the earth from over-heating. However, when pollutants change the composition of the atmosphere, less heat escapes and thus; causes the earth's temperature to rise.

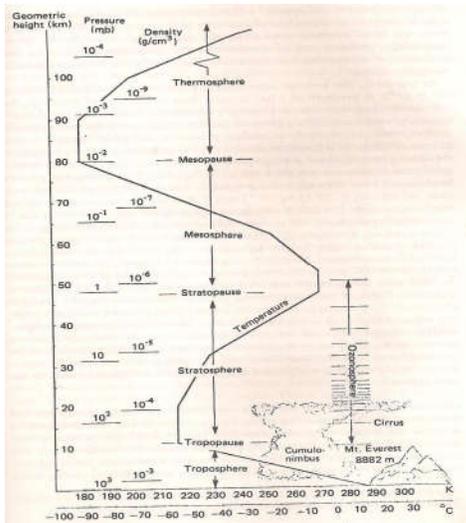


Fig.1. Structure and composition of the atmosphere

The Industrial Revolution

The era referred to as the Industrial Revolution in Europe and United States (18th and 19th Centuries) witnessed the use of machines in doing work (manufacturing). Exhaust gases fuming from those machines contribute to the GHG which include carbon dioxide, nitrous oxide, sulphur dioxide, hydrogen sulphide, methane and water vapor. Recall that the use of fossil fuels like coal, oil and gas produce large volumes of these exhaust gases into the atmosphere whose concentration has increased markedly since the start of the industrial revolution for over twenty-five decades now.

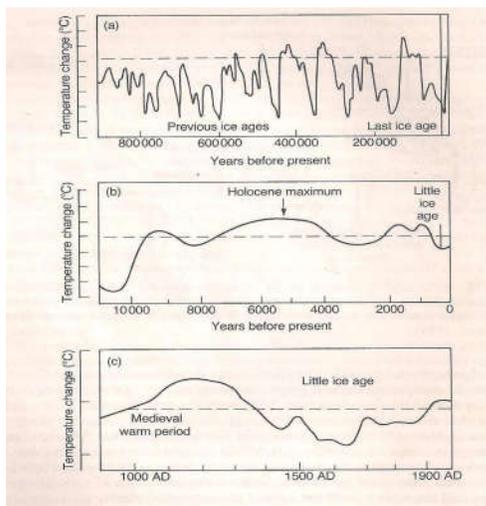


Fig.2. Schematic diagrams of global temperature variations since the Pleistocene (a) the last million years (b) the last ten thousand years (c) the last thousand years.

Human activities

Another greenhouse-enhancing factor appears to be the rising population of farm animals whose digestive processes produce methane and nitrous oxide continuously. This is human activity as we rear livestock to produce food. Other human activities are all the actions we take, directly or indirectly, knowingly or inadvertently, to degrade our environment (Moutgomery, 2000; Chukwu, 2008). These include deforestation, bush-burning and hunting, dumping of toxic materials and depletion of the ozone layer. Aerosol of natural and anthropogenic origins needs be mentioned, too. Their effects (i.e. aerosols and gases) can be either long- or short-lived. While short-lived aerosols absorb and reflect radiation and decrease temperature, the long-lived gases trap the radiation and cause increase in temperature. We can as well add increase in human population and man's insatiable desires.

Solar activity

Temperature variation is one other important factor worth mentioning as its fluctuations occasioned by sunspots and solar flares correlate with fluctuations in solar energy output. As this solar activity progresses it causes temperatures to vary significantly within the Earth's surface and atmosphere (Lowrie, 1997).

Table 1. Atmospheric gases due to human activities

	<i>Carbon dioxide</i>	<i>methane</i>	<i>nitrous oxide</i>	<i>CFC-11</i>	<i>CFC-12</i>
Concentration by volume (1750-1800)	pp10 ⁶	pp10 ⁶	pp10 ⁶	pp10 ⁹	pp10 ⁹
1990	280	0.8	0.288	0	0
Current increase/yr	353	1.72	0.310	0.280	0.484
Life time years	0.5%	0.9%	0.25%	4%	4%
	50-200	10	150	65	130

Source: Houghton *et al.*, 1990

The Earth's rotation and revolution are two motions which also have some effects on the global climate. As the earth moves in cycles that take many years to complete round the sun, it affects the planet's distance from the sun since the orbital path is not a perfect circle or sphere. There is also the influence of volcanic dust (Moutgomery, 2000), changes in magnitude and direction of oceanic currents, etc.

IMPACTS AND IMPLICATIONS

Several climatic and environmental conditions we have not witnessed before have been taking place within the past few decades. For instance, the "August Break" (a two- or three-week spell of dry weather) we used to observe during the rainy season has ceased to exist, there is extinction of some certain plant and animal species, the usual period and duration of harmattan have changed, high temperature and ocean rise have been recorded. In Nigeria some streams/rivers have dried up, pattern of rainfall changed (Audu *et al.*, 2007; Ayoade, 1988; Ogolo and Falodun, 2007), and desert encroachment in the northern part of the country while devastating gully erosions and flood in the south are observed. Incessant production of GHG, depletion of the ozonosphere with fully-halogenated chlorofluorocarbon (CFC) produced by manmade activities

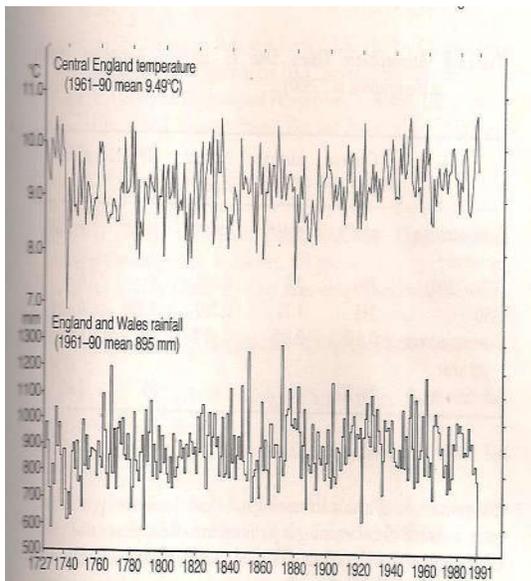


Fig.3. Temperature and rainfall fluctuations in the UK since 1727.

and others are still going on (Chukwu, 2008). From Fig.4 it can be seen that the concentration of carbon dioxide in atmosphere has been on the increase starting from the era of the industrial revolution and it is assuming an unprecedented astronomical increase within the new millennium. It is also pertinent to note that CFC's were not present in the atmosphere by 1940 (Fig. 4) yet it is rapid and increasing concentration is alarming (Houghton *et al.*, 1990). There have been reported cases of severe and catastrophic weather conditions across the West Africa sub-region and the globe as a whole. Table 2 shows a few of the disasters in 2007 alone.

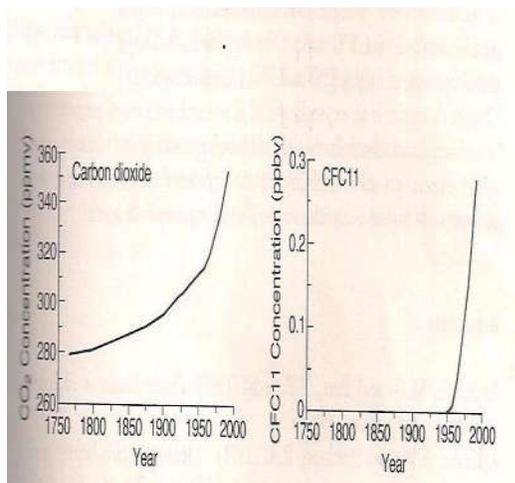


Fig. 4. Concentration of carbon dioxide and CFC 11

(Note rapid increase of CO₂ by 1950 and emergence of CFC after 1940) (from Houghton *et al.*, 1990).

Remedies

Having known what global warming is all about, having been acquainted with some of the causative factors and the possible consequences to our earth and humanity, some thought-provoking questions come up: ‘What do we do?, Do we watch our global habitat to be in grave peril or proffer solutions to

the prevailing problem?’ The latter is a more auspicious option, so we must do something. We begin by creating serious awareness through well-articulated campaigns and education towards sustainability of our environment. Adopting plausible scientific measures to reduce to its barest minimum the activities that could degrade our earth, accurate forecasting and predictions are necessary with some other measures. Our policy-makers should come up with a well-tailored program to tackle the issues bordering on climate change to include mandatory limits on fossil-fuel emission, sanctions to offenders, better alternative energy sources, etc. To this end, the recent research initiatives by different bodies and organizations relating to this problem need be commended. Specifically, the recent efforts by Intergovernmental Panel on Climate Change (IPCC) towards projections of global warming and regional climate changes using sophisticated climate models to determine temperature trends and other climate variables is highly commendable; IPCC met with reports in 1990, 1995, 2001, 2004 and 2010. In the same vein, the Earth System Physics (ESP) section of International Centre for Theoretical Physics (ICTP) in Italy is using the laws of physics, climate data; natural phenomena that influence climate to develop the Regional Climate Model (RegCM) which could enable us zoom in on specific regions of the globe and obtain fine-scale information. This is important because climate varies drastically from region to region or even within the same region (ICTP, 2004; Shaw, 1994; ICTP, 2009). These research efforts should be applauded.

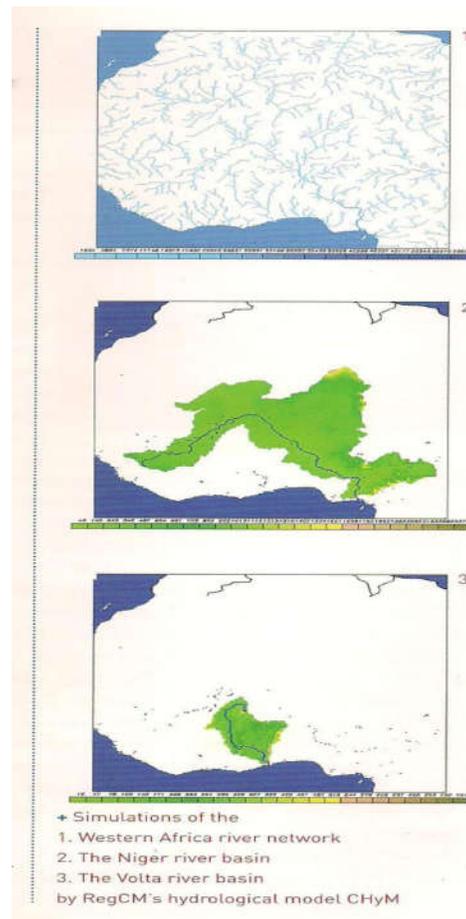


Fig.5. Typical regional models developed by ICTP

The existence and issue of global warming have been scientifically established as real. Our Earth is a system which requires a certain measure of stability. When considerable stress is applied on it by a number of factors like climate change, increasing temperature trend, environmental abuse, etc its stability may be affected and as such the overall stable ecosystems may be disorganized, thus resulting into series upheavals mankind experience today. As we have observed most of the causes that bring about global warming are man-made. For instance, a closer look at Fig.4 shows that the production of CFC whose emissions destroy the ozone-layered shield of the stratosphere allows the lethal ultra-violet (UV) radiation to fall on the Earth's surface penetrating the troposphere (Fig.1). The sharp trend of the graph (Fig.4) depicts that much destruction has been inflicted on the protective cover (ozone layer) which started about sixty years ago. One thing is certain, we can reduce this rate if we are determined to do it. The same thing applies to generation of carbon dioxide, its rate of concentration in part per million volume in the atmosphere is very alarming (Table1). Also, Figures 2 and 3 show us typical temperature and rainfall variations for many years up to the present. This shows that we could acquire a lot of data which when incorporated with the laws of physics, other climate data and natural phenomena that influence climate (Fig .5), our scientists could be able to evolve reliable regional and local climate models for forecasting and prediction. This is exactly what is happening at ICTP- Italy and other places (ICTP, 2009). The data in Table 2 are weather-related records in 2007 alone. Between 2007 and now more climatic/weather disasters of greater magnitude had taken place which impliedly suggests that greater debasement had been inflicted on our earth within this short period. This calls for more serious attention. More devastating weather reports keep coming everyday from China, Pakistan, Nigeria (Sokoto/Kebbi States), India, etc.

Conclusion

Having outlined the causes and impending consequences of global warming of our earthly habitat, it is pertinent for man to reduce very drastically those activities that can aggravate global warming. To achieve this we should address our mind and ruminate over the root causes of the earth's problems which include human greed, self-interest, ignorance, inept government, illiteracy, poverty and apathy. Our earth's life-sustaining environment is being gradually degraded by pollution, deforestation, urbanization, large-scale combustion, and extinction of flora and fauna species, to mention but a few factors. We should stop or minimize such activities that are inimical to global warming. In the light of climatic models and predictions, some certain measures should be taken through good policy-making and legal framework.

These must include mandatory limits on fossil-fuel emissions, penalties for offenders, introduction and involvement of more environmentally friendly technologies like solar energy. When once these anti-environmental measures are checked and controlled, the rate of global warming and climate change will reduce, at least to a much lower tolerable level.

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