
Federal University of Technology, Minna

*"METEOROLOGY*
*A Cornerpiece for Nation Building"*

# Weather events, Climate Variability and CHANGE in relation to NEEDS and MDGS. 'Problems and Prospects of the Nigerian Economy'

# *INAUGURAL LECTURE*

*BY*

Daniel Oladele Adefolalu, B.Sc, M.Sc, Ph.D; FNMS

*(Professor of Applied Meteorology).*

*Inaugural Lecture Series 9*

*23rd November, 2006*

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# 'A People without Information..... .....is dead'

# (Afghan-farmer CNN, 2000)

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# "METEOROLOGY
# A Cornerpiece Environmental Science For Nation Building"

## PROLOGUE

Since World War II the meteorology of West Africa has continued to receive attention for many reasons. The War turned Africa into a "recruitment-ground" for support commands and necessitated airlifting of men and materials which required weather briefs for pilots. The weather of the sub-region was closely monitored resulting in the first and (up-to-date) most comprehensive treatise by Hamilton and Archbold (1945). Thus and unfortunately, the importance of meteorology to aviation led to partial efforts in bringing out the -full benefits of meteorological service to countries in West Africa and for many years, most (if not all) national weather services offered no other useful contributions to nation building. It is however to be observed that 'de-emphasis' of Aviation is perhaps contributory to the demise of the Industry in Africa which has only 4% of Aircrafts but accounts for over 25% of global air crashes. Nigeria has had more than her quota of this misfortune in the last 12months with the commercial planes, one private and one military crashes with incredible high profile losses. As AVIATION EXPERT under the Medium Term Sector Strategy (MTSS) by the new Reform Agenda, it was clear from the shopping list from all sub-section in Aviation that a lot need to be done.

The severe drought of 1969 to 1973 which came to a climax in 1972 /1973 seemed to have posed a challenging question in relation to the relative weighting of the different aspects of services that meteorological Departments can and should offer. Meetings of Heads of Governments, especially in the Sahel since that catastrophic episode (which still linger on) have culminated in a call for better understanding of the Weather and Climate and its variabilities as they affect the livelihood of the people in the sub-region in particular and Africa in general. That Drought caused hundreds of thousands of death of man and livestock but perhaps did not 'draw' as much attention as one or two plane crashes.

It is an important turn-around by Governments which, hitherto, had been very lukewarm when it comes to meteorology. In 1991 the African Centre for Meteorological Applications for Development (ACMAD) was

established in Niamey-Niger by the World meteorological Organisation (WMO) and the Economic Commission for Africa (ECA) at the instance of the Ministerial Council of the Organisation of African Unity (OAU).

Having realized, howbeit belatedly, the potentials of meteorological research in national development, the various Governments would wish to see a continuity in the diverse efforts in various places and at varying levels of sophistication in order to ensure a rapid rejuvenation of economic development in the era of Climate Change. Prior to this, the West African Monsoon Experiment (WAMEX) during the first GARP Global Experiment (FGGE) was conducted in 1979 to bridge the gap between observational and climatological approaches during Pre- Global Atlantic Tropical Experiment (GATE) and the synoptic dynamic and Numerical Modelling research efforts since GATE-1974. Anew 'Experiment' is now being developed by the WMO known as THORPEX to rise to the challenges of severe weather episodic events. We have been invited to take part in THORPEX Africa.

In this Lecture, a brief review of the "State of the art" prior to WAMEX is first given. Then the scientific breakthroughs emanating from research in comparison to other findings are highlighted in Sections Three and Four. The next section of the paper deals with major observational studies, diagnostic results and numerical modeling, respectively. What next? This is sketched out as the concluding remarks.

## 1.0 METEOROLOGY

### 1.1 Definitions and Explanations

**"Then God commanded, "Let lights appear in the sky to separate day from night and to show the time when days, years and season begins" (Genesis 1[14])**

METEOROLOGY is the physical and chemical science of the atmosphere (Gr. meteora and logos, the science of things above of the things in the air). The subject, which is a branch of geophysics, comprises the study of the whole atmosphere but, for practical and observational reasons, weather and climate have been largely concentrated, on the processes in the lowest 10-15 km, which give rise to weather. By creation of lights (sun and moon)

and the energy released by the sun to the atmosphere is characteristically in motion at all points, and its properties are always changing. This sequence of change constitutes WEATHER a term often but not necessarily referring to the atmospheric changes directly apprehensible be man. The quantitative study of the sequence of change is the subject matter of physical, dynamic and synoptic meteorology.

The observations on which synoptic charts are based are made by standardized procedures of Instrument meteorology. Subjecting the data to rigorous mathematical manipulations based on the physical laws of motion and thermodynamic principles call for assumptions and approximations for them to be applicable to other branches including:

- Atmospheric acoustics dealing with propagation of sound through
t he atmosphere
- Atmospheric electricity the study of electric field, currents (lighting), space charge and charge separation.
- Atmospheric optics covering optical reflections, refractions, in addition to scattering phenomena: mirages, rainbows, halos, sky colours, etc.
- Radio meteorology which, apart from being a tool, is concerned with the effect of the troposphere as the propagation of radio waves or pulses. In his doctoral work, Oyedum (2005) demonstrated the poor information technology performance in Nigeria and related it to lack of adaptation of measures to neutralize the effects of degrading and attenuation of signals by thunderstorms and rain, respectively.

This lecture deals with physical, dynamic and synoptic meteorology including aspects that are responsible for weather events and climate variability and change which are current issues of national and international concerns.

### 1.2 Historical Background

***"Who is wise enough to count the clouds and tilt them over to pour out the rain----?" (Job 38[37])***

Weather has been of primary concern to mankind for all times. Biblical stories of NOAH's flood, Drought and famine in Pharaoh's Egypt and others during King Solomon's reign while the life and times of Elijah, Ezekiel and the rest prophets 'told' vividly 'established' the Quasi regular famine episodes.

Aristotle and his student Theophrustus (380-300 BC) were the first to document treatises in meteorology. But for another 2000 years, no breakthroughs were recorded due to lack of instruments to make sustained observations and meteorology did not become a systematic science until Galileo invented the Thermometer in 1607, Evangelist Torricelli the Barometer in 1639 through which Lavoisier (1783) and Dalton (1800) made observations to explain the behaviour of atmospheric air and variations of water vapour, respectively-thus marking the beginning of physical basis of modem meteorology.
The 'arrival' of synoptic charts signaled the beginning of weather forecasting and by 1853 through 1990, during which the International Meteorological Organisation (IMO) came into being, the understanding of atmospheric behaviour had became clearer through analyses of pressure level charts of winds, temperature and geopotential heights by the famous Norwegian scholars. Establishment of upper air networks after World War II in 1945 and rockets, aircrafts and weather Satellites in the 50s into the 60s hastened the evolution of Forecasting.

Since those early achievements (only 130 odd years ago) improved Information Technology has moved the world from synoptic to Numerical Weather Prediction and with the advent of super computers, Global General Circulation (Prediction) models have enabled Climate models which could not have come at a better time for 'modelling' of Climate Change and current world-wide disasters associated with its impact.

### 1.3 *21st Century Meteorology And Future*

***"Now then; these are all one people and they speak one language: this is just the beginning of what they are going to do (of men who built the tower of Babel). Soon they will be doing anything they want! Let us go down and mix up their language so that they will not***

*understand one another"*
*(Genesis* $11^{6-7}$).

### 1.3.1 Climate Change Defined

Climate Change, as defined in the United Nations Framework Convention on Climate Change (UNFCCC), is

> ***"a change of climate which is attributed directly or indirectly to human activity that alters the composition of global atmosphere and, which is, in addition to natural climate variability observed over comparable time periods"***

Man woke up to Climate Change in the new Millennium not knowing what to make of Global Warming and its Consequences. Decades of research notwithstanding, there was (and still are) misgivings as to the definition of Climate Change and who should do what to ameliorate a dangerous trend on impacts of effects of the Change. Nations are still divided on the Instrument- the Kyoto Protocol-to implement the United Nations Convention on Climate Change although they are in agreement on the most Vulnerable Countries (or areas) which in accordance with Article 4.8 and 4.9 of the Convention, include

a. Small Island Countries.
b. Countries with low-lying coastal areas.
c. Countries with arid and semi-arid areas liable to forest decay.
d. Countries with areas prone to natural disasters.
e. Countries with areas liable to drought and desertification.
f. Countries with areas of high urban atmospheric pollution.
g. Countries with fragile ecosystem, including mountainous ecosystem.
h. Countries whose economics are highly dependent on income generated from oil production processing and export, and/or consumption of fossil fuels and associated energy-intensive product.
i. Land-locked and transit countries.

Article 4.9 States where Response measures will adversely affect the