

NIGERIA

INTRODUCTION

Environmental problems emanating from ozone depletion and other sources have always been of great concern to the government and people of Nigeria. As the regional and global atmospheric pollution problems continue to assume a wider dimension, putting a high population at risk and seriously threatening the ecosystems, various programmes have been embarked upon in Nigeria to address these problems. Succeeding governments have implemented existing policies on environmental issues and formulated new ones in line with global programmes designed for the achievement of a friendly and sustainable environment. This commitment to environmental issues by the government led to the signing and ratification of the Montreal Protocol on substances that deplete the ozone layer by Nigeria on the 31st of October, 1988.

Monitoring and research on ozone, UV radiation and related atmospheric constituents are carried out by different institutions in Nigeria. The aim is to support government policies on environment and thereby contribute positively to the implementation of the Vienna Convention for the protection of the ozone layer and its Montreal Protocol, as well as the United Nations Conference on Environment and Development in 1992 which emphasized the need for global understanding and proposed corrective actions in several areas of global environmental change, among them the effects from changes in the ozone layer. The increasing involvement of these institutions has greatly enhanced the development of the national programme on ozone monitoring and research in Nigeria.

MONITORING OF GAW PARAMETERS:

The monitoring of total column ozone and other atmospheric constituents under the auspices of Global Atmosphere Watch (GAW) programme of WMO started in Nigeria in 1993 with the establishment of a GAW station each in Lagos (Latitude 06°36'N; Longitude 03°26'E; Elevation 10m) and Oshogbo (Lat. 07° 47'N; Long. 04° 29'E; Elevation 304.5m) by the Nigerian Meteorological Agency (NIMET) which was then known as Department of Meteorological Services in the Ministry of Aviation.

Total Column Ozone

The GAW station in Lagos measures total column ozone and it is the only such station in Nigeria. Subject to the state of the atmosphere, daily routine measurements up to a maximum of ten observations are made with the Dobson spectrophotometer #5703 (Shimatzu type). Total ozone measurements are archived in the database of NIMET in Lagos.

Other GAW and Related Parameters

When the Oshogbo GAW station was established in 1993, a number of parameters were being measured as shown in table 1. However, due to factors which include non-regular calibration of the instruments, non availability of spare parts and essential consumables, some of these parameters are not being measured currently. Efforts are being made to resuscitate the station for effective operation under the expansion of GAW programme by NIMET.

UV Measurements:

Apart from the GAW stations in Lagos and Oshogbo, NIMET has commenced measurements of surface UV-B and Solar radiation at several locations in Nigeria. The automatic weather stations that measure these parameters and some meteorological variables were set up as part of the implementation of the Agency's programme on studies relating to the effects of UV-B on human health and the ecosystems. The UV is measured with silicon photodiode sensor.

Table 1: Parameters measured at GAW station, Oshogbo.

Parameter	Instrument
Surface Ozone	UV-Photometric Ozone Analyzer
Aerosols	Improved module aerosol sampler
UV_B Radiation	Kipp & Zonen Pyranometer
Total Radiation	LI-COR Silicon Pyranometer
Diffuse Radiation	Kipp & Zonen Pyranometer
Incident Radiation	Kipp & Zonen Pyranometer
Net Radiation	PH Schenk Net Radiation Sensor
Atm. Turbidity	Mainz 11 Noll Sun Photometer
Precipitation Sample	Aerochem Metric ppt. collector

It is expected that in the near future the range of UV index measurements across the country would be evaluated and that could form a basis for developing a programme on early warning system for the general public on UV-B exposures in Nigeria.

Air Quality/Air Pollution Monitoring:

A number of institutions are engaged in the monitoring and research needed to improve the understanding of ozone issue and other trace gases in Nigeria. For instance, the Obafemi Awolowo University (OAU) set up an automatic air quality monitoring station in Lagos in 1991. The station measures trace gases mixing values including surface ozone at 10 metres height. Also, the Atmospheric Research and Information Analysis Laboratory (ARIAL) of the Centre for Energy and Development of the same university has recently engaged in the assessment of available satellite data for stratospheric and tropospheric ozone over Nigeria. This is intended to be used to provide the trends and spatial resolutions forecast of these parameters over Nigeria. NIMET collaborates with OAU and some other institutions on issues relating to the protection of the ozone layer, impact of UV-B on human health and the environment in general.

Calibration/Intercomparison

Our Dobson spectrophotometer is calibrated (mercury lamp and standard lamp tests) every month and the calibration data are documented. The instrument has also successfully participated in two international intercomparisons organized by WMO for all the Dobson instruments operated in Africa. These took place in Pretoria, South Africa in 2000 and Dahab in Egypt in 2004.

TRENDS IN TOTAL OZONE AND SURFACE OZONE

Figure 1: shows trend in total ozone in Lagos from 1993 – 2004, while Figures 2-5 show surface ozone on selected days at Oshogbo.

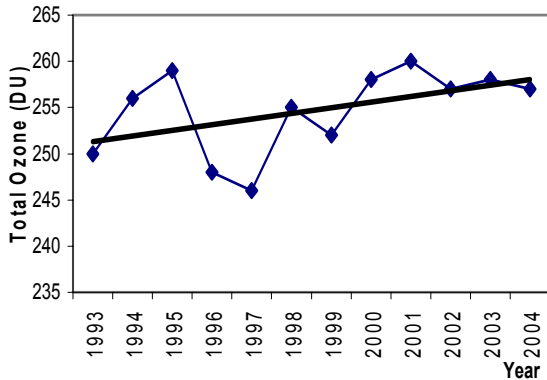


Fig. 1: Total Ozone in Lagos (1993 - 2004)

ONGOING STUDIES AND RESEARCH INTERESTS

Total column ozone and UV-B radiation observations by NIMET are not yet sufficient for comprehensive studies. However, a number of studies are being carried out using available data. These include:

- Diurnal variation of total ozone in Lagos
- Relationship between total ozone and some meteorological variables in Lagos
- Seasonal variation of total ozone over equatorial belt
- Influence of stratospheric ozone on local weather
- UV-B trends in Nigeria
- UV-B daily forecast in Nigeria
- Effects of UV-B on human health and ecosystems.

Recent Papers

Various investigations are at different stages. However, some presentations have been made at conferences, symposia, seminars and workshops in recent times. They include:

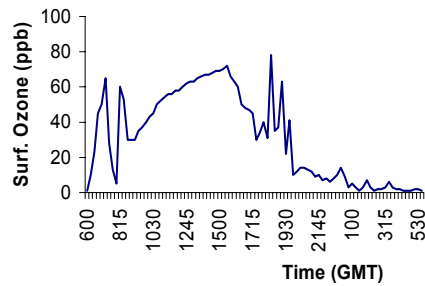


Fig. 2: Surface Ozone at Oshogbo on Dec 23/24 1993

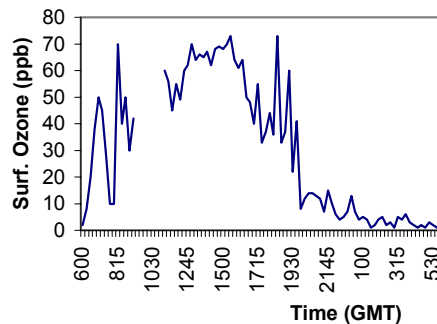


Fig 3: Surface Ozone at Oshogbo on Feb. 15/16, 1994

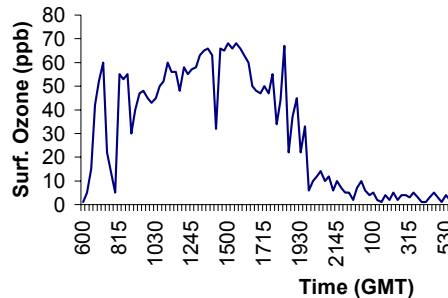


Fig. 4: Surface Ozone at Oshogbo on Nov 5/6 1999

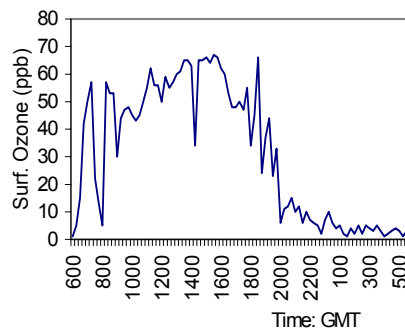


Fig.5: Surface Ozone at Oshogbo on Oct.10/11,2000

- Measurement and variation of total ozone in Lagos, Proc., 12th and 13th Departmental Symposia, 1997, pp.40-49
- Scientific assessment of total column ozone over Lagos, Nigeria, Proc., Int'l Conf. on Sustain Africa, 1995, Vol 4, pp26-29
- Meteorology and Air Pollution Monitoring in Nigeria, Presentation, Conf. on Air Quality Monitoring and Management, 2002.

DISSEMINATION OF RESULTS

Submission of data to WOUDC

Total ozone data measured in Lagos are transmitted monthly to the World Ozone and Ultra-Violet Data Centre (WOUDC) in Toronto, Canada. As at the time of preparation of this report, the latest total ozone data from Nigeria in WOUDC are for the month of June, 2005.

Public Awareness Campaign on Ozone Issue:

In Nigeria, priority attention is given to public awareness campaign on the consequences of a depleted ozone layer. Various activities are regularly organized by NIMET to sensitize the general public on the need to protect the ozone layer. Since 1997, NIMET has been observing the International Day for the Preservation of the Ozone Layer on the 16th of September each year. Activities during such occasions in the past included press release by the Director-General/Chief Executive Officer of NIMET on the state of ozone in Nigeria and the Global Update of the Ozone Layer, public lectures on ozone in relation to the health, socio-economic and industrial sectors, poster sessions on ozone issue, quiz competitions among secondary school students on ozone and the environment, etc. Policy makers, industrialists, scientists, students, the press and the grassroots are usually involved in activities. Indeed the awareness programme is yielding the desired results in Nigeria. The series of lectures on ozone day in the past will be published and made available to the public during this year's ozone day observation. Titles of past public lectures on ozone day are stated below:

- Can man rebuild the ozone layer he destroyed in order to save the earth?, 1999 Osaghaede, S.E.
- Public awareness on ozone issue for the benefit of man, 2000, Osaghaede, S.E. and Muyiolu, S.K.
- The ozone issue and socio-economic life: the past, present and future, 2001, Nnodu, I.D.
- Is ozone monitoring and research beneficial to man?, 2003, Obioh, I.B.
- Extending lives of humans, animals and plants through ozone monitoring, 2004, Abu, A.

IMPLEMENTATION OF THE MONTREAL PROTOCOL

It is pertinent to state here that since Nigeria signed and ratified the Montreal Protocol on substances that deplete the ozone layer, the government has taken a number of actions towards the protection of the ozone layer and the environment in general. Some of these actions include:

- Control of environmentally harmful substances such as CFCs and Halons known to deplete the ozone layer
- In the refrigeration and air-conditioning sectors, old technologies are being replaced with state-of-the-art ozone-friendly alternatives as part of efforts to implement the phase-out of Ozone Depleting Substances (ODS).
- Banning of importation of used refrigerators and freezers.

FUTURE MONITORING AND RESEARCH PLANS:

There is a deliberate plan by the government of Nigeria to continue to encourage and carry out monitoring and research that will improve the understanding of ozone issue and thereby contribute positively to the regional and global efforts towards the protection of the ozone layer and sustainability of the environment. The Nigerian Meteorological Agency is spearheading this course and with adequate funding by local and international organizations, the agency will vigorously pursue the following programmes:

- Continuation of Total Ozone and UV-B radiation measurements.
- Increase in network of GAW stations for the monitoring of total ozone, surface ozone, greenhouse gases, UV-B radiation, solar radiation, acid rain, etc.
- Measurement of ozone profile with Dobson spectrophotometer and other methods.
- Daily UV-B radiation forecast for Nigeria.
- Effects of increased UV-B on human and animal health, as well as the ecosystems.
- Continuation of awareness campaign on ozone and related issues.
- Increased collaboration with local and international organizations on ozone and related issues.

NEEDS AND RECOMMENDATIONS

In order to facilitate the ongoing and planned ozone, UV radiation monitoring and research programmes in Nigeria, assistance will be needed in the following areas:

- Expansion of total column ozone measurements. This will involve among other things, acquisition of Brewer spectrophotometer and other modern instruments.
- Acquisition of instruments for ozone profile measurement.
- Expansion of our UV-B and solar radiation monitoring network.
- Regular calibration of instruments especially in the developing countries to ensure high quality data for research and other purposes.
- Training of personnel to enhance professional competence in monitoring, data processing and research especially in the developing countries.
- Provision of spare parts and essential consumables.
