SOUTH AFRICA

INTRODUCTION AND OBSERVATIONAL ACTIVITIES

The South African Weather Service (SAWS), an agency of the Government Department of Environmental Affairs and Tourism, is the national focal point of ozone monitoring and research activities in South Africa. These activities are greatly enhanced by collaboration with a few centers involved but mainly the Universities.

The ozone monitoring and research activities are conducted within the context of the World Meteorological Organizations (WMO) Global Atmosphere Watch (GAW) programme. The Global Atmosphere Watch component of the South African Weather Service (SAWS), as part of its Public Good Service, are conducting certain specialized atmosphere monitoring and research services for the Department of Environmental and Tourism Affairs (DEAT), in order for the Department to fulfill its national, regional and international obligations. The Department has the responsibility for implementing the Montreal Protocol and facilitates the coordination role with industry. South Africa is dealing effectively with its commitments under the Protocol.

The depletion of the stratospheric ozone layer, increases in troposphere ozone, higher levels of acidity in rain, rising carbon dioxide and methane concentrations, and changes in the radiative balance of the earth-atmosphere energy system - all reflects the increasing influence of human activity on the global atmosphere, the life-support system of planet Earth. Environmental issues and policy matters have to play a pivotal role in meeting the developing needs and challenges of the people in a new democratic South African Society. Clauses in protecting and respecting the environment in a sustainable context, is embedded in the South African Constitution.

Worldwide it is proven that sustained systematic observation only survives under the auspice and responsibility of a Government. More and more of these specialized environmental monitoring activities are shifted towards the responsibilities of National Meteorological Services. This is undoubtedly a core service resulting from international agreements undertaken by government of the Republic of South Africa.

Figure 1: Regional Networks.

CAPE POINT, GLOBAL GAW STATION – TRACE GASES
IRENE AND SPRINGBOK – OZONE DOBSON # 89 AND # 132 (IRENE SHADOZ SITE)
DE AAR - BSRN STATION - SOLAR RADIATION
NATIONAL UV-B REAL TIME MONITORING NETWORK

Column measurements of ozone and other atmospheric variables

The first South African column ozone measurements were made during 1964 until 1972 with Dobson #089 operating from Pretoria. Reinstating South Africa's commitment to the Vienna Convention, the Weather Service now operates two Dobson ozone spectrophotometers, #089 at Irene near Pretoria (25.9 S, 28.2 E) since 1989, and #132 at Springbok (29.7 S, 17.9 E) since 1995. Both these instruments have been regularly calibrated with reference to the world standard.

A WMO/GAW International Comparison of Dobson Spectrophotometers (SAWB2000IC) was organized by the World Meteorological Organization and the South African Weather Service in close cooperation with the USA National Oceanic and Atmosphere Administration's Climate monitoring and Diagnostics Laboratory (NOAA/CMDL). This first Africa, WMO Region-I Intercomparison event was conducted in Pretoria from 18 March – 10 April 2000. In addition the Czech Republic Hydro meteorological institute continued to provide expert assistance to southern African training of Dobson operators.

The South African Dobson observation programme includes daily total ozone measurements (mostly high quality direct sun observations), and weekday Umkehr observations during sunrise. On average 500 total ozone readings per month are collected, and weather permitting between 10 and 15 Umkehr measurements. Final Umkehr results are still hampered by the inadequate knowledge that exists within our institution and collaboration partners are seeked for assistance.

Since November 1998, the Weather Service has been fortunate to reinstate its ECC RSG80-15GE Ozonesonde sounding programme, which operated during the period 1990 until 1993. Weekly ozonesonde soundings are conducted. This data is shared with the Southern Hemisphere Additional OZonesondes (SHADOZ - http://croc.gsfc.nasa.gov/shadoz/) programme from NASA, USA, which also is submitted to WOUDC. Since 2000, the Irene ozonesonde station was officially accepted into the SHADOZ network. The Irene Ozone Launching programme also now forms part of the AURA validation of OMI/TES and data after each launch is submitted in near real time.

Surface ozone measurements are undertaken at Cape Point since 1982. Our programme has also extended surface ozone measurements to the South African National Antarctic Expedition Base (SANAE IV) in Antarctica since December 2003. The SAOZ instrument which operated at SANAE during early 1990's, has be refurbished at LSCE, CRNS, France and it is expected to be re-instated at SANAE in December 2005.

Other gases and profile measurements

The pristine location of Cape Point (34.3S, 18.5E) enables measurements to be made in air that has passed over the vast clean Southern Ocean. Such long-term observations are representative of background conditions, making it possible to detect changes in the atmospheres composition. The Cape Point GAW Laboratory is also scientifically twinned with a research partner, namely the Fraunhofer Institute for Atmospheric Environmental Research (IFU) in Garmisch, Germany, now IMK-IFU (Forschungszentrum Karlsruhe).

Measurements include a wide range of parameters namely: - surface O_3, gases which lead to stratospheric ozone depletion such as: $CFCl_3$, CCl_2F_2, $CCl_2F\text{-}CClF_2$, CH_3CCl_3, CCl_4 and N_2O, greenhouse gases in the troposphere such as CO, CO_2, and CH_4. UV-A and UV-B and global radiation (total and diffuse) are also measured as well as the normal surface meteorological parameters. Radon measurements to assist with the classification of air masses arriving at Cape Point, have been successfully established over the last five years. Regular scientific audits from EMPA, Switzerland for surface O_3, CO and CH_4 have been successfully conducted over the past seven years. Last year, the WCC-N_2O (IMK-IFU and Umweltbundesamt) conducted and audit for N_2O at Cape Point.

Ultraviolet-B measurements

Since January 1994 the Weather Service has maintained a routine programme for monitoring erythemally weighted UV-B radiation at Cape Town (34.0S, 18.6E), Durban (30.0S, 31.0E) and Pretoria (25.7S, 28.2E), De Aar (30.7S, 24.0E) and Port Elizabeth (33.9S, 25.5E). The equipment used in this network is the Solar Light Model 501 Robertson-Berger UV-Biometer. The programme was motivated by and in collaboration with the School of Pharmacy at the Medical University of Southern Africa (MEDUNSA), near Pretoria.

Since December 2001, the UV-Biometers are directly linked on the Services wide area network, and available in real-time on the SAWS WWW-site. UV-B forecasts are also issued for the Cape Town, Durban and Pretoria-Johannesburg metropolitan areas since 1 December 1997. The main purpose of the UV-Biometer network is to make the public aware of the hazards of excessive exposure to biologically active UV-B radiation, and it contributes to the schools awareness programmes for education. Regular enquiries from scholars are dealt with to satisfy their need to acquire more ozone and ultraviolet radiation knowledge. Two UV-B narrow-band (~306nm) Kipp & Zonen sensors are located at the two Dobson sites to investigate possible trend correlation between ultraviolet radiation and total ozone. Great strides have been made to develop our own numerical weather predictions outputs for UV indices. Celebrations around 16 September, each year, usually focuses to create public awareness. Once a year on this day it is also dedicated to the hard working ozone observers and technicians gathering the measurements.

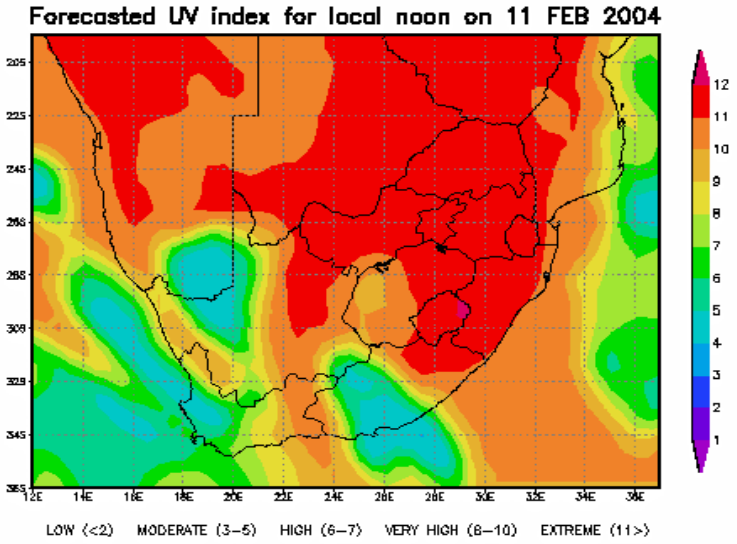

Figure 1: SAWS Numerical Product Developed for UV Index forecasting with cloud cover.

Calibration activities and data submissions

All primary ozone and trace gas data are submitted regularly to WMO recognized World Data centers. Dobson column ozone is submitted to WOUDC, Toronto, Canada. Since the inception of the Dobson Programmes these instruments have been internationally calibrated through inter-calibration campaigns as supported by WMO. The next all-African Dobson calibration is scheduled to take place in South Africa during 2008, currently recognized as an unofficial Regional African Calibration Centre.

Regular scientific audits from EMPA, Switzerland for surface O_3, CO and CH_4 have been successfully conducted over the past seven years. Last year, the WCC-N_2O (IMK-IFU and Umweltbundesamt) conducted and audit for N_2O at Cape Point. Next laboratory calibrations are scheduled for September 2006. The regular scientific audit from EMPA, Switzerland, continues to

reveal very successfully surface ozone calibrations at the Cape Point Laboratory, which also in future will serve as calibration facility for regional instruments.

RESULTS FROM DATA OBSERVATIONS

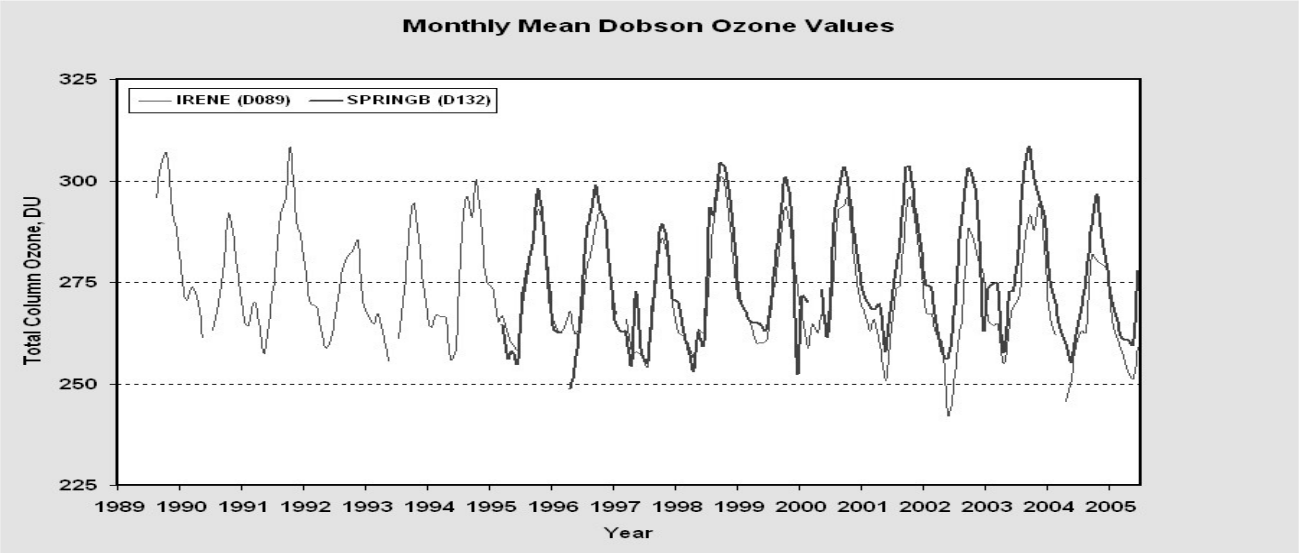

Figure 2: Only Column Total Ozone are displayed.

COLLABORATION - NATIONAL AND INTERNATIONAL

Ozone and related research are conducted sporadically within the country, mostly at a few academic institutions such as the University of Kwazulu Natal in Durban, the University of Cape Town and the University of the Witwatersrand in Johannesburg. Research interest of the effects of ultraviolet radiation amongst the medical and environmental sectors has also become more pronounced.

South African, Prof Roseanne Diab from the University of Kwazulu Natal and Mr G Coetzee of SAWS are both members of the International Ozone Commission http://ioc.atmos.uiuc.edu/ Mr G Coetzee is also a member of the established WMO-Ad Hoc committee on Dobson Operations. Prof. Roseanne Diab has been participating in many international ozone assessments, and has also been actively involved in strengthening ozone research/collaboration efforts throughout Africa. During early 2004 a very successful “African” ozone workshop was also conducted in Durban. Mr E-G Brunke of the Cape Point GAW laboratory is a member of the WMO SAG GHG.

South Africa must also acknowledge its many international collaborators with specific references to international programmes and Institutions such as:

- SHADOZ/NASA/GSFC/USA
- USA NOAA CMDL
- WMO - World Meteorological Organisation
- WOUDC and ARQP, Toronto, Canada
- GAWTEC http://www.schneefernerhaus.de/e-gawtec.htm , Germany
- GAWSIS http://www.empa.ch/gaw/gawsis/ and IMK-IFU Garmisch, Germany
- LSCE, CNRS and DEBITS, Paris and Toulouse, France
- EML, New York, USA
- NORWEGIAN – SOUTH AFRICAN BILATERAL COOPERATION
- THE CZECH NHMS

FUTURE PLANS AND RECOMMENDATIONS

In collaboration with various research institutes we still would like to improve the general circulation models for ozone and UV-B predictions. This will increase our understanding and ability to render a more efficient public service. The Weather Service is continuing with efforts to ensure real-time data availability on the SAWS WWW- site at http://www.weathersa.co.za

The installation of spare Dobson spectrophotometers and other instruments on "permanent lease" from more Europe partners will be established to complement the Southern African and surrounding Oceans observing platforms. In December 2005, the SAOZ instrument which has been refurbished at LSCE will once again operate at the South African National Antarctic Base, SANAE IV and form part of the global network of SAOZ instruments.

Further strengthening our collaboration in the Southern African regional context to enhance monitoring and research effort such as with the establishment of the Dobson #15 at Maun, Botswana in 2004. This is where EU Partners and resources can play a significant role to assist in partnerships and collaborated projects.

The International Polar Year (IPY) also provides ample opportunity for the extension of collaboration and monitoring networks in the southern Oceans and Antarctica. Plans are being develop to enhance RSA ozone and trace gas measurement activities, to the South African National Antarctic Base at SANAE. These could also include the enhancement at the monitoring stations at Gough (40S, 10W) and Marion (47S, 37E) islands where permanent South African Weather Stations are operating.

Enhancing ozone and trace gas activities on the African continent, remains a great need and a great challenge. Many countries have expressed their willingness to participate and to become more actively involved in sustaining measurement programme in some form. The challenge, we as scientific community thus faces, is how to assist those who also needs further investment, capacity and encouragement to secure and enhance the global network. Under the auspice of the WMO GCOS programme more opportunities can also include ozone and meteorological related observation.

The small South African ozone community on this front is also committed to collaboration in our region to enhance future ozone monitoring and related parameters research activities. With this we draw inspiration from the **Ne**w **P**artnership for **A**frica's **D**evelopment (NEPAD) plan.

RELEVANT RESEARCH PAPERS (co -authored)

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