POLAND

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INSTITUTE OF METEOROLOGY AND WATER MANAGEMENT

Monitoring

- The ozone soundings have been performed at Legionowo (52.40N, 20.97E) upper-air station since 1979. Up to May 1993 the OSE ozone sensor with the METEORIT/MARZ radiosounding system was used. Since June 1993 the ECC ozone sensor with OMEGA (since 1997 LORAN) DigiCora/RS80 radiosounding system has been in use. The ozone soundings are launched regularly on each Wednesday. The data are submitted to the WMO Ozone Data Centre regularly on monthly schedule.
- The Legionowo ozone profiles were used in the validation procedures of ozone profiles derived from satellite projects: GOME, POAM III, ILAS.
- Since 1993, on the base of the NOAA/TOVS satellite data, total ozone maps over Poland and surroundings have operationally been performed at a satellite receiving station in Krakow.
- In July 1993 broadband UV Biometers model SL 501 vers. 3, have been installed at three stations in Poland: Leba (54.75N, 17.53E), *Baltic Coast,* Legionowo (52.40N, 20.97E), *Centre of Poland,* and in *Tatra Mountains:* Kasprowy Wierch 1989m (49.32N, 19.98E), operated until 1996, in 1995 a Biometer was installed at Zakopane 857m (49.30N, 19,97E).
- The reference UV Biometer model SL 501 for the IMWM network takes part in the intercomparison campaigns (Helsinki in 1995, Thessaloniki in 1999, Ispra in 2004).
- In 2000 two NILU-UV spectral filter instruments were installed at Legionowo, measuring the UV-B, UV-A, total ozone and optical depth.
- Since 2001 the NILU-UV spectral filter instrument has been regularly (yearly), calibrated at NRPA, Norway.
- Surface ozone measurements with Monitor Labs. ML9810 started in 1995 at 3 stations: Leba (54.75N, 17.53E) *Baltic Coast*, Jarczew (51.81N, 21.98E) *Centre of Poland*, Sniezka (50.73N, 15.73E) *Sudety Mountains*.

Research

- Ozone and UV research activities are carried on in the Centre of Aerology in Legionowo in co-operation with the Satellite Research Department in Krakow.
- The Centre of Aerology participates since 1994 in the European Stratospheric ozone campaigns: SESAME, THESEO and O3-LOSS in the Match programme (evaluation of ozone chemical destruction in Polar Vortex). At Legionowo, during the winter/spring months, ozone soundings are performed more frequently, two or three times weekly, according to expected ozone deficiencies over Poland.
  Since 2005 IMWM has been participating in the ENVISAT/SCIAMACHY atmospheric profiles validation programme. At the days, when the ENVISAT satellite orbit passes over Poland, additional ozone soundings are performed.
  The results are submitted operationally to the Data Base at NILU (Norway).
- The ozone research studies focus continuously on the long term changes (trends) in ozone profile in connection with the temperature profile changes and on the case studies of dramatic stratospheric ozone deficiencies, observed with growing frequency during the last years in winter/spring months. These cases are connected either with the excursions of Polar Vortex into the midlatitudes, either with European ozone "mini-holes". The dynamical background of appearance of these cases over Poland is studied.

- During the last years, the ozone and UV research activities were directed mainly on UV forecasting. For that reason, several studies have been performed on: short term day to day changes of total ozone; the relation of total ozone to atmospheric characteristics (tropopause, geopotential heights, etc.); validation of total ozone derived from NOAA/TOVS satellite with dobson total ozone; elaboration of a method of one-day total ozone forecast; radiative transfer modelling and adaptation of libRadtran model to local conditions; sensitivity of UVR on ozone profile, clouds and albedo.
- In the years 1996-2000 IMWM participated in the UVRAPPF EC project and in the COST-713 Action - *UV forecasting*.
- On the base of these research experiences a method of UV Index forecast for Poland has been worked out and implemented operationally.
- In the years 2002-2004 IMWM participated in the EDUCE EC project and since 2004 has been participating in the COST 726 Action.

Public information

- Since 1999 the UV Index forecast for Poland has been available from May to August on www.imgw.pl. One of the key tasks of COST-713 Action - *UV forecasting* was the development of efficient methods for dissemination of the UV Index forecasts and for warning the public against the possible detrimental health effects. A booklet "UV Index for the Public" was prepared (with Polish participation) and published in 2000 (EC publications). In 2001 a Polish version of the booklet, "Indeks UV a człowiek", was prepared and published by the IMWM, sponsored by the Chief Inspection for Environmental Protection.

POLISH ACADEMY OF SCIENCES - INSTITUTE OF GEOPHYSICS

Monitoring

Measurements are carried out at the Belsk Observatory (51° 50' N. 20° 47'E).
Since 1963 total ozone measurements and Umkehr series have been performed by means of the Dobson spectrophotometer. In 1991 Brewer spectrophotometer was installed. Total ozone and Umkehr profile series have been re-evaluated in 1983 and 1987 respectively.

- The Dobson and Brewer spectrophotometers are regularly calibrated. The recent calibration of the Dobson instrument took place in 2005 at Hohenpeissenberg, and Brewer instrument was calibrated against Brewer#17 maintained by International Ozone Corporation in 2005 at Hradec Kralove.
  The ozone data are regularly submitted to the WMO Data Centre in Toronto. The mean daily values of total ozone are also submitted operationally to the Laboratory of Atmospheric Physics, Aristotle University of Thessaloniki, Greece, and to the World Ozone and UV Data Centre in Toronto.
  Systematic measurements of ground level ultraviolet solar radiation (UV-B) with the Robertson-Berger meter have been carried out since 1975. In 1992 UV Biometer SL501A was installed. Spectral distribution of UV radiation has also been monitored with the co-located Brewer spectrophotometer.
  The surface ozone measurements with Monitor Labs, ML8810 meter started in 1991, and since 1992 NOx measurements have been performed with Monitor Labs, (ML8841) meter.

Research

The ozone research activities mainly focus on statistical analyses (trends) on local and global scale, and methodology of ozone measurements. The changes in the ozone layer over middle altitudes are examined in connection with changes in the dynamic factors characterising the atmospheric circulation in the troposphere, the lowermost stratosphere, and the stratospheric overworld. The problem of the gradual recovery of the ozone layer in the atmosphere is also investigated. The study is focused on the role played by the dynamical factors in ozone variability,

because natural dynamical processes in the Earth's atmosphere can perturb the recovery of the ozone layer.

Factors influencing the UV radiation (ozone content, aerosol, cloudiness) are studied, with particular emphasis on the response of UV radiation to forcing factors, at various time scales.
The Belsk UV data series is the longest time series of UV measurements in Europe and similarly to ozone series is a subject of intensive study. In the studies of the UV-B variability advanced statistical methods such as wavelet decomposition and multivariate adaptive regression spline are used.

Future plans of ozone and UV activities in Poland

- Participation in the COST 726 Action.
- Participation in validation of OMI instrument on board of Aura satellite.
- Participation in the ENVISAT/SCIAMACHY ozone profile validation programme.
- Implementation of an operational monitoring of UV Index from the IMWM network on the web-page.
- Implementation of the DigiCora III/RS92 system to ozone soundings.
- Participation in preparation of the Scientific Assessment of the Ozone Depletion 2006.

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