Geophysical Research Abstracts
Vol. 12, EGU2010-3161, 2010
EGU General Assembly 2010

50 years of monitoring of the ozone layer in the Czech Republic – results and challenges

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Long-term observations of total ozone (TOZ) and vertical ozone profiles, the basic parameters of the ozone layer, have been performed at the Solar and Ozone Observatory (SOO) Hradec Kralove and at the Aerological Department (AD) Praha of the Czech Hydrometeorological Institute (CHMI) since 1961 and 1992 respectively. The Dobson and Brewer spectrophotometers regularly calibrated towards the international references and electro-chemical ECC ozone sondes are used for the measurements. The observations contribute to the global GAW and NDACC ozone monitoring systems.

Up to now analyses of the data give the basic findings given bellow and documented in the presentation. Some of them have important implication to the international ozone monitoring infrastructure, as well.
- The decrease of TOZ by about 5-7 % in the winter-spring months towards the pre ozone-hole period have occurred since the mid eighties. This is in good agreement by the magnitude and time with depletion of the ozone layer due to chemical destruction of ozone in the NH mid-latitudes.
- Significant depletion 3-5 % of TOZ has been identified also in the summer season since the early nineties. As this can not be attributed to the man-made chemical processes a change in the UT/LS dynamics over Central Europe is the most probable reason.
- Aerological measurements taken at AD show that the summer reduction of TOZ very well coincides with a change of UT/LS temperature that persists for about two decades over the Czech territory. Therefore it has a long-term character that can be regarded as a climate shift in UT/LS and need to be further investigated.
- 15 years of unique simultaneous Dobson/Brewer observations of TOZ performed at SOO show systematic seasonal deviations between both data sets that exceed instrumental accuracy of measurements. The differences are mostly caused by different wavelengths and their ozone absorption coefficients used by both instruments. As the Brewer observations are being preferred to continue the TOZ data series at SOO the seasonal effect need to be eliminated to avoid their effect in trend estimations and validation of satellite observations.. This is going to be done by assimilation of the Dobson data series to the Brewer one and creation of the homogenized data set.
- The Brewer Umkehr observations have been implemented at the SOO in the recent years to expand measurements of vertical distribution of ozone in stratosphere over Central Europe. Accuracy of the new UM-04 algorithm developed for processing of the Umkehr profiles from SOO is being tested using the ozone sonde observations from AD. First results confirm a good perspective of this technology for implementation in the global network.

Further improvement of monitoring and investigation of stratospheric ozone continues in the CHMI. Currently the activities are supported by the project P209/10/0058 “Long-term changes of the ozone layer over the Czech territory” of the Czech Grant Agency (2010-2012). The main goals of the Project are defined are specified in the presentation.