ABSTRACT

The ozonesonde measurement program at Marambio was established in late 1980s, soon after the discovery of the Antarctic ozone hole. The Marambio Antarctic Station is located in an island at the North-East of the Antarctic Peninsula, surrounded by Weddell Sea (lat. 64°S, 56°W 198 m a.s.l.). The location is suitable for observing Antarctic ozone hole. In addition to the springtime measurements we have also performed regular soundings during other seasons. The soundings have been made by Electrochemical Concentration Cell ozonesondes, using a potassium iodide solution. The sounding system at Marambio is DigICOR/A III from Vaisala and the radiosondes are Vaisala RS92-SGP. The sondes measure ozone profiles from surface up to the altitude of 30-35 km. The effective altitude resolution is 100-150 meters. Uncertainty of the stratospheric and tropospheric ozone measurements is about 5%. In this work we present results of the long term measurements. The time series have been reanalyzed using the knowledge from dual ozone sondes experiments. Some results show high variability in the different layers of the atmosphere during the ozone hole season. The ozone sondes observations are also compared to the total ozone measurements by a ground based Dobson instrument at Marambio and by satellite borne instruments. The meteorological conditions in the low stratosphere during the Southern Winter (June-August) set the stage for the seasonal annual cyclical ozone loss phenomena. Temperatures below ~78°C allow the formation of PSCs clouds in the stratosphere and the conditions that would trigger the ozone depletion.

RESULTS

In August-September are the coldest stratospheric conditions: meanwhile in October there are evidences of higher variability in stratospheric temperature and several episode of ozone destruction were observed in a wide vertical range.

Ozone vertical variation during the year (mPa):

The O3 depletion over Marambio occurs suddenly between day ~235 to ~300. The aim in the near future is to study in more detail the smoothly varying tropopause height and the O3 vertical variation in the range of 15-15 km and the interlink with ozone hole phenomena.

SUMMARY

The resulting time series show that in the upper troposphere and lower stratosphere (UTLS) region the ozone concentrations are generally lower during Spring, showing a large natural variability and a strong dependency on the stratospheric meteorological condition. The variability can be explained by changes in Antarctic the effective equivalent stratospheric chlorine (EESC) and meteorological conditions while in the upper troposphere (UT) the ozone concentrations maintain a similar amount along the year.

In the troposphere, mean profiles show a stable trend of ozone concentrations over the year as well.

The ozone sondes record provides the relevance source for deriving ozone trends in the troposphere and UTLS, especially during seasons when the sunlight is not present and it is not possible to use other ozone observational methods.

Each flight providing complement measurements to the ozone and temperature information, such as vertical profiles of wind, pressure and RH is crucial for a further research by inter-linked strands to understand the concept of the evolution and changes in the Antarctic atmosphere.

It is important to continue monitoring the ozone layer to be sure that we are on the right track according to the Montreal Protocol objectives and obtaining the predicted ozone layer long-term recovery in the next decades.

REFERENCES


OSS-DQA – Guide Lines for Homogenization of Ozone Sonde Data (H.Smit et al)

WMO Antarctic Bulletin (by G.Braathen)

Ozone Loss Rates over the Arctic and Antarctic Measured with the Match Approach (Striebel, M. et al)

GRUAN OZONESONDE TECHNICAL DOCUMENT

Version 1.1.3.3 (http://cros.gplc.nasa.gov/shadiac/)

WMO Report #01 Quality Assurance and Quality Control for Ozone Measurements in GAW by Periman G.J. Smit and the Panel for the Assessment of Standard Operating Procedures for Ozone sondes (ASOPS) (http://www.asops.net)

ACKNOWLEDGEMENT

The present work is supported by FMI and SMNA. We want to thank the people that were involved since the beginning: Prof. Kyrki, Ing. Maximo González, Dr. Pettet Tsalas, Mr. Mario Garcia & Lic. Eduardo Piacentini among others. Gratefully acknowledged to the Argentina Air Force and all the operators at Marambio Station.

Many thanks to Dr. G. Braathen of the WMO/GAW programmes for reflecting the results in WMO/Antarctic Ozone Bulletin.

Most of the ozone sonde data are available in WOUDC. The complete set of data files will be submitted in near future (http://www.woudc.org)