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## **Internship Project Jonas Lähnemann**

### **Validation of satellite total ozone measurements above Nairobi**

Ozone is an important trace gas in the atmosphere. In the stratosphere, it acts as a filter for the harmful UV radiation from the sun and thereby protects life on earth. At the same time, ozone is an irritating gas and in higher concentrations adversely affects the health of both humans and plants. Therefore, ozone close to the surface is considered as a pollutant. Human activities have changed ozone concentrations in the atmosphere. Stratospheric ozone is reduced through catalytic cycles involving halogen species that were released in the form of CFCs and HFCs. This is most dramatically observed in the polar spring ozone hole but ozone columns in low and mid latitudes are also decreasing. Tropospheric ozone on the other hand is increasing, mainly through emission of nitrogen oxides and hydrocarbons from combustion processes and biomass burning.

Ozone columns are routinely measured by a number of satellite instruments, for example TOMS, GOME, SCIAMACHY or OMI. The advantage of satellite measurements is their global coverage but the data need continuous validation by independent measurements. Historically, validation measurements were mainly performed in northern mid- and high latitudes and to a lesser degree also in southern high latitudes. However, the tropical regions play an important role for atmospheric ozone production and transport, and validation at these latitudes is much needed. One type of instrument that can be used for the validation of ozone columns is the DOAS (Differential Optical Absorption Spectrometer) instrument. Such an instrument was installed at the UNEP in Nairobi by the University of Bremen in July 2002, and has been operational since that time.

As a semester project, a student could perform a validation of satellite ozone columns above Nairobi for the years 2003 / 2004 and possibly beyond. Ozone columns from several satellites can be obtained via the internet, and ozone columns measured with the DOAS instrument in Nairobi can be made available by the University of Bremen. In addition, there are ozone sonde measurements close to Nairobi, and these profiles could be included in the comparison. The outcome would be a compilation of ozone measurements for this location and error estimates for the different satellite instruments.

The main steps in the project would be

- reading and learning on measurement techniques used for ground-based, space-borne and sonde measurements of ozone
- reading on global behaviour of ozone with an emphasis on the tropics

- collection of data from satellite instruments (TOMS, GOME, SCIAMACHY, ...) for the location and time considered
- collection of data from relevant ozone sonde launches
- homogenization of the data set (e.g. format, date, units, integration and extrapolation of sonde data)
- comparison of the different data sets and analysis of systematic differences
- preparation of a summary report on the analysis and the results

The Institute of Environmental Physics at the University of Bremen will support this project by provision of ozone columns measured by the DOAS instrument in Nairobi and by provision of useful links to information and data sources. It can also provide limited support for questions related to data handling and interpretation.