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Data Set Description:

PI: Prof. Justus Notholt
Instrument: Millimeter wave radiometer
Site(s): Ny-Alesund
Measurement Quantities: Ozone vmr

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Instrument Description:

The Radiometer for Atmospheric Measurements (RAM) is a ground-based microwave radiometer, which detects an emission line of ozone at 142.175 GHz. The RAM is a passive device. The signal of the atmosphere is passed through a quasi optical system, which focusses the beam and is frequency selective. The beam is mixed with a strong signal from a local oscillator to transform it to a lower frequency in order to amplify it (heterodyne principle). The intermediate frequency is 6.8 GHz to 8.5 GHz. The amplified spectrum is analyzed by an FFT spectrometer (Aquiris AC240) The spectrum is calibrated with the spectra of a hot and a cold calibration load, which emit black body radiation (total power method).

Algorithm Description:

The algorithm transforms the spectra into profiles of volume mixing ratio. There is a nearly linear relationship $Ax=d$ between the spectrum d and the vmr x , so an inversion algorithm is used. Because the problem is ill-posed, a-priori-information is used to evaluate the profiles. The used algorithm is called Optimal Estimation. An a-priori covariance of 1 ppm is used for most heights. In addition to the spectra temperature and pressure profiles from NCEP and ECMWF are needed to calculate the data. The result is height as the independent variable and vmr as the dependent variable. The resolution is about 10 km in a range from 12 to 55 km height.

Expected Precision/Accuracy:

The relative error in the vmr is less than 10% for heights above 18 km and less than 20% for lower heights (compared with ozone sondes).

Instrument history:

- 20.11.94 begin of continuous measurements
- 17.02.95 polarizer added for suppression of unwanted radiation
- 03.11.95 dichroic plate added as a bandpass
- 11.12.96 bandwidth of the spectra doubled
- 11.02.97 elimination of a Fabry-Perot effect that caused a baseline on the spectrum
- 18.05.97-14.11.97 AOS changed
- 03.2003 AOS replaced after major failure.
- 08.2006 AOS appended with an CTS to finely resolve the O₃ line center.
Measurement strategy refined to resolve mesospheric enhancement.
- 10.2007 AOS had a major failure. AOS and CTS replaced by an FTS (AC240).