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Satellite observations of OClO from 1995 to 2012 in comparison to ECMWF data and EMAC simulations

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Satellite instruments like GOME, GOME-2 and SCIAMACHY measure the spectral intensity of the sunlight, scattered back from Earths atmosphere, on an almost global and daily scale. By applying the DOAS method to the spectral measurements, the integrated concentration along the light path, the so called Slant Column Density (SCD), can be derived for a wide range of absorbers. Chlorine dioxide (OClO) is an important indicator for stratospheric chlorine activation, the basis for massive ozone depletion in polar spring.

Due to the daily coverage of the Polar regions, the OClO measurements give a good overview of the intensity and the extension of the chlorine activation. While the observations in nadir geometry (i.e. perpendicular to Earths surface) provide a (indirect) measurement of the total column, the limb observations (i.e. tangential view) can be inverted to vertical profiles.

We investigated GOME, GOME-2 and SCIAMACHY data from 1995 to 2012, covering Arctic and Antarctic winters with very different meteorological situations (very cold and very warm winters; early and major warmings). In particular, the long lasting cold stratospheric temperatures inside the vortex for the Arctic winter 2010/11 led to large levels of chlorine activation until mid of March, also observed in the OClO data.

The derived OClO columns and vertical profiles are compared to ECMWF analysis data, looking at inter-hemispheric and inter-annual differences and studying the dependence of the OClO enhancements on meteorological parameters like stratospheric temperatures, potential vorticity, PSC area and volume.

Also, the OClO observations are compared to correlated ECHAM5/MESSy2 (EMAC) simulations, which were calculated for the exact time and place of the satellite observations. We investigate the agreement of the observed and simulated OClO profiles for the dataset from 2003 to 2012 (regarding the magnitude, the altitude of the profile peak and their evolution throughout the winter).