Geophysical Research Abstracts
Vol. 13, EGU2011-837, 2011
EGU General Assembly 2011

Probing the polar vortex for two-dimensional chemical and dynamical features with MIPAS-STR measurements in January and March 2010 during the RECONCILE Campaign

Wolfgang Woiwode (1), Hermann Oelhaf (1), Thomas Gulde (1), Christof Piesch (1), Andreas Ebersoldt (2), and Johannes Orphal (1)

(1) Institute for Meteorology and Climate Research, Karlsruhe Insitute of Technology, Karlsruhe, Germany, (2) Institute for Data Processing and Electronics, Karlsruhe Insitute of Technology, Karlsruhe, Germany

The MIPAS-STR (Michelson Interferometer for Passive Atmospheric Sounding – Stratospheric Aircraft) instrument is an airborne FTIR limb-sounder and was operated onboard the high-altitude stratospheric aircraft M55-Geophysica during the RECONCILE Campaign in the arctic winter 2009/10. MIPAS-STR is measuring IR emission spectra of atmospheric trace gases in the spectral range of 725-2100 cm^{-1} at an unapodized spectral resolution of 0.036 cm^{-1}. Depending on the strength of the spectral signatures of the individual trace gases, ozone and many different ozone-relevant species can be analysed (e.g. HNO_3, $ClONO_2$, ClO and different CFCs). From the spectra of MIPAS, vertical trace gas profiles and cross-sections along the flight route are derived in the altitude-range of 5-20 km, at a vertical resolution of 1-2 km and a horizontal resolution across the flight path of 20-40 km. The retrieval of the vertical trace gas profiles from the measured spectra is performed using the Karlsruhe Optimised and Precise Radiative Transfer Algorithm (KOPRA) and the inversion-tool KOPRAFIT. MIPAS-STR was operated during the whole RECONCILE Campaign between January and March 2010, which was based in Kiruna in Northern-Sweden. The scientific flights were carried out in the area above and around Scandinavia and Spitzbergen, allowing for an extended sampling of different chemical, microphysical and dynamical phases of the polar vortex.

Vertical profiles and cross-sections of different trace-gases are shown for three flights, covering three phases of the polar vortex during the winter and spring in the beginning of 2010: (i) The cold, compact polar vortex at the end of January directly after the end of a phase with extended PSC-coverage, (ii) the edge of the late Canadian vortex remnant after the splitting event in February, sampled in the beginning of March, and (iii) a vortex-filament at the very end of the polar winter in the middle of March. Key aspects are the discussion of renitrification, chlorine activation and filamentation in the different phases. The results are discussed in context with ECMWF-analyses.

In particular, for the first selected flight of January 30^{th} 2010, an air-mass with strongly enriched HNO_3 due to renitrification is found between 14 and 18 km altitude, soon after the end of the extended PSC-phase. A correlated maximum is found for $ClONO_2$, which is likely to result from the in-situ-production from NO_2 (resulting from the HNO_3-enrichment) and ClO. For the second selected flight of March 2^{nd} 2010, the edge of the late Canadian part of the vortex after the splitting event can be clearly identified, showing descended air with low concentrations of CFC-11 and CFC-12, along with significantly increased concentrations of $ClONO_2$. A separate vortex-filament in the extra-vortex air is identified, characterised by a significant enrichment of HNO_3 and $ClONO_2$. In the case of the last flight on March 10^{th} 2010, the vortex has largely dissolved and mixed with mid-latitude air, but still a broad filament with a remnant of renitrified air is identified in the cross-section of HNO_3.