Geophysical Research Abstracts
Vol. 21, EGU2019-12935, 2019
EGU General Assembly 2019

Chemical structure and transport timescales in the UTLS from HALO observations and CLAMS

Peter Hoor (1), Amelie Mayer (1,4), Felix Ploeger (2), Franziska Weyland (1), Daniel Kunkel (1), Björn Kluschat (1), Jens-Uwe Grooß (2), Bärbel Vogel (2), Andreas Zahn (3), Jens Krause (1,5)

(1) Johannes Gutenberg University, Institute for Atmospheric Physics, Physics, Mainz, Germany (hoor@uni-mainz.de), (2) Institute of Energy and Climate Research (IEK-7), FZ Jülich, Germany, (3) Institute for Meteorology and Climate Research, Karlsruhe Institute of Technology (KIT), Germany, (4) Deutescher Wetterdienst (DWD), Offenbach, Germany, (5) Exceltas Technologies, Wiesbaden, Germany

The composition of the lower stratosphere is crucial for a quantitative understanding of surface temperatures (e.g. Riese et al., 2012), but subject to large uncertainties due to the variability of and the range of scales of the underlying processes and the spatio temporal variability of the tropopause itself. The seasonal cycle of large scale dynamical processes like diabatic downwelling from the stratosphere or impact from the monsoon systems further affects the structure of the lower stratosphere.

We will present a comparison of trace gas measurements of CO, N2O, and ozone from different HALO missions over the Europe and the northern Atlantic (TACTS: September 2012, PGS: December to March 2015/16 and WISE: September to October 2017) to investigate the seasonal cycle the chemical composition and the age structure in the upper troposphere/lower stratosphere (UTLS). To analyse the underlying time scales of transport we will perform comparisons with the chemical Lagrangian model of the stratosphere (ClaMS). For this purpose we will particularly use information from age spectra, which are provided by ClaMS and which are available for each individual data point along the flight track

The consistent comparison of simulated chemical tracers with observations in combination with the age spectral information shows a remarkably good agreement of the CO measurements and the ‚young' age fraction (younger than six months). We find a distinct seasonal cycle of tropospheric air in the lowermost stratosphere maximising by the end of summer and a large fraction of aged air by the end of winter as expected. For equivalent latitudes > 50° the fraction of CO-rich young air dominates the extratropical transition layer (ExTL). Its upper boundary corresponds to the location of the tropopause inversion layer (TIL).

We extended the campaign based data to the climatological view including the southern hemisphere. The vertical extent of the SH ExTL is less pronounced than in the northern hemisphere particularly during the respective winter. During summer, the northern hemisphere lower stratosphere shows a larger contribution of young air than the southern summer counterpart.