Geophysical Research Abstracts
Vol. 20, EGU2018-18980, 2018
EGU General Assembly 2018

The Wave-driven Isentropic Exchange (WISE) mission: Campaign overview and first results

Martin Riese (1), Peter Hoor (2), Daniel Kunkel (2), Martin Kaufmann (1), and the WISE team

(1) Research Centre Jülich, Institute of Energy and Climate Research, IEK-7: Stratosphere, Jülich, Germany (m.riese@fz-juelich.de), (2) Johannes-Gutenberg Universität, Mainz, Germany

Changes in the distributions of trace gases, like water vapor and ozone, and thin cirrus clouds in the upper troposphere and lower stratosphere (UTLS) strongly impact radiative forcing of the Earth's climate and surface temperatures, and are of key importance for understanding climate change (e. g. Solomon et al., 2010). It is therefore of great importance to quantify the physical and chemical processes that govern composition in the UTLS, for example, exchange processes between the subtropical upper troposphere and extratropical lowermost stratosphere. We present contributions from the recent HALO campaign WISE, which took place in autumn 2017 in Shannon / Ireland. A unique spatially highly-resolved data set of temperature and static stability (N2), various trace gases (e. g. water vapor, ozone, tracers), and cirrus clouds was obtained from remote-sensing and in-situ measurements during 15 flights. Based on this data set the following scientific objectives was addressed:

(1) Relation of the tropopause inversion layer (TIL) and trace gas distribution

(2) Role of Planetary wave breaking for water vapor and pollutant transport into the extra-tropical lowermost stratosphere

(3) Role of halogenated substances for ozone and radiative forcing in the UTLS region

(4) Occurrence and effects of sub-visual cirrus (SVC) in the lowermost stratosphere

During the campaign we encountered a great variety of interesting meteorological situations and observed strong signatures of air originating from the Asian monsoon or tropical cyclones (e. g. hurricanes Maria and Ophelia). Furthermore, the meteorological situation was dominated by a period of strong Rossby wave activity associated with frequent mixing events, which led to a rather tropospheric chemical signature of the UTLS.

We will give a brief overview on the mission and will present some first results, with a focus on the impact of the Asian monsoon on UTLS composition as well as transport of water vapour by Rossby wave breaking and associated stirring and mixing. In addition mixing processes associated with a strong modification of the tropopause structure during baroclinic developments could be identified as well as the impact of hurricane Ophelia on the UTLS.