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The Polar Stratosphere in a Changing Climate (POLSTRACC): Mission overview and first results

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The POLSTRACC mission aims at providing new scientific knowledge on the Arctic lowermost stratosphere and upper troposphere under the present load of halogens and state of climate variables. POLSTRACC employs the German High Altitude and LOng Range Research Aircraft (HALO) and is the only HALO mission dedicated to study the UTLS at high latitudes several years after the last intensive Arctic campaigns. The scientific scope of POLSTRACC is broadened by its combination with the SALSA (Seasonality of Air mass transport and origin in the Lowermost Stratosphere using the HALO Aircraft) and GW-LCYCLE (Gravity Wave Life Cycle Experiment, a BMBF/ROMIC project) missions, which address complementary scientific goals sharing the same HALO payload. POLSTRACC, SALSA and GW-LCYCLE offer the unique opportunity to study the bottom of the polar vortex and the high-latitude UTLS along with their impact on lower latitudes throughout an entire winter/spring cycle.

The payload for the combined POLSTRACC, SALSA and GW-LCYCLE campaigns comprises an innovative combination of remote sensing techniques providing 2- and 3-D distributions of temperature and a large number of substances, and precise in-situ instruments measuring T, O_3, H_2O, tracers of different lifetimes and chemically active species at the aircraft level with high time-resolution. Drop sondes will add information about temperature, humidity and wind in the atmosphere underneath the aircraft. The POLSTRACC consortium includes national (KIT, Forschungszentrum Jülich, DLR, Universities of Frankfurt, Heidelberg, Mainz and Wuppertal; PTB) and international partners (e.g. NASA).

The field campaign is divided into three phases for addressing (i) the early polar vortex and its wide-scale vicinity in December 2015 (from Oberpfaffenhofen, Germany), (ii) the mid-winter vortex from January to March 2016 (from Kiruna, Sweden), and (iii) the late dissipating vortex and its wide-scale vicinity in March 2016 (from Kiruna and Oberpfaffenhofen). The activities from Kiruna will be split into two intensive phases, with a focus on gravity wave observations in January 2016. Mission and flight planning is supported by a variety of model tools. The airborne field observations will be complemented by ground-based activities (e.g. lidars, radars and radio soundings) and satellite observations (e.g. CALIPSO, MLS and ACE-FTS).

The first phase was concluded by Dec. 21 with two long flights, one dedicated to SALSA objectives towards the Atlantic sea, the other, designed as early winter survey, went from Oberpfaffenhofen northwards, around Spitsbergen at 81°N, and back over Scandinavia. With both flights the very unusual dynamical situation in Dec 2015 could be addressed. This Arctic stratospheric winter started to be exceptionally cold and the early winter measurements from our flights provide an excellent reference for the upcoming observations planned during the Kiruna phases.

The presentation is intended to give a brief overview of the scientific objectives, the payload, and the mission, along with first results.