Geophysical Research Abstracts
Vol. 18, EGU2016-16798, 2016
EGU General Assembly 2016


# Interaction of mid-latitude air masses with the polar dome area during RACEPAC and NETCARE

Heiko Bozem (1), Peter Hoor (1), Franziska Koellner (1,2), Daniel Kunkel (1), Johannes Schneider (2), Christiane Schulz (2), Andreas Herber (3), Stephan Borrmann (1,2), Manfred Wendisch (4), Andre Ehrlich (4), Richard Leaitch (5), Megan Willis (6), Julia Burkart (6), Jennie Thomas (7), and Jon Abbatt (6)

(1) University Mainz, Institute for Atmospheric Physics, Mainz, Germany (bozemh@uni-mainz.de), (2) Particle Chemistry Department, Max Planck Institute for Chemistry, Mainz, Germany, (3) Climate Sciences, Sea Ice Physics, Alfred Wegener Institute, Bremerhaven, Germany, (4) Leipzig Institute for Meteorology, University of Leipzig, Leipzig, Germany, (5) Climate Research Division, Environment and Climate Change Canada, Toronto, Canada, (6) Department of Chemistry, University of Toronto, Toronto, Canada, (7) Sorbonne Universités, UPMC Univ. Paris 06; Université Versailles St-Quentin; CNRS/INSU, LATMOS-IPSL, Paris, France

We present aircraft based trace gas measurements in the Arctic during RACEPAC (2014) and NETCARE (2014 and 2015) with the Polar 6 aircraft of Alfred Wegener Institute (AWI) covering an area from 134°W to 17°W and 68°N to 83°N. We focus on cloud, aerosol and general transport processes of polluted air masses into the high Arctic.

Based on CO and $CO_2$ measurements and kinematic 10-day back trajectories as well as Flexpart particle dispersion modeling we analyze the transport regimes of mid-latitude air masses traveling to the high Arctic prevalent during spring (RACEPAC 2014, NETCARE 2015) and summer (NETCARE 2014). In general more northern parts of the high Arctic (Lat > 75°N) were relatively unaffected from mid-latitude air masses. In contrast, regions further south are influenced by air masses from Asia and Russia (eastern part of Canadian Arctic and European Arctic) as well as from North America (central and western parts of Canadian Arctic). The transition between the mostly isolated high Arctic and more southern regions indicated by tracer gradients is remarkably sharp. This allows for a chemical definition of the Polar dome based on the variability of CO and $CO_2$ as a marker.

Isentropic surfaces that slope from the surface to higher altitudes in the high Arctic form the polar dome that represents a transport barrier for mid-latitude air masses to enter the lower troposphere in the high Arctic. Synoptic-scale weather systems frequently disturb this transport barrier and foster the exchange between air masses from the mid-latitudes and polar regions. This can finally lead to enhanced pollution levels in the lower polar troposphere. Mid-latitude pollution plumes from biomass burning or flaring entering the polar dome area lead to an enhancement of 30% of the observed CO mixing ratio within the polar dome area.