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Characterization of Transport Regimes and the Polar Dome During NETCARE 2014 and 2015

Heiko Bozem (1), Peter Hoor (1), Koellner Franziska (1,2), Kunkel Daniel (1), Schneider Johannes (2), Herber Andreas (3), Leaitch Richard (4), Willis Megan (5), Burkart Julia (5), Thomas Jennie (6), and Abbatt Jon (5)

(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) Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Bremerhaven, Germany, (4) Environment and Climate Change Canada, Toronto, Ontario, Canada, (5) Department of Chemistry, University of Toronto, Toronto, Canada, (6) 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 NETCARE (2014 and 2015) with the Polar 6 aircraft of Alfred Wegener Institute (AWI) covering an area from Spitsbergen to Alaska (134°W to 17°W and 68°N to 83°N).
Based on CO and CO_2 measurements and kinematic 10-day back trajectories we analyze the transport regimes of mid-latitude air masses traveling to the high Arctic during spring (NETCARE 2015) and summer (NETCARE 2014). During the summer two different meteorological regimes over the course of the measurements in July are observed. The first part of the campaign (4.-12.7.2014) was dominated by a high pressure area over Resolute Bay with weak northerly flow whereas a cyclonic regime was prevalent during the second phase (17.-21.7.2014).
During the first part of the campaign only 15% of trajectory origins were located south of the Arctic circle (66.5°N). This fraction increases to 55% during the second period with the North American continent being the dominant source region of the air masses. Especially the influence of active biomass burning in the Northwestern Territories alters the composition of the lower Arctic troposphere resulting in an increase of mean CO mixing ratios from 78 ppbv for the first period to 95.0 ppbv for the second period.
In spring 2015 the origin of air masses shows a strong dependence on the measurement region. Alert (35% of trajectories originate south of Arctic circle) and Eureka (35%) are more isolated from mid-latitudinal influence compared to Longyearbyen (70%) and Inuvik (96%). This suggests the transport barrier known as the “polar dome” preventing mid-latitude air masses to penetrate the high Arctic lower troposphere. Based on the distribution of CO and CO_2 and the back trajectories we identify the effect of the transport barrier associated with the “polar dome” on the composition of the air masses.