



Arctic UTLS composition measured by the MARSCHALS instrument during the PREMIEREX and ESSENCE campaigns

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An overview of the results obtained by the MARSCHALS (Millimetre-wave Airborne Receivers for Spectroscopic CHaracterisation in Atmospheric Limb Sounding) instrument during Premier-Ex (March 2010, Kiruna, Sweden) and ESSenCe 2011 (December 2011, Kiruna, Sweden) aircraft Arctic campaigns is presented.

The two campaigns were part of the activities conducted as preparatory studies for PREMIER (Process Exploration through Measurements of Infrared and millimeter-wave Emitted Radiation), one of the three candidate core missions of ESA Earth Explorer 7. The primary objective of PREMIER is to gain a better understanding of the processes that are linking atmospheric chemistry and dynamics with climate. PREMIER will achieve this by observing the Upper Troposphere / Lower Stratosphere (UTLS) - a region of particular importance in the study of climate change - with unprecedented spatial and temporal resolution. PREMIER combines the complementary capabilities of two limb-sounders in the infrared and millimeter-wave spectral regions and MARSCHALS was developed as an airborne demonstrator of the PREMIER millimeter-wave spectrometer.

In the frame of the two Arctic campaigns, MARSCHALS sampled the Arctic UTLS retrieving vertical profiles of its main atmospheric targets (T, H₂O, O₃, HNO₃, N₂O, CO).

The obtained vertical profiles have been used to investigate chemical and dynamical processes taking place in the Arctic atmosphere. In particular, we found the presence of filaments of vortex air during the Premier-Ex campaign and of re-nitrification or HNO₃ redistribution due to sedimentation followed by evaporation of Polar Stratospheric Cloud (PSC) particles during the ESSenCe campaign. Furthermore, the results of the comparison between MARSCHALS and MIPAS-STR products as well as the state of the atmosphere during the ESSenCe campaign simulated by the CLaMS (Chemical Lagrangian Model of the Stratosphere) and EMAC (ECHAM/MESSy Atmospheric Chemistry) models will be presented.