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FTIR Limb-Sounding in the Arctic UTLS under Cloudy Conditions: The MIPAS-STR PSC Flights during RECONCILE and ESSenCe

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The FTIR Limb-Sounder MIPAS-STR (Michelson Interferometer for Passive Atmospheric Sounding - STRatospheric Aircraft) was operated onboard the high-flying ($\sim$19 km) research aircraft M55-Geophysica during the RECONCILE (Reconciliation of essential process parameters for an enhanced predictability of arctic stratospheric ozone loss and its climate interactions) and the ESSenCe (ESa Sounder Campaign 2011) campaigns in arctic spring 2010 and early arctic winter 2011/2012. From the MIPAS-STR measurements, vertical profiles and spatially resolved vertical cross-sections of temperature, trace-gases (e.g. HNO_3, O_3, $ClONO_2$, ClO, CFCs) and cloud-coverage are derived in the vertical range between 4 and 20 km. During some RECONCILE and ESSenCe flights, MIPAS-STR probed air-masses below and inside Polar Stratospheric Clouds (PSCs). This region is hardly accessible by satellite-borne and balloon-borne IR remote-sensing, since vertically extended and optical thick PSC clouds complicate or even hamper IR measurements in this altitude-range. In contrast, MIPAS-STR onboard the Geophysica aircraft sampled the lower boundary of extended PSC clouds and the area below, allowing for spatially resolved insights into the chemical properties of this region. We discuss our retrieval approach for spectra with low cloud indices (i.e. increased optical thickness in the IR) and show current results from cloud-affected measurements at tropospheric and stratospheric altitudes, with emphasis on denitrification processes and chlorine chemistry. The results support the candidate Earth Explorer 7 mission PREMIER (PRocess Exploration through Measurements of Infrared and millimetre-wave Emitted Radiation) with regard to the probing of the UTLS region under cloud-free and cloudy conditions with high spatial resolution, and gives a perspective of the capabilities of the new GLORIA (Gimballed Limb Observer for Radiance Imaging of the Atmosphere) instrument, which has been developed at the KIT (Karlsruhe Institute of Technology, Germany) and the FZJ (Forschungszentrum Jülich GmbH, Germany), followed by maiden flights in December 2011.