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CRISTA-NF measurements with unprecedented vertical resolution made during the RECONCILE aircraft campaign

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The Cryogenic Infrared Spectrometers and Telescope for the Atmosphere - New Frontiers (CRISTA-NF), an airborne infrared limb-sounder, was operated aboard the high-flying Russian research aircraft M55-Geophysica during the Arctic RECONCILE campaign from January to March 2011. This poster describes the calibration process of the instrument and the employed retrieval algorithm and then proceeds to present retrieved trace gas mixing ratio cross-sections for one specific flight of this campaign. We are able to resolve the uppermost troposphere / lower stratosphere for several trace gas species for several kilometres below the flight altitude (16 to 19km) with an unprecedented vertical resolution of 400 to 500m for the limb-sounding technique. The observations are also characterised by a rather high horizontal sampling along the flight track that provides a full vertical profile every ≈15km. Assembling the vertical trace gas profiles derived from CRISTA-NF measurements to cross-sections depicts filaments of vortex and extra-vortex air masses in the vicinity of the polar vortex. By using horizontal regularisation, the vertical resolution of the retrieved volume mixing ratios could be improved even further, especially for trace gases with a low signal-to-noise ratio.

During this campaign, the M55-Geophysica carried further instruments, which allows for a validation of trace gas mixing ratios derived from CRISTA-NF against measurements by the in situ instruments HAGAR and FOZAN and observations by MIPAS-STR. This validation sug- gests that the retrieved trace gas mixing ratios are both qualitatively and quantitatively reliable.

The derived dataset allows the observation of several filaments of air with a very small vertical extent in the order of 500m to 1km in the lower stratosphere. These filaments stem from different sources and can be exploited to examine mixing processes in the lower stratosphere.