Time dependent 3D tomography of a mountain wave over the Andes with GLORIA IR limb imager

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The Gimballed Limb Observer for Radiance Imaging of the Atmosphere (GLORIA) is an aircraft-based Fourier transform spectrometer with a 2D detector array jointly developed by Forschungszentrum Jülich and Karlsruhe Institute of Technology. Air temperature and volume mixing ratios of various trace gases are retrieved from the measured IR spectra. GLORIA’s viewing direction can be panned between 45° and 135° w. r. t. the flight direction. Combining this capability with flight paths that encircle the observed atmospheric region, multiple measurements of the same air mass can be performed, allowing for 3D tomography of the atmosphere with a vertical resolution down to 250 m and horizontal resolution of around 25 km.

GLORIA flew on the German HALO research aircraft during the SouthTRAC measurement campaign held in southern Argentina in September-November 2019. One of the main goals of the campaign was gravity wave study using GLORIA, as well as an upward looking ALIMA lidar instrument developed by Deutsches Zentrum für Luft- und Raumfahrt (DLR), and in situ instruments. During one of the research flights, a large amplitude mountain wave was observed over the Andes. The air volume near the mountains was encircled twice, providing a unique opportunity to study the time evolution of an orographic gravity wave with a help of 3D time dependent temperature retrieval. We present the initial analysis of this dataset, showing complex temperature structure with several overlapping gravity wave families at altitudes of 9 to 14 km. GLORIA data is complemented by the ALIMA lidar temperature retrieval at altitudes between about 20 and 60 km, providing insight into further upward propagation and breaking of the observed mountain wave. We also compare our results with ECMWF model data.