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JURASSIC Retrieval Processing

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The Gimballed Limb Observer for Radiance Imaging in the Atmosphere (GLORIA) is an aircraft based infrared limb-sounder. This presentation will give an overview of the retrieval techniques used for the analysis of data produced by the GLORIA instrument. For data processing, the JUelich RApid Spectral SImulation Code 2 (JURASSIC2) was developed. It consists of a set of programs to retrieve atmospheric profiles from GLORIA measurements.

The GLORIA Michelson interferometer can run with a wide range of parameters. In the dynamics mode, spectra are generate with a medium spectral and a very high temporal and spatial resolution. Each sample can contain thousands of spectral lines for each contributing trace gas. In the JURASSIC retrieval code this is handled by using a radiative transport model based on the Emissivity Growth Approximation. Deciding which samples should be included in the retrieval is a non-trivial task and requires specific domain knowledge. To ease this problem we developed an automatic selection program by analysing the Shannon information content. By taking into account data for all relevant trace gases and instrument effects, optimal integrated spectral windows are computed. This includes considerations for cross-influence of trace gases, which has non-obvious consequence for the contribution of spectral samples. We developed methods to assess the influence of spectral windows on the retrieval. While we can not exhaustively search the whole range of possible spectral sample combinations, it is possible to optimize information content using a genetic algorithm.

The GLORIA instrument is mounted with a viewing direction perpendicular to the flight direction. A gimbal frame makes it possible to move the instrument 45° to both direction. By flying on a circular path, it is possible to generate images of an area of interest from a wide range of angles. These can be analyzed in a 3D-tomographic fashion, which yields superior spatial resolution along line of site. Usually limb instruments have a resolution of several hundred kilometers. In studies we have shown to get a resolution of 35km in all horizontal directions. Even when only linear flight patterns can be realized, resolutions of $\approx$70km can be obtained. This technique can be used to observe features of the Upper Troposphere Lower Stratosphere (UTLS), where important mixing processes take place. Especially tropopause folds are difficult to image, as their main features need to be along line of flight when using common 1D approach.