

4D-var assimilation of CRISTA-NF H₂O and MLS retrievals with the high resolution SACADA system

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In order to draw full advantage from high resolution limb sounding instruments, like CRISTA-NF (Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere - New Frontiers), the grid configuration of the SACADA assimilation system has been improved. SACADA is a 4-dimensional variational assimilation system for trace gas observations. Kernel of this system is a novel global chemistry transport model and its adjoint version. The German Weather Service global forecast model (GME) serves as an online meteorological driver, and the icosahedral grid structure, the horizontal transport and the parallelisation strategy are adopted from GME. Recently the horizontal and vertical scheme resolution of the model grid was refined: The distance of the horizontal grid points was reduced to about 150 km and vertical separation between grid levels is now less than 1 km below 22 km altitude. In order to better describe chemical processes in the lower stratosphere/upper troposphere (UT/LS) the chemistry module was extended and revised.

As a case study, assimilation of MLS (Microwave Limb Sounder) data with diagnosis of observation and background error statistics in observation space for H₂O was performed. Relative humidity is used to filter observations and the background field. It is shown that the H₂O analysis significantly improves compared to the ECMWF operational analysis. Additionally, data from the CRISTA-NF instrument, which has been operated on board the Russian high altitude research aircraft M-55 Geophysica, was assimilated. These CRISTA-NF observations have been taken during the AMMA (African Monsoon Measurements Analysis) Campaign in summer 2006 by ICG I (Institute of Chemistry and Dynamics of the Geosphere, Research Centre Jülich). A basic finding is that the H₂O-analysis based on the additional CRISTA data in the UT/LS region improves with the SACADA high resolution configuration.