Geophysical Research Abstracts,
Vol. 10, EGU2008-A-09189, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-09189
EGU General Assembly 2008

Validation and assimilation of GPS water vapor and slant delays from COPS campaign

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During the field experiment COPS ('Convective and Orographically Induced Precipitation Study') in 2007, GFZ Potsdam provided near real-time GPS-derived tropospheric products from the German network with about 220 GPS stations to the meteorological community. The Integrated Water Vapour (IWV) has been analysed with a temporal resolution of 15 minutes and the Slant Total Delay Data (STD) with a resolution of 2.5 minutes. A monitoring and quality control system for the slant delays has been established complementing the existing IWV monitoring system. The IWV data provide detailed information about the horizontal water vapour distribution above Germany and the huge data set of nearly 1 million STDs per day can be used to obtain spatially resolved 3D humidity fields. The STDs have been validated using different independent observations, e.g., from water vapor radiometers and with analyses from the numerical weather model COSMO-DE of the German Weather Service.

Parallel to the data validation first assimilation studies have been carried out at the University of Hohenheim. The 4D-VAR assimilation system of the Mesoscale Meteorology Model 5 (MM5) has been used operationally during COPS to assimilate STD data. It could be shown that the STD assimilation leads to an enhanced water vapour distribution in the MM5 fields and has a positive impact on the precipitation forecast. The same STDs could also be used to reconstruct the humidity field by means of tomographic techniques. The GFZ Potsdam developed a GPS tomography system which relies directly on the STDs and some additional meteorological observations

and provides 3D humidity fields. These fields can be compared to other observations.