GPS-derived Atmospheric Water Vapour at GFZ: from Near Real-Time to Real-Time Processing

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Precise knowledge about the temporal and spatial distribution of the atmospheric water vapour is one precondition for the monitoring of climatic variations of the atmosphere as well as for a number of meteorological applications such as precise numerical weather forecasts, hazard mitigation, and water management. GPS based techniques for atmospheric remote sensing came up in the recent years and offer with all-weather capability and high temporal and spatial resolution a powerful tool for studying atmospheric processes.

Operational determination of water vapour from a GPS ground station network is being carried out by GFZ in Potsdam since 2000. Currently data from about 350 stations in Germany and neighbouring countries are used for the operational data analysis.

The GPS data processing at GFZ runs in near real-time and provides Zenith Total Delay (ZTD), Integrated Water Vapour (IWV) and Slant Total Delay (STD) data. ZTD and IWV observations are available with a temporal resolution of 15 minutes and provide reliable information on the total amount of water vapour above the GPS network. Vertical water vapour profiles can be reconstructed from slant delay data, which are available with a sampling rate of 2.5 minutes. This large data set of more than 60,000 slant delays per hour can be combined to a three-dimensional representation of the humidity above Germany by using tomographic techniques.
Recently a real-time GPS analysis software (Earth Parameter and Orbit System in Real-Time, EPOS-RT) is developed at GFZ, which operates in streaming mode and has the capability to provide all the mentioned atmospheric parameters with a delay of only some seconds.

Initial tropospheric results from EPOS-RT will be presented and validated with independent meteorological measurements and numerical weather models.