Geophysical Research Abstracts,
Vol. 11, EGU2009-4675, 2009
EGU General Assembly 2009

A new parameterized fully ellipsoidal 3D-filtered tomographic approach for GNSS water vapor retrieval

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Water vapor plays an important role in atmospheric processes and is therefore a key quantity in numerical weather prediction (NWP). Nevertheless, the distribution of water vapor in the atmosphere is only measured with a coarse resolution in time and space. One of the promising methods to enhance the spatio-temporal resolution is GNSS water vapor tomography. In spite of impressive progress in the recent years, water vapor values from GNSS tomography are not yet operationally assimilated in NWP models. Recent studies carried out at our institute have shown weak points of water vapor tomography. We therefore devised new tomographic algorithms which address the identified problems: the tomographic inversion problem is formulated as Kalman filter with parameterized voxels in ellipsoidal coordinates. This leads to a C^0-continuous three-dimensional field of wet refractivity at a temporal resolution of 30 seconds. Analyses based on simulated and measured observations were carried out. They reveal superior performance regarding accuracy and quality compared to the commonly used constant voxel approach. After a short summary of the developed algorithms, the results will be presented and advantages and disadvantages of the new algorithms will be discussed in terms of accuracy and spatio-temporal resolution.