Geophysical Research Abstracts
Vol. 18, EGU2016-6007, 2016
EGU General Assembly 2016

GNSS tomography and assimilation test cases during the 2013 Central Europe floods

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GNSS tomography is a technique which allows to reconstruct refractivity fields of atmospheric water vapor from observations of a dense ground-network of GNSS receivers. Dependent on the network and the observation geometry (station density, satellites in view, . . .) a more or less detailed picture of the current distribution of water vapor in the atmosphere can be retrieved.

In order to identify the potential of the tomography technique two study areas in the mountainous and the rather flat region of Austria have been selected and the observations of existing GNSS reference stations in these areas were preprocessed. Different reconstruction methods (least squares, multiplicative algebraic reconstruction technique), a priori refractivity fields and weights have been tested to identify a precise and robust setting. A first validation has been carried out by comparing the tomography refractivity fields with refractivities derived from passive radiometer measurements in the Inn Valley, Austria.

The reconstructed wet refractivity fields were assimilated into the numerical weather prediction (NWP) model AROME – operated at the Central Institution for Meteorology and Geodynamics (ZAMG) - using a combined 1DVAR/3DVAR approach. By comparing different model runs with and without considering these additional observations a significant impact on the forecast field was identified. To get a more detailed picture the changes in the distribution of specific humidity, temperature and accumulated precipitation were analyzed to see whether these parameters can be predicted more reliable by assimilating GNSS derived wet refractivity fields.

In this presentation we will highlight some test cases in May and June 2013. Thereby we will focus on settings which have been defined to derive the improved refractivity fields, the quality of the tomography results and its potential for assimilation into NWP models.