GNSS-ATom

Project GNSS-ATom aims at the 3D-modelling of the lower troposphere in the alpine region. Thereby a horizontal resolution of 10km x 10km (about 15 vertical layers) with an update rate of 15min is aspired. The troposphere tomography is based on processing of GPS/GLONASS signals collected by a subnet of reference stations of an Austrian GNSS service provider (ÖBB). Remaining range residual along the signal path reflect the tropospheric signal delay not captured by an apriori hydrostatic model. We make use of these residuals to reconstruct the wet refractivity of each voxel in a 3D-grid above the area of interest. This problem is ill-conditioned due to the small number of observations compared to the number of voxels. To stabilize the inversion an initial wet refractivity field is introduced which is improved by each iteration step. The computation of range residuals in each step is performed by ray-tracing (in-house software). The finally determined grid of wet refractivity is transformed to pressure, temperature and humidity fields in the various height levels. These fields are used for assimilation by ZAMG.

This project also investigates the potential of significant densification of the observing network by means of cheap single-frequency receivers. Furthermore the added value of processing Galileo signals (E1 and E5) will be investigated. A high density network increases the number of signals passing the voxels and therefore strengthens the ill-conditioned parameter estimation problem. The Galileo signals can be used to improve the observation geometry further. Both the single frequency network observations as well as the additional Galileo data will established by means of a signal generator available at the institute.

The high-resolution weather model AROME operated by ZAMG will be modified for being capable of assimilating the GNSS results. Case studies will be carried out to evaluate the impact of the GNSS data on the forecast of specific weather events like heavy convective storms which require precise information of spatial and temporal variation of moisture field. This allows for an assessment of GNSS observations as innovative sensor to contribute to weather forecast.