Validation of GNSS-based Integrated Water Vapor for the Swabian MOSES 2023 field campaign

Florian Zus[1], Annika Oertel[2], Rohith Muraleedharan Thundathil[3], Galina Dick[1], Peter Knippertz[2], and Jens Wickert[3]

[1]GFZ Potsdam, Potsdam, Germany (zusflo@gfz-potsdam.de)
[2]Karlsruhe Institute of Technology, Karlsruhe, Germany (annika.oertel@kit.edu)
[3]Technical University Berlin, Berlin, Germany (r.thundathil@tu-berlin.de)

The Swabian MOSES (Modular Observation Solutions for Earth Systems) field campaign was conducted between June and September 2023 in the southeastern Black Forest, the Neckar Valley and the Swabian Alb in southwestern Germany. It focused on hydro-meteorological extreme events, including the initiation and intensification of convective events which are accompanied by heavy rain and can lead to local flooding. As a part of the observing system the GFZ installed eight additional GNSS stations in the region of interest and operated them in near real time during the measurement campaign. The precise point positioning technique was utilized to provide Integrated Water Vapor (IWV) estimates with a temporal resolution of 15 min. In this contribution we provide a first comparison of these IWV estimates with those derived from atmospheric (re-) analysis datasets. We utilize the atmospheric reanalysis ERA5 (horizontal resolution 31 km) and the operational analysis ICON-D2 (horizontal resolution 2 km) provided by the German Weather Service. Ground-based GNSS data are not assimilated into ERA5 and ICON-D2. In general, we find good agreement between GNSS and (re-)analysis estimates: the root mean square error is 1-2 kg/m^2. Our goal is to better understand the remaining station specific systematic and random deviations. For example, for all stations, the random deviations are smaller for the high compared to the low resolution model data. We attribute this to smaller representative errors and smaller forward model (interpolation) errors. However, for the systematic deviations the result is not too obvious. Comparisons with measurements from instruments which are collocated with the GNSS stations are envisaged to better understand the issue.