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Working Group 1 "Advanced GNSS Processing Techniques" of the COST Action GNSS4SWEC: Overview of main achievements

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The COST Action ES1206 GNSS4SWEC addresses new exploitations of the synergy between developments in GNSS and meteorological communities. The Working Group 1 (Advanced GNSS processing techniques) deals with implementing and assessing new methods for GNSS tropospheric monitoring and precise positioning exploiting all modern GNSS constellations, signals, products etc. Besides other goals, WG1 coordinates development of advanced tropospheric products in support of weather numerical and non-numerical nowcasting. These are ultra-fast and high-resolution tropospheric products available in real time or in a sub-hourly fashion and parameters in support of monitoring an anisotropy of the troposphere, e.g. horizontal gradients and tropospheric slant path delays.

This talk gives an overview of WG1 activities and, particularly, achievements in two activities, Benchmark and Real-time demonstration campaigns. For the Benchmark campaign a complex data set of GNSS observations and various meteorological data were collected for a two-month period in 2013 (May-June) which included severe weather events in central Europe. An initial processing of data sets from GNSS and numerical weather models (NWM) provided independently estimated reference parameters – ZTDs and tropospheric horizontal gradients. The comparison of horizontal tropospheric gradients from GNSS and NWM data demonstrated a very good agreement among independent solutions with negligible biases and an accuracy of about 0.5 mm. Visual comparisons of maps of zenith wet delays and tropospheric horizontal gradients showed very promising results for future exploitations of advanced GNSS tropospheric products in meteorological applications such as severe weather event monitoring and weather nowcasting.

The Benchmark data set is also used for an extensive validation of line-of-sight tropospheric Slant Total Delays (STD) from GNSS, NWM-raytracing and Water Vapour Radiometer (WVR) solutions. Seven institutions delivered their STDs estimated based on GNSS observations processed using different software and strategies. STDs from NWM ray-tracing came from three institutions using four different NWM models. Results show generally a very good mutual agreement among all solutions from all techniques. The influence of adding not cleaned GNSS post-fit residuals, i.e. residuals that still contains non-tropospheric systematic effects such as multipath, to estimated STDs will be presented.

The Real-time demonstration campaign aims at enhancing and assessing ultra-fast GNSS tropospheric products for severe weather and NWM nowcasting. Results are showed from real-time demonstrations as well as offline production simulating real-time using Benchmark campaign.