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Towards the Homogenization of GNSS Tropospheric Delay Time Series: Status and Recent Developments

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In the past years, several long-term (20+ years) reprocessed GNSS tropospheric delay and water vapor time series datasets have been produced and are available for climate studies. It includes worldwide datasets (e.g. the International GNSS Service ‘IGS troposphere repro 1’), pan-European datasets (e.g. the EUREF Permanent Network ‘EPN troposphere repro 2’), but also regional datasets.

At the same time, several individual groups studied these reprocessed GNSS tropospheric delay and water vapor time series and found evidence for remaining inhomogeneities due to e.g. instrumental changes, environmental changes, etc. These inhomogeneities impact e.g. the calculation of the long-term water vapor trend (and its associated error), hence preventing a correct and precise interpretation of the dataset in terms of climate change. The homogenization of these datasets is thus mandatory prior any proper usage for studying the climate.

In that context, several of these groups joined their efforts within the sub-WG “Data Homogenization” of the COST Action ES1206 “Advanced Global Navigation Satellite Systems tropospheric products for monitoring severe weather events and climate” (GNSS4SWEC), focusing first on the IGS repro 1 tropospheric dataset as a case study. The COST Action being ended, this work is now continued in the framework of the IAG WG 4.3.8 “GNSS Tropospheric Products for Climate”.

Amongst their activities, the working group (1) inventoried the existing homogenization tools that could be applied on the GNSS tropospheric delay and water vapor time series, (2) produced synthetic datasets (based on the true characteristics of the IGS repro 1 and ERA-Interim datasets, but with known offsets included) in order to (3) benchmark (blindly) the performance, weakness and advantages of each of these methods (via e.g. statistical scores and CRMEs, trend differences), and (4) finally assessed different methods for computing trends and their uncertainties in these time series.

This presentation will summarize the working group activities, focusing on the most recent developments and achievements towards the homogenization of GNSS-based tropospheric delay and water vapor time series.