



GNSS climatology: A summary of findings from the COST Action ES1206 GNSS4SWEC

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Working Group 3 of COST Action GNSS4SWEC promoted the coordinated development and assessment of GNSS tropospheric products for climate research. More than 50 researchers from 17 institutions participated in the discussions. The activities were organised in five main topics, each of which led to conclusions and recommendations for a proper production and use of GNSS tropospheric products for climate research.

1) GNSS data processing and validation: an inventory was established listing the main existing reprocessed datasets and one of them (IGS repro1) was more specifically assessed and used as a community dataset to demonstrate the capacity of GNSS to retrieve decadal trends and variability in zenith tropospheric delay (ZTD). Several groups performed also processing sensitivity studies producing long term (15 years or more) solutions and testing the impact of various processing parameters (tropospheric models, cutoff angle...) on the accuracy and stability of the retrieved ZTD estimates.

2) Standards and methods for post-processing: (i) elaborate screening methods have been developed and tested for the detection of outliers in ZTD data; (ii) ZTD to IWV conversion methods and auxiliary datasets have been reviewed and assessed; (iii) the homogeneity of long ZTD and IWV time series has been investigated. Standardised procedures were proposed for first two points. Inhomogeneities have been identified in all reprocessed GNSS datasets which are due to equipment changes or changes in the measurement conditions. Significant activity is on-going on the development of statistical homogenisation techniques that match the GNSS data characteristics.

3) IWV validations: new intercomparisons of GNSS IWV estimates to IWV retrieved from other observational techniques (radiosondes, microwave radiometers, VLBI, DORIS...) have been encouraged to enhance the results of the past and contribute to a better evaluation of inter-technique biases and absolute accuracy of the different IWV sensing techniques.

4) GNSS climatology: as a major goal of this working group, applications have been promoted in collaboration with the climate research community such as the analysis of global and regional trends and variability, the evaluation of global and regional climate model simulations (IPCC, EC-Earth, CORDEX...) and reanalysis products (ERA-Interim, ERA20C, 20CR...).

5) Databases and data formats: cooperation with IGS and EUREF fostered the specification and development of new database structures and updated SINEX format for a more efficient and enhanced exchange, use, and validation of GNSS tropospheric data.