DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

Continuous Global Positioning System (GPS) observations are playing increasingly a prominent role to help us understanding many of the Earth's internal and external processes. Among the others, GPS contributes to the understanding of the consequences of climate change, for example, sea-level rise, surface-mass changes and atmospheric studies. GPS unexpectedly has proven to infer the conditions of the atmosphere, as the GPS signal travels from the transmitting GPS satellites to the ground-located receiver. Since being transmitted through ionosphere and troposphere, the GPS signal is subjected to variable atmospheric conditions. The atmosphere bends the GPS signal causing a delay in the arrival time (path lengthening). The delay depends on the integral effect of the densities of dry air and water vapour along the entire atmospheric column. Because the amount of delay in troposphere is directly related to the integrated observations of atmospheric conditions, including the amount of water vapour, GPS can remotely sense integrated atmospheric water vapour and in-doing so improve e.g. the accuracy of assimilated numerical weather models. Specially, GPS is well suited in the study of the atmospheric conditions since it is increasingly deployed ever widely around the globe. A Zenith Total Delay (ZTD) provides a measure of the integrated tropospheric state and has two components: Zenith Hydrostatic Delay (ZHD) and Zenith Wet Delay (ZWD). Taking into account surface pressure and temperature, the ZTD can be converted via the ZWD into an estimate of the Integrated Water Vapour (IWV) content of the atmosphere. Now we have access to more than two decades of ZTD or IWV estimates from a global GPS network of stations. On the other hand, the long term trend or more so the uncertainty of the ZTD or IWV is not well understood. However, the long term trend and noise characteristics of ZTD or IWV is a major uncertainty for a comprehensive understanding for the global climate system. A proposed project aims at recognition of stochastic properties of Zenith Total Delay time series derived from GNSS (Global Navigation Satellite System) processing for proper evaluation of trends and their uncertainties for homogeneously reprocessed and properly homogenized ZTD time series, which could be interpreted these days in terms of climate change. The research hypothesis reads as follows: "a proper recognition of stochastic part of ZTD (Zenith Total Delay) time series is indispensable to reliably estimate the parameters of deterministic part and their uncertainties (including trend used in analyses of climate change)" and is going to be put up against a reference assumption still used by geodetic community that "noise in ZTD data is as uncorrelated as white noise". We presume that noise characteristic of ZTD long time series is best described by autoregressive noise process, as climatologists are describing in this way any of climate series: temperature, pressure or humidity. Moreover, within this project we will derive an optimal method to homogenise the ZTD data, i.e., identify discontinuities, which may artificially influence a value of trend, before trend is going to be estimated with an innovative approach with synthetic data, manual blind tests, semi- and automatic methods. This will bring us a solution on most appropriate method to be used for a task of ZTD homogenisation. If our assumption proves to be correct, the ZTD trends with uncertainties that have been used in climate studies till today could have been underestimated of an order of magnitude and should not be considered for future climate analyses studies. Having used a proper noise model for ZTD data derived in this research, we will provide the most recent picture of ZTD trends and their uncertainties for different climate zones, according to Köppen-Geiger climate classification.