EGU General Assembly 2024

EGU24-2522, updated on 17 Apr 2025
https://doi.org/10.5194/egusphere-egu24-2522
EGU General Assembly 2024


# First results about height correction of tropospheric delay mapping function in GNSS applications

**Miaomiao Wang**[1,2], Ping Li[1], Ruyu Lu[1], Shuheng Wang[1], and Fangyu Zhang[1]
[1]School of Computer Science and Information Engineering, Changzhou Institute of Technology, Changzhou 213032, China;
[2]Key Laboratory of Meteorological Disaster, Ministry of Education (KLME); Joint International Research La-boratory of Climate and Environment Change (ILCEC); Collaborative Innovation Center on Forecast and Evaluation of Meteorological Disasters (CIC-FEMD);

One of the dominant error sources for Global Navigation Satellite System (GNSS) measurements is the correction for delay of an electromagnetic wave as it traverses the neutral atmosphere, which is usually shorted as tropospheric delay. Generally, tropospheric delay must be calculated or estimated since refractivity along ray path is not easily or economically measured. Empirically, the line of sight delay for either hydrostatic or wet component is modeled as product of zenith delay and a mapping function. The accuracy of estimated geodetic parameters for GNSS could be limited due to the indeterminacy of mapping function, when observations are typically made to low elevation angles. Nowadays, there are many different empirical tropospheric delay mapping functions are generated and used in GNSS applications, the sensitivity of mapping functions to height above the geoid of point of observations are mostly corrected with method and formulas proposed in Niell (1996), in which the height corrections are only concerned in hydrostatic delay mapping function. In Niell (1996), the adopted form of height correction for hydrostatic delay mapping function is linearly dependent on height, and the linear coefficient is empirically chosen for fitting precision purpose. In this work, similar to many current works about modelling mapping factors to operational mapping functions, with the help of ERA-Interim reanalysis data set from the European Centre for Medium-range Weather Forecasts (ECMWF), the sensitivity of both hydrostatic and wet delay mapping factors to height are calculated and preliminary analyzed. As an important part of the work, the needed data set sources, i.e., the tropospheric delays at some ground-based stations along some previously set ray paths with different elevation angles, azimuth angles, heights and time epochs, are generated with a self-generated tropospheric delay ray-tracing package named GTRATS (Gnss Tropospheric delay RAy Tracing Software). The first results show that for a specific not low elevation angle, the variations of both hydrostatic and wet mapping factors to the height are not too obvious; the hydrostatic mapping factors change linearly to height with different performances, while wet mapping factors are not with linearly change, especially for low elevation angles; height corrections with method in Niell (1996) for hydrostatic mapping factors actually perform well in some cases, while maybe correct too much or too less in some stations at some time epochs, thus maybe new correction strategy can be accounted; the height correction should also be concerned for wet delay mapping functions, while there is no obvious, regular and reliable relation or appearance can be observed according to our first results,

and more efforts should be made for the examination and investigation of this problem.