

Mapping functions for atmospheric delay modelling in GNSS analysis

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In this presentation we compare four different mapping functions which are used for mapping the atmospheric zenith delay to the direction of line-of-sight. Two of them are based on data from numerical weather models (NWM): the Isobaric Mapping Functions (IMF) are determined from the height of the 200 hPa pressure level for the hydrostatic part and from temperature and humidity for the wet part which can be easily extracted from NWM on a global grid, and the Vienna Mapping Functions 1 (VMF1) which are rigorously determined from the refractivity profiles downloaded with best resolution at selected sites. On the other hand, we compare them with the widely used Niell Mapping Functions (NMF) and the Global Mapping Functions (GMF): both of them depend only on the station coordinates and the day of year. The GMF are based on three years of global NWM data using spherical harmonics to be consistent with VMF1. We validate these four mapping functions with radiosonde data. Then results are shown from a global VLBI solution (1984 to 2005) with the software package OCCAM and from a global GPS network over a 12 month period (April 2004 to March 2005) with the GAMIT software package. The analyses reveal a very good agreement between the terrestrial reference frames determined with VMF1 and GMF, and between VMF1 and IMF in their ability to account for distinct weather conditions. Finally, we discuss these four mapping functions in terms of availability and applicability for certain purposes, e.g. for the determination of the terrestrial reference frame or for geophysical studies.