VMF3o: Enhanced Tropospheric Mapping Functions for Optical Frequencies

Janina Boisits[1], Daniel Landskron[1], Krzysztof Sosnica[2], Mateusz Drozdzewski[2], Johannes Böhm[1]
[1]TU Wien, Vienna, Austria, [2]Wroclaw University of Environmental and Life Sciences, Wroclaw, Poland

Tropospheric delay modelling is crucial for space geodetic techniques, such as Satellite Laser Ranging (SLR). The currently recommended Mapping Functions (MF) for tropospheric delays in the optical frequency range is a continued fraction function with coefficients depending on station height, station latitude, and temperature at the site.
TU Wien is now developing enhanced Mapping Functions for SLR observations. Analogously to VMF3 for microwave-based techniques, the coefficients of the Vienna Mapping Functions for optical frequencies (VMF3o) are estimated from ray-traced delays using numerical weather model data. The total mapping factor is split into a hydrostatic and a non-hydrostatic part. Annual and semi-annual signals of the coefficients bh, bw, ch, and cw are estimated in an extensive campaign from 10 years of ray-traced delays on a 5°x5° grid. The coefficients ah and aw are then calculated from ray-traced delays on a 1°x1° grid and a temporal resolution of 6h.
First tests were carried out using the software Bernese. Applying VMF3o coefficients to SLR observations to LAGEOS-1 and LAGEOS-2 satellites results in a reduction of observation residuals especially at low elevation angles. Therefore, VMF3o is a promising, new tool for the advancement of tropospheric delay modelling in the optical frequency range. Further tests will be carried out to validate the model and to assess the effects on SLR products.