Tropospheric delay modeling in SLR solutions based on numerical weather models and the estimation of tropospheric bias corrections

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The tropospheric delay modeling in SLR data relies on in-situ meteorological observations collected at SLR stations. However, some meteorological sensors can be affected by systematic errors and biases. Furthermore, the asymmetry of the atmosphere is not accounted for when considering in-situ meteorological data from one station because the atmosphere around the station cannot be well characterized. In this study, we test different methods of accounting for the tropospheric delay based on numerical weather models provided in the Potsdam Mapping Function (PMF) for SLR data and the Vienna Mapping Function 3 for optical measurements (VMF3o). We can identify those stations which possibly may have issues with barometer readings from the comparison between numerical models and meteorological data from SLR stations. We also test the possibilities to separate the mapping function for the wet and hydrostatic delays as well as the horizontal gradients derived from VMP3o, PMF, and a simple parametric model of gradients. We test the models based on SLR observations to LAGEOS-1/2 satellites as well as to GPS-based SWARM-A/C/B satellite orbits with and without the estimation of corrections to the zenith delay and horizontal gradients.