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Vienna Mapping Functions for Optical Frequencies

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The determination of delays in the neutral atmosphere is crucial to space geodetic techniques, such as Very Long Baseline Interferometry (VLBI) and Global Navigation Satellite Systems (GNSS). The Vienna Mapping Functions (VMF) and the Global Pressure and Temperature model (GPT) are proven and widely used tools for delay modelling for microwave-based techniques. Satellite Laser Ranging (SLR) observations, however, are based on optical wavelengths. In this frequency range, the delay caused by the hydrostatic component is comparable to that in the microwave range, whereas the delay caused by the non-hydrostatic component is significantly smaller. Hence, the present VMF and GPT dedicated to microwave observations are not applicable for SLR. Our aim is to develop a Vienna Mapping Function for optical frequencies (VMF3o). Analogously to VMF3, a, b, and c coefficients of the continuous fraction mapping function are estimated using ray traced delays. First tests with preliminary VMF3o coefficients applied to SLR observations to LAGEOS-1 and LAGEOS-2 satellites show a reduction of observation residuals especially for observations at low elevation angles. Final coefficients will be estimated and tested in an extensive campaign using ten years of numerical weather model data. VMF3o represents a new tool for modelling tropospheric delays in the optical frequency range with the capability of a further advancement of the current accuracy level.