How Do Atmospheric Tidal Loading Displacements Differ Temporally as Well as between Models?

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Abstract. Mass redistribution within the Earth's fluid envelope including the atmosphere, the oceans, and the continental hydrosphere elastically deforms the crust hence inducing displacements of geodetic markers in excess of 1 cm at sub-daily to seasonal timescales. In this contribution we study high-frequency deformation induced by atmospheric tides. While the effect is responsible for crustal deformation at the mm-range, it is crucial to be considered during space geodetic data analysis to mitigate aliasing artefacts. Herein, we have identified the waves that are responsible for the largest mass anomalies in the sub-diurnal frequency band and calculated the associated displacements upon convolving them with globally 1D symmetric load Green's functions in the center of mass isomorphic reference frame. Mass anomalies are retrieved by three different global reanalyses: ECMWF's ERA5, NASA's MERRA2 and JMA's JRA55. At this point, atmospheric pressure loading over the oceans as the atmospheric contribution to ocean tides is not considered, but will be explicitly treated with a global ocean tide model (Sulzbach et al., 2021) for all relevant frequencies, thereby making any assumption about an inverse barometric response of the ocean superfluous. We assess the extent to which the predictions of atmospheric tides differ depending on the numerical weather model, as well as how much they differ as a function of time. While the inter-model differences are below 10% of the signal, we note significant annual and semi-annual modulations for the main spectral lines, the S1 and S2, as well as non-linear long-term amplitude and phase trends. Model results that are available globally will be finally contrasted against the 5-minute final solutions of selected GNSS station coordinate time-series from the Nevada Geodetic Laboratory.