Delineating the Migrating Solar and Lunar Semidiurnal Atmospheric Tides in the General Circulation Model

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During periods of Sudden Stratospheric Warming (SSW), large disturbances in the lower atmosphere propagate up to the thermosphere, inducing plasma density fluctuations of 50-150% in the low-latitude F-region. Understanding the mechanisms by which the atmospheric layers couple is important to the prediction of space weather, which affects communications and the operation of satellites in low Earth orbit. Part of this understanding requires the ability to accurately quantify the amplitudes and phases of the solar and lunar semidiurnal tides. In most cases, the migrating solar semidiurnal tide (SW2) is much larger in amplitude than the migrating lunar semidiurnal tide (M2) in the lower thermosphere, but in periods of SSW, the lunar component is enhanced and becomes comparable in magnitude to the solar component. As the two tides have very similar periods, they are difficult to separate. In this project, we test a new method for extracting the lunar semidiurnal tide, M2, that hinges upon subtracting an average over solar local time from total values and binning residuals by lunar local time. Results from testing on synthetic data show that the percent error of the method for amplitudes is in the range of 0.33% (for data resolution of 30 minutes) to 1.42% (data resolution of 1 hour). The method was then applied to data generated by TIME-GCM and compared to results published earlier this year in Maute et al. *(*2016). Our results show agreement in general features and structure, with amplitude differences of <x>%. With additional refinements to extract the phase and account for sinusoidally varying amplitudes and phases, the method shows promise for use in future studies.