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Global Structure of the Lunar Tide in Ionospheric Total Electron Content

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The global structure of the lunar tide in the ionosphere is studied based on observations of the global positioning system (GPS) total electron content (TEC). The unprecedented spatial and temporal resolution afforded by the GPS TEC observations enables illustration of the latitude, longitude, solar local time, and seasonal variability of the lunar tide in the ionosphere. Based on analysis of the multi-year mean from 1999-2008, the semidiurnal component is found to achieve a maximum amplitude of $\sim$6% of the background TEC in the equatorial ionization anomaly crest regions between November and February. A slight hemispheric asymmetry is present with larger amplitudes in the Northern Hemisphere. Furthermore, the maximum amplitudes in the semidiurnal lunar tide are found to occur during Northern Hemisphere winter and during 9-15 solar local time. During certain years, a secondary maxima in solar local time is also observed demonstrating the influence of the lunar tide on the prereversal enhancement. Lastly, the observations reveal significant longitudinal variability in the semidiurnal lunar tide that is most prominent between November and February. Although the dominant component is the migrating semidiurnal lunar tide, the longitudinal variation reveals that non-migrating components are also present. The non-migrating components are thought to result from the non-linear interaction between stationary planetary waves and the migrating semidiurnal lunar tide.