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Simulations with the Global Ionosphere Plasmasphere (GIP) model driven by Whole Atmosphere Model (WAM) winds show significant longitudinal and day-to-day variations in the ionospheric parameters. Under fixed solar and geomagnetic activity levels, the contributions of lower atmosphere tides to the longitudinal and day-to-day variability in the upper atmosphere are estimated. Larger relative variability is found in the nighttime than in the daytime, which is consistent with observations. The perturbations from the lower atmosphere contribute about half of the observed variability in the ionospheric F2 peak density under moderate solar activity and geomagnetic quiet conditions. Simulations also suggest that the wave-4 and wave-3 longitudinal variations in the equatorial vertical drifts during September are dominated by the diurnal eastward propagating non-migrating tides with zonal wave number 3 (DE3) and 2 (DE2), respectively.

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