Influences of migrating semidiurnal tide variabilities on the low latitude ionosphere

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In this study, we investigate the variability of ionosphere and its electrodynamic responses to the changes in amplitude and phase of migrating semidiurnal tide (SW2) associated with sudden stratospheric warming (SSW) using numerical experiments under boreal winter and solar minimum condition. A sensitivity assessment of the Thermosphere-Ionosphere-Electrodynamics General Circulation Model (TIE-GCM) simulations shows that ionospheric variabilities greatly depend on the SW2 condition in the lower boundary. Our results show that the earlier phase shift of SW2 causes the morning-enhanced and afternoon-reduced TECs by modulating equatorial vertical E ×B drift, which agrees with the observation qualitatively but with insufficient magnitude. Instead, the increase in amplitude of SW2 only drives temporally upward E ×B enhancement at local noon; nevertheless, it is suppressed soon by the rise of SW2 tidal dispassion from the westward acceleration of F-region zonal winds. The long sustained and stronger earlier local time of upward drift arises from a combination of the amplitude and phase changes of the SW2, demonstrating the combination of amplified and earlier phase SW2 are required to reproduce ionospheric SSW effects. Additionally, the equilibrium duration in response to the amplitude and phase change of SW2, and the importance of perturbed zonal and meridional tidal wind in generated equatorial vertical E ×B drift are determined.

Keywords: ionospheric variability responses to the migrating semidiurnal tide, sudden stratospheric warming, dynamo modification from the tidal wind

