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Tidal effects on longitudinal differences in electron density at mid-latitudes

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This study studied the migrating and non-migrating tidal effects from the troposphere on the longitudinal variation of electron density (ΔNe) at mid-latitudes. Both CHAMP and Thermosphere Ionosphere Electrodynamic General Circulation model (TIEGCM) were used for the investigation. ΔNe at altitudes higher than 200 km were affected by upward propagating tides. The tidal effects were largest at altitudes around 300 km. Migrating tides resulted in reduced longitudinal differences in ΔNe over North America and in the Southern Hemisphere. Non-migrating tides resulted in a wave-4 structure of ΔNe in both hemispheres, which was weaker than migrating tidal effects. The meridional wind effects on ΔNe were stronger than zonal wind in response to migrating tides in the Northern Hemisphere, while less in the Southern Hemisphere. The meridional wind effects on ΔNe were larger than the zonal wind in response to non-migrating tides in both hemispheres. The non-neutral wind processes played the dominant role in regulating the longitudinal structure of ΔNe over neutral wind under tidal conditions, while the neutral winds mainly weakened ΔNe. It was thus important to include neutral composition disturbance field at the low boundary of the model for better reproduction of atmospheric tidal effect at mid-latitudes.