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Longitudinal Variations of Low-Latitude Gravity Waves and Their Impacts on the Ionosphere

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The lower atmospheric forcing has important roles in the ionospheric variability. Previous study suggested that atmospheric tides from the troposphere induce the wavenumber 4 signatures on the ionosphere. However, influences of lower atmospheric gravity waves on the ionospheric variability are still not clear due to the simplified gravity wave parameterizations in general circulation models (GCMs) and the limited knowledge of gravity wave distributions. In this study, we aim to study the longitudinal variations of gravity waves and their impacts on the ionospheric variability.

Variations of lower atmospheric gravity waves are characterized using SABER temperature observations from 2002 to 2012 and also the physically based gravity wave parameterization in the Specified-Dynamics Whole Atmosphere Community Climate Model (SD-WACCM). Longitudinal variations of gravity waves from SABER and WACCM show the largest variability in June-August at low latitudes. We have implemented these low-latitude gravity wave variations into the thermosphere-ionosphere-mesosphere-electrodynamics general circulation model (TIME-GCM) to study the responses of the ionosphere. TIME-GCM shows that wavenumber 3-4 components of TEC variations in June-August are increased by ˜10-15% with the longitudinal variations of gravity waves but there are no significant changes in other months. Potential mechanisms of TEC responses to gravity wave variations will be discussed.

Keywords: Gravity Wave, Ionosphere, Tides