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The response of thermosphere and ionosphere to forcing by geomagnetic activity and lower atmospheric waves

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The National Center for Atmospheric Research-Thermosphere Ionosphere Electrodynamics General Circulation Model (RTIEGCM) was run to simulate the response of thermosphere wind and temperature to changes in solar-terrestrial environment. We first investigate thermosphere-ionosphere response to variations in the energy and momentum inputs from the magnetosphere under various solar wind conditions. It is found that there were significant enhancements of the westward neutral winds at low and middle latitudes around 190 km during and after a storm. A diagnostic analysis of the model outputs shows that momentum advection from high latitudes to low and middle latitudes was the major cause of these neutral wind changes and that the specific altitude range in which these changes occurred was related to the height distribution of the total momentum forcing. We then examine the day-to-day variability of the ionosphere to study its correlation with geomagnetic activity and lower atmospheric waves. It is found that at middle and high latitudes, the ionosphere appeared to respond directly to the solar-wind/geomagnetic activity forcing at high latitudes, with the day-to-day variability having similar spectral peaks as those in solar-wind and geomagnetic activity. At the geomagnetic equator and in the equatorial-anomaly region, the ionosphere showed more complicated day-to-day variability, suggesting the effect of the interplay of the nonlinear interaction between geomagnetic activity and lower atmospheric waves.

Keywords: Neutral wind, Neutral temperature, Ionospheric density