CURRENT SYSTEM IN THE DAYTIME AND POST-SUNSET IONOSPHERE

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Ionospheric currents and their magnetic signatures are measured by ground magnetometers, rocket-borne magnetometers and incoherent scatter radars. However, these observations provide us incomplete information about the current system: ground-based instruments can only observe local time variations at a specific location, rockets sample only one location at a single time, while satellites provide data mainly at a restricted range of altitudes only twice a day near a given location. Global models can help connect these observations and aid in their interpretation. The NCAR Thermosphere Ionosphere Electrodynamics General Circulation Model (TIE-GCM) has been improved to calculate the three-dimensional current system in the ionosphere. In this research, we conduct TIE-GCM simulations under moderate solar activity (F10.7=150) and geomagnetic quiet conditions to examine the ionospheric currents during the daytime and post-sunset periods. From theory, daytime F region current can flow along the magnetic field lines and close through the E region because of the large E region conductivity. During the post-sunset period, without significant E region conductivity the current must close mainly within the F region. An upward wind-driven current in the F region is largely balanced by downward electric-field-driven current on the same field line. By using the TIE-GCM, we are able to examine the ionospheric currents in three dimensions and to evaluate the effects of winds and conductivities in the ionospheric E and F regions during the post-sunset period to further understand the pre-reversal enhancement and diagnose the complex electrodynamic processes.

Ionospheric current; model simulation; pre-reversal enhancement

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