MODELING THE ELECTROMAGNETIC SIGNATURES OF LOWER-THERMOSPHERIC WINDS

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Models of the ionospheric wind dynamo can predict how different distributions of thermospheric winds affect ionospheric electric fields and geomagnetic perturbations at the ground and in space, allowing us to use observed electromagnetic variations to infer information about the winds. Ionospheric dynamo effects depend not only on the wind distribution, but also on the ionospheric electrical conductivity and on electrodynamical coupling with the magnetosphere at high latitudes. We use the National Center for Atmospheric Research Thermosphere-Ionosphere-Electrodynamics General-Circulation Model (TIE-GCM) to simulate electromagnetic perturbation fields, and compare these with observations for geomagnetically quiet days. The simulations reveal how geomagnetic perturbations at low latitudes depend sensitively on the altitude and latitude variations of the winds in the lower thermosphere and on magnetospheric effects. We also test procedures for inferring the uncertain amplitudes and phases of atmospheric tides at the TIE-GCM lower boundary, and the uncertain nighttime ionization rates, by matching simulated and observed electromagnetic fields through a Bayesian analysis.

thermosphere, ionosphere, electric field, magnetic perturbation

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