PHYSICAL INTERPRETATION OF TEC RESPONSE DURING INTENSE GEOMAGNETIC STORMS

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The physical and energy transport processes in the magnetosphere-thermosphere-ionosphere system become extremely complex during magnetic storms. During disturbed periods, magnetospheric electric fields can penetrate to the low-latitude ionosphere and a significant amount of energy proceeding from the solar wind is transferred to the polar ionosphere and thermosphere. Convection electric fields and ionospheric currents heat and expand the polar thermosphere producing pressure gradients that generate strong neutral winds flowing equatorwards. The disturbed thermospheric circulation modifies the neutral composition and moves the plasma along the magnetic field lines, changing rates of production and recombination of the ionized species. These winds, under the influence of the geomagnetic field and the action of the Coriolis force, produce polarization electric fields through the dynamo effect, modifying the electrodynamics and the structure of the Earths upper atmosphere. A combination of effects due to many of these mechanisms can be responsible for the ionization enhancements and depletions observed in the ionosphere during magnetic storms. The identification and investigation of these effects is feasible when using an assimilation model to compute TEC values during a storm and comparing the output of this model with the output of a physics model, so one can determine the appropriate choice of model drivers that are able to reproduce the observed storm-time response. In this work, we are using the University of New Brunswick Ionospheric Modelling Technique (UNB-IMT) and the global, three-dimension, time-dependent, nonlinear coupled model of the thermosphere, ionosphere, plasmasphere and electrodynamics (CTPIE) to investigate the dynamic and electrodynamic response of the global ionosphere during an intense geomagnetic storm. By using both data assimilation and physical models, contributions can be made to the understanding of the physical processes driving the ionospheric response to magnetic storms and so improving space weather forecasts. The impact of space weather on the ionosphere can influence the performance and reliability of space-borne and ground-based communication and navigation systems.

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