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Empirical Ionospheric E-Region Solar-Geomagnetic Storm Correction to the IRI Model Using TIMED/SABER Data

We propose to develop an empirical ionospheric E-region storm-time correction to the International Reference Ionosphere (IRI) model. Observations from the Sounding of the Atmosphere using Broadband Emission Radiometry (SABER) instrument onboard the Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) satellite will be used to correct the E-region IRI NO+ and electron densities for solar-geomagnetic activity. The objective of this proposal will be achieved in two steps: (1) derive a parameterization of the E-region response to solar-geomagnetic storms as a function of integral ap-index, and (2) validate the proposed storm model by comparisons with SABER-derived NO+(v) volume emission rates (VER), incoherent scatter radar measurements, and results from the Ionospheric Model for Auroral Zone (IMAZ). The proxy used to develop the storm model is SABER-derived profiles of NO+(v) VER. NO+(v) VER during all magnetically disturbed periods contained in the SABER database from 2002-2006, for example the April 2002 and October-November 2003 storm periods, will be used to develop the storm model parameterization using linear impulse-response theory. The NO+(v) VER will be retrieved from SABER 4.3 um limb emission measurements by (1) removing the background contribution from CO2 infrared emission, and (2) by performing a standard Abel inversion on the residual radiance to obtain the vertical profiles of NO+(v) VER. The latitude range of the storm model extends from the polar region to mid- to low-latitudes. The magnetic local time coverage is in the dawn to dusk sector. The altitude range is roughly 90 km to 180 km. The empirical storm model is independent of NO+ or electron density profile shapes, and independent of chemistry, kinetics, or spectroscopic parameters. Our storm model will help accurately specify the lower ionosphere during solar-geomagnetic disturbances for all space technologies that use radio wave propagation through the ionosphere. This work is proposed in support of the LWS Tools and Methods component of the Targeted Investigations Program, which also supports NASA's Strategic Objective (15).