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# Storm-Time Characterization and Analysis of Earth's Ionospheric E-Region from TIMED/SABER Observations of Broadband 4.3 um Limb Emission

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A new data product derived from TIMED/SABER measurements of 4.3 um limb emission is the NO+(v) volume emission rate (VER). We have found NO+(v) VER to be versatile analysis tool for studying the ionospheric E-region response to solar-geomagnetic storms. Enhancements in nighttime 4.3 um emission during storm periods are due to vibrational excitation of NO+ (i.e., NO+(v)), caused by auroral dosing and subsequent ion-neutral chemical reactions, followed by radiative emission at 4.3 um. The NO+(v) VER is derived by (1) removing the background CO2 infrared emission using SABER observations and non-LTE radiation transfer models, and (2) by performing a standard Abel inversion on the residual radiance. Since NO+ is the terminal E-region ion, the NO+(v) VER is an excellent proxy for characterizing the morphology of the E-region response to magnetic disturbances, for studying E-region ion-neutral chemistry and energetics during auroral dosing, and for quantifying the enhancement in the E-region electron density as a response to magnetic disturbances. Thus, we report results on the storm-time E-region morphology, quantitative analysis of E-region ion-neutral chemistry and energetics during auroral dosing, and an empirical model of the response of the E-region electron density during solar-geomagnetic storms. As a result of this work, we also discuss ways in which infrared limb emission may be used to extract information on Mars' ionosphere and atmospheric-solar wind interactions.