Observation and analysis of E-Region response to solar-geomagnetic storms from the TIMED-SABER instrument

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Nighttime thermospheric infrared emission at 4.3 um was enhanced by several orders of magnitude during recent solar-geomagnetic storms, as observed by the TIMED-SABER instrument. Auroral electron dosing followed by ion-neutral chemical reactions leads to vibrationally excited NO+ and prompt emission at 4.3 um in the ionospheric E-region. Consequently, nighttime measurements from the SABER 4.3 um radiometer channel provide an excellent proxy to monitor the global E-region response to solar-geomagnetic disturbances and to conduct a detailed study of E-region electron dosing, ion-neutral chemistry, and energy transfer processes. Specifically, we derive NO+ 4.3 um volume emission rates (VER) from SABER 4.3um limb emission measurements during the April 2002 and October-November 2003 solar storms and use the derived VERs as an observation-based proxy to study storm-induced E-region electron density enhancements and assess the current understanding of E-region ion-neutral chemistry. The VERs are derived from SABER 4.3 um limb radiance measurements. The analysis is conducted using temperature, pressure and CO2 abundance retrieved from SABER, SABER non-LTE CO2 and radiation transfer models, simulations from the field-line interhemispheric plasma (FLIP) model, and auroral electron energy characteristics derived from NOAA/POES measurements.