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# Empirical model of SSUSI-derived auroral ionization rates

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Solar, auroral, and radiation belt electrons enter the atmosphere at polar regions leading to ionization and affecting its chemistry. Whole-atmosphere chemistry–climate models such as WACCM(-X) or EDITh usually parametrize this ionization based on in-situ satellite particle measurements. Widely used particle data are derived from the POES and GOES satellite measurements which provide in-situ electron and proton spectra at the satellite location.

Here we present an empirical model derived from the electron energy and flux data products from the Special Sensor Ultraviolet Spectrographic Imagers (SSUSI) on board the Defense Meteorological Satellite Program (DMSP) satellites. This formation of currently three operating satellites observes the auroral zone in the UV from which electron energies and fluxes are inferred in the range from 2 keV to 20 keV. We use these observed electron energies and fluxes to calculate auroral ionization rates in the lower thermosphere (≈ 90–150 km). We derived our empirical parametrization from these previously validated ionization rates on a magnetic local time/geomagnetic latitude grid. The regression model is driven by geomagnetic indexes Kp, PC, and Ap, and the solar radio flux F10.7. The resulting parametrization is simple in application and particularly targeted for use in whole-atmosphere chemistry–climate models that include the upper atmosphere, such as WACCM-X or EDITh. An initial comparison to the AIMOS/AISstorm ionization rates shows that the order of magnitudes are comparable, but we observe differences in the peak ionization altitude.

## Solicited or Contributed

Contributed

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