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Estimating Joule Heating using Different Methods

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Joule Heating is the Ohmic heat dissipation in the upper atmosphere due to the collision of neutrals and drifting charged particles. Joule Heating constitutes one of the most dominant energy sinks of the upper atmosphere from the magnetosphere during substorms and geomagnetic storms. Joule Heating can be estimated by several ways including the use of proxies like AE index, or Scandinavian sector IL index, or can be calculated by direct measurements of electric field combined with model conductivities and conductivities gathered from UV images of satellites as it is the scalar product of electric field and the current flowing parallel to the electric field. Here, we will present our findings from three substorm case studies which were observed during March 2008 and compare the results of the Joule Heating calculated using AE and IL proxies, IRI2007 model conductivities combined with SuperDARN electric field measurements and Joule Heating rates from SWMF/BATSRUS model runs. Our preliminary results show that the BATSRUS model gives lower Joule Heating rates than those calculated using AE and SuperDARN method. We will discuss the differences in terms of the role of magnetotail, solar wind input, and local ionospheric phenomena on the determination of Joule Heating.