Scale Dependence of the Field-Aligned Current and Relationship to Joule Heating: Tentative Analysis Framework

C. Bunescu (1), O. Marghitu (1), I.M. Ivan (1), S. Kaki (2)
(1) Institute of Space Science, Bucharest, Romania
(2) Finnish Meteorological Institute, Helsinki, Finland

The auroral current circuit, coupling the ionosphere and magnetosphere, is maintained by a dynamic and multiscale interaction in which both the magnetospheric and ionospheric ends provide input and receive feedback from each other in a self-consistent way. The energy input from the magnetosphere is transported by precipitating particles and Poynting flux, which is partially converted to ionospheric Joule heating and partially reflected. One of the main agents which intermediates the transfer of energy and momentum in the circuit is the field-aligned current (FAC), which couples to the curl-fee component of the ionospheric current, typically associated with Pedersen current, while the divergence-free component is in general associated with Hall current. However, these associations are not one to one and the actual Pedersen and Hall contributions to the curl-free and divergence-free ionospheric currents can vary, in particular during disturbed times. By exploring the multiscale structure of the field-aligned and Pedersen currents, one can check both the actual FAC closure and the efficiency of the related Joule heating (generated only by Pedersen current), depending on scale. In this study, we aim to develop an investigation framework, based on the application of the multiscale FAC analyser [*Bunescu et al. 2015*] to a test-bed data set observed by Swarm.