Geophysical Research Abstracts
Vol. 14, EGU2012-7282, 2012
EGU General Assembly 2012

On estimating the properties of the auroral magnetospheric generator from ionospheric observations of discrete auroral arcs and a magnetosphere-ionosphere coupling.

H. Lamy (1), M. Echim (1,2), and C. Simon Wedlund (1)

(1) Belgian Institute for Space Aeronomy, Brussels, Belgium (herve.lamy@aeronomie.be), (2) Institute for Space Sciences, Bucharest, Romania (marius.echim@aeronomie.be)

We propose a method to estimate the properties of the auroral generator, like electron density (n_e) and temperature (T_e), from ionospheric observations of the energy flux of precipitating electrons, ε, measured across an auroral arc. For this purpose, we use a quasi-static magnetosphere-ionosphere (M-I) coupling model based on the current continuity in the ionosphere (Echim et al, 2007) and a kinetic description of the magnetospheric generator derived from the models of tangential discontinuities (Roth et al 1993). The model is run iteratively for typical values of magnetospheric n_e and $T_e$that are adjusted until εg the precipitating energy flux provided by the model, fits the ionospheric observations. The latter can be obtained either from in-situ spacecraft measurements or from optical ground-based observations.

First, we test the method by using the precipitating energy flux observed by DMSP on April 28, 2001, above a discrete auroral arc. For this particular date we have been able to compare the generator properties determined with our method with actual magnetospheric in-situ data provided by Cluster. The results compare very well and hence validate the method.

Next, we use the energy flux of precipitating electrons obtained from optical images of discrete auroral arcs obtained simultaneously with the CCD cameras of the ALIS (Auroral Large Imaging System) network located in Scandinavia. Indeed, with tomography-like techniques, the three-dimensional (3D) volume emission rates at 4278 Å can be retrieved and used to derive the energy spectra of precipitating magnetospheric electrons in 2D, along and across the arc, with a spatial resolution of approximately 3 km. These spectra directly provide E_0, the characteristic energy and ε, the total flux energy of precipitating electrons. The generator properties are derived from this new set of auroral observations using the iterative technique validated with data from the DMSP-Cluster conjunction. We thus discuss a new method to explore the properties of the quasi-stationary magnetospheric generator of auroral arcs from ionospheric observations of the precipitating energy flux