

Characteristics of eastward propagating aurora vortices obtained by aurora tomography

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We investigate characteristics of three mesoscale aurora vortices observed in the Northern Scandinavia by aurora campaign observation in March, 2013, which was conducted in collaboration with the Swedish Institute of Space Physics (IRF) and the Finnish Meteorological Institute (FMI). The aurora vortices propagated eastward intermittently at about 15-minute intervals in the post-midnight sector (0:00-0:40 UT; 2:30-3:10 magnetic local time) after the substorm onset. They were simultaneously observed by three monochromatic (427.8nm wave length) all-sky EMCCD imagers at Tromso (69.6N, 19.2E), Norway, Kilpisjarvi (69.0N, 20.9E), Finland, and Abisko (68.4N, 18.8E), Sweden, with an exposure time of about 2 seconds and a sampling rate of about 10 seconds. In addition to these optical data, geomagnetic field data from the IMAGE magnetometer chain were also available.

The propagation speed of these vortices was approximately 3 to 10 km/s at 100 km altitude. The ionospheric equivalent current system accompanied by the aurora vortices indicated a two-vortex structure. By applying tomographic inversion analysis to the events, we also obtained 3D distributions of volume emission rate and ionospheric electron density, as well as horizontal distribution of auroral precipitating electrons. It is also possible to estimate horizontal distribution of the ionospheric conductivity from the electron density distribution at every 10-second interval. In the presentation we will discuss the magnetosphere - ionosphere coupling process of the aurora vortices and the relationship with the omega bands that are generally observed in the post-midnight sector.

Keywords: aurora, tomography, substorm, vortex structure, imager, ionospheric current