3D current system of eastward expanding auroral surges

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We investigate three-dimensional (3D) current system of eastward expanding auroral surges (EEASs) observed by ground-based network of all-sky imagers and magnetometers in Fennoscandia on March 9, 2013. Three EEASs were observed intermittently at about 15-minute intervals in the post-midnight sector (01:55-02:40 MLT) by three monochromatic (428nm) all-sky EMCCD imagers at Tromso (69.6N, 19.2E), Norway, Kilpisjarvi (69.0N, 20.9E), Finland, and Abisko (68.4N, 18.8E), Sweden and the IMAGE chain magnetometers. These data set allowed us to retrieve the height-integrated ionospheric conductivity in the horizontal area of about 300km by 300km and ionospheric equivalent current at high-sampling (10-seconds) intervals. The ionospheric conductivity was estimated from 3D distribution of the 427.8nm volume emission rate, which was obtained by applying the auroral computed tomography (ACT) method to multiple auroral images, and some theoretical and empirical models. Furthermore, we calculated horizontal distributions of ionospheric current, field-aligned current (FAC), and electric field at 10-sec resolution by the local KRM method using the obtained height-integrated ionospheric conductivity and equivalent current. The results indicate that a pair of upward and downward FACs was accompanied by the EEASs and the divergence of the ionospheric Hall current due to the ununiform conductivity may be a significant component of FACs for EEASs.

Keywords: auroral computed tomography, 3D current system, local KRM method, magnetosphere ionosphere coupling system, eastward expanding auroral surges

