

## 3D current system of auroral vortices in the discrete arc estimated by auroral tomography and local KRM methods

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In the magnetosphere-ionosphere coupling, three-dimensional (3D) current system on the ionosphere is essential to understand how electromagnetic energy and momentum are transported between the magnetosphere and ionosphere. However, it is generally difficult to derive the 3D current system of the auroral phenomena from the observation. One of the methods to obtain the 3D current system on the ionosphere is so-called Kamide-Richmond-Matsushita (KRM) method. This method calculates the 3D current system from the ionospheric equivalent current and the ionospheric conductivity; the former is derived from the ground-based magnetometer network data and the latter is often given by the empirical model.

In this study, we estimate the 3D current system of auroral vortices in the discrete arc, which were observed with the multiple imagers with a wavelength of 427.8 nm in Northern Europe at 22:15-22:20 UT on March 14, 2015, by using the local KRM method (Vanhamaki et al., 2006). The advantage of this study is to obtain the ionospheric conductivity from the imager network observation. We applied the auroral computed tomography method to the multiple monochromatic images and obtained 3D distribution of the volume emission rate of 427.8 nm every 10 second during 22:15-22:20 UT. By using the theoretical model and the empirical atmosphere model, we converted the volume emission rate to the electron density in the ionosphere. As a result, we obtained the height-integrated conductivity in the horizontal area of 150 km x 300 km. The ionospheric equivalent current was derived every 10 second from the IMAGE chain magnetometer data. Finally, we estimated 3D current system around the discrete arcs by using the local KRM method. The results showed that pairs of upward and downward field-aligned current (FAC) drifted eastward along the arc together with the auroral vortices. It was found that the distribution of the upward and downward FACs was distorted, which was caused by the divergent ionospheric Hall current due to the non-uniform ionospheric conductivity.

Keywords: aurora tomography, 3D structure of aurora, 3D current system, magnetosphere ionosphere coupling, auroral vortex structure