3D structure of discrete arcs obtained by auroral computed tomography analysis

Yoshimasa Tanaka[1,2,3], Yasunobu Ogawa[2,3],Akira Kadokura[1,2,3], Takanori Nishiyama[2,3], Akimasa Yoshikawa[4], Björn Gustavsson[5], Kirsti Kauristie[6], Carl-fredrik Enell[7], Urban Brändström[8], Tima Sergienko[8], Alexander Kozlovsky[9], Tero Raita[9], and Vanhamäki Heikki[10]

[1] *Polar Environment Data Science Center, Joint Support-Center for Data Science Research, Research Organization of Information and Systems*
[2] *National Institute of Polar Research*
[3] *The Graduate University for Advanced Studies (SOKENDAI)*
[4] *Kyushu University*
[5] *University of Tromsø - The Arctic University of Norway*
[6] *Finnish Meteorological Institute*
[7] *EISCAT Scientific Association*
[8] *Swedish Institute of Space Physics*
[9] *Sodankylä Geophysical Observatory, Finland*
[10] *University of Oulu, Finland*

We present three-dimensional (3D) structure of auroral discrete arcs obtained by auroral computed tomography analysis. The discrete arcs were observed with multi-point monochromatic all-sky and wide field-of-view imagers (wavelength = 427.8 nm) during 22:15-22:20 UT on March 14, 2015. We investigated the magnetosphere-ionosphere (MI) coupling process around the auroral arcs. The 3D structure of the 427.8-nm emission in the discrete arcs and horizontal distribution of precipitating electron's energy were obtained every 10 second during 22:15-22:20 UT. We newly found that the averaged energy of precipitating electrons was higher around the center of auroral vortices where the total energy flux was also greater than the other area. The relationship between the averaged energy and total energy flux of the precipitating electrons is consistent with the Ohm's law along the field lines, which indicates that the field-aligned current is proportional to the field-aligned potential difference. The obtained emission profile was similar to the electron density profile simultaneously observed by the EISCAT UHF radar, therefore, we estimated the height-integrated conductivity in the horizontal area of 150km x 300km from the optical emission using the MSIS atmosphere model. We will further combine the ionospheric conductivity with the equivalent current system estimated from the IMAGE chain magnetometer data and analyze the distribution of the ionospheric current and field-aligned current, i.e., 3D current system around the discrete arcs.