Application of Generalized Auroral Computed Tomography to the EISCA T 3D project

Yoshimasa Tanaka, Yasunobu Ogawa, Akira Kadokura, Hisao Yamagishi, Hiroshi Miyaoka, Takehiko Aso, Genta Ueno, Satoko Saita

1 National Institute of Polar Research, 2 The Graduate University for Advanced Studies, 3 The Institute of Statistical Mathematics, 4 Transdisciplinary Research Integration Center, Research Organization of Information and Systems

Aurora Computed Tomography (ACT) is a method for retrieving three-dimensional (3-D) distribution of auroral luminosity from auroral images obtained simultaneously by the multi-point observation. As a next step of the ACT, we have developed Generalized - Aurora Computed Tomography (G-ACT) that reconstructs the energy and spatial distributions of precipitating electrons from multi-instrument data, such as ionospheric electron density from the EISCA T radar, cosmic noise absorption (CNA) from imaging riometer, as well as the auroral images. This method is compatible with 3-D ionospheric data observed by the EISCAT 3D radar, because the tomography method essentially assumes that the observational data are the projection of the 3-D data.

In this study, we examine how the G-ACT method can contribute to the EISCAT 3D project by numerical simulation. We first obtained auroral images observed by ALIS (Aurora Large Imaging System) and the electron density distribution observed with the EISCAT 3D radar by assuming spatial and energy distribution of incident electrons and then applied the G-ACT to these data. The results showed a possibility that the G-ACT can interpolate the electron density distribution observed with the EISCAT 3D radar at a higher spatial resolution. On the other hand, the 3-D aurora distribution reconstructed from only optical images was improved by a use of the EISCAT 3D data. Furthermore, we suggest where new imagers should be installed for simultaneous observation with the EISCAT 3D radar.

Keywords: aurora tomography, EISCAT_3D, inverse problem, 3 dimensional structure, aurora imager, ionospheric electron density