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Inverse analysis of multi-instrument data of the polar ionosphere

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In the past, analysis techniques of auroral data have dealt primarily with one kind of observational data in one or two dimensions. In recent year, however, many kinds of auroral data have been obtained by the comprehensive observation with various instruments. Further, new projects of the three-dimensional (3-D) ionospheric observations such as the next generation European Incoherent Scatter radar system (EISCAT-3D) are planned in the near future. Therefore, the development in the analysis technique is needed to make use of the multi-instrument and the 3-D data.
One of the promising methods is the Aurora Computed Tomography (ACT), which is a method to reconstruct 3-D distribution of auroral luminosity from monochromatic images simultaneously obtained at the multi-point stations. We have extended this method to a 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 incoherent scatter radar, cosmic radio noise absorption from imaging riometers, as well as the auroral images. In this presentation, we describe the reconstruction algorithm of this method in detail. Further, we test the feasibility of this method under various conditions of station locations, auroral forms, and observational errors, by numerical simulation.

Keywords: aurora, ionosphere, tomography, Bayesian model, inverse problem