Study on ionospheric responses to aurora activity using the EISCAT radar and the multi-wavelengths photometer

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An important aspect of the coupled magnetosphere-ionosphere system at high latitudes is to know horizontal two-dimensional distributions of the electron density or the conductance in the ionosphere. This is because the energy deposition in the magnetosphere-ionosphere coupled system is characterized by the fine structure, which tends to vary with time. Many researchers proposed methodology to estimate the two-dimensional distribution by using optical data taken with various wavelengths. While these researching activities allowed us to estimate the horizontal map of the ionospheric conductance with some confidence, the methodology has not yet been in complete agreement with results from the incoherent-scatter (IS) radar, which can provide height-resolved data of the electron density with better quality but in a restricted area. One of important issues to reduce the discrepancy is to develop more sophisticated method to be employed for estimating the ionospheric parameter from optical data.

To improve the method, we believe that the best way is to conduct experiment with the IS radar and the multi-wavelengths photometer by fixing both line-of-sights along a magnetic field line. The experiment provides data taken in a same volume in the ionosphere and at a same time resolution between the instruments. Since this method can reduce uncertainty associated with spatiotemporal discrepancies in the monitored area with two instruments, differences between results from the two instruments should be attributed to the method employed on analyzing optical data.

In this paper we analyzed data sets obtained for simultaneous observations between the European Incoherent Scatter (EISCAT) radar and the multi-wavelengths photometer collocated at Tromsoe, Norway (69.6 N, 19.2 E). The data sets were taken at dark night with clear-sky from 2001 to 2006 for total 105 hours. The presentation will address dependencies of the emission intensity at several wavelengths (557.7, 427.8, 844.6, 670.5, and 630.0 nm) on the height-resolved electron density from the EISCAT radar. Furthermore, we plan to address relationships between the emission intensity and the ionospheric conductance.