# Study on polar electrodynamics by simultaneous satellite-EISCAT observations

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The final goal of this study is to understand the ionospheric current closure of the field-aligned currents and the relative importance of the electric field and the ionospheric conductivity to the field-aligned current density. In October, 1999, we made satellite-EISCAT conjugate experiment with EISCAT special experiments. In order to derive the gradient of the ionospheric conductivity and divergence of the electric field, the special experiment employed an EISCAT radar mode. A preliminary analysis of the EISCAT radar data disclosed that the divergence of the electric field played a more significant role in the closing field-aligned current rather than the gradient of the ionospheric conductivity.

EISCAT measurements provide temporal and spatial variations of ionospheric parameters such as the electron density and the electric field. From these parameters we can derive the ionospheric current. Spatial variations of the ionospheric parameters, i.e., the gradient of the ionospheric conductivity and divergence of the electric field enable us to determine the field-aligned current density. This method is very unique and same as that adopted for the CLUSTER satellite. One of the advantages of this method is that you can quantitatively determine how the ionospheric current is connected to the field-aligned current. On the other hand, as is well known, satellite measurements of the magnetic field and plasma also allow us to derive the field-aligned current under some assumptions. Since the determination method of the current proposed here must first be validated whether it provides meaningful current density or direction, comparison study based on simultaneous observations is important.

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