

An Observation of Polar Cap Aurora with RISR and OMTI: A Feasibility Study for EISCAT_3D

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One of the primary scientific objectives of the planned EISCAT_3D would be "3D imaging of aurora", especially 3D imaging of dynamically moving auroral arcs at the time of substorm expansion phase onset. In order to discuss the specification of the EISCAT_3D system, we have to know how such an effort of 3D imaging of aurora is being made by using currently-working IS radar systems. For this purpose, we introduce an event of isolated auroral arc in the polar cap region which was simultaneously observed by an all-sky imager of OMTIs (Optical Mesosphere Thermosphere Imagers) and RISR (Resolute Bay Incoherent Scatter Radar) at Resolute Bay, Canada (74.7 N, 265.0 E, 82.9 MLAT) in winter/2009. By using the data during this event, we visualized the plasma structure near the arc in 3D fashion. In particular, we tried to reproduce the 3D structure of electric field and corresponding electric current through a quantitative estimation of horizontal plasma velocity along the arc. As a result, ion velocity around the arc was found to show a shear reversal flow across the arc at 200-400 km altitudes; -1500 m/s on the dusk-side of the arc and 1000 m/s on the other side of the arc. This reversed flow corresponds to an electric field (i.e., Pedersen current) structure converging towards the center of the arc. Such a converging Pedersen current is consistent with upward field-aligned currents (FACs) within the arc which are possibly carried by precipitating electrons leading to the generation of the arc. Possible 3D structure of electric field and electric current including FAC around the arc will be discussed as a feasibility study for the EISCAT_3D system.