

Small and large structures of the cusp observed with CLUSTER and EISCAT Svalbard radar

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The coupling and interactions between ionosphere, magnetosphere, and magnetopause around the cusp are studied using simultaneous CLUSTER and EISCAT Svalbard radar (ESR) data between 09-10 UT on March 4, 2002. The Interplanetary magnetic field (IMF) B_z is positive most of the time, except two periods with negative IMF B_z . The plasma convection seen by the ESR is equatorward except in a period of negative IMF B_z when it turns poleward. This is consistent with lobe reconnection going on when IMF B_z positive. Magnetic structures seen by CLUSTER in the exterior cusp move sometimes sunward, sometimes tailward, suggesting that a reconnection line is located sometimes tailward, sometimes sunward of CLUSTER. They are associated with both field-aligned and perpendicular currents. The strongest current is seen after a change of IMF B_z direction from positive to negative. The field-aligned current fluctuates between up- and downward, and the perpendicular current and electric field are mainly a generator around 0905 UT and a load around 0935 UT at the CLUSTER location.

A corresponding magnetic variation is recorded at the ground by magnetometers on Svalbard. The ESR shows so-called naturally enhanced ion-acoustic lines (NEIALs) which are associated with upward ion flow and intense particle precipitation. Thus our coordinated observations demonstrate how after a change of the IMF, presumably associated with a new location of magnetic reconnection, magnetic stress and energy are transmitted to the cusp ionosphere, and also how magnetosheath plasma reaches the ionosphere in form of soft particle precipitation and affects it.