Overshielding caused by the substorm during geomagnetic storms

Takashi Kikuchi[1]; Kumiko Hashimoto[2]; Yukitoshi Nishimura[3]; Yusuke Ebihara[4]; Tomoaki Hori[5]; Nozomu Nishitani[6]; Tsutomu Nagatsuma[7]; Ken T. Murata[8]
[1] STEL, Nagoya Univ.; [2] KIU; [3] STEL, Nagoya Univ.; [4] RISH, Kyoto Univ.; [5] STE lab., Nagoya Univ.; [6] STELAB, Nagoya Univ.; [7] NICT; [8] NICT

The overshielding responsible for the equatorial counterelectrojet (CEJ) is often associated with the convection reduction due to the decease in the southward IMF or northward turning of the IMF under a condition of well developed Region-2 field-aligned currents (R2 FACs). This condition often occurs during substorms (Kikuchi et al., 2000, 2003) and storms (Kikuchi et al., 2008). Kikuchi et al. (2008) demonstrated that the overshielding during the storm recovery phase was associated with the rapid poleward shift of the auroral oval. They suggested that the substorm-associated overshielding may have contributed to the decay of the ring current. On the other hand, the overshielding during isolated substorms often accompanies increases in both the R1 and R2 FACs at the onset of the substorms, and the R2 FACs are strong enough to cause the overshielding at the equator (Hashimoto et al., 2011). In this paper, we show that the overshielding occurs over a period of increasing convection electric field during the main phase of the geomagnetic storm on December 14-15, 2006. The auroral oval continues to move equatorward on the dayside during the substorm expansion phase as observed by SuperDARN. The electric field responsible for the stormtime CEJ at the dayside equator has been attributed to the disturbance dynamo (Fejer et al., 2007). However, we confirmed substorm signatures such as the auroral breakup, westward auroral electrojet intensification and mid latitude positive bay on the nightside for the CEJ event during the storm main phase. Our observational results suggest that the overshielding causes the CEJ even during the storm main phase. It has been shown in this paper and previous one (Kikuchi et al., 2008) that the overshielding occurs during the storm main phase as well as during the recovery phase. The role of the substorm-associated overshielding still remains an issue in the evolution of the geomagnetic storm.