

Overshielding associated with the substorm expansion as observed with polar-equatorial magnetometer array and SuperDARN

Kumiko Hashimoto[1]; Takashi Kikuchi[2]; Manabu Kunitake[3]; Shinichi Watari[3]

[1] Kibi International Univ.; [2] STELab; [3] NICT

Ionospheric currents opposite in direction to the DP2 currents have often been observed with magnetometers at subauroral latitudes and at the dayside geomagnetic equator, when the convection electric field reduced because of the northward turning of the IMF. The reversed currents have been explained by means of the overshielding electric field due to the Region-2 field-aligned currents (R2 FACs). In this paper, we report a new type of overshielding that initiated at the substorm expansion, accompanying an increase in the DP2 currents at auroral latitudes as observed with the IMAGE and Greenland magnetometer arrays. With the SuperDARN convection map, we confirmed that reversed current corresponded to an anti-sunward convection flow equatorward of the sunward auroral flow. We further confirmed that the counter-electrojet was superimposed on the equatorial eastward electrojet caused by the quiet-time dynamo. All these data infer that both the R1 and R2 FACs were intensified at the onset of the substorm, and that the electric field associated with the R2 FACs overcame that of the R1 FACs at mid-equatorial latitudes. The substorm current system (DP1 current) should be modified so as to include the ionospheric currents at the dayside mid-equatorial latitudes.