

Response of the reverse convection to sharp IMF turnings: Observations from multi-spacecraft and ground magnetometer stations

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How strongly the dayside high-latitude convection is controlled by the orientation of the IMF for periods of the steady IMF is well established. However, the nature of the transition that the convection makes when the IMF changes sharply is still not fully understood. In the present paper, we report the characteristics of the transient nature of the reverse convection on the basis of observations from multi-spacecraft and ground magnetometer stations. During a period of northward IMF on 22 April 2006 the magnetic field observations from three ST-5 spacecraft identified distribution change in the polar cap field-aligned current which responds to a quick IMF turning from the purely northward orientation to the duskward orientation. At this time ST-5 flew over one of the Greenland magnetometer stations located near 1200 MLT. The analysis of the ground magnetic perturbations shows that the field-aligned current distribution, which is closely related to the reverse convection pattern, was changing gradually during about 10 min before reaching a steady state. When the steady state was going on, the IMF changed sharply from the duskward orientation to the dawnward orientation. Immediately after this IMF turning, three DMSP spacecraft (F13, F15, and F16) traversed the dayside polar cap in the northern hemisphere. The ion drift observation indicates that the polar cap convection changed from the clockwise circulation to the counter-clockwise circulation during about 10 min. The data from the Greenland magnetometer stations show that a transient state, i.e., deformation or reduction of the clockwise circulation started in the near-noon and postnoon sectors almost simultaneously when the ion drift consisting of the clockwise circulation is still seen in the prenoon polar cap by the DMSP spacecraft. We discuss the changing global patterns that occurred over the whole dayside polar cap during the course of the 10-min transient state for both cases.