Generation mechanisms of the IMF By-controlled field-aligned current systems on the dayside

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It is well accepted that the field-aligned current systems (FACs) on the dayside are controlled by the dawn-dusk (B_y) component of the interplanetary magnetic field (IMF). We here describe the FAC systems for southward IMF. During IMF B_y-dominated periods, there appears a pair of FAC sheets in the midday sector. When IMF B_y is positive, in the Northern Hemisphere, the equatorward current (midday region 1) flows into the ionosphere while the poleward current (midday region 0) flows away from the ionosphere. The flow directions are opposite in the Southern Hemisphere. When IMF B_y is negative, the above-mentioned flow directions reverse. Although the morphology is well established, as for the understanding of the magnetospheric sources of those currents, there has been almost no progress in the past two decades. This is because observations cannot provide global information on plasma processes. To overcome this difficulty, we performed numerical magnetohydrodynamic (MHD) simulation using the Reproduce Plasma Universe (REPPU) code developed by T. Tanaka. The MHD simulation successfully reproduced the IMF B_y-controlled FAC system. The midday region 1 and region 0 FACs are closed in the magnetospheric cusp, spiraling around the high-pressure region. The dynamo is located in the poleward side of the cusp, while the equatorward part is the electromagnetic energy load. The plasma processes of the dynamo and the load are interpreted, respectively, in terms of expanding and contracting slow mode disturbances.