PENETRATION OF MAGNETOSPHERIC ELECTRIC FIELDS TO THE LOW LATITUDE IONOSPHERE DURING GEOMAGNETIC STORMS

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Penetration of the magnetospheric electric fields to low latitude ionosphere was examined using magnetometer data from high latitude to the equator for geomagnetic storms characterized by an equatorial enhancement of storm amplitude. To detect the penetrated electric fields, we analyzed magnetic disturbances at the geomagnetic equator, Yap (-0.3° GML), subtracted by those at low latitude, Okinawa (14.47° GML). During storm main phase, the equatorial electrojet (EEJ) was enhanced by the dawn-to-dusk convection electric field which was associated with the Region-1 field-aligned currents (R1 FACs). The excess part of the stormtime EEJ relative to the quiettime EEJ is an equatorial part of the global DP 2 currents which was driven by the dawn-to-dusk convection electric field. Simultaneous development of the global DP 2 currents suggests instantaneous transmission of the convection electric field from the polar to equatorial ionosphere. The electric field associated with the ionospheric currents will be transmitted to the F-region ionosphere and to the inner magnetosphere, and caused quick response of ionospheric motion at low latitude and of the ring current after the EEJ enhancement. The electric field penetration continued for several hours during the whole period of storm main phase, but shielding became effective in late main phase because of development of the R2 FACs. The shielding electric field became dominant, i.e., overshielding occurred in the beginning of storm recovery phase, causing the counter-electrojet (CEJ) at the dayside equator. On the other hand, there often occurred CEJs which were not associated with the mid latitude DP2 currents. This kind of CEJ occurred during both storm main and recovery phases. The disturbance dynamo could be a cause of this type of CEJ. However, it still remains a crucial issue to distinguish the overshielding electric field from that produced by the disturbance dynamo.

geomagnetic storm, penetration electric field, equatorial electrojet

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