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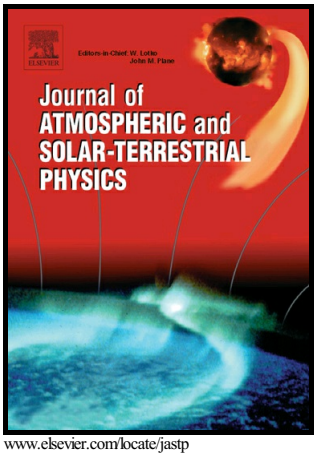

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Interplanetary Drivers of Daytime Penetration Electric Field into Equatorial Ionosphere during CIR-Induced Geomagnetic Storms

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Abstract

Observations based on the magnetometer data of the response of the daytime equatorial electric field to the geomagnetic storms induced by corotating interaction regions (CIRs) during 2007−2010 reveal many events of striking long duration of multiple short-lived prompt penetration electric fields (PPEFs). The PPEFs essentially occurred in the main phase of the storms, which are associated with the ring current and magnetic reconnection of the southward $z-$component of the interplanetary magnetic field (IMF Bz) in relation to the Alfvén waves. The behaviors of the electric field penetration during the storms are consistent with the shielding theory. Particularly, the PPEF is found to be complex due to transient variations in the solar wind dynamic pressure (SWDP) and the IMF Bz in the CIRs. The PPEF is temporary suppressed for about an hour under a shock in association with a drop in the SWDP. The interplanetary electric field Ey is the main driver of the PPEFs, when the solar wind speed, SWDP, and the symmetric ring current are nearly constant, even in the recovery phase. The PPEF is allowed under the condition of high and variable SWDP. The shocks with a northward IMF Bz shield the PPEFs when the SWDP is nearly constant. The partial ring current is strongest in the large and northward IMF Bz, where the shielding effect is greater than the undershielding caused by the large

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