

Plasma Sheet Convection During Storms: Global Statistical Patterns and Mesoscale Bursty Flows

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Abstract

During geomagnetic storms, the nightside of Earth's magnetosphere experiences significant disturbances, with multiple phenomena interacting with each other on various scales. Enhanced convection and particle injections influence the development of the ring current during storm times. Additionally, mesoscale structures like bursty bulk flows (BBFs) and dipolarization fronts play a crucial role in transporting plasma and magnetic flux in the plasma sheet, though their specific roles during storms are not well understood.

In this study, we quantify the magnetic flux transport in the plasma sheet using data from the Geotail and Magnetosphere Multiscale (MMS) missions. Our statistical analysis examines how properties of plasma sheet convection vary during different storm phases (main and recovery) and at various distances from Earth.

We find that the convection electric field is elevated across the plasma sheet during storms, displaying a dawn-dusk asymmetry. On the dawn side, magnetic flux transport is linked to faster plasma flow, while on the dusk side, it is associated with more dipolar magnetic fields. These results align with recent findings on the location of magnetic reconnection sites and with the presence of a dawnside current wedge (DCW) during storm time ring-current intensification.

Finally, we assess the contribution and importance of bursty mesoscale fast flow intervals in magnetic flux transport across the magnetotail. Our preliminary findings reveal various asymmetries in properties and occurrences when comparing quiet and storm times, highlighting the complex dynamics at play.