Evaluating the magnetic and plasma flux transport in the plasma sheet during geomagnetic storms using MMS

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Abstract

During geomagnetic storms, the nightside of Earth's magnetosphere experiences significant disturbances, featuring various phenomena that interact with one another. These include enhanced convection and particle injections influencing ring current development, alongside mesoscale structures like bursty bulk flows (BBFs) and dipolarization fronts, which play roles in plasma and magnetic flux transport within the plasma sheet. However, their specific functions during storms are not fully comprehended.

In our work, we evaluate the transport of magnetic and plasma flux in the plasma sheet region using data obtained from NASA's Magnetosphere Multiscale (MMS) mission. Leveraging MMS's extensive measurements from the plasma sheet, a statistical analysis is conducted based on nearly 200,000 data points (at 4.5-second resolution) obtained from the Fast Plasma Investigator (FPI) during quiet and disturbed geomagnetic periods.

The statistical examination primarily focuses on how different properties describing convection in the plasma sheet vary across distinct phases of storms (main and recovery) and at various distances from Earth. Furthermore, we compare our results with these obtained by prior research from other missions. Additionally, we assess whether variations in instrumental capabilities, such as time resolution and energy range among different instruments on MMS, could influence the statistical outcomes.