EPSC Abstracts
Vol. 8, EPSC2013-516, 2013
European Planetary Science Congress 2013

Near-Earth magnetotail current sheet disturbances induced by the solar wind and IMF changes

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Abstract

Plasma processes in the Earth's magnetotail current sheet are resulting in particle acceleration and precipitation, as manifested by auroral substorms, thereby leading to enhanced ionospheric coupling and dissipation of the incoming and transported solar wind energy from dayside magnetopause, hence playing a key role in the Earth's space-weather. The response of the magnetotail current sheet depends both on the driver (solar wind/IMF) and its internal condition. We discuss the different mode of the near Earth's current sheet disturbances due to the changes in IMF and/or solar wind direction based on multi-point magnetospheric observations by THEMIS and Cluster, which allow to monitor the spatial and temporal changes in the magnetotail current sheet. Particularly, we highlight two different types of interaction: (1) Tailward development of the current sheet disturbance in a two-onset substorm due to a gradual changes of northward IMF component. (2) Azimuthally propagating current sheet waves leading to an onsets of a substorm caused by change in the solar wind direction. It is shown that in both cases, the magnetic field configuration, particularly the distribution of the normal component of the magnetic field in the current sheet, is an important factor for development of different plasma instabilities leading then to magnetotail reconnection with a larger scale consequences such as substorms.