

The relationship between fluctuating plasma sheet and substorm development: Cluster and Double Star TC1 case study

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During magnetospheric substorms, the magnetic field configuration in the near-Earth tail often changes drastically, from tail-like to a more dipolar configuration. This dipolarization seems to be caused by the disruption of cross-tail currents in the near-Earth tail or by bursty bulk flows (BBFs) in the midtail. Around the disturbances, it is also known that the plasma sheet sometimes fluctuates strongly (magnetotail flapping, kink-like motion or sausage modes). The relationship between such a fluctuating plasma sheet and BBFs/dipolarization is still unknown.

In this study, conjunction events of Cluster in the midtail region and Double Star TC1 in near-Earth tail are investigated. We present two global dipolarization events observed by Cluster and TC1 on Sep. 3, 2004, that were preceded by a fluctuating plasma sheet. Dipolarization took place associated with a global onset and a fluctuating plasma sheet was observed during periods of pseudo-breakup. In the first case, a fluctuation of plasma sheet (kink-like) preceded an auroral brightening. In the second case, a fluctuating plasma sheet (kink-like and sausage mode) followed the auroral brightening. In both cases, the following substorm expands globally and both spacecraft observe the propagating dipolarization front. We discuss how the fluctuating plasma sheet relates to localized activation during the growth phase and leads to a large scale onset of the substorm.