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Evolution of dipolarization fronts observed by Cluster and MMS

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Dipolarization fronts (DFs) are characterized by a rapid increase in the northward magnetic field component (B_z) and play a crucial role in the energy and magnetic flux transport in the magnetotail. Multispacecraft observations of DFs in a large portion of the magnetotail by e.g. Geotail, Cluster and THEMIS have been reported for over three decades.

During the commissioning phase of MMS the spacecraft observed DFs in a string of pearl configuration at radial distances within 12 Re, and hence events within the flow braking region are also included. We present a statistical study of DFs, using magnetic field data from both MMS and Cluster at radial distances between 12-20 Re and interspacecraft distances less than 200 km.The amplitude of the DFs observed by MMS is larger compared to similar events observed by Cluster further down the tail as expected from flow braking. Both spacecraft flotillas found that DFs with velocities greater than 100 km/s are observed when the field is in a more dipolar field configuration (higher average B_z), are temporally shorter and spatially larger, compared to slow propagating DFs (velocities smaller than 100 km/s). This relationship between velocity and B_z indicates a higher flux transport rate when the ambient B_z is larger and is not expected when the flow is simply stopping in a near-Earth dipole region. It suggest rather that the flow with high flux transport rate causes an enhanced magnetic flux pileup ahead of the front or importance of additional processes such as rebound (bouncing) of the DF at the magnetic dipole-dominated near-Earth plasma sheet.