



On the Origin of the Dips ahead of Dipolarization Fronts: A MMS multi-case study

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Magnetic reconnection in the magnetotail accelerates plasma in short duration bursts of fast flows, referred to as Bursty Bulk Flows (BBFs) towards the Earth. These BBFs are typically accompanied by a sharp increase in the northward magnetic

field component, the so-called dipolarization front (DF). This rapid increase in northward magnetic

field is often preceded by a decrease, the so called DF-dip, where the northward magnetic field component sometimes even changes sign and turns southward. Here we present a statistical study of the DF-dip of 43 events, using observations from the Magnetospheric Multiscale (MMS) mission during summer 2017, when MMS's apogee was located in the magnetotail around 25RE. The 43 events are subdivided into two categories according to their DF-dip: 20 events where the DF-dip stays northward (positive DF-dip category) and 23 events where the DF-dip turns fully southward (negative DF-dip category). We

find that (1) the magnetic field depression ahead of the DF of the positive DF-dip events correlates mainly with perpendicular currents and diamagnetic currents flowing ahead of the DF; (2) the magnetic field depression ahead of the DF of the negative DF-dip events correlates mainly with

field-aligned currents, and that this type of events might be (a) earthward moving flux rope-like structures caused by multiple X-line reconnection and/or (b) are a result of localized, single X-line reconnection under a guide-field.