



Fast Tailward Flows in the Plasma Sheet Boundary Layer during a Substorm on March 9, 2008: THEMIS Observations

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Tailward flows in the plasma sheet boundary layer (PSBL) were observed simultaneously by the five THEMIS probes at downtail distances $X \sim 7.6$ to ~ 17.6 RE for ~ 10 minutes during an interval of successive substorm intensification in a storm-time on March 9, 2008. The flows first occurred close to Earth and then propagated along the magnetic field lines in the PSBL with a speed of 150~350 km/s. We show that the occurrence of tailward flows is highly dependent on proximity to the plasma sheet boundary. Higher speeds occurred in the outer part of the PSBL, while either lower tailward speeds (or even earthward flows) were seen in the inner part of the PSBL. The tailward flow occurrence increased during magnetotail stretching, and decreased or ceased during magnetic field dipolarizations. These PSBL tailward flows near the Earth can be understood as an outflow of the earthward flows that essentially empty the central plasma sheet (CPS). The tailward flows along the field line filled the void left behind by the dipolarization front.