

BBF-like characteristics of fast tailward flows in the near tail region: Event study of Geotail observations

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Fast plasma flows in the near tail region has been studied as an element which characterizes the plasma sheet boundary layer (PSBL), and there was a time in which such fast flows only exist in the PSBL region. However, later, it was found that fast flows also exist in the central plasma sheet (CPS), playing a significant role carrying magnetic fluxes and energies in the magnetotail. It was also found that such flows in the CPS has a duration about 1-3 min and consist of several intermittent flows, so that typical duration is about 10 min as a whole. Now, it is called bust bulk flows (BBFs) after such characteristics. In the near tail region, earthward BBFs can be observed in all phases of substorms. However, tailward BBFs can be observed only during the expansion or recovery phase of substorm associated with the formation of the near Earth neutral line (NENL).

With these regards, we investigated the fast tailward flow events on January 23, 1997 observed by Geotail when the spacecraft was located at (X, Y, Z) GSM~ (-30, 5, -3) Re. There were at least three plasmoid passages at the spacecraft location at 10:41, 11:18 and 11:45 UT. Associated tailward flows continued for 25, 22 and 18 min for each event. Those flows can be interpreted to correspond to the Geotail encounter with the post plasmoid plasma sheet (PPPS).

The velocity V_x itself did not necessarily show intermittent variations. However, interestingly if we decompose it into the parallel and perpendicular components with respect to the local magnetic field, it was found that the perpendicular component shows intermittent variation with characteristic time of 1-5 min. It was also found that the southward magnetic fields accompanied the perpendicular tailward flows, carrying significant magnetic fluxes to the down tail region. With those evidences, the fast perpendicular flows can be regarded as similar to the BBFs. The physical mechanism of creating such intermittency is not well known, but one possibility is that it is the reflection of the variation of NENL itself, and the other is the reflection of the hydromagnetic oscillations of the current sheet that contains the BBFs.