Analysis of low-frequency magnetic field fluctuations in the near-Earth plasma sheet prior to dipolarization with Geotail data

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Using magnetic field and low-energy ion data from Geotail, we have studied a possible cause for magnetic field fluctuations observed in the plasma sheet of the near-Earth magnetotail prior to dipolarization onset associated with auroral breakups. The analysis methodology in the present study is twofold: The first part is for obtaining common features of the near-Earth tail at X˜-10Re, particularly close to the equatorial plane, before dipolarization on a statistical basis. We selected eight dipolarization events in which the satellite remained in the close vicinity of the neutral sheet prior to dipolarization for more than twenty minutes. In five events, the plasma beta increased to more than fifty for several minutes during the late growth phase due to the decrease in the magnetic field intensity. This feature of high beta plasma sheet is favorable for the occurrence of many kinds of tail instability that are sensitive to the ion anisotropy and ambient field configuration. The second part of our methodology is for obtaining wave properties by assuming observed fluctuation as a plane MHD wave. Here this assumption was checked by minimum variance analysis. A set of MHD equations of linear perturbations in a low-frequency limit (0.007-0.03Hz) gives the relationship between the perturbations of the parallel magnetic field and the ion velocity vector. Applying this relationship to the observed fluctuations, we estimated the fluctuation frequency in plasma frame, propagation direction, and ambient field inhomogeneous features.