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Statistical analysis of magnetic field fluctuations in the near-Earth magnetotail by THEMIS

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Abstract. We made a statistical analysis of severe magnetic field fluctuation around the inner magnetosphere (X = – 6 ∼ – 12 R_E), which is considered as a necessary cause for current disruption in the substorm model raised by *Lui* (2001). We used two-year magnetic field data of 2013 and 2014 with a sampling rate of 4 *Hz*, which were obtained by the FGM instrument aboard the TH-E (P4) probe of THEMIS. The occurrence rates of severe magnetic-field fluctuation events with C >0.5 were estimated for the nightside near-earth tail at (X_{GSM}, Y_{GSM}, Z_{GSM}) = (– 9 ± 3, ± 5, ± 3) R_E, where C was defined as a ratio between standard deviation and average value of magnetic field intensity during 10-s interval. We found that the occurrence rates are extremely low, of 0.011% for all regions, 0.002% for $|X_{GSM}|$= 6 – 8 R_E, 0.010% for $|X_{GSM}|$= 8 – 10 R_E, and 0.017% for $|X_{GSM}|$= 10 – 12 R_E. We also compared these fluctuation events with simultaneous ion velocity and spectrum data from the ESA instrument on the same probe, and found that magnetic field fluctuation and ion acceleration do not always happen synchronously. Assuming that two substorms occur every day with a 5-min duration of current disruption, we suggested that the low occurrence rate (0.011%) of severe magnetic field fluctuations may indicate that the current disruption region is very localized (∼ 2.6 $R_E{}^3$) in the tail, or the current disruption model is not suitable for most substorm cases. In the presentation, we will show results of similar statistical analysis to magnetic field fluctuations with time scales faster than the local ion cyclotron periods by using higher time-resolution data, in order to investigate the importance of non-MHD processes in the near-Earth tail dynamics.

Reference

A. T. Y. Lui., A multiscale model for substorms, *Space Sci. Rev.,* 95, 325-345, 2001.