FEASIBILITY OF THE FROZEN-IN FIELD LINE CONDITION IN MAGNETOSPHERIC DISTURBANCES: ANALYSIS OF THEMIS-A DATA

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The frozen-in condition (FIC) is one of the fundamental equations in magnetohydrodynamics. It is supposed to describe the space plasma behavior in planetary magnetospheres, heliosphere, and interstellar medium. Therefore, verifying the validity of FIC is crucial for space plasma physics. FIC can be expressed by the equation $E = -u \times B$, where E is the electric field, u is the particle flow velocity, and B is the magnetic field induction. In this study, we performed a statistical analysis of the FIC's fulfillment in Earth's magnetosphere.

The data from THEMIS A satellite mission between January 2017 and February 2018 was used. We introduced a statistical parameter aimed to estimate of the extent to which this was the case. A distribution of the probability of the condition being fulfilled was plotted for different regions of the magnetosphere. Based on this distribution and the results of the analysis, we can see that using the parameters included in the equation, FIC is not always met. This allows a better understanding of which space weather factors may influence the inability to reach the frozen-in condition, and under what conditions frozen-in is most likely to happen.