



Average plasma sheet polytropic index as observed by THEMIS

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Being in orbit for almost 10 years, THEMIS provides the opportunity to statistically infer many average properties of Earth's magnetosphere. In this work, the determination of the average polytropic index in Earth's plasma sheet is recapitulated. Findings of earlier studies in the 1990's are taken as the starting point to give an update on methodology and results.

The usual approach, namely fitting a power law distribution to the total density-pressure-space or subsets of, confirms previous results by giving a close-to-adiabatic polytropic index estimate. However, the weakly-correlated data suggest that the analysis needs to be performed in smaller subsets of the data or on shorter timescales.

To achieve this, the data are analyzed for each individual spacecraft orbit separately. From this, distributions of polytropic indices can be derived. The results indicate that there is a wealth of polytropic processes ranging between $\gamma = 2/3$ and $\gamma = 2$, resulting in the constant presence of heat exchange of the plasma. Spatial analysis suggests a radial dependence related to the flow braking region of the near-Earth plasma sheet. No hemispheric differences are observed in the magnetosphere. The findings question the application of constant-polytropic-index approximations in many models and simulations.