**SM019 – Past, Present, and Future Inner Magnetosphere Missions: Science Targets, Gaps, and Opportunities**

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**Enabling Intelligent Data Downlink Prioritization of In-Situ Observations through Generalizable and Computationally Inexpensive Anomaly Detection**

High-fidelity measurements of magnetic fields and other observed properties, such as energetic particle fluxes, are a necessary component to our understanding of the highly dynamic near-Earth space environment. As our desire to study smaller-scale phenomena such as shocks and dipolorizations has increased, we have been driven to take and telemeter measurements at higher cadences. Unfortunately, many missions are unable to downlink all their captured data due to the well-known data transmission bottleneck at the DSN. These missions must then prioritize their high-cadence data such that the most scientifically useful intervals are transmitted. One simple prioritization technique uses the spacecraft position to telemeter data from only the region of interest. Although easy to implement, this method does not leverage the available scientific data and can omit intervals of useful scientific data when they lie outside the region of interest. The Magnetospheric Multiscale Mission (MMS) uses mission-specific parameterization of several data products to automatically prioritize scientifically useful intervals. Then, MMS verifies the automatically selected intervals by having a domain expert manually select intervals for downlink. The overall complexity required by this technique make it prohibitive for deployment on low-cost platforms (i.e., CubeSats) or on future missions featuring large constellations of satellites such as the Geospace Dynamics Constellation (GDC). We present preliminary results for a simple, generic, and data-driven method of downlink prioritization for magnetic field (and other) measurements. Specifically, Principal Components Analysis (PCA) and One-Class Support Vector Machines (OC-SVMs) are used to detect intervals containing anomalous activity, which can then be prioritized for subsequent downlink. The computational simplicity of this algorithm makes it an excellent candidate for implementation on spaceflight hardware, as well as provide generalizability to a broad range of missions and data products. Initial analysis of this technique has been performed using magnetic field measurements from the Magnetospheric Multiscale Mission and CASSIOP, where it automatically identified scientifically interesting intervals containing Alfvén waves and EMIC activity.