SM53B-08 Data-mining reconstruction of extreme magnetic storms: Going before the L1 era

📅 Saturday, 16 December 2023

🕑 02:22 - 02:32

📍 *208 - South (Level 2, South, MC)*

Abstract

The geomagnetic field, electric currents and storm-time plasma pressure are reconstructed for the strongest storms before 1995, the July 1982 superstorm and the March 1989 Hydro-Québec grid collapse event, using an improved data-mining algorithm, where gaps in the L1 electric field parameter were filled using a recently published machine learning algorithm. The data mining is renormalized using available statistics of the nearest neighbor bins to reduce the bias toward weaker activity events. The description of storm and substorms is combined using a concurrent reconstruction method: Storm and substorm features are first reconstructed independently with the focus on the inner and outer magnetospheric regions. Then the data fitting is reiterated using both the original historical records and the synthetic data generated after the first round of reconstructions. Data fitting is further optimized to improve the resolution of the field-aligned currents, which are weakly constrained by low-altitude observations. Testing the new mining algorithm with the November 2003 and 1982 superstorms shows a significant improvement of validation results for in-situ observations and the substantial increase of the peak ring current. The ring current becomes so strong that is results on the formation of an X-line crescent or even ring within geosynchronous orbit, which effectively reduces the ring current pressure.

First Author

Grant Killian Stephens

S   Johns Hopkins University Applied Physics Laboratory

Authors

S   Mikhail I. Sitnov
     Johns Hopkins University Applied Physics Laboratory

T   Nikolai A Tsyganenko
     Saint-Petersburg State University

View Related