Project Details

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Project Title:
Dynamic Inner Magnetospheric Energetic Particle Data and Model Synthesis

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Summary:
The harsh radiation environment in the inner magnetosphere up to geosynchronous orbit is of major concern to an ever increasing amount of space hardware. The energetic particle fluxes from these regions are of further concern to regions of low-Earth orbit such as occupied by the International Space Station, especially during disturbed conditions. While the average or quiescent conditions of the energetic particle population are fairly well characterized, the dynamics during magnetic storms are severely under-sampled. The underlying processes responsible for the large variability in the observed behavior of the relativistic electron component in particular, are still a matter of intense scientific debate.
We intend here to use a theoretical model (Salammbo) to extend and combine existing energetic particle measurements to interpolate in L and to extrapolate the energy range. Combining both measurements and model enables us to increase both the spatial and temporal resolution of the data, and allows us to define time-dependent maps of the radiation belts, both for now-casting and research purposes.
Salammbo is a sophisticated particle transport code which has been used successfully to reproduce the global radiation belt dynamics for energetic electrons and protons, using relatively few inputs such as geosynchronous data as a boundary condition and Kp. In the absence of other data inputs, Kp is used as a scaling proxy for radial diffusion, plasmapause location and wave activity. Salammbo also includes a small-scale recirculation process which has been used to model the dynamics of relativistic electrons.
Data is from the DOE/DOD geosynchronous, GPS, HEO, and SAMPEX satellites, which carry energetic particle instrumentation and provide almost total coverage of the magnetosphere ranging in L from 1.1 to 8 and at altitudes from low earth to beyond geosynchronous. These spacecraft, all currently operational, provide nearly continuous data over periods of almost a decade. They form the first proper inner magnetospheric constellation and are an ideal testbed for future constellation-type missions such as envisioned by the Living with a Star Program at no operational cost.

Publication References:

no references