Project Title:
Superposed Epoch Analysis of Ring Current Geoeffectivenss Related to Solar Wind and Plasma Sheet Drivers

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Project Information:
It is known that the strength of the stormtime ring current is controlled by two driver functions: the convection strength (largely controlled by the interplanetary conditions) and the near-Earth plasma sheet intensity. The availability of interplanetary and geosynchronous orbit plasma observations over the past solar cycle provides a unique opportunity to investigate the relationship between these two driver parameters and the stormtime ring current. In addition, first-principle-based models of the hot ions of the inner magnetosphere have reached a level of sophistication allowing quantitative comparison with observations. Also, with the increased dependence of humanity on near-Earth space for communications, surveillance, and positioning, space weather prediction models are be-coming a necessity for reliable spacecraft operation. It is proposed to perform a superposed epoch analysis of the driver functions in relation to the attributes of the ring current (both observed and modeled) in order to better understand the connections between them. Many storms will be considered from 1989 to the present (more than a solar cycle), including an analysis of detailed kinetic modeling results of at least 20 of them (simulated for other projects). The expected outcomes from the proposed study are as follows: (1) specification of the relationship between solar wind drivers, inner plasma sheet characteristics, and ring current properties during magnetic storms; (2) examination of the dependence of geoeffectiveness on solar cycle; (3) determination of satellite spacing and instrumentation at geosynchronous orbit needed for accurate ring current modeling in space weather simulations; (4) improved prediction of the severity and duration of magnetic storms based on geosynchronous plasma observations; and (5) large-scale testing of statistical energy input functions against observed energy inputs to the inner magnetosphere.

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