Project Details

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Project Title:
A Strengthened Numerical Foundation to Enable Integrated Ring Current and Radiation Belt Specification and Prediction

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Summary:
In an era of increasing reliance on space-based satellite assets, hazards associated with space weather and climate are becoming increasingly important. Modeling the coupled ring-current/radiation belt systems of the inner magnetosphere is one of the key ingredients for our understanding and possible forecasting of this region, leading to scientific insight that is beyond the scope of our current statistical-based models of both the geomagnetic fields and particle populations of this region. We propose here to radically extend and enhance our present modeling capabilities by adding additional physics modeling (cross-coupled diffusion) and by introducing fully self-consistent magnetic fields into an existing code. We expect this work to address the following scientific objectives, which directly relate to section 3.3.4 and 3.3.5 of the 2003 LWS TR&T Science Definition Team Report for the LWS Targeted Research and Technology [2003 LWS TR&T SDRT]: 1. Model and describe geomagnetically induced currents during disturbed times 2. Model the physical processes responsible for the acceleration, transport and loss of radiation belt particles throughout the inner magnetosphere 3. Provide a physics-based inner magnetospheric magnetic field model For this study we will build on the existing UNH-RAM code and significantly enhance its capability through new and novel numerical diffusion solvers and computation resources available at LANL. Self-consistency with the magnetic field description will be achieved by requiring force-balance with the calculated particle pressures. New insights on radiation belt dynamics will be achieved by a comprehensive inclusion of wave particle interactions and fully coupled energy, pitch angle and radial diffusion. We expect the work proposed here to lead to a more comprehensive and much more powerful numerical model, enabling a realistic approach to radiation belt evolution.

Publication References:

no references