Project Details

ROSES ID: NRA-NNH04ZSS001N
Selection Year: 2005
Program Element: Focused Science Topic

Topic: To determine the mechanisms responsible for the formation and loss of new radiation belts in the slot region in response to geo-effective solar wind structures.

Project Title:
Quantitative Assessment of Radiation Belt Driver Modeling: The Stormtime Ring Current and Plasmasphere

PI Name: Michael Liemohn
PI Email: liemohn@umich.edu
Affiliation: University of Michigan
Project Member(s):
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Summary:
We propose to assess the physical processes responsible for the formation and dynamics of the outer zone radiation belt with an array of physics-based models. In particular, the ring current and the plasmasphere are two primary factors influencing the radiation belts. The dynamics of the radiation belts are highly dependent on the magnitude and morphology of the ring current through magnetic field perturbations and wave excitation. It is also highly dependent on the morphology and evolution of the plasmasphere, particularly the location of the plasmapause and the different plasma wave regimes inside and outside of this boundary. The Space Weather Modeling Framework (SWMF) will be employed to test various inner magnetospheric models for these two plasma populations. Because the SMWF allows for easy exchange of subroutines for a given science module (once implemented within the framework), several models each will be used for the plasmasphere and the ring current, resulting in model combi-nations of varying degrees of sophistication. Two magnetic storms will be considered: the CAWSES interval in March-April 2004 (high-speed stream and a small storm) and the Halloween superstorms of October-November, 2003 (with 3 Dst minima below -350 nT). Both of these intervals had post-storm enhancements of the outer zone fluxes, yet the storm sizes are very different. Several more storms will also be simulated in the second half of the project, as defined by the Focused Science Topic (FST) Team. All model results will be made available to the other funded researchers for use in their observational, theoretical, or numerical studies of the radiation belts. Extensive data-model comparisons of the plasmasphere, ring current, and near-Earth magnetic field will yield a quantitative accuracy-versus-sophistication assessment of the SWMF for these two events. The ''best-fit'' simulation will be used to calculate adiabatic invariants for several relativistic electron data sets throughout these storms. From this, fluxes can be converted to phase space densities and an assessment will be made of the formation and dynamics of the outer zone radiation belt. In particular, the question of an internal or external source will be examined, as well as the influence of the plasmasphere and ring current on inner magnetospheric relativistic electrons.

Publication References:

Summary: no summary

Reference: Liemohn, Michael W.; (2006), Introduction to special section on ``Results of the National Science Foundation Geospace Environment Modeling Inner Magnetosphere/Storms Assessment Challenge'', Journal of Geophysical Research: Space Physics, Volume 111, Issue A11, CiteID A11S01, doi: 10.1029/2006JA011970