Project Details

ROSES ID: NNH08ZDA001N
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Program Element: Independent Investigation

Topic: Measure the properties of the solar dynamo that affect solar irradiance and active region generation.

Project Title:
An improved self-consistent model of the near-Earth magnetosphere magnetic field

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Summary:
The Earth's radiation belts have received considerable attention recently due to the hazards they pose for spacecraft operating in Earth orbit. A major factor hampering our understanding and prediction of their dynamics is our insufficient knowledge (on an event basis) of the magnetic field in the near-Earth environment. To improve the specification of this field, we propose to develop and test a new approach for self-consistent, realistic three-dimensional magnetic field modeling in the near-Earth magnetosphere. The basis for our approach will be a recent coupling of a bounce-averaged kinetic model of particle evolution (the RAM code) with a 3D plasma equilibrium code with anisotropic pressure. Starting from that coupling, three major proposed improvements will drive our model toward realistic magnetic field computation in the entire near-Earth magnetosphere: 1). a novel Euler potential technique will eliminate the spatial limitations in the preliminary approach, and allow us to treat not only the inner magnetosphere, but also the critical transition region in the near-Earth (6-12 RE) magnetotail; 2). the tilt of the Earth s magnetic axis will be included for the first time in the model, and 3). the electric fields induced by the time change of the magnetic field will be computed and added to the convection field in RAM. Boundary conditions for the coupled model will be either observation-based (from empirical models) or from global model runs at CCMC. Comparisons with Cluster, IMAGE, Polar, THEMIS and geosynchronous plasma and field data will be performed to validate model results, through both in-situ model/data comparison and by employing phase space density analysis. The proposed research will significantly impact NASA LWS program and Heliophysics science in general, as the near-Earth magnetic field is a key element in understanding and predicting radiation belt dynamics. The results will also directly benefit the upcoming NASA mission RBSP.

Publication References:

no references