Project Details

ROSES ID: NNH06ZDA001N
Selection Year: 2007
Program Element: Independent Investigation

Topic: Investigate the Global Distribution, Sources and Effects of Large Electron Density Gradients at Middle and Low Latitudes

Project Title:
Modeling variations in solar energetic particle access to the inner magnetosphere and Earth during geomagnetic storms

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Summary:
The development and validation of a numerical model of solar energetic particle (SEP) access and trapping in the magnetosphere is proposed, to improve predictive capability of SEP fluxes and our understanding of magnetospheric dynamics responsible for variations in SEP fluxes during geomagnetic storms. During severe storms sudden changes in SEP access to Earth are caused both by cutoff variations due to changes in the geomagnetic field configuration and by the transport and heating of ions due to the storm sudden commencement (SSC) inductive electric electric field pulse associated with the impact of an interplanetary shock on the magnetosphere. An accounting for both of these effects is needed to model energetic particle fluxes in the geospace environment. A numerical model that predicts SEP fluxes in the magnetosphere from a given solar wind energetic particle distribution will be developed. The distribution is modeled by following Lorentz and guiding center test particle trajectories in time-dependent fields from a global MHD magnetospheric model, driven at its sunward boundary by measured solar wind parameters. Points in phase space are sampled using test particles weighted by an observed solar wind SEP distribution and retain their weight along particle trajectories. Fluxes predicted by the model will be compared with SAMPEX and HEO spacecraft measurements. The model will be used to improve our understanding of the mechanism(s) responsible for SEP access to low L-shells during storms. The proposed work is submitted under 1.2.2 Independent Investigations in the ROSES 2006 Solicited Research Programs Appendix B, and addresses the NASA LWS TR\&T goal of developing ``the knowledge needed to provide advance warning space environment predictions along the path of robotic and human exploration.'' and to characterize ``those aspects of the Earth's dynamic environment needed to design reliable electronic subsystems for use in air and space transportation systems.''

Publication References:

Summary: no summary

Reference: Kress, B. T.; Hudson, M. K.; Looper, M. D.; Albert, J.; Lyon, J. G.; Goodrich, C. C.; (2007), Global MHD test particle simulations of >10 MeV radiation belt electrons during storm sudden commencement, Journal of Geophysical Research, Volume 112, Issue A9, CiteID A09215, doi: 10.1029/2006JA012218