MODELING SOLAR ENERGETIC PARTICLE TRAPPING AND ENHANCED RADIATION BELT FLUXES AT LOW L

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The prompt trapping of Solar Energetic Particles (SEPs) in the inner magnetosphere has been observed at the recent Solar Cycle 23 maiximum, including electrons, protons and heavier ions, in association with high speed interplanetary shocks and Storm Sudden Commencements (SSCs). These observations include the Bastille Day 2000 CME-driven storm as well as two in November 2001, and again associated with the Oct-Nov 2003 storm intervals. These events produced a long-lived new proton belt in 2001, trapping of ultra-relativistic electrons in 2003 and trapping of heavy ions up to Fe. A survey of such events around the most recent solar maximum, including high altitude measurements from Polar and HEO satellites along with low altitude measurements from the SAMPEX satellite, indicates similarities to the well-studied March 24, 1991 SSC event. A requirement for such shock-induced acceleration is a high-speed CME- shock at 1 AU, which launches a perturbation with comparable velocity inside the magnetosphere. The CME-shock itself is a source of solar energetic particles, which act as a seed population inside the magnetosphere. Integration of SEP trajectories in electric and magnetic fields taken from the Lyon-Fedder-Mobarry (LFM) global MHD model, using solar wind input parameters from spacecraft measurements upstream from the earths bow shock, has been carried out for the November, 2001 SEP trapping events, as well as the Bastille storm for heavy ions. The results indicate that an enhancement in solar wind dynamic pressure for these events plays a role in the observed injection of ions to low L-values.

Lifetimes at low altitude where the new belts form L=2-2.5 have been investigated with both particle and photon data from the RHESSI spacecraft in low earth orbit, and due to high sensitivity of the Ge detectors provide a window to loss processes to the atmosphere which predominate in the South Atlantic Anomaly. Comparisons with WIND spacecraft measurements during the recent July 2004 interval of recurring high speed streams provides insight into conditions for enhanced trapped fluxes at low L which supplement GOES measurements at geosynchronous.

Abstract Submission Form

2004 National Radio Science Meeting

Abstract: hudson614

Date Received: September 24, 2004

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