RELATIONSHIP OF THE VAN ALLEN RADIATION BELTS TO SOLAR WIND DRIVERS

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The dynamic variability of outer zone electrons is tied to distinct types of heliospheric structure which vary with the solar cycle. The largest fluxes occur during the declining phase from solar maximum, when high speed streams and co-rotating interaction regions (CIRs) dominate the inner heliosphere, leading to recurrent storms tied to solar rotation. The most intense events are typically driven by high speed CMEs which prevail around solar maximum. Only about half of moderate storms, defined by intensity of the ring current, lead to an overall flux increase[1], emphasizing the need to quantify loss as well as source processes; both increase when the magnetosphere is strongly driven. Three types of acceleration will be described with emphasis on the first two: prompt and diffusive radial transport, which increases energy while conserving the first invariant, and local acceleration by waves which changes the first invariant. The latter also produces pitch angle diffusion and loss, as does outward radial transport, especially when the magnetosphere is compressed. MHD-test particle simulations driven by measured solar wind input will be compared for three CME-driven storms in February, 1994; November, 2004; and January, 2005, where in situ solar wind driving conditions are measured, along with the magnetospheric response. The effect of a dynamic geosynchronous boundary condition on radial diffusion of radiation belt electrons over a longer timescale (more than one solar rotation) will be described, for a period of CIR-driven, moderate activity level following the great storm of March 24, 1991, which produced a prompt injection, multi-MeV electron population at L=2.5, persisting for years.

[1]Reeves G. D., K. L. McAdams, R. H. W. Friedel, T. P. O'Brien, Acceleration and loss of relativistic electrons during geomagnetic storms, Geophys. Res. Lett., 30 (10), 1529, doi:10.1029/2002GL016513, 2003.

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