INSIGHTS ON RADIATION BELT PHYSICS FROM THE DYNAMIC RADIATION ENVIRONMENT ASSIMILATION MODEL, DREAM

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The Dynamic Radiation Environment Assimilation Model (DREAM) is a coupled, inner magnetosphere model with modules that include the ring current, the radiation belts, self-consistent global magnetic fields, Kalman filter data assimilation, and customized user applications. DREAM was developed at Los Alamos National Laboratory with the goals of specifying, predicting and understanding the near-Earth space environment. Here we will focus on new understanding of physics of the inner magnetosphere that DREAM has provided and, even more specifically, on the physics of radiation belt acceleration, transport, and loss. One early and important contribution was providing definitive evidence that local acceleration processes acting inside or near geosynchronous orbit are required in order to explain radiation belt dynamics. Another critical process we investigated was loss of radiation belt electrons by radial diffusion or transport to the magnetopause. A critical calculation here is accurate determination of the adiabatic redistribution of particles due to the storm-time ring current (the "Dst" effect) which can cause both apparent "loss" of particles at a given satellite. At different times and at different energies, DREAM can determine whether the region outside the trapping boundary acts as a source (the plasma sheet) a sink (the magnetopause) or a combination of both. Another fundamental sink of radiation belt electrons is the atmospheric loss cone where pitch angle scattering can remove electrons trough precipitation. In the final topic for this talk we will describe how we use DREAM to determine the relationship between trapped and precipitating populations and how we relate LEO measurements to high-altitude measurements using observed and modeled characteristics of magnetospheric wave populations.

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