Geophysical Research Abstracts, Vol. 7, 09824, 2005 SRef-ID: 1607-7962/gra/EGU05-A-09824 © European Geosciences Union 2005



Nonlinear Parameter Estimation in Space Physics

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Data assimilation is becoming an increasingly important tool for both understanding and prediction of space physics processes. With plentiful data sets becoming available and sofisticated models being developed, the use of high-performance data assimilation methods is getting feasible in this field of geophysics. The outstanding issues and problems in assimilation of observations in numerical models are demonstrated by studying acceleration of relativistic electrons during magnetic storms in the Earth's radiation belts. We apply Extended Kalman filter and observations from the CRRES satellite to estimate the lifetime parameter of high-energy electrons in a code for radial diffusion of electrons. Systematic errors in the estimates for this parameter are attributed to missing physics, and in particular to a complex nature of the competing effects of various acceleration and loss processes.