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Influence of solar wind and plasmasphere on radiation belts fluxes

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Analysis of the near-Earth radiation environment is complicated by the unavoidable restrictions of space-borne observations to a single point in time and space. Combination of measurements contaminated by systematic errors and noises also present significant a significant challenge. Data assimilation techniques can provide algorithms to combine various incomplete and inaccurate space-borne observations from different sources with different errors with physics-based dynamic models in an optimal way, and to reconstruct the entire radial profile of the electron PSD with errors lower than the observational errors of each individual satellite. This approach is becoming an increasingly useful and important tool for obtaining considerably improved understanding of the radiation belt electron dynamics. Analysis of a multi satellite data shows that peaks in phase space density are clearly correlated with the dynamics of the plasmapause. Using data assimilation we show that peaks in phase space density are strongly correlated with the dynamics of the plasmapause. We also show that majority of drop outs in the radiation belt fluxes occur simultaneously with the sudden increases in the solar wind dynamic pressure, which indicates that electrons are lost to magnetopause and to the outward radial transport. Use of 3D models in terms of energy, pitch angle, and L-shell in data assimilation will allow to utilize not only radial profiles of phase space density but also information on pitch-angle distributions and energy spectra. We present results of 2-D and 3-D assimilation of the synthetic and actual PSD data into the UCLA 3-D Versatile Electron Radiation Belt model. Application of the developed multi-dimensional data assimilation tools will be critical for combining measurements from RBSP, THEMIS, GPS, GEO,Cluster, and Lomonosov.