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Validation of three-dimensional data assimilation and reanalysis of radiation belt electrons

Juan Sebastian Cervantes-Villa (1) and Yuri Y. Shprits (1,2,3)

(1) Section 2.3 Earth's Magnetic Field, GFZ German Research Centre for Geosciences, Potsdam, Germany (jscv@gfz-potsdam.de), (2) Institute of Physics and Astronomy, University of Potsdam, Potsdam, Germany, (3) Earth, Planetary, and Space Sciences, University of California, Los Angeles, California, USA

Satellite observations are often incomplete and inaccurate and may have only limited spatial coverage. However, through data assimilation they can be blended with information from physics-based models, in order to fill gaps and lead to a better understanding of the underlying dynamical processes. Data assimilation methods have been extensively used to analyze and predict meteorological, oceanographic, and climate processes. With the advent of space-borne observational data and the development of more sophisticated space-physics models, dynamical processes in the Earth's radiation belts can be analyzed and assessed using data assimilation methods.

In this study, reanalysis of radiation belt electrons is achieved through data assimilation of Van Allen Probes mission and Geostationary Operational Environmental Satellite with the 3D Versatile Electron Radiation Belt using a split-operator Kalman filter technique. Results are statistically validated for several field models and boundary conditions. Sensitivity of the reanalysis electron flux to available spacecraft data is also assessed.