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Split-Operator Kalman Filter as an efficient data assimilation method for the radiation belts

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The Van Allen radiation belts are composed of charged particles confined by the Earth's magnetic field. Energetic electron activity in Earth's radiation belts can present dangerous hazard to both satellites and humans in space. In this study, we rely on operator-splitting method to make Kalman filter computationally efficient for assimilating electron phase space density (PSD) into the radiation belts model. We compare the conventional Kalman filter, on the one hand, and its modification developed in this study, on the other, by assimilating synthetic data, as well as actual satellite observations into multi-dimensional Fokker-Plank equation for PSD. The dimension-splitting Kalman filter is considerably faster compared to the standard Kalman filter implementation, while yielding similar analysis errors.