Data assimilation of radiation belt electrons using the DREAM code and multiple spacecraft data of Arase, Himawari, and GPS

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We report data assimilation results of multi radiation belt electron data into Dynamic Radiation Environment Assimilation Model (DREAM). DREAM is a data assimilation software that can calculate radiation belt electron flux for arbitrary spacecraft positions using 1-D radial diffusion equation based on the ensemble Kalman filtering method. In this study, observation data from three spacecrafts with different orbits; Arase (high elliptical orbit with inclination 31 degrees), Himawari-8 (geosynchronous), and seven GPS (semi-geosynchronous) were fed into DREAM, and energetic electron fluxes along Van Allen Probe in the high elliptical orbit with inclination 10 degrees were sampled for the evaluation. Data assimilation were performed for one month of August 2018 which includes a geomagnetic storm event of Dst=-188 nT on 26 Aug. The observed flux variations of ~700 keV and ~1 MeV electrons were almost perfectly reproduced by DREAM both for quiet and storm times along the orbit of Van Allen Probe A. We found that the performance of prediction highly depended on energy range, L shell, and quality fed data set. The results suggest that DREAM can be a powerful tool for prediction of radiation belt electron flux along arbitrary orbits with high accuracy if it is fed appropriate data set.

Keywords: radiation belt, data assimilation

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