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Improvement of the radiation belt model using the data assimilation

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It is known that high energy electrons in the radiation belts often cause satellite anomaly and malfunctions. Therefore, the forecast of the time variation of energetic electrons is important to protect satellites against high energy electrons in the radiation belts. The time variations of the radiation belt electrons have been modeled with the Fokker-Plank equation. The performance of the forecast using the Fokker-Planck equations depends on the parameters used in the model, so that the improvement of the parameters is important for the space weather forecast. In this study, we estimate the radial diffusion coefficient and the whistler-mode wave amplitude that are used in the Fokker-Plank equation with the data assimilation. As a result of the data assimilation, the typical variations of the outer belt, and the slot region are well reproduced; the outer belt flux decreases and then recovers and increases during magnetic storms. On the other hand, there are several discrepancies between the simulation and the observations. Especially, we found the differential flux obtained from the data assimilation is lower than that from observations at L=5 to 6. The estimated diffusion coefficients from the data assimilation using 400 keV channel correlate roughly with that from 800 keV channel, and there are about 1-order differences between these two energy channels. The estimated wave amplitudes are lower than the result from the past observations on the plasmaspheric hiss. In this presentation, we also report the assimilation results including the non-adiabatic source term in the Fokker-Plank equation.

Keywords: radiation belts, space weather, data assimilation, particle filter