Enhanced radial diffusion in Jupiter's radiation belt induced by solar wind: a simulation study

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Abstract

Radiation belt is a layer of energetic particles (~few tens MeV) held by geomagnetic fields, ranging up to several planetary Radii in distance. Jovian Radiation Belt, where in-situ measurement is limited, Jupiter's synchrotron emission (JSR) observation is a key tool for determining physical process therein, and various diffusion models have been proposed to account for observed JSR's variations. As for short-term variation, fluctuating dynamo electric field inside the ionosphere [Brice et al., 1973] had been thought to be the only source until the very recent.

In 2016, Extreme ultraviolet spectroscope HISAKI found evidence of a new kind of electric field - solar-wind-driven convection electric field inside Jupiter's magnetosphere, which could contribute to radial diffusion in JRB as well.

In this study, I construct a simulation code to calculate short-term JSR variation resulted from the estimated solar-wind-driven convection electric field, and compare the result to the previous study based on dynamo electric field [Miyoshi et al., 1999]. I suggest that convection electric field could be a good source of radial diffusion and could also be responsible for short-term variation of JSR alongside with fluctuating dynamo electric field.