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# Modeling of evolution of magnetospheric ring current using a data assimilation approach

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The ring current is an electric current flowing in the inner magnetosphere and driven mainly by the plasma pressure gradients of ions with nergies of the order of 10-100 keV. The electric field in the inner magnetosphere controls the ring current as well as the plasmasphere, and is also of crucial importance for the radiation belts. Perhaps more importantly, the electric field is more manifestation of the coupling between the ring current and the ionosphere. Therefore, the large-scale electric field is a key quantity critical to understand the phenomena of the entire inner magnetosphere and sub-auroral ionosphere. However, since the number of available observations in the magnetosphere is too sparse, it is difficult to completely know the temporal evolution and the global distribution of the inner-magnetospheric electric field. In order to overcome the lack of observations in the inner magnetosphere, we employ a data assimilation approach. We have developed a data assimilation scheme for assimilating energetic neutral atom (ENA) data from the IMAGE satellite into a two-dimensional kinetic ring current model developed by Fok and Moore (1997). Data assimilation is performed with the merging particle filter/smoother. The dimension of this kinetic ring current model is more than 2,000,000. However, we consider uncertainties only in the electric potential distribution and ion properties at the outer boundary of the simulation domain. The electric potential distribution is reprenseted by a sum of the background Volland-Stern type field and the deviation from it. The deviation is represented as a series of cylindrical functions. Then, the degree of freedom of the model is reduced to about 20. This scheme allows us to effectively estimate the temporal variations of the electric potential distribution in the inner magnetosphere.