A pilot study for reconstruction of the inner-magnetosphere by data assimilation of global ENA and EUV measurements

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During these several years, we have developed two data assimilation techniques for the inner magnetosphere. One is for reproducing the temporal evolution of the ring current by assimilation of energetic neutral atom (ENA) imaging data from the IMAGE satellite. The other is for reproducing the evolution of the plasmasphere by assimilation of extreme ultra-violet (EUV) imaging data from the IMAGE satellite. Both of the two techniques uses the data from the same satellite, and both are based on similar frameworks in which the electric field is treated as an unknown quantity. Therefore, it is expected that these two techniques are unified to obtain a comprehensive picture of the evolution of the ring current, the plasmasphere, and the electric field. Since the ring current is located in a different region from the plasmasphere, the ENA and EUV data would provide the information on different regions in the inner magnetosphere. Thus, the use of both the ENA and EUV data could remarkably improve the estimate of the electric field.
We are developing the unified data assimilation technique which incorporates ENA and EUV data into a model of the inner magnetosphere, the comprehensive inner magnetosphere ionosphere model (Fok et al., 2014). We have conducted a pilot study using synthetic ENA and EUV data sets generated from a simulation run under a certain condition. In this study, the distributions of the electric field, the ring current, and the plasmasphere were successfully estimated. The current status of the development of our data assimilation technique will be reported.

Keywords: ring current, plasmasphere, data assimilation

