Assimilation of EUV and ENA measurements for modeling of the inner magnetosphere

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The observations in the magnetosphere are usually sparse in space. It is thus basically difficult to obtain a global picture of the magnetosphere. However, remote imaging observation from the IMAGE satellite provided the information on the global structures of the plasmasphere and the ring current, both of which play important roles in various physical processes in the inner magnetosphere. The extreme ultraviolet (EUV) measurement from IMAGE provided the information on the global structure of the plasmasphere where cold plasma is densely concentrated. The measurement of energetic neutral atoms (ENA) provided the information on the global structure and energy spectrum of the ring current which consists of high energy ions of tens of keV. In our previous studies, we conducted the EUV data assimilation and the ENA data assimilation for the modeling of the plasmasphere and the ring current, respectively. We are developing a data assimilation framework for reproducing temporal evolution of the plasmasphere and the ring current by exploiting the EUV and ENA imaging data from the IMAGE satellite. The result of some preliminary experiments showed the spatial distributions of the plasmasphere and the ring current can be estimated by assimilating the EUV and ENA data into an inner magnetosphere model. The electric potential distribution which controls the distributions of the plasmasphere and the ring current was successfully obtained. It was also demonstrated that the ENA and EUV data would provide the complementary information on the inner magnetosphere because the plasmasphere and the ring current are located in different regions.

Keywords: data assimilation, ring current, plasmasphere, ensemble Kalman filter, inner magnetosphere

