Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

PEM04-P01 Room:Poster Time:April 28 18:15-19:30

Retrieval of plasmaspheric He+ density field-aligned distributions from EUV imaging data

KEIKA, Kunihiro[1*] ; BRANDT, Pontus C.[2] ; TOIGO, Anthony[2] ; ROBERT, Demajistre[2]

[1]Solar-Terrestrial Environment Laboratory, Nagoya University, [2]The Johns Hopkins University Applied Physics Laboratory

We retrieve the spatial distributions of He+ density (n_{He+}) in the Earth ' s plasmasphere from EUV imaging data, by using a forward modeling technique. We use a parametric model for the density distribution to simulate line-of-sight integrated He+ densities (i.e., EUV images), and then find parameters that give the best fit to real EUV images. The parametric model used in this study is described as a function of L and magnetic latitude (λ): $n_{He+} = n_0 (L_0/L)^{alpha\_L} \times (r_0/L_0 \cos\lambda^2)^{alpha\_f}$, where n_0 and L_0 are He^+ density and L value at the inner boundary of this model (i.e., the topside ionosphere), and α_L and α_f are parameters that represent L and field-aligned dependence of He^+ density, respectively.

In this paper, we evaluated how well our forward model can retrieve the He^+ density spatial distribution, by performing the following analysis. (1) EUV emission intensities were simulated through the EUV camera response function, given a vantage point of the IMAGE satellite. (2) EUV images were simulated for a large number of (α_L, α_f) pairs: α_L was chosen from 4.0 to 6.0 with 0.1 increment, and α_f was from 0.0 to 2.0 with 0.1 increment. (3) The EUV image corresponding to the (α_L, α_f)=(5.0, 1.0) pair was chosen as our synthetic EUV image. After noise was added to the synthetic image, the forward modeling was applied to all simulated images made in (2). The reduced χ^2 ($\chi_r{}^2$) was used to determine how well simulated image data fit to the synthetic image. The results of this analysis confirm that the He^+ density distributions can be retrieved with good certainty within |40 deg.|MLAT. However, beyond this magnetic latitude it is difficult to determine the L dependence or field-aligned dependence of plasmaspheric He^+ density.

Next, in order to decouple the synthetic data from the parametric formula, we will use density distributions provided by physics-based ionosphere/plasmasphere models as our synthetic data. We will also apply our forward simulation model to real EUV image data from the EUV imager onboard the IMAGE spacecraft.

Keywords: Plasmasphere, Helium ion density, Inner magnetosphere, Plasma refilling, Forward modeling