THE QUIET PLASMASPHERE'S RESPONSE TO THE SOLAR WIND AND THE TOPSIDE IONOSPHERE

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ABSTRACT

The density structure of helium ions in the plasmasphere depends on the coupling with the topside ionosphere as well as the detailed structure of the magnetospheric convection electric field. We investigate the predictions of our model (MSKPM, "multi-species kinetic plasmasphere model," [1]) of the density and temperature structure of the major plasmaspheric consituents, which needs both the conditions at the topside ionosphere and the details of the convection electric field as inputs. We then compare these predictions with observations.

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The density structure of helium ions in the plasmasphere (and hence the structure of remote sensing images gathered by satellites such as IMAGE) depends on both the coupling with the topside ionosphere as well as the detailed structure of the magnetospheric convection electric field. In turn, the coupling with the ionosphere depends on the density and temperature structure of the topside ionosphere at the footpoint of the local magnetic field line, and the electric field depends on the properties of the solar wind. We investigate the predictions of our model of the density and temperature structure of the major plasmaspheric consituents, the "multi-species kinetic plasmasphere model," MSKPM [1]. This model needs both the conditions at the topside ionosphere and the details of the convection electric field as inputs, and these boundary conditions are supplied by MHD simulations. In addition, we compare these predictions with observations.

First, we examine the coupling with the ionosphere by looking at the past 11 years of density measurements by the LANL geosynchronous satellites to evaluate the plasma density as a function of local time during periods of low Kp. We find a strong 24-hour variation, and compare this result with the prediction of a version of MSKPM that uses a parameterized version of FLIP results (Melendez-Alvira et al., Eos, 1999) to determine the conditions in the topside ionosphere. The observations places limits on the maximum local time variation of the exobase at 60-70 degrees magnetic latitude.

Second, we examine the structure of the equatorial electric field that is predicted by a global MHD simulation (Fedder and Lyon, GRL 1987) during quiet conditions, as a function of the IMF and the solar wind density. We use this electric field as input to MSKPM, along with the topside ionospheric density, to predict the global structure of the plasma density, in particular that of helium ions. A study of the details of the electric field also lends insight into the problem of the mechanism of the formation of the plasmapause during both quiet and disturbed conditions.

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REFERENCES

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