A New Global Core Plasma Model of the Plasmasphere

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Abstract

The Global Core Plasma Model (GCPM) is the first empirical model for thermal inner magnetospheric plasma designed to integrate previous models and observations into a continuous in value and gradient representation of typical total density. New information about the plasmasphere in particular makes possible significant improvement. This Hyperion Mission Focused Science Team (HFST) has released the GCPM on the NGS website. The NASA Dynamics Explorer 1 Retarding Ion Mass Spectrometer (RIMS) has provided densities in temperatures in the plasmasphere for 5 ion species. These and other works enable a new more detailed empirical model of thermal plasma that will be presented. Specifically shown here are the inner plasmasphere RIMS measurements, scaled to densities and temperatures for the inner, middle, and outer zones and the most associated with their normal values. Also shown are mean value densities on the 10 P-Parameter (see Richards et al. [1994]).

Ion Density Dependence On Radial Distance

Ion densities in the inner plasmasphere are included for all radial distances out to r=5RE. In what follows only the inner plasmasphere is considered where the line between inner and outer depends on the ion density behavior. The distinction is made because of the clear variation in behavior and in order to focus on one pattern of behavior at a time. The inner plasmasphere may be less expected to follow different behavior and to be more closely impacted by magnetic activity. Other general dependences of plasmasphere densities and temperatures will continue to be explored. Meanwhile expansion of GCPM can be provided for broad use.

Inner Plasmasphere Ion Dependence On Radial Distance

Ion densities in the inner plasmasphere and of all available temperatures are plotted against radial distance. The scattered results fit a linear function, the fit parameters are shown below. Also shown are the standard deviations for the parameters and the standard deviation of the percentage error between the linear fit and the parameter values. Error is obtained from the difference between data and trend modeled by the line. A fit of scatter remains. The dependence on other spatial parameters is small. The dependence on magnetic latitude previously discussed is attributed to a dependence on radial distance.

Ion Dependence On F10.7 P-Parameter (f10.7+f10.7 81day-ave)/2

The strongest dependent of either density or temperatures on several indices is on the P-parameter. The quantities tested are Kp, Dst, F10.7, P, and trending values for each. Trends are determined by fitting equation: ion moment = 10^((A + B*r) * (C + D)*P) for all MLT.