Geophysical Research Abstracts, Vol. 8, 08781, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08781
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Modeling the F2 Topside and Plasmasphere for IRI

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Empirical models are an important tool for the study of the different geospace regions from Earth to sun, providing the user with easy access to a synthesis of reliable measurements from ground and space specific parameters and regions. This paper describes a new effort to develop a coherent model of the topside F2 layer and the plasmasphere with the goal to improve the representation of the topside electron density in the IRI model and to extend the IRI description into the plasmasphere. An α-Chapman function with a continuously varying scale-height, dubbed a vari-Chap function, is used to describe the topside F2 vertical electron density profile N(h) that seamlessly connects the ionosphere with the plasmasphere. The Chapman (neutral) scale-height H(h) varies only slowly near hmF2 and increases rapidly at the O^+ to light-ion transition height. A hyperbolic tangent function suitably represents this variation. New plasmasphere density profile data from the IMAGE/RPI measurements and topside profiles from the ISIS topside sounders are used to construct a continuous profile from hmF2 to several R_E altitude.