GLOBAL ASYMMETRY OF THE EARTH'S IONOSPHERE

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Abstract:

In this paper we demonstrate that the transition zone between the ionosphere and plasmasphere (IP Boundary) which is regarded to be located at the height of 1000 km over the Earth could vary for different solar and geophysical conditions. Three sources of information have been used: (1) the ionosonde critical frequency foF2, propagation factor M3000F2 and (optional) the sub-peak semi-thickness; (2) the total electron content TEC observations from signals of the Global Positioning System (GPS) satellites; (3) data-adaptive management of the International Reference Ionosphere extended towards the plasmasphere, IRI*. Combining TEC with ionosonde derived F2 layer peak electron density NmF2 one obtains a measure of the shape of electron density profile, the ionospheric slab thickness Tau. Eliminating the plasmaspheric slab thickness from the total Tau, we can analyse proportion of the slab thickness in the topside and bottomside ionosphere. The ratio of slab thickness to the real thickness in the topside ionosphere expressed through the similar ratio available in the bottomside ionosphere multiplied by the weight Rw allows estimate of the IP Boundary. Model weight Rw is represented by superposition of the base-functions of local time, geomagnetic latitude (hemispheric asymmetry is assumed), solar activity and magnetic activity. Seasonal dependence is provided by including sunrise and sunset hours evaluated at the IP boundary height. Analysis of the IP Boundary has been made for intense space weather storms (September 2002, October-November 2003, November 2004). We conclude that the ionosphere is not a sphere: it is supressed at daytime due to the pressure of solar wind with an ncreased 'ionospheric tail' above 1000 km to more than 2000 km existing at nighttime both under quiet and disturbed space weather conditions. The ionosphere is expanding towards the greater heights as compared with the quiet state during the "negative" phase of the ionospheric storm compatible with reduced F2 layer critical frequency but increased peak height. These effects are interposed on a trend of increasing IP transition height with solar activity when both the critical frequency foF2 and the peak height hmF2 are growing during the solar cycle.