Modeling center-of-mass of the ionosphere from the slab-thickness

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Abstract

Input of the F2 layer critical frequency foF2 and peak height hmF2 is an internal option of the International Reference Ionosphere, IRI, its extension to the plasmasphere, IRI-Plas, and NeQuick model (if the code is modified in a suitable way as it has been done by IRI-NeQuick option). The instant global ionospheric maps of the critical frequency foF2 and peak height hmF2 based on ionosonde data would improve the real-time model results but these maps are available in open access only as images which are not suitable for model implementation. Assimilation of the instant numerical global maps of total electron content, GIM-TEC, freely downloadable from several Data Analysis Centers is applied by the IRI-Plas code. As a result, the TEC-based instantaneous F2 layer critical frequency maps, GIM-foF2 (or the peak electron density NmF2) and the peak height, GIM-hmF2, with the ionosphere slab-thickness GIM-τ are obtained as ratio of TEC to NmF2 at each cell of a map. The slab-thickness τ includes its bottom part, τbot, below hmF2, and topside, τtop. It has been shown that TEC and peak parameters assimilation by NeQuick model can improve the description of the topside electron density profile shape (scale height and τtop). The production of height profile of electron density Ne(h) is complemented now by IRI-Plas and NeQuick calculation of electron content height profile TEC(h) from the bottom boundary of the ionosphere (65 to 80 km) to varying altitude h upto 20,000 km (GPS orbit). The center-of-mass of the ionosphere, TECc, is evaluated as a by-product of slab-thickness model at the height Hc within the range of TEC(h) profile between the borders of τ at the bottom side (hmF2 - τbot) and topside (hmF2 + τtop). The Hc estimates by IRI-Plas and NeQuick models are compared under different helio-geophysical conditions. The paper presents global ionospheric maps of center-of-mass, GIM-Hc, evaluated with IRI-Plas model from global ionospheric maps GIM-TEC provided by JPL from 1994 to present. Statistical characteristics of GIM-Hc maps can serve for validation and updating the shell height with Hc parameter varying over the globe for improved vertical TEC evaluation from slant STEC observations.