EMPIRICAL ELECTRON DENSITY MODELS FOR TRANSIONOSPHERIC PROPAGATION OF RADIO WAVES UPDATED TO STORM CONDITIONS

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Abstract:

The usual empirical electron density models like the International Reference Ionosphere (IRI) or the „model family" developed at Trieste and Graz (NeQuick, COSTprof and NeUoG-Graz) provide monthly medians but allow updating. Input parameters are the geographic coordinates and (universal or local) time (3D and time dependent models). The IRI and the members of our "model family" are "profilers" and use "anchor points" to which the height profile is attached or between which the height profile is gained by means of an interpolation algorithm. The models use "maps" for the anchor point properties. In general "updating" means replacing map values for the F2 peak density (and peak height) by actual values. If this is done for isolated height profiles of electron density we need no further modification. However, realistic updating for propagation parameters calculated along a slant ray path (e.g., from a satellite transmitter to a ground receiver or from satellite to satellite) needs updating along the entire ray path. Assessment studies need slant electron content calculation for many rays. As reported previously we therefore replace the monthly median "maps" by "data grids". Presently, the data grids are based on hourly data and have a grid spacing of 2.5 degrees in latitude and 5 degrees in longitude. In constructing the data grids we have the choice between several strategies, e.g.,1)data driven global grids, produced on the basis of global displays of ionospheric electron content,2)background "maps" combined with data driven regional grids and with regional grids constructed to reflect regional positive and negative storm effects (enhancements and depressions of ionization).Presently data driven global grids can be produced be-hourly or (with some interpolation) hourly. The timing interval for data driven regional grids can be reduced to about 20 minutes. Since many applications (e.g., assessment studies) need continuity in time we use spline interpolation.Under magnetic storm conditions the basic grid resolution in space and in time might not be sufficient. Therefore we have developed a "modulation method" which adds smaller scale and dynamic structures by multiplying the background (= data grid driven) model with sub-models for these structures.

We have developed the following "storm modulations"Soliton like dynamic structures Traveling Atmospheric Disturbances (TADs) (modelling the effects of expanding composition changes etc.) Storm troughs  Storm TIDs.The combination of We will present examples for storm modulations and for relevant slant electron content data.