



Equatorial bubble modulation of empirical electron density models

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Equatorial bubbles are important dynamic structures which influence the electron density distribution in lower latitudes. The “modulation method” allows to adapt empirical electron density models of the “profiler” type to actual and/or realistic situations. We have developed a flexible model for geomagnetic field aligned bubbles. They are depressions of electron density with Gaussian shapes in three dimensions: along a simplified magnetic field line, across the field line but in the magnetic meridian plane and perpendicular to the magnetic meridian plane. A typical bubble is born in the lower F region, expands and rises through the ionosphere and dies after a life time of one to several hours. Our model bubbles are able to move horizontally (change in magnetic meridians) and the user has a choice in depression level, bubble extensions and in several parameters which influence our rather complex bubble dynamics. We show examples for model bubbles and for changes in electron density and electron content produced by model bubbles. These calculations use the NeQuick model modulated with equatorial bubbles. Emphasis is given to the time dependence of slant electron content on the rays from GNSS satellites to receivers on the ground.