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Modelling geomagnetic storm effects for empirical electron density models

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The ionosphere (the thermal plasma below a height of 2000 km) shows two types of geomagnetic storm effects, namely depressions of ionization ("negative storm effects") and enhancements of ionization ("positive storm effects"). Responsible for these effects are magnetic storm related changes in the thermospheric composition (especially changes of the particle density ratio [O] / [N_2]), changes of the thermospheric wind pattern which induce changes in plasma drift effects, additional or modified large scale electric fields which induce changes of the $\vec{E} \times \vec{B}$ drift of the plasma and modifications of the magnetic field aligned exchange of thermal plasma between the ionosphere and the plasmasphere. If the geomagnetic storm is strong enough we expect ionospheric effects but we are not able to predict their strength or to predict which regions will be affected. For empirical electron density models we have to rely on data (*a posteriori* analysis of storms) or on the inclusion of "typical" storm structures in models for undisturbed conditions.

We present several types of such "modulations" which can be used to adapt three dimensional and time dependent models of the "profiler" type. In detail we describe two dynamical (time dependent) structures for the propagation of storm effects, namely a soliton like travelling disturbance and a model for "Travelling Atmospheric Disturbances – TADs" which transport storm effects from higher to mid latitudes.