UPPER ATMOSPHERE STORM MODELING

A.A.Namgaladze[1,2] and R.Yu.Yurik [2]

[1]*Murmansk State Technical University, 13 Sportivnaya Str., Murmansk, 183010,*
e-mail: namgaladze@mstu.edu.ru;
[2]*Polar Geophysical Institute, 14 Halturina Str., Murmansk, 183010,*
e-mail: Roman.Yurik@pgi.ru

A review of the recent numerical results of the global upper atmosphere storm modeling is given. The results have been obtained by the use of the global upper atmosphere model (UAM) by Namgaladze et al. (1998). This model describes the Earth's mesosphere, thermosphere, ionosphere, plasmasphere, and the inner part of the magnetosphere confined by the closed geomagnetic field lines as a single system including its electrodynamics. The cross-polar cap electric potential estimated from the hourly AE index serves as a main model input parameter when the storm-time behaviour of the upper atmosphere is being modeling. The precipitating electron fluxes depending on the Kp index are used as model input parameters as well. The resolution of the numerical integration of the modeling equations is variable in altitude and latitude and may be chosen dependending on the task. The latitudinal integration step of 2 degrees is the most common now.

The model allows to investigate the relations between the magnetosphere, ionosphere and neutral atmosphere dynamics as well as the relations between the plasmapause, main ionospheric trough and light ion trough dynamics during the magnetic storms and substorms. The calculated global patterns of the winds, neutral and ion composition, electron concentration, electron and ion temperature, electric fields and alfven velocity at various altitudes are presented for different magnetic storms (at low and high solar activity, at equinox and solstice). The contributions of the themospheric winds and gas composition storm changes as well as those of electric fields and geomagnetic field tube filling and depletion processes into the coupled storm dynamics of the ionospheric F2-layer troughs, light ion troughs and plasmapause under different geophysical conditions for different MLT sectors hve been considered.

The hot ion zone formation in the outer plasmasphere is dicussed as well as the localized high-speed upward and downward winds over the auroral zone. A comparison of the calculated and observed during storm periods upper atmosphere parameters such as neutral mass density and electron concentration has been made and shows rather good agreement between them.

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References

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