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Development of Comprehensive Model of Earth Ionosphere and its Application for Studies of MI-coupling

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A comprehensive model of the Earth ionosphere has been developed [Sydorenko and Rankin, 2012 and 2013]. The model is two-dimensional, it resolves the meridional direction and the direction along the geomagnetic field. The dipole coordinates are used, the azimuthal symmetry is assumed. The model considers torsional Alfven waves and includes the meridional convection electric field. The electric field along the geomagnetic field is calculated from the condition of quasineutrality. The ions (H+, N+, O+, N2+, NO+, and O2+) and the electrons are represented as conducting fluids. The neutrals (H, N, O, N2, NO, and O2) are considered as a stationary background, the meridional wind can be included but it does not change the neutral parameters. Numerous heating and cooling processes, chemical reactions between ions and neutrals, recombination, and effects of energetic electron precipitation and EUV radiation are included. The main simulation area covers the altitude range from 100 km to few thousand km, the width of the main area at the bottom is up to few hundred km. The model was applied to study oxygen ion upwelling caused by electron precipitation and Alfven waves. Recently, the model was used to investigate plasma density and temperature oscillation observed by EISCAT during the period of intense magnetospheric activity and predicted that the event was accompanied by significant modification of the composition of neutrals in the thermosphere.

Sydorenko, D., and R. Rankin (2012), Simulation of ionospheric disturbances created by Alfvén waves, J. Geophys.Res., 117, A09229, doi:10.1029/2012JA017693.

Sydorenko, D., and R. Rankin (2013), Simulation of O+ upflows created by electron precipitation and Alfvén waves in the ionosphere, J. Geophys. Res. Space Physics, 118, 5562–5578, doi:10.1002/jgra.50531.

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