Horizontal Plasma Drift Influence on the F2-layer Electron Density Variations in Subauroral Latitudes

Yulia V. Zubova and Alexander A. Namgaladze
Physics Department of the Murmansk State Technical University, Sportivnaya St.13, Murmansk, 183010, Russia

The F2-layer behaviour during the period of April, 2002 magnetic storms was modeled using the global numerical Upper Atmosphere Model - UAM [1]. The calculations were performed using various model configurations. The model results were compared with the ionospheric data provided by the incoherent scatter radar network [2] and ionosondes in Sondrestrom and Millstone Hill. The comparison

has showed that as a whole the UAM reproduced the F2-layer parameters variations. But the model strongly underestimated the electron density measured in Millstone Hill during the night hours of April 16, 2002 (see Fig.1). At the same time the model F2-peak height variation agreed with the ionosonde data (see Fig.2).

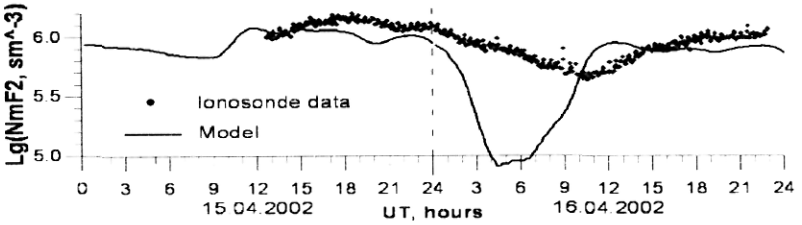

Fig.1 Variations of NmF2, calculated by the UAM (solid lines) and observed by the Millstone Hill ionosonde during April 15-16, 2002 (dots).

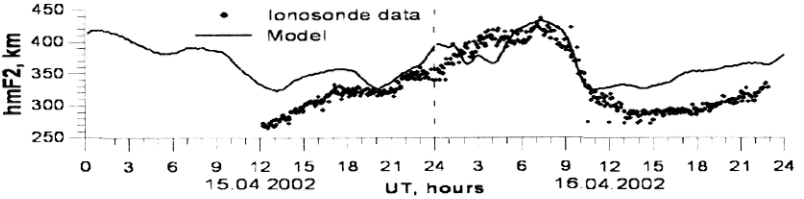

Fig.2 Variations of hmF2, calculated by the UAM (solid curve) and observed by the Millstone Hill ionosonde during April 15-16, 2002 (dots).

The comparison of the modeled and observed electric field variations has showed that the UAM meridional electric field is the opposite to the measured one (see Fig.3).

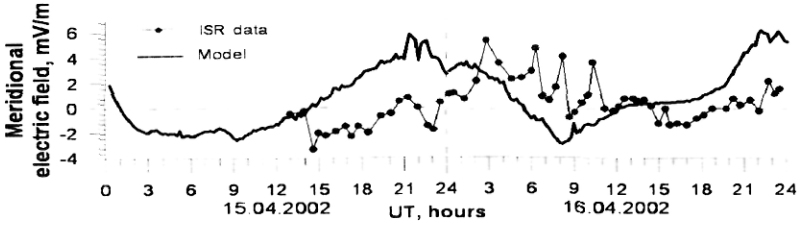

Fig.3 Meridional electric field calculated by the UAM (firm curve) in comparison with the observation data (curve with dots)

The numerical experiments have showed that the reason of the disagreement of the model results with the night-time electron density observations was the difference between the model and measured electric fields. The UAM modeled the usual convection pattern with the diverging zonal plasma flow over Millstone Hill. The electric field observations corresponded to the zonal drift converging plasma to the midnight meridian. Such "anomalous" convection pattern can be caused by the FAC2 forcing and moving to higher latitudes.

The observed electric field variation was reproduced in the model simulations with setting the FAC1 and FAC2 in the magnetic latitudes of 80° and 75° correspondingly. Such moving field-aligned currents to higher latitudes has improved the agreement of the model electron density with the measurements. But this numerical experiment was not quite correct because the field-aligned currents position must be changed taking into account the magnetic field configuration changes, particularly that of the polar cap position.

Thus, the investigation will be continued using the magnetospheric block of the Upper Atmosphere Model which allows to simulate the magnetospheric plasma sheet dynamics and to calculate the FAC2 distribution. Using the magnetospheric block we plan to reproduce the "anomalous" convection pattern with the zonal flow converging plasma to the midnight meridian.

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1. A.A. Namgaladze, O.V. Martynenko, M.A. Volkov, A.N. Namgaladze and R.Yu Yurik, *High-latitude version of the global numerical model of the Earth's upper atmosphere*, Proceedings of the MSTU, v.1, No.2, 1998, pp.23-84.

2. A.A. Namgaladze, Yu.V. Zubova, A.N. Namgaladze, O.V. Martynenko, E.N. Doronina, L.P. Goncharenko, A. Van Eyken, V. Howells, J.P. Thayer, V.I. Taran, B. Shpynev and Q. Zhou, *Modelling of the ionosphere/thermosphere behaviour during the April 2002 magnetic storms: A comparison of the UAM results with the ISR and NRLMSISE-00 data*, Adv. in Space Research, V. 37, Is. 2, 2006, pp. 380-391.