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INVESTIGATION OF THE IONOSPHERIC F-LAYER RESPONSE TO THE FAC2 VARIATIONS DURING APRIL 16 AND 17, 2002 USING THE UPPER ATMOSPHERE MODEL

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Our previous papers [Namgaladze et al., 2003, 2006] described the results of the ionospheric parameters (electron density, ion and electron temperatures) numerical modelling using the UAM - Upper Atmosphere Model [Namgaladze et al., 1998]. The model results were compared with the data obtained by seven incoherent scatter radars during the geomagnetic storms period of April, 2002 [Namgaladze et al., 2006].

The ionosphere responded to the April, 2002 geomagnetic disturbances mainly by the electron density decrease in 2 and more times over all radar stations. The effect was accompanied by the ion and electron temperatures increase. The UAM have reproduced the features of the ionospheric effects of geomagnetic storm and demonstrated the qualitative and quantitative agreement with the observation data. The model calculations have approved the fact that the neutral composition change was the main mechanism which caused the electron density decrease. The zonal electromagnetic drift accounted for the night-time enhancement of the electron density in the subauroral latitudes in quiet geomagnetic conditions. The drift caused the plasma convergence to the midnight meridian and thus kept the electron density level during the night hours [Zubova et al., 2003].

However some of our colleagues noticed that by analyzing the ionosphere parameters variations at the fixed altitudes we introduced additional errors concerned with the Ne(h) profile definition. And the model results should be compared with the data for the F-layer peak parameters, i.e. foF2 and NmF2. Besides, it was noticed that the only NmF2 is not enough to making the conclusion about the roles of neutral composition and thermospheric wind. The model hmF2 should be compared with the ionosonde data because the plasma drag by the thermospheric wind plays a great role in the hmF2 behaviour.

We have compared the F2-layer peak parameters (foF2 and hmF2) calculated by the UAM for the period of April 15-18, 2002 with the Millstone Hill and Sondrestrom ionosondes data. The values calculated by the UAM version with the neutral composition and temperature by the NRLMSISE-00 [Picone et al., 2002] are marked as "UAM(M)" and pictured by the dotted lines, the solid lines relate to the fully self-consistent model version marked as "UAM(T)".

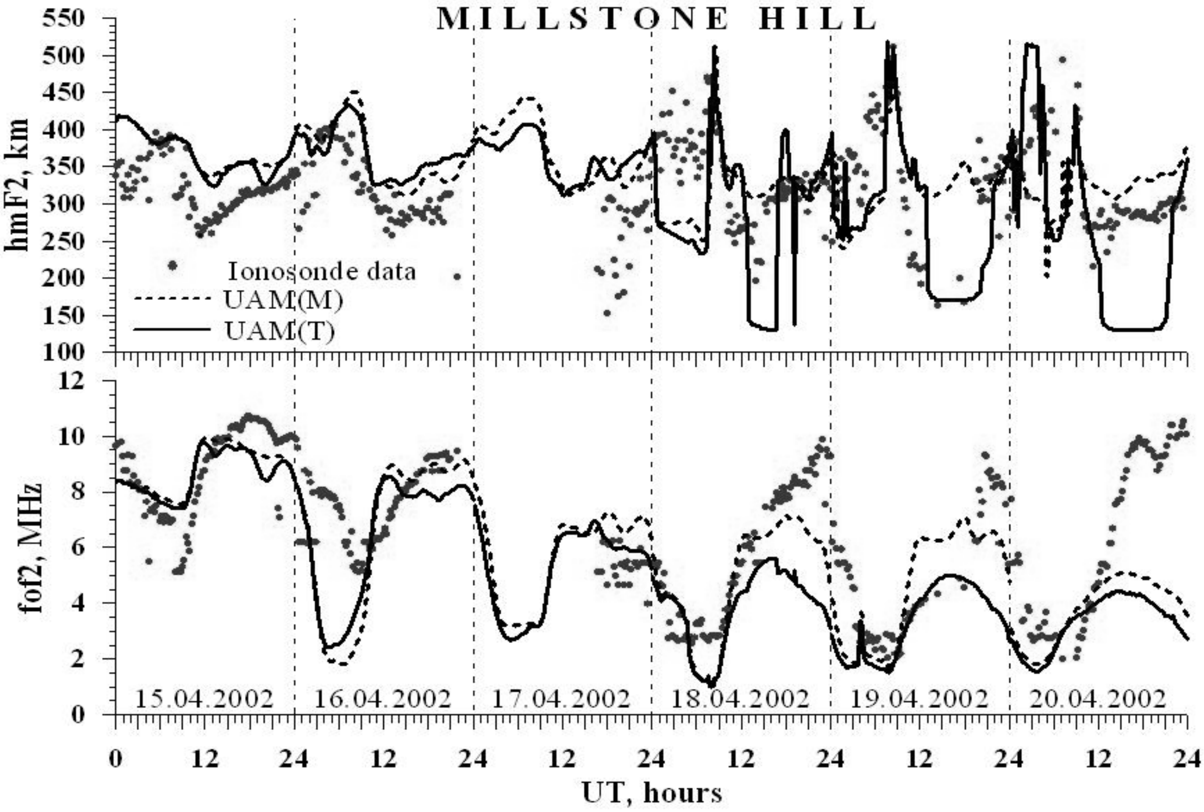

Figure 1. The time variations of hmF2 (above) and foF2 (below) observed by the Millstone Hill ionosonde during April 15-20, 2002 (dots) in comparison with the UAM results (solid and dotted lines).

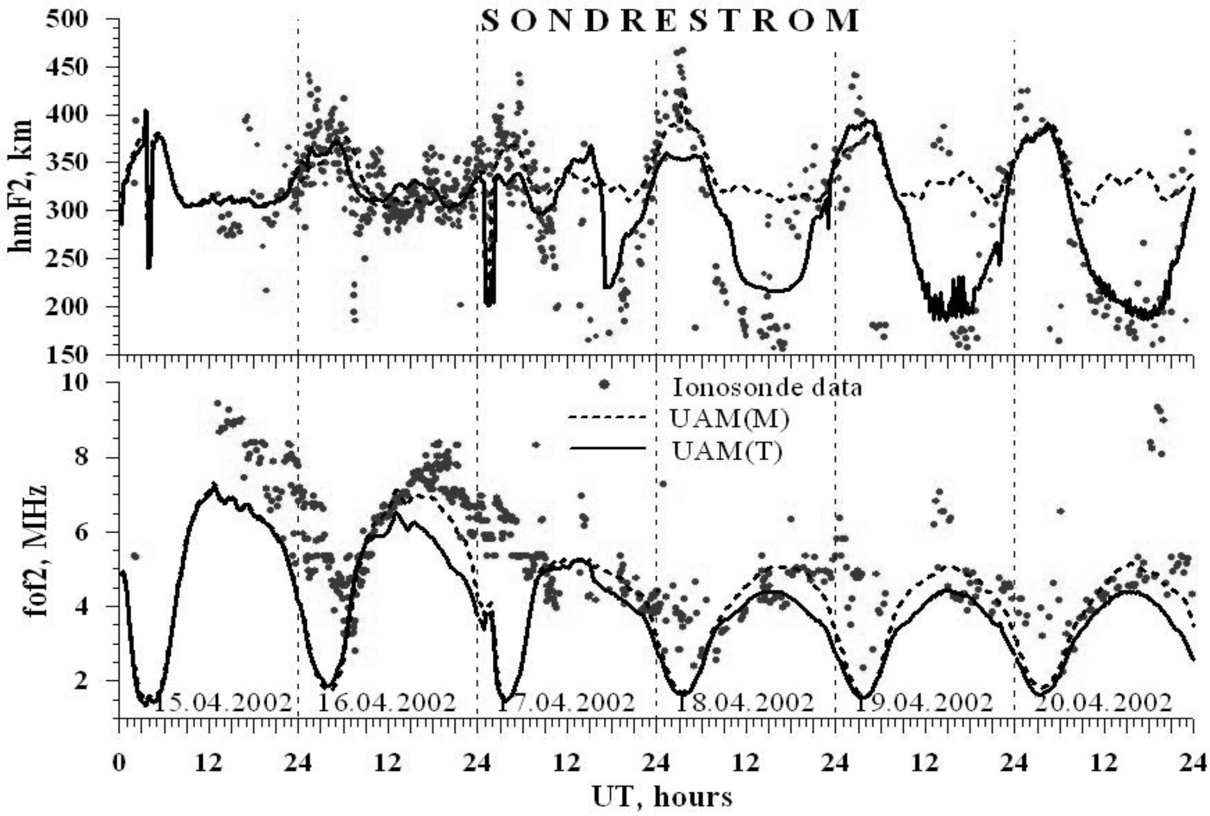

Figure 2. The time variations of hmF2 (above) and foF2 (below) observed by the Sondrestrom ionosonde during April 15-20, 2002 (dots) in comparison with the UAM results (solid and dotted lines).

The results presented in Figure 1 and Figure 2 confirmed our previous conclusions. The figures demonstrate the acceptable agreement of the model hmF2 values with the Millstone Hill and Sondrestrom ionosondes data especially in the UAM version using the NRLMSIS. But the numerically calculated foF2 differ values dramatically from the Millstone Hill data for the night hours of April 16 and 17, 2002. This disagreement of the foF2 values calculated by both UAM versions and the observations reaches the factor of 4 and more.

So, the ionospheric plasma behaviour during night hours over Millstone Hill was caused not by the thermospheric wind variations but by the plasma convergence to the midnight meridian due to the zonal electromagnetic drift.

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