



Variations in the Upper Atmosphere over Kharkov during Severe Magnetic Storms

Vitaliy Taran, Mykhaylo Lyashenko, Leonid Chernogor, Igor Domnin, Yelena Grigorenko, and Valeriy Pulyayev
Institute for ionosphere, Kharkov, Ukraine (mlyashenko@ya.ru / +38 057 706 22 87)

We study the features of well pronounced negative ionospheric disturbances accompanying severe magnetic storms on 25 September 1998, 29–30 May 2003 and 7–10 November 2004 ($K_p \geq 8$) as observed by the Kharkov incoherent scatter radar (49.6°N, 36.3°E). Among considered features there are depletion in electron density by a factor of 3.5–7, uplifting of ionospheric F2 region by more than 100 km, unusual nighttime heating of plasma up to daytime values of ion and electron temperatures, and infringements of plasma transfer process and of thermal balance in the ionosphere – plasmasphere system. During the September 1998 storm, an unusual increase in the upward plasma drift velocity was registered in the morning sector. It was shown that such disturbance could be caused by superposition of the effects of two sources: equatorward storm-induced surge in the neutral wind and/or electric field pulse, which both were generated by bursts of substorm activity. On 29–30 May 2003 during the main storm phase a depletion in the relative density of hydrogen ions by more than an order of magnitude with its further increasing during the recovery storm phase was revealed that could manifest an emptying of the magnetic flux tube over the Kharkov radar and its subsequent filling. The effects usually observed in the high-latitude ionosphere, including the oblique coherent backscatters, at that even in the daytime, are detected during the main phase of the 10 November 2004 storm. These phenomena are explained in terms of thermospheric disturbances, Joule heating, particle precipitation, penetration of magnetospheric electric fields to midlatitudes, and the shift of auroral oval and related structures towards the radar latitude. The examine results allowed distinguish the common regularities and specific peculiarities in the evolution of these disturbances at midlatitudes of the Central Europe.