Variations of the parameters of the D-layer of the ionosphere during X-ray flashes based on the monitoring data of VLF transmitters in the GPO "Mikhnevo"

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For several years, the signals from the stations, operating in the VLF frequency band, are registered in the GPO "Mikhnevo". Among the stations received at the Mikhnevo HFO, there are 2 GQD and GBZ transmitters operating at 22.1 kHz and 19.58 kHz. The distance between these transmitters is 32 km, so we can assume that the signals from them propagate along the same route. Within the framework of the two-parameter model of the Ferguson-White ionosphere D-layer, the electron concentration profiles on the signal propagation path were reconstructed from the measured values of the amplitude-phase characteristics of the signals from these transmitters. In this model, the height profile of the electron concentration is described using two quantities: h' is the effective reflection height and β is the parameter that determines the growth rate of the electron concentration, or the "rigidity" of the upper wall of the waveguide. To restore the electron concentration profile, the LWPC program was used. The paper discusses the results of measurements during several X-ray flashes of M and X classes. The dependences of the effective reflection height of the VLF signal and the "rigidity" of the upper wall of the waveguide on the X-ray flux (according to the GOES satellite data) are constructed.

The analysis of the influence of the "rigidity"of X-ray radiation on the characteristics of the D-layer of the ionosphere was carried out. It is shown that during X-ray flashes, the effective reflection height decreases to 60-65 km. In this case, the main influence on the value of the effective height of the reflection is exerted by X-rays in the range of 0.5–4 A. It is noted that during the X-ray flash, the recombination coefficients of the ionized component vary greatly. This feature is characteristic of an effective reflection height of about 70-74 km.