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IMPACT OF A STRONG MAGNETIC STORM AND TWO X-RAY FLARES ON THE IONOSPHERIC HF CHANNEL IN THE SUMMER SOLSTICE OF 2015 ACCORDING TO OBLIQUE SOUNDING IN THE EURASIAN REGION

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We present the results of observations of the impact a strong magnetic storm and two X-ray flares in the summer solstice of 2015 on the HF signal characteristics during oblique sounding of the ionosphere in the Eurasian region. It was found that the negative phase of the magnetic storm led to a strong degradation of the ionospheric channel, up to a long blackout on the paths adjacent to the subauroral latitudes. On the midlatitude paths, a decrease in the maximum observable frequency of the F layer reached 50% with respect to the average values for an undisturbed ionosphere. The propagation velocity of the negative phase of a disturbance from the subauroral to the midlatitude ionosphere is determined (it is equal to about 100 m/s). It is shown that during a magnetic storm the least observable frequency and the average signal-to-noise ratio for the propagation mode via the sporadic E_s layer correlate well with the auroral AE index. Anomalous signals were detected in the main phase of the magnetic storm on the Cyprus — Rostov-on-Don path when a chirp ionosonde–radio direction finder was operated in the over-the-horizon HF radar mode. On the basis of modeling and comparison with experimental data, it is shown that the anomalous signals are due to scattering of radio waves by small-scale irregularities located in the subauroral ionospheric F region.

1. INTRODUCTION

Despite the development of satellite and fiber communication lines, HF radio communication still plays an important role in solving the applied problems of ionospheric propagation of radio waves. The advantages of HF radio communication are long-range operation, high mobility, and low cost compared with other types of communication.

The main problem of HF radio communication is the non-stationarity of the ionospheric radio channel, which, first of all, is due to the impact of various kinds of disturbances of the natural and artificial origin (solar flares, coronal mass ejections, magnetic storms, passage of the terminator, solar eclipses, industrial explosions, rocket launches, heating of the ionosphere, etc.) and interference created by alien radio stations. The ionospheric disturbances caused by a magnetic storm lead to a change in the regular distribution of the electron density, increased absorption, enhanced ionospheric irregularities, and the appearance of anomalous

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