Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06918, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06918
EGU General Assembly 2008
© Author(s) 2008

Study of Doppler frequency shift and spectral broadening of ionospheric HF-signals

I. Petrova, V. Bochkarev

Kazan University, Russia (ipetrova@ksu.ru / Fax: +7 843-2315325 / Phone: +7 843-2928192)

Research of processes in ionosphere has importance not only for the problems of dynamics of the upper atmosphere, but also for the questions connected with the radio communication. The method of measurement of Doppler frequency shift of ionospheric signal - a Doppler method - is one of well-known and widely used methods of ionosphere research.

Since 2000 we carry out measurements of Doppler frequency shift (DFS) and spectral broadening (DSB) of ionosphere HF-signal. We have analysed features of intensity and spectral distribution of these parameters variations for different time of day, seasons and levels of geomagnetic activity.

Range of DFS variation in the afternoon is the tenth parts of Hz, and it increases to 1-2 Hz during sunrise and sunset . At night the fluctuation spectrum is much wider, than in the afternoon. In the afternoon DSB variations are insignificant and value tends to zero. At night DSB values achieve several hertz and significant variations of this parameter are observed. In the afternoon the signal is reflected and the spectrum is narrow. In night there is scattering on ionospheric irregularities. This is the reason of spectrum spreading.

The DFS variation range during autumn and winter seasons is greater than during spring and summer seasons. In summer the effects of traveling ionospheric disturbances are observed only at some hours of day. In the winter such effects are observed within all day. Apparently it depends on favorable conditions for distribution of internal gravity waves from the bottom layers of the atmosphere. The periods of DFS variations with the maximal intensity are 6-12 minutes for a winter season and 20-40

minutes for an autumn season.

Spectral features of DFS variations with the periods of traveling ionospheric disturbances have been analysed for the days with high level of geomagnetic activity. We have found out that intensity of variations for these days is higher. The exponent of approximating power function is greater for the periods 16 - 32 minutes and more then 120 minutes. It testifies to influence of disturbances with the periods of medium scale and large scale during geomagnetic storm.

Algorithms of forecasting of HF radio signals parameters have been developed on the basis of the obtained results. Models of linear prediction and nonlinear autoregress, adapted for task of forecasting of radio signal parameters have been used. These algorithms have been used for forecasting average values of DFS, range of variations and level of HF radio signal for various time intervals. Application of the developed methods allows to reduce aprioristic uncertainty of DFS values in 3-5 times depending on interval of averaging and conditions of propagation using linear models, and in 5-10 terms using neuronet forecasting. Prediction accuracy of DFS values averaged on 15-minute intervals is 0.03 Hz.