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THE IONOSPHERE PARAMETERS VARIATIONS BY KHARKIV INCOHERENT SCATTER RADAR DATA

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Abstract.

1 INTRODUCTION

The study of an ionosphere structure and dynamics is important as for understanding physics of processes, proceed in it, and for radiophysical problems solution. The method incoherent scatter of radio waves allows determining experimentally both regular variations of the basic parameters ionosphere, and their behaviour during perturbation.

The incoherent scatter radars provide the potentiality to realize the most complete diagnostics of this phenomenon. At the ionosphere investigation by incoherent scatter method there are directly measured the power spectrum (or autocorrelation function) of scattered signal. With using of rather complex procedure of the received signal processing it is possible to estimate the majority of the ionospheric parameters - density and kinetic temperature of electron and main ions, the plasma drift velocity and others.

2 FACILITIES

In the given investigations are presented measurements data provided by IS radar located near Kharkiv, Ukraine (geographic coordinates: $49.6^oN, 36.3^oE$, geomagnetic coordinates: $45.7^oN, 117.8^oE$). The Kharkiv radar is single incoherent scatter facility on the middle latitudes of European region. The radar is operates with 100-m zenith parabolic antenna at 158 MHz with peak transmitted power $\sim$ 2.0 MW. The Kharkiv IS radar is able to determine the heights-temporal distribution of ionosphere parameters in height range of 70-1500 km.

3 METHOD

For measurements of electron density the sounding mode by compound two-element dualfrequency signal is applied. The double-frequency measuring channel provided $\sim$ 20-km resolution in range $\sim$100-400 km and $\sim$100-km in range $\sim$200-1100 km. The sounding

signal, which is formed from two radio pulses - large duration $T_1 = 700s$, and small duration - $T_2 = 130s$. The carrier frequencies are differs on 100 KHz. This method has allowed essentially reducing an error of the electron density determination in region F2 layer maximum and below. The auto-correlation function measurements were taken at 18 of time delays, with a $\sim 30 - \mu s$ lag. At IS signal receiving at the first element frequency there are determined the height dependences of scattered power and complex correlation function which used to calculate the scattered crossection and correlation function of thermal fluctuations of electron density. On the base of these data the electron concentration, ion and electron temperatures, drift velocity and ion composition are calculated. The signal integration over 10-15-min intervals when the input signal-noise ratios are of 10-0.2 permits the ionosphere parameters to be determined with accuracy of about 3-10%.

4 OBSERVATIONS RESULTS

This study is mainly concerned with ionosphere electron density variations obtained during several experiment in 2004-2008. It is presented experimentally obtained altitude and spatialtemporal dependences of electronic density (N_e) of ionosphere plasma in the heights range 100-1000 km during typical seasons in quiet geomagnetic conditions for the period of low solar activity.

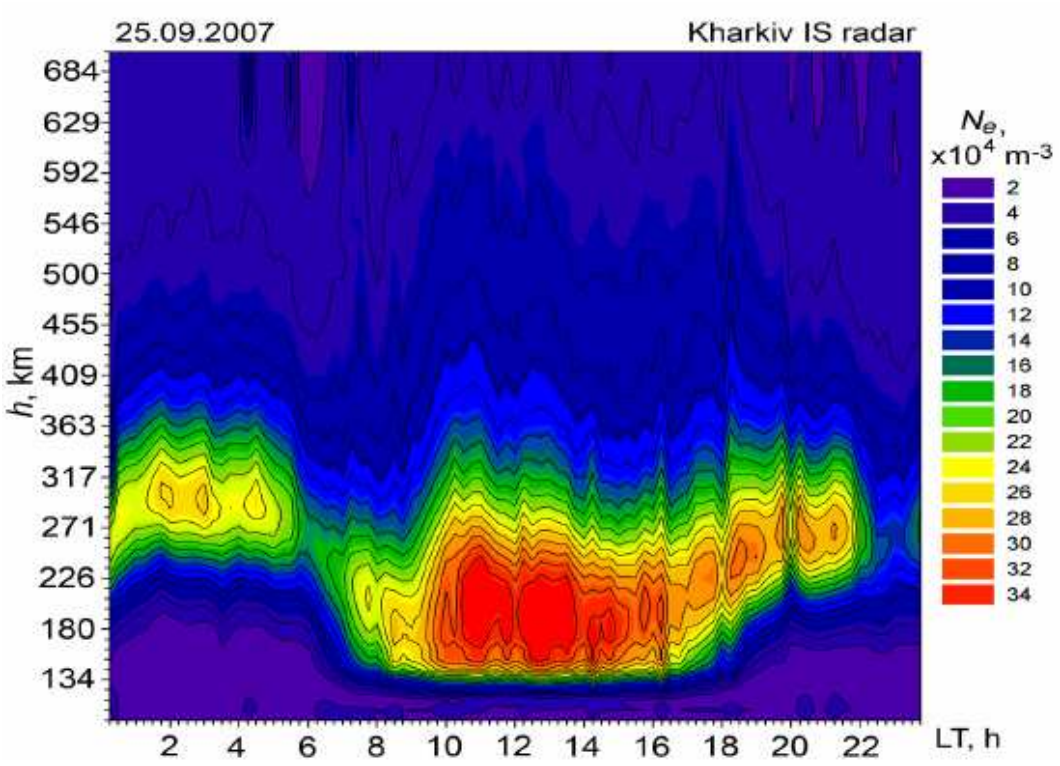

Figure 1: Altitude-temporal variations of ionosphere plasma electronic density at autumnal equinox 2007.

The equipment and measurement technique, developed by authors, are allows obtaining certain data about behavior of an ionosphere during various origin and intensity ionosphere perturbations. It is presented and analyzed experimental data about variations of electron density and incoherent scatter signal parameters in the East Europe region during a period two sun eclipse and few magnetic storms.