# The study of the ionosphere disturbed volume over the SURA facility using vertically sounding ionosonde

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## Abstract

Digital ionosonde near from Kazan enables us to sound the disturbed region of the ionosphere over the SURA ionospheric heating facility and measure the characteristics of artificial ionospheric irregularities, as was shown in [1, 2]. In this paper we study some ionospheric effects. The experiments were carried on September 14, 2015. The SURA antenna pattern was directed to zenith. The ionosonde "Cyclon" of Kazan Federal University operated every 15 min in the ionogram mode. Ionograms were recorded for 20 seconds; in the rest of time ionosonde emitted and received at 10 fixed frequencies. Figure 1 shows that this method enables us to obtain information about the characteristics of generation and relaxation of artificial ionospheric irregularities at various altitudes. The frequency 4375 kHz of the receiving channel of the ionosonde corresponds to the frequency of the wave SURA facility in this measurement session. Characteristics of the ionosonde “Cyclon” can be found in [3].

## Image

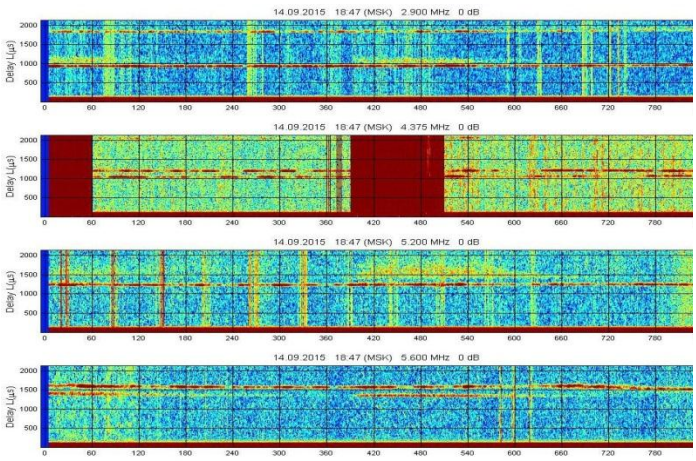


Figure 1. Example of the vertical sounding signals and scattered or reflected signal from the ionosphere disturbed volume

An analysis of the experimental results indicated that beside typical observed scattered signals we observed a signal, which has ”week diffusion” that corresponds to specular reflection of radio waves in the ionosphere and that must come from the local area enough. We tried to interpret the phenomenon by the zenith of magnetic field, where according [4, 5] the development of the most intense plasma density perturbations is observed within the range from meters to tens of kilometers. Such a structure of disturbed region leads to strong distortions of the refractive sounding radio waves and to the appearance of narrow frequency bands, which may be the conditions of aspect scattering or specular reflection. It is necessary to perform modeling of propagation conditions in the disturbed ionosphere for a clear clarification of the nature of this "week diffusion" signal.

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## Recent Publications

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2. Sergeev EN, Zykov EYu, Akchurin AD et al. (2012). Results of integrated studies of the perturbed ionosphere region using short-wave ranging in a wide frequency band and stimulated electromagnetic emission of the ionosphere. Izv. vuzov. Radiofizika 55(1-2):79-93.
3. Zykov EYu, Sherstyukov ON, Akchurin AD (2013). Research ionosonde "Cyclone" of Kazan university and program of autoscaling ionograms. Geliogeofizicheskie issledovania 4:39–46.
4. Frolov VL, Erukhimov LM, Metelev SA et al. (1997). Temporal behavior of artificial small-scale ionospheric irregularities: Review of experimental results. J. Atmos. Solar-Terr. Phys. 59(18):2317-2333.
5. Frolov VL (2015). The spatial structure of plasma density disturbances induced ionospheric modifications in its powerful HF radio waves: a review of experimental results. Solnechmo-zemnaia fizika 1(2):22-45.

Biography

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## Notes/Comments