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THE DEVELOPMENT OF SMALL-SCALE IRREGULARITIES IN THE IONOSPHERE DISTURBED BY POWERFUL OBLIQUE HF RADIO WAVES

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ABSTRACT

It is shown that small-scale artificial turbulence develops in the middle latitude ionosphere due to disturbance by a powerful oblique high frequency radio wave. The conclusion is based on experimental data obtained by the method of the aspect-sensitive scattering of the HF wave from inhomogeneities with scales of $\ell_\perp$~12 m transverse to the geomagnetic field $\vec{H}$. This work shows that changes in the amplitude and frequency spectra of the probe waves are correlated with changes in the HF power during ionospheric modification by powerful oblique radio emission. The data obtained provide evidence of strengthening of small-scale non-isotropic fluctuations in electron density for the situation when the interaction of the powerful radio waves with the ionosphere does not have a resonant nature, because in the case of oblique propagation the radio waves are reflected below the level at which the frequency of the wave is equal to the plasma frequency.

INTRODUCTION

It was shown in the last 15 to 25 years that the parameters of the ionosphere change considerably under the influence of powerful radio emissions. The bulk of experimental researches on artificial modification of the ionosphere were made using vertically directed powerful radio waves when their interaction with plasma was of a resonant nature. Among numerous effects discovered in these experiments, the examination of small-scale field-aligned irregularities with length scales transverse to the geomagnetic field of $\ell_\perp < \lambda_h$ (where λ_h is the wave length of the heating radio waves) is very important (Fialer, 1974).

The problem of the modification of the ionospheric plasma by powerful oblique HF radiation is investigated less often than the problem of interaction of vertical radio emission with the ionosphere. The first results of the changes in ionospheric parameters due to oblique radio emission were obtained in the experiments of Bochkarev *et al.* (1979) and Bochkarev *et al.* (1982). Vertical and oblique sounding measurements of frequency shift and phase differences of probe waves were applied by Blagoveshenskaya