NUMERICAL ANALYSIS OF THE ANOMALOUS IONIZED IONOSPHERE

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The purpose of the work is the numerical analysis of the phenomenon of abnormal decreasing of the VLF signals up to a level of the atmosphere radio noise on the high-latitude trace Aldra-Apatity [1]. It is clear, that such decreasing takes place due to the compensation of the ground wave by the first ionospheric ray. However the previous research [2] has shown, that the analysis of described situation on the basis of the so called reflective formulas is not correct because of their inapplicability in our case of low effective high of the waveguide. So the calculation of the first ionospheric ray field is required taking into account its diffraction property. The diffraction ray is described by a contour integral on a complex plane of parameter t. An impedance δ of the top conventional boundary h of the waveguide (in our case it is equal to 100 meters) enters into the subintegral function. This impedance is a characteristic of the unmonotonous structure of electron concentration profile in our case: the ionosphere and the ionized middle atmosphere layer [3].

The field of the first ionospheric diffraction ray was calculated correctly. A contour of integration passed along the contour which was close to the descent contour for the subintegral expression on the complex plane of the division parameter. The impedance δ was got by the numerical integration of Rickatty equation in an interval of heights from h up to "infinity" for the chosen effective electron concentration profile (the unmonotonous structure) and for the effective collision frequency profile of electrons. Varying a value of electron concentration increment and a width of a homogeneous electric conductivity layer inserted in the profile of electron concentration, the inverse VLF-problem was solved relatively to the effective electron concentration profile. For it the powerful VLF-disturbances was modelled. VLF-variation refers to the powerful one if the amplitude of a radio signal in an average zone of the radio source is decreased up to a level of the atmosphere noise (for the reception frequency range of 20 Hz for an amplitude channel).

References:

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