

Excitation of the Earth-ionosphere waveguide at the frequencies near the transverse resonances frequencies by ionospheric and ground-based sources

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The report is dealing with the results of registration of natural and artificial electromagnetic emissions in the ionosphere heating experiment carried in October 2016 at "EISCAT/Heating" facility (Tromsø). The HF heating modulates the electron temperature in the D-region ionosphere that leads to conductivity modulation. The auroral electrojet electric field with modulated conductivity generates a time-varying current which radiates electromagnetic wave at the modulation frequency. The report reviews the results of registration signals, emitted by formed in this way ionospheric source, at the frequencies (1817 and 2017 Hz) near the Earth-ionosphere transverse resonance frequency. It is shown, that the polarization of a horizontal magnetic field with distance from the source tends to a totally circular left polarization. Estimations of the incidence angles of waves decrease with distance from the source (at the Barentsburg station, located at the most remote point, they are 15-35 degrees). Tweek-atmospherics recorded during the heating experiment also exhibit similar behavior.

We are used the numerical modelling to study the features of excitation of the Earth-ionosphere waveguide at these frequencies. Two types of electromagnetic field sources are considered: lightning discharges, represented by an oscillating vertical current dipole located in the waveguide; currents in the D-region of the ionosphere caused by changes in the Hall and Pederson conductivities during ionosphere heating. The ionosphere reflection coefficients and excited waveguide modes has been analyzed under the conditions of the daytime and nighttime lower ionosphere. The results of observations are compared with the results obtained by modeling of the electromagnetic ELF/VLF waves generation and their propagation in the Earth-ionosphere waveguide.