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Sounding of the modified by powerful HF radio waves ionosphere by navigational satellites radio transmissions.

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In this work we report on the results of the ionospheric heating experiments, which were carried out at the Sura facility (Radio Physical Research Institute, N. Novgorod) during two campaigns in March, 2009 and in August, 2010 in daytime and nighttime ionospheric conditions.
We present experimental evidences for the influence of the electron density perturbations, induced by HF-heating in the midlatitude ionosphere, on the radio signals of satellite navigation systems.
The inospheric heating was scheduled to provide crossing of the heated area by the ionospheric penetration points of GNSS and low-orbital navigational satellites. We study the characteristics of the observed perturbations for different heating regimes both for high orbital and low orbital navigational satellites. Variations in TEC (total electron content proportional to the reduced phases of the navigational signals) obtained from GNSS satellites show that in case of square-wave modulation of the effective radiated power (with broad range of periods) of the heating wave, perturbations with periods of the main modulation of heating and its harmonics appear in the wavelet spectrum of TEC variations. Examples are presented of identification of the heating-induced variations in TEC, including the determination of amplitudes and time characteristics of such variations. We discuss the differences in the results obtained in daytime and nighttime conditions.
We also present and discuss examples of the amplitude scintillations of the beacon signals from low orbital navigational satellites and corresponding TEC perturbations caused by heating as well as tomographic crossections of the heated area.
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