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GPS-study of Ionospheric TEC variations induced by powerful HF-heating.

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The studies of the influence of powerful HF radio waves on the ionosphere revealed strong heating of the ionospheric plasma and generation of artificial irregularities in the ionospheric electron density with the scale sizes from fractions of meter to dozens of kilometers near the reflection height of the powerful radio wave. These irregularities have a considerable effect on the parameters of VHF/UHF/L-band radio waves propagating through the heated area of the ionosphere.

The aim of this work is to report the experimental results on the influence of the electron density perturbations caused by HF heating in the dayside midlatitude ionosphere on GPS signals. The experiments were carried out at the Sura heater (Radio Physical Research Institute, N. Novgorod, Russia) in March, 2009. The effective radiated power of the heater was up to 80MW. Different modulations of effective radiated power were applied, in particular, square-wave modulations with periods of 1, 6, 10 and 15 minutes. Variations in the total electron content (TEC) proportional to the reduced phases of navigational signals were studied for those satellite passes, when the rays linking these satellites with the ground receiver intersected the heated region during the periods of heating. We show that the wavelet spectrum of GPS TEC variations contains spectral components (main modulation frequency and its harmonics) corresponding to the modulation and timing of HF-heating when the ionospheric penetration points of the tracked GPS-satellites fall within the heated area. Examples are presented of identification of the heating-induced variations in TEC along the satellite-to-receiver ray, including the determination of amplitude and time characteristics of these variations.

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