

# **Radiotomography and HF ray tracing of the artificially disturbed ionosphere above the Sura heating facility**

Andreeva E., Frolov V., Kunitsyn V., Kryukovskii A., Lukin D., Nazarenko M., Padokhin A.  
*Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia*

---

## **Abstract**

©2016. American Geophysical Union. All Rights Reserved. We present the results of the radiotomographic imaging of the artificial ionospheric disturbances obtained in the recent experiments on the modification of the midlatitude ionosphere by powerful HF radiowaves carried out at the Sura heater. Radio transmissions from low orbital PARUS beacon satellites recorded at the specially installed network of three receiving sites were used for the remote sensing of the heated ionosphere. We discuss the possibility to generate acoustic-gravity waves (AGWs) with special regimes of ionospheric heating (with the square wave modulation of the effective radiated power at the frequency lower than or of the order of the Brunt-Vaisala frequency of the neutral atmosphere at ionospheric heights during several hours) and present radiotomographic images of the spatial structure of the disturbed volume of the ionosphere corresponding to the directivity pattern of the heater, as well as the spatial structure of the wave-like disturbances, which are possibly heating-induced AGWs, diverging from the heated area of the ionosphere. We also studied the HF propagation of the pumping wave through the reconstructed disturbed ionosphere above the Sura heater, showing the presence of heater-created, field-aligned irregularities that effectively serve as “artificial radio windows.”

<http://dx.doi.org/10.1002/2015RS005939>

---

## **Keywords**

HF heating, HF propagation, ionosphere, radiotomography