

Analysis of the lower ionosphere using the RDSN-20 transceivers signal propagation received in the auroral and circumpolar regions.

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We present results of an analysis of horizontal magnetic and vertical electric field component from VLF transmitters of the radio navigation system Alpha (long-range navigation system RSDN-20), registered in the Arctic auroral and circumpolar regions. The records are being collected since 2017. The permanent points are the geophysical station «Lovozero» (67.98 N; 35.08 E) of Polar Geophysical Institute, and the research base «Barentsburg» (Spitsbergen archipelago, 78.093 N; 14.208 E). The episodic observations are during the expedition «Transarctica 2019» on the science forwarding vessel «AKADEMIK TRESHNIKOV» nearby the Franz Josef Land archipelago, and the Arctic expedition Umka-2021 on the Franz Josef Land archipelago.

We focused on temporal variations of the amplitudes and phases of the signal and of the electromagnetic field structure. Note that unlike the most other receivers used for similar investigations, the VLF receiver designed in Polar Geophysical Institute besides the horizontal magnetic components, H_x and H_y , provides the vertical electric component, E_z . This allows us to analyze variations of the wave impedance which may reveal appearance of local heterogeneities in the lower ionosphere. We took into analysis events observed for both quiet and perturbed heliogeophysical conditions. In order to explain the experimental results, we compared the observations to the results of modeling of the radio wave propagation in the Earth-ionosphere waveguide. The modeling involved the Long Wave Propagation Capability (LWPC) program and a numerical solution of the wave equation (full-wave method) in the horizontally stratified media.