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ADIABATIC APPROXIMATION ERRORS IN DESCRIBING LOW-FREQUENCY SOUND LOSSES IN ARCTIC-TYPE SHALLOW-WATER WAVEGUIDE WITH A ROUGH BOUNDARY INTERFACE

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For the intensity of a low-frequency sound signal propagating in a waveguide of a shallow sea with a rough bottom boundary, based on the local mode approach a comparison of results of the adiabatic theory and the one-way propagation (OW) method is performed. The study is conducted for sound propagation conditions corresponding to the shelf zones of the Russian Arctic seas, as well as the Sea of Japan in winter. The comparison is made for a rough bottom boundary with different scales of random irregularities and different reflectivity. It is quantitatively estimated what errors of the influence of irregular bathymetry along the propagation path on the sound intensity should be expected within the framework of the adiabatic approximation. In particular, it is shown that the errors of the adiabatic description increase with decreasing characteristic scale of roughness. As a consequence, at relatively small scales of irregularities, the adiabatic approximation leads to a certain degree of distortion of the intensity pattern of the signal propagating in the waveguide. In addition, in the case of multimode waveguides with pronounced interference of modes, significant discrepancies are observed between the results of the adiabatic approximation and the OW method in local sections of the distance where intensity oscillation minima are formed.

Keywords. Irregular shallow water arctic waveguide, randomly rough bottom boundary, local mode approach, adiabatic approximation, one-way propagation method.

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