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Predicting Effective Propagation Velocities of Acoustic Signals Using an Ocean Circulation Model

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Abstract—The possibility of applying ocean circulation modeling data to forecast the effective velocities of pulse acoustic signal propagation from the continental slope to the deep ocean is studied. Prediction of these velocities is crucial for reliable operation of acoustic navigation and ranging systems, while typical lengths of paths and the prediction accuracy requirements almost completely exclude the use of direct measurements for this purpose. Analysis of experimental data obtained on a 200-km-long acoustic path shows that the NEMO ocean circulation model used for reconstruction of the sound speed distribution along this path allows one to calculate with sufficiently high accuracy the effective velocities of propagation of pulse acoustic signals transmitted by a source on the shelf and received in the deep-water part of the Sea of Japan. The proposed method for calculating the effective velocities is based on the adiabatic mode theory of sound propagation on the shelf, as well as on the fact that in the deep-water part of the path, the group velocities of low-number modes are very close to each other.

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