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ESTIMATION OF THE SYNOPTIC EDDIES INFLUENCE ON THE ACOUSTIC RANGING ACCURACY

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The development of acoustic navigation and acoustic ranging systems is currently one of the most important practical problems of ocean acoustics. In this study, the influence of large-scale inhomogeneities on the sound speed field in the ocean on the accuracy of acoustic ranging problem solution is considered. As a representative example of an inhomogeneity of this kind, we chose a stable anticyclonic eddy that is observed in the southern part of the sea of Japan in summer. In this work, computational experiments are conducted in order to study the influence of this eddy on the structure of the sound field formed along an acoustic path passing through the eddy's center by a source of navigation signals (SNS) located on the shelf. In the course of these experiments, a model of a range-dependent "shallow-to-deep-sea" waveguide was constructed along this path using hydrological data obtained from NEMO and INM RAS global ocean circulation models. After that, the acoustic field produced by the SNS in this waveguide was simulated by the method of wide-angle parabolic equations. The mode structure of the field along the path is studied, localization intervals of various modal components of the signal are determined, and the effective propagation velocities of signals transmitted by SNS are calculated at various reception horizons. The influence of the synoptic eddy on these waveguide characteristics is also investigated. On the basis of this analysis, the effect of the eddy on arrival times of the signals propagating from the SNS to the reception point is estimated, as well as the additional error in the solution of acoustic ranging problem caused by the presence of the eddy. The results of the study show, that within the framework of the considered technique of acoustic ranging problem solution, even the presence of a large unaccounted synoptic eddy, with its core located directly on the acoustic path, has a relatively weak effect on the accuracy of range estimation (about 30 m for a path 300 km long, or 0,01%).

Key words: sacoustic ranging, impulse signal, anticyclonic eddies, group velocities, normal modes method.

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