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Transformation of surface and internal waves at the bottom step

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Transformation of surface and internal gravity waves on the oceanic shelf is studied theoretically and numerically within the framework of the linear approximation. It is assumed that waves pass over the continental shelf experiencing partial transmission and reflection. The problem is studied for the simplified model of the shelf which is approximated by the bottom step. The fluid density is assumed constant in the case of surface waves, whereas in the case of internal waves it is assumed that the constant density in the upper layer is ρ1 and in the lower layer it is ρ1>ρ2. The theoretical formulae are derived for the transmission and reflection coefficients as functions of incoming wave frequency, density ratio, depth of the interface between the layers, and depth ratio before and after the step edge. It is shown that the rigorous solution of the problem requires accounting for the infinite set of non-propagating evanescent modes nestled up to the edge of the bottom step. The spatial structures of the evanescent modes, as well as their excitation coefficients are calculated. Results of direct numerical modelling of surface and internal wave transformation are presented as functions of all aforementioned parameters. The modelling was undertaken by means of the numerical code MITgcm. The results obtained are analysed in detail and compared against the theoretical predictions. The simple approximation formulae are proposed for the coefficients of wave transformation; their effectiveness and accuracy are estimated and validated.

Biography

Yury Stepanyants obtained his PhD in 1983 from the Marine Hydrophysical Institute of the Ukrainian Academy of Sciences in Sebastopol and then the highest degree of Doctor of Physical and Mathematical Sciences in 1992 at the Institute of Applied Physics of the Russian Academy of Sciences in Nizhny Novgorod. He is currently a Professor of Mathematics at the School of Agricultural, Computational and Environmental Sciences, University of Southern Queensland, Toowoomba, Australia. He has published more than 100 papers in reputed journals and has been serving as the Editorial Board Member of the *"Journal of Mathematics and Statistics*" and *"Chaos"*.

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