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Non-Reflecting Internal Wave Beam Propagation in the Deep Ocean

T. Talipova (1), R. Grimshaw (2), and E. Pelinovsky (1)

(1) Institute of Applied Physics, Laboratory of Hydrophysics and Nonlinear Acoustics, Nizhny Novgorod, Russian Federation (tata@hydro.appl.sci-nnov.ru), (2) Loughborough University,Department of Mathematical Sciences, Loughborough, UK

It is well-known that internal waves can propagate downwards in the interior of the oceanic and this process has been modeled numerically and in laboratory. According to general wave theory in the general case of the arbitrary distribution of the buoyancy frequency with depth an internal wave should transform and reflect. However, various observations and numerical simulations of a nonlinear internal wave field in the ocean show that internal waves of tidal period propagate as beams with no visible internal reflection. Here we analyze theoretically the penetration of internal waves in an ocean with continuous stratification in background density and a shear current. We will show that for certain vertical distributions of the oceanic stratification internal waves can be considered as traveling waves which propagate without any internal reflection. Further these profiles can represent real oceanic data rather well. Our simplified theory confirms that the internal reflection of internal waves in the deep ocean is quite weak when compared with the reflection from the ocean bottom and near-surface pycnocline.