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Free surface manifestation of internal processes in the shelf zone

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Hydrodynamics of the shelf zone, particularly an induction of periodic near-shore flows, was studied rather thoroughly. But an existing analysis of the natural data did not give an adquate interpretation of the periodic flows observed appearing in the shallow part of the shelf in different regions of the World Ocean. A study of the hydrological data (the bathymetry, the hydrology, wind velocities, near-shore flows and internal waves) published earlier and made by the author proved clearly an assumption of the decisive role of internal waves in the formation of the near-shore flows observed.

Bottom irregularities normal to the direction of propagation of the internal wave can induce near-bottom shear flows or three-dimensional wave motion with the wave vector normal to that of the incoming wave.

In case when the pycnocline was considerably above the shelf ("deep" shelf) the internal wave could propagate above the shelf as well. Parameters of the initial wave became different at the shelf and in the deep part of the tank. In such conditions propagation of two mentioned parts of the wave will be described by different theories. As the amplitude of the wave was of about the shelf's depth this part of the incoming wave was formed further in accordance with the fully non-linear theory. Another part of the wave continued its propagation in the initial form. Such a combination of two plane waves of different profiles produced intense three-dimensional wave motion at the level of the pycnocline. And longitudinal propagation of the solitary wave along the tank transformed to the transverse wave motion with the wavelength of about the shelf's width.

The difference between the character of fluid motion produced by the "shallow" and the "deep" shelf is that in the latter case one could observe an induced horizontal periodic shear flow of the internal wave period in the pycnocline layer above the shelf.

An understanding of the nature of interaction between hydrological processes at the shelf edge based on the experimental and natural investigations may be used for the development of the theoretical and numerical models of the field phenomena.

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