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Experiments on Interaction of Internal Solitary Wave with Extended Obstacle@

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The results of the experimental investigations dealing with finite-amplitude internal solitary waves in a two-layer fluid system are presented. Particular attention has been given to the study of the interaction of solitary waves with an extended obstacle that is placed on the bottom of the basin 7m long, 0.33 m wide and 1.5 m high. The walls of the basin were made from plexiglass. A salt-stratified system was constructed by filling the basin with salt water (of density approximately 1014 kg/m$^{3)}$ in the lower layer and then fresh water (of density 1000 kg/m$^{3)}$ above. Fresh water slowly run through the fibrous material which acted as an energy dissipater to reduce the mixing. This material was placed at the ends of sheet of wood board floating on the salt water.

The generation of solitary waves was realized following the method proposed by Michallet & Ivey (1999). A watertight movable gate was located near the upstream end of the basin. There was the gap between the lower end of the gate and bottom. Fresh water runs through the additional filling system placed within separated part of the basin and reintroduced on the other side of the gate due to gap. Thus the lowering of halocline level in the separated part of the basin takes place compared with the main part. The gate was lifted to initiate a run. In distinction from Michallet & Ivey (1999) the gate replace after given time interval to cut off mixed fluid and vertical structures caused by motion of the gate.

Density profile was obtained by traversing a micro-conductivity probe over depth. Calibration of the probe was fulfilled by using series of test reservoirs with given salinity. Measurements of the interfacial displacement caused by moving solitary waves were made by longitudinal capacitive transducers that were submerged in water completely. Calibration of these transducers was fulfilled by using reservoir with fresh water in

which small reservoir with salt water was placed.

The boundary between layers was dyed. This allows to visualize the displacement of the boundary caused by moving solitary waves and to analyze the pattern of flow in vicinity of obstacle.

The influence of the height of the obstacle on the scattering of the incident solitary wave was studied for the case when the horizontal size of the obstacle was close to the wave length. The critical height of the obstacle when wave did not penetrate behind the obstacle was found for given thicknesses of the layers and amplitude of wave. Sharp steepening of wave is observed that accompanied by the growth of its amplitude and subsequent breaking, the arising of thin shear layer and vortical structures and the forming of the solitary wave propagating in opposite direction. Length of reflected wave and its amplitude are less than corresponding values of the incident wave due to considerable increase of dissipation.

Presented results bring to more deep understanding of physical features of the process of interaction between solitary wave and extended obstacle.

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