



Experiments on Transformation and Breaking of Internal Solitary Waves by Local Lateral Constriction of the Channel

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The results of the experimental investigations of transformation and breaking of internal solitary waves by local lateral constriction of the channel are presented. Experiments were conducted in the basin 7m long, 0.4 m wide and 1.5 m high. The walls of the basin were made from plexiglass. A configuration with shallow fresh water on the top of a deeper layer of salt water was used. It was created by filling the basin to the desired layer depth with salt water (density approximately 1014 kg/m^3). The fresh water was then slowly spread over the salt water by using wood sheet with fibrous material that served as energy dissipater to reduce the mixing.

Interfacial solitary wave generation was similar to the method proposed by Michallet & Ivey (1999). A watertight movable gate separated small part of the basin was located near upstream end. The additional filling of the separated part of the basin with fresh water was fulfilled by using the special filling system. There was the gap between the lower end of the gate and the bottom. It allowed to adjust the location of the level of halocline in the separated part in respect to the level of halocline in the main part of the basin and to keep the same free-surface level in the whole basin. The gate was lifted to initiate a run.

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 extended capacitive transducers that were submerged in water completely. Calibration of the transducers was fulfilled by using reservoir with fresh water in

which small reservoir with salt water was placed. The upper layer was dyed. This allows to visualize the displacement of the interface and to analyze the pattern of flow in vicinity of obstacle. The digital photo-camera was used.

The local lateral constriction has the sinusoidal shape in order to ensure the smooth coupling with lateral wall of the channel. The transformation and the breaking of internal solitary wave were studied for the cases when the characterizing length of the constriction was less, greater and approximately equal to wave length. The critical regime was found depending on the amplitude of solitary wave. Sharp steepening of wave accompanied by the growth of the amplitude in narrow part and subsequent breaking, the forming of the horizontal vortex on the back of wave were observed. Kinematic and energetic parameters of the incident and reflected solitary waves were measured, the characteristics of "wave tail" were described. The influence of the breadth on the channel in the narrow part on the interaction of solitary wave with constriction depending on the amplitude of wave was investigated. The condition of the forming of trapped solitary wave depending on the ratio between amplitude and breadth was found.

The results bring to more deep understanding of physical features of the process of propagation of solitary waves in channel with constriction.

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