



Transformation of the first mode internal solitary wave over topography in three-layer flow

Kateryna Terletska¹, Tatiana Talipova², Roger Grimshaw³, Zihua Liu³, and Vladimir Maderich¹

¹Marine and River Systems Modelling Department, IMMSP (NASU), Kiev, Ukraine (kterletska@gmail.com)

²Department of Applied Mathematics, Nizhny Novgorod State Technical University n.a. R.E. Alekseev, Nizhny Novgorod, 603950, Russia

³Department of Mathematics, University College London, London, United Kingdom

Transformation of the first mode internal solitary wave over the underwater bottom step in three-layer fluid is studied numerically. In the three layer flow two modes (the first and the second) of the internal waves are existed. It is known that interaction of the first mode internal solitary wave with an underwater obstacle is the mechanisms of second-mode internal solitary waves generation. Different scenarios of transformation are realized under different wave characteristics: wave amplitude, position of the step and thickness of the layers as is the two layer case [1]. Formation of the second mode internal solitary waves during interaction of the first mode internal solitary waves occurs only for special range of wave characteristics and thickness of the layers that was defined in this investigation. The second mode internal solitary waves appear as in the reflected wave field as well as in the transmitted wave field. Transfer of energy from incident mode one wave into reflected and transmitted waves (the first and the second modes) during transformation is also studied. Dependence of the amplitudes of generated solitary waves (transmitted and reflected) from amplitude of the incident wave is obtained. Comparison of numerical results (reflected and transmitted coefficients) with the theoretical calculations [2] shows good agreement in the range of wave characteristics that corresponds to the weak interaction.

1. Talipova T., Terletska K., Maderich V., Brovchenko I., Pelinovsky E., Jung K.T., Grimshaw R. Internal solitary wave transformation over a bottom step: loss of energy. *Phys. Fluids*. 2013. № 25. 032110; doi:10.1063/1.4797455

2. Liu Z., Grimshaw R. and Johnson E. The interaction of a mode-1 internal solitary wave with a step and the generation of mode-2 waves *Geophysical & Astrophysical Fluid Dynamics* 2019, N 4, V 113, <https://doi.org/10.1080/03091929.2019.1636046>

How to cite: Terletska, K., Talipova, T., Grimshaw, R., Liu, Z., and Maderich, V.: Transformation of

the first mode internal solitary wave over topography in three-layer flow, EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-6932, <https://doi.org/10.5194/egusphere-egu2020-6932>, 2020