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Solitary wave transformation on the underwater step: asymptotic theory and numerical experiments

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The transformation of a solitary wave on an underwater step is studied analytically and numerically. The theoretical model includes the linear potential description of the wave transformation on a step and the weakly nonlinear theory of long waves based on the Korteweg–de Vries equation for reflected and transmitted waves far from a step. Numerical simulation of solitary wave transformation on an underwater step is performed in the framework of an extended 1D Boussinesq-like system and fully nonlinear fully dispersive 2D Navier–Stokes equations. The results of numerical simulations for the incident solitary wave of weak amplitude are in agreement with the theoretical predictions for the wave shapes of the secondary solitons, but not with the predictions for travel times.

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