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Competition of nonlinearity and inhomogeneity in the framework of weakly-nonlinear KdV-type models for interfacial solitary waves in a two-layer fluid

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We consider the problem of the propagation of a localized perturbation at the interface in a two-layer fluid over an uneven bottom in the framework of weakly nonlinear models of the KdV hierarchy for an inhomogeneous medium. The thickness of the upper layer of liquid is assumed to be constant. With a decrease in the total depth of the fluid, the amplification parameter (similar to the Green's factor for surface waves) increases due to bottom inhomogeneity, but the quadratic nonlinearity coefficient in the equation decreases (in absolute value). In this case, such combinations of parameters of the medium are possible, that an attenuation of the wave is observed, and not its amplification, which is expected intuitively when the wave reaches the shallow water. With an increase in the total depth of the basin, the opposite situation is observed: the amplification parameter decreases, but the coefficient of quadratic nonlinearity increases in modulus, and we can observe the amplification of the wave in an inhomogeneous medium when it propagates to the deeper zone. One can try to choose the configuration of the medium so that the amplitude of the wave at the interface in a two-layer fluid varies slightly as it propagates over a substantially uneven bottom. This possibility is discussed in the framework of a weakly nonlinear theory. The situations of a change in the sign of the quadratic nonlinearity parameter (equal thicknesses of the layers) should in this case be treated separately.

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