Chesnokov, A. A.; **Liapidevskii, V. Yu.**

Evolution of the horizontal mixing layer in shallow water. (English. Russian original)

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Summary: Horizontal shear motion of a homogeneous fluid in an open channel is considered in the approximation of the shallow water theory. The main attention is paid to studying the mixing process induced by the development of the Kelvin-Helmholtz instability and by the action of bottom friction. Based on a three-layer flow pattern, an averaged one-dimensional model of formation and evolution of the horizontal mixing layer is derived with allowance for friction. Steady solutions of the equations of motion are constructed, and the problem of the mixing layer structure is solved. The bottom friction produces a stabilizing effect and reduces the growth of the mixing layer. Verification of the proposed one-dimensional model is performed through comparisons with available experimental data and with the numerical solution of the two-dimensional equations of the shallow water theory.

MSC:

76E20 Stability and instability of geophysical and astrophysical flows
76E17 Interfacial stability and instability in hydrodynamic stability
76E05 Parallel shear flows in hydrodynamic stability
86A05 Hydrology, hydrography, oceanography

Keywords:

Kelvin-Helmholtz instability; three-layer shear flow; bottom friction effect; averaged model

Full Text: DOI

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