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Internal wave resonances in the two-layer channel of variable depth

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The structure of the resonant modes in the closed two-layer channel is studied in the framework of the one-dimensional linear shallow-water theory. The bottom profile and channel width are chosen having the special shapes allowed the existence of internal travelling waves with no inner reflection. Upper layer with light fluid has the constant thickness. On the boundaries two-layer flow matches with one-layer fluid. It is shown that eigenmodes (seisches) are expressed through the Chebyshev polynomials of the second kind. Some properties of the eigenmodes are analyzed. In particular, eigenmodes are described for the following configurations of channel: 1) constant width, 2) constant depth, 3) self-consistent channel of variable width and depth. They can be expressed in the parametric form. Singularities in the critical points (where two-layer fluid transfers into one-layer fluid) are specially investigated. In conclusion, the physical interpretation and the feasibility of the obtained solutions are discussed.

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