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An analytical model of large amplitude internal solitary waves

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A new model equation of strongly nonlinear internal waves of permanent form propagating along the sharp pycnocline is constructed. This equation generalizes approximate models suggested by Ovsiannikov (1985) and Miyata (1985) for a two-fluid system with constant densities in both the layers, as well as the "2.5-layer" model considered by Voronovich (2003). The derivation method involves asymptotic analysis of fully nonlinear Euler equations. We use long-wave perturbation procedure with small Boussinesq parameter which characterizes small slope of the density profile in upper- or lower layer. As a consequence, resulting model takes into account the influence of weak density stratification outside of pycnocline. Parametric ranges of solitary wave solutions are obtained and analyzed by codes in MATHEMATICA. Extreme configurations of solitary waves such as broad table-top waves and fronts are discussed. This work was supported by the grants INTAS-SB RAS No. 06-1000013-9236, SB RAS No. 2006-113 and RFBR No. 05-05-64460.