Abstract Submitted
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Steady-state propagation of gravity currents into a linearly stratified ambient: a generalization of Benjamin's results MARIUS UNGARISH, Dept. Computer Science, Technion, Haifa, Israel — The classical results of Benjamin (J. Fluid. Mech. vol. 31, 1968) concerning the propagation of a steady gravity current into a homogeneous ambient fluid, are generalized to the case of a stratified ambient fluid. The current of thickness h and density ρ_c propagates, with speed U, at the bottom of a long horizontal channel of height H, into the unperturbed ambient fluid whose density increases linearly from ρ_o to ρ_b. The reduced gravity is $g' = (\rho_c/\rho_o - 1)g$ and the governing parameters are $a = h/H$ and $S = (\rho_b - \rho_o)/(\rho_c - \rho_o)$, with $0 < a < 1,\ 0 < S < 1$; here g is the gravitational acceleration. Flow-fields derived from Long's model subject to a global flow-force balance are used for analyzing the behavior of $Fr = U/(g'h)^{1/2}$ and head loss (dissipation). The classical results of Benjamin are fully recovered for $S \to 0$. For small S and fixed a, the values of Fr and head loss are shown to decrease with S. For larger S several solutions are possible. Criteria for the physical acceptability of the multiple solutions are presented, and the possibility of experimental verification of the new results are discussed.

Erez Hasman
Mech. Eng. Technion, Haifa, Israel

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