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The dam-break of non-Boussinesq gravity currents of various fractional depth: two-layer shallow-water results MARIUS UNGARISH, Technion Haifa Israel — The dam-break initial stage of propagation of a gravity current released from a lock of length x_0 and height h_0 into an ambient fluid in a channel of height H^* is considered. The system contains heavy and light fluids, of density ρ_H and ρ_L, respectively. When the Reynolds number is large, the resulting flow is governed by the parameters $R = \rho_L/\rho_H$ and $H = H^*/h_0$. We focus attention on non-Boussinesq effects, when the parameter R is not close to 1; in this case significant differences appear between the "light" (top) current and the "heavy" (bottom) current. Using a shallow-water two-layer formulations, we obtain "exact" analytical solutions for the thickness and speed of the current and ambient by the method of characteristics. We shown that a jump (instead of a rarefaction wave) propagates into the reservoir when $H < H_{crit}(R)$, and that propagation with critical speed occurs for some combinations of H, R. The theory is applied to the full-depth lock exchange $H = 1$ problem, and also to more general cases $H > 1$. Comparisons to previously published results are discussed. This is a significant extension of the Boussinesq problem (which is recovered by the present solution for $R = 1$), which elucidates the non- Boussinesq effects during the first stage of propagation of lock-released gravity currents.

Erez Hasman
Technion

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