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Initial lock ratio effects on the dynamics of constant-volume density currents THOMAS BONOMETTI, IMFT, Universite de Toulouse, INPT, UPS, CNRS, MARIUS UNGARISH, Department of Computer Science, Technion, Haifa, Israel, S. BALACHANDAR, Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, FL, USA — The behaviour of non-Boussinesq constant-volume density currents of density ρ_c, released from a lock of height h_0 and length x_0 into a ambient of height H and density ρ_a, are considered. Two-dimensional Navier-Stokes simulations are used to cover a wide range of density ratio $10^{-2} < \rho_c/\rho_a < 10^2$ and initial lock ratio $0.5 \leq \lambda \leq 18.75$. The Navier-Stokes results are compared with predictions of a shallow-water model. In particular, we derive novel insights on the influence of the lock aspect ratio $\lambda = x_0/h_0$ on the shape and motion of the current in the slumping stage. It is shown that a critical value exists, λ_{crit}; the dynamics of the current is significantly influenced by λ if below λ_{crit}. We conjecture that this critical lock ratio depends on two characteristic time scales, namely the slumping time and the time of formation of the current's head. Comparison with space-time diagrams obtained from the Navier-Stokes simulations show a good agreement. We present a simple analytical model which support the observation that for a light current the speed of propagation is proportional to $\lambda^{1/4}$ when $\lambda < \lambda_{crit}$.

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