Abstract Submitted
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Entrainment dynamics in self-adjusting gravity currents using simultaneous velocity-density measurements[1] SRIDHAR BALASUBRAMANIAN, Department of Mechanical Engineering, Indian Institute of Technology Bombay, QIANG ZHONG, HARINDRA FERNANDO[2], Department of Civil and Environmental Engineering and Earth Sciences, University of Notre Dame, USA — Gravity currents can modify their flow characteristic by entraining and mixing with the ambient fluid. The entrainment in such systems may depend on a variety of intrinsic parameters such as, initial density difference, $\Delta\rho$, total height of the fluid, H, and slope of the terrain, α. Thus, it is imperative to study the entrainment dynamics of a gravity current in order to have a clear understanding of the mixing transitions that govern the flow physics such as the shear layer thickness, δ_u, and the mixing layer thickness, δ_ρ. Experiments were conducted in a lock-exchange type facility, where a self-adjusting gravity current is formed, for which the only governing parameter is the Reynolds number, Re=$\frac{u_f H}{\nu}$, where u_f=0.4$\sqrt{g'H}$ is the frontal velocity. Simultaneous PIV-PLIF technique is employed to get the velocity and density statistics. A control volume based flux method is used to calculate the flux entrainment coefficient, E_f, for a Reynolds number range of Re=400-12000 used in our experiments. The results show transition at Re 4x10^3, where the mixing occurs due to Kelvin-Helmholtz billows that promote small scale local mixing, and cause a spike in the flux entrainment velocity.

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