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Experimental and computational investigation of underwater buoyant oil jets LEANDRE BERARD, MEHDI RAESSI, MICHAEL BAUER, PETER FRIEDMAN, STEPHEN CODYER, University of Massachusetts Dartmouth, UNIVERSITY OF MASSACHUSETTS DARTMOUTH TEAM — We present experimental and numerical results on the breakup of underwater positively buoyant oil jets at a wide range of Reynolds, Weber and Richardson numbers and several viscosity ratios. Three main jet breakup regimes are observed: atomization, skirt-type and pinch-off. A threshold Weber number for the atomization regime is found to be around 100, varying slightly with the jet Eötvös number. The Ohnesorge-Reynolds correlation proposed by Masutani and Adams as the boundary for the atomization regime is shown to be applicable to our broader data set as well. Results suggest that the breakup of a positive buoyancy-driven jet occurs only when the jet is accelerated to a point where the local Richardson number becomes less than 0.4, in which case the local Weber number is above 10. The numerical results reveal the mechanisms leading to formation of small droplets around the perimeter of energetic jets and umbrella-shaped jet separations at less energetic cases. The time-averaged lateral expansion of the simulated jets, representing four different conditions, are presented as a function of the height along the jet.

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