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Effects of Droplet Size on Intrusion of Sub-Surface Oil Spills[1]
ERIC ADAMS, GODINE CHAN, DAYANG WANG, Massachusetts Institute of Technology — We explore effects of droplet size on droplet intrusion and transport in sub-surface oil spills. Negatively buoyant glass beads released continuously to a stratified ambient simulate oil droplets in a rising multiphase plume, and distributions of settled beads are used to infer signatures of surfacing oil. Initial tests used quiescent conditions, while ongoing tests simulate currents by towing the source and a bottom sled. Without current, deposited beads have a Gaussian distribution, with variance increasing with decreasing particle size. Distributions agree with a model assuming first order particle loss from an intrusion layer of constant thickness, and empirically determined flow rate. With current, deposited beads display a parabolic distribution similar to that expected from a source in uniform flow; we are currently comparing observed distributions with similar analytical models. Because chemical dispersants have been used to reduce oil droplet size, our study provides one measure of their effectiveness. Results are applied to conditions from the 'Deep Spill' field experiment, and the recent Deepwater Horizon oil spill, and are being used to provide "inner boundary conditions" for subsequent far field modeling of these events.

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