Abstract Submitted
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Droplet Size Distributions Resulting form Entrainment of Surface Oil Slick by Breaking Waves[1] CHENG LI, JOSEPH KATZ, Johns Hopkins University — A spectrum of droplet sizes, ranging from submicron to several millimeters, is generated by breaking waves impinging on an oil slick. Their size distribution is crucial for modeling the fate of oil spill, and understanding the underlying flow physics. Digital holography microscopy (DHM) is used for measuring the droplet size distributions at high resolution (1.1 μm/pixel), and at varying temporal scale, from the initial plunging phase (seconds) to long term (hours). The time-resolved DHM data is acquired simultaneously with high speed visualizations of the breakup and large scale features of the entrainment process. Experimental conditions include: (i) plunging and spilling breakers with wave heights of 28.8, 24.9, 22.28 cm; (ii) crude oil (MC252 surrogate), and oil premixed with dispersants (Corexit-9500A) giving two order of magnitude range of water-oil interfacial tension; (iii) Crude, fish, and motor oils with viscosity of 9.4, 63.1 and 306.5 cst, respectively. Shortly after entrainment of crude oil, the droplet radius distribution is bimodal, with a primary peak in the 0-25 μm range, and a secondary peak at 200-250 μm. Adding dispersants reduces the latter to 150 μm. The drastic reduction in interfacial tension upon introduction of dispersants increases the primary peak, and causes short term micro threading. The Secondary peaks dampen within seconds, as the larger droplets rise, whereas the primary peaks are sustained for longer periods.

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