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Rain Drops and Oil Slicks: Impact of Water Droplets on a Surface Oil Layer[1] DAVID MURPHY, DAVID MORRA, JOSEPH KATZ, Johns Hopkins University — Petroleum spills in aquatic environments form oil slicks on the water surface. These slicks, the thickness of which ranges from microns to several millimeters, negatively impact the natural environment and economic resources. While dispersion of these slicks as small droplets by breaking waves has long been investigated, the dispersive power of another environmental flow, rainfall, has not been considered. The impact of a water drop on a floating layer of immiscible fluid introduces a challenging flow physics problem. Our experimental observations examine processes occurring when falling water droplets impact on floating layers of sweet petroleum crude oil of various thicknesses and dispersant concentrations. The latter alter the surface tension by orders of magnitude. Impact events recorded at high-speed, using UV light to cause oil fluorescence, show the expected formation of modified multiphase Worthington jets, air cavities, as well as breakup of the slicks into clouds of oil droplets and oil-coated bubbles. The latter rise back to the surface and pop. Results include droplet size and spatial distributions as a function of rainfall momentum, oil properties, and processes involved.

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