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Numerical simulation of ocean surface oil plume dispersion and its impact on upper-ocean light field.[1] SHUOLIN XIAO, DI YANG, University of Houston, DI YANG TEAM — Crude oil plumes from offshore spills can be dispersed over a wide area by the upper-ocean turbulence and Langmuir circulations, inducing significant impact on the ocean ecosystem. Clouds of suspended crude oil droplets can cause significant light absorption and scattering, strongly affecting the sunlight penetration in the ocean euphotic zone where photosynthesis occurs. In this study, the turbulent dispersion of surface oil plumes and the resultant variations of upper-ocean light field are studied using high-fidelity numerical simulations. In particular, the ocean flow field and the oil plume dispersion are simulated using large-eddy simulation, and the sunlight transport is simulated using Monte Carlo method. The simulation results show that oil plumes of different droplet sizes are dispersed very differently by the ocean turbulence and Langmuir circulations, with large oil droplets concentrating in confined regions near the ocean surface, while small oil droplets being diluted smoothly in the ocean mixed layer. The differences in oil droplet size and dilution rate yield different inherent optical properties for the mixture of oil droplets and seawater, resulting in very different light field variations for different ocean flow and oil plume conditions.

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