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**Effects of swell on dispersion of oil plumes within the ocean mixed layer**[1] BICHENG CHEN, Department of Meteorology, Pennsylvania State University, DI YANG, Department of Mechanical Engineering, Johns Hopkins University, MARCELO CHAMECKI, Department of Meteorology, Pennsylvania State University, CHARLES MENEVEAU, Department of Mechanical Engineering, Johns Hopkins University — Oil plumes from deep-water blowouts rise through the ocean and reach the ocean mixed layer (OML), where dispersion is strongly affected by Langmuir turbulence generated by interactions between the wind forcing and the wave regime. The wind-driven wave field is approximately aligned with wind direction. However, the swell wave can have an arbitrary orientation relative to the local wind. We used large-eddy simulation (LES) to study the influences of the misalignment between wind and wave field on the transport and dispersion of oil plumes in the OML. Results show that the plume response to these forcing is strongly dependent on the size of the oil droplets. For the large oil droplets, the center line of the time-averaged surface plume tends to follow the mean surface current direction; for small droplets, the change of orientation of center line with wave direction is smaller than that of large droplets. Vertical eddy diffusivity calculated from LES data is compared to closures currently used in ocean models (such as the KPP model employed in HYCOM). The magnitude of the eddy diffusivity changes by a factor of two as the misalignment between swell and wind changes, and it is typically much larger than predicted by KPP.

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Bicheng Chen
Department of Meteorology, Pennsylvania State University

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