Microplastics at the Ocean Surface: Waves, Turbulence, and Particles

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Microplastic pollution poses a critical threat to the world's oceans, but critical knowledge gaps surrounding plastic fate and transport impede remediation and prevention efforts. Predicting the behavior of microplastics is non-trivial for two primary reasons: their physical properties (size and density) are fundamentally different from traditionally studied environmental particles like sediment and bubbles, and complex interactions among waves, turbulence, and particle inertia in the ocean surface boundary layer (where most microplastics reside) are not well-understood, especially for buoyant particles such as microplastics. In this talk, I will discuss the importance of surface waves in predicting the transport and distribution of microplastics. I will present results from both an analytical study and laboratory experiments of particles in wavy flows, and discuss implications for microplastic transport in the ocean.

Michelle DiBenedetto is an Assistant Professor in the Mechanical Engineering department at the University of Washington in Seattle. She received her B.S. in Environmental Engineering from Cornell University in 2014 and her Ph.D. in Civil & Environmental Engineering from Stanford University in 2019. For her doctoral work on the dynamics of microplastics in ocean waves, she was awarded the APS Andreas Acrivos Dissertation Award in Fluid Dynamics and the Lorenz Straub Award. Prior to her current appointment, she was a postdoctoral scholar at the Woods Hole Oceanographic Institution in the biology and physical oceanography departments. She was awarded the NSF CAREER award in 2023, and is currently an Associate Director of the Pacific Marine Energy Center. Her lab at the University of Washington uses theory, laboratory experiments, and field observations to study environmental and biological fluid dynamics in the ocean, with specific projects focused on pollutant transport, ocean sensing, and biological interactions in waves and turbulence.

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