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A Laboratory Study of Sea Spray from Breaking Waves. Microphysical Droplet, Wind and Wave Properties

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Sea spray generated from wave breaking processes at the ocean surface plays a significant role in air-sea fluxes, yet present sea spray flux parameterizations are solely wind-speed based. Wave breaking and subsequent spray development is forced by turbulence and energetics at the air-sea interface. The heat and momentum exchange between the sea spray droplets and the surrounding air and water modifies the boundary layer structure on both sides of the interface. This energy exchange cannot be resolved in operational models until the sea spray production rate and droplet size distribution are parameterized more accurately with regard to wave breaking properties.

This presentation describes results from our laboratory effort (SPANDEX-II) to develop an accurate sea spray source function parameterization through coincident observations of sea spray and wave breaking, turbulent kinetic energy dissipation rate and turbulent fluxes. SPANDEX-II was conducted in a salt water wind-wave flume at the UNSW Water Research Laboratory wind-wave facility and featured several observational advances compared to SPANDEX-I.

We describe progress towards developing an accurate sea spray source function parameterization. Properties of the observed sea spray profiles as a function of forcing will be discussed and compared with several profile parameterizations available in the literature. Our results show that the sea spray source function is dependent on the near-surface water-side turbulent kinetic energy dissipation rate in the presence of breaking waves. We compare these results to correlations based on either wind speed and friction velocity.