High-speed imagery captures new sea spray formation mechanism

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When strong winds blow over ocean waves, small droplets of sea spray rise into the air, enhancing the exchange of heat, mass, and energy between the air and the sea. How effective sea spray is at mediating each of these dynamics depends on the rate at which droplets are created and the drop size distribution of the mist. Unfortunately, research has been limited by a dearth of observational evidence that could explain the details of sea spray generation, including understanding the drop size distribution or the effects of different wind speeds. Previous research with high-speed cameras aiming to capture the moment of drop formation was limited by camera resolutions too low to see all but the largest drops.

Updating this previous line of work with improved technology, Veron et al. measured the formation of freshwater sea spray in a wave tank that also had controllable wind. The authors tested three different wind speeds: 31.3, 41.2, and 47.1 meters per second (70, 92.2, and 105.3 miles per hour), which equates to tropical storm strength winds up to a category 1 hurricane on the Saffir-Simpson scale. They used two different cameras: a high-speed camera that captured 1,000 frames per second and allowed them to observe spray-forming dynamics, and a high-resolution camera that let them observe droplets as small as 140 micrometers (0.006 inches).

The authors find a higher abundance of large drops, those above a millimeter (0.04 inches) in diameter, than is expected by theoretical work. Further, they also identify a novel spray formation mechanism whereby strong winds cause a thin sheet of water from the crest of a wave to fill up like a balloon and burst in a spray of droplets, a mechanism which they suggest may be applicable only for hurricane force winds.

More information: Sea spray spume droplet production in high wind speeds, *Geophysical Research Letters*, doi:10.1029/2012GL052603 , 2012

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