Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

On the Relationship between the Thermal Signature of the Cooling Foam and the Bubble Plume Dynamics in Breaking Waves[1] NAEEM MASNADI, CHRIS CHICKADEL, ANDREW JESSUP, Applied Physics Lab University of Washington — This study is motivated by the observation that after a wave breaking event in the ocean, the residual surface foam left in the wake of the breaker rapidly cools down. The relationship between the cooling foam and the characteristics of the breaking wave such as bubble plume dynamics, visible surface foam, and energy dissipation is investigated experimentally. Previous studies have suggested that the decay time of the visible foam can be used to determine the dynamics of the subsurface bubble plume and to estimate the energy dissipation by the breaking process but the foam decay process can be greatly affected by the surfactants concentration in the ocean. We present a new approach that utilizes the thermal signature of the cooling foam to infer the breaking characteristics. The experiments are conducted in a wave flume that is equipped with a piston-type wavemaker and is filled with salt water. Breaking waves are generated using the focusing wavepacket technique and are designed to cover a wide range of slope and breaking intensity. The bubble plume and the surface foam are imaged using visible cameras and the surface temperature is captured using an IR camera. It is found that the onset of cooling of the foam scales with energy dissipation and the slope of the breakers. It is observed that the foam decay time is prolonged by the presence of additional surfactants but the onset of cooling is not significantly affected.

[1]The support of the National Science Foundation is gratefully acknowledged.

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Date submitted: 01 Aug 2019 Electronic form version 1.4