Abstract Submitted
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High-resolution DNS of Breaking Waves[1] WOUTER MOSTERT, Mechanical and Aerospace Engineering, Princeton University, STÉPHANE POPINET, Institut Jean Le Rond d'Alembert, CNRS UMR 7190, Sorbonne Université, LUC DEIKE, Mechanical and Aerospace Engineering, Princeton University — We present bubble and droplet size distributions resulting from breaking ocean waves in deep water, using high-resolution three-dimensional direct numerical simulation. We use the open-source Basilisk code to simulate the viscous Navier-Stokes equations in two phases with surface tension at effective resolutions of up to 4096^3. The interface is represented and advected with a momentum-conservative volume-of-fluid scheme. The high effective resolutions are made possible with an octree adaptive mesh refinement scheme which is robustly implemented in Basilisk. The wave is initialized in one wavelength with an unstable third-order Stokes formulation, which produces local conditions leading to a plunging breaker which entrains air and ejects spray, which are directly resolved by the mesh. Varying the Bond and Reynolds numbers, which control surface tension and viscosity relative to the gravitational and inertial effects respectively, we discuss issues such as bubble breakup in turbulent flow; dimensionality in the transition to turbulence; droplet production and breakup; and numerical grid convergence.

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