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Surface tension effects in wave breaking LUC DEIKE, W.K. MELVILLE, Scripps Insitution of Oceanography, University of California San Diego, STEPHANE POPINET, Institut d'Alembert, Univeriste Pierre et Marie Curie, Paris
— We present a numerical study of wave breaking by solving the full Navier-Stokes equations for two-phase air-water flows using the solver Gerris [1]. We describe a parametric study of the influence of capillary effects on wave breaking using two-dimensional simulations. The onset of wave breaking as a function of the Bond number, Bo, and the initial wave steepness S is determined and a phase diagram in terms of (S,Bo) is presented that distinguishes between non-breaking gravity waves, parasitic capillaries on a gravity wave, spilling breakers and plunging breakers. The wave energy dissipation is computed for each wave regime and is found to be in good agreement with experimental results for breaking waves. Moreover, the enhanced dissipation just by parasitic capillaries is comparable to the dissipation due to breaking [2]. Extending the simulations to three dimensions permits studies of the generation and statistics of bubbles and spray during breaking.

[1] Popinet, S. 2003. Journal of Computational Physics 190, 572–600. Popinet, S. 2009. Journal of Computational Physics 228, 5838–5866.
[2] Deike, L., Popinet, S., and Melville, W.K. Submitted to Journal of Fluid Mechanics (June 2014).

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