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Air entrainment and bubble statistics in three-dimensional breaking waves LUC DEIKE, W.K. MELVILLE, Scripps Institution of Oceanography, University of California San Diego, STEPHANE POPINET, Institut d'Alembert, UPMC, Paris — Wave breaking in the ocean is of fundamental importance in order to quantify wave dissipation and air-sea interaction, including gas and momentum exchange, and to improve parametrizationsfor weather and climate models. Here, we investigate air entrainment and bubble statistics in three-dimensional breaking waves through direct numerical simulations of the two-phase air-water flow using the Open Source solver Gerris [1]. As in previous 2D simulations[2], the dissipation due to breaking is found to be in good agreement with previous experimental observations and inertial-scaling arguments. For radii larger than the Hinze scale, the bubble size distribution, is found to follow a power law of the radius, $r^{-3}$and to scale linearly with the time dependent turbulent dissipation rate during the active breaking stages. The time-averaged bubble size distribution is found to follow the same power law of the radius and to scale linearly with the wave dissipation rate per unit length of breaking crest. We propose a phenomenological turbulent bubble break-up model that describes the numerical results and existing experimental results. [1] Popinet, S. 2003. Journal of Computational Physics 190, 572–. Popinet, S. 2009. Journal of Computational Physics 228, 5838–. [2] Deike, L., Popinet, S., and Melville, W.K. 2015. Journal of Fluid Mechanics. vol 769, p541-569.

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