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Numerical Simulation of Air Entrainment and Bubbles in Wave Breaking QIANG GAO, LIAN SHEN, Univ of Minnesota - Twin Cities — Bubbles generated by breaking waves play an important role in air-sea interactions, environmental sciences, and ocean engineering. Air entrainment, void fraction distribution, and bubble size spectrum are dominant factors for the bubble effects in breaking waves. In this study, we perform numerical simulations for wave breaking and bubbly flows using a new simulation method that computes resolved bubbles and subgrid-scale bubbles dynamically. Bubbles larger than the grid size are directly captured by a coupled level-set and volume of fluid method. Subgrid-scale bubbles are modeled using a four-way coupled polydispersed two-fluid model. By analyzing the data from our simulation results, we investigate the air entrainment, void fraction, bubble size spectrum, and bubble cloud in breaking waves. We also study the behaviors of different sizes of bubbles. The results show that our numerical method can capture the wave breaking and air entrainment processes accurately. Behaviors of bubble cloud decay consistent with experimental observations have been obtained from our simulation data.

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