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Numerical Study of turbulent coherent structures and bubble entrainment under surfzone breaking waves GANGFENG MA, JAMES KIRBY, FENGYAN SHI, University of Delaware — Wave breaking in the surf zone entrains large volumes of bubbles into the water column. These bubbles are involved in intense interactions with mean flow and turbulence, producing a complex two phase bubbly flow field. It is necessary to describe the dynamics of breaking waves as two-phase flow with air bubbles of appropriate size distribution. The present study employ a three- dimensional large eddy simulation coupled with a two-phase bubbly flow model to investigate the detailed interactions between coherent structures and bubble entrainment in a laboratory scale breaking wave. Our results show that the vortical structures under the wave front are characterized by counter-rotating vortices. These vortices are initially carried downward by the downbursts, and then subject to stretching and bending to form obliquely descending eddies. To study the effects of coherent structures on turbulence and momentum transport, we conduct a TKE budget analysis. It is found that the TKE and Reynolds stress transport are closely related to obliquely descending eddies behind wave crest. Using the two-phase bubbly flow model, we are able to simulate the bubble entrainment and transport after wave breaking. Our results support the conclusion that the obliquely descending eddies have great effects on bubble entrainment and downward dispersion.

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