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Vortex kinematics and dynamics in deep-water breaking waves[1]
KEN MELVILLE, NICHOLAS PIZZO, LUC DEIKE, Scripps Institution of Oceanography, UC San Diego — Surface wave breaking can be modeled as a transitional process from irrotational to turbulent flow. Thus the introduction of vorticity across the range of inertial to dissipative scales is of great significance for the kinematics and dynamics of breaking. In this presentation, we review laboratory experimental data showing the introduction of coherent vortices at breaking and present an impulsive force model (just half of the smoke ring problem) that predicts the coherent circulation in terms of the wave energy dissipated by breaking. We then use this model, supported by DNS of breaking, to predict the distribution of the energy lost from the wave field between turbulence and the coherent vorticity. The models and available experimental and numerical data are consistent with inertial scaling of the wave energy dissipated by breaking.

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