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Quantifying wave-breaking dissipation using nonlinear phase-resolved wave-field simulations with a phenomenological-based wave breaking model YUSHENG QI, DICK YUE, Department of Mechanical Engineering, MIT — We use direct nonlinear phase-resolved simulations based on a High-Order Spectral (HOS) method (Dommermuth & Yue 1987) to understand and quantify wave-breaking dissipation in the evolution of general irregular short-crested wave-fields. We achieve this by incorporating a robust phenomenological-based wave breaking model in HOS simulations to account for energy dissipation. This model can automatically simulate the onset of wave breaking, and the simulated wave-breaking dissipation strength differentiates corresponding to different wave breaking type (such as spilling or plunging breaking waves). The efficacy of this model is confirmed by direct comparisons against measurements for the energy loss in 2D and 3D breaking events. By comparing simulated wave-fields with and without the dissipation model in HOS, we obtain the dissipation field, which provides the times, locations and intensity of wave breaking events. From the dissipation field we further calculate the distribution of total length of breaking wave front per unit surface area per unit increment of breaking velocity (Phillips 1985), and obtain qualitative agreement with Phillips theoretical power-law.

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