Breaking waves in a fully non-linear potential flow model

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Once generated by wind, ocean waves evolve, with complex kinematics and dynamics, as a result of nonlinear and dispersive effects, the effects of bathymetry, and dissipation from wave breaking and bottom friction, to name a few. Accurate simulations of this evolution are crucial for predicting phase-resolved surface wave properties in complex sea states, which govern wave interactions with fixed and floating objects, including offshore renewable energy systems, and surf zone parameters that drive nearshore currents and sediment processes, whose understanding and prediction are key to coastal management decisions.

Due to the computational complexity of modeling these phenomena over large domains in Navier–Stokes models, researchers rely on using simpler models and explicitly introduce the desired effects, e.g., the addition of a dissipative term in the Euler equations. Our work is concentrated on using the existing knowledge of breaking waves to mimic its effects in simpler models such as potential flow.

Extensive research has been done on understanding the many aspects of wave breaking (e.g., Duncan [1], Stive [2], Banner and Peregrine [3], Barthelemy et al. [4], Derakhti et al. [5]). This knowledge is used extensively to model breaking waves in 2D, in specific conditions (e.g, Simon et al. [7], Papoutsellis et al. [6], Grilli et al. [8]). We propose a unified method for modeling 2D depth-limited breaking waves, which is also being currently extended to 3D waves.

Références

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