Breaking Waves – viscous and inviscid models
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joint work with Alan Riquier and Christophe Lacave.

Water Wave breaking is among the most common and probably most beautiful fluid flows occurring in nature. Yet, it remains extremely challenging to study from a modelling point of view. I will discuss two numerical strategies to study the evolution of two-dimensional water waves in the presence of a plunging jet. In the case of the inviscid water waves, the problem can be reformulated using quantities defined on the water-air interface only. We can numerically approximate the free-surface Euler equations using a dipole (or double layer potential) formulation of the integro-differential equation governing the surface evolution. Introducing a symplectic (or geometric) integrator, we are able to follow the interface until the splash, without introducing any artificial regularizing parameter. Alternatively, the free-surface Navier–Stokes solution can be obtained with a finite, but small, viscosity. We observe the formation of a surface boundary layer where the vorticity is localized. We highlight convergence to the inviscid solution. The effects of dissipation on the development of a singularity at the tip of the wave can be investigated by characterizing the vorticity boundary layer appearing near the interface.

Refs:
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