Numerical Simulation Of Surface Gravity Waves

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The dynamics of surface gravity waves, i.e. waves at the interface between water and air, is governed by the Navier-Stokes equations that account for the conservation of momentum and mass of a small but macroscopic element of fluid. Boundary conditions at the free surface are required in order to describe the dynamics of the interface.
The numerical simulations of the Navier-Stokes equations is in general not an easy task, especially if the Reynolds number is large enough and turbulence takes place.
In the specific case of surface gravity waves, the computation is even more complicated by the fact that two fluids (air and water) are part of the domain. Moreover, waves are generated by a turbulent wind and waves may go through a breaking process in which air is entrapped in water forming bubbles.
In the talk I will present the state of the art of the simulations of ocean waves and discuss some recent results obtained using
1) a level set method (in collaboration with A. Iafrati) and
2) boundary-fitted approach (in collaboration with F. Zonta).

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