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Funwave-SPHysics model to study extreme waves propagation

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The periodic passage of storm near Iberian Peninsula gives rise to dangerous waves on the shore line during winter time. The study of these events cannot be analyzed by means of a single model due to the presence of multiple scales both in time and in space. The present study considers the use of different models to generate and propagate the wave field from the open sea to the coastal region. In particular, the interaction between high waves and coastal structures is considered.

A variety of oceanography models using different numerical and physical approaches have been developed to handle wave propagation and different types of wave transformations as refraction, diffraction, breaking, runup and overtopping. Recently, research is focused on coupling models with different numerical and mathematical approaches (Nie et al. (2004) and Sitanggang et al. (2006)). These models have several advantages and limitations, but the primary goal of such an approach is to combine the advantages of the individual models in a single model, thus increasing the accuracy, efficiency and regime of validity.

A hybrid method is developed starting from two existing wave propagation models. The model couples the finite difference Boussinesq FUNWAVE (Wei et al. (1995)) to SPHysics (http://wiki.manchester.ac.uk/sphysics), a Smoothed Particle Hydrodynamics (SPH) model.

Fully nonlinear extensions of Boussinesq equations are derived to simulate surface

wave from deep water with accuracy and with satisfactory results both in the open ocean and in near shore areas but they do not provide information about the possibility of flooding in coastal areas. So a 2D version of SPHysics model is considered to analyze the nature of coastal structures overtopping since SPH has been used for wave impact studies on offshore structures (Gomez-Gesteira and Dalrymple, 2004; Gómez-Gesteira *et al*., 2005; Crespo *et al.*,2007) showing good agreement between numerical and experimental results.

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