Conference in Numerical Analysis 2014 (NumAn 2014)
September 2-5, 2014
Chania,Greece

A wave breaking mechanism for an unstructured finite volume scheme

Maria Kazolea[a], Argiris I. Delis[b] and Costas E. Synolakis[a]

[a]School of Environmental Engineering, Technical University of Crete, Chania, Crete, Grece

[b]School of Production Engineering and Management, Technical University of Crete, Chania, Crete, Greece

mkazolea@isc.tuc.gr, adelis@science.tuc.gr, costas@usc.edu

Abstract

Wave breaking is a natural phenomenon of fundamental significance in the near-shore and one of the most important issues once have to consider in the numerical modeling of non-linear wave transformations. In this work a new methodology is presented and incorporated to TUCWave code, as to handle wave breaking over complex bathymetries in extended two-dimensional Boussinesq-type (BT) models. In the TUCWave code the 2D BT equations of Nwogu(1993), are solved using a novel high-order well balancing finite volume (FV) numerical method in unstructured meshes following the median dual node-centered approach. The novel wave breaking mechanism is of a hybrid type and consists of to parts. We first estimate the location of breaking waves using certain explicit criteria. Once breaking waves are recognized we switch locally in the computational domain from BT equations to the Non-linear Shallow Water Equations (NSWE) by suppressing the dispersive terms in the vicinity of the wave fronts. An additional methodology is presented on how to perform a stable switching between the BT and the NSWE equations within the unstructured FV framework. Comparison with laboratory data reveals that the proposed mechanism can accurately predict wave's breaking position along with wave's height decay and mean water level for both regular and solitary waves propagation on sloping beaches and submerged shoals.

Key words: wave breaking, unstructured, Boussinesq-type equations