LABORATORY STUDY OF WAVE HYDRODYNAMICS IN THE SURF ZONE IN PRESENCE OF ROUGHNESS

Solène Dealbera, Université de Pau et des Pays de l'Adour, E2S UPPA, SIAME, Anglet, France, solene.dealbera@univ-pau.fr
Damien Sous, Université de Toulon, Aix Marseille Univ, CNRS, IRD, MIO, La Garde, France and Université de Pau et des Pays de l'Adour, E2S UPPA, SIAME, Anglet, France, sous@univ-tln.fr
Héloïse Michaud, Shom, France, heloise.michaud@shom.fr
Denis Morichon, Université de Pau et des Pays de l'Adour, E2S UPPA, SIAME, Anglet, France, denis.morichon@univ-pau.fr

INTRODUCTION

In the global context of increasing anthropic pressure on coastal environments, understanding and modelling the physical processes leading to submersion or erosion of the coastline are key factors in anticipating these risks. Many studies of nearshore wave transformation have been conducted mainly on sandy beaches or gentle slopes. On this type of beach, wave transformation models give generally satisfactory results (Thornton and Guza, 1983). Yet, the hydrodynamics of other types of bottoms, specifically rough and/or steep bottoms, are not fully understood and modelled, especially the effect of roughness on frictional dissipation (Péquignet et al, 2011; Monismith et al, 2015; Poate et al, 2018).

METHODOLOGY AND ANALYSIS

Thus, a laboratory experiment, in the wave flume (6m long) of Seatech Engineering School, in Toulon, France was conducted both to improve the understanding of physical processes in controlled environment, and to connect the hydrodynamics to the seabed structure. A whole range of sloping seabeds was reproduced, from smooth homogeneous bottom (used as a reference case) to macro-roughness according to 27 configurations (Figure 1). Eight irregular wave cases were run on each seabed configuration. After extracting the incident signal from the free surface elevation data along the cross-shore profile, statistical and spectral analyses of the data are performed before estimating the energy dissipation from the energy flux gradient.

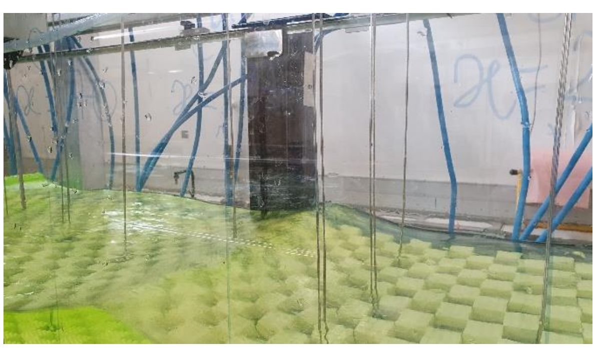

Figure 1 – Example of an irregular wave case running over a complex seabed in the Seatech wave flume

The breaking model by Thornton and Guza, 1983 was first optimized on the reference smooth seabed for each irregular wave case. The parameters of this model are then reused to estimate the breaking dissipation rate for the rough seabed configurations and thus separate the respective contribution of breaking and friction processes on the wave energy dissipation.

RESULTS AND PROSPECTS

The current work aims at finding the best approach to the frictional dissipation to represent each configuration. Once the hydrodynamic parameters are being optimized, the next step is establishing a connection with the characteristic roughness parameters (elevation standard deviation, asymmetry, kurtosis, roughness wavelength, etc.) using multivariate statistics and evaluating the performance of the modelled hydrodynamic parameters. Eventually, we wish to implement this new parameterization in spectral and phase-resolved models.

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