PARAMETERS INFLUENCING OVERWASH HYDRODYNAMICS

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Abstract

Overwash hydrodynamics were measured during a storm event. Data from literature and fieldwork were used to setup a numerical model, using XBeach in non-hydrostatic mode. Different simulations were conducted to assess the influence of several factors on overwash statistics. Nearshore morphology was found to greatly influence overwash. Sediment mean grain-size, and less importantly, lagoon water levels also produce measurable effects.

Keywords: Overwash; XBeach; Storms; Hydrodynamics; Fieldwork dataset.

1. Introduction

Overwash hydrodynamic datasets are mixed in quality and scope, and are hard to obtain due to fieldwork experimental difficulties. The objectives of this work are to present accurate fieldwork data on overwash and to develop a reliable model of overwash hydrodynamics for a low-lying sandy barrier in order to study overwash conditioning factors.

2. Study Area and Field Work

Fieldwork was performed on Barreta Island (Ria Formosa, southern Portugal), during an overwash episode that took place on 13/12/2013. Tides reached 0.9 m above Mean Sea Level (MSL), and storm surge was negligible. Offshore waves had average Hs of 2.5 m and Tp of 11 s. SWAN nearshore wave propagation model (Booij et al., 1999) was used to obtain wave spectral parameters in the nearshore. The episode was monitored with a video camera, pressure transducers and a current-meter. For more than 4 hours, circa 120 shallow (average depth = 0.07 m) and fast (average velocity = 2 ms^{-1}) overwash events occurred. Barrier morphology changed by erosion of the oceanic beach and accumulation on the barrier top.

3. Hydrodynamic Model Setup

This study used the one-dimensional approach of XBeach model of Roelvink et al. (2009) in non-hydrostatic mode. The boundary forcings were parameterized using the available fieldwork measurements (nearshore and barrier profile, wave spectra, tidal levels, and D50).

4. Results and Discussion

The calibrated model over predicts overwash (average of +4 events, each time-step) with better results during the rising-tide. The baseline model was forced to simulate overwash conditions with a different nearshore morphology (measured during surveys between 2012 and 2013), grain-size (coarser and finer), and lagoon water level (0.88 and -0.28 m, MSL). For all tests, overwash average depth and velocity remained relatively similar. Nevertheless, an average decrease of ~30% overwash was obtained due to changes in nearshore morphology (Fig. 1). The coarser and finer grain-size runs produced an 11% difference in overwash, lower on the coarser barrier. Changing lagoon water levels had a reduced effect.

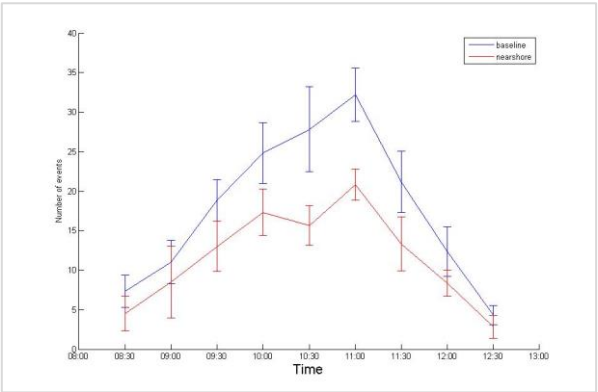

Figure 1. Number of overwash during each time-step for the baseline model and a model with different nearshore morphology.

Acknowledgements

FCT funded this study through EVREST project (PTDC/MAR-EST/1031/2014), A. Matias (IF/00354/2012) and A. Pacheco (IF/00286/2014) contracts, and A.R. Carrasco grant (SFRH/BPD/88485/2012). T. Plomaritis was funded by the EU FP7 project Risc-Kit (RISC-KIT-GA-2013-603458). The authors acknowledge Instituto Hidrográfico for the spectral wave data.

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