MORPHODYNAMIC MODELLING OF A TIDAL INLET DURING HURRICANE LESLIE (2018)

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Abstract

The XBeach modelling system was used to hindcast the morphological evolution of an ephemeral tidal inlet during Hurricane Leslie (2018). Simulations of morphological evolution were compared against daily observations from topographic surveys conducted at the Albufeira Lagoon during this event. On the one hand, numerical simulations successfully reproduced the observed accumulation pattern at the flood delta. On the other hand, numerical simulations displayed a slight tendency to overestimate the sediment erosion that took place at the transitional channel.

Palavras-chave: XBeach; Morphological modelling; Field observations

1. Introduction

Extreme events, such as hurricanes, cyclones or typhoons can induce important morphological changes on infrastructures located at the sea-land interface. At those locations, numerical models capable of simulating waves, tidal currents, sediment transport and the associated bottom evolution can be used to assist coastal engineering projects. Despite their use in practice, these types of models, usually designated as morphodynamic models, are rarely assessed against field observations of morphological evolution during extreme events. The present study uses the XBeach modelling system to hindcast the morphological evolution of an ephemeral tidal inlet – the Albufeira Lagoon - during Hurricane Leslie (2018). The further comparison of this hindcast against field observations shows that XBeach skilfully simulates the main morphological changes.

2. XBeach numerical modelling system: results, discussion and conclusion

The XBeach modelling system was applied in surfbeat mode (Roelvink *et al.*, 2009). This allowed us to simulate infragravity (IG) waves during Hurricane Leslie (2018), which were shown to play an important role in the evolution of the Albufeira Lagoon inlet (Bertin *et al.*, 2019). Figure 1 depicts the observed (circles) and simulated (blue lines) morphological evolution patterns along two transects (P1 and P2) on 14 and 15 October 2018. At the northern transect (P1), XBeach was able to simulate the landward displacement of the northern spit. On 15 October, the observed 1 m sediment accumulation at X = 140 m was successfully reproduced by XBeach. At the transitional channel (P2), XBeach was able to simulate the observed southward migration between 13 and 14 October. However, XBeach simulations predicted channel erosion while observations indicate a slight accumulation between 14 and 15 October. The latter behaviour might be associated with the empirical parameterization of bottom friction. Overall, the observed accumulation pattern at the flood delta was skilfully simulated by XBeach.

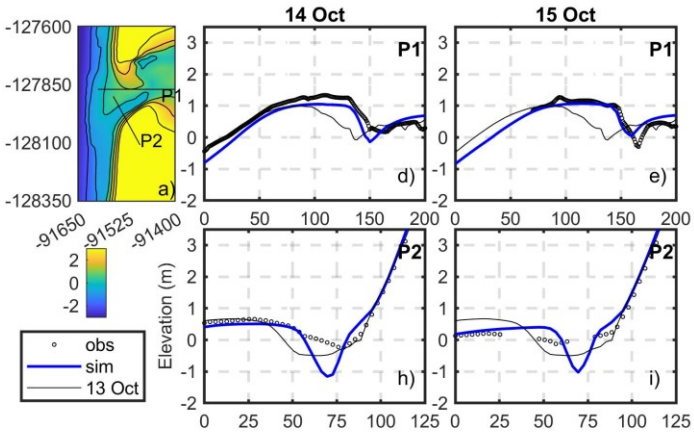

Figure 1. Observations (circles) and XBeach simulations (blue line) of the morphological evolution along transect P1 (northern sand spit) and P2 (transitional channel) on 14 and 15 October 2018, and on the 13 October (thin black lines).

Acknowledgements

The first author acknowledges Foundation for Science and Technology's (FCT) support through funding UIDB/04625/2020 from the research unit CERIS. This research was carried out in the scope of the project INLEX, funded by the French ANR and the FCT (project 40791ZC).

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