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Testing coastal DRR in current and climate change scenarios – Artificial winter dune system in a highly touristic beach in the Northern Adriatic.

Enrico Duo (1,2) and Clara Armaroli (1,2)

(1) Department of Physics and Earth Science, University of Ferrara, Ferrara, Italy, (2) Consorzio Futuro in Ricerca, Ferrara, Italy

Artificial dunes are common features built along the coast of the Emilia-Romagna region (Italy) that act as temporary protections during the stormy season in order to prevent damages and inundation to the structures located on the backshore. The RER coast is in fact characterised by low sandy beaches that are exploited for tourism and where beach huts are permanently present on the rear part of the beach. While scientists and regional managers already provided proofs of the capacity of the artificial dunes to lower the hazard component, any study has never investigated their direct impacts in the current (CS) and climate change scenarios (CCS).
The RISC-KIT project (www.risckit.eu) provided a methodology for testing DRRs at local level integrating hydro-morphological numerical modelling with a Bayesian Network to assess the consequences of extreme events for different scenarios. The approach was applied at the beach of Lido degli Estensi and Spina (Comacchio, Italy) in the Emilia-Romagna coast. It is a highly touristic area with concessions directly facing the sea, providing sun-and-beach tourism services during summer time, and private residences, commercial activities and hotels at the seafront. The flooding and erosion hazards were analyzed, along with their impacts.
A 2DH XBeach model was built and forced with a large number of triangular storms, representative of many different representative combinations of waves' and total water level's ranges observed at regional level. Flooding and erosion results were input into a Bayesian Network which included, as feeding variables categories, deep water boundary conditions (including the CCS trigger), receptors (type and location of assets at the coast), hazard intensity affecting the receptors, impacts and DRR. Therefore, it was possible to integrate a flood damage curve and an erosion potential damage function for the analyzed receptors (beach concessions and residential/commercial buildings), in order to calculate the direct impacts. The artificial dune system was implemented, as representative of the DRR scenario, modifying the topography through the DuneMaker 2.0 Matlab tool. The CCS was implemented through a predicted RSLR under RCP8.52050.
The results evidenced that the DRR positively influenced both flooding and erosion hazard intensities distributions. The impacts for the CS showed that, potentially: 20% of residential and commercial buildings and 90% of concessions will be preserved from flood impacts; more than 50% of concessions will be preserved from erosion impacts. The impacts of the CCS evidenced that, potentially: 65% of residential and commercial buildings and 95% of concessions will be preserved from flood impacts; more than 30% of concessions will be preserved from erosion.
The positive effect on coastal extreme storm impacts of the implementation of the artificial dunes was evidenced and quantified in comparison with current and climate change scenarios without any DRR implemented. Ongoing studies on the artificial winter dunes, comparing field drone observations and numerical modelling, are being implemented starting from October 2016. Besides, the methodology, if properly adapted, can be applied for any type of DRR, as demonstrated by the RISC-KIT project. It is able to help managers in comparing DRR solutions or strategic alternatives.