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Resilience of Punta s'Aliga Barrier Beach to Storm Impacts

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Resilience of Punta s'Aliga Barrier Beach to Storm Impacts

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Abstract: Beach and dune provide natural defense against erosion and flooding, and associated mitigation measures are classical coastal engineering problems studied by many researchers. Winter storms cause severe erosion leading to dune breaching and then flooding of the hinterland areas. Resiliency of a barrier beach depends on the ability of the dune (resistor) to recover in height and extent following storms. Whereas erosion of the beach and dune occurs over hours and days, it can be years to decades before the beach and dune are able to recover to their pre-storm state. In the last two decades, numerical modelling methods have been developed to accurately predict different regime of dune change during storms. The XBeach model is an open-source, process-based morphodynamic model that has proven to be capable of predicting storm impact, overwash and breaching processes on sandy beaches. This paper presents the application of model XBeach to the Punta s'Aliga barrier beach, located on the South-Western coast of Sardinia (Italy) where during severe winter storms the dune system is completely submerged and the washover penetration is significant large, leaving the surface close to the watertable and covered by a lag of shell and gravel. Specifically the aim of the paper is to quantify the rate of dune recovery using the extensive field surveys carried out to validate the XBeach model in the Punta s'Aliga barrier beach where a large beach restoration project will be designed to reestablish and stabilize the dunes. Results show that complete recovery of the largest dunes (in height and volume) will take several years while the areas of Punta s'Aliga beach with the smallest dunes exhibited a rapid recovery. A change in storm magnitude and/or frequency is a potential threat to Punta s'Aliga beach resilience, particularly for those sections of the beach where dune recovery has historically taken the longest time.

Keywords: Beach and dune system, storm recovery, beach resilience, XBeach, Punta s'Aliga barrier beach