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Statistical characterization of wind wave-induced erosion in the Venice Lagoon: evidence from the past and trends for the future

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Wind waves promote the erosion and degradation of ubiquitous geomorphic features of tidal landscapes, such as subtidal platforms, tidal flats and salt marshes. Wind-wave induced erosion is one of the main processes controlling the morphodynamic evolution of shallow tidal basins, both in the vertical and in the horizontal planes. Wind-wave induced bottom shear stresses can promote the disruption of the polymeric microphytobenthic biofilm and lead to the erosion of tidal-flat surfaces and to the increase in suspended sediment concentration, which in turn affects the stability of intertidal ecosystems. As an example, the Venice Lagoon has experienced strong erosion processes in the last two centuries, which progressively deepened the lagoonal bottoms, promoted the loss of fine cohesive sediments through the inlets after storms, and lead to the loss of extensive salt-marsh areas.
Towards the goal of developing a synthetic theoretical framework to represent wind wave-induced resuspension events and account for their erosional effects on the long-term biomorphodynamic evolution of tidal systems, we employed a full-fledged finite element model accounting for the role of wind waves and tidal currents on the hydrodynamic circulation in shallow basins.
Our analyses of the spatial and temporal characteristics of wind-induced erosion events, for the current and past configurations of the Venice Lagoon, allow us to reconstruct erosive trends typical of past lagoonal configurations and to provide predictions on future scenarios for the Venice Lagoon.