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Ship traffic and shoreline erosion in the Lagoon of Venice

Gian Marco Scarpa (1), Luca Zaggia (2), Giuliano Lorenzetti (2), Giorgia Manfè (2), Kevin Parnell (3), Emanuela Molinaroli (1), John Rapaglia (4), and Sofia Gionta (1)

(1) Environmental Sciences, Informatics and Statistics, Ca' Foscari University,Venice, Italy , (2) Institute of Marine Sciences, National Research Council, Venice, Italy, (3) College of Marine and Environmental Sciences, James Cook University, Townsville, Australia, (4) Department of Biology, Sacred Heart University, Park Avenue, Fairfield, USA

A study based on the analysis of a historical sequence of aerial photographs and satellite images combined with in situ measurements revealed an unprecedented shoreline regression on the side of a major waterway in the Venice Lagoon, Italy.
The study considered long and short-term recession rates caused by ship-induced depression wakes in an area which was reclaimed at the end of the '60 for the expansion of the nearby Porto Marghera Industrial Zone and never used since then. The GIS analysis performed with the available imagery shows an average retreat of about 4 m yr-1 in the period between 1965 and 2015. Field measurements carried out between April 2014 and January 2015 also revealed that the shoreline's regression still proceed with a speed comparable to the long-term average regardless of the distance from the navigation channel and is not constant through time. Periods of high water levels determined by astronomical tide or storm surges, more common in the winter season, are characterized by faster regression rates. The retreat proceeds by collapse of slabs of the reclaimed muddy soil after erosion and removal of the underlying original salt marsh sediments and is a discontinuous process in time and space depending on morphology, intrinsic propertiesand vegetation cover of the artificial deposits.
Digitalization of historical maps and new bathymetric surveys made in April 2015 allowed for the reconstruction of two digital terrain models for both past and present situations. The two models have been used to calculate the total volume of sediment lost during the period between 1970 and 2015.
The results of this study shows as ship-channel interactions can dominate the morphodynamics of a waterway and its margins and permitted to better understand how this part of the Venice Lagoon reacted to the pressure of human activities in the post-industrial period. Evaluation of the temporal and spatial variation of shoreline position is also crucial to predict future scenarios and manage the lagoon and its ecosystem services in the future.