

Padova, 29 November 2021

## **STORM-SURGE BARRIERS AFFECT THE FUTURE OF SALT MARSHES IN THE VENICE LAGOON**

Field data from the Venice Lagoon highlight possible negative effects of storm-surge barriers – designed to reduce flooding of coastal urban areas – on the morphological evolution of the surrounding natural environment and salt marshes, in particular. The study, carried out by researchers from the University of Padova, has been published in the journal «Nature Geoscience».

The storm-surge barrier, known as Mo.S.E. system, designed to protect the city of Venice will prevent the flooding of the city, at least in the near future, but it will dramatically affect the morphodynamic evolution of the surrounding lagoon and, in particular, of salt marshes. Measurements show that sedimentation allowing salt marshes to keep pace with relative sea-level rise is mainly driven by storm-surge events. Storm-surge barriers, designed to cap high water levels associated with storm surge events in order to reduce the flood risks in coastal urban areas, can seriously hinder this large storm-driven sediment supply, thus questioning salt-marsh survival in view of current and future rates of relative sea-level rise.

**The results found by researchers of the Department of Civil, Environmental and Architectural Engineering (ICEA) and Department of Geosciences of the University of Padova, have been published in the journal «Nature Geoscience».**



*Andrea D'Alpaos*

“Salt marshes are peculiar landforms of tidal systems, such as lagoons and estuaries,” said **Andrea D'Alpaos** from the Department of Geosciences of the University of Padova. “They offer valuable ecosystem services, such as coastal protection, water quality improvement, carbon sequestration and habitat provision. Marshes need a relevant sediment supply to keep pace with relative sea-level rise. However, it is still unclear whether this sediment input is mainly provided by regular tidal flooding or episodic storm surges.”

“Combining a three-year-long record of sedimentation measurements in the salt marshes of the Venice lagoon and modelling tools, we found that storm surges are essential suppliers of sediment to marshes,” said **Davide Tognin** from the Department ICEA. “Indeed, storm-driven contribution accounts for more than 70% of the annual sedimentation, despite the relatively short duration of storm-surges.”



*Davide Tognin*

The Mo.S.E. system modifies the propagation of storm surges within the lagoon to avoid extensive flooding of the city of Venice, reducing water levels and, thus, marsh flooding.



*Luca Carniello*

“Most of the salt-marsh sedimentation occurs during storm surges, but, as mobile barriers will reduce marsh flooding during severe storms, they will reduce marsh sediment supply too,” said **Luca Carniello** from the Department ICEA. “We estimated that storm-surge barrier operations reduce the yearly sedimentation on salt marshes by more than 25%, thus increasing the negative effects of sea-level rise and questioning marsh survival.”

“Many coastal cities worldwide are more and more commonly adopting storm-surge barriers,” said **Marco Marani** from the Department ICEA. “The most famous

examples include barriers in the river Scheldt Estuary (the Netherlands), the River Thames (UK), New Orleans (USA), and St. Petersburg (Russia). Similar barriers are being planned to protect Shanghai, Houston and New York. Most of these urban areas are surrounded by coastal wetlands, lagoons and estuaries, which will be negatively affected by flood-regulation of storm-surge barriers, according to our results that clearly suggest how man-induced interventions lacking a holistic perspective may reduce marsh resilience to sea-level rise and affect the preservation of natural coastal environments.”



*Marco Marani*

The study has been carried out within the Venice 2021 research project promoted by Provveditorato for the Public Works of Veneto, Trentino Alto Adige, and Friuli Venezia Giulia, coordinated by CORILA (Consortium for coordination of research activities concerning the Venice lagoon system).

Link: <https://www.nature.com/articles/s41561-021-00853-7>

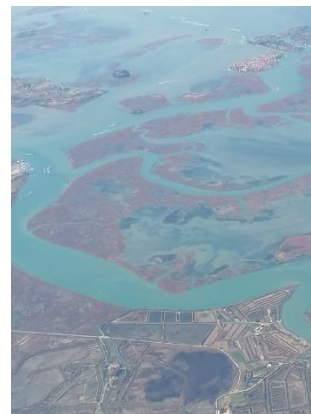
Title: *Marsh resilience to sea-level rise reduced by storm-surge barriers in the Venice Lagoon* – «Nature Geoscience» – 2021

Authors: Davide Tognin, Andrea D’Alpaos, Marco Marani, Luca Carniello



*Salt marshes in the Venice Lagoon.*

*Island of Burano in the background.*



*Aerial view of the salt marshes in the Venice lagoon between the San Felice and Burano canals.*

*Islands of Burano and Mazzorbo at top right.*