

Historic storms and the hidden value of coastal wetlands for nature-based flood defence

Authors: Zhenchang Zhu^{1,2,3}, Vincent Vuik^{4,5}, Paul J. Visser⁴, Tim Soens⁶, Bregje van Wesenbeeck⁷, Johan van de Koppel¹, Sebastiaan N. Jonkman⁴, Stijn Temmerman⁸ and Tjeerd J. Bouma^{1,9,10}

¹Department of Estuarine and Delta Systems, Royal Netherlands Institute for Sea Research and Utrecht University, Yerseke, the Netherlands.

²Guangdong Provincial Key Laboratory of Water Quality Improvement and Ecological Restoration for Watersheds, Institute of Environmental and Ecological Engineering, Guangdong University of Technology, Guangzhou, China.

³Southern Marine Science and Engineering Guangdong Laboratory (Guangzhou), Guangzhou, China.

⁴Delft University of Technology, Civil Engineering and Geosciences, Delft, the Netherlands.

⁵HKV Consultants, Lelystad, the Netherlands.

⁶Department of History, University of Antwerp, Antwerp, Belgium.

⁷Deltares, Delft, the Netherlands.

⁸Ecosystem Management Research Group, University of Antwerp, Wilrijk, Belgium.

⁹Faculty of Geosciences, Department of Physical Geography, Utrecht University, Utrecht, the Netherlands.

¹⁰Building with Nature group, HZ University of Applied Sciences, Vlissingen, the Netherlands.

Abstract

Global change amplifies coastal flood risks and motivates a paradigm shift towards nature-based coastal defence, where engineered structures are supplemented with coastal wetlands such as saltmarshes. Although experiments and models indicate that such natural defences can attenuate storm waves, there is still limited field evidence on how much they add safety to engineered structures during severe storms. Using well-documented historic data from the 1717 and 1953 flood disasters in Northwest Europe, we show that saltmarshes can reduce both the chance and impact of the breaching of engineered defences. Historic lessons also reveal a key but unrecognized natural flood defence mechanism: saltmarshes lower flood magnitude by confining breach size when engineered defences have failed, which is shown to be highly effective even with long-term sea level rise. These findings provide new insights into the mechanisms and benefits of nature-based mitigation of flood hazards, and should stimulate the development of novel safety designs that smartly harness different natural coastal defence functions.

Keywords:

Building with Nature

Nature-based flood defences

Schorren

Kwelders

Dijkdoorbraken

The full article can be requested at the publisher or at HKV consultants (secretariaat@hkv.nl), for personal use only.