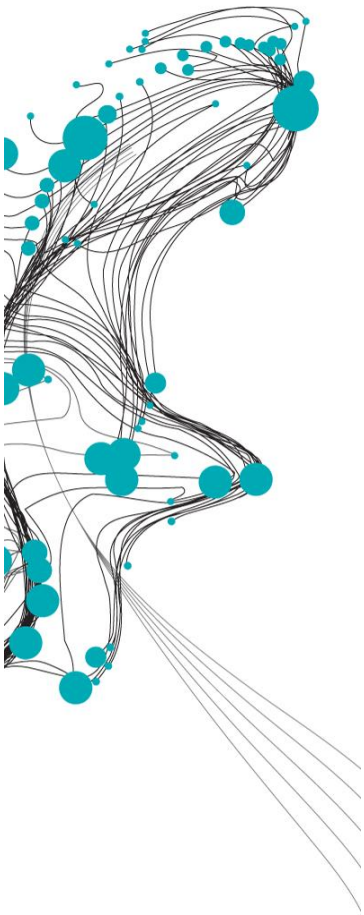
MODELLING CONSEQUENCES OF ARTIFICIAL STRUCTURES ON SALT MARSH DYNAMICS IN THE WADDEN SEA



Salt marshes are more and more recognized as resilient and sustainable supplements to traditional engineering structures for protecting coasts against flooding. Nevertheless, many salt marshes face severe erosion. There is a general consensus that creating an area which is sheltered from high energetic conditions can improve the potential for salt marsh growth. However, little proof is provided on the explicit influence of structures to promote salt marsh growth. The thesis investigates how engineering solutions can be used to steer the morphological development of salt marshes.

A morphological model (Delft3D Flexible Mesh) was applied which enables the analysis of various human interventions. A small salt marsh in the Wadden Sea was modelled. This marsh has seen heavy erosion (retreat rate of 0.9m/year) since maintenance of its sedimentation field and groyne was halted. In the model we simulate both daily conditions and storm conditions. The model performed well in simulating the hydrodynamic conditions. Key processes relevant for the morphological development of salt marshes are captured and several simulated morphological patterns are observed and identified in literature.

Table 1. An overview of the artificial structure configurations implemented in the model simulation.

Name	Description
Short	A short groyne of 2.5m high, 300 m long and perpendicular to the coast
Long	A long groyne of 2.5m high, 900 m long and perpendicular to the coast
Combi Long	Combination of the long groyne and a proposed sedimentation field
Combi Short	Combination of the short groyne and a traditional sedimentation field

The model simulations showed that, without artificial structures erosion of the salt marsh and tidal flat occurs. Simulations with artificial structures implemented, those described in brief in Table 1, indicate that there is potential for salt marsh growth in the study area. More broadly, the results show that the salt marsh accretes during storm events, which demonstrates that salt marsh systems may provide a resilient and sustainable supplement to hard structures to improve coastal safety in the face of the increasing storminess. In addition, the thesis indicates how morphological development of a salt marsh can be steered by implementing various artificial structures.

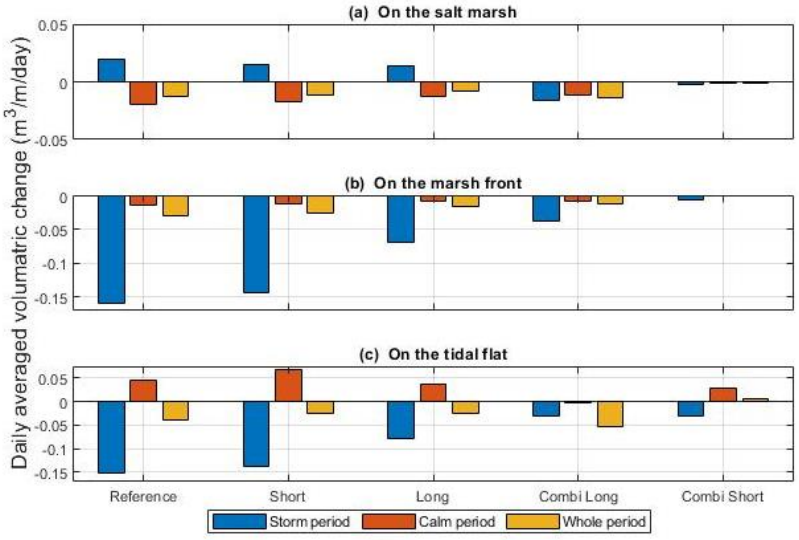


Figure 1: Simulated daily and length averaged volumetric change (a) on the salt marsh, (b) on the salt marsh front and (c) on the tidal flat. The storm period is the combined bed-level change for the storms of 4-5 October 2017 and 27-28 October 2017. The calm period is from 8 to 21 October 2017. The whole period is for the whole simulated month of October 2017.

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