

# Effects of extreme wave and wind events on morphodynamics of estuaries: An idealized model study

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## Introduction

Estuaries are often situated in very densely populated areas with high economic activities that often strongly conflict with their ecological values. Understanding of the long-term (order decades to centuries) morphodynamic evolution in estuaries is of great importance to successfully manage these areas, such as maintaining shipping routes and preserving ecosystems. Climate scenarios generally predict an increased storminess in the future, where extreme wave and wind events are expected to occur more often. Little is known about the impact of these events on morphodynamics of estuaries, and particularly, how tidal channels and shoals will respond to these events.

The overall aim of this study is to improve fundamental understanding of how an increased storminess affect estuarine morphodynamics on medium and long time scales. Specifically, first, impact of extreme wave and wind events on the evolution of tidal channels and shoals is examined. Second, sensitivity of model results to intensity of extreme events as well as to their strength and chronology of their occurrence is investigated. The Scheldt estuary is used as a case study (Figure 1).

## Methodology

In this study the coupled SWAN-Delft3D numerical model is used, which accounts for both flow, waves and wind. This model has been successfully applied to morphodynamic modeling of estuaries and other coastal systems. A curvilinear grid is created, which extends from Ghent to 30 km seaward (Figure 1). Size of grid cells ranges between 100 m and 300 m in the area of interest (Western Scheldt and its mouth area) and it increases to ~ 2.5 km at the offshore boundaries. Model experiments start from an idealized bathymetry, which is obtained by averaging the measured bedlevel over the width of the domain. As boundary conditions, the model is forced by a tidal wave with three harmonic constituents M2, M4 and M6 at the seaward boundaries (southern, western and northern boundaries in Figure 2).

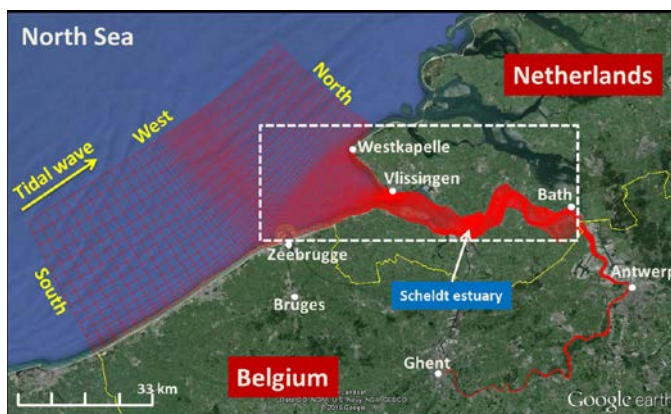


Figure 11 Delft3D computational grid (red), which covers entire Scheldt estuary and part of the North Sea. Focus area of present study (Western Scheldt and its mouth area) is indicated by white rectangle. The white arrow indicates direction of the propagating tidal wave in the North Sea (south-north).