

MORPHOLOGICAL MANAGEMENT FOR THE SCHELDT ESTUARY COMBINING SAFETY, PORT ACCESSIBILITY AND ECOLOGY

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This study will investigate the possibilities to optimize and harmonize three important estuarine functions by morphological management: port accessibility, safety against flooding and ecology. With morphological management we mean the modification of bed morphology by strategic dredging and disposal of sediment, and construction, adaptation or removal of hard structures such as groynes, dike-protection measures and dikes. The aim is to identify those morphological modifications that can have a combined positive effect on flood defense, port accessibility and ecology.

The impact of different kinds of morphological modifications will be studied by hydrodynamic modeling. A new hydrodynamic Telemac 2D model of the Scheldt Estuary will be built. The Telemac model uses an unstructured grid that allows refining calculations in areas of interest and roughening the grid in other areas to increase calculation time. The bed morphology is an important input for hydrodynamic models, while the output consists of a spatial pattern of water levels and current velocities that dynamically changes with the tide. For the analysis of the model output, we will focus on a number of specific hydrodynamic parameters at specific scales, depending on whether we want to assess the impact on flood defense, port accessibility, or ecology:

1) In terms of flood defense, the study will focus on the relationships between bed morphology and simulated high water levels along the whole estuary, especially for extreme storm surges. In this way the impact of bed morphological features on tidal flood wave and storm surge propagation or attenuation are assessed.

2) In terms of port accessibility, the study will focus on current velocities and patterns and bed shear stresses that are calculated at the sills. For example, the duration of bed shear stresses that exceed the critical thresholds for erosion and sedimentation during an average spring-neap tidal cycle, is a measure for the self-eroding capacity at the bars. If necessary, the hydrodynamic computations may be coupled with sediment transport modeling for more detailed subsections of the model grid that concentrate on sills.

3) In terms of ecology, the study will focus on water depths and current velocities that are simulated on the undep subtidal and intertidal flats. Intertidal benthic communities (and vegetation) are known to be closely related to tidal inundation, flow velocities, and sediment composition (Ysebaert et al., 2002). The water levels and flow velocities that are simulated with the hydrodynamic model will be translated into the impacts on benthic organisms by coupling with ecological models on the spatial distribution of benthic organisms in the Westerscheldt.

References

Ysebaert T. and P.M.J. Herman. 2002. Spatial and temporal variation in benthic macrofauna and relationships with environmental variables in an estuarine, intertidal soft-sediment environment Marine Ecology Progress Series 244:105-124.