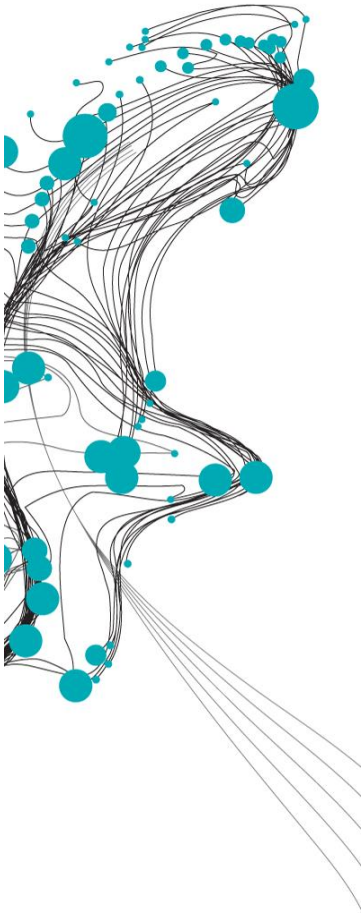
THE EFFECTS OF PLANIMETRIC AND ALTIMETRIC CHANGES ON TIDAL AMPLIFICATION IN COASTAL PLAIN ESTUARIES

CASE STUDY: SCHELDT ESTUARY



Estuaries are unique coastal features that occur all over the world. Many estuaries are surrounded by densely populated areas and are very important to local economy, because they provide easy access to shipping ports inland. Dredging operations are performed to guarantee access to ports for larger ships by widening and deepening the main channels. Recent studies have shown that this can lead to an increase of the tidal amplification in funnel-shaped coastal plain estuaries.

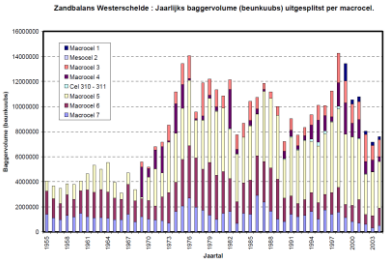


Figure 1: Dredging volumes in the Western Scheldt over the last 50 years

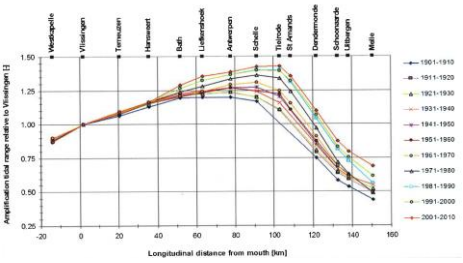
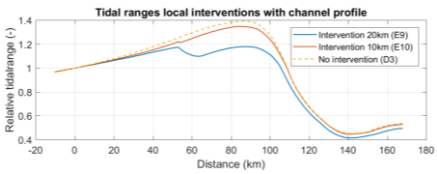
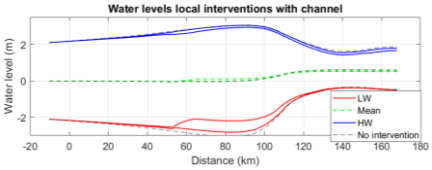


Figure 2: Relative tidal range (to Vlissingen) along the length of the Scheldt estuary over the last 100 years

To determine the effects of deepening and widening operations in estuaries, an idealized 2DH hydrodynamic model has been designed using Delft3D-FLOW, to analyze the tidal dynamics in a simplified funnel-shaped estuarine tidal basin. The results show that bottom depth, lateral convergence and reflection of the tidal wave, are the main drivers behind amplification or damping of the tidal range. The process of shoaling does not significantly influence the amplification of the tide in these types of estuaries, while the channel-shoal profile does have a very significant influence.

Analysis of historic bathymetric profiles and several artificial interventions has shown that it is possible to increase or decrease the tidal amplification in an estuary through human interventions. However, to reduce the tidal range, large scale interventions are necessary. Additionally, the results show that local increases of bottom elevation hardly reduce water levels during high tide.





This study has shown that it is possible to estimate the general effects of planimetric and altimetric changes, caused by human interventions, in a strongly simplified 2DH hydrodynamic model. The model designed in this study could be used for additional research of the effects of the channel-shoal system on tidal amplification and assess the effect of more detailed and localized interventions.

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