

On the sand exchanges between the Scheldt estuary and its ebb-tidal delta:

An idealized model study

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1. Introduction

The morphology of the Scheldt mouth is characterised by an extensive shallow area, which is flanked by two deeper (shipping) channels (Dumon et al. 2006, Kornman *et al.*, 2000). As such, the morphology of this region echoes the characteristics of an ebb-tidal delta.

The Scheldt ebb-tidal delta has a great ecological and economical value. Knowledge about the physical mechanisms that control its morphodynamic development and how it interacts with the estuary is still lacking. As a first step towards a better understanding of these mechanisms, this contribution focuses on the residual sediment exchange between the Scheldt estuary and its mouth.

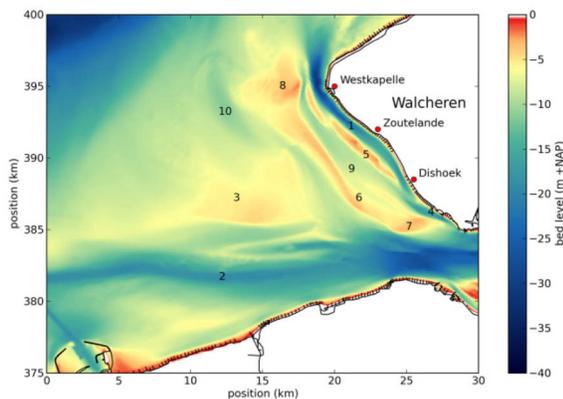


Figure 1: Bathymetric map of the Scheldt mouth.

2. Methodology:

An idealized 2DH numerical model is used for this study. The geometry of the estuary is that of an estuary with a converging width. In the default setting, the water motion is forced by prescribing an M_2 tidal component. First, the model is calibrated by comparing the amplitudes and phases of the tidal elevation and velocity with observations. Second, the tidally averaged residual sediment transport is

computed for different parameters settings (geometry, bottom profiles, adding M_4 component..)

3. Results

...are presented here.

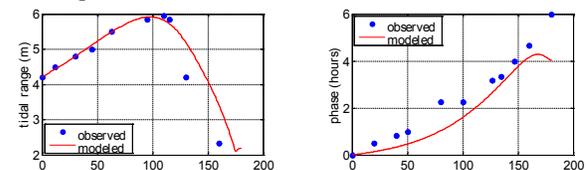


Figure 2: Left: Tidal range (m) vs. long-channel distance. Right: As in Left, but for the phase (hours).

- Tidal amplification/asymmetry occurs in the estuary in agreement with observations.
- Prescribing an M_4 component affects asymmetry of tidal velocity: net sediment exchange changes.

4. Conclusions

Preliminary results show that prescribing an M_4 tidal component has a great impact on the net sediment exchange.

References

- Kornman, B.; Arends, A.; Dunsbergen, D. (2000) Westerscheldemond 1970 – 2020: een morfologische blik op de toekomst. Ministerie van Verkeer en Waterstaat, Directoraat-Generaal Rijkswaterstaat, Rijksinstituut voor Kust en Zee/RIKZ.
- Dumon, G.; Balcaen, N.; Huygens, M.; Hyde, Philippe; Haerens, P. (2006). Hydrodynamica ter hoogte van de Vlakte van de Raan. Studiedag De Vlakte van de Raan van onder het stof gehaald. 13 oktober 2006. VLIZ