

A modeling analysis of the morphodynamics of the Scheldt mouth

Abdel Nnafie¹, Bart De Maerschak¹, Jebbe van der Werf², Julia Vroom², Arnold van Rooien², Mick van der Wegen², Marcel Taal², Toon Verwaest¹ and Tomas Van Oyen^{1,3}

¹Flanders Hydraulics Research, Berchemlei 115, Antwerp, Belgium

²Deltares, P.O. Box 177, 2600 MH Delft, The Netherlands

³Department of Civil Engineering, Ghent University, Technologiepark, 904, Belgium

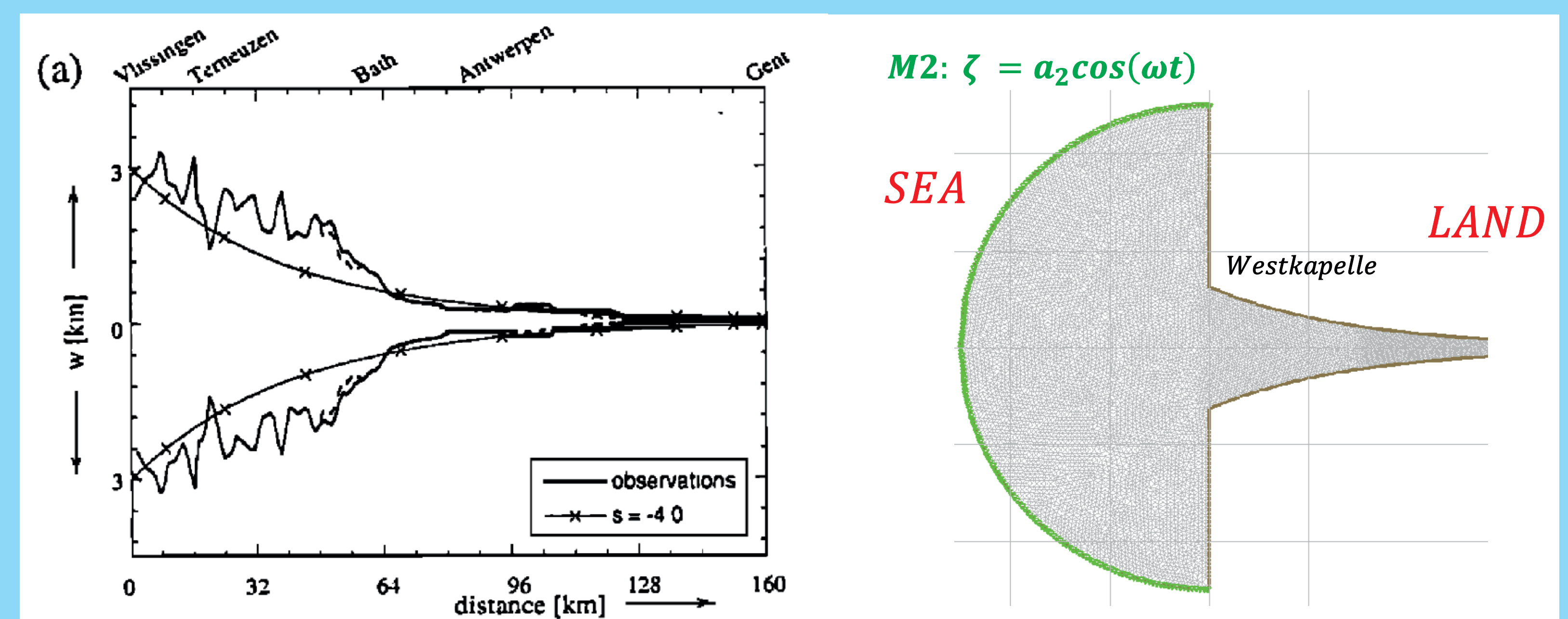
Email: tomas.vanoyen@mow.vlaanderen.be

Schematized Approach

Summary

The bathymetry of the Scheldt mouth is characterized by an extensive shallow area. This region (the "Vlakte van de Raan") is flanked by two deeper (shipping) channels such, that the morphology of this region echoes the characteristics of an ebb-tidal delta.

The overarching goal of this study is to identify the key factors leading to the present morphology and observed bathymetrical evolution. In particular, by using a numerical morphological model as an experimental tool, we aim to quantify the relative importance of several particular characteristics of the Scheldt mouth (hydrodynamic forcing, geometry, ..) on the resulting bathymetry. As such, this study is intended to complement predictive numerical modeling results by identifying overall physical mechanisms governing the phenomena.



Left. Field observations of the depth averaged width along the Scheldt estuary.

Figure adopted from Schuttelaars and de Swart (2000).

Right. Illustration of the adopted schematized numerical model geometry and mesh.

Field Observations

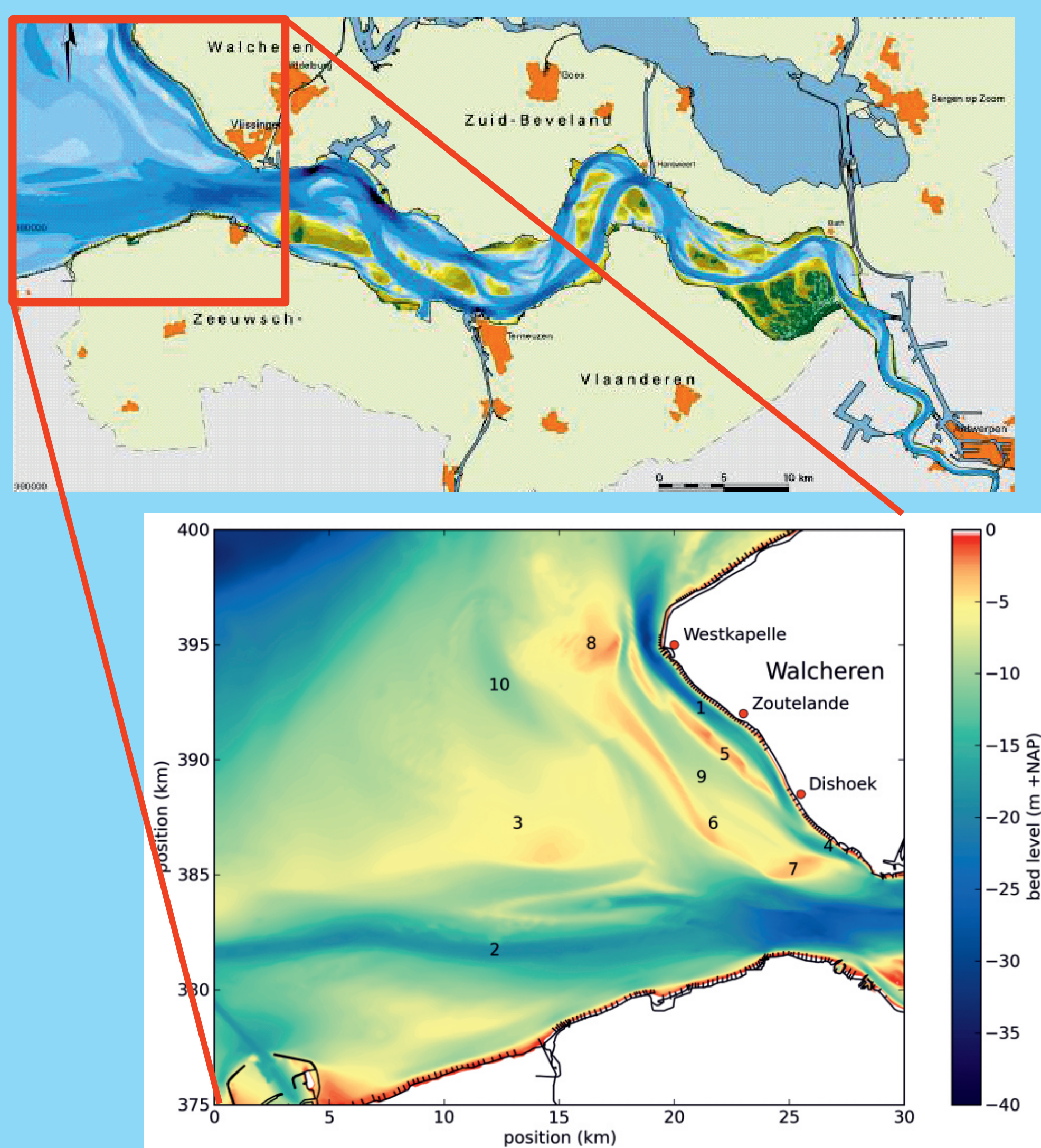
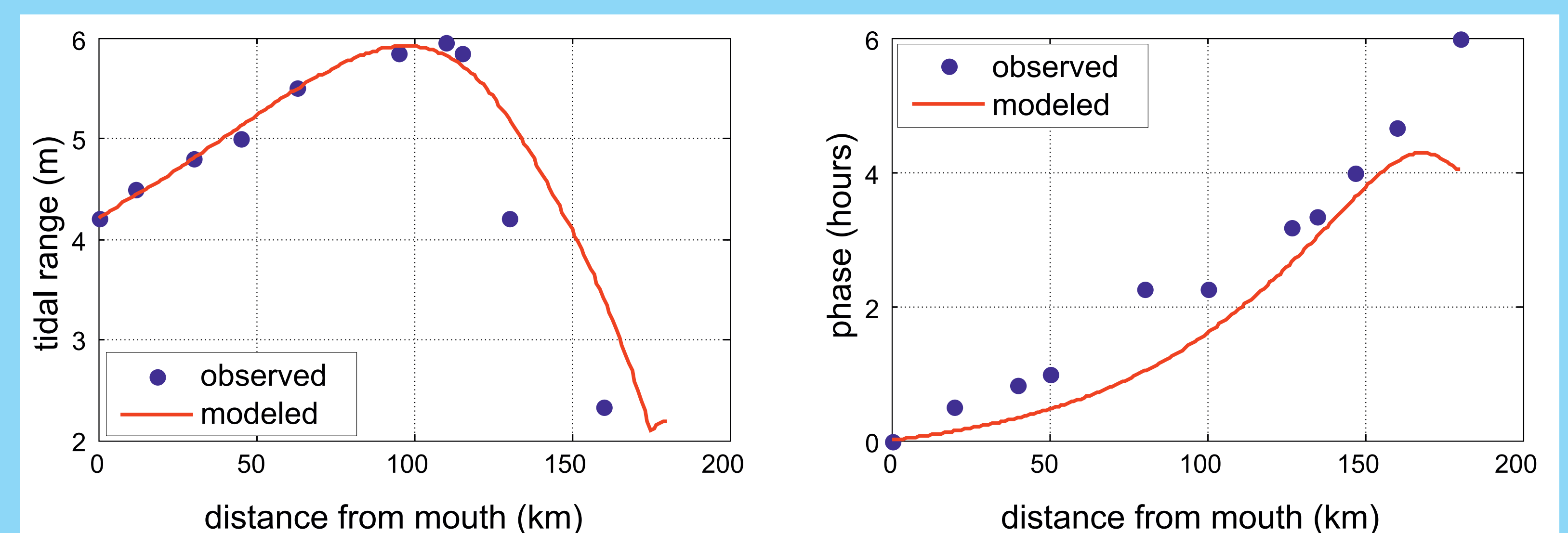


Figure illustrating the bathymetry and geometry of the Scheldt. Figure adopted from Damen (2014)

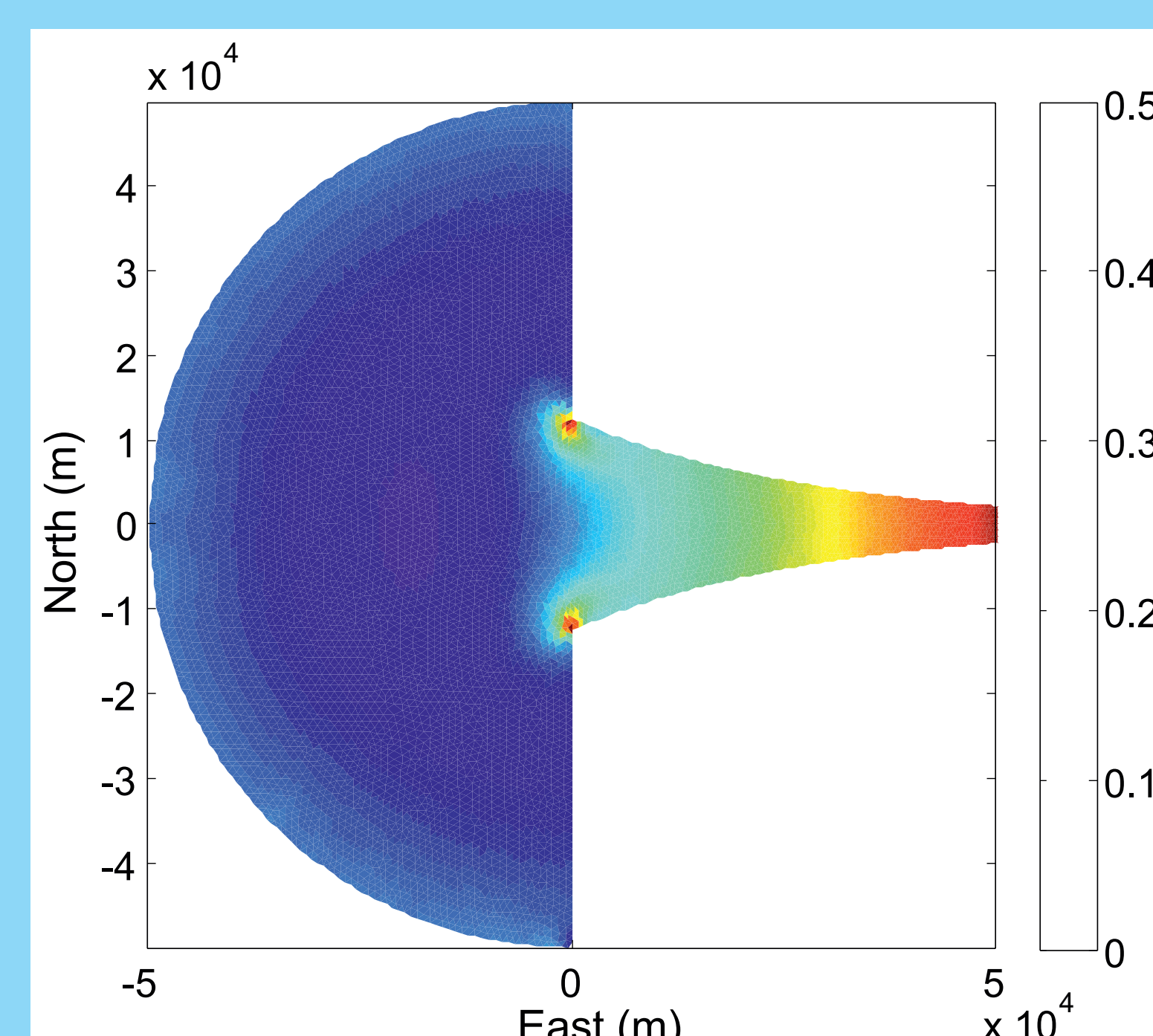
Preliminary Results



Left. Comparison of the modeled tidal range along the Scheldt estuary from the mouth up to Gent with field observations.

Right. Observed phase difference between high tide in the estuary and at the mouth versus modeled phase difference.

Below. Contourplot of the tidally averaged value of u^3



Conclusions

- Morphodynamic model of Scheldt ebb-tidal is currently being set up
- Comparison of vertical tide within the estuary reveals that the schematized approach is relevant
- Results from preliminary experiments are encouraging

References

- Damen, J. (2014). "Coastal erosion processes in tidal channel Oostgat". MA thesis. Universiteit Twente: the Netherlands
- Schuttelaars, H. M.; Swart, H. E. de (2000). Multiple morphodynamic equilibria in tidal embayments. J. of Geophys. Res.: Oceans 105. C10