

THE DRIVING MECHANISMS BEHIND MORPHOLOGICAL CHANGES IN THE WESTERN SCHELDT MOUTH AREA OVER THE PAST TWO CENTURIES – A DATA ANALYSIS

E. Brand^{1,2*}, T. van Oyen¹, A. Nnafie¹

¹ Flanders Hydraulics Research, evelien.brand1@gmail.com, tomas.vanoyen@mow.vlaanderen.be, abdel.nnafie@mow.vlaanderen.be

² Utrecht University

Introduction

The Western Scheldt mouth area has shown significant changes in morphology over the past two centuries, but the driving mechanisms behind these changes are not yet fully understood. In this study, historical bathymetries of the mouth and the estuary, the external tidal forcing, and human interventions were analysed, to improve the understanding of the morphology of the mouth area.

Methods and results

First, the morphological changes were quantified, by digitizing historical bathymetrical maps (Figure 2) and calculating the orientations and cross-sectional areas of the channels. From this data, it appears that the most significant changes in the mouth are the growth of the Wielingen and the rotation and decrease in area of the Spleet and the Deurloo. In the estuary the most important changes are the decrease in area of two channels towards areas that are now reclaimed and a rotation of the main channel at the inlet.

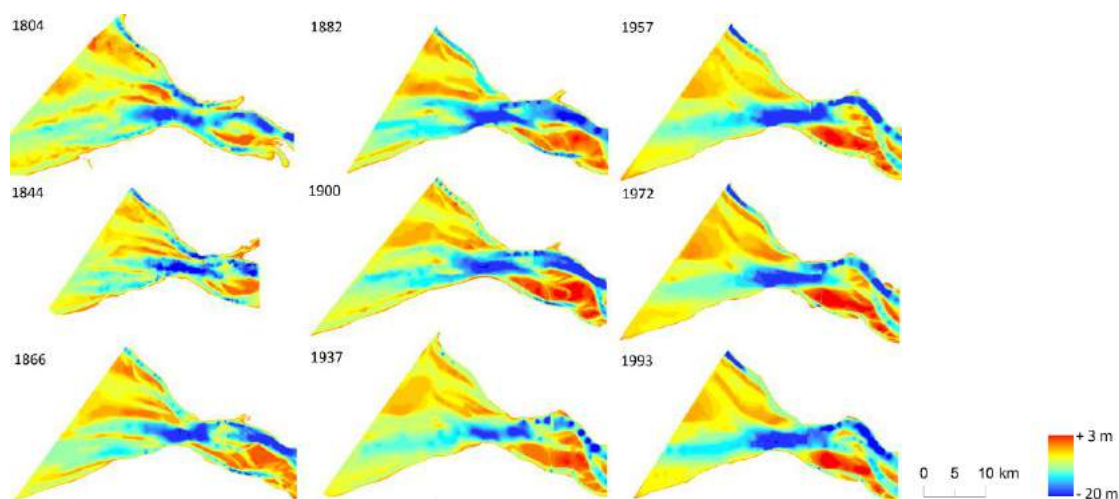


Figure 2. Digitized bathymetries of the Western Scheldt (mouth) from the past two centuries

Second, we studied the evolution of the external tidal forcing over the last two centuries, revealing that the M_2 tidal amplitude has increased due to sea level rise. The M_4 amplitude has also increased, but this could also be due to local changes in geometry. As a result of this, the tide at Vlissingen has become less flood dominant since 1900. A Delft3D model was used to study the effects of the changes in the hydrodynamic forcing on the sediment transport. From the model results, it appears that the changes in the incoming tide, resulted in an increase in sediment transport out of the estuary. Third, the influence of human interventions is studied by evaluating the temporal correlation between the morphological changes with the taken measures. From this effort, it appears that only the land reclamations in the estuary seem to have influenced the long-term, large-scale morphology.

Conclusions

Over the past two centuries, the Wielingen has grown significantly. Previously, it was thought that this was most likely due to the preferred channel location in combination with the delaying effects of the geology. However, this study shows that the growth of the Wielingen might as well be due to the changing orientation of the channel at the inlet. Moreover, this study shows that sea level rise might have influenced the Western Scheldt mouth area significantly.