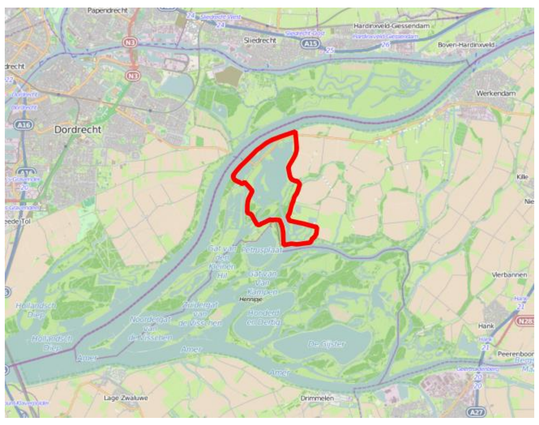
Assessment of the impact of sea level rise on tidal freshwater wetlands – a case study

E.Verschelling [a,b], E.C. van der Deijl [a], M. van der Perk [a], H. Middelkoop [a]

a Utrecht University, Faculty of Geosciences, The Netherlands
b Deltares, the Netherlands

1. Introduction

Tidal freshwater wetlands are under threat of drowning due to sea level rise. Whether the elevation of such areas is able to keep pace with SLR depends for a large part on the net sedimentation rate.



Kleine Noordwaard case study area, located in the Brabantse Biesbosch

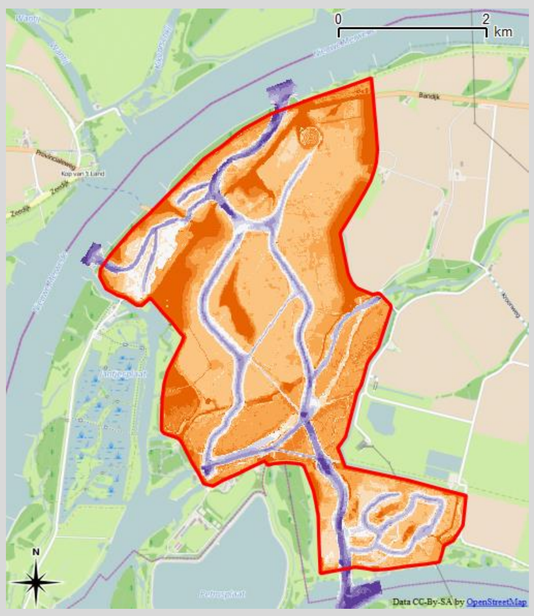
For polders-turned-into-wetlands we need to understand the sediment processes and their controls. Such knowledge is essential for local stakeholders if they want to prevent the area from drowning in the future. This research focuses gaining a better understanding of the relevant processes in one of such areas, polder Kleine Noordwaard, part of Brabantse Biesbosch in the Netherlands.

2. Research questions

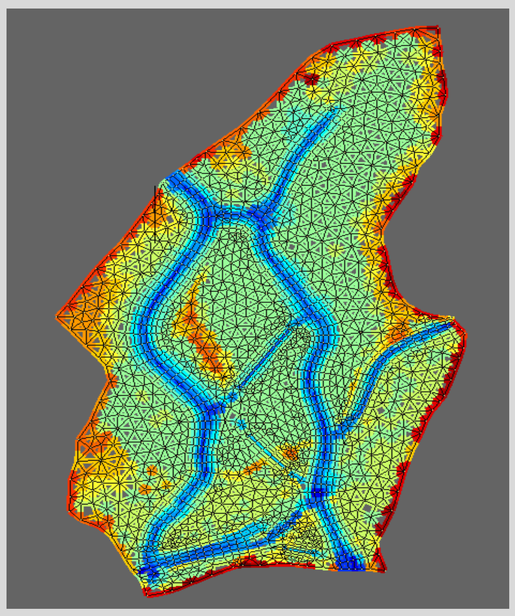
- Which factors determine total net sedimentation in the new wetland?
- Which factors determine the spatial distribution of the net sedimentation in the wetland?
- Can the major factors be influenced in such a way that net sedimentation is maximized?

3. Main methods

- Measurement campaigns to determine the relevant hydro-morphologic parameters
- Construction of detailed D-FLOW FM and Delft-2D FLOW/MOR/WAVE models of the hydro-morphologic processes
- Model-based sensitivity analysis to evaluate the contribution of different combinations of forcing conditions (wind & river discharges, among others) to net sedimentation rates
- Model-based optimization of sediment trapping capacity



Bathymetry dataset of case study area, showing the artificially dug network of trenches



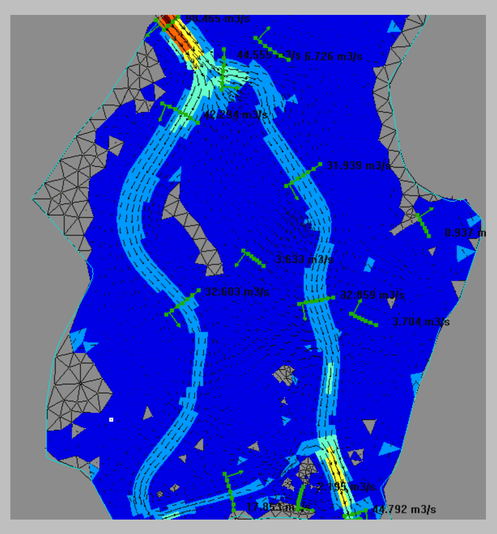
Early example of a D-FLOW FM model with finer grid resolution in thenches

4. Preliminary results

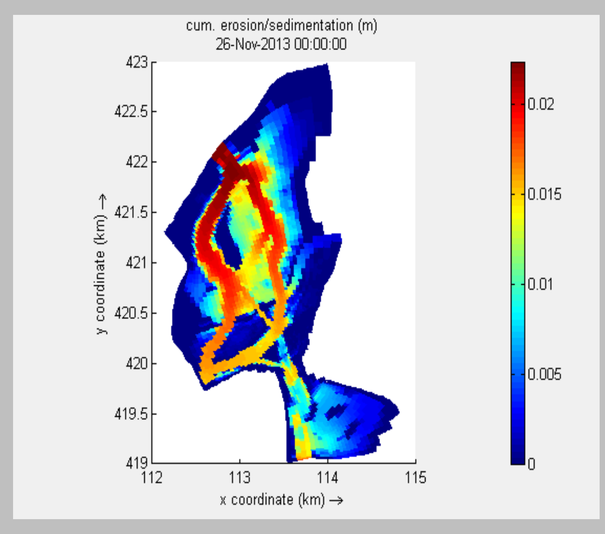
- (Re)suspension due to wind seems to play an important role
- The system seems to depend on medium-high river discharge events for input of sediment and strong wind events for (re)distribution of sediment throughout the area
- Different combinations of discharge and wind seem to lead to very different net sedimentation or erosion rates

Analysis of the composition of the top soil

Point samples of sedimentation layer thickness (in cm)



Example of flow velocity vector field during standard semi-diurnal tidal conditions, showing locations where sedimentation can be expected (strong velocity gradients)



Example of expected net sedimentation after 2 years of average flow and tidal conditions

5. Future research

Future research will focus on the evaluation of future scenarios of climate-related variables. The effects of local subsidence due to compaction will be included as well as the effect of vegetation growth on hydraulic parameters and autogenic primary production will be included. The research area will be increased to the size of the entire Brabantse Biesbosch.

6. Acknowledgements

This project is financed by the Dutch Technology Foundation STW (proj.12431). We thank Rijkswaterstaat, Staatsbosbeheer and Hans de Boois for their support.

Universiteit Utrecht
Deltares Enabling Delta Life
STW Enabling new technology
NCR
NWO Netherlands Organisation for Scientific Research