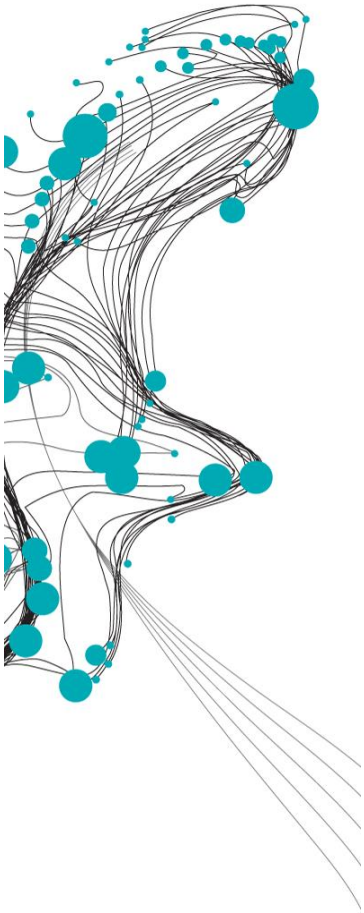
NUMERICAL MODELLING OF MORPHOLOGICAL DEVELOPMENT IN A MANAGED REALIGNMENT PROJECT

A CASE STUDY OF THE PERKPOLDER PROJECT, WESTERN SCHELDT, THE NETHERLANDS



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The Perkpolder project is a managed realignment project located in the Western Scheldt, the Netherlands. Part of the dike was breached and a new defence line was built further inland which created an intertidal area. The artificial creeks were shaped inside the Perkpolder intertidal area before the breaching which resulted in a deep pond near the inlet and the branches of the creeks which spread over the area.

Measured currents in the inlet and topographic changes of the Perpolder intertidal area were analysed. The discharge through the inlet shows that the intertidal area appeared to be flood dominant. The observed flow fields indicated that the tide driven inflow and outflow is constrained by the bathymetry as the inlet channels directed the flow propagation. The largest sedimentation was found in the pond and along the creeks. However, a channel with less sedimentation appeared in the pond. This is the result of high velocities during the inflow as can be observed in the flow fields.

A numerical model has been setup, using Delft3D, with tides as the major driving force and multi-fraction sediment interaction, imcluding cohesive and non-cohesive sediment behaviour. The model has been calibrated with the measured velocity at the inlet and the measured sedimentation and erosion pattern in the Perkpolder. The model showed its ability at reproducing measured the velocity components with a NS score indicating a good model performance. Moreover, the model successfully simulated the major bed level changes inside the Perkpolder intertidal area.

Based on the model results, the sedimentation inside the Perkpolder intertidal area appeared to be strongly related to the flow circulation. The circulation is formed due to the shape of the Perkpolder and the bathymetry (Fig.1). This resulted in A 'S' shape sediment transport circulation during the outflow phase (Fig.2). The circulations results in the pond to acting like a sediment sink. While the erosion happens mainly during the inflow as the high velocity during inflow results in high bed shear stress. This brings the sediment into suspension.

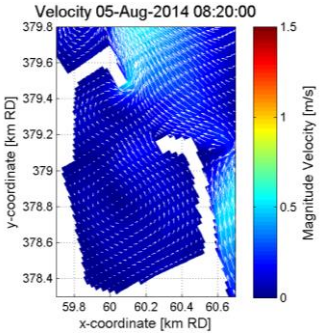

Figure 1: Circulation during the inflow

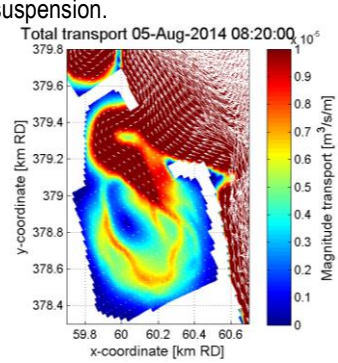

Figure 2: 'S' shape sediment transport during outflow

Moreover, the influence of creeks and the breach width was studied. The creeks protect its surroundings as the erosion is constrained along the creeks. Without the creeks, sedimentation cannot be observed at the larger area near the inlet. While by varying the breach width, the difference in sedimentation and erosion pattern is relative small. However, with a wider breach, more sedimentation has been found in the pond, probably because the sediment transport circulation during outflow is more focussed on the pond.

For managed realignment project which is aiming at creating intertidal area, the sedimentation is beneficial. Therefore, including creeks in the Perkpolder intertidal area is a smart design as the creeks improve the spatial distribution of sedimentation in the fields.

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