COMBINING RIVER INTERVENTIONS TO MITIGATE BED DEGRADATION IN THE BOVEN-WAAL

The ongoing bed degradation in the Dutch Rhine delta hinders the achievement of goals set for the river areas within the Integrated River Management (IRM) programme. The Boven-Waal is currently the fastest degrading river branch, while also exerting a large influence on the discharge distribution at the Pannerdensche Kop, necessitating prompt intervention. Currently the potential of combining different river interventions to mitigate long-term bed degradation is underexplored. This research quantifies the effects of implementing different combinations of groyne lowering, longitudinal training dams and side channels with summer dike lowering in the Boven-Waal, on the mitigation of ongoing long-term bed degradation and its consequences. To achieve this, different combinations of river interventions have been schematized and simulated with the 2D 'Duurzame Vaardiepte Rijndelta' (DVR) model. The DVR model runs on the computational core of Delft3D and was made for the purpose of long-term morphological modelling by using a steady-step hydrograph.

The results indicate that the connection of lower lying areas in the floodplains of the meandering Boven-Waal via side channels, is unlikely to effectively mitigate ongoing bed degradation, due to limited space in the floodplains and the considerable amount of sediment that is deposited in the side channels. Instead, a combination of groyne lowering and longitudinal training dams in the Boven-Waal is identified as most effective for mitigating ongoing bed degradation. Promising development of the bed level of the Boven-Waal (+0.6 cm/year) is achieved. Besides, the desired discharge distribution at the Pannerdensche Kop, as defined in IRM, is close to being reached when combining groyne lowering and longitudinal training dams, which implies that this combination of river interventions can divert more discharge towards the Pannerdensch Kanaal during low discharges. Nevertheless, further optimization is necessary to achieve an optimal design for mitigating ongoing bed degradation, as the trade-off between navigability of the Boven-Waal and additional discharge to the Pannerdensch Kanaal during low discharges is delicate. The results contribute valuable insights to the already extensive knowledge base on river interventions, facilitating progress toward a comprehensive plan for addressing bed degradation in both the Boven-Waal and the Dutch Rhine delta as a whole.

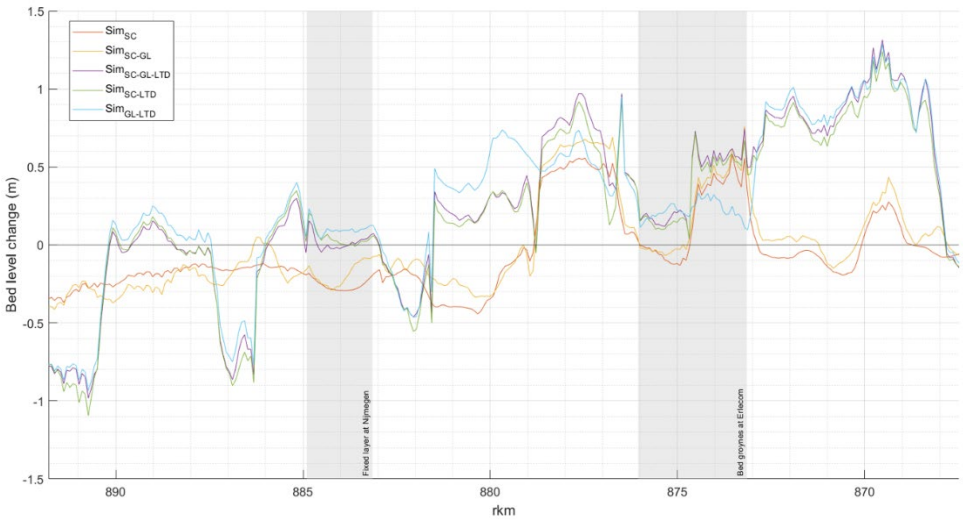

Figure 1: Cross-sectionally averaged bed development in the Boven-Waal compared to the reference simulation after 20 years of morphological simulation. Every simulation is labeled by which interventions it includes. The label 'sc' is for side channels and summer dike lowering, the label 'gl' is for groyne lowering and the label 'LTD' is for longitudinal training dams.

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