



Distinguishing internal and external sediment sources in a tidal freshwater wetland, the Netherlands

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Many deltas across the globe suffer from drowning due to sea level rise or land subsidence in combination with sediment starvation. The process of drowning can be attenuated by enhancing sediment inputs or the sediment trapping efficiency of deltas.

To examine the sediment budget of delta areas based on measurements of sediment deposition, it is essential to distinguish the sediment that has entered the area from upstream areas from sediment that has been redistributed within the area. This pilot study aims to explore the prospects to distinguish between external and internal sediment sources based on the geochemical composition of the sediment deposited.

This study was carried out in the Kleine Noordwaard, which is part of the Brabantse Biesbosch, a former inland delta located in-between the Rhine and Meuse rivers in the south-western part of the Netherlands. A significant part of this area has been embanked and turned into polder areas in the early 19th century. In contrast to many tidal creeks and flats, the polder areas have not received inputs of severely contaminated river sediment between the 1930s and 1980s. A number of polders have recently or are currently being de-poldered again, i.e. converted from agricultural polder land into an inundated tidal freshwater wetland, in order to increase the conveyance capacity of the Rhine River during extreme discharge situations, thereby lowering the peak water levels upstream and to enhance the nature values of the area.

The external and internal sediment sources of the sediment deposited in the Kleine Noordwaard could be discriminated based on the zinc (Zn) and rubidium (Rb) concentrations. These two elements exhibit a different linear relation for the more contaminated external sediment originating from the Rhine River and the less contaminated, internally redistributed sediment originating from the topsoil of the former polder area. The mixture proportion for each sediment sample could not be directly derived because the zinc and rubidium concentrations of the Rhine and polder sediments making up the sediment mixture were unknown. Nevertheless, they could be constrained by their respective statistical distributions based on the samples that exclusively consisted of sediment from the Rhine River or polder topsoil. This allowed the estimation of the distribution of the mixture proportion for each sample.