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# Sediment transport and sorting processes at a back-barrier beach nourishment

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In the context of coastal climate adaptation, coastal protection interventions involving soft and dynamic structures have noticeably gained popularity over the past decades. Huge sand nourishments of the order of $Mm^3$ to tens of $Mm^3$ have already been implemented along several stretches of vulnerable coastline. In most cases the added sediment concerned well-sorted sand with a $D_{50}$ often very similar to that of the host area and was deposited in an open-coast system, where the morphodynamics are dominated by waves. Consequently, most of our understanding of nourishment dynamics stems from well-sorted sediment in wave-dominated environments. However, sand nourishments are increasingly applied to more sheltered systems, where tidal currents become dominant over wave-driven processes. Here, sand deposits are usually retrofitted to inadequate, hard flood defences to act as a buffer against erosion of such infrastructure. Frequently, coarser sediment than that of the host area is used in parts of the design to enhance this buffering capacity. Introducing different grain sizes into a system is expected to result in more complex, differentiated sediment transport, as coarser fractions are mobilised at different moments and places than finer fractions. By focussing on a nourishment on the leeward side of a barrier island, we aim to find quantitative answers to the questions when and how the mixed-sediment composition changes and what implications that has for the morphologic evolution of the area.

This research is based on an extensive 6-week field campaign in the early fall of 2021 at the 3-km long Prins Hendrikzanddijk, a retrofit nourishment on the island of Texel. We deployed long- and cross-shore arrays of instruments that measured a range of parameters such as pressure, flow velocity, suspended sediment concentration and bedforms. These measurements were further complemented by almost daily DGPS-measurements of the bed levels and a spatially extensive set of sediment samples which had been collected from the foreshore and upper shoreface at various time intervals. The conditions captured during the study period ranged from very calm (no waves) to stormy ($H_{m0}$ up to 0.6 m), while tidal currents reached velocities up to 0.6 m/s. Throughout these varying conditions, we encountered wide grain-size distributions in the top 5-6 cm of the bed almost everywhere, which sometimes also revealed multimodality. From a longshore perspective, $D_{50}$ was generally largest in the centre, decreasing in either direction away from it. The beach surface was further characterised by transient bands/patterns of surfacing coarse and shell-rich

material, which could disappear altogether overnight –often hand in hand with a smoothening of the cross-shore profile and a shift in beach-step position– after a period of increased wave activity. We will further elaborate on our obtained results and findings at the conference.