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In-situ tidal marsh erodibility under high flow velocities

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Coastal defences such as dikes are increasingly pressured by climate change. Increasing storm surge, extreme rainfall and periods of draught requires evermore strengthening of dikes to maintain flood risk standards. Conventional dike strengthening (i.e., heightening and/or widening) will be either structurally or financially unfeasible. Therefor, engineers are exploring other, more sustainable, methods to ensure future flood safety. A promising method is incorporating tidal marshes in the coastal defence system. Tidal marshes reduce dike loads by wave attenuation, increase bio diversity and ecology and under the right circumstances are able to grow with sea level rise. Moreover, in case of dike failure, resulting in a dike breach and inundation of the hinterland, tidal marshes have been shown to reduce breach erosion rates. This reduction positively affects flood risk. However, in order to quantitatively estimate the effect, dike breach models need to also model tidal marsh erosion. In this study we tested a mature tidal marsh, in-situ, in winter conditions under high flow velocities (up to 2.5 m/s) to measure the erosion and estimate erodibility. We measured little erosion, order millimeters after a cumulative 2-2.5 hours. Small-scale experiments, such as the Jet Erosion Test, showed high resistance to erosion (85-140 Pa) and large varying erodibility (6.5-45 $cm^3/N{\cdot}s$). By estimating the shear stresses acting on the soil during the experiment we compare the data with the small-scale results. The comparison gives insight in whether the small-scale experiment results can be accurately translated to full-scale erosion. Also, the experiment showed which (erosion) mechanisms are important for tidal marshes during a dike breach.