SUPPLEMENTAL MATERIALS

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Projecting Hydro-Morphodynamic Impacts of Planned Layout Changes for a Coastal Harbor

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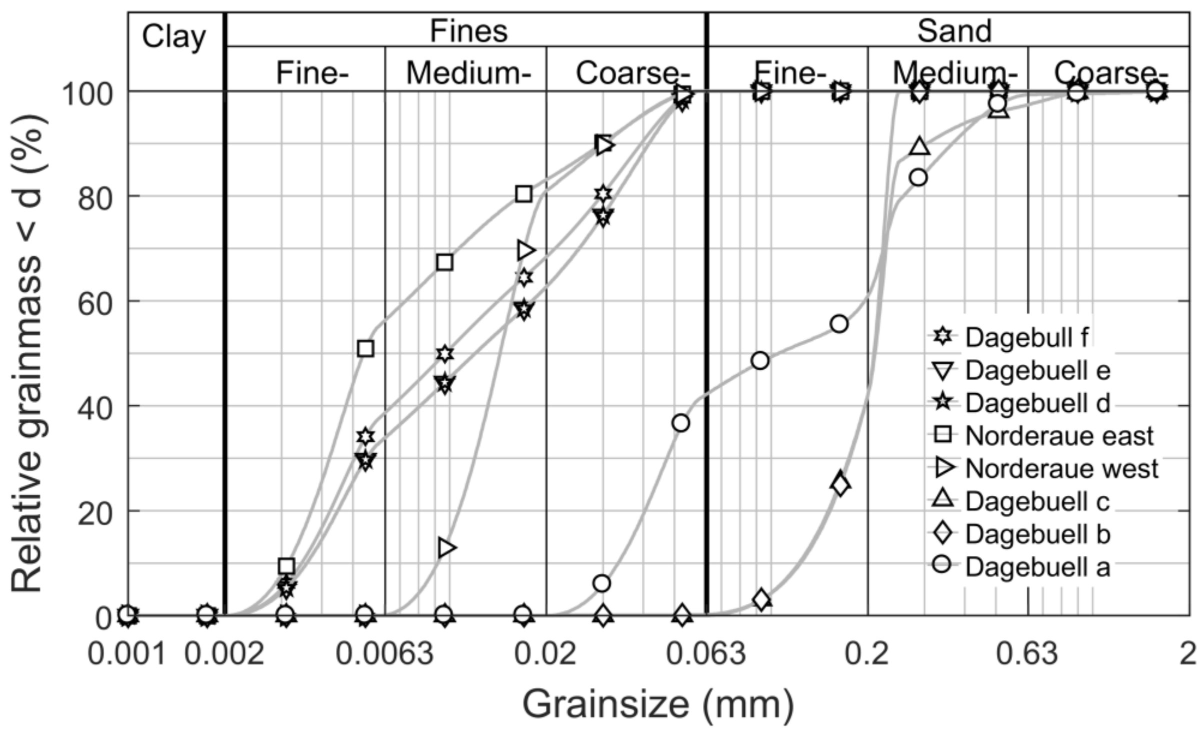

Figure S1. Grain size distribution curves obtained from analysis of field measurements. Markers indicate the location of the sampling sites and correlate with roughness values assigned to grid cells in Figure S2.

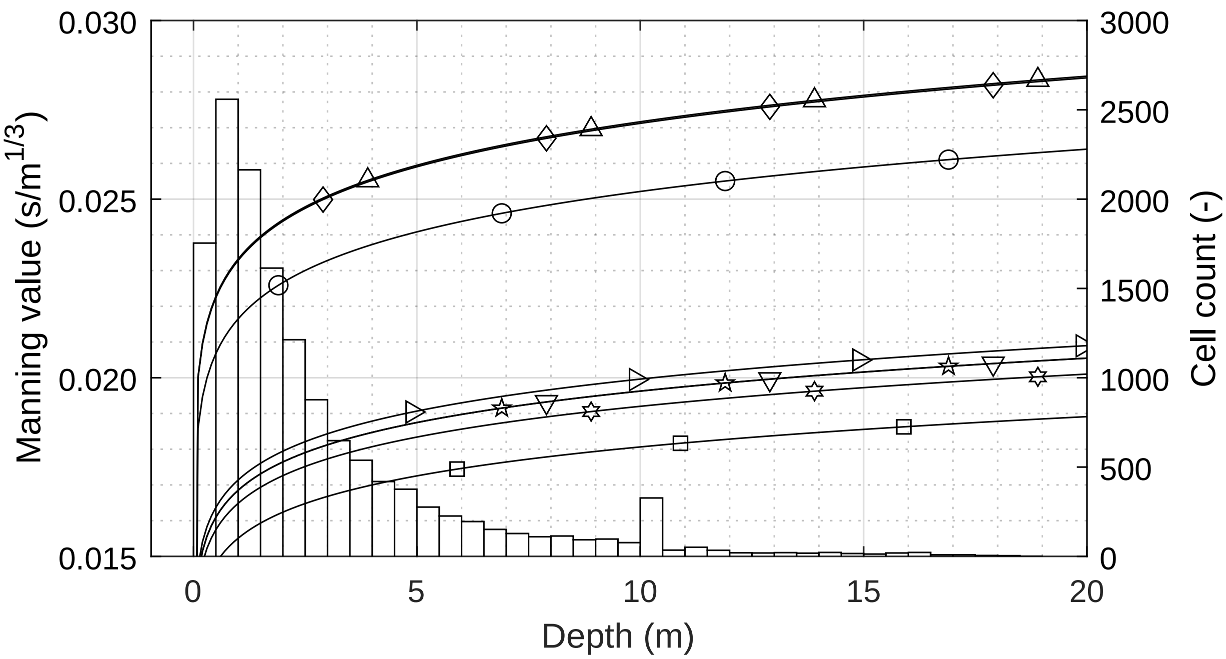

Figure S2. Distribution of numerical grid cells according to depth as bar plots. Graphs indicate the assigned Manning values, which correlate with the sediment samples and use identical markers as in Figure S1. Cumulative spatial distribution of surface roughness values within grid cells, based on a bed roughness predictor developed by Brownlie 1983. Seafloor sediment samples have been obtained at six locations around the port of Dagebüll, as well as two more samples along the southern model boundary. A sieve analysis was conducted, revealing grain sizes vary from <0.063 to 0.63 mm and correlates to bed roughness values from 0.018 for the samples collected within the port vicinity and up to to 0.026 for the sand dominated samples collected in the navigational channel. Manning bed roughness values (left y-axis) are calculated for the sediment samples analysed in relation to the depth of the focus area (x-axis) and occurring depth distribution (right y-axis) and represent the chosen values.

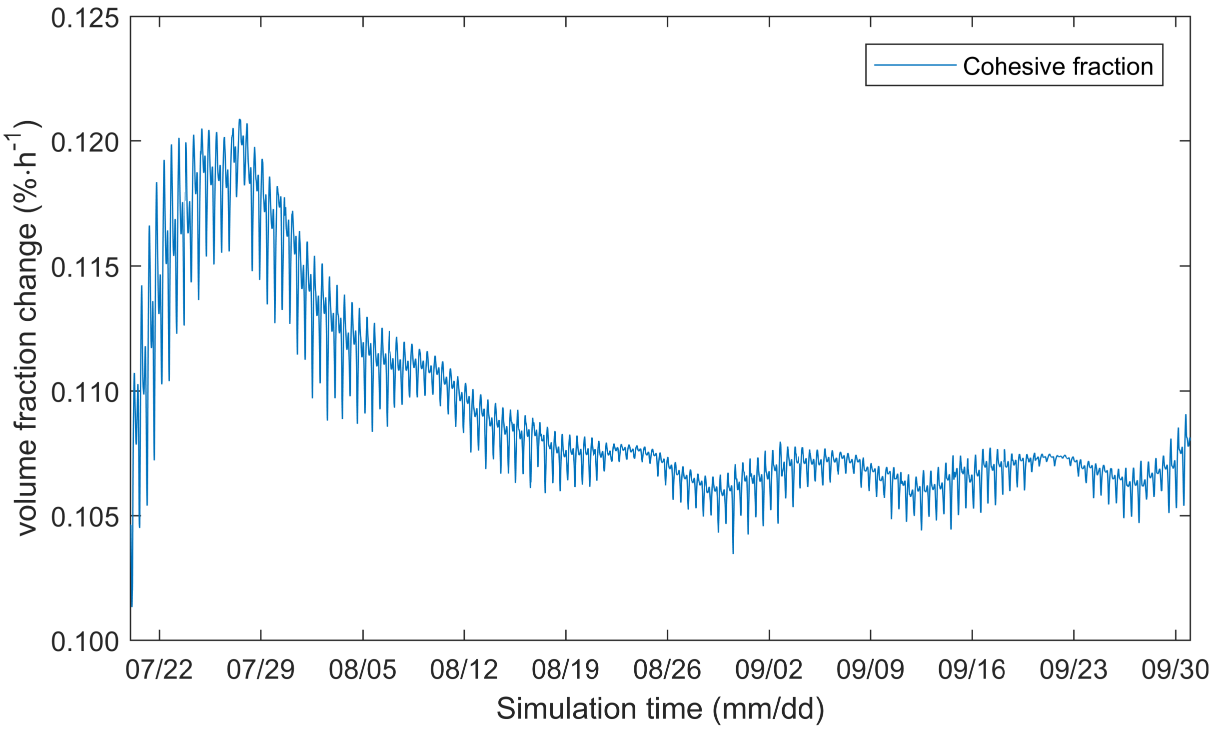

Figure S3. Morphodynamic quasi-equilibrium of the cohesive fraction. The simulated bed composition generation run response for the individual sediment fractions is given for the cohesive fraction. The cohesive fraction shows an initially high volume fraction change in % across the model domain, which after approximately 1 month starts to fluctuate around 0.1075 ‰ following the tidal dynamics. Therefore, a quasi-equilibrium is reached for this fraction and simulations investigating the questions at hand can be investigated.

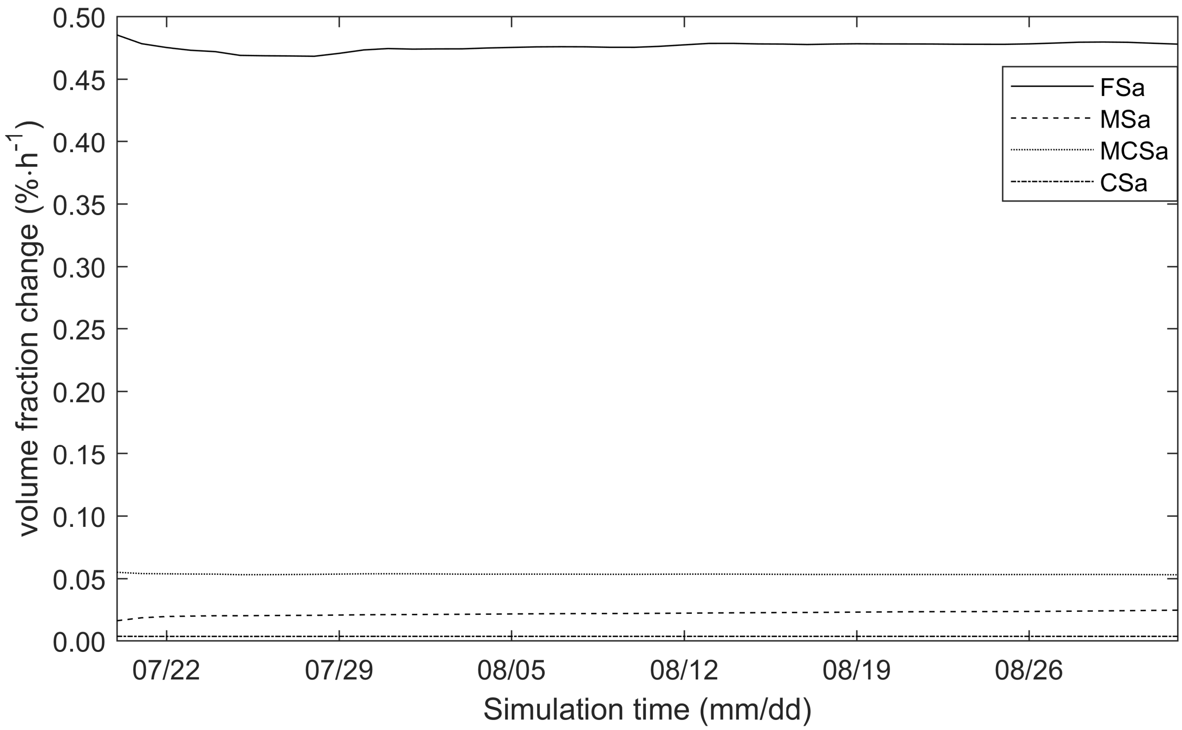

Figure S4. Morphodynamic quasi-equilibrium of the non-cohesive fractions. The non-cohesive sand fractions show an initial phase of activity, but reach a quasi-equilibrium after a simulated period of one week, much earlier than the easily transported cohesive fraction.

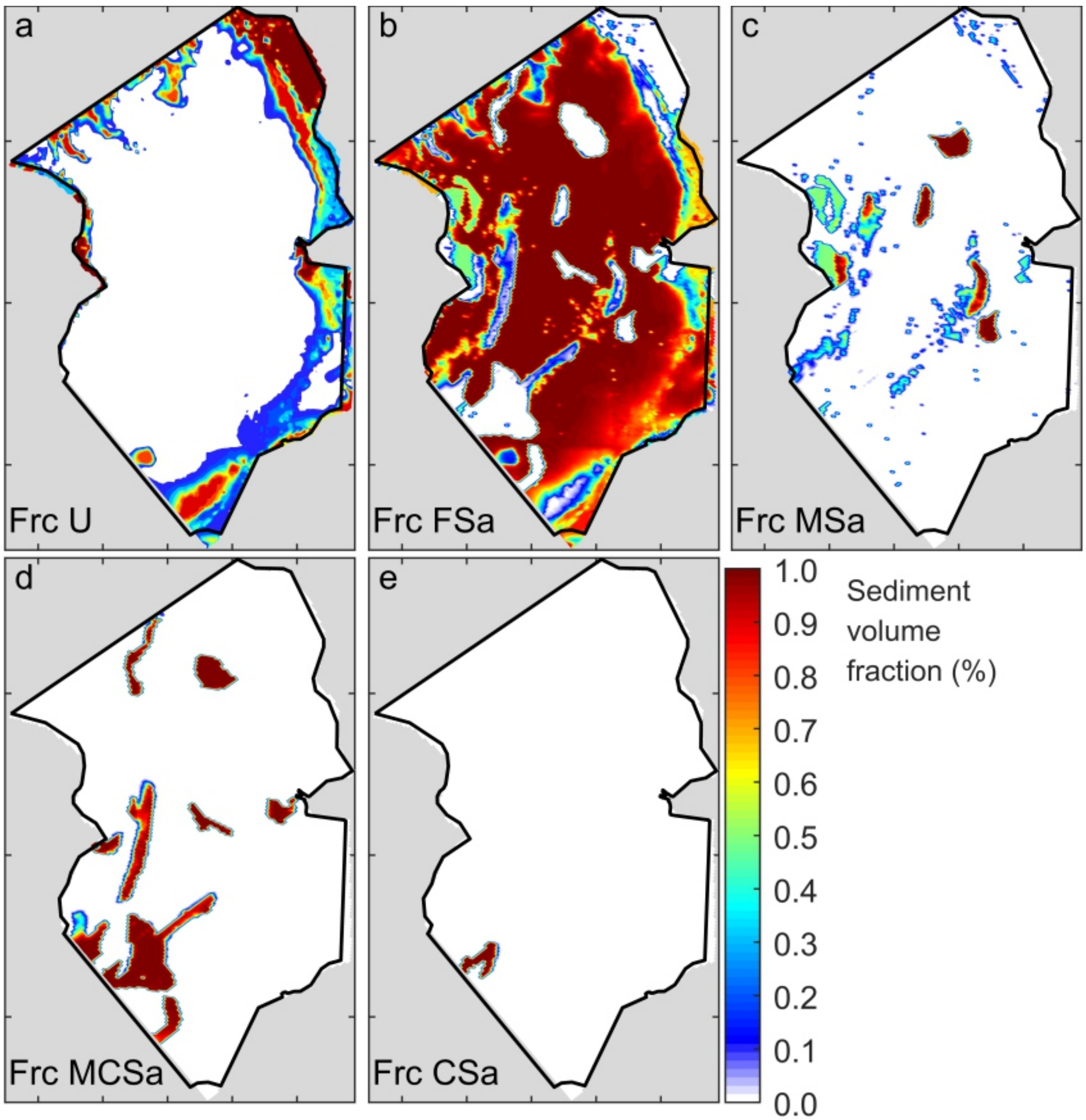

Figure S5. Redistribution pattern of the simulated sediment fractions after the initial bed composition run as sediment volume fraction. Volume fractions for (a) Cohesive sediments; (b) Fine Sand; (c) Medium Sand; (d) Medium Coarse Sand; (e) Coarse Sand.

References

Brownlie, W. R. (1983). “Flow depth in sand–bed channels.” *Journal of Hydraulic Engineering*, 109(7), 959–990.