



Improved planning of coastal protection measures by analysis of long-term transect measurements of sandy beaches on Langeoog

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Sandy beaches of barrier island coasts are highly depended on complex natural variability in dynamics of sand transport at the island's surf zone and across tidal inlets. Since dunes are an essential part of the coastal protection system of the East Frisian Islands, an adequate sand supply is necessary to ensure the stability of coastal protection.

The East Frisian Islands do have a fixed position in the mesotidal sector of the German North Sea coast. Fixed positions in a high dynamic system result in changes of the intensity of sedimentation and erosion. Shoals and bars connecting the ebb-tidal delta to the islands characterize the sand supply of the islands beaches. This morphodynamic system is highly depended on changes in the hydrodynamic forces and sand availability in the system.

A tool to forecast erosion or sedimentation would lead to a next level of coastal protection and risk mitigation management. However, the complexity of different factors is pushing applied analysis methods like numerical modelling to its limits.

Here we show that data analysis of long-term transect measurements together with recently measured data sets is key for a better understanding and design of 'Building with Nature'-Solutions, e.g. sand nourishments.

We analyzed about 70 years of transect data and found different recurring migrating systems of sand transport. It is possible to reveal the morphodynamic speed of these systems in historical data, leading to a possibility to estimate the future systems behavior on short time scales and to access the effect on the coastal protection system, i.e. dune safety.

Our results demonstrate how analysis of long-term data can lead the way to improved planning of sand nourishments regarding to timing, placement and volume. The value of long-term and high resolution monitoring with innovative methods emphasizes the need of ongoing measurement programs to support 'Building with Nature'-Solutions.