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

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BACKGROUND

Sandy beaches of barrier island coasts are highly depend 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 in the North Sea (Lower Saxony, Germany), an adequate sand supply is necessary to ensure the stability of dunes. Sand nourishments balance the natural sand supply and are also known as ‘Building with Nature’ (BwN) or ‘Nature Based-Solutions’ (NBS).

METHODS

Transect and bathymetry data covering a period of 70 years are analyzed, to find recurring migrating systems of sand transport and reveal their morphodynamic speed. First, different height levels are assigned to a morphological response - Coastal State Indicators (CSI), also for transnational comparing coastal laboratories within the BwN-project. A monitoring concept for measuring terrestrial and hydrographic data supports the current database for the ongoing BwN-project. During the monitoring period, sand samples are taken to determine the spatiotemporal grain size distribution before, during and after the nourishment. Additionally, hydrodynamic measurements in the beach area and 2.5 km offshore are carried out to give insight into the conditions in this area, comprising wave, current and water level data. Bathymetry data before and after a storm surge combined with the results of the monitoring program give input for numerical models like Xbeach to validate the model output and obtain a deeper insight in the process of beach and dune erosion.

RESULTS

Within the INTERREG project ‘Building with Nature’ Coastal State Indicators are developed to link a measured value of the beach to a morphological response. Also different morphological systems are derived from long-term transect data for Langeoog. For those morphological systems the past behavior is evaluated. Recurring phases of erosion or sedimentation are assigned to the measured value of the beach to a morphological response. The aim is to gain enough system understanding to still provide a sufficient safety level, but also allowing natural variability and in the best case use natural forces within coastal protection. This poster presents interim results of the European Union INTERREG North Sea Region Vb project ‘Building with Nature’ focusing on results for Langeoog (Hillmann et al. 2018 - scan code below; WP3 BwN 2017).

CONCLUSIONS AND FURTHER RESEARCH

Analysis of long-term transect data returns system understanding in the framework of coastal protection management. This leads the way to improved planning of sand nourishments regarding timing, placement and volume. The value of long-term and high resolution monitoring emphasizes the need of ongoing measurement programs to support ‘Building with Nature’ Solutions and to evaluate their effectiveness. If the system is well known and natural positive behavior for coastal protection is detected to avoid unnecessary negative impacts by building hard structures, soft structures are an alternative regarding possible ecological and morphological impact. Results of the monitoring program can be analyzed further to support these findings by numerical models like Xbeach.