

GUIDELINES FOR DESIGNING SAND NOURISHMENT ON LOW TO VERY EXPOSED COASTS

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MOTIVATION

Every citizen in Denmark has a right to access the beach and walk along it, even though beaches often are privately owned. The law also states that coastal protection may not hinder this. Sand nourishment must therefore be a part of every coastal protection scheme countering erosion. Sand nourishment design must be considered in regards to the objectives and the natural coastal variations. As a part of the European Interreg project "Building With Nature" (BwN) common guidelines on designing sand nourishment will be developed in mid 2020. This abstract has a special focus on the coasts in Denmark. If it is possible to use the same general design approach on the Danish north sea coast as in the Netherlands millions of Euro can be saved each year in sand nourishment, while still maintaining the same safety level.

METHODOLOGY

Special emphasis will be on establishing knowledge on the natural variability of the coasts, because it is vital when designing the most effective coastal protection scheme and for evaluating the net effect of a nourishment. The pathway along which the sediment are transported spans from offshore at the outer bar to the hinterland, and the understanding of the full system is considered in this project.

10 beach nourishments in Denmark and Sweden, and 8 shoreface nourishments in Denmark will be analyzed. The nourishment volumes ranges from 4,000 to 2,000,000 m³. Results from the trans-national co-analysis in BwN of nourishments in Belgium, Netherlands and Germany will also be included.

It is the aim to be able to determine the paths along- and cross-shore in which nourishment sand are transported, the diffusion velocity and the impact on the surrounding coasts. Based on the results of the analysis, guidelines on how to design sand nourishment to counteract erosion in a sustainable and socioeconomically way will be presented.

ANALYSIS

In this abstract the ongoing work will be represented by the analysis of a shoreface nourishment at southern Holmsland barrier, and a beach nourishment at Nørlev beach, both on the Danish North sea coast. Fig 1 show the natural variability at Sdr. Holmlands Tange in the active profile over a period of 10 years. Especially the bars are highly dynamic. Analysis have shown a relatively significant pattern in the long-, and cross-shore variability bar system.

Satellite images from Sentinel 2 and regular drone footage have been used for determination of variability in the active coastal zone at Nørlev. Fig 2 shows Sentinel2 images with a resolution of 10x10m. The variability of the bar system has been identified, and a depression in the outer bar is identified outside of a location of significant dune erosion (red line).

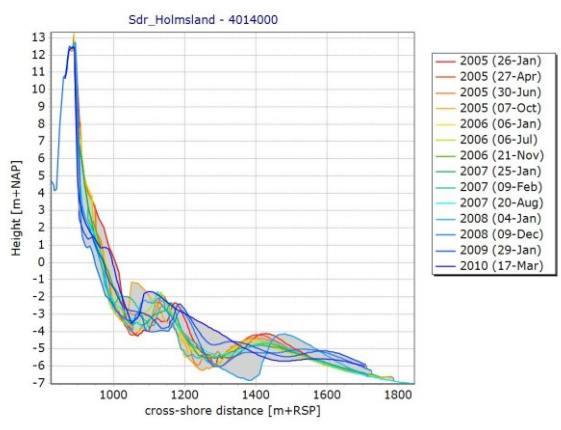


Figure 1 - Natural variations 2005-10, 14 surveys.

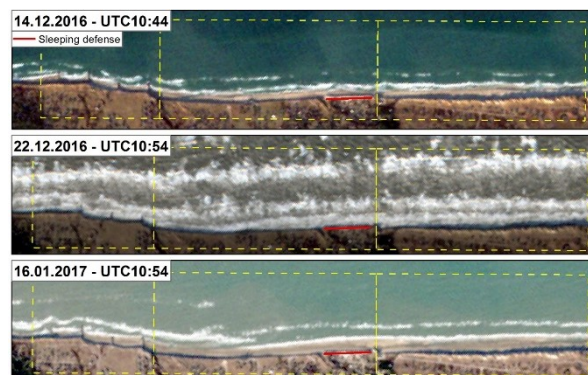


Figure 2 - Satellite images of breaker bar system

CONCLUSIONS

The use of frequent data (survey, satellite, orthofoto and drone images) to quantify the natural variation on a erodible coast, has improved the ability to asses and quantify the effects of sand nourishment. The planned and ongoing further analysis are expected to result in statistically significant results, which will improve national guidelines on the design on nourishments significantly.

ACKNOWLEDGMENT

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