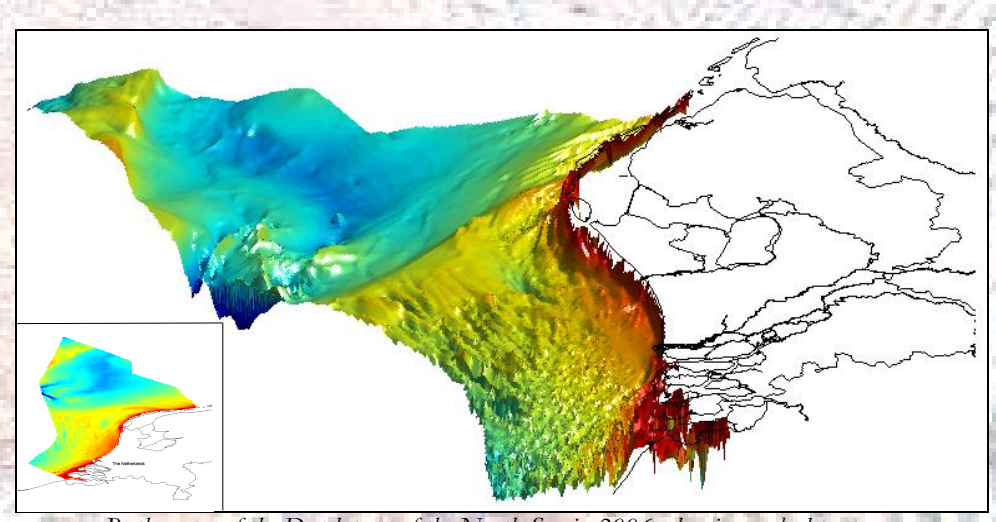
Research project description

uncovering inherent dynamics in coupled bio-geomorphodynamic systems offshore



Bathymetry of the Dutch part of the North Sea in 2006, showing seabed patterns.

On the bed of the North Sea sand waves are present, which grow up to 25% of the water depth and migrate at a speed of tens of meters per year. These sand waves can pose a hazard to offshore constructions, navigation, pipelines and telecommunication cables.

The bed of the North Sea is also covered by a great number of organisms live in and on the bed of the sea. These organisms try to optimize their habitat, resulting in bio-geomorphological interactions.

The precise interaction between the biological activity and geomorphodynamics is not known at this moment. Such knowledge is of great interest for reliable long-term geomorphodynamic predictions, especially in marine environments with large biological activities.

The objectives of the study are as follows: (a) to increase the knowledge in the interactions between biological activity and geomorphodynamics in offshore locations, (b) to implement and validate bio-geomorphological models, and (c) to find the dominant processes and timescales in the influence of bio-geomorphological interactions.

Data on both seabed dynamics and biological activity will be analyzed (Step I). These data are recently becoming available. Based on these data and (possibly) new field experiments, the influence of biological activity on sea bed dynamics can be parameterized (Step II). Large-scale sea bed patterns are successfully modeled using idealized models on which stability analysis and perturbation techniques are applied. The parameterized biology will be included into such an idealized model, and the different time scales in the bio-geomorphological interactions will be determined (Step III). Subsequently, the proposed parameterization and the gathered data can be applied to different test cases (Step IV). Finally, the feedback from the morphodynamic processes to the biological processes will be modeled, resulting in a bio-dynamic model (Step V), allowing us to investigate the inherent dynamics of the coupled bio-geomorpholdynamic system.

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