

Predicting sand transport and coastal profile development:

Bypassing the complexity: a combined Process-based Empirical Model for COASTal profile development (PEMCOAST)

WHY?

Climate change is expected to lead to sea-level rise and increased storminess. This will potentially cause drastic changes to the world's coastal profiles, even in areas which are normally close to being in a stable equilibrium. To predict the development of coastal profile shape, the cross-shore (perpendicular to the beach) sediment transport processes are important. Current state-of-the-art numerical coastal engineering models are not capable of handling the cross-shore sediment transport accurately, probably due to small errors in the prediction of the individual sub-processes accumulating and leading to an erroneous result.

THE IDEA

In this project the aim is to by-pass the complexity and develop a novel type of cross-shore model, which only simulates the first of the sub-processes (the wave evolution) using a traditional processbased approach, but substitute remaining sub-models with an empirical model. This approach will potentially eliminate the accumulation of errors from individual sub-processes, which is typical in existing state-of-the-art models.

THE STRATEGY

To develop the sediment transport model first a novel wave model will be developed based on new experiments in a state-of-the-art wave flume at the Technical University of Denmark. Additionally, datasets of past experiments regarding coastal profile evolution will be gathered. The experiments will be simulated with the new wave model, and the combined results of the wave-model and the experimental data will be used to develop the final cross-shore morphological model.

WHEN AND WHO

The project is scheduled to start January 2025 and run until the end of 2026. The project will be carried out by Senior Researcher Bjarke Eltard Larsen from the Technical University of Denmark. He is an expert modeler of coastal processes and has recently solved another long-standing problem related to modeling of waves. His solution has been included in many state-of the-art open source and commercial coastal engineering computer models.

IMPACT AND DISSEMINATION

If successful, the project will have a wide impact on future coastal research and coastal management. It will have solved the problem of accurately predicting cross-shore sediment transport, where the scientific community has been stuck for decades. The results of the project will be disseminated through journal publications and international conferences.