KLIWAS at a Glance

KLIWAS encompasses five main research tasks with a total of 30 projects and a coordination unit. The programme is focussed on climate change and its impacts on waterways and navigation:

- Validation and evaluation of climate projections
- Impacts on hydrologic systems of coastal waterways
- Impacts on water quality and ecosystem functions
- Impacts on hydrologic systems of inland waterways
- Impacts on the maintenance of inland waterways

The research programme is carried out by four departmental research institutions of the Federal Ministry of Transport, Building and Urban Development *(BfG, BAW, BSH,* and *DWD)* and number of universities and other research institutions. Its main aim is to identify and propose options for adaption to climate change including economic analyses. Thus, KLIWAS provides a sound basis for political decisions.

KLIWAS operates in the national and international research framework, using outputs of EU research programmes such as ENSEMBLES (FP 6) and giving inputs to other national and international projects (e.g. Klimzug) and to international commissions (e.g. PIANC, ICPR).

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Federal Ministry
of Transport, Building
and Urban Development

Partners

DWD
Deutscher Wetterdienst

BSH
BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE
Federal Maritime and Hydrographic Agency

BAW
Federal Waterways Engineering and Research Institute

KLIWAS

Impacts of Climate Change on Waterways and Navigation

A German departmental research programme

Wave Height Distribution in Shallow Waters

Objective

Within this study we looked for a mathematical way to predict wave-height distributions in shallow waters, particularly under storm conditions. Such predictions are crucial to find the best design for offshore or coastal structures such as dams or wind parks. They will also support safe navigation at the coasts.

Method and Results

We compared several mathematical approaches to computing wave heights with our field data from three gauges in the North Sea (Research Platform Fino 1, Gauge Borkum, Lighthouse *Alte Weser*) and found that one method overestimates wave heights (Rayleigh distribution), while others (Battjes-Groenendijk approach) underestimate the probability of high waves. Therefore we modified parameters until we found a way to compute wave-height distributions in shallow waters.

For details see:

Mai S., J. Wilhelmi, U. Barjenbruch (2010):
Wave-height distributions in shallow waters.
In: Proceeding of the International Conference on Coastal Engineering, no 32(2010).
http://journals.tdl.org/ICCE/article/view/1140

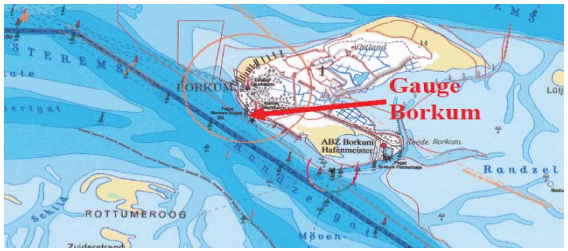

Figure 1: Location of gauge Borkum

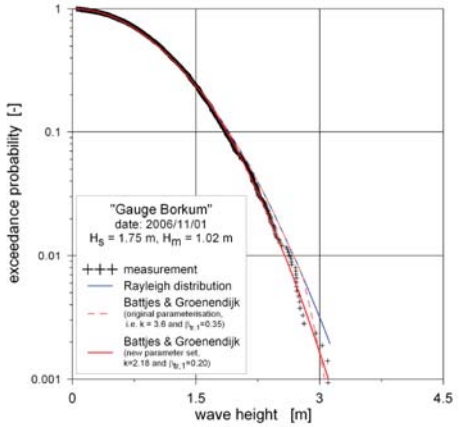

Figure 2: Wave height distribution at the gauge Borkum

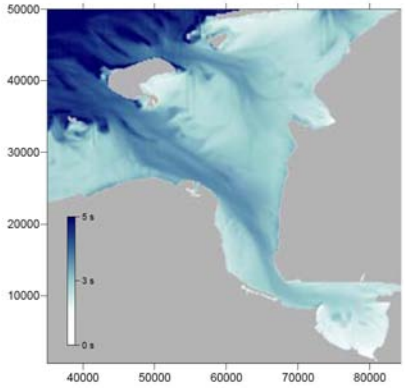

Figure 3: Significant wave heights with current-interaction

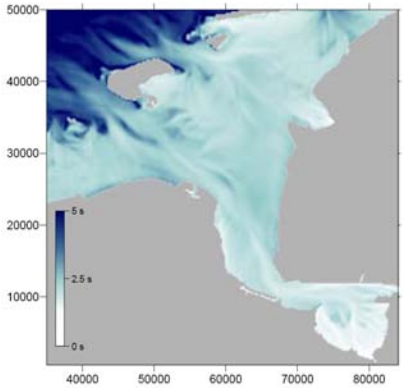

Figure 4: Significant wave heights without current-interaction

Wind Waves and Currents

Objective

In this study we aim to estimate how climate change impacts physical processes - particulary wind-waves and currents - that act on coastal structures and coastal ecology. Our main objective is to find a possibly simple method to estimate local impacts of climate change, and thus allowing sound political decisions.

Method

In this study, we focussed on the interactions of wind-waves and currents and studied how they drive other estuarine processes. Our aim was to simulate hydrological conditions and physical processes over longer periods of time. Therefore we coupled two models that address different aspects: to simulate currents and sea-levels, we used the model HAMSON (Hamburg Shelf Ocean Model) and to compute waves, we employed the model SWAN (Simulating Waves Nearshore). Both these models are able to simulate changes occuring within years or decades.

Results

By varying the parameters that drive our simulations we found out that currents usually impact waves by up to 10 %, and in estuaries up to 25 %. To verify these results further studies should be carried out.
A next step will be to improve long-term simulations.

For details see:

Hein H., S. Mai, U. Barjenbruch (2010):
Interaction of wind-waves and currents in estuaries with focus on climate change.
In: Proceedings of the ninth International Conference on Hydro-Science and Engineering (ICHE 2010), IIT Madras, Chennai, India.
2-5 August 2010.