



Competence for Waterways

Adapting the spatial characteristic analysis to a numerical model of the German Bight



MOTIVATION

> NUMERICAL MODEL

computation Area-wide of characteristic is tidal an fundamental tool for a better understanding of the hydrocomplex coastal dynamics, current e.g. velocities, water levels and their relations.

- 3D hydrodynamic model for the North Sea based on UnTRIM2
- Focus area German Bight

SPATIAL CHARACTERISTIC ANALYSIS

 Analysing tidal characteristics requires knowledge of tidal wave propagation to identify individual events (e.g. timing of tidal high water)



- 20 years hindcast (1996-2015)
- Unstructured grid
- Huge data output (every 10 min)
- The propagation is determined with a chain of reference positions (Fig. 1) along which the tidal phase information is transferred
- One master reference position, to relate tidal events to (before or after), here Helgoland (Fig. 1, black dot)
- Extreme values, mean values, quantiles and ratios for tidal characteristics are calculated for every tide and tidal phase per year e.g. mean high water, mean low water, residuals currents, mean salinity, M2 amplitude and phase

Fig. 1: (Simplified) reference postions in the German Bight (red dots) and the entry time of high water in reference to Helgoland (black dot)

RESULTS FOR SPATIAL ANALYSIS



Fig. 2: Tidal range in the German Bight for 2009 in m

Spatial analysis for:

Water levels

ght for Fig. 3 : 99% quantile of maximum ebb velocity in the German Bight for 2009 in m/s

Fig. 4: maximum effective bottom shear stress in the German Bight for ebb for 2009 in N/m^2

Spatial patterns of exemplary characteristics:

Tidal range (Fig. 2) increases in shallower areas and estuaries

- Partial tides
- Current velocities
- Bottom shear stress
- Salinity

- Maximum current velocities for ebb (Fig. 3) are higher in the channels than in deeper parts of the German Bight, maximum velocities occur in Elbe estuary
- Maximum effective bottom shear stress (Fig. 4) as indicator for impact of tidal currents on seabed

RELEVANCE AND OUTCOMES

Objective representation

New perspectives

Reduced datasize

- Efficient way to extract key dynamic parameters from large 4D-datasets and visualize as 2D
- Increased understanding of spatial structure of tidal dynamics
- Leads to less complicated data management and publishing

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