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Long-term morphodynamic modelling for the entire German Bight

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AufMod* Long-term Morphodynamic Modelling for the entire German Bight

A. Plüß & F. Kösters

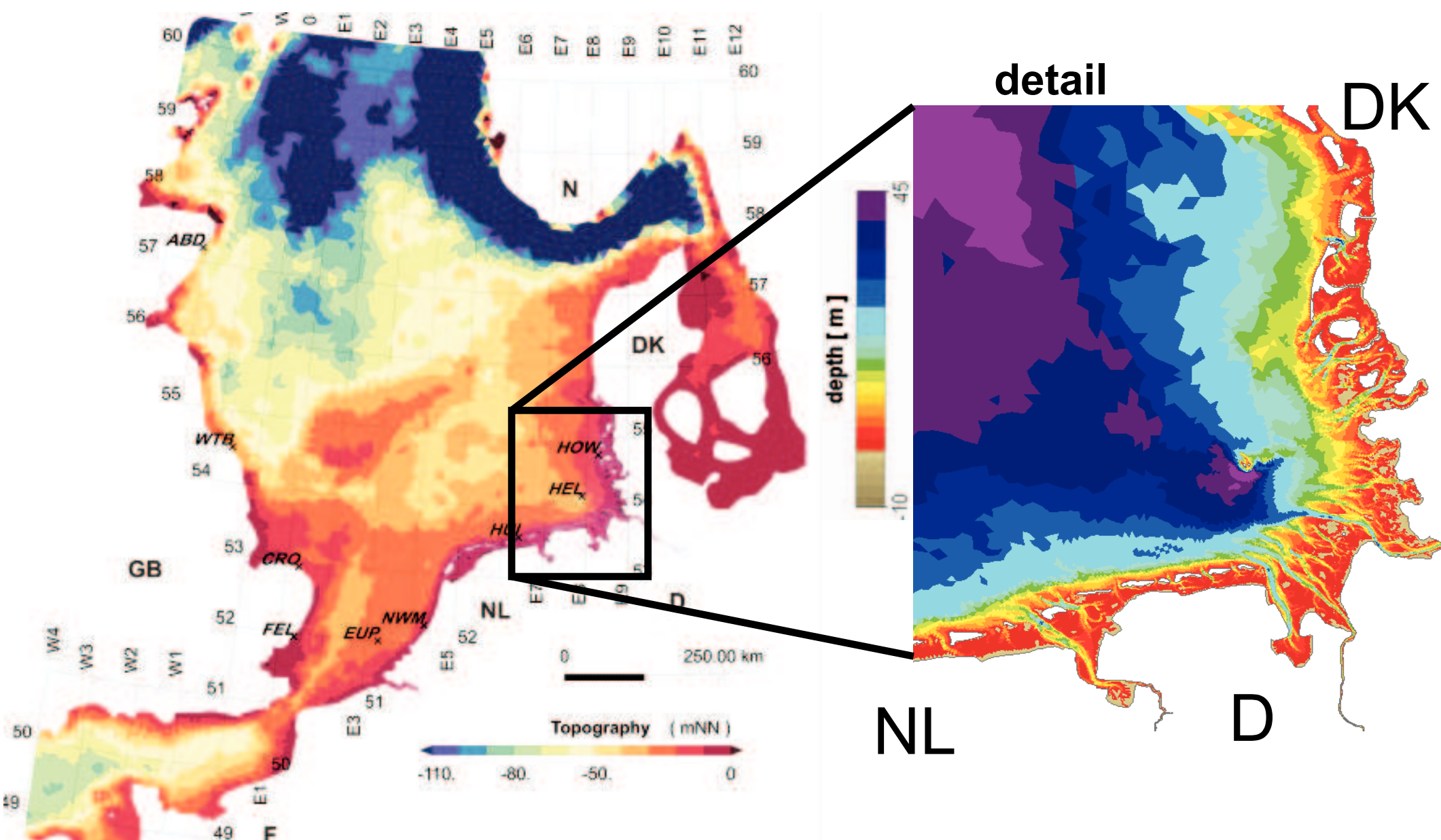
andreas.pluess@baw.de / frank.koesters@baw.de

Time series at Cuxhaven Jan/Feb/Mar 2006

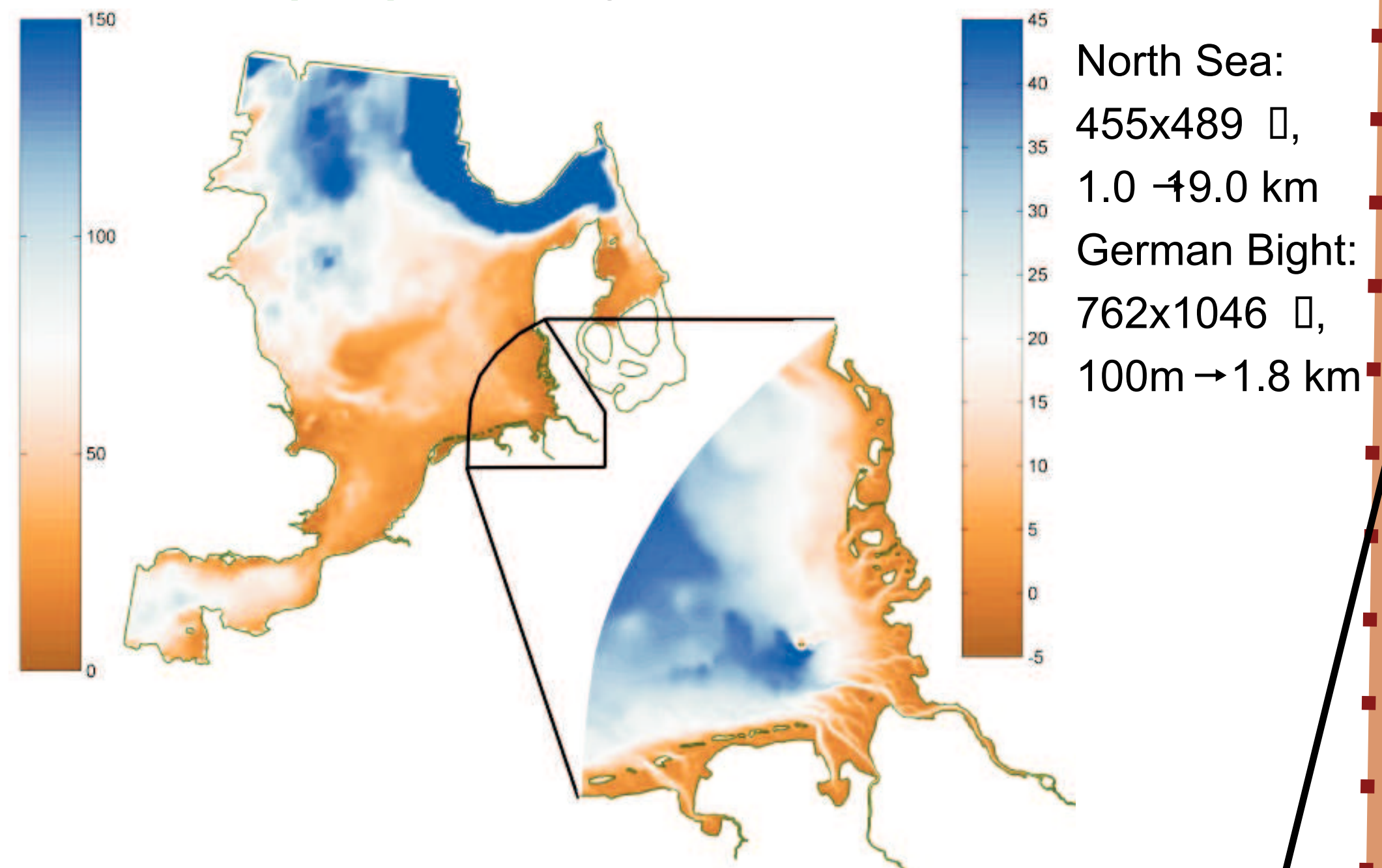
velocity waterlevel SPM-transport

Model set-up

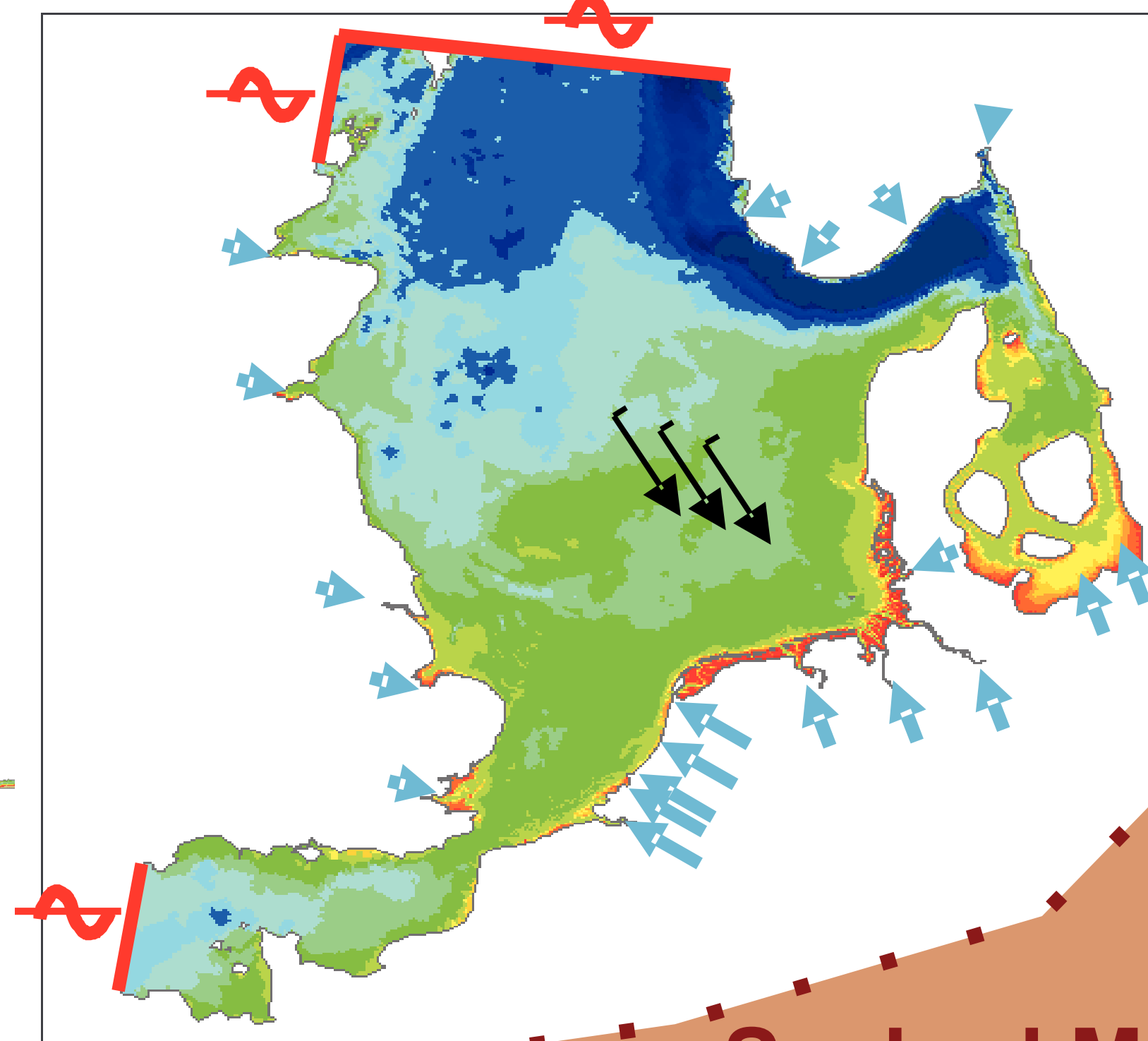
Multi-Model-Approach:
UnTRIM/SediMorph/UnK + DELFT/MOR/SWAN



UnTRIM (3D) elements: 77,500 Δ 80 m \rightarrow 24.0 km
Delft3D (2D) nesting North Sea \rightarrow German Bight



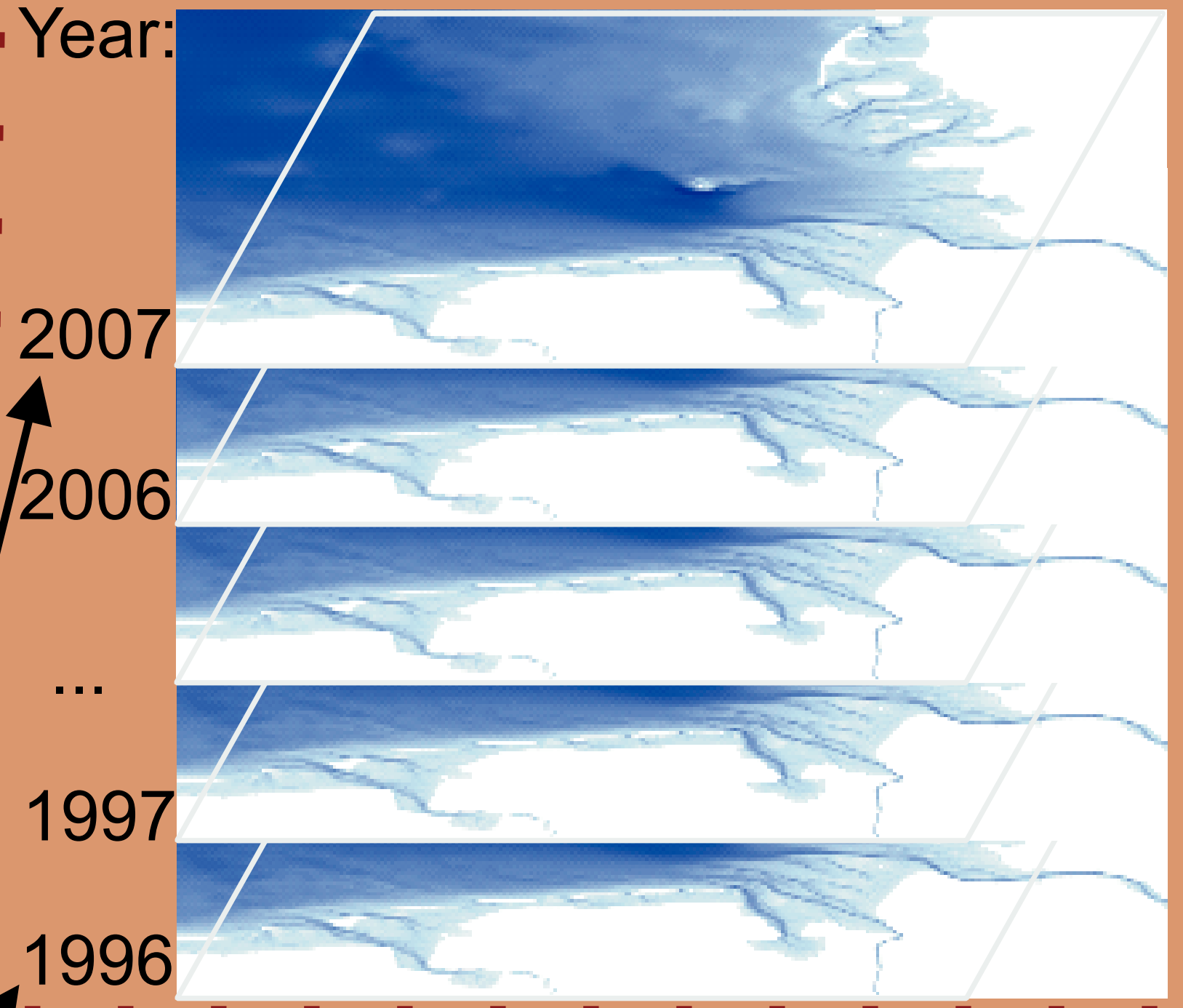
Boundary conditions / Seabed Model



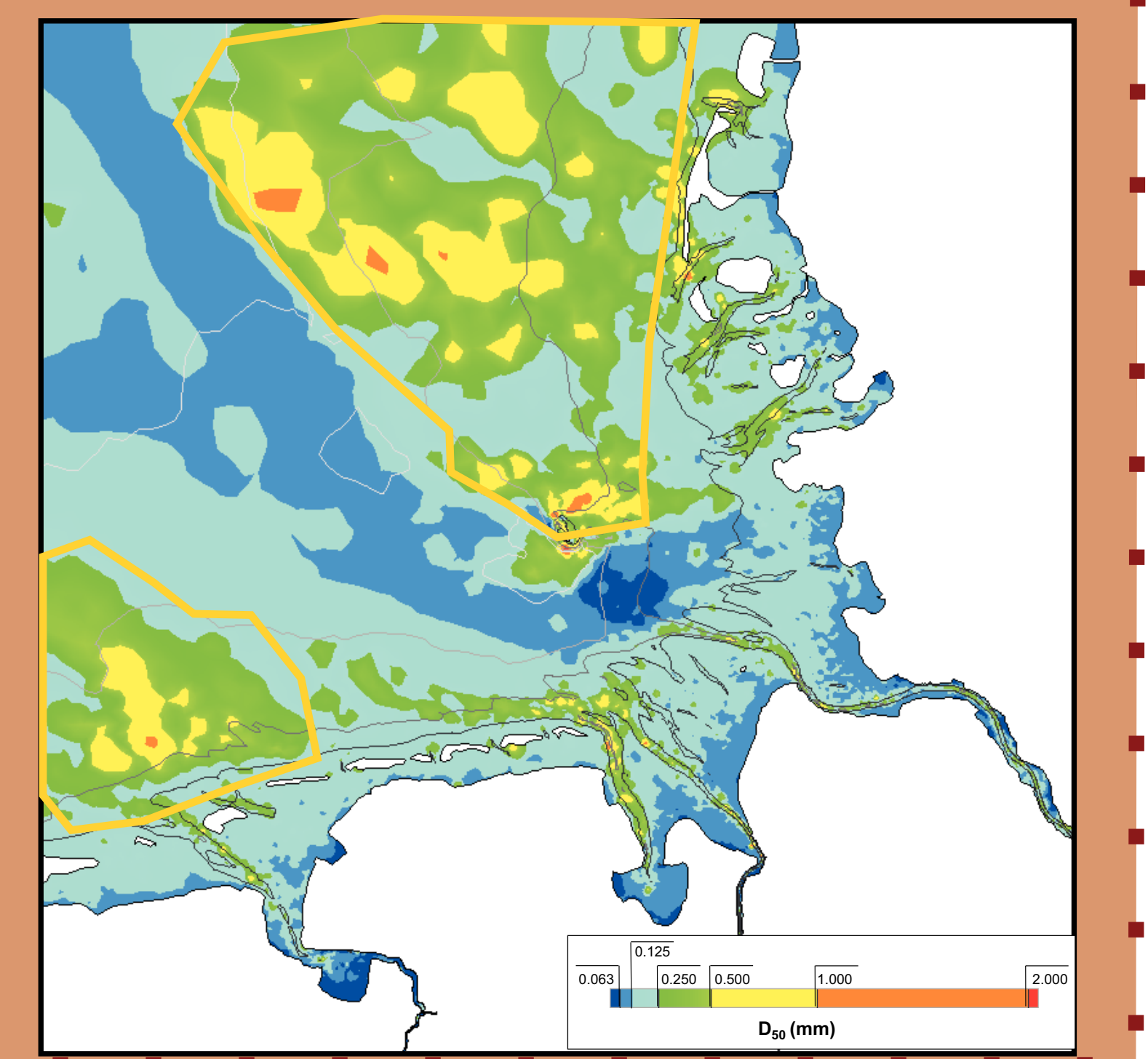
Boundary Conditions
time variable:
tides (\Rightarrow tidal constituents)
external surge
river discharge + spm
cliff erosion
wind (forecast) + pressure
time constant:
bottom friction derived
- seabed sediments
- ripples

Seabed Model

Separate bathymetries for every simulation year



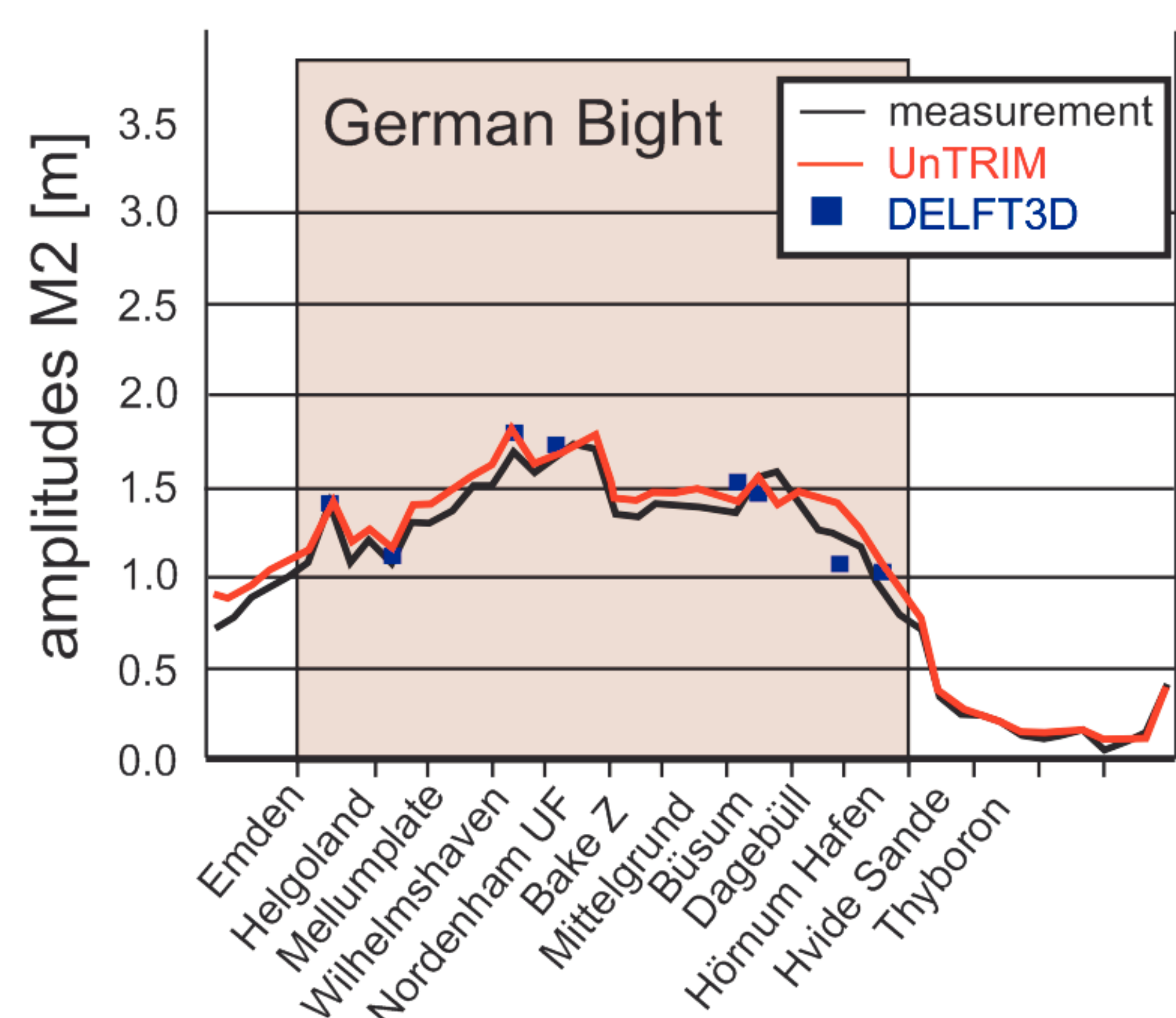
Sediment distribution/mixture



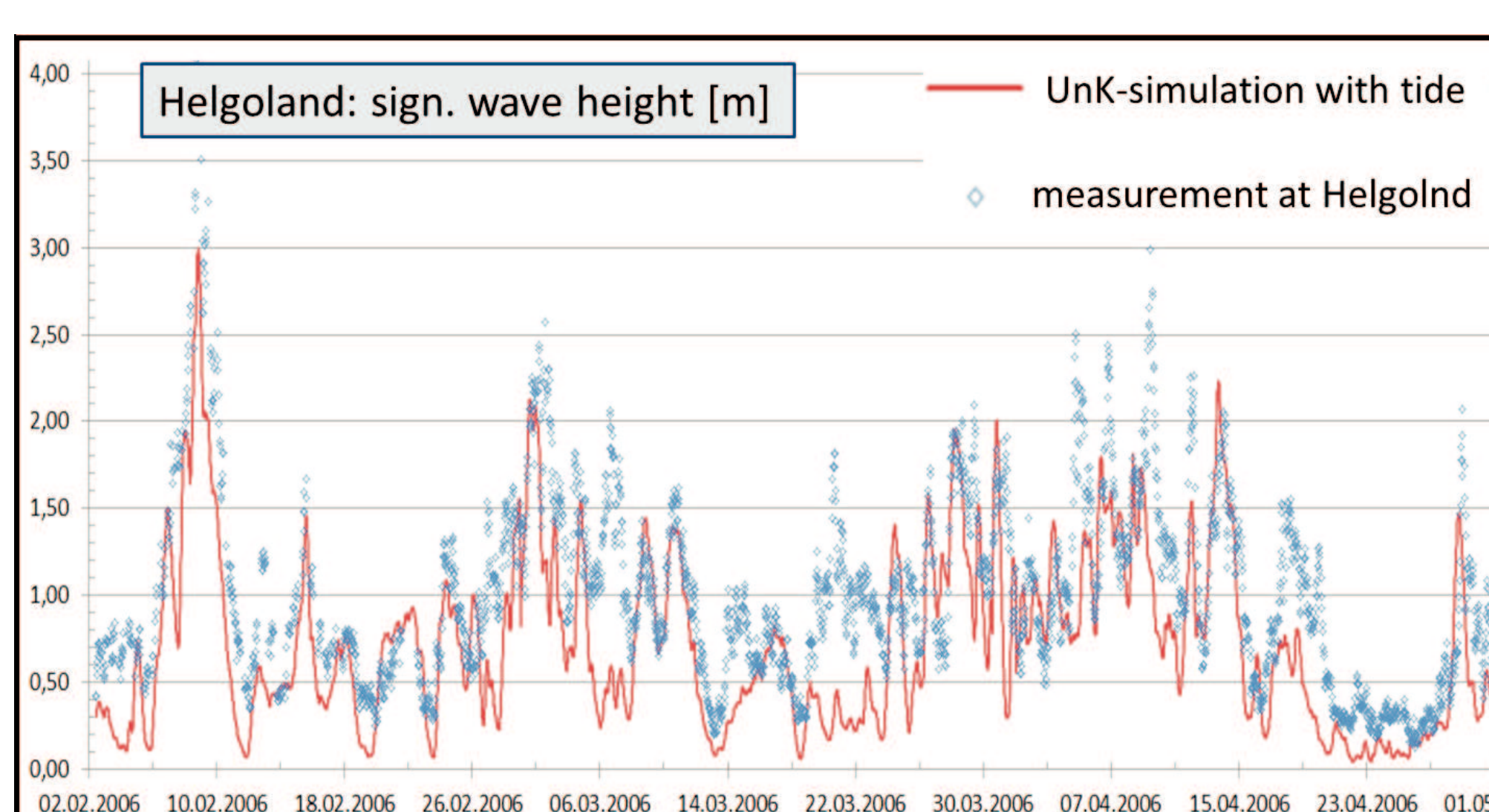
Validation / Calibration

Simulation period: 1996-2007

Calculated water level (M2-partial tide) vs measurements around the German Bight

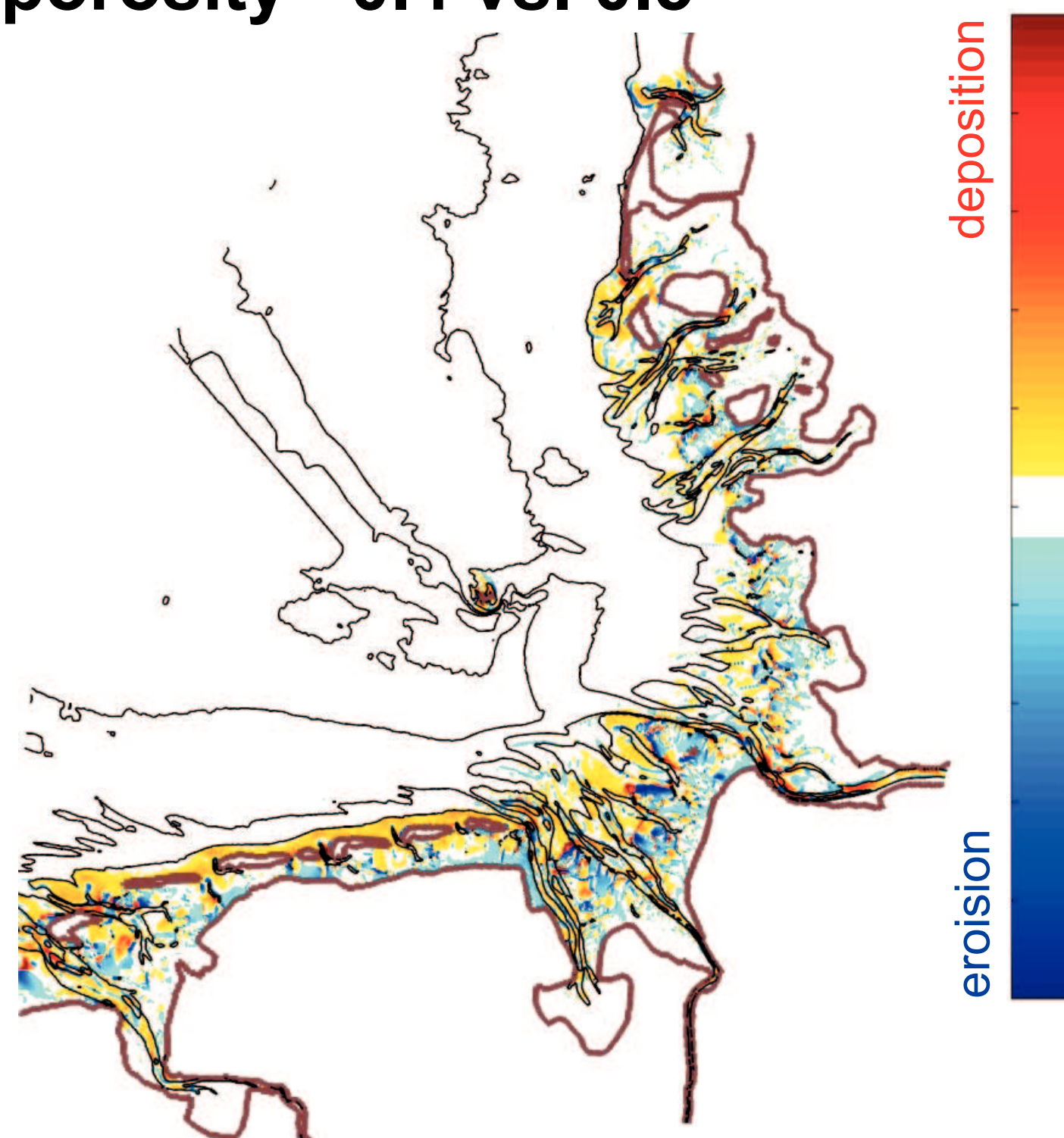


Wave: measurement vs. calculation

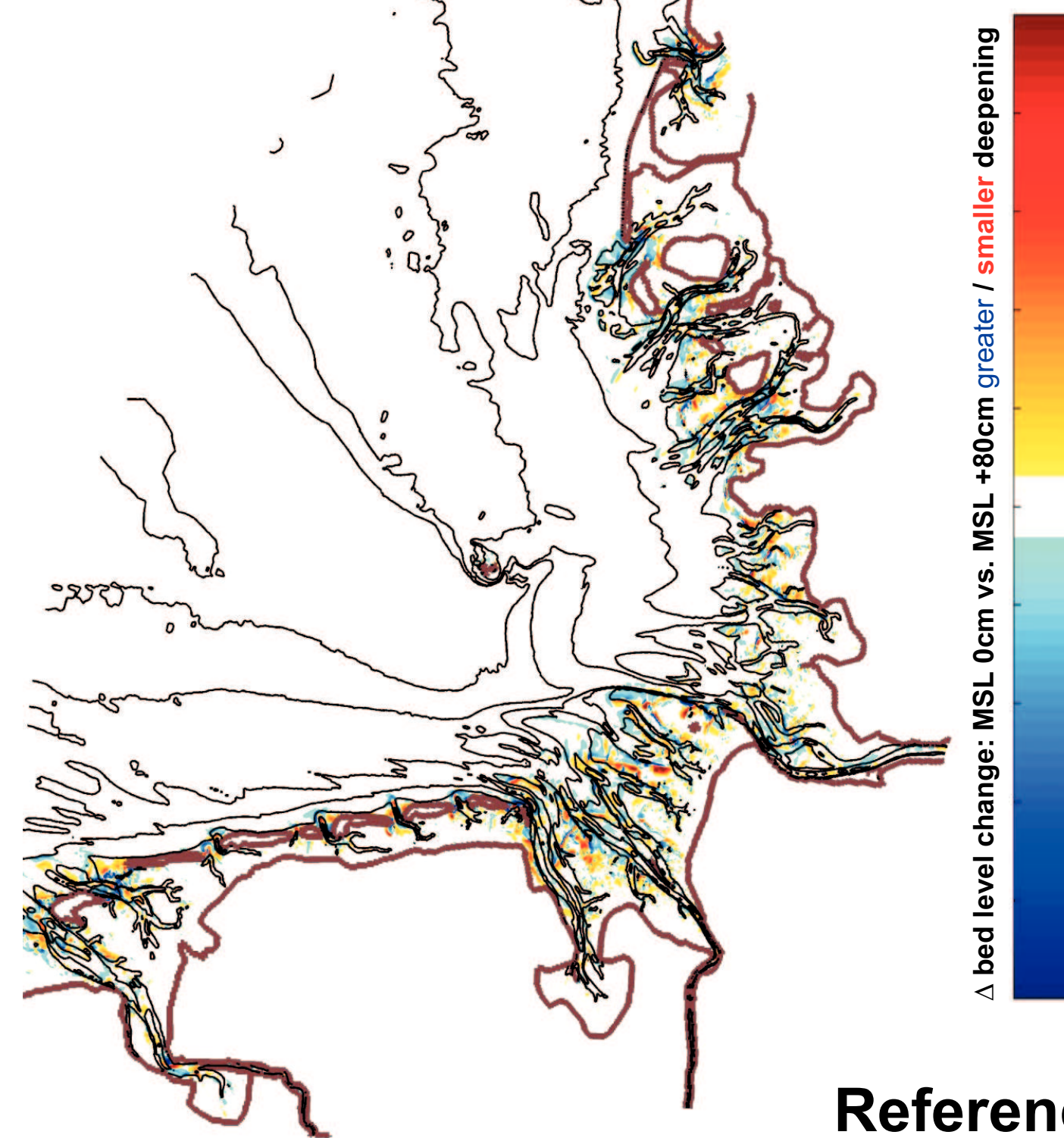


Results / Effects

Difference bed level change porosity= 0.4 vs. 0.5

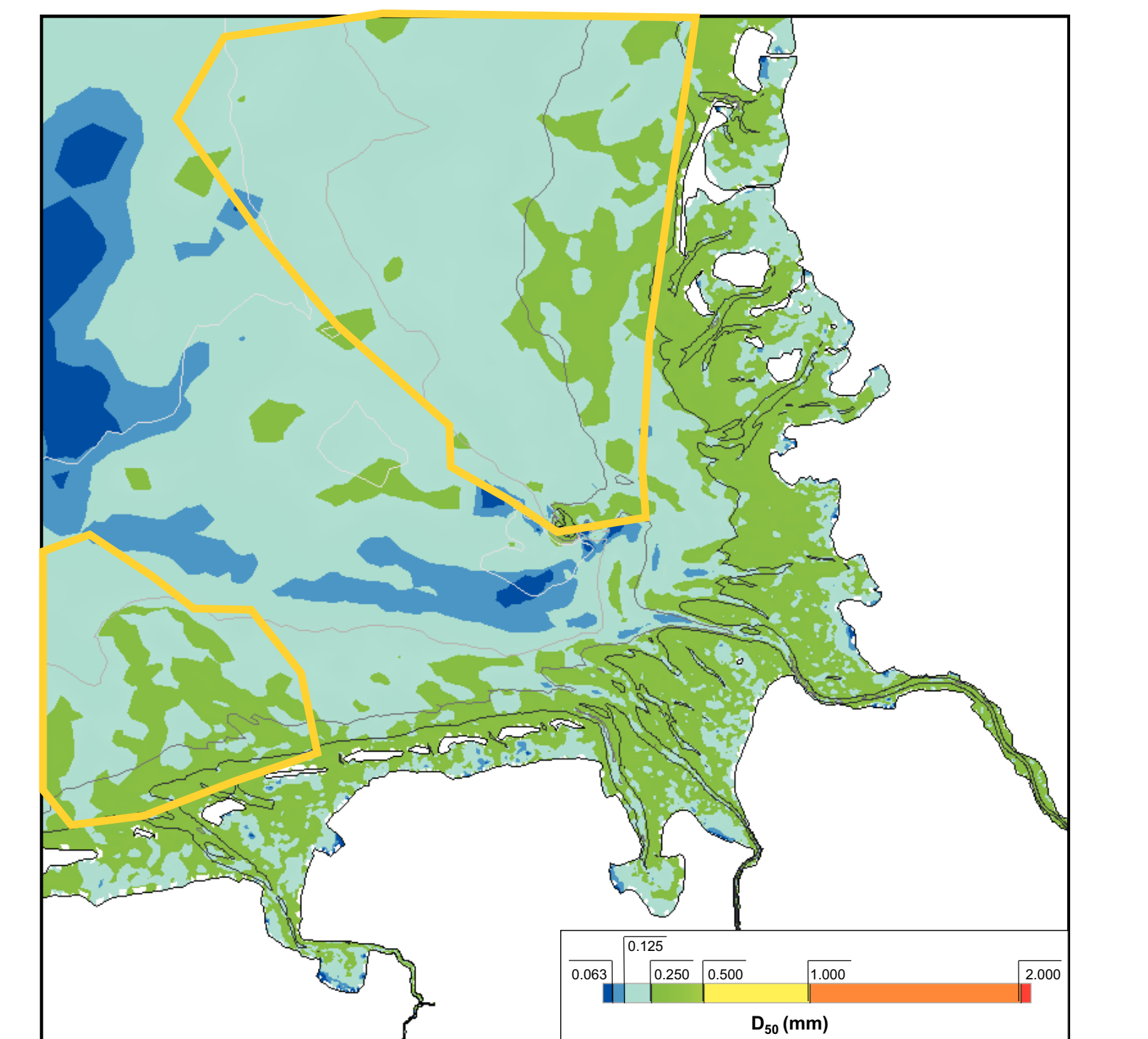


Difference bed level change: MSL 0cm vs. MSL +80cm



pleistocene sand areas not calculated here

calculated sediment distribution



Conclusion:

- \rightarrow set-up 2 MD-models for the entire German Bight
- \rightarrow consistent / verified sediment distribution / mixture
- \rightarrow bathymetry analysis for every simulation year
- \rightarrow simulation of tides, waves and transport for 12 years
- \rightarrow parameter studies MSL, porosity
- \rightarrow data-set for further simulations / analysis
- \rightarrow boundary conditions for detailed models

References

Casulli and Zanolli (2002). V. Casulli and P. Zanolli. Semi-Implicit Numerical Modelling of Non-Hydrostatic Free-surface Flows for Environmental Problems. Mathematical and Computer Modelling, 36:1131-1149, 2002.
Plüß (2003). A. Plüß.: Das Nordseemodell der Bundesanstalt für Wasserbau, Dienststelle Hamburg. Die Küste, Heft 67, 2003, ISBN 3-8042-1058-9, pp 83-128

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