

Towards regional coupled climate modelling at BSH

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Introduction



Project:

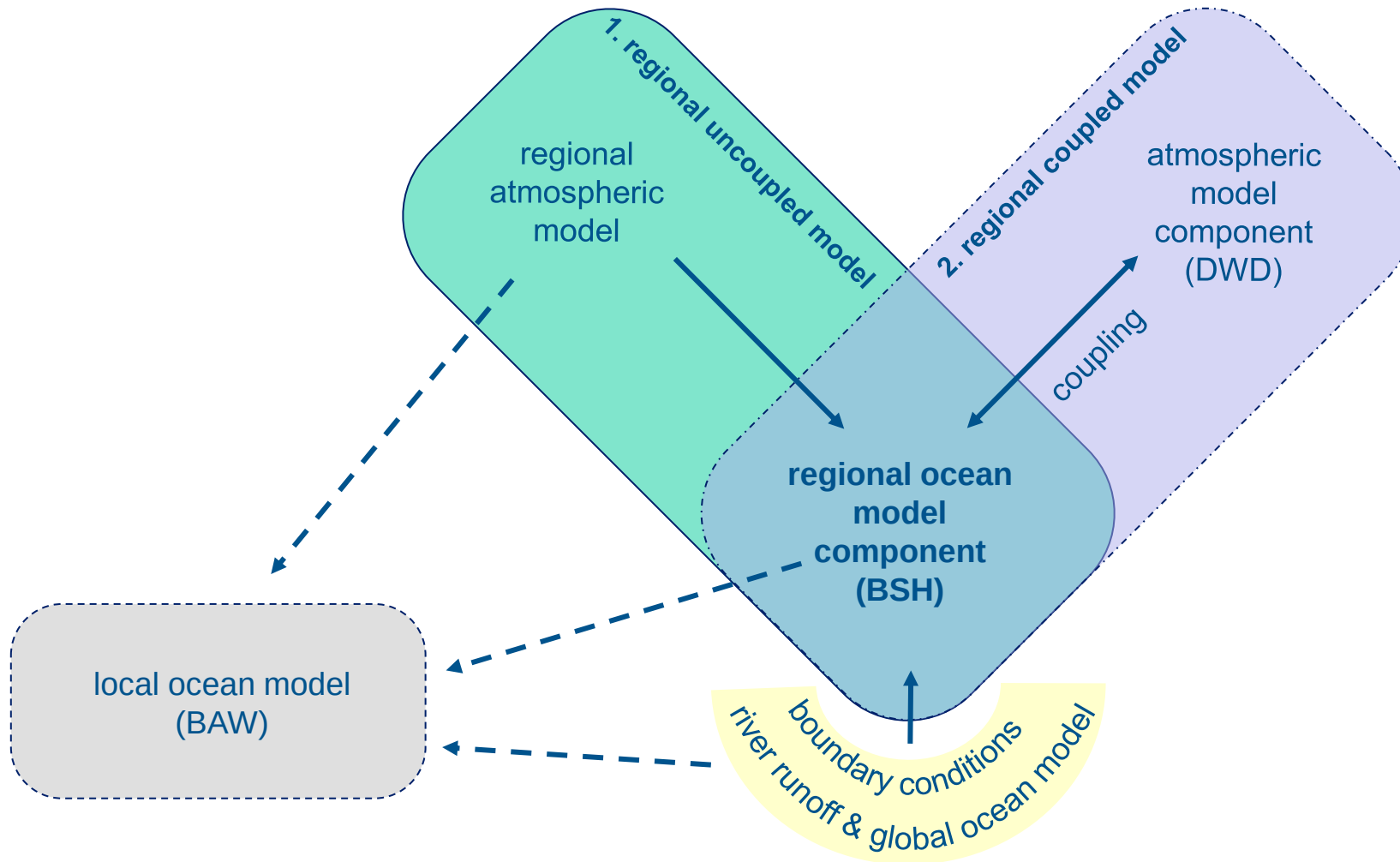
- ProWaS: „Projection Service for Waterways and Shipping“
- Pilot study as part of the „German Strategy for Adaption to Climate Change“ (DAS)
- participation of four German Federal Agencies
- establishment of an operational forecasting and projection service for climate, extreme weather and coastal and inland waterbodies



BSH tasks:

- selection and preparation of the ocean component for an operational coupled climate model
- carry out case studies and scenario runs
- prepare preliminary assessments concerning the impact of global climate change on German coastal regions

ProWaS model system



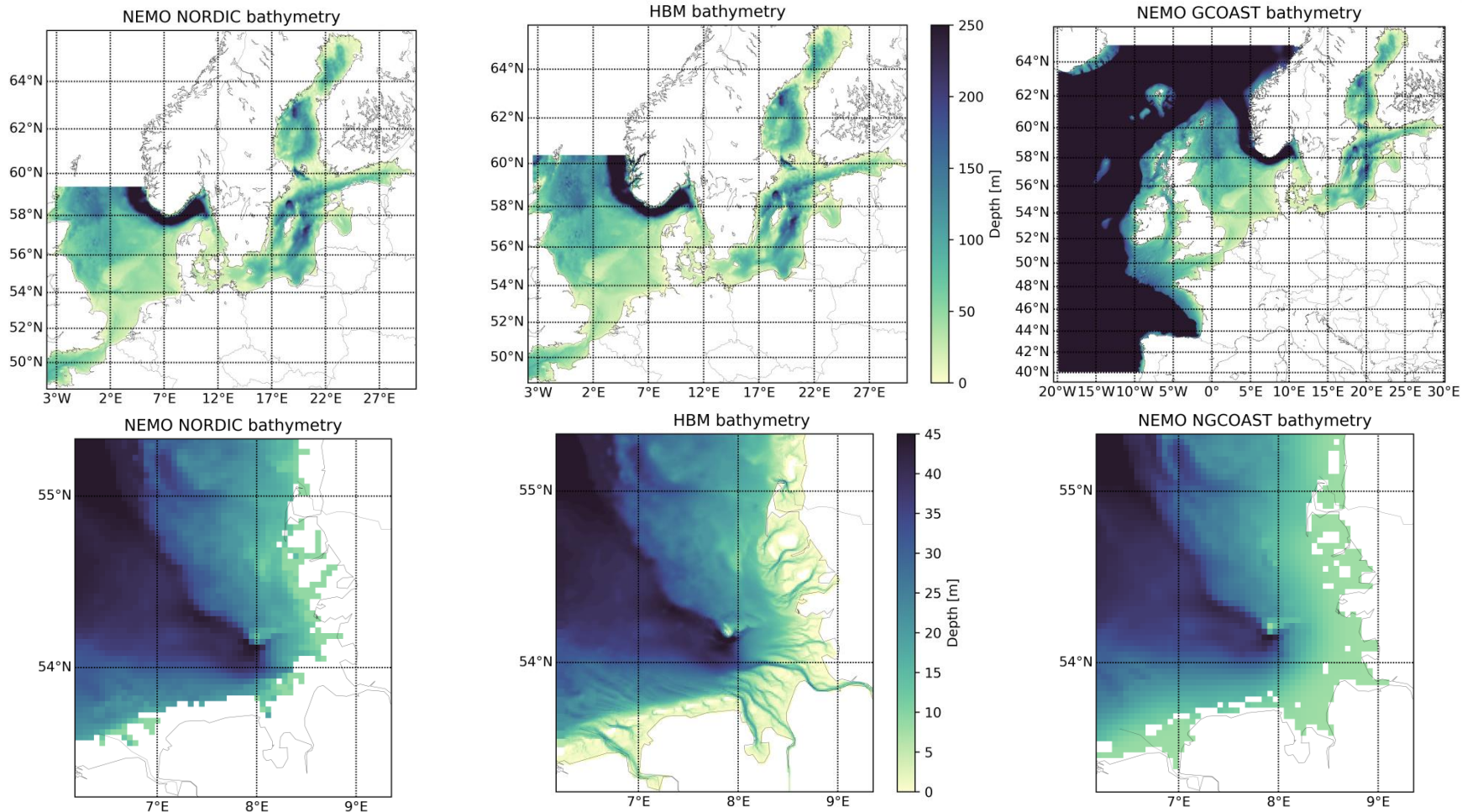
regional ocean models

comparison of applied regional ocean models

	NEMO Nordic v3.3	HIROMB- BOOS model (HBM)	NEMO GCOAST v3.6
nesting	no	yes	no
horizontal resolution	2 sm	3 sm / 0.5 sm	2 sm
# layer	56	36 / 25	51
vertical coordinates	z	z	σ
sea ice module	LIM3	model intern	LIM3
wetting and drying	no	yes	no
minimum water depth	10 m	-	8 m

regional ocean models

comparison of used model bathymetries



hindcast simulation

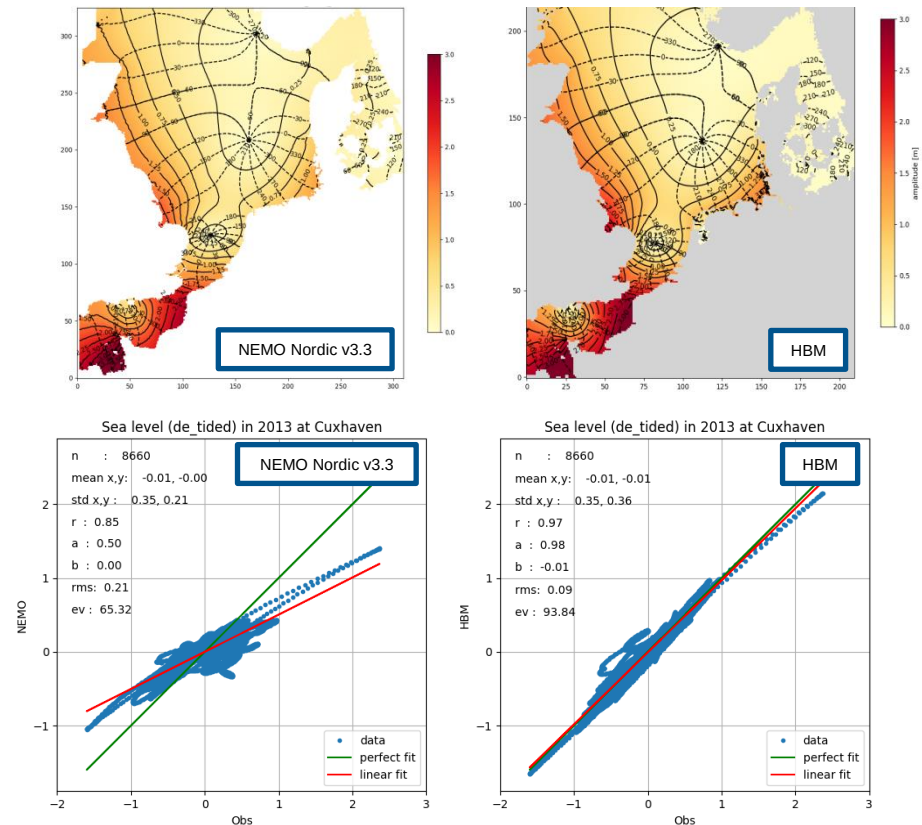
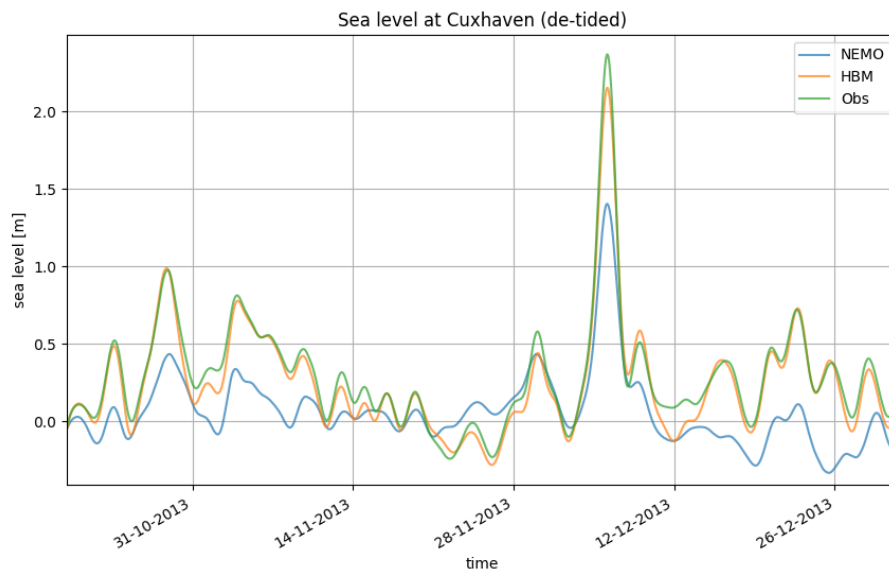
comparison of forcings for regional ocean models

	NEMO Nordic v3.3	HIROMB-BOOS model (HBM)	NEMO GCOAST v3.6
atmospheric forcing	COSMO-REA6	COSMO-REA6	COSMO-REA6
river runoff	E-HYPE (corrected)	climatology	E-HYPE (corrected)
tides	OSU Tidal Inversion Software	based on observations	OSU Tidal Inversion Software
boundary conditions	monthly (T,S,SSH, U,V)	15 min (SSH,U,V) climatology (T,S)	daily (T,S,SSH, U,V)
model run	06/1996- 12/2015	06/1996-12/2015	06/1996-12/2015

model validation and comparison

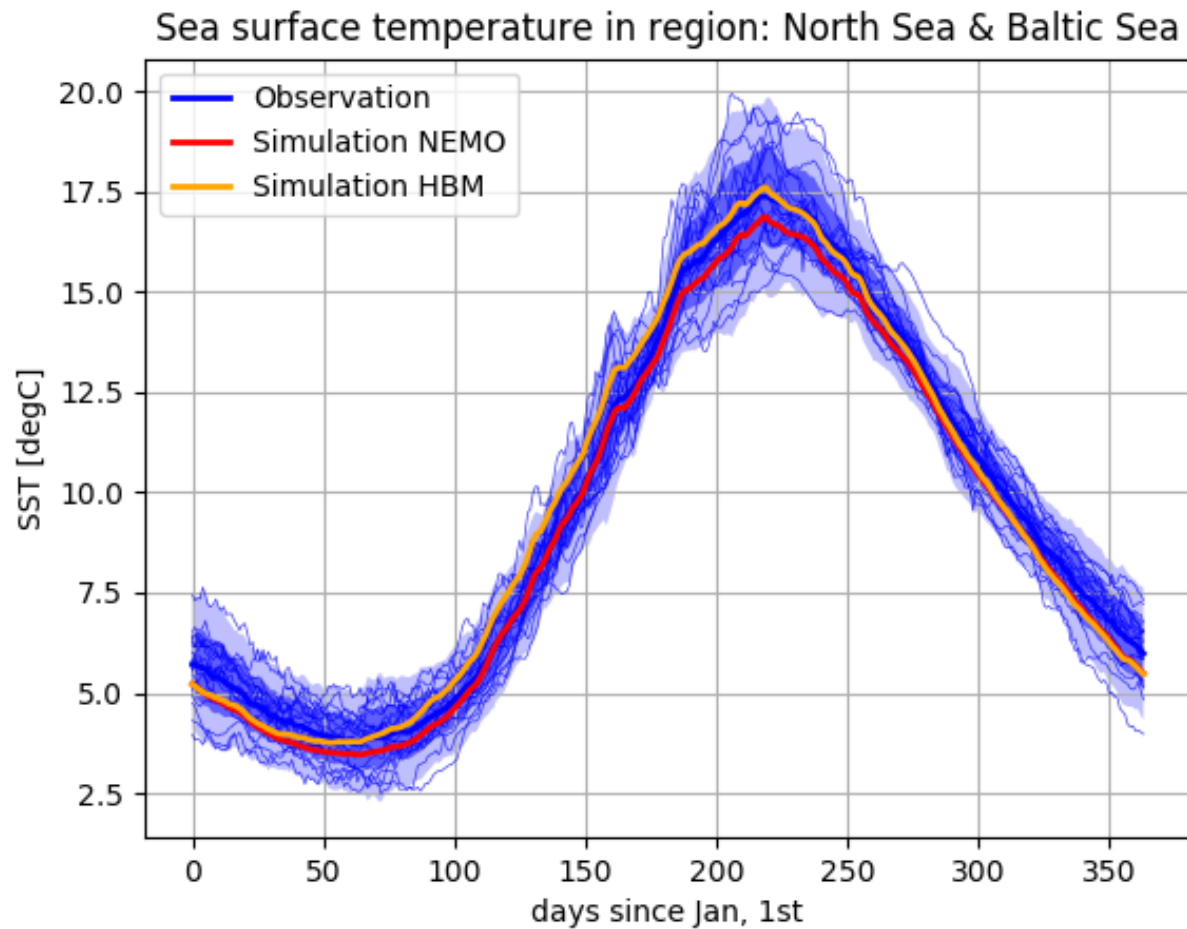
sea level validation

- proper reproduction of M2 tide
- HBM shows higher correlations with observations compared to NEMO Nordic v3.3 due to:
 - minimum water depth (10m) in NEMO Nordic v3.3 (no wetting&drying scheme available)
 - differences in bathymetry and coastline
 - different boundary conditions



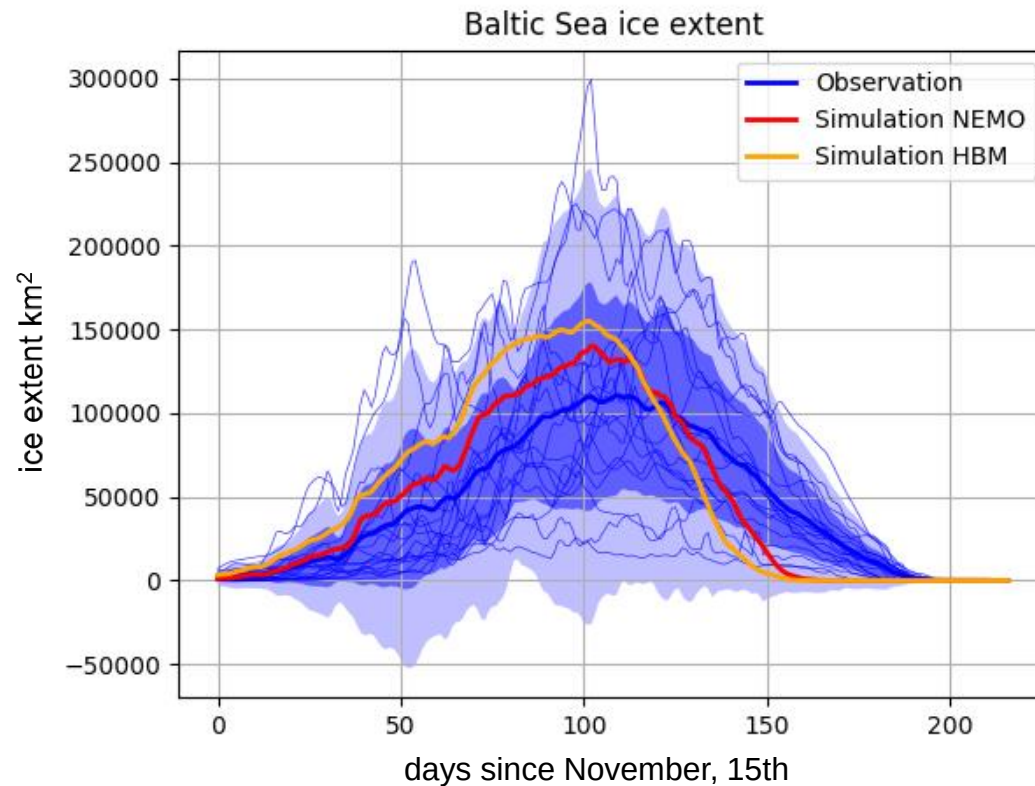
model validation and comparison

sea surface temperature (SST)



model validation and comparison

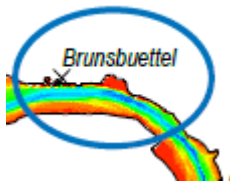
sea ice extent 06/1996 – 12/2015



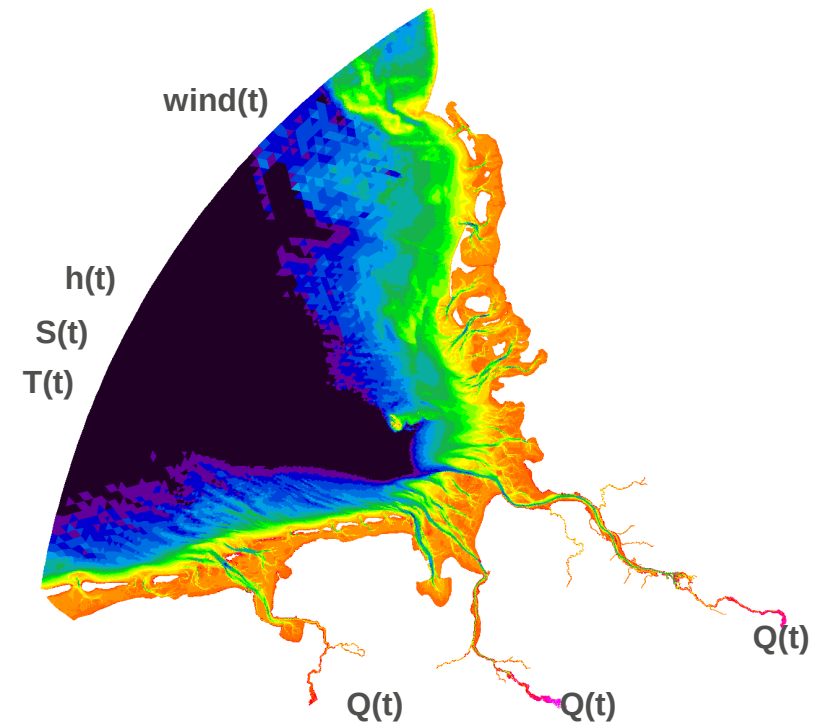
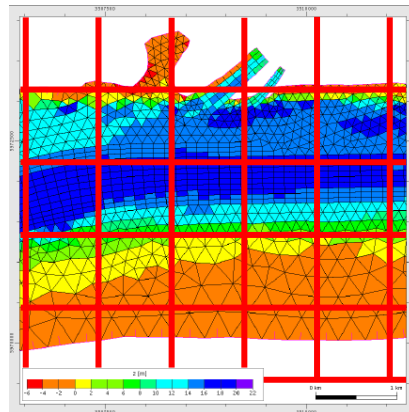
BAW local model

downstream module in model chain

- UnTRIM² model of German Bight and estuaries (Elbe, Weser, Ems)
- wind: COSMO-REA6
- sea level, temperature and salinity: model results from NEMO / HBM
- running at Federal Waterways Engineering and Research Institute (BAW)



comparison
resolution regional
and local model



discussion on model choice

	present		future
	NEMO Nordic v3.3	HIROMB- BOOS Model	NEMO GCOAST v4.0
nesting			
coastline resolution			
wetting and drying			
minimum water depth			
coupling			
data handling (boundary conditions)			
further model development			

general discussion:

- model resolution for local effects
- which resolution is sufficient for which region?

model discussion:

- HBM delivers better results than NEMO Nordic v3.3 due to an advantageous setup for regional modelling
- model handling in NEMO is functional and model is under permanent active development

model choice:

improvement of NEMO GCOAST v3.6 setup through HBM (setup) advantages

- **operational downscaling of IPCC (CMIP 5, 6, ...) scenarios for the German coast**
- **delivery of tailored results for different groups of customers**
 - sea level rise
 - changes in water temperature and salinity
 - extreme events (e.g. storm surge)
 - sea ice
- **steps of implementation**
 - study the impact of model resolution for different issues: which resolution is sufficient for which issue
 - comparison of uncoupled ocean model results to coupled model setup
 - comparison of regional ocean model with local model including estuaries
 - refinement of boundary data, e.g. river inflow data

Thank you very much!



Questions?