Institute of Coastal Research

Research Unit 1 System Analysis and Modelling

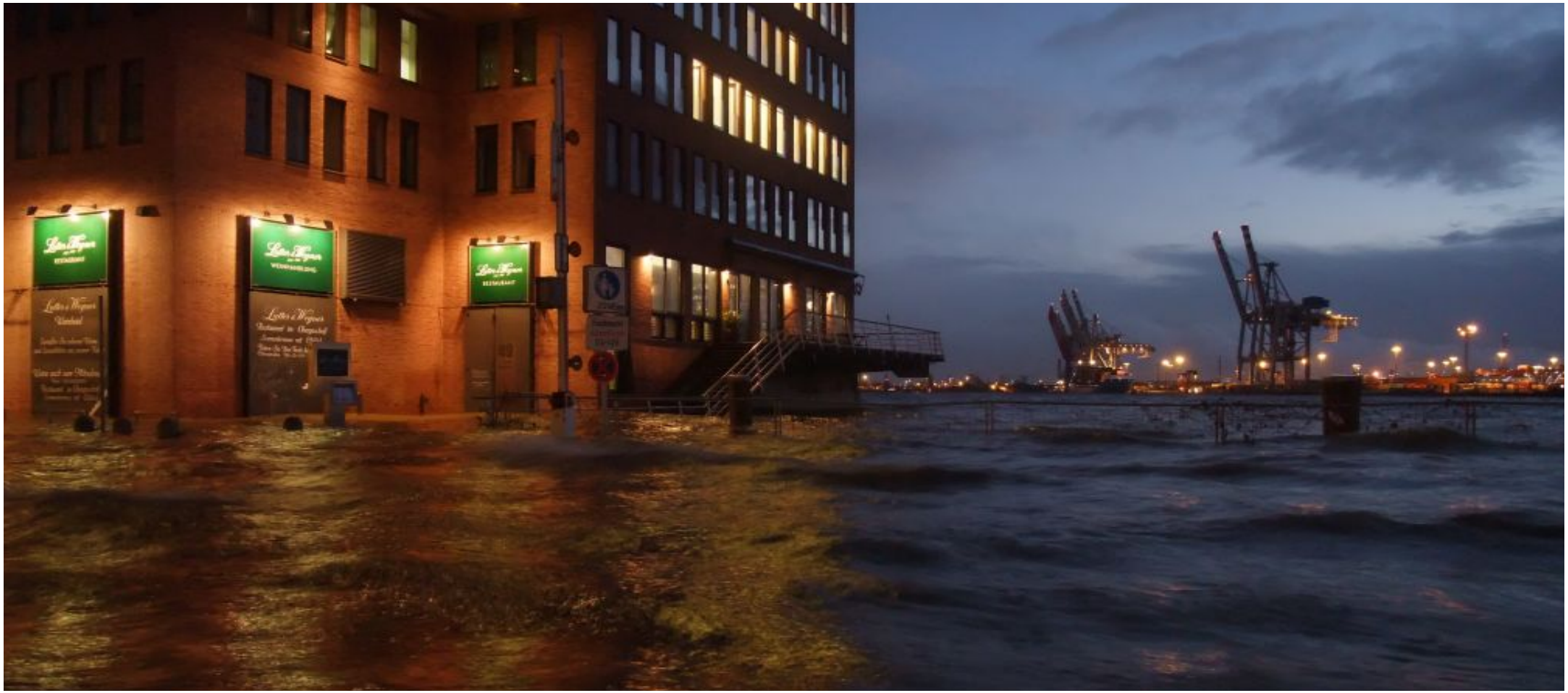
RU 1

Helmholtz-Zentrum Geesthacht

Centre for Materials and Coastal Research

Overview and Highlights

Prof. Corinna Schrum

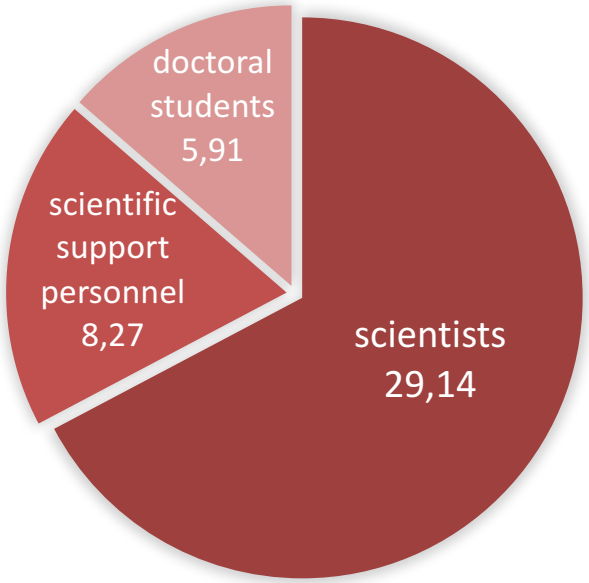


The Research Unit in numbers

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

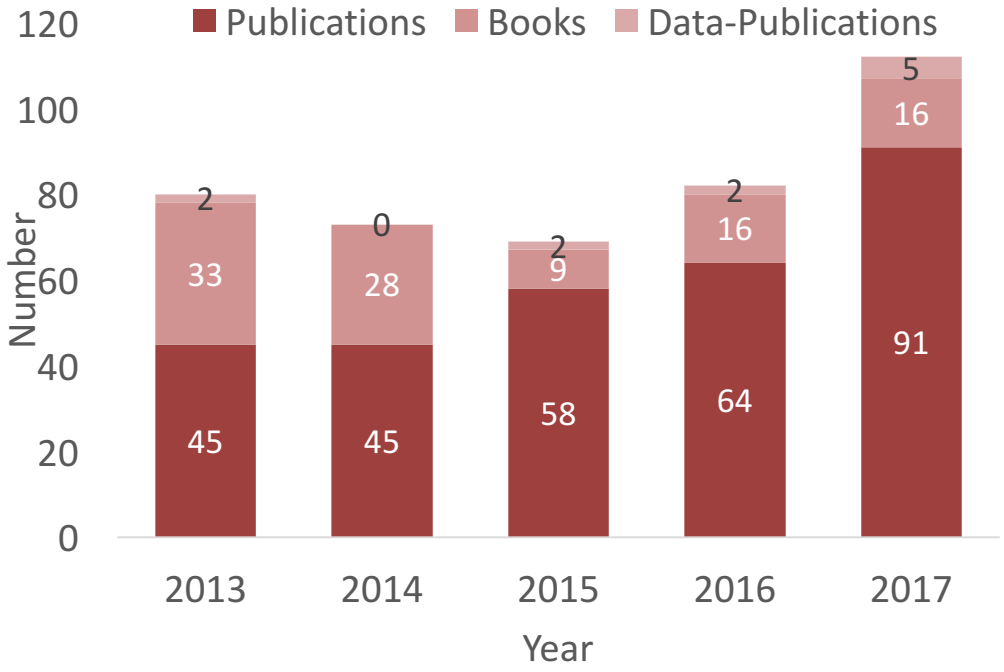
2016 Personnel – core funded/ FTE

about 70% Topic 2 (31), 30% Topic 4 (12)



Currently 12 doctoral students
PhD theses completed 2013-2017 38

Publications



2013-2017

Publications ISI or SCOPUS listed	303
Books & chapters	102
Data publications	11

Academic Partner

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG
C A U
Carl von Ossietzky universität Oldenburg

Research Goals and Objectives

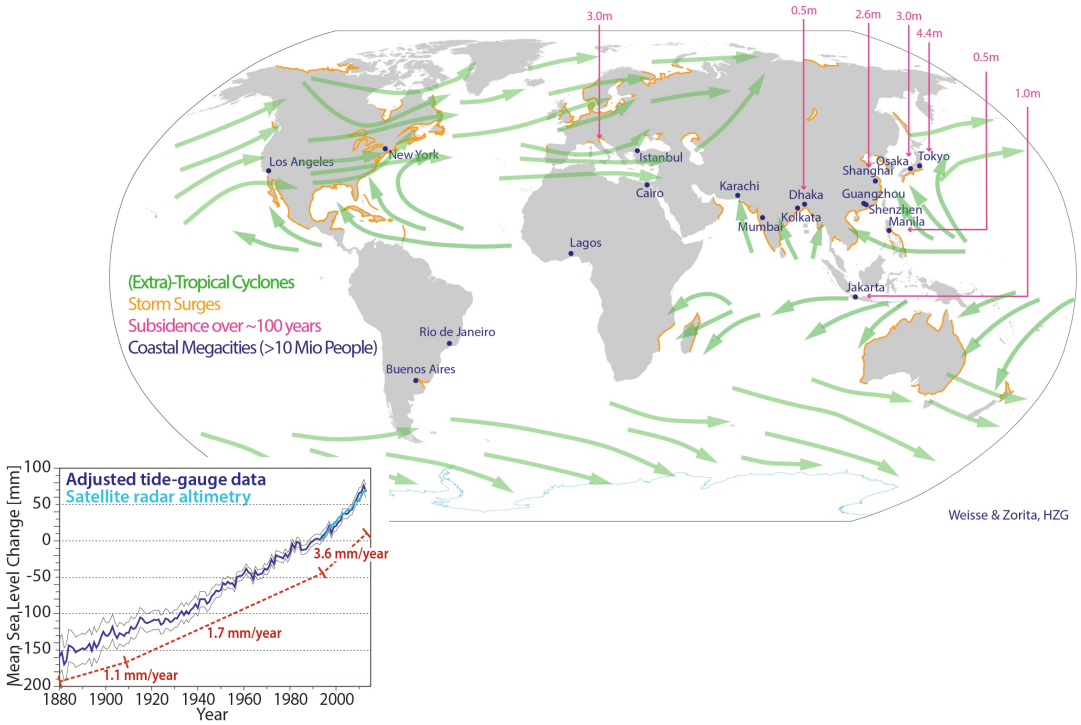
Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

- Understanding longterm changes and variability of coastal systems *atmosphere, coastal ocean (shelf sea, estuaries, inter-tidal) and human system*
- Advancement of coastal modeling capacity to address *new exciting research questions, to understand system functioning* and to *serve societal demands*
- Transfer of knowledge: foster *implementation* of tools and models, provide *knowledge* to society, maintain *stakeholder dialog*

Longterm changes and variability

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

Wind, storm and sea level changes in different parts of the world



- observation-based *consistent* datasets and observation-related model datasets -*reconstructions*
- sea level > 40 publications & 10 book chapters
- wind & storms ≈ 40 publications

Topic 2

Longterm changes and variability

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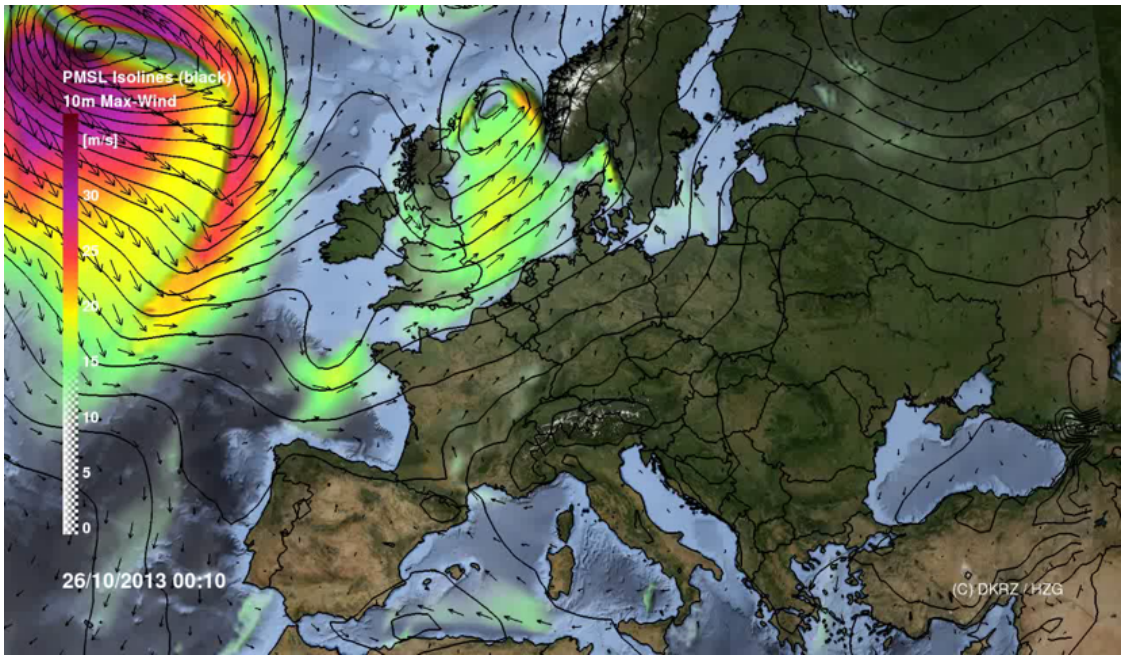
Wind, storm and sea level changes in different parts of the world



Wind and storm changes

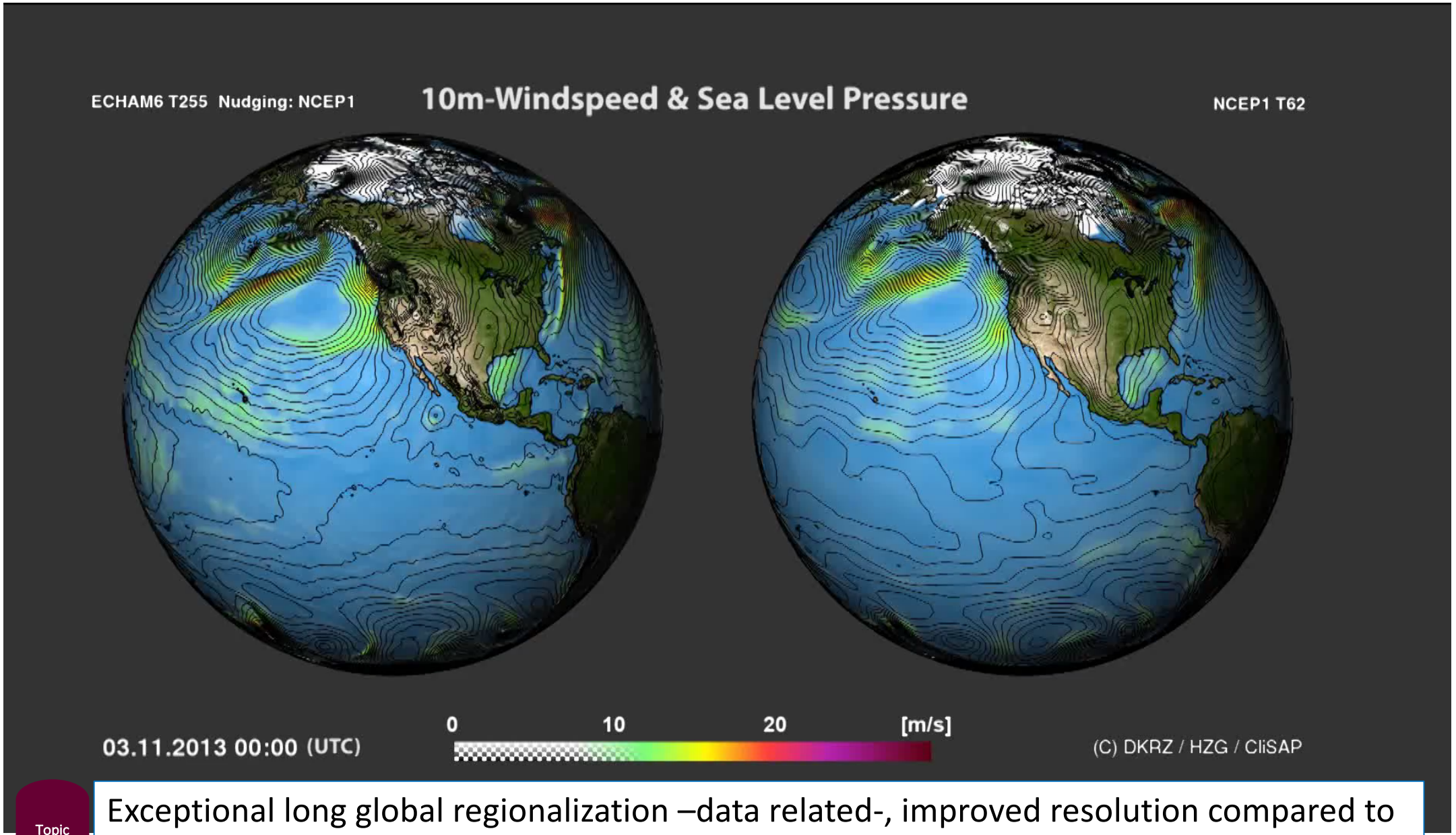
- High resolution regional 3-d atmospheric reconstructions created using downscaling and spectral nudging
- Reconstructions using observational data and statistical methods
- Global climate models

- Detection of multi-decadal natural variability of storm activity over NW-Europe
- Observed wind trends still compatible with natural variability

Topic 2

Feser, F., M. Barcikowska, O. Krueger, F. Schenk, R. Weisse, L. Xia, 2015: Q. J. R. Meteorol. Soc.;
Gagen M, Zorita E, McCarroll, Zahn M, et al. 2016. Nature Geoscience

Global Model reconstruction 1948-2015 - Taifun Yolanda/Haiyan



Topic 2

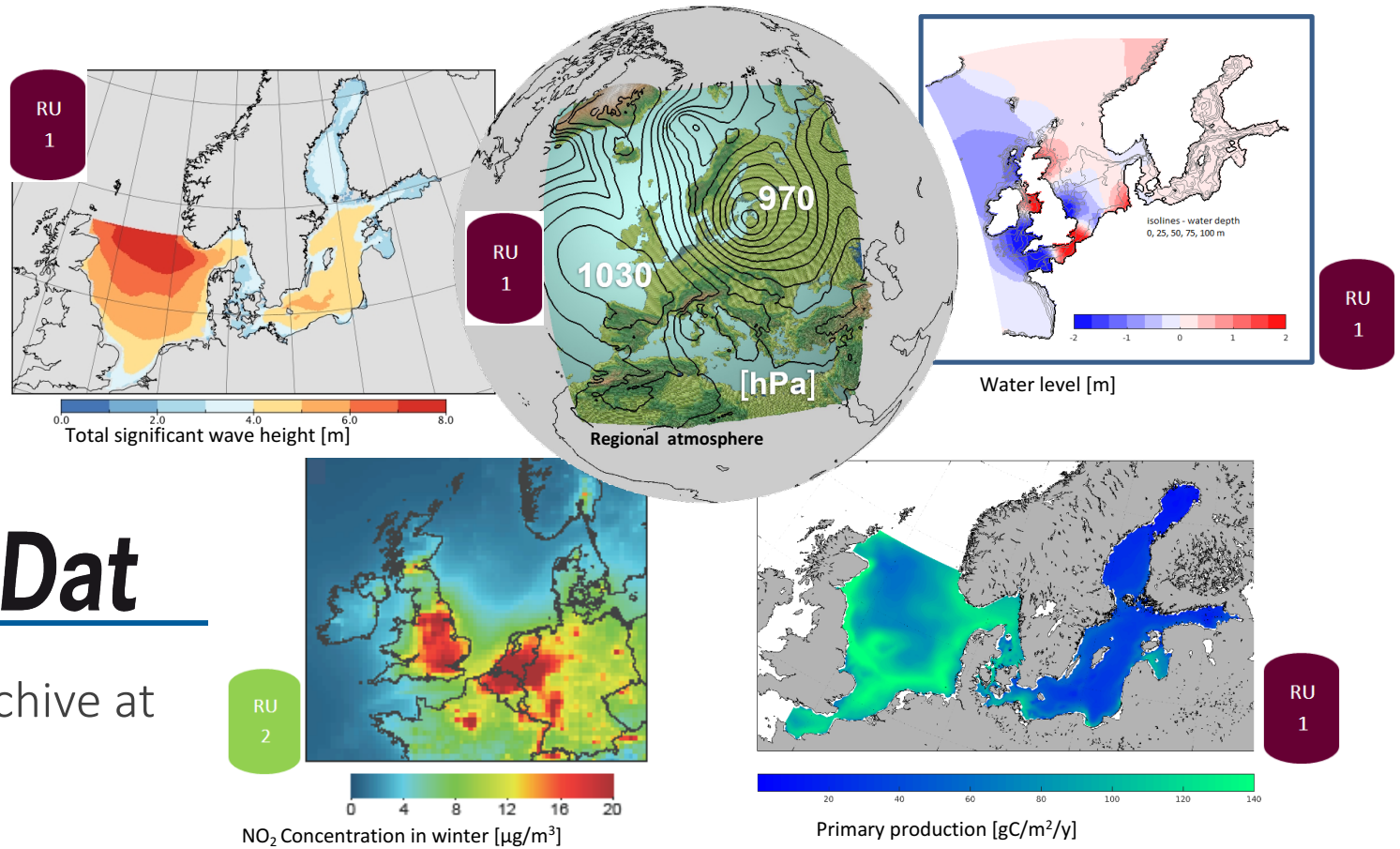
Exceptional long global regionalization –data related-, improved resolution compared to global reanalysis (-comparable to JRA55), significant better temporal resolution

Schubert-Frisius, M., F. Feser, H. von Storch, and S. Rast, 2017, Monthly Weather Review

Regional reconstructions and scenarios

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

4-d model based data, open access



coastDat

WDC climate data archive at DKRZ, 86 TB data

Topic 2+4

Broad implementation of our research data: > 100 users from research (45%), commercial entities (40%) and public authorities (15%)

Low frequency variability in marine ecosystems

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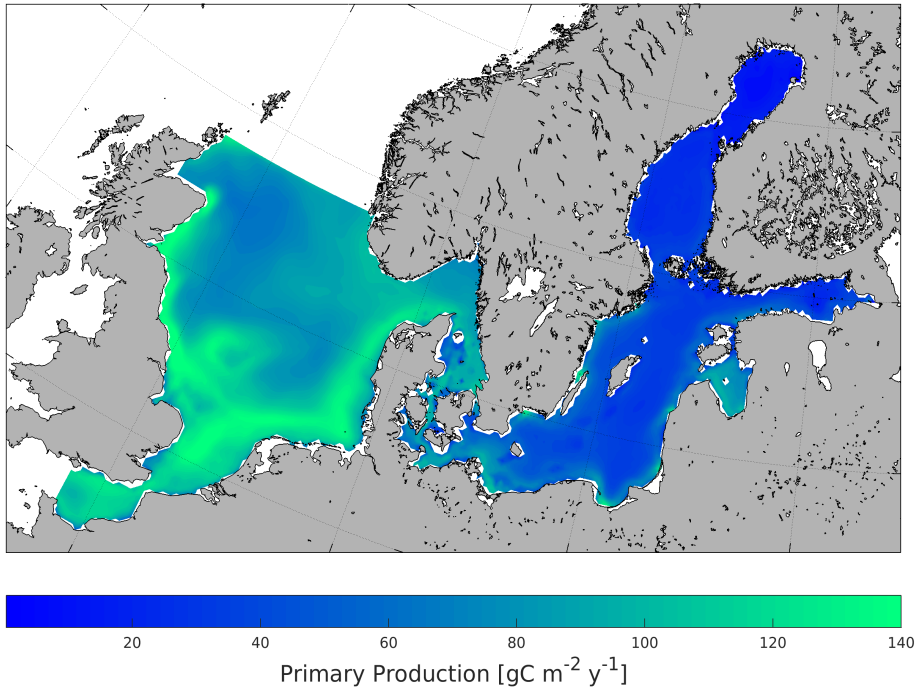
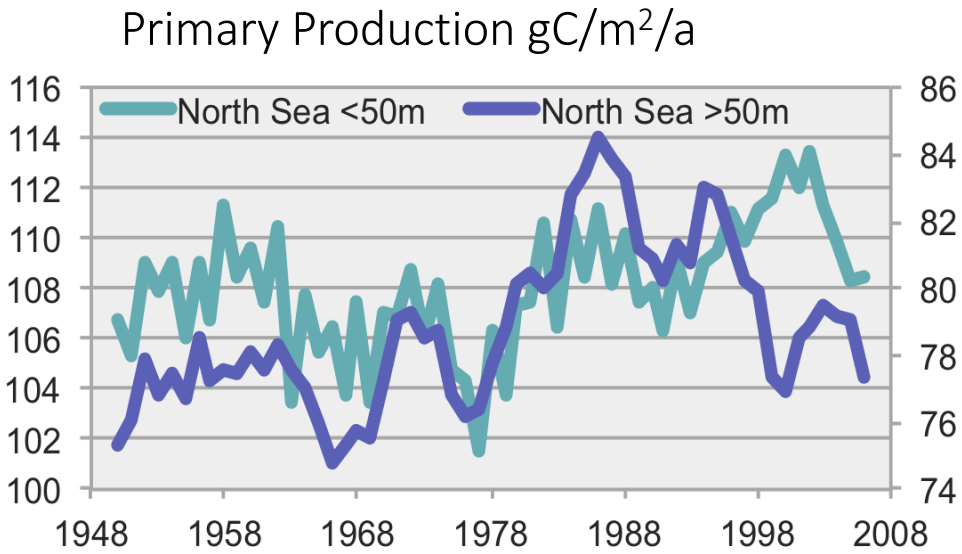
Multi-decadal reconstruction, data and model based





Novel understanding: Decadal and multi-decadal primary production changes forced by changes in wind forcing

Topic 2

Daewel, U and Schrum, C 2017. Earth Syst. Dynam.

Regional reconstructions and scenarios

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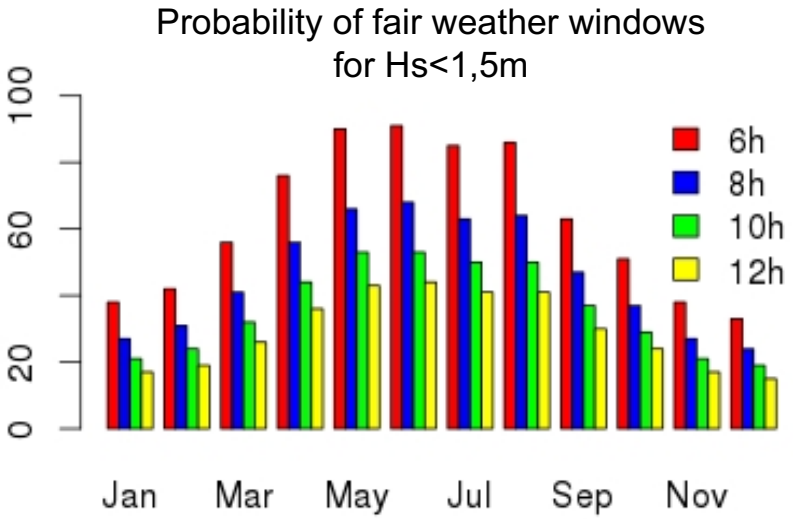
Offshore wind energy & industrial applications

- ***assess potential and variability*** of renewable energy production
- ***optimize design and logistics,*** coastDat used for nearly all wind farms in the German EEZ



Linking basic and applied research: Multifaceted implementation, ***joint projects,*** commercial partners and federal agencies

Topic 2+4

Weisse et al., 2015; Li & Geyer, 2016; Geyer, Weisse et al., 2015

coastDat

Earth system modeling

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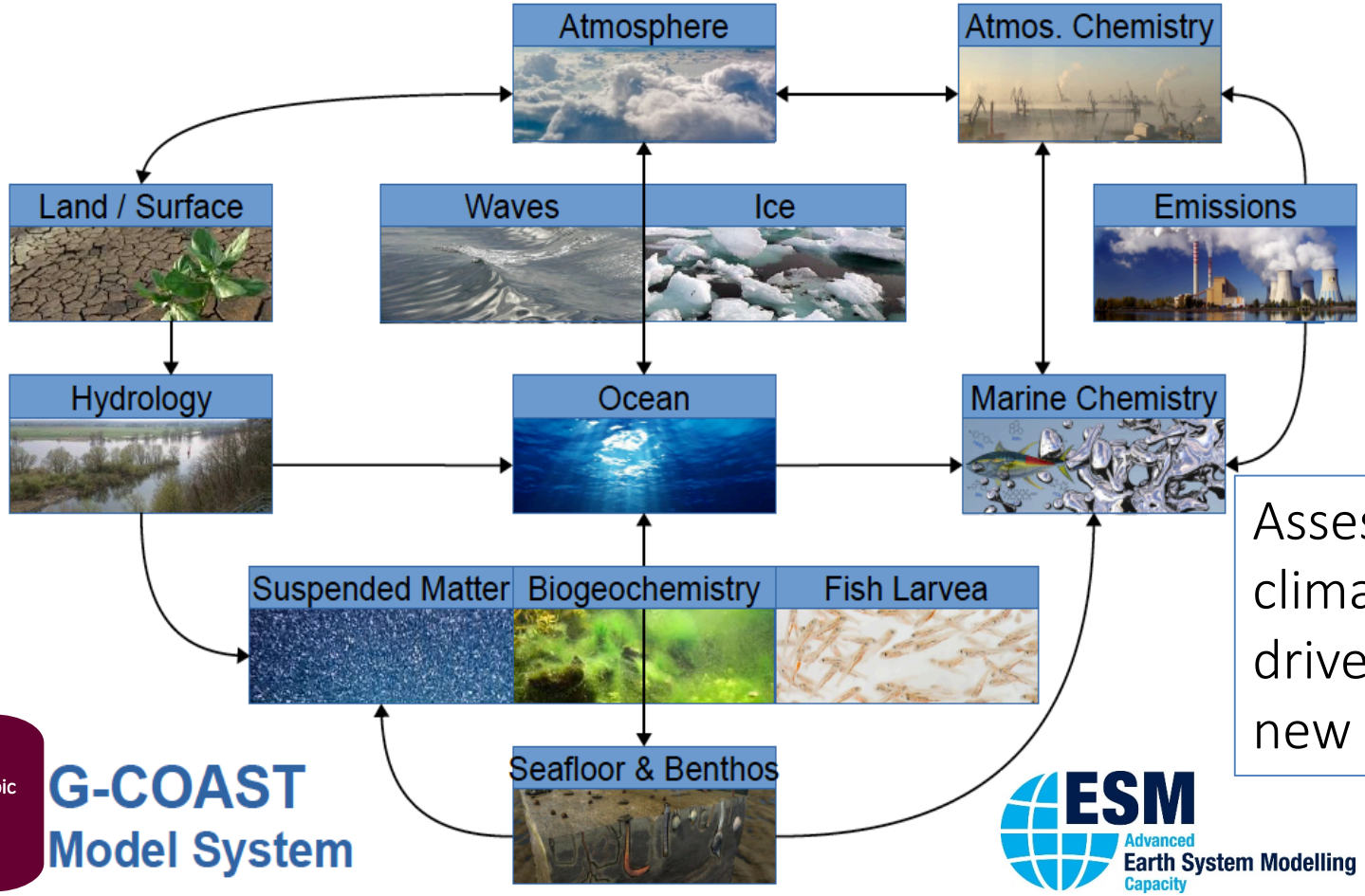
- *coastdat* models are uncoupled compartment models
- Matter and energy is exchange across compartments



Assessment of impacts of climate and anthropogenic drivers requires coupling and new model development

Topic 2

G-COAST Model System

ESM Advanced Earth System Modelling Capacity

RU 1 RU 2 RU 3

Integrated impact assessment advance coastal model capacity

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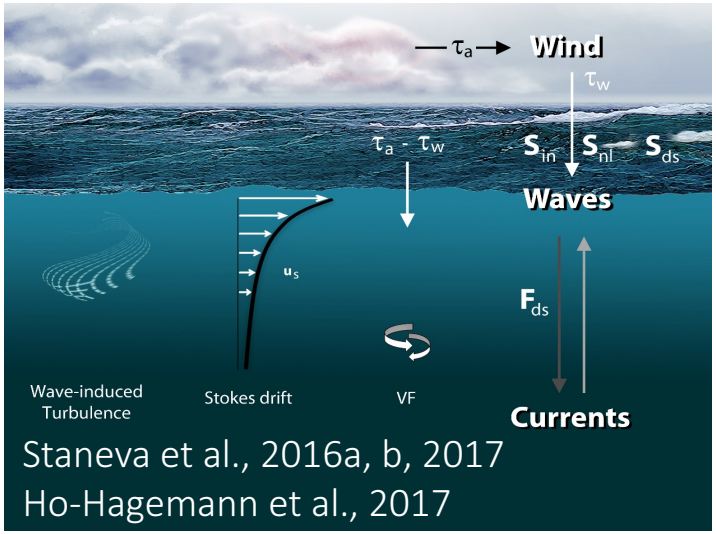
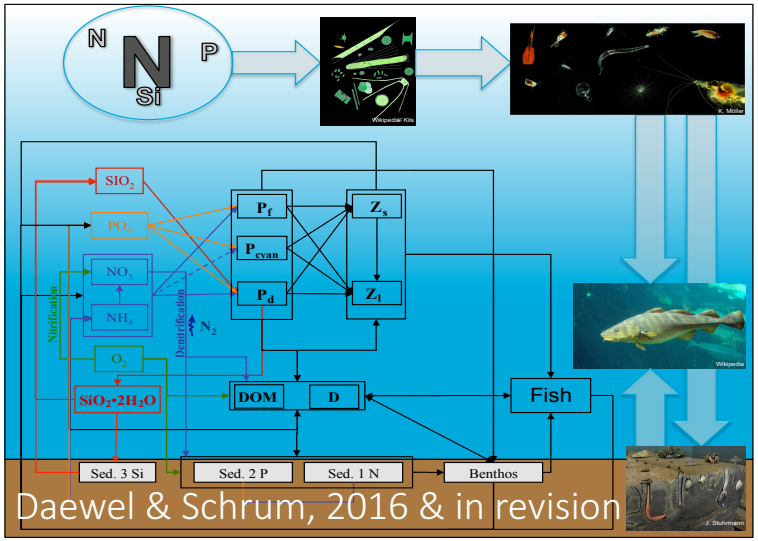
Coupling atmosphere-ocean



Staneva et al., 2016a, b, 2017
Ho-Hagemann et al., 2017

Foodweb E2E –fish, benthos



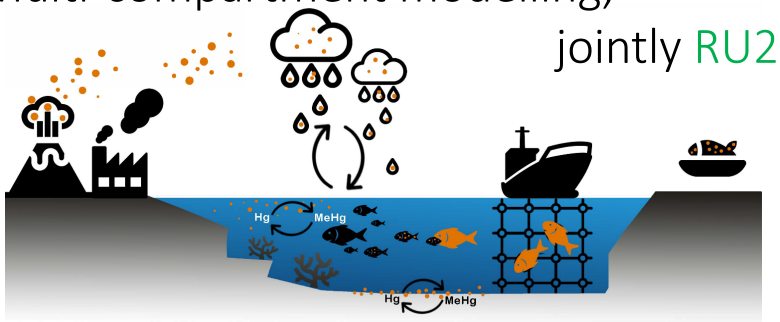
Daewel & Schrum, 2016 & in revision

Copernicus Marine and Environment Monitoring Service CMEMS

Phys-bio coupling at the seafloor

Zhang & Wirtz, 2017

Multi-compartment modelling, jointly RU2



MERCURY POLLUTION CYCLE

Bieser & Schrum, 2016 &2018

Topic 2

Integrated impact assessment advance coastal model capacity

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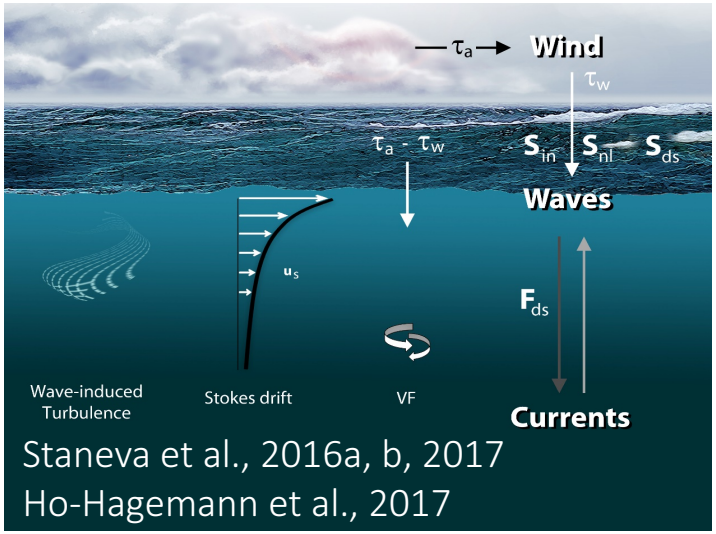
Centre for Materials and Coastal Research

Coupling atmosphere-ocean



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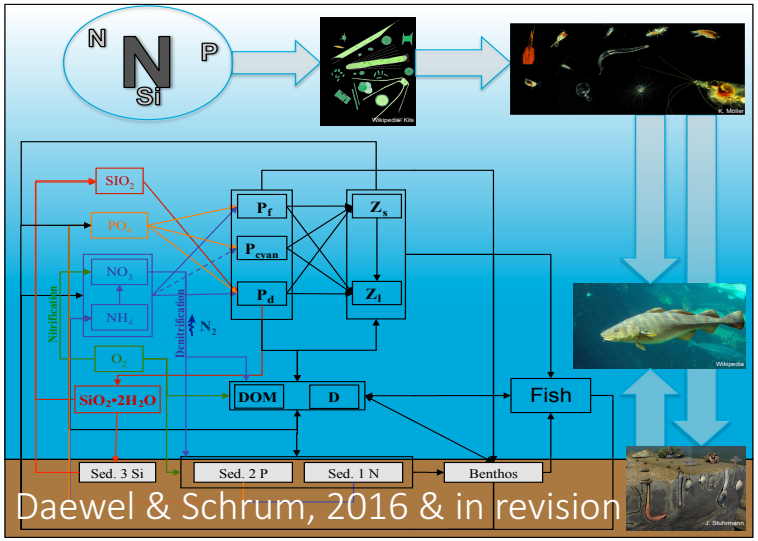

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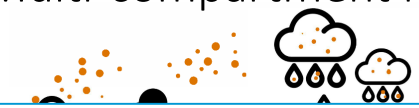

jointly RU2

Topic 2

Novel contributions to system understanding: *key coastal hydrodynamics*; *foodweb dynamics and benthic-pelagic coupling*; *resolving the role of shelf seas role in environmental mercury cycling.*

New model developments are already in implementation at international levels

Bieser & Schrum, 2016 &2018

Developments in the context of Operational Oceanography

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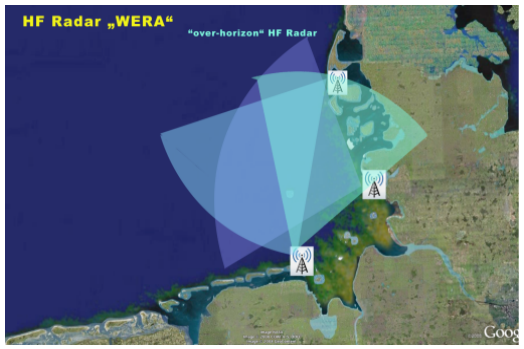
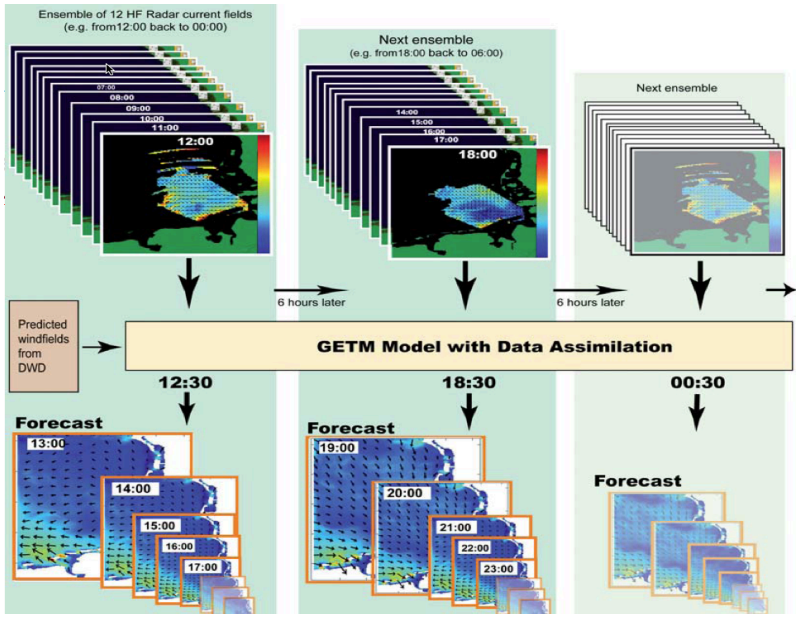
- COSYNA: Forecasting currents, assimilation of HF radar data- RU3
- Wave model development
- Pre-operational development of ocean physics and wave forecasting system for the Black Sea, CMEMS-MFC phase I & II





Wave model development at national and international leading levels, wide national and international implementation

Stanev et al., 2016, 2015

Topic 4

Unstructured grids - cross scale modeling

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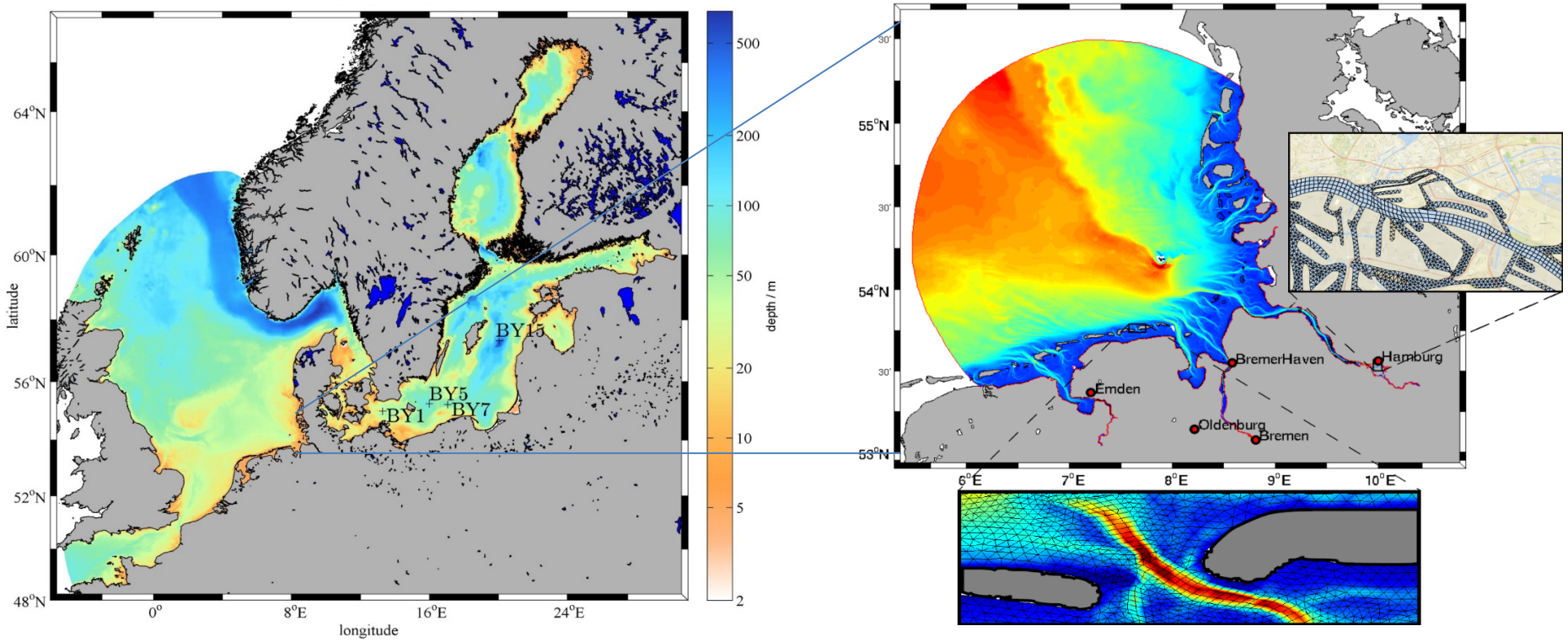

Resolves the land-ocean transition, narrow straits and belts, inter-tidal, estuaries and obstacles

Topic 2

Zhang et al., 2016, Jacob et al., 2016; Pein et al. 2016

VIMS William & Mary Virginia Institute of Marine Science
HPA Hamburg Port Authority

Outlook: Estuaries

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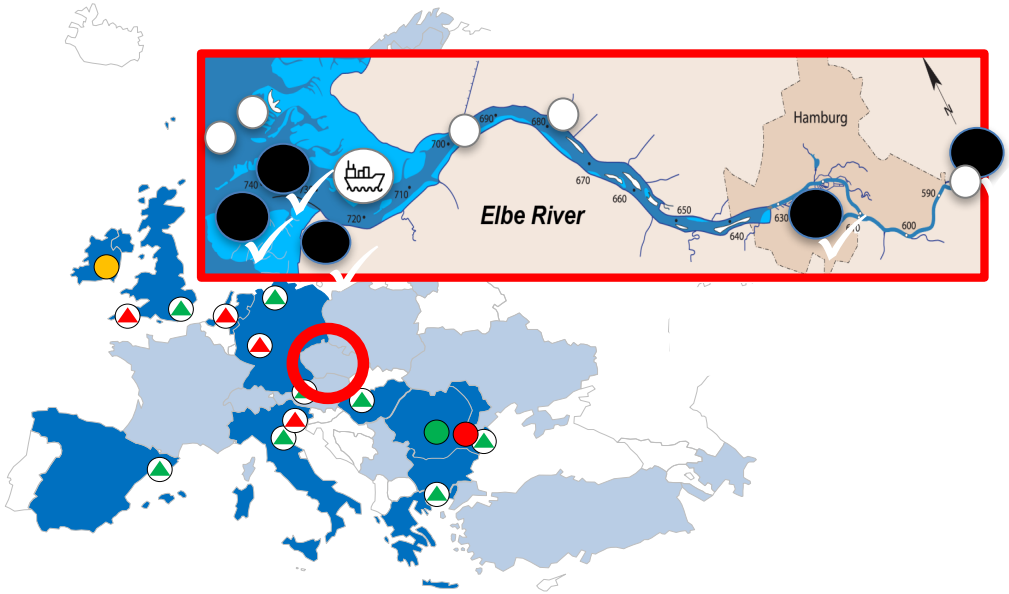
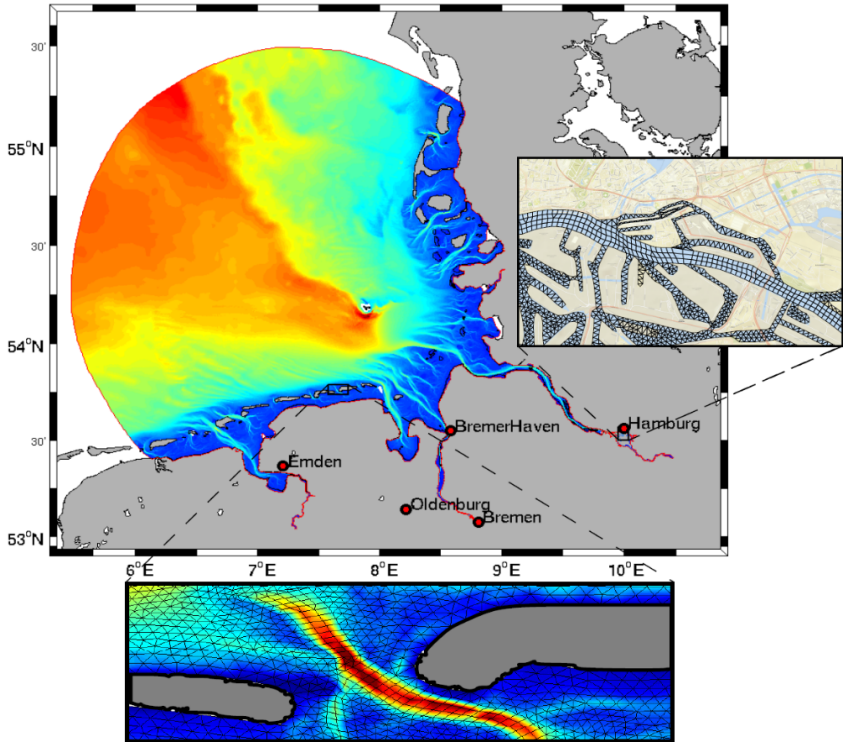
Centre for Materials and Coastal Research

DANUBIUS-RI

European Strategy Forum
on Research Infrastructures

HZG: Supersite - Integrated observation, process understanding & modelling system for the Elbe-North Sea continuum





RU 1 joined DANUBIUS-RI modeling node
Assessing climate and anthropogenic impacts

Global land ocean transition zone - Resolving land *and* ocean controls

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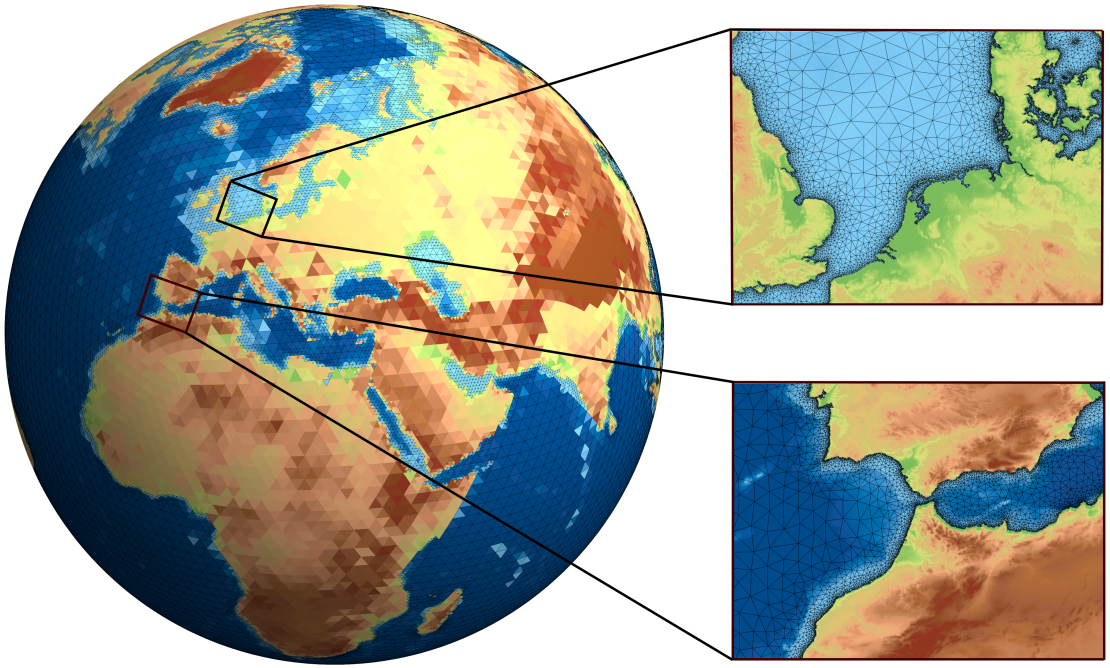
Towards a global coastal model – Cross scale modeling 100km-1km



Infrastructure & collaboration:

High performance computer access, DKRZ and local cluster, collaboration with observational groups is important, recruiting of talents

RU 1 RU 2 RU 3

CliCCS

Max-Planck-Institut für Meteorologie

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

DKRZ

Knowledge transfer to society and outreach general public

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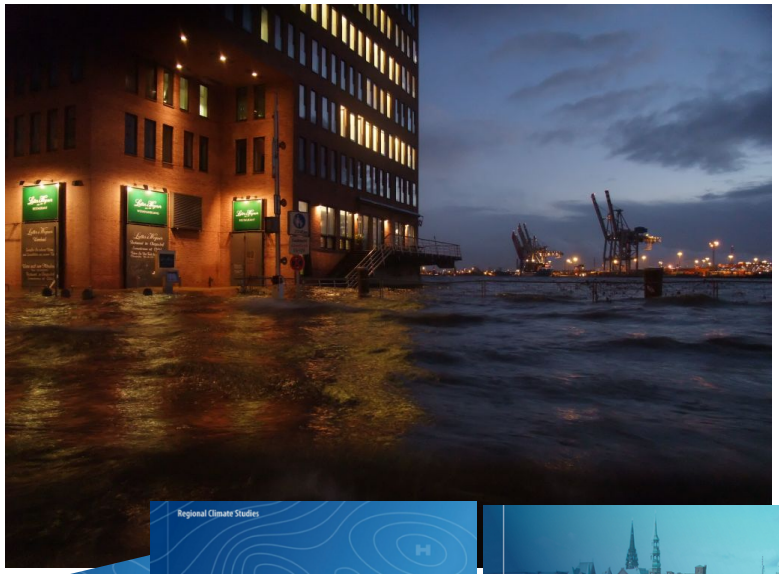

Assessing climate change impacts, international and national regional assessments, internationally leading role together with RU2, RU3 and RU4

Norddeutsches Küsten- und Klimabüro

Helmholtz network of Regional Climate Offices

- Establish and maintain stakeholder dialogues, > 1900 users
- User directed coastal climate information
- Web-based interactive communication formats based on *coastDat*

Topic 2+4

RU1 role: Leading role in initiating, coordination of (Hamburger Klimabericht), lead author contributions to all nat. & int. regional climate change assessment reports

ERA4CS

Summary

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

- Novel contributions to coastal system dynamics and regional climate variations at internationally leading levels
- Cutting-edge model development and notably broad Earth System Modelling expertise at internationally leading levels
- Substantial publication activity - rel. earth science-, many contributions in high impact journals
- Unique regional reconstructions, provided open access and widely used in the national and international research community and beyond
- Broad implementation of data, tools and models at international and national levels (federal agencies, industry)
- Wide ranging outreach activities, with leading contributions at international and national levels

Thank you!

Helmholtz-Zentrum Geesthacht
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