40. Sitzung des Wissenschaftlichen Lenkungsausschusses der Deutsche Klimarechenzentrum GmbH

Beginn der Sitzung: 15. Juni 2020 um 9:36

Teilnehmer

Dr. Joachim Biercamp, DKRZ
Dr. Hendryk Bockelmann, DKRZ
Prof. Dr. Claus Böning, GEOMAR Kiel
Dr. Frauke Feser, Helmholtz-Zentrum Geesthacht
Dr. Bernadette Fritzsch, AWI Bremerhaven (Vorsitzende des DKRZ-Usergroup-Komitees)
Prof. Dr. Andreas Hense, Institut für Geowissenschaften, Abt. Meteorologie Universität Bonn
Prof. Dr. Thomas Ludwig, DKRZ
Dr. Armin Mathes, DLR PT (BMBF)
Dr. Mathis Rosenhauer, DKRZ (Protokoll)
Prof. Dr. Robert Sausen, DLR Oberpfaffenhofen (Vorsitz)
Hannes Thiemann, DKRZ
Prof. Dr. Uwe Ulbrich, Institut für Meteorologie, Freie Universität Berlin
Dr. Martin Werner, AWI Bremerhaven
Dr. Sönke Zaehle, Max-Planck-Institut für Biogeochemie

1. Annahme der Tagesordnung

Die Tagesordnung wird ohne Änderungen angenommen.

2. Organisatorisches

a) Annahme des Protokolls der 39. Sitzung

Das Protokoll wird angenommen.

b) Ort und Termin der nächsten Sitzung

Die nächste Sitzung wird am 30.11.2020 in Hamburg stattfinden.

c) Wahl des Stellvertreters des Vorsitzenden

Frauke Feser wird mit sechs Jastimmen und einer Enthaltung zur stellvertretenden Vorsitzenden des WLA gewählt.

3. Bericht DKRZ

a) Nutzung HLRE-3 (Biercamp)

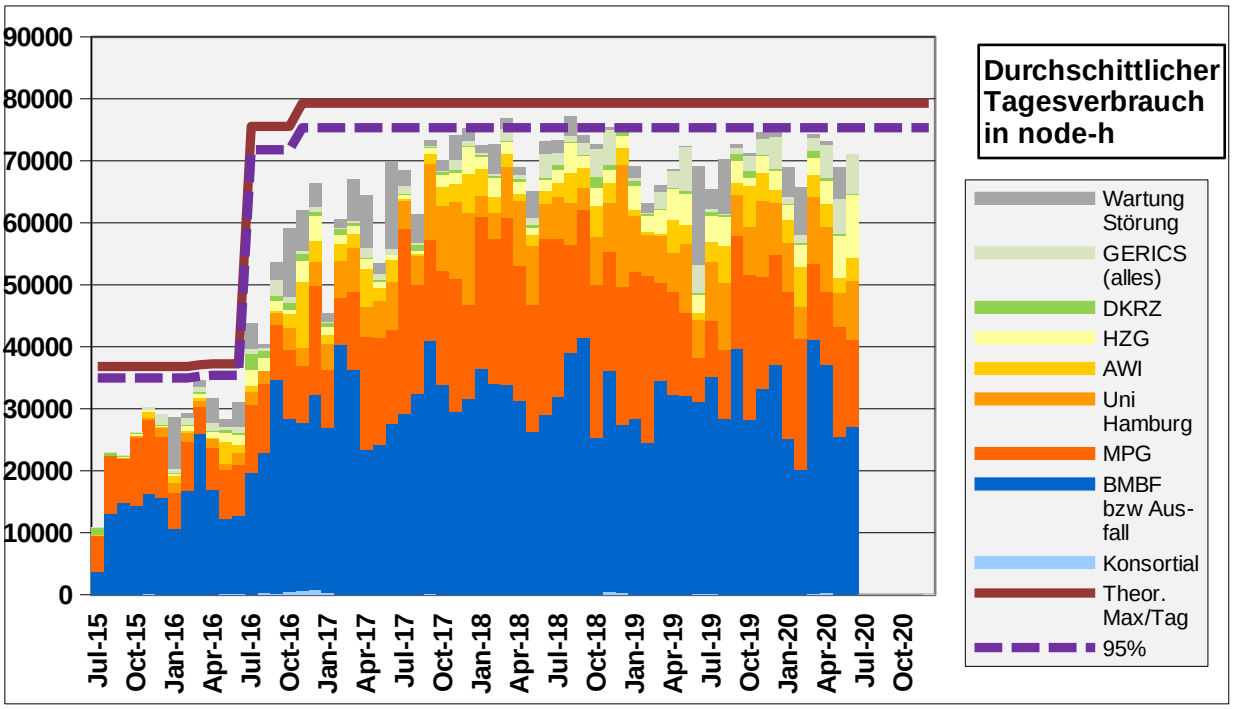


Abbildung 1: Durchschnittlicher Tagesverbrauch auf Mistral in Knotenstunden

Zu Beginn der Corona-Zeit im März diesen Jahres war die Auslastung von Mistral sehr gut. In den vergangenen zwei Monaten ist die Nutzung des Community-Anteils etwas zurückgegangen. Dies konnte durch verstärkte Nutzung der Gesellschafter-Anteile weitgehend ausgeglichen werden. Die Warteschlangen des Batch-Systems sind weiterhin relativ kurz. Insgesamt lag die Auslastung des Systems unter Berücksichtigung von Wartungen stets nahe der angestrebten 95%.

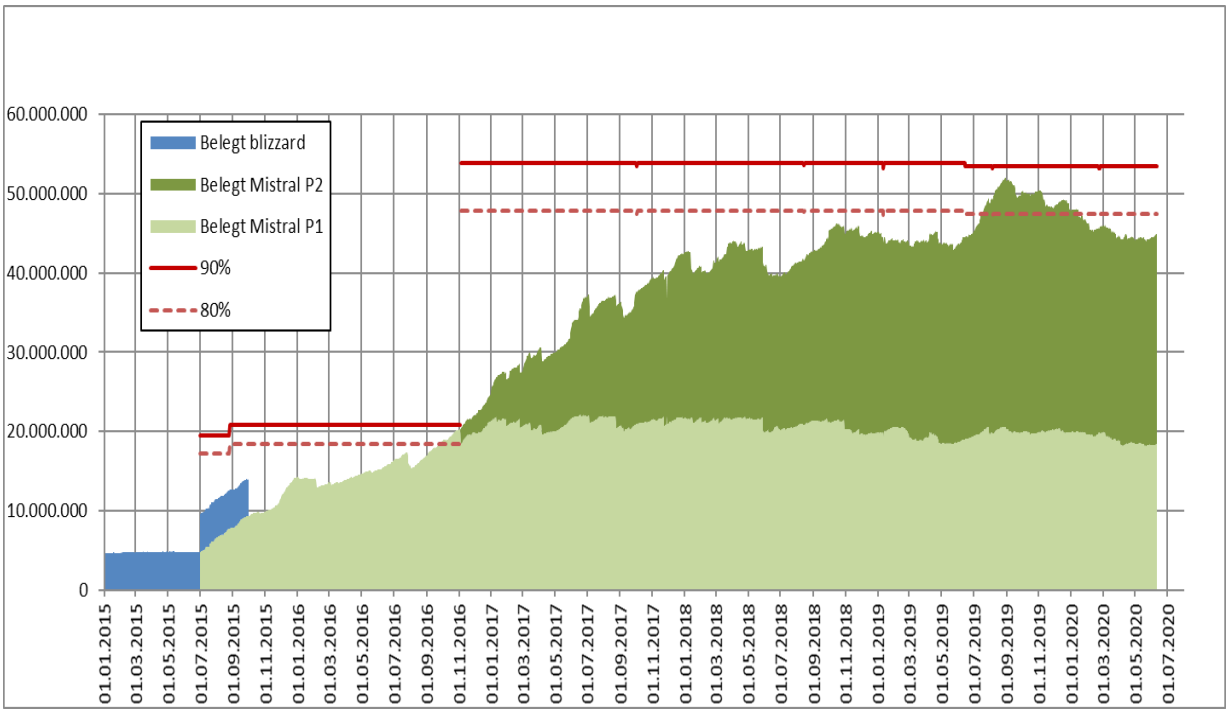


Abbildung 2: Belegung des Lustre Dateisystems [GB]

Die Nutzung der beiden Lustre-Dateisysteme liegt wieder unter 80%. Bei diesem Füllstand ist ein performanter Betrieb sichergestellt. Die zum 1.7.2020 neu bewilligte Projekte werden ihre Ressourcen

im Dateisystem nutzen können. Die wenigen Projekte, welche ihren zugesagten Speicherplatz überziehen, zeigen sich beim Abbau der Überbelegung kooperativ.

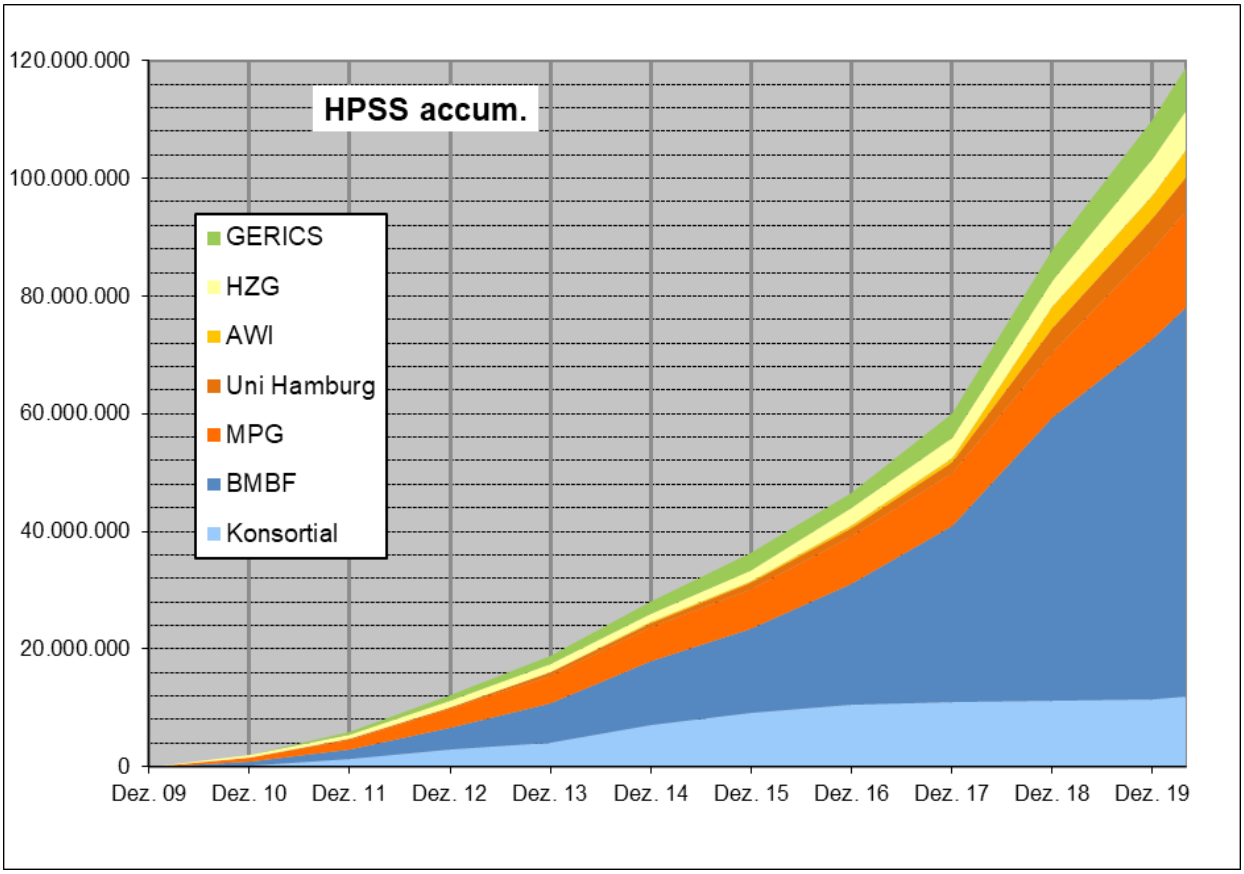


Abbildung 3: Belegung des Bandarchivs [GB]

In diesem Jahr werden voraussichtlich 20 – 25 PB neuer Daten archiviert. Für das kommende Jahr ist im Zuge der Inbetriebnahme von HLRE-4 eine verstärkte Nutzung des Archivs zu erwarten.

Der Rechenzeit-Verbrauch der Gesellschafter im Jahr 2020 (bis zum 15.06.2020) beträgt anteilig :
BMBF 46,53%
MPG 26,74%
UNI-HH 13,00%
AWI 6,18%
HZG 7,55%
(Konsortial 0,15%)

Die Nutzung des allgemeinen Datenbereichs /pool/data sollte in Zukunft über Projekte verwaltet werden. Nur so ist eine gerechte Nutzung der zugeteilten Plattenkapazitäten möglich. Über die Zuständigkeit der Zuteilung muss noch eine Absprache gefunden werden. Derzeit erfolgt die Zuteilung durch das DKRZ.

Es wird eine Arbeitsgruppe bestehend aus H. Thiemann, F. Toussaint, S. Zaehle und M. Rosenhauer, sowie Mitgliedern der User-Group eingerichtet, die ein Konzept zur Nutzung von /pool/data erarbeitet.

b) Perspektiven, u.a. Planung HLRE-4 (Ludwig)

Der Zuschlag für HLRE-4 wurde dem Angebot der Firma Bull/Atos erteilt. Grundlage war die zugesagte Leistung der Phase 1, welche etwa der vierfachen Leistung von Mistral entspricht. Eine Kooperation mit Bull zur Portierung von ICON auf GPUs wurde begonnen. Sechs Monate vor Installation der zweiten Phase des Rechners wird deren GPU-Anteil festgelegt. Die Leistung der zweiten Phase wurde, bezogen auf einen rein CPU-Basierten Aufbau, auf die Leistung von Mistral festgesetzt.

Die Energiezufuhr für HLRE-4 ist problemlos möglich und am Standort des DKRZ bis 4MW gesichert. Für die Wärmeabfuhr ist jedoch ein Ausbau der Kühlkapazitäten erforderlich. Aufgrund von Platzmangel auf dem Dach des DKRZ-Gebäudes werden Ausweichflächen auf Nachbargebäuden evaluiert.

Die Planung für HLRE-5 hat begonnen und nach derzeitigem Stand ist der jetzige Standort nicht mehr geeignet. Der Betrieb des Rechners wird bei höherer Leistungsaufnahme hinsichtlich Energiezufuhr, Wärmeabfuhr und Statik des Gebäudes problematisch. Ausweichstandorte werden derzeit untersucht.

Die Abwärme von HLRE-3 wird seit einiger Zeit genutzt, um benachbarte Labore zu heizen. Mehr Energie kann nicht abgenommen werden. An einem neuem Standort wäre dies aber unter Umständen möglich.

In der KW 24 fanden Bietergespräche im Rahmen der Ausschreibung für das HSM statt. Zur nächsten Gesellschafterversammlung kann möglicherweise schon ein Vorschlag für eine Zuschlagserteilung gemacht werden.

4. Bericht aus der DKRZ-User-Group (Fritzsch)

Ein Organisationsteam der User-Group bereitet derzeit einen Nutzerworkshop vor, welcher parallel zur Einweihung von HLRE-4 stattfinden soll.

Die von der User-Group vorgeschlagenen Maßnahmen zur Plattennutzung gemäß der Zuteilung durch den WLA wurden umgesetzt. So konnte die übermäßige Belegung abgebaut werden, sodass die Belegung insgesamt bei 80% liegt.

Die Bewilligungen von Konsortialprojekten hat Auswirkungen sowohl auf den Community-Anteil, wie auch auf den Gesellschafteranteil. Um auf Verschiebungen rechtzeitig reagieren zu können schlägt die User-Group vor die Informationen über bewilligte Konsortialprojekte zeitnah vom DKRZ veröffentlichen zu lassen. Dies würde auch die Sichtbarkeit der Konsortialprojekte in der Community erhöhen.

Für die Nutzung von /pool/data wird ein Konzept erarbeitet (s. 3.a). Die User-Group wünscht sich, dass das DKRZ mehr Unterstützung beim Dataprocessing leistet.

5. Berichte zum Stand von Großprojekten

a) ESiWACE: Scalability of Earth System Models

Gast: Bjorn Stevens

S. Präsentation im Anhang.

b) SFB-Transregio

Gast: Jin-Song von Storch

S. Präsentation im Anhang.

c) MiMeMo – Mikroben bis Megafauna Modellierung im arktischen Ozean

Gast: Ute Daewel

S. Präsentation im Anhang.

d) CLICCS: Climate, Climatic Change and Society

(entfallen)

Die Präsentationsunterlagen wurden nachgereicht und befinden sich im. Anhang.

6. Sonstiges

Ein Textvorschlag zu besserer Abstimmung von konvektionsauflösenden Regionalmodellierungen wird im WLA erarbeitet und anschließend vom DKRZ an alle Projektleiter verschickt.

7. Rechenzeitanträge

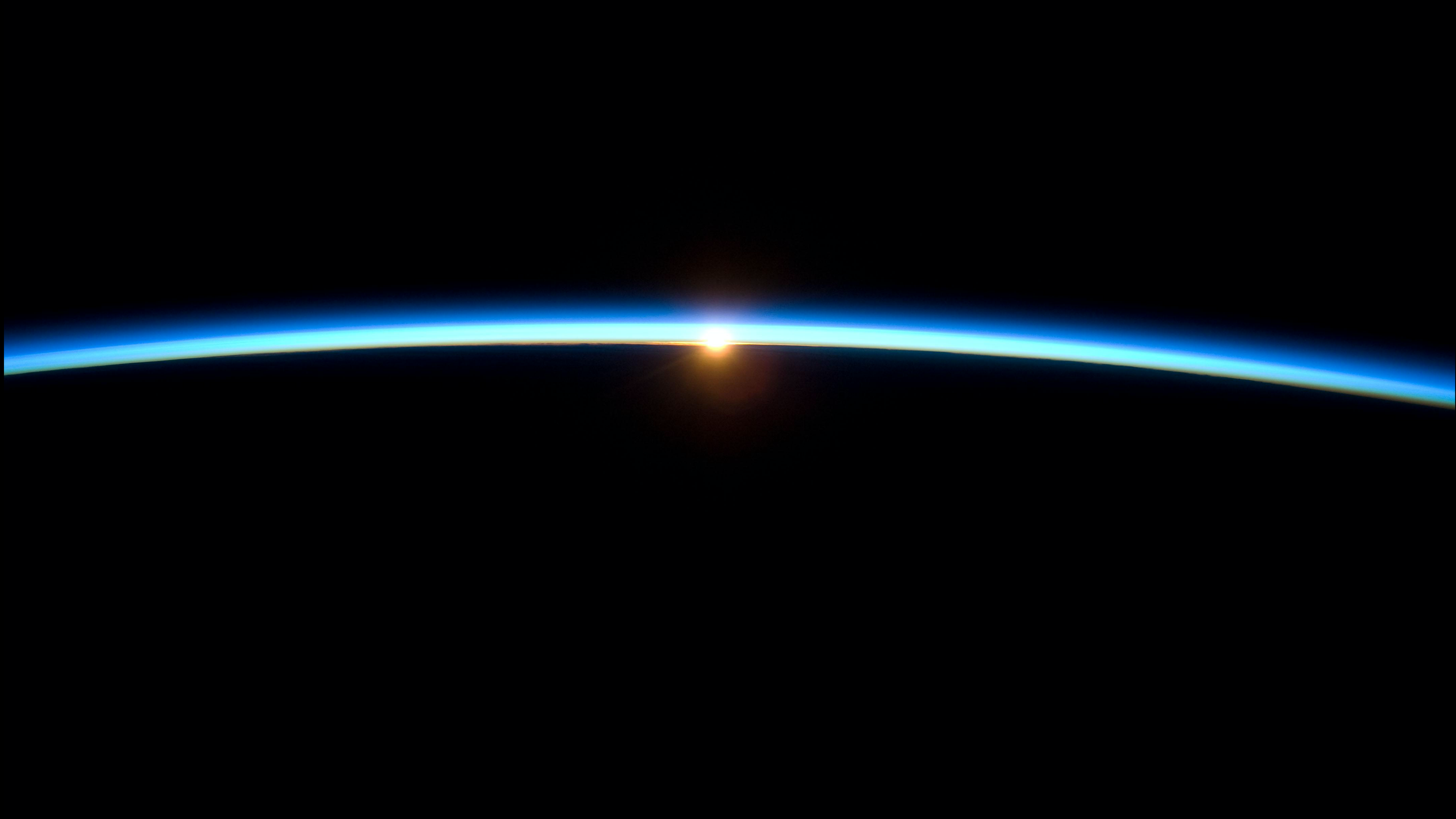
Im nichtöffentlichen Teil der Sitzung wurde unter anderem über die Rechenzeitanträge für Community-Projekte beraten.

Es wurden Ressourcen für Neu- und Folgeprojekte über den Zeitraum vom 1.7.2020 bis 30.6.2021, sowie zusätzliche Ressourcen über den Zeitraum vom 1.7.2020 bis 31.12.2020 bewilligt. Im einzelnen sind dies:

	Beantragt	Bewilligt	Durchschnittliche Kürzung
Mistral [Node hours]	8.722.049	3.260.914	62%
Lustre work [GiB]	6.642.323	2.349.513	65%
HPSS arch [GB]	9.071.691	5.199.653	43%
HPSS docu [GB]	590.304	369.147	37%

Für Konsortialprojekte wurden keine zusätzlichen Ressourcen bewilligt.

Ende der Sitzung: 16:34



ESiWACE2: developing the workflow for a new era in climate modelling

What we aim to do

- Coupled simulations, 40 days at 2.5 km (DYAMOND Winter) and 365 days at 5 km.
- Atmosphere only simulations at 2.5 km and regionally zoomed over EUREC^{4}A experimental area.
- Develop a workbench for the analysis of storm (and ocean-eddy) resolving models.

Who are we:

Florian Ziemen (DKRZ), Daniel Klocke (DWD), Bernadette Fritzsch (AWI), Bjorn Stevens (MPI-M), Julian Kunkel (ECMWF), Joachim Biercamp (DKRZ)

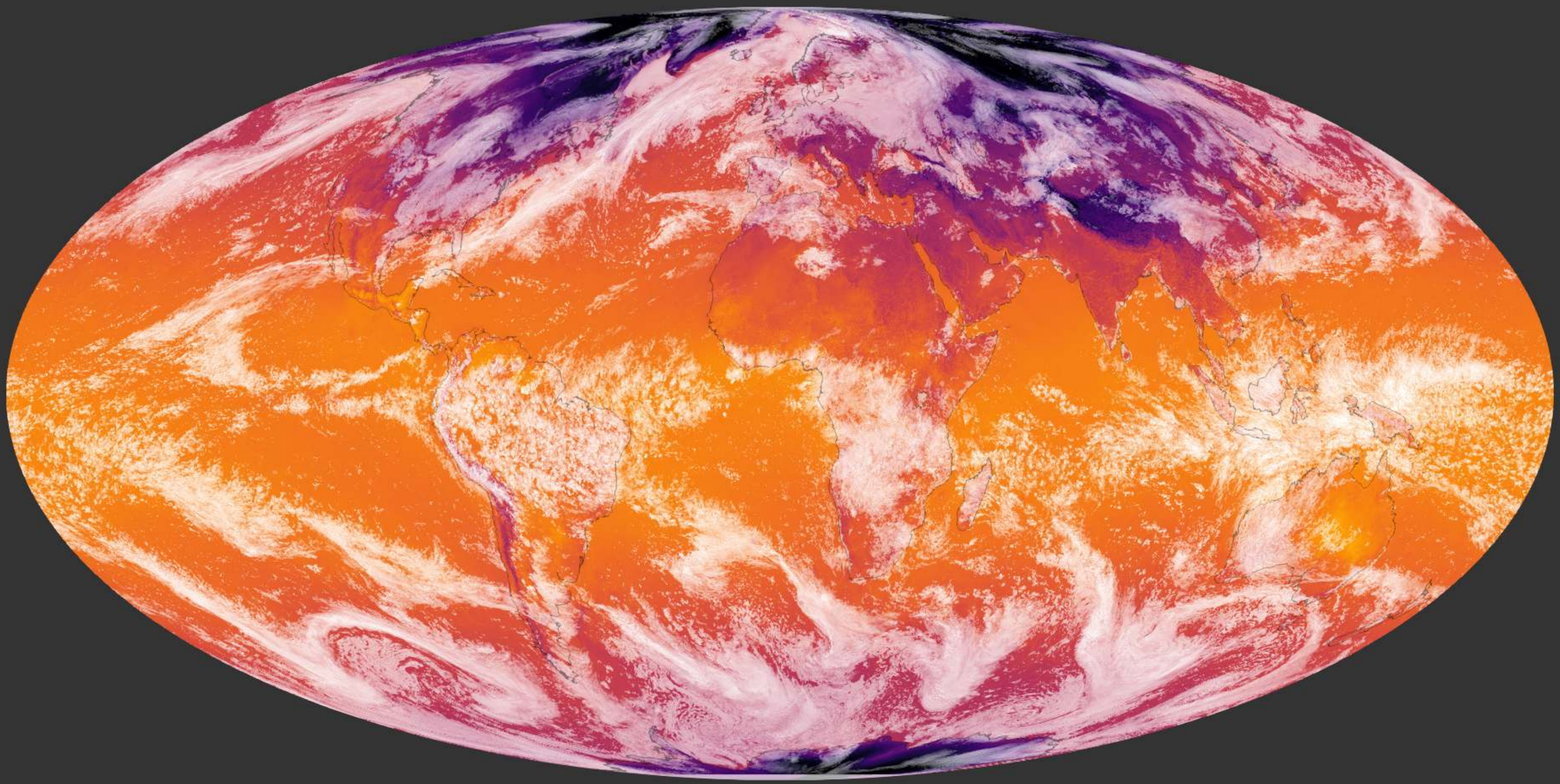
But our activities support not only the ESiWACE project, but also the:

- German atmospheric research community participating in EUREC^{4}A, (DFG, MPG) and MOSAIC (HGF).
- German climate science community developing next generation climate models (MPI,BMBF, H2020, ERC).
- German HPC initiatives aiming to establish leadership within the EU's *Destination Earth*.

DYAMOND

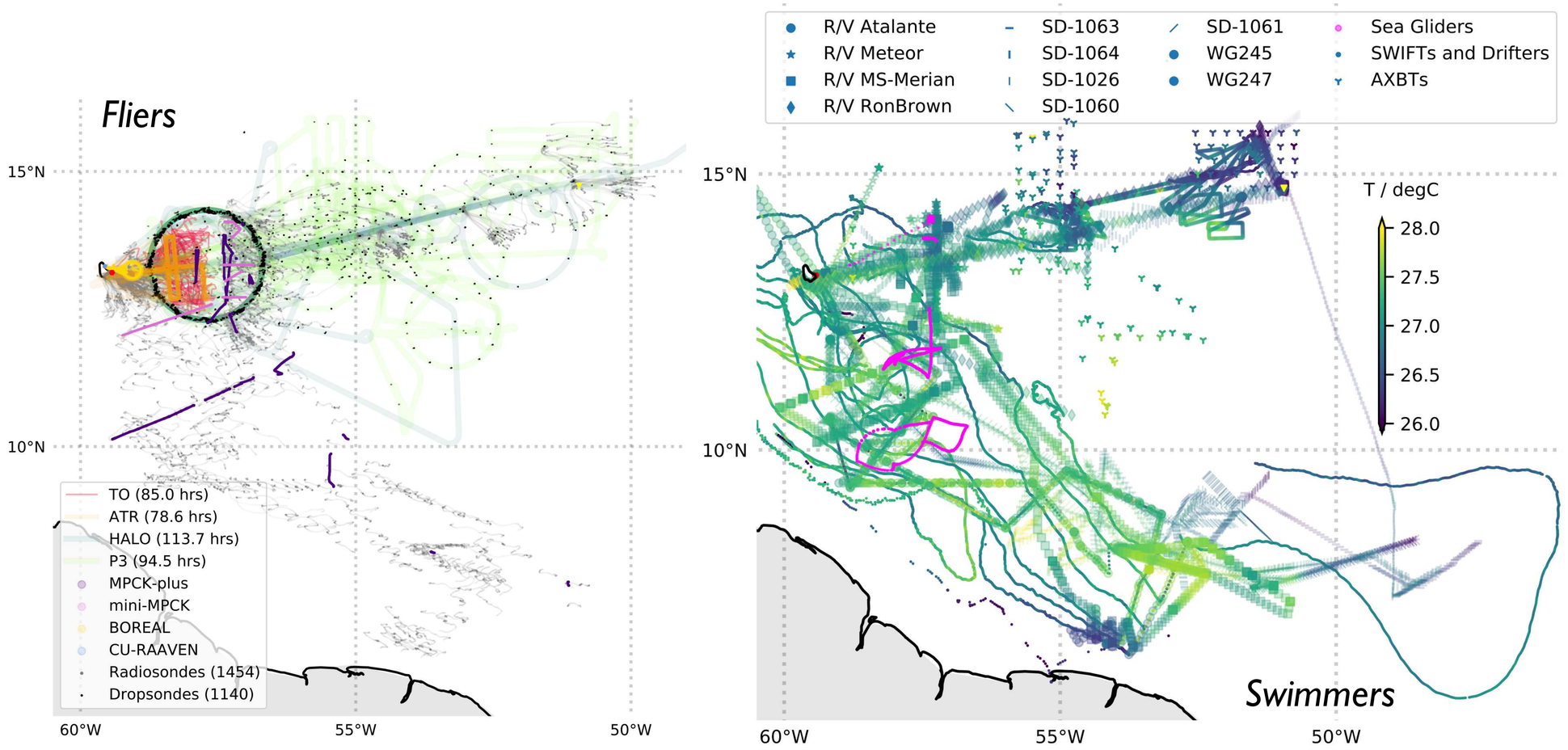
1. Longest published runs of global models run at less than 5 km
2. First ever intercomparison of global storm (ca 3 km) resolving models
3. Pioneering future workflow:
   - Hackathons,
   - CDO developments,
   - storage facilities, object stores, disk caching of tape, etc,
   - server side processing with JUPYTER and xarray/dask.

Stevens et al. *Progress in Earth and Planetary Science* (2019) 6:61, Satoh et al., *Curr. Clim. Change Rep.* (2019), Hohenegger et al., *J. Meteorol. Soc., Japan*, (2019).



DYAMOND Winter is introducing global storm and ocean eddy resolving models

EUREC⁴A (Jan 20 to Feb 20, 2020, near Barbados)



1. *More than 250 scientific participants (95 from Germany)*
2. *Five research aircraft, 8 UASs, 4 research vessels, 7 gliders, 5 saildrones, 22 drifters, 3 wave gliders*
3. *Several thousand atmospheric and oceanic soundings*
4. *Measurements designed to benchmark models.*

What we are asking for

- Mistral for a six days (442 500 node hours).
- 1.8 PB Tape (/arch/), 0.93 PB disk, 0.1 PB /doku/

MPI will match the WLA compute allocation

Why it matters

- Guides developments in workflow which benefit everyone (ESiWACE2).
- Positions German researchers at the forefront of the development of a new generation of climate models, and associated initiatives like Destination Earth.
- Strengthens DKRZ as a world leading climate computing center at the dawn of exascale.
- Supports the continuing model-data integration for EUREC^{4}A and MOSAIC, two landmark field campaigns in which the German research community has played a leading role.

Supporting our project is really an investment in the future.

Project bm1102

(TP L2 and W2 in Energy Transfers in Atmosphere and Ocean, TRR 181)

Jin-Song von Storch

- Second phase: July 2020 - June 2024
- The review is postponed from March to October 2020

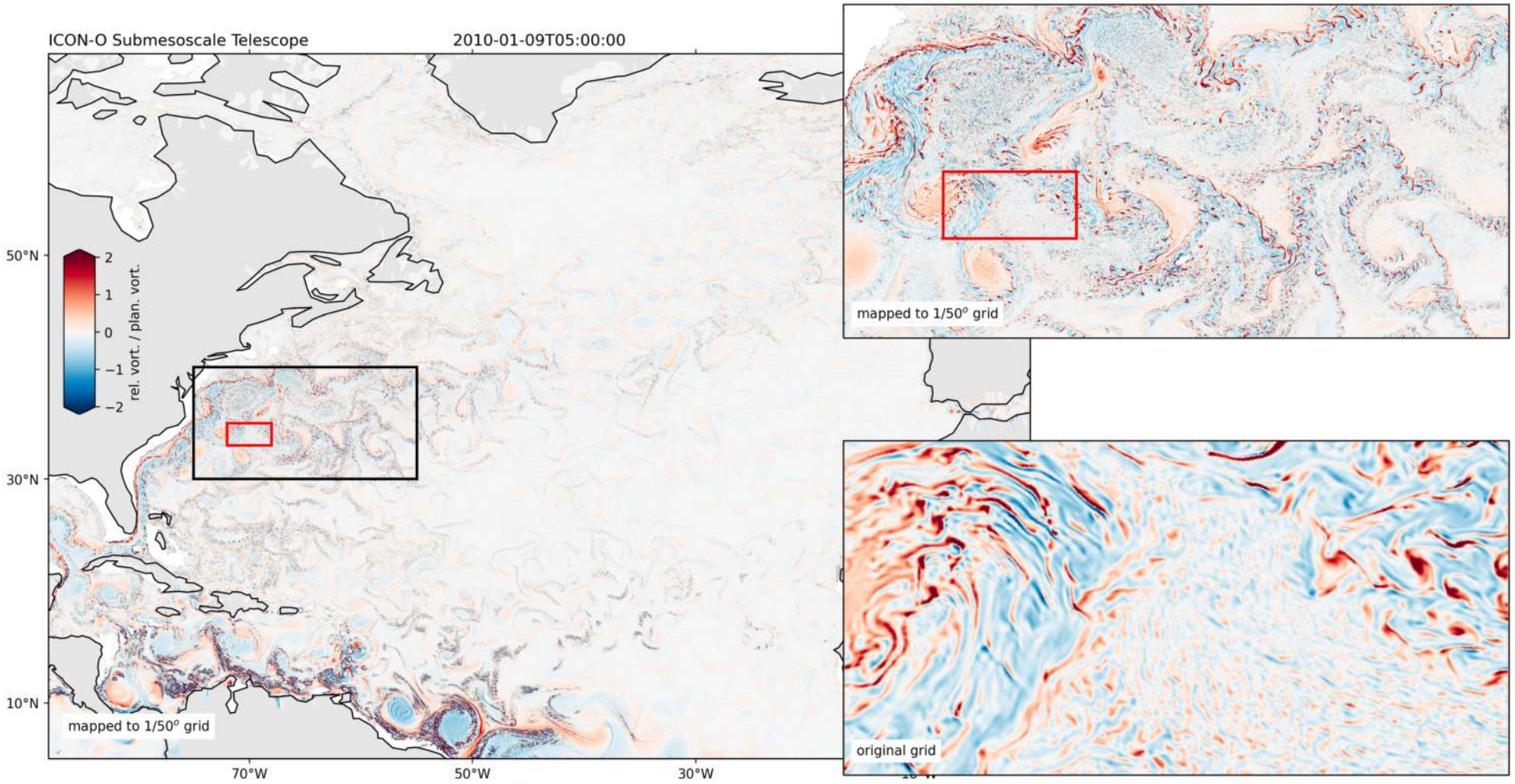
Plan for the second phase:

A multi-year telescope simulation with ICON-O including tides, centered the SONETT region, where major TRR observational campaigns will take place in October/November 2021 and February/March 2022

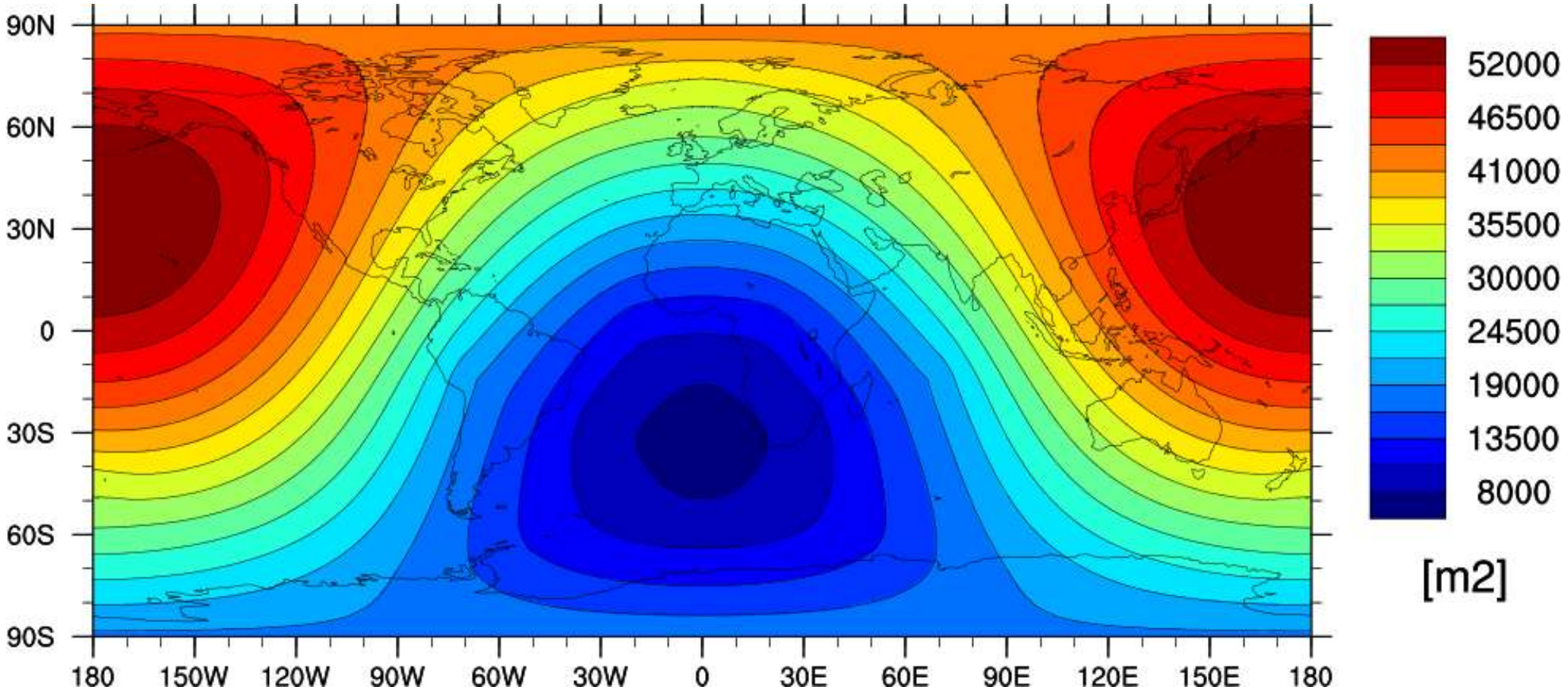
Scientific questions:

- W2: to quantify the eddy-induced changes in the magnitude, direction, and vertical structure of internal tides in the mid-latitude ocean
- L2:t to better quantify two different dynamical regimes, namely that of mesoscale to submesoscale eddies and that of internal waves, by developing regime-separation methods

Work done in the past half year: proof of concept



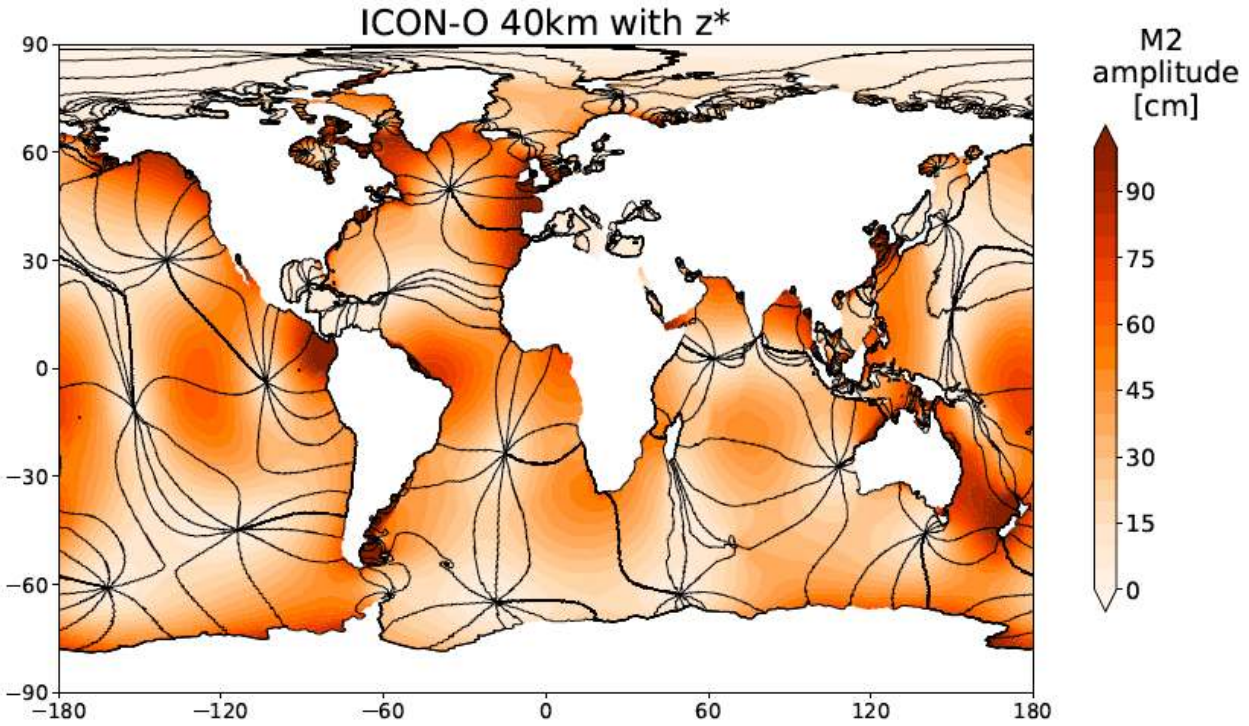
Work done in the past half year: set up the new grid



Work done in the past half year: implementing tides and z*

RSS-skill (compared with pelagic stations)

model	year	total
tide()	2020	76.21
tide()	2021	81.78
tide()	2022	81.81
tide()	2023	81.86
tide()	2024	74.04
tide_mpi()	2020	76.06
tide_mpi()	2021	81.69
tide_mpi()	2022	81.72
tide_mpi()	2023	81.78
tide_mpi()	2024	74.00



Experiments planned:

Experiments	**Length**	**Node hours**	**Lustre work (GB)**
ICON 10 km + tides	10 years	36.000	10.000
ICON 10 km + tides + z*	10 years	36.000	10.000
BC_SONETT	10 years	36.000	10.000
BC_SONETT + z*	10 years	36.000	10.000
HC_SONETT	5 years	2.034.250	150.000
		2.178.250	190.000

Output:

Since the SONETT telescope simulation focuses on processes on short time scales, we need for most of analyses high frequency data over a short time period. We hence plan to store hourly prognostic variables over 2 months, plus a few monitoring variables. The simulation has however to be much longer than 2 months due to test and spin-up runs.

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Federal Ministry of Education and Research

NERC SCIENCE OF THE ENVIRONMENT

THE UNIVERSITY OF STRATHCLYDE IN GLASGOW

Helmholtz-Zentrum Geesthacht

Centre for Materials and Coastal Research

University of St Andrews

MiMeMo
Microbes to Megafauna Modelling of Arctic Seas

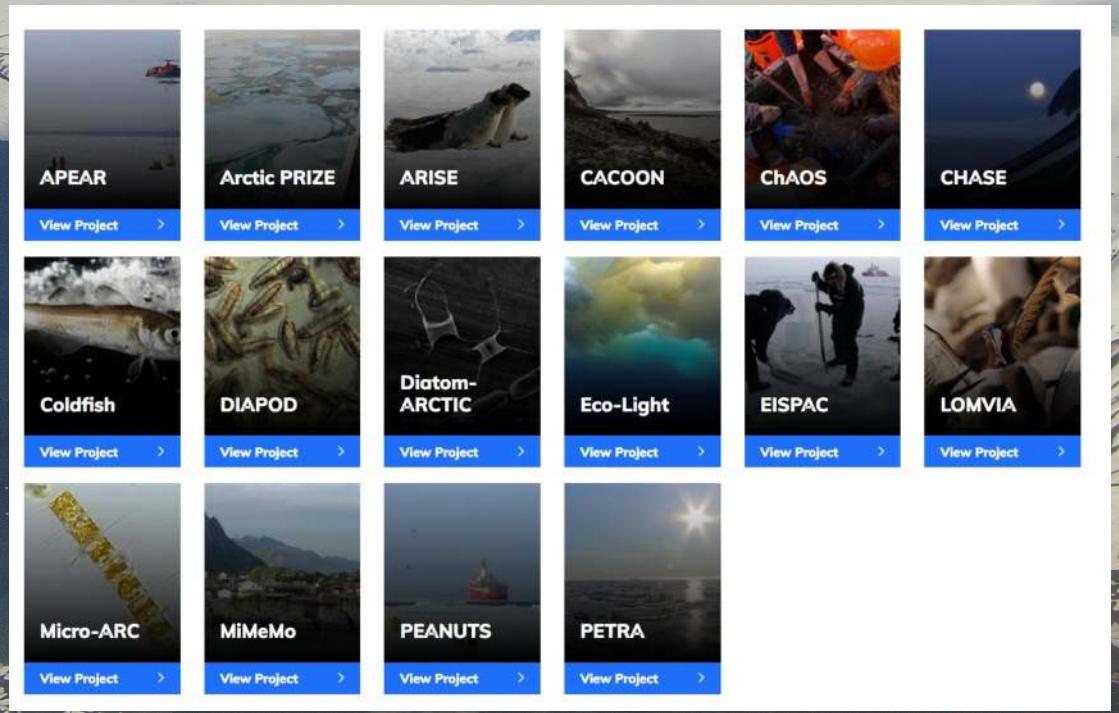
Changing Arctic Ocean NERC

www.changing-arctic-ocean.ac.uk/project/mimemo/

Fishing village with cod-drying racks in the Norwegian Arctic

Changing Arctic Ocean Program

The Changing Arctic Ocean programme started in February 2017 with four large projects (Arctic PRIZE, ARISE, ChAOS, DIAPOD) funded by NERC. A further 12 projects joined the programme in July 2018, co-funded by NERC and the German Federal Ministry of Education and Research. Each one investigates different aspects of the Changing Arctic Ocean. Combined, the projects involve 32 research institutions and organisations in the UK and Germany, and more than 180 scientists.



The Team

University of Strathclyde Glasgow

Michael Heath

Douglas Speirs

Jack Laverick

Robert Wilson
(DIAPOD project)

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

Ute Daewel

Corinna Schrum

Deborah Benkort

(Richard Hofmeister)

University of St Andrews

Andrew Brierley

Roland Proud

Context for the project

On 30 November 2017, 10 major fishing nations agreed not to develop fisheries in the Central Arctic Ocean for at least the next 16 years, to give time for development of scientific understanding before fisheries are established.

Our high-level objective is to scope the extent of trade-offs between fisheries and cultural values of the Arctic (reputation, tourism) , and how these may change with warming.










Central questions for MiMeMo:

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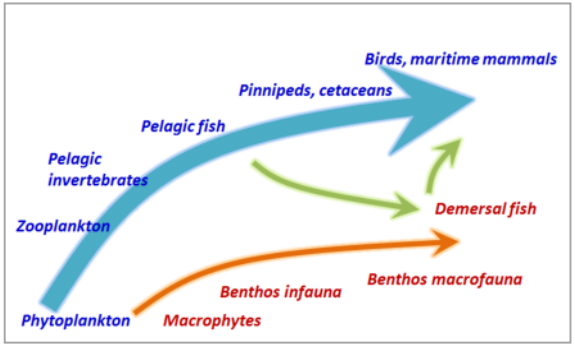
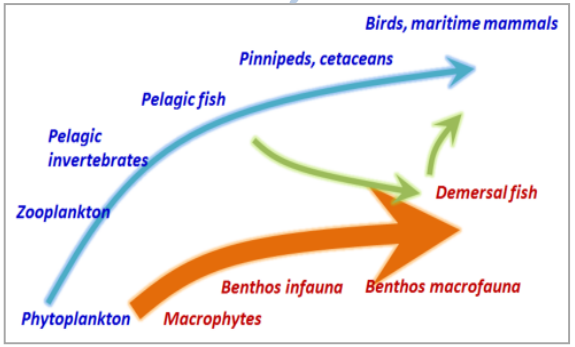
How will the propagation of primary production up the food web change as sea-ice retreats?

Enhanced pelagic system

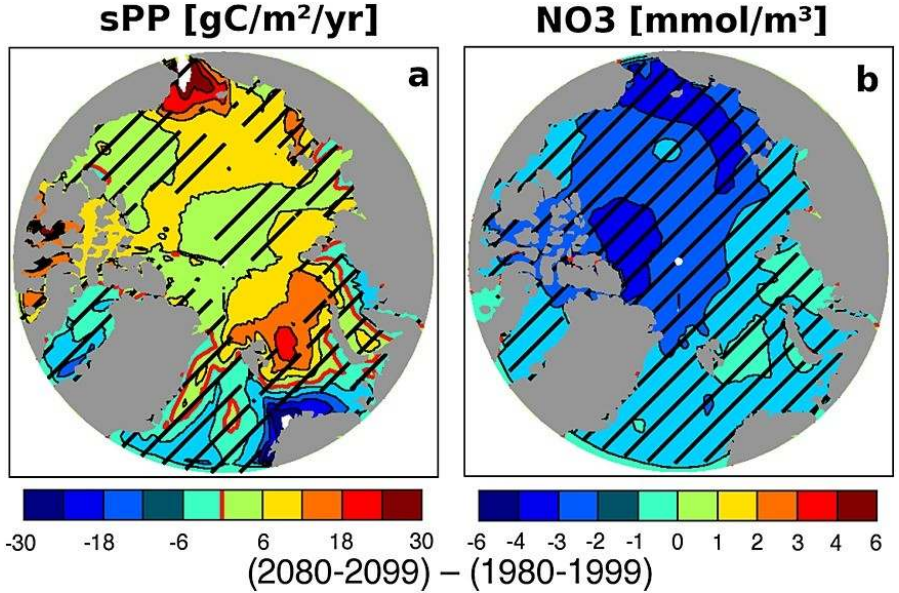


Enhanced benthic system



?

How will these changes be spatially distributed?



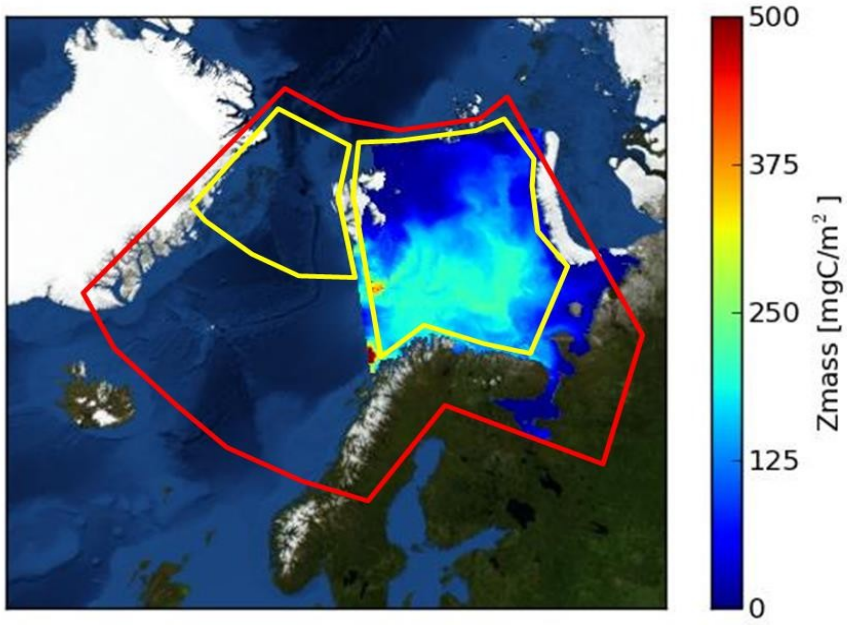
Spatial distribution of mean model 2080–2100 differences with respect to 1980–2000 for (a) annual sPP and (b) nitrate concentration. Hatched regions indicate where 80% of the models agree on the sign of the change.
(Vancoppenolle et al. 2013, Global Biogeochemical Cycles)

DELIVERABLES AND DETAILS

Scientific deliverables: simulations of the end-to-end (E2E, microbes to megafauna) top-down and bottom-up cascading trophic effects of multiple stressors (changing sea-ice cover & warming, fisheries) in the Barents Sea, Fram Strait, and the wider Atlantic-Arctic.

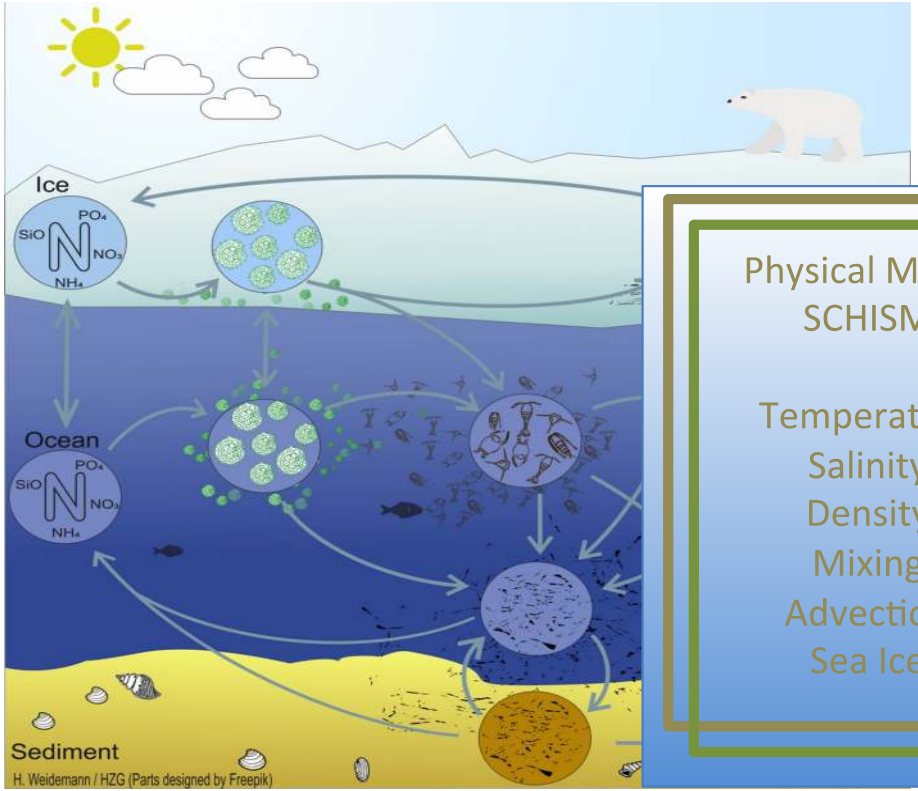
General approach – Data synthesis, and modelling

- **Data synthesis** – assembly of ecosystem data spanning physics to top predators – especially in mesopelagic fish and zooplankton
- **Modelling** - two different types of E2E models will be used to represent the Arctic ecosystem – ECOSMO-E2E and StrathE2E. Both are based on functional groupings of taxa.



Colours: zooplankton biomass simulated with ECOSMO.
Polygons: proposed CAO model domains

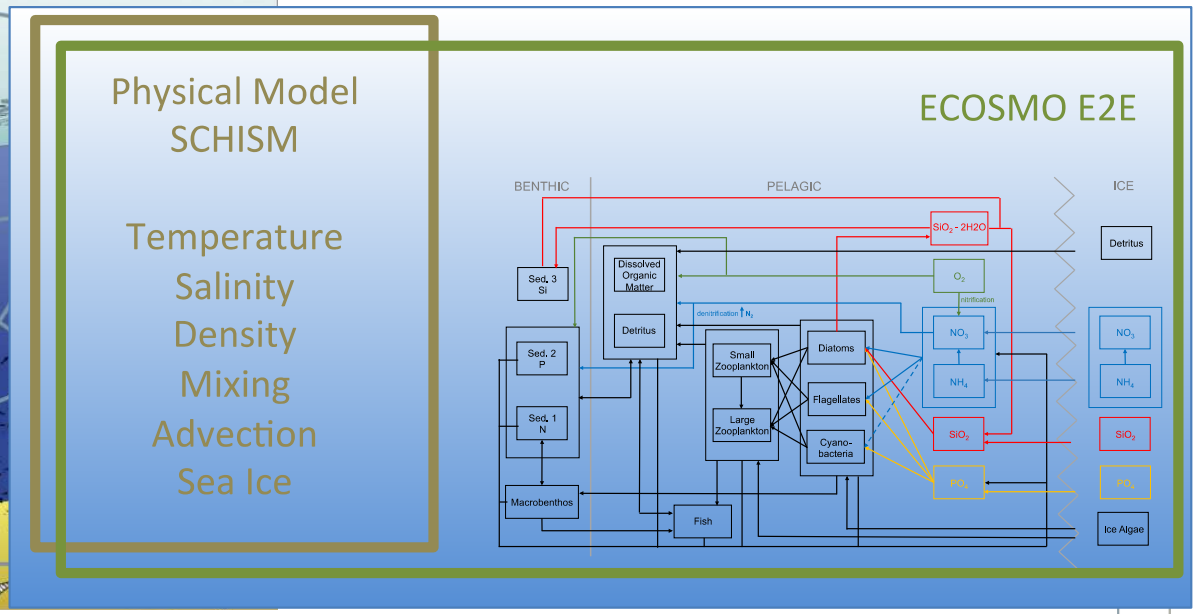
Development of a complex ecosystem model for the Arctic (including Ice algae, fish, macrobenthos, migration strategies)



Fully coupled physical-biological model SCHISM-FESIM-ECOSMO E2E

Required forcing data:

- Atmosphere
- Boundaries (physics, biogeochemistry, Ice)
- River runoffs & nutrient loads



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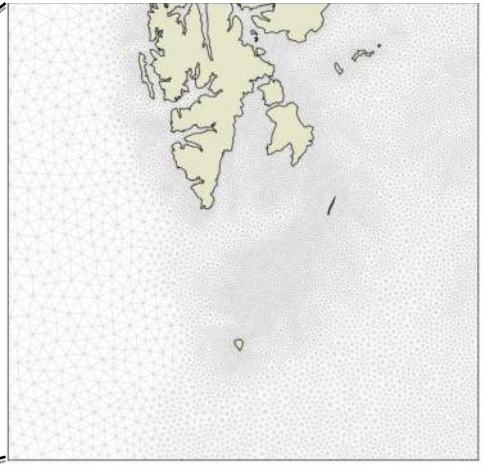
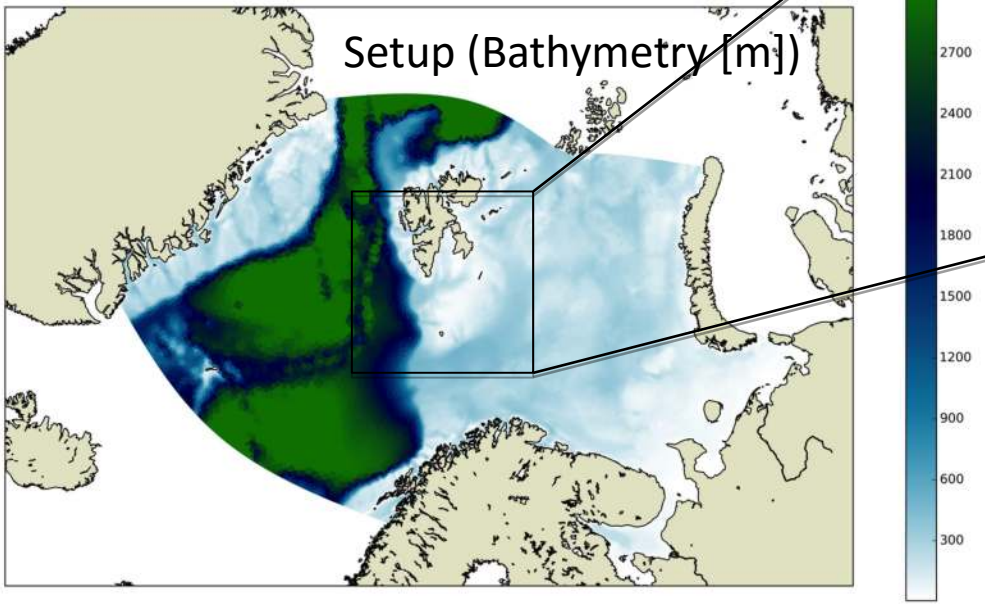
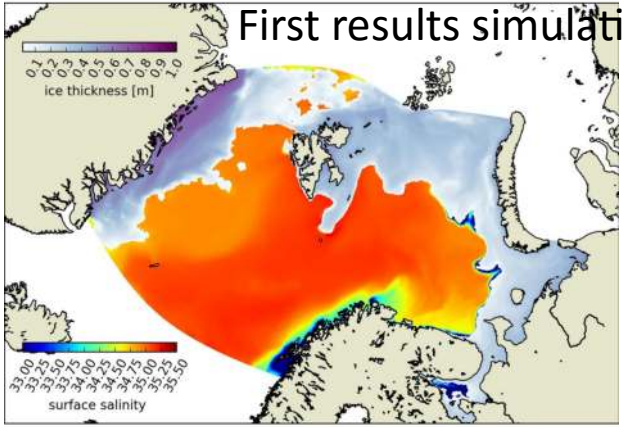
SCHISM

- unstructured grid model, 3d finite-volume discretization
- hybrid sigma-geopotential, vertical coordinates
- FESIM ice module (newly implemented)
- Generic coupling to pelagic biogeochemical models, incl. ECOSMO



Model grid example





First results simulation year (2013)

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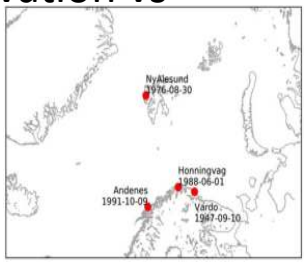
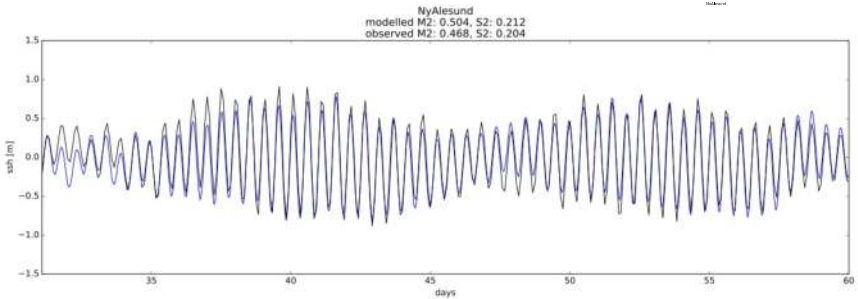
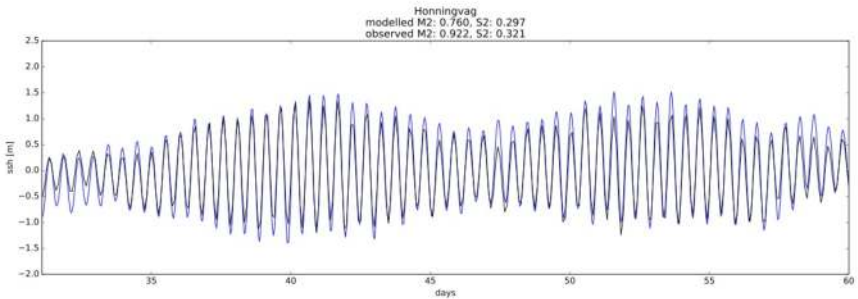
Modelled sea surface elevation vs observations

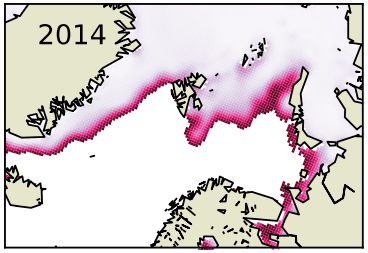


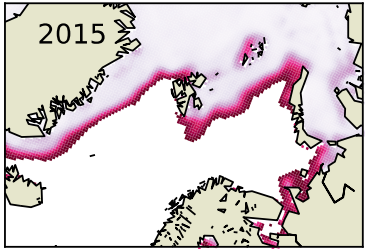




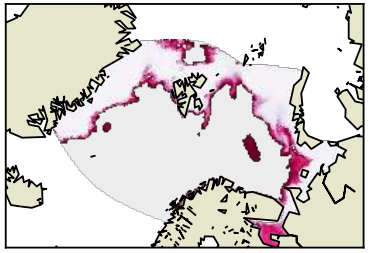
Modelled ice concentrations vs observations from ESACCI satellite

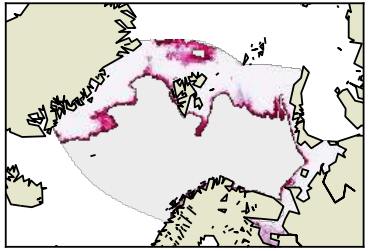
Model





ESACCI



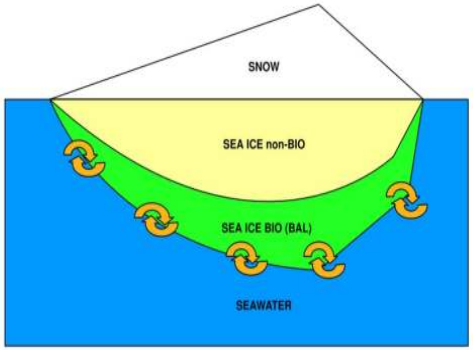


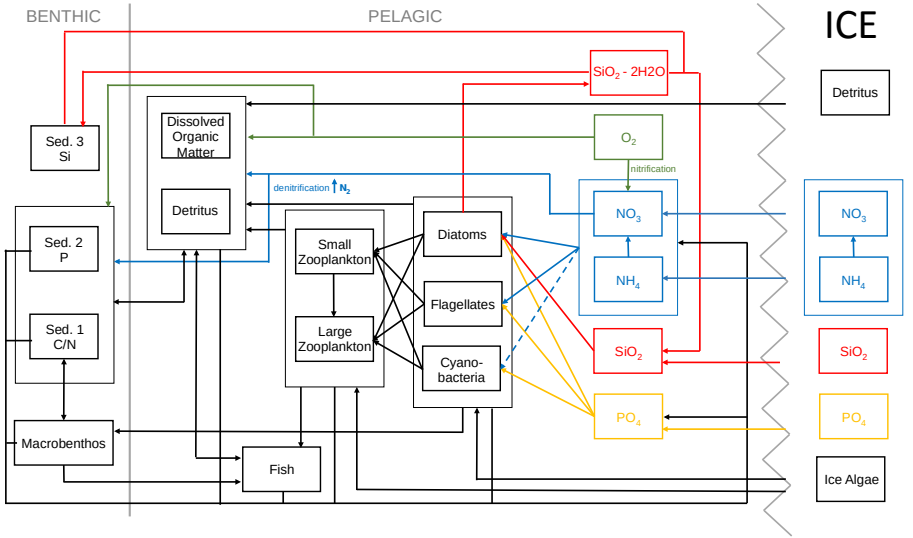
ECOSMO
MODEL ADAPTATION FOR THE ARCTIC

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coasta esearch

1. coupling ECOSMO to sea ice biology (Benkort et al. Subm. to Frontiers in Environmental Science)

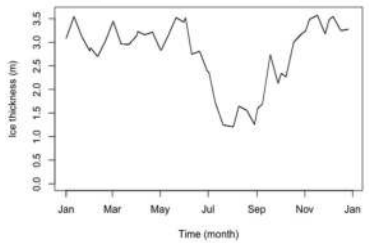
Biological Active Layer (BAL) aproach



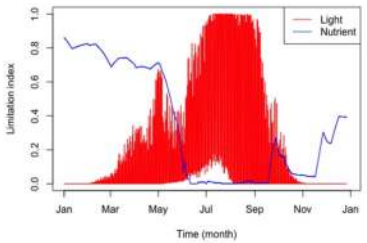


Exemplarily simulation results from 1d model application

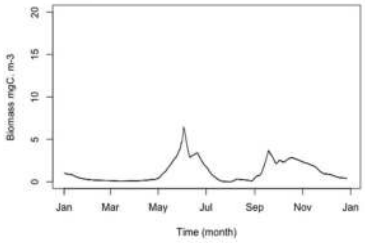
Ice thickness



Modelled light & nutrient limitation



Ice algae biomass



ECOSMO
MODEL ADAPTATION FOR THE ARCTIC

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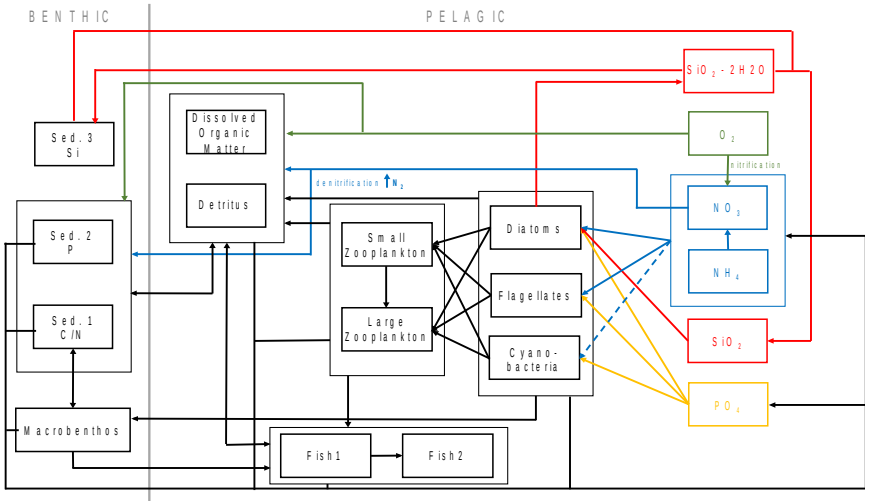
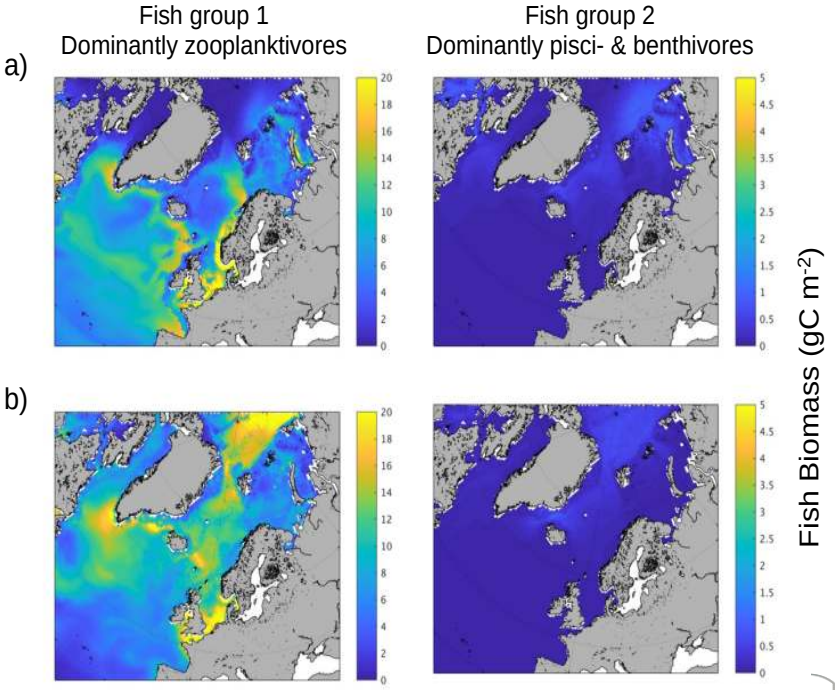
2. Further developing the fish component of the ecosystem model including migration strategies

ECOSMO E2E (Daewel et al. 2019) : a novel modelling approach that includes higher trophic levels in a fully coupled ecosystem model on the basis of functional groups



Simulation of annual mean fish biomass in the North Atlantic with (b) and without (a) fish migration (physical model: HYCOM, 10 yr spinup)



SCHISM-ECOSMO E2E STATUS

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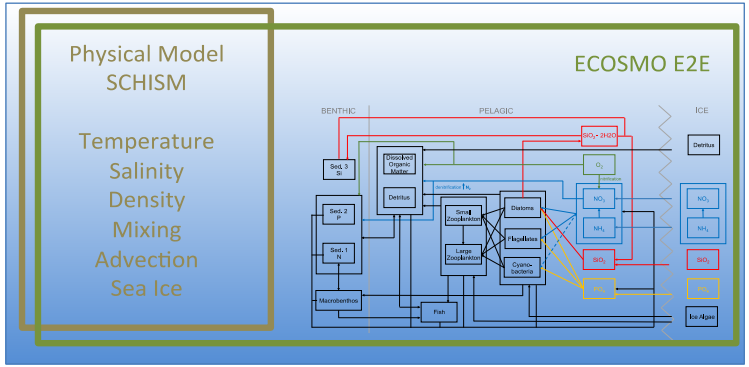

-Model components are coupled through a generic coupler framework FABM (Bruggemann & Bolding)
-Boundary conditions for the ecosystem components are prepared based on available simulations from the coupled model NEMO-MEDUSA (Andrew Yool pers. Comm, the model has been used before in the CAO program and hindcast simulations as well as RCP scenarios are available)
-boundary conditions for the fish groups in the model could stem from the coarser grid model HYCOM –ECOSMO E2E
-first test simulations on the fully coupled system are currently in progress

SCHISM-(ECOSMO) COMPUTATIONAL REQUIREMENTS

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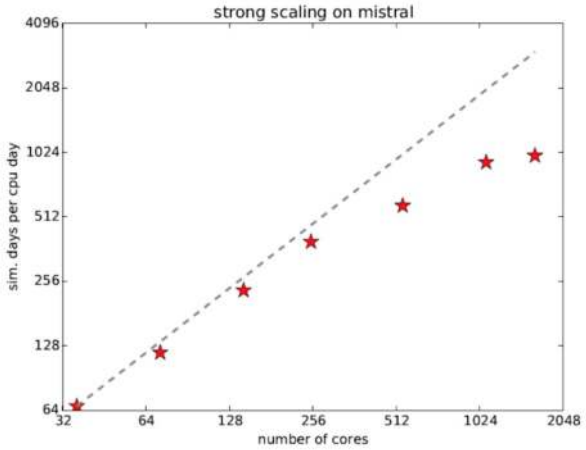
Centre for Materials and Coastal Research

- 1080 cpus (30 nodes with 36 cores each) simulate 210 days in the simulation per day.
- A 10 years simulation period is finished with 12528 node hours.
- disk space requirement of at least 10 GiB per month, 10 years of simulation requires 1200 GiB of disk space



SIMULATIONS FOR MIMEMO

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Centre for Materials and Coastal Research

How will the propagation of primary production up the food web change as sea-ice retreats?

How will these changes be spatially distributed?

purpose	Length of simulation	Number of simulations	Time frame
Model calibration	40 years	O(10)	7/2020-12/2020
Model sensitivity	10 years	O(10)	7/2020-12/2020
Full-hindcast production Including specific human use scenarios	40 years	O(5)	1/2021-6/2021
Transient climate projections	100 years	O(2)	1/2021-6/2021

Requested node hours in the allocation period: 800000 node hours (36 cores)
Requested disk space: 84000 GiB

DATA MANAGEMENT MIMEMO

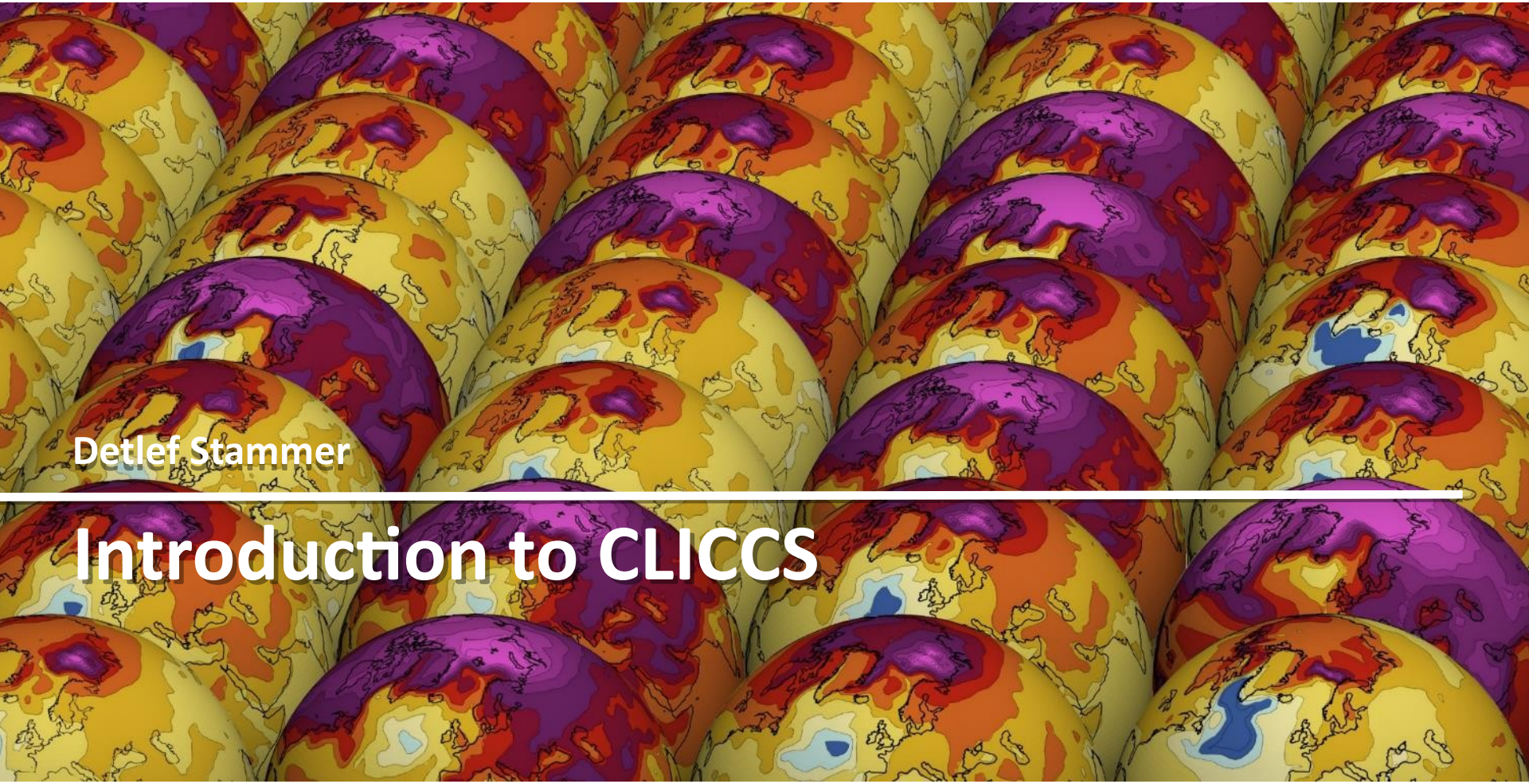
Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

- Data on sensitivity studies and calibration runs will be analyzed, averaged and, where necessary, stored on archive
- Final production runs will be either stored on archive, or …
- All data used for publications and project deliverables will be archived and published through CERA and will be part of the HZG CoastDat database

Note: MiMeMo officially ends 06/2021. Due to the drop out of key personnel and the COVID situation a no-cost extension of 6 month is possible and will be requested.

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

CLUSTER OF EXCELLENCE
CLIMATE, CLIMATIC CHANGE,
AND SOCIETY (CLICCS)

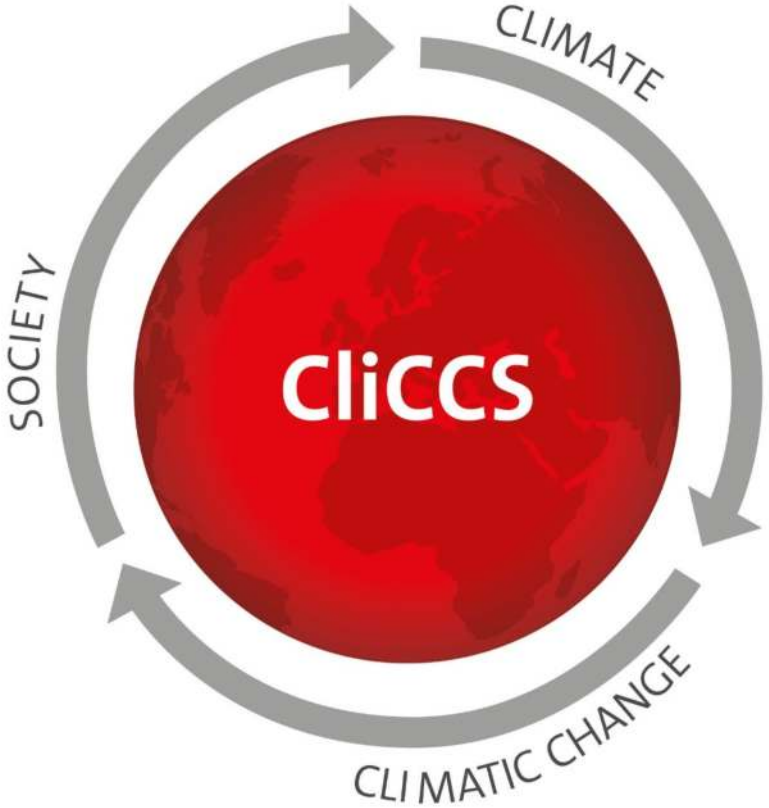


Detlef Stammer

Introduction to CLICCS

DFG Deutsche Forschungsgemeinschaft

WHAT IS CLICCS ABOUT?

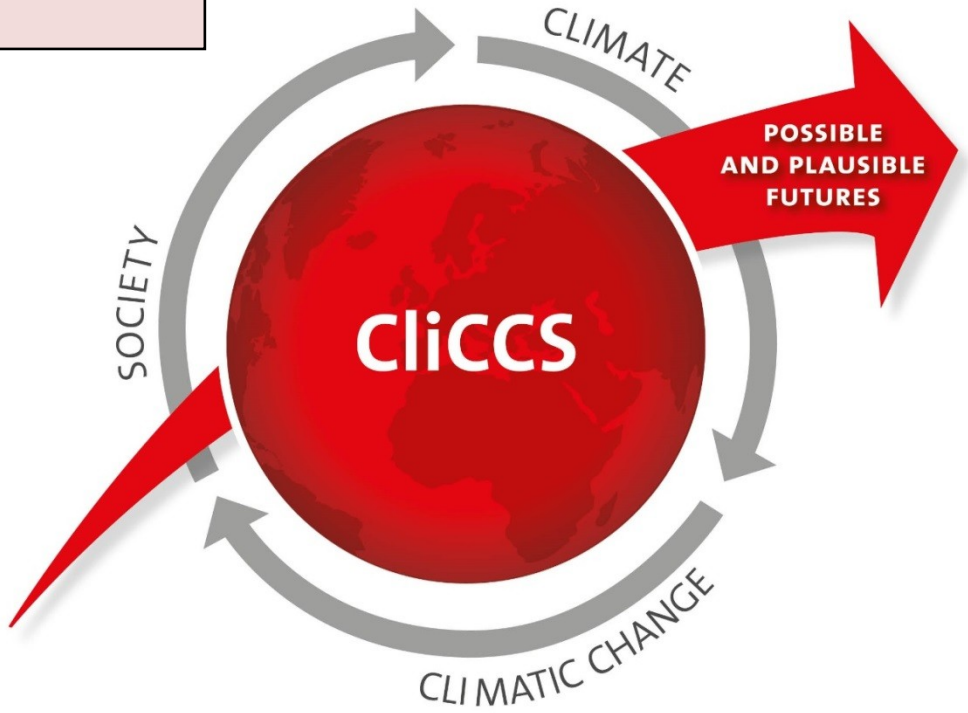


- Basic research on climate dynamics and climate-related social dynamics
- Development of pilot sustainable adaptation scenarios
- Transdisciplinary exploration of human–environment interactions

THE CLICCS OVERARCHING QUESTION

Which climate futures are possible and which are plausible?

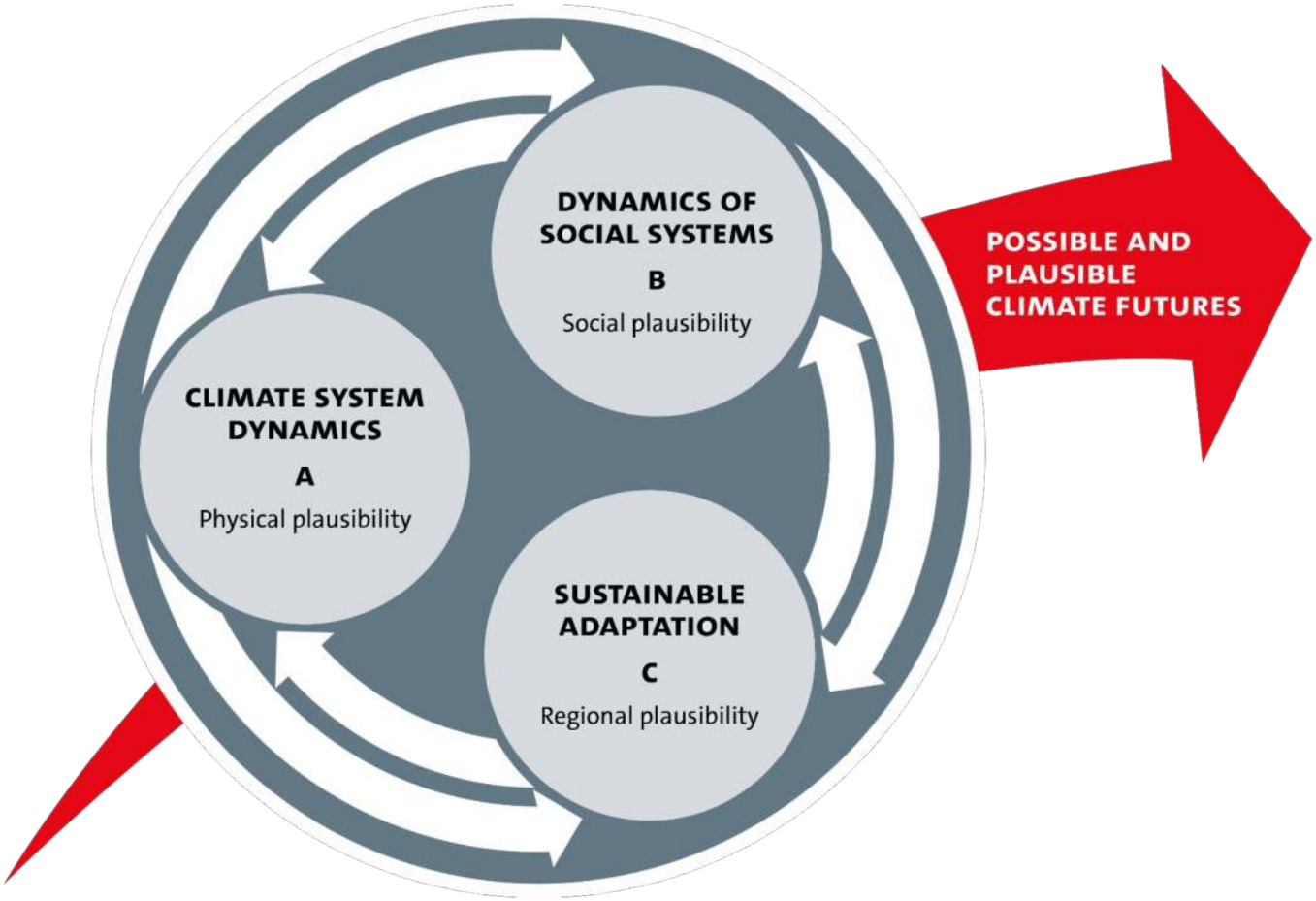
- Possible: consistent with our joint understanding of climate and social dynamics
- Plausible: expected to unfold with appreciable probability



SOME POSSIBLE CLIMATE FUTURES …

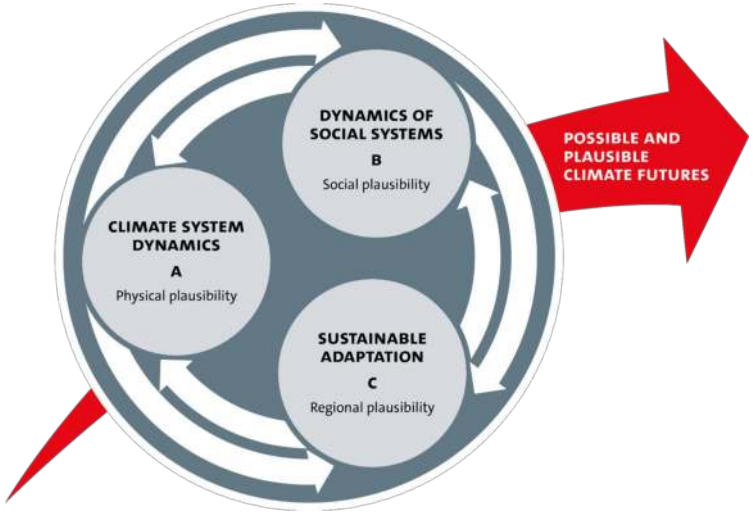
- Simulated late-21st-century surface warming, compared to preindustrial
- Three emissions scenarios, 11 climate models, many initial conditions
- Are all these simulated futures possible? Which are plausible? Why?

INTERDISCIPLINARY INTERACTIONS ARE KEY TO CLICCS



EXPECTED INTERACTIONS BETWEEN THEMES

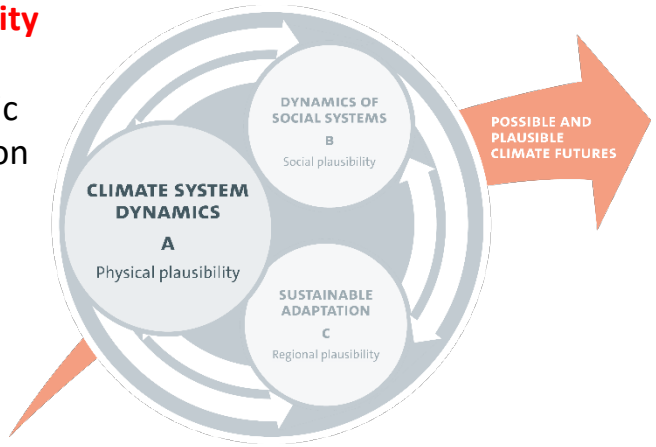
- Interactions between Themes B and C generate new plausible CO_2 scenarios as input to Theme A
- Plausible CO_2 scenarios enable new climate predictions in Theme A
- Understanding actors enables climate modelers to compute relevant climate parameters
- Recursive interactions generate self-consistent scenarios



DETAILED PROJECT STRUCTURE

Theme A: Sensitivity and Variability in the Climate System

- **A1:** Carbon Dynamics in the Arctic
- **A2:** Clouds and Tropical Circulation
- **A3:** Canopies in the Earth System
- **A4:** African and Asian Monsoon Margins
- **A5:** The Land-Ocean Transition Zone
- **A6:** Earth System Variability and Predictability in a Changing Climate



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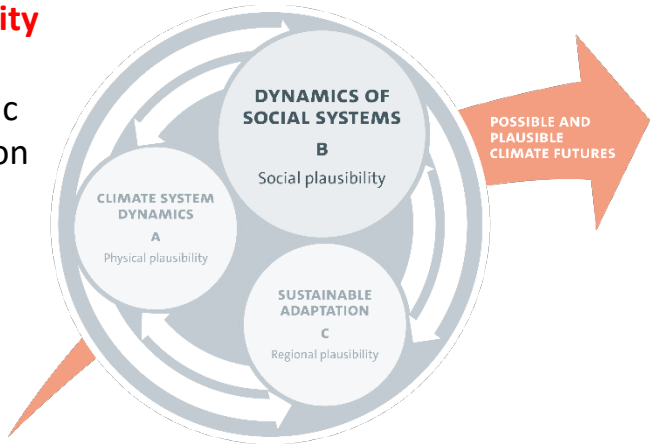

Theme B: Climate-Related Dynamics of Social Systems

- **B1:** Social Constructions of Climate Futures
- **B2:** Dynamics of Climate Governance: Norms, Contestation, and Policies
- **B3:** Conflict and Cooperation at the Climate-Security Nexus
- **B4:** From Company Responses to Decarbonization of the Economy
- **B5:** Coping with Climate-Related Uncertainties and Variabilities

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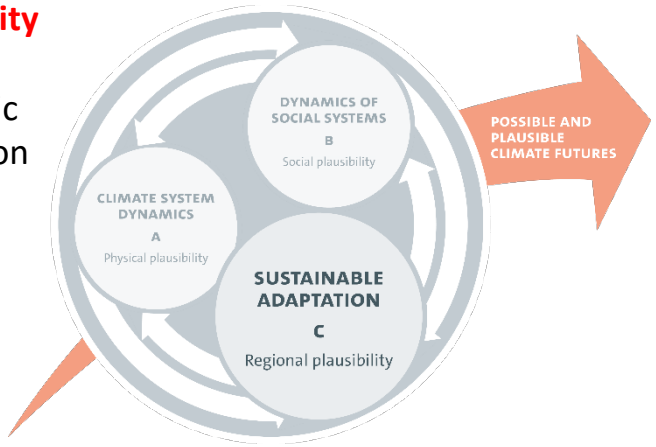

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Theme C: Sustainable Adaptation Scenarios

- **C1:** Sustainable Adaptation Scenarios for Urban Areas – Water from Four Sides
- **C2:** Sustainable Land-Use Scenarios: Soil, Biodiversity, Water, Food and Energy Security
- **C3:** Sustainable Adaptation Scenarios for Coastal Systems

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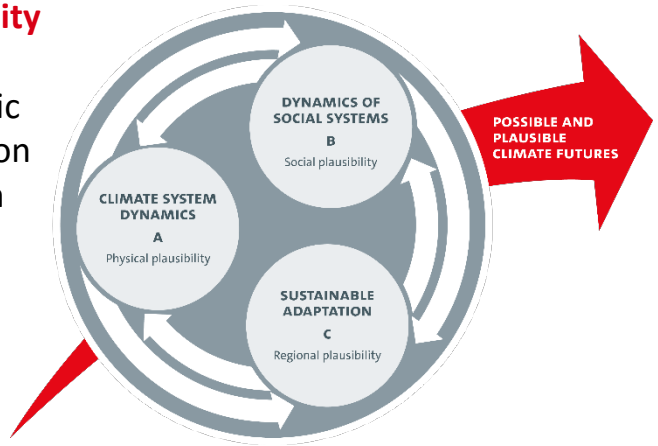

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High-Performance Computing and Data-Intensive Science

Hamburg Climate Futures Outlook: Synthesis and annual report

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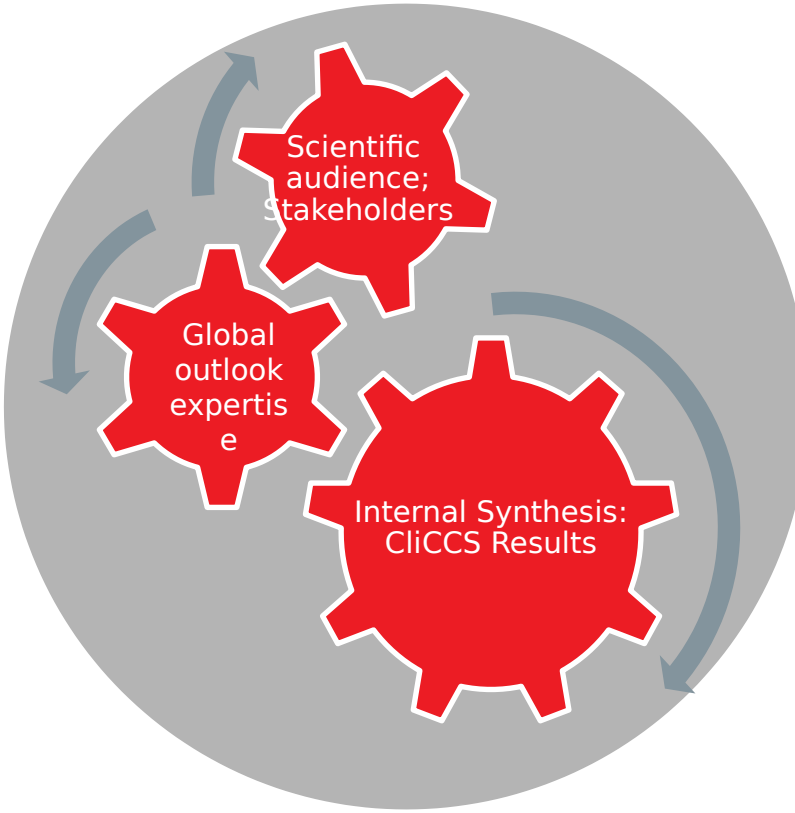
SYNTHESIS AND ANNUAL HAMBURG CLIMATE FUTURES OUTLOOK

Orchestrates the processes of

- Internal synthesis
- Interactions with global community and outlooks
- Integration of external expertise
- Addressing scientific audience

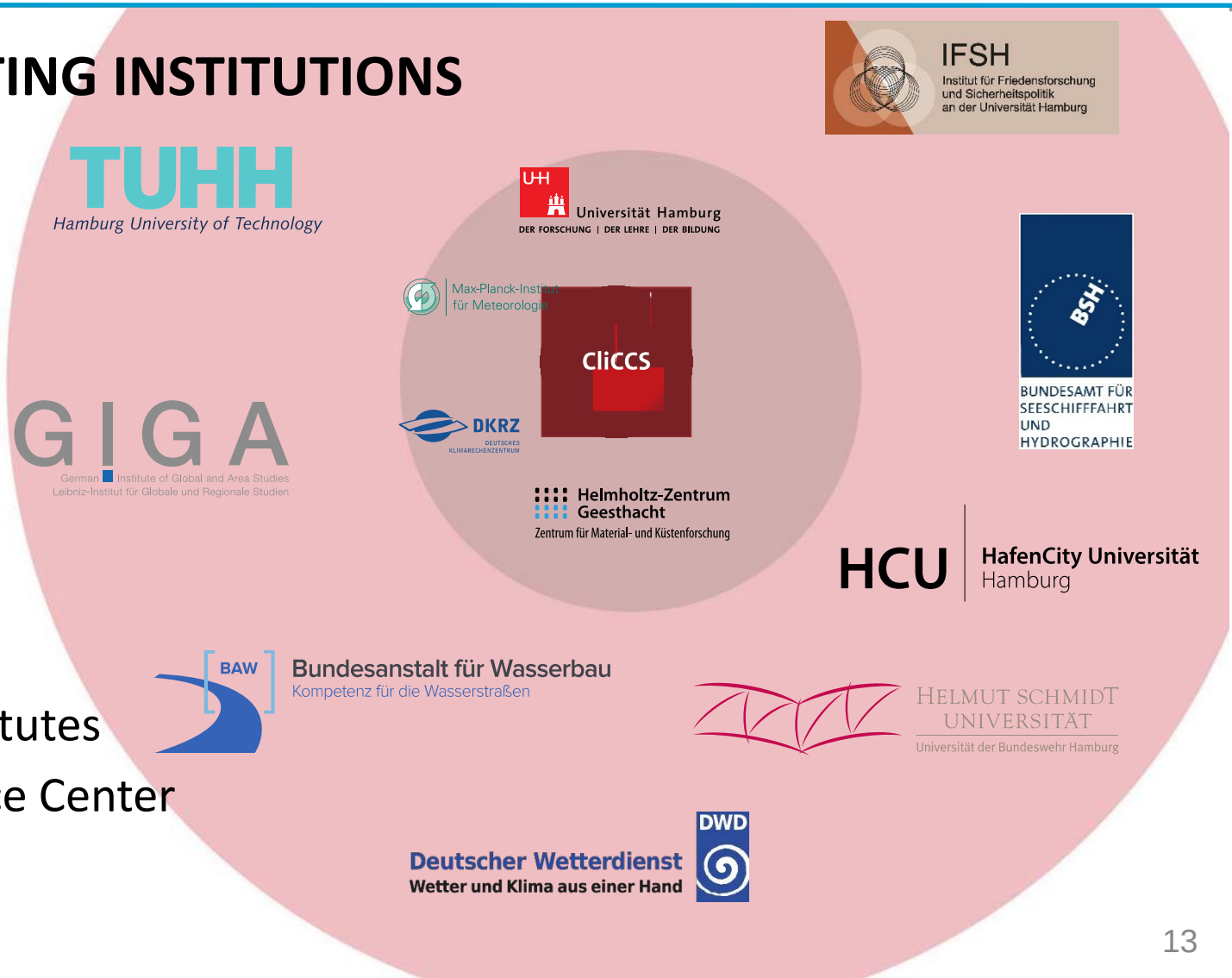
Generates the

Hamburg Climate Futures Outlook (annually)



CLICCS COMMUNITY

12 PARTICIPATING INSTITUTIONS



- Universities
- Research Institutes
- Climate Service Center
- Agencies

CLICCS Science Team

Starting with 106 participating researchers (proposal)

+ 3 Professors

+ 50 Scientists (PhD's and Postdocs) already hired in 2019

+ 7 scientists will still be hired during 2019,

+ 20 Scientists will join at the beginning of 2020

+ 29 Scientists funded by other sources already involved

About 200 scientists involved in CLICCS!

Thank you for your attention

Funded by:
DFG Deutsche Forschungsgemeinschaft