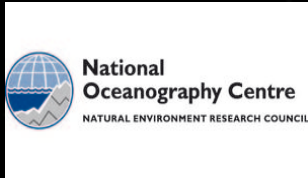


Ocean models for coupled seamless prediction

Helene Hewitt



Met Office in collaboration with
NOC and BAS

Outline

- Coupled seamless prediction
- Model development process for GC models
- Process Evaluation Groups
- Resolution

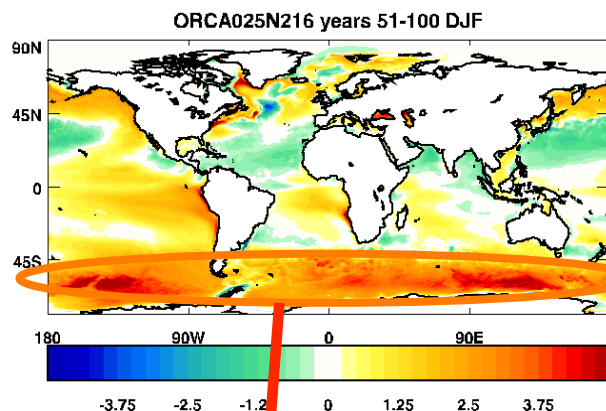
Global Physical Modelling

Unified Prediction across Timescales

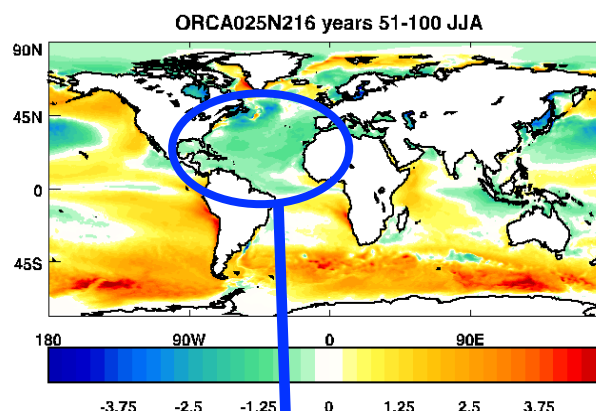


Using seamless prediction to look at biases

Climate: 50 yr mean

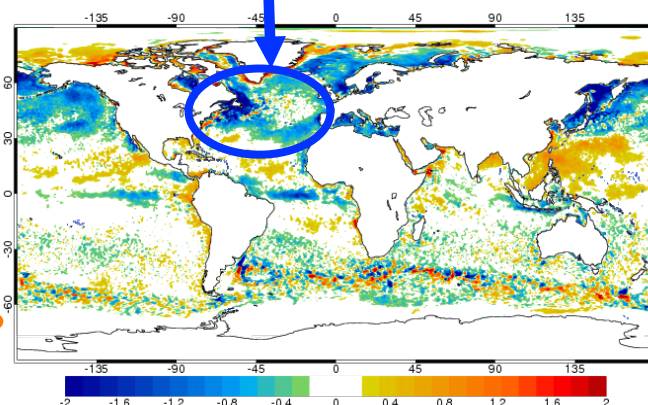
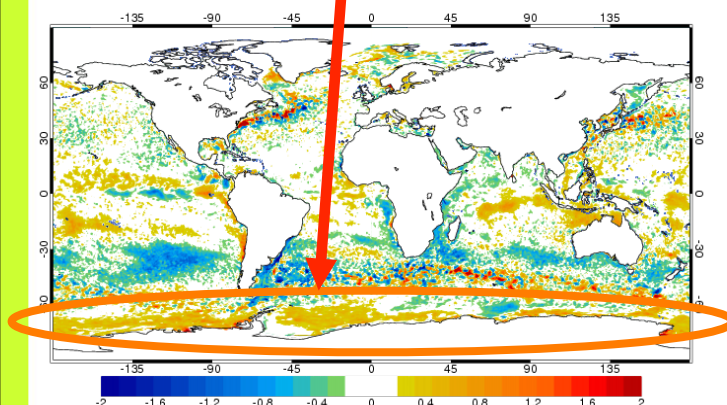


Mean winter coupled Temperature error (C) at 0.51m depth at day 14



Mean summer coupled Temperature error (C) at 0.51m depth at day 14

Coupled NWP: Day 14

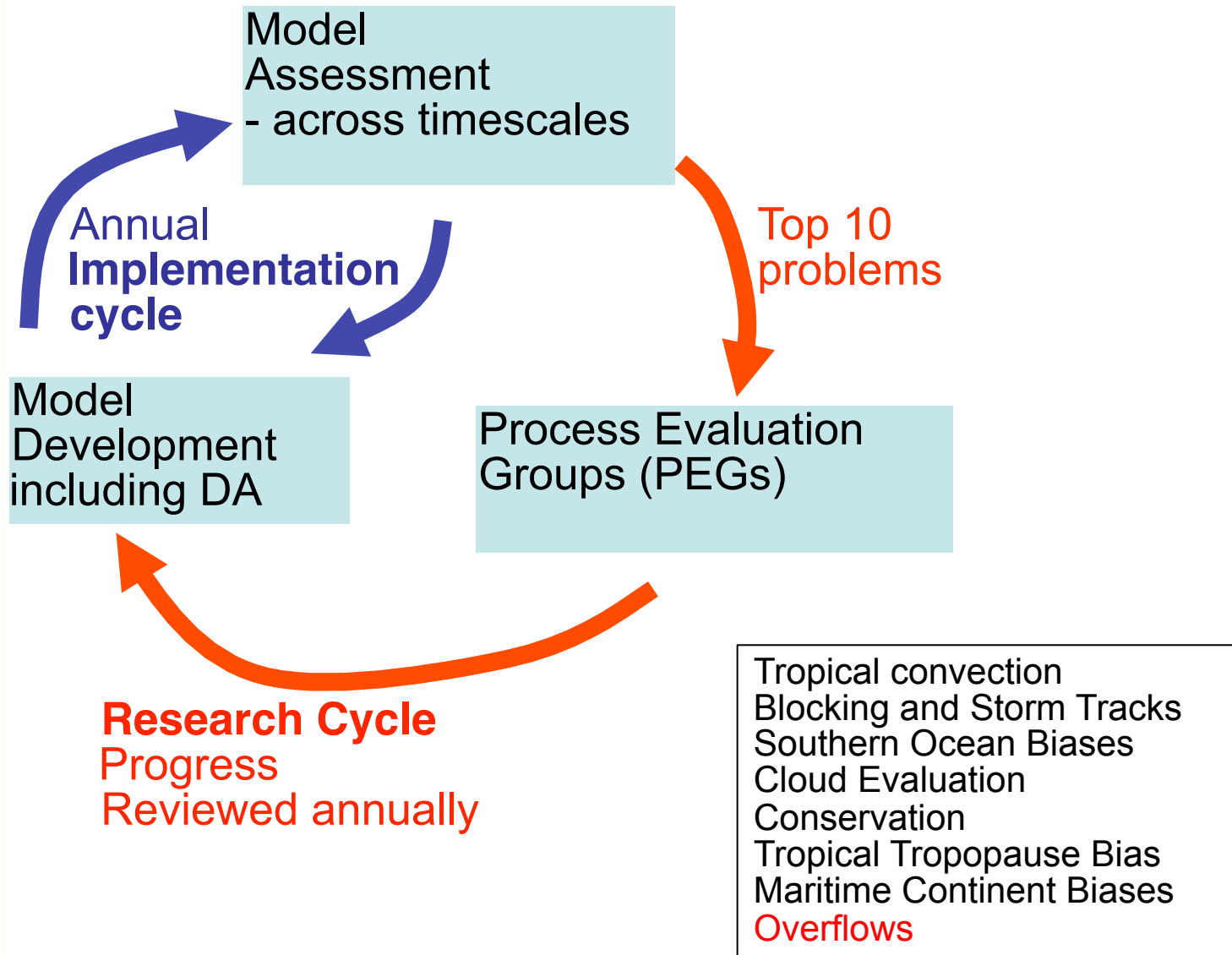


Tim Johns



Met Office
Hadley Centre

GC Development Process



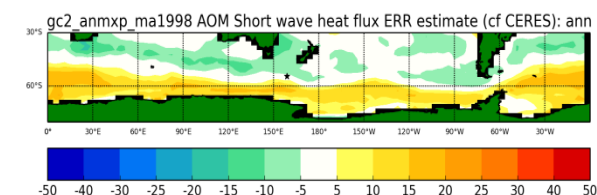
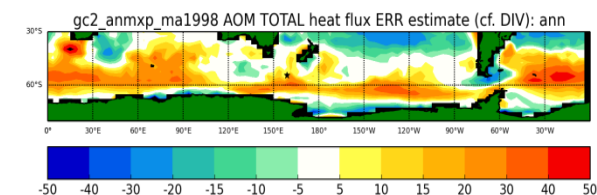
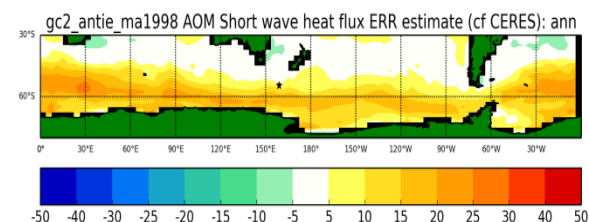
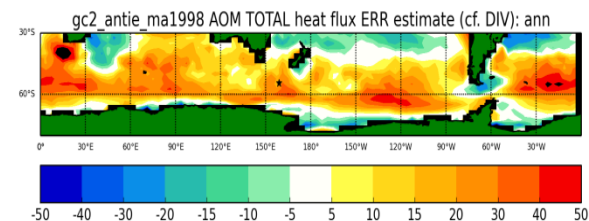
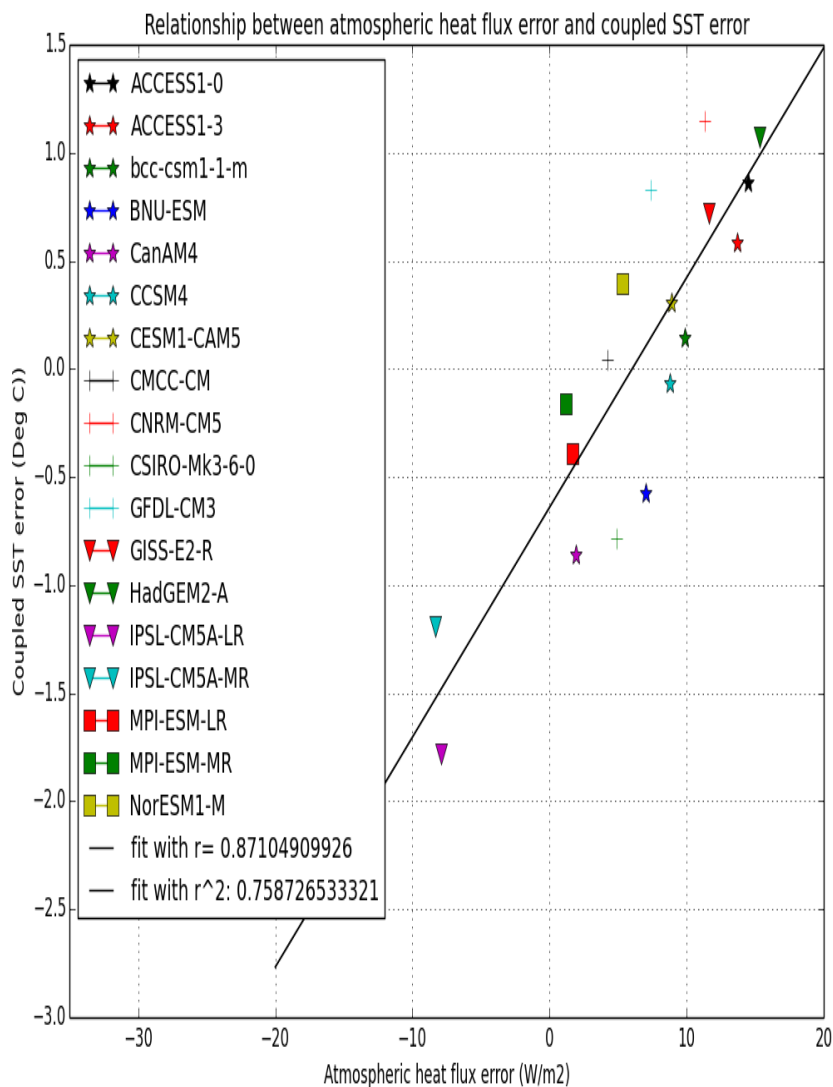


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Across
CMIP5, flux
errors
account for
75% SST
variance in
S Ocean

Flux errors
are reduced
in GC3

Southern Ocean PEG

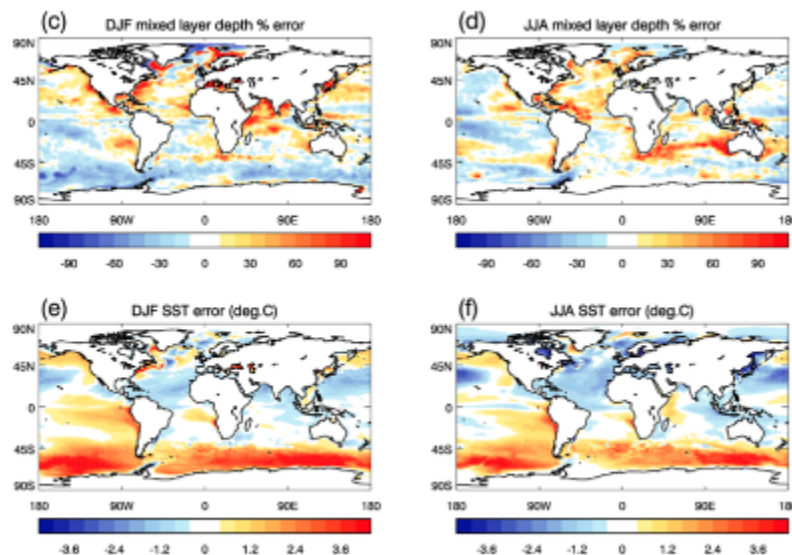


Hyder et al., in prep.

OSMOSIS

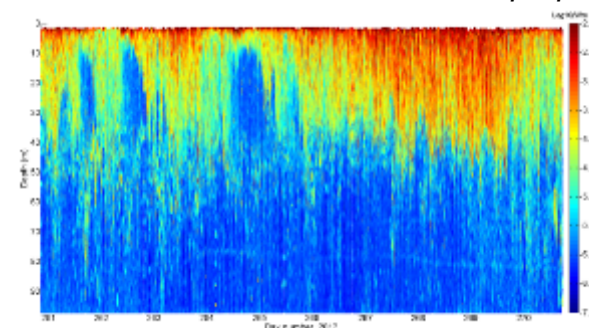
Ocean Surface Mixing, Ocean Sub-mesoscale Interaction Study

Aim: To develop new, physically based and observationally supported, parameterisations of processes that deepen and shoal the OSBL, and to implement and evaluate these parameterisations in a state-of-the-art global coupled climate model, facilitating improved weather and climate predictions.

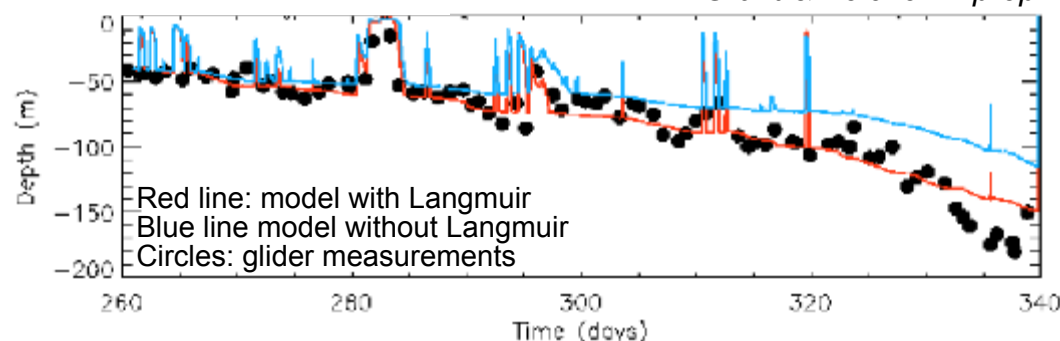


Data from HadGEM3;
Belcher et al (2012) *GRL*

Glider measurements of turbulence
Belcher et al in prep



OSMOSIS OSBL model
Grant & Belcher in prep





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National
Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL



British
Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

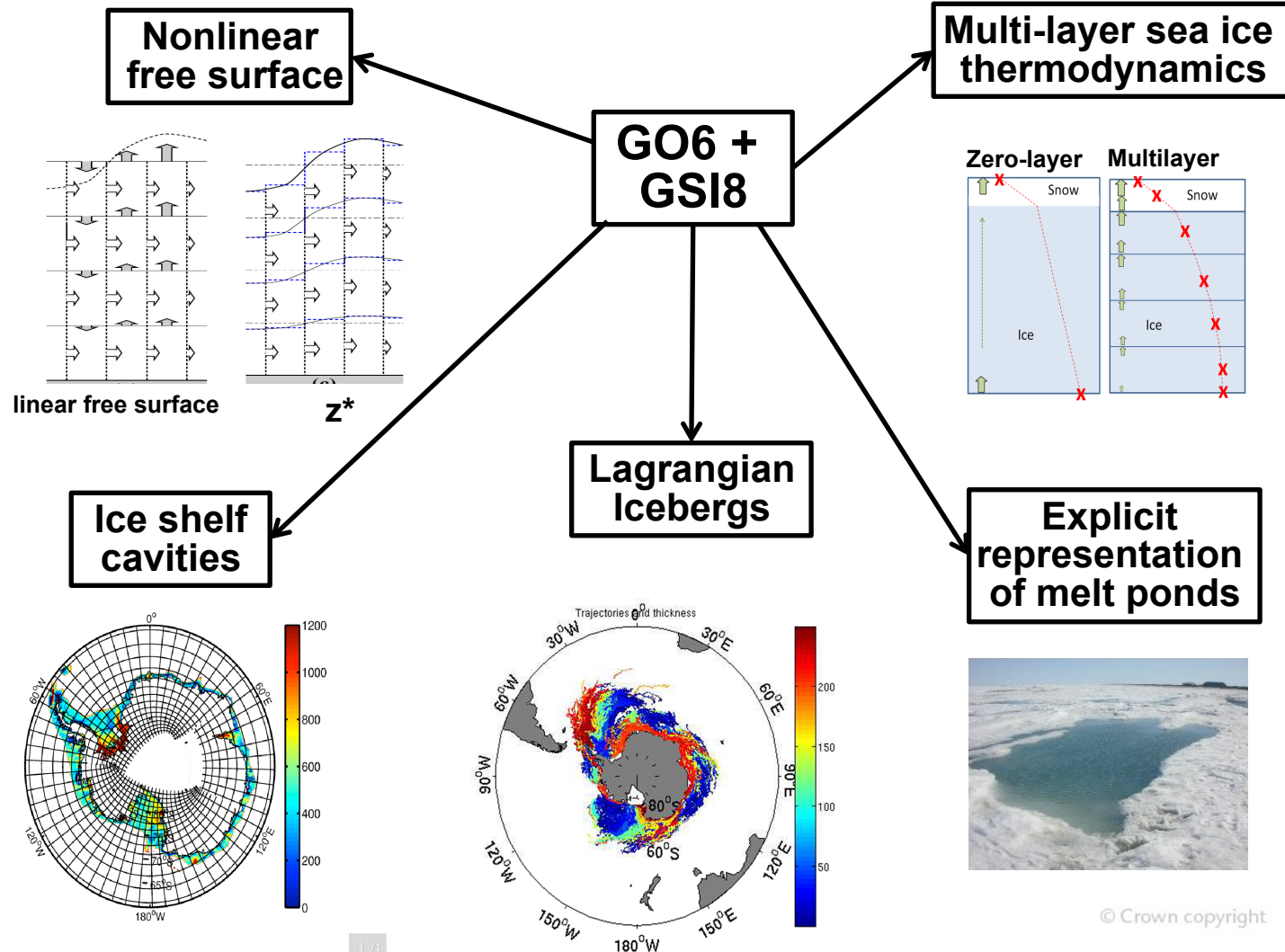
Developed
via Joint
Programmes
under
NERC-Met
Office
JWCRP

www.metoffice.gov.uk

Global Ocean and Sea Ice model for CMIP6

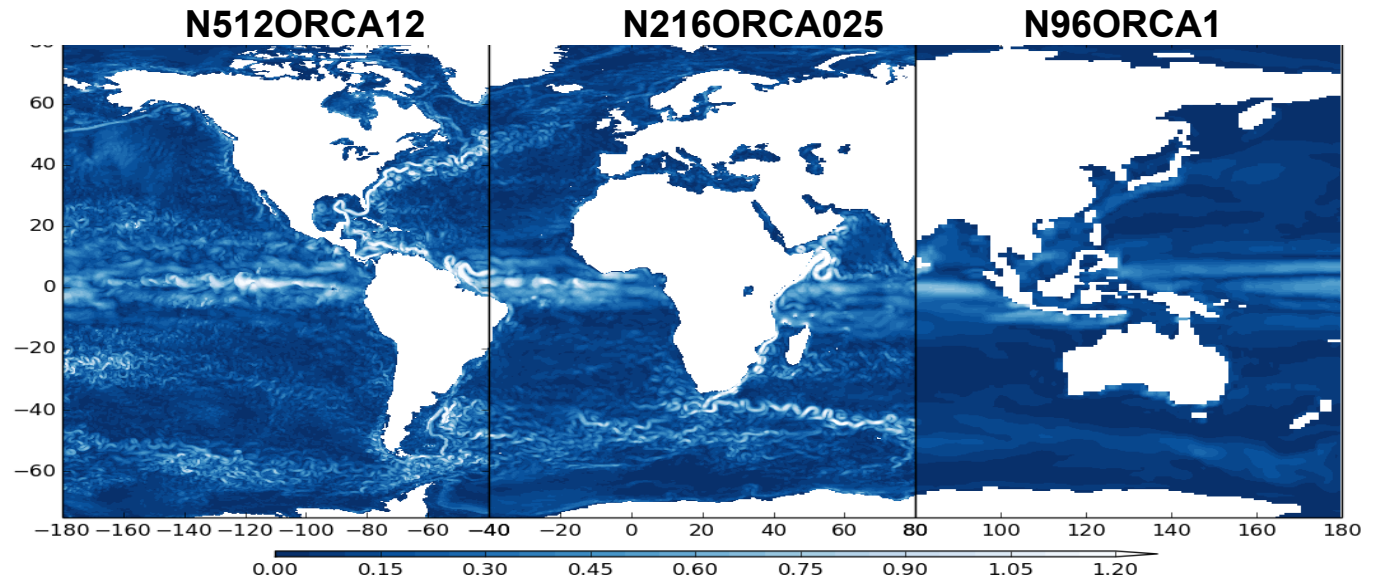
NEMO 3.6

CICE5



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Traceable resolution hierarchy



**Climate: EU
PRIMAVERA**

**Seasonal:
CHARISMA**

Coupled NWP

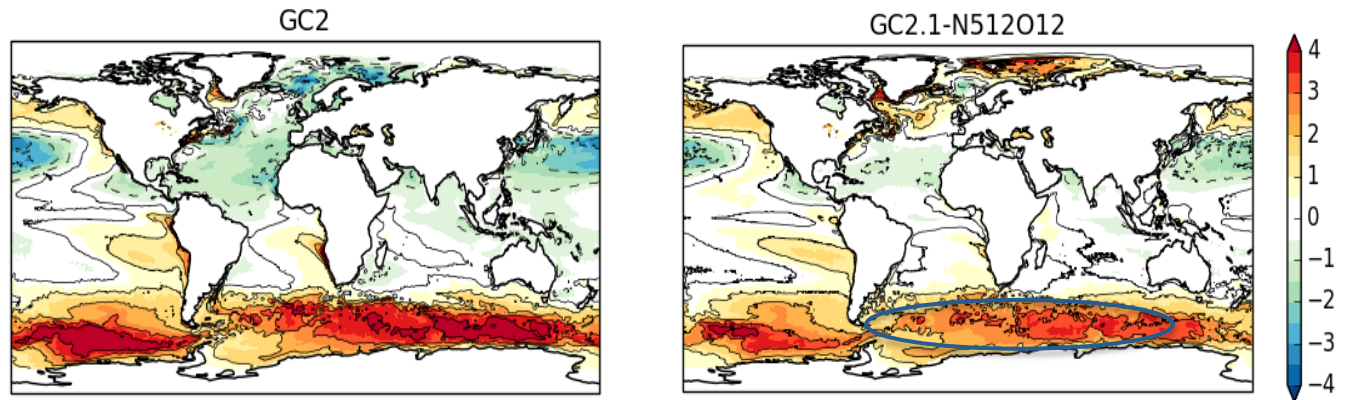
**GC3 for CMIP6
(+N96ORCA025)**

**Seasonal and
decadal**

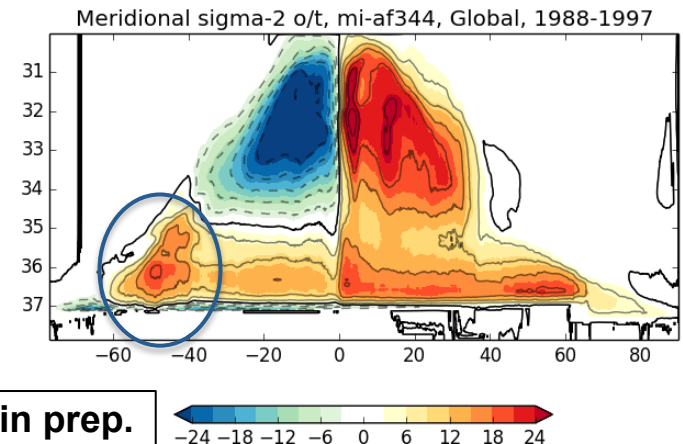
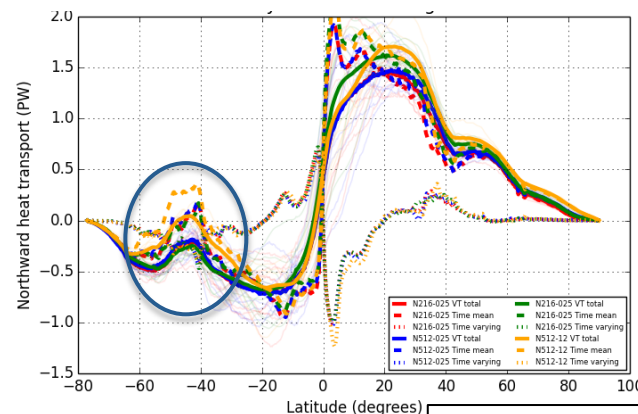
**UKESM1
CMIP6**

Improved
ocean
circulation
reduces
ocean drift

Results from eddy-resolving resolution



Upper branch of MOC strengthened at 1/12°
Poleward heat transport reduced in SH
Feeds back onto westerlies





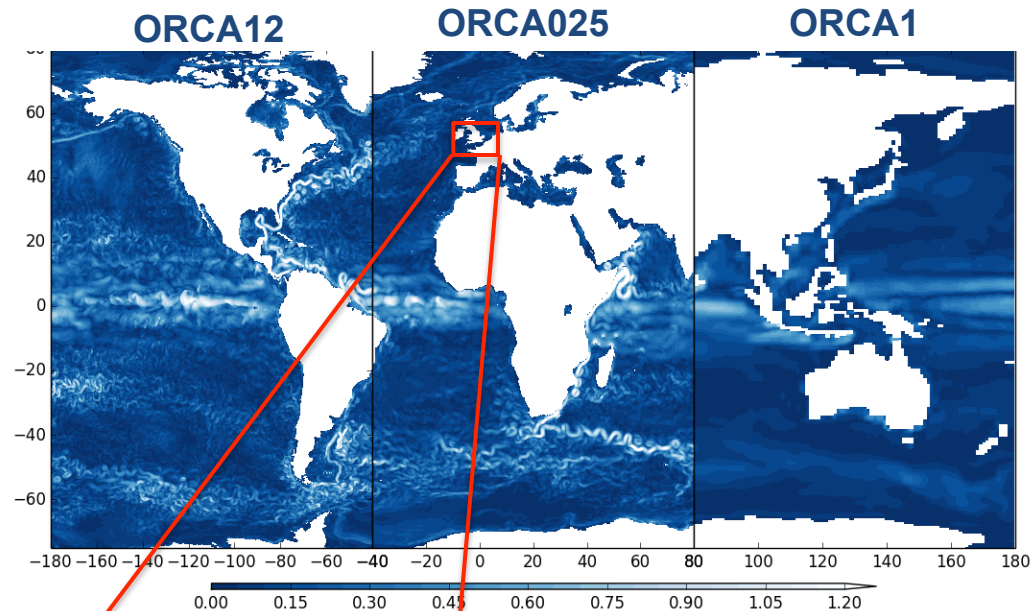
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Shelf sea enabled global model

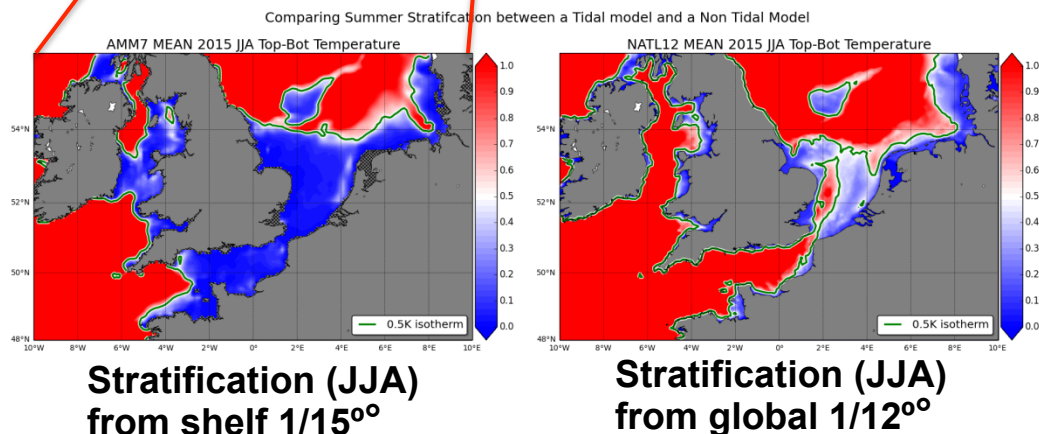
- Nutrient and carbon exchange with global ocean
- Global marine impacts incl. coastal sea level
- Marine methane release

The next frontiers in global ocean models

Eddies and shelf processes



High resolution improves currents, eddies, open ocean processes BUT...



...need tides and shelf processes to capture well-mixed regions

Summary

- Seamless prediction offers scientific opportunities as well as economy of effort. It is challenging to meet the requirements of a range of users.
- Development for the GC models is motivated both by improving processes and reducing biases. Eg, Southern Ocean PEG has reduced the SST bias by understanding and improving the processes.
- We are building a traceable hierarchy of GO and GC models. The importance of high resolution will be explored via climate and ensemble experiments.
- We also plan to improve the representation of shelf seas at high resolution.



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Any questions?

