



ATLAS GA, Edinburgh, 9/3/2020

Evert de Froe, Christian Mohn, Jørgen L. S. Hansen, Stuart Cunningham, Stefan Gary, Eva Friis Møller, Clare Johnson, Karline Soetaert, Anna van der Kaaden, Kirstin Schulz, Marina Carreiro Silva, Carlos Domínguez Carrió, Lorenzo Rovelli, Dick van Oevelen

A Mechanistic Modelling Approach to Predict Cold-Water Coral Biomass Based on Organic Matter and Hydrodynamics

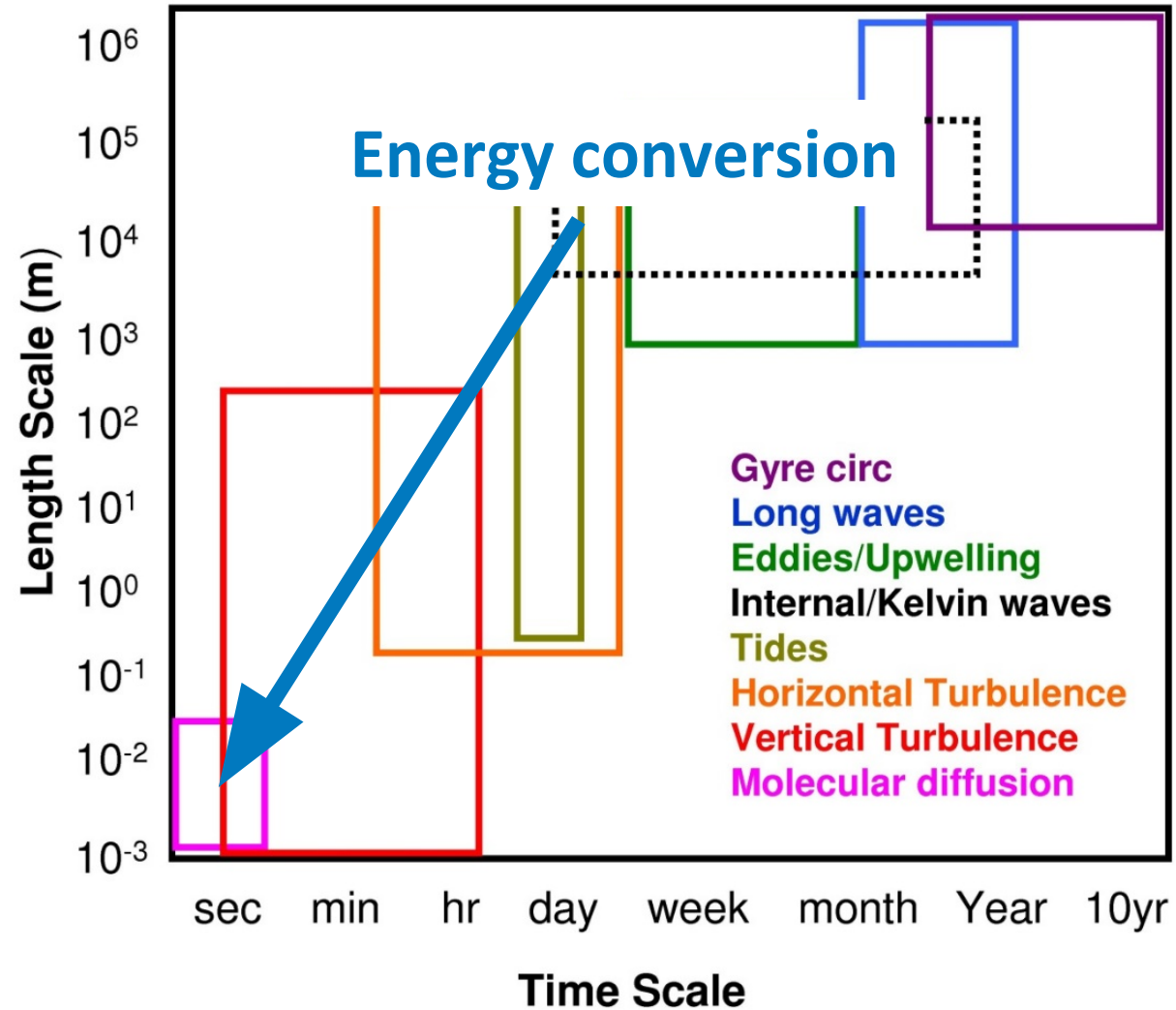


Tasks and challenges



- Improve capacity to predict cold water coral biomass by modelling sub-mesoscale hydrodynamics and organic matter transport with linked high-resolution models.
- Identify hotspots of ecologically relevant processes (internal wave action, energy transfer and mixing) and how they can be affected by alternating states of the AMOC system.
- Predict drivers and spatial distributions of organic matter and coral biomass.
- Provide a mechanistic modelling framework for a wide range of environments and species.

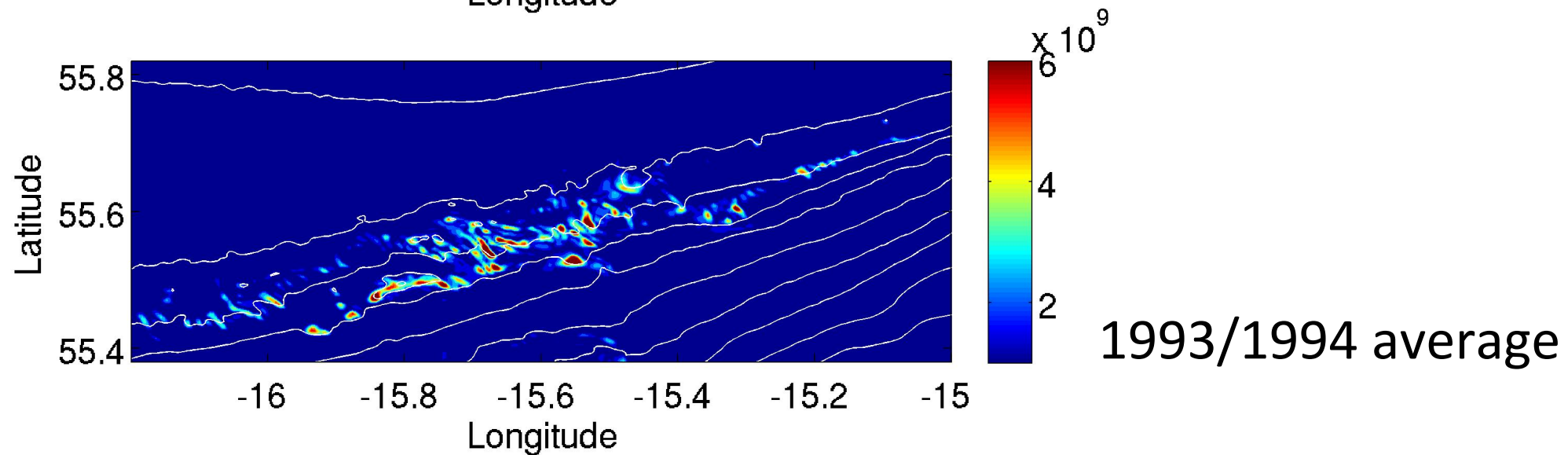
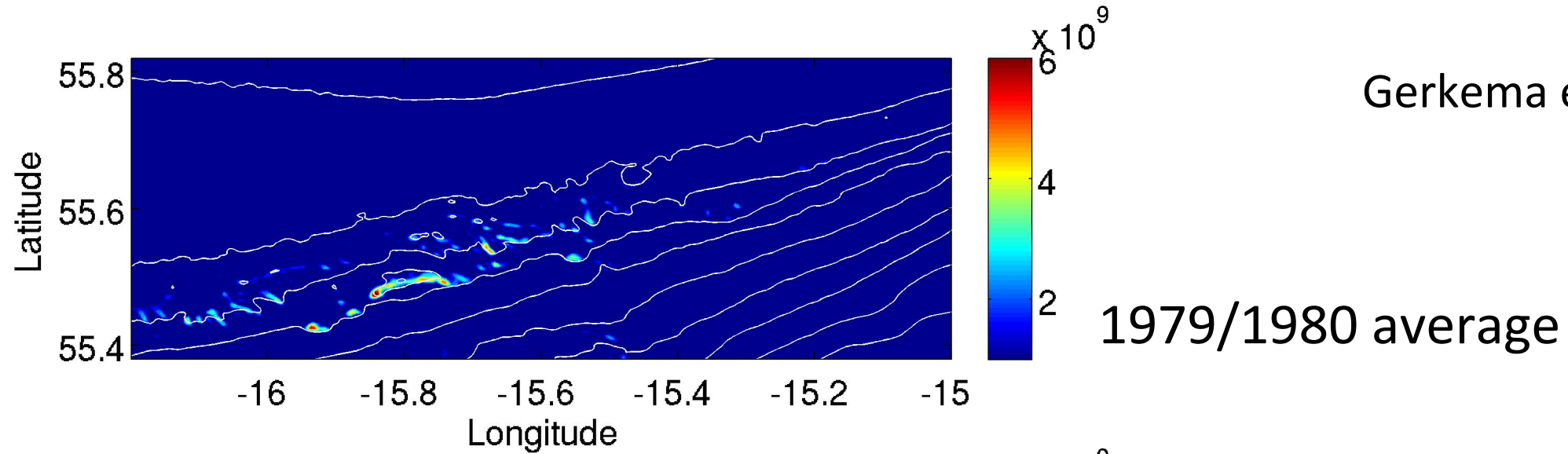
Physical processes in the ocean



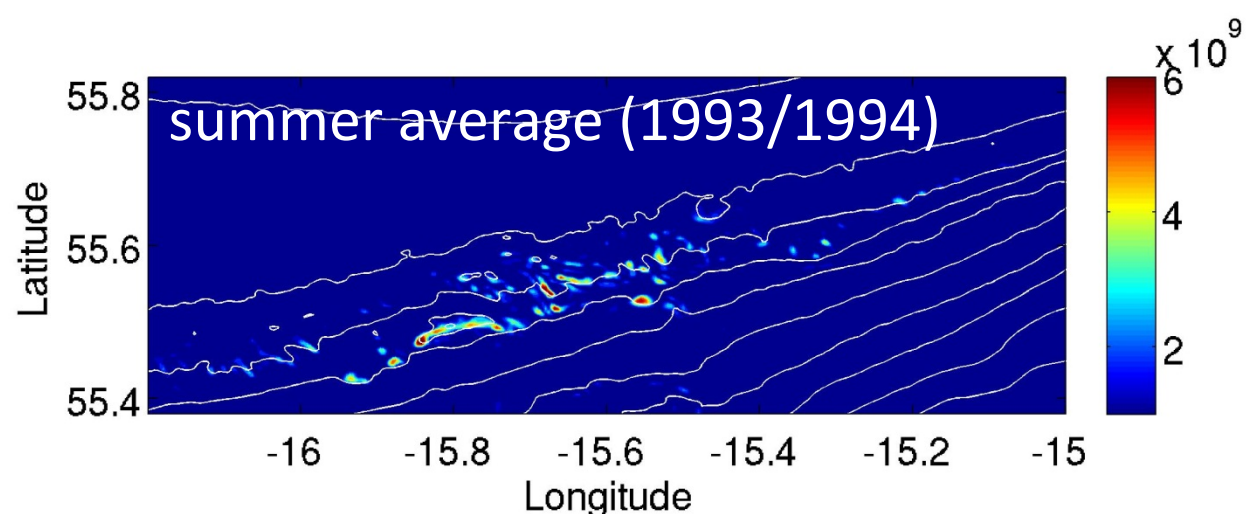
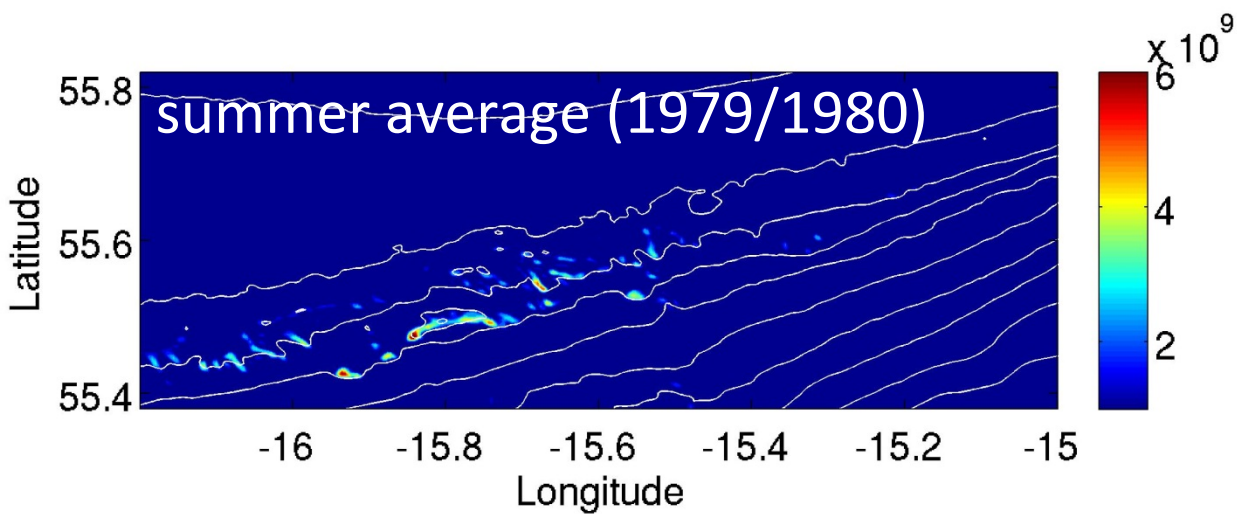
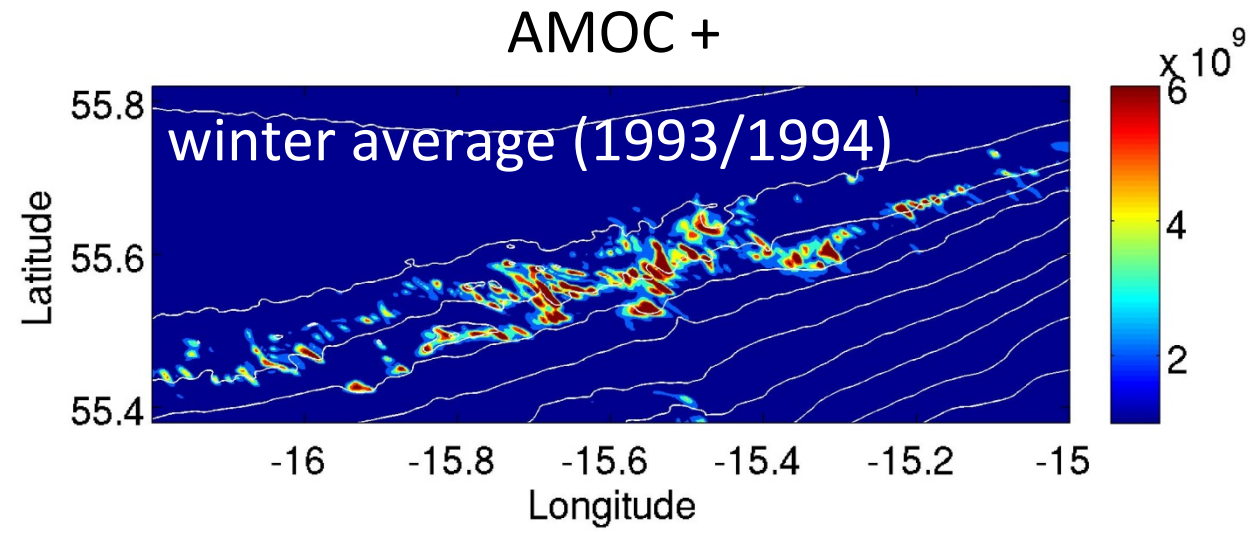
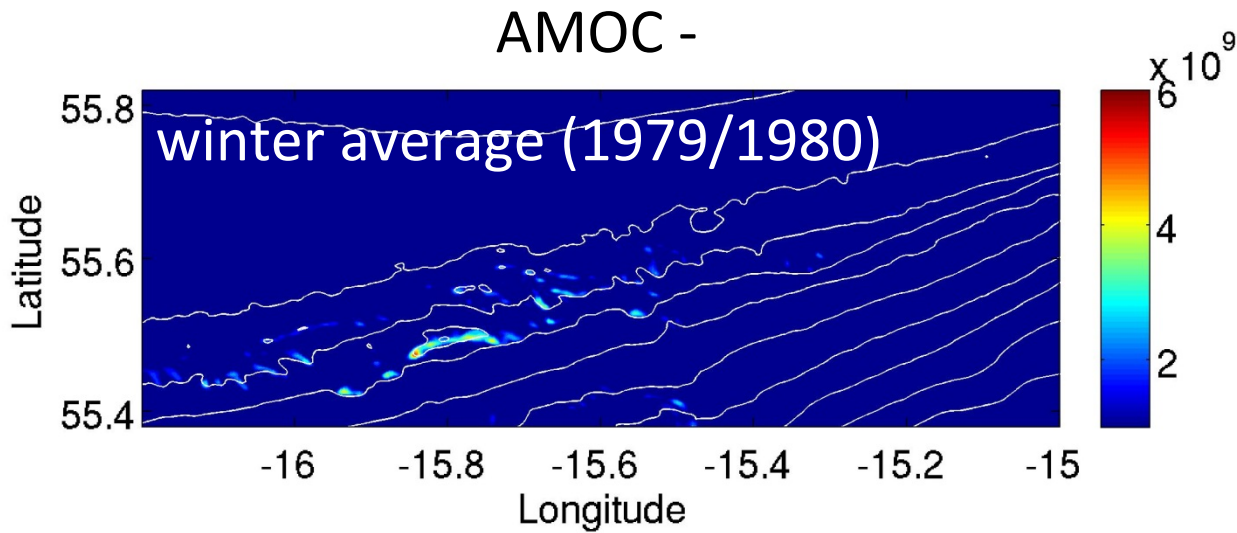
Rockall Bank: Energy conversion into baroclinic tides (W/m^3) atlas



Gerkema et al (2004)



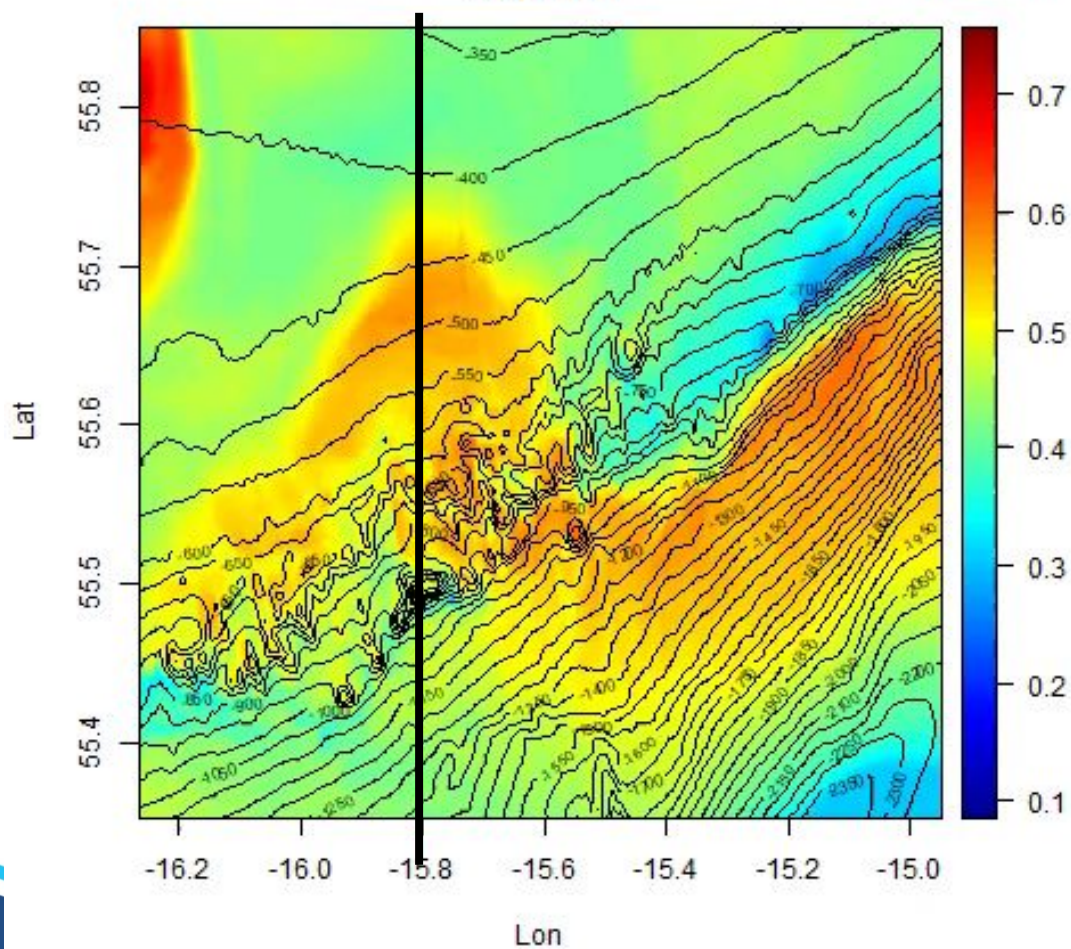
Energy conversion into baroclinic tides (W/m^3) - Seasons



Modelling organic matter transport

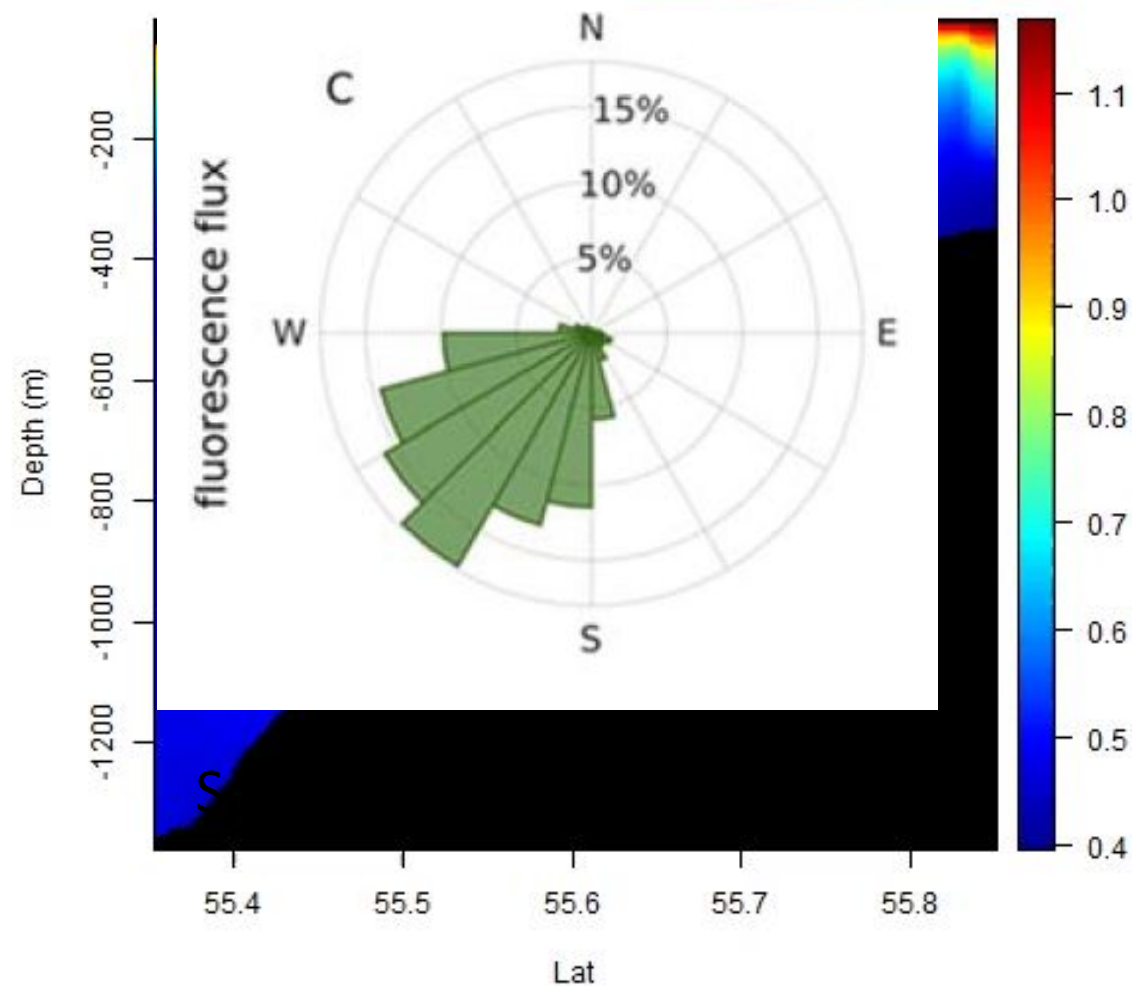
POM bottom layer March 1979
day 0.125

mmol C m⁻³



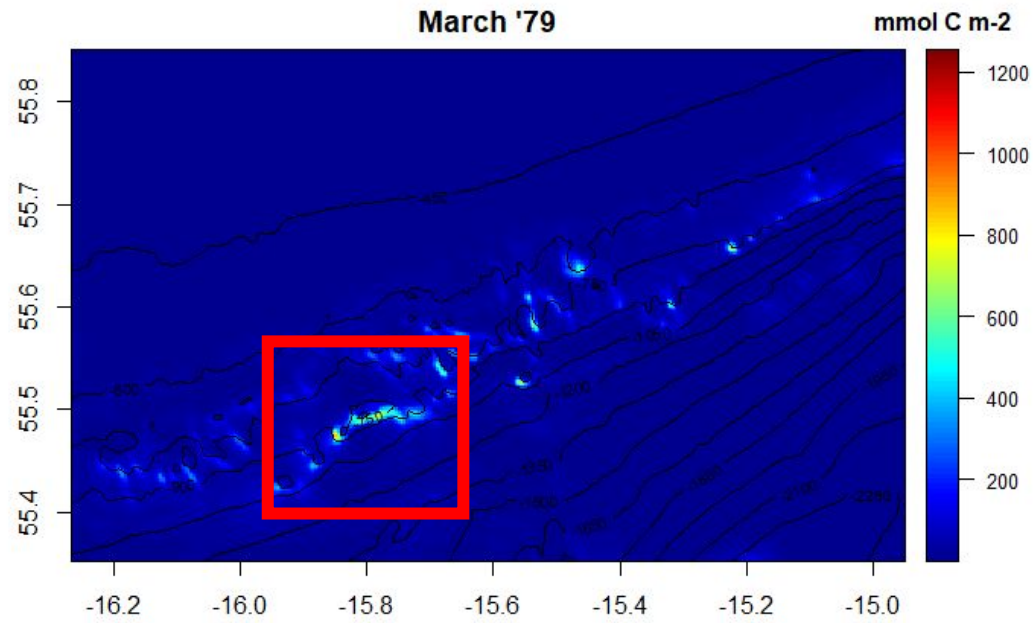
POM transport March 1979
day 0.125

mmol C m⁻³

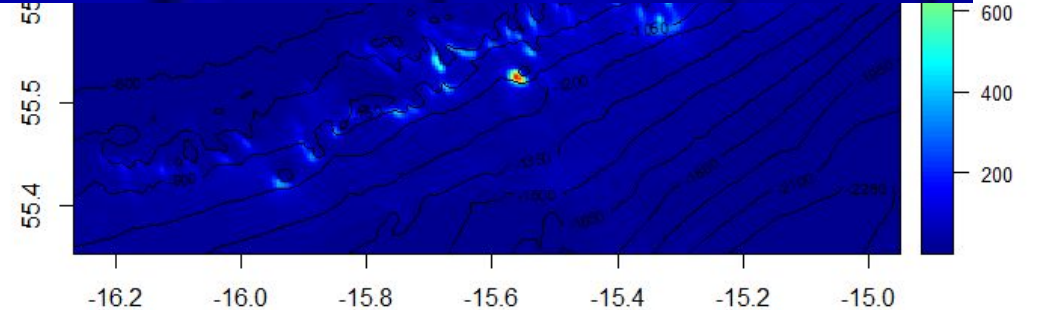
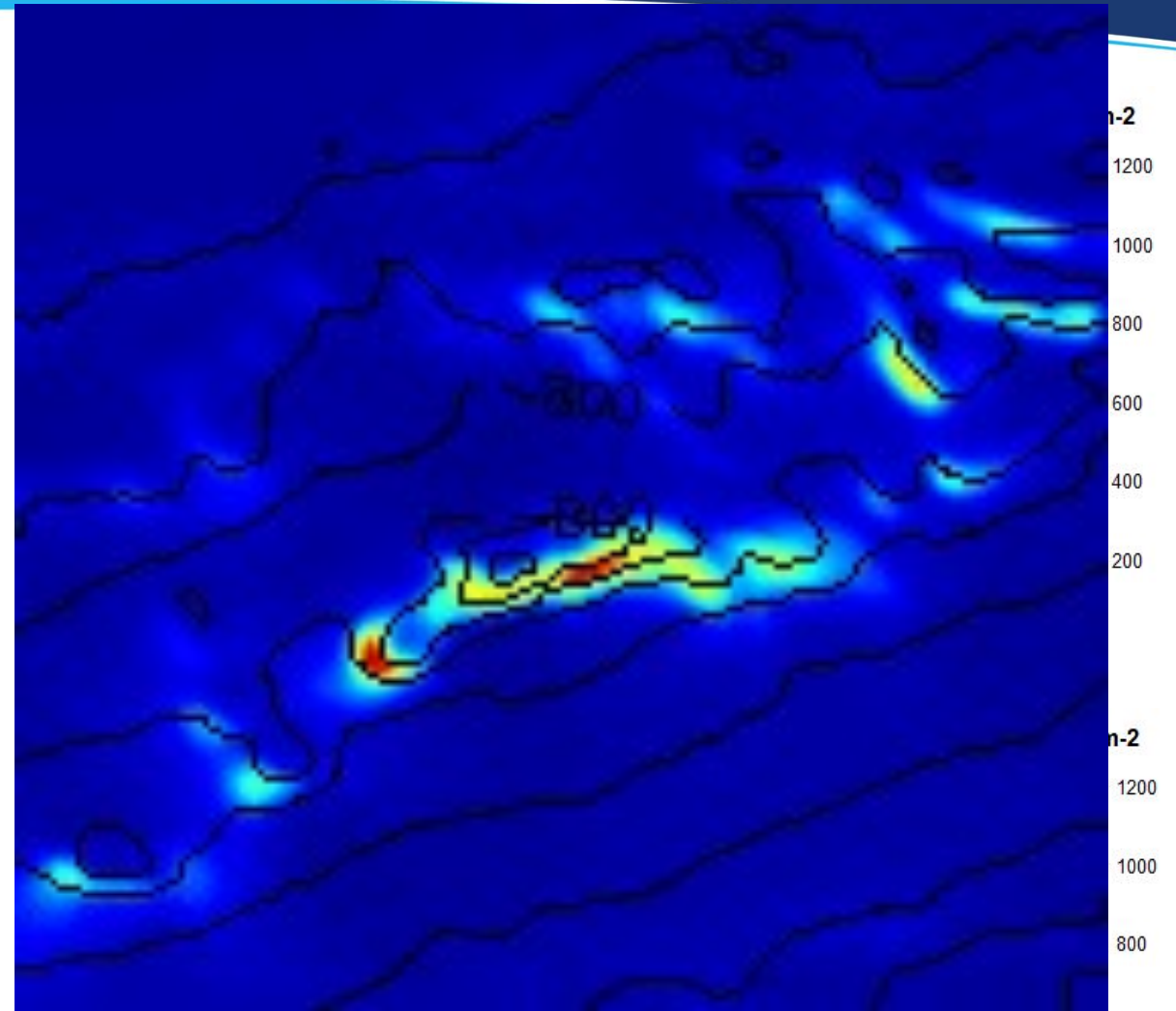
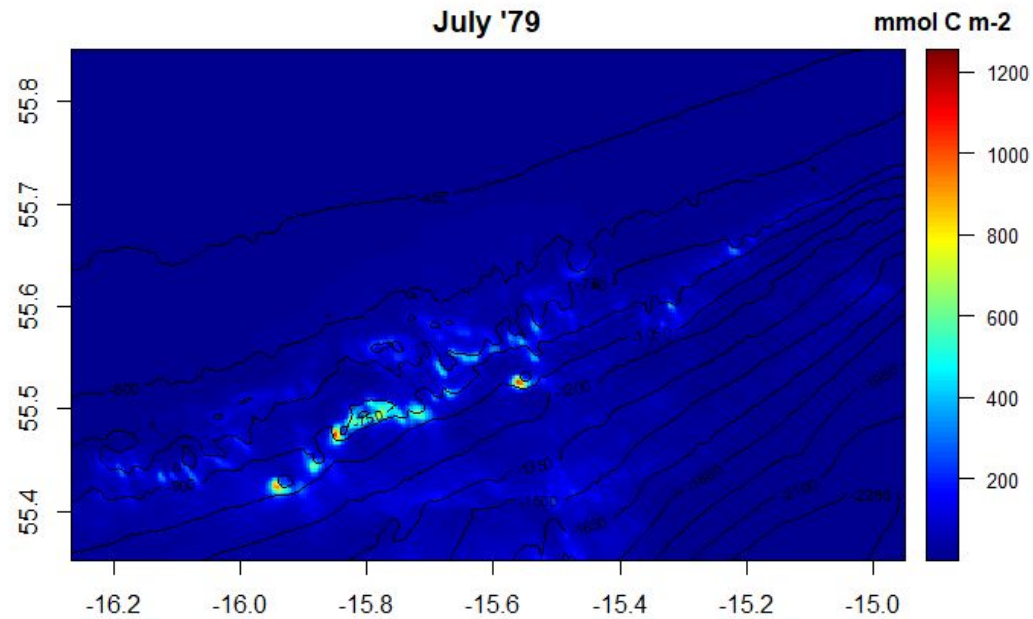


AMOC -

March '79



July '79

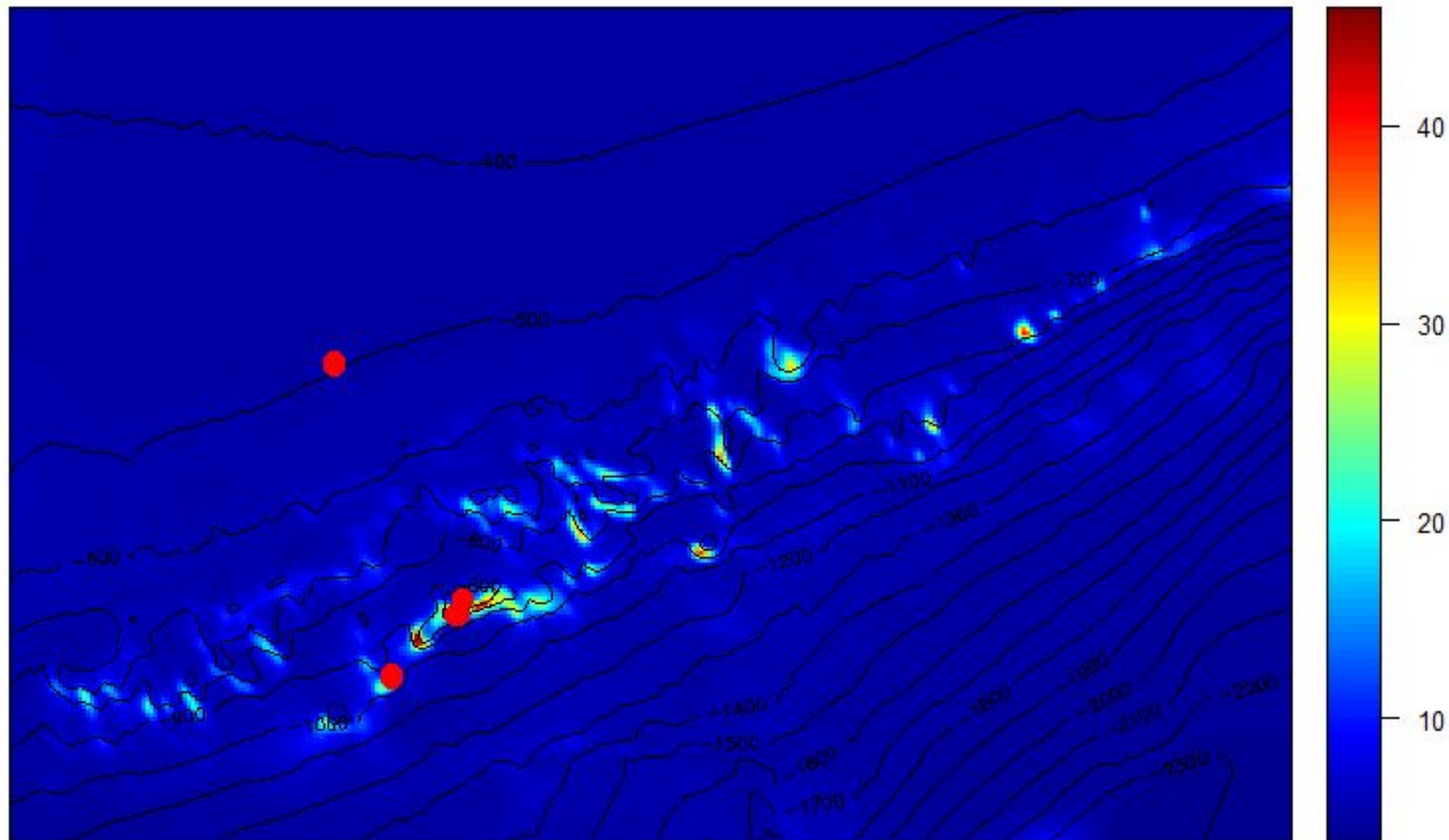


Benthic respiration

Benthic respiration

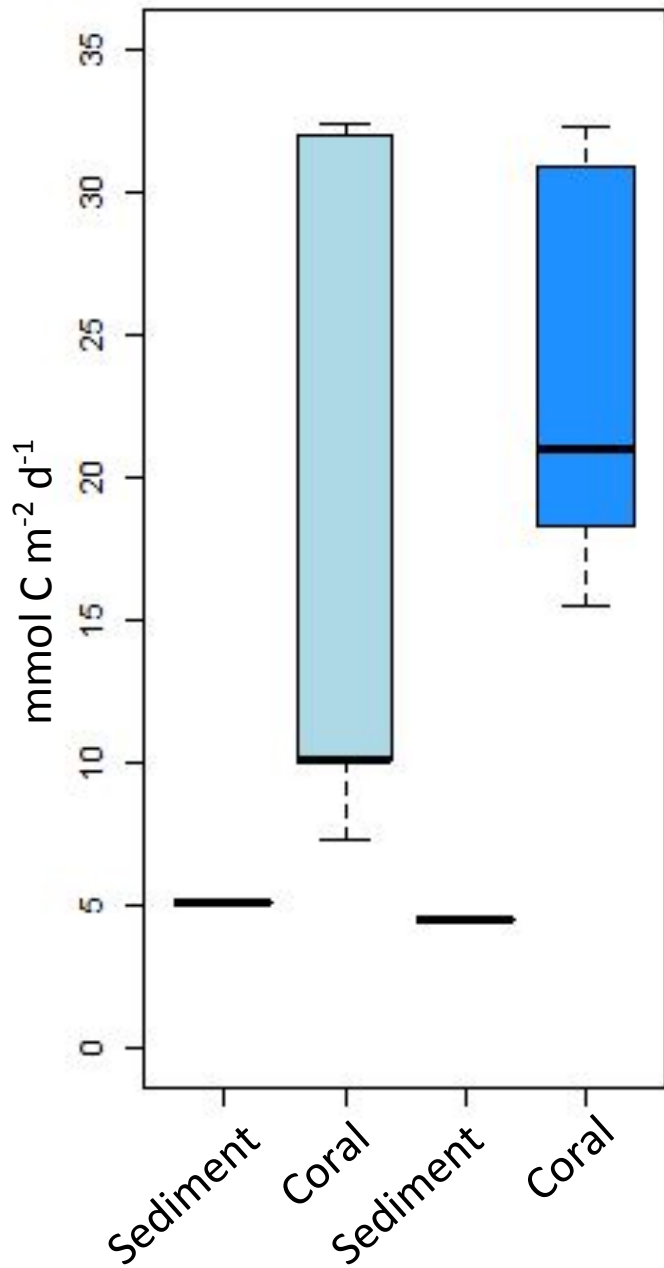
mmol C m⁻² d⁻¹

tlas

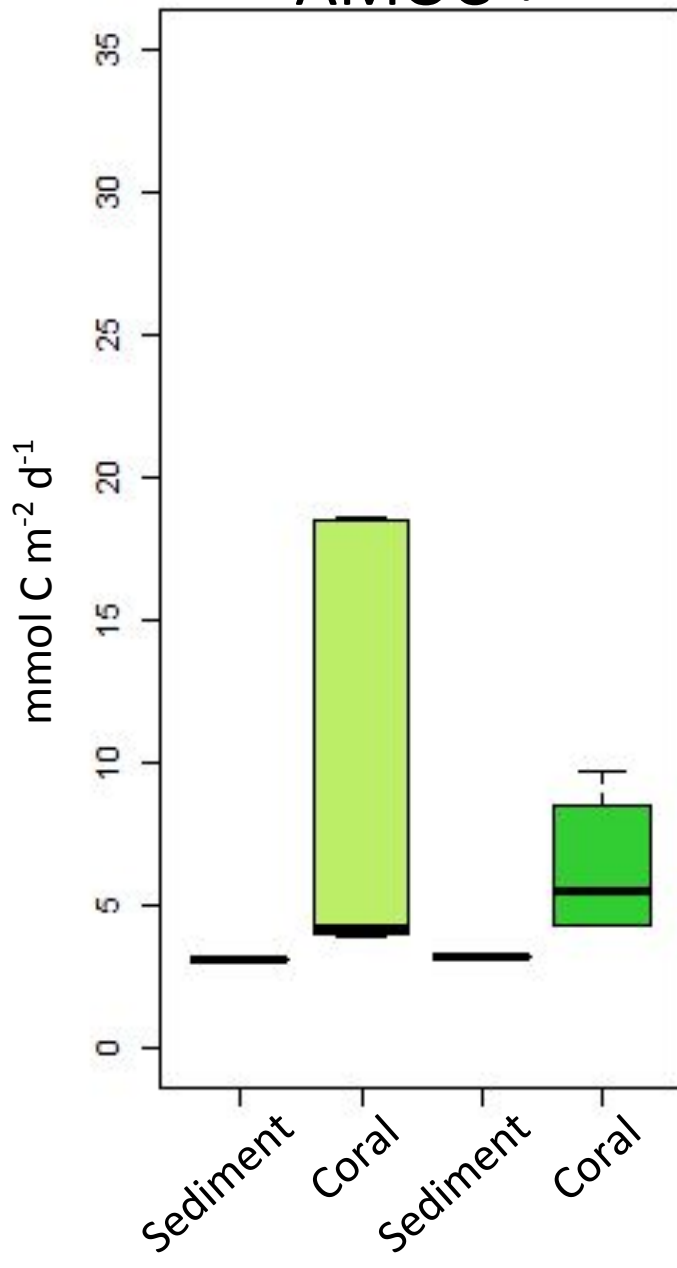


Benthic respiration

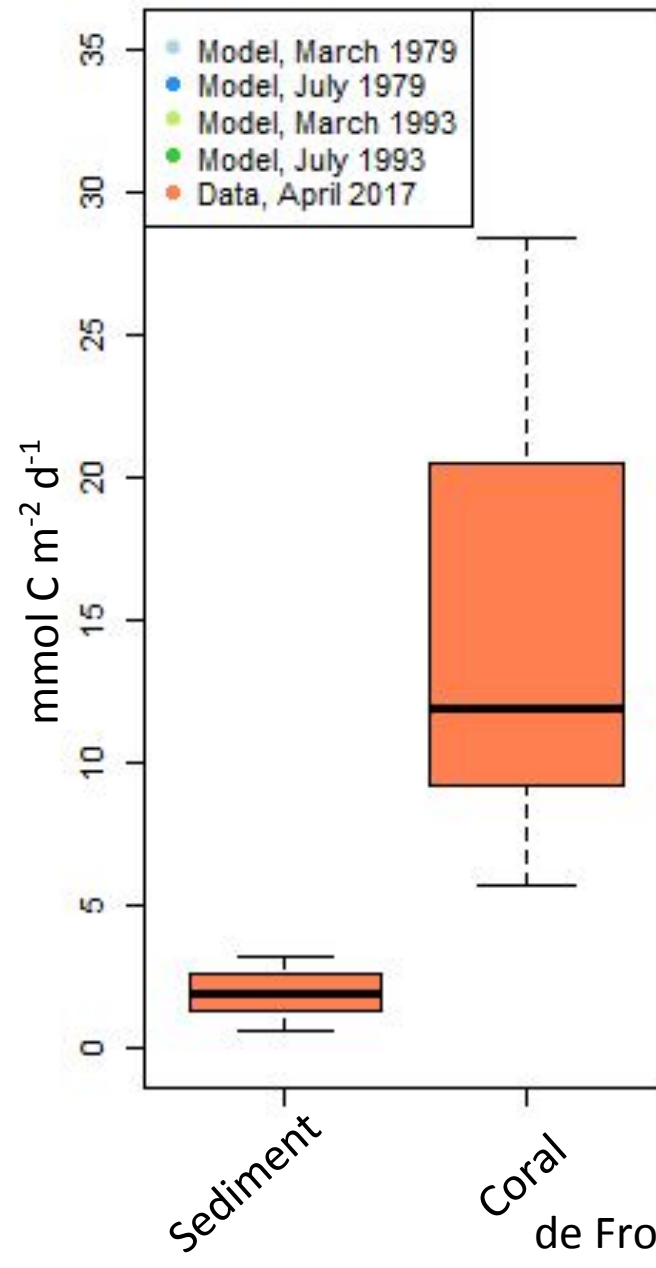
Model:
AMOC -



Model:
AMOC +

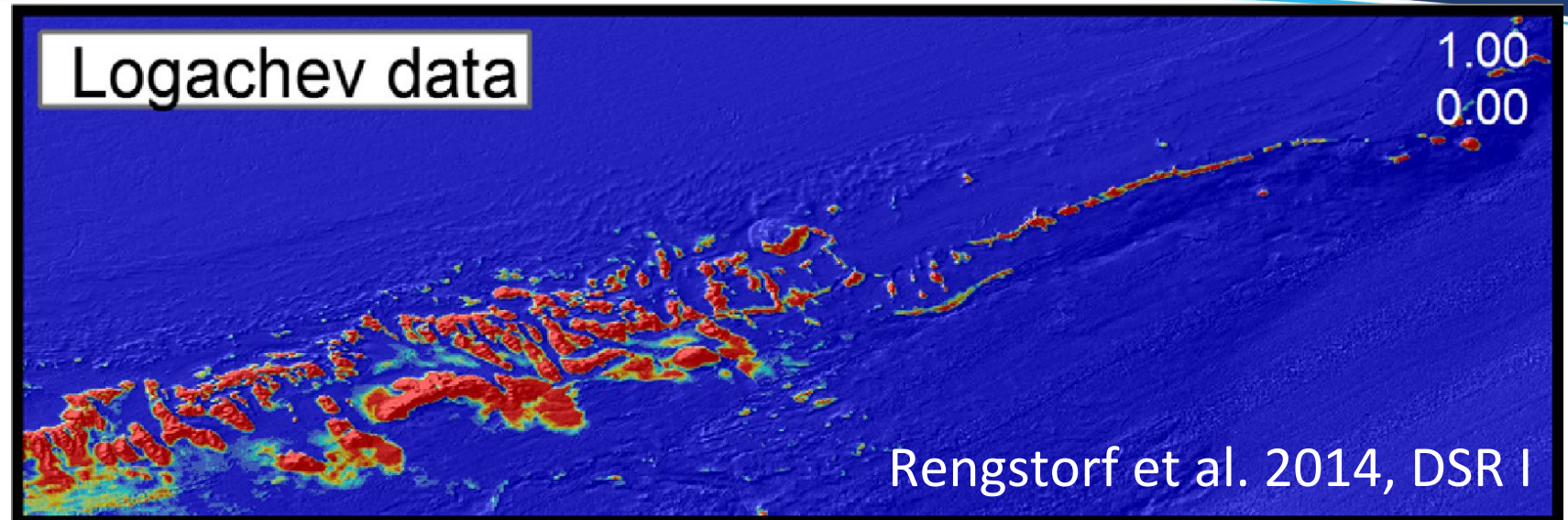


Data

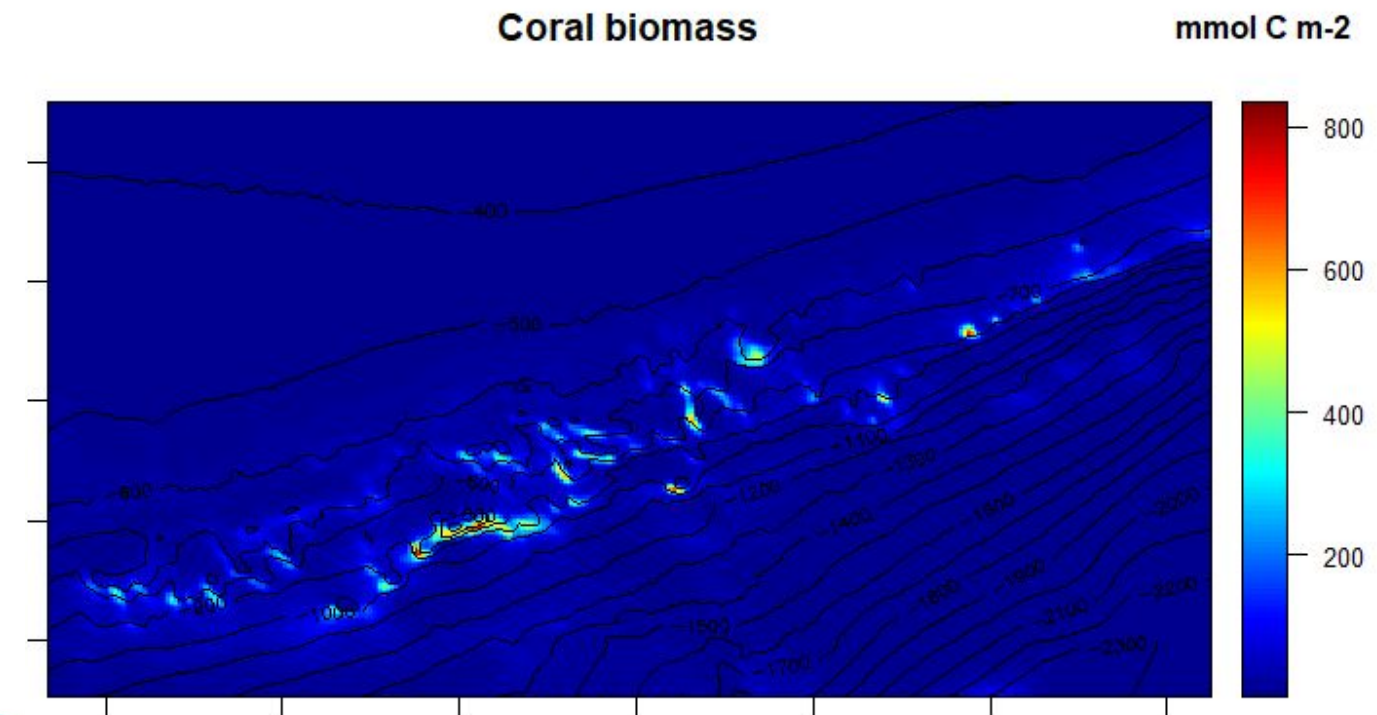


as

- Statistical model



- Mechanistic model



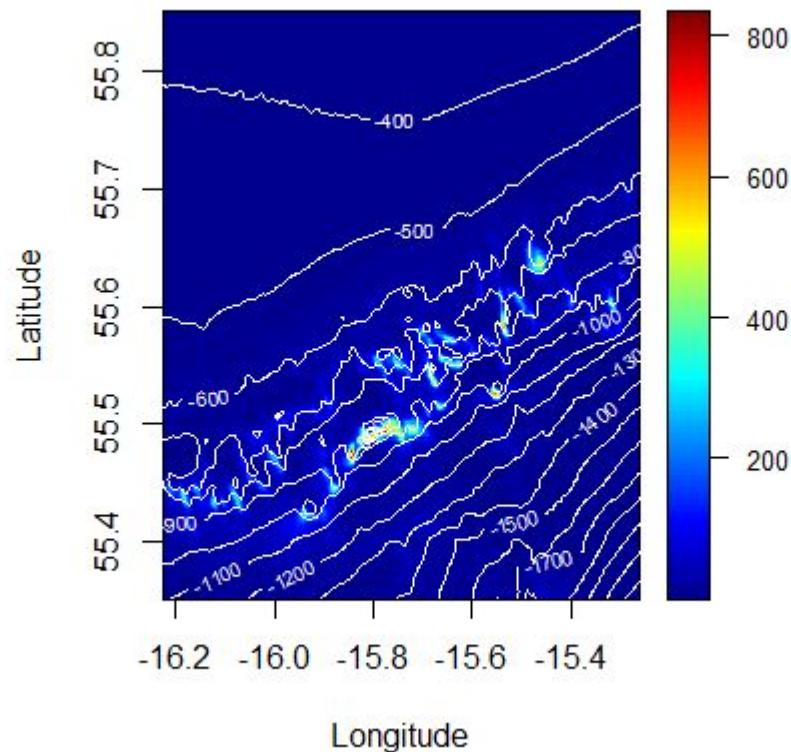
Discussion and future work

- Spatial distribution of corals depend on hydrodynamics
- Coral biomass is higher at southern slopes of coral mounds
- Realistic benthic respiration rates
- Coupling of POM in bottom layer and coral biomass is key
- Effect of AMOC on predicting coral biomass needs more thought

- Being a mechanistic model, this means that model parameters can be adjusted to investigate how future ocean, e.g. higher temperature, change in OM export, OA may modify CWC biomass distribution.
- Model can also be applied to Condor seamount and Davis strait with different organisms i.e. sponges, gorgonians

Rockall Bank

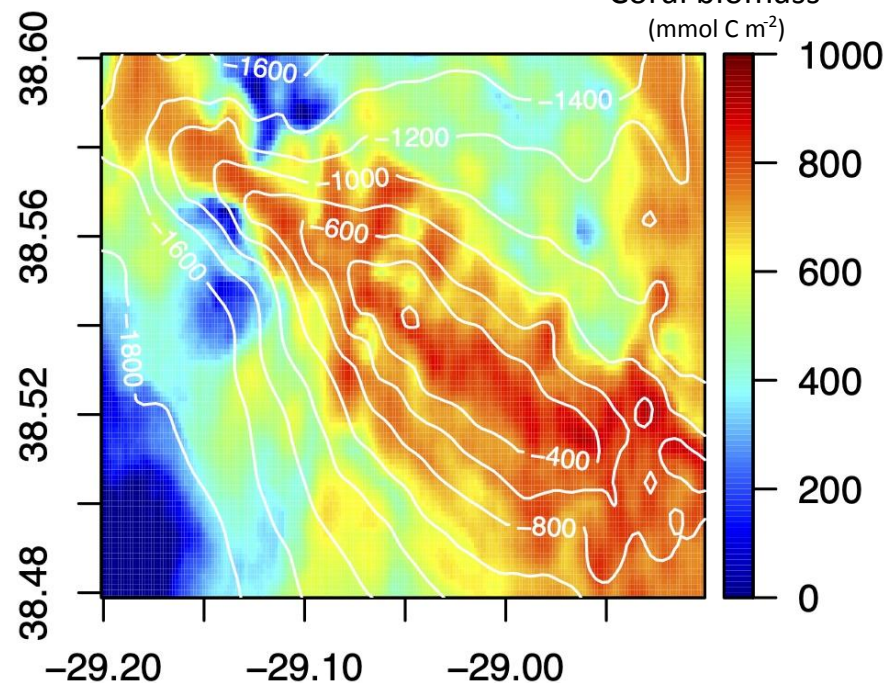
Coral biomass
(mmol C m⁻²)



Colours indicate predicted coral biomass. White lines are depth contours.

Condor Seamount

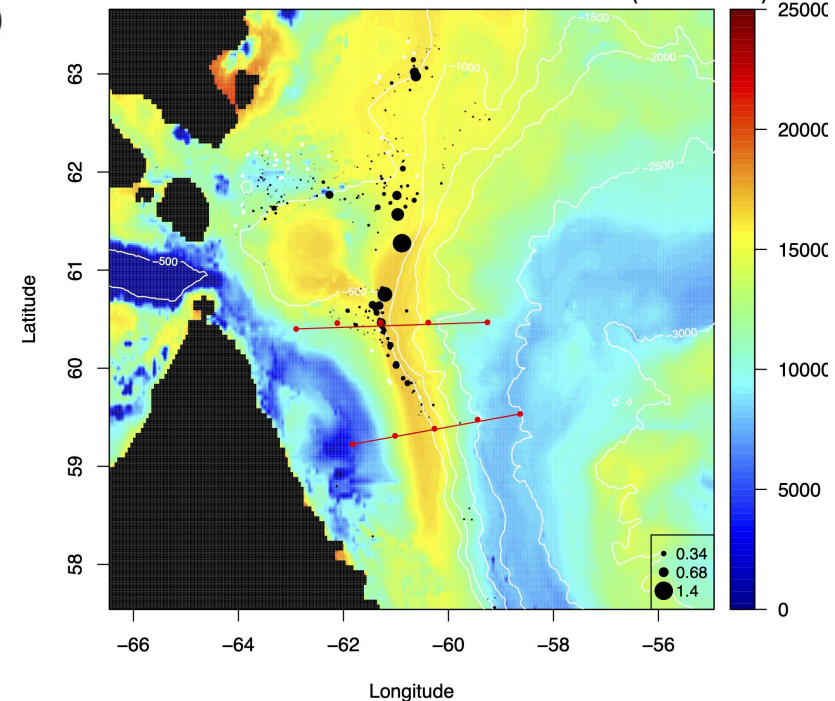
Coral biomass
(mmol C m⁻²)



Colours indicate predicted coral biomass. White lines are depth contours.

Davis Strait

Sponge biomass
(mmol C m⁻²)



Colours indicate predicted sponge biomass. White lines are depth contours. Black dots are proportional to sponge biomass (trawl), white dots no-sponge catch. Red lines are CTD transects that were sampled in the ATLAS project for model validation