Maurice Huguenin

ETH zürich → Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
MeteoSwiss → UNSW SYDNEY → WOODS HOLE **OCEANOGRAPHIC** INSTITUTION

Disclaimer: It was more like this 

Acknowledgment of Country

- **Bedegal people**

- sovereignty has never been ceded
- climate justice for First Nations people

Mindil Beach, Darwin, AU

Drivers and distribution of global ocean heat uptake over the last half century

Maurice F. Huguenin, Ryan M. Holmes and Matthew H. England

Nature Communications

Australian Government
Australian Research Council

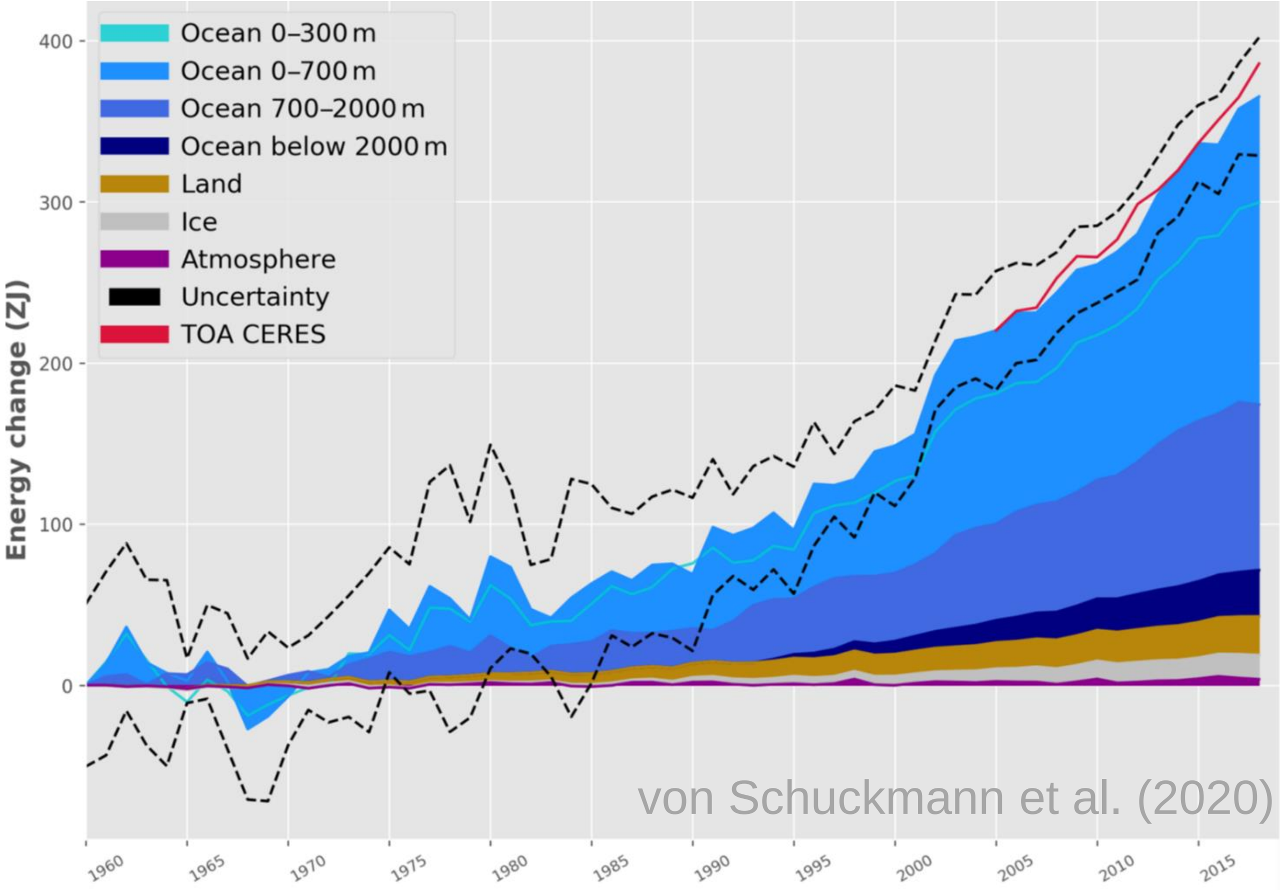
The Australian Centre for Excellence in Antarctic Science is a Special Research Initiative funded by the Australian Research Council

University of Tasmania
IMAS
Australian National University
UNSW Sydney
The University of Melbourne
Curtin University
University of South Australia
The University of Western Australia
University of Canberra

This research was supported by the Australian Research Council Special Research Initiative, Australian Centre for Excellence in Antarctic Science (Project Number SR200100008)

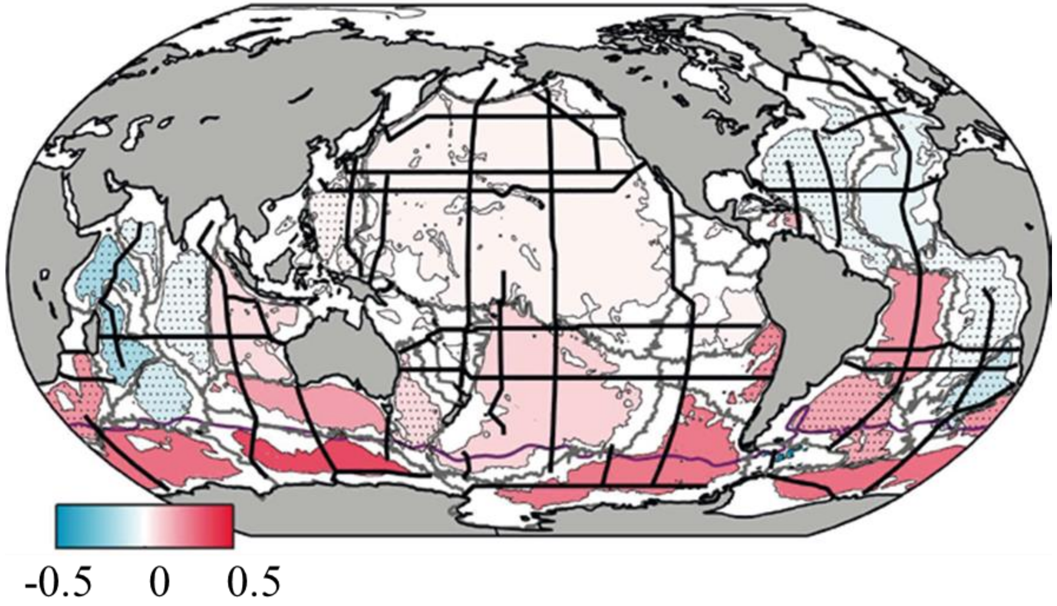
Importance of ocean heat content

Earth heat inventory relative to 1960 (ZJ = 10^{21} J)



von Schuckmann et al. (2020)

Warming rate (°C century^{-1}) below 4000 m



IPCC SROCC, Ch. 5, Fig. 5.4b, Allison et al. (2019)

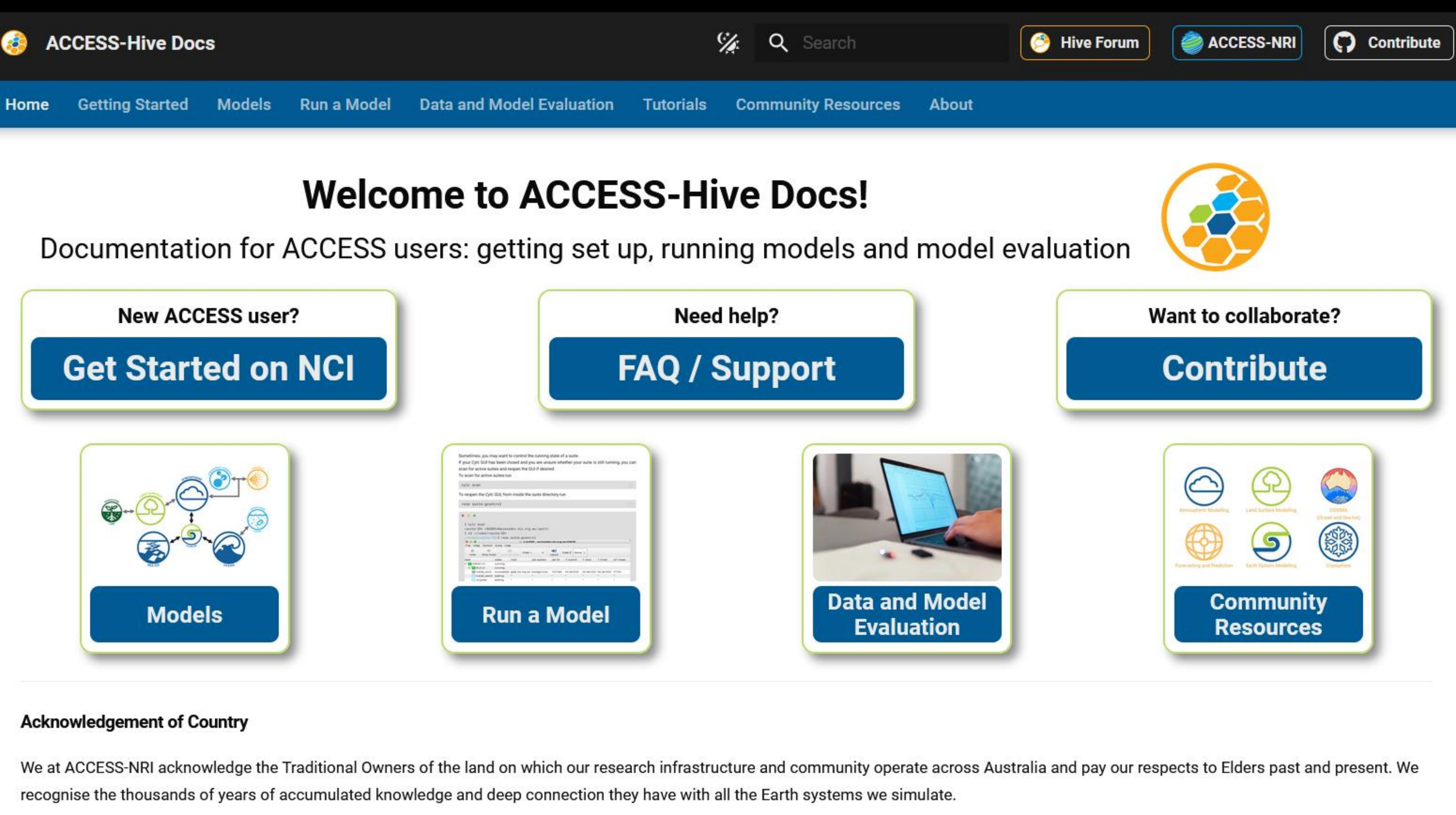
- Where has heat entered the ocean?
- Where is it today?
- What are the roles of wind and thermal forcing?

Global ocean-sea ice model

- ACCESS-OM2 (Kiss et al., 2019)
- MOM5.1, CICE5.1.2
- Input: atmospheric reanalysis JRA55-do (Tsujino et al., 2018)

access-hive.org.au

ARC linkage grant funds ~2 positions



Welcome to ACCESS-Hive Docs!

Documentation for ACCESS users: getting set up, running models and model evaluation

New ACCESS user?

Need help?

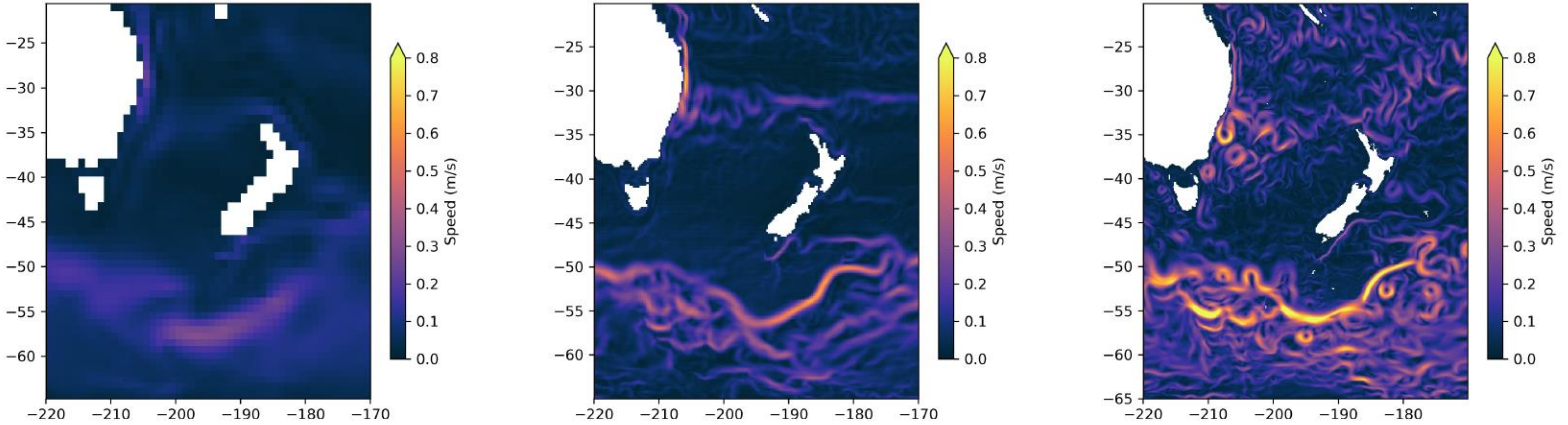
Want to collaborate?

Acknowledgement of Country

We at ACCESS-NRI acknowledge the Traditional Owners of the land on which our research infrastructure and community operate across Australia and pay our respects to Elders past and present. We recognise the thousands of years of accumulated knowledge and deep connection they have with all the Earth systems we simulate.

Global ocean-sea ice model

- ACCESS-OM2 (Kiss et al., 2019)
- MOM5.1, CICE5.1.2
- Input: atmospheric reanalysis JRA55-do (Tsujino et al., 2018)

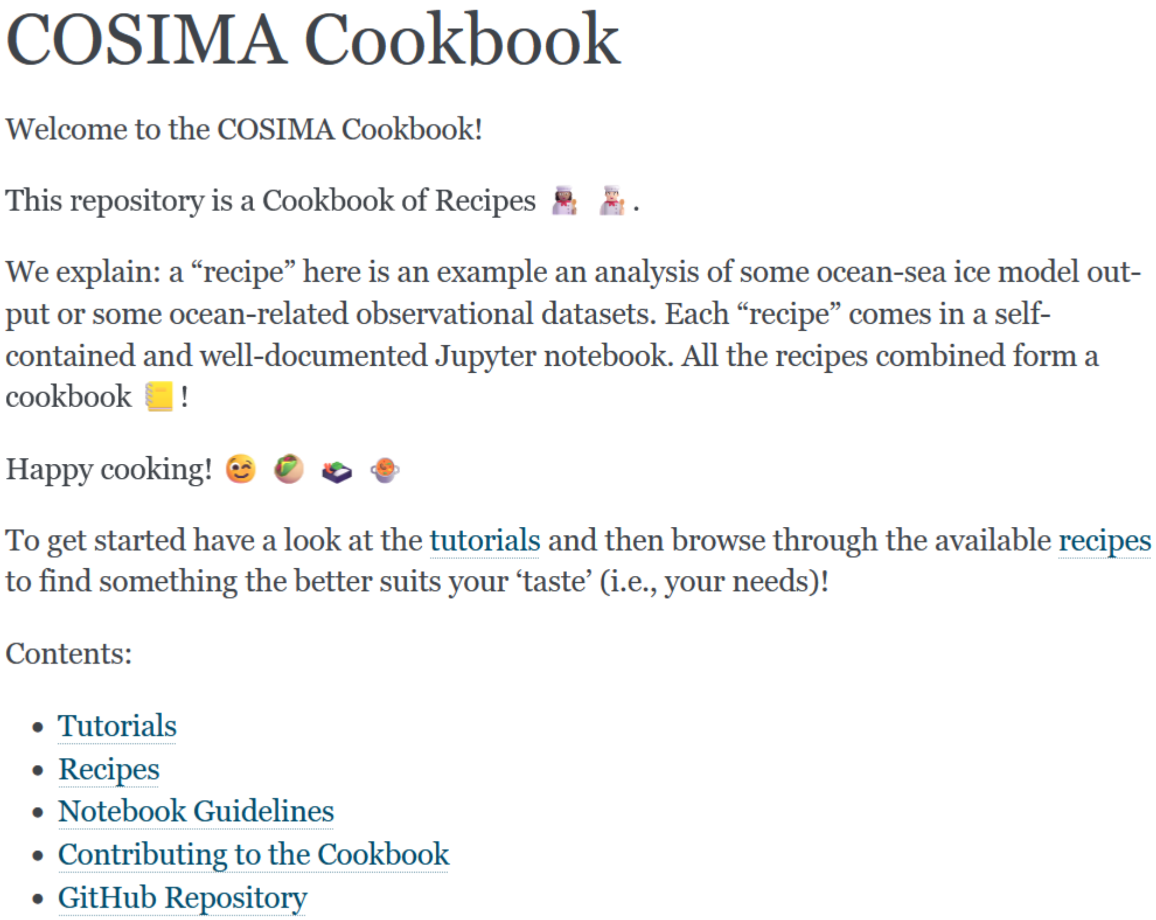


1°

1/4°

1/10°

Kiss et al. (2019)



COSIMA Cookbook

Welcome to the COSIMA Cookbook!

This repository is a Cookbook of Recipes 👩🏾‍🍳 👨🏻‍🍳.

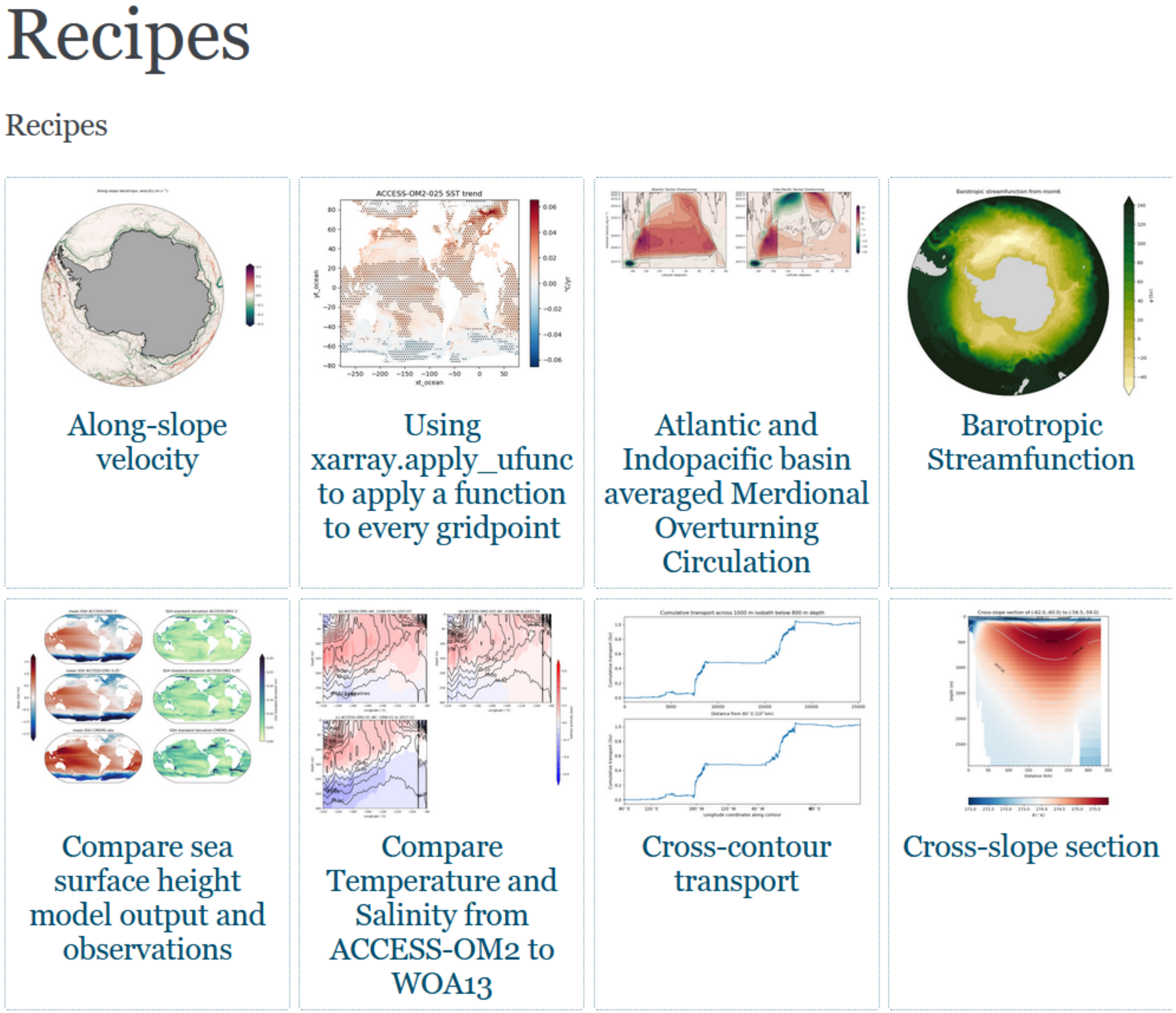
We explain: a “recipe” here is an example an analysis of some ocean-sea ice model output or some ocean-related observational datasets. Each “recipe” comes in a self-contained and well-documented Jupyter notebook. All the recipes combined form a cookbook 📒 !

Happy cooking! 😋 🥑 🍣 🍲

To get started have a look at the tutorials and then browse through the available recipes to find something the better suits your ‘taste’ (i.e., your needs)!

Contents:

- Tutorials
- Recipes
- Notebook Guidelines
- Contributing to the Cookbook
- GitHub Repository



Recipes

Recipes

Along-slope velocity

Using xarray.apply_ufunc to apply a function to every gridpoint

Atlantic and Indopacific basin averaged Merdional Overturning Circulation

Barotropic Streamfunction

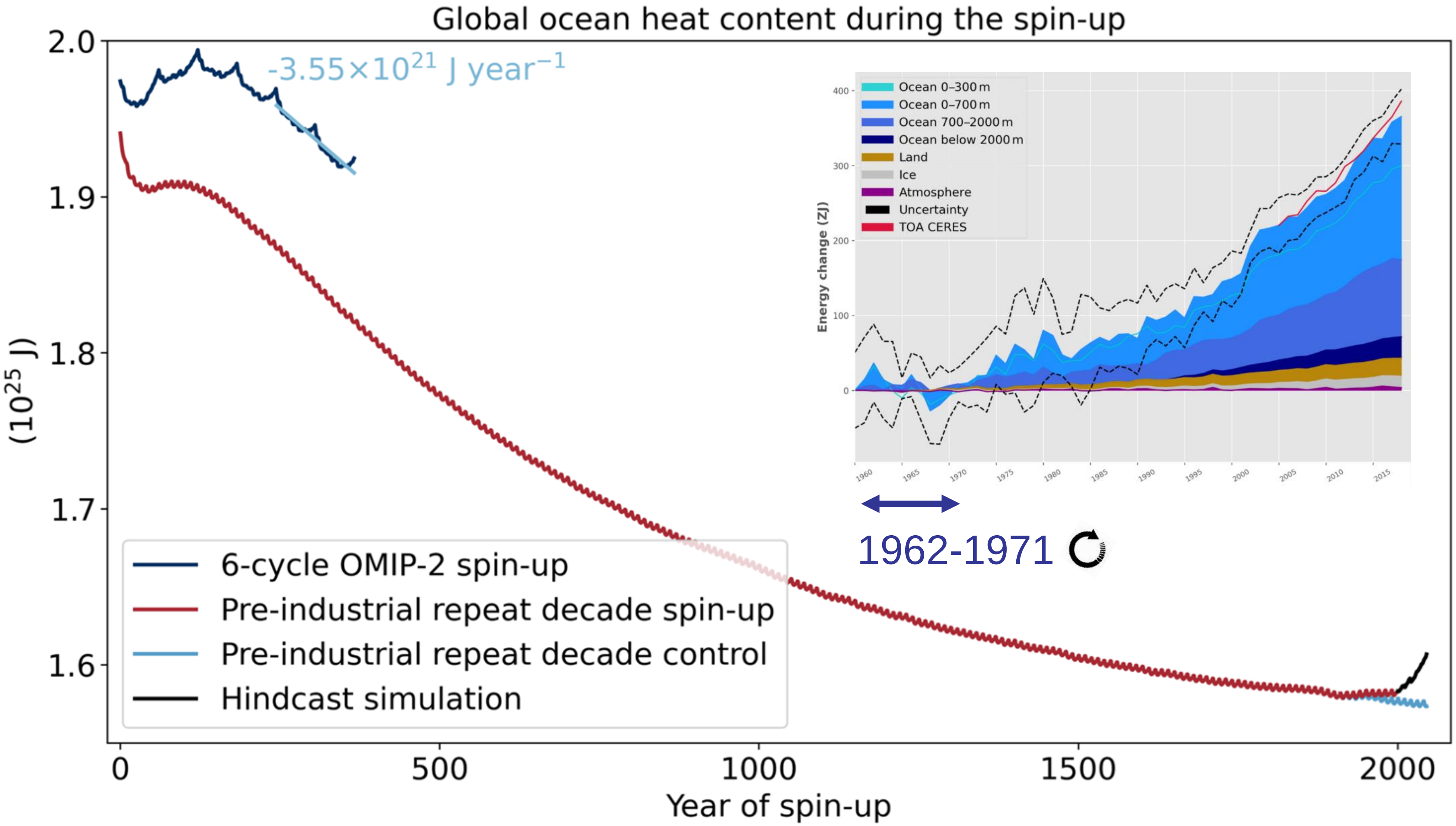
Compare sea surface height model output and observations

Compare Temperature and Salinity from ACCESS-OM2 to WOA13

Cross-contour transport

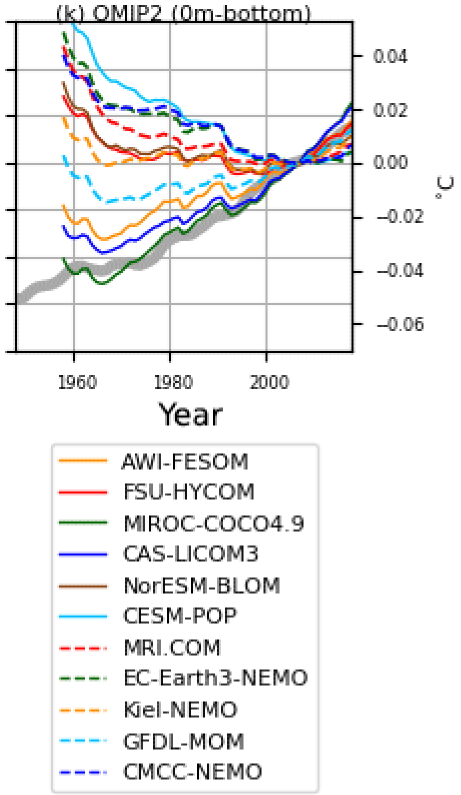
Cross-slope section

New spin-up for ocean-sea ice models



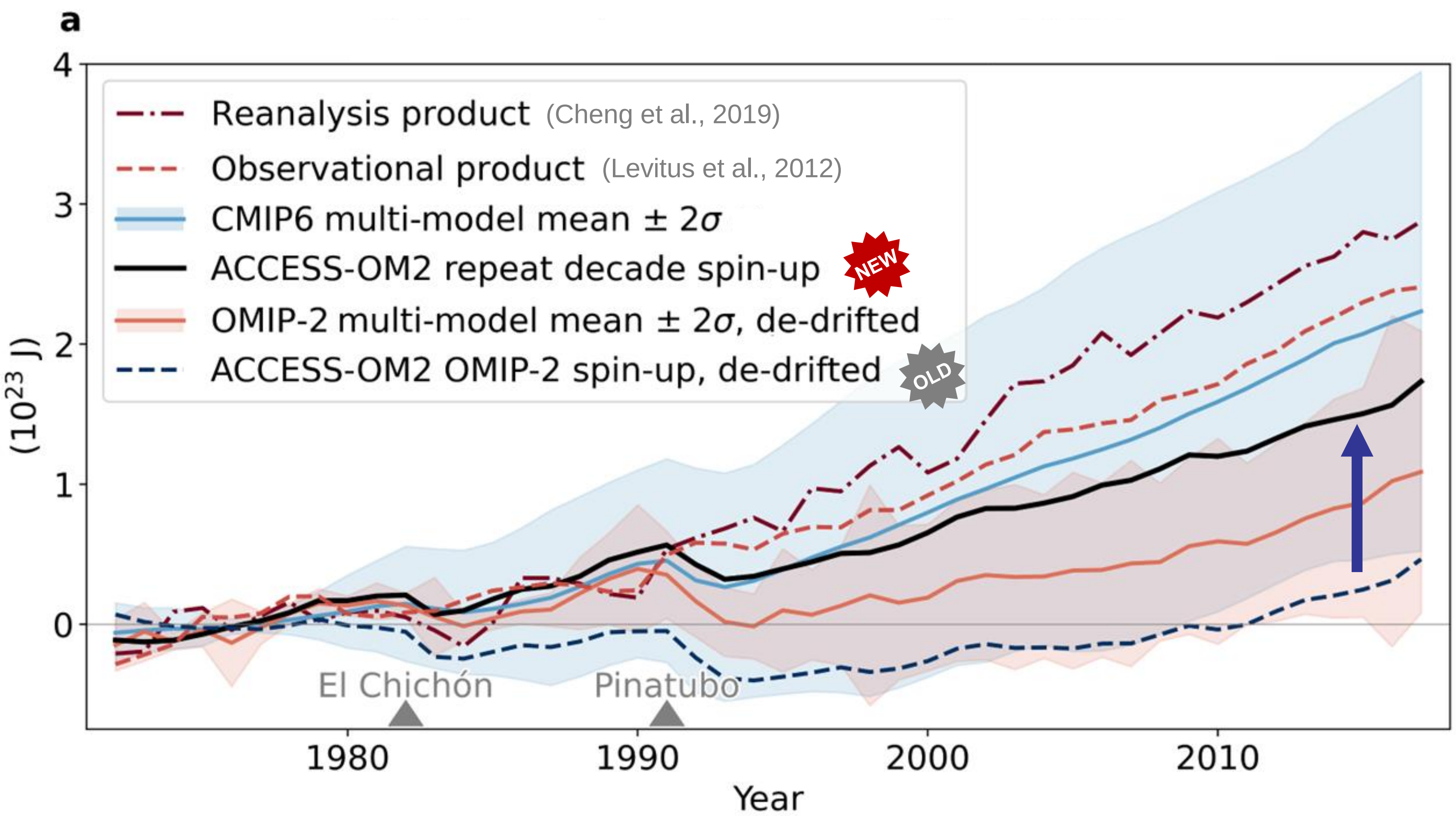
Global ocean heat content during the spin-up

1962-1971

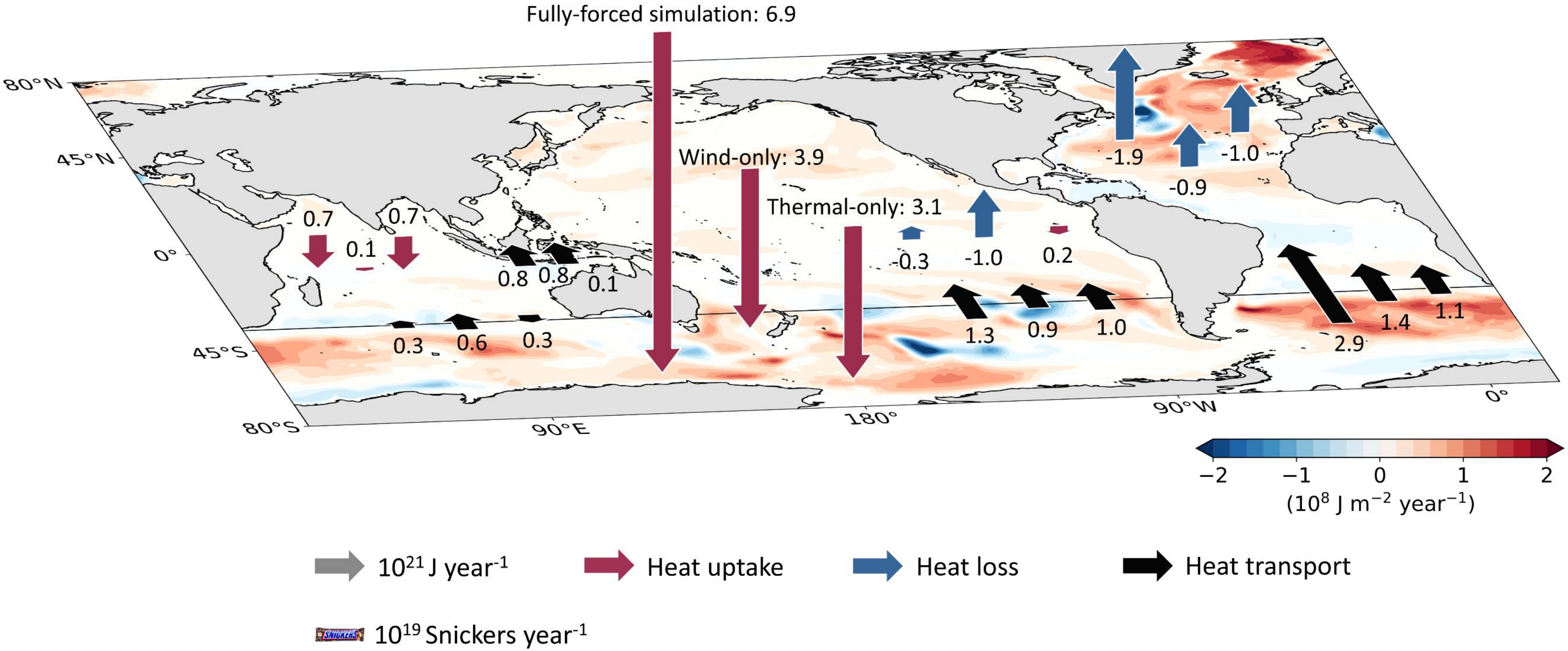


Tsujino et al. (2020)

Global ocean heat content anomalies, 0-2000 m



Schematic

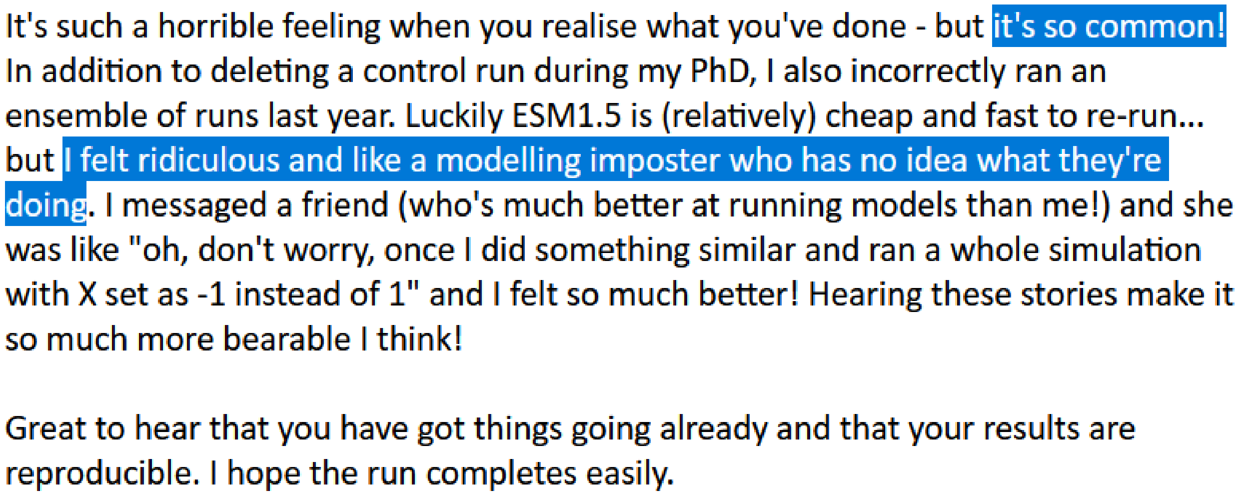


1 Snickers = 250 cal ≙ 1046 J

7 April 2022

rm –rf *

- deleted 12 TB of data
- everything from every project



It's such a horrible feeling when you realise what you've done - but it's so common! In addition to deleting a control run during my PhD, I also incorrectly ran an ensemble of runs last year. Luckily ESM1.5 is (relatively) cheap and fast to re-run... but I felt ridiculous and like a modelling imposter who has no idea what they're doing. I messaged a friend (who's much better at running models than me!) and she was like "oh, don't worry, once I did something similar and ran a whole simulation with X set as -1 instead of 1" and I felt so much better! Hearing these stories make it so much more bearable I think!

Great to hear that you have got things going already and that your results are reproducible. I hope the run completes easily.

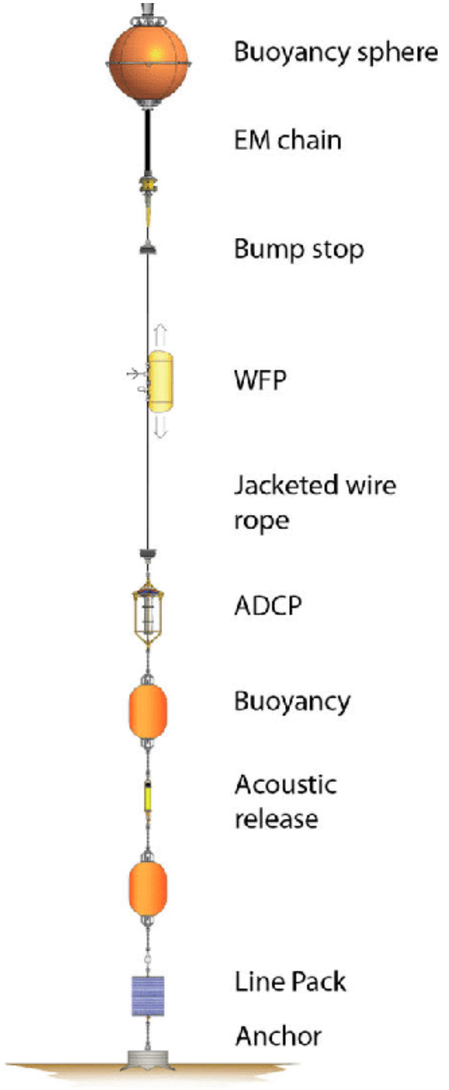
Shutterstock

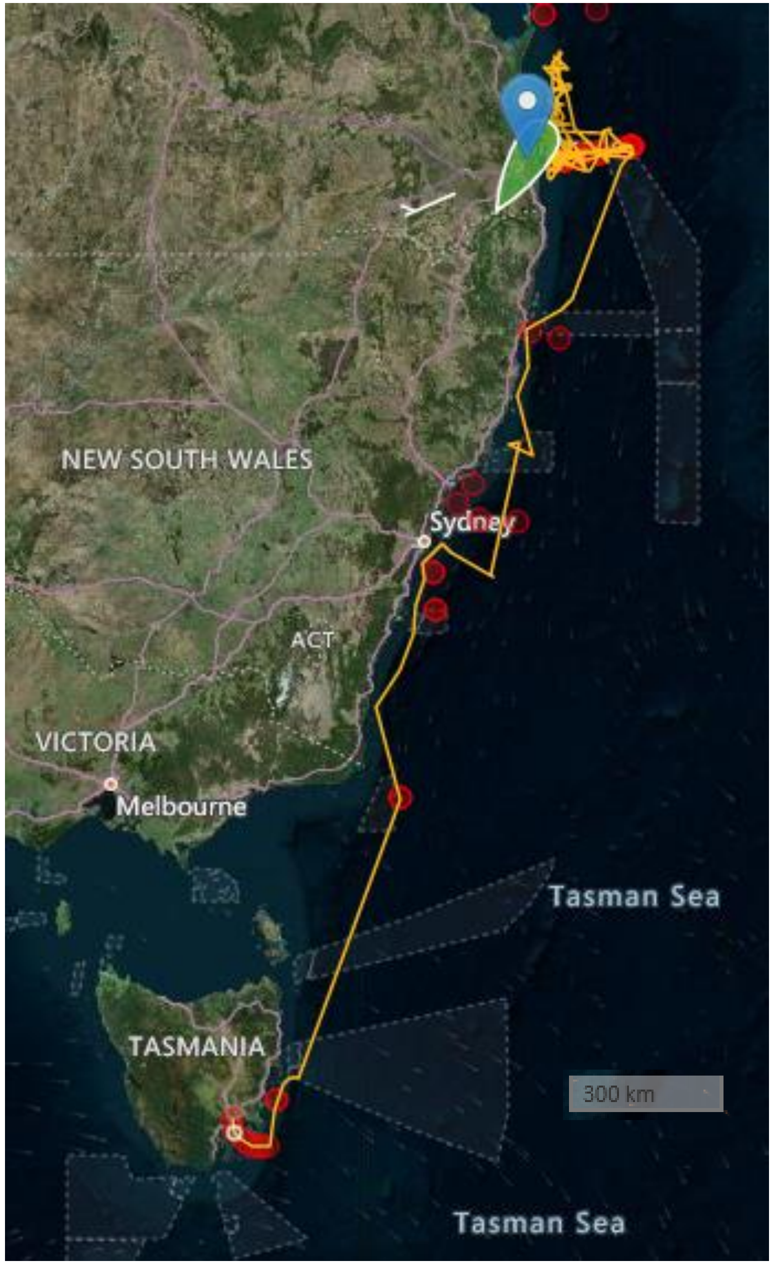
The Southern Ocean absorbs more heat than any other ocean on Earth, and the impacts will be felt for generations

Published: September 7, 2022 7.18pm AEST

Maurice Huguenin, *UNSW Sydney*, **Matthew England**, *UNSW Sydney*, **Ryan Holmes**, *University of Sydney*

Cruise break





Thanks Amandine Schaeffer,
Chris Chapman & Iain Suthers

Subsurface warming of the West Antarctic continental shelf linked to El Niño events

Maurice F. Huguenin, Ryan M. Holmes, Paul Spence and
Matthew H. England

Geophysical Research Letters

Australian Government
Australian Research Council

The Australian Centre for Excellence in Antarctic Science is a
Special Research Initiative funded by the Australian Research Council

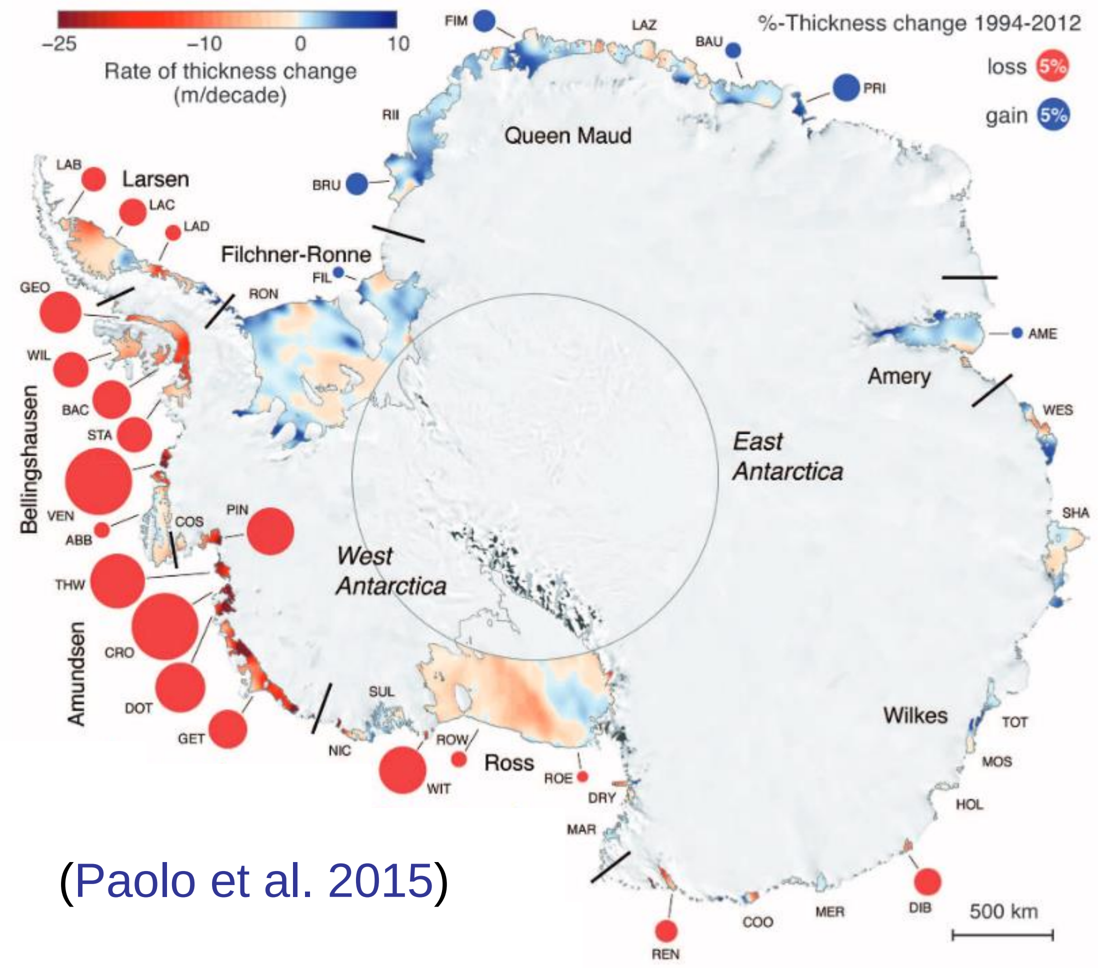
This research was supported by the Australian Research Council Special Research Initiative, Australian Centre for Excellence in Antarctic Science (Project Number SR200100008)

Background

- Volume loss from Antarctic ice shelves is accelerating (Paolo et al. 2015)
- Ice loss influenced by internal climate variability and anthropogenic forcing (Holland et al. 2019)
- El Niño: ↑height but ↓mass of West Antarctic ice shelves (Paolo et al. 2018)

❄️

🌡️



(Paolo et al. 2015)

The questions

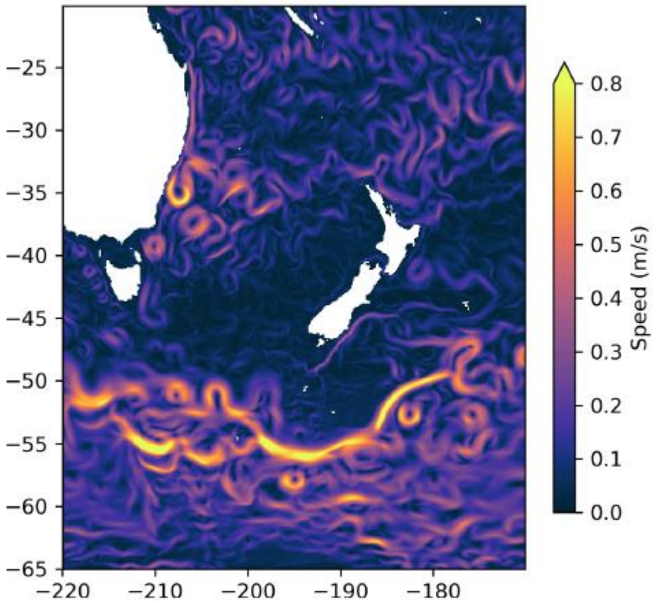
- How do El Niño & La Niña impact the West Antarctic shelf circulation?

- What processes are responsible for warming and cooling on the shelf?

The method

- ACCESS-OM2 (Kiss et al. 2020)
  - 1/10° configuration
  - JRA55-do reanalysis (Tsujino et al. 2018)

1/10°



Kiss et al. (2019)

- Repeat-year forcing spin-up
- ENSO anomalies on top

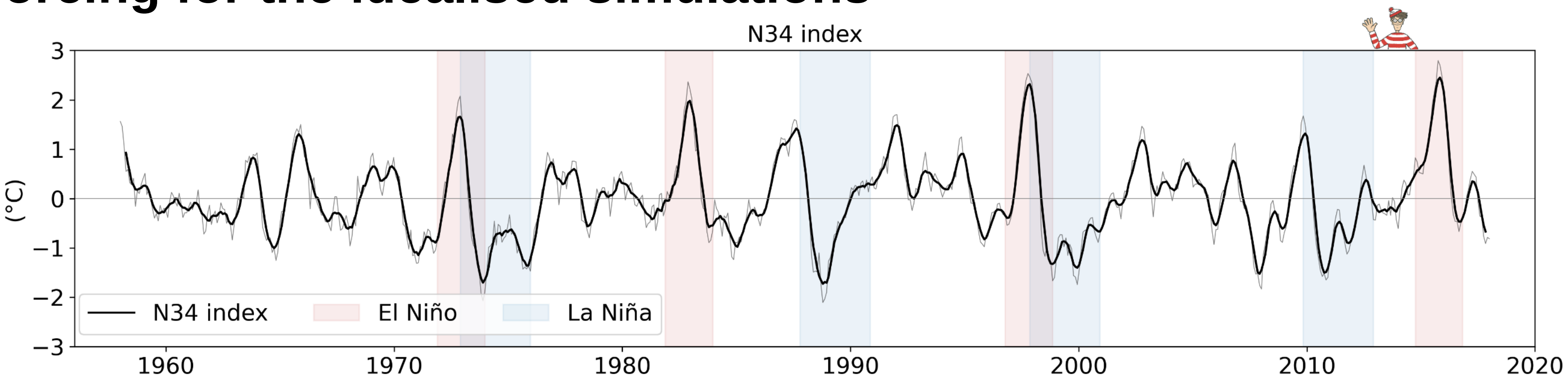
Forcing for the idealised simulations

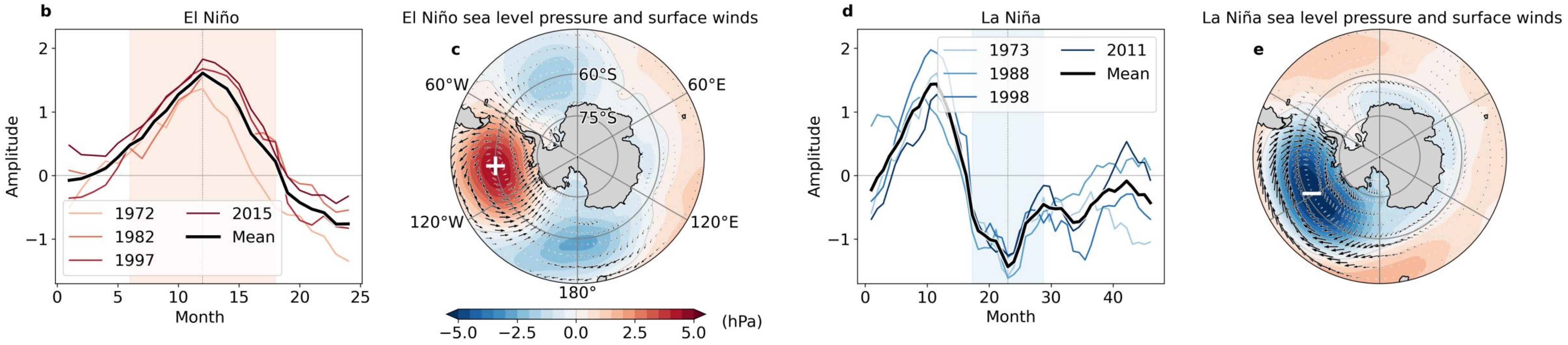
Repeat-year forcing [t, x, y]

+

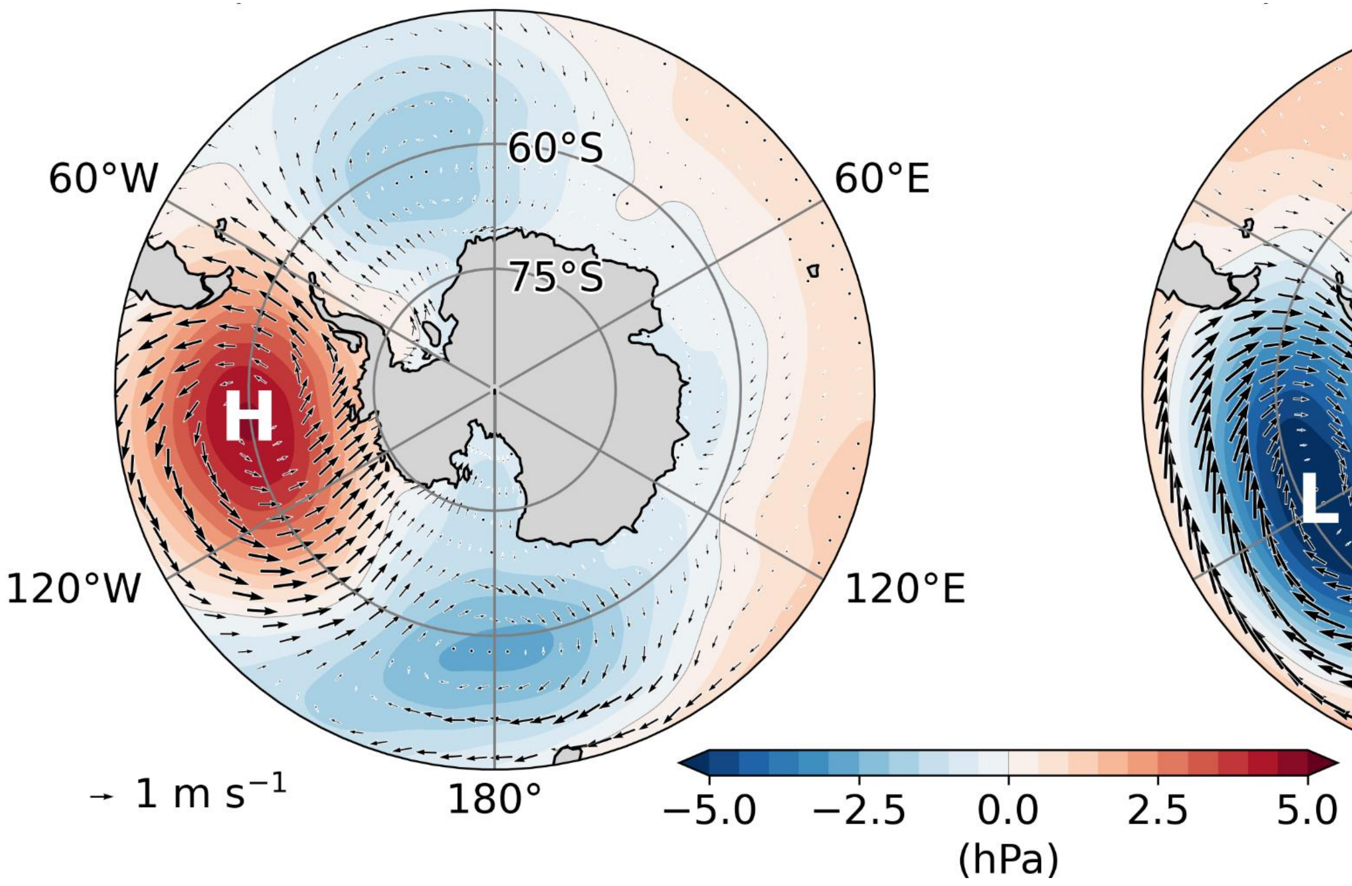
ENSO anomalies (time series [t] × spatial pattern [x,y])

Forcing for the idealised simulations





Forcing for the idealised simulations



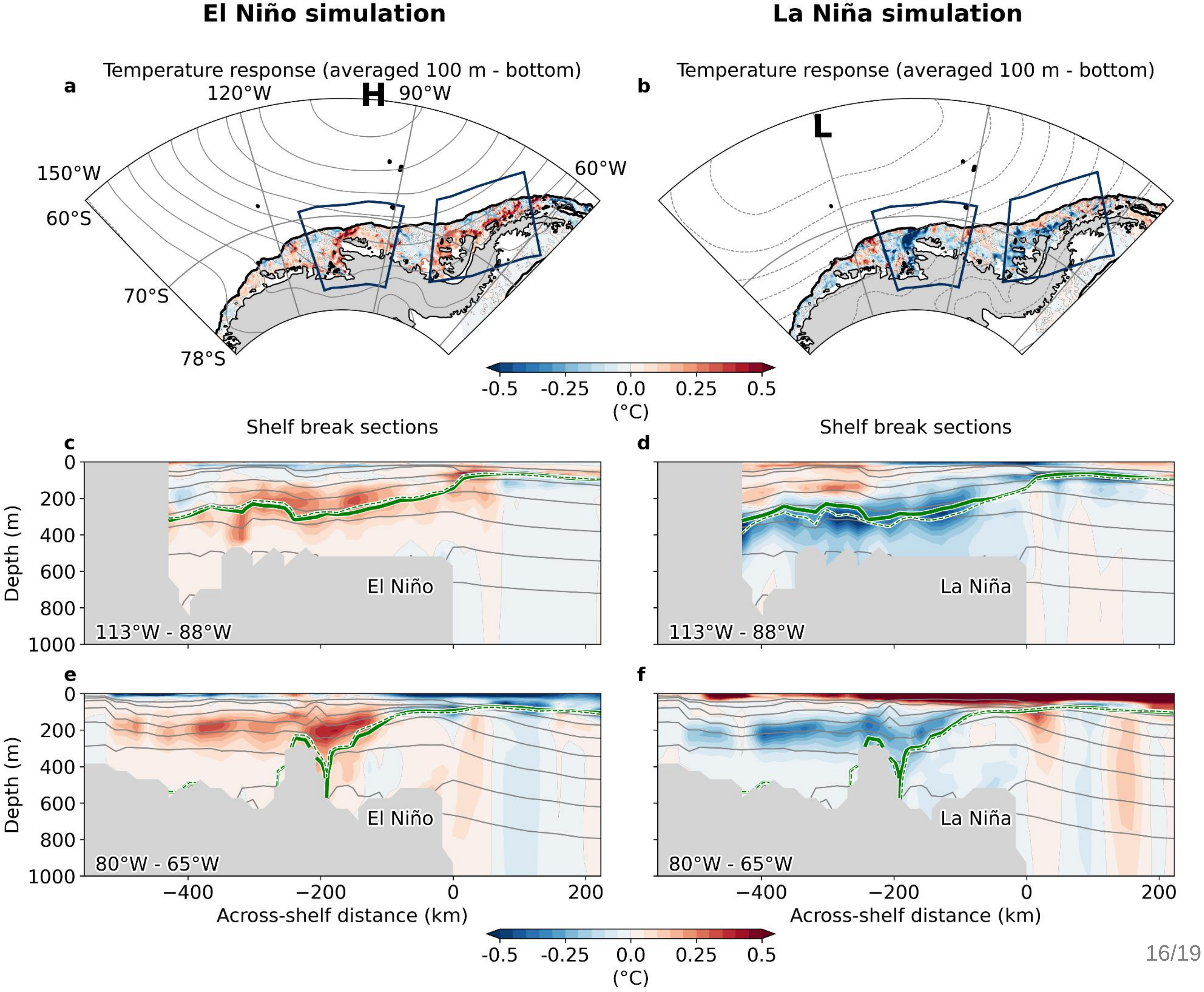
El Niño sea level pressure and surface winds

La Niña

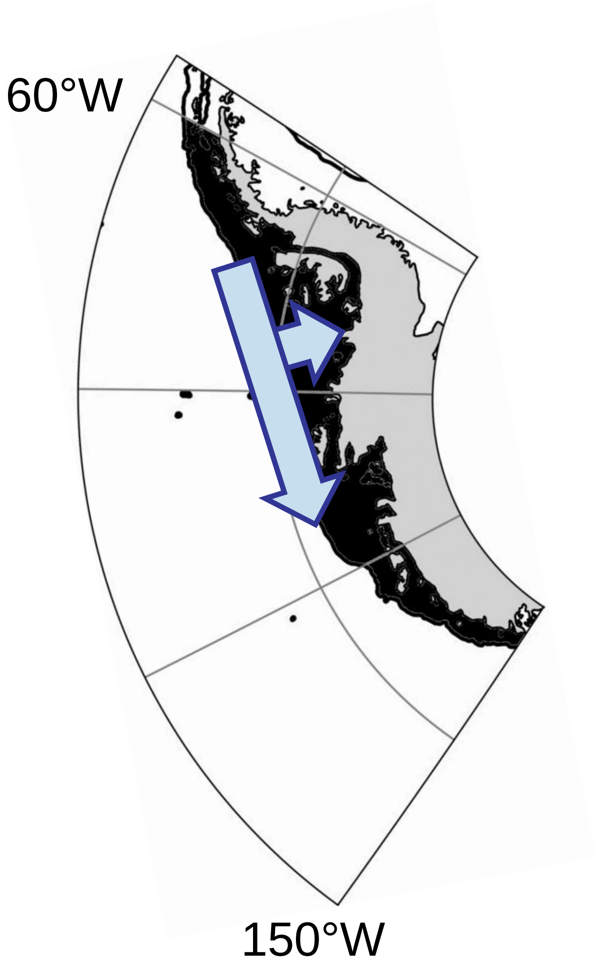
Shelf response to ENSO forcing

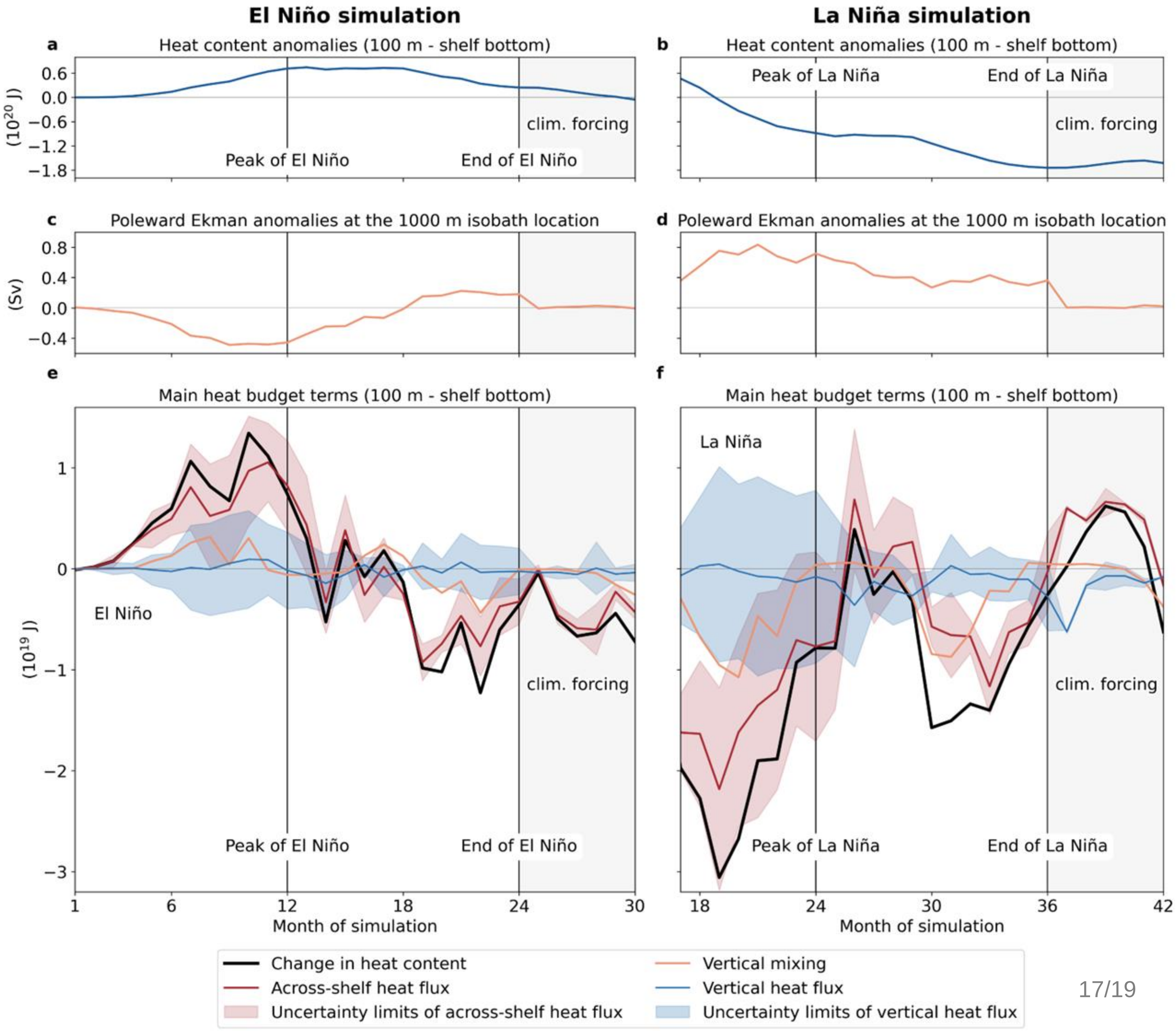
isopycnals

0°C isotherm

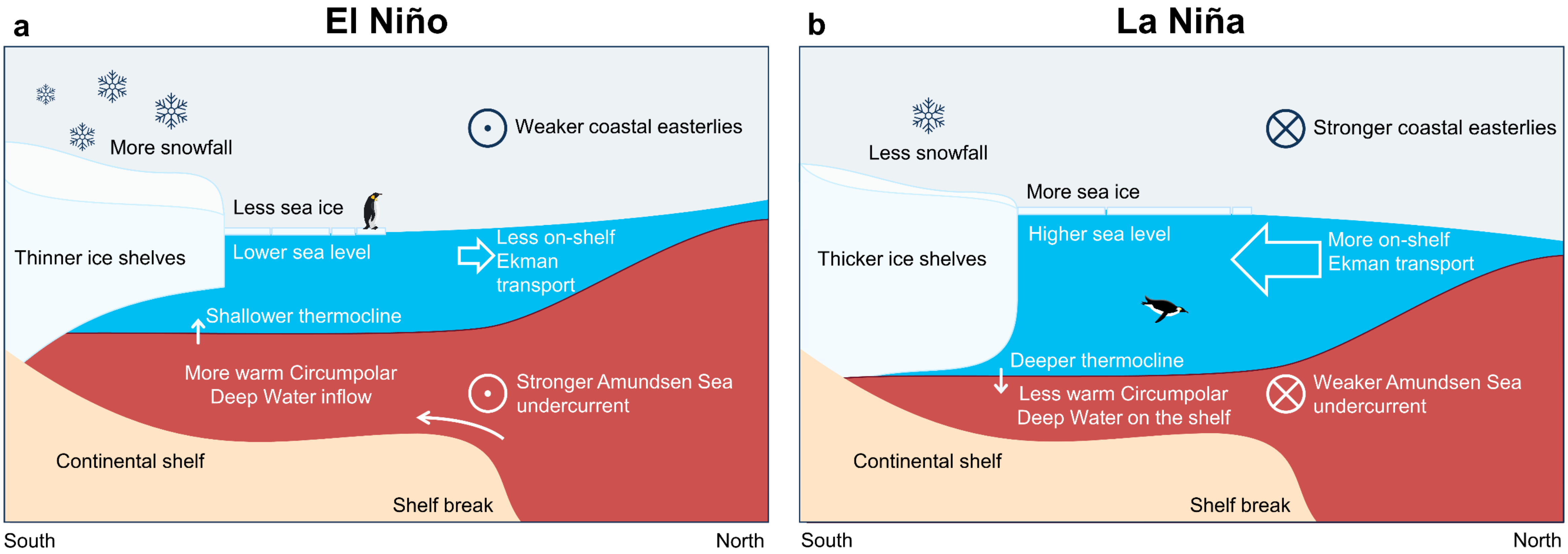


The subsurface heat budget





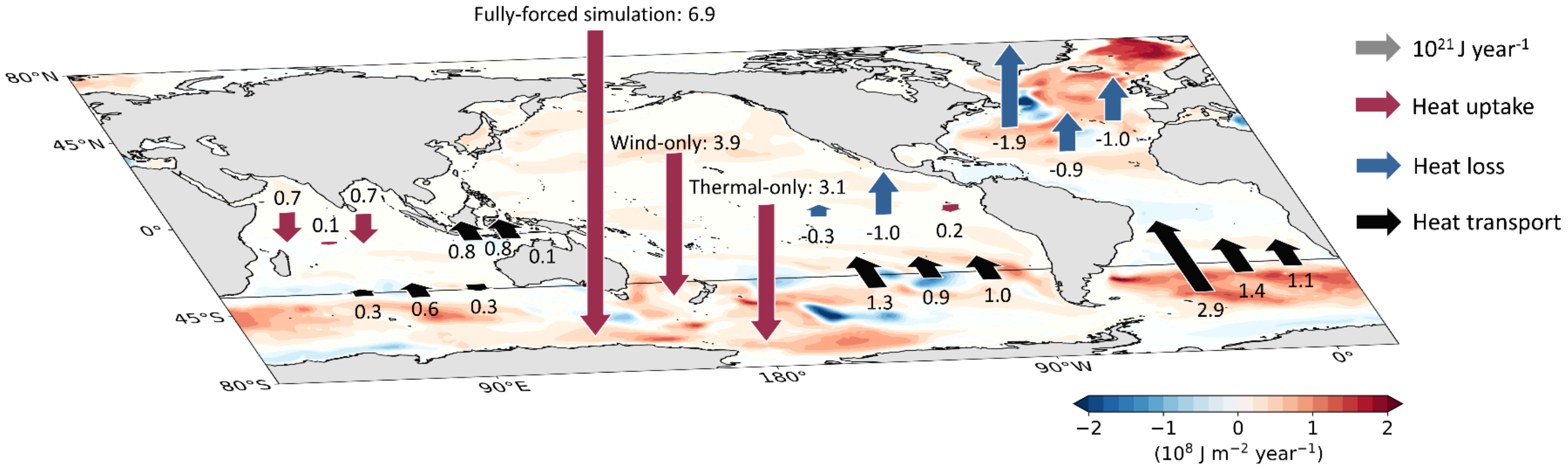
Schematic



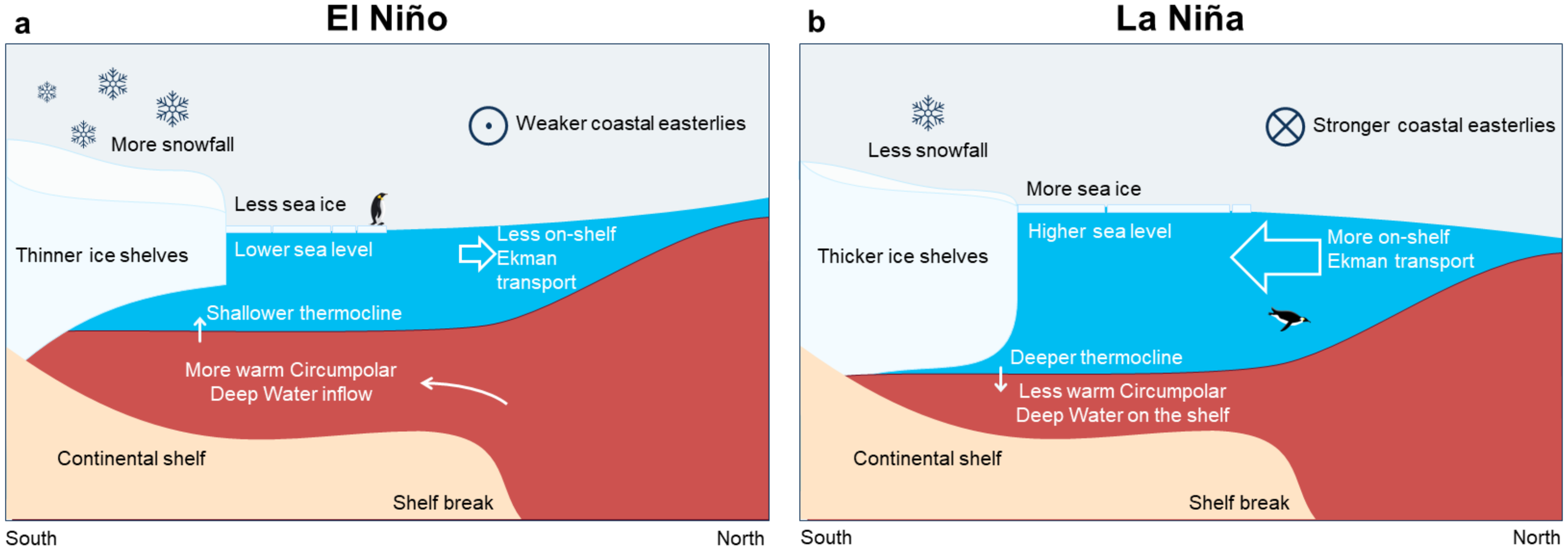
- *bottom Ekman response*
- *baroclinic adjustment*
- *Amundsen Sea undercurrent*
- *eddies*

A journey through two research projects

1. **Drivers and distribution of global ocean heat uptake over the last half century**
   (Huguenin et al. 2022, Nat. Comms.)



2. **Subsurface warming of West Antarctic coastal waters linked to El Niño events**
   (Huguenin et al., 2020, J. Clim.)



work in progress slides omitted

48:20.46	37:17.17	37:31.56	37:26.94	39:48.61
39:26.58				