European Pavilion

Digital Ocean

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2 - 13 JUNE 2025

Cryosphere and ocean feedback on sea level rise and climate change

Inspire

sea level rise

Inspire

sea level rise

Dr. Andrew Meijers

British Antarctic Survey

NATURAL ENVIRONMENT RESEARCH COUNCIL

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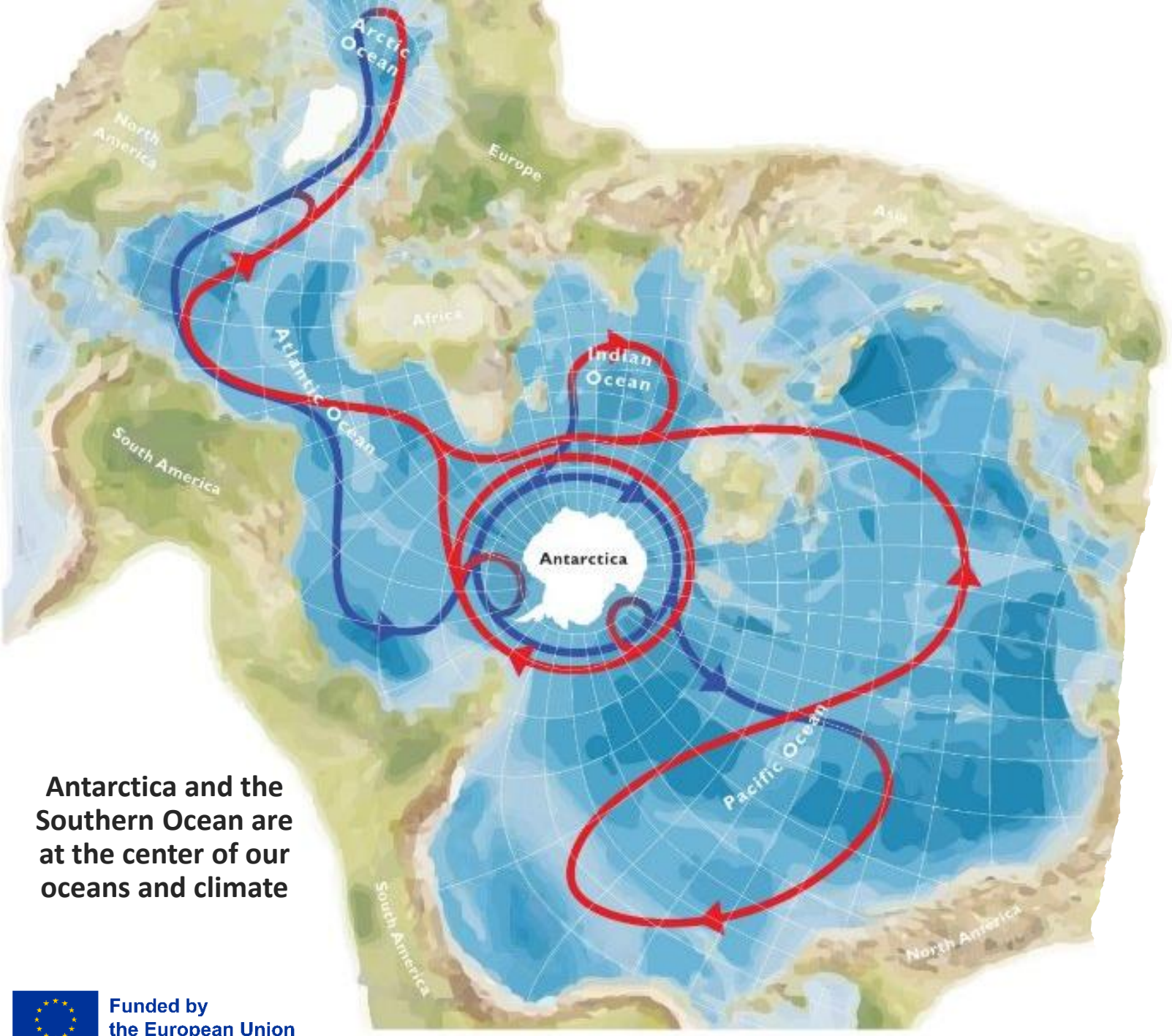

Antarctica and the Southern Ocean are at the center of our oceans and climate

Ice sheet melt and ocean freshening has global consequences beyond just sea level rise

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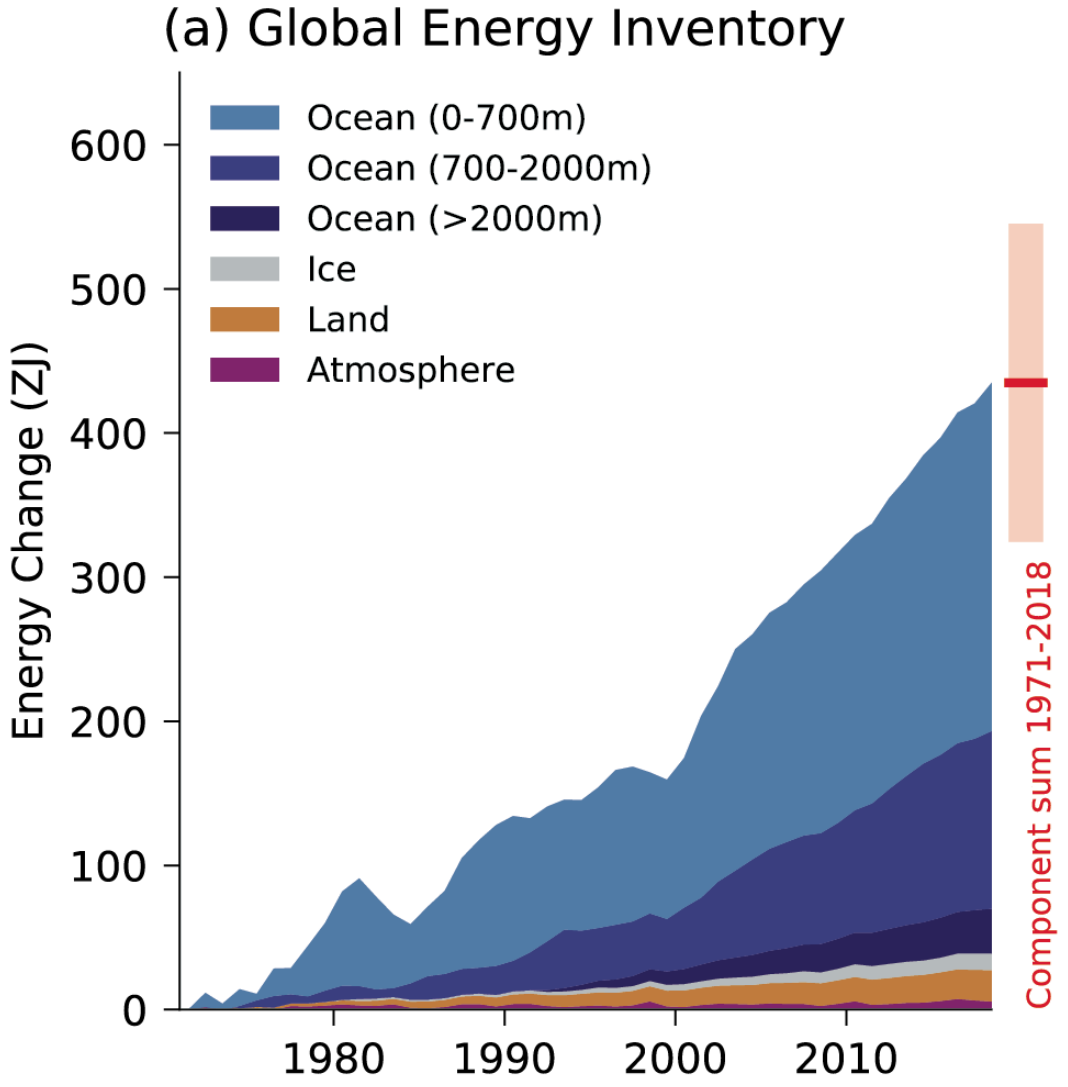
Global warming is really ocean warming

>90% of all anthropogenic heat goes into the ocean, mostly via the Southern Ocean



IPCC AR6 (2021)

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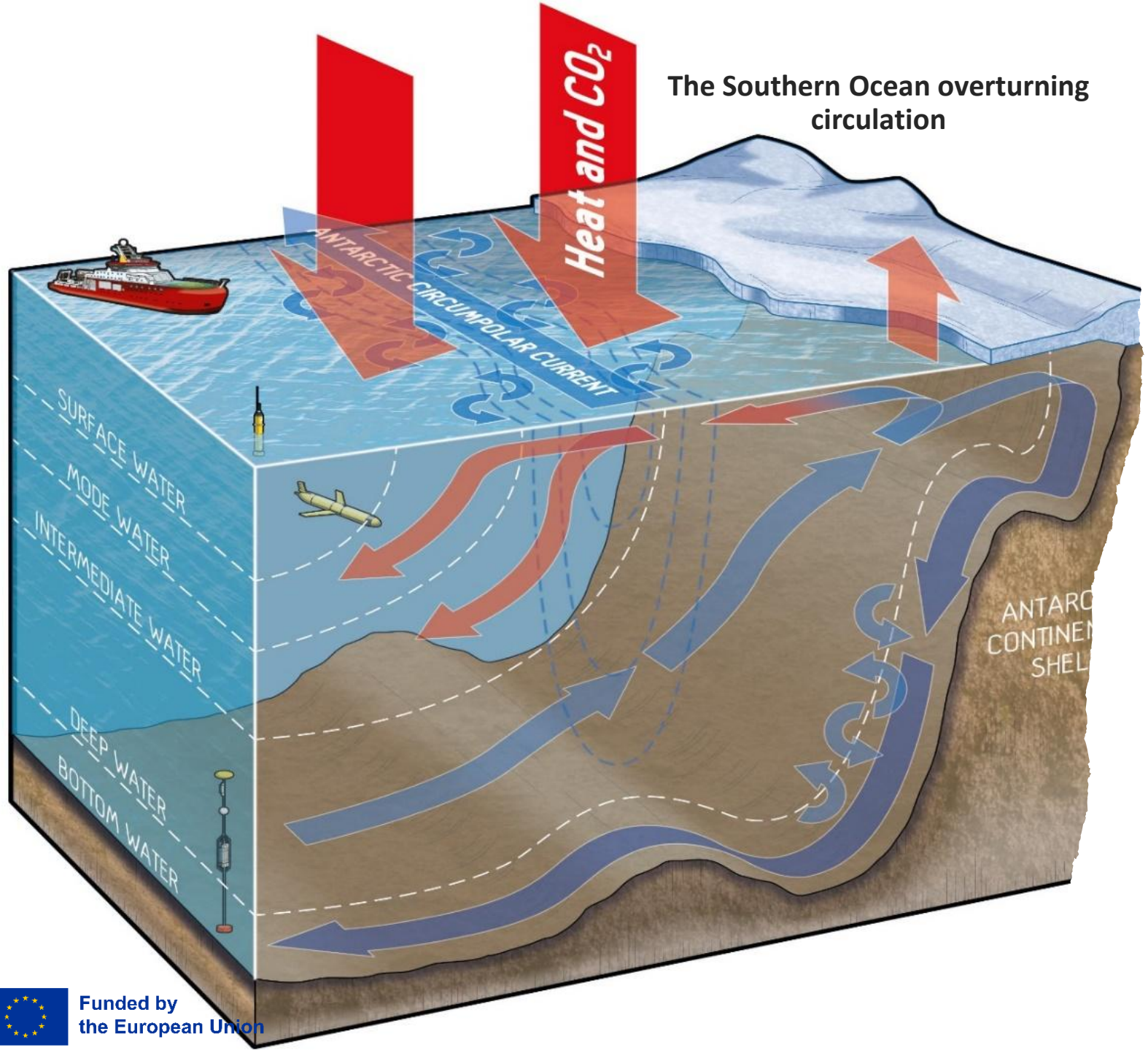

The Southern Ocean overturning circulation

The Southern Ocean has taken up over 90% of human induced ocean warming – and 40% of the ocean's anthropogenic carbon

A €60 billion per year carbon sequestration climate service

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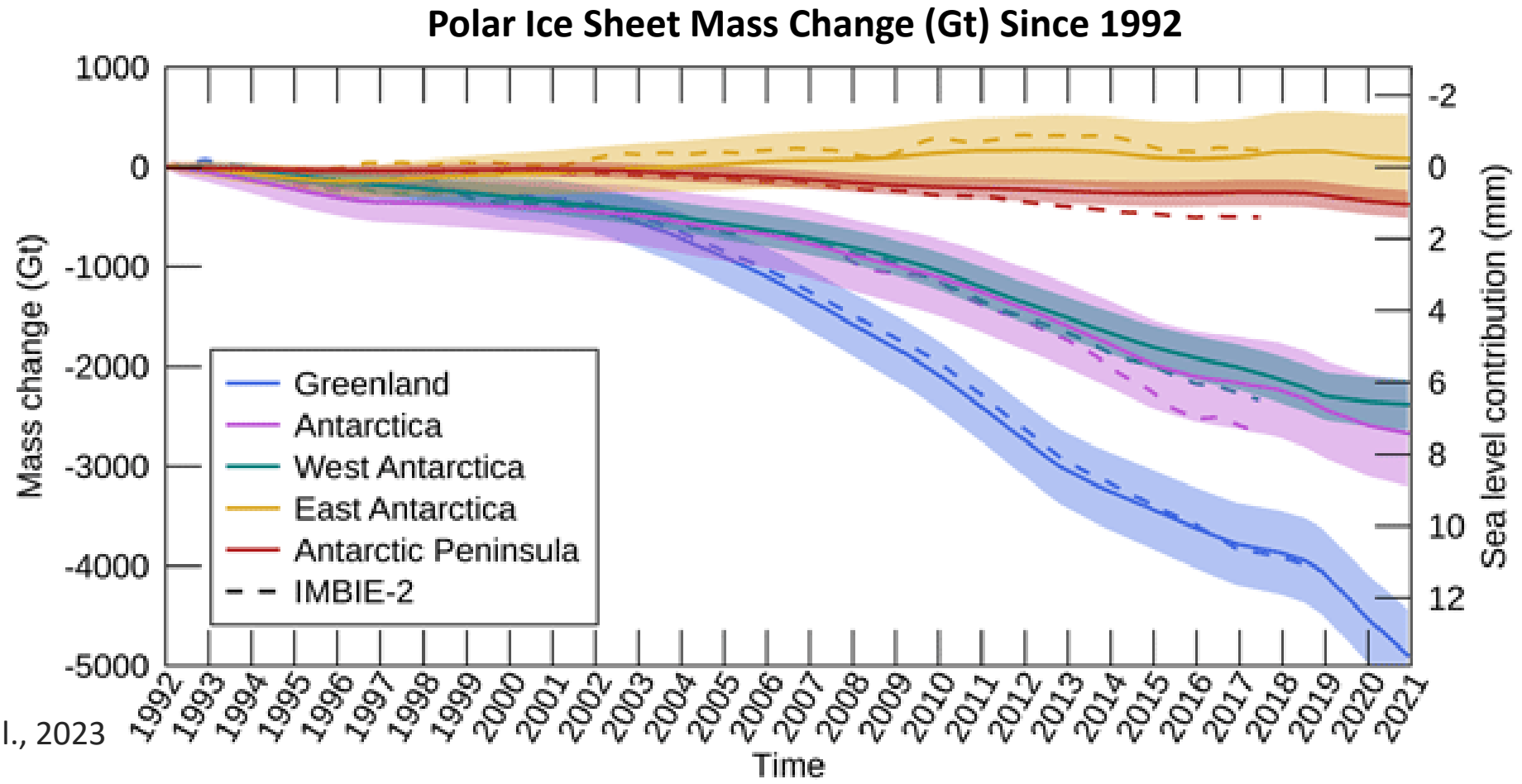

Otosaka et al., 2023

But what is the impact of adding ice sheet (and sea ice) melt to the oceans?

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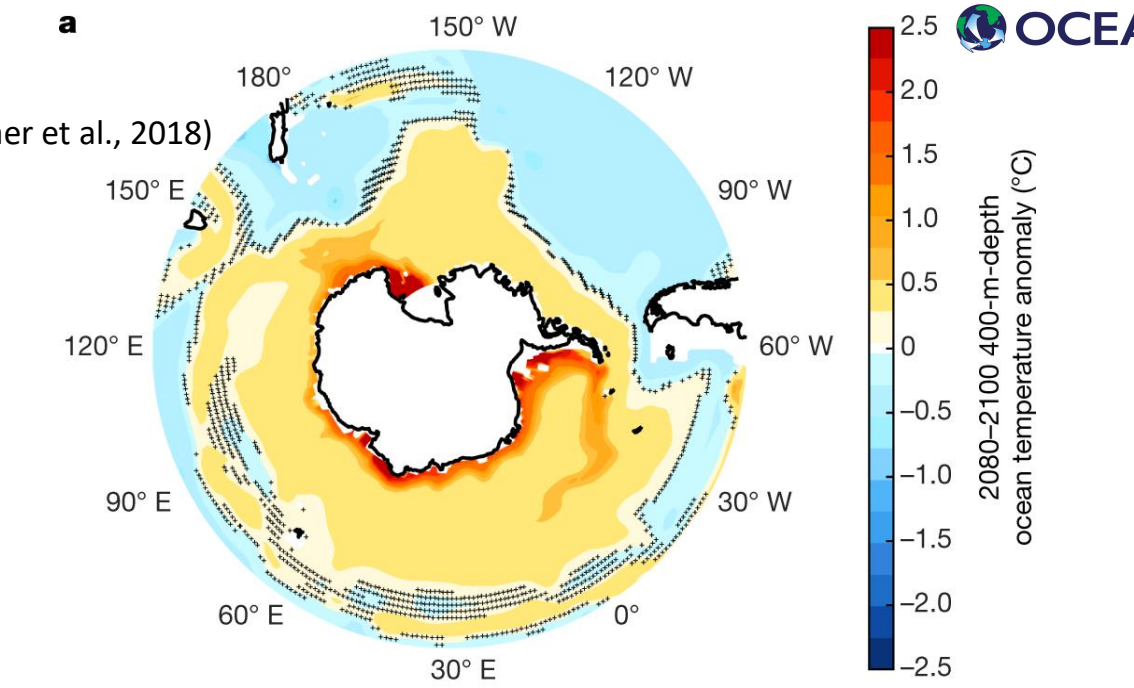
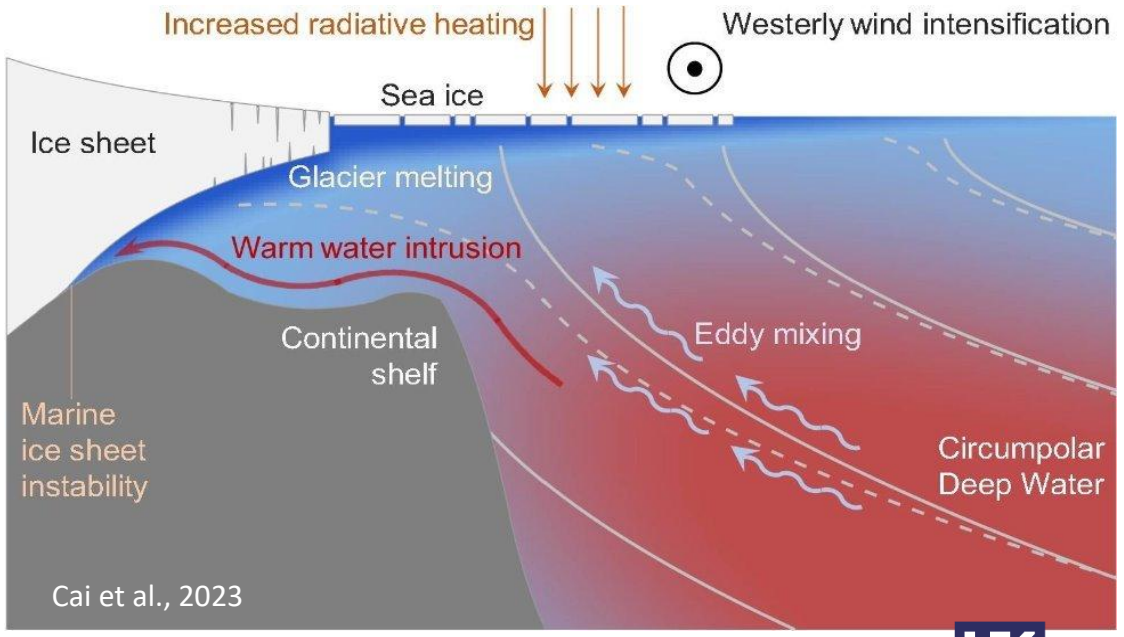
Surface freshening traps extra ocean heat at depth, warming the base of ice shelves and driving a melt-warming feedback loop…

(Bronselaer et al., 2018)





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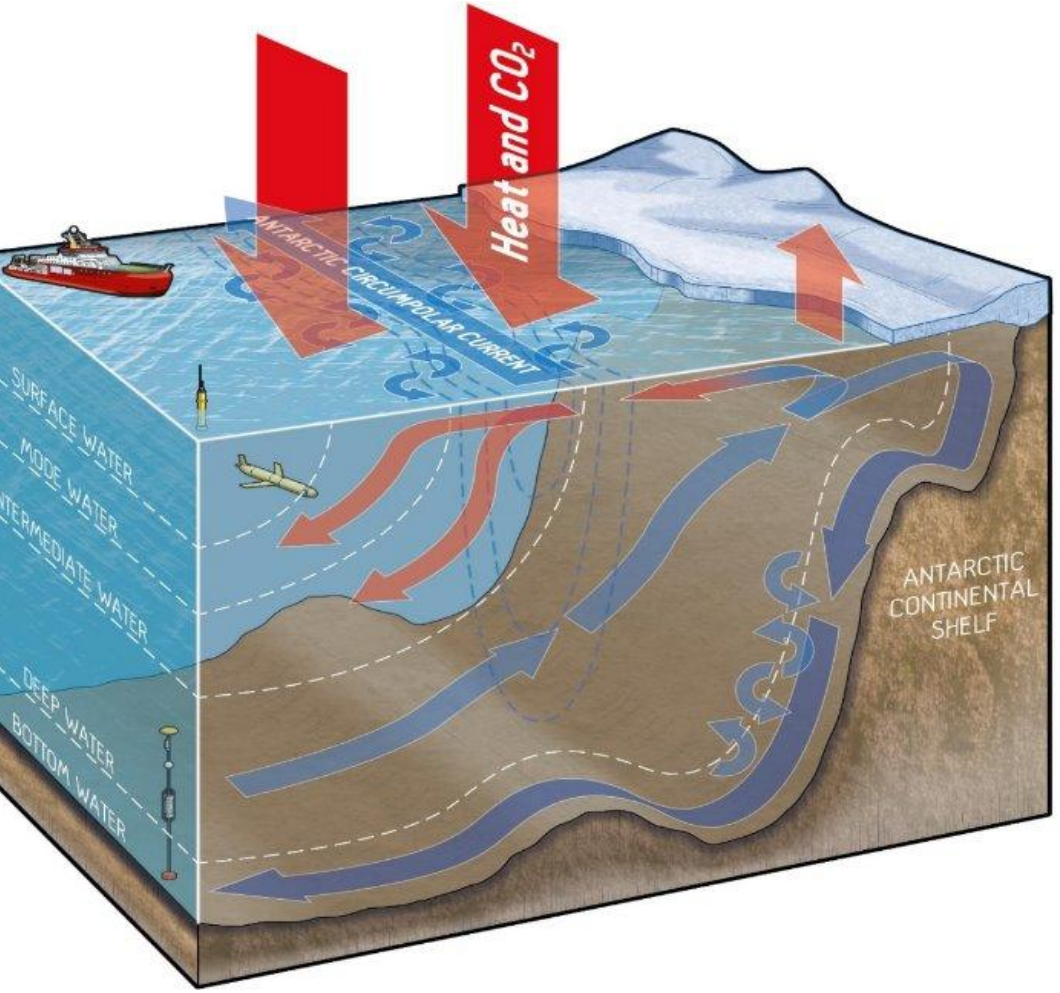

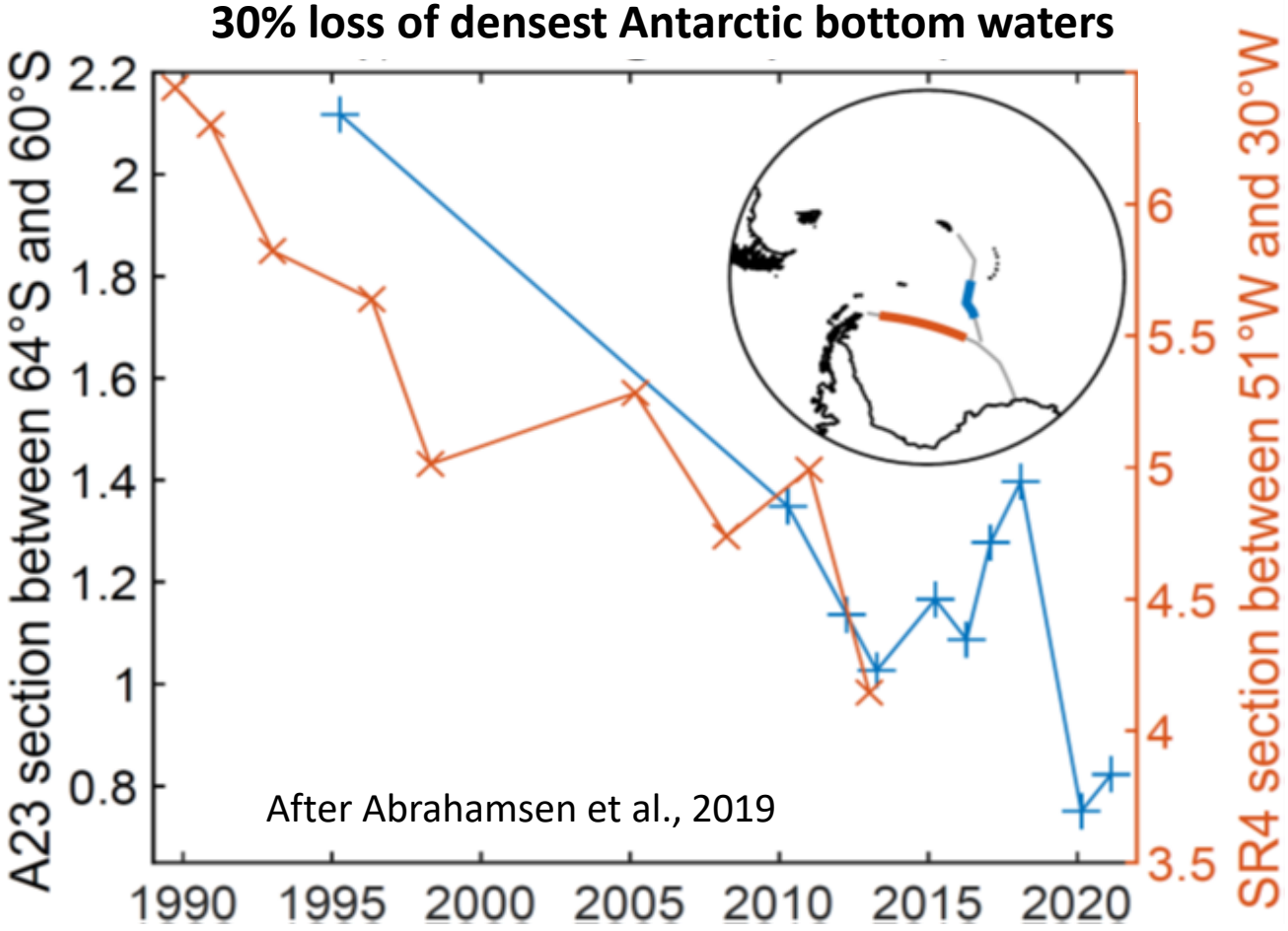

...and is weakening the deep ocean overturning

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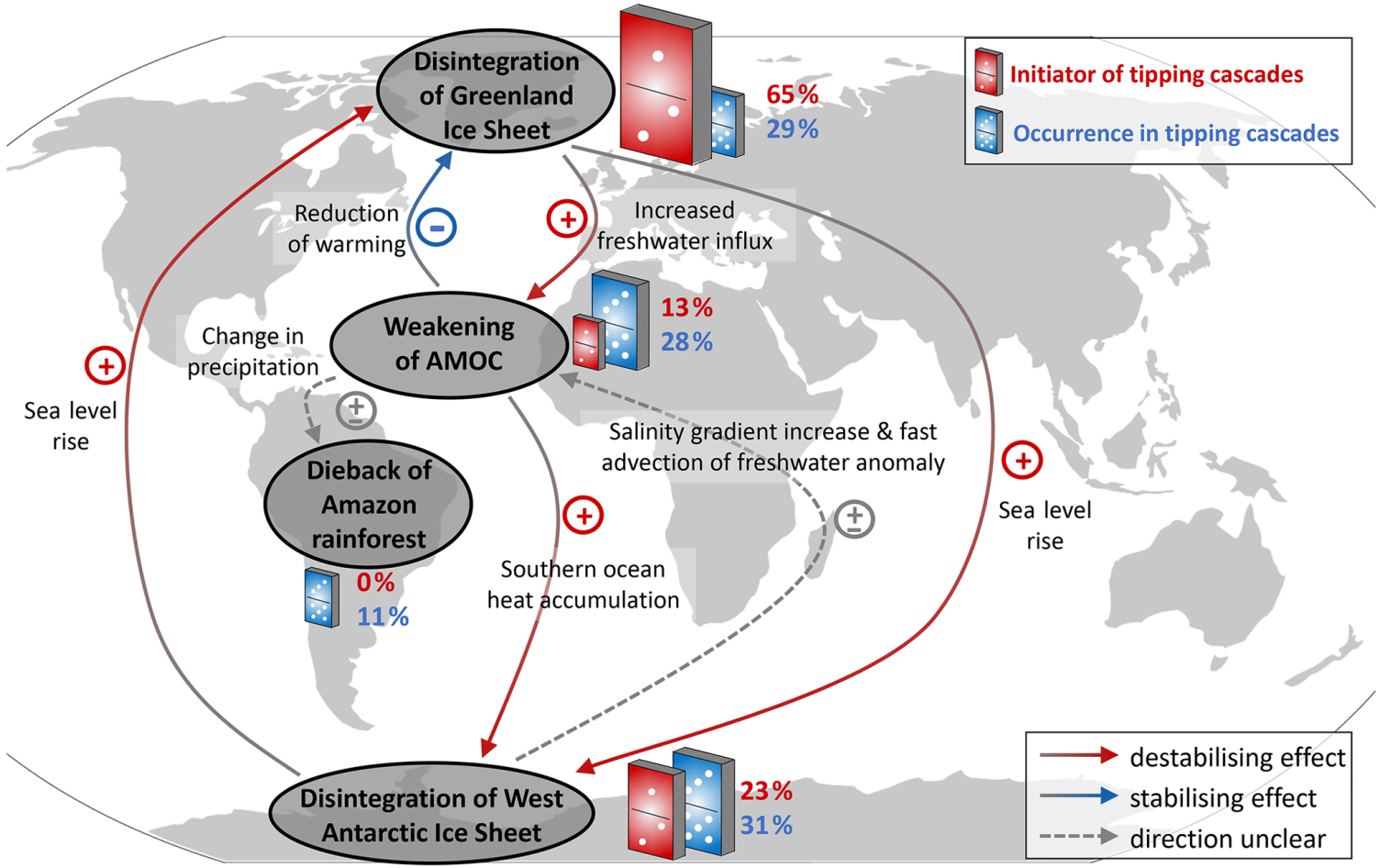

Wunderling et al. (2021)

These ocean and ice feedbacks may lead to tipping points, or even 'cascades' of tipping points

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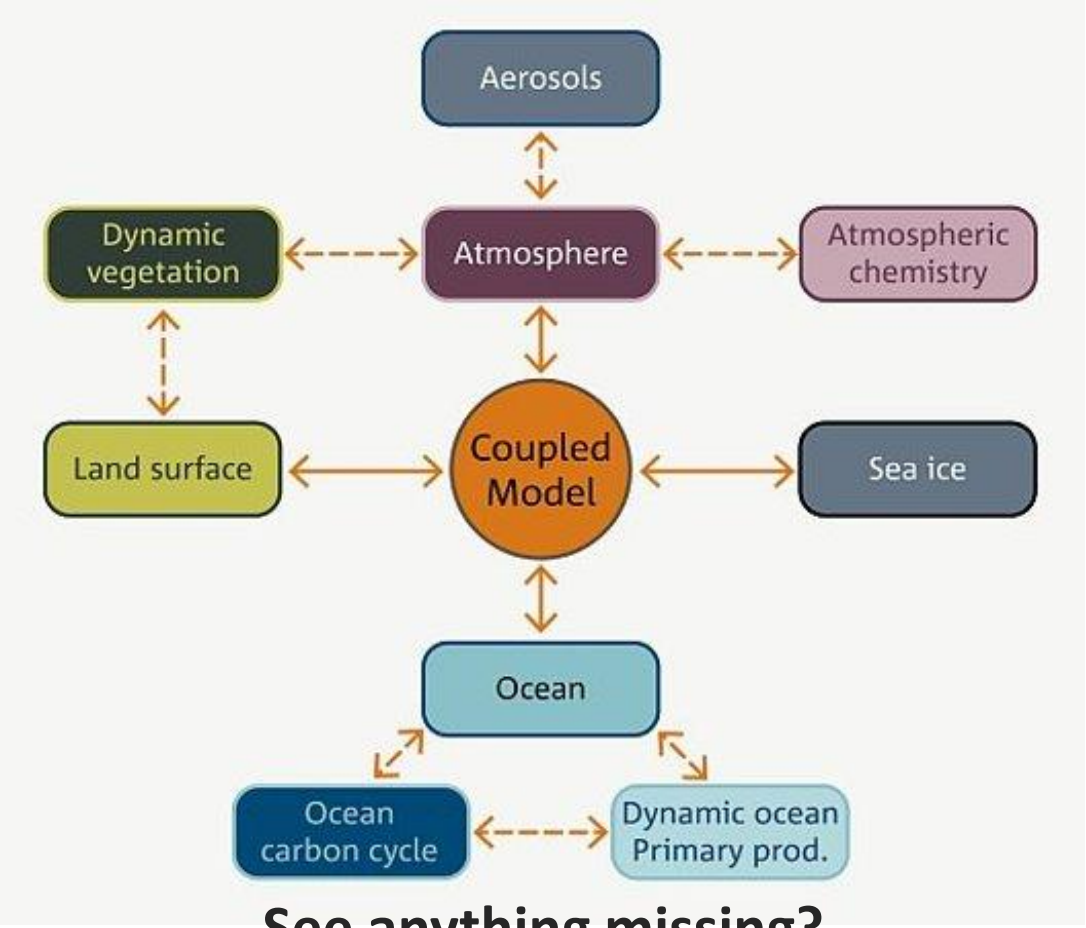
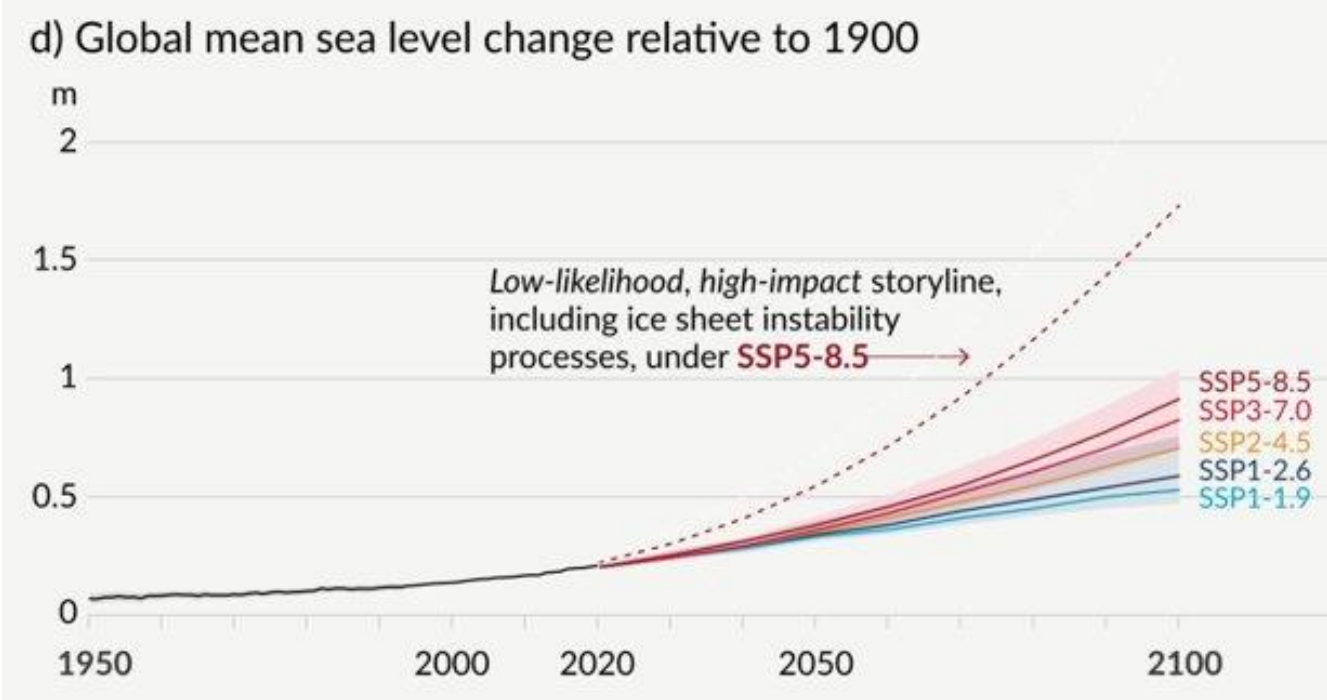


See anything missing?



IPCC AR6 (2021)

But ice sheets (and their melt) aren't included in our climate models!

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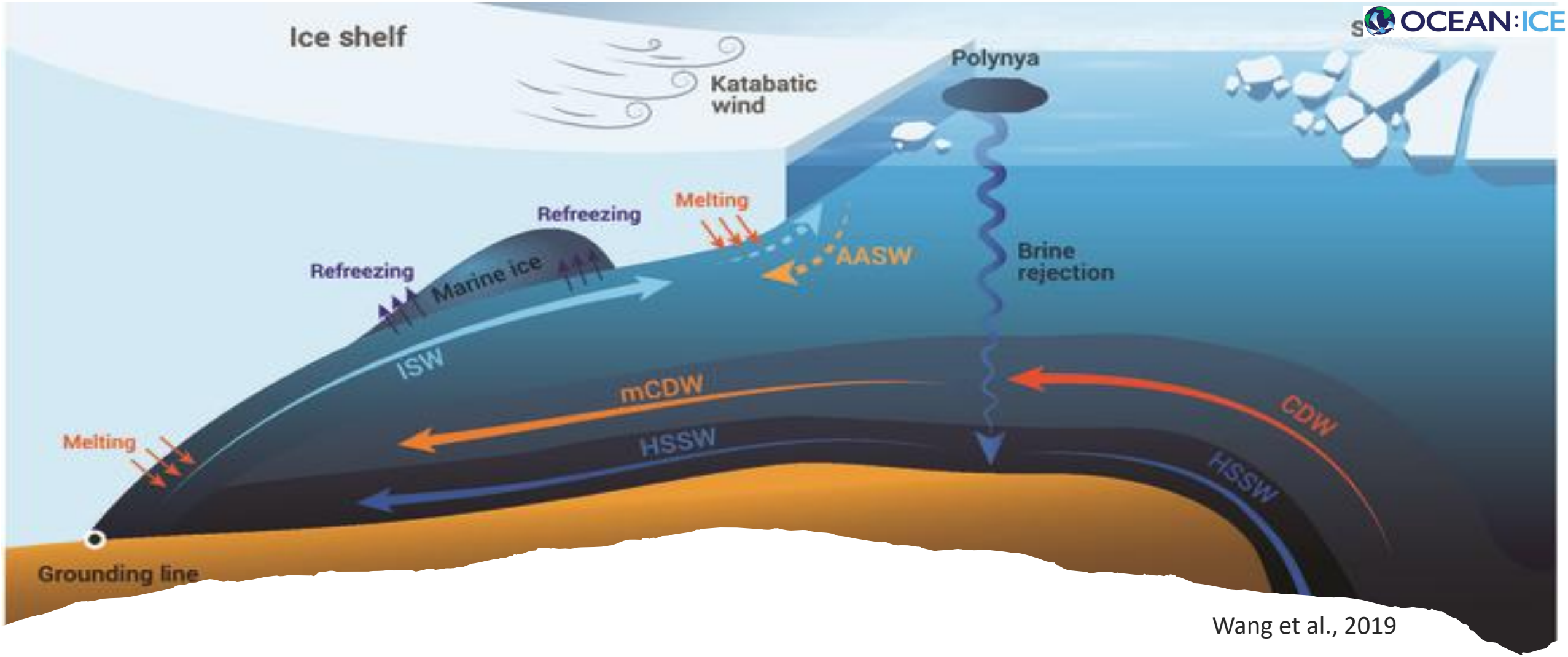

Wang et al., 2019

We struggle to observe, understand and model the complex processes driving ice shelf melt and ice sheet response

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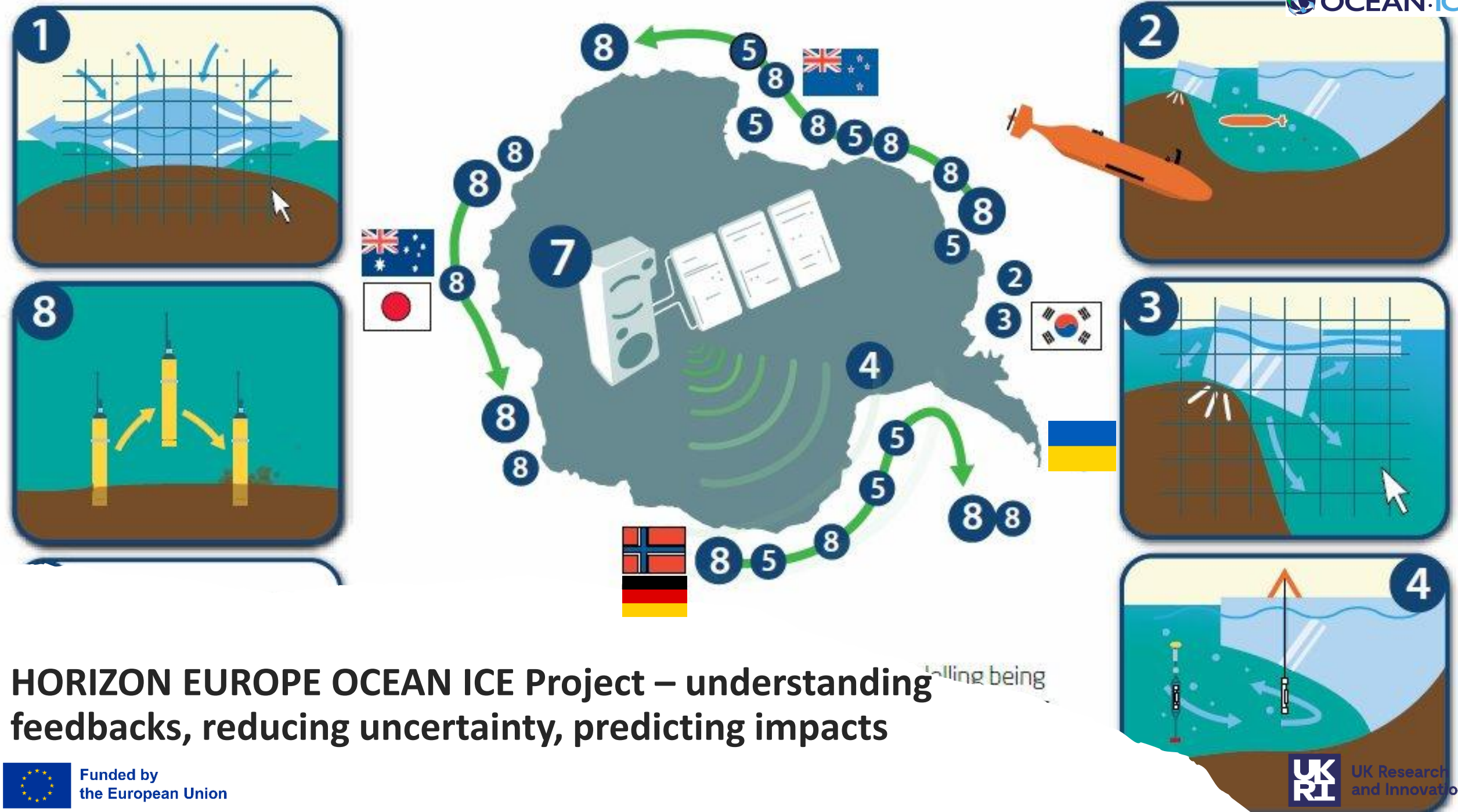

HORIZON EUROPE OCEAN ICE Project – understanding feedbacks, reducing uncertainty, predicting impacts

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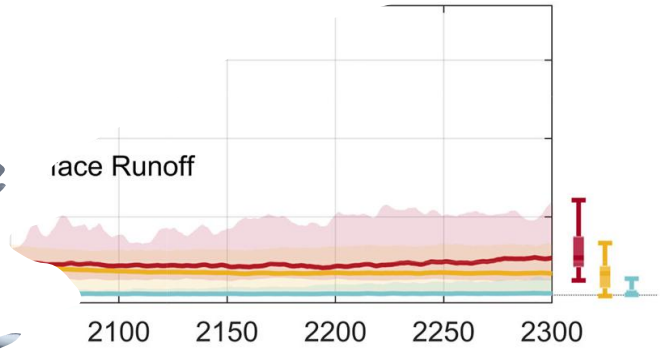
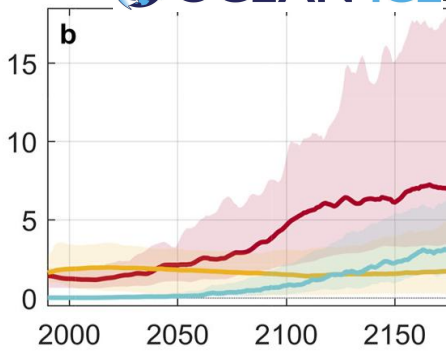
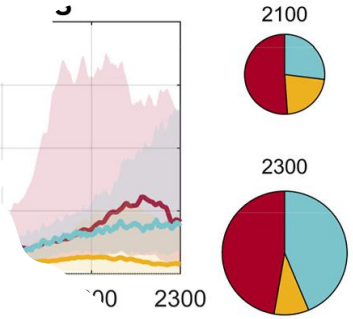
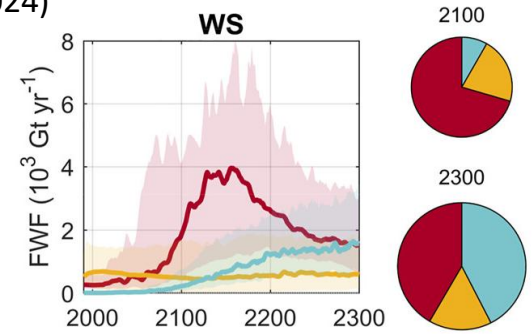
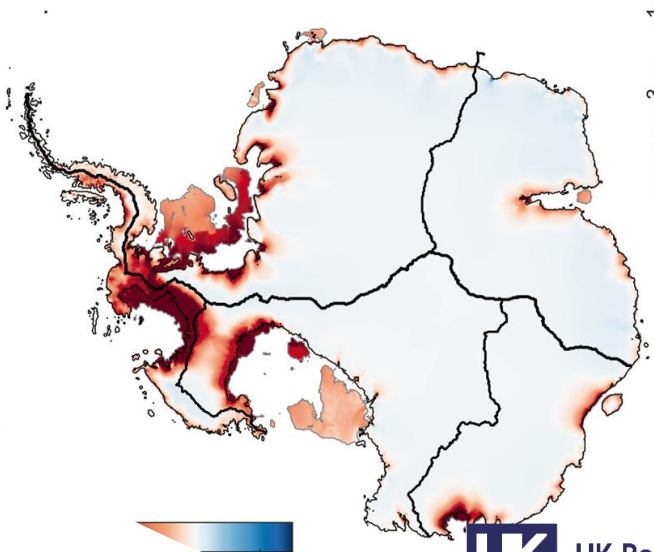


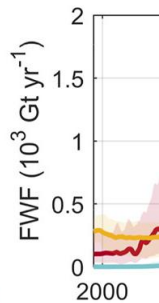


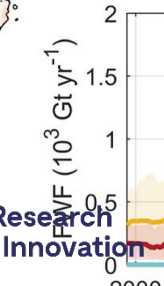
(Coulon et al., 2024)











Observations and modelling well underway – new projections of future melt, feedbacks and climate impact

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- Poor understanding of ice sheet processes and...
- ...ice sheet-ocean interactions limit our ability to predict future sea level rise
- Leading to future sea level rise uncertainties in the 10s of m
- Melt is already altering ocean circulation, potentially accelerating global change and risks tipping points
- New observations and model advances are reducing this uncertainty, but more research – and climate action - is urgently needed

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Protect CRYOSPHERE & SEA LEVEL

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sea level rise

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