



# Climate Change: a view from the polar regions

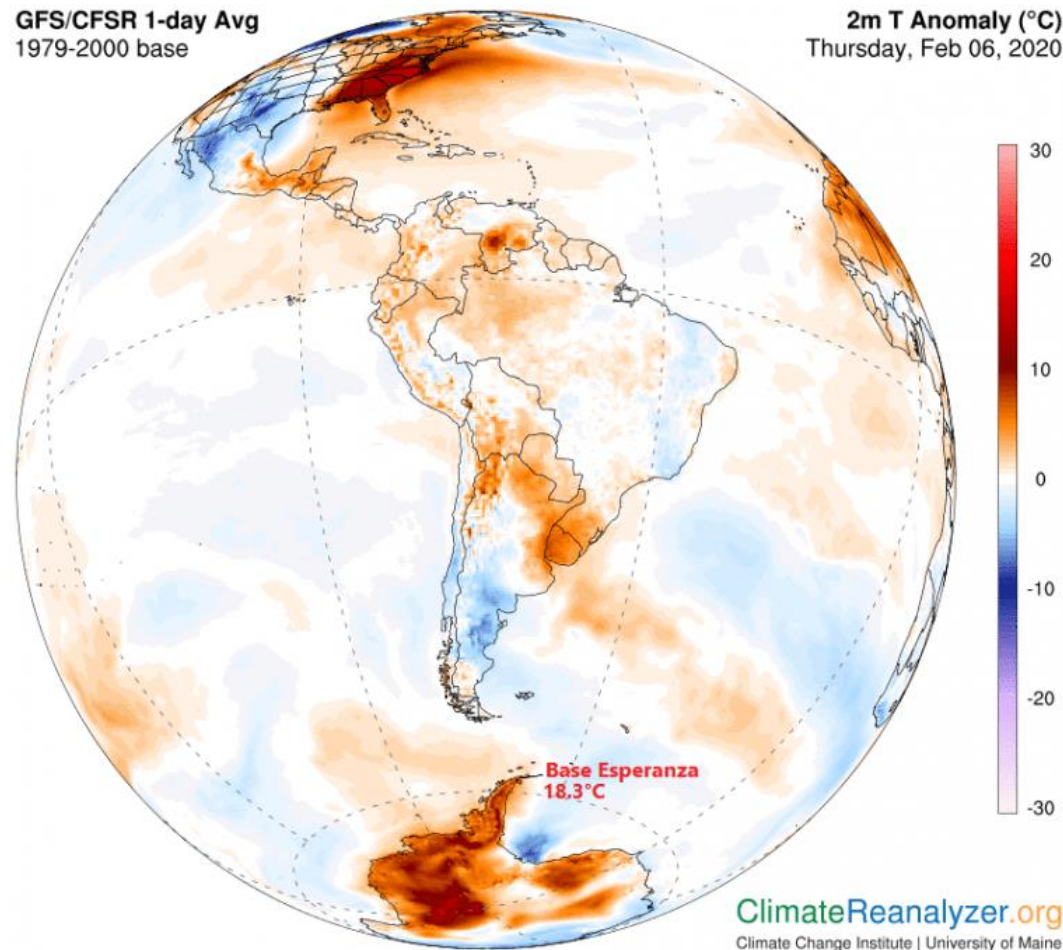
Dominic Hodgson

BRITISH ANTARCTIC SURVEY

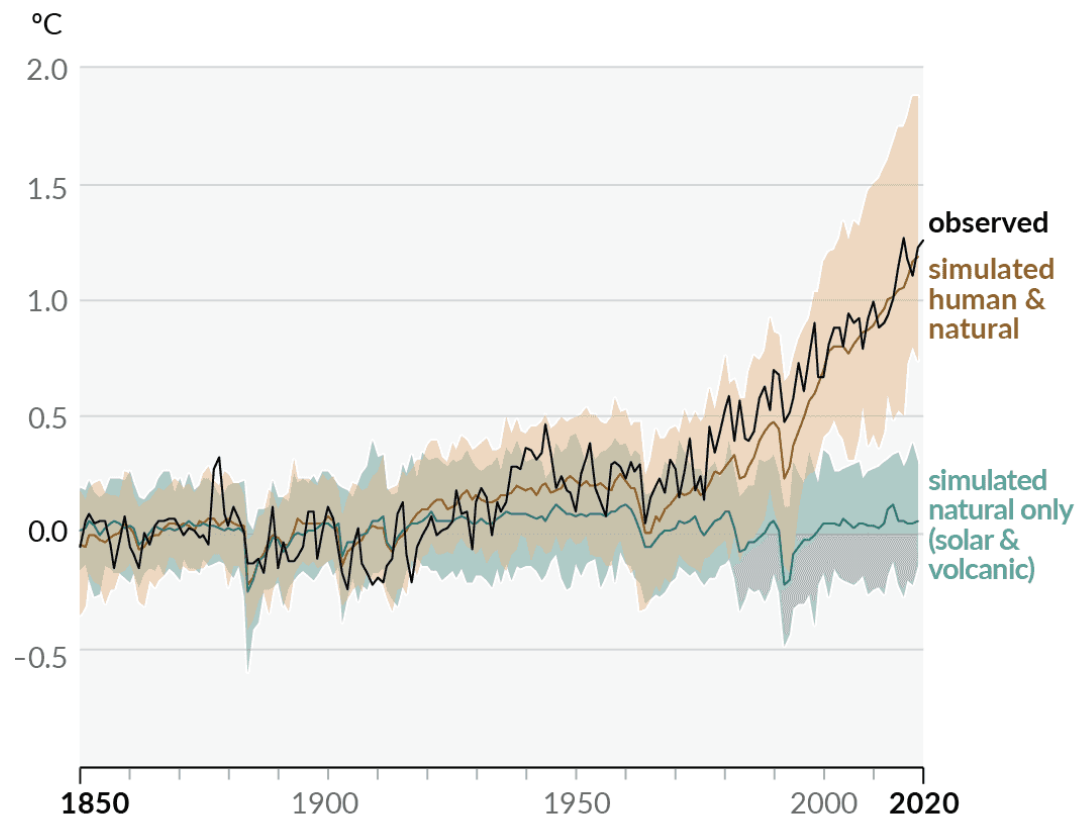
# Are temperatures rising?

GFS/CFSR 1-day Avg  
1979-2000 base

2m T Anomaly (°C)  
Thursday, Feb 06, 2020



(b) Change in global surface temperature (annual average) as **observed** and simulated using **human & natural** and **only natural** factors (both 1850–2020)





# Is there evidence that the temperature rise is linked to CO<sub>2</sub>?

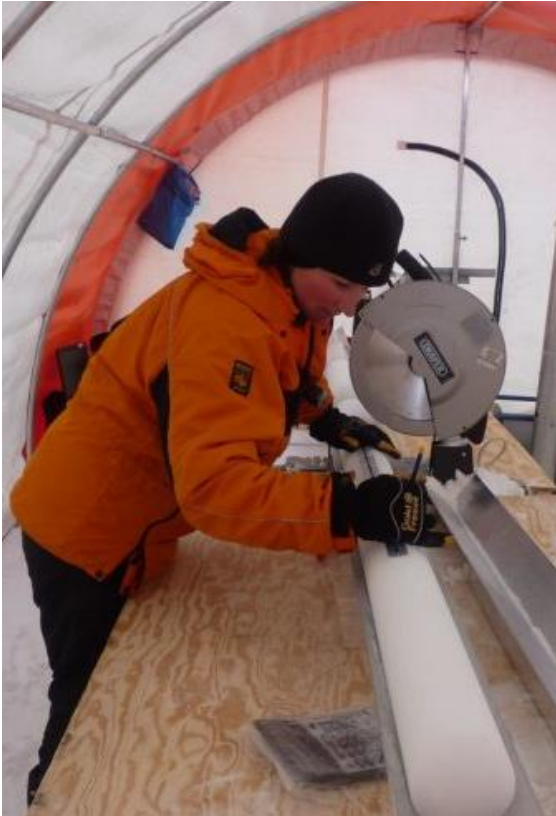
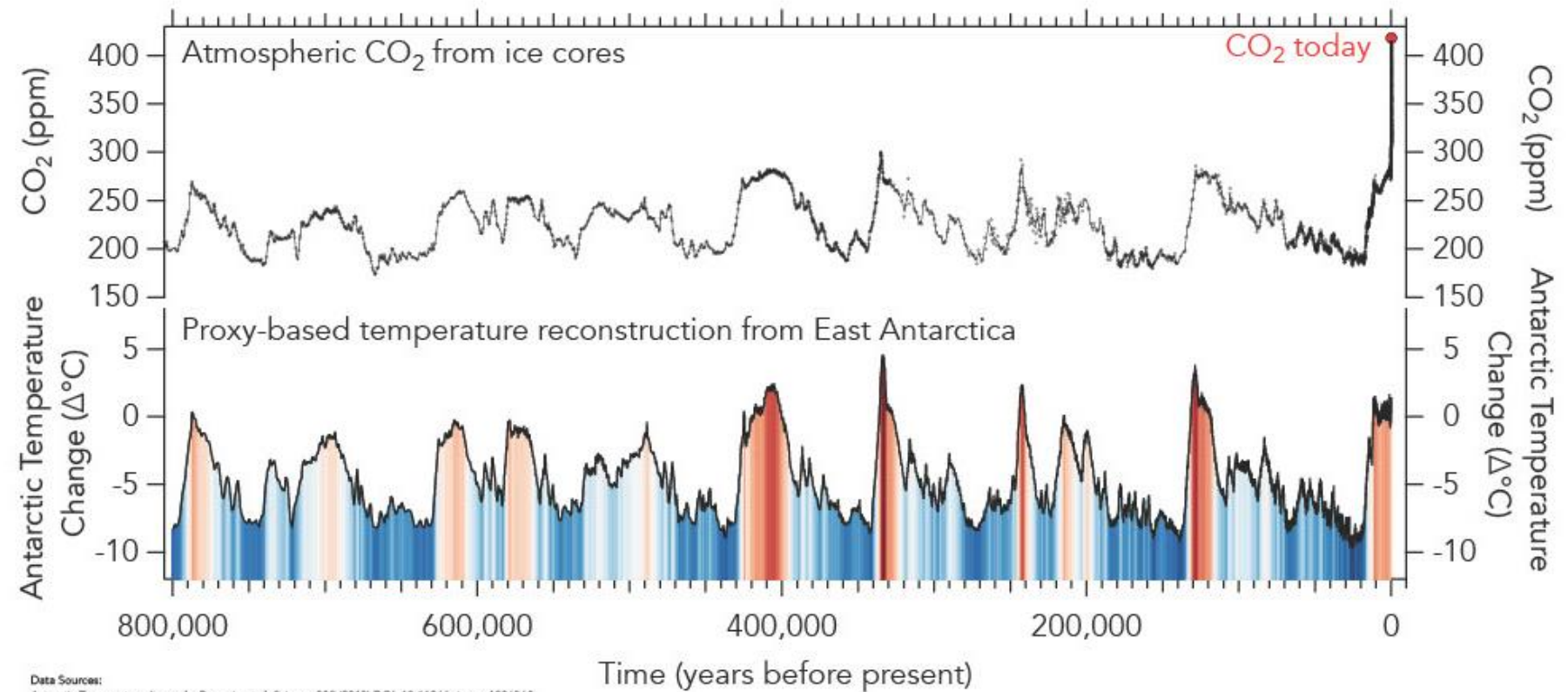


Figure 3: The oldest ice core records for atmospheric CO<sub>2</sub> and temperature change in Antarctica

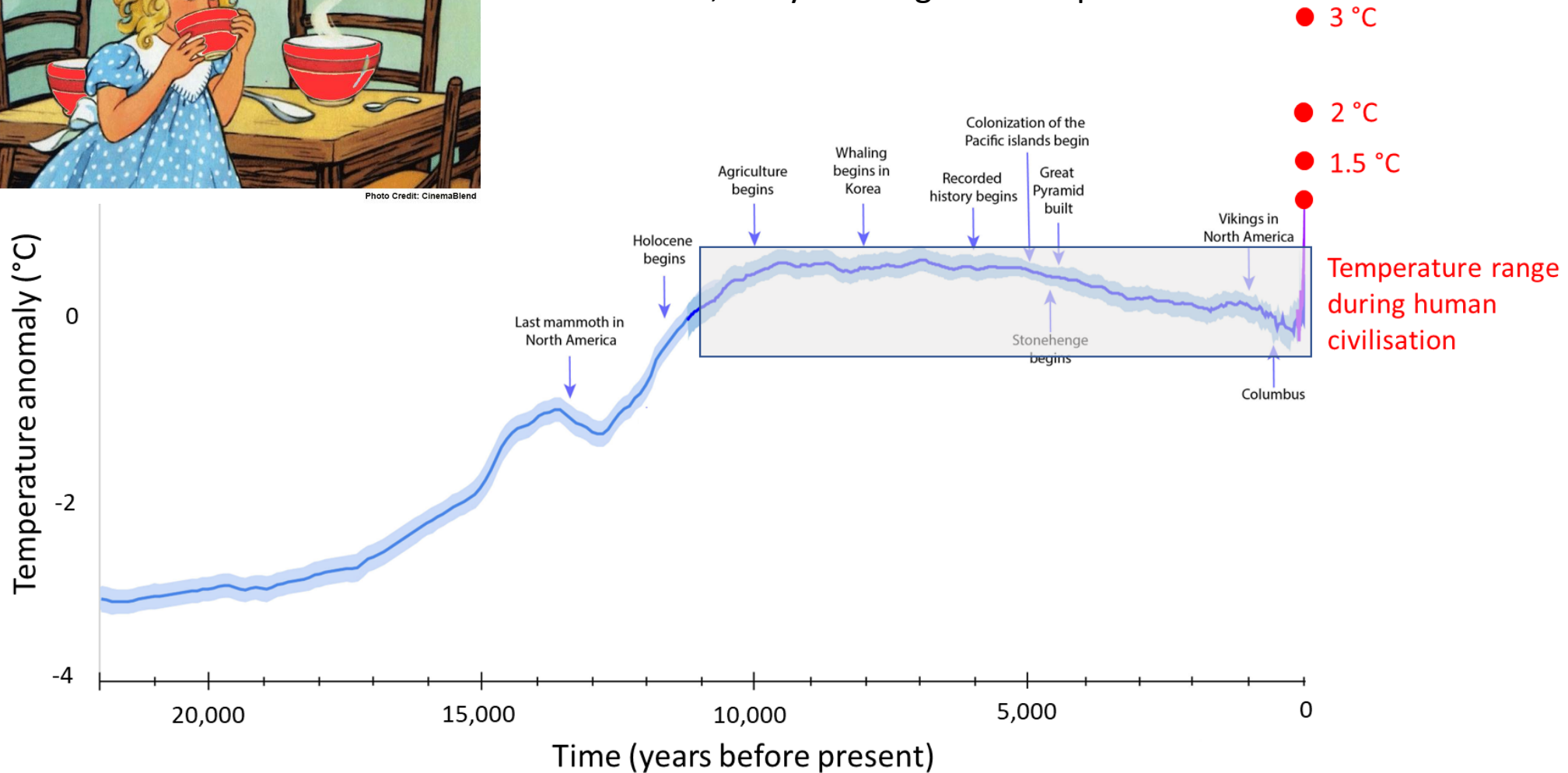


# Why worry about a few degrees?



Photo Credit: CinemaBlend

Last 22,000 years of global temperature

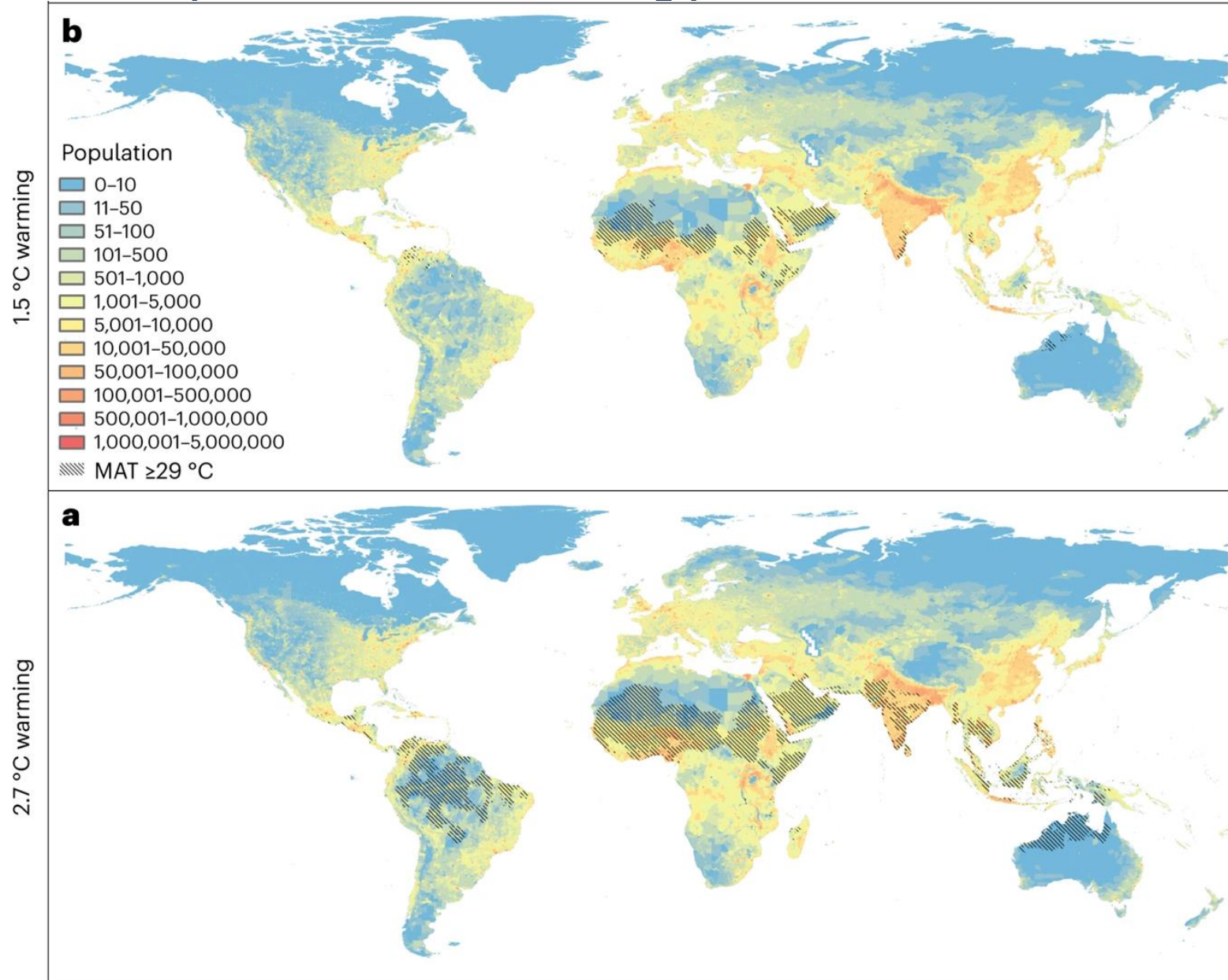


World has warmed by >1°C since Industrial Revolution ...





# How, and how badly, will this hurt us?

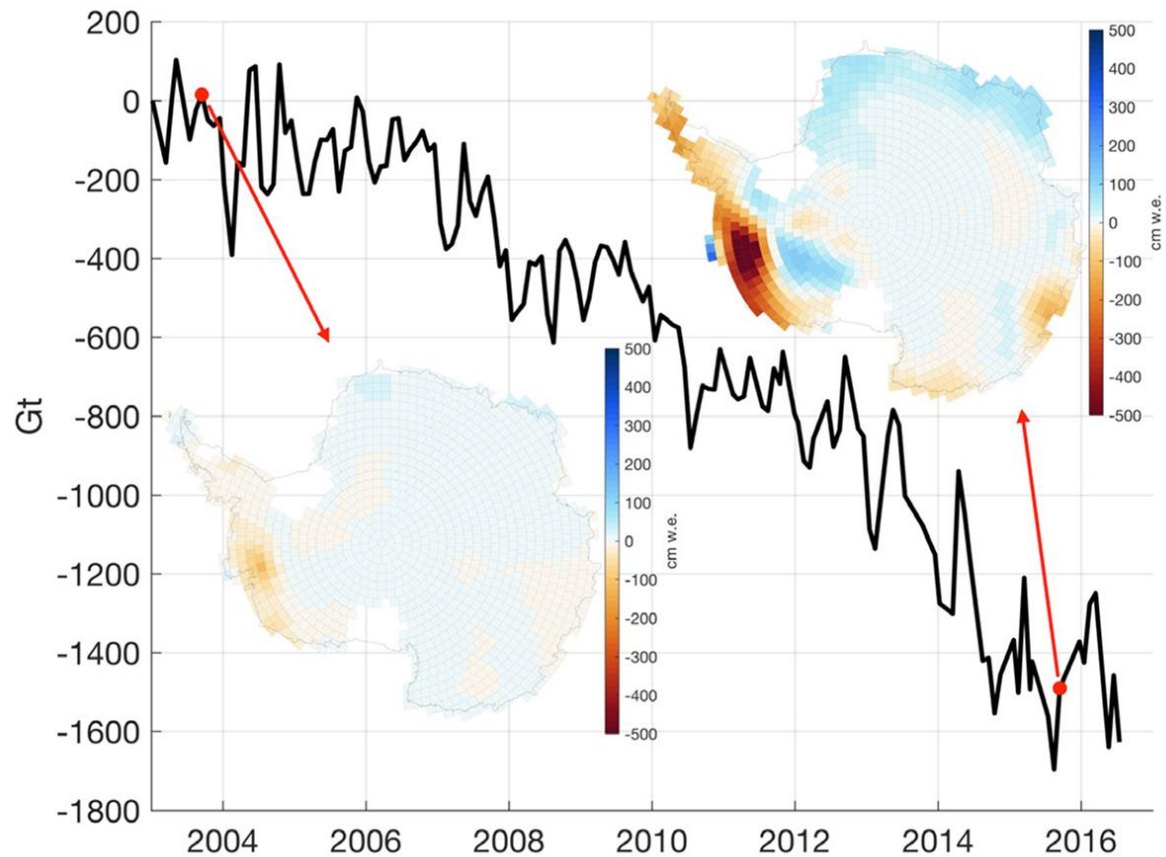
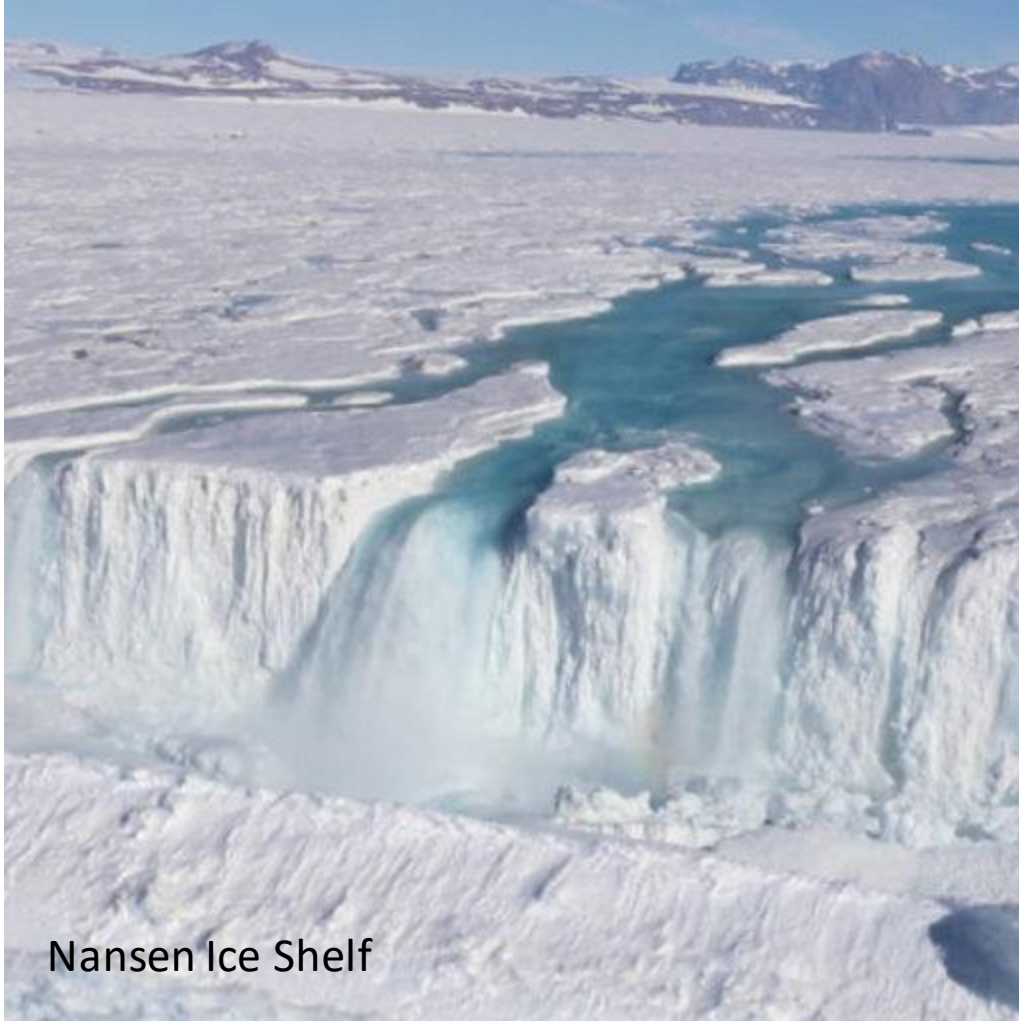


Current trajectory ( $\sim 2.7^\circ\text{C}$  warming) could put a third of the world population outside the “human climate niche”.

(Lenton et al., 2023)



# Is temperature really melting the ice sheets?

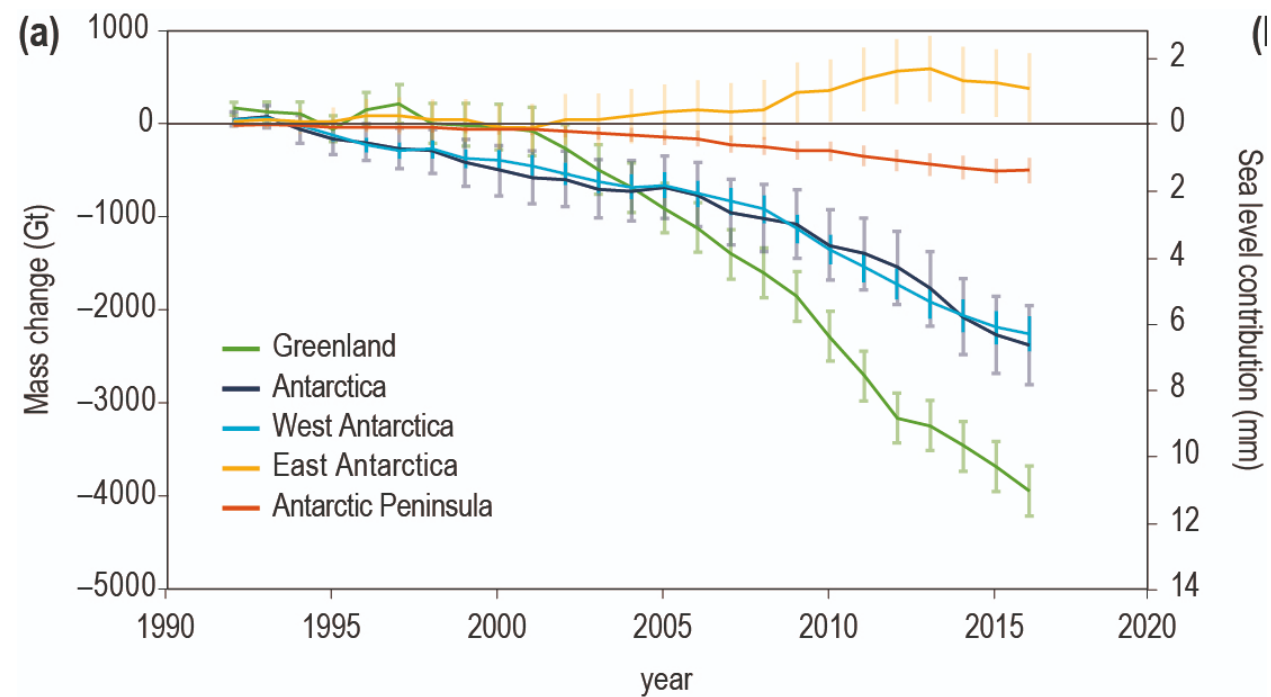


Nowicki and Seroussi, *Oceanography*, 2018





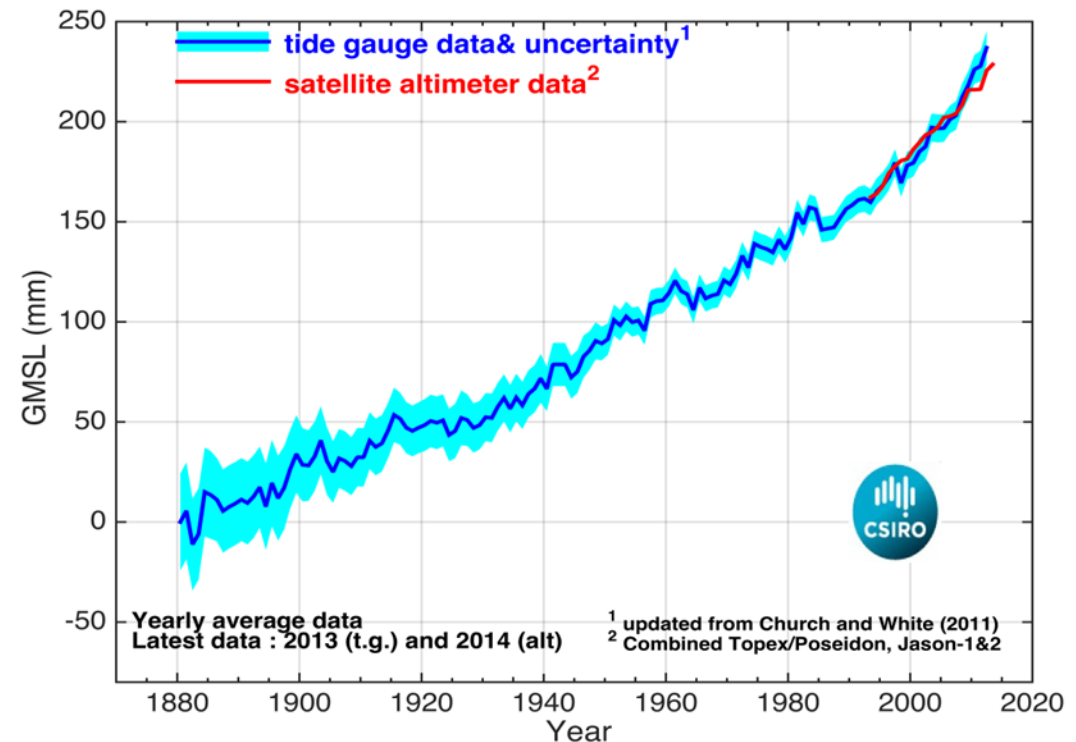
# Don't warmer temperatures grow ice sheets?



# Is melting ice contributing to sea level rise?



Unavoidable sea level rise matters to 1 billion people who will be affected by annual high tide by 2100!

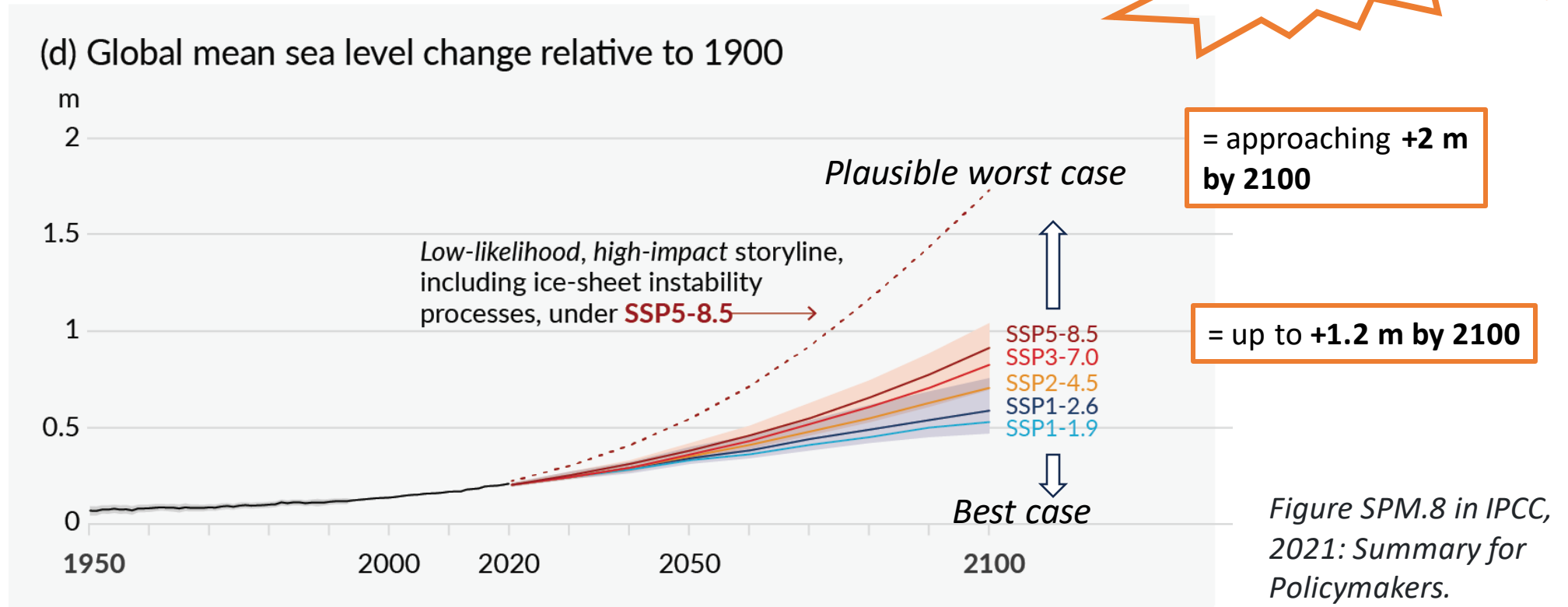


Global mean sea level has risen 21–24 cm since 1880 due to melt from glaciers and ice sheets and thermal expansion of seawater





# How much sea level rise is predicted?

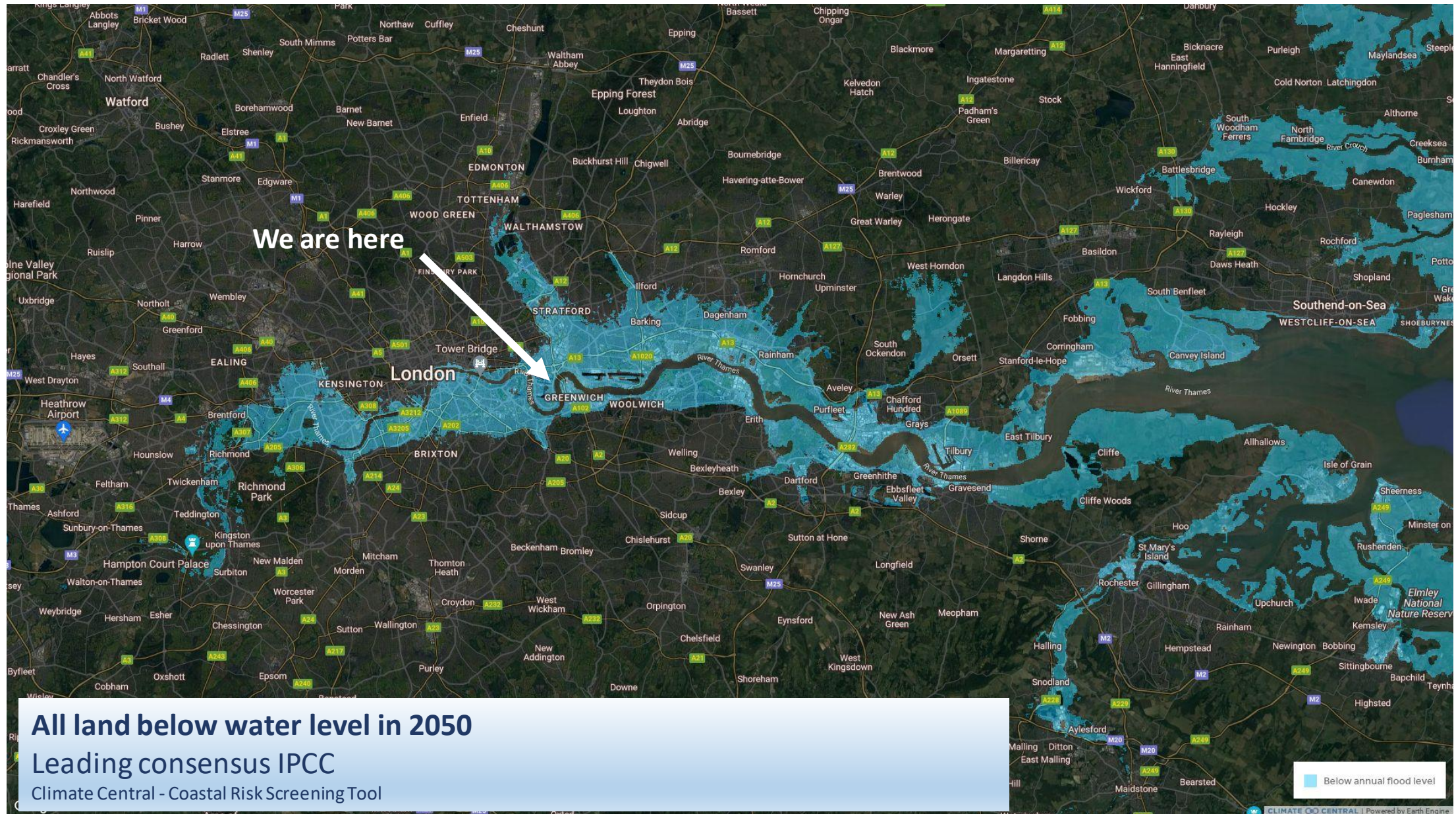


## The low-confidence, high-impact storyline – the dashed line:

“Global mean sea level rise above the likely range – approaching **2 m by 2100** and **5 m by 2150** under a very high GHG emissions scenario (SSP5-8.5) (low confidence) – cannot be ruled out **due to deep uncertainty in ice sheet processes**” ...IPCC AR6 WG1 SPM

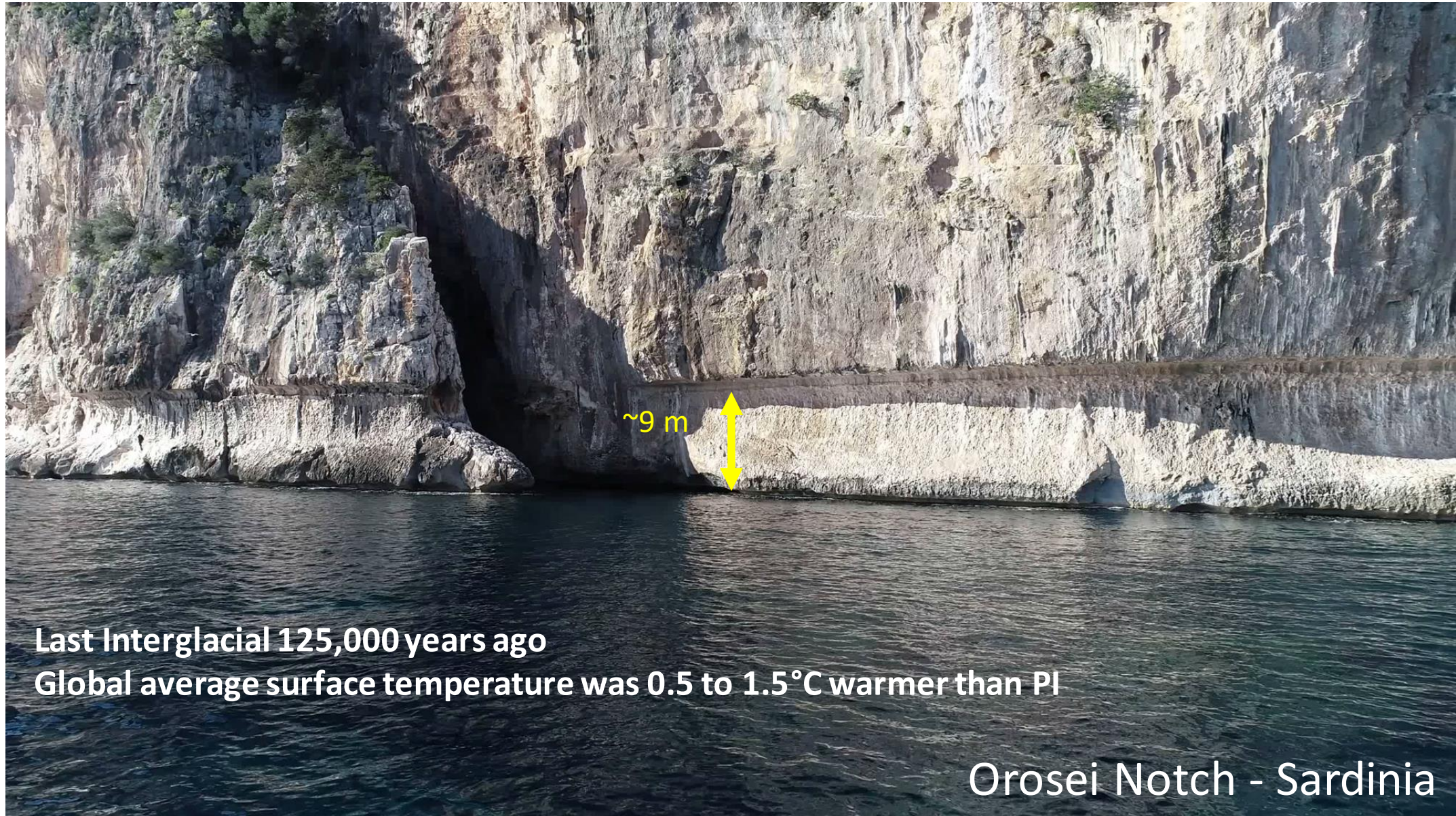


# What does this look like?





# How much sea level rise is possible?

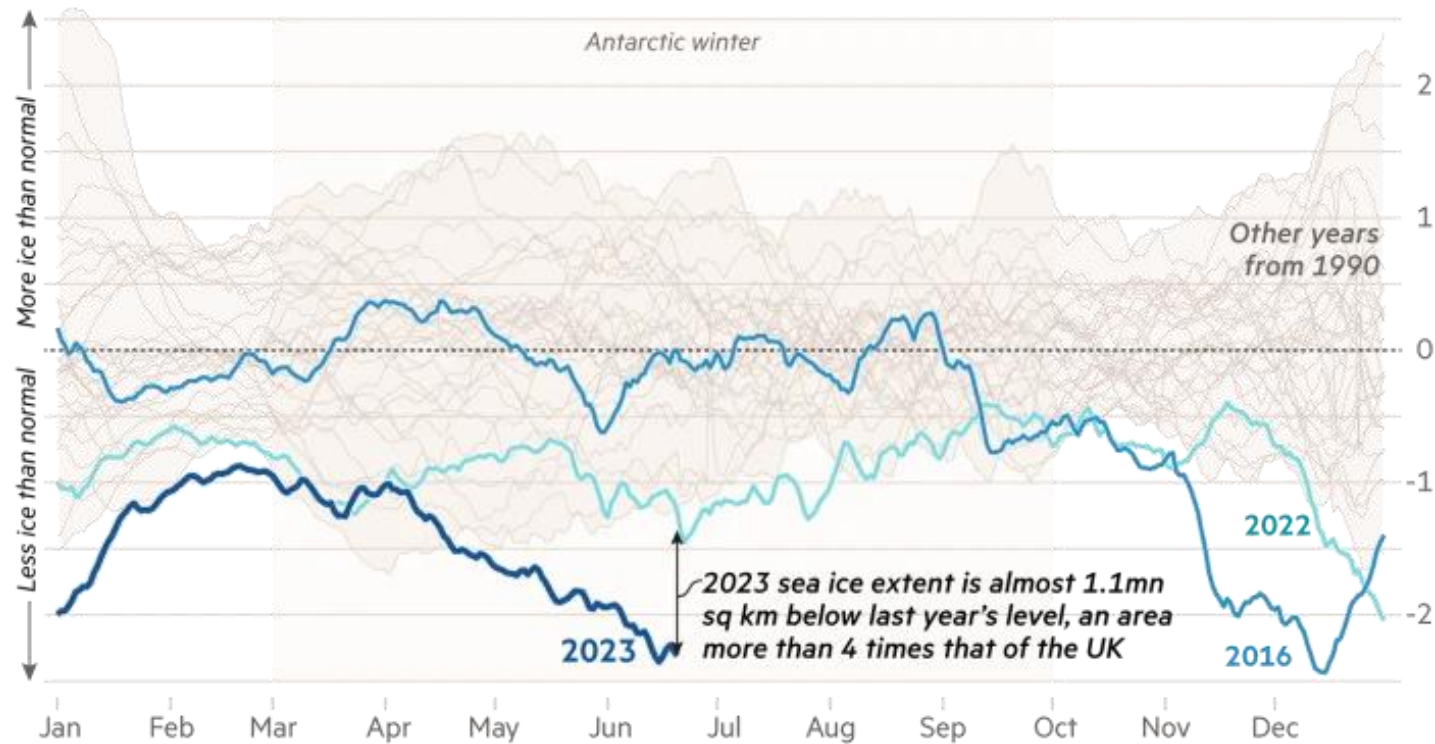




# Is the loss of sea ice important?

## Antarctic sea ice extent declines further from average

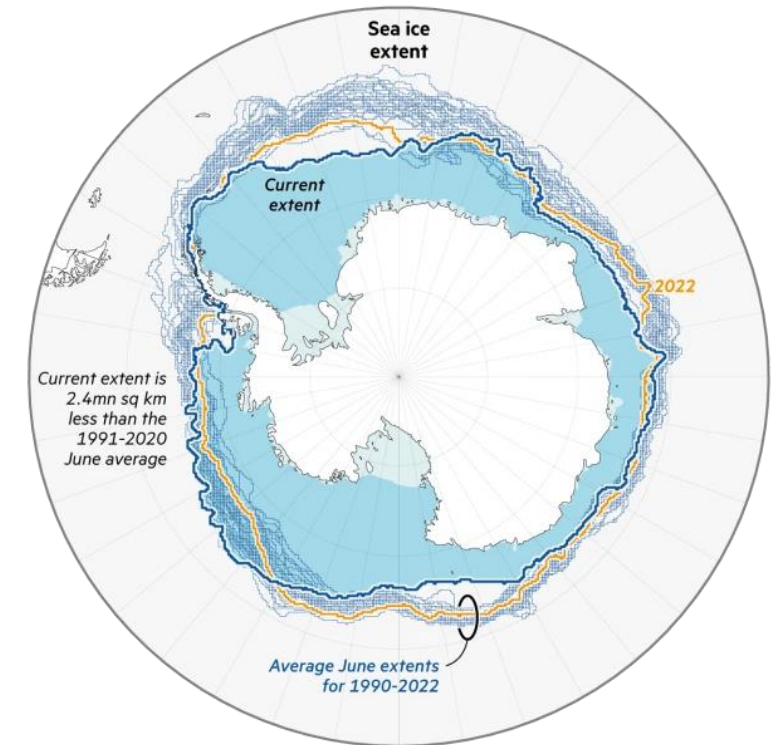
Sea ice extent anomaly\* (million square kilometres)



Source: Arctic Data Archive System  
© FT

\* compared with 1990-2023 average

Antarctic sea ice extent at record low for June



2023 data for June 20  
Source: National Snow & Ice Data Center's Sea Ice Index  
© FT

**If the sea ice loss was a country it would be the 10th largest**

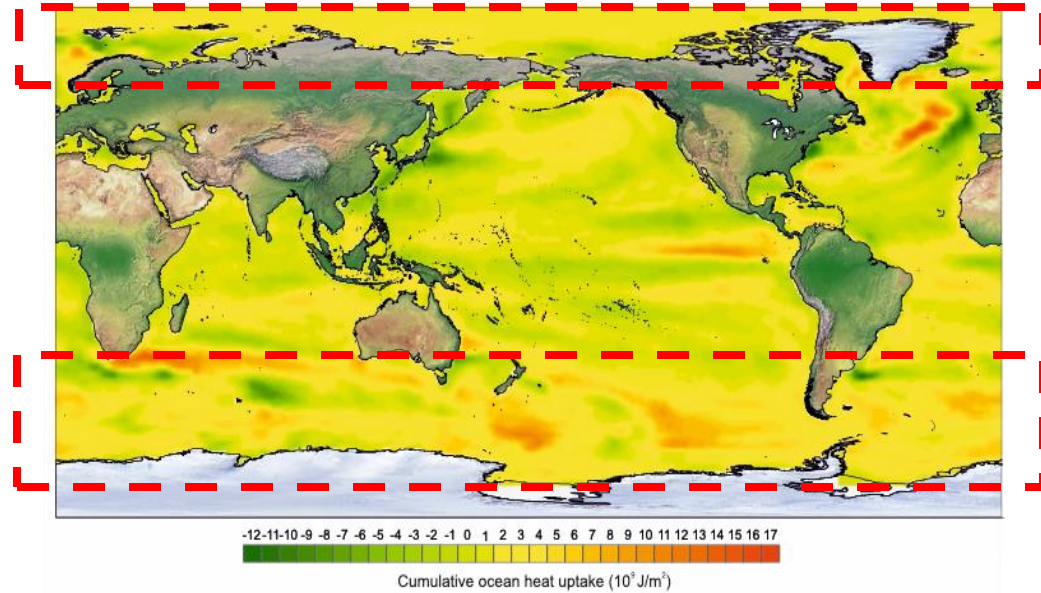


**SEA ICE LOSS  
2.4**

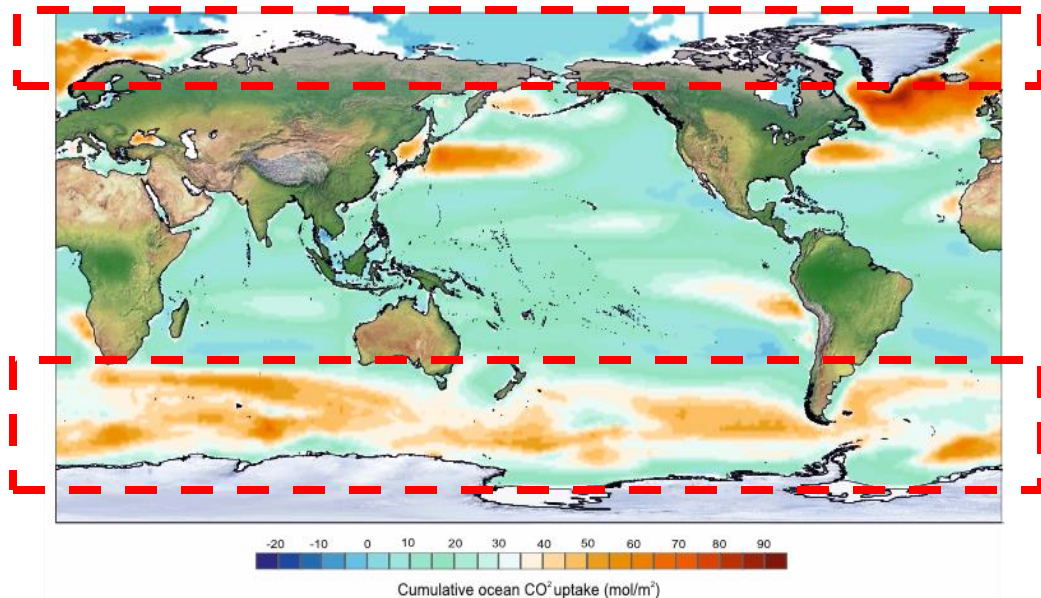
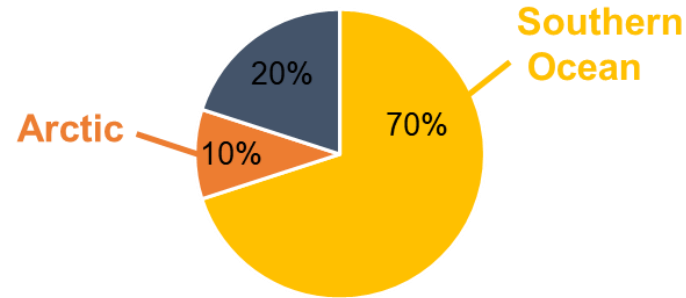
Implications for planetary albedo, climate, ecosystems and ocean circulation



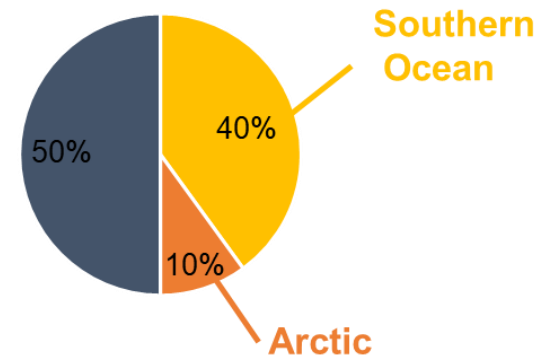
# What role do the Polar oceans play?



Ocean Heat Uptake

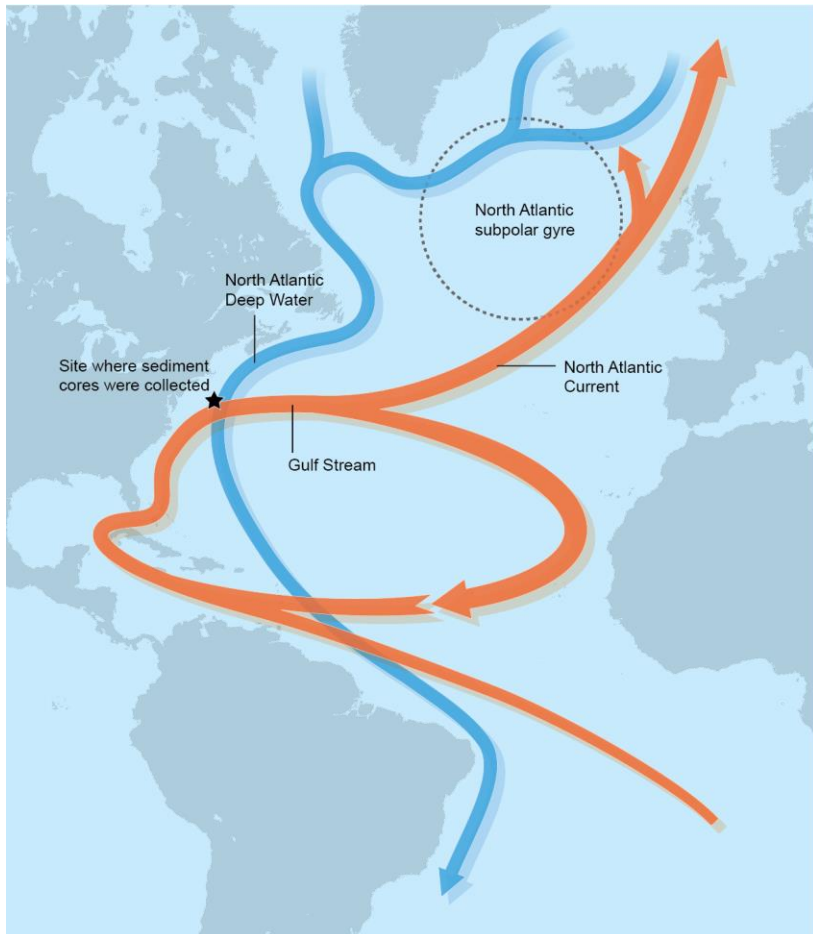


Ocean Carbon Uptake



# Will a weakening AMOC cool Europe?

IPCC SROCC – Chapter 6. There is *medium confidence* that the AMOC has weakened over the historical era but there is insufficient evidence to quantify a *likely* range of the magnitude of the change



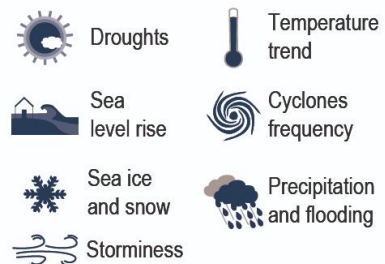
Direction of the change

▲ Increase  
▼ Decrease

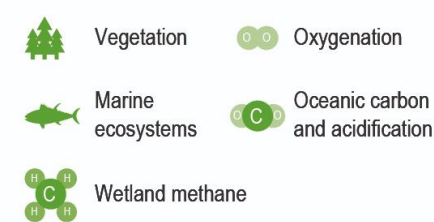
Confidence in process understanding

●●● High  
●● Medium  
● Low

## Physical system



## Biological system

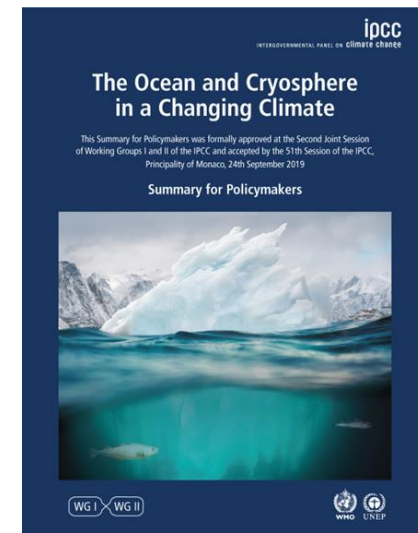
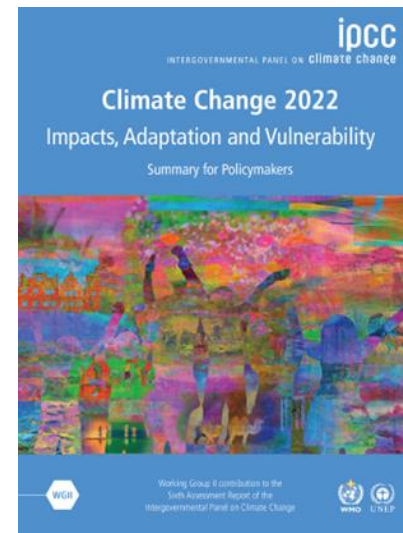
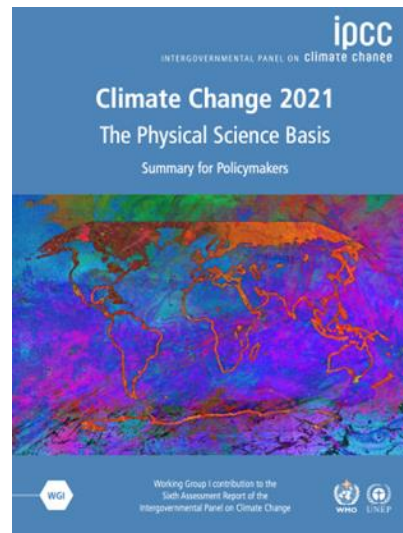


## Human and managed systems





# The IPCC consensus



- IPCC AR6 WGII unambiguously emphasizes the urgent need for action:

‘cumulative scientific evidence is unequivocal: Climate change is a threat to human well-being and planetary health. Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all.’

