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Climate Change – **Ice Sheets and Sea Level**

SDU Climate Thursdays 2022-09-15

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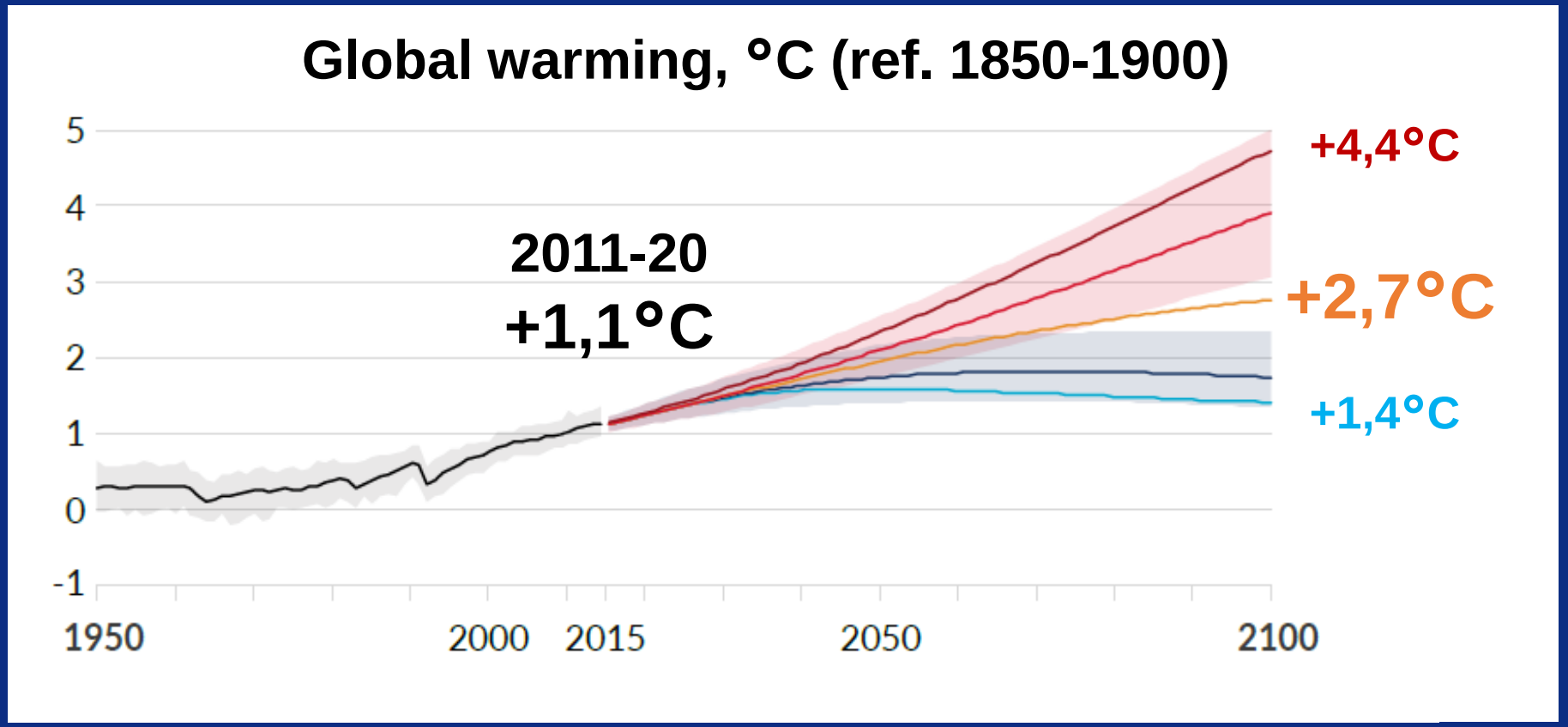

Current ambitions to reduce emissions (pre-COP26) result in a warming of 2,7°C in 2100

IPCC AR6 WGI 2021

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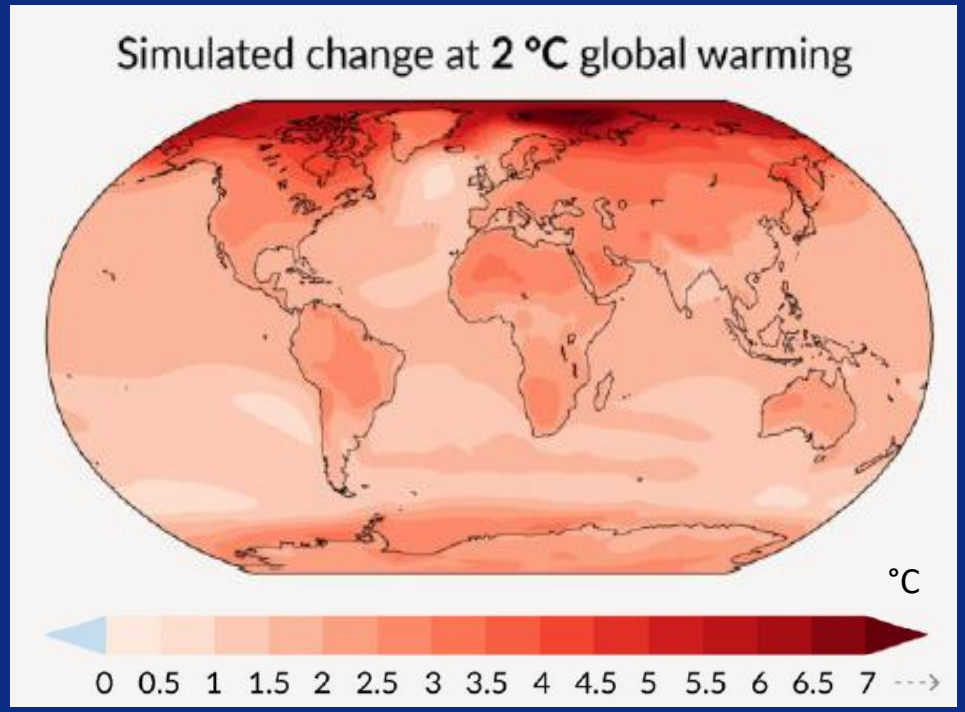
Polar amplication of warming



It is virtually certain that ***the Arctic will continue to warm more than global*** surface temperature, with high confidence ***above two times the rate of global warming.***

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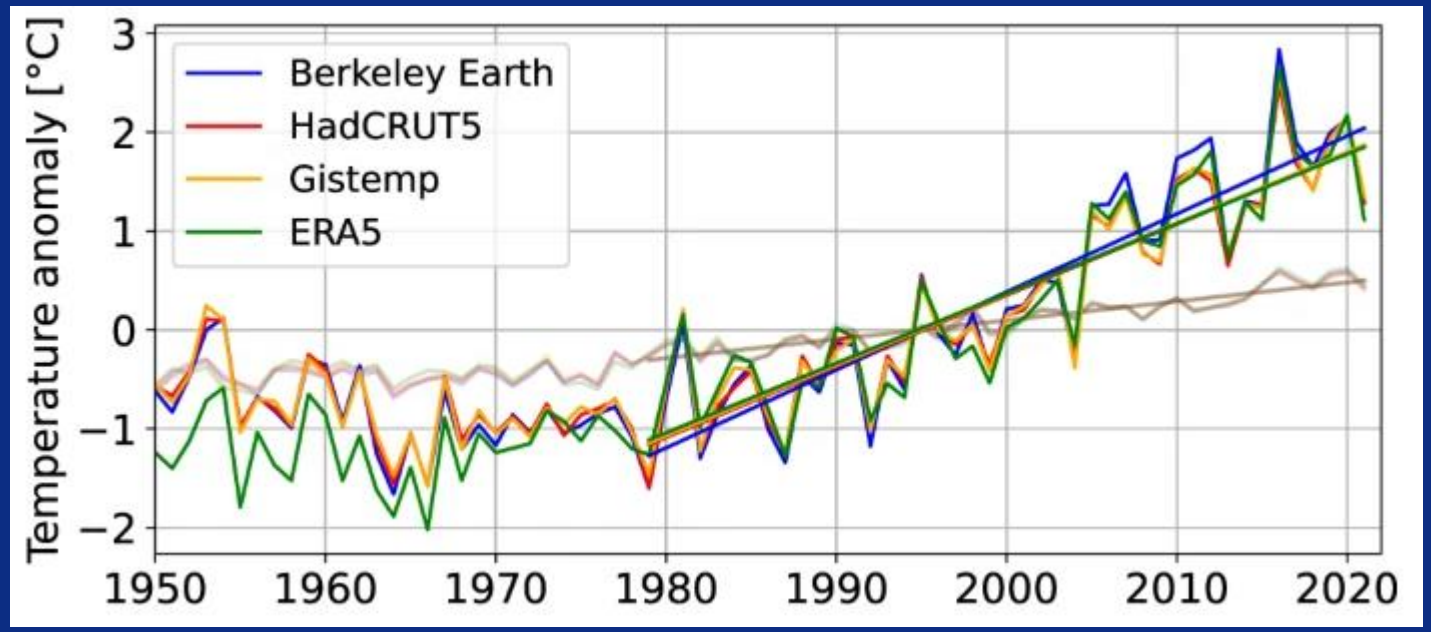
The Arctic has warmed 4 times faster than the global average



Rentanen et al 2022

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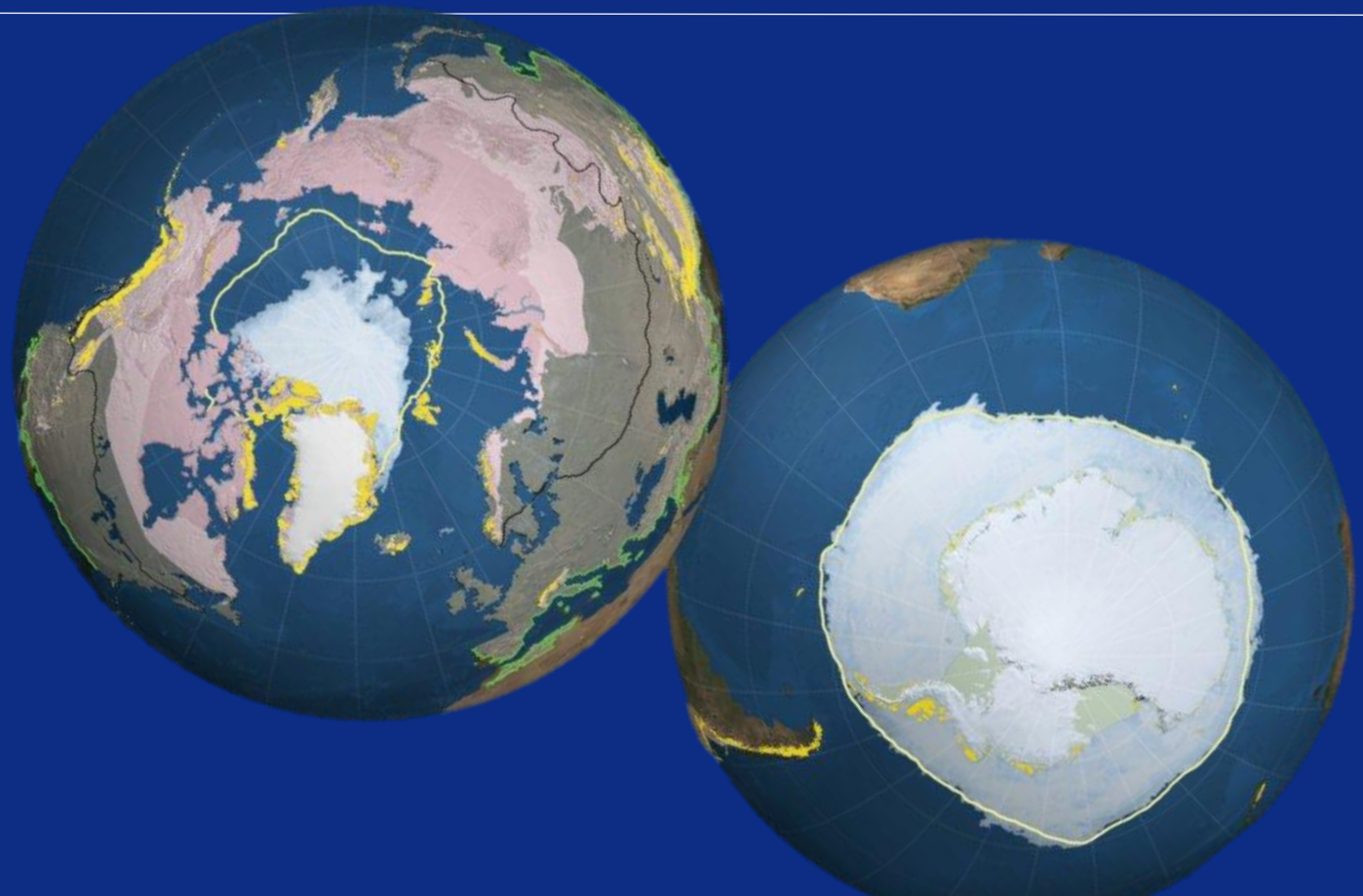
The Arctic and the Antarctic



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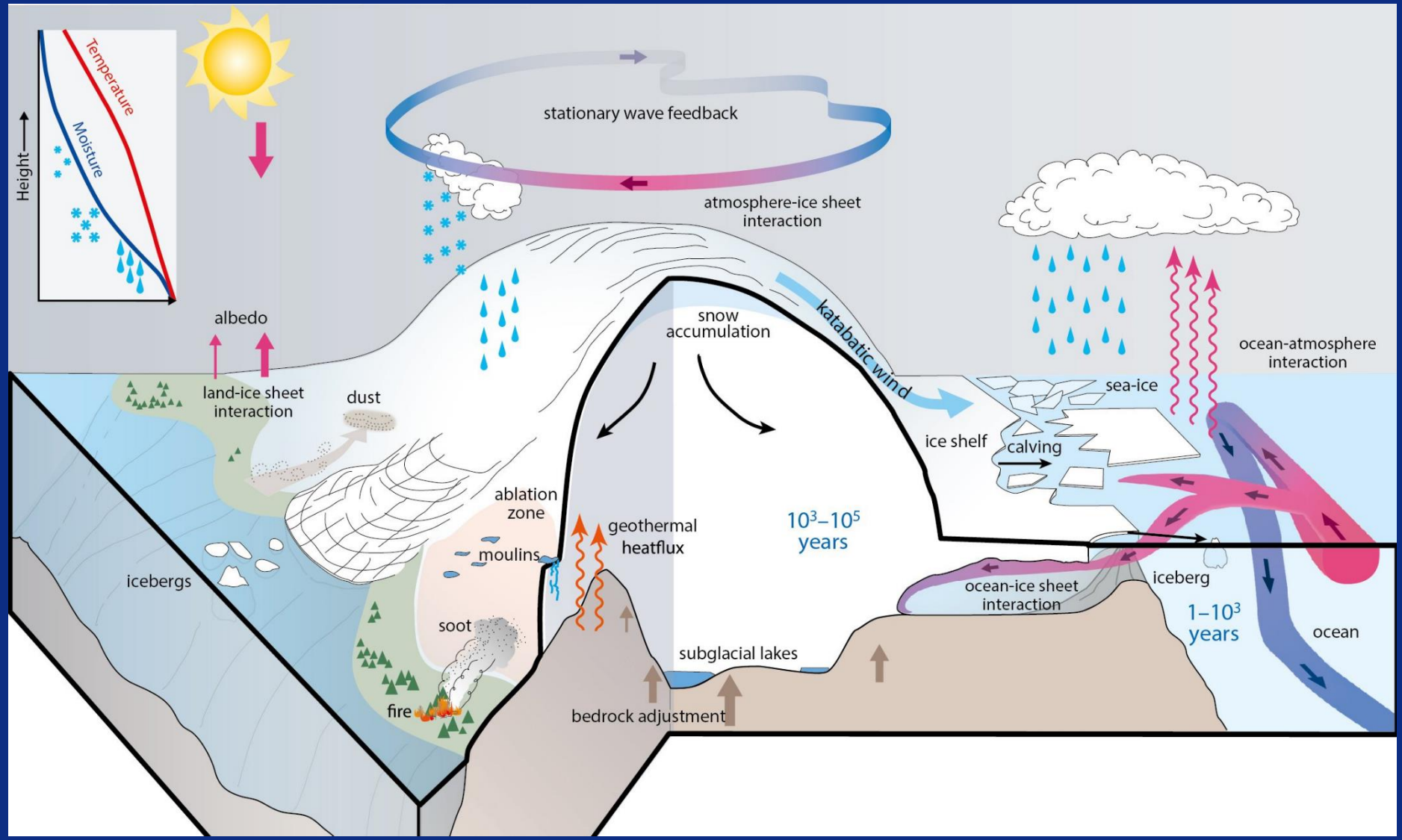
Ice sheets in the climate system



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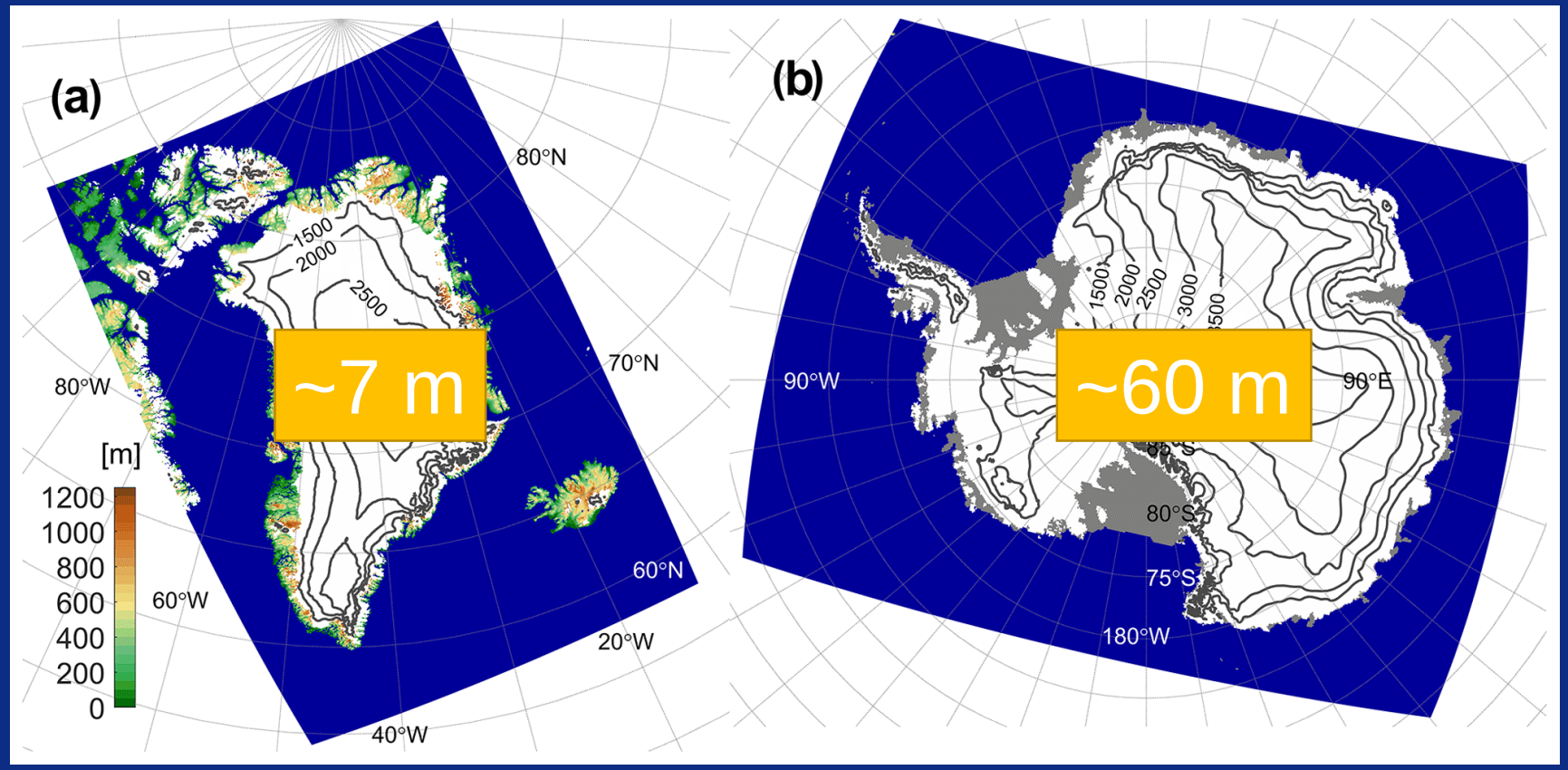
Greenland and Antarctica – potential sea level contributions



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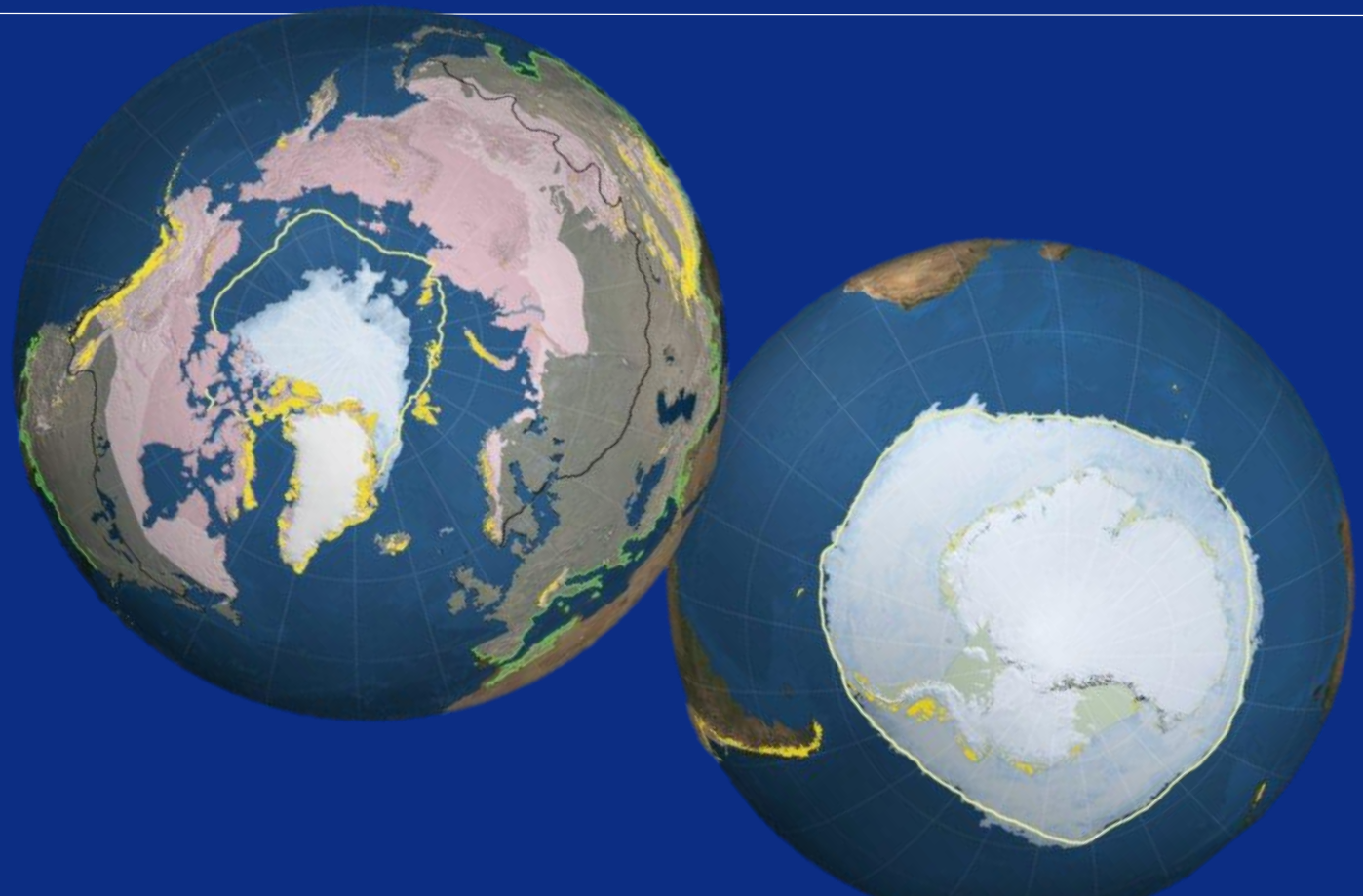
Greenland and Antarctica – potential sea level contributions



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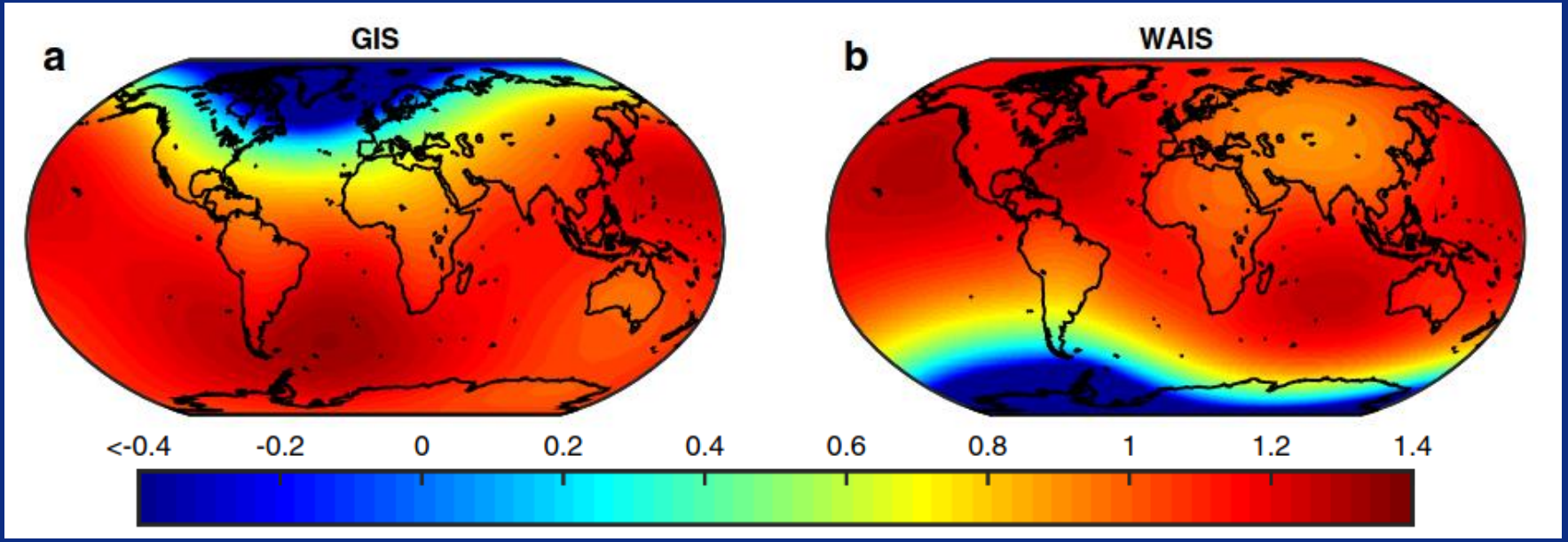
Ice sheets and sea level: *Meltwater is distributed unevenly*



- The reduced gravitational pull from the smaller ice sheets compensates the sea level increase locally.
- Changes in the Antarctic ice sheet has relatively larger impacts on the Northern Hemisphere.

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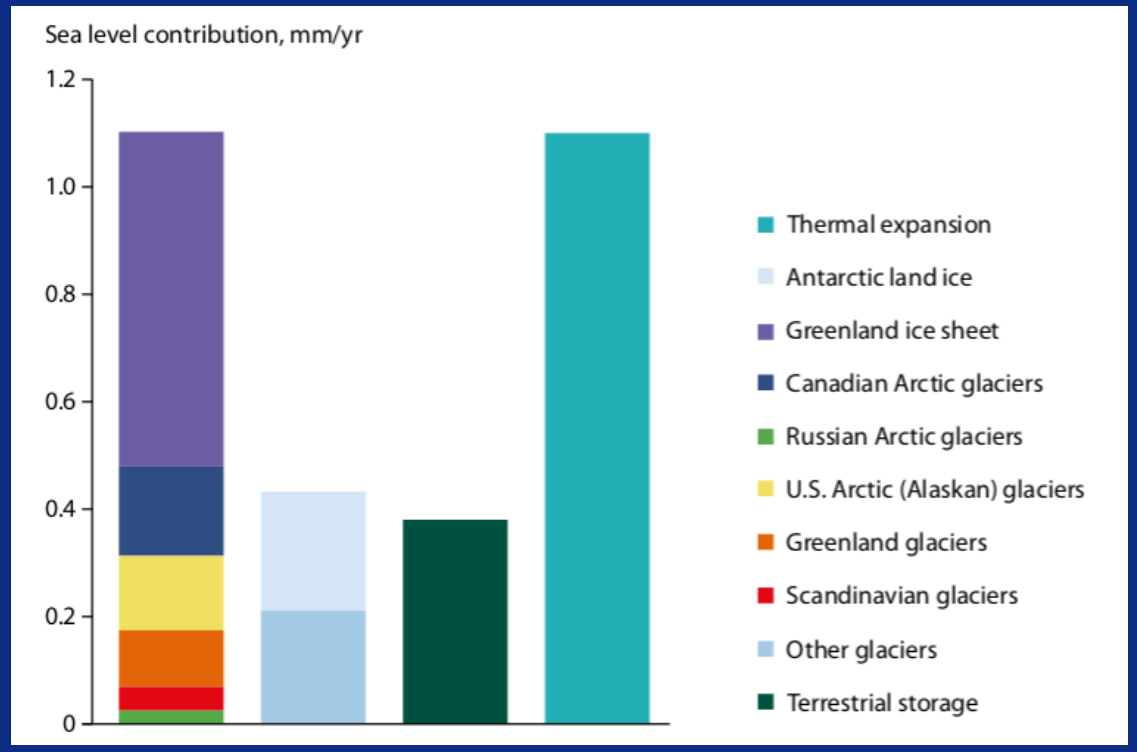
Global consequences of a warming polar regions

- Ice sheets and smaller glaciers cause about half the current sea level rise
- The global mean sea level rise is ~20 cm compared to 1900



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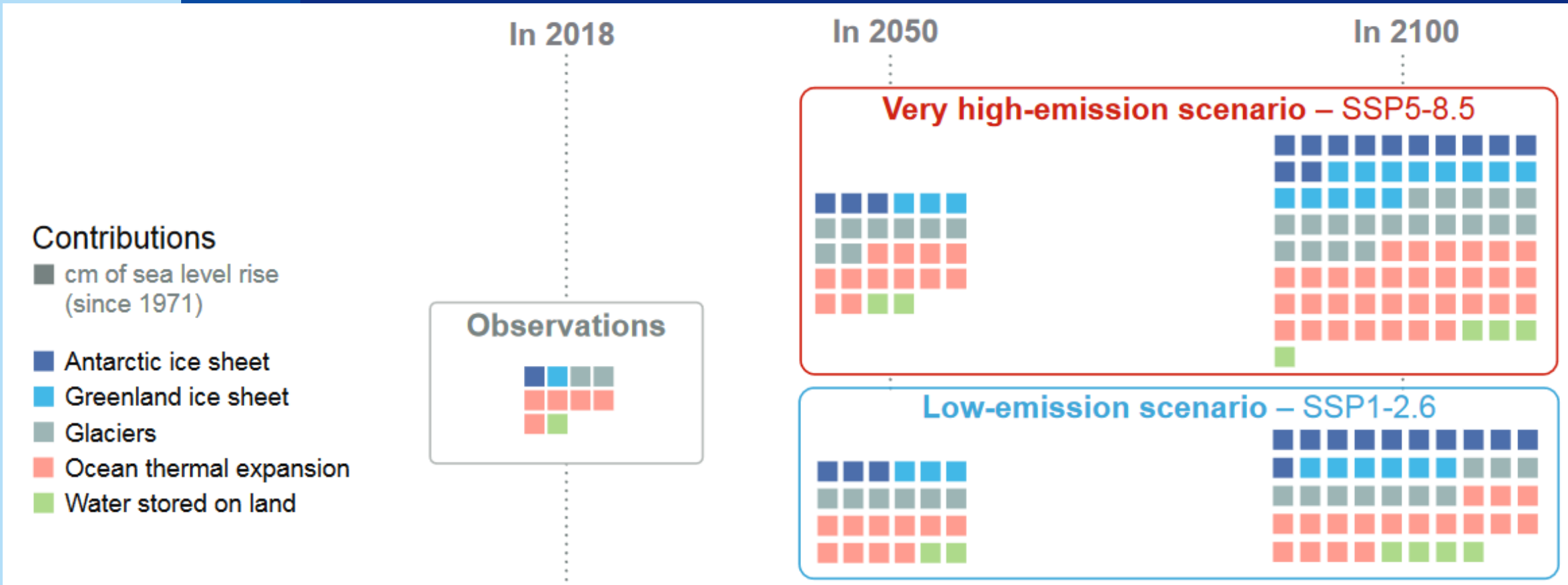
Contributions to sea level rise – *now and in the future*



IPCC 2021: *In the longer term,* ***sea level is committed to rise for centuries to millennia*** *due to continuing deep-ocean warming and ice-sheet melt and will remain elevated for thousands of years.*

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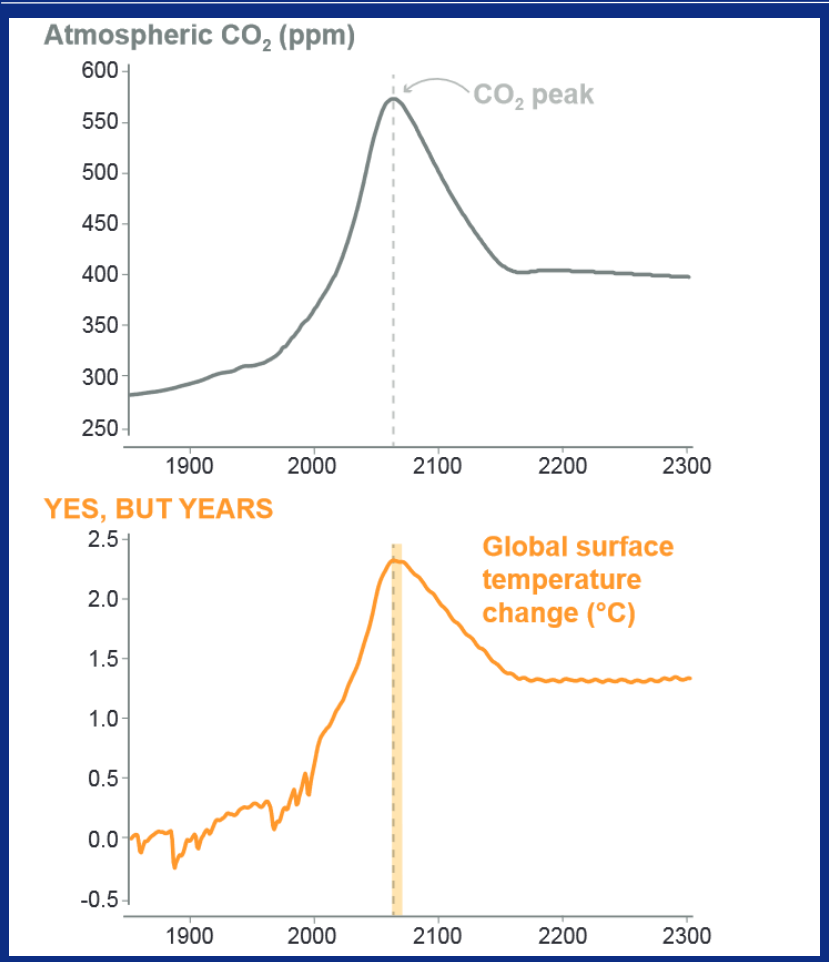
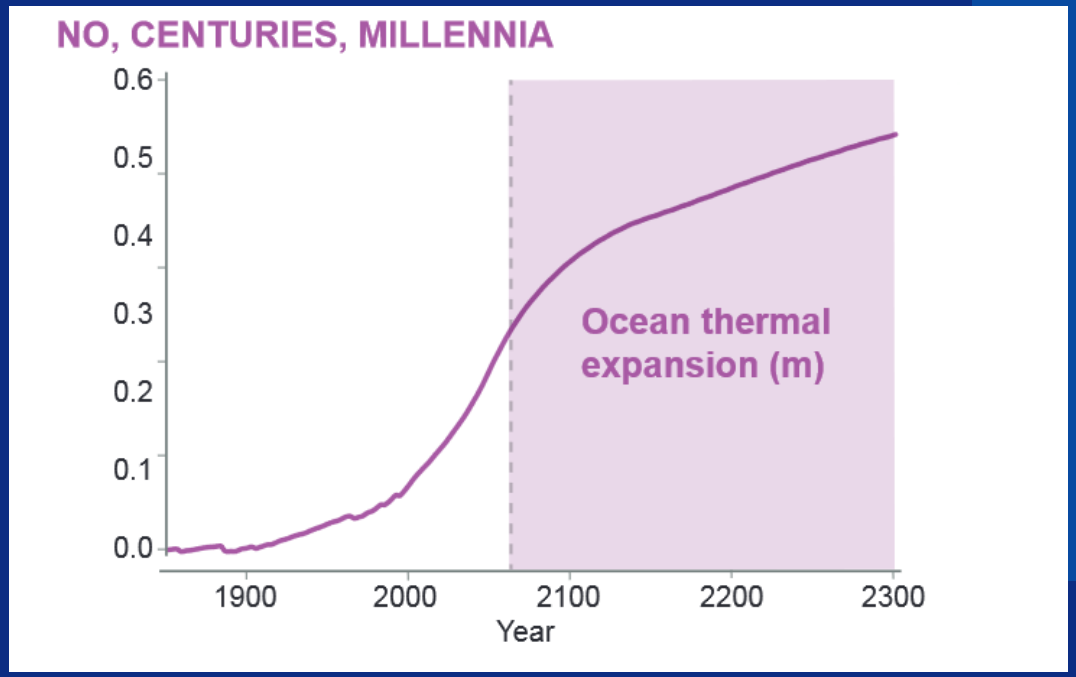
Can CDR* stop or reverse sea level rise?

*(*Carbon Dioxide Removal)*





…and the ice sheets

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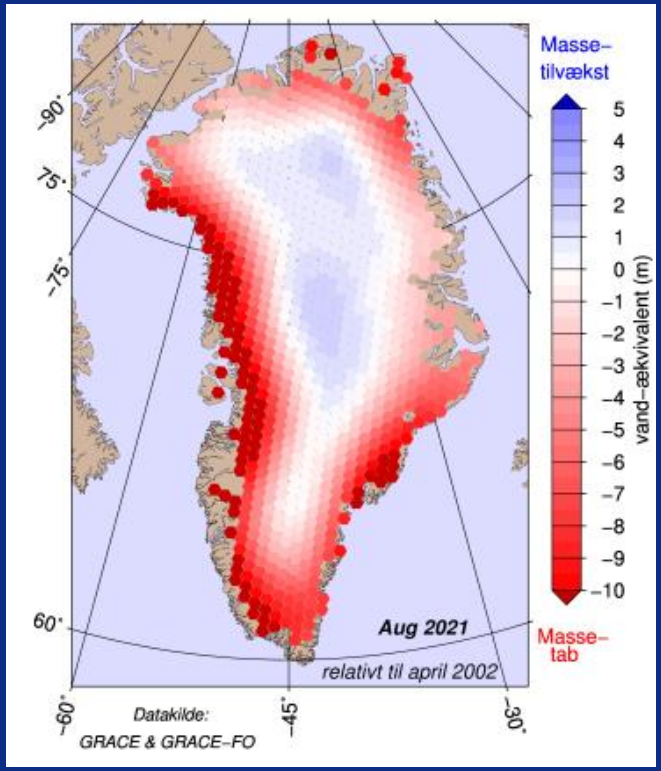
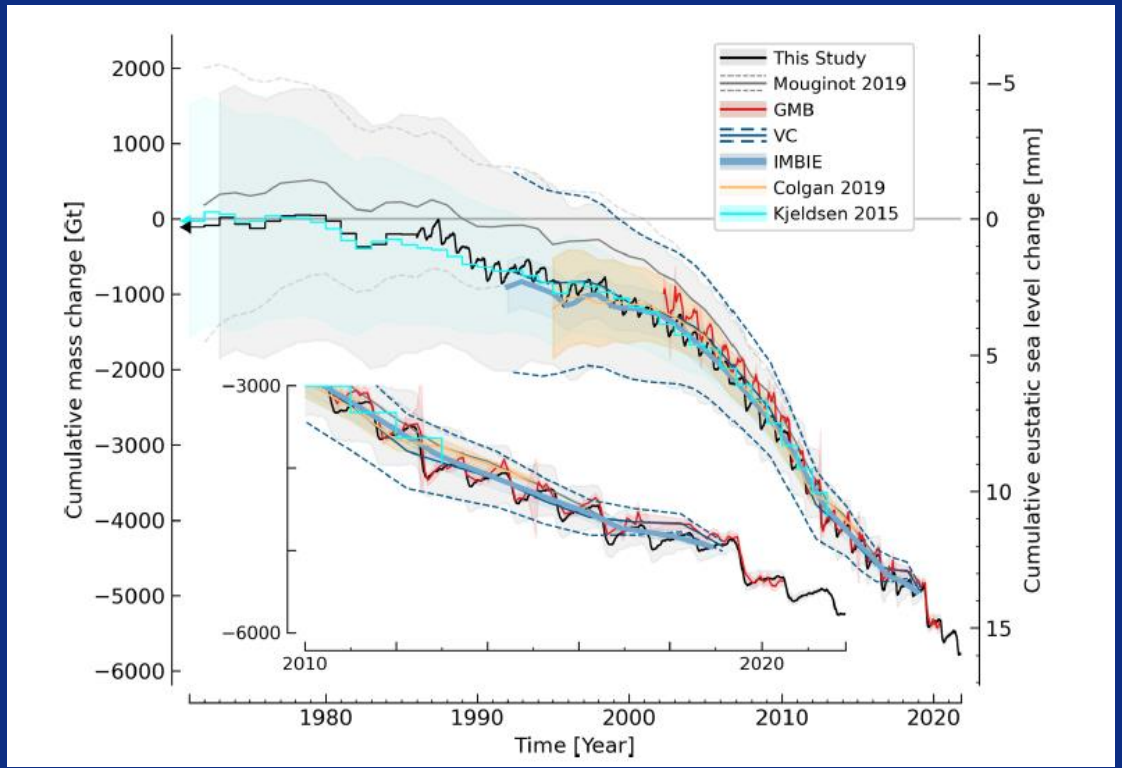
Greenland Ice Sheet: 1,5 cm of global sea level rise since 1990





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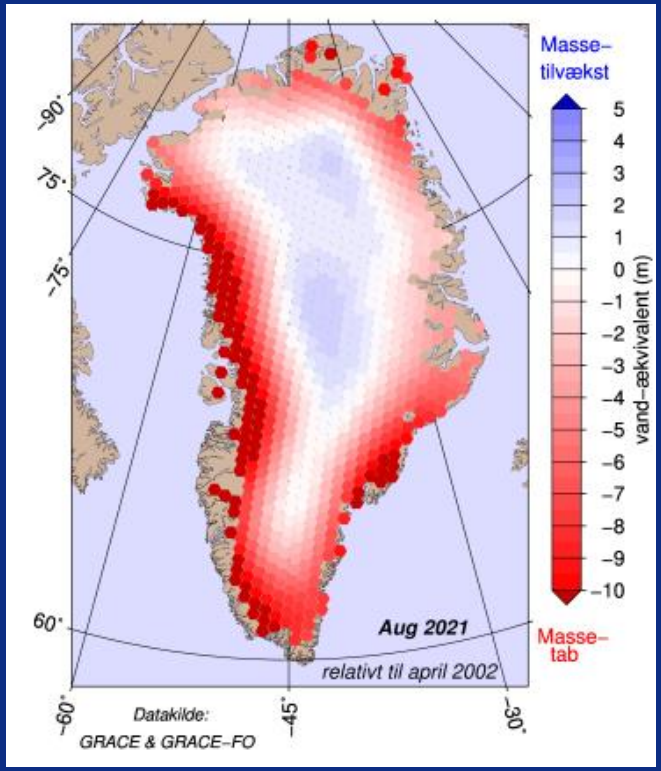
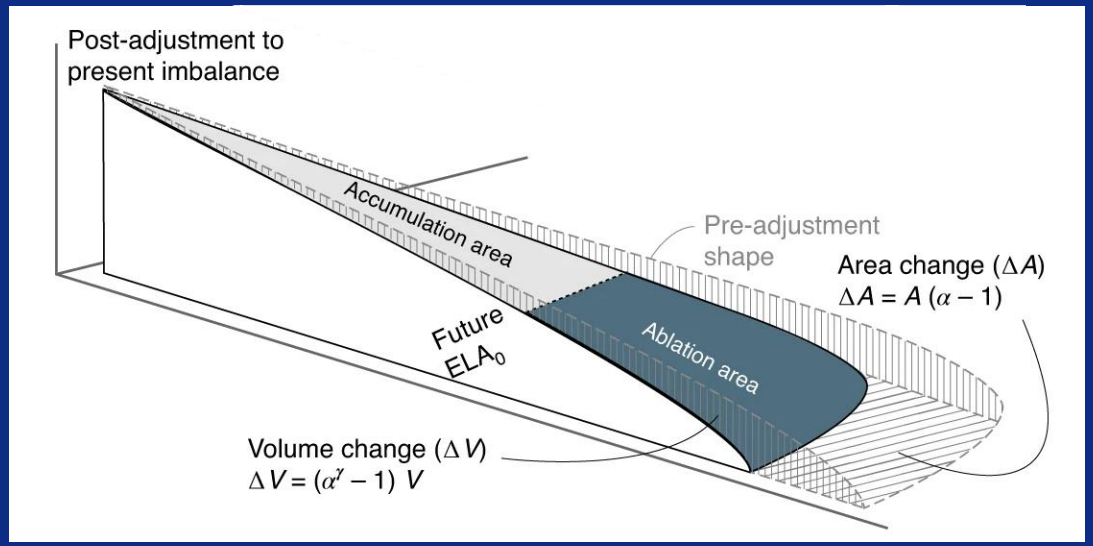
‘Committed melt’ with current warming: 27 cm sea level rise





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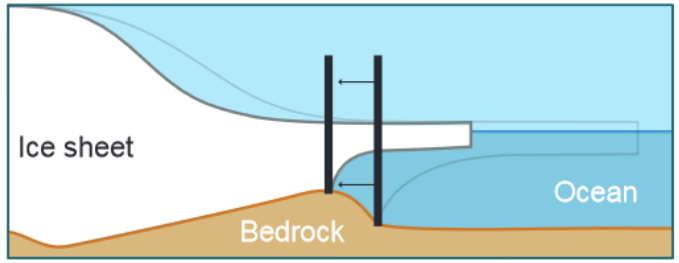
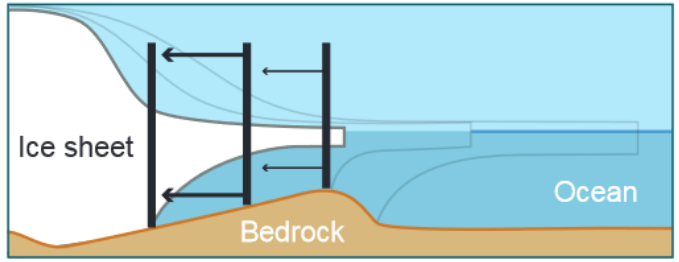
Feedbacks and ice sheet *tipping elements*

Melting driven by ocean temperature

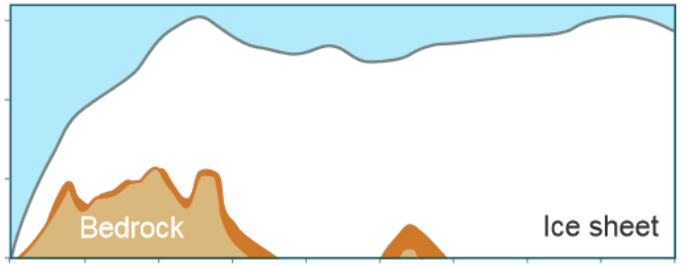


When bedrock dips seaward or is flat, the retreat stops when warming stops. When ice sheet retreats, **less ice** is released into ocean

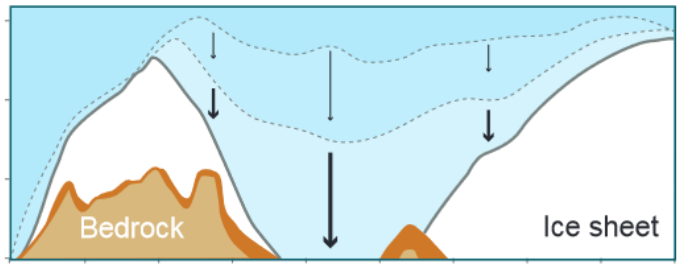


When bedrock dips landward the retreat is quick and self-sustained. When ice sheet retreats, **more ice is released into ocean** – ice sheet retreats further

Melting driven by air temperature



The ice sheet is very thick therefore its surface is very high and the air at high altitude is very cold



As the ice sheet melts, its **surface goes down** until it reaches a threshold, where the surrounding air is warmer and melts the ice even more quickly

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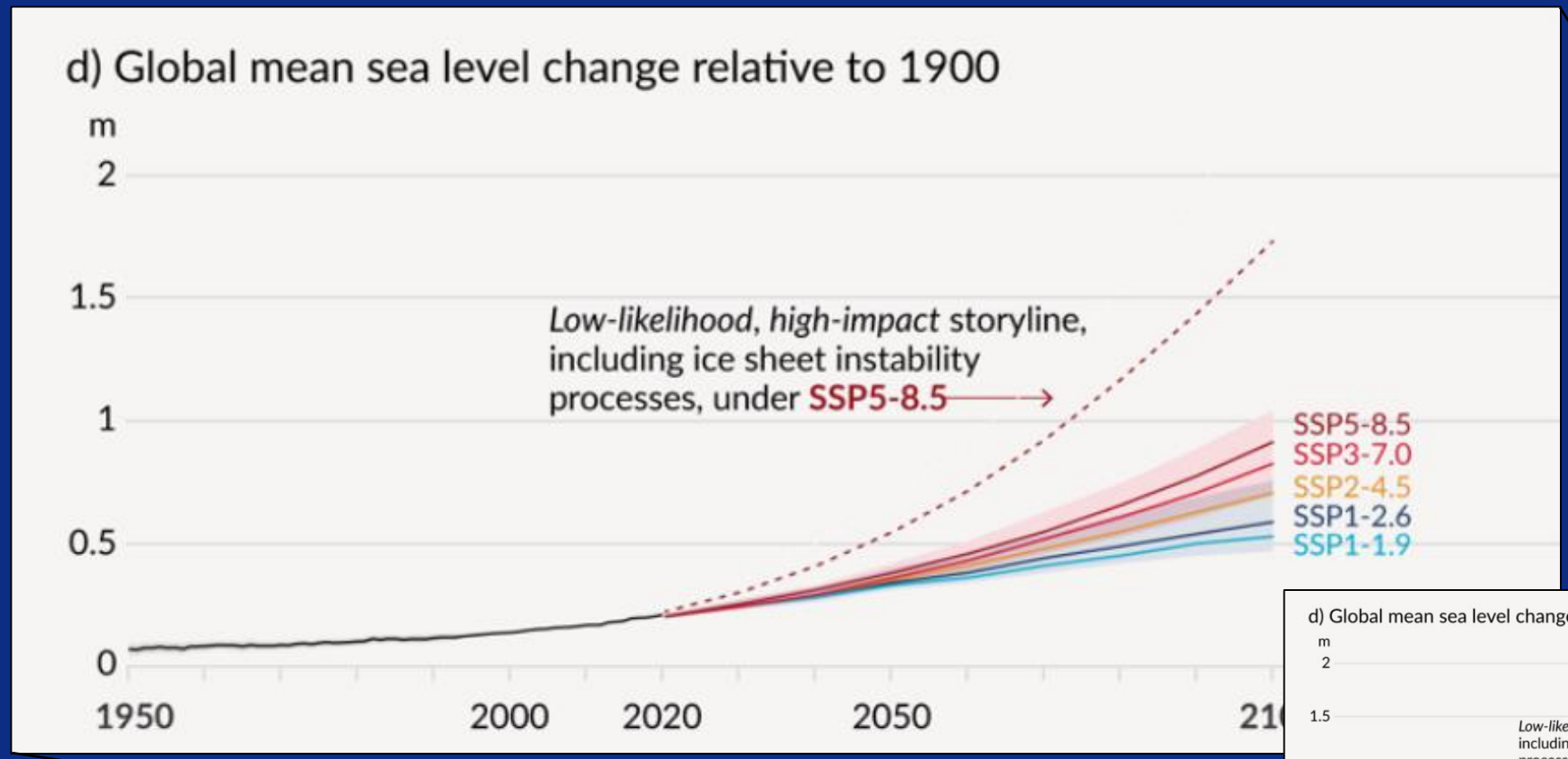
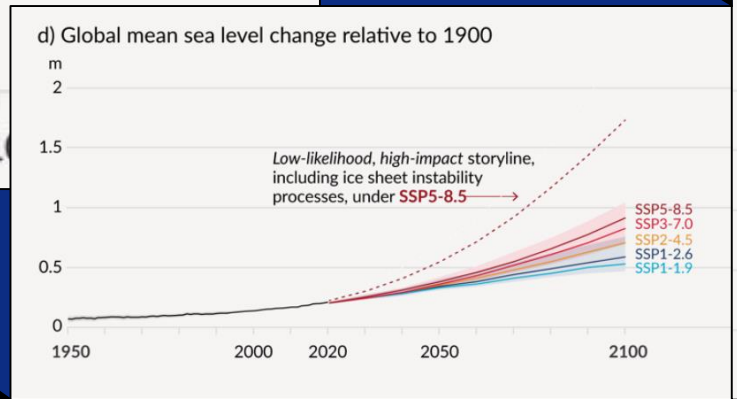
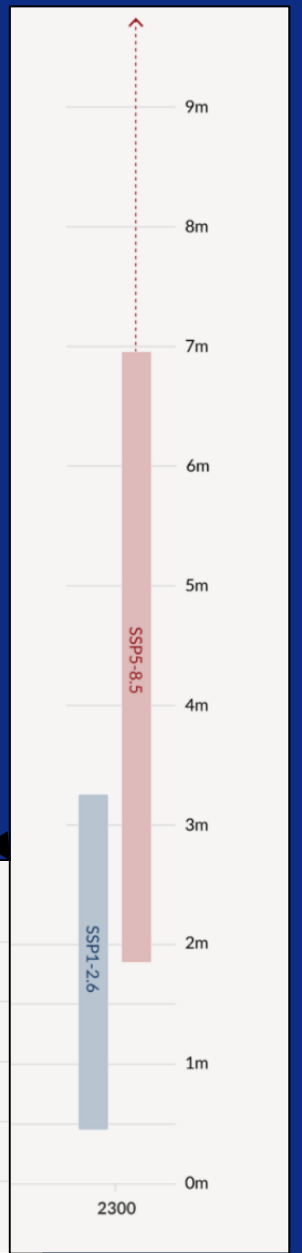
Future sea level: IPCC looking beyond the most likely







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Comments or questions?

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