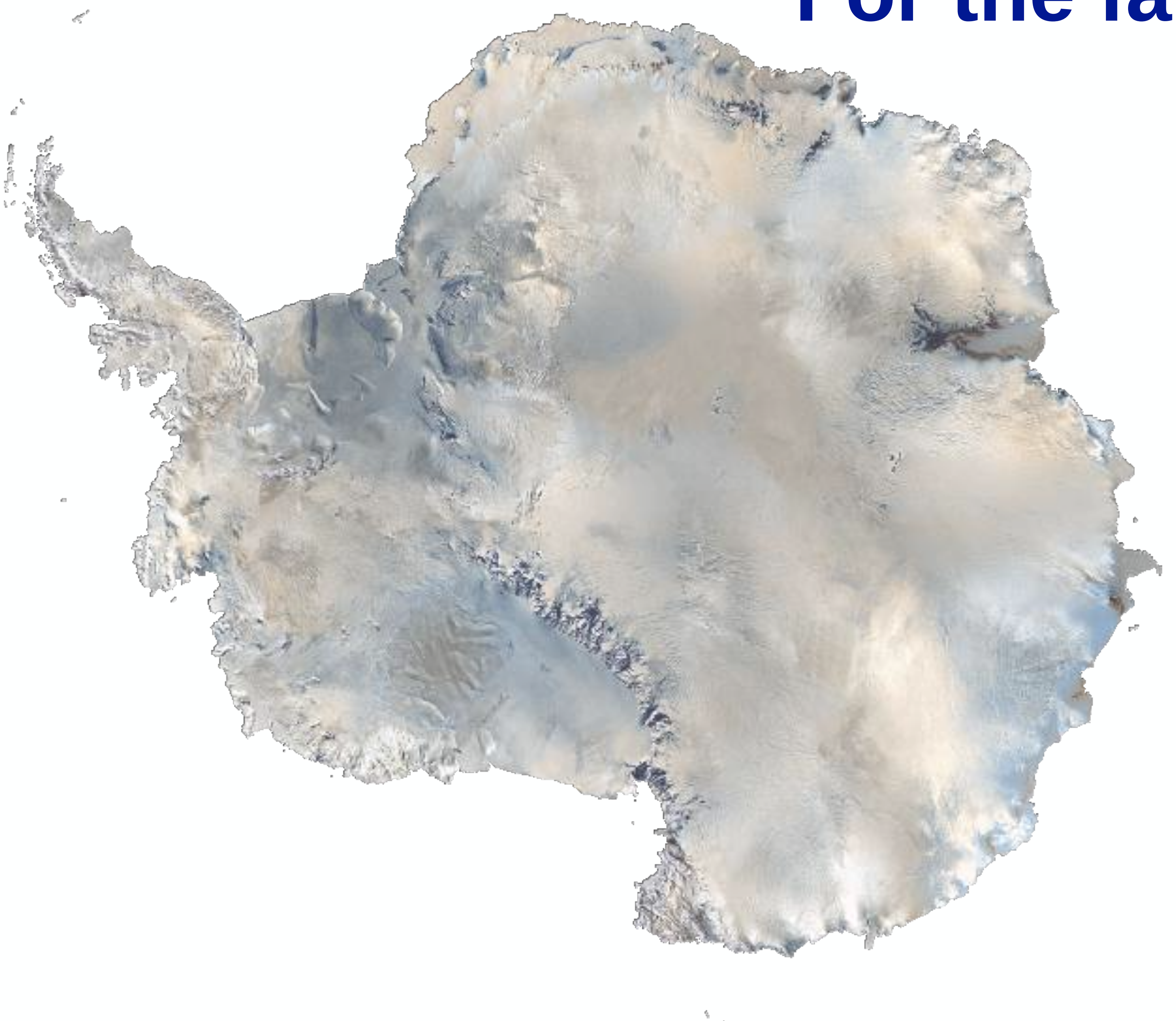
"Why should we care For the fate of Antarctica?"



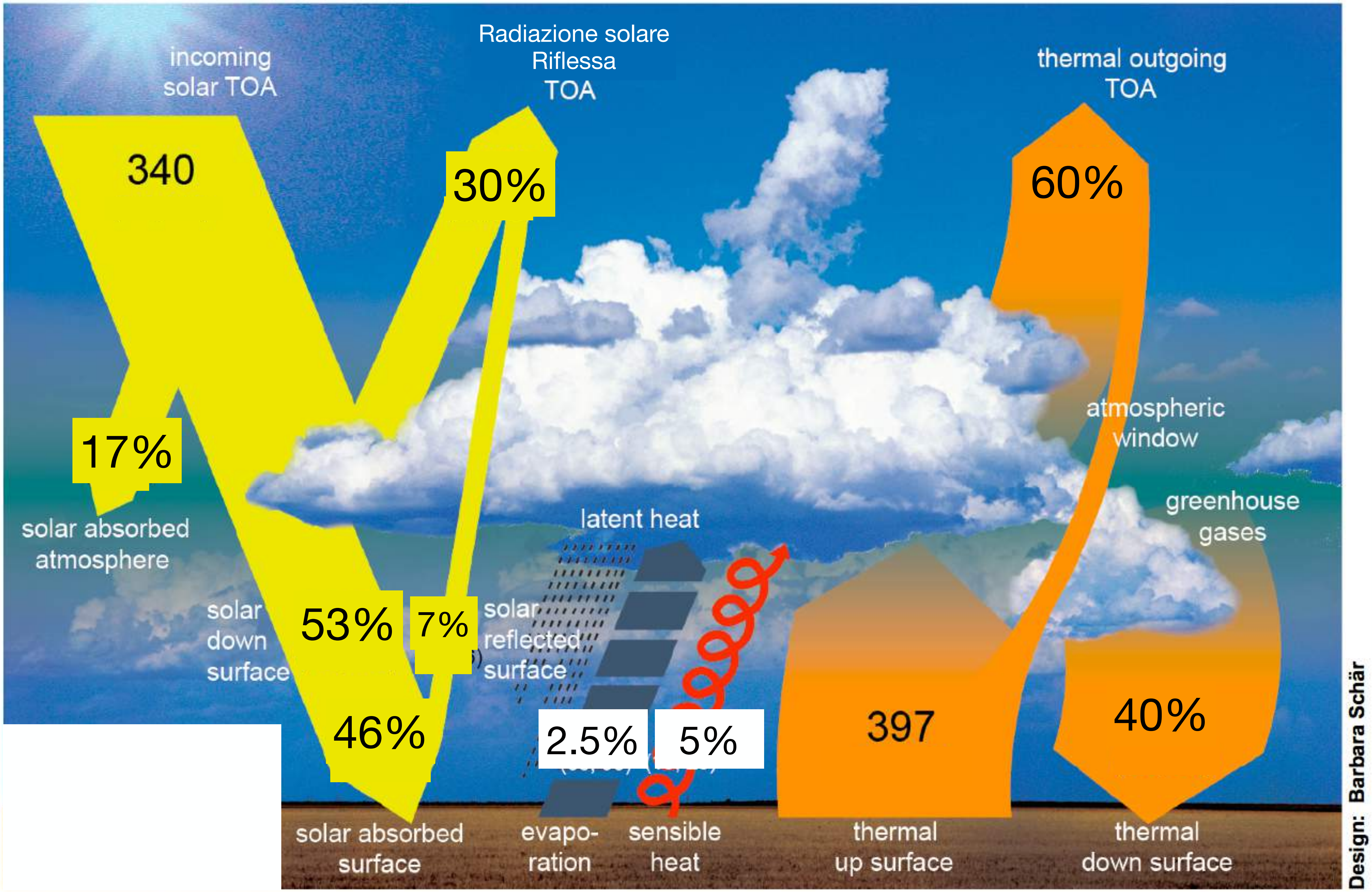
Florence Colleoni

fcolleoni@ogs.it

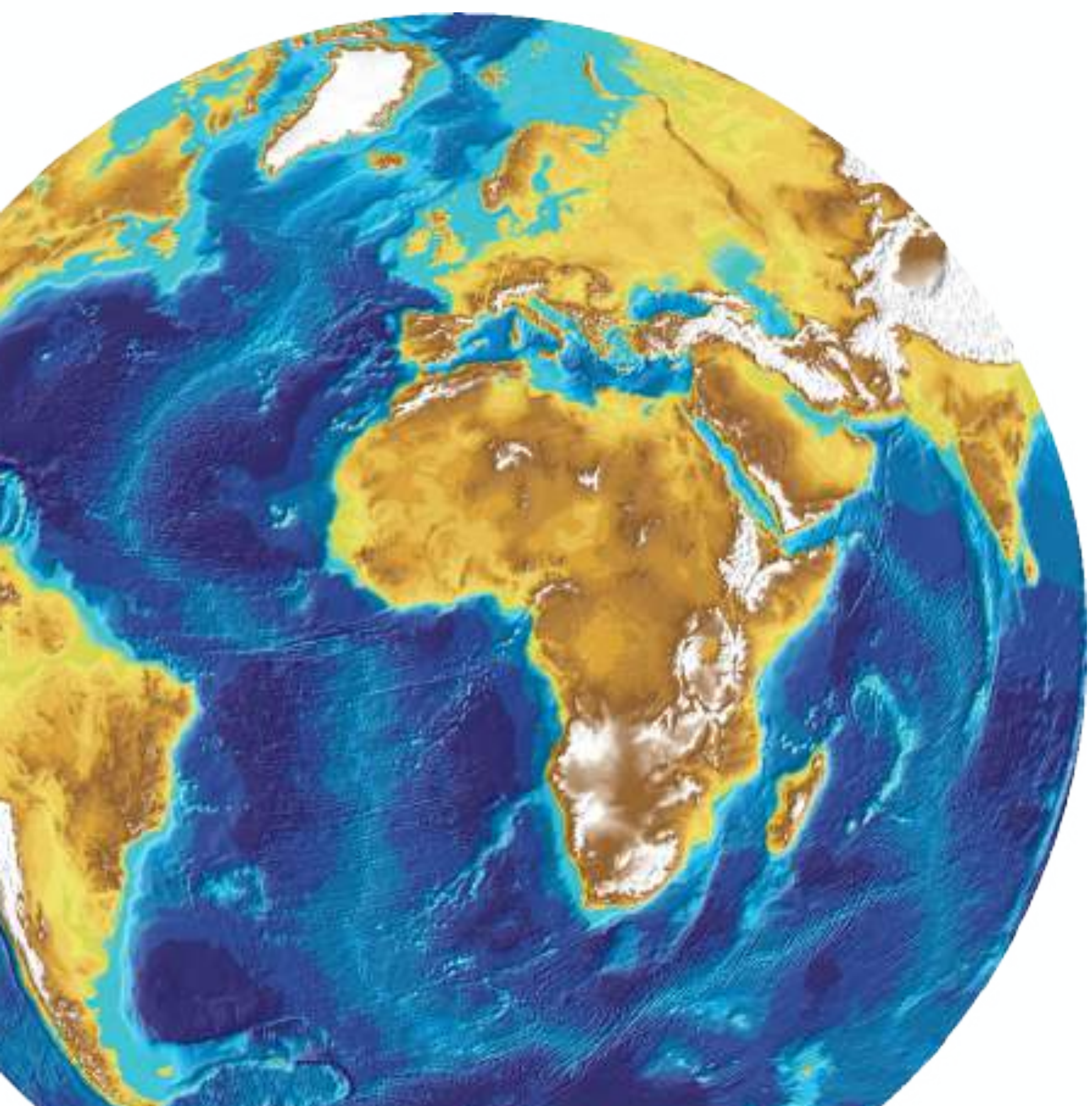
What are climate changes?

Earth radiative balance

Unità W m^{-2}

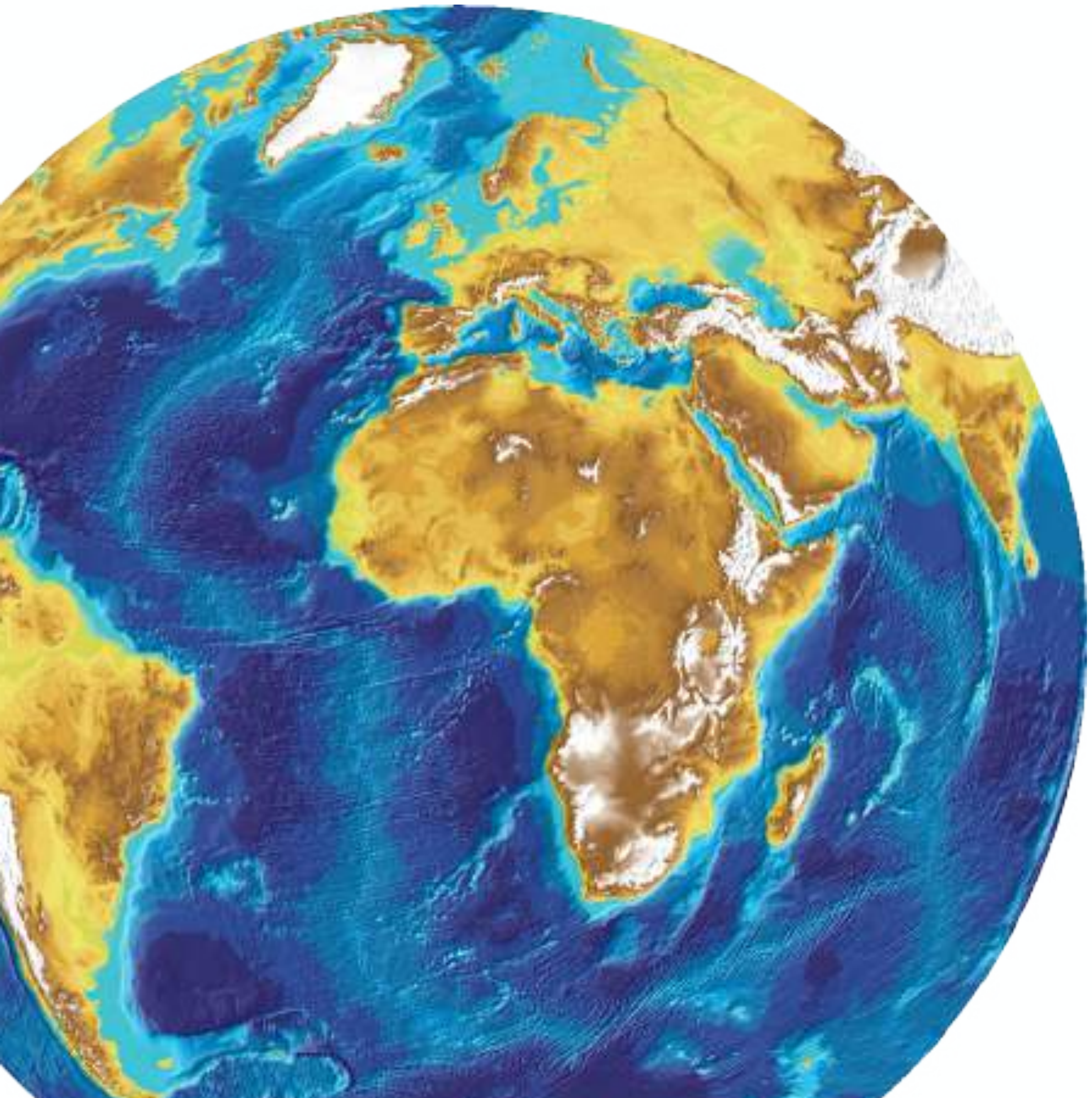


Greenhouse effect



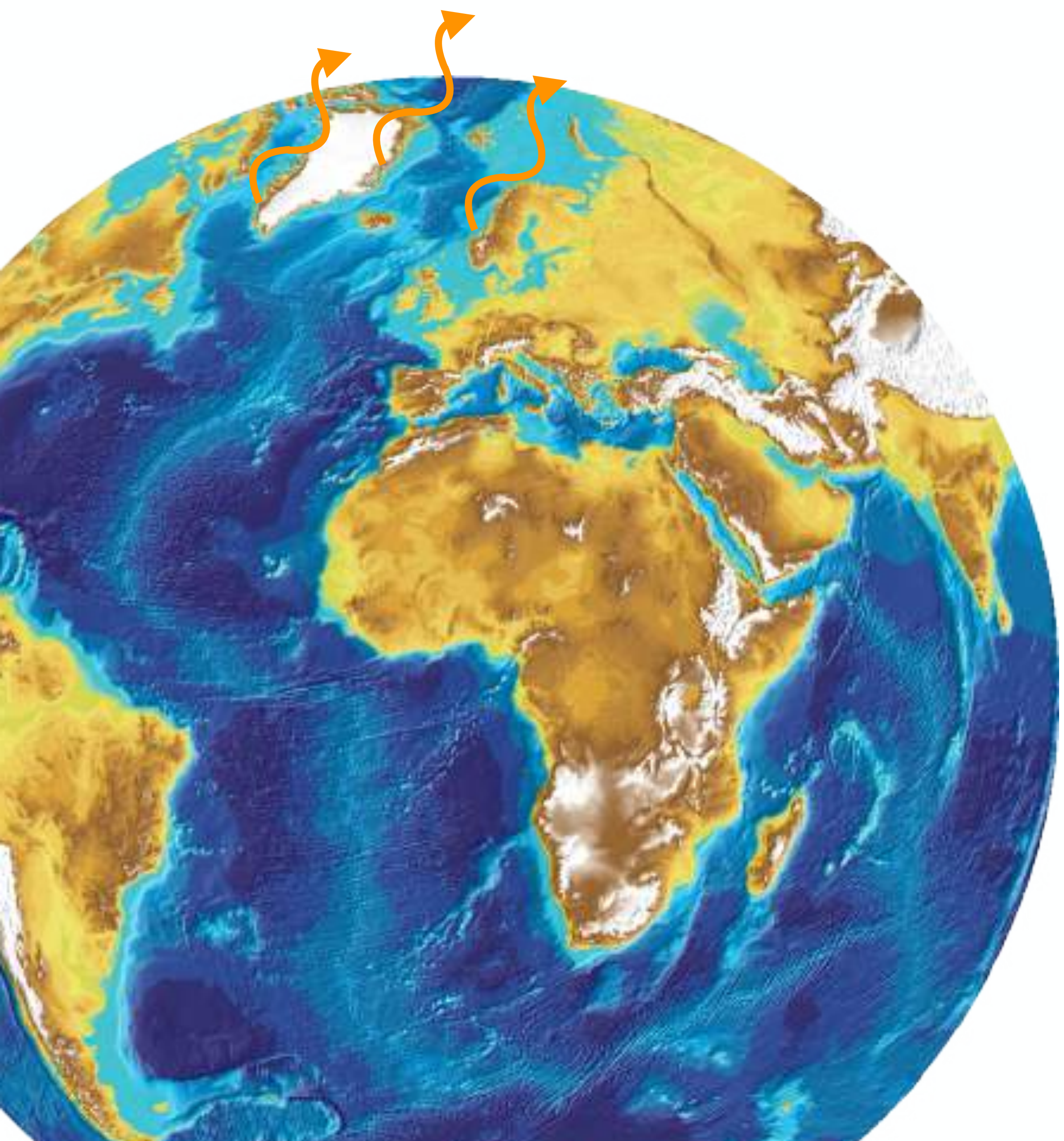
Greenhouse effect

Heat emitted
by the Earth
(inner + surface)



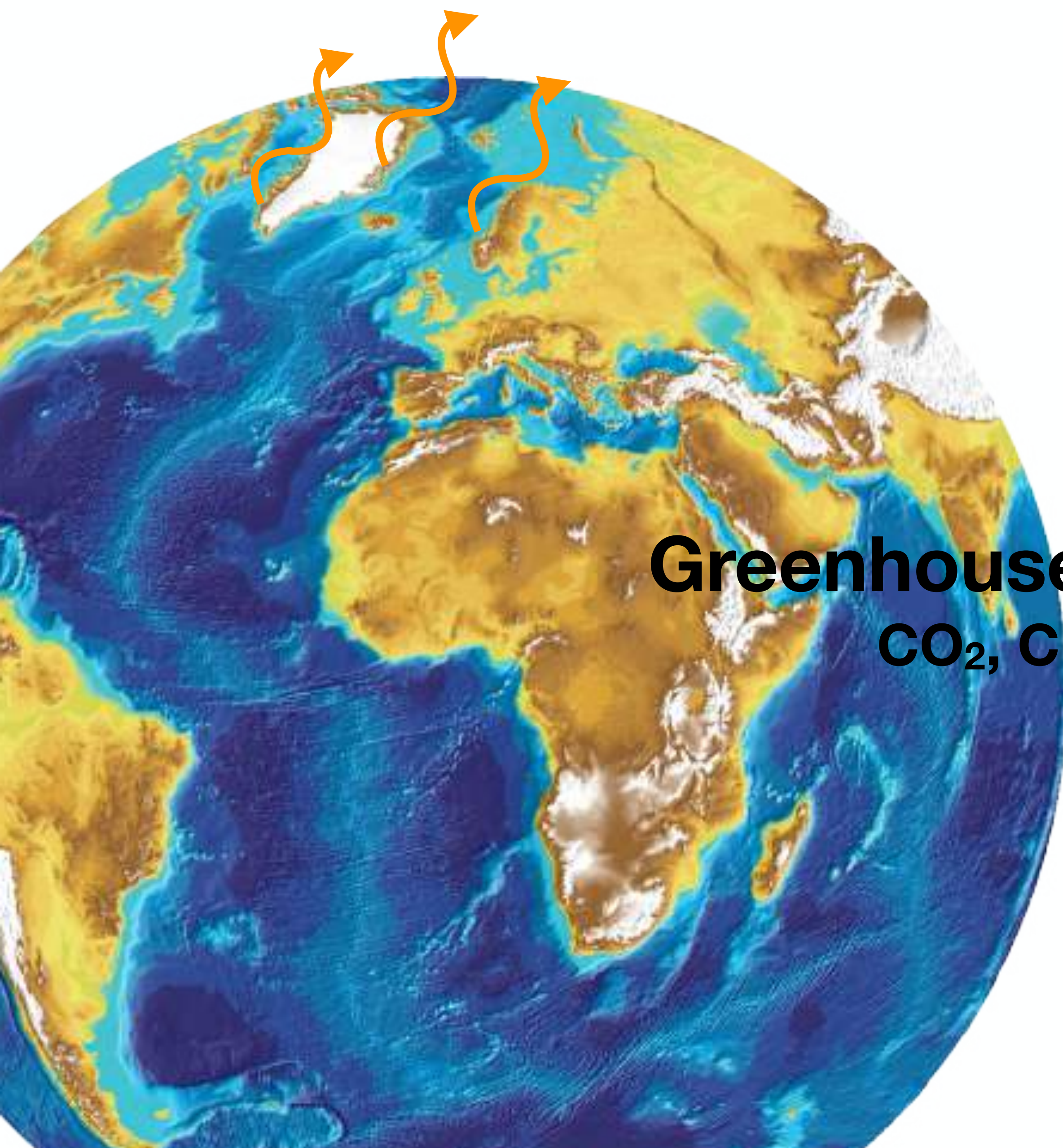
Greenhouse effect

Heat emitted by the Earth (inner + surface)



Greenhouse effect

Heat emitted by the Earth (inner + surface)

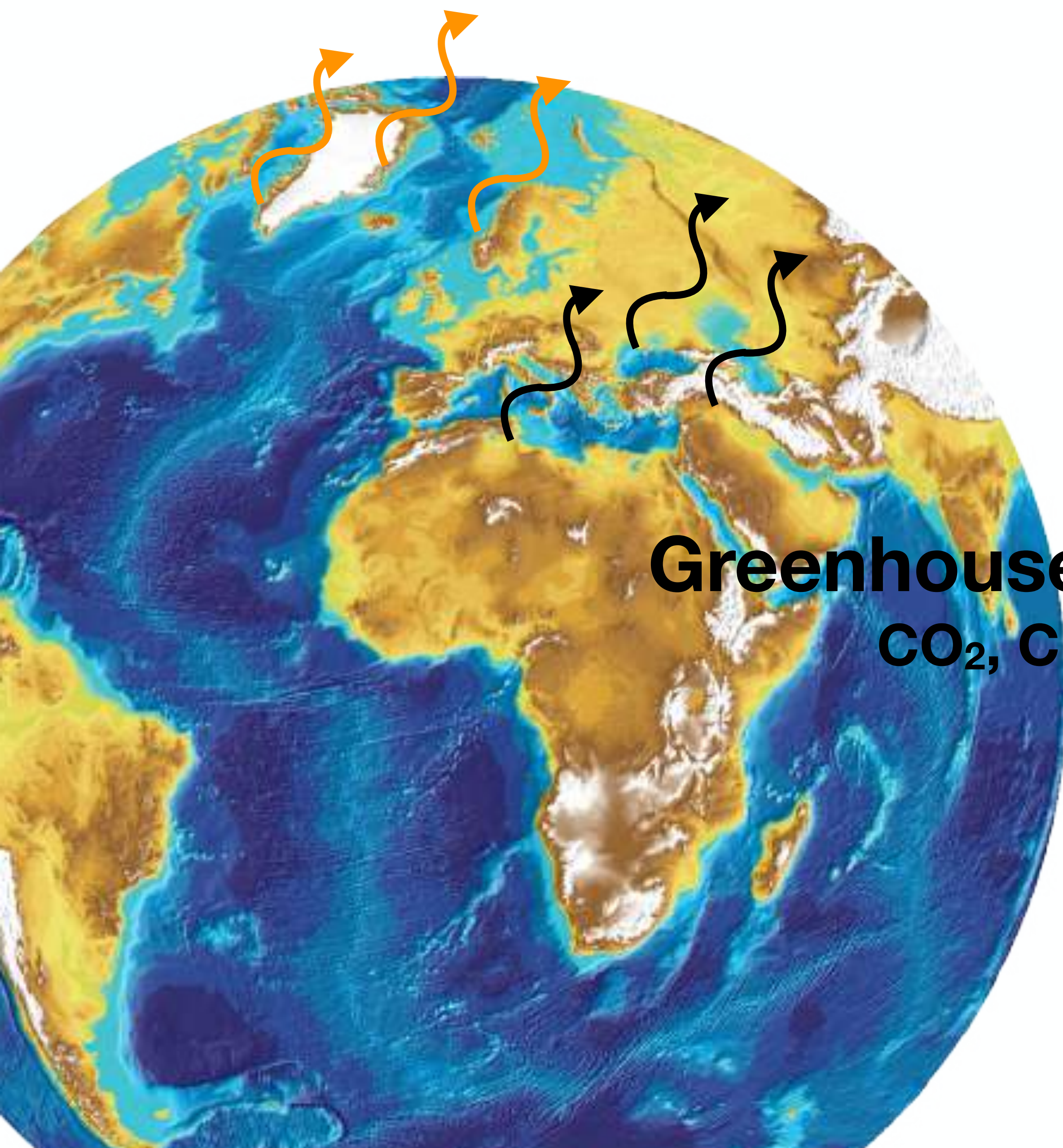


Greenhouse gas emissions

CO_2, CH_4, H_2O, NO_2

Greenhouse effect

Heat emitted by the Earth (inner + surface)



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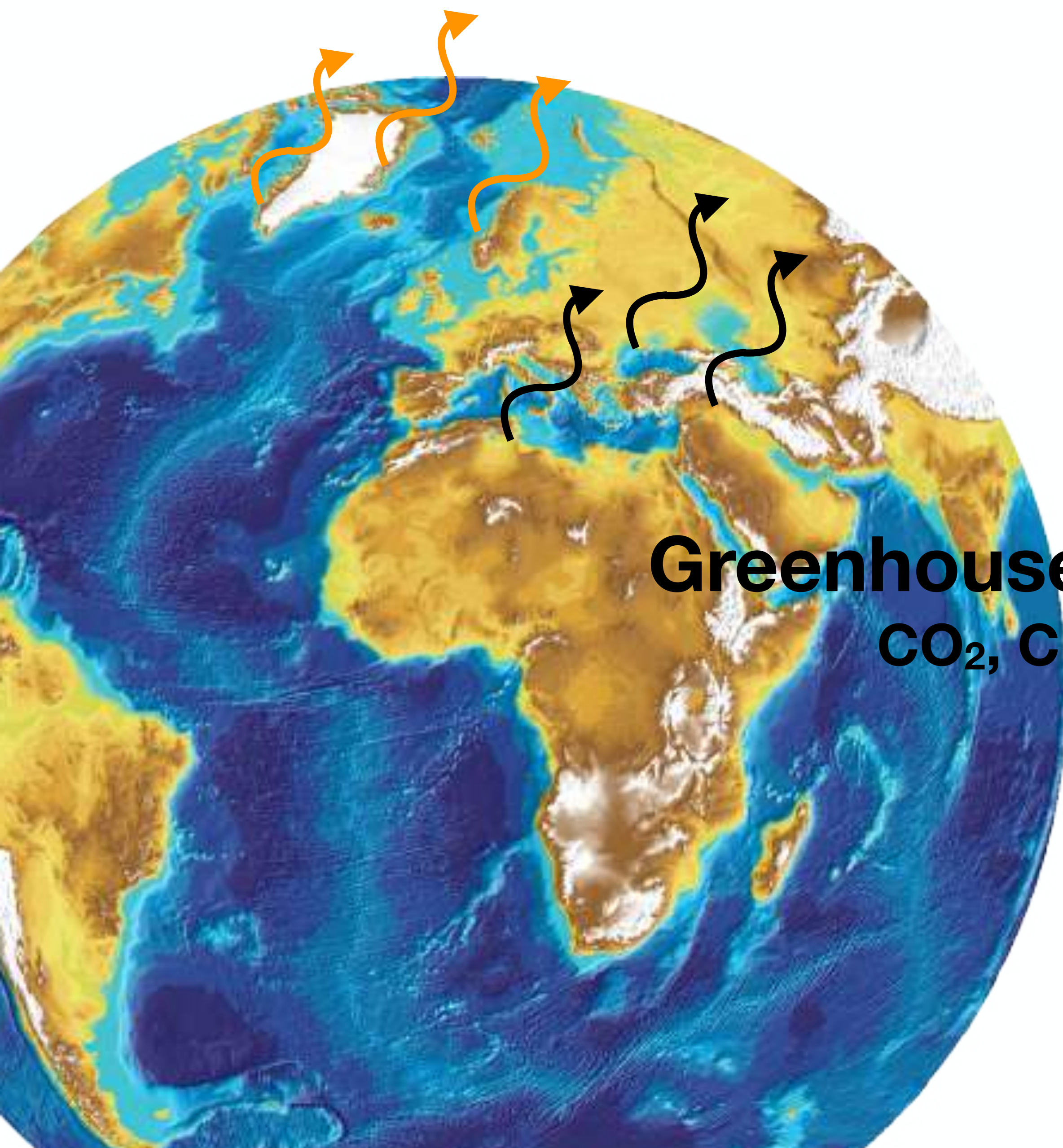
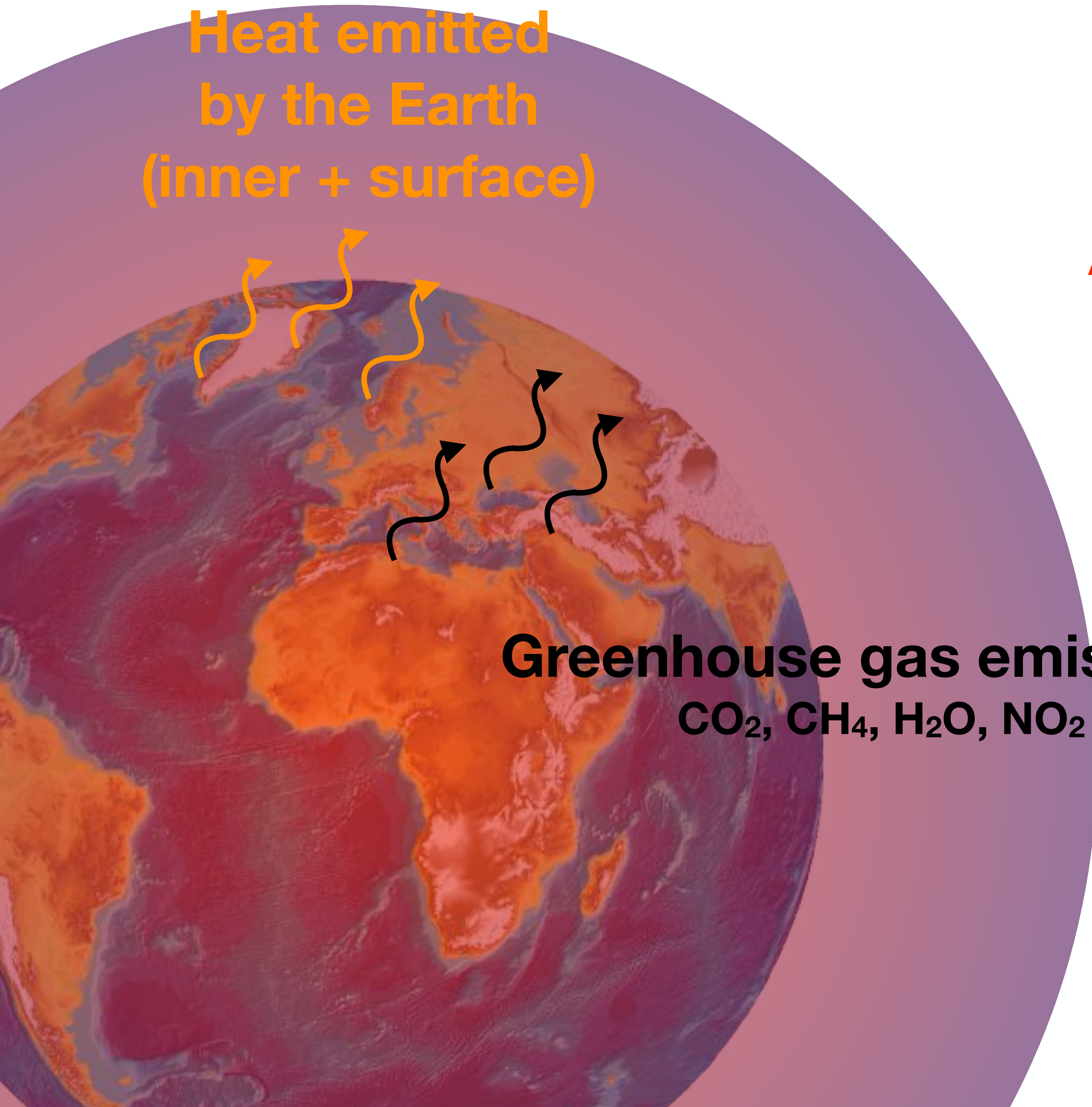
Greenhouse effect



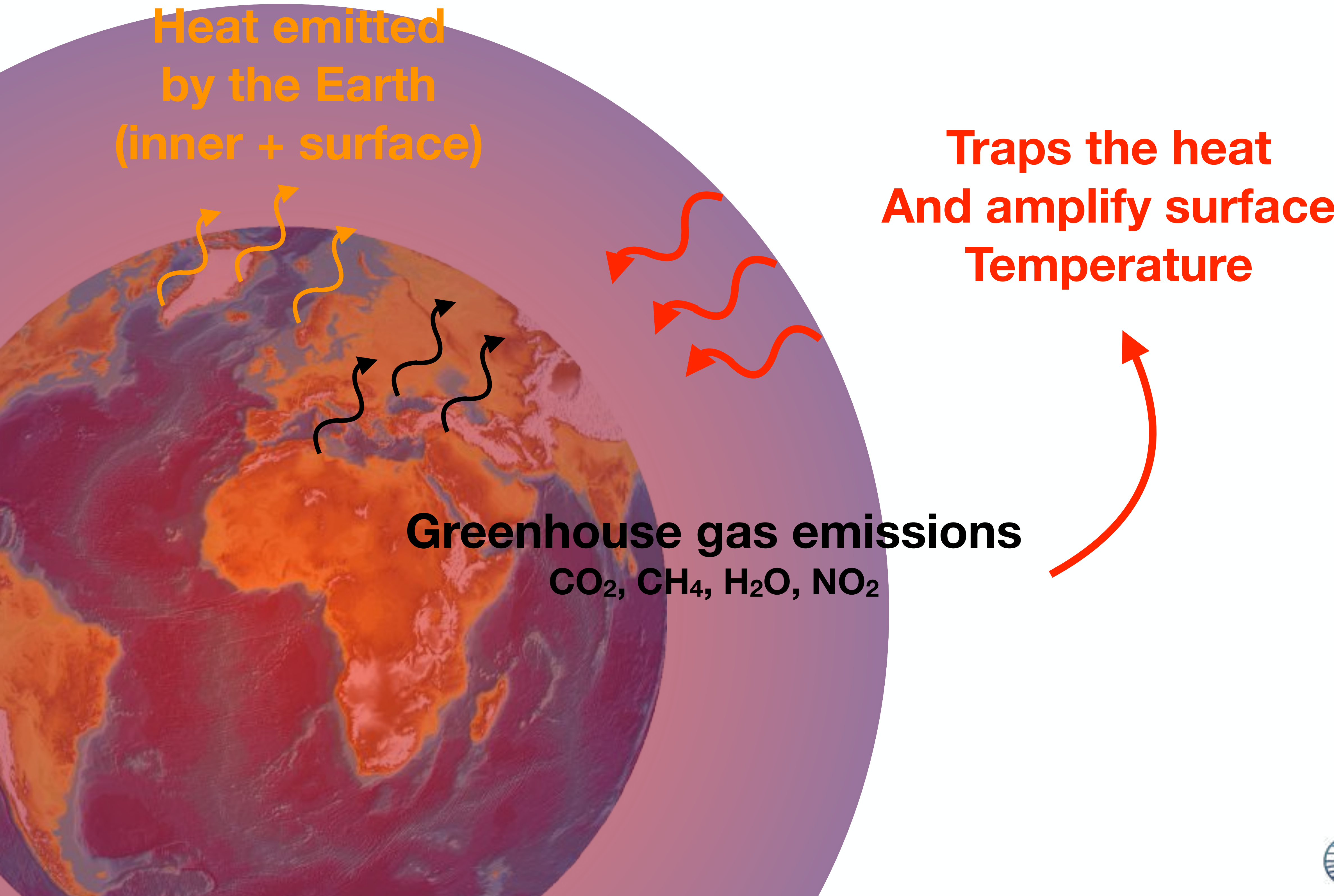
OGS

Greenhouse effect



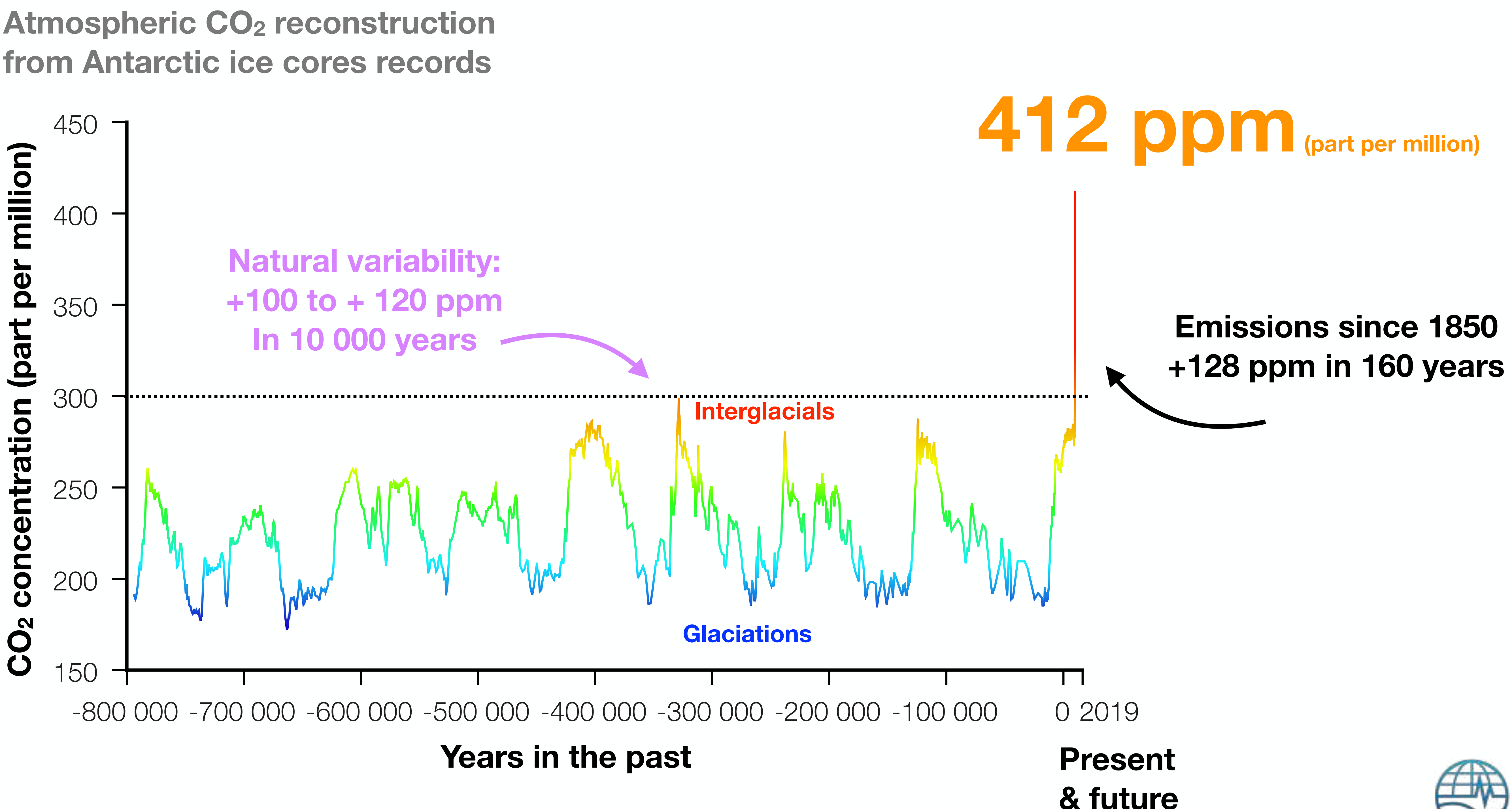
Traps the heat
And amplify surface
Temperature

Greenhouse effect



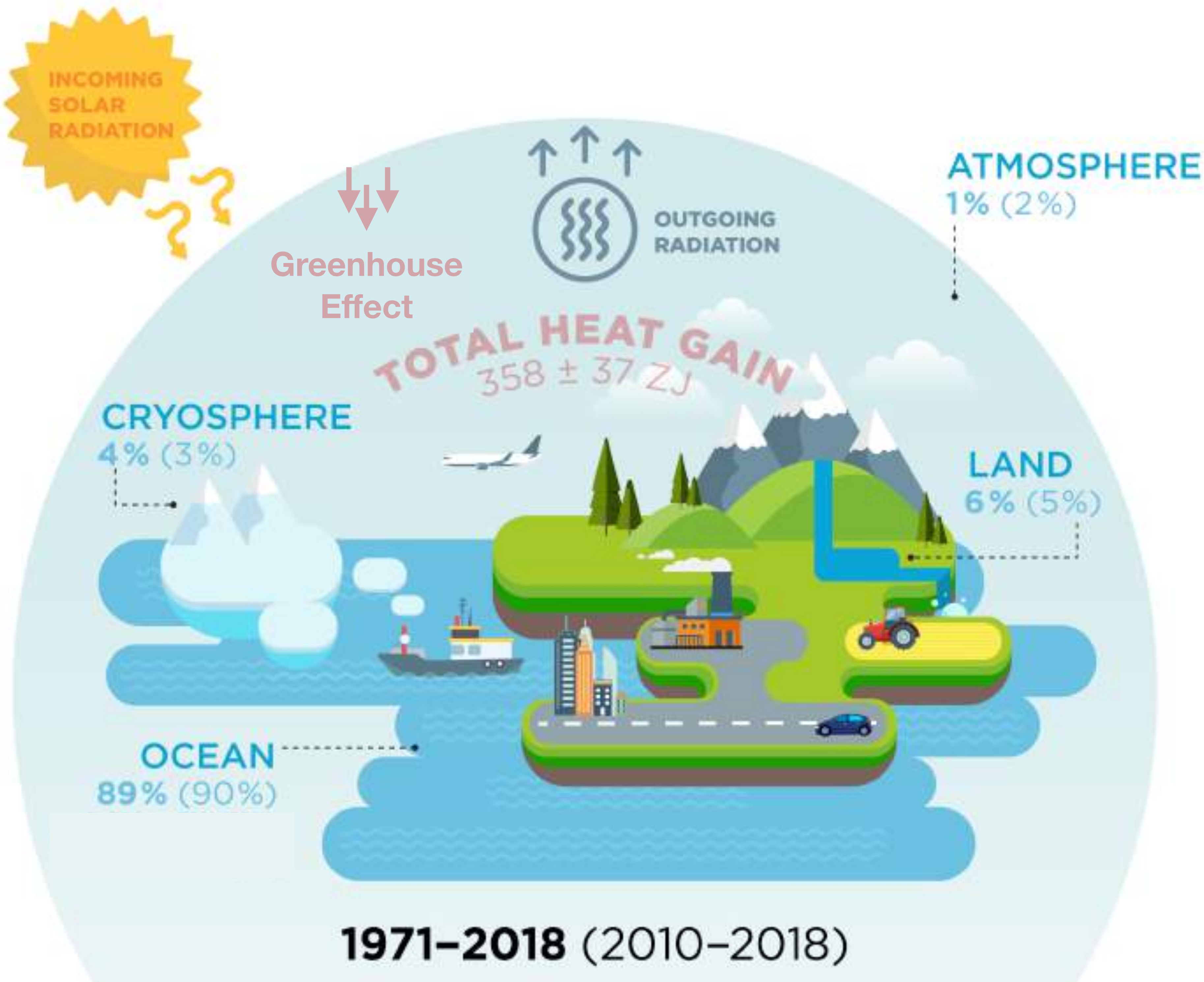
OGS

CO_2 concentration



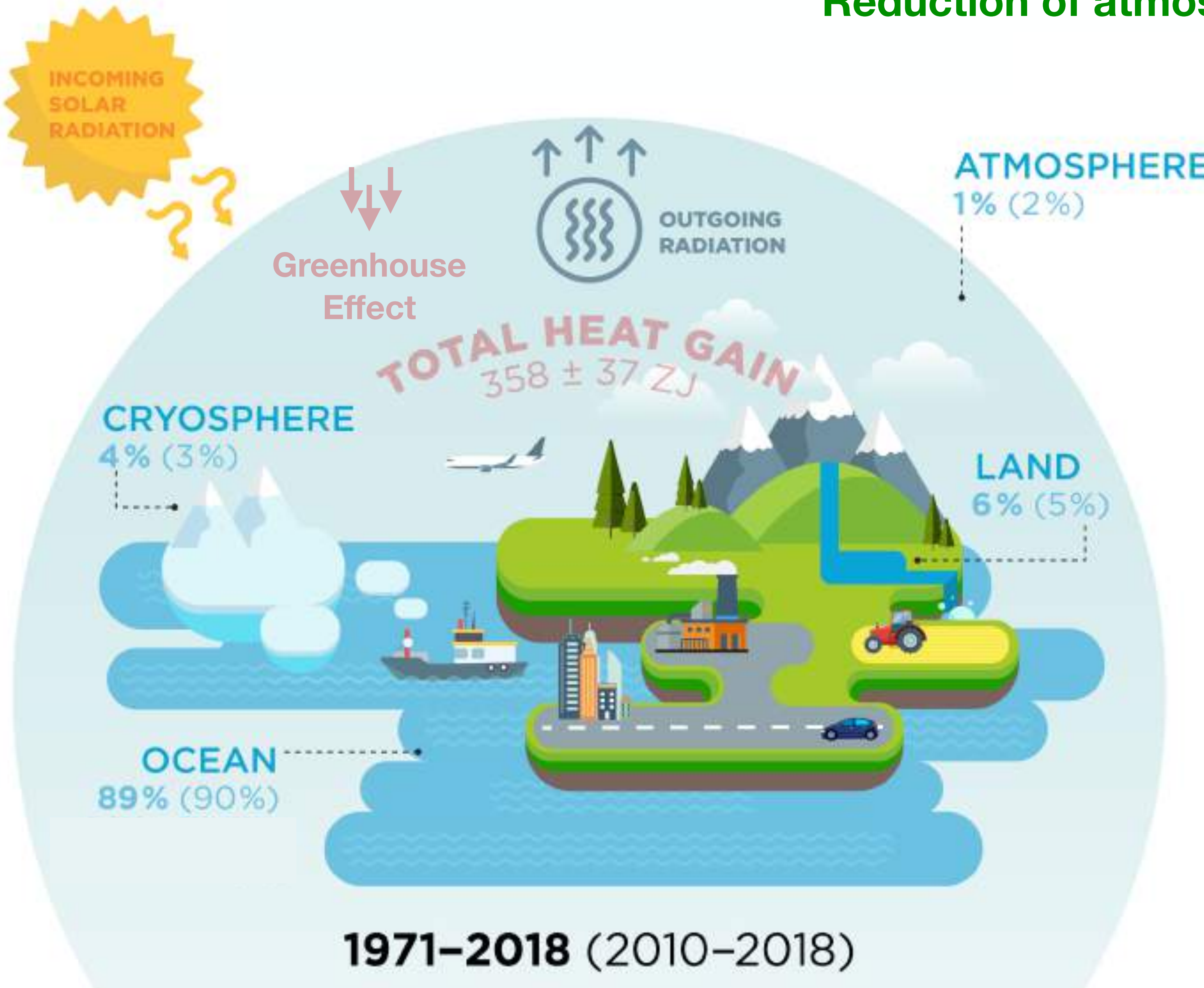
Source: EPICA Project (Antarctica); Nasa Climate Change

Radiative unbalance

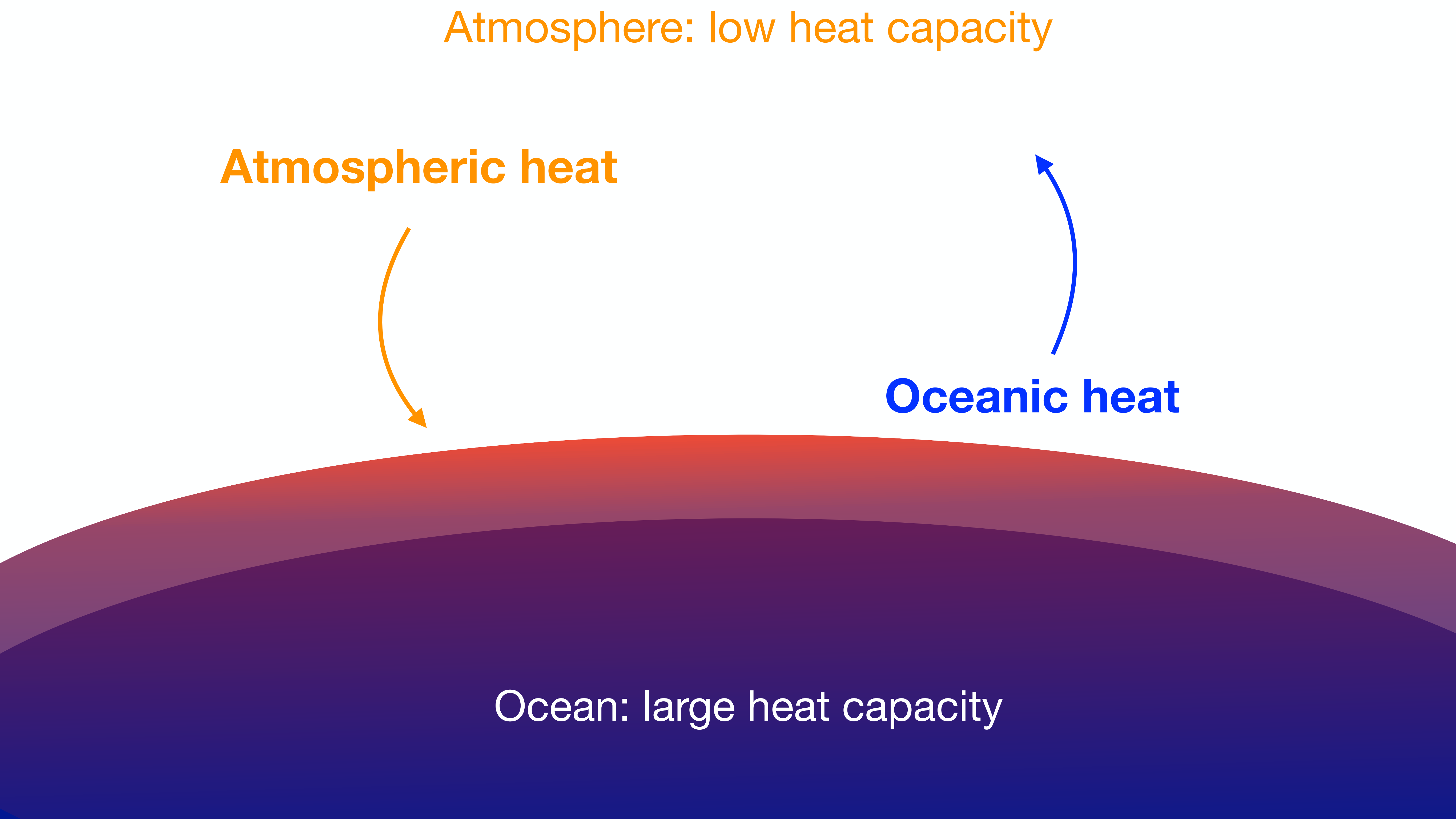


Radiative unbalance

Balance: Incoming=Outgoing
Reduction of atmospheric CO_2: ~ 60 ppm



Ocean: thermo-regulator

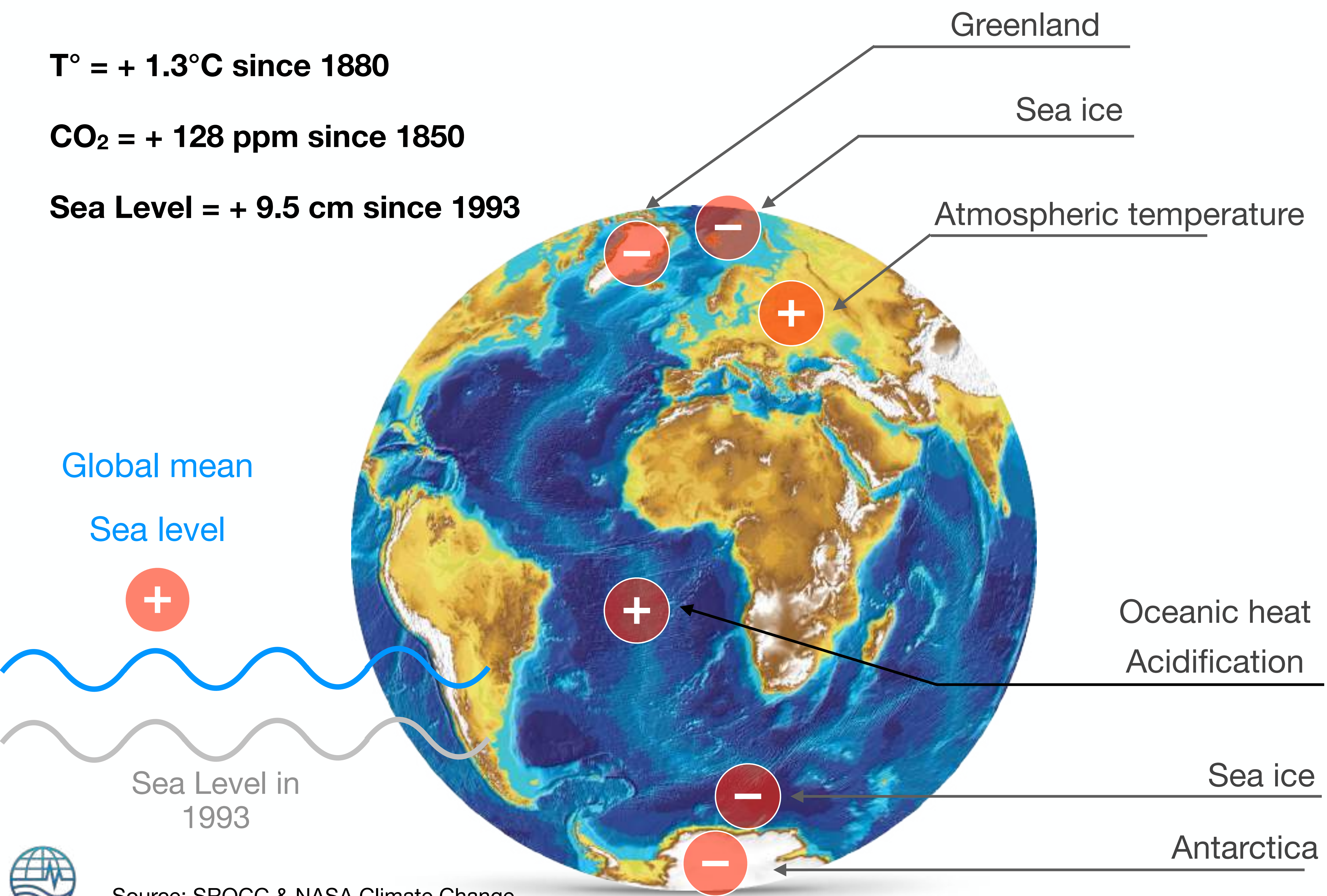


Current climate

T° = + 1.3°C since 1880

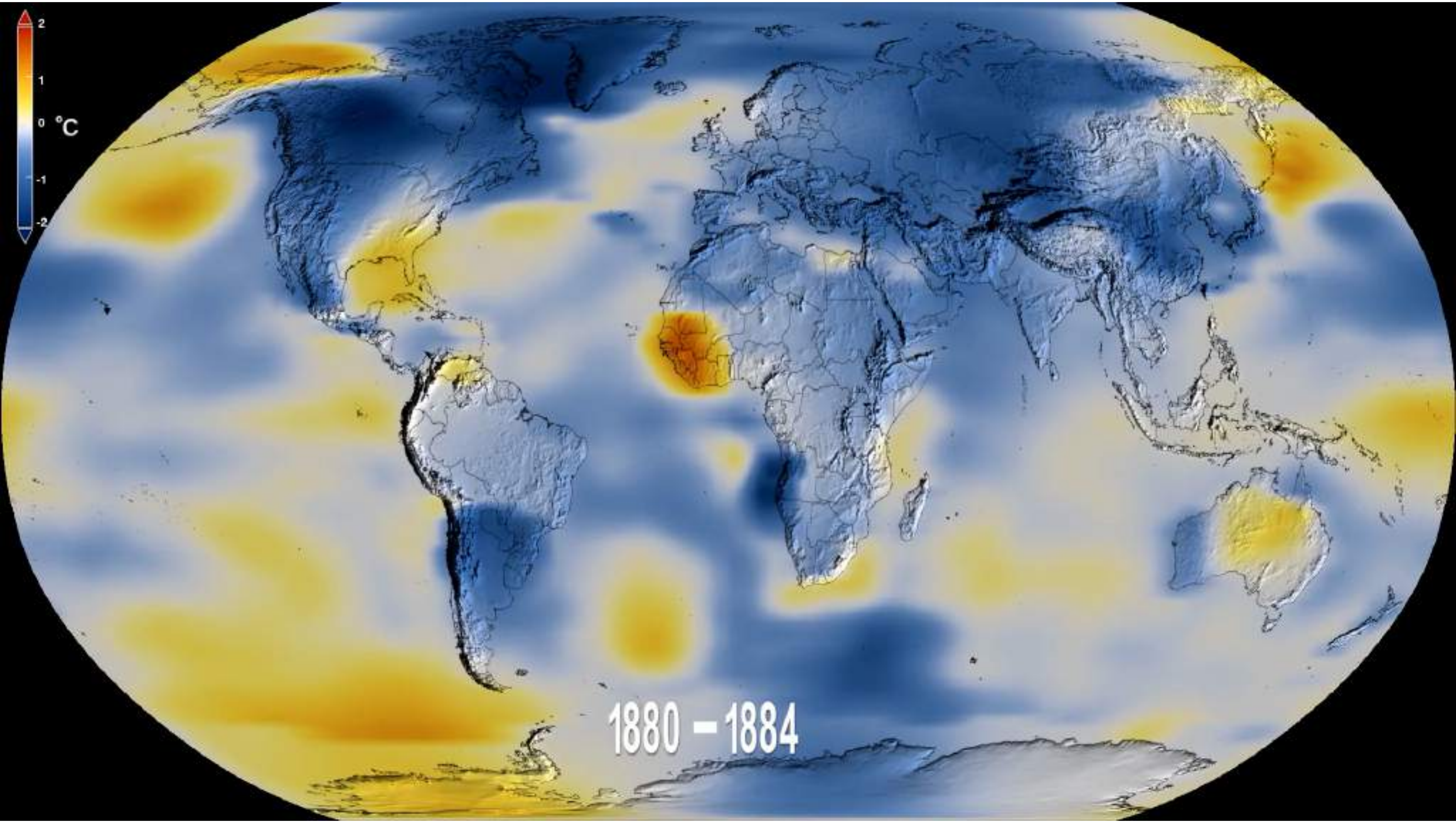
CO_2 = + 128 ppm since 1850

Sea Level = + 9.5 cm since 1993



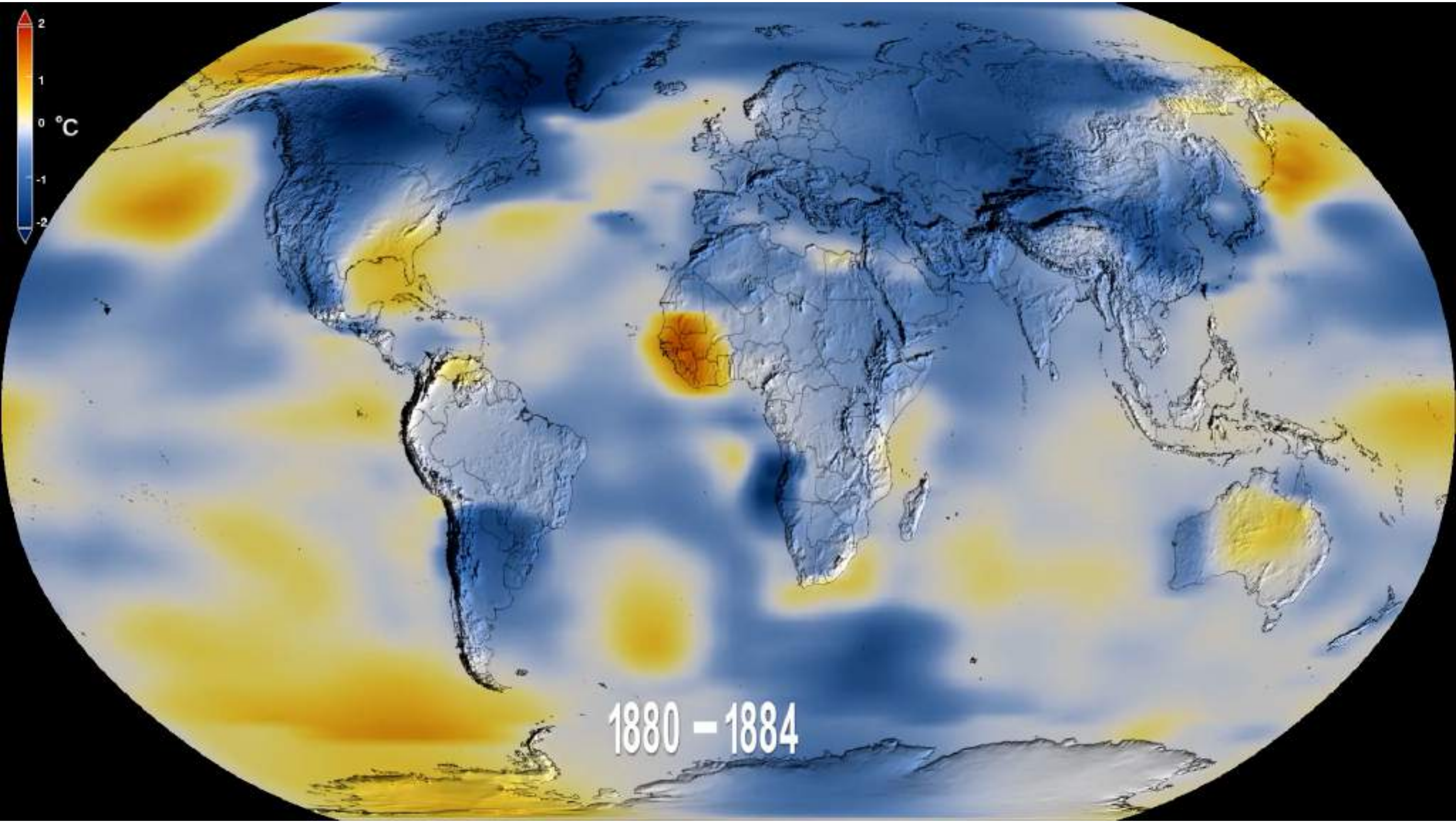
Source: SROCC & NASA Climate Change

Temperature evolution since 1880



Source: NASA Climate Change

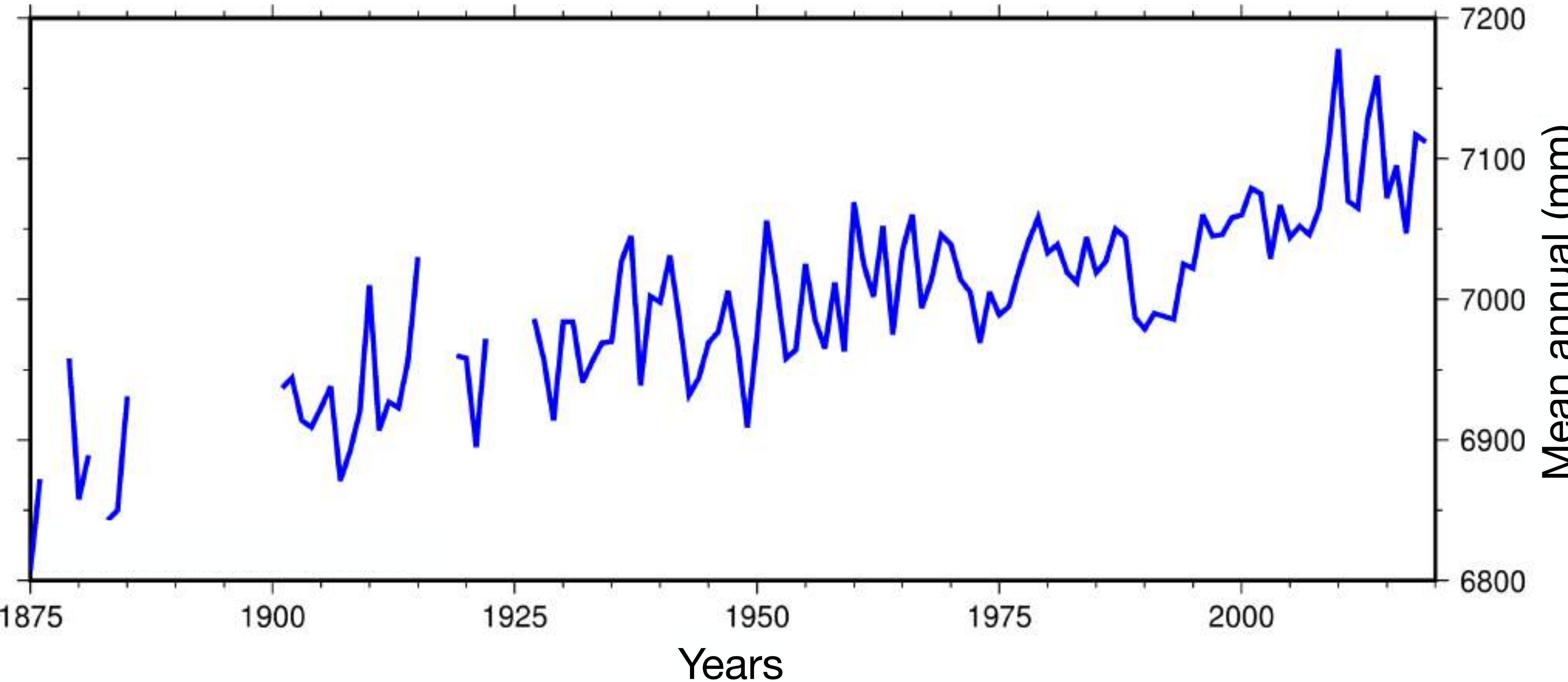
Temperature evolution since 1880



Source: NASA Climate Change

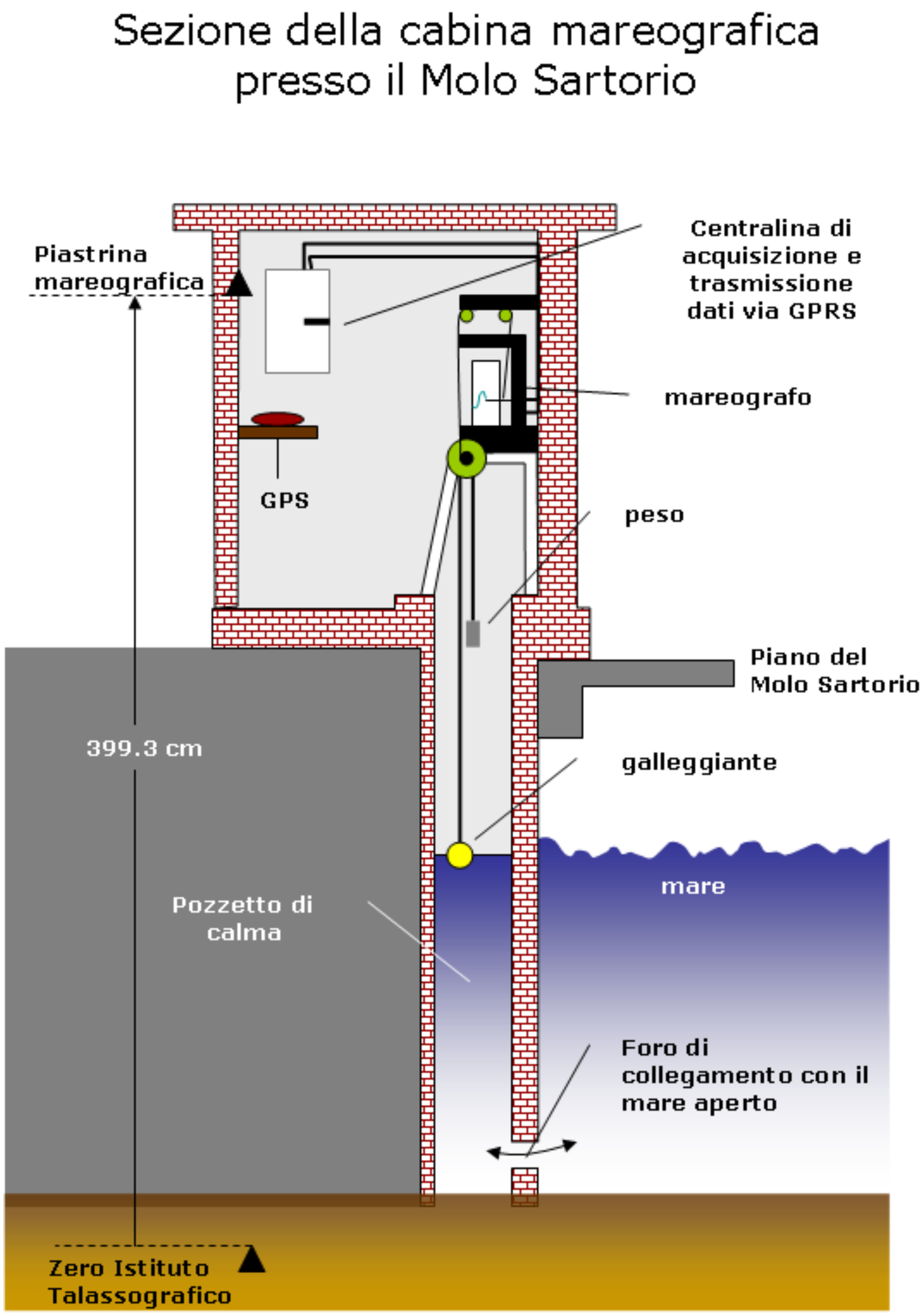
Sea level changes

Sea Level change in Trieste



+3.5 - 4 mm/year in Trieste

Tide gauge



la cabina mareografica prima e dopo l'inglobamento nella nuova sede dello Yacht Club Adriaco avvenuta nel 2004

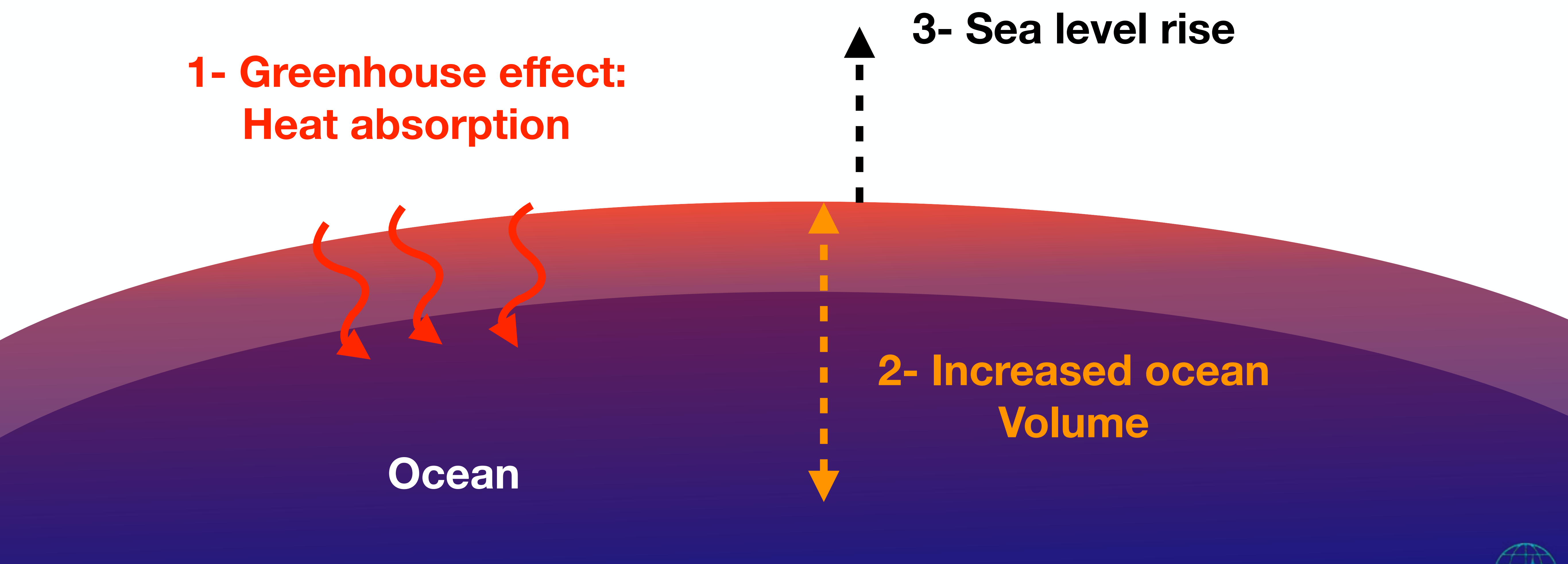
TRIESTE
Misure a cura CNR ISMAR

Steric Effect

Global mean

+ 1.4 mm/year

Averaged over 2006-2015

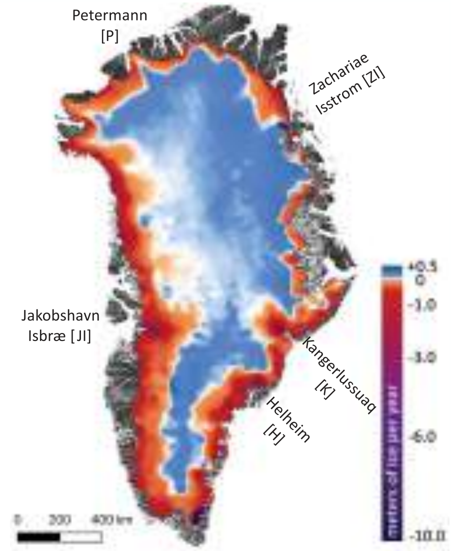


“The Ocean and the cryosphere in a changing climate”, IPCC SROCC, Sept- 2019

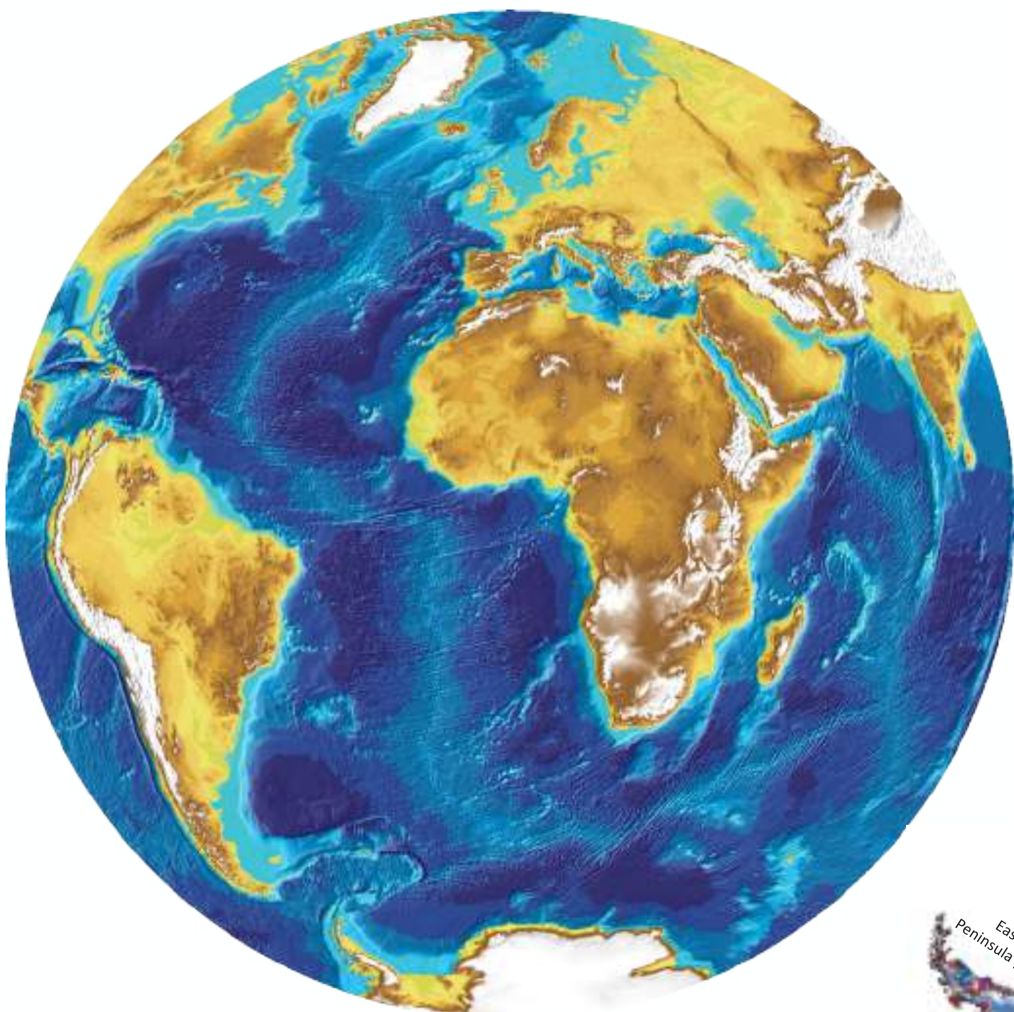
Land ice

+1.9 mm/year
average 2006-2015

0.77 mm/year



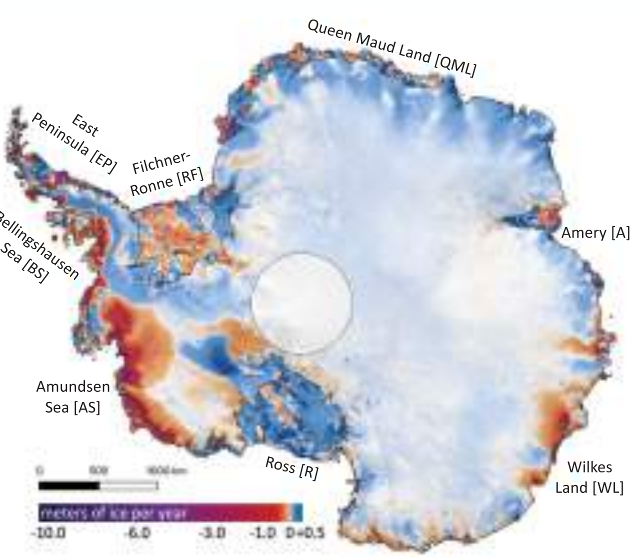
Smith et al. (2020)



0.61 mm/year

Mountain glaciers

0.43 mm/year



Smith et al. (2020)

Source: IPCC, 2019, 2021

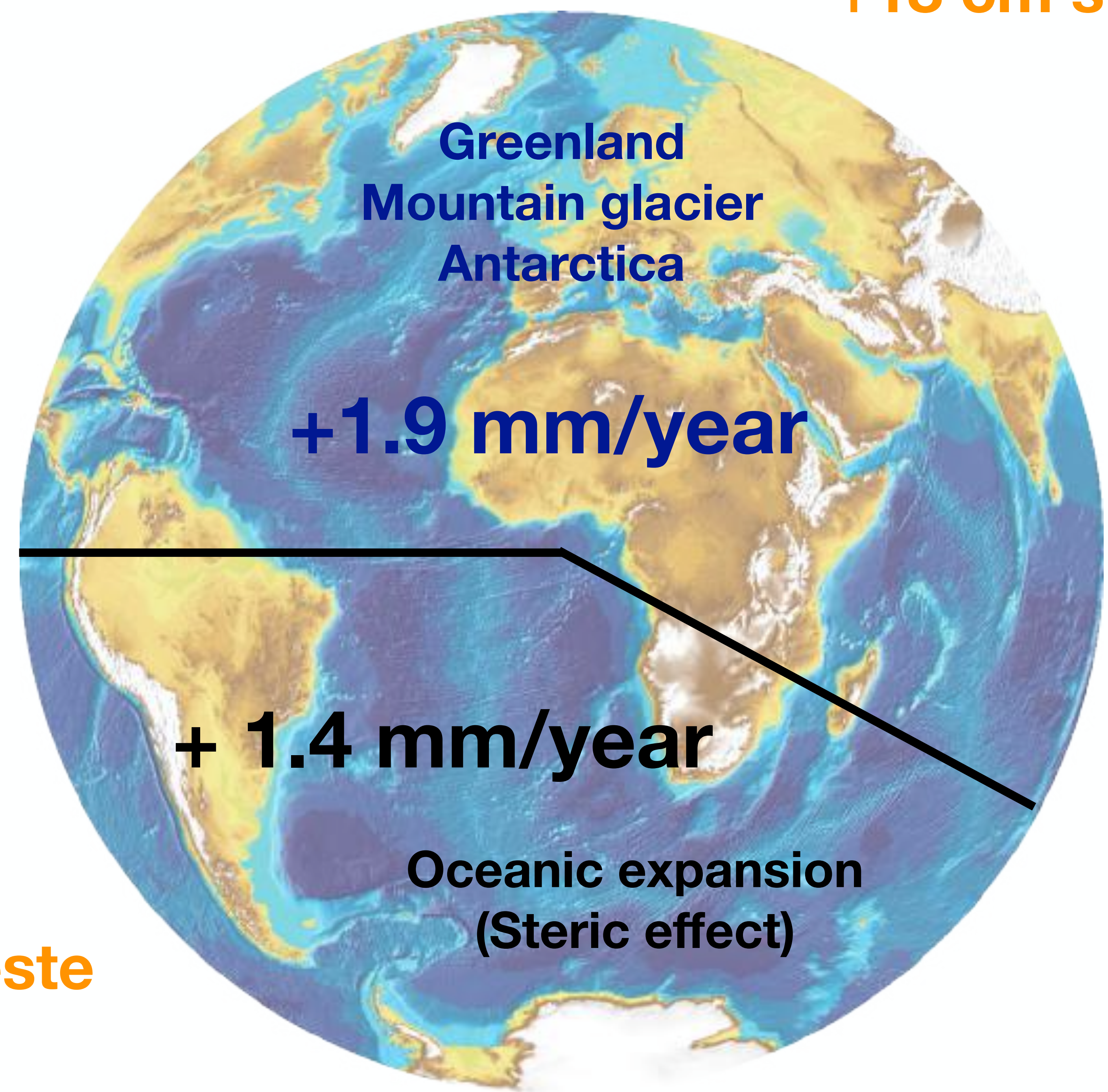
OGS

Sea Level rise

Global mean Average: 2006-2015

Current rate of sea level rise: +3.3 mm/year

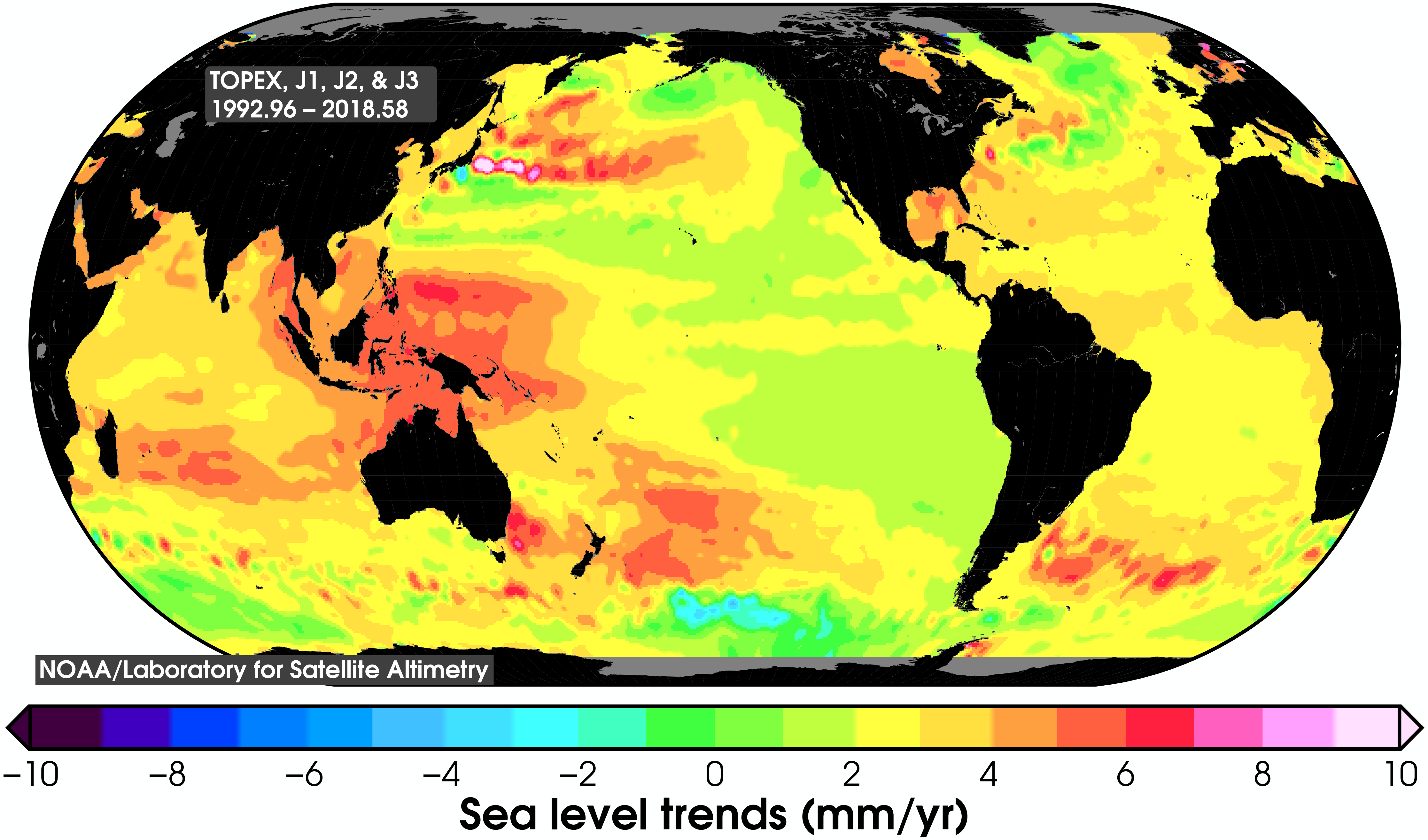
+18 cm since 1900



+3.4 mm/year in Trieste

Source: IPCC, 2019, 2021

Observed sea level changes



Satellite: altimetro

Future climate changes

Future scenarios

Future scenarios

Years in the future

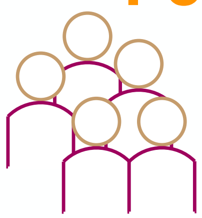
Future scenarios

Risorse
Naturali

Years in the future

Future scenarios

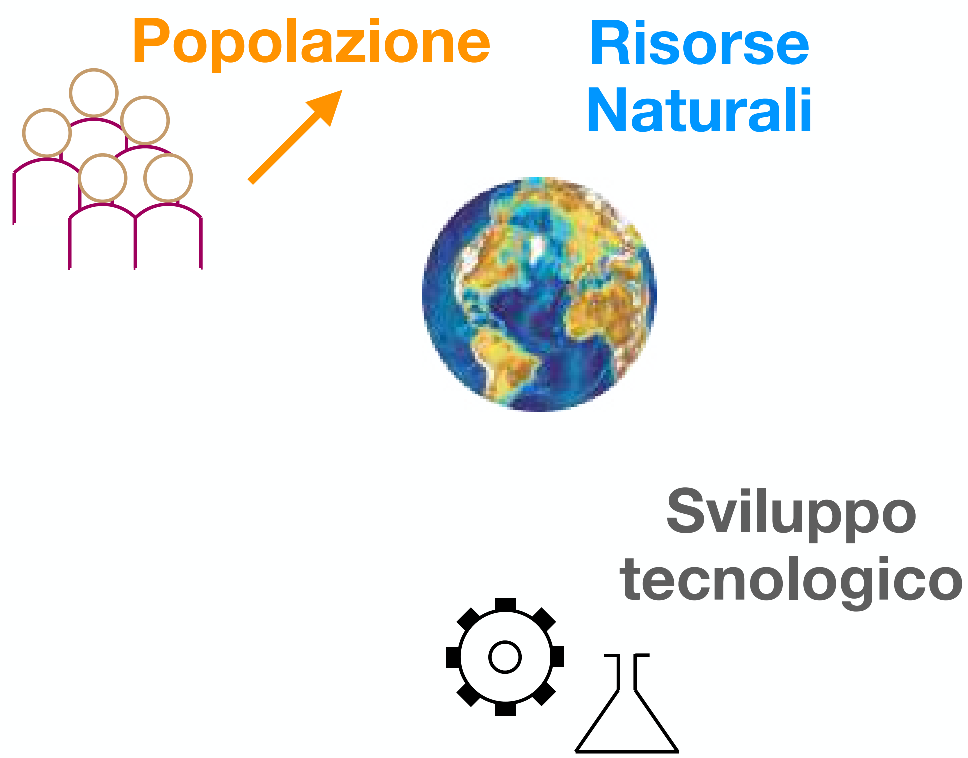
Popolazione



Risorse Naturali

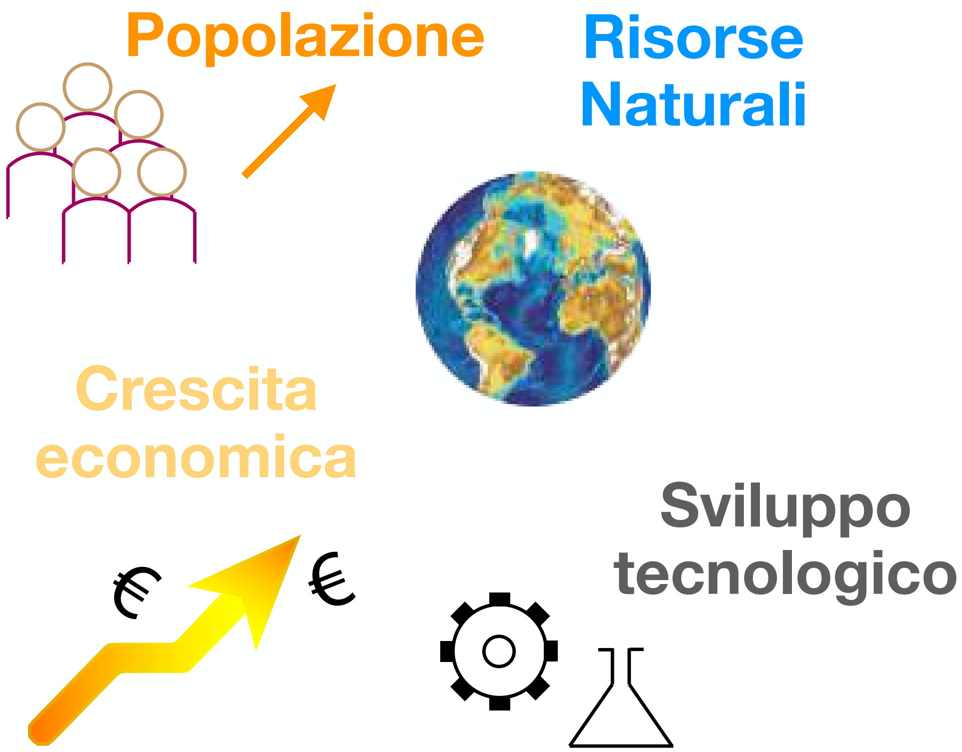
Years in the future

Future scenarios



Years in the future

Future scenarios

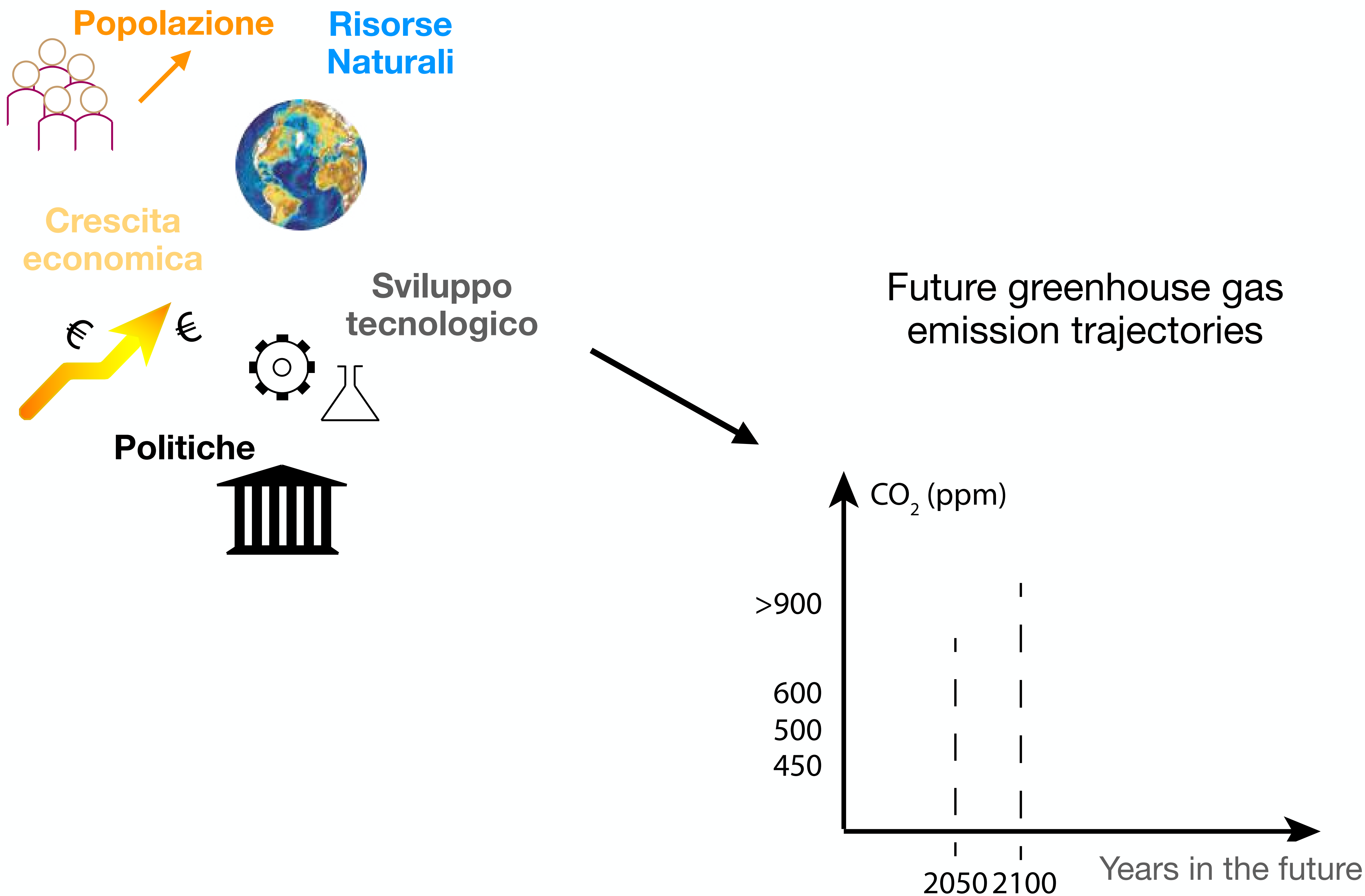


Years in the future

Future scenarios

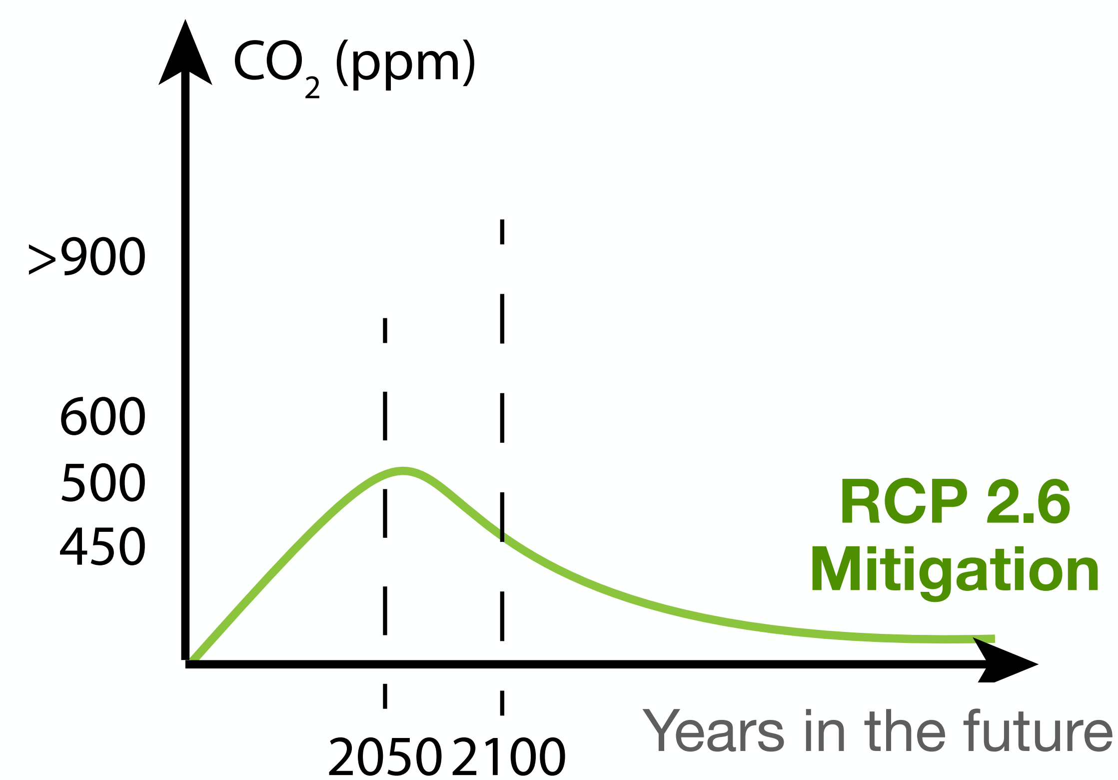
Years in the future

Future scenarios



Future scenarios

Future greenhouse gas emission trajectories



Future scenarios

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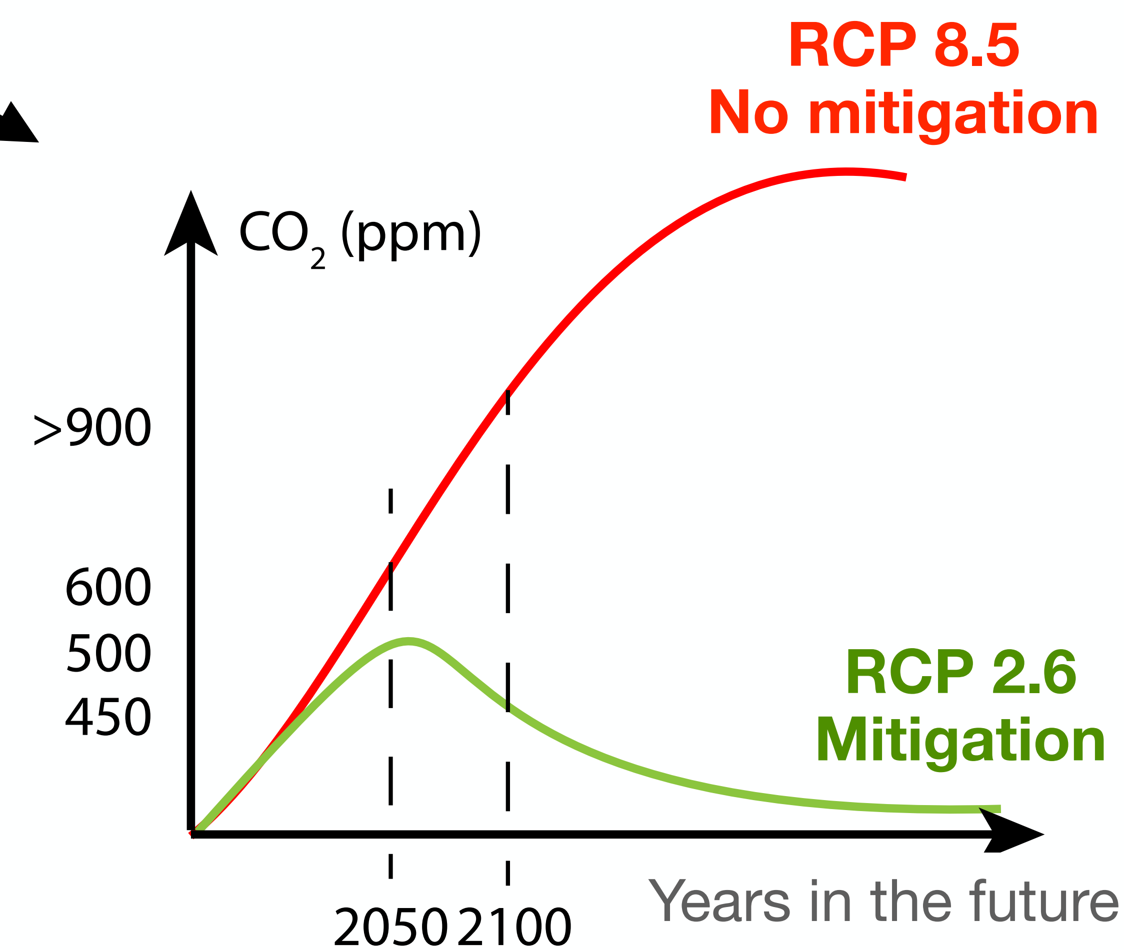
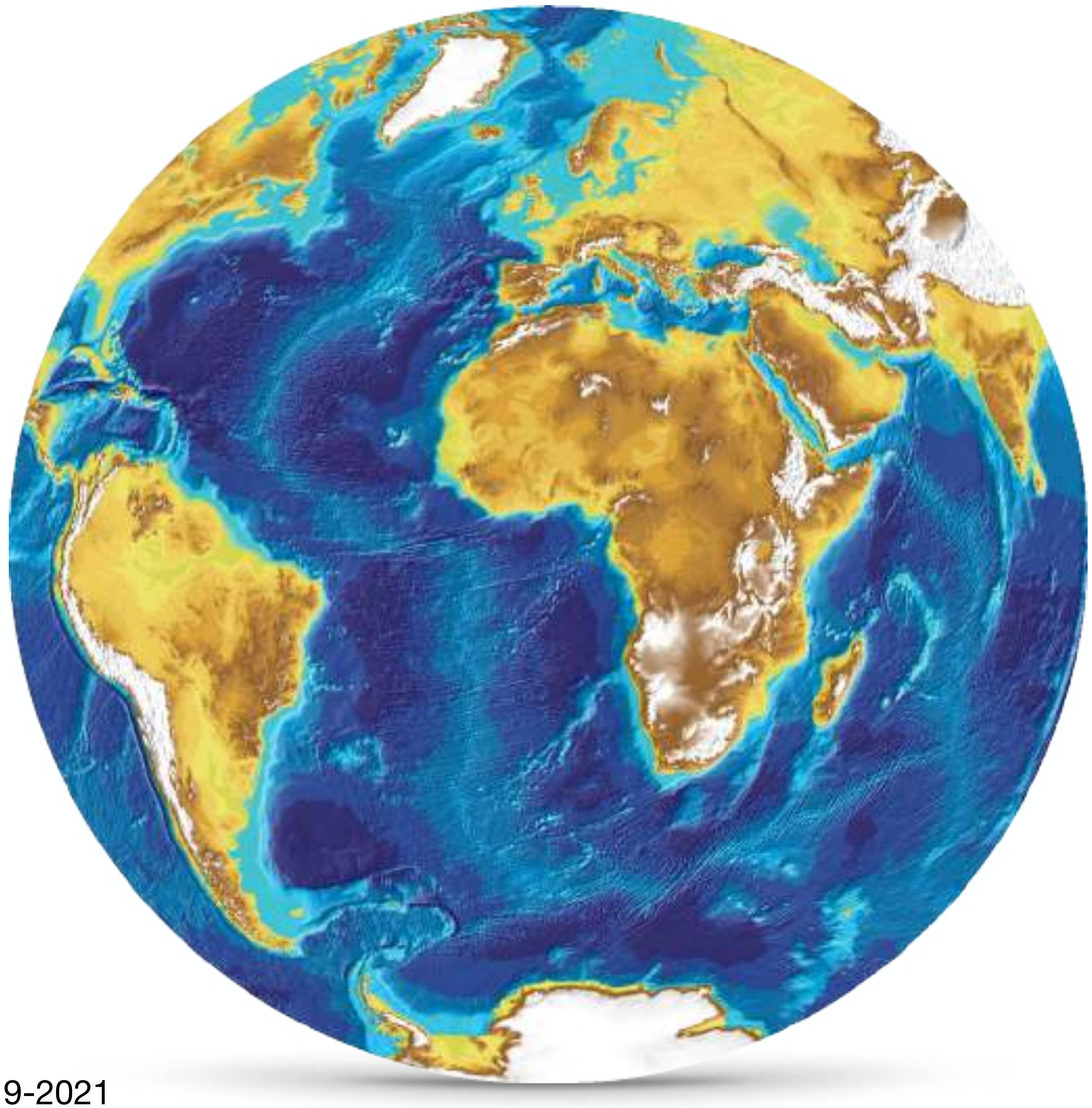


Low CO_2 emissions

T° up to + 1.6°C

Min: 0.9°C Max: 2.4°C

CO_2 ~ 440 ppm



Up to 38 cm
in 2100

Source: SROCC & AR6 IPCC, 2019-2021

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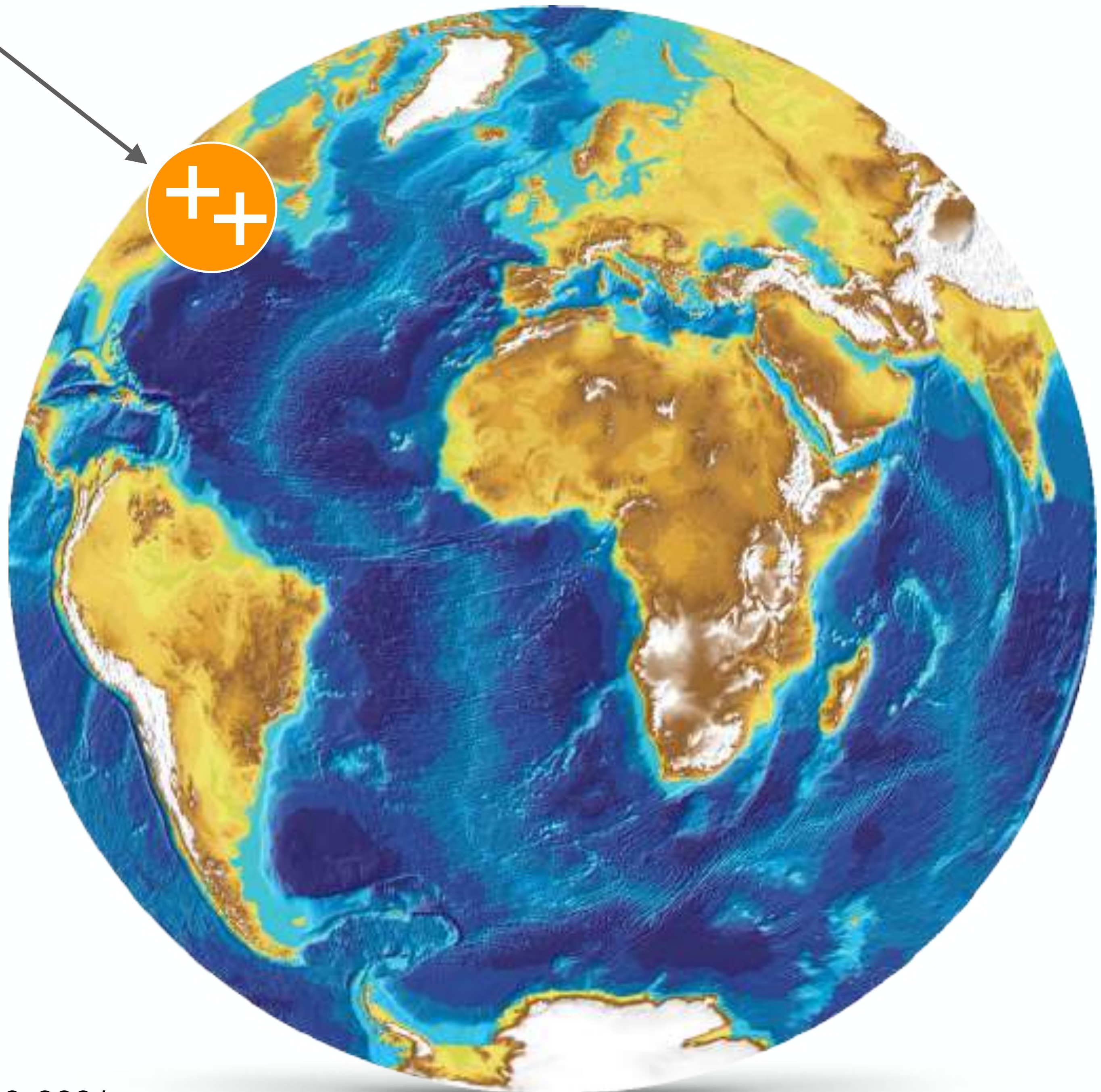
Atmospheric
temperatures



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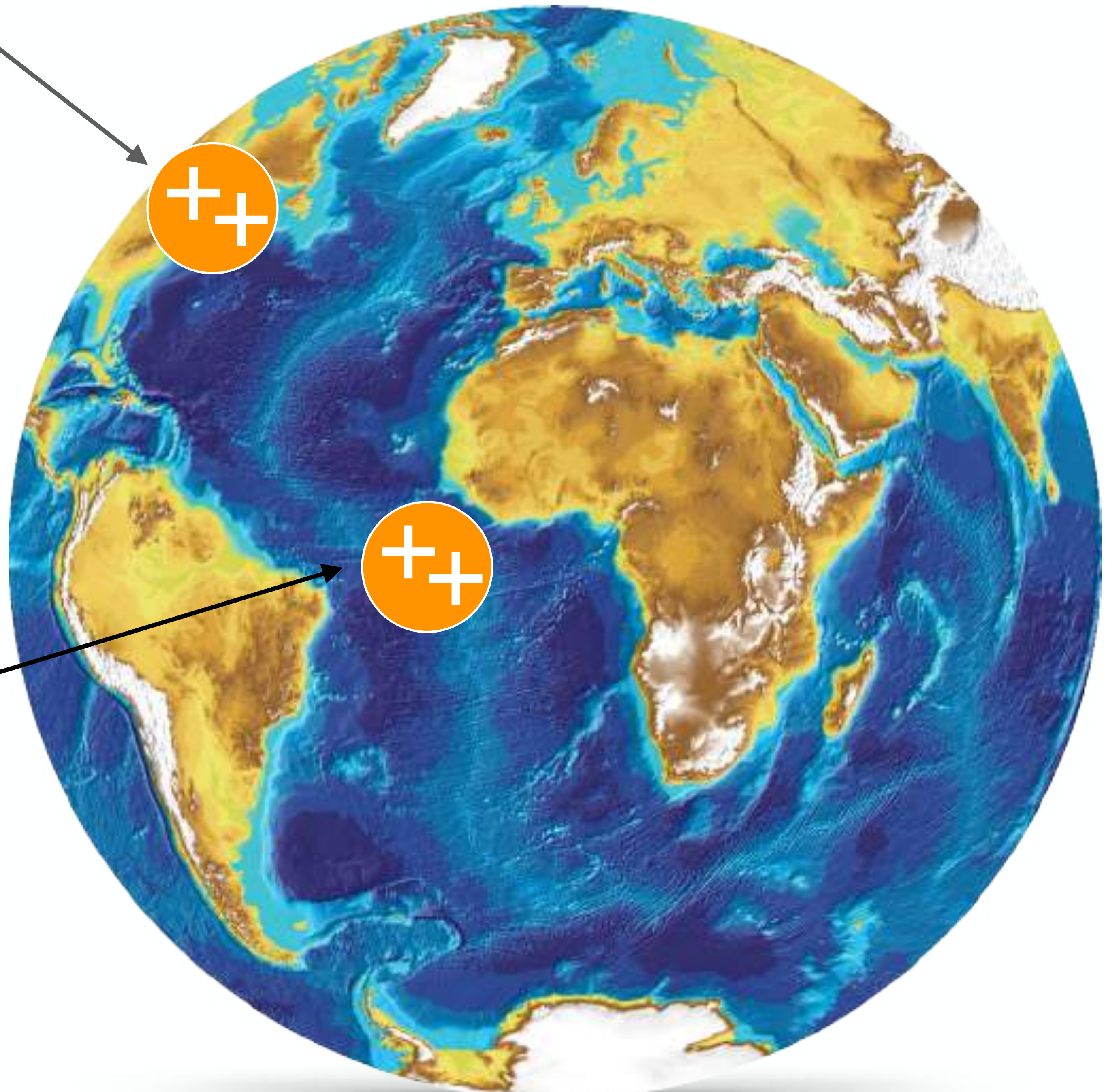


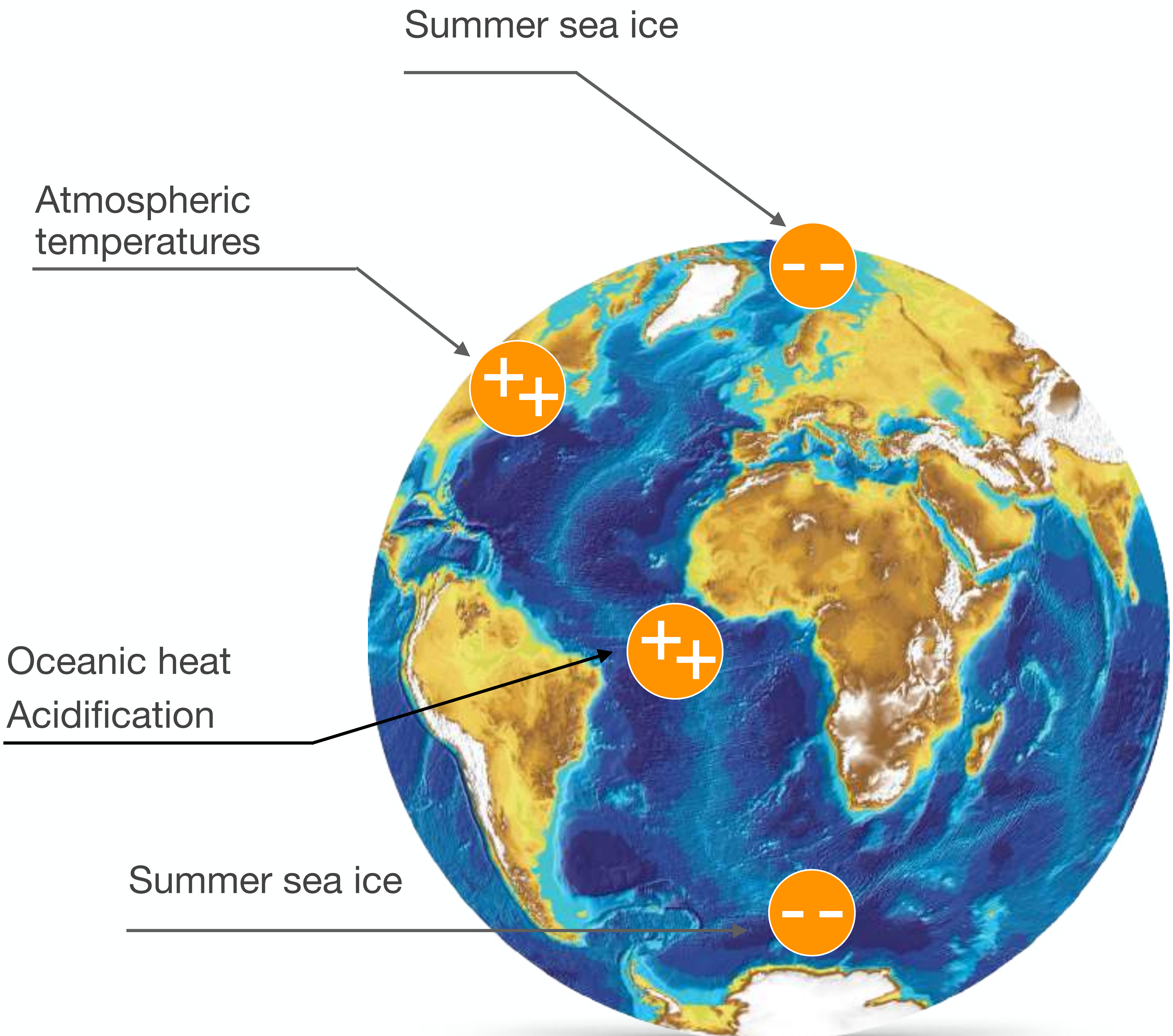
Oceanic heat

Acidification

Up to 38 cm in 2100

Source: SROCC & AR6 IPCC, 2019-2021

Low CO_2 emissions



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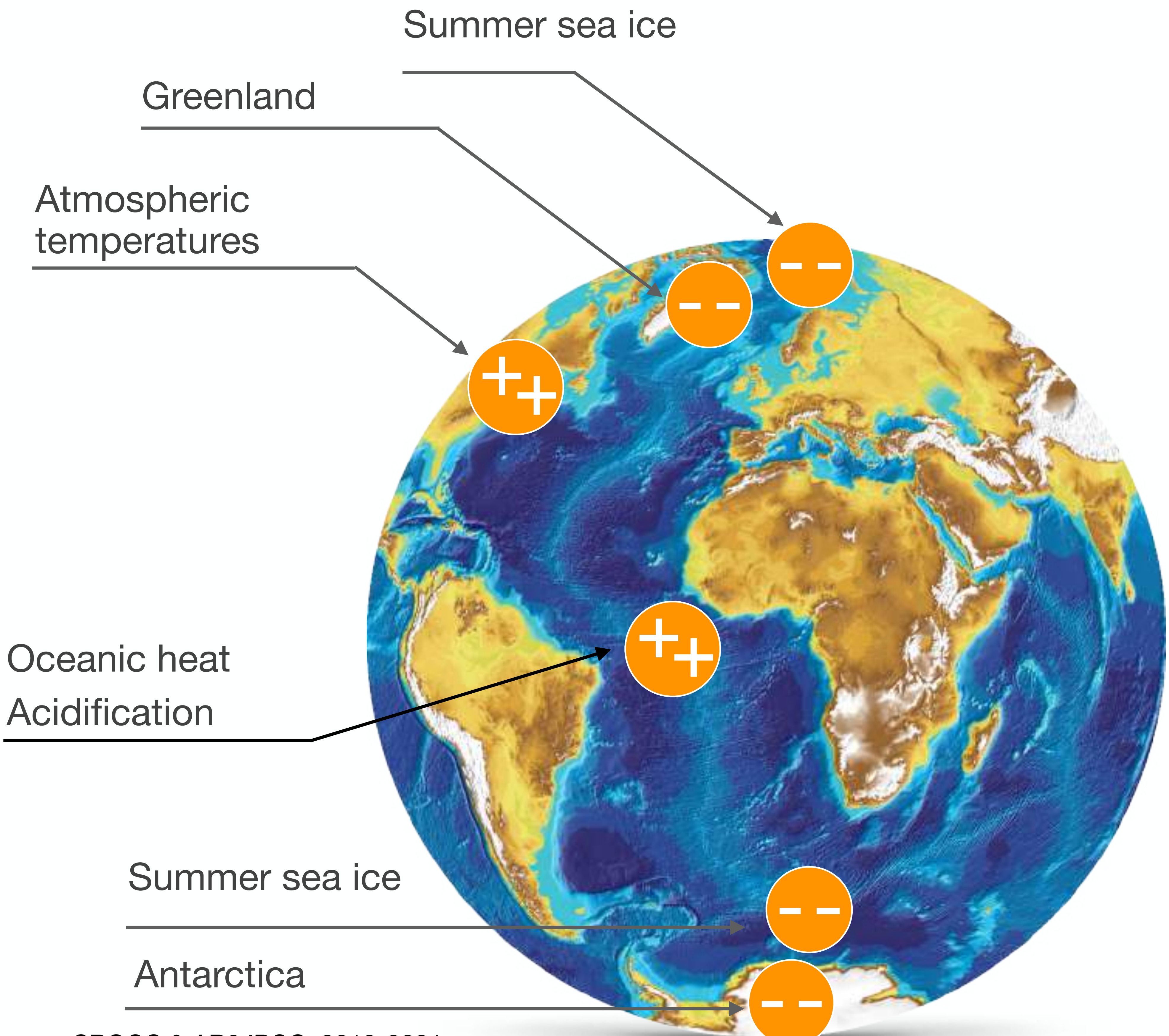

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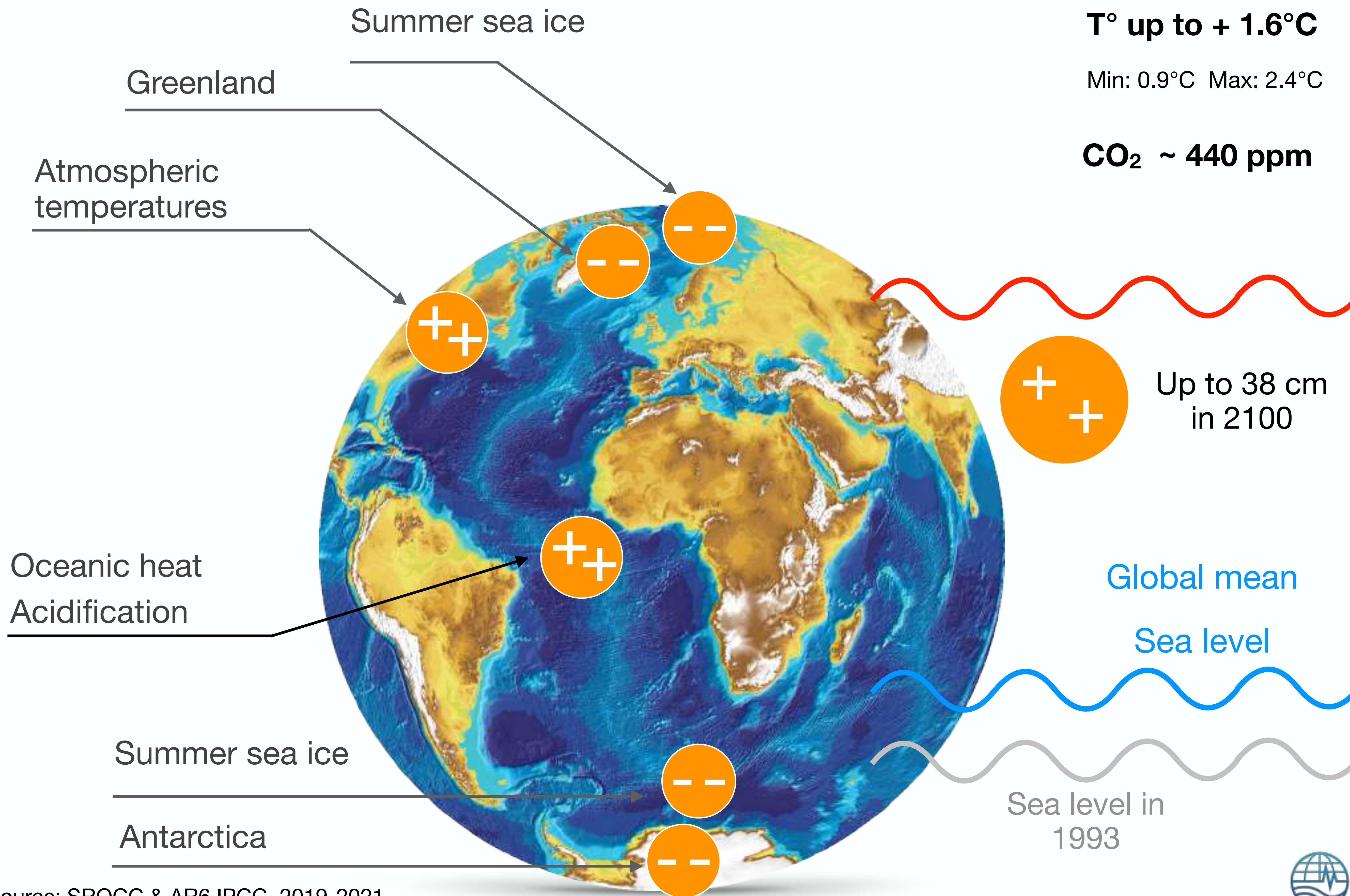


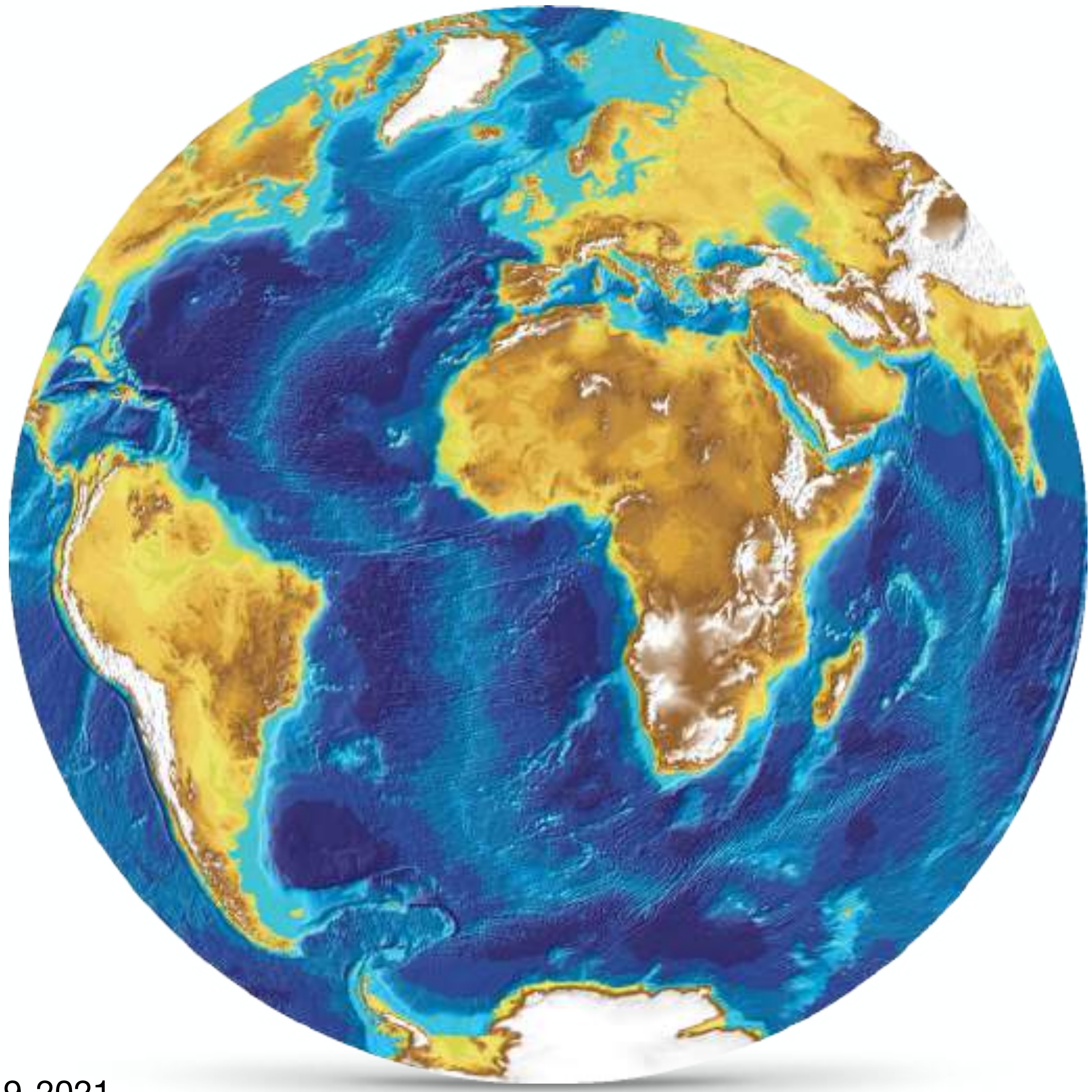
Source: SROCC & AR6 IPCC, 2019-2021

High CO_2 emissions

T° up to + 4.3°C

Min: 3.2°C Max: 5.4°C

CO_2 ~ 1130 ppm



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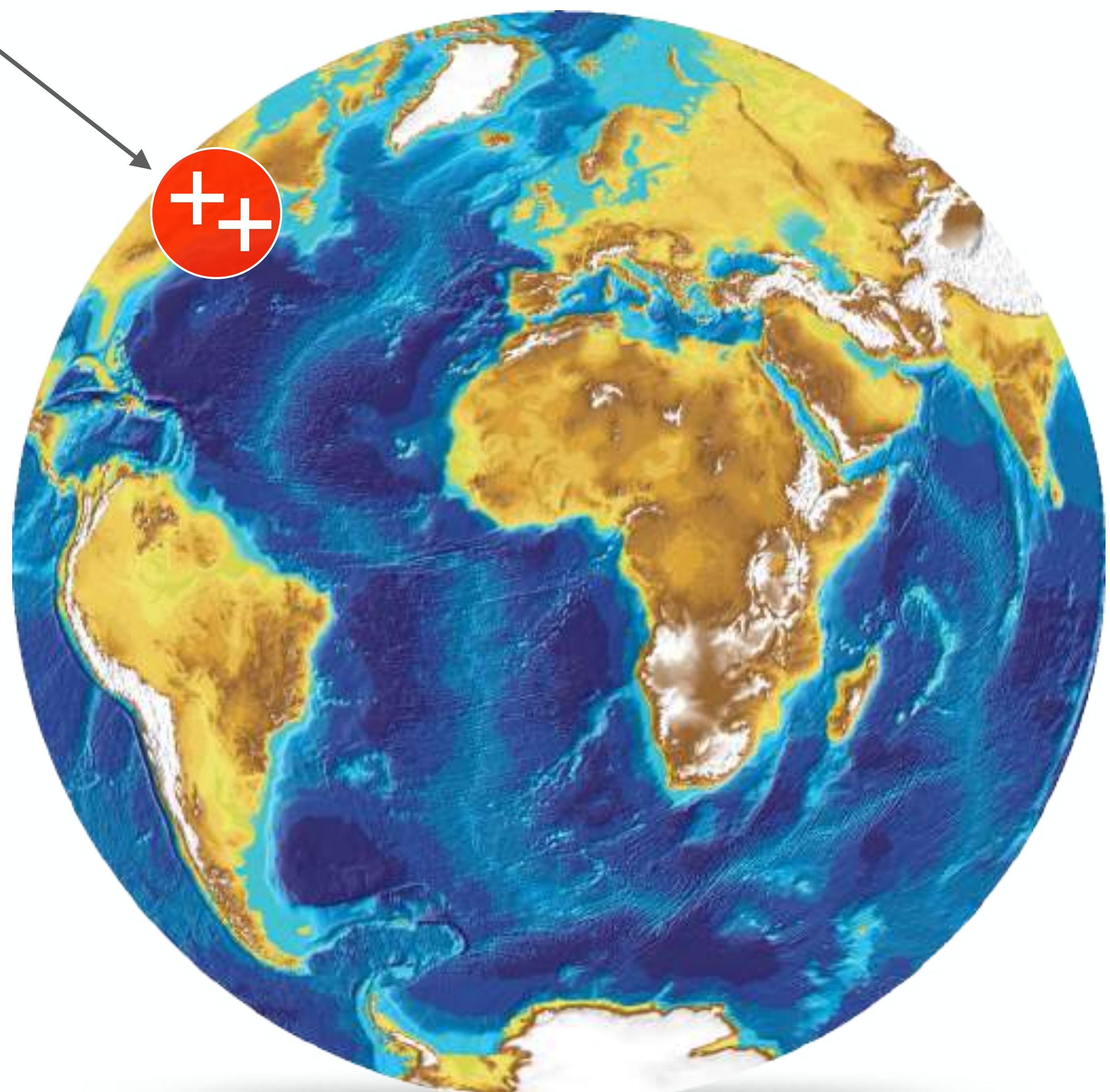
Atmospheric Temperature



Source: SROCC & AR6 IPCC, 2019-2021

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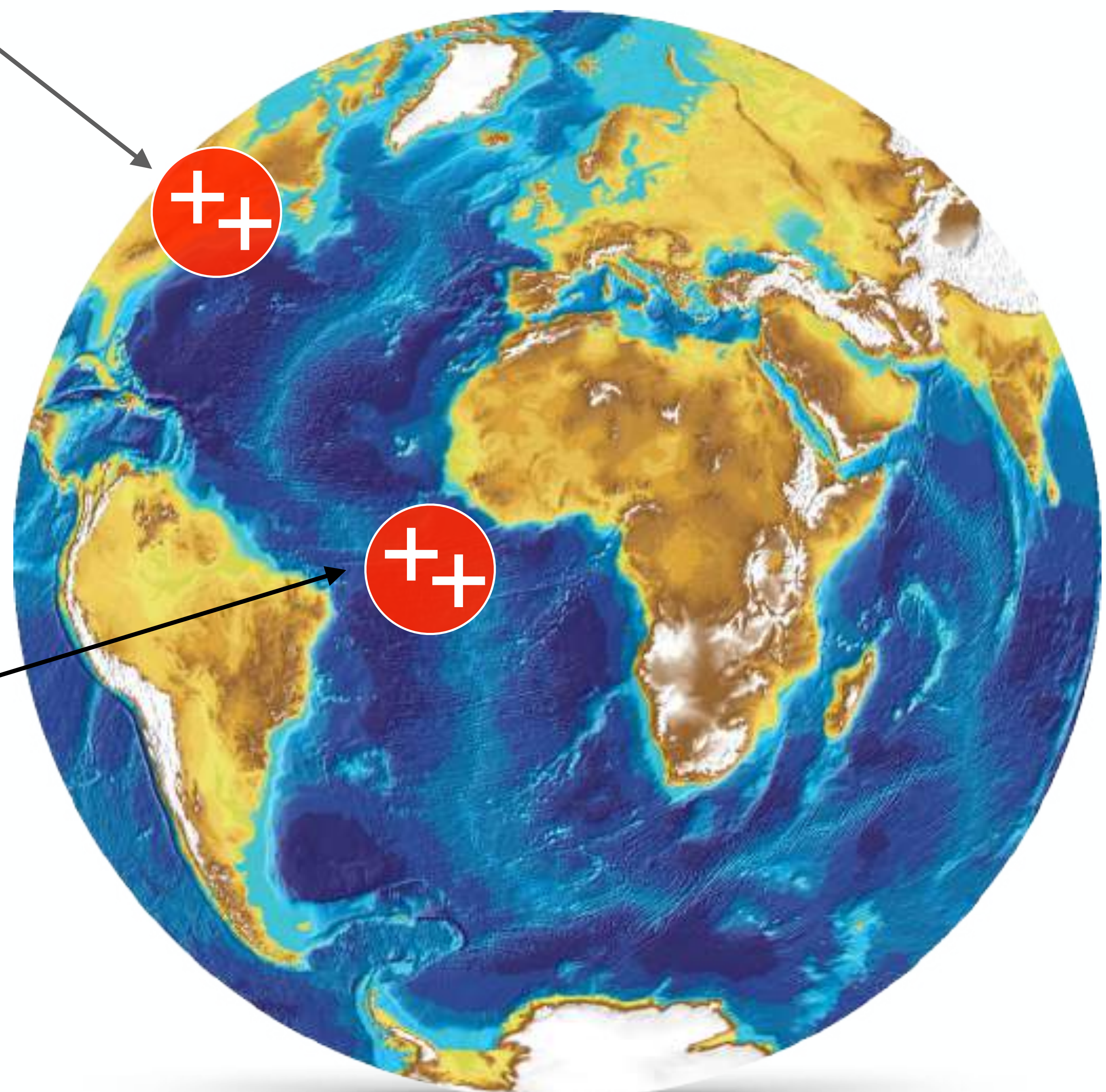
Atmospheric
Temperature



Oceanic heat
Acidification

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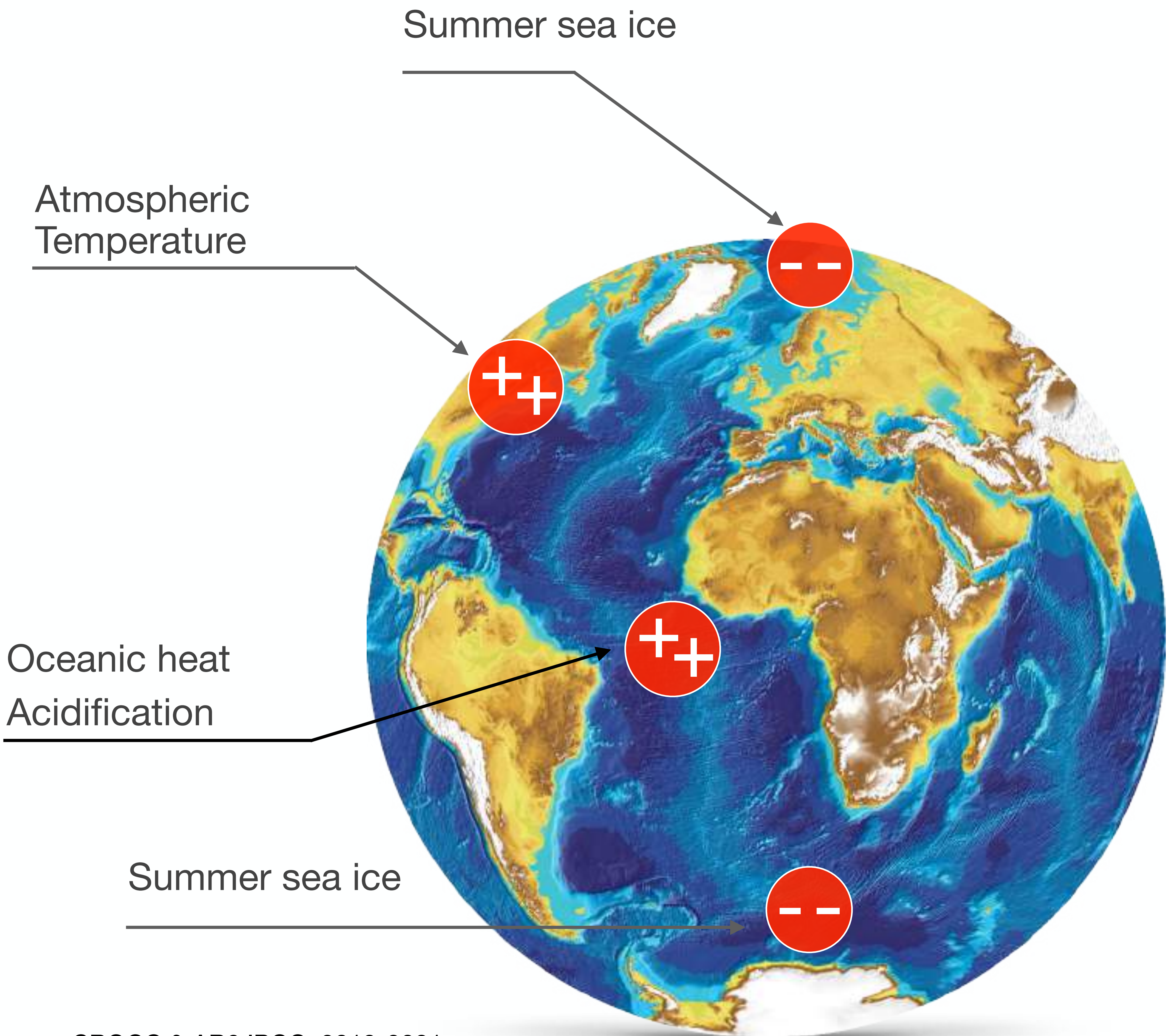

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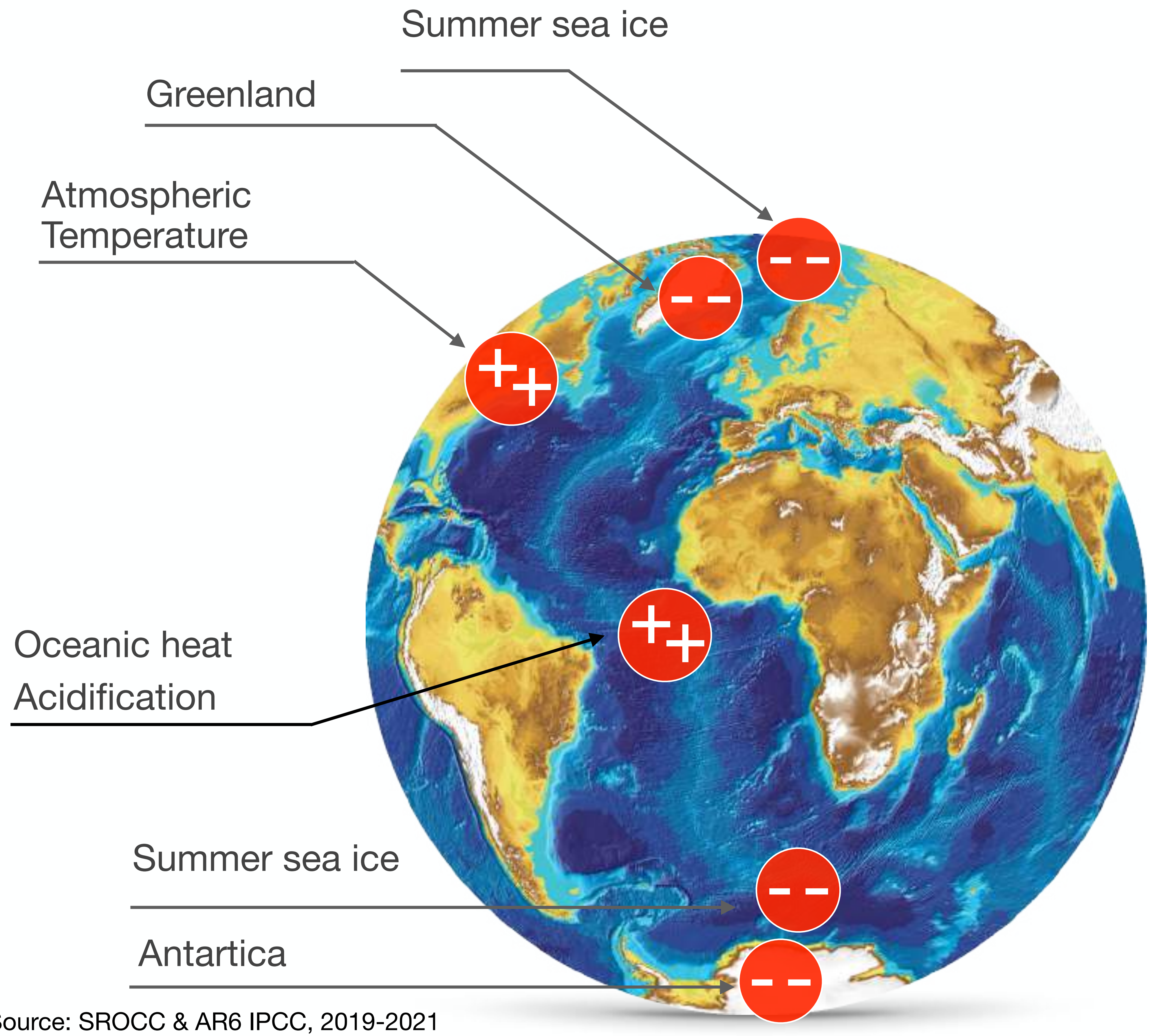

Source: SROCC & AR6 IPCC, 2019-2021

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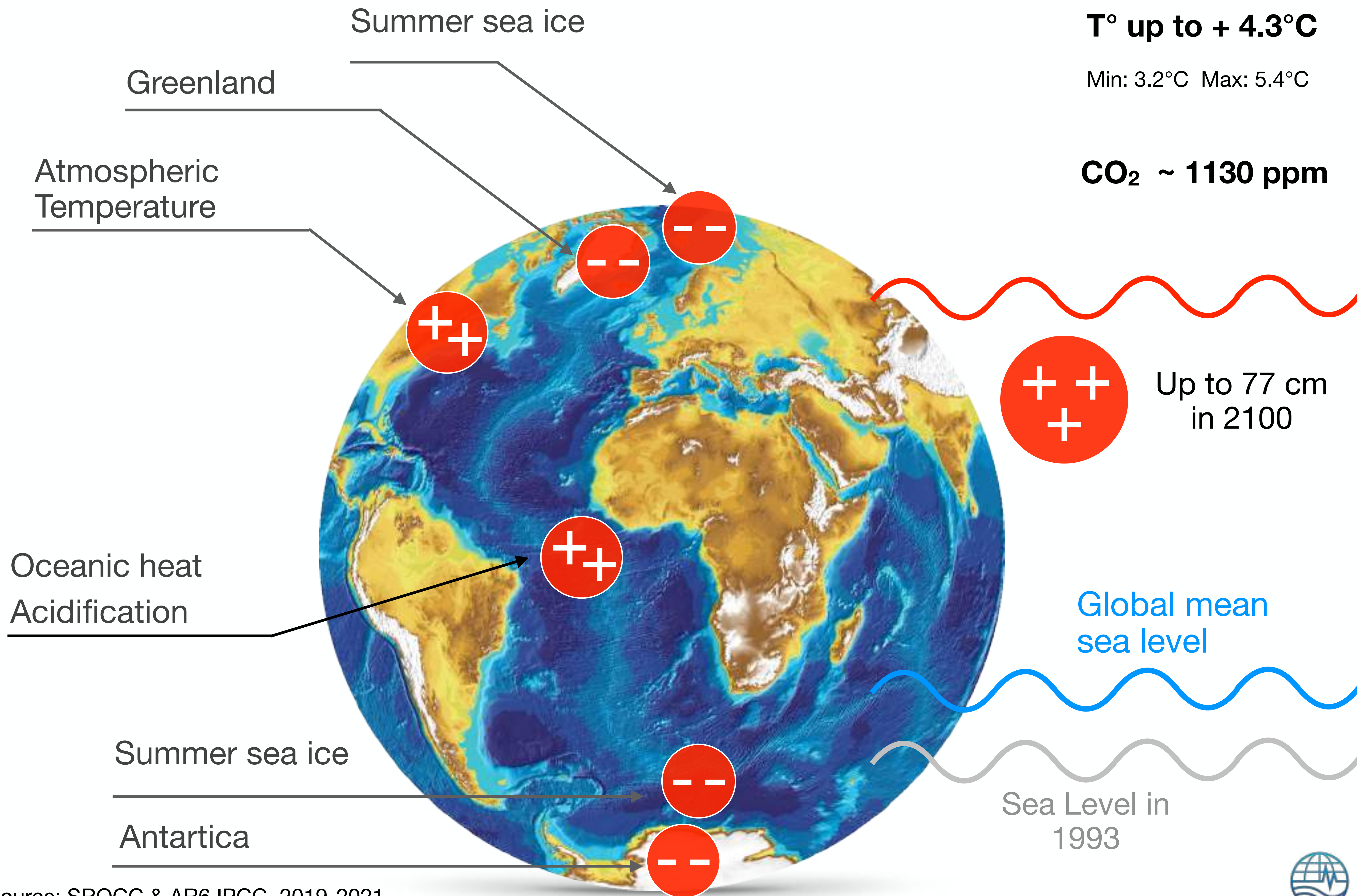
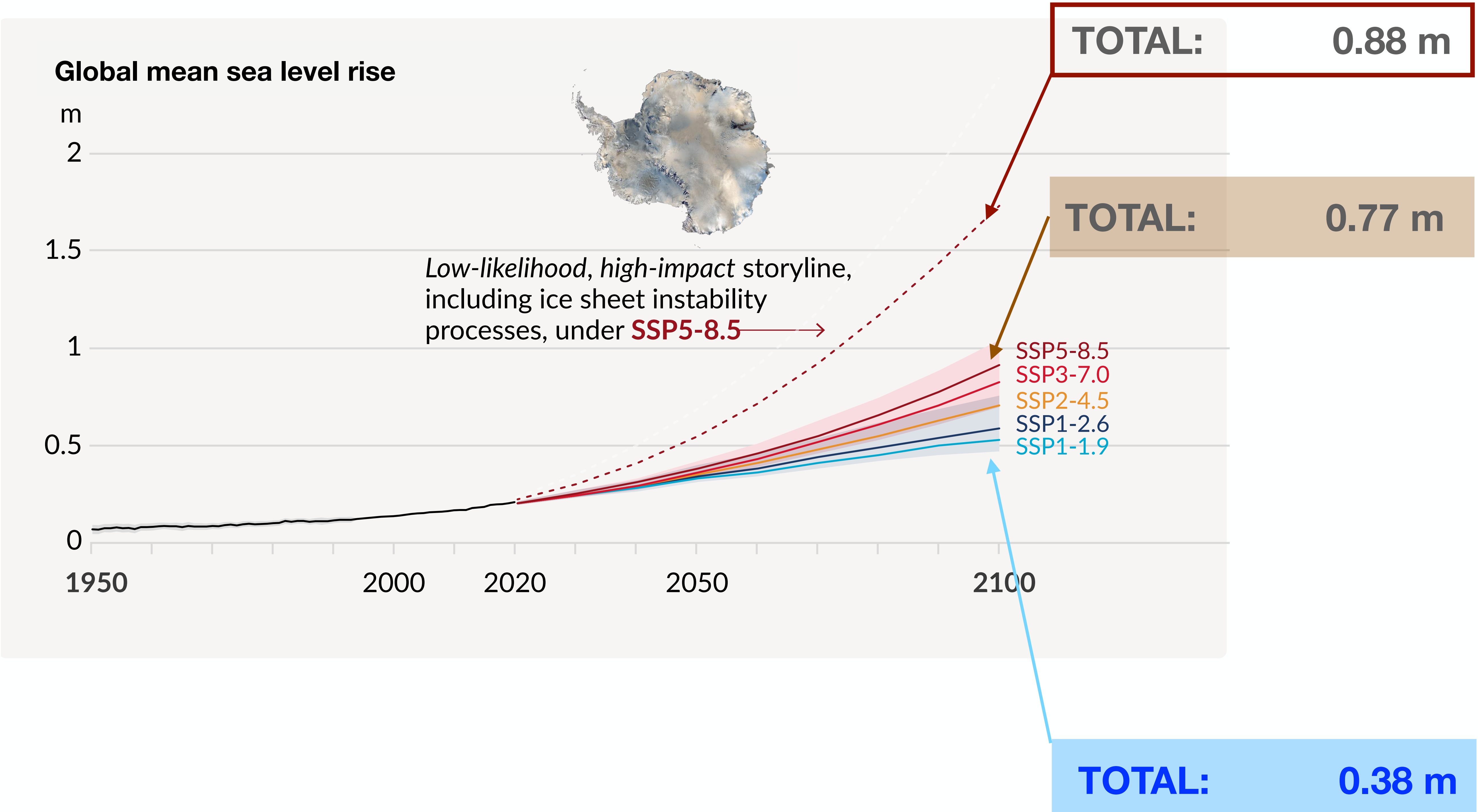


Source: SROCC & AR6 IPCC, 2019-2021

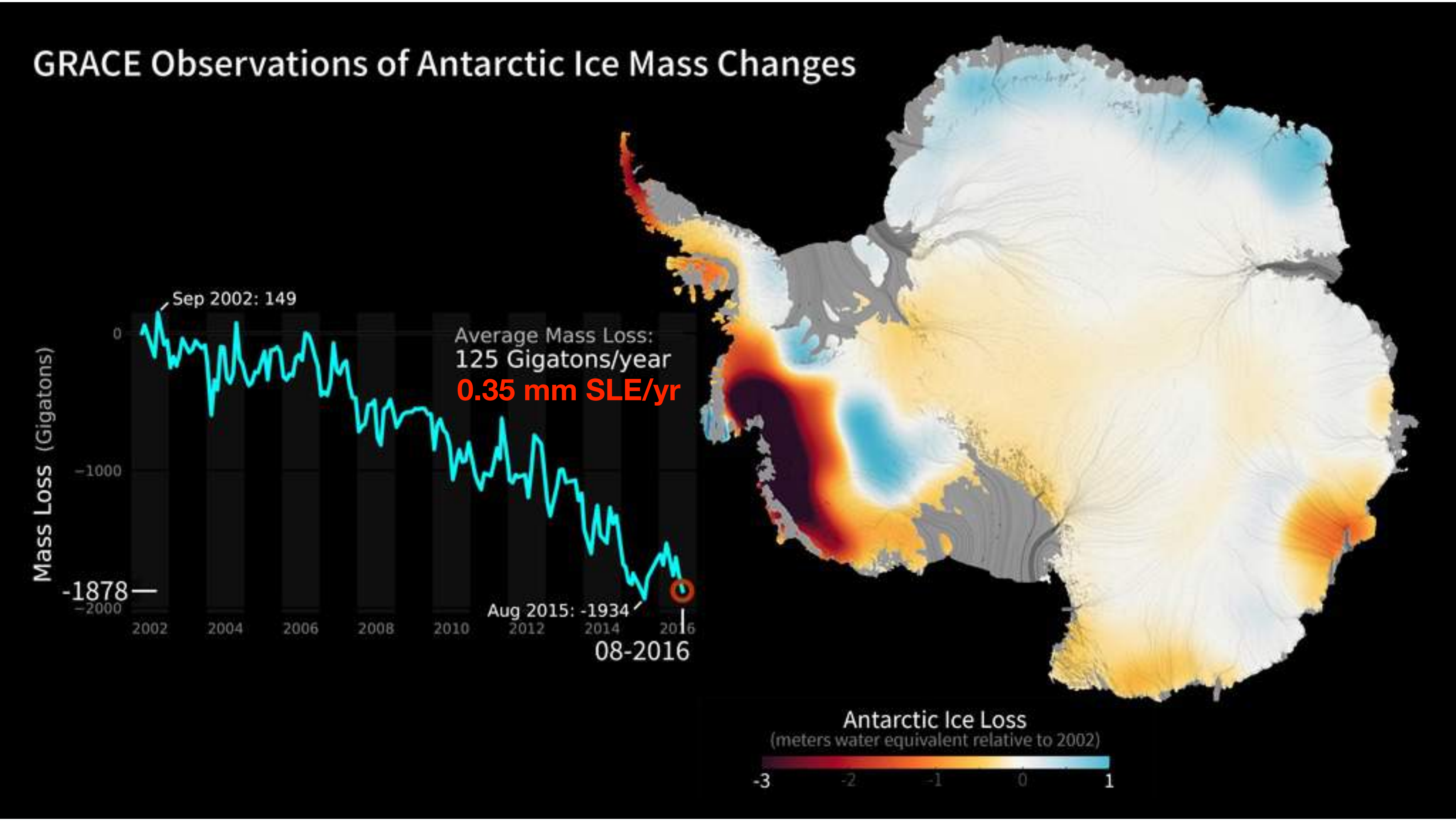
Projected sea level rise until 2100



*IPCC AR6: ocean + land ice + vertical movements

Why should we care for Antarctica?

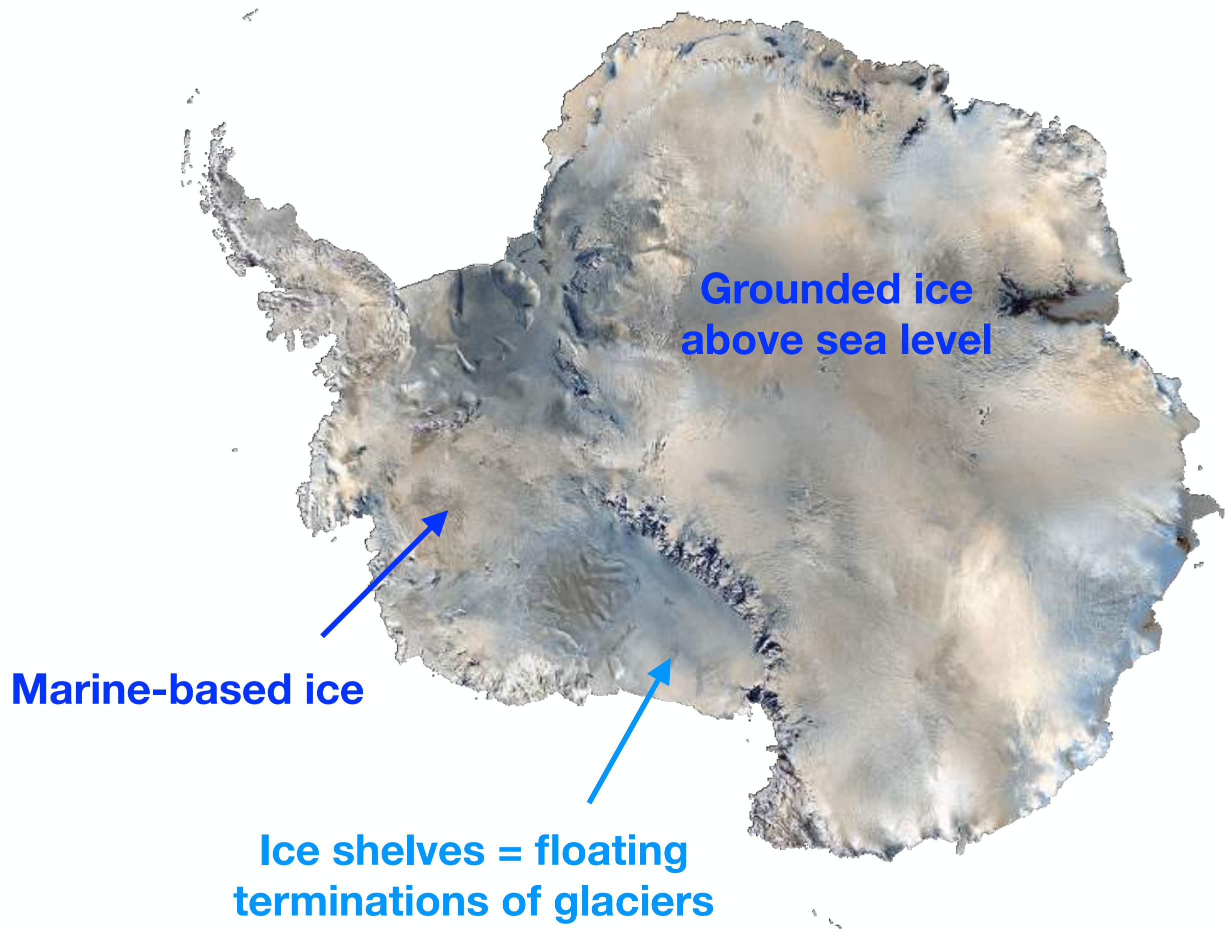
How is Antarctica?



Antarctic ice flow

Antarctic ice flow

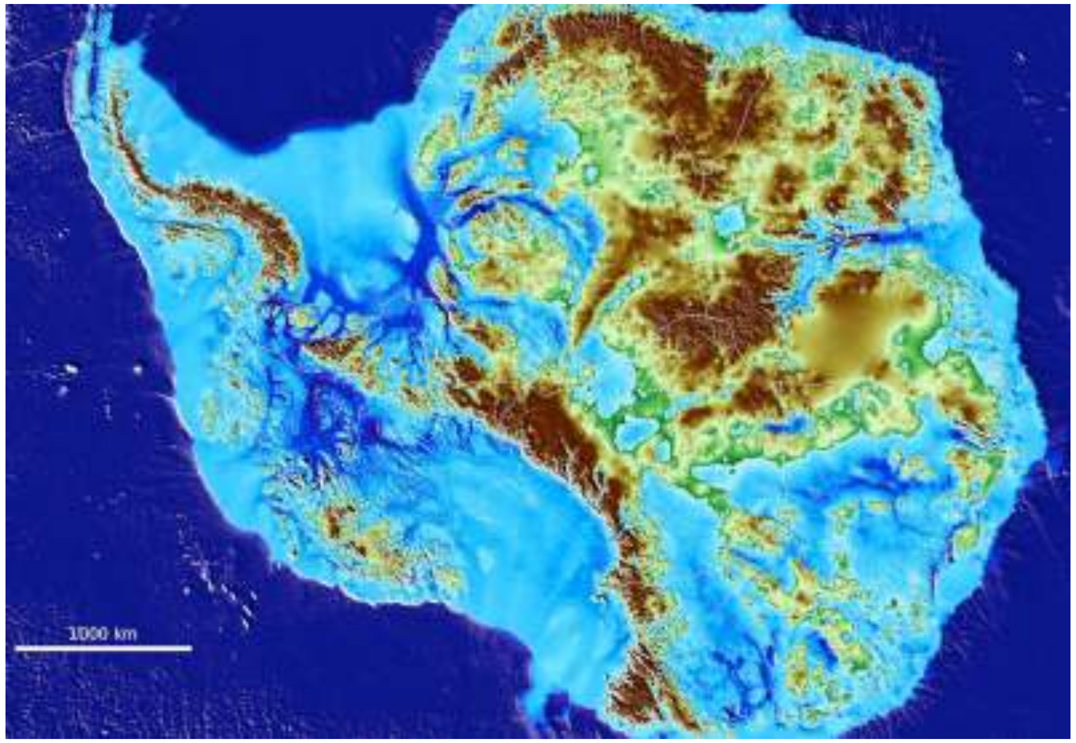
Antarctic vulnerability to climatic changes



Bed topography below the ice sheet

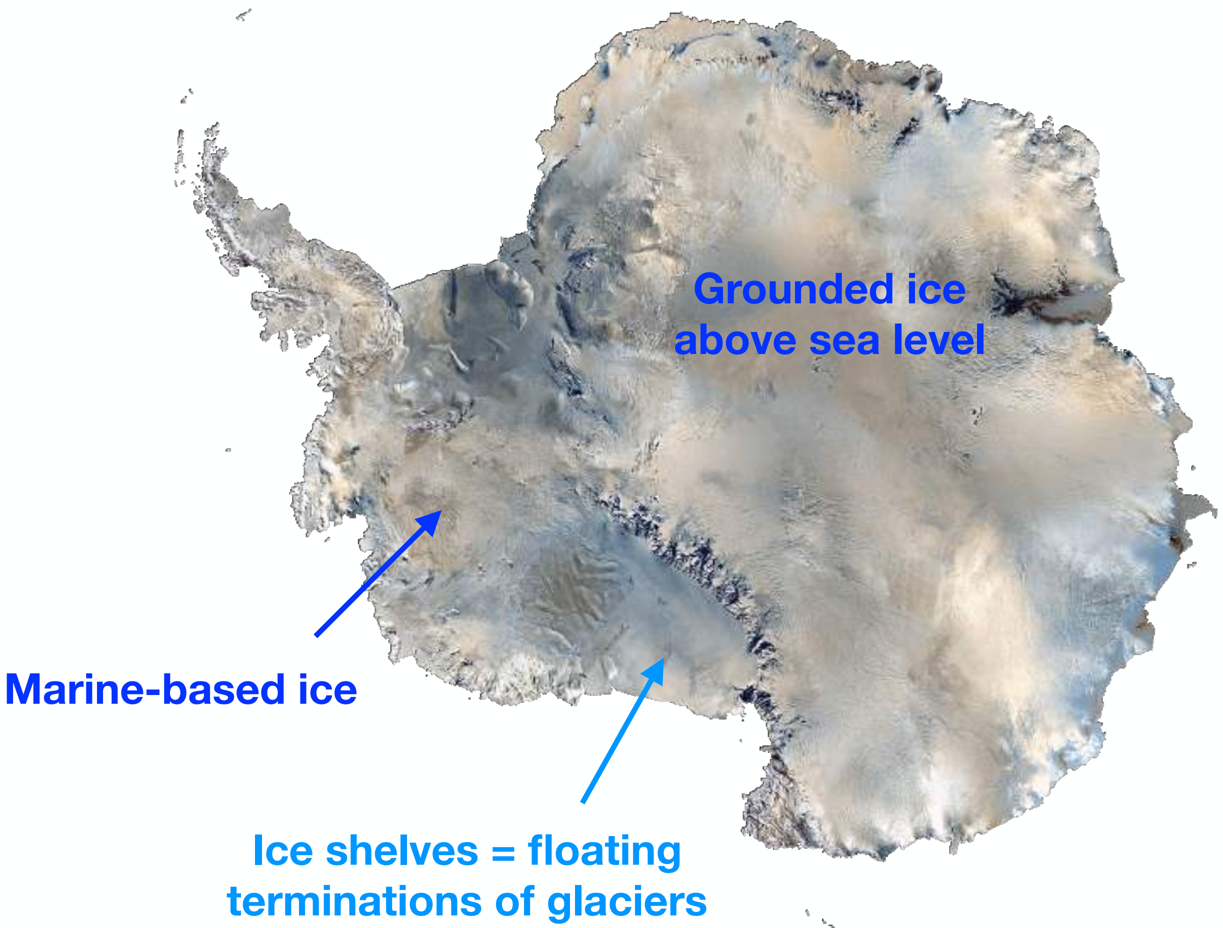
Blue: **below** sea level

Brownish: **above** sea level



Morlinghem et al. (2020)

Antarctic vulnerability to climatic changes



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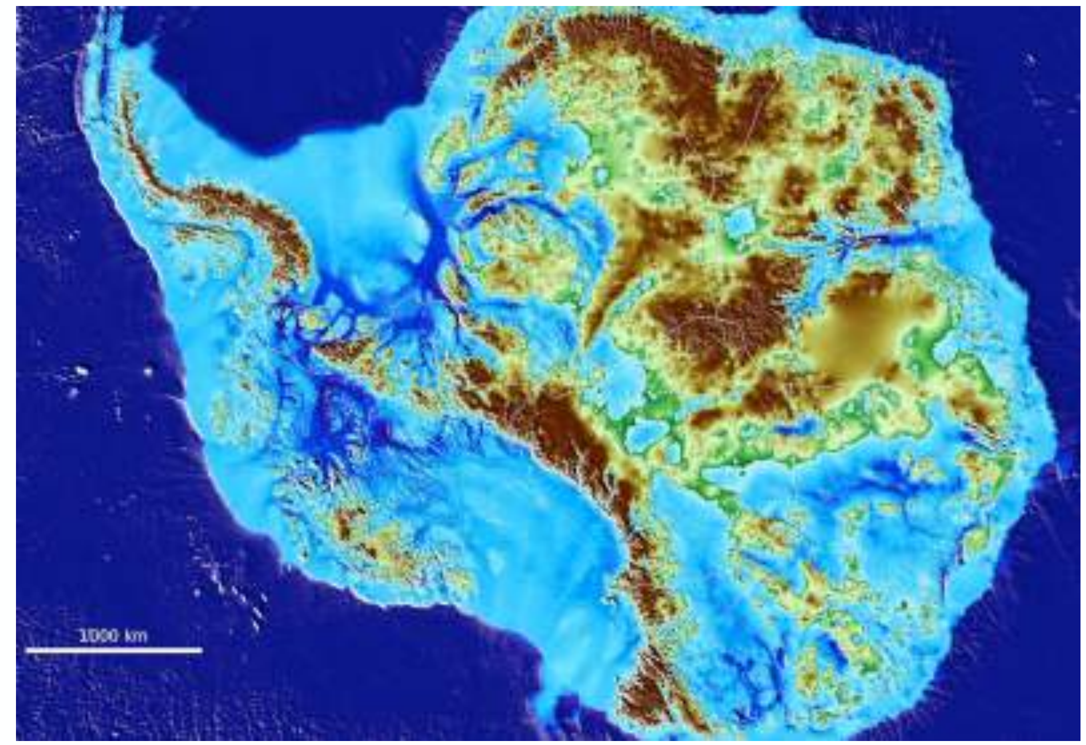

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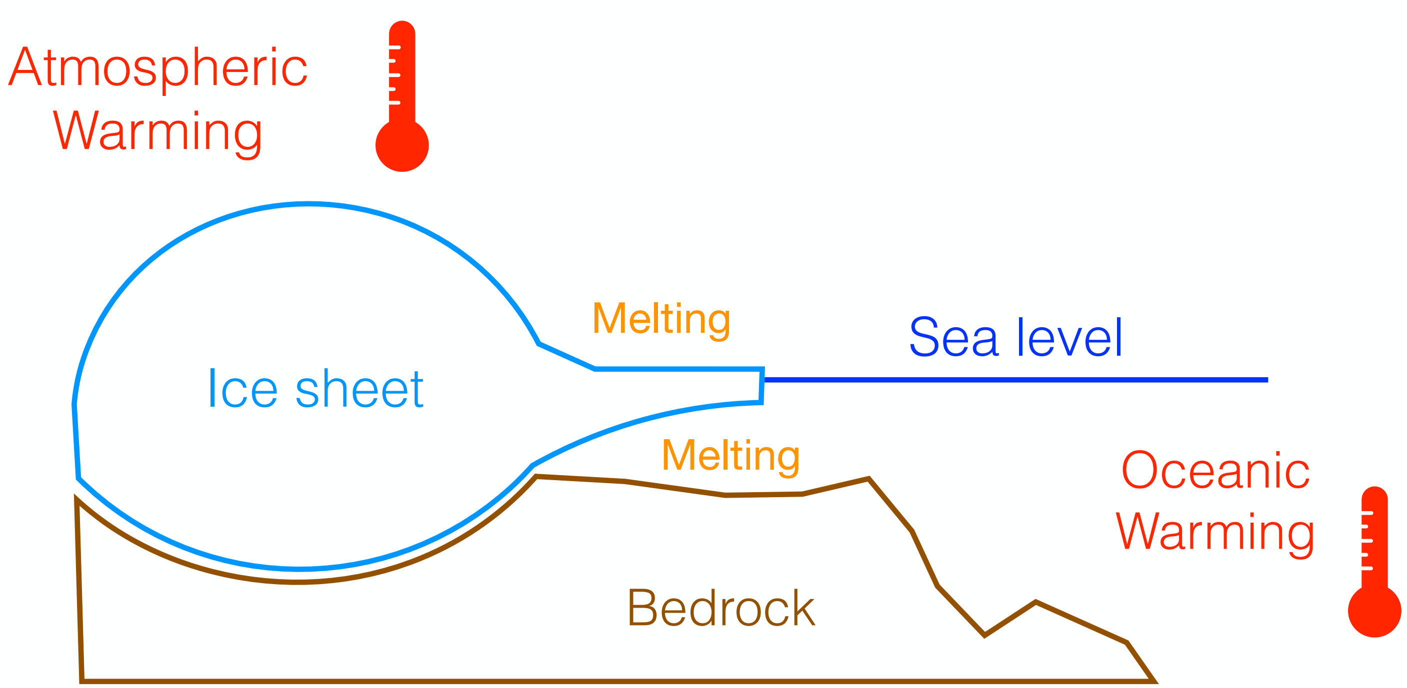
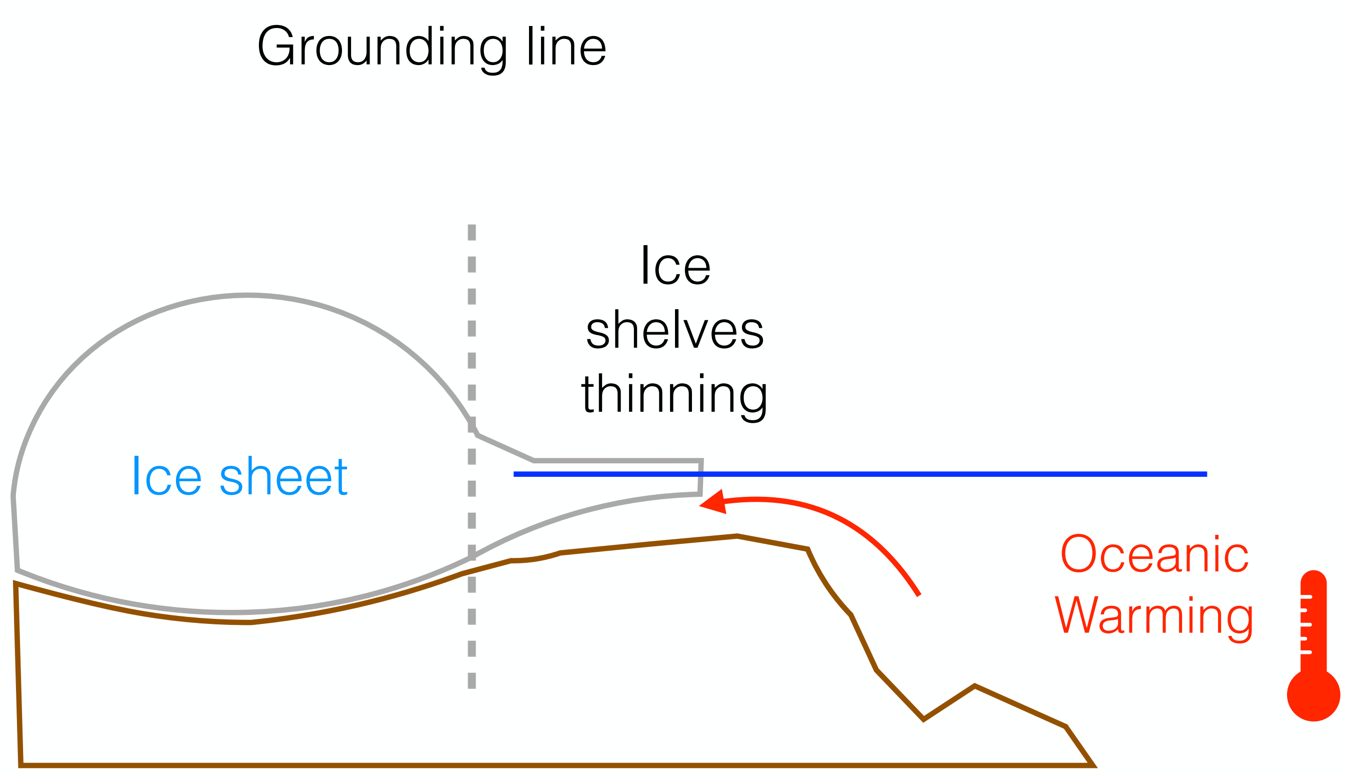


Antarctic Ice Sheet Instabilities



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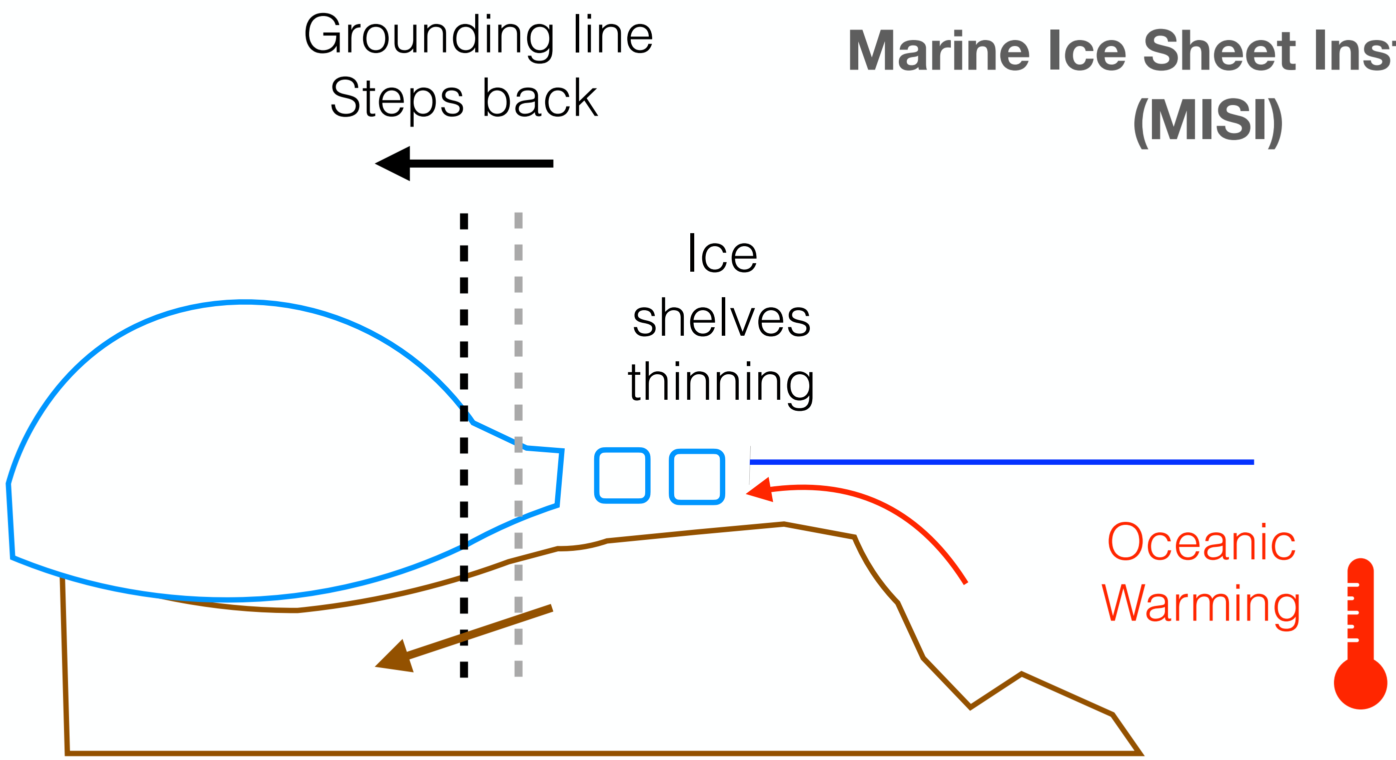
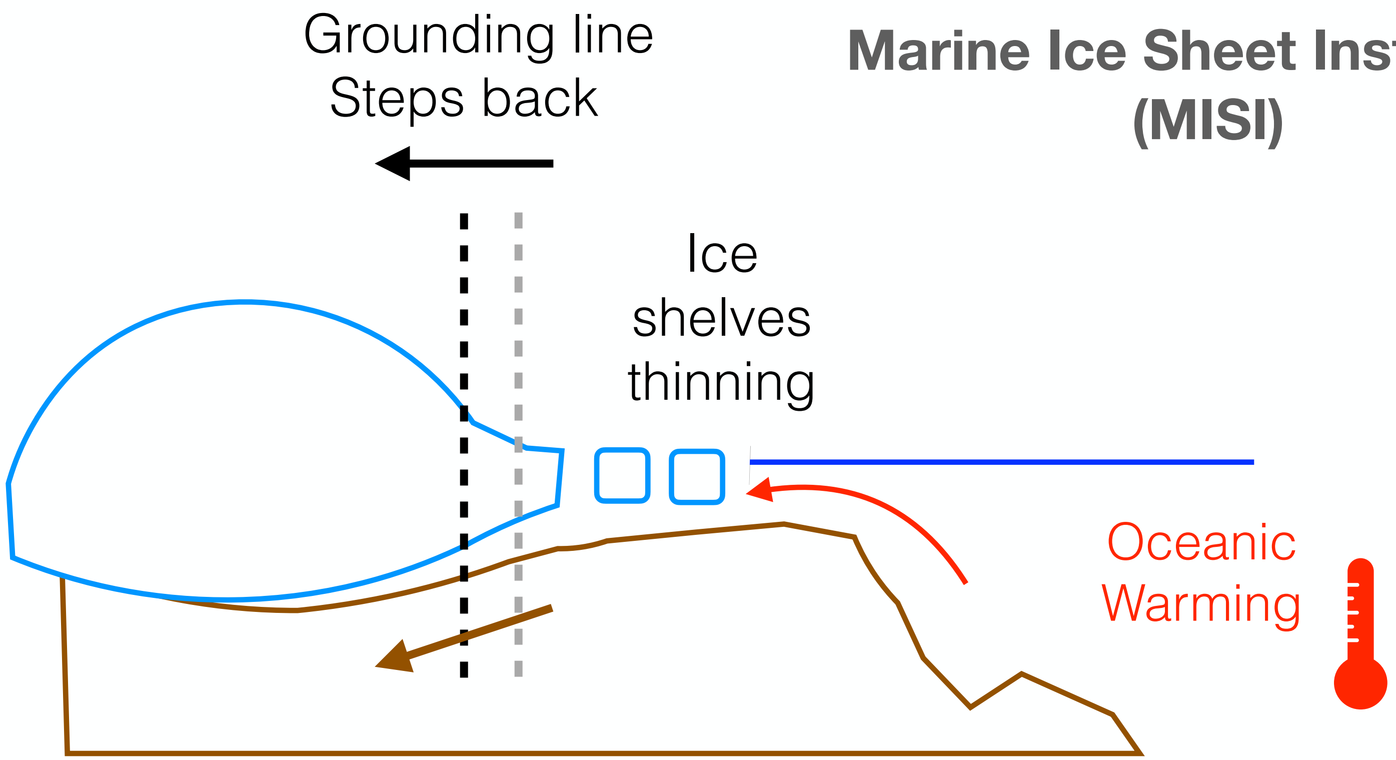
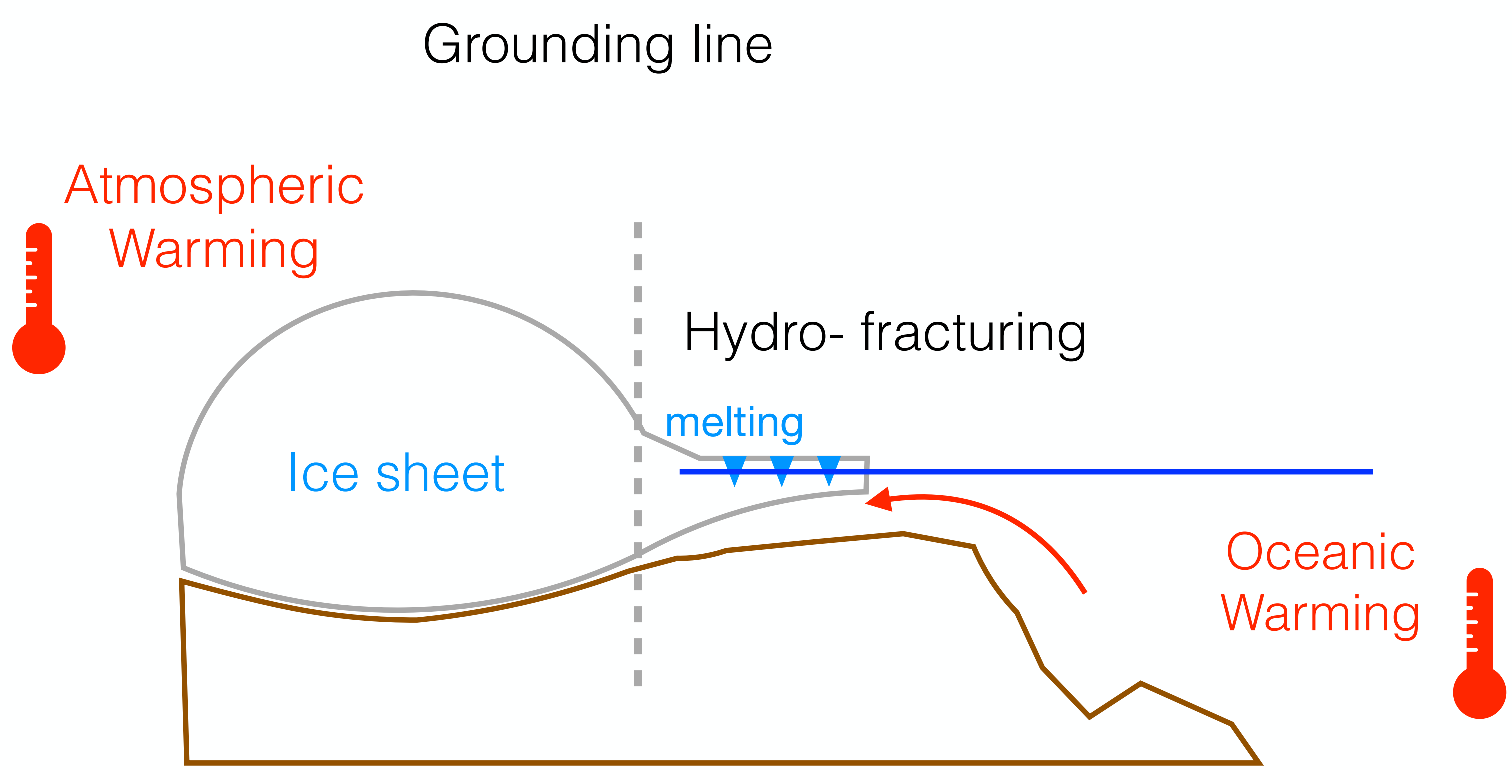


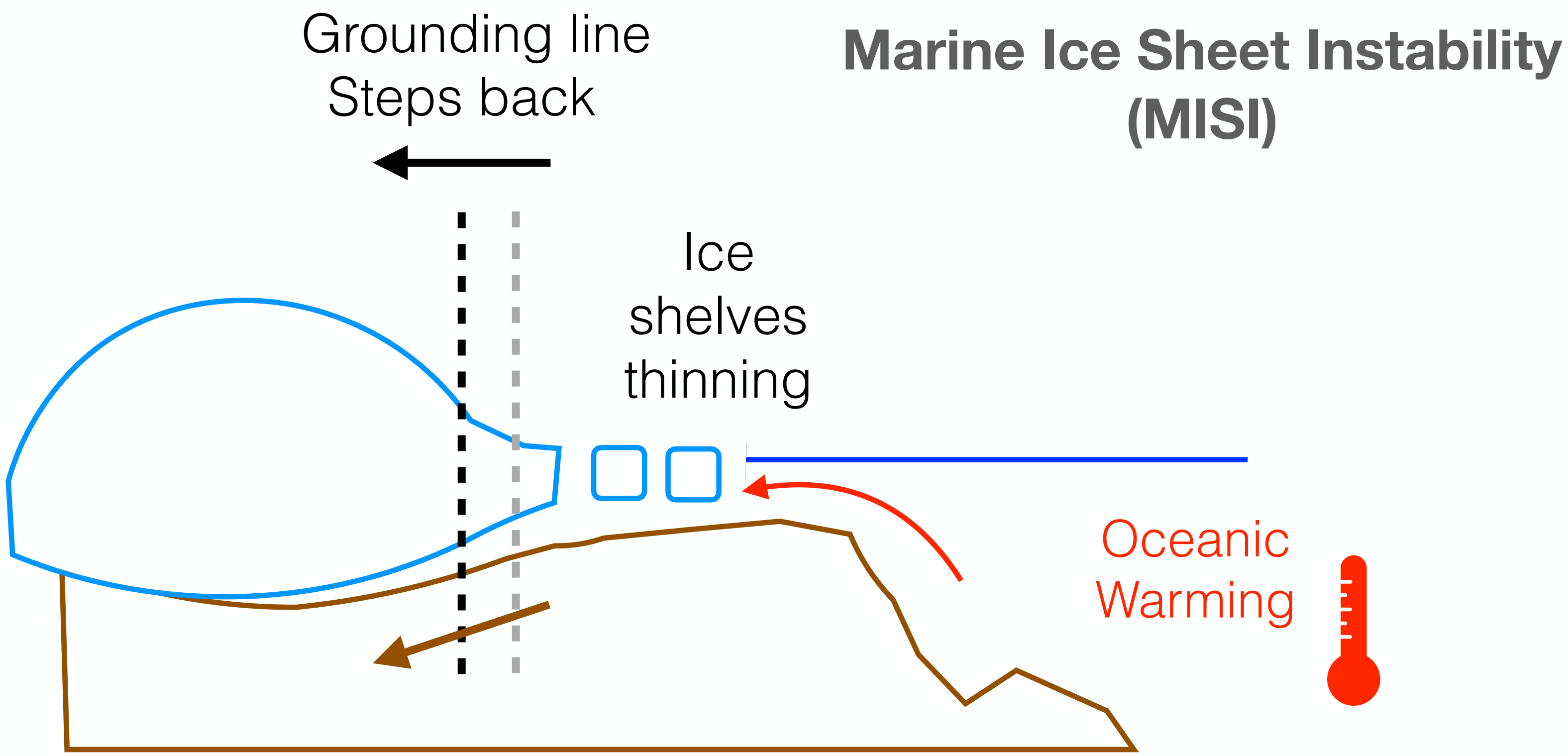
Antarctic Ice Sheet Instabilities

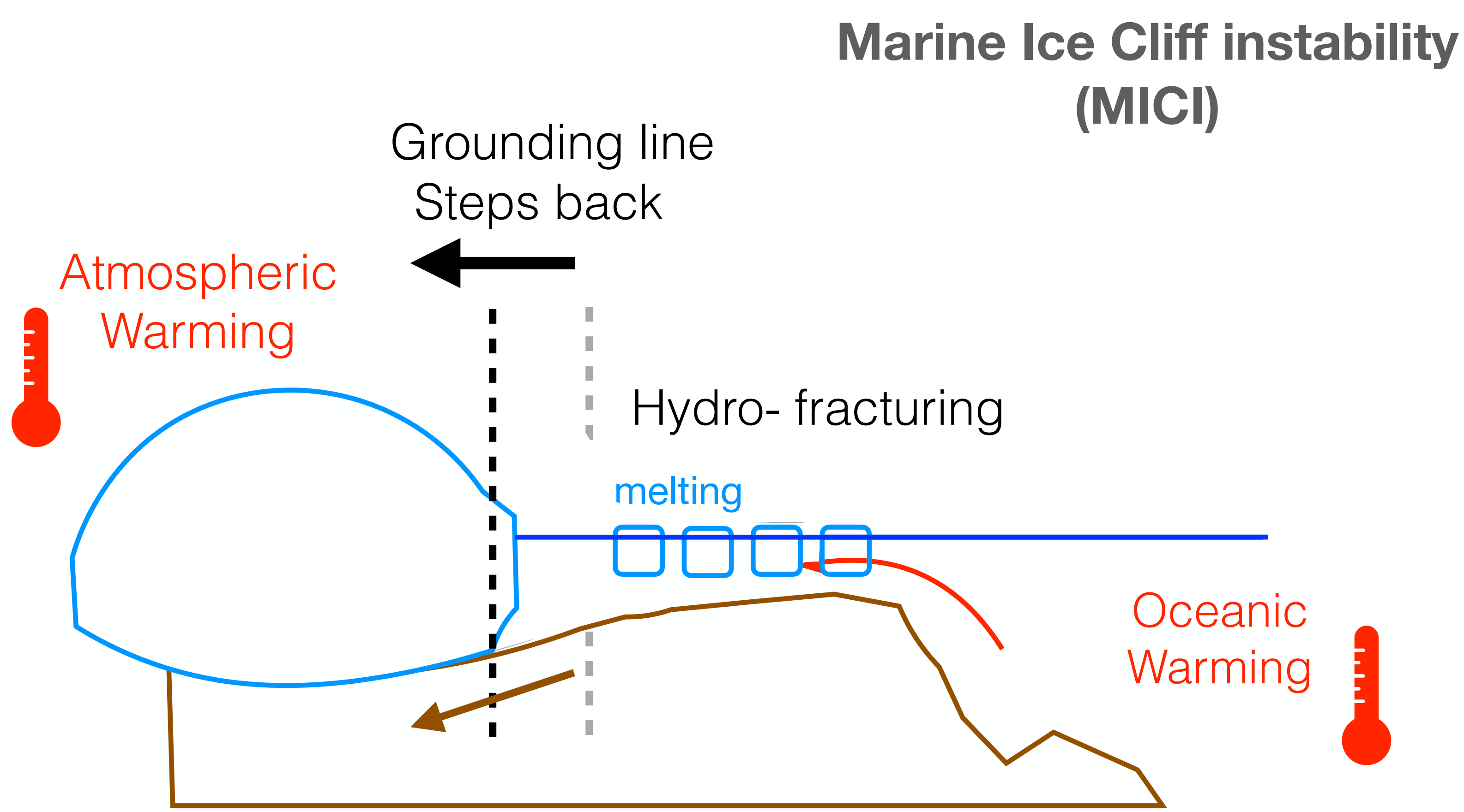
Marine Ice Sheet Instability (MISI)





Antarctic Ice Sheet Instabilities

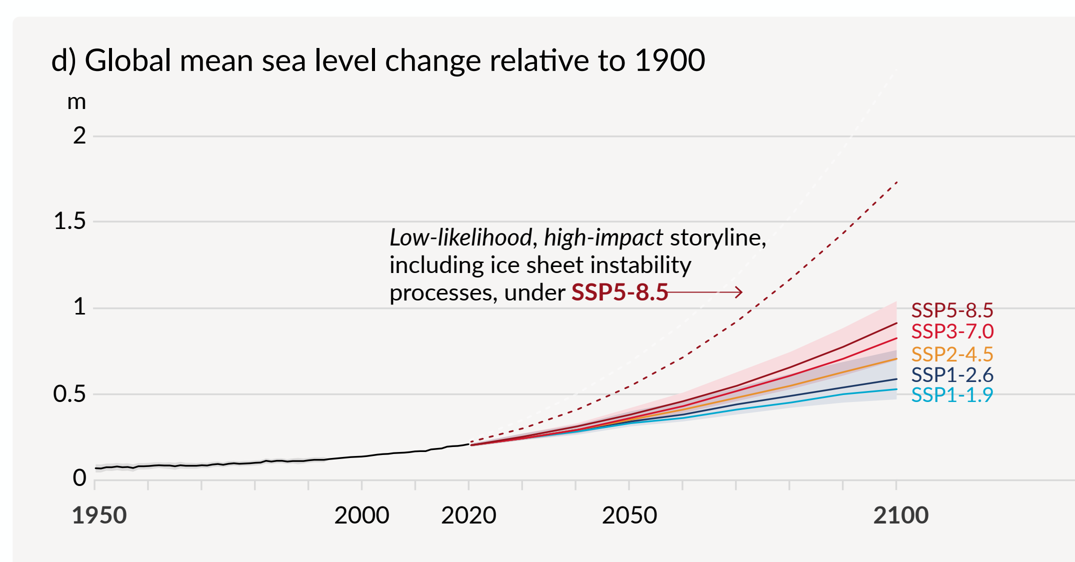




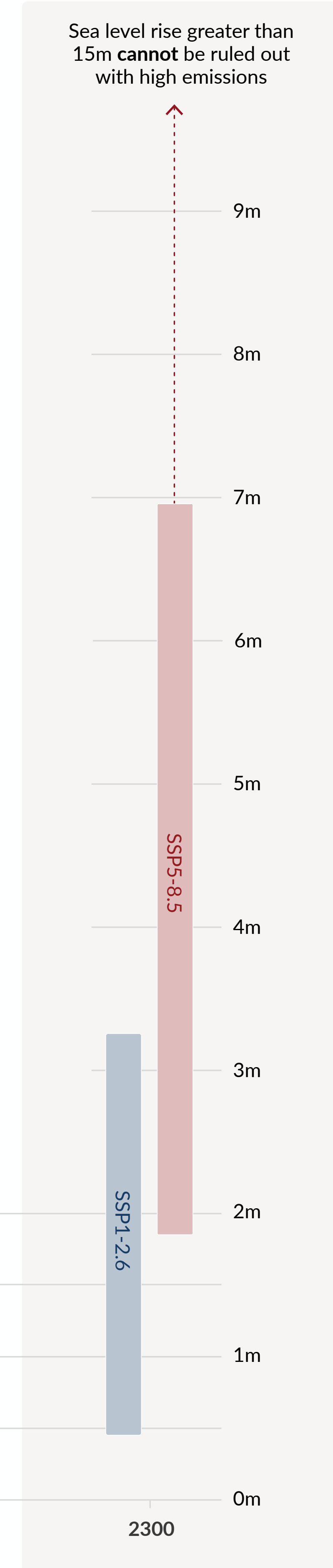
It does not all stops in 2100…need to look beyond

- The ocean traps heat on the long term
- The ice traps heat on the long term

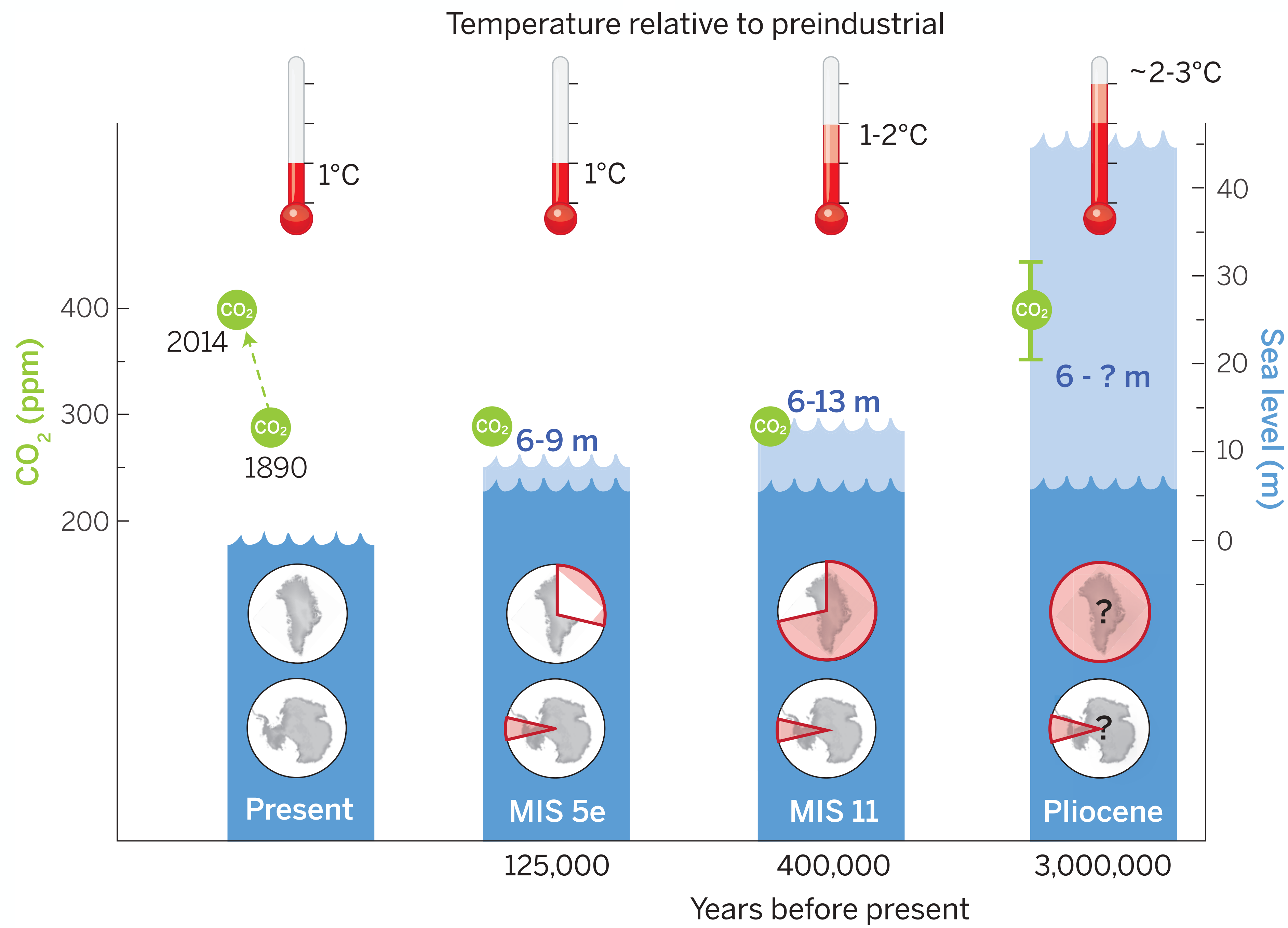
**Long-term projections
Allows us to understand
The real impact of our
environmental policies**



e) Global mean sea level change in 2300 relative to 1900



Are sea level projections science fiction?



Thanks to paleoclimatic reconstructions

Dutton et al. (2015)

Impact of sea level rise

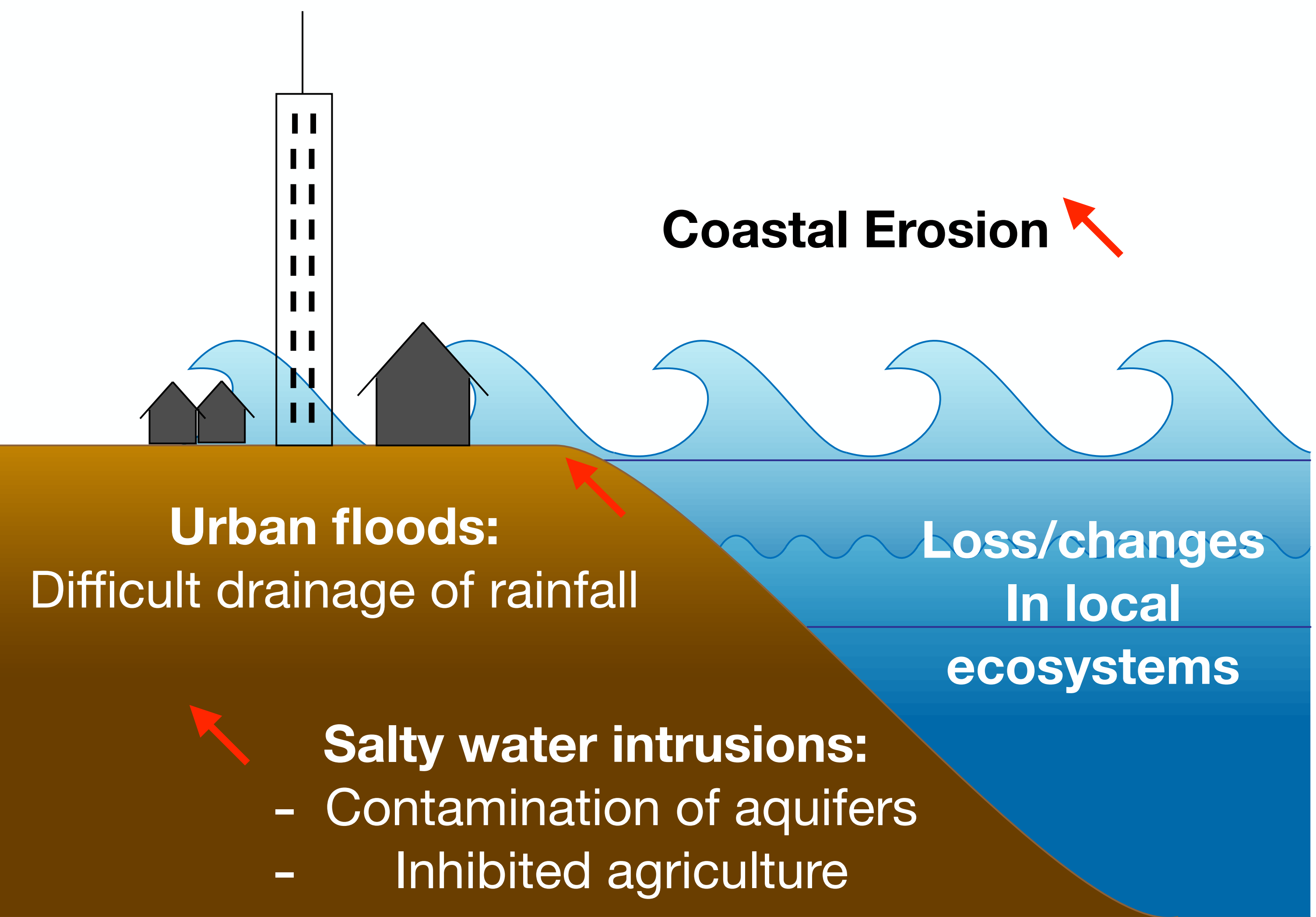
Low coastal areas

Delta

Floodings due to
Strom or high tides:
More frequent
Permanently flooded areas

Extreme events:

+intense +frequent

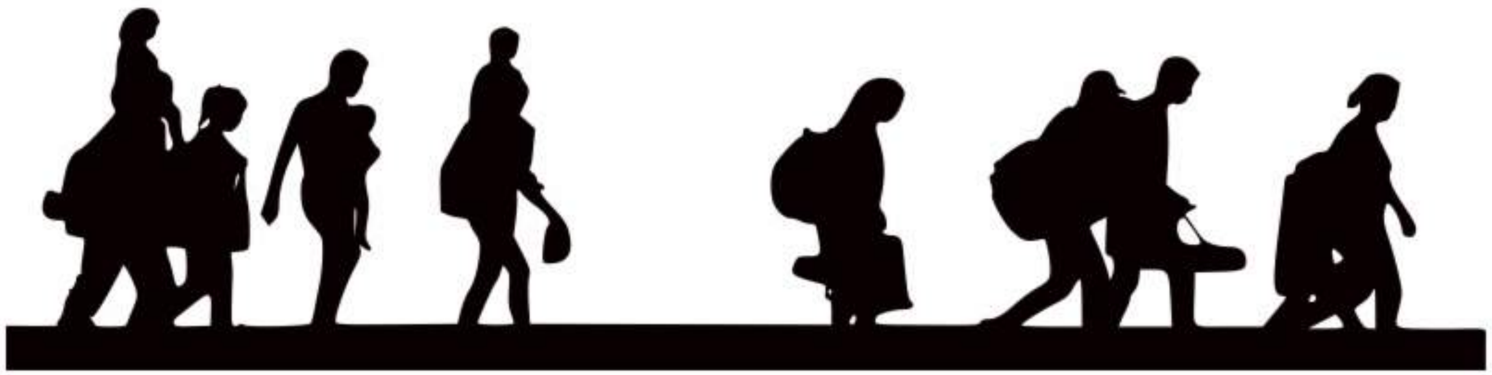


High tide

Low tide

Source: IPCC, SROCC, sept. 2019

Impact of sea level rise



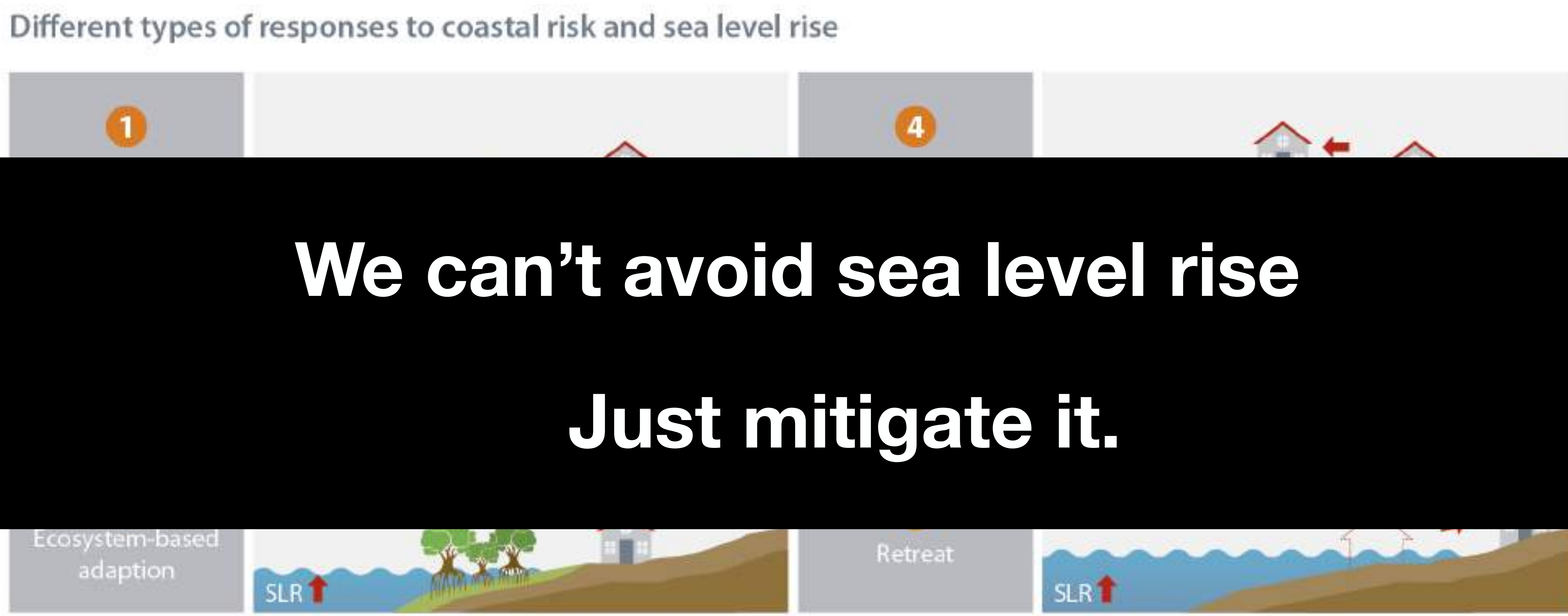
Human migrations

Green & blu economies

We need to adapt

Source: IPCC (2019) - SROCC

We need to adapt



We can’t avoid sea level rise

Just mitigate it.

Source: IPCC (2019) - SROCC