CAP FLAGSHIP: REGIONAL SEA LEVEL RISE

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*"Beyond 2100, sea level will **continue to rise for centuries** due to continuing deep ocean heat uptake and mass loss of the GIS and AIS and will **remain elevated for thousands of years** (high confidence)." (IPCC AR6)*

IPCC AR6

"extreme sea levels that occurred *once per century* in the recent past *will occur annually or more frequently* at about 19–31% of tide gauges by 2050 and at about 60% (SSP1-2.6) to 82% (SSP5-8.5) of tide gauges by 2100 (medium confidence)." (IPCC AR6)
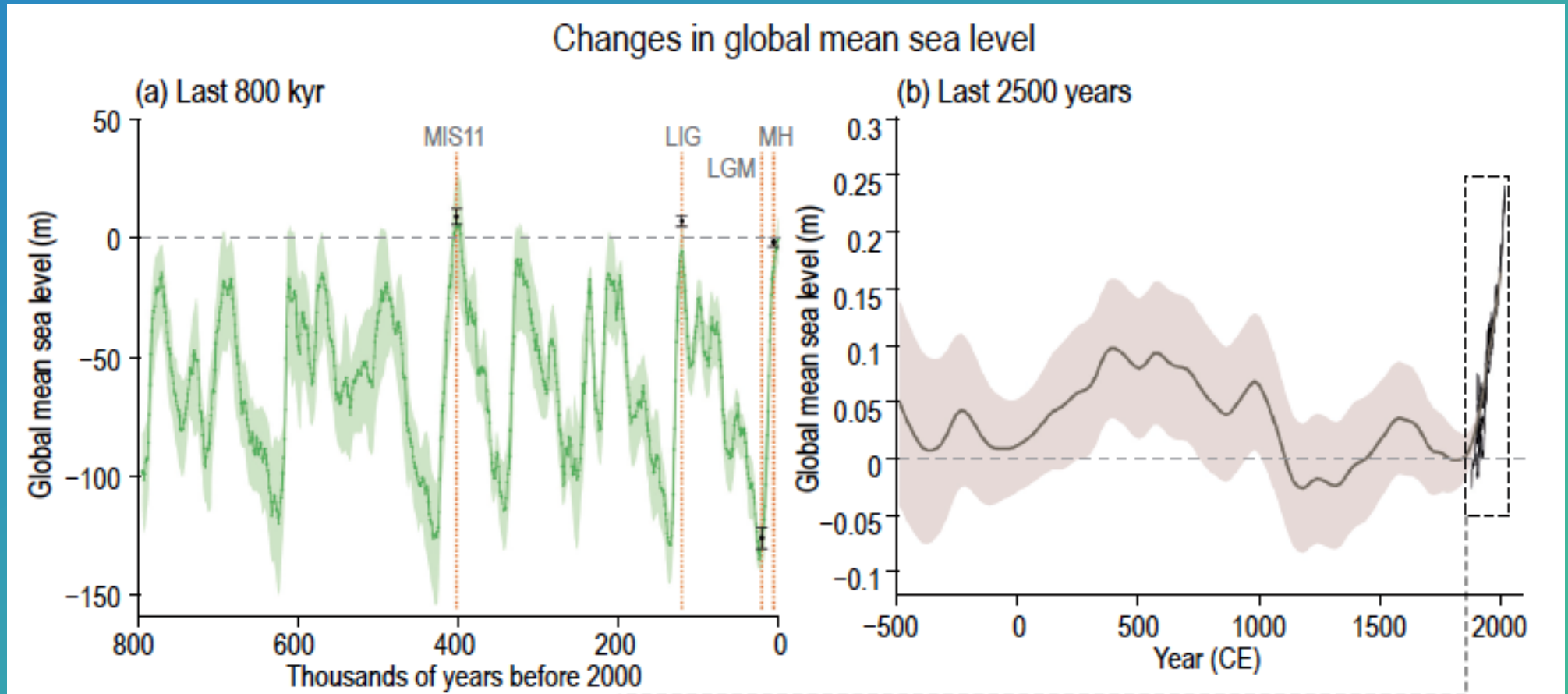
IPCC AR6

GLOBAL SEA LEVEL

Historical records

Changes in global mean sea level

(a) Last 800 kyr

(b) Last 2500 years

IPCC AR6

Sea level rise components

Increase volume (but not mass)

Increase mass

Heating

Freshening

Ice sheet melt

Icons source: Flaticon.com

Sea level rise components

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Projections

Sea level has risen faster in the recent years · The scenario does not matter too much · The scenario matters a lot

SSP5-8.5 · SSP1-2.6 · Global sea level rise (cm)
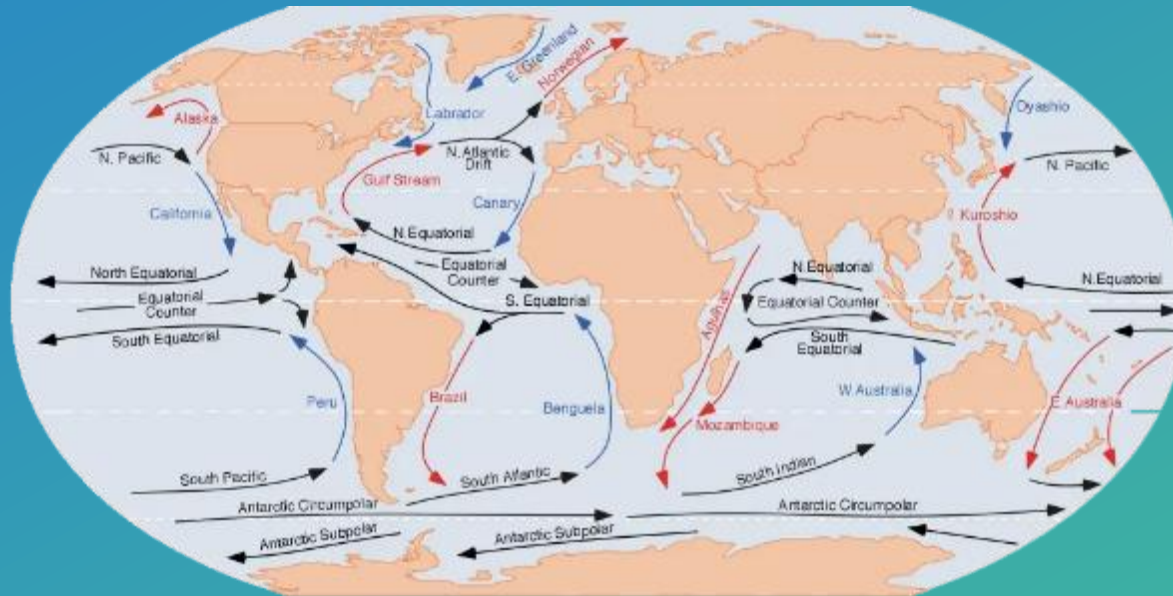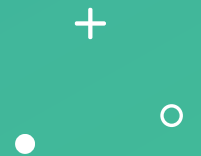
IPCC AR6
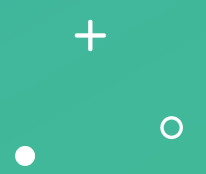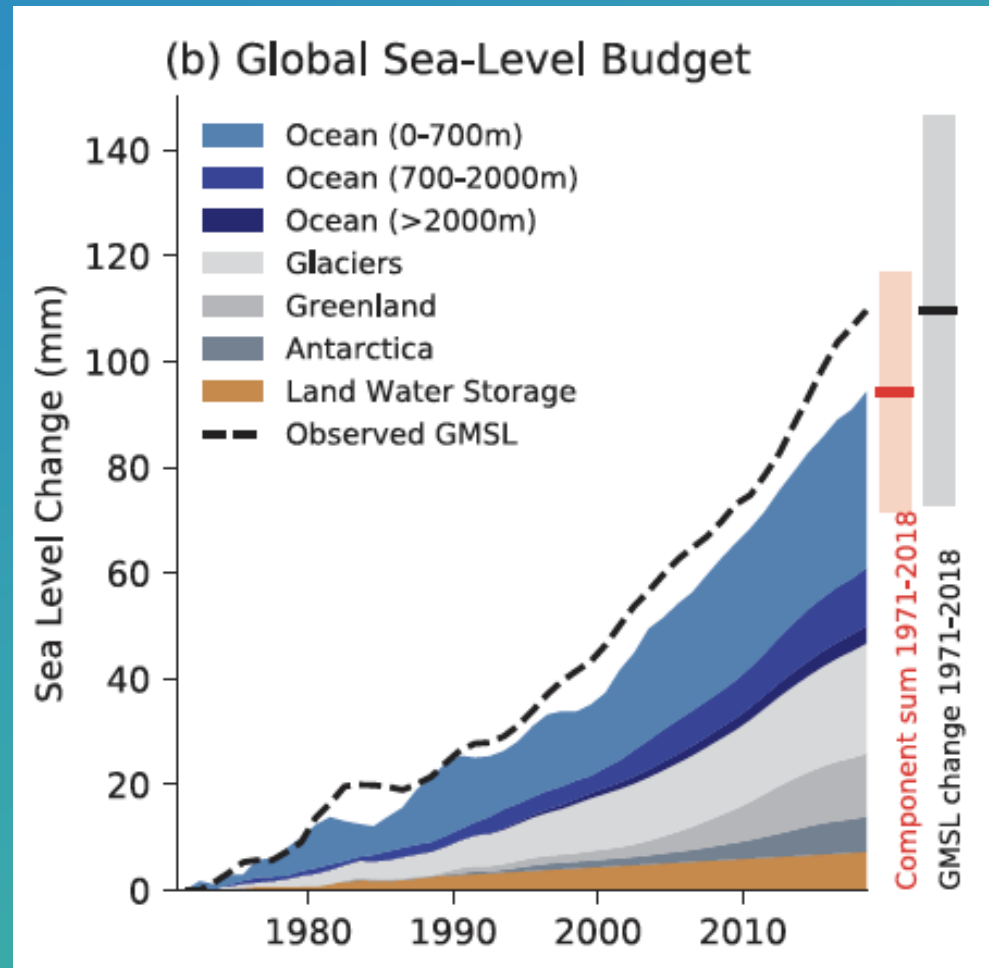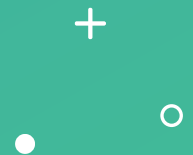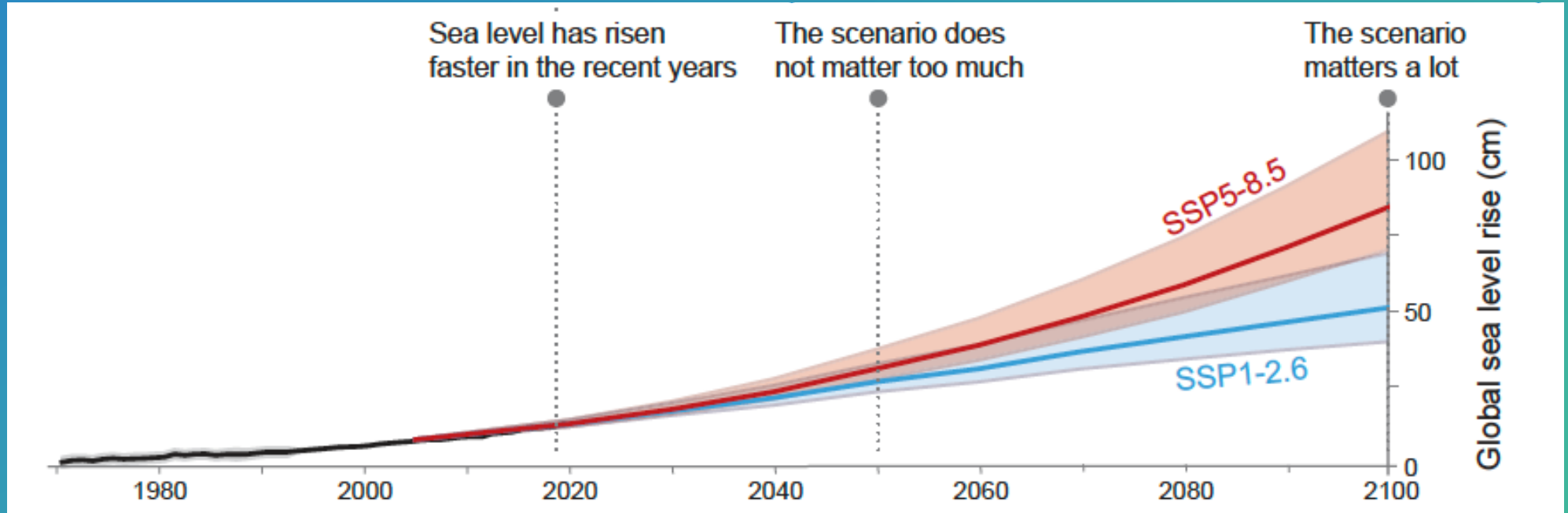
LARGE-SCALE PATTERNS

Sea level rise patterns
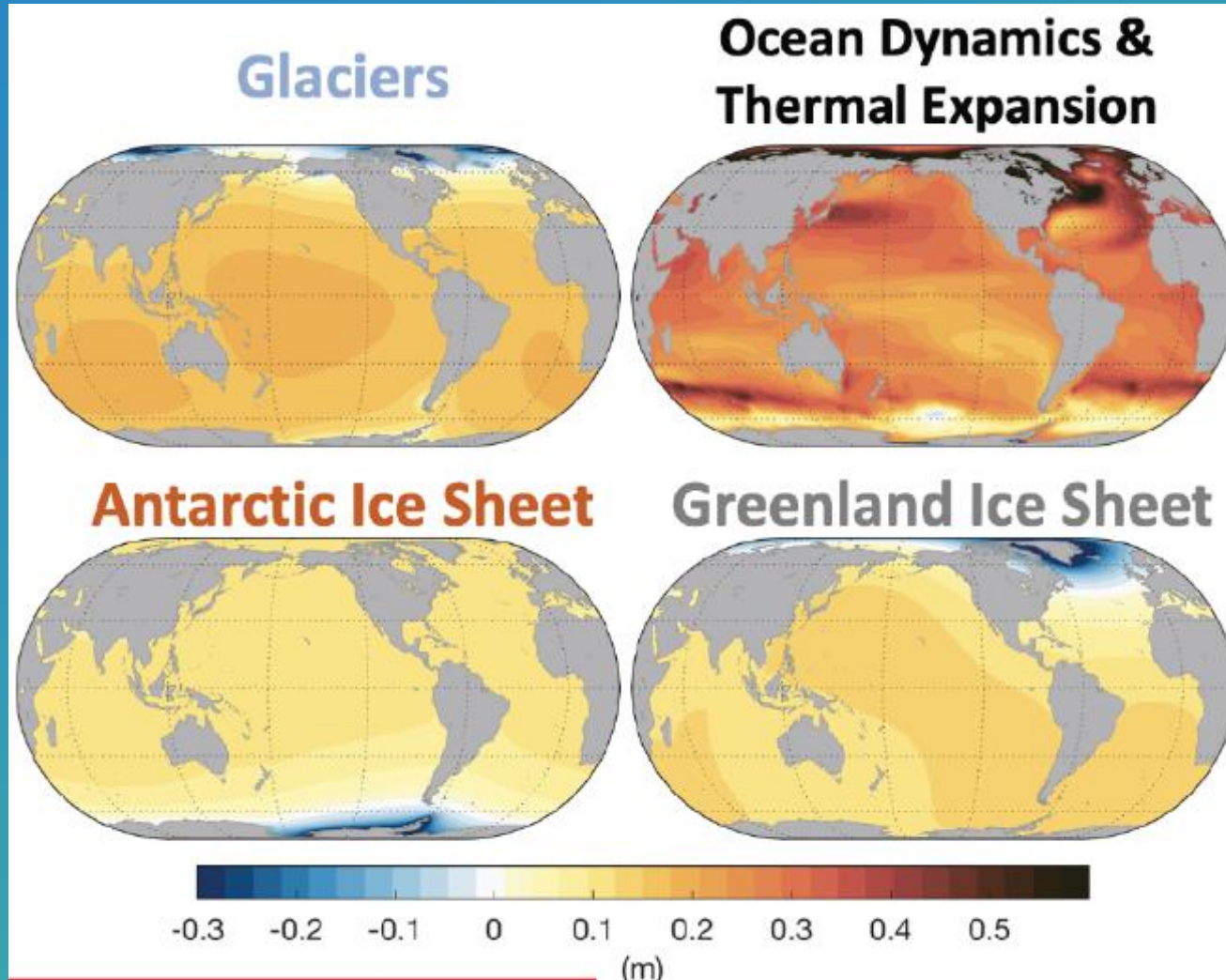
- Projections for 2100 compared to 1995-2014 period

- High emission scenario (other scenarios have same patterns but lower amplitude)

IPCC AR6

Global ocean circulation patterns

Wind-driven circulation: Ocean gyres

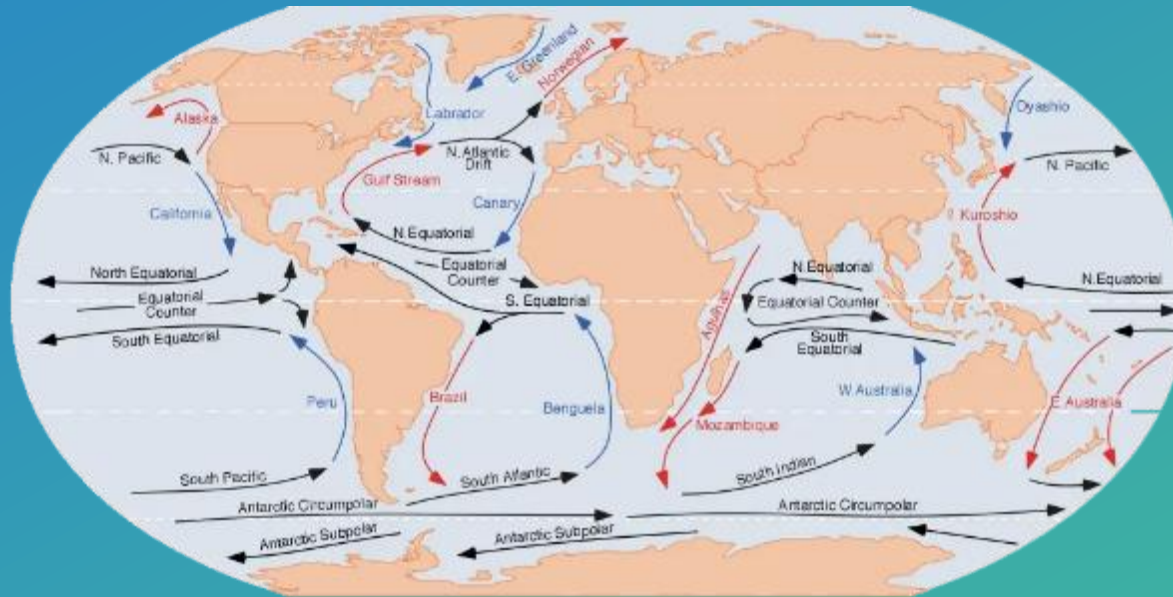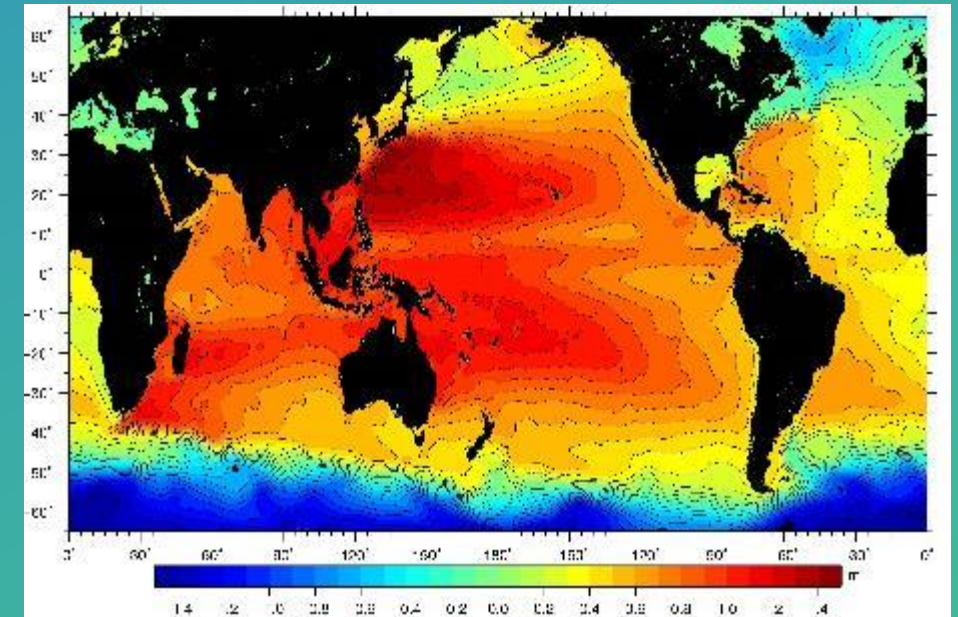Ocean currents

Global ocean circulation patterns
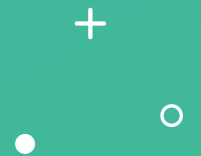
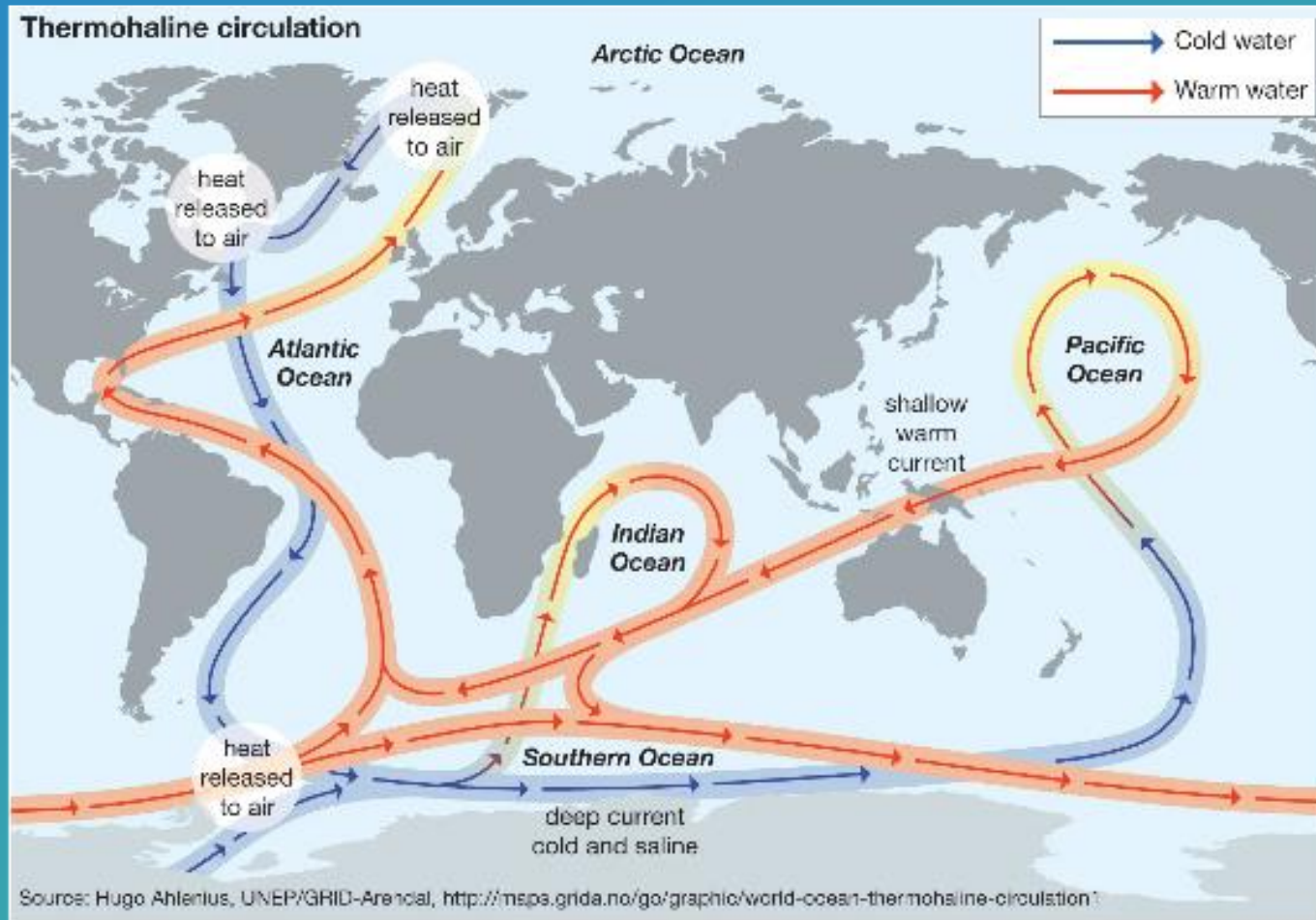## Wind-driven circulation: Ocean gyres

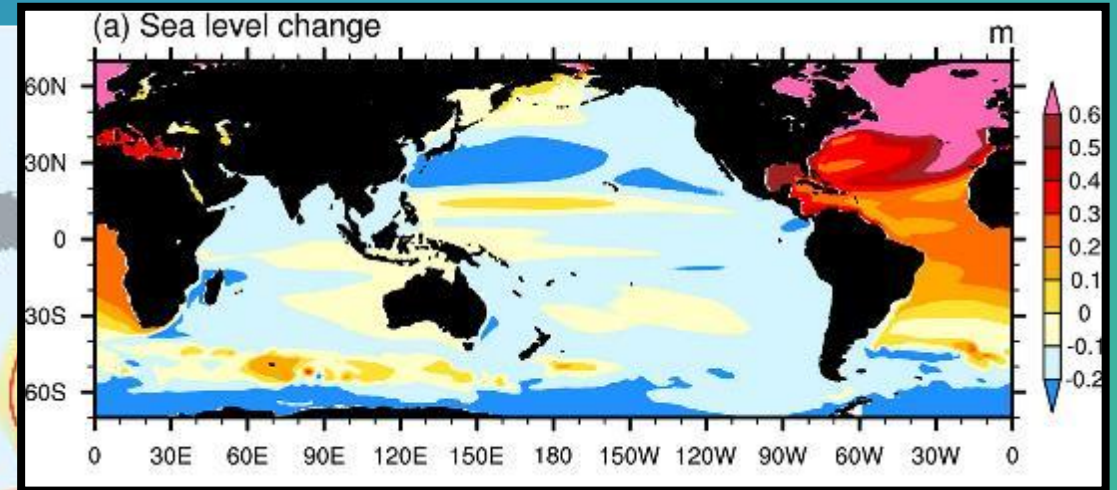

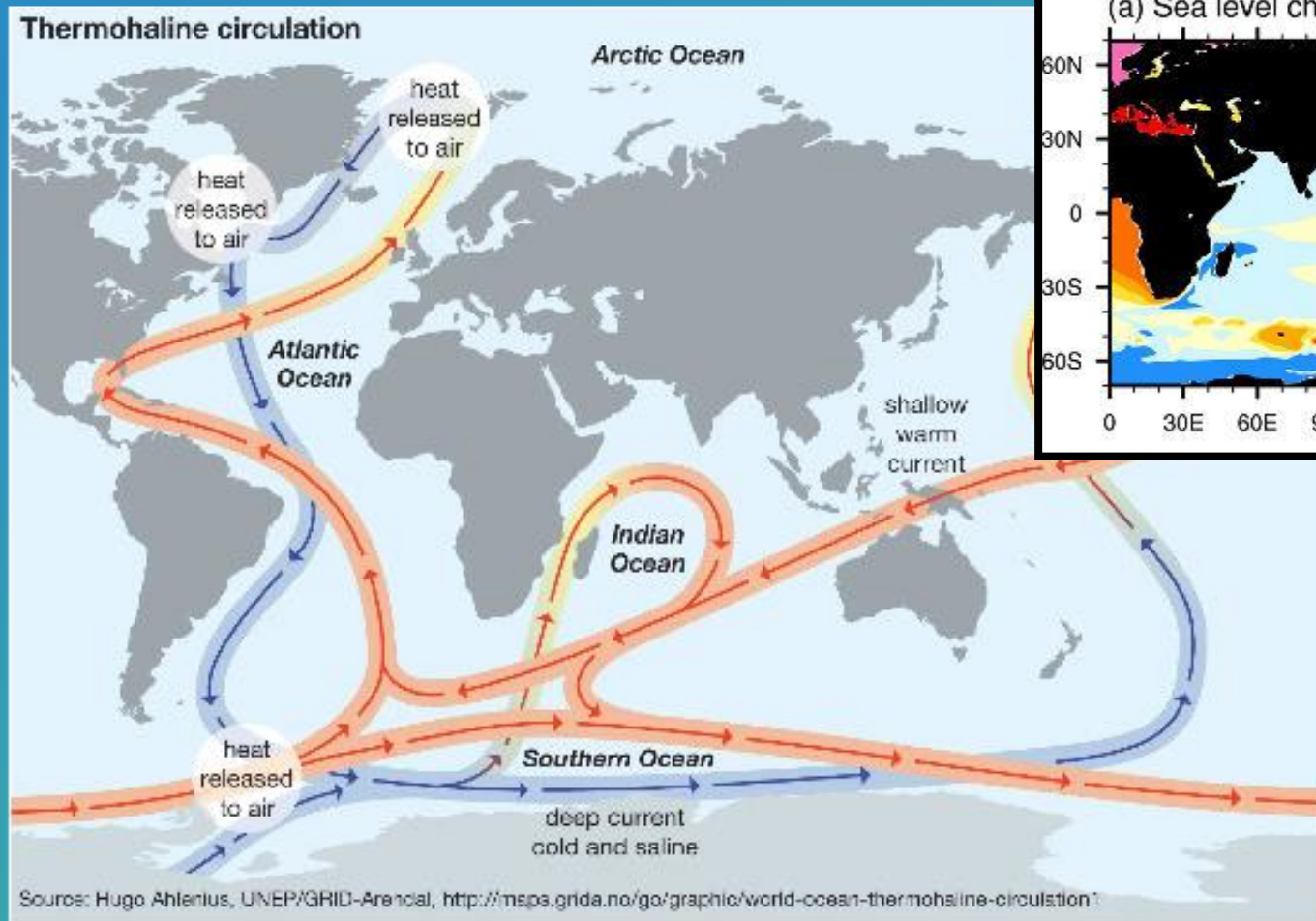Ocean currents

Sea surface height

Global ocean circulation patterns

Thermohaline circulation

Global ocean circulation patterns

Thermohaline circulation

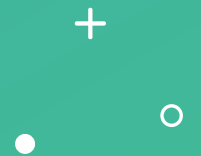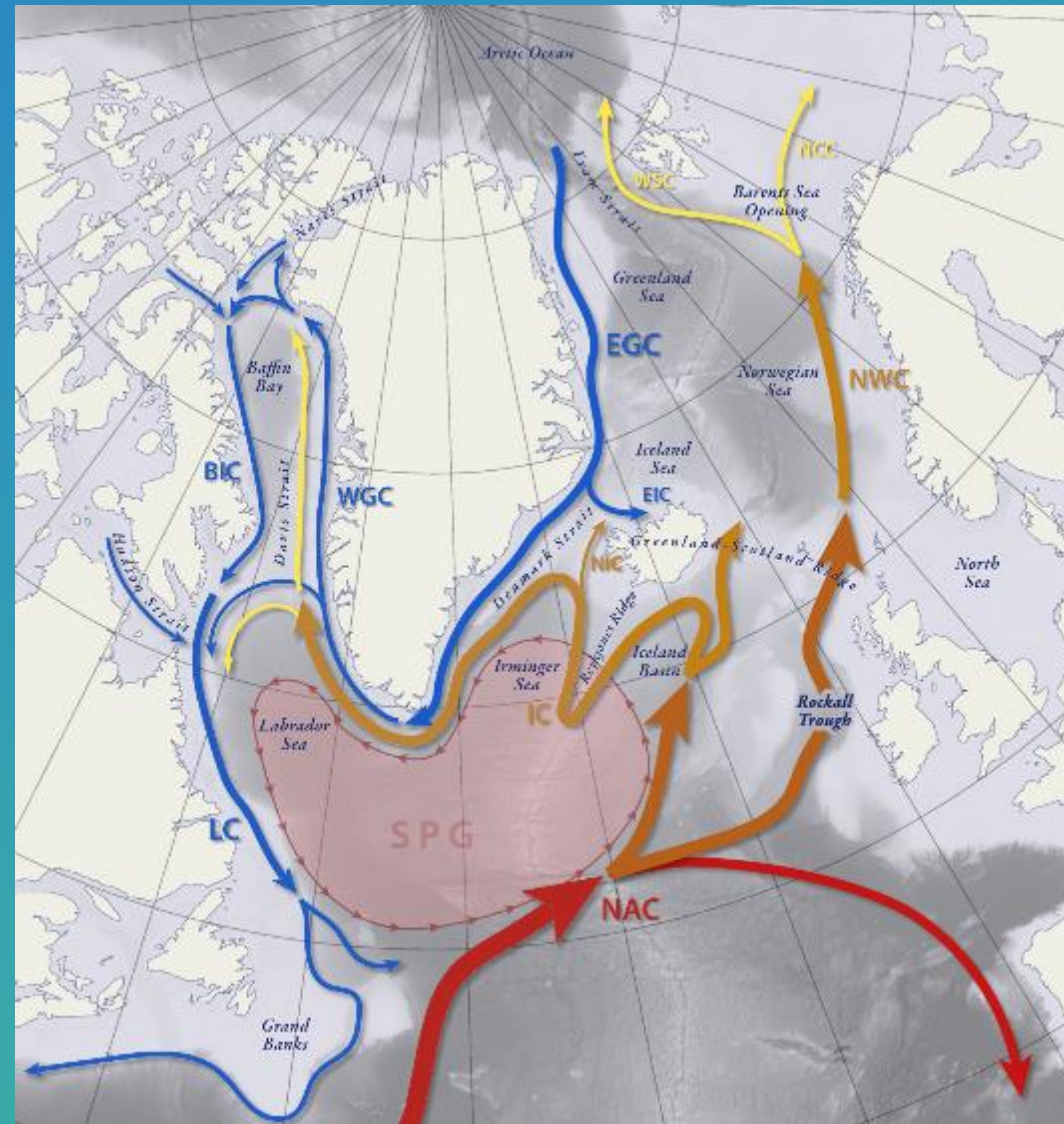- Sea level response to hosing in coarse resolution climate model
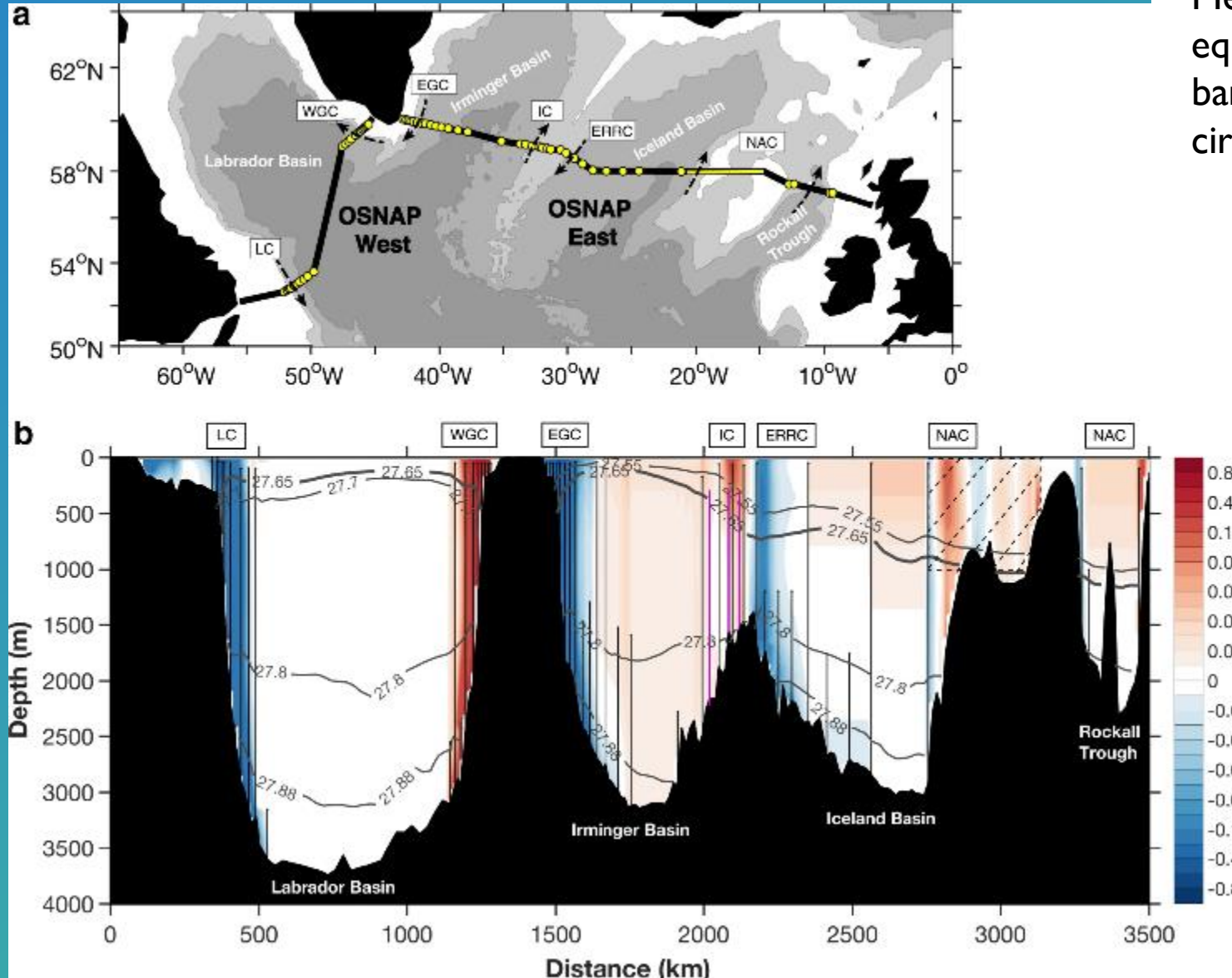
Chen *et al.* 2018, GRL

FROM THE OCEAN TO THE CONTINENTAL SHELF

Ocean-shelf boundary

Ocean-shelf boundary
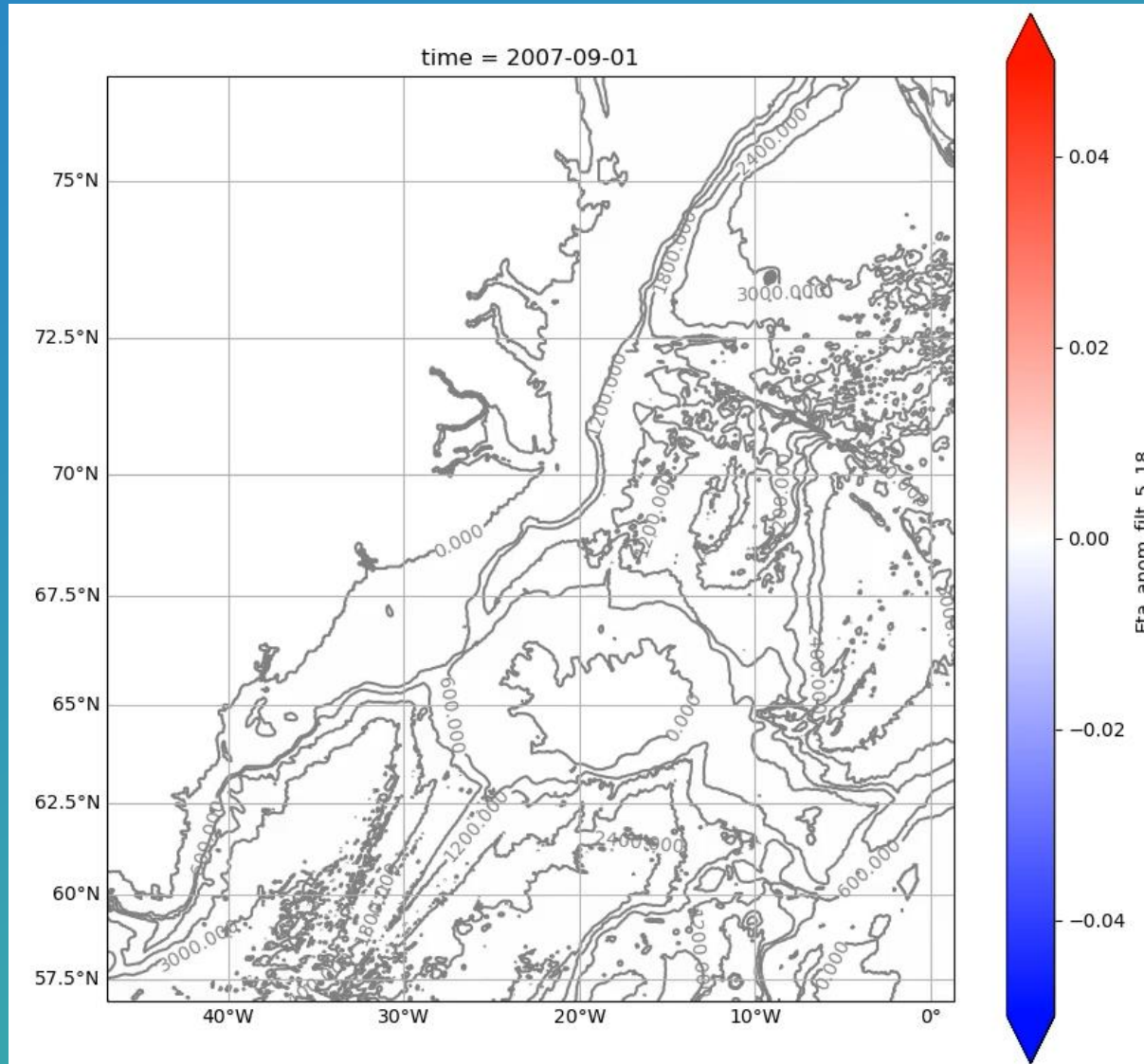

Mean flow is *along* contours of equal depth → shelf break acts as barrier (need secondary circulation)

Image credit: Li *et al.* 2021

Coastal trapped waves
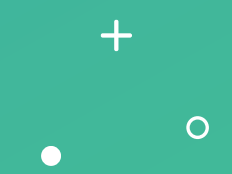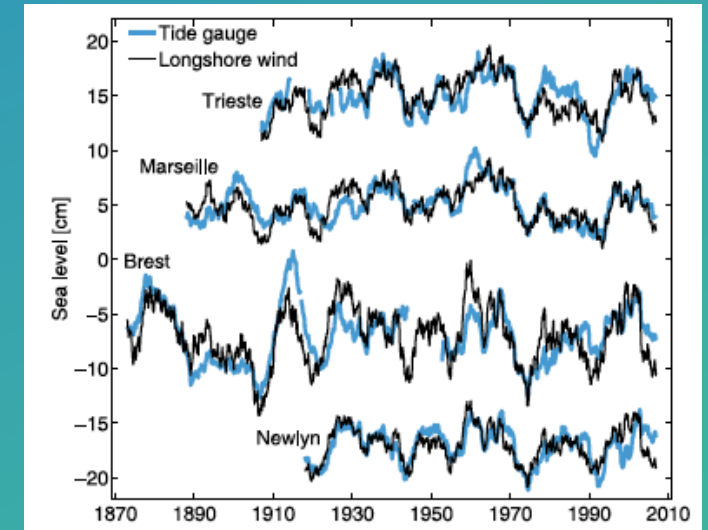
Above: Calafat *et al.* 2012
Left: Gelderloos *et al.* 2021
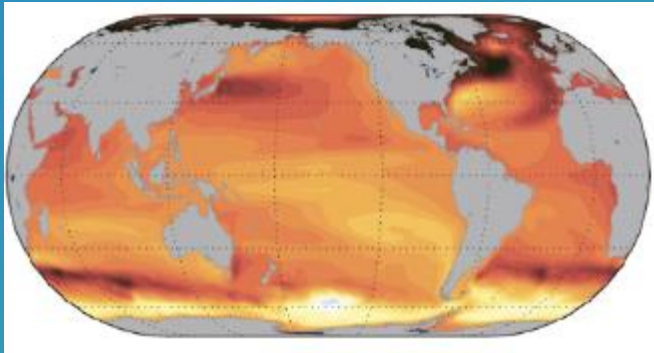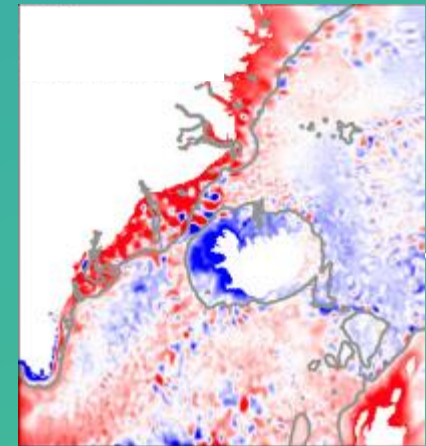
WRAP UP

Main points

- Global sea level rises, and we understand why and by how much

Sea level rise varies regionally, largely due to ocean circulation

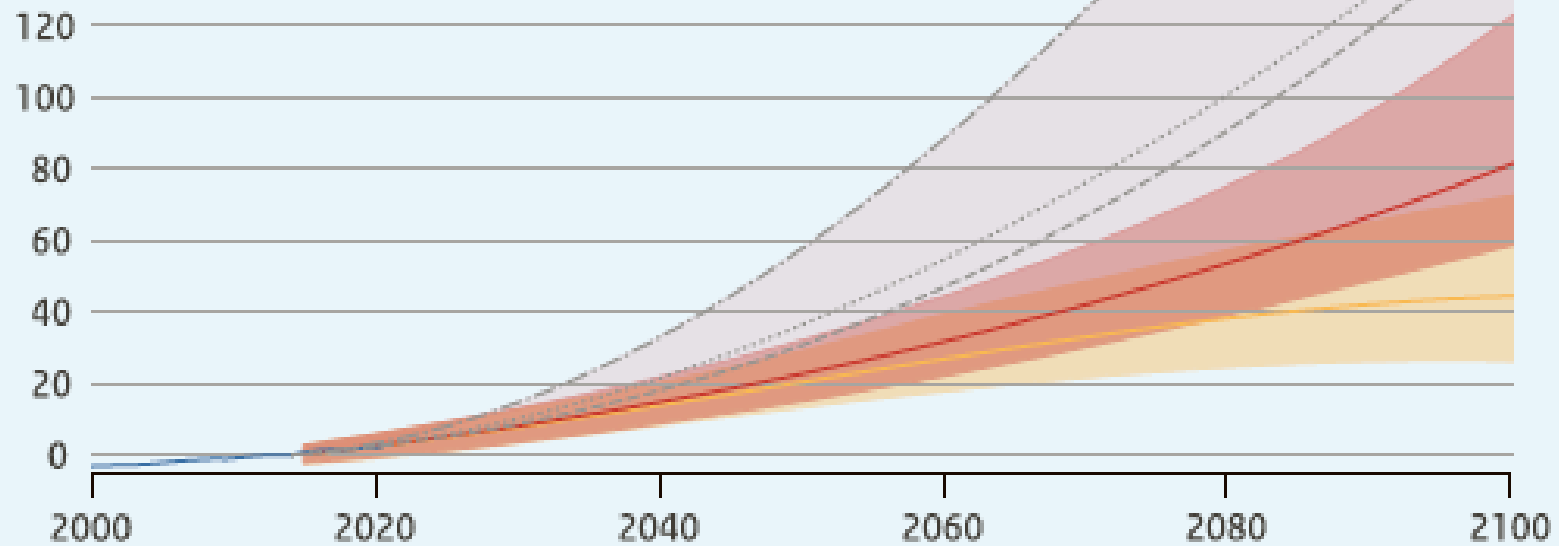Deep ocean sea level rise ≠ sea level rise on the continental shelf

BACKUP SLIDES

Projections for the Netherlands

KNMI Klimaatscenario's 2023

Impact of model resolution

Standard deviation of Sea Surface Height

Observed | OMIP (high-resolution; 3 models) | OMIP (low-resolution; 3 models)

0   0.1   0.2   0.3   0.4 (m)

IPCC AR6