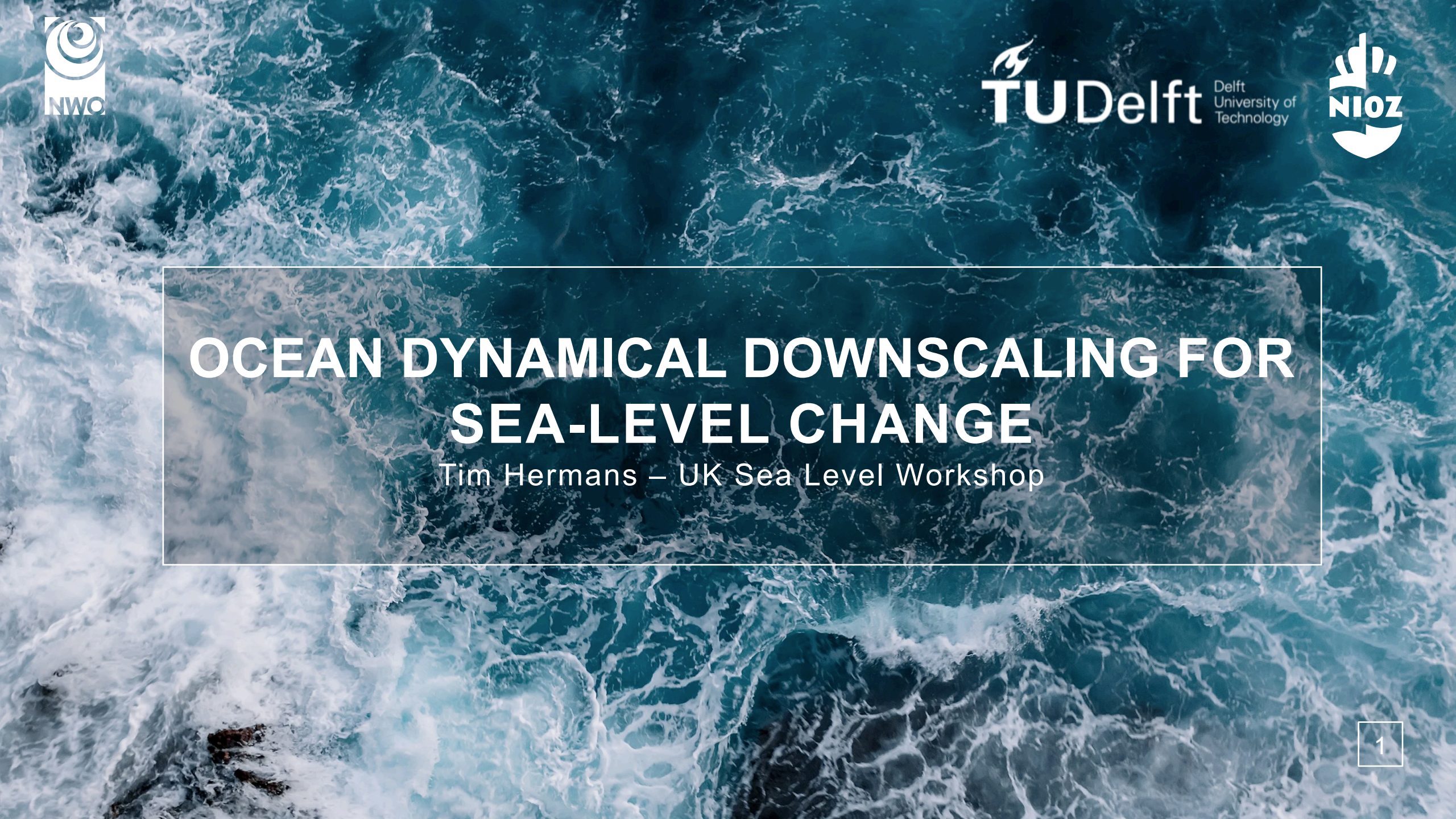


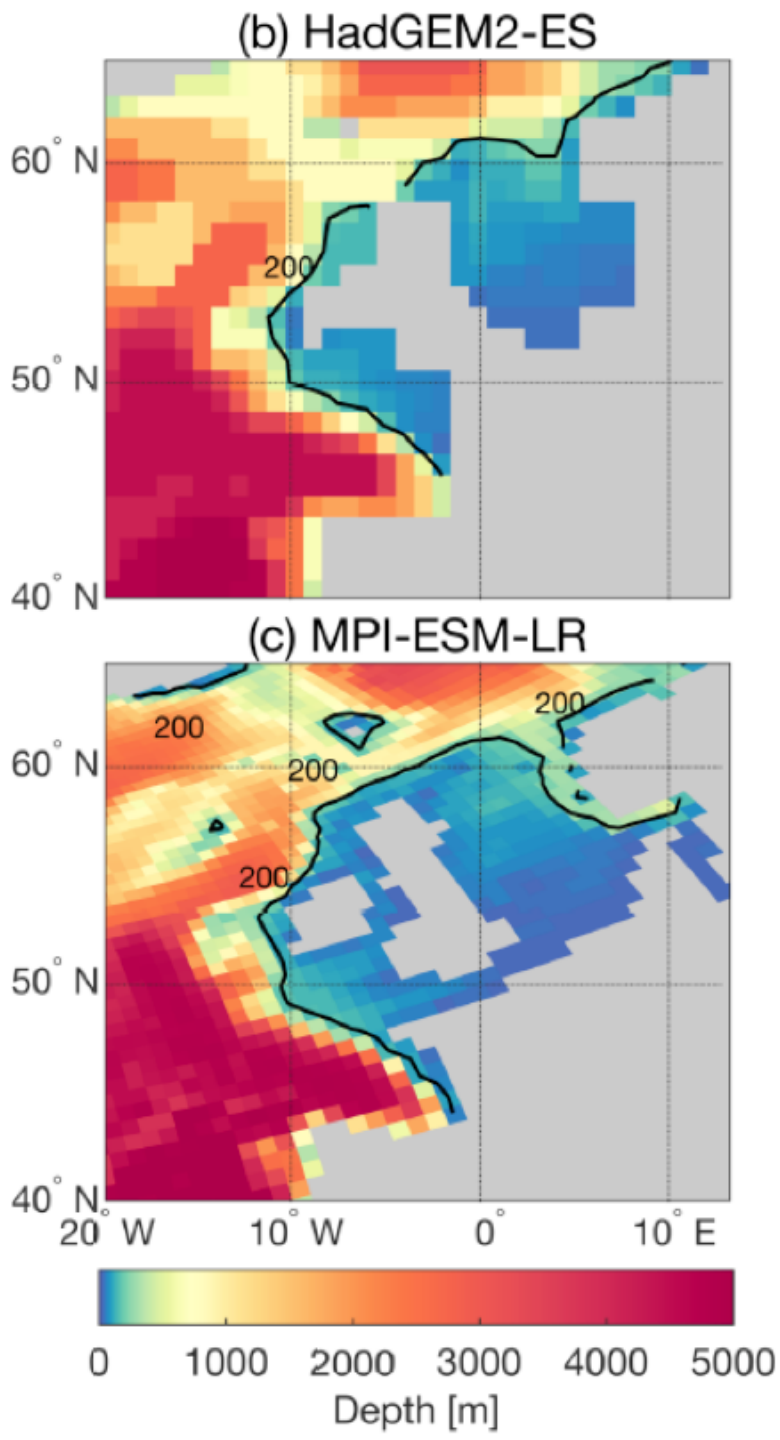
OCEAN DYNAMICAL DOWNSCALING FOR SEA-LEVEL CHANGE

Tim Hermans – UK Sea Level Workshop

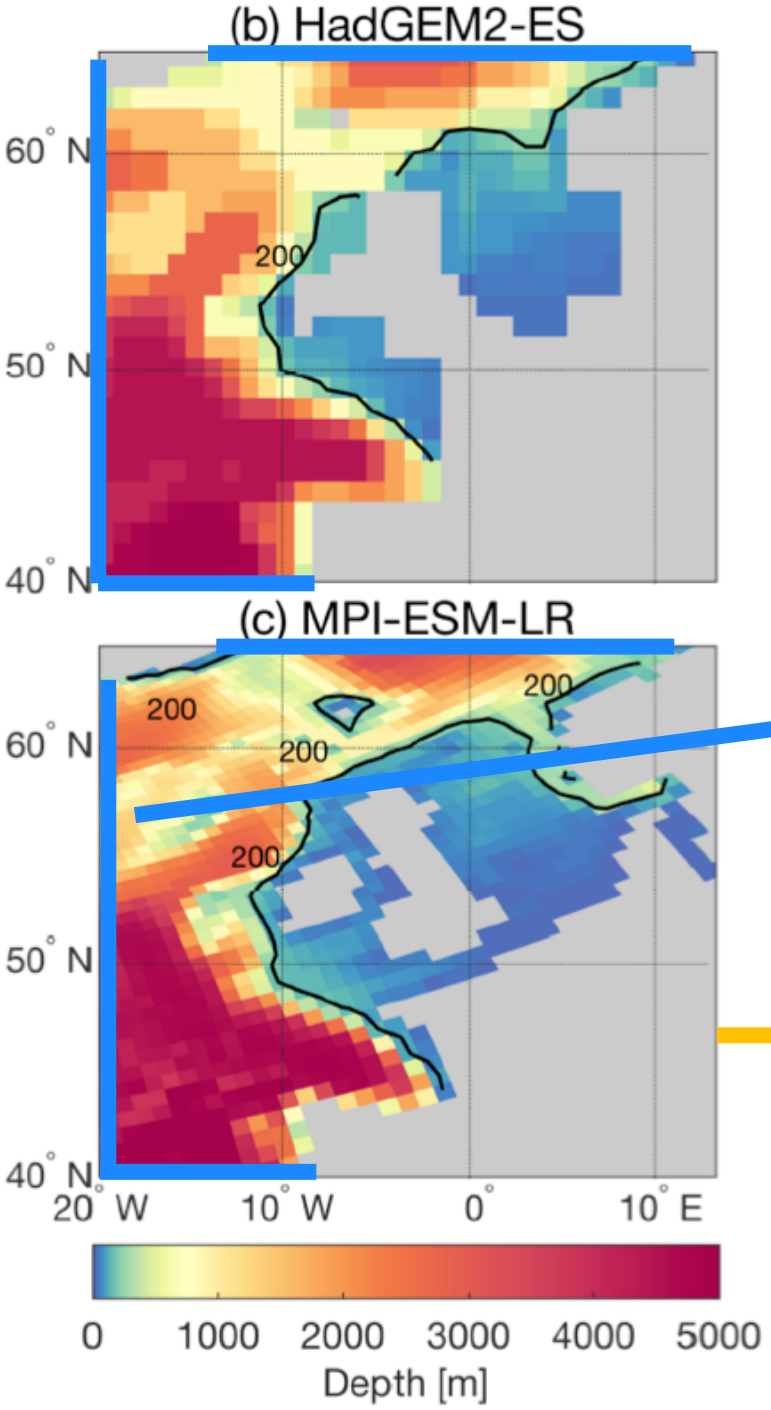
Why dynamical downscaling?

- Global climate models used to project ocean dynamic sea-level change
- Limited horizontal & vertical resolution
- No tides

➔Refine using a regional model



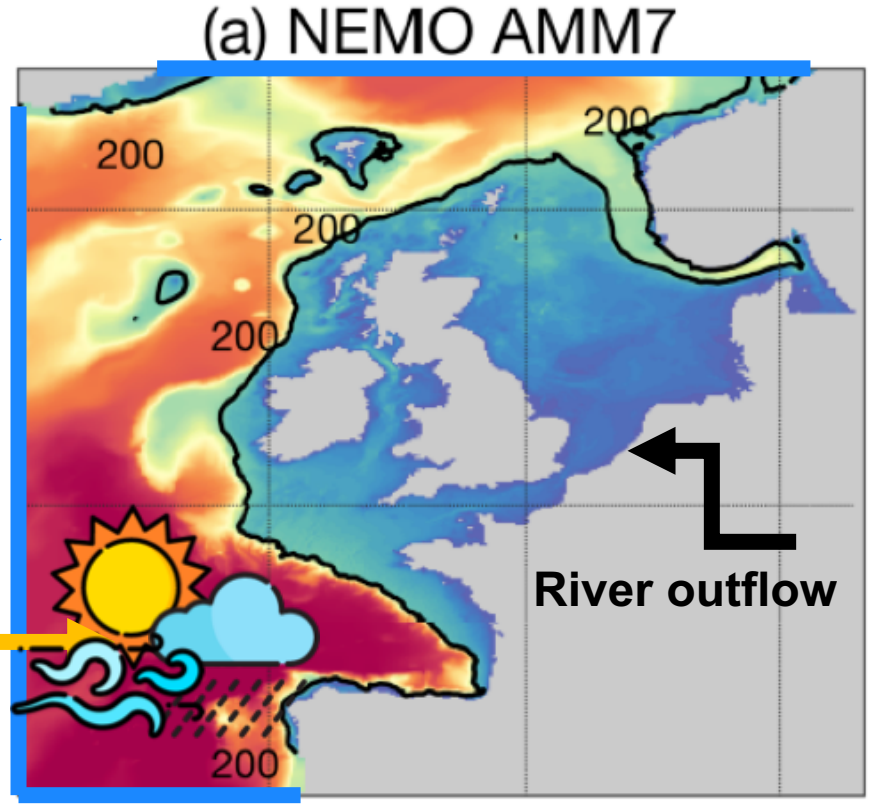
Dynamical downscaling: how it works



Lateral boundary conditions:
-Temperature
-Salinity
-U&V
-SSH (tides)

Atmospheric downscaling

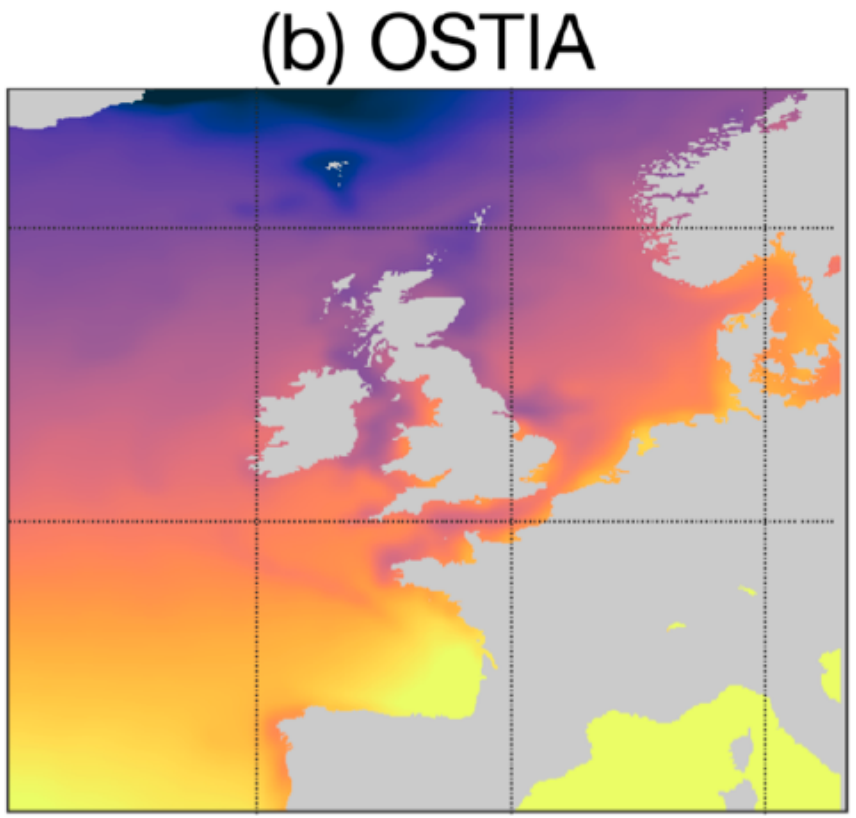
Atmospheric forcing

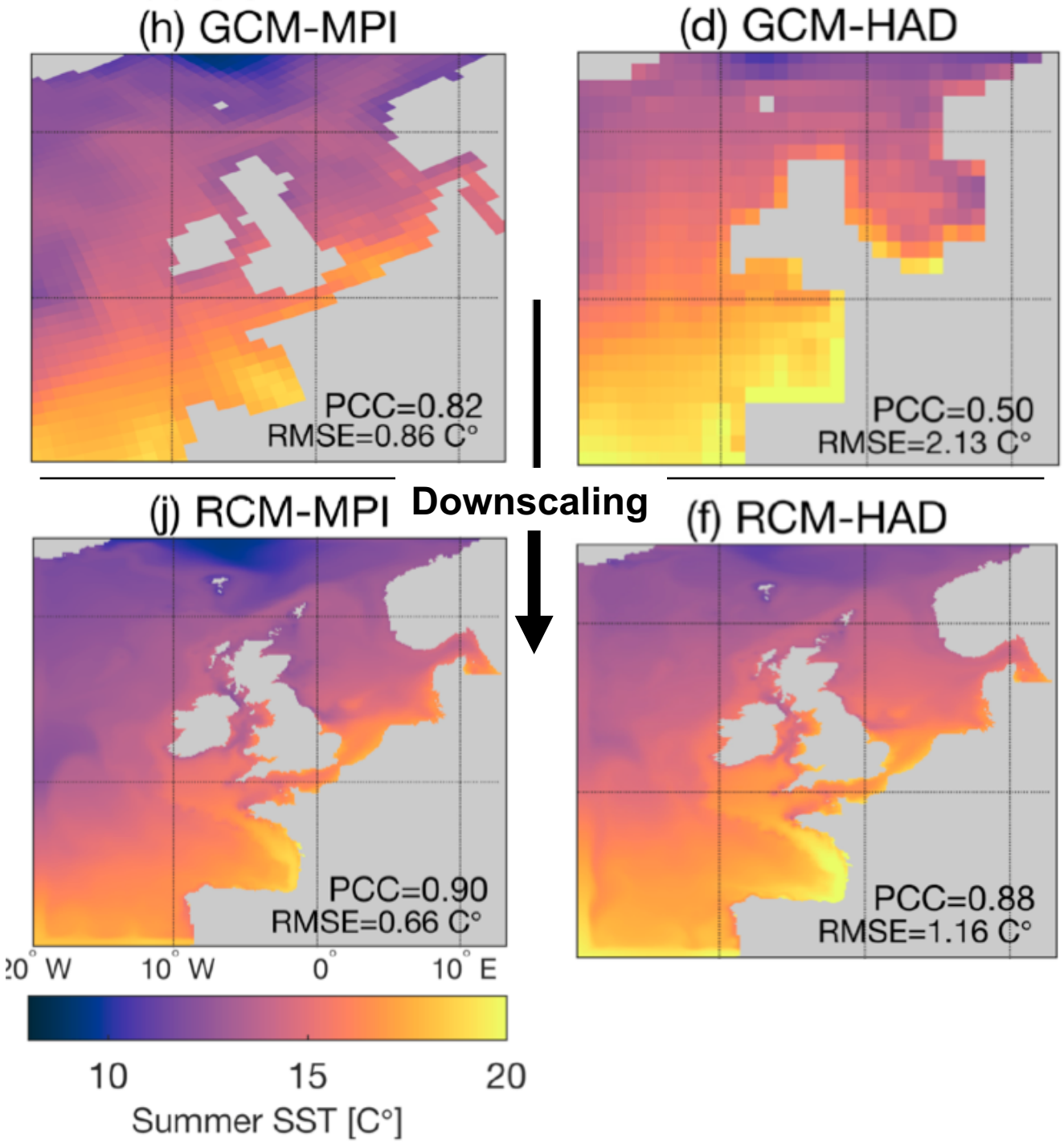


Hermans et al. (2020), Clim. Dyn.

Historical performance

Observations:

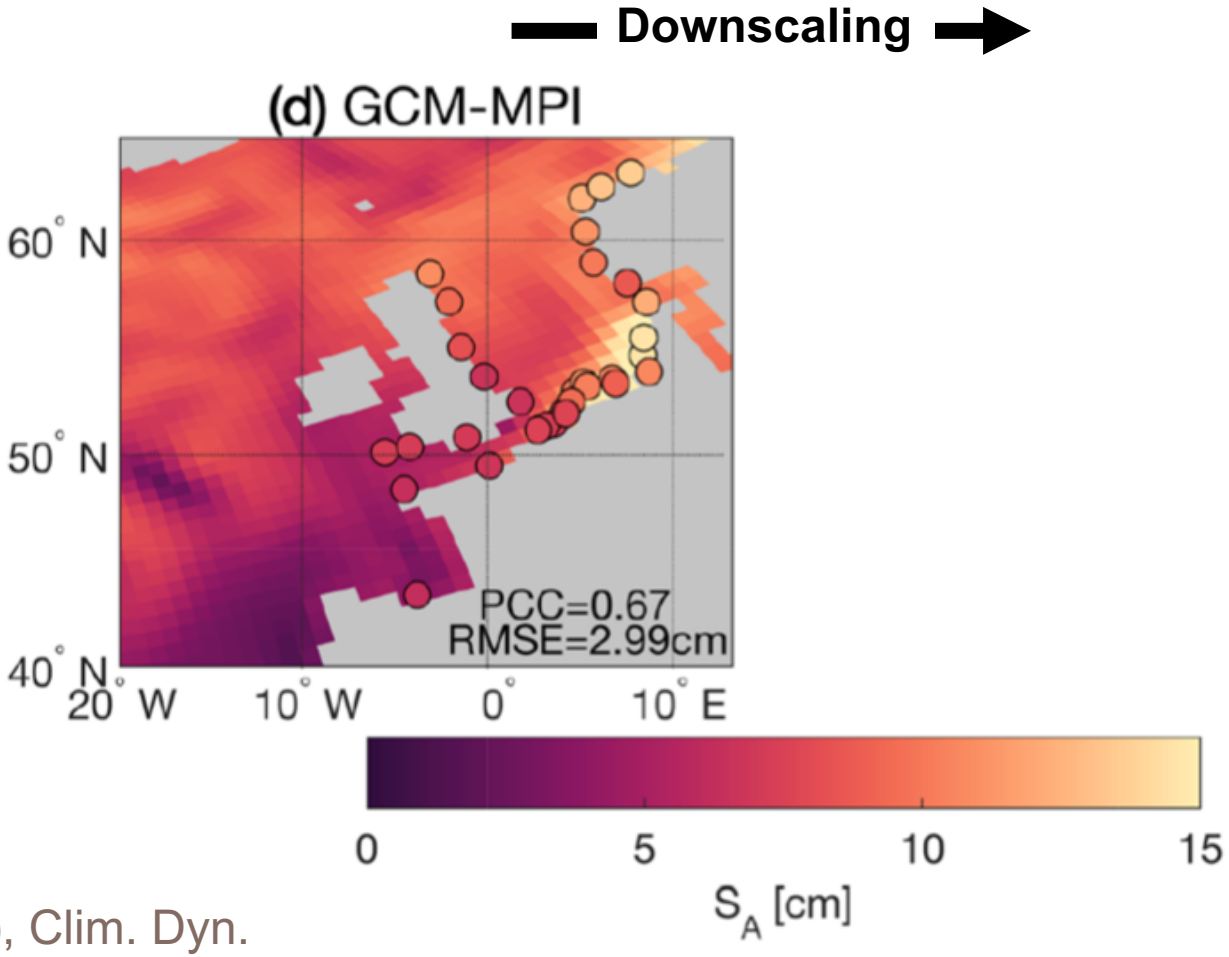




Hermans et al. (2020), Clim. Dyn.

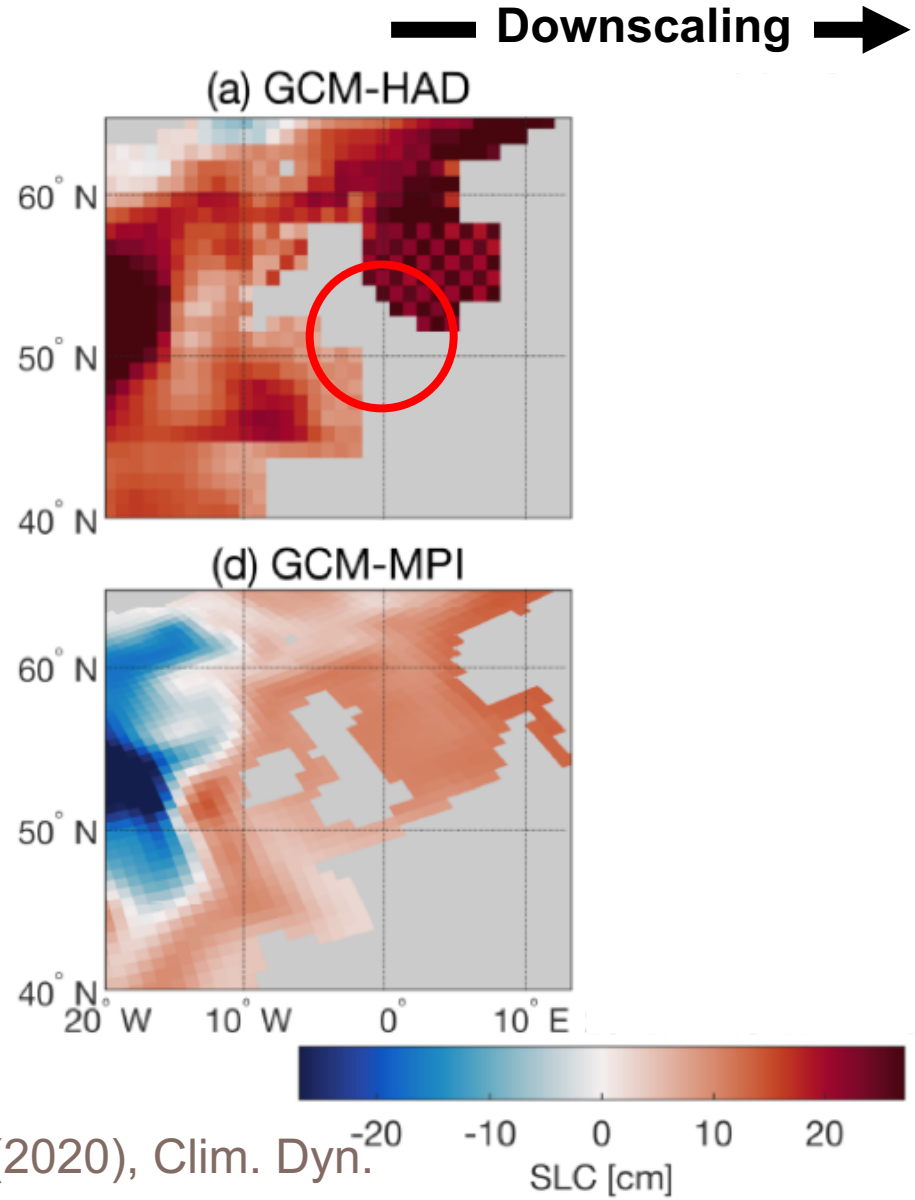
Historical performance

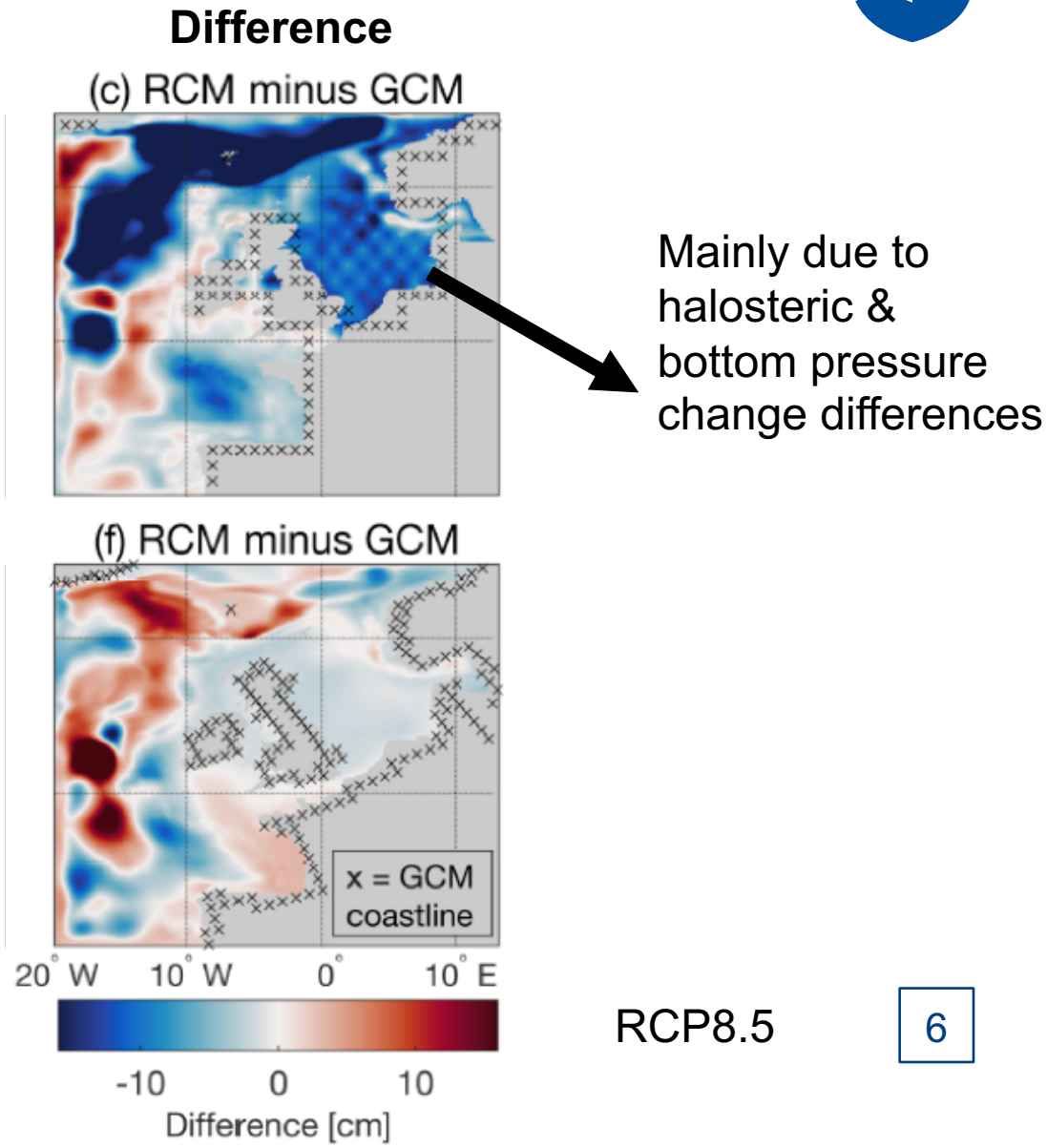
- Amplitude of the seasonal sea-level cycle S_A



Hermans et al. (2020), Clim. Dyn.

Effect on sea-level projections





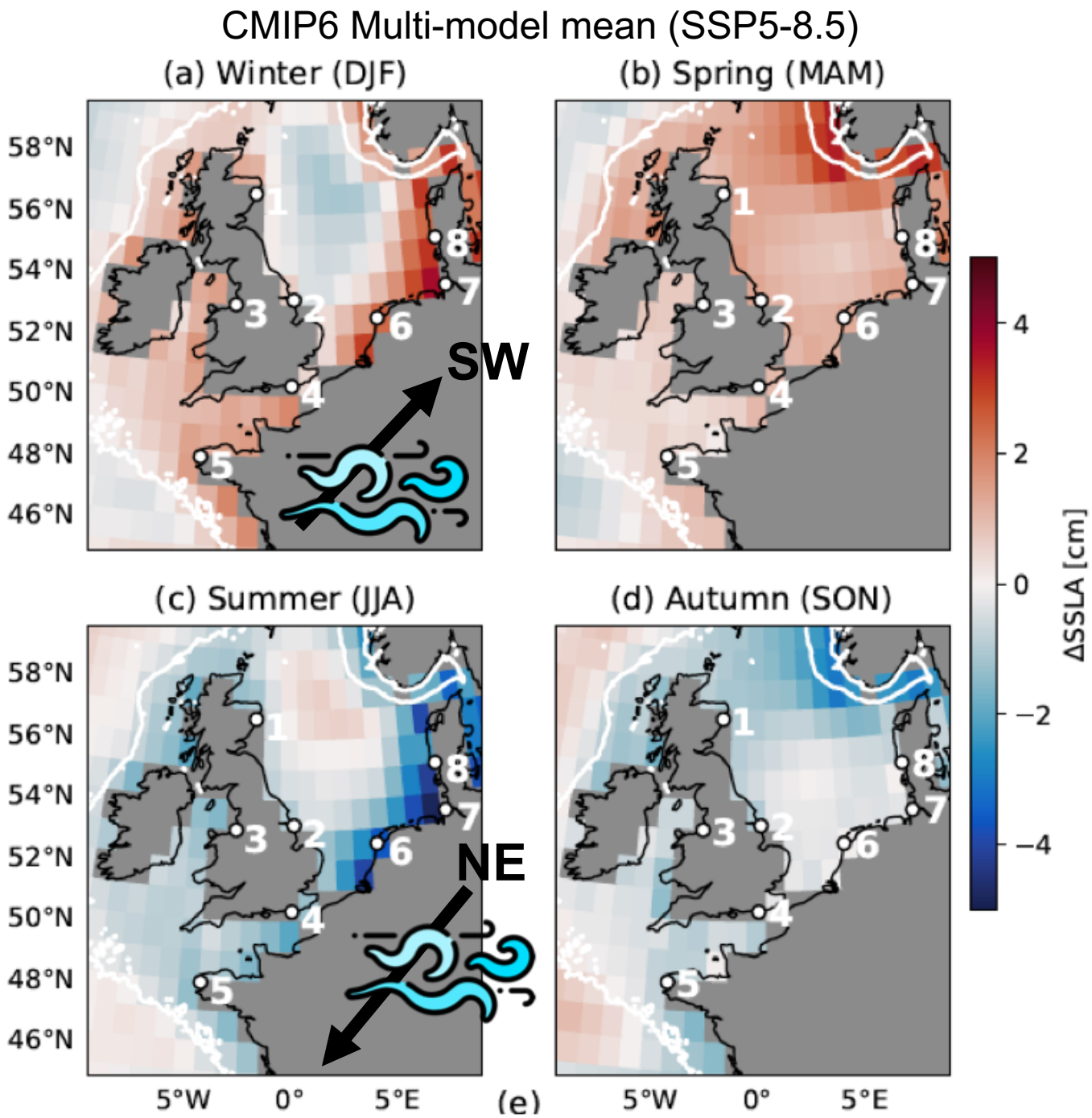
Mainly due to halosteric & bottom pressure change differences

RCP8.5

Hermans et al. (2020), Clim. Dyn.

Seasonal sea-level change

- Seasonal **relative** to annual mean change
- Effect of a closed English Channel



Hermans et al. (under review)

Discussion & Conclusions

Dynamical downscaling for regional sea-level projections?

Challenges:

1. Ensemble size
   - Time-slice methods, downscaling ensemble mean?
   - Data availability
   - Which models?

2. Evaluating performance
   - Historical ↔ Future
   - Model selection/weighing

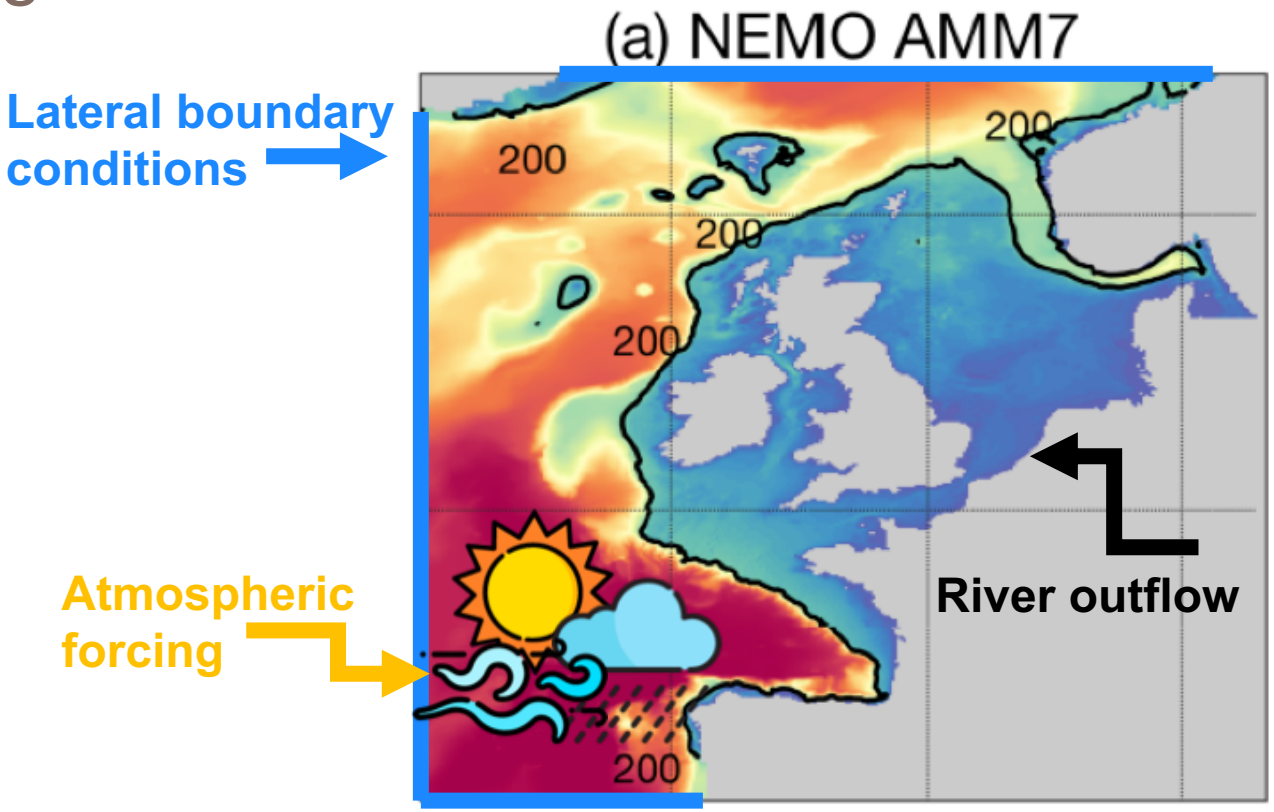
3. Uncertainty due to downscaling set-up

Bonus:

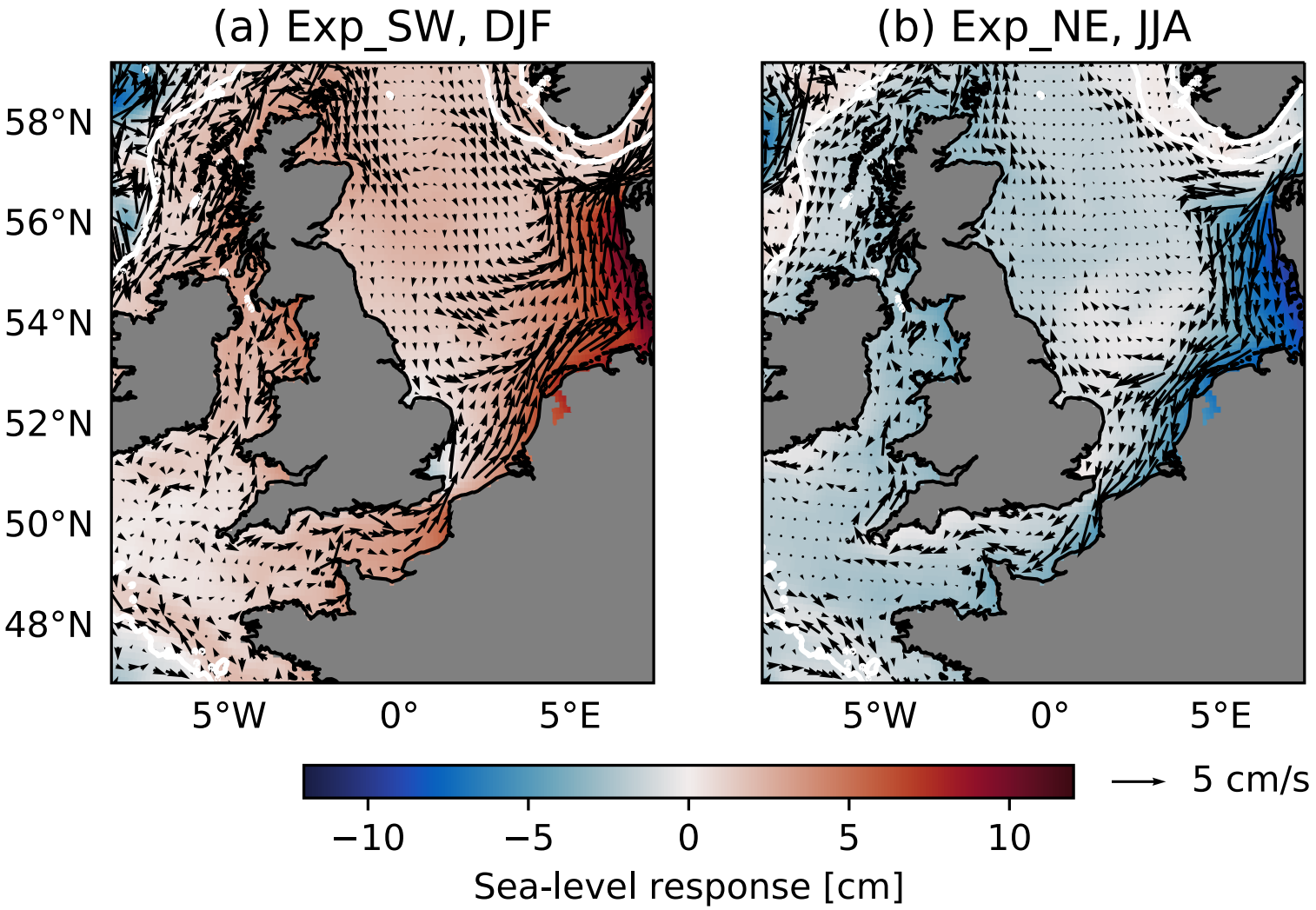
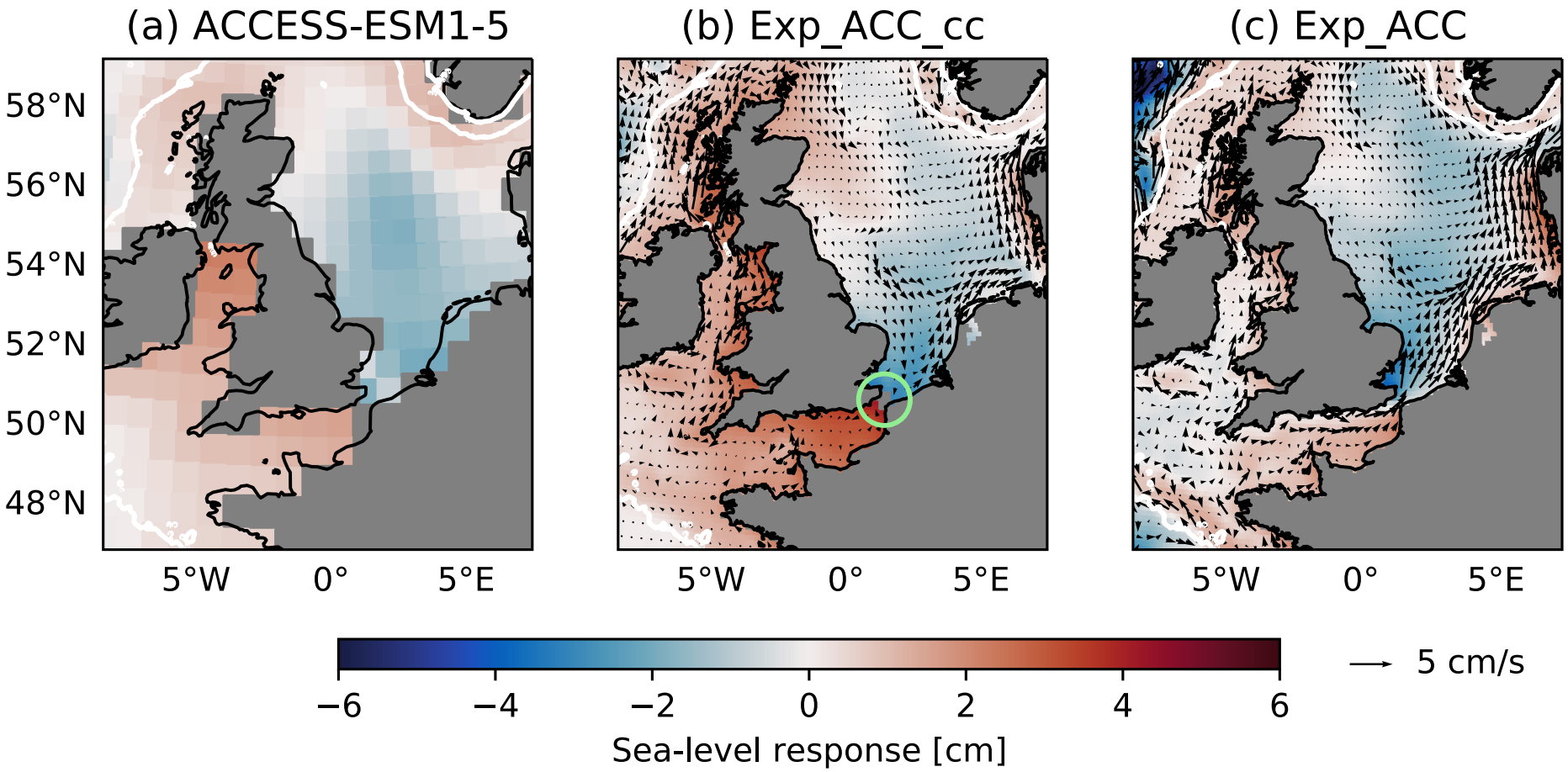
Dynamical downscaling: sensitivity experiments

- Modifying the boundary conditions

- Using reanalysis forcing
  - Hermans et al. (2020), JGRo
- Using HadGEM3-GC3.0
  - Tinker et al. (2020), Clim. Dyn.
- Long-term integration
  - Jin et al. (2021), JCLim (marginal seas China)



ROMS experiments



ROMS experiments 2