Regional Aerosol MIP

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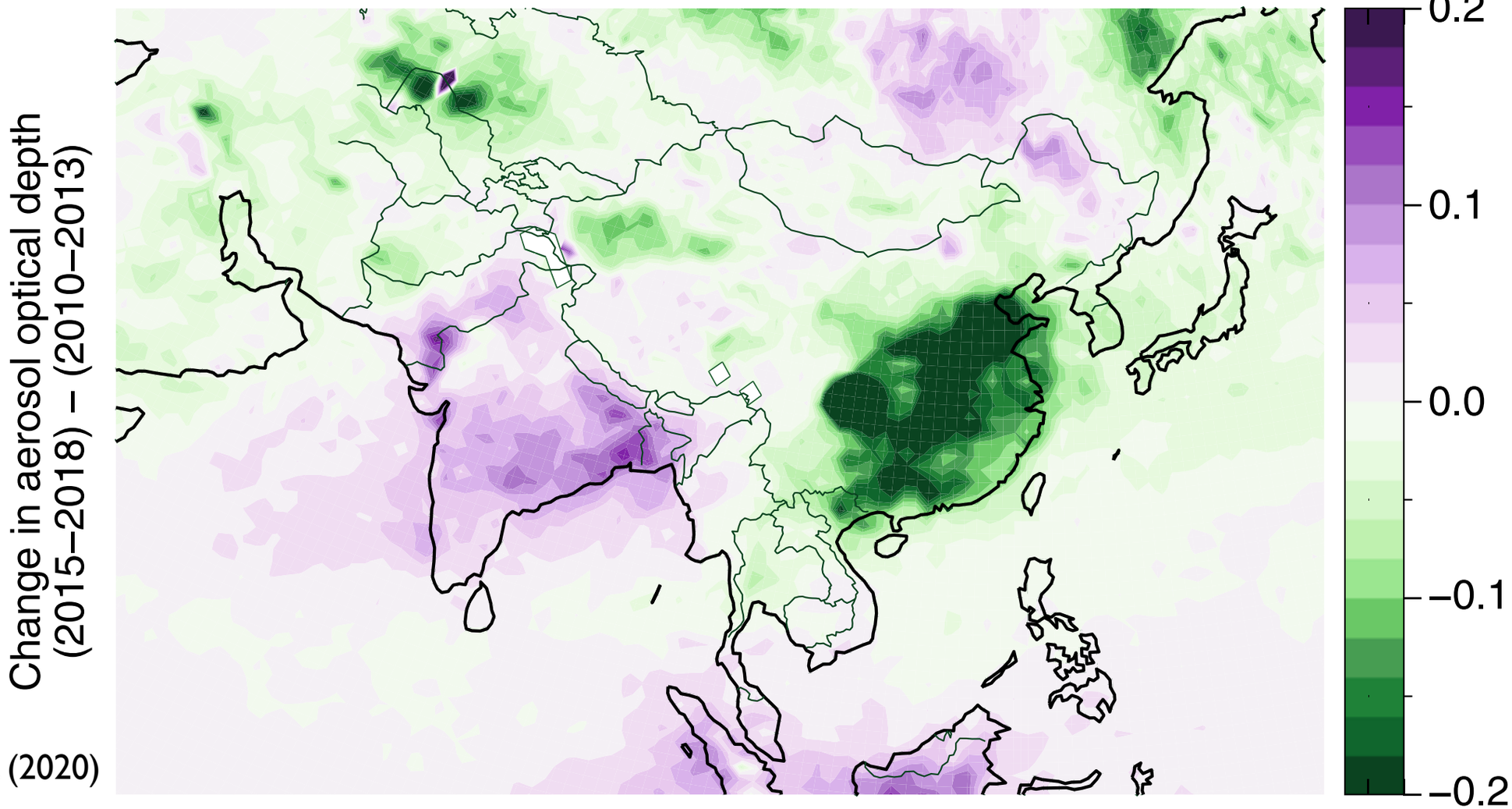

Samset et al. (2020)

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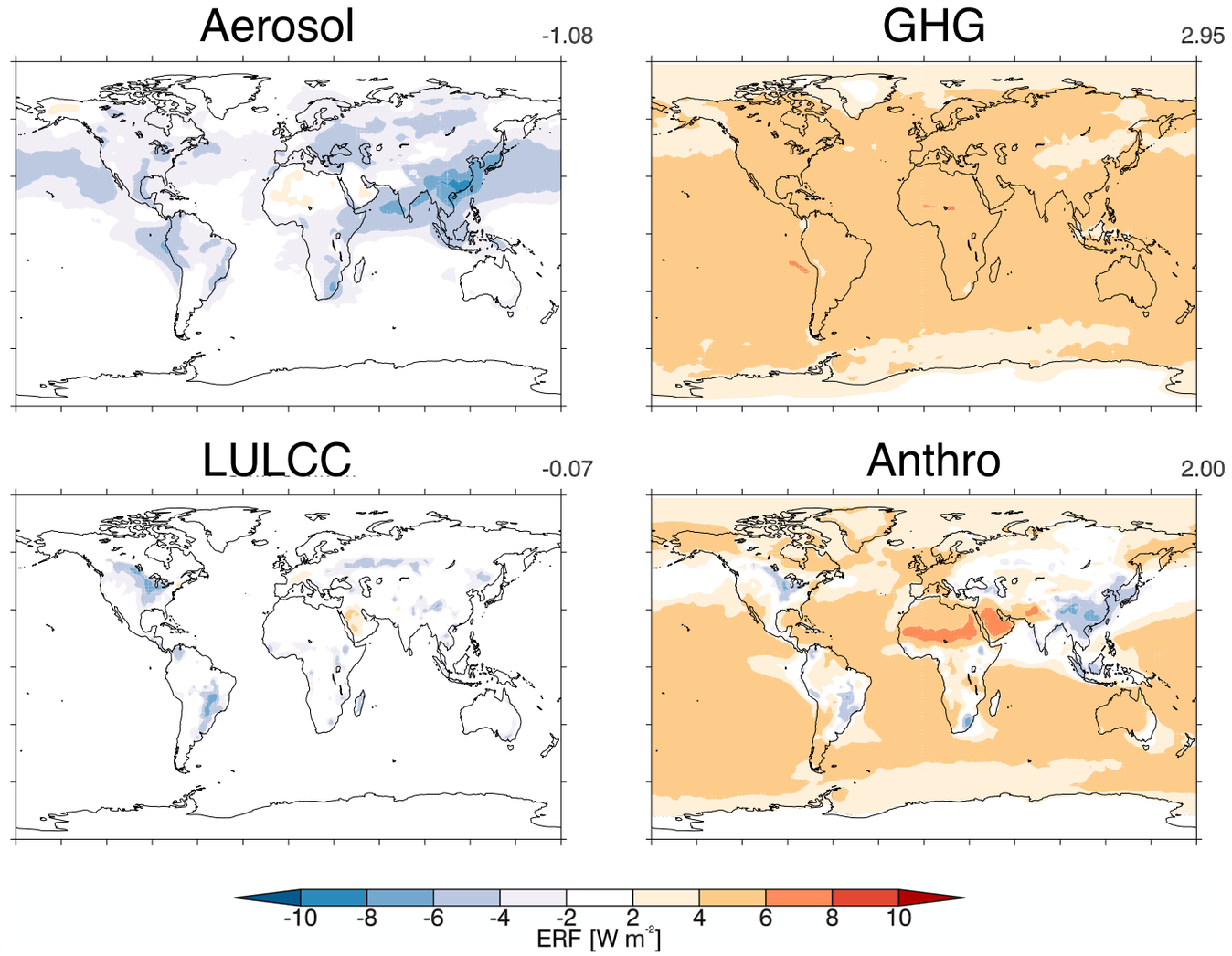
Objectives

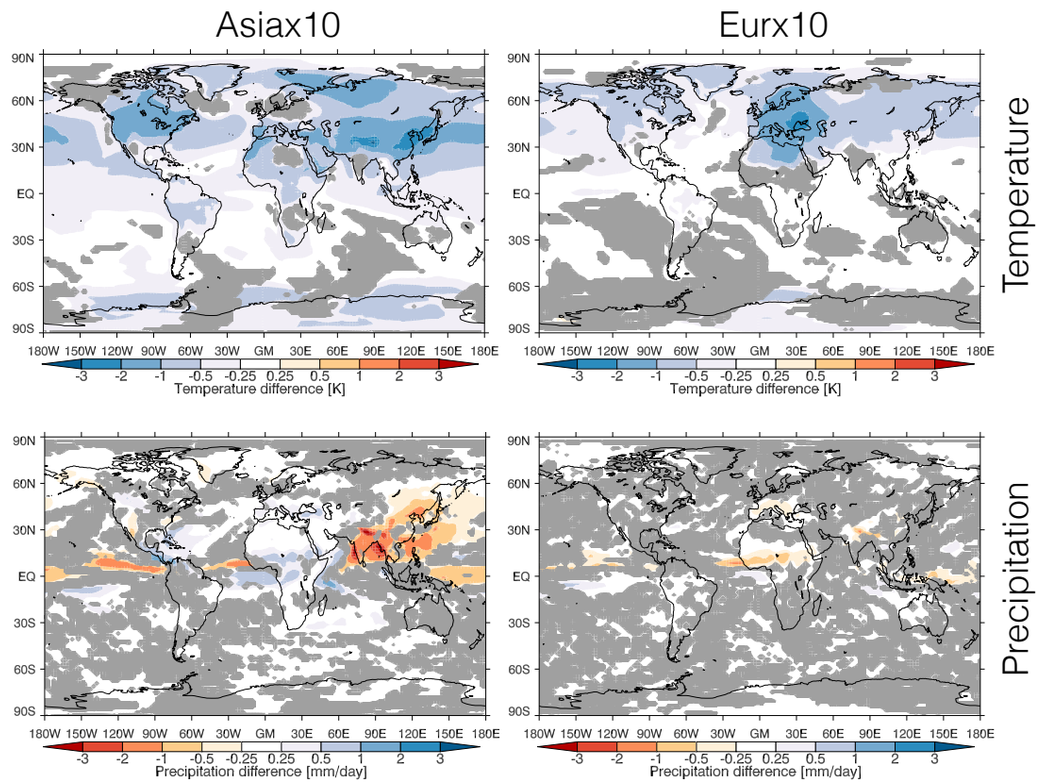
- Aerosol is key in the pattern and magnitude of historical forcing, and large, rapid changes are expected in the near future
- Uncertainty in forcing compounded by uncertainty in the dynamical response at regional scales



- **Perform a set of experiments across a number of models that better enable us to assess the potential contribution of aerosols to near-future climate change, to describe the robust features of the response to regional aerosol changes, and to identify where the key uncertainties lie.**

RAMIP builds on previous efforts

- PDRMIP:
  - Consistent experiment design, multiple models, large regional aerosol changes
  - Equilibrium experiments underpin understanding of the response to regional forcing, and the importance of model differences



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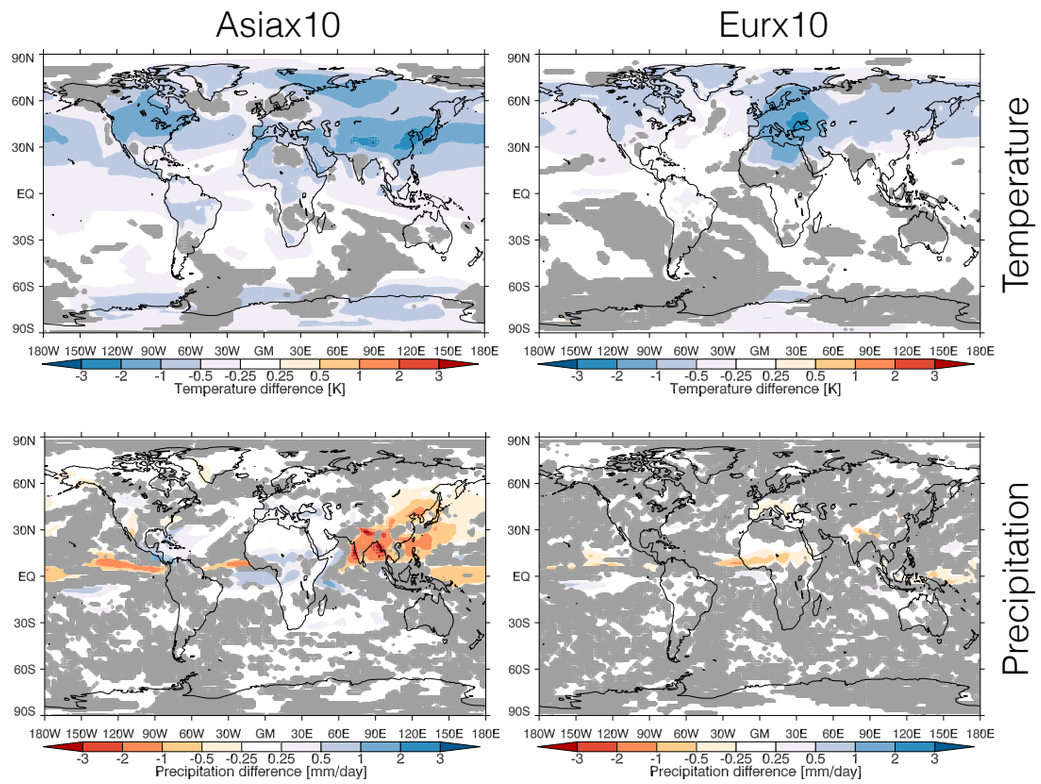
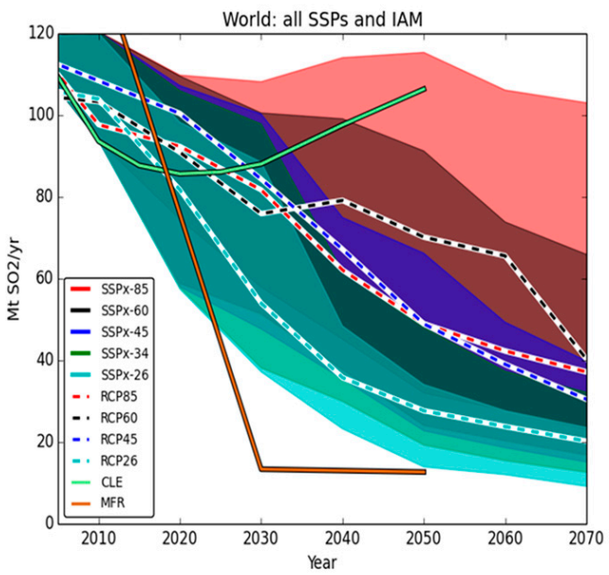
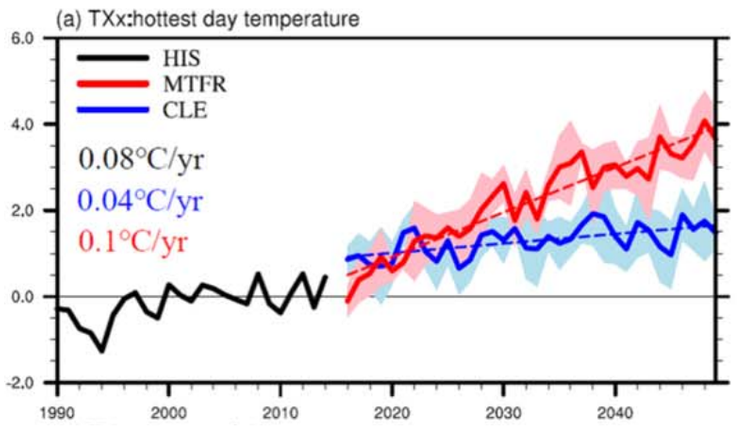




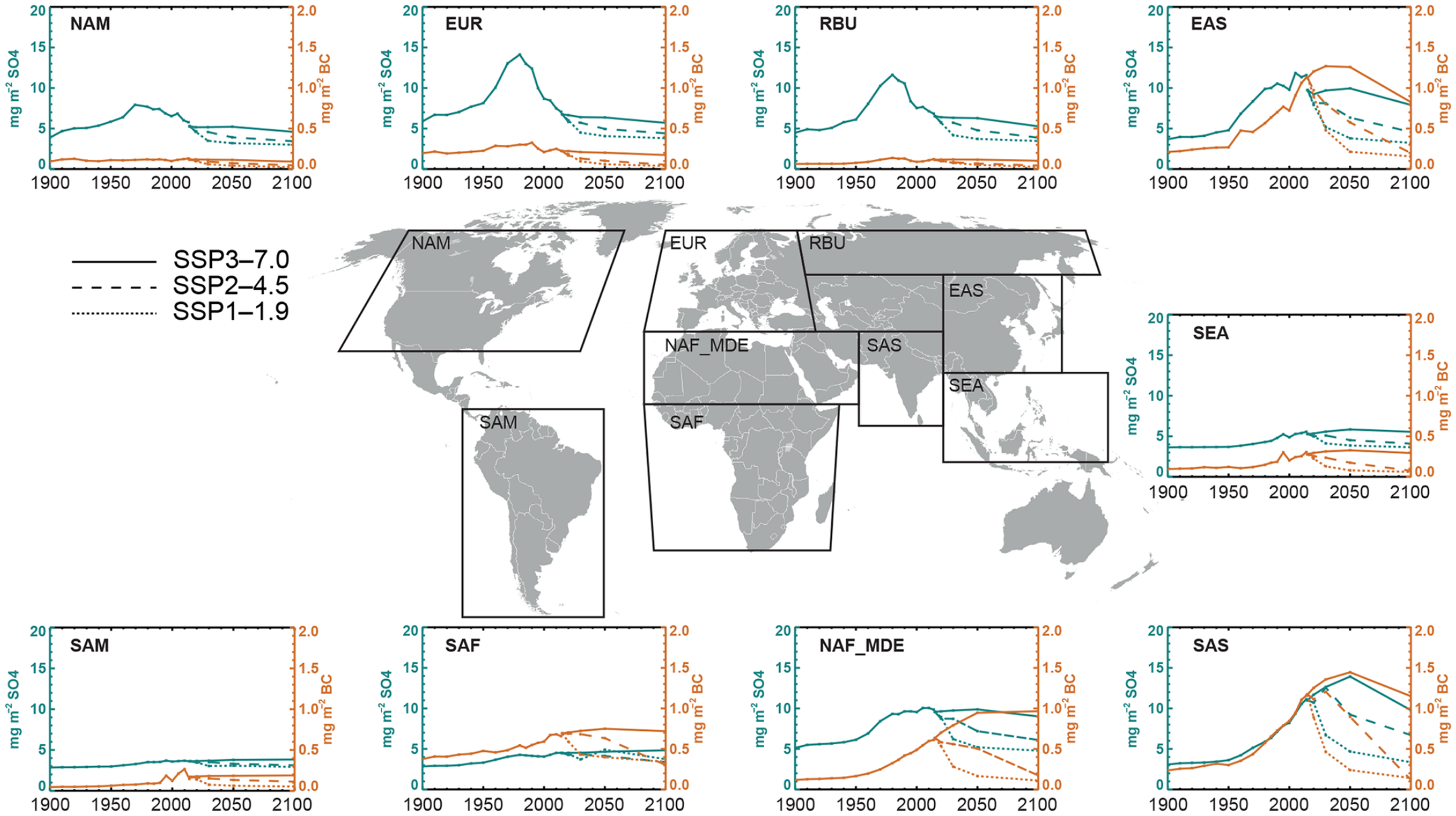
Scannell et al. (2019)



Luo et al. (2020)

- ECLIPSE:
  - Pathways span uncertainty in future emissions
  - Link uncertainty in global emissions to uncertainty regional responses

Uncertainty in global emissions largely from Asia and Africa



- Future emission uncertainty is particularly large over Asia, Africa, and the Middle East
- How important is this for patterns and rates of change?

Lund et al., 2019

Regional Aerosol MIP

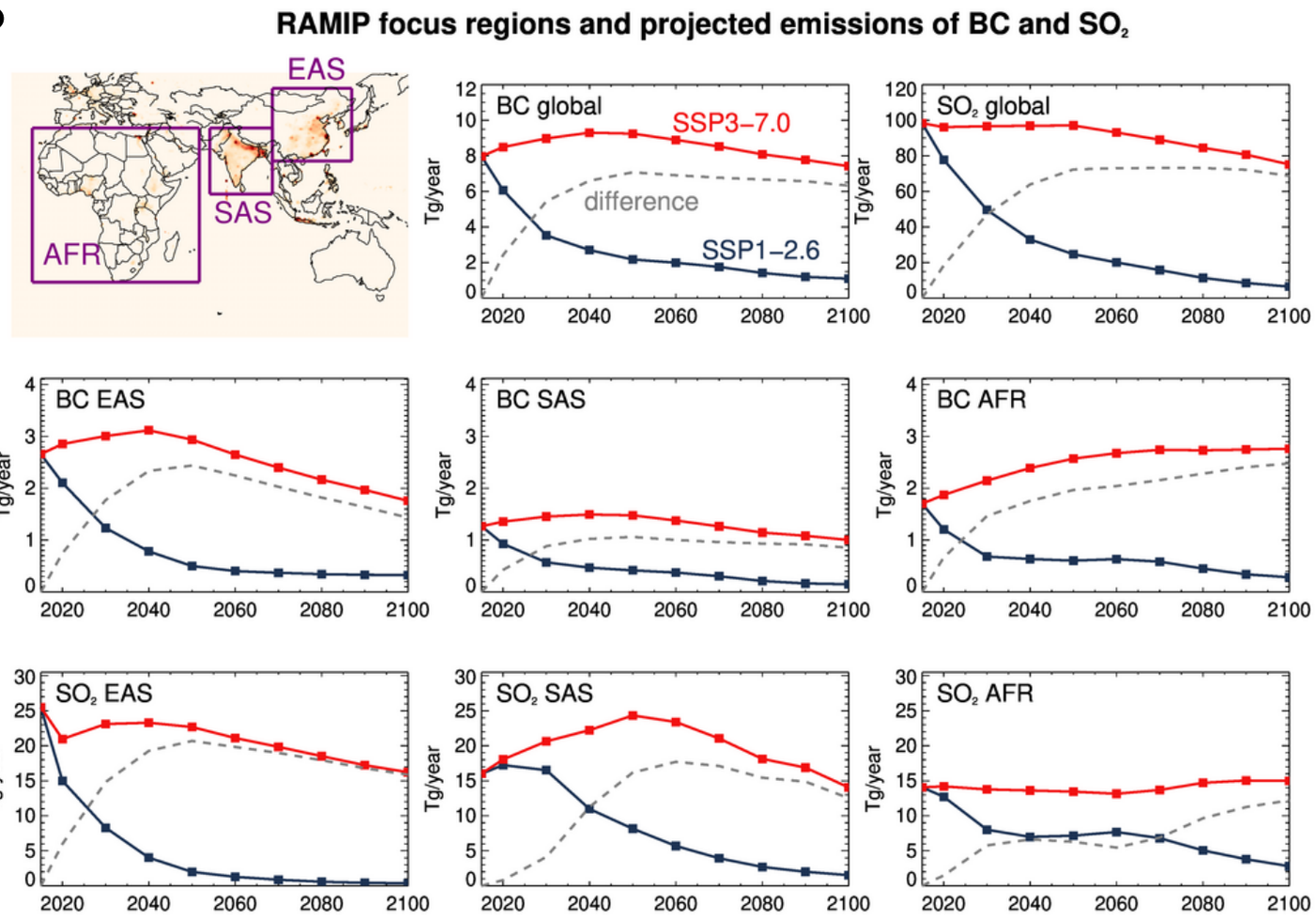
- Coupled transient simulations (January 2015 to February 2051)
- At least 10 members per experiment, continuing from historical simulation

- SSP3-7.0 baseline
- Regional perturbations based on SSP1-2.6

Tier 0 (≤370 years)
- SSP3-7.0

Tier 1 (~1500 years)
- Global
- Africa and the Middle East
- East Asia
- South Asia

Tier 2 (~1000 years)
- South+East Asia
- Sub-Saharan Africa carbonaceous
- South Asia carbonaceous



Participating models (so far):
CESM2, EC-Earth3, GFDL-CM4, GISS-E2-1, MIROC6, NorESM2, UKESM1

Wilcox et al., in prep for GMD

Objectives and challenges

- **Perform a set of experiments across a number of models that better enable us to assess the potential contribution of aerosols to near-future climate change, to describe the robust features of the response to regional aerosol changes, and to identify where the key uncertainties lie.**
  - Consistent treatment of aerosol emissions
  - More realistic aerosol perturbations, with straightforward parallels to SSPs and air quality
  - Emission regions with a future focus

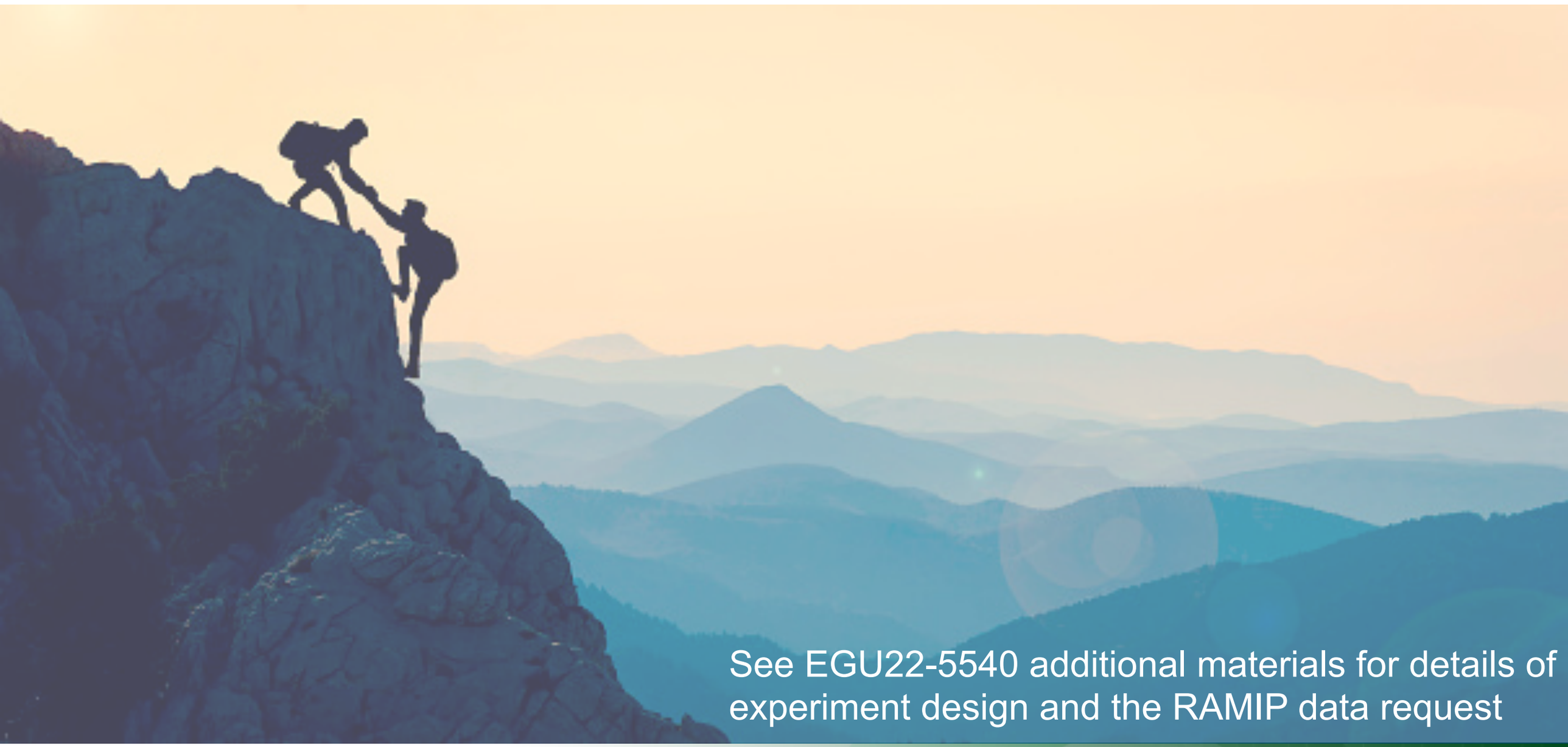
- Poor signal?
  - **We know it works** for global aerosol perturbations, e.g. Rotstayn et al., 2013; Acosta Navarro et al., 2017; Scannell et al., 2019; Allen et al., 2020, 2021; Luo et al., 2020; Im et al., 2021; Zhang et al., 2021; …
  - **We have seen significant responses** to regional changes in transient experiments, e.g. Undorf et al., 2018; Wilcox et al., 2019; Chen et al., 2019; …
  - At least **10 ensemble members** per simulation
  - Encouraging results from **RFMIP-style test simulations**

- What's new here vs. AerChemMIP and PDRMIP?
  - Information about the pattern, and the timescale of the response
  - Regional changes simplify dialogue for mitigation and adaptation
  - Potential to explore nonlinearities

We need you...

- Interested in contributing simulations?
- Want to make sure we archive your favourite variables?

➡ Email l.j.wilcox@reading.ac.uk



See EGU22-5540 additional materials for details of experiment design and the RAMIP data request

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