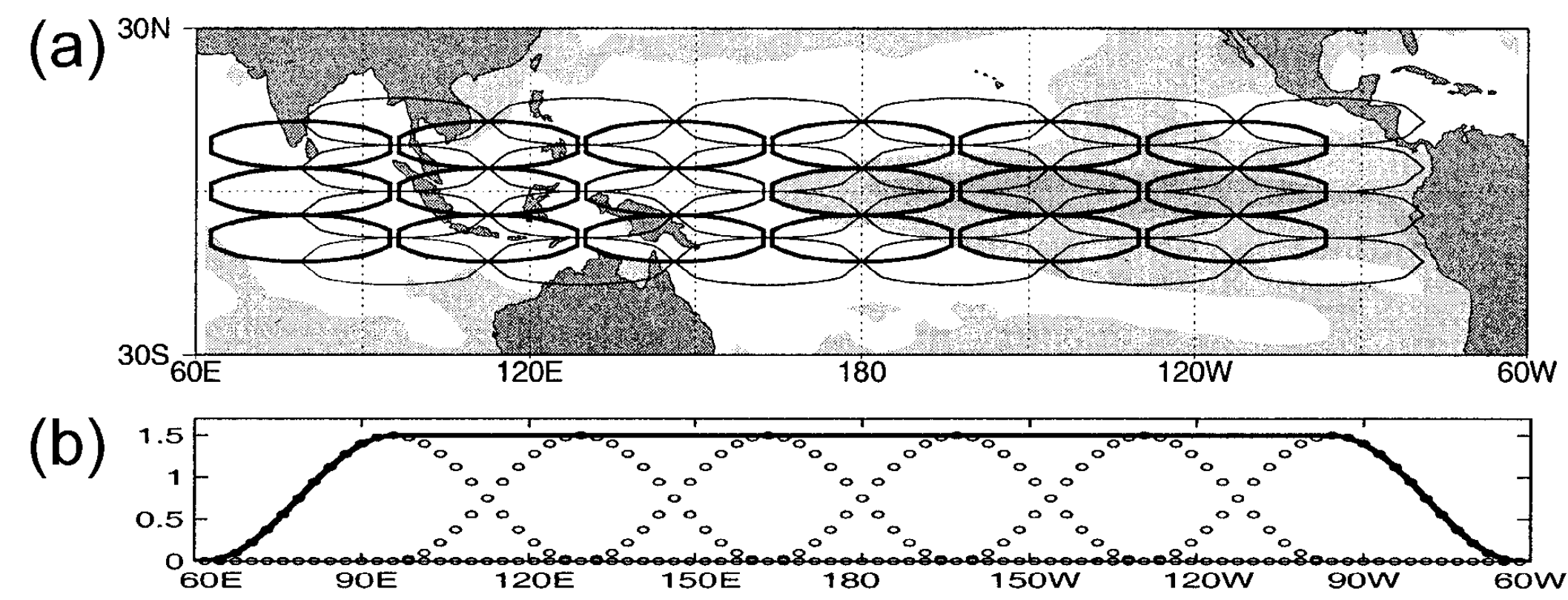
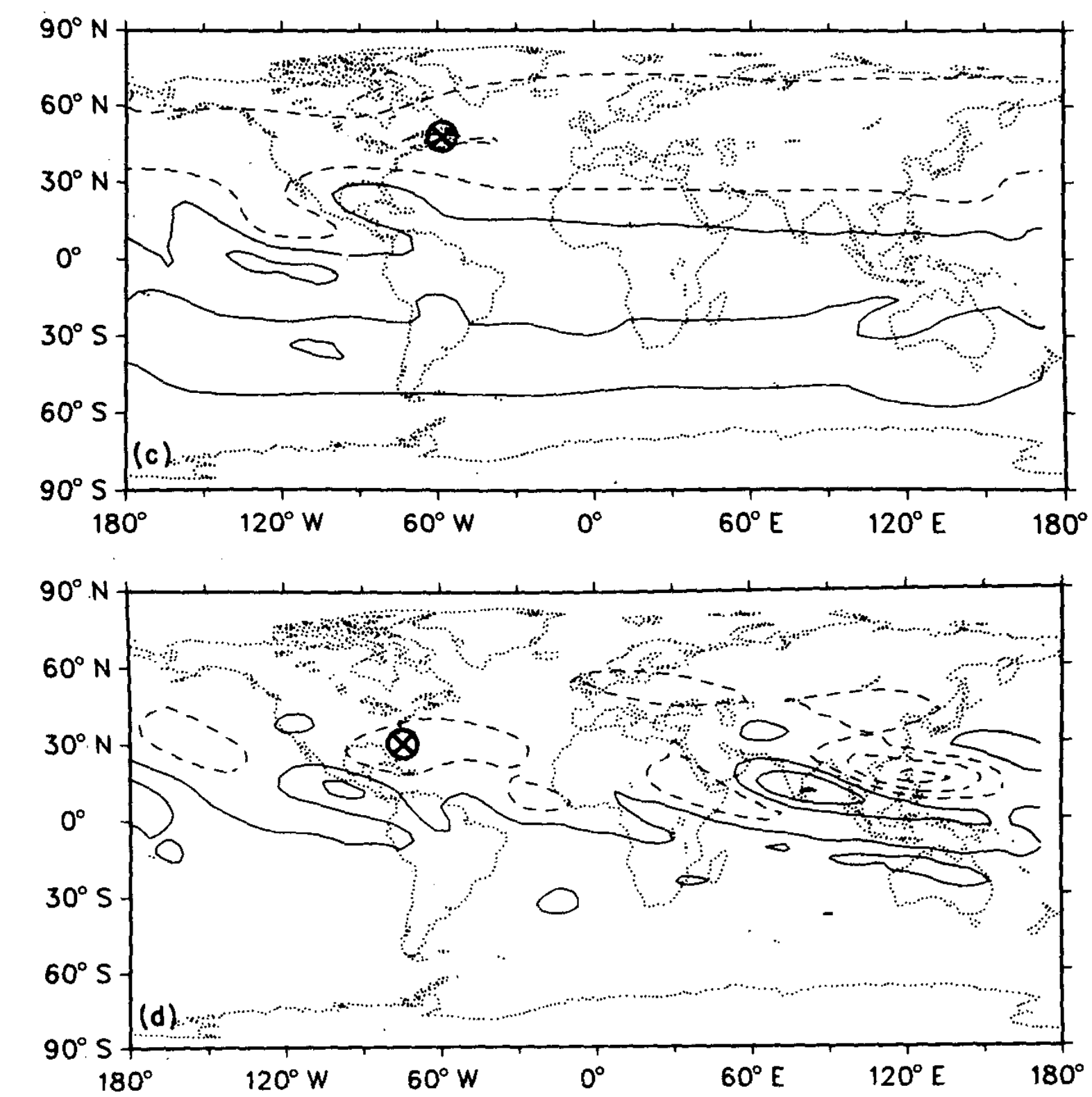




Barsugli and Sardeshmukh 2002



“Analysis of GCM SST Anomaly Simulations Using a Linear Model.” Branstator 1985

GFMIP

Pattern Workshop, 5/12/22

Jonah Bloch-Johnson, with help from Maria Rugenstein, Marc Alessi, Cristi Proistosescu, Jonathan Gregory, Chen Zhou, Yue Dong, Bosong Zhang, Ming Zhao, Jason Cole, and Andrew Williams, and more...

Why Green's functions?

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Understand pattern-driven changes in radiative feedbacks

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Expand our thinking beyond local radiative feedbacks

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When they “fail,” that can teach us something too.

What do we need for a GFMIP Protocol?

Background state

- What climatology (recent obs vs. piControl)
- How many years should one run the climatology to get flux averages?

Patch setup

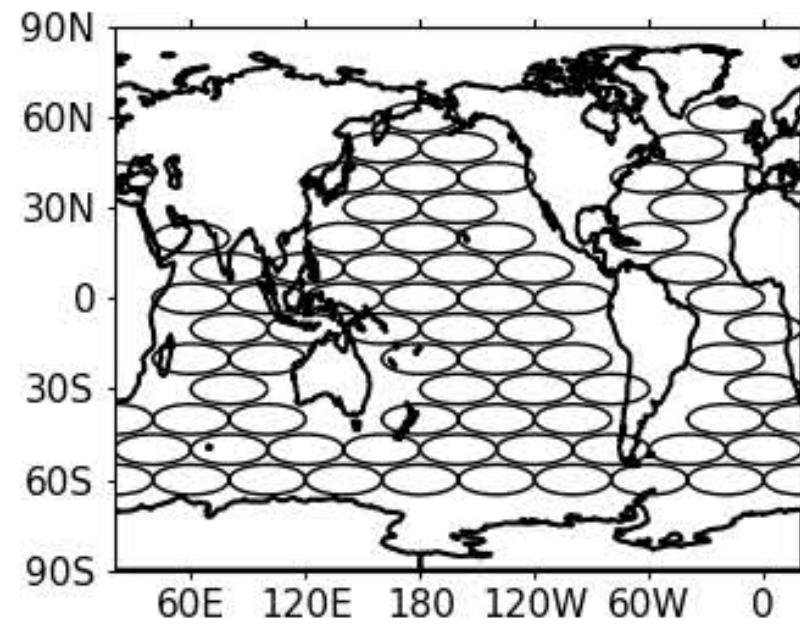
- Amplitude
- Size
- Location
- Shape
- # of years run

Other sst patterns?

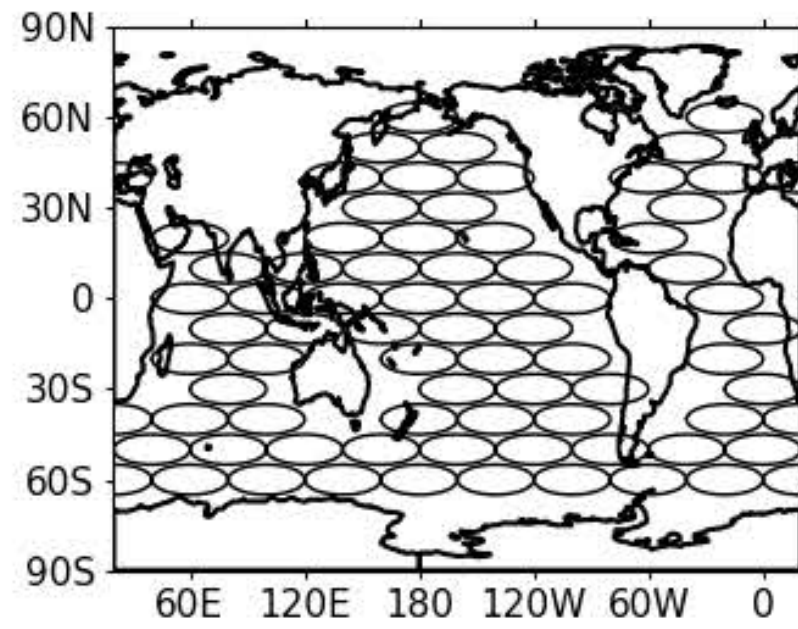
Output to save/publish

- Just Jacobians, or also full patches?

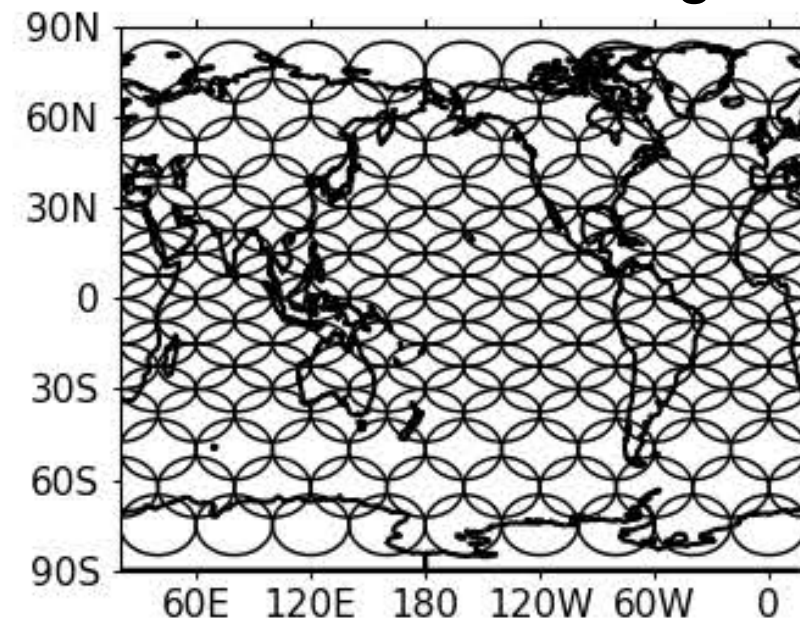
CAM5
source: Chen Zhou



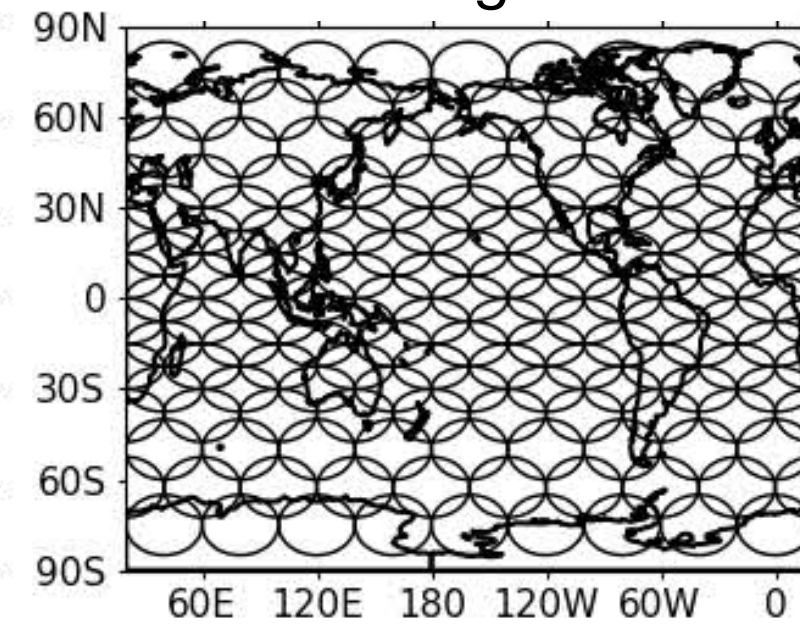
CanESM5
source: Jason Cole



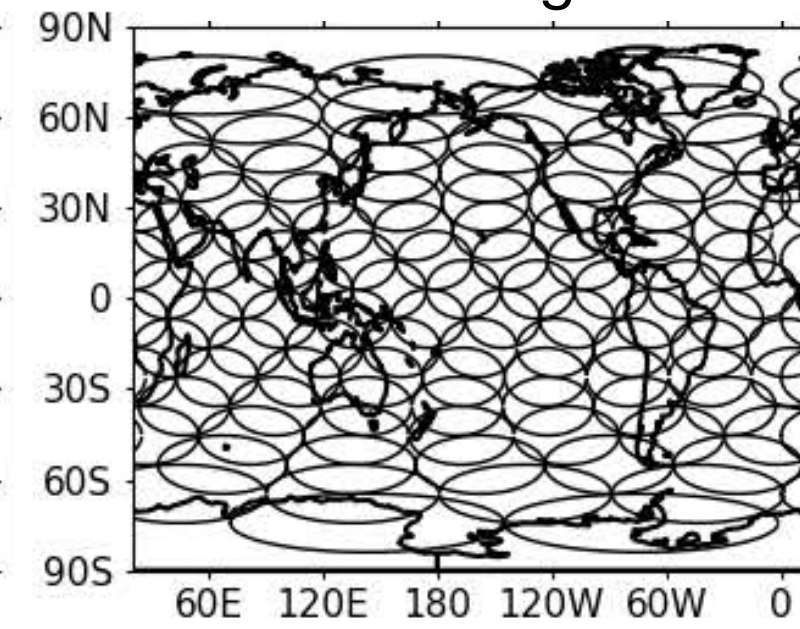
CAM4
source: Yue Dong



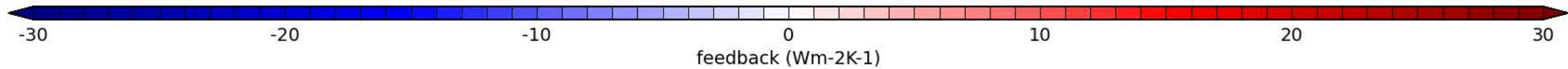
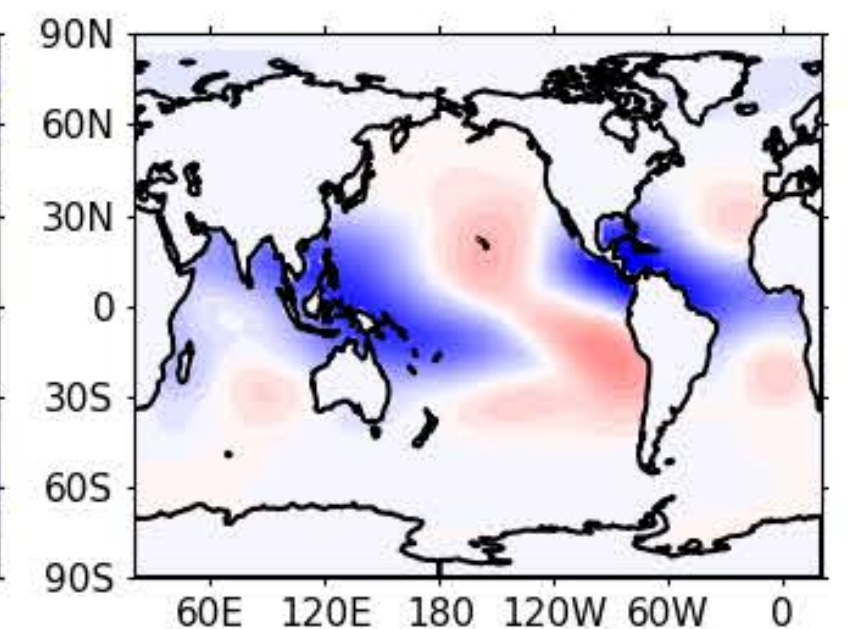
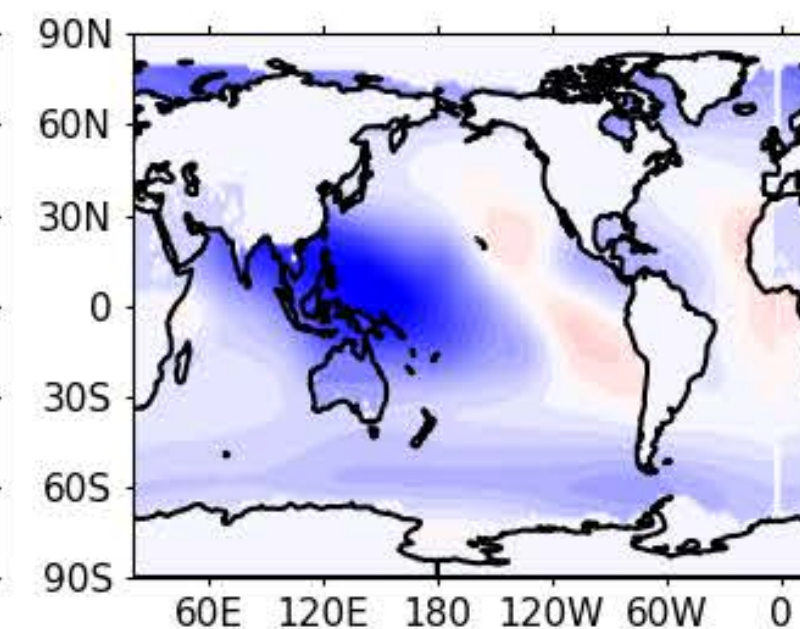
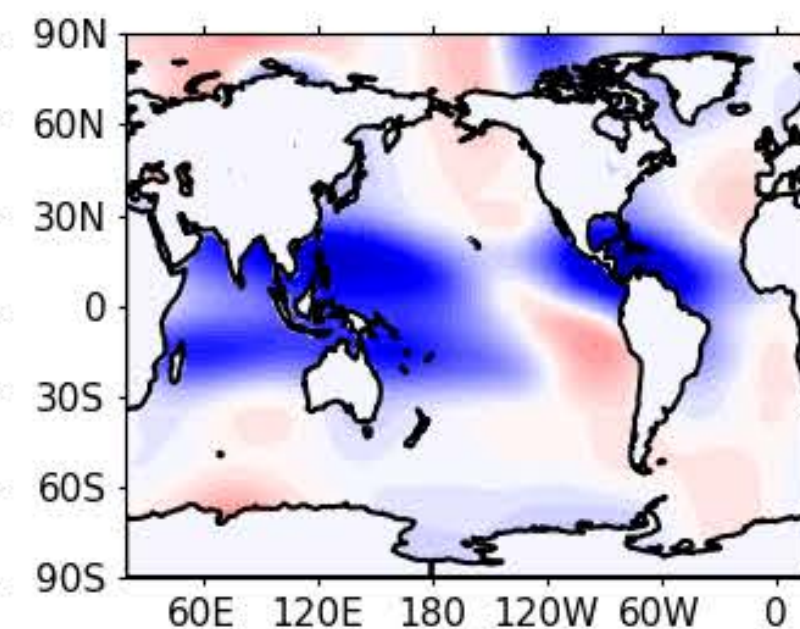
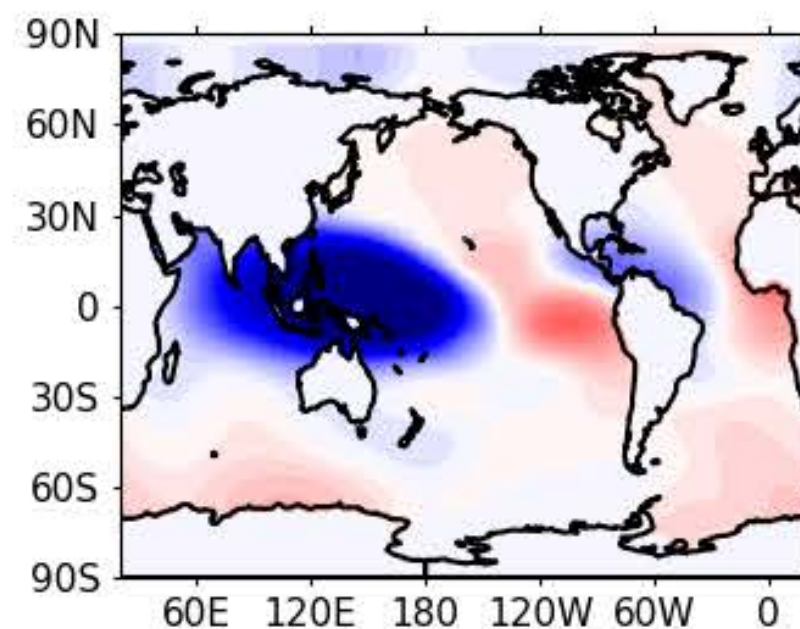
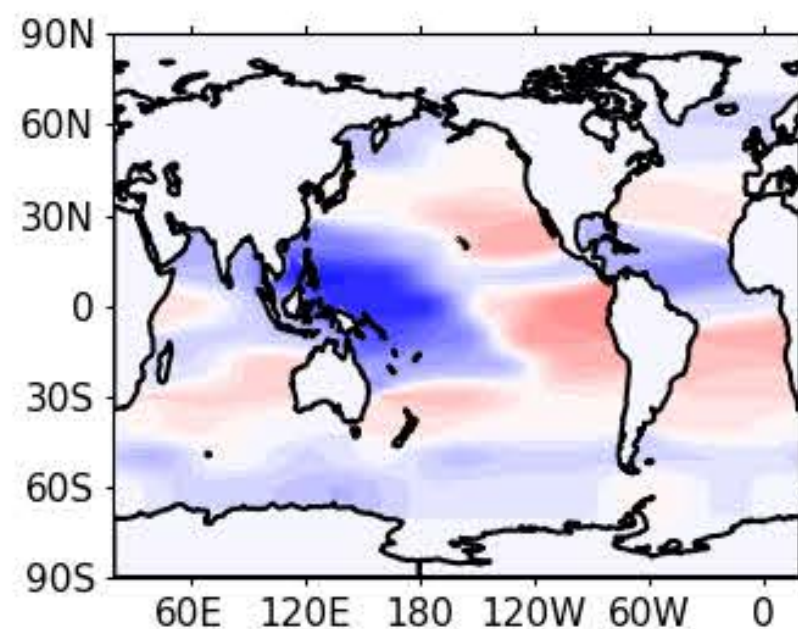
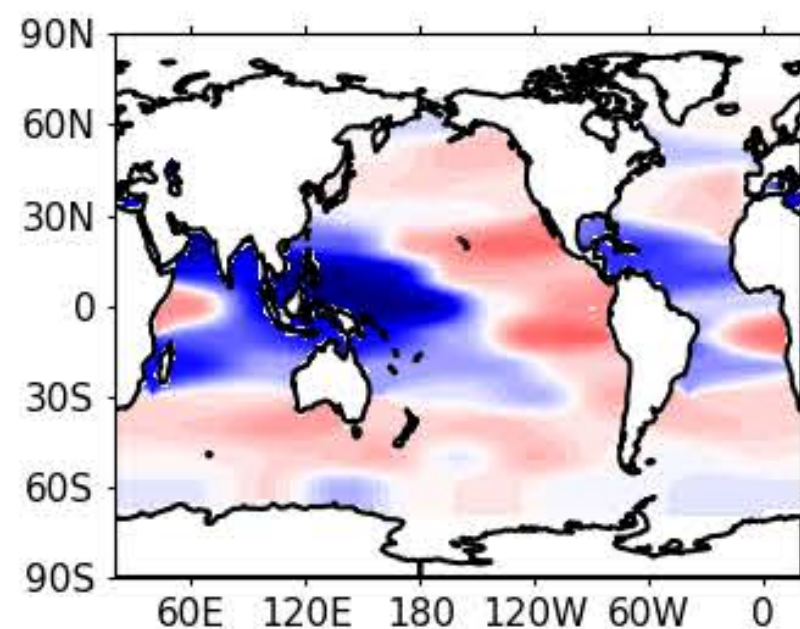
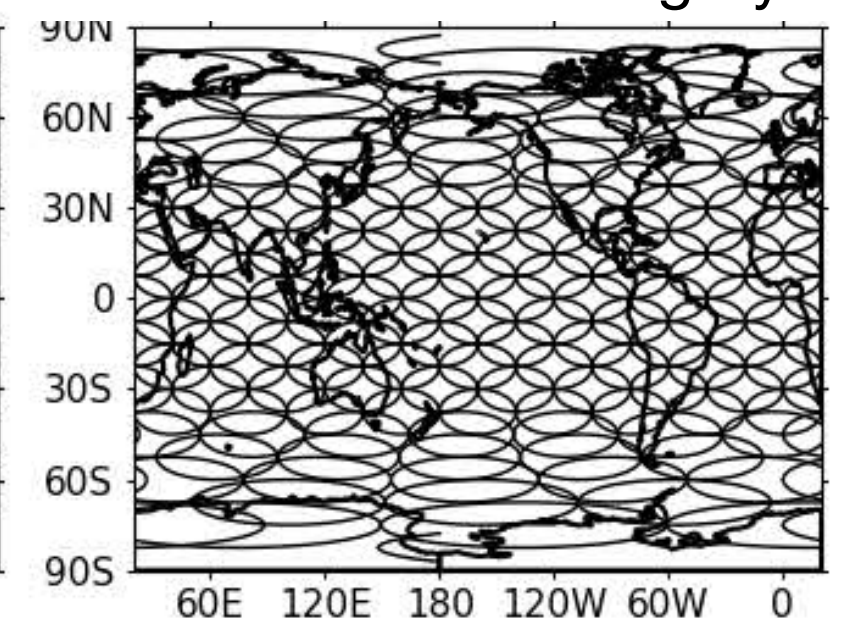
GFDL-AM4
source: Bosong Zhang
and Ming Zhao

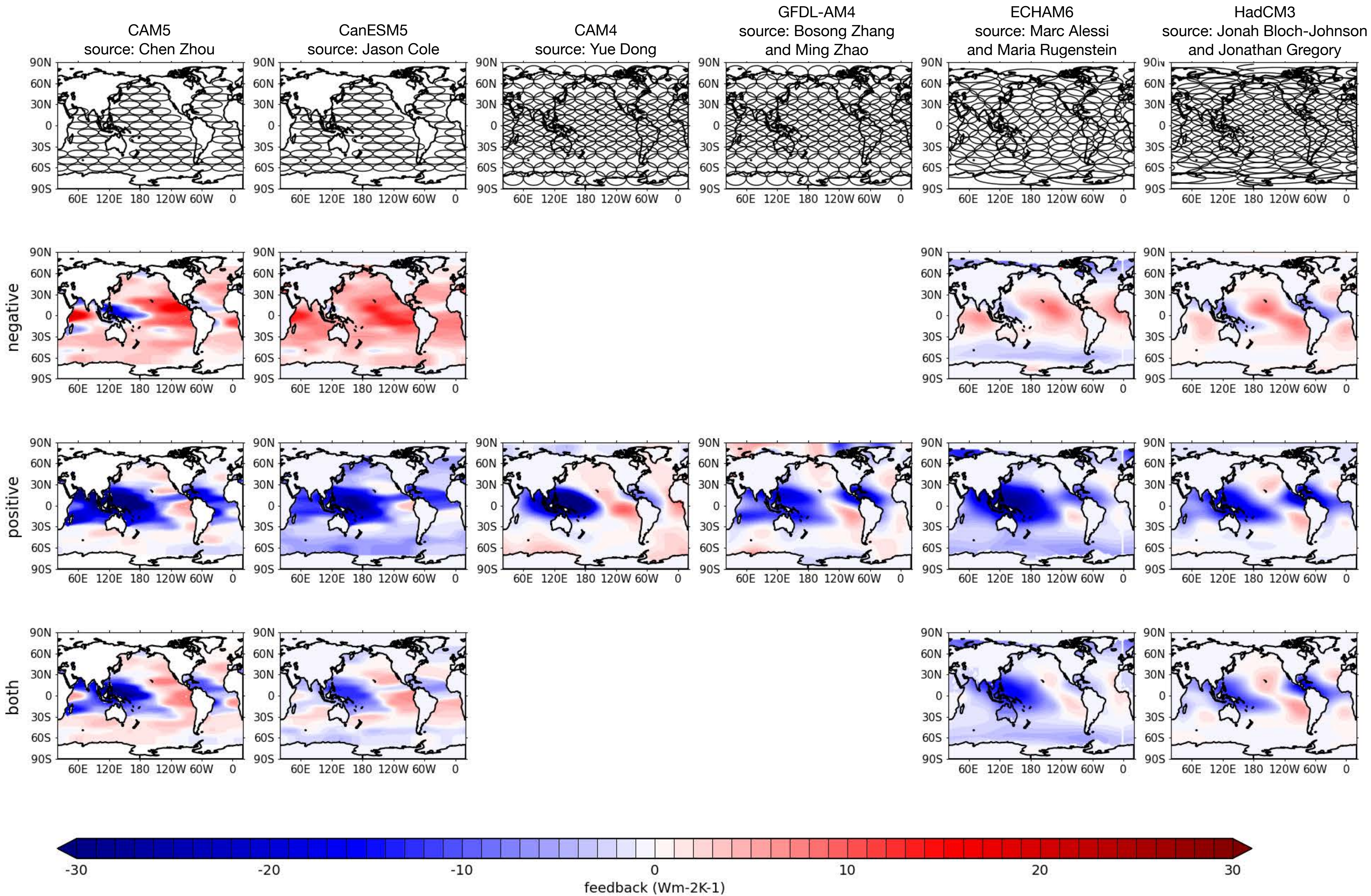


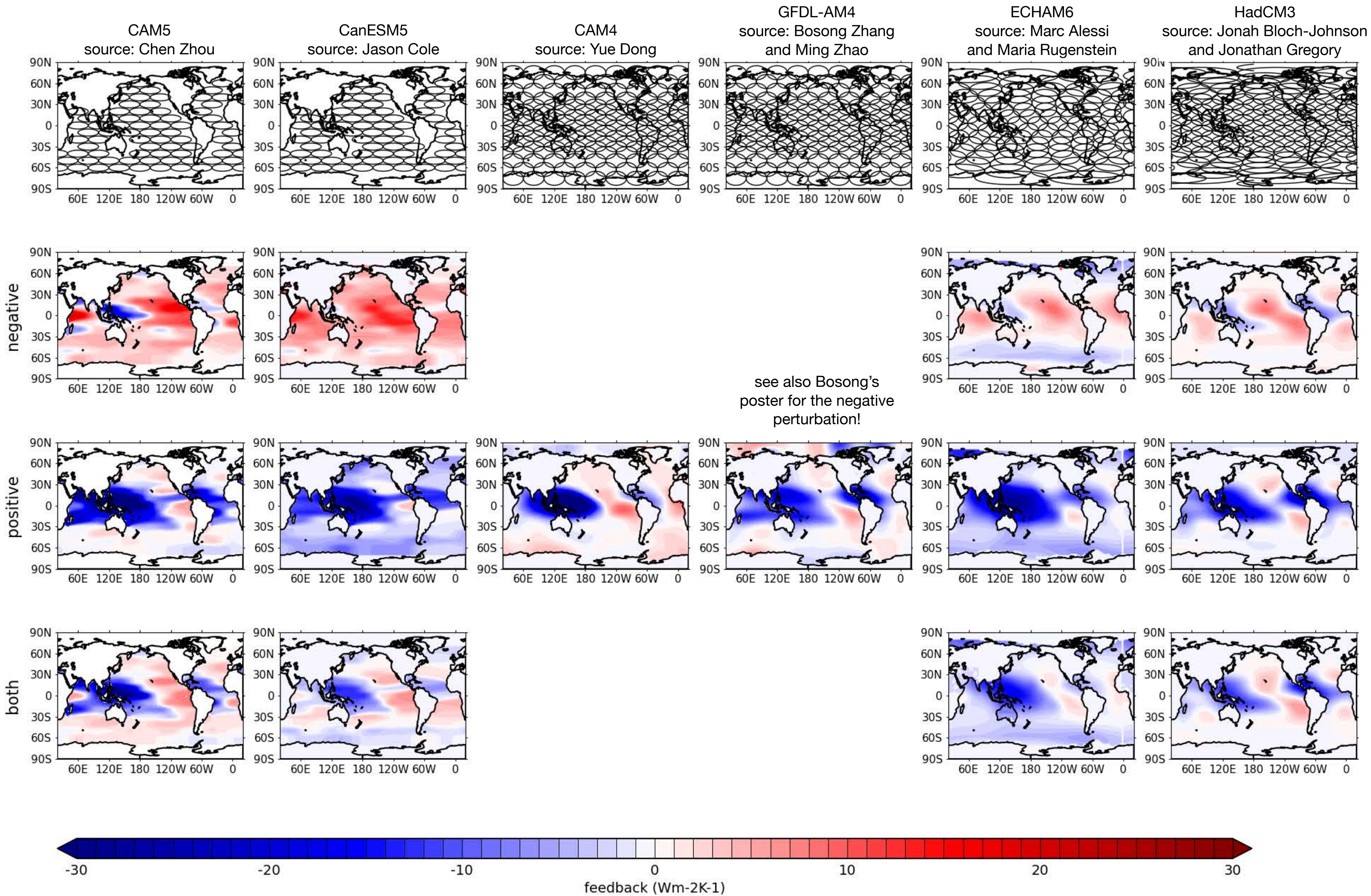
ECHAM6
source: Marc Alessi
and Maria Rugenstein



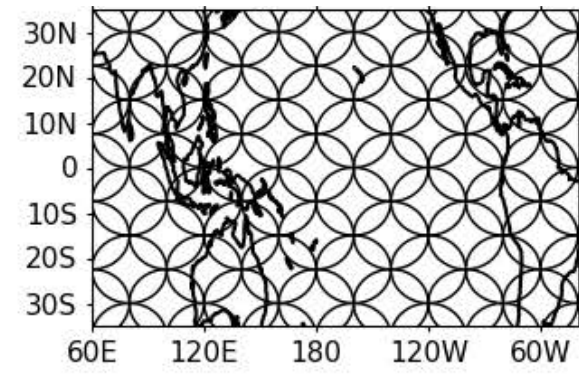
HadCM3
source: Jonah Bloch-Johnson
and Jonathan Gregory



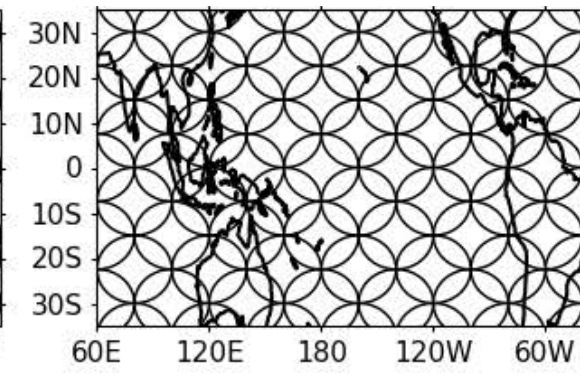




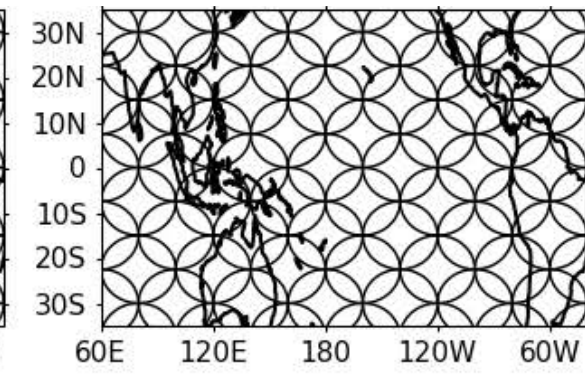
CanESM5
source: Jason Cole



HadCM3



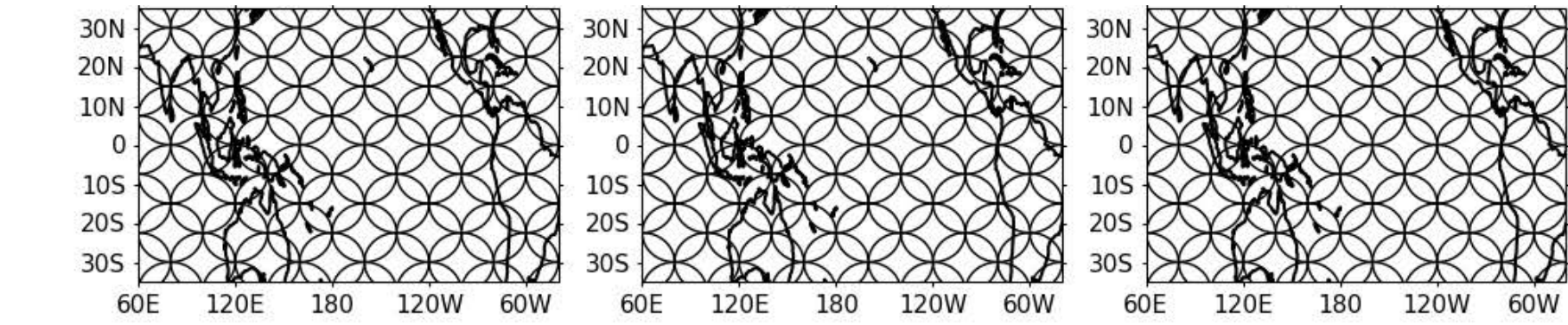
ICON
source: Andrew Williams



CanESM5
source: Jason Cole

HadCM3

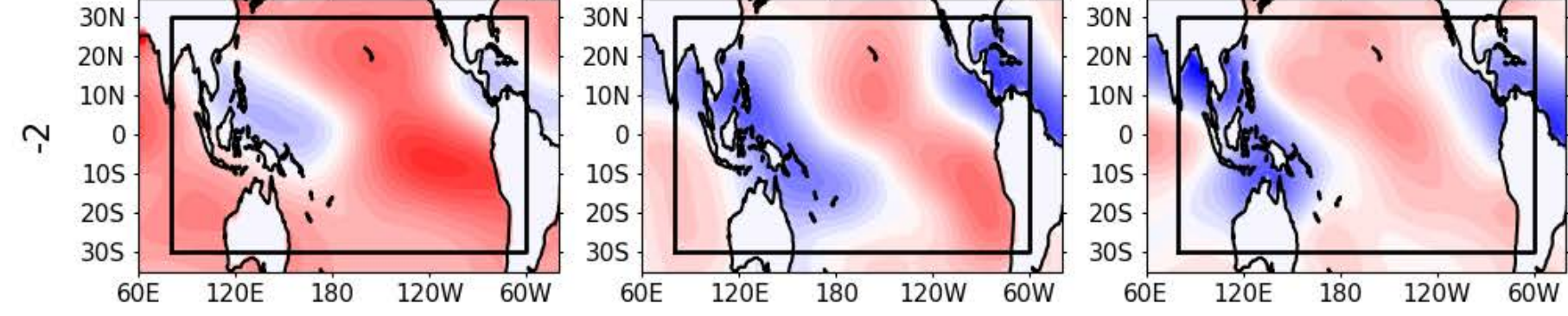
ICON
source: Andrew Williams



mean: 3.52

mean: 0.56

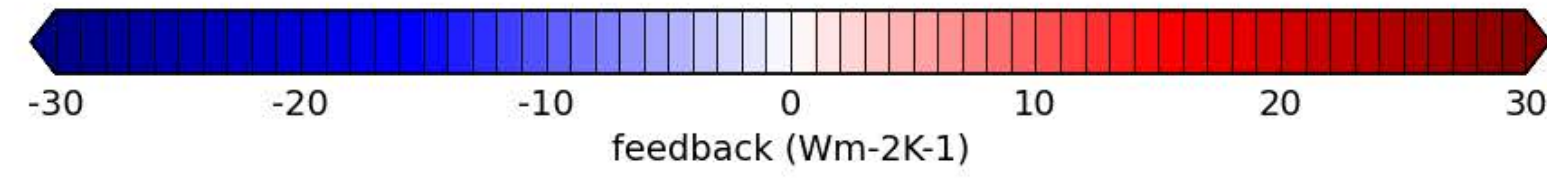
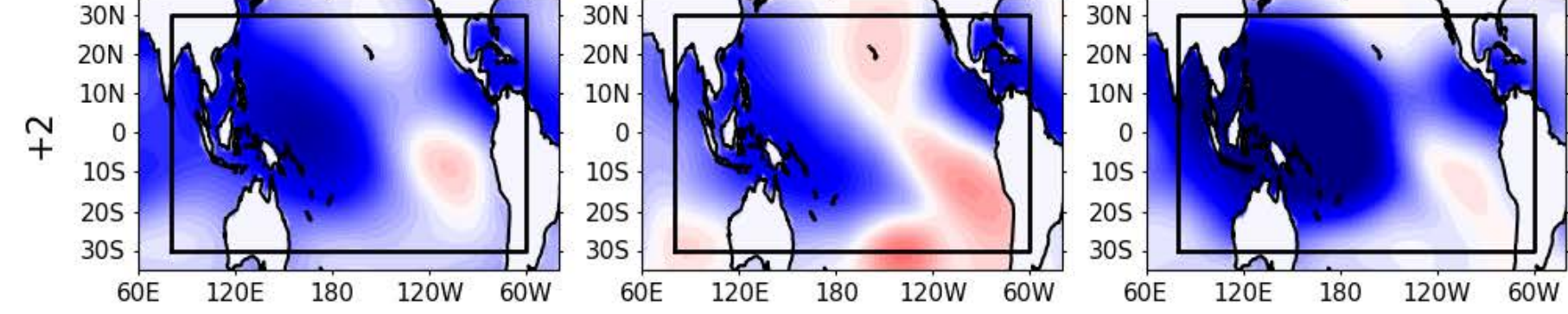
mean: 0.22

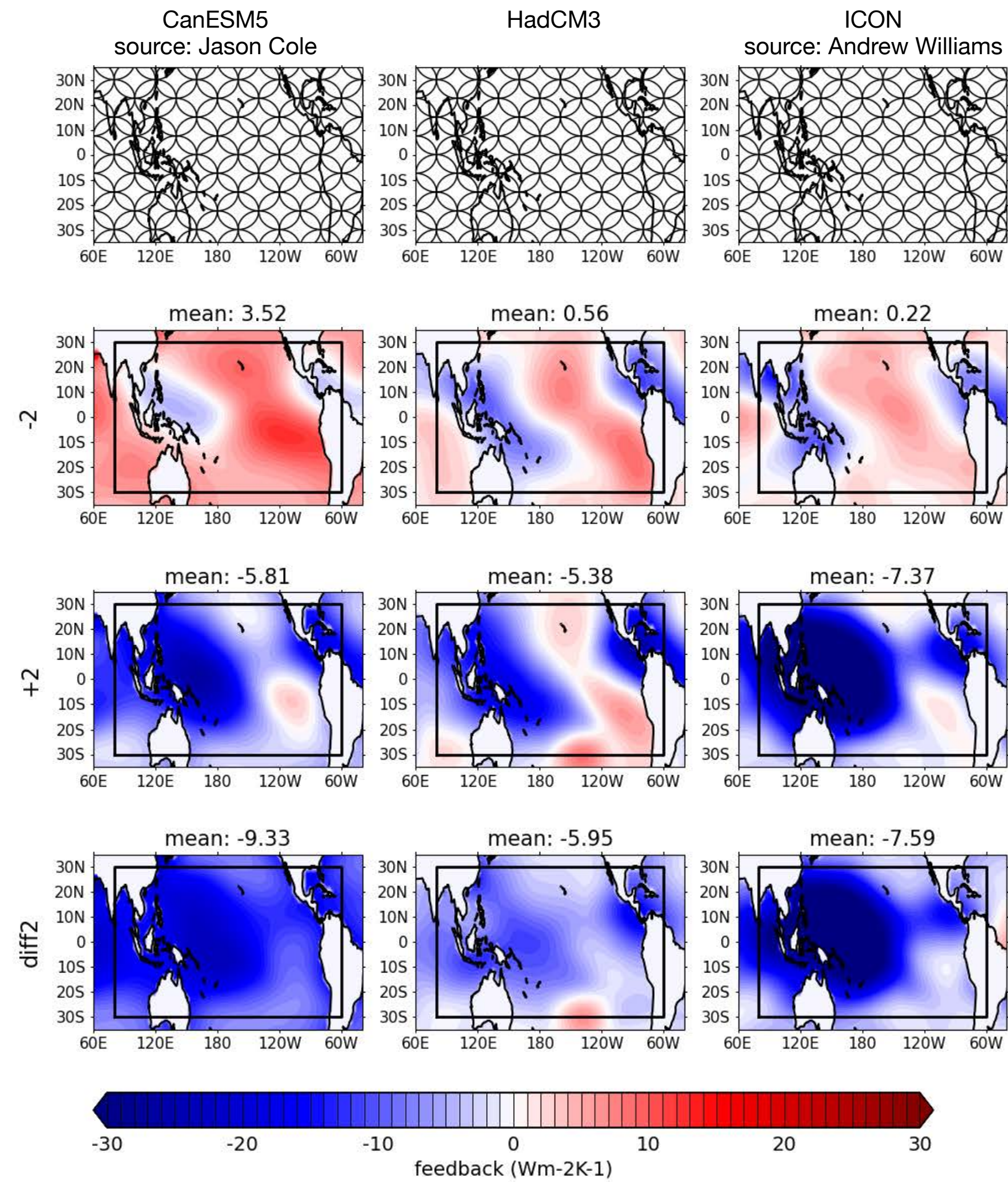


mean: -5.81

mean: -5.38

mean: -7.37

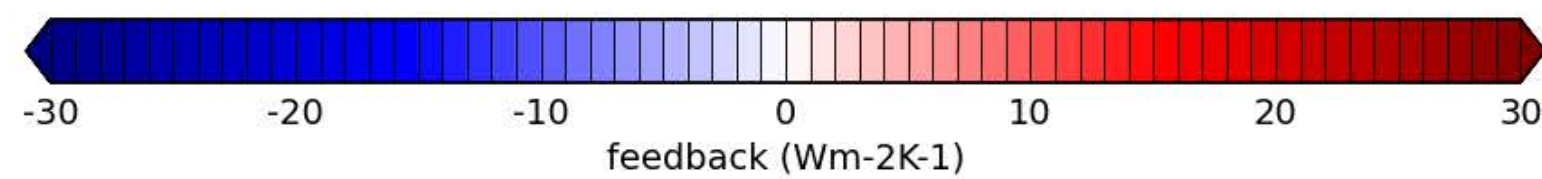
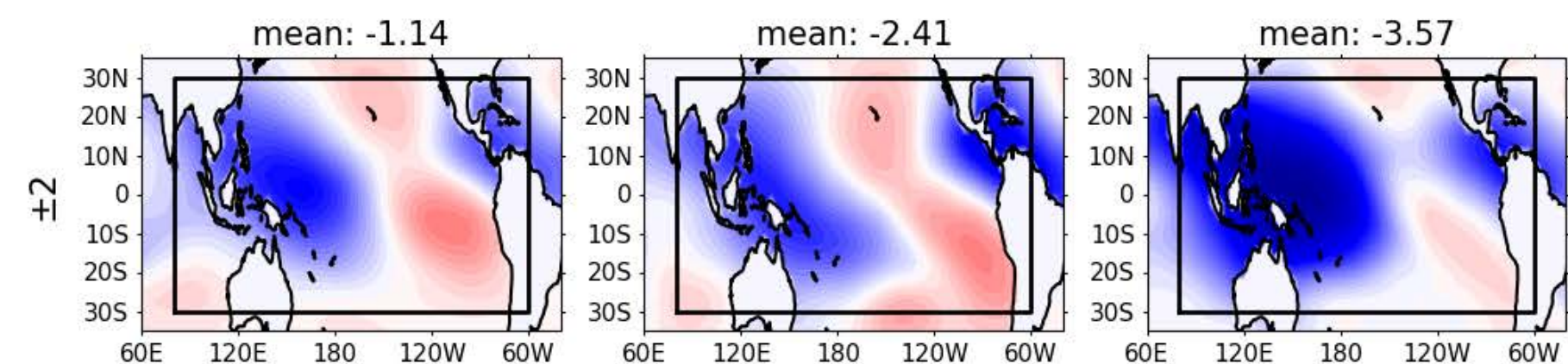
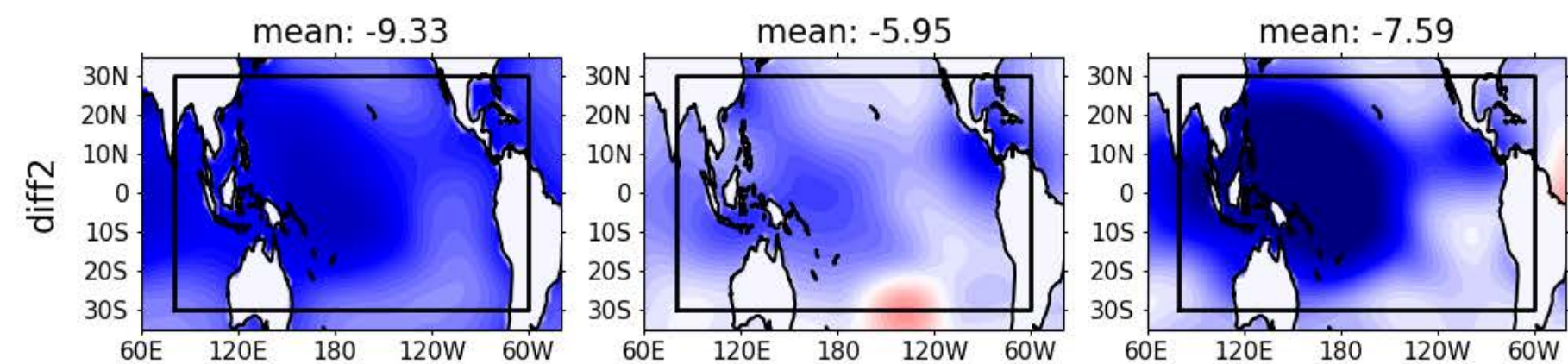
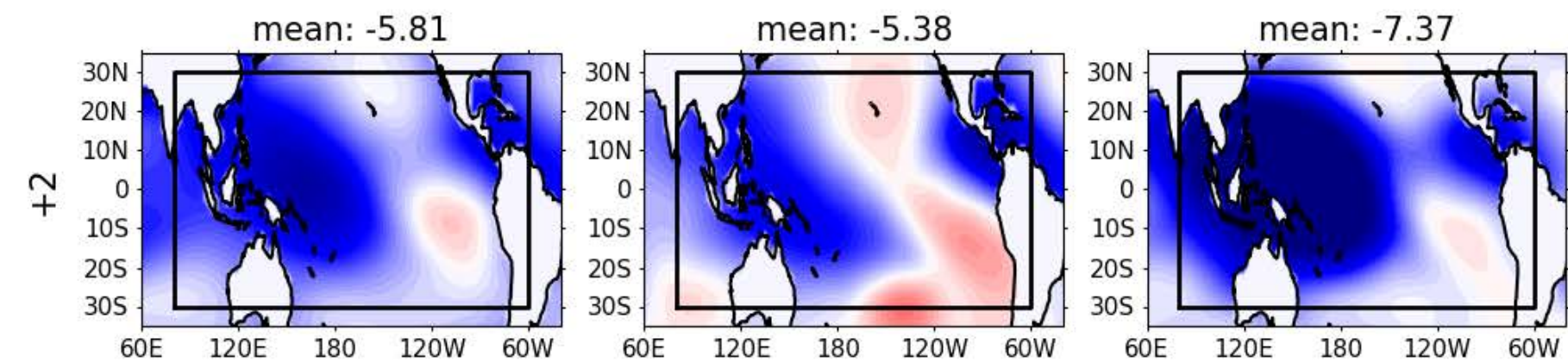
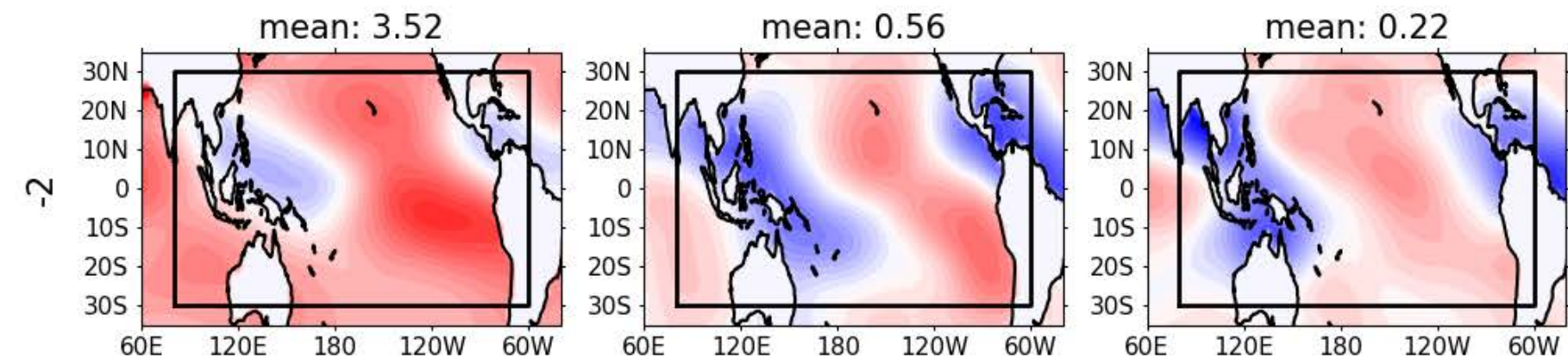
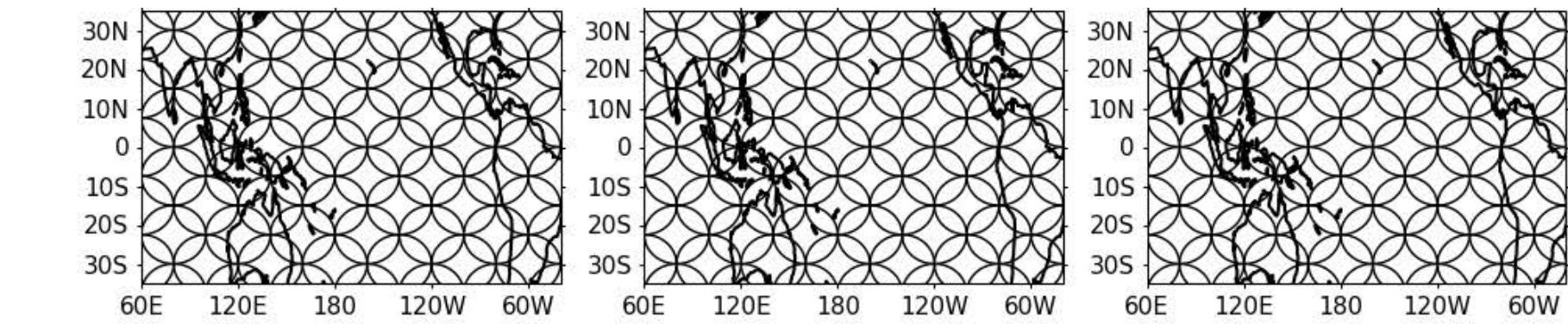


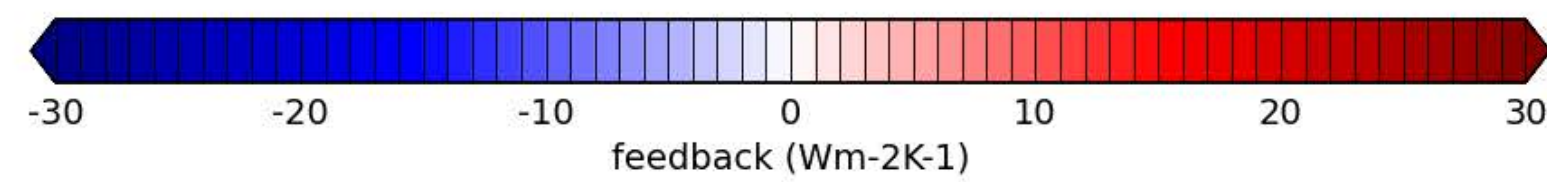
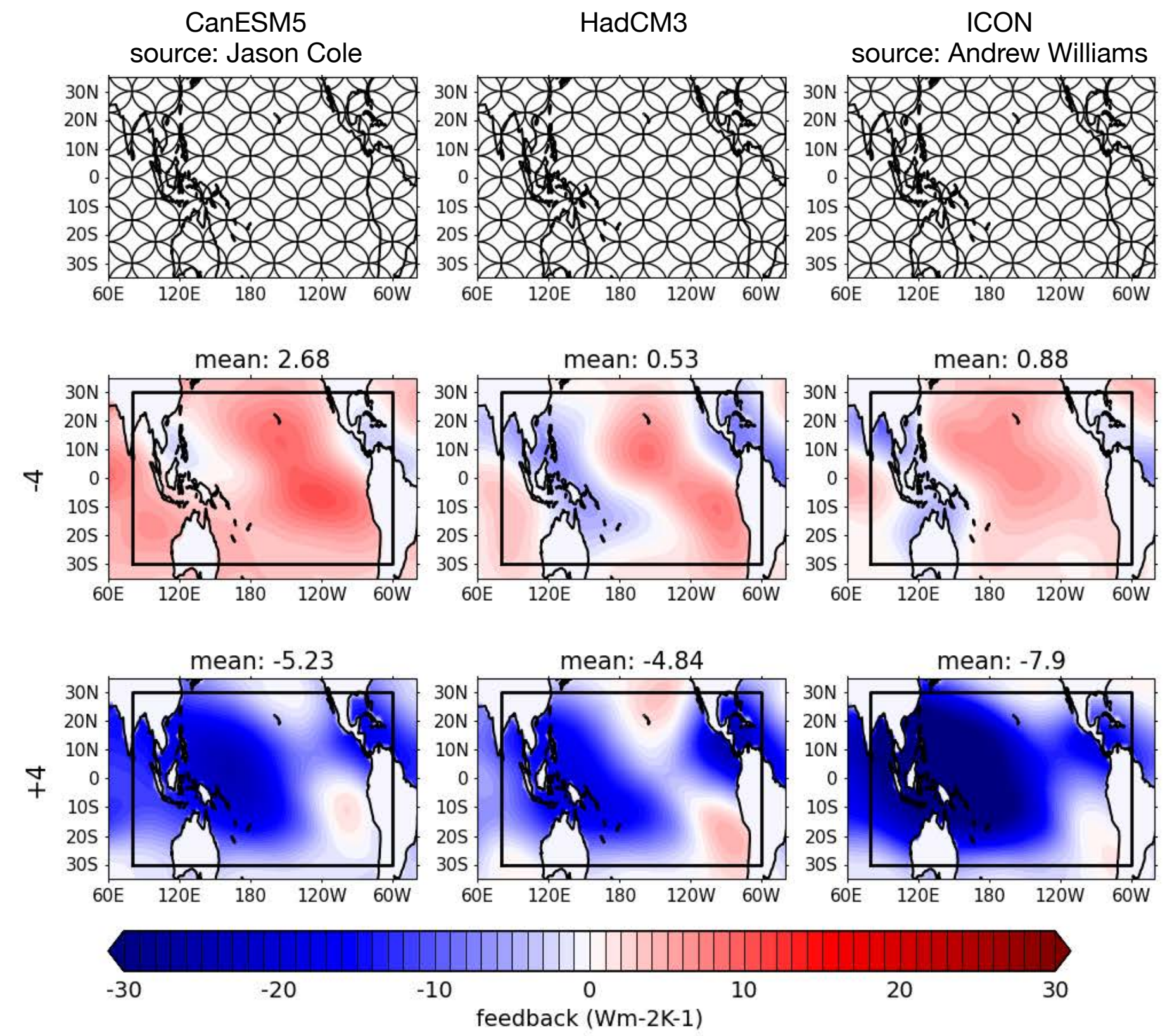
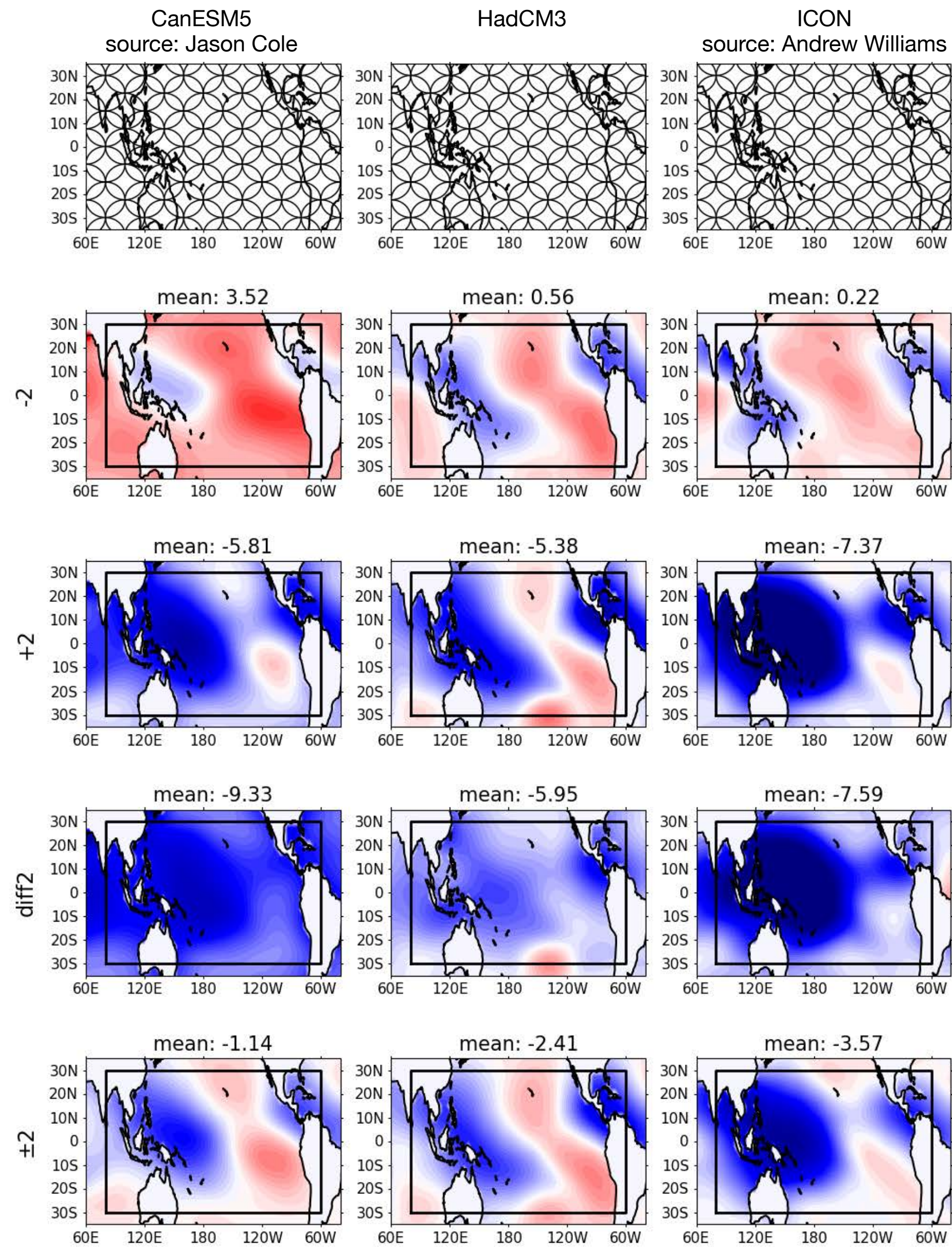


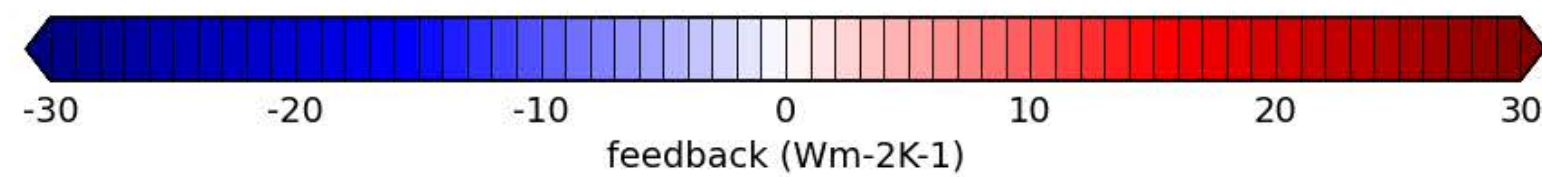
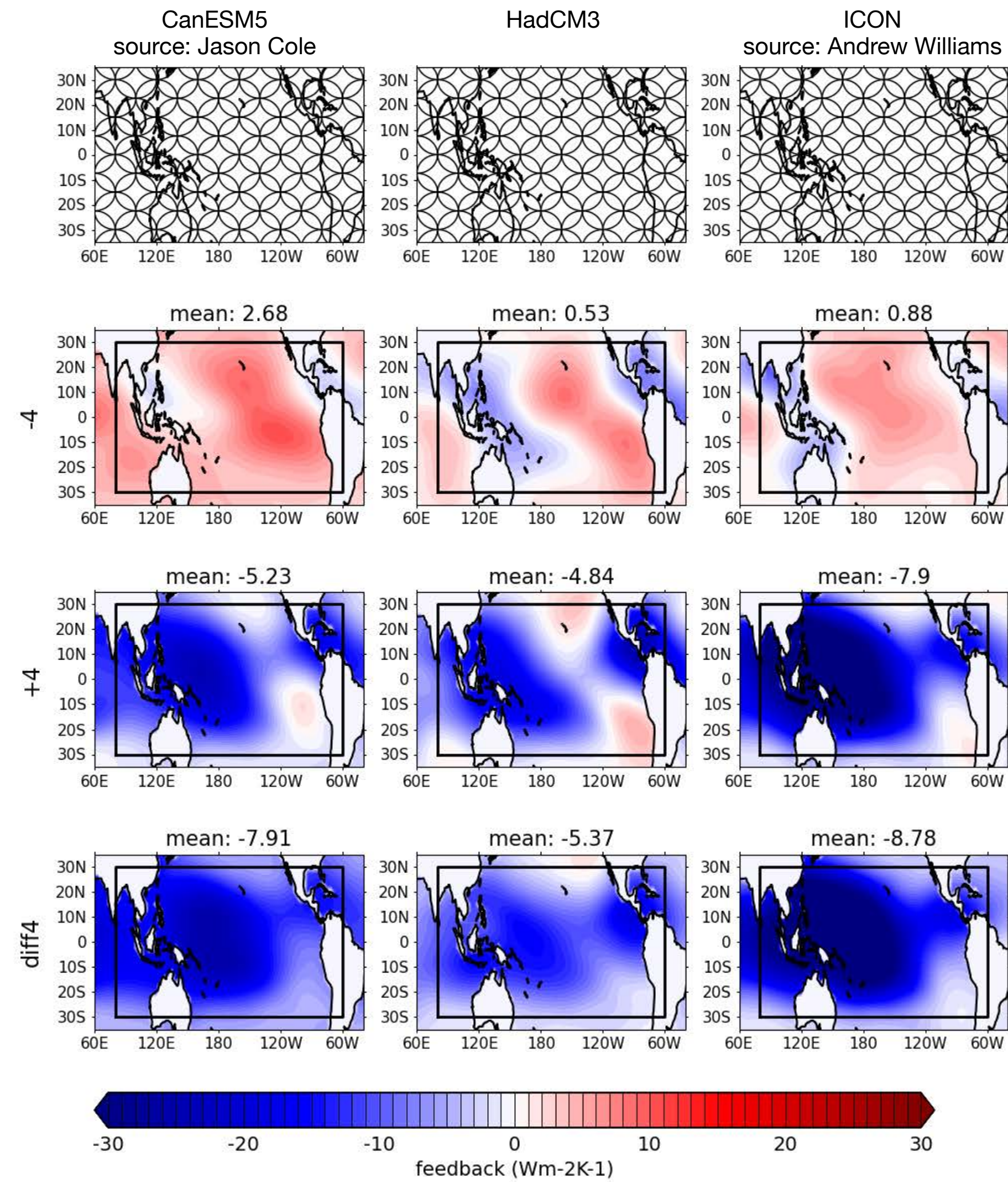
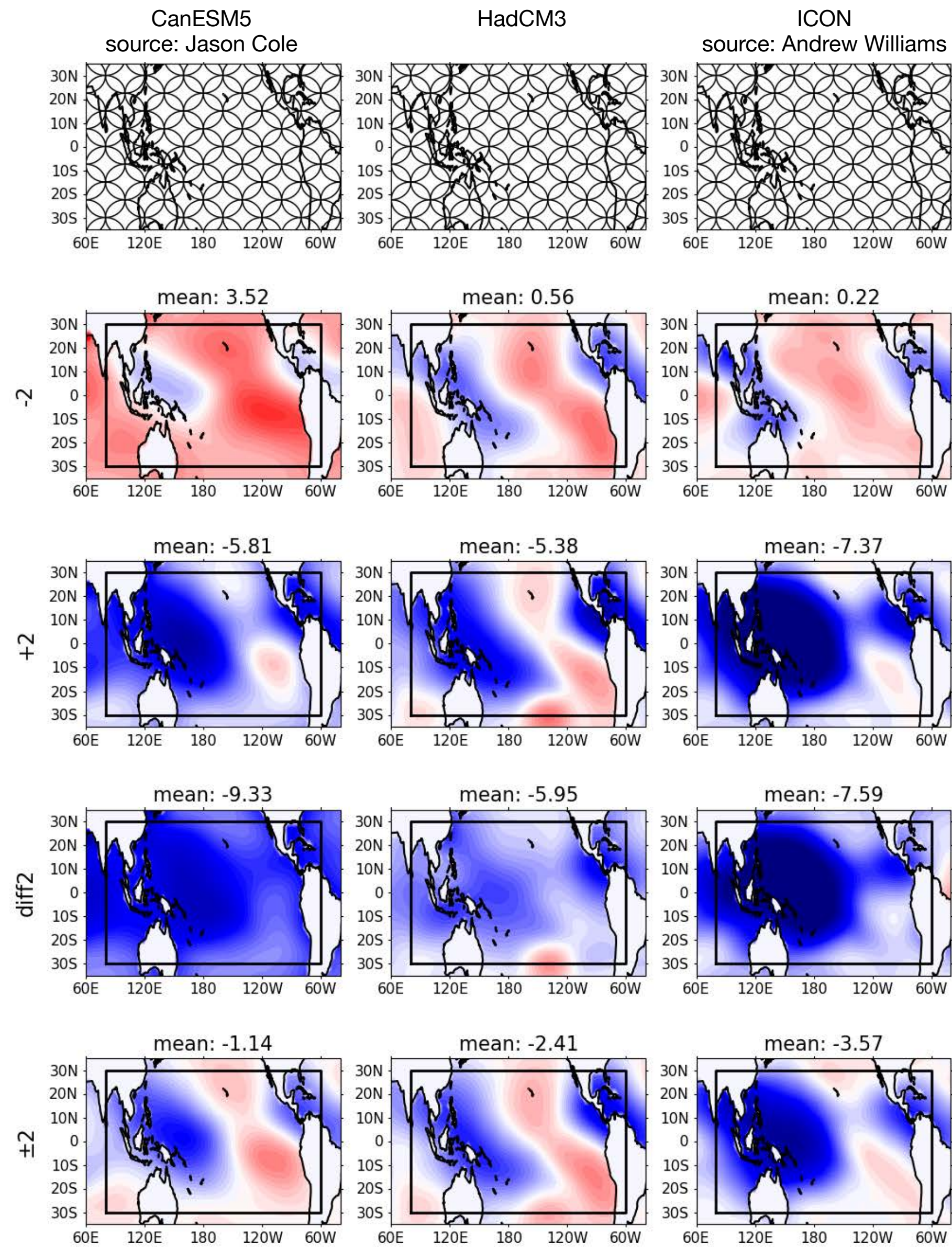
CanESM5
source: Jason Cole

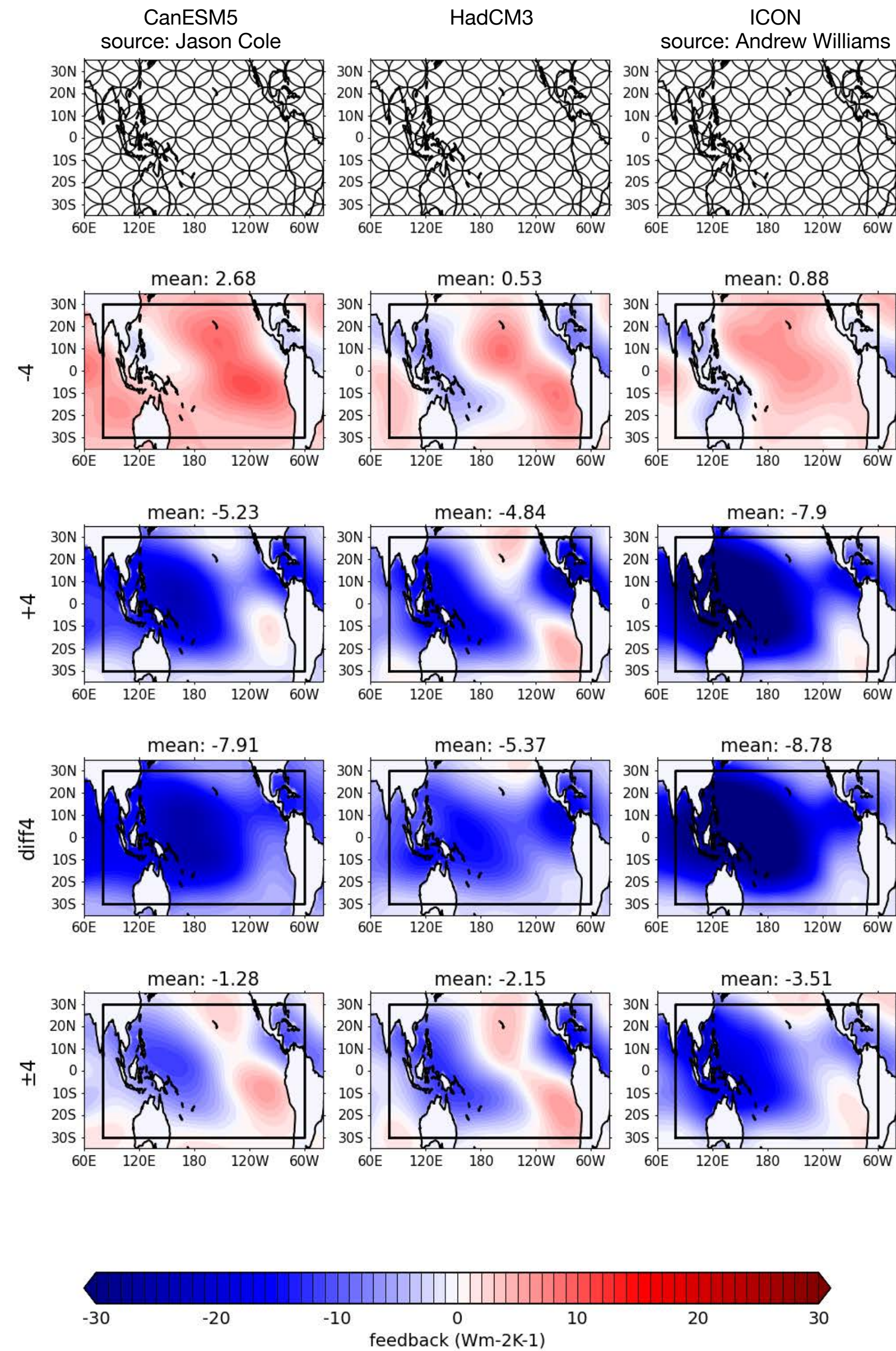
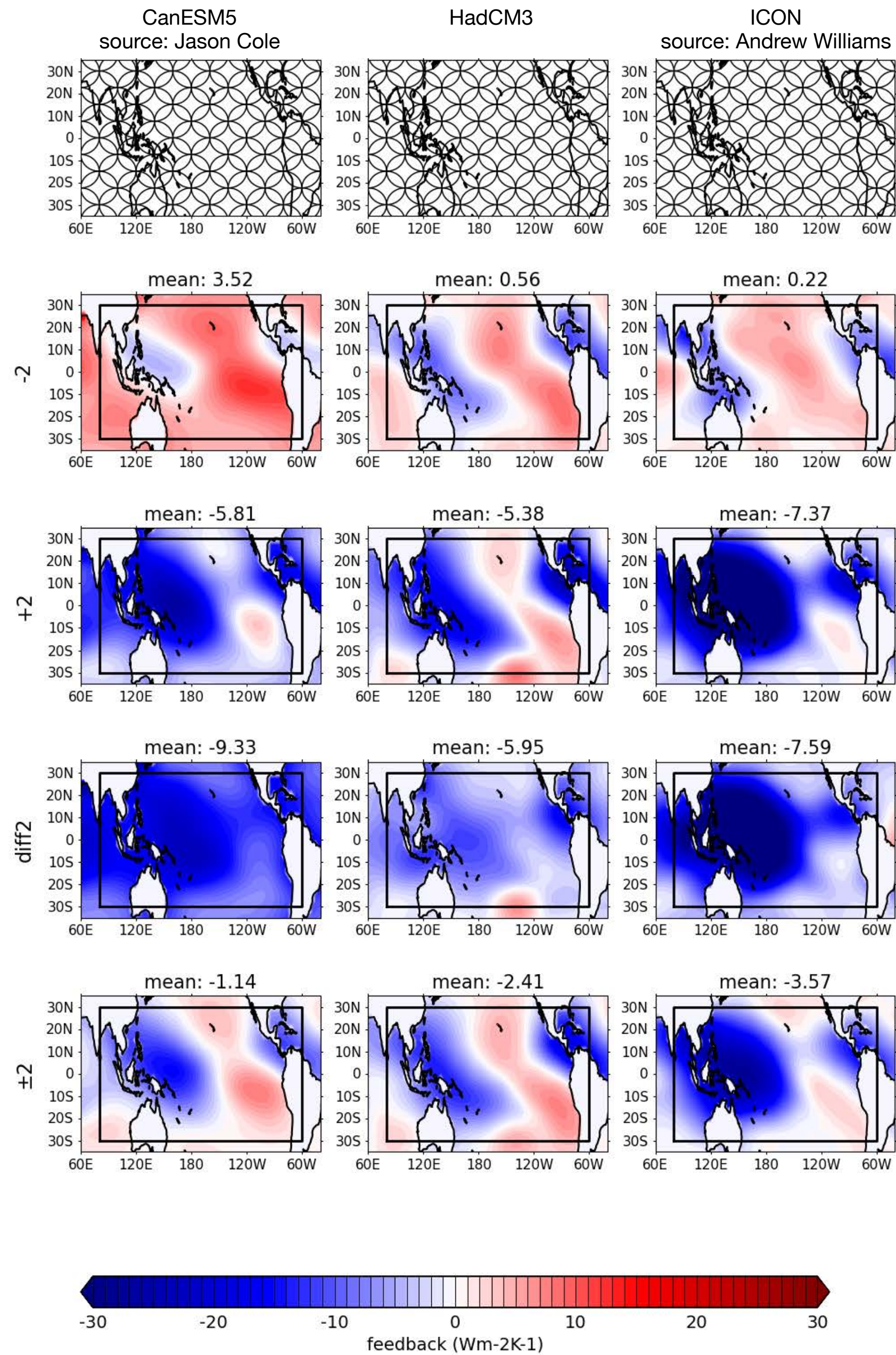
HadCM3

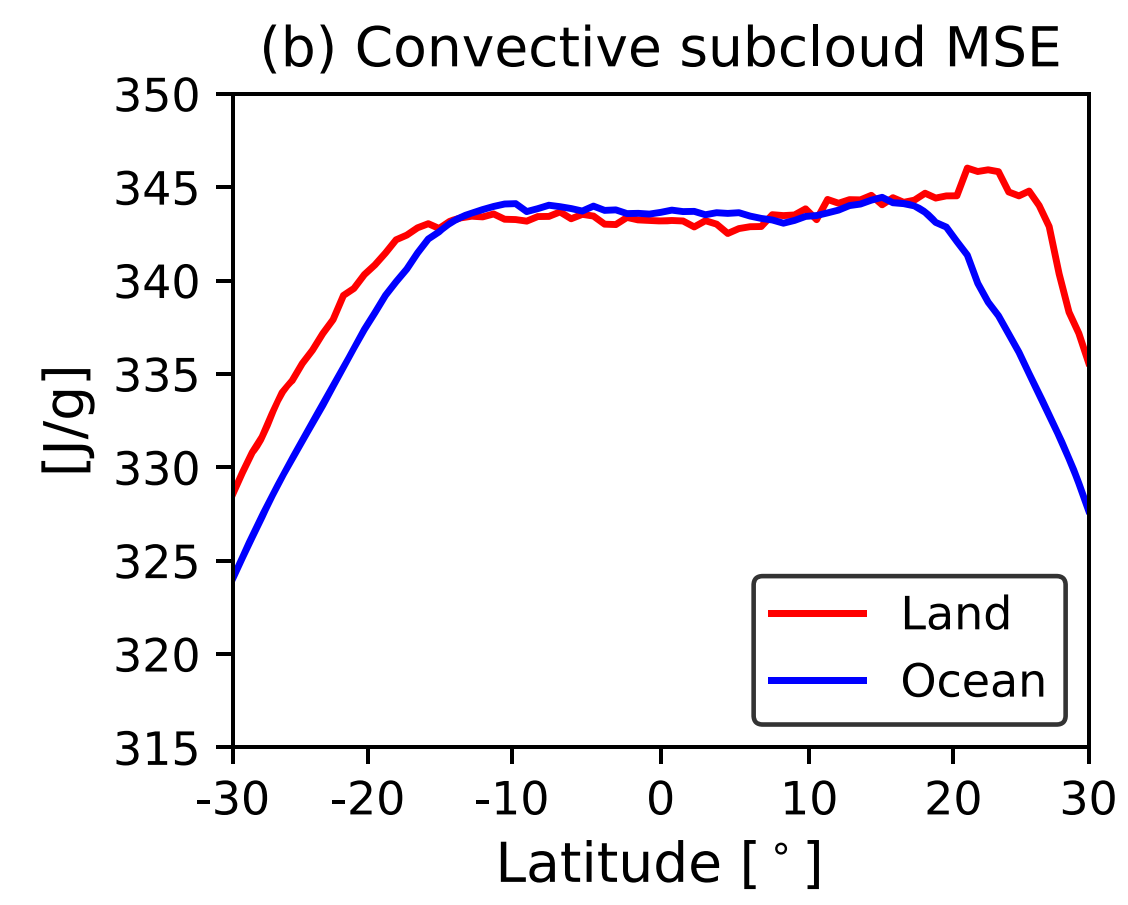
ICON
source: Andrew Williams



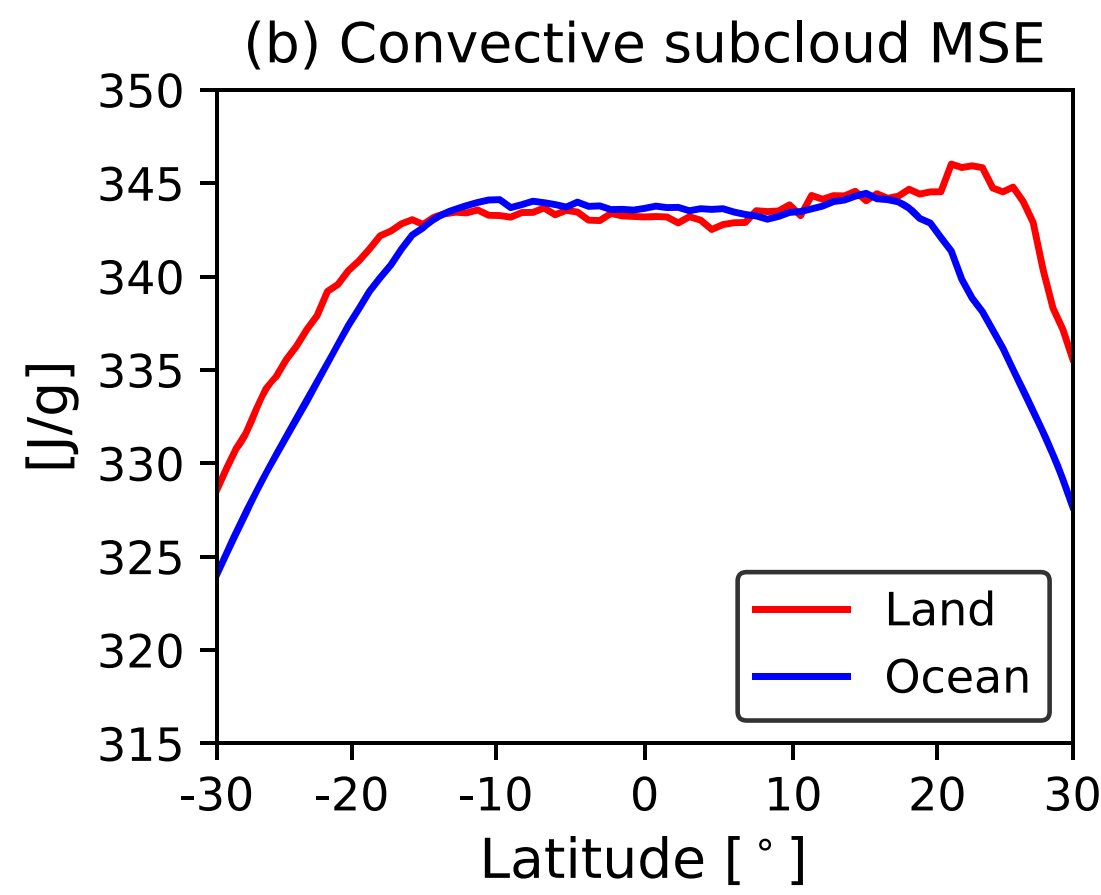






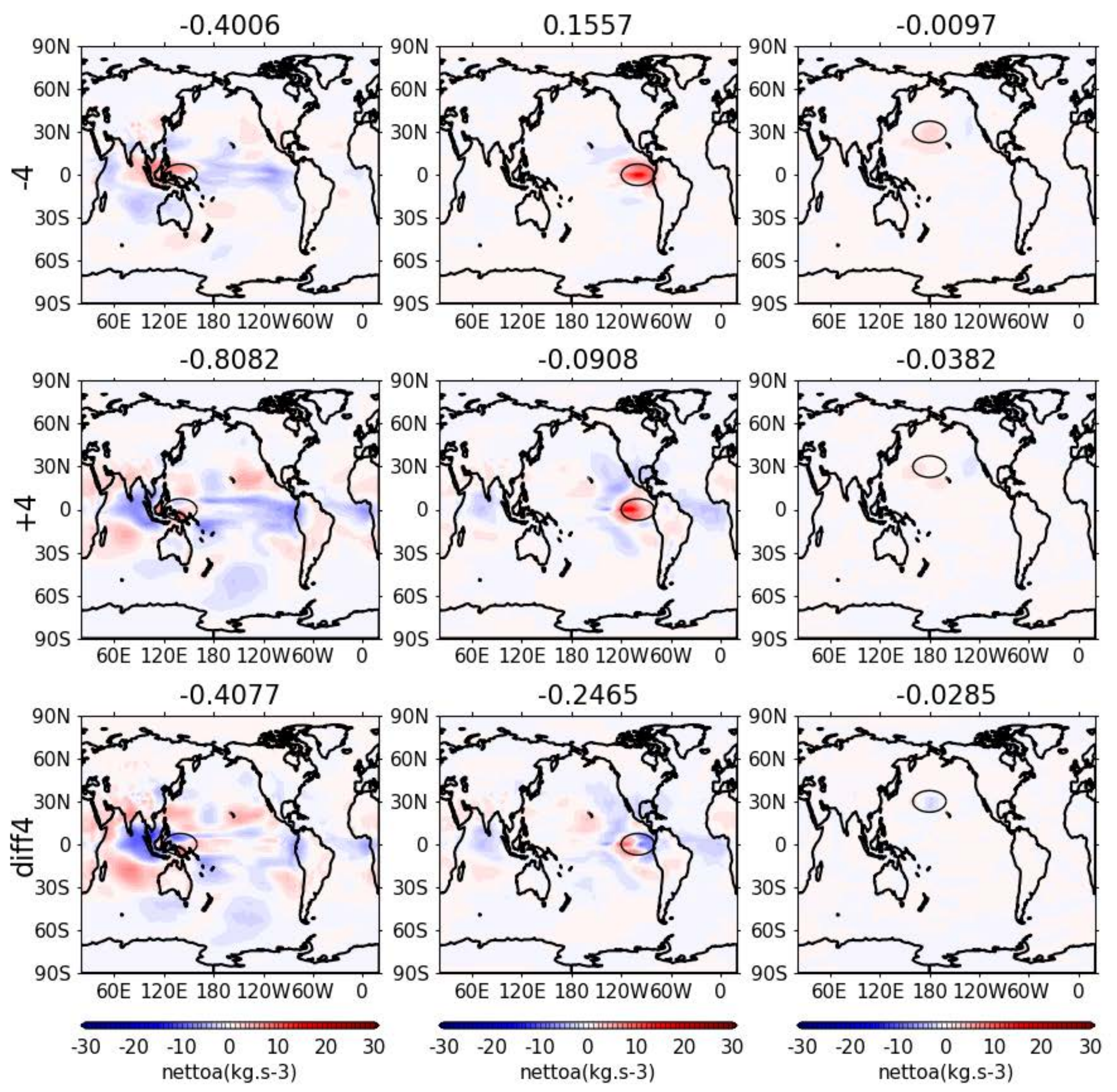


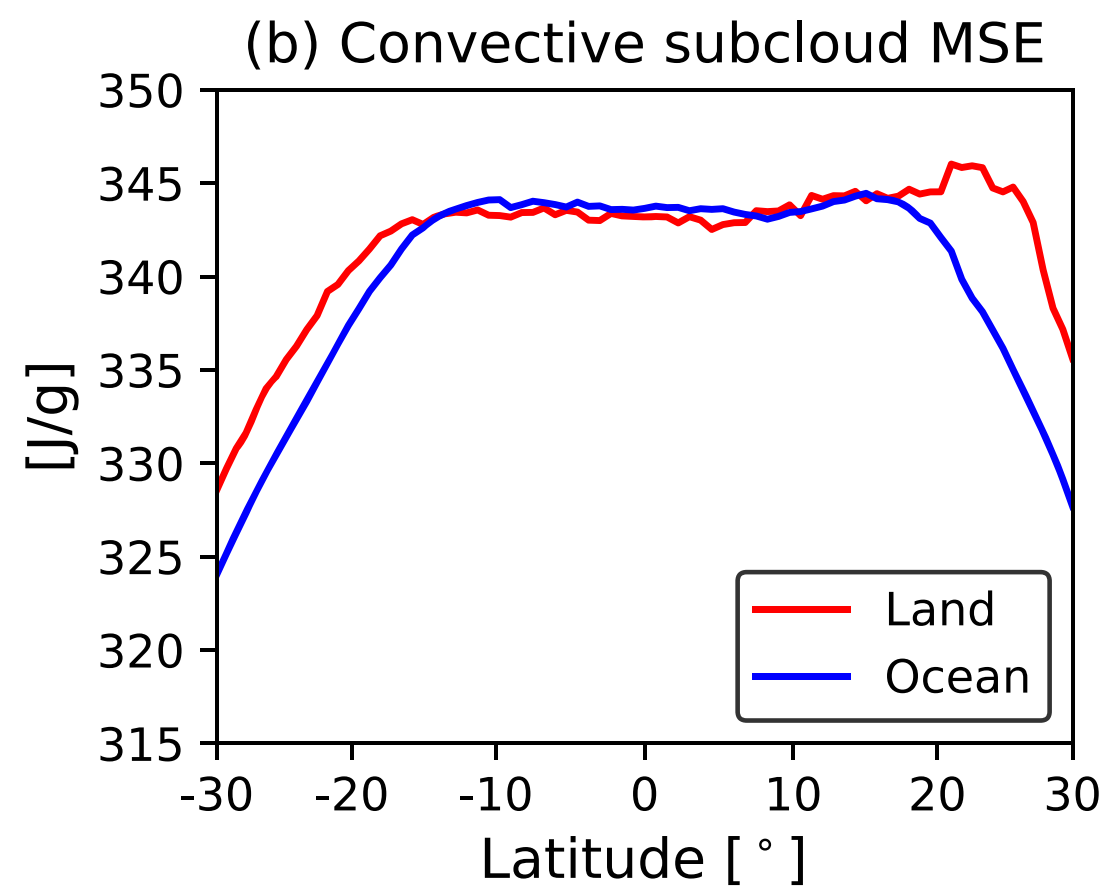
Zhang and Fueglistaler, 2020



Zhang and Fueglistaler, 2020

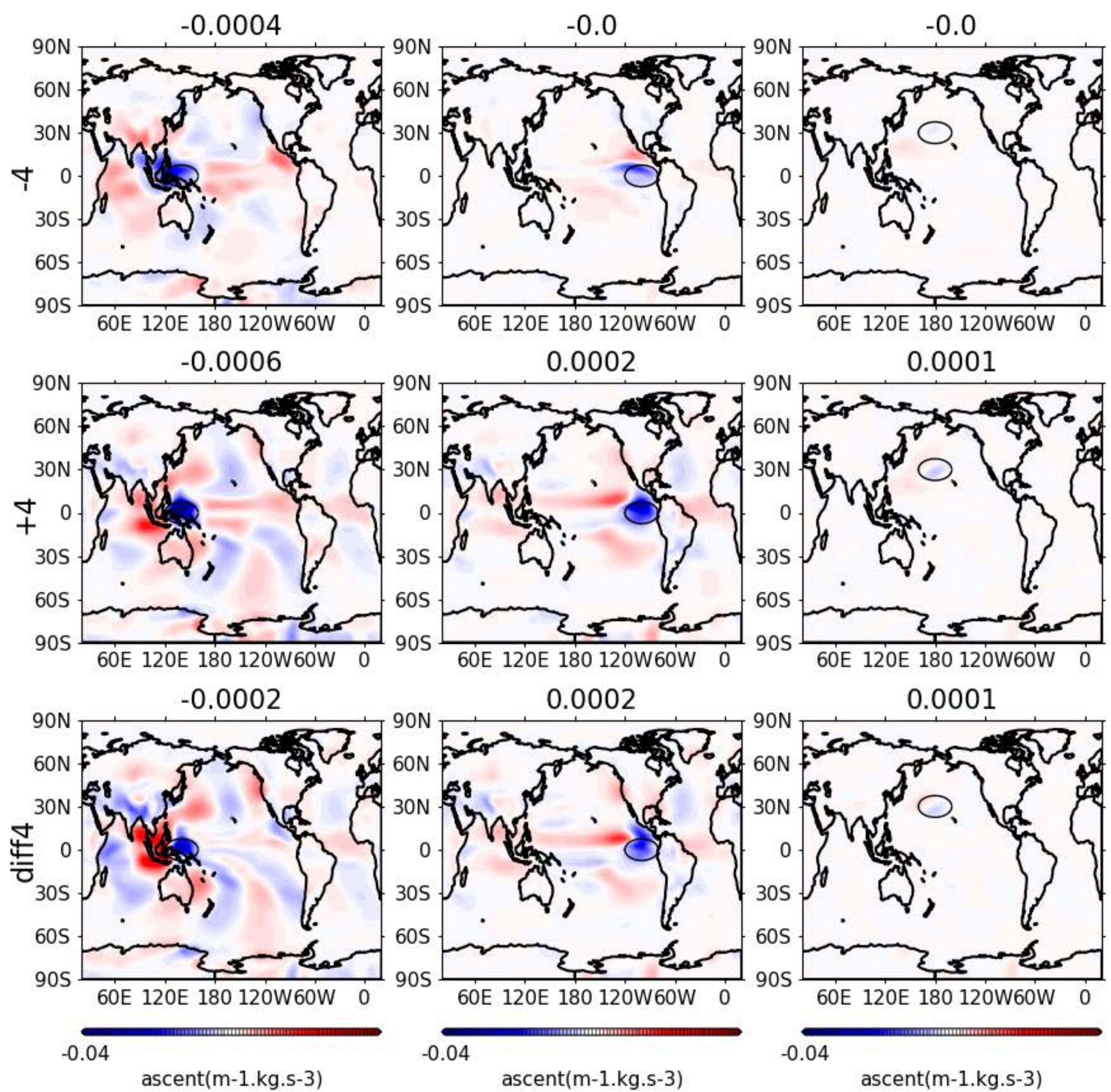
net TOA flux



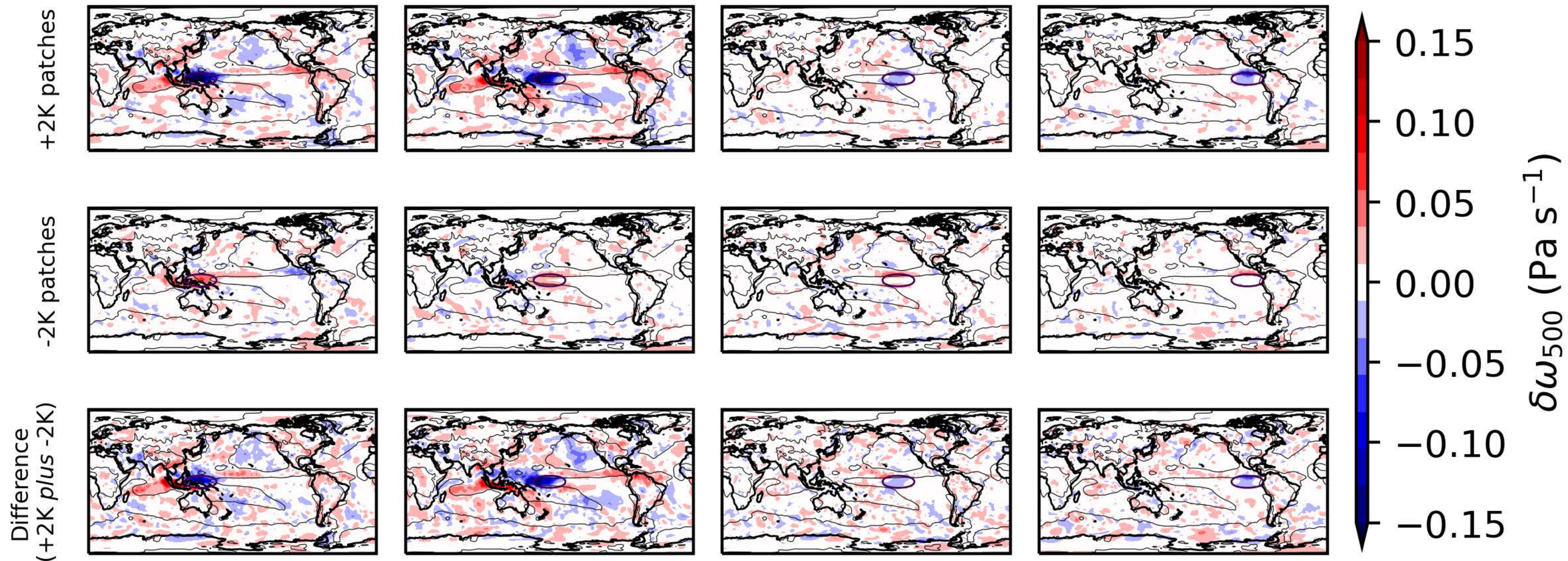


Zhang and Fueglistaler, 2020

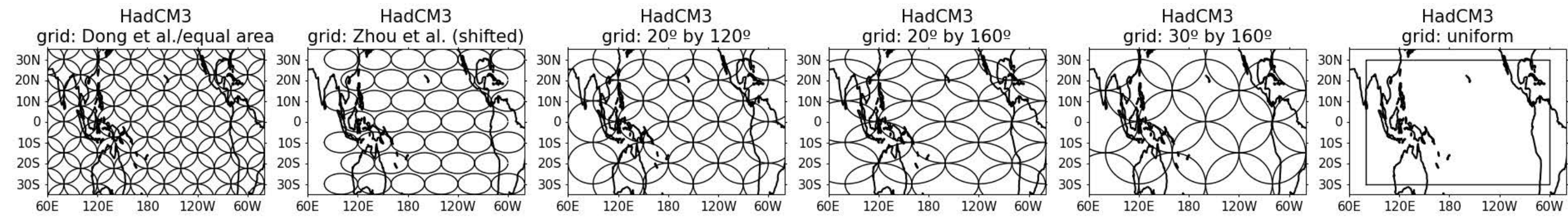
ascent, 750hPa

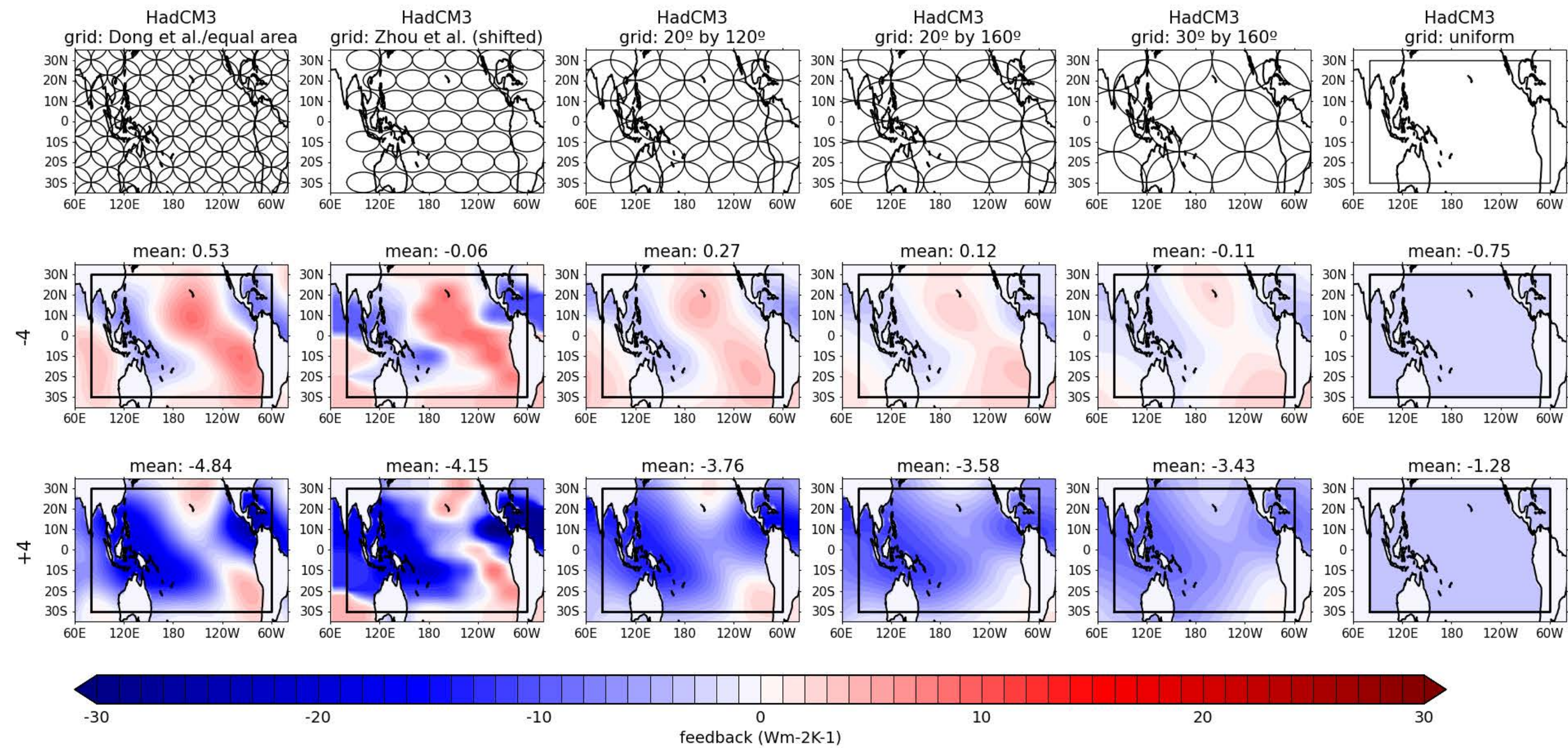


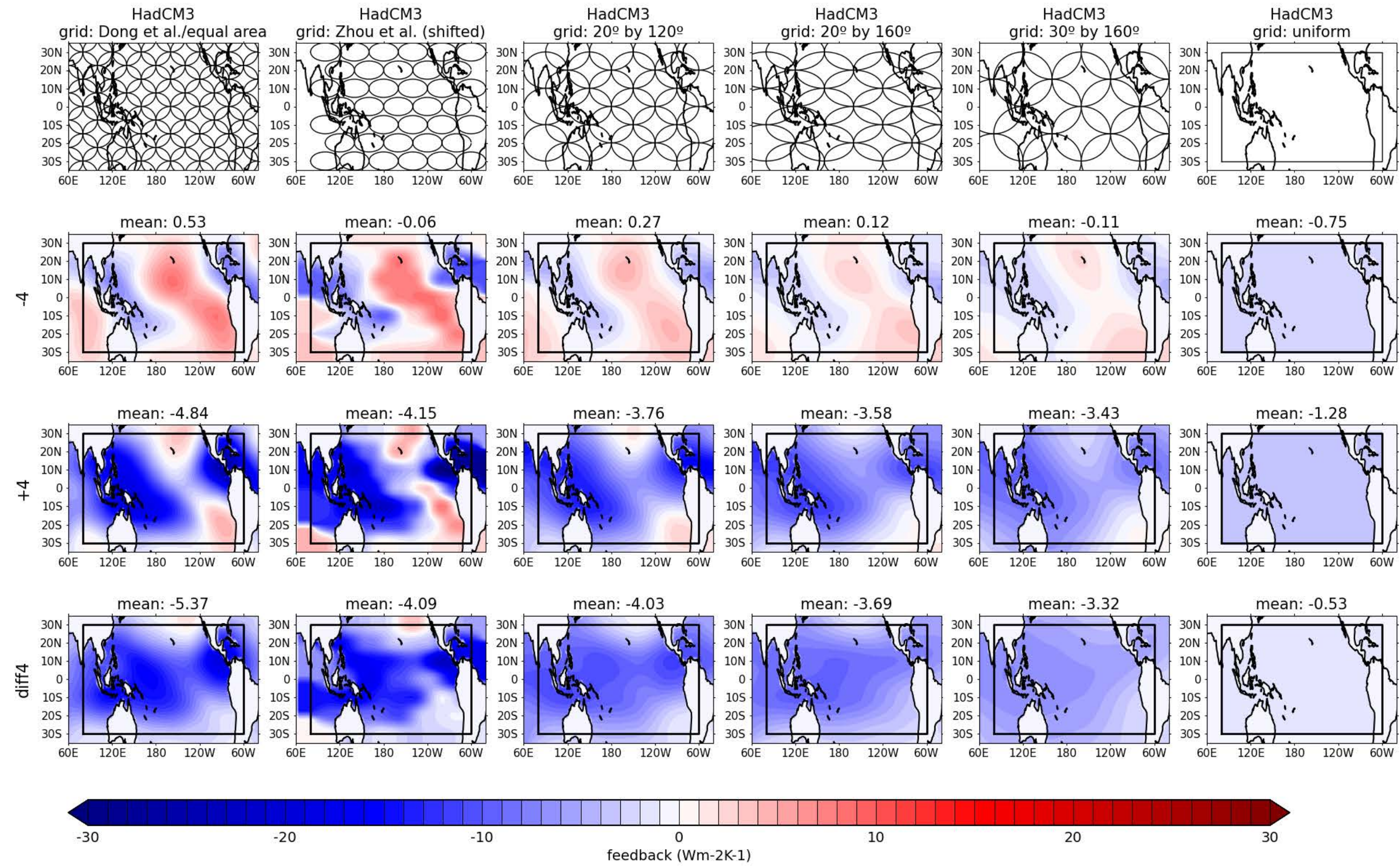
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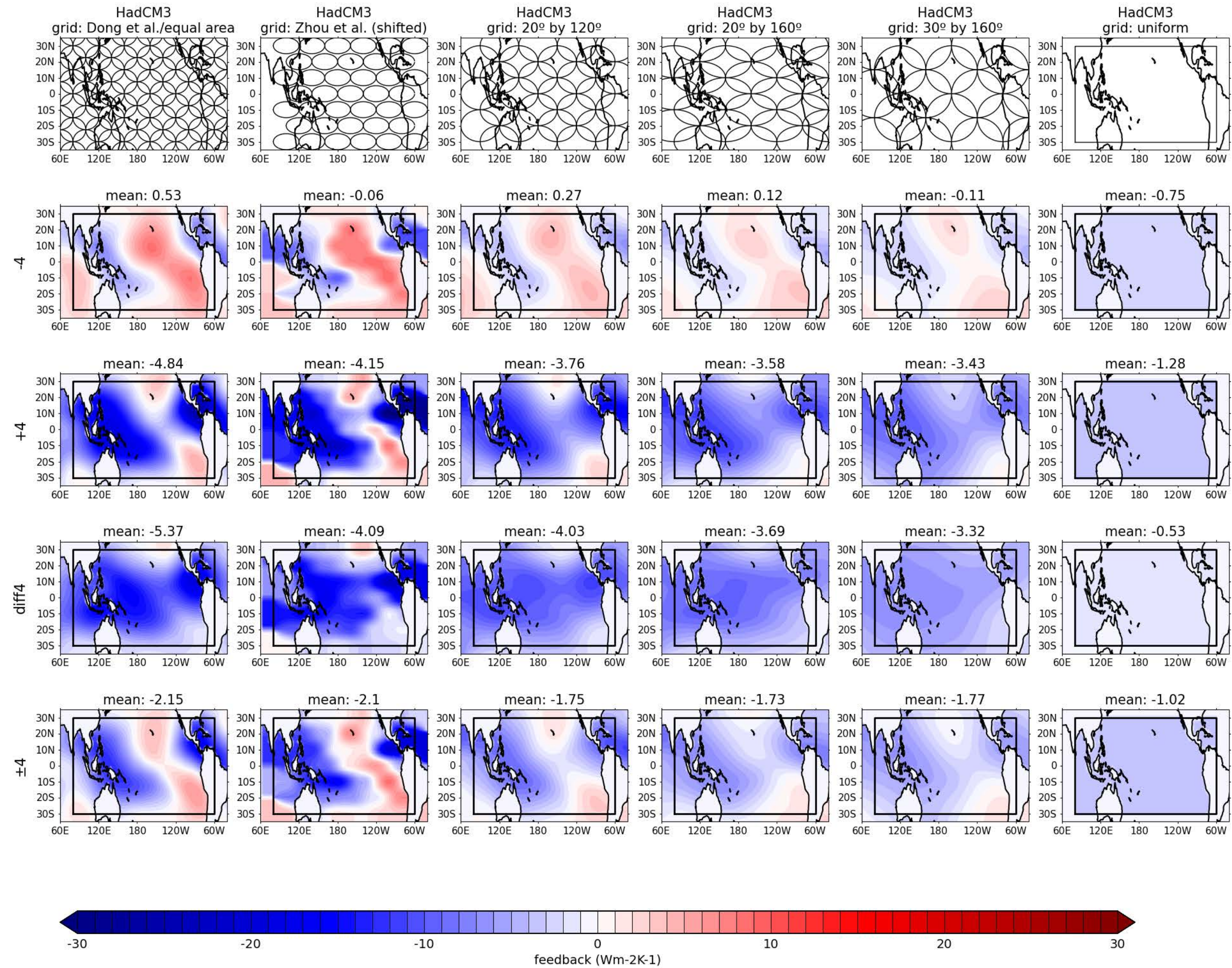


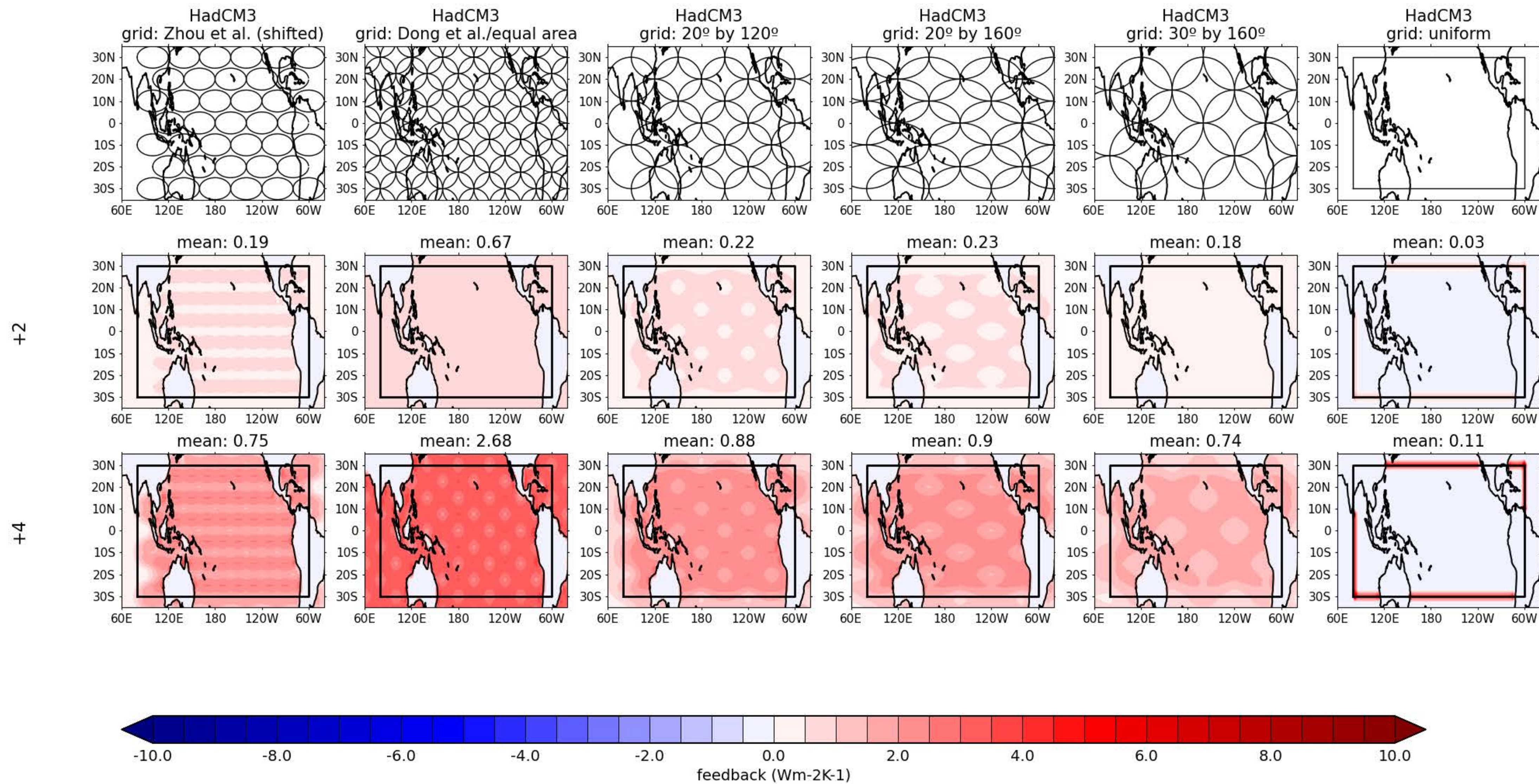
runs/figure from Andrew Williams



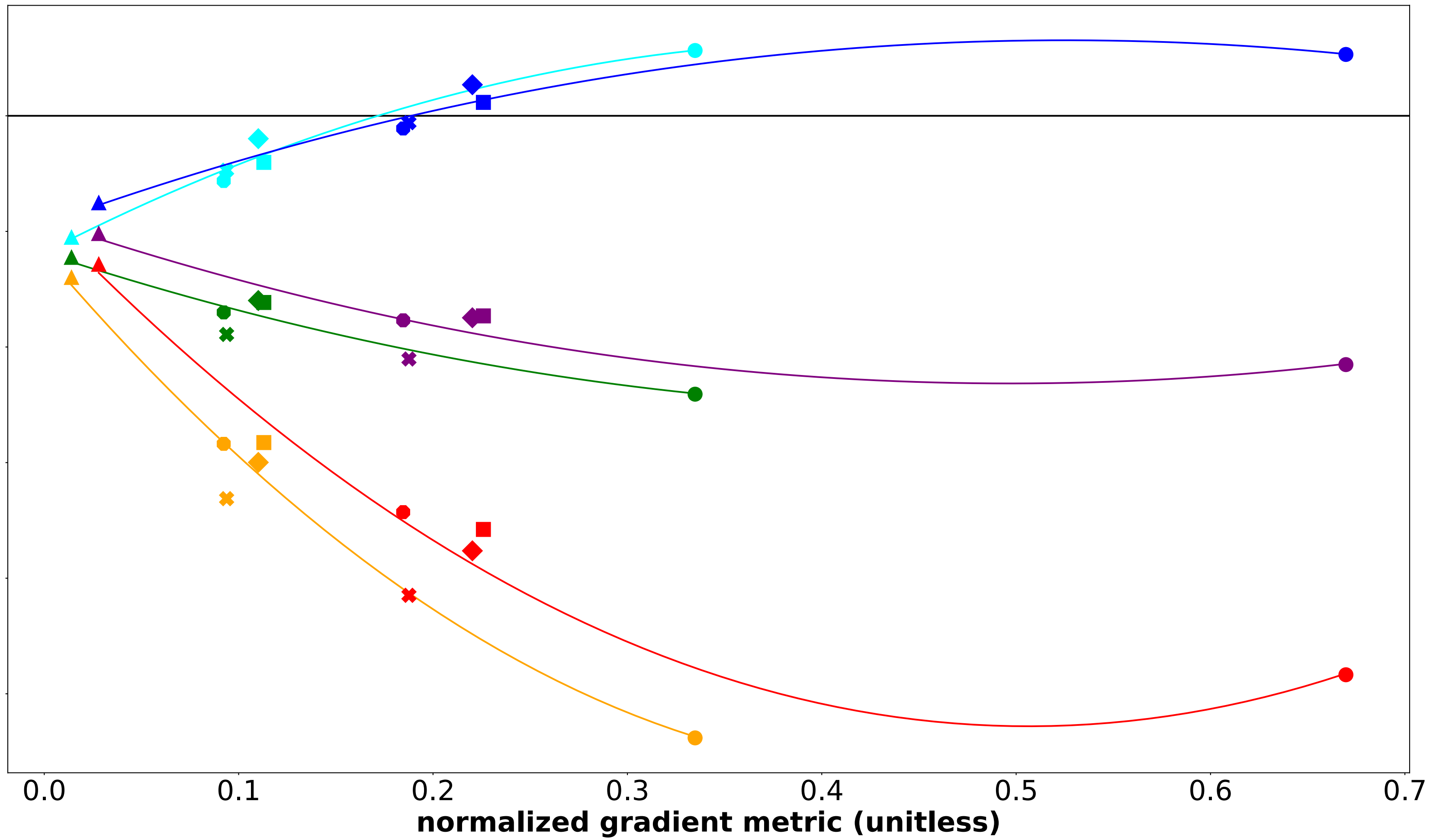




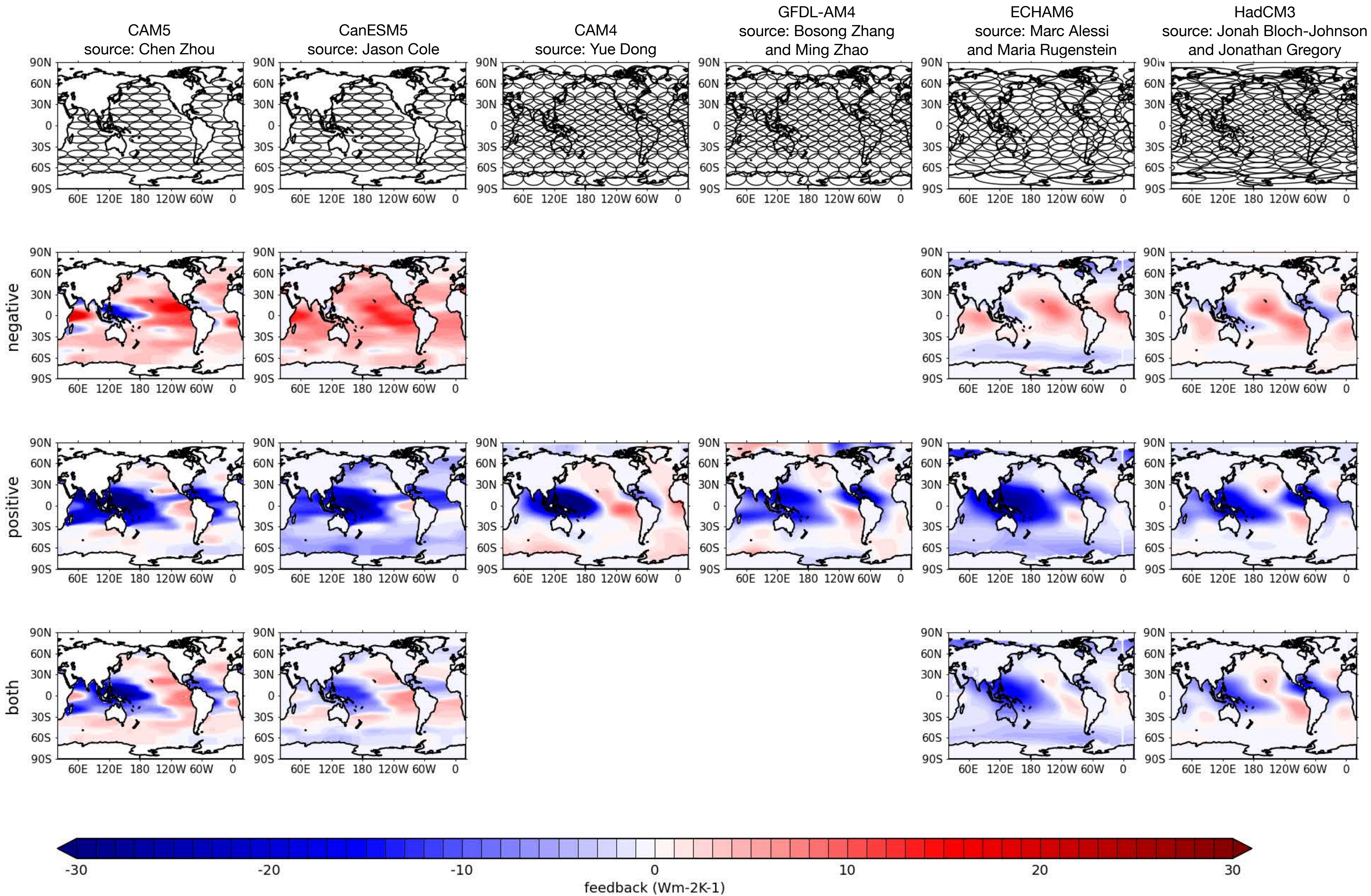




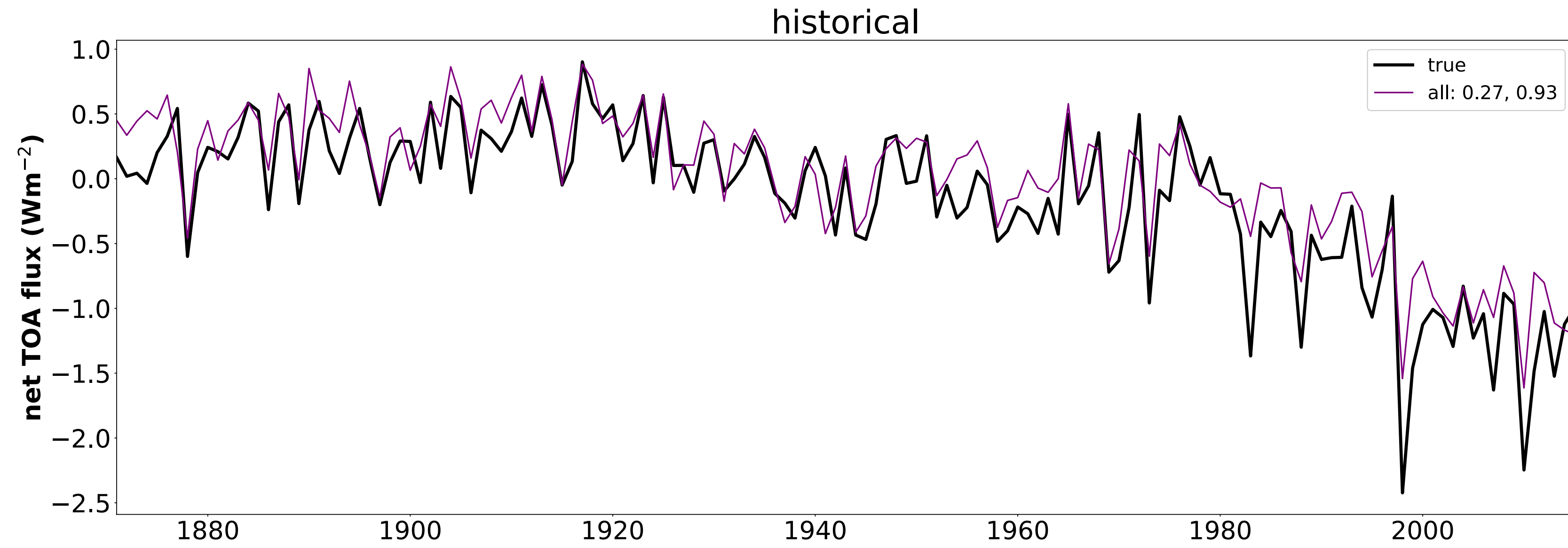
net feedback from warming the tropical Pacific (Wm^{-2}/K)



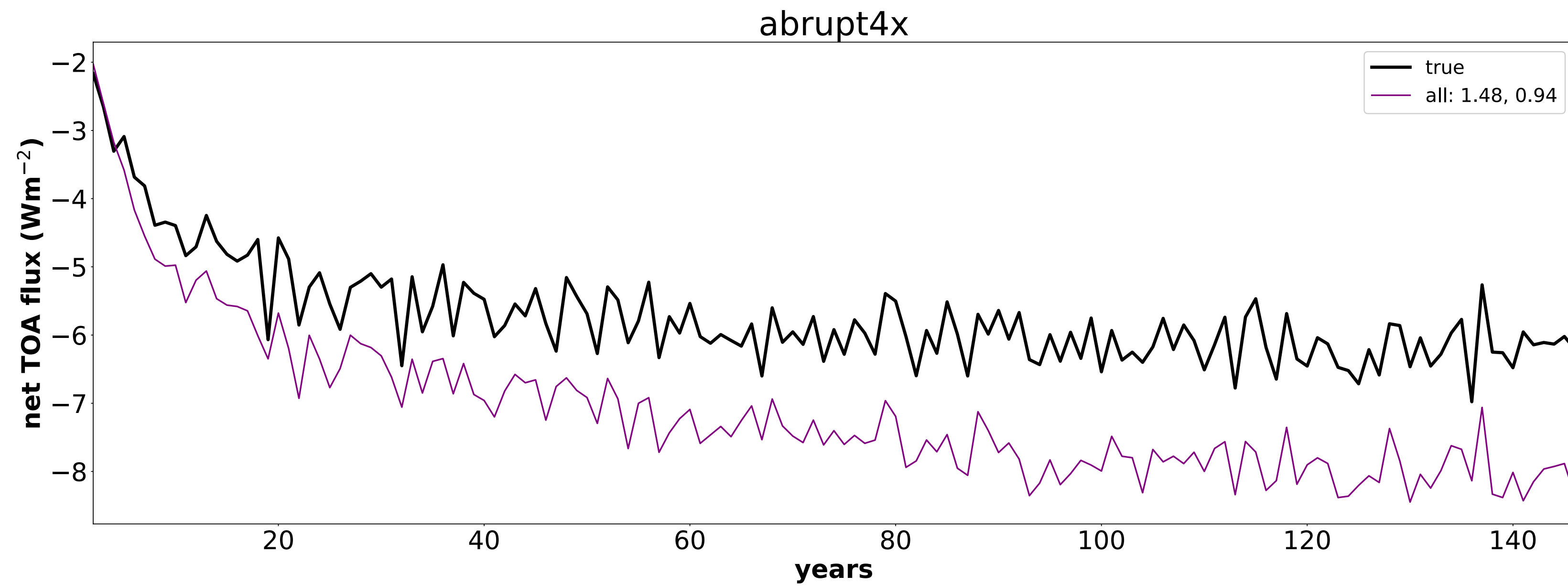
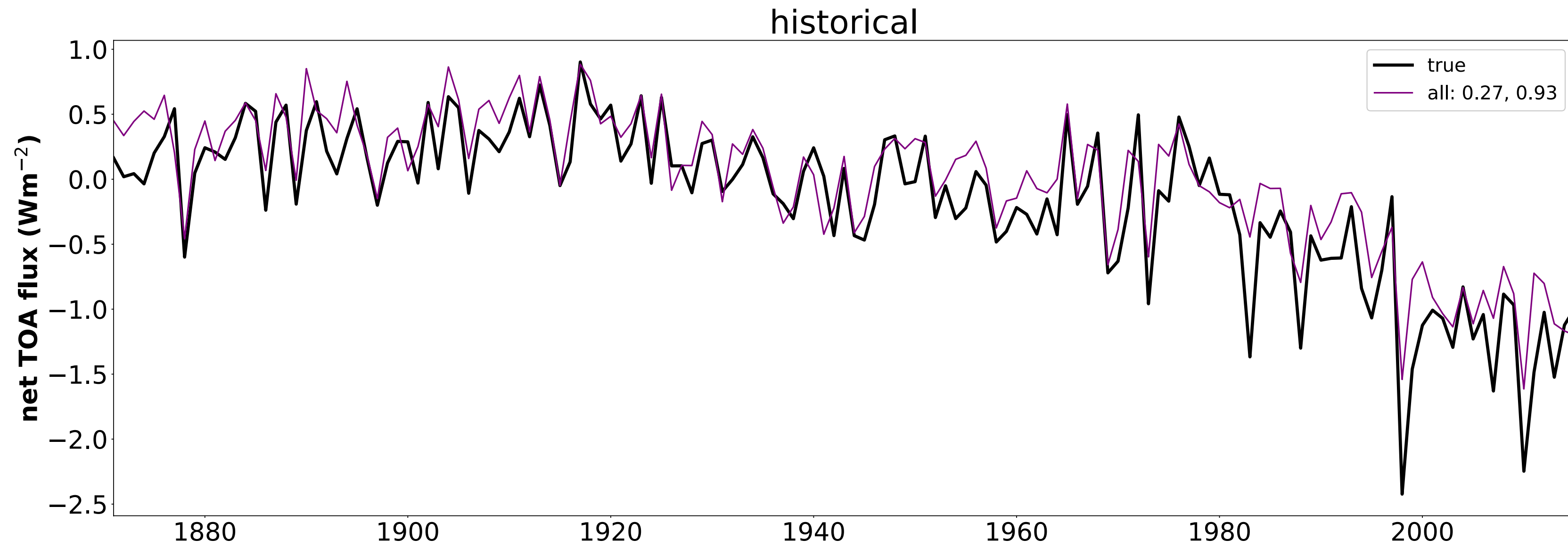
- ◆ -4
- ◆ -2
- ◆ +2
- ◆ +4
- ◆ ± 2
- ◆ ± 4
- ✕ Zhou et al. (shifted)
- Dong et al./equal a
- ◆ 20° by 120°
- 20° by 160°
- 30° by 160°
- ▲ uniform

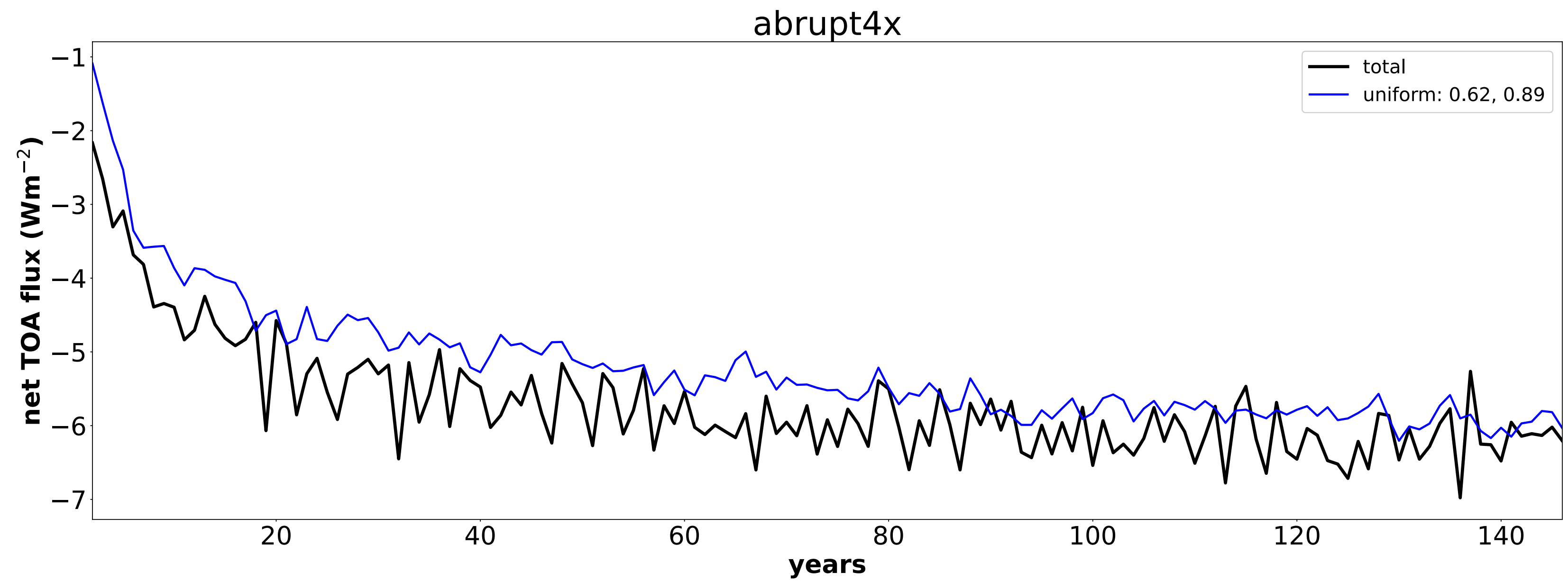
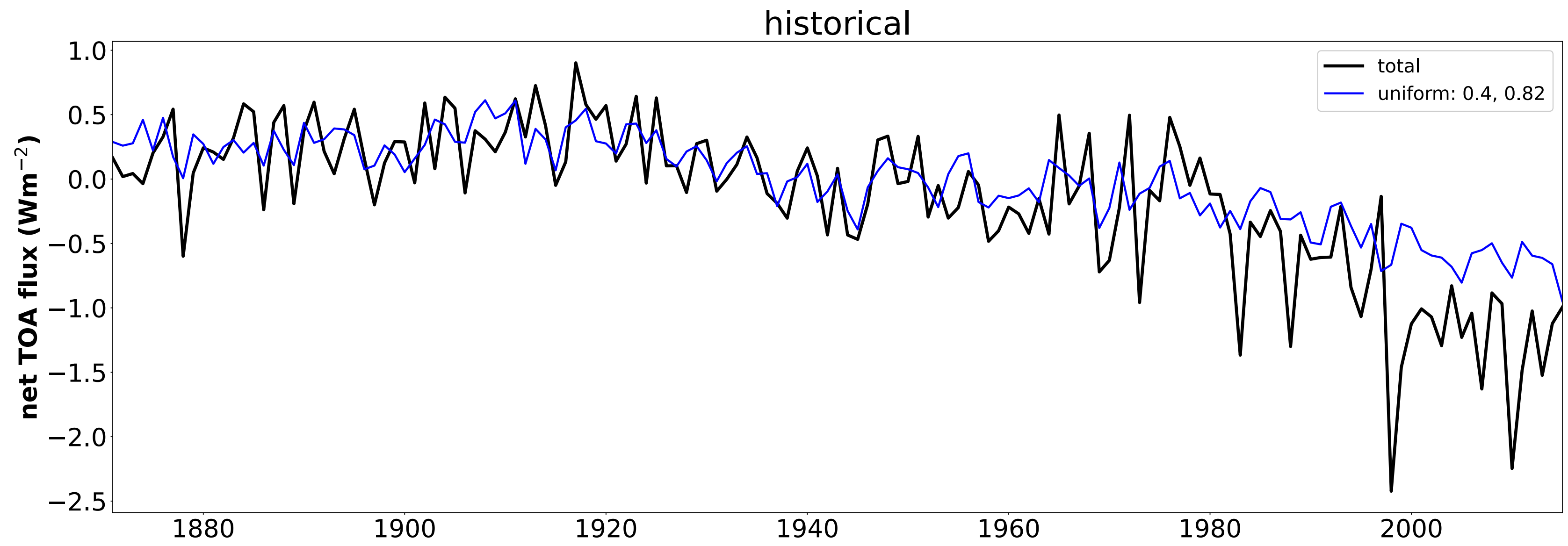


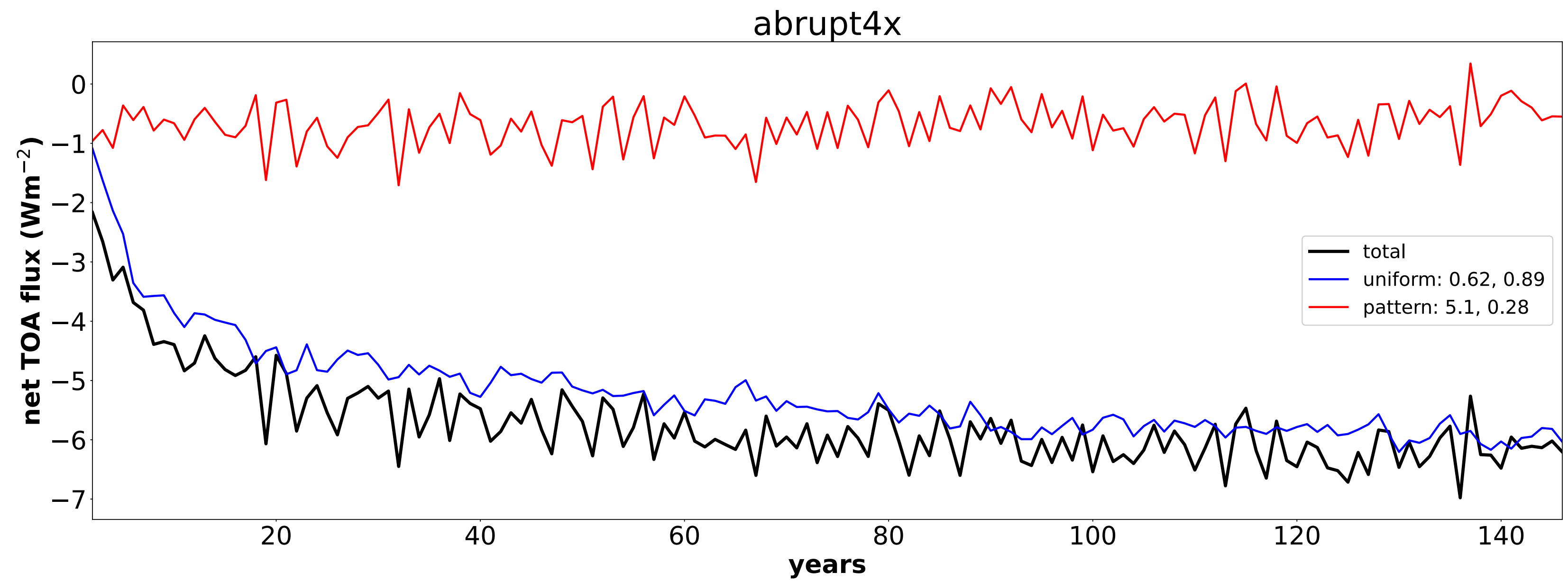
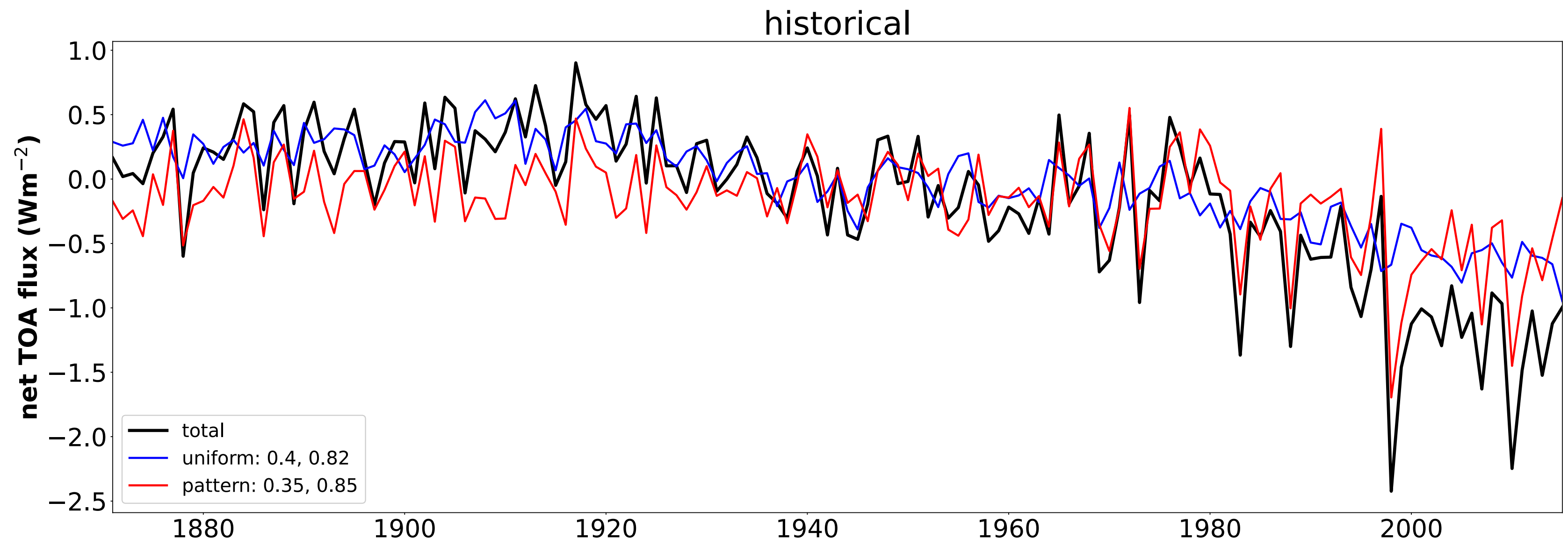
HadCM3, full: Dong et al./equal area, annual

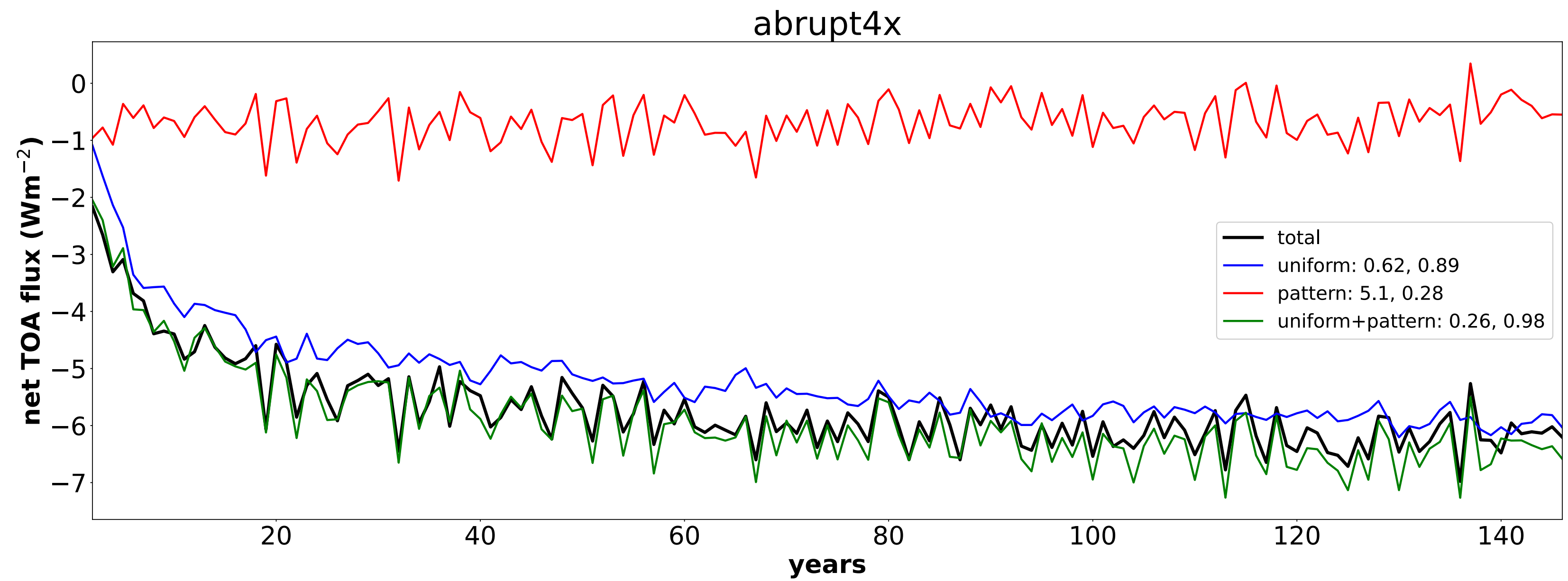
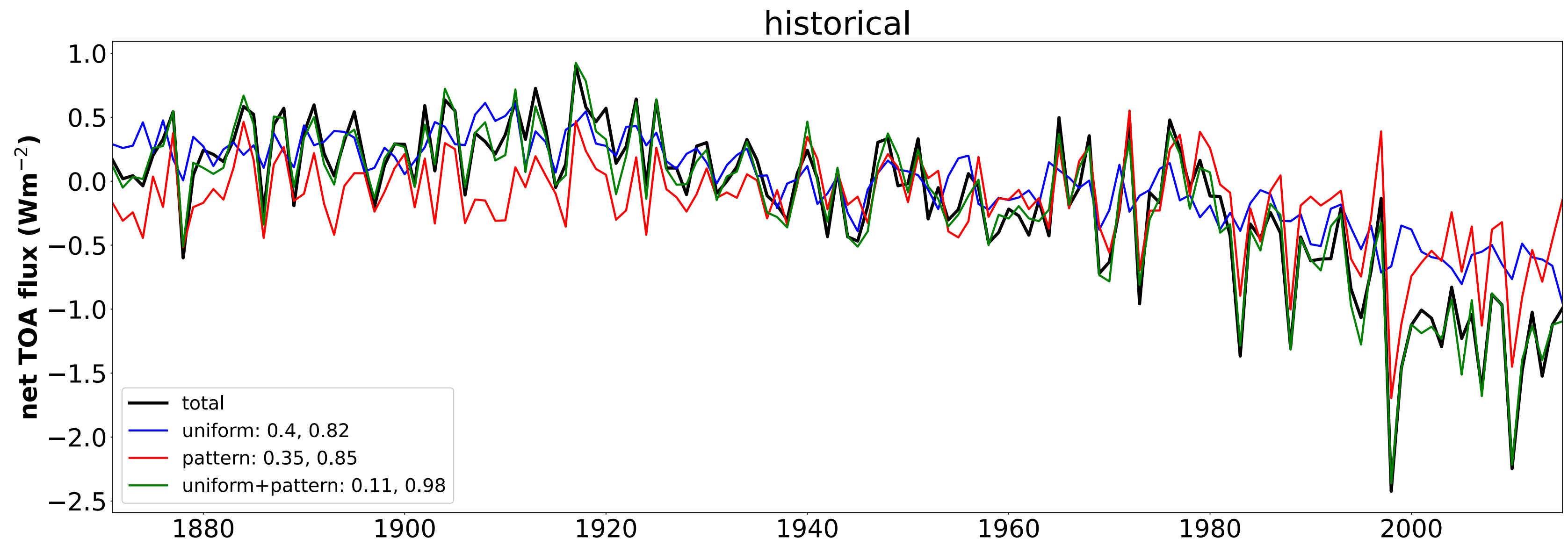


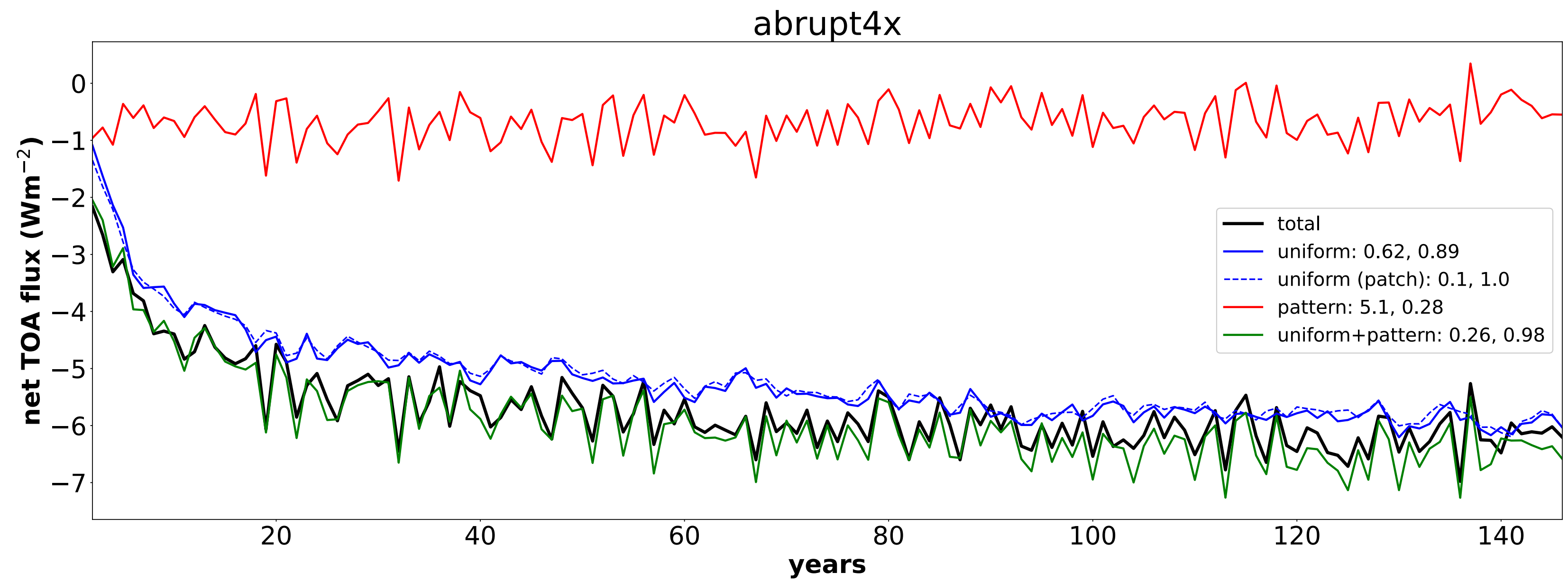
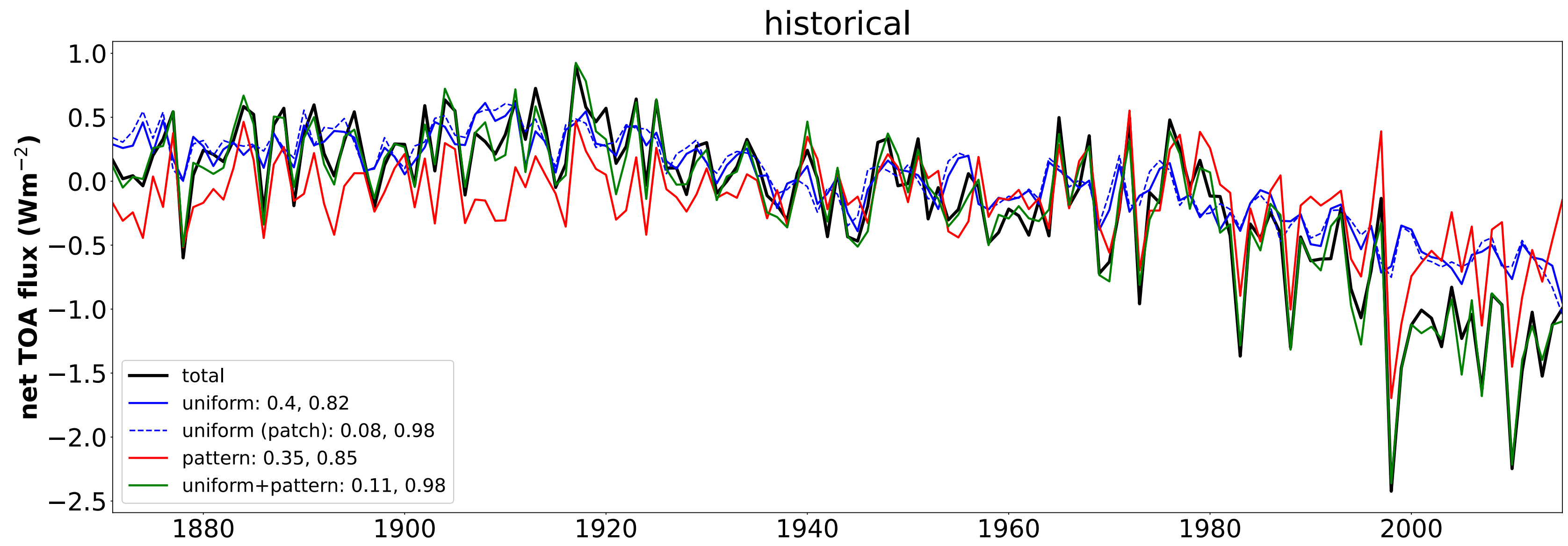
HadCM3, full: Dong et al./equal area, annual

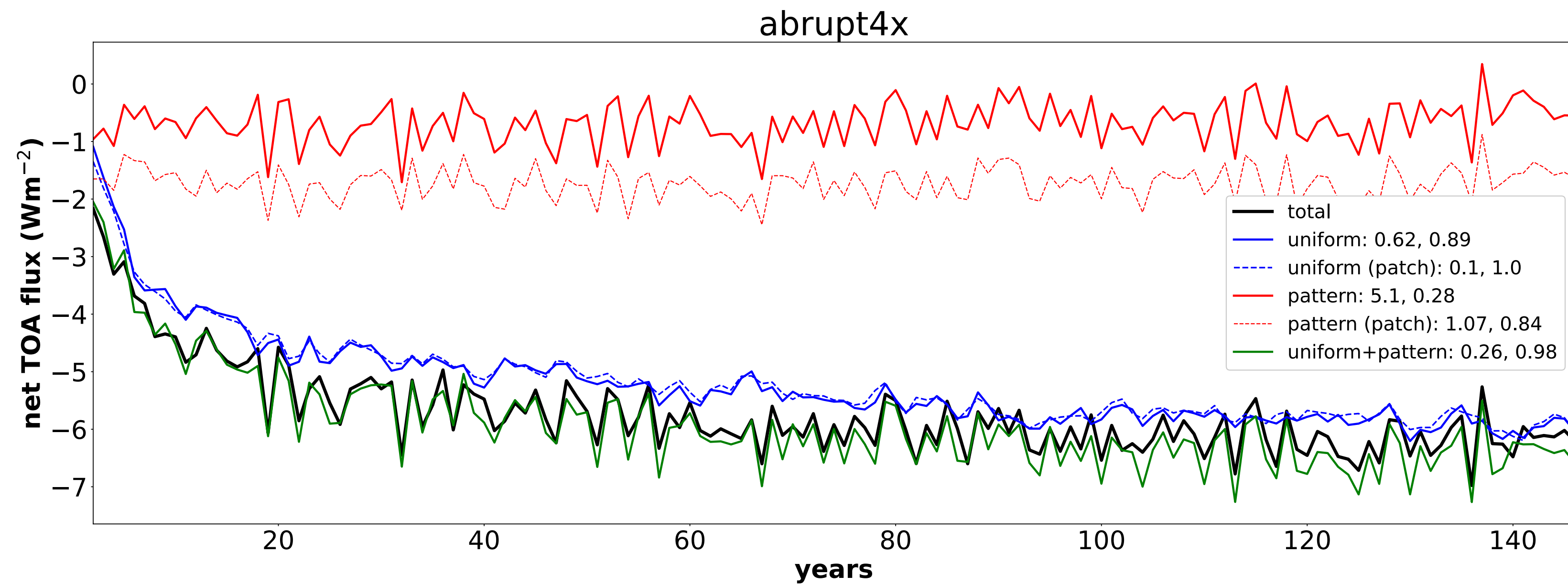
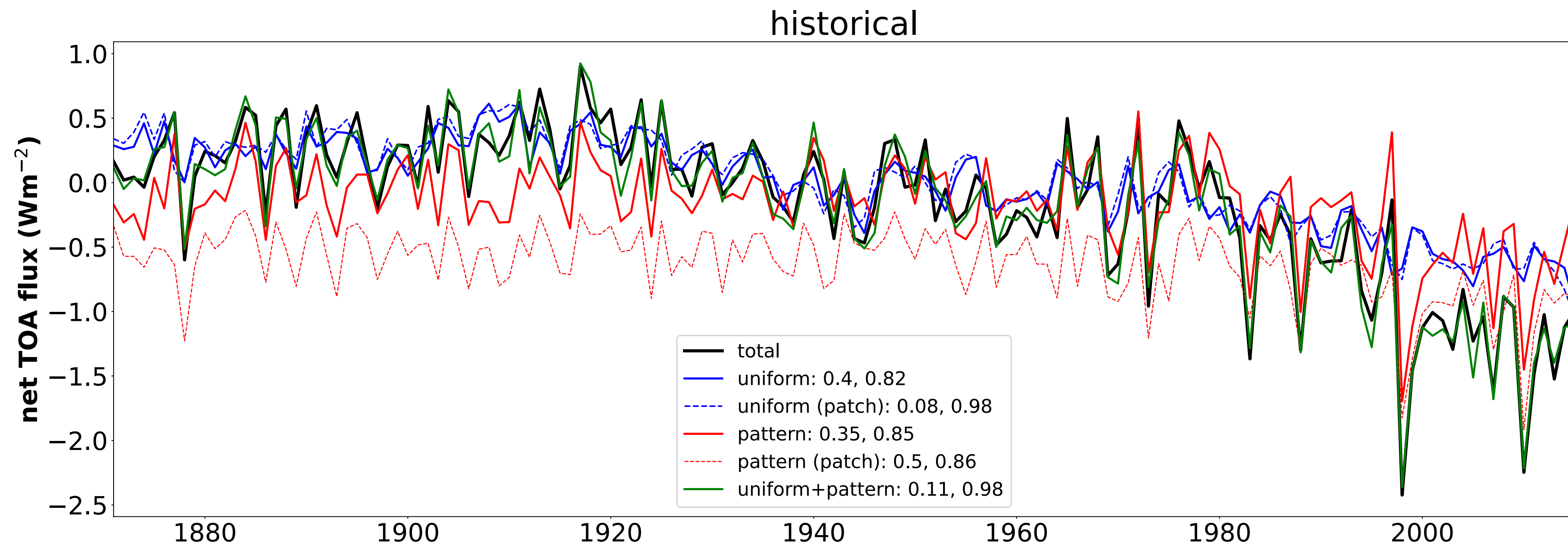


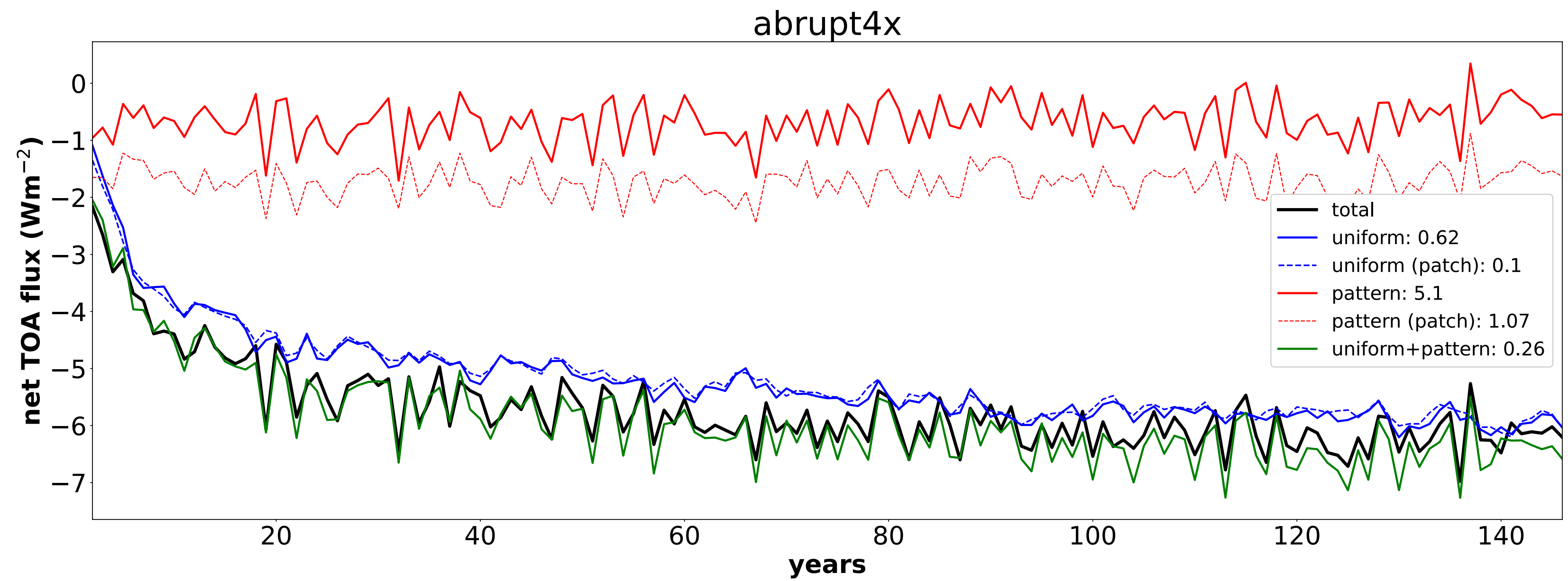
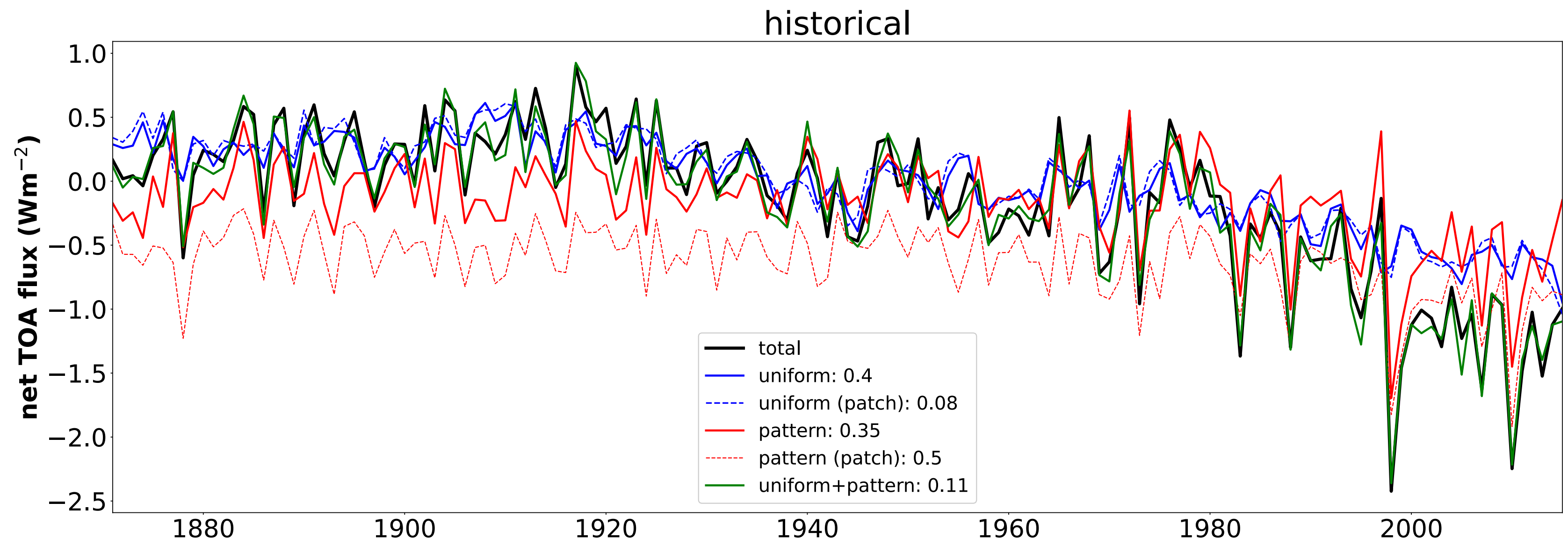




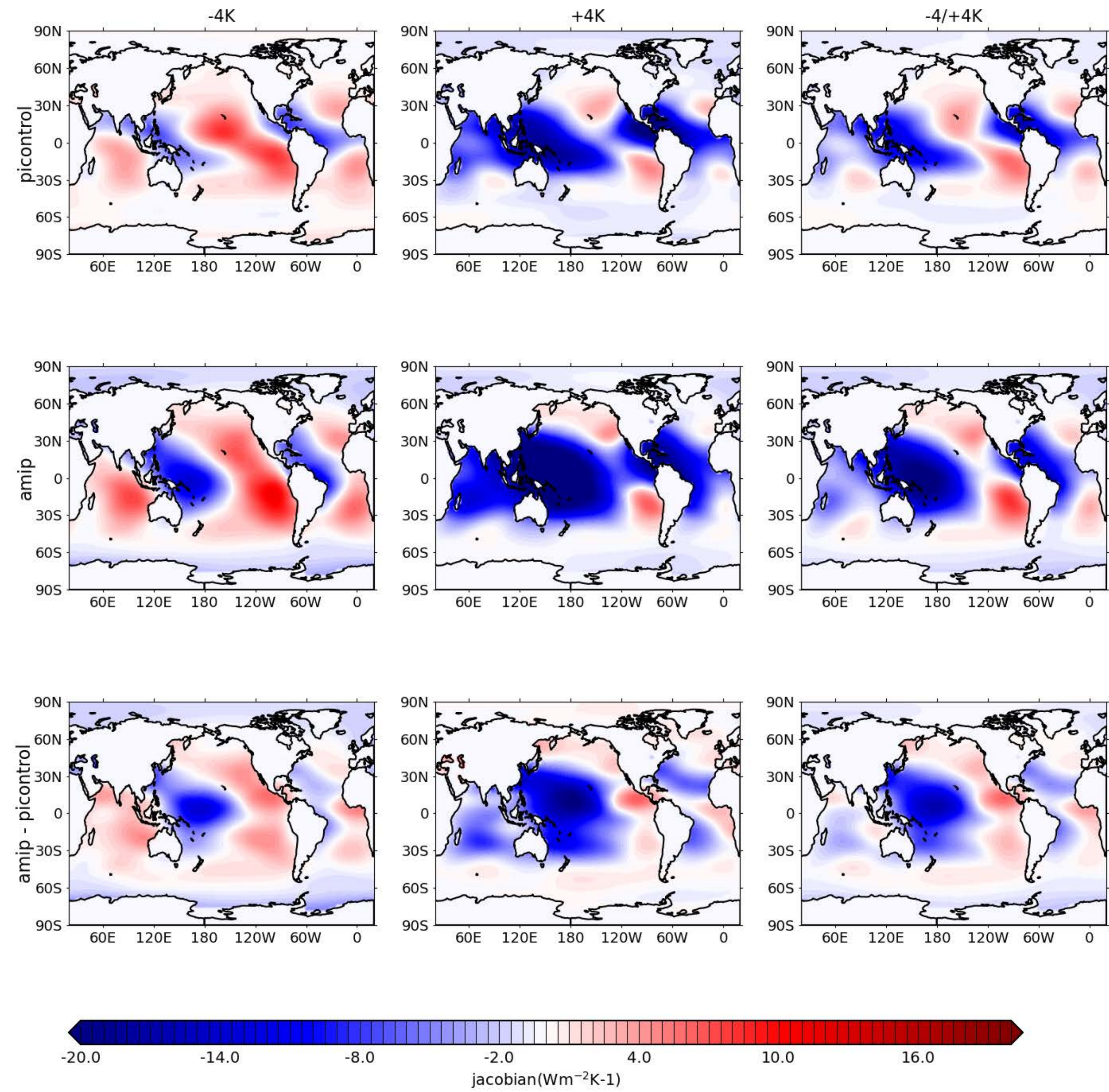




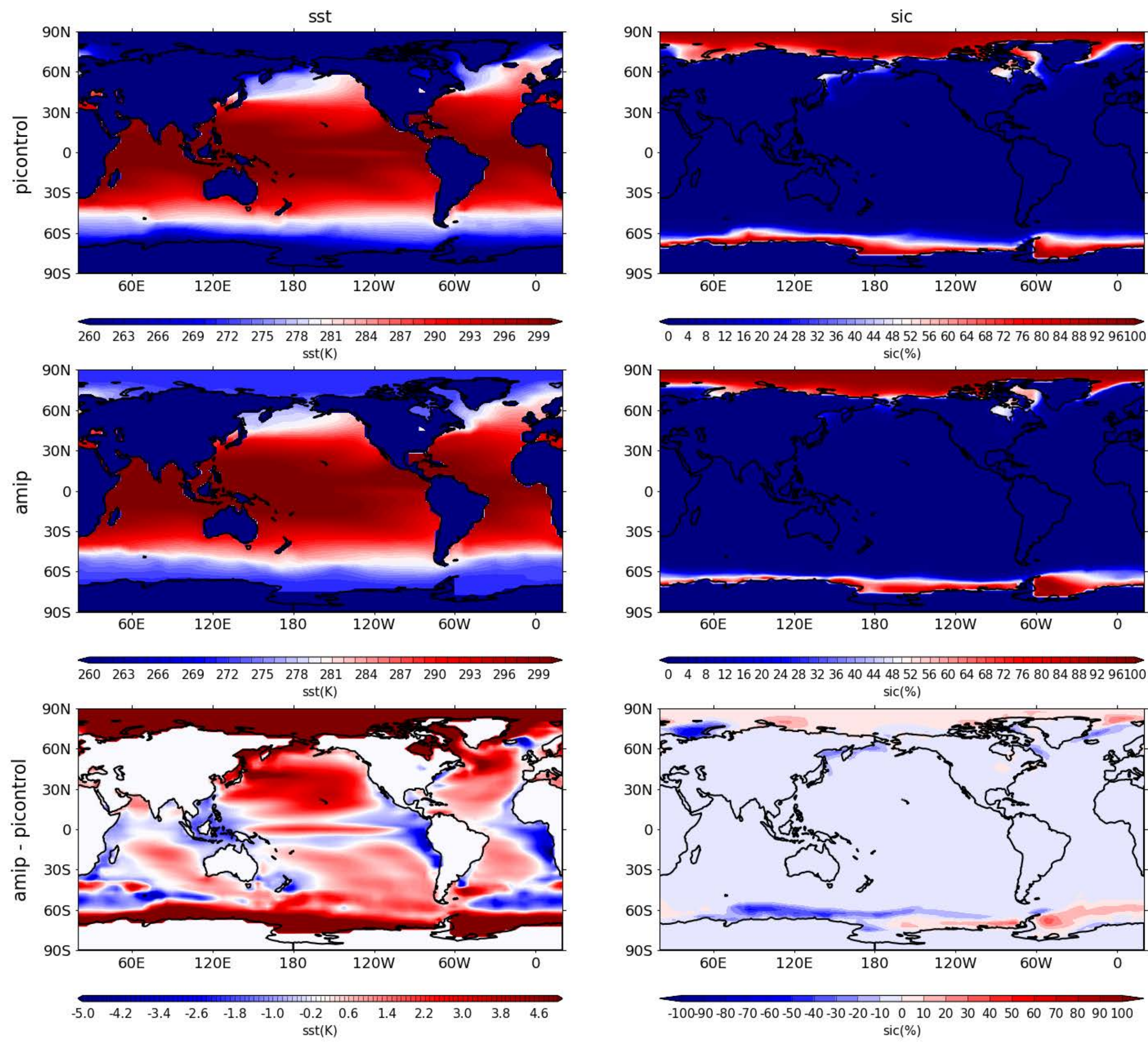




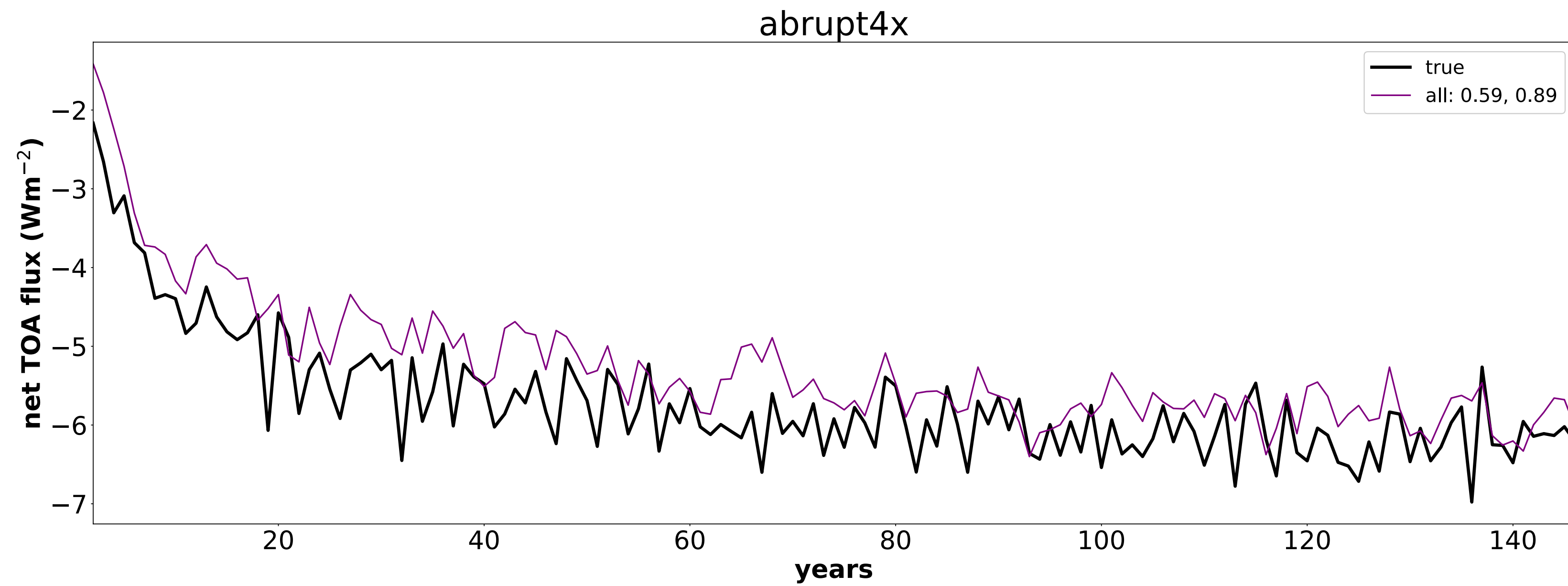
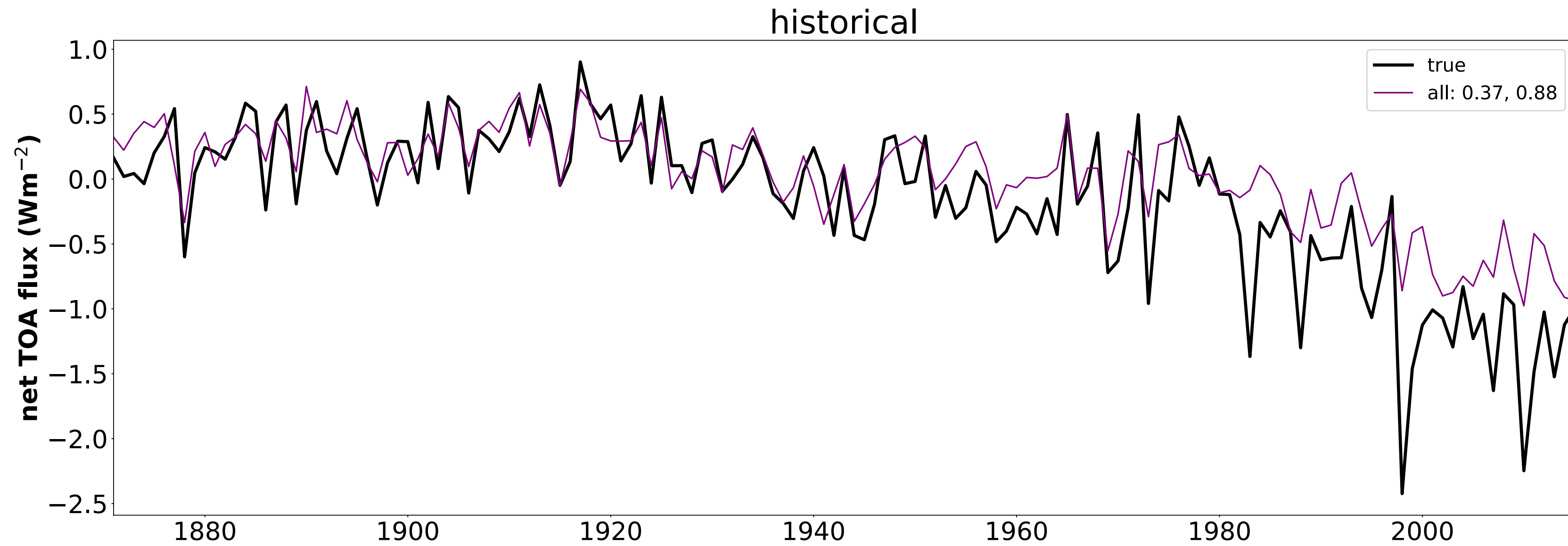
Different base climate?



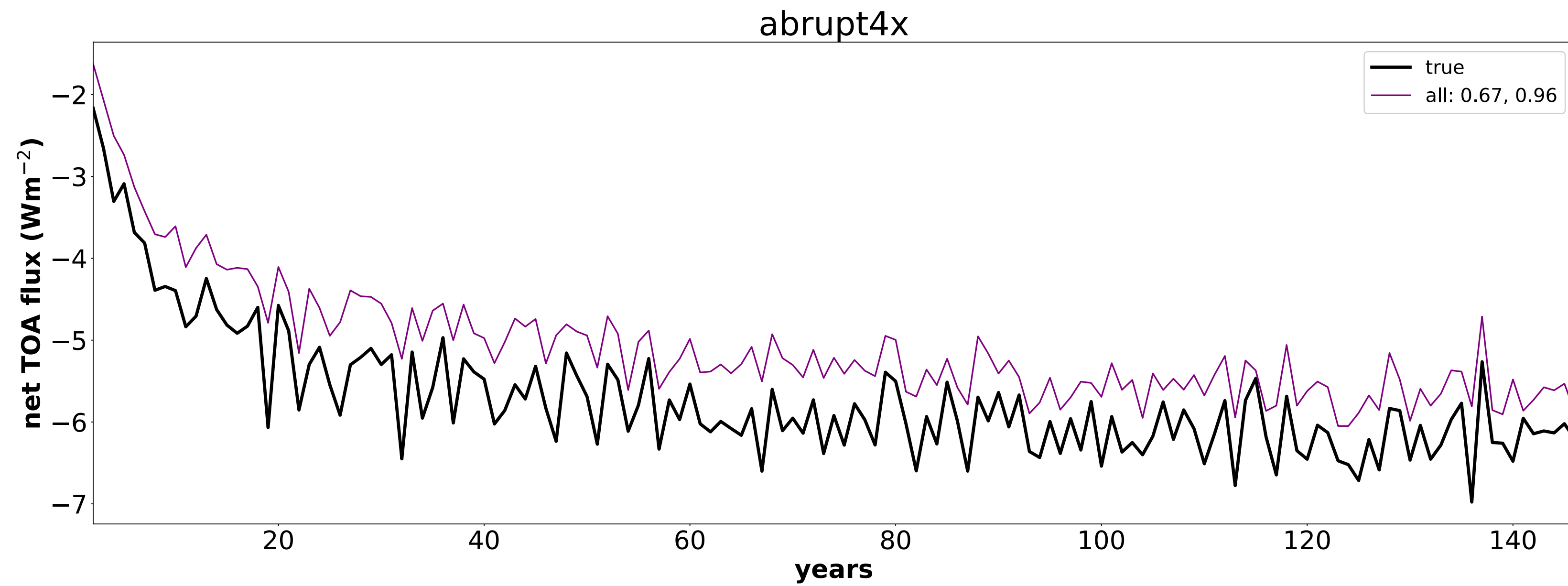
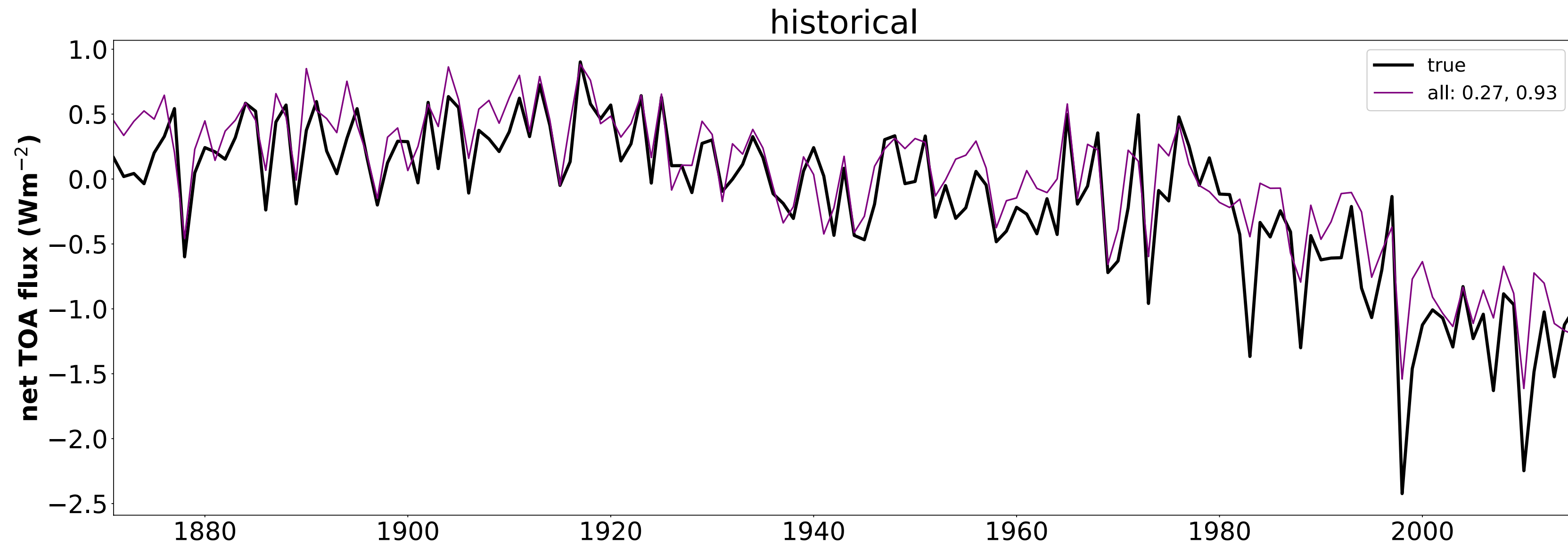
Different base climate?



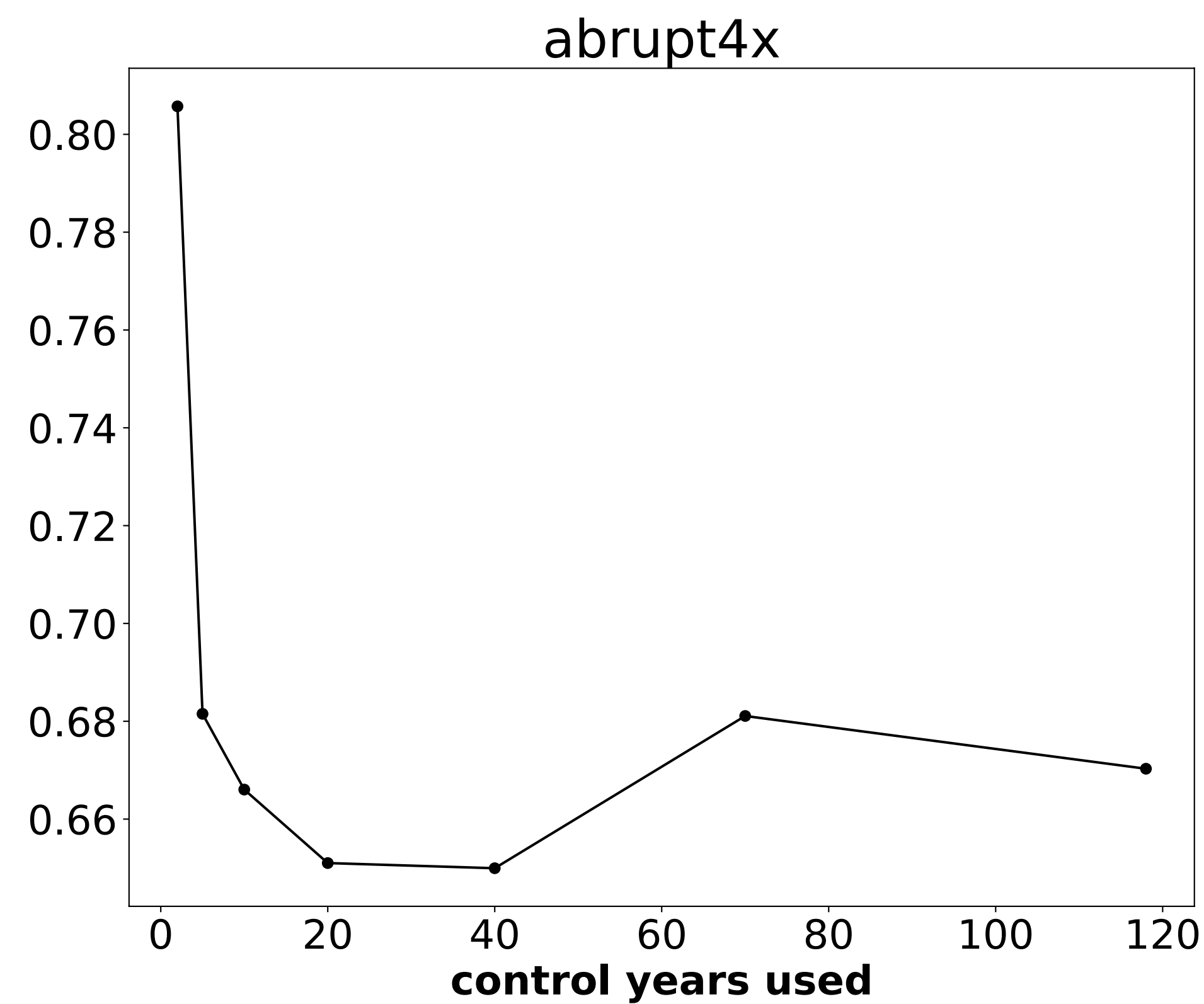
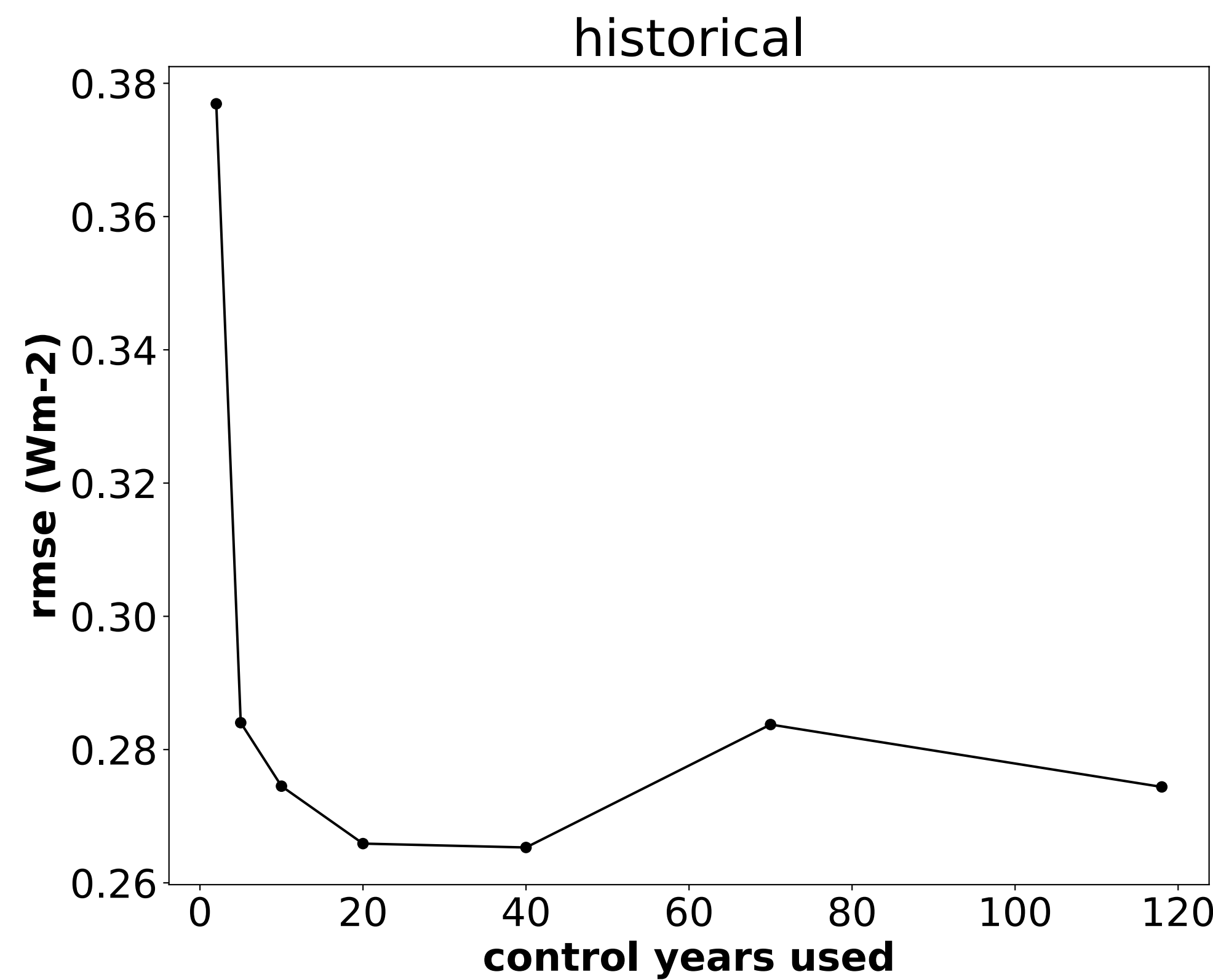
HadCM3, full: Dong et al (shifted, AMIP), annual



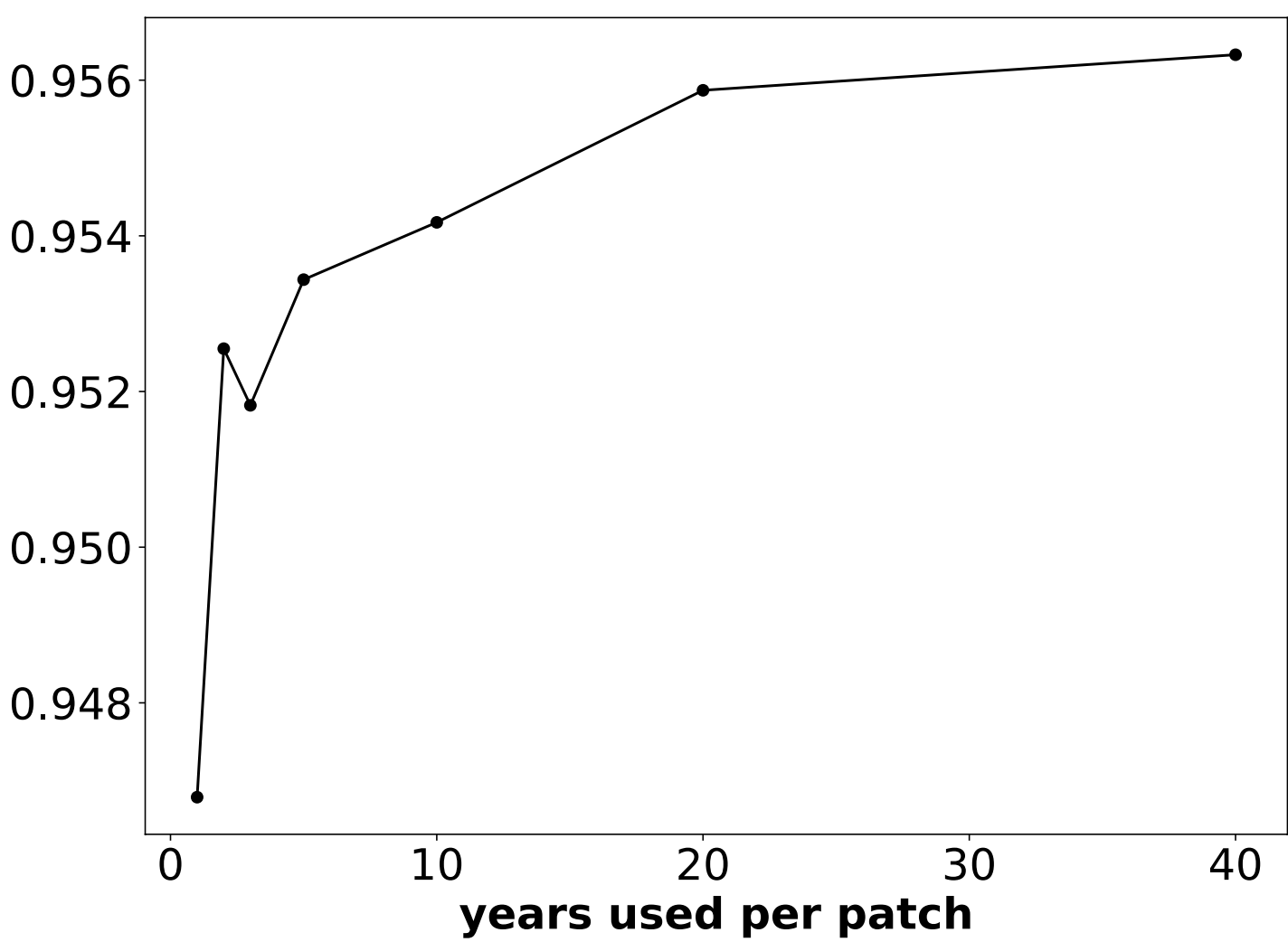
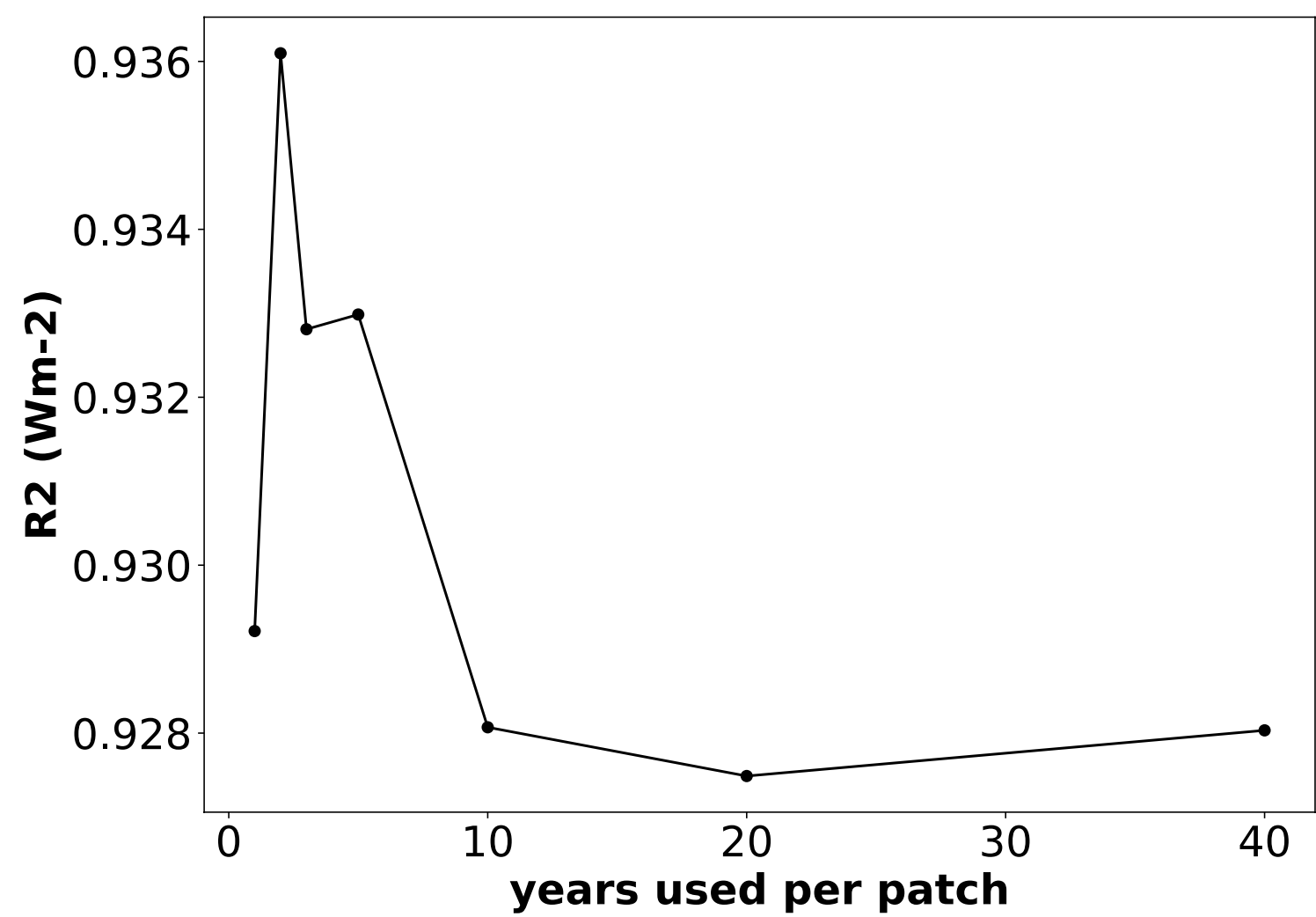
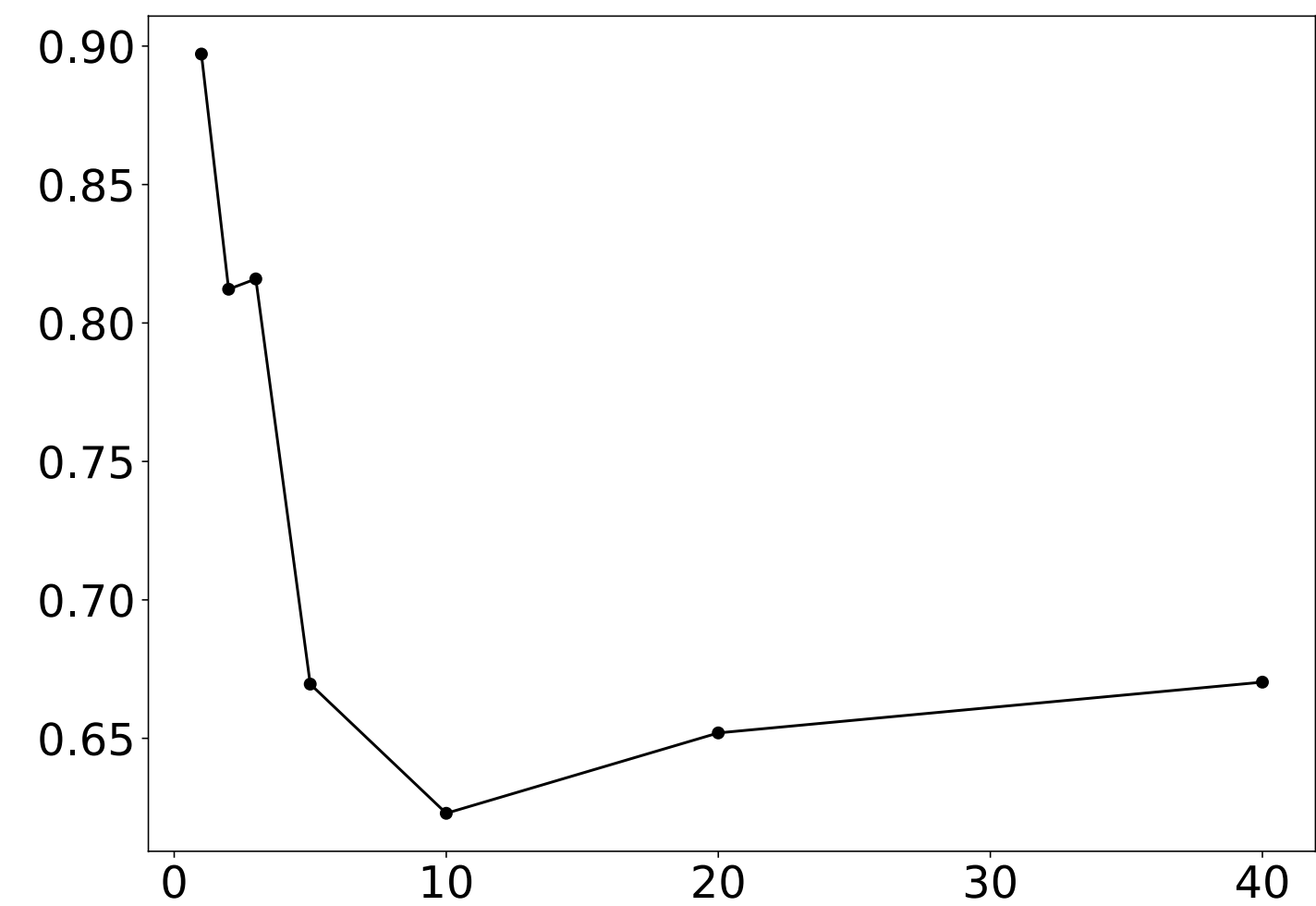
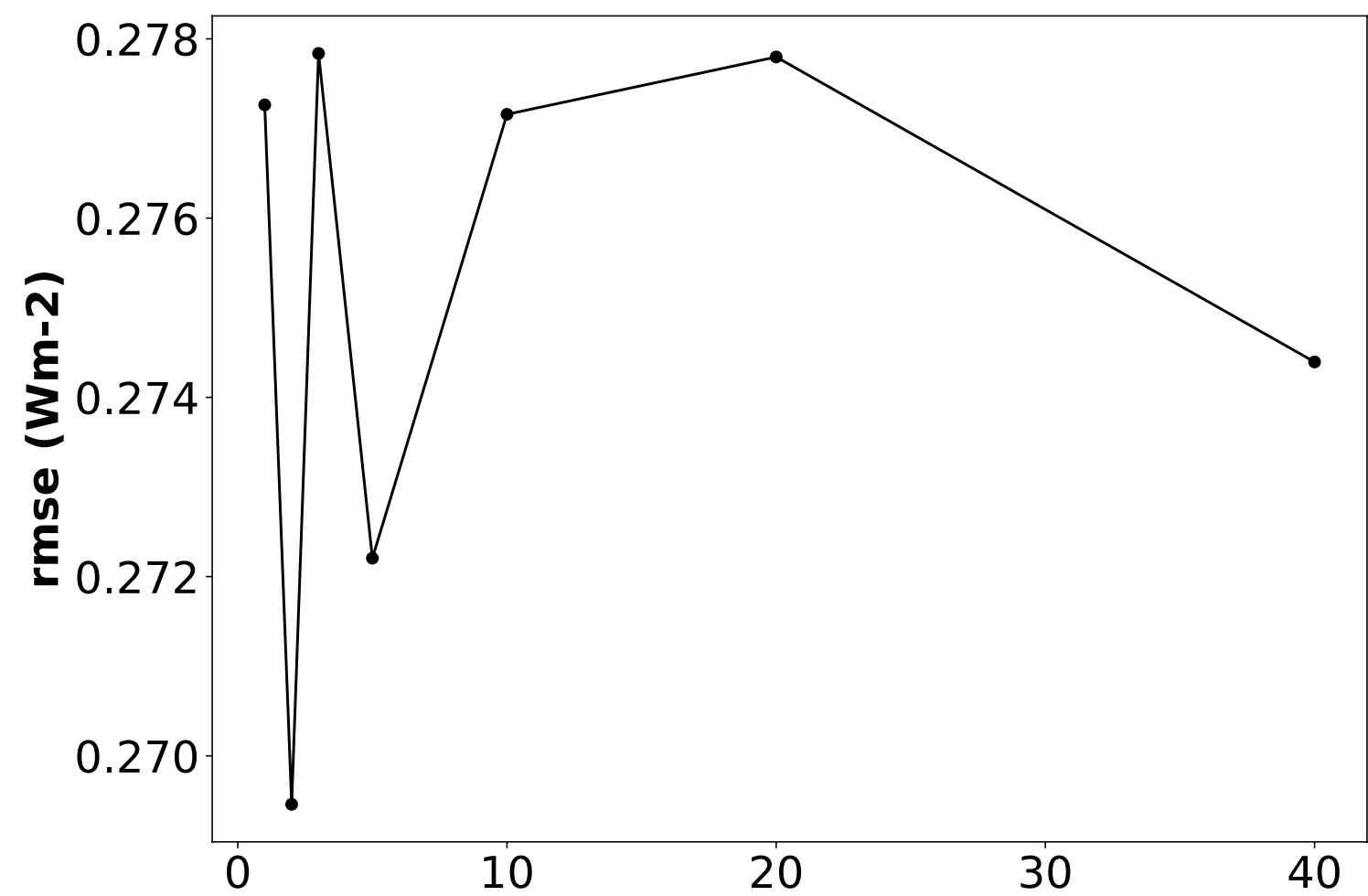
HadCM3, full: Dong et al./equal area, annual



Control years needed

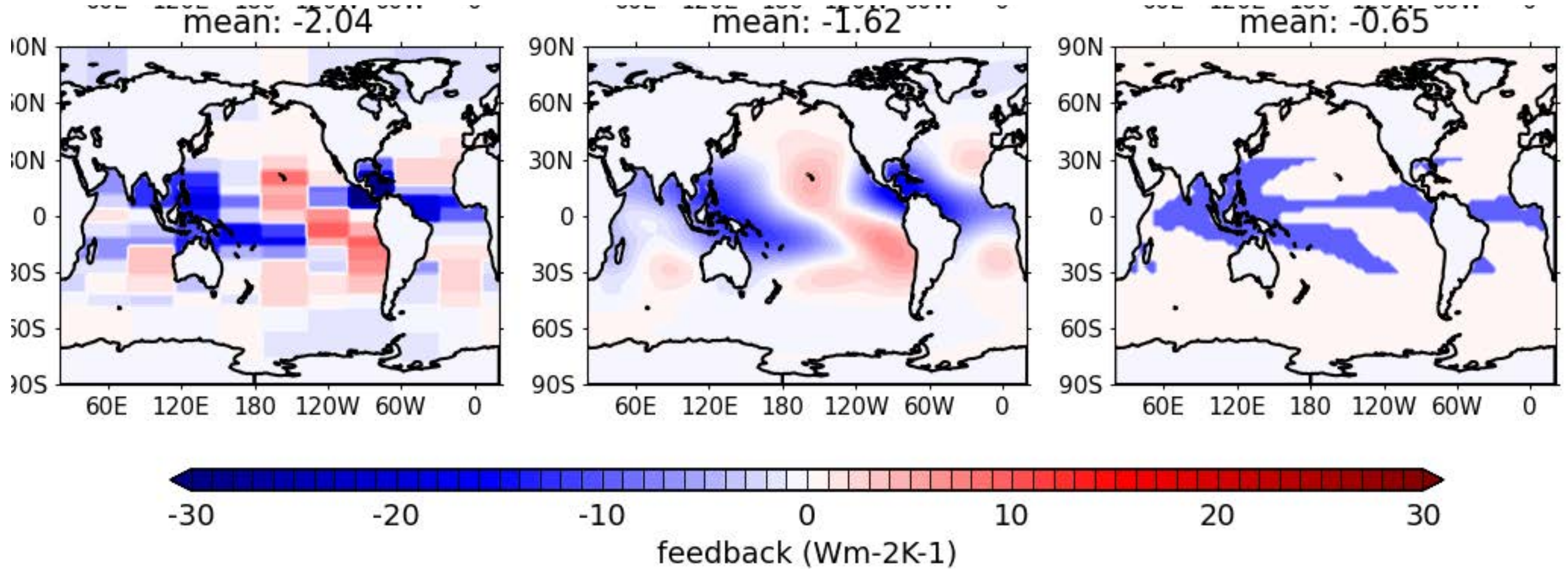


Patch years needed

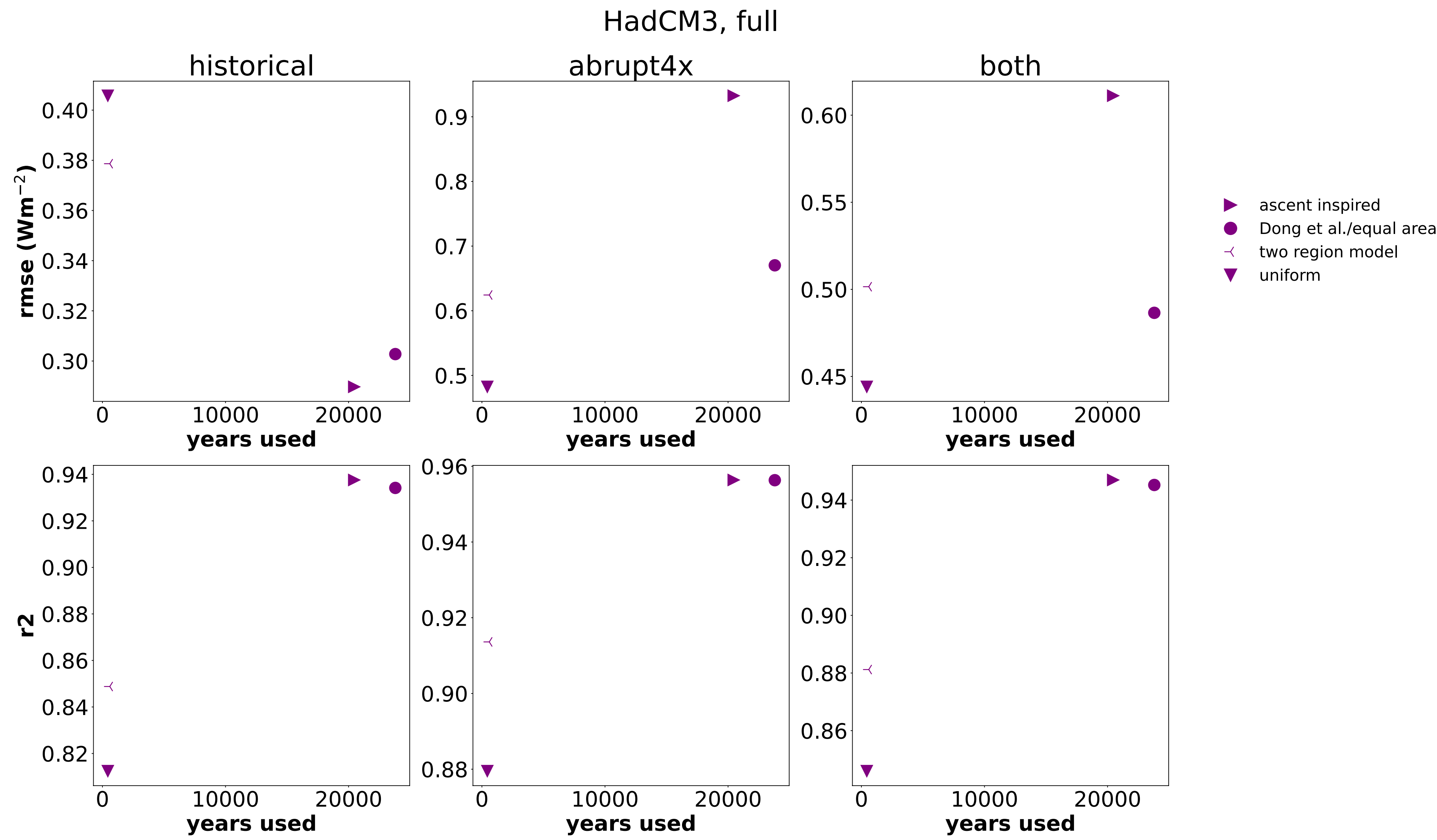


(x4, for 4
perturbation levels)

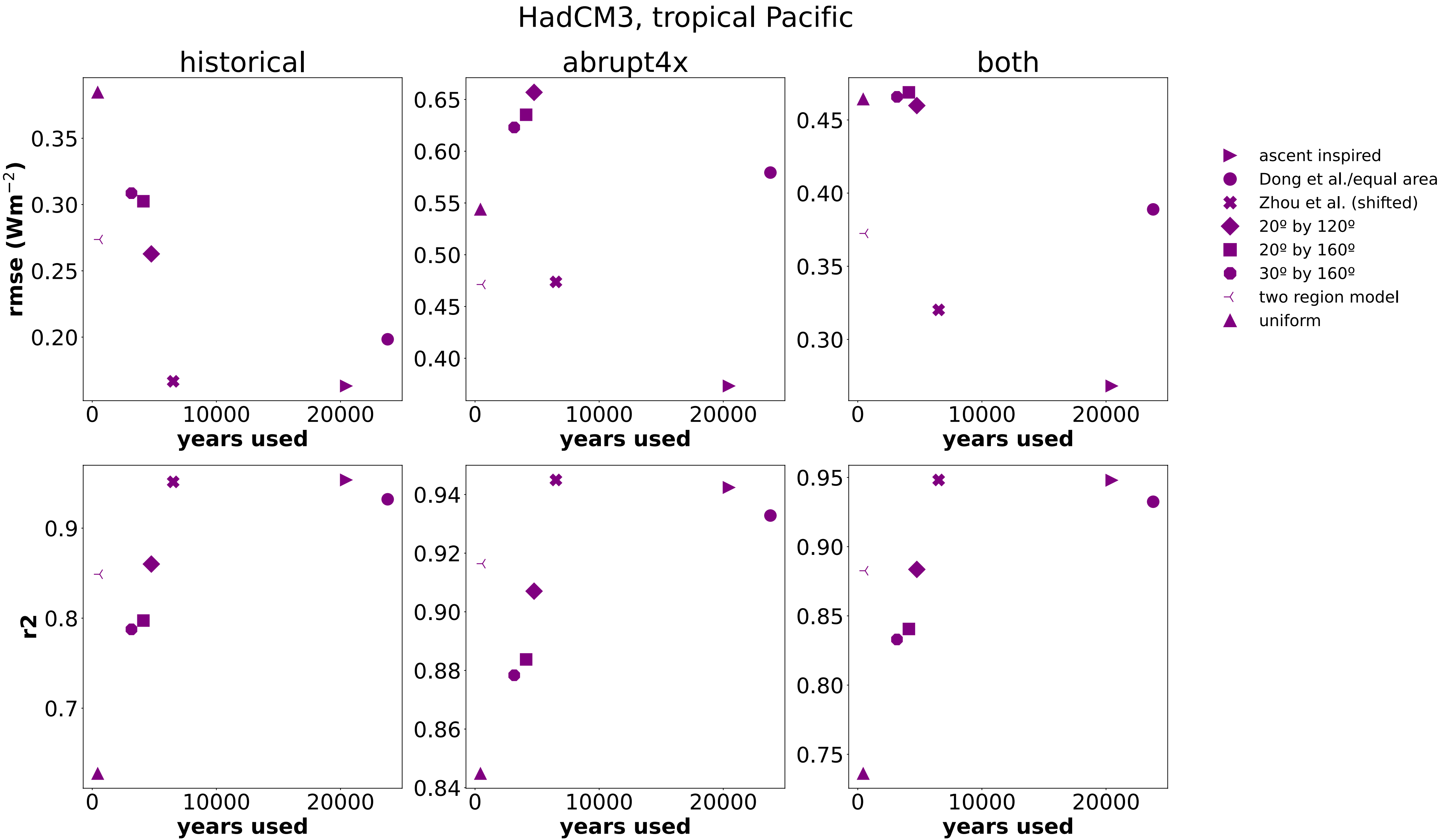
Size/location/shape



Size/location/shape

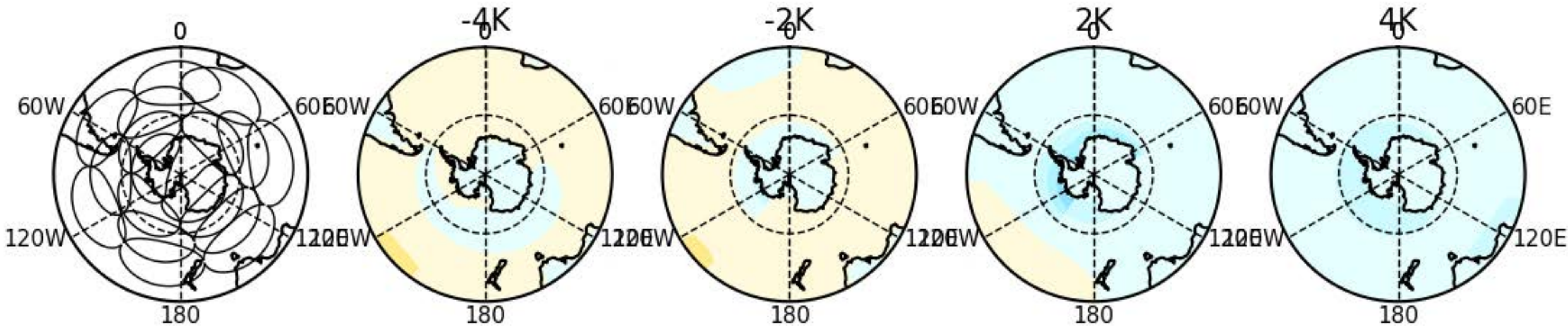


Size/location/shape

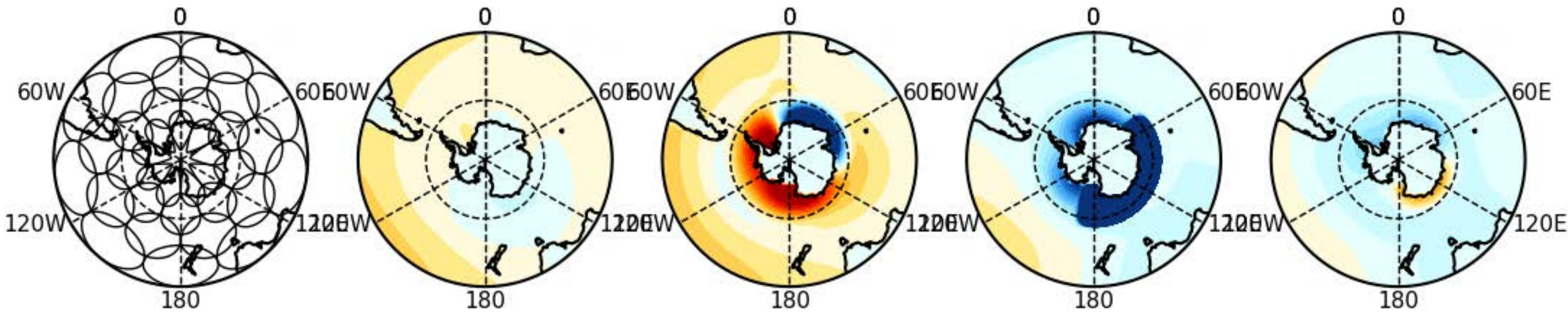


Size/location/shape

Equal area:



Equal lat/lon:



GFMIP Protocol

Control simulation

- **What climatology** - *recent obs, because it allows for intermodel comparison?*
- **How many years to run the climatology to get flux averages?** - *even 10 years is enough?*

Patch setup

- **Amplitude** - *both positive and negative needed?*
- **Size/location** - *more work needed to figure out how to account for resulting asymmetry*
- **Shape** - *potential advantage to non-overlapping patches?*
- **# of years run** - *10 for 4 temp levels (or 20 for 2 temp levels)*

Other sst patterns? - Uniform, especially -4, -2, +2, +4, to help us get the global response when doing abrupt4x?

Output to save/publish

- **Just Jacobians, or also full patches?**