

Revisiting bias correction of earth system models for climate-informed ecosystem based management

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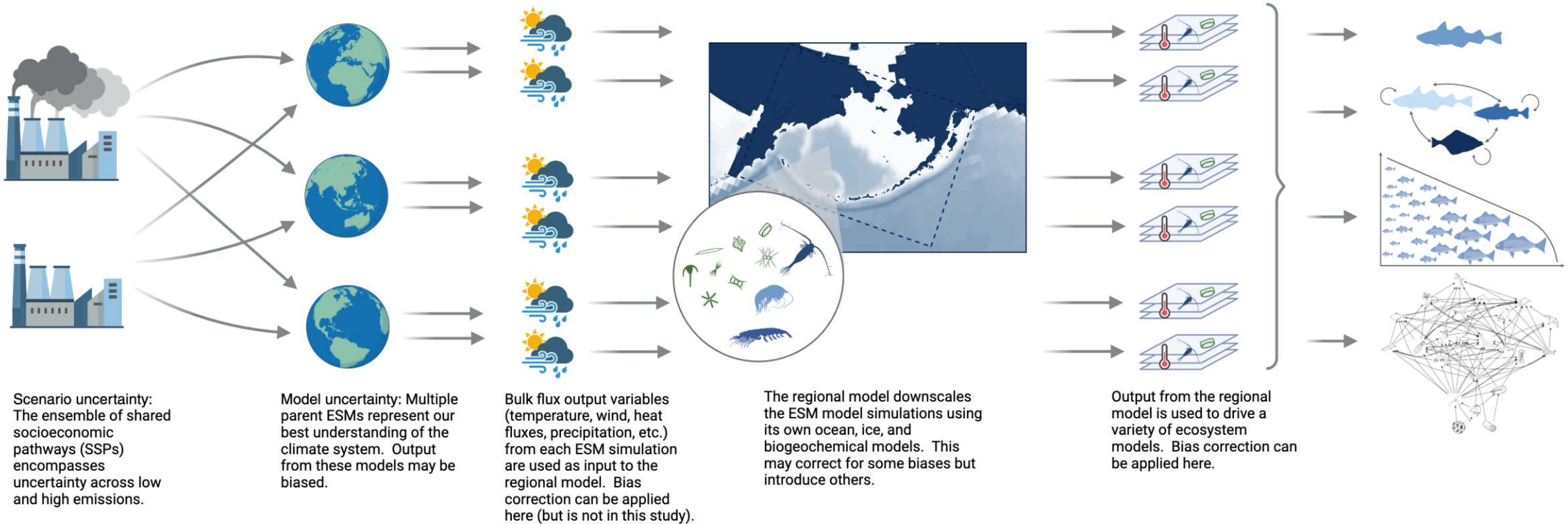
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Bias correction in regional modeling: why, when, and how?



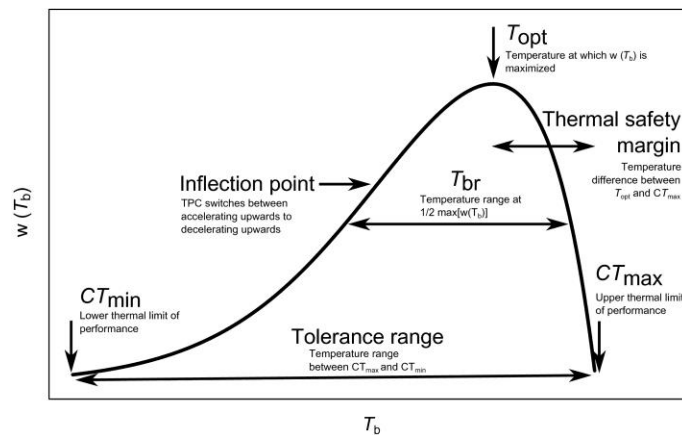
Alaska Climate Integrated Modeling Project
Hollowed et al., 2020



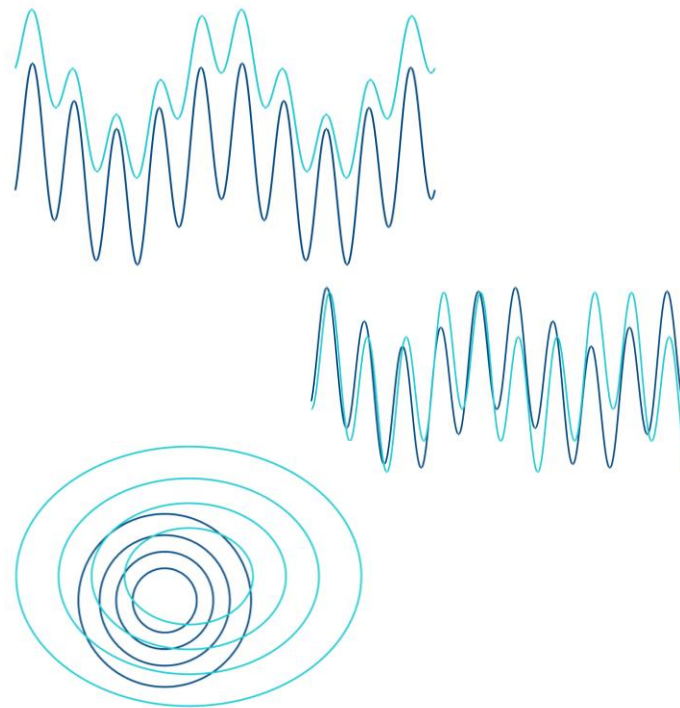
Bias correction in regional modeling: why, when, and how?

Small biases matter

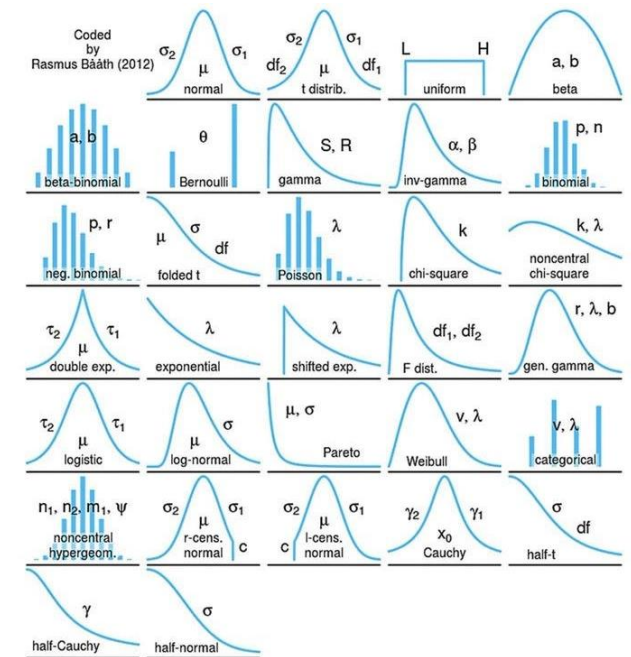
Sinclair et al., 2016



Value? Space? Time?



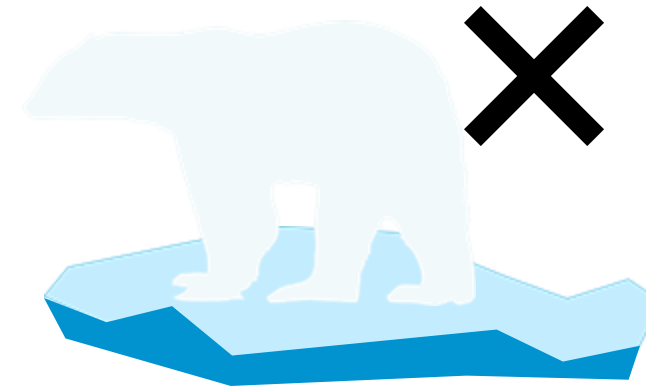
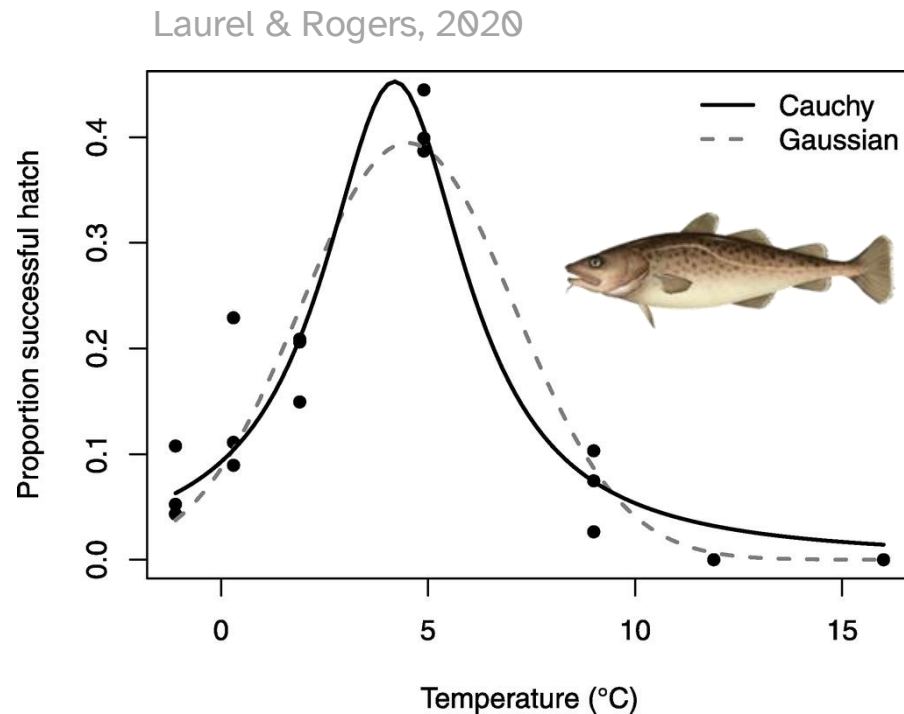
All the indices!



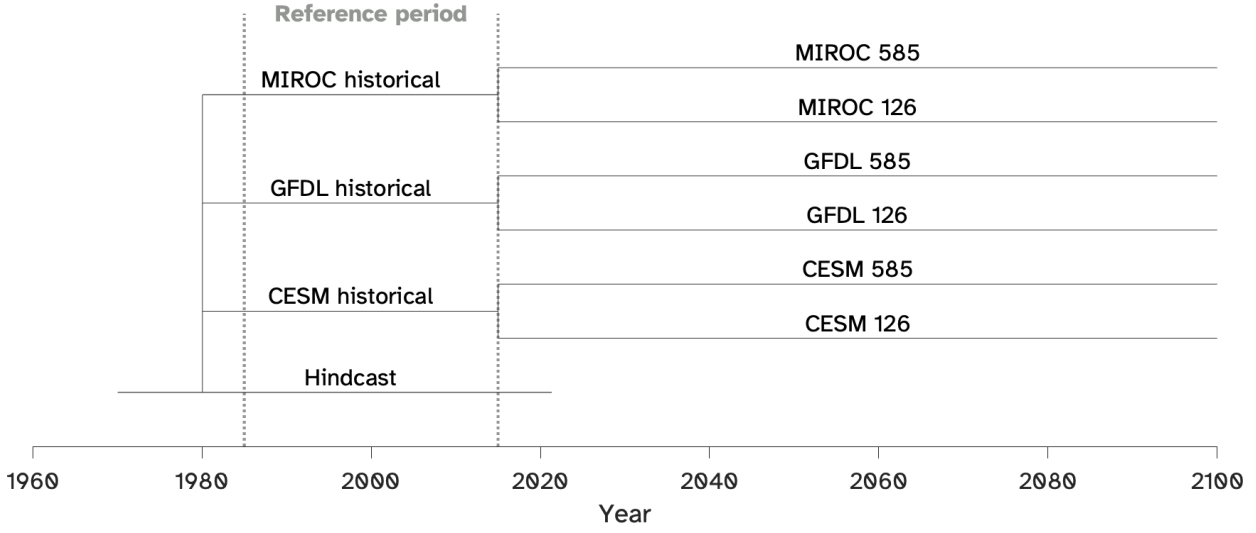
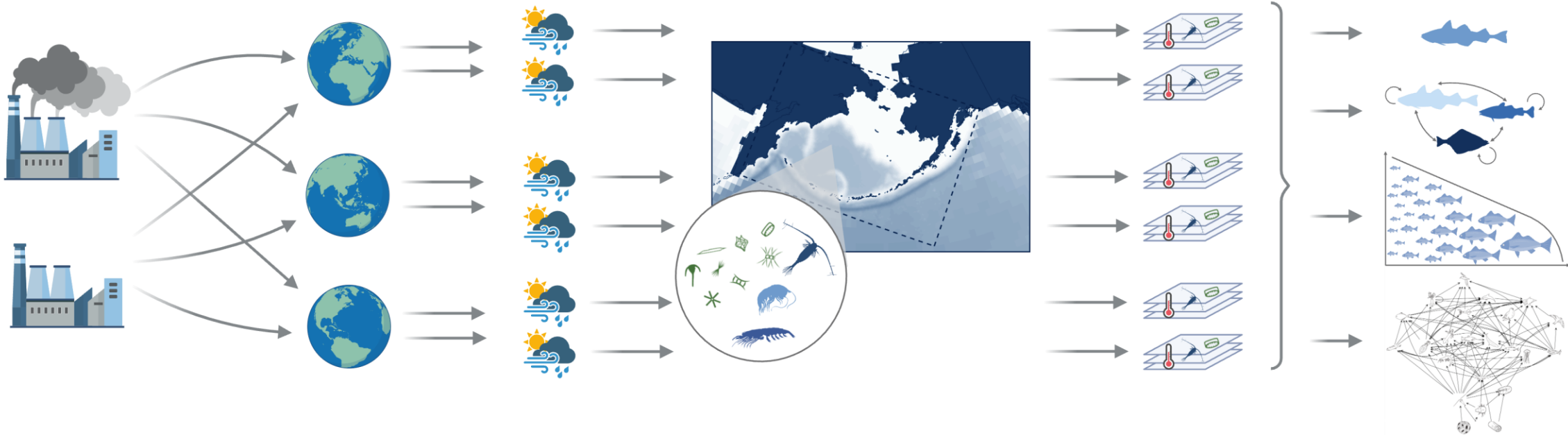
Bias in a tipping-point context

1. How will spawning suitability change for P.cod across the eastern Bering Sea shelf?

2. Will the southeastern Bering Sea shelf become ice-free in the winter?



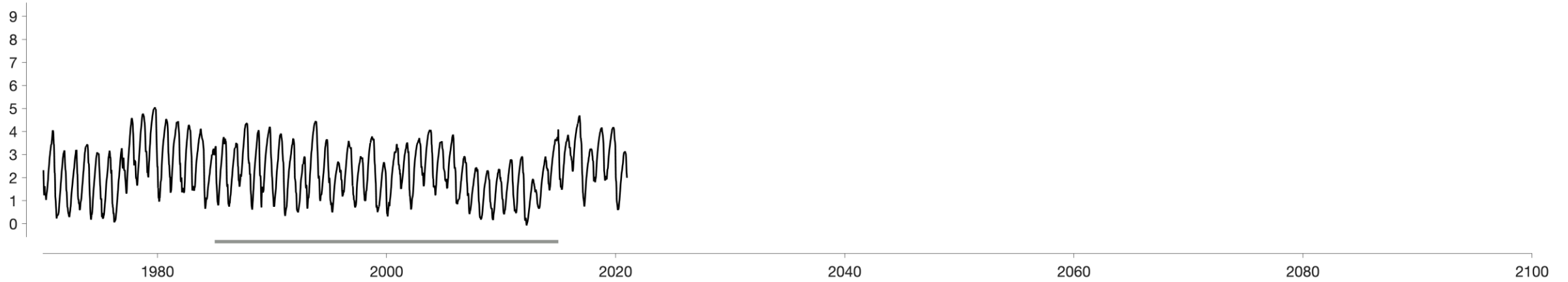
Regional model simulations



Bottom temperature (°C)

CESM GFDL MIROC

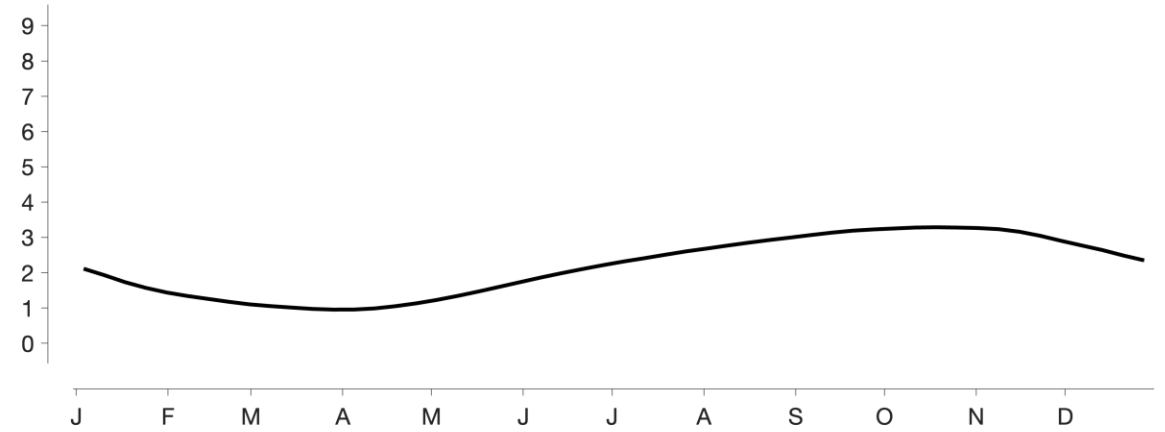
Time series



Distribution



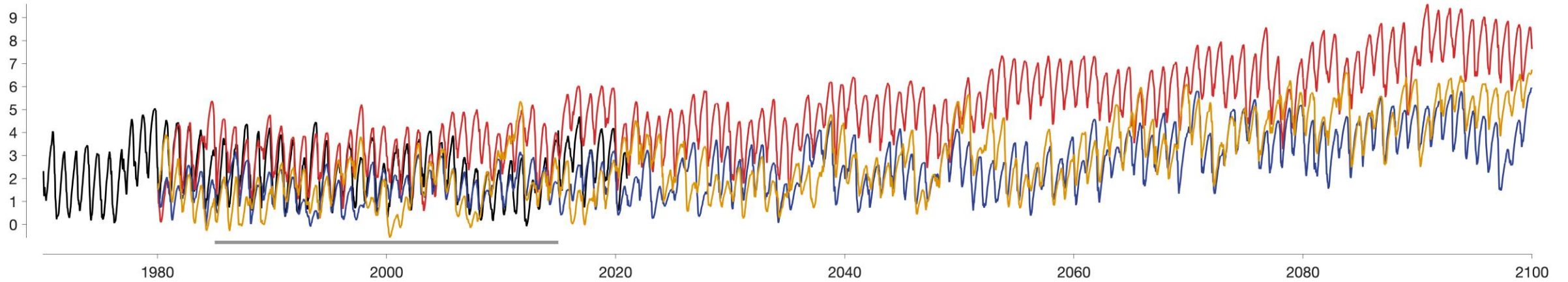
Climatology



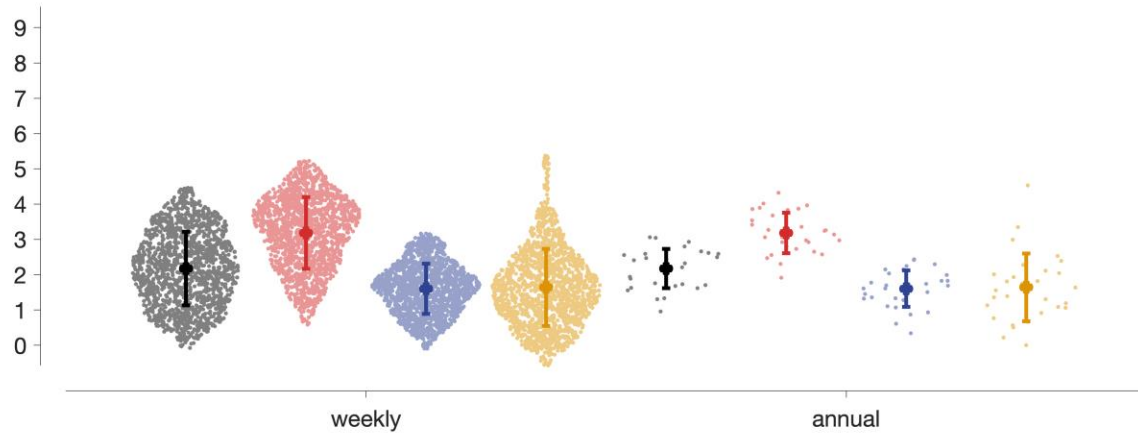
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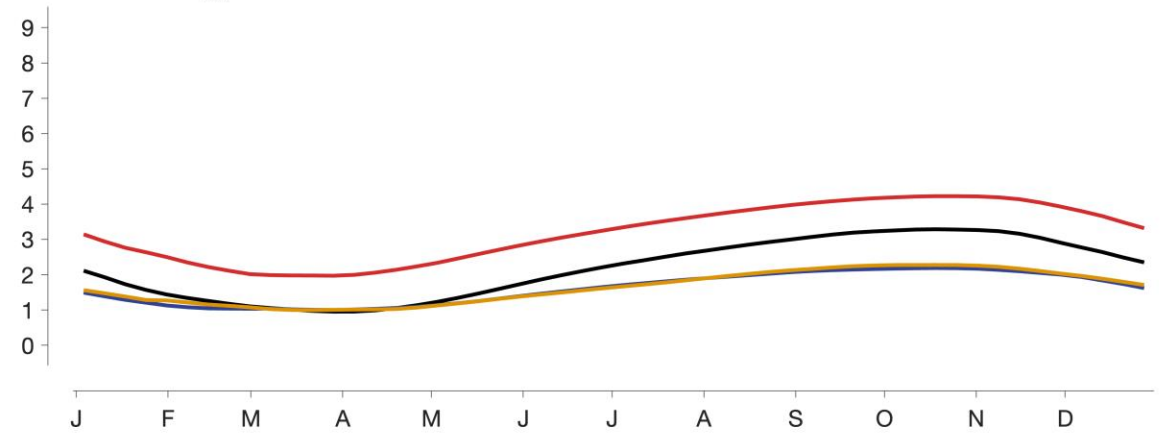
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Distribution



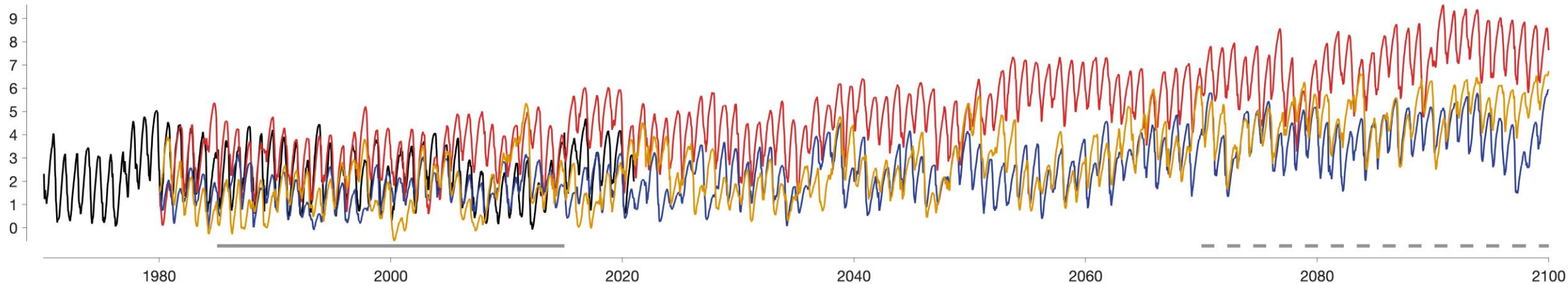
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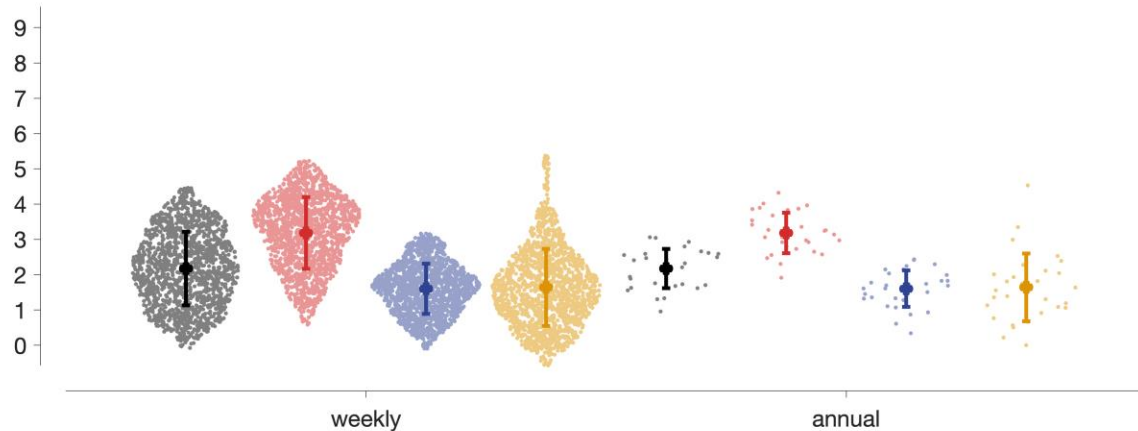
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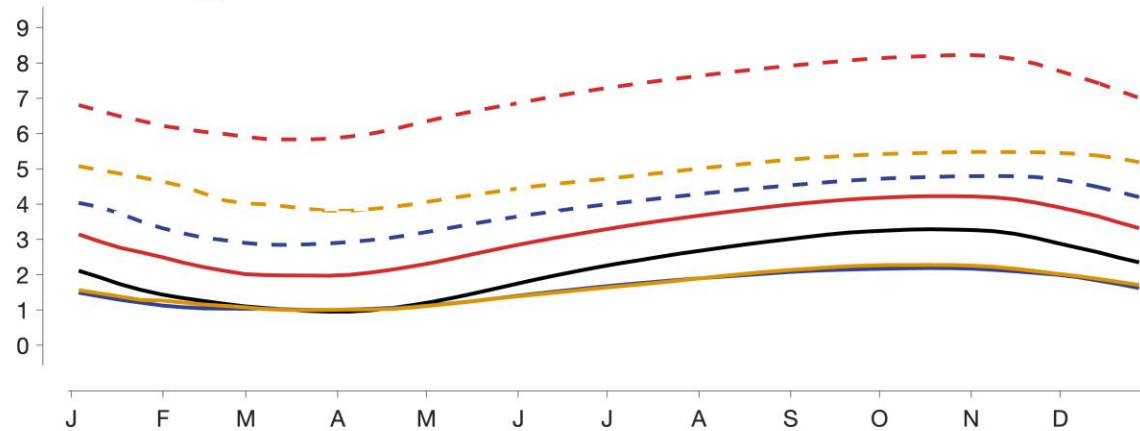
Time series



Distribution



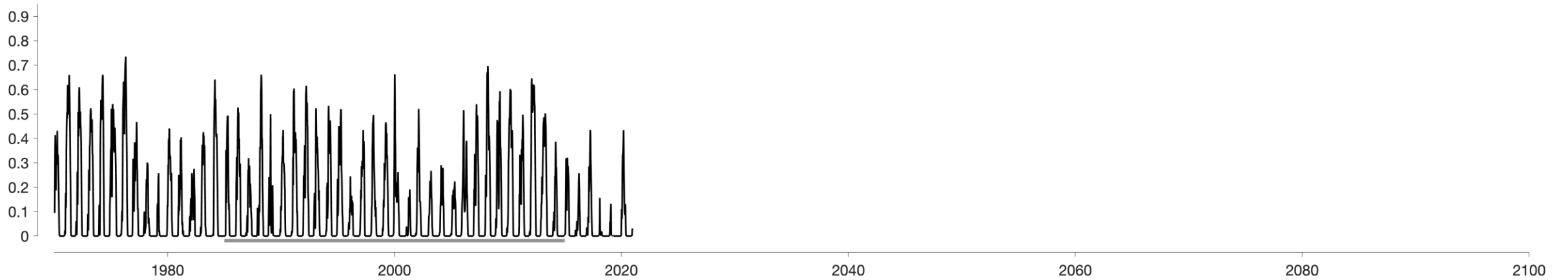
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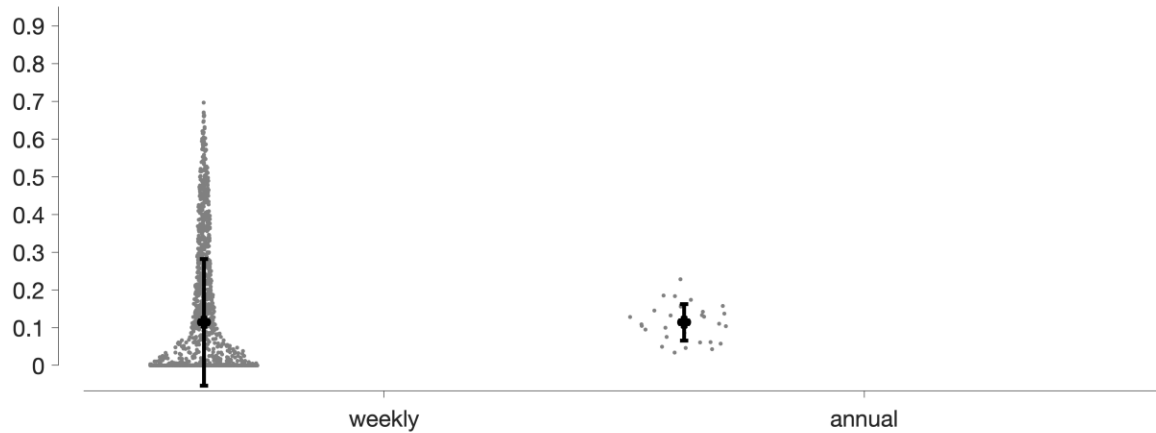
Sea Ice Fractional Coverage

CESM GFDL MIROC

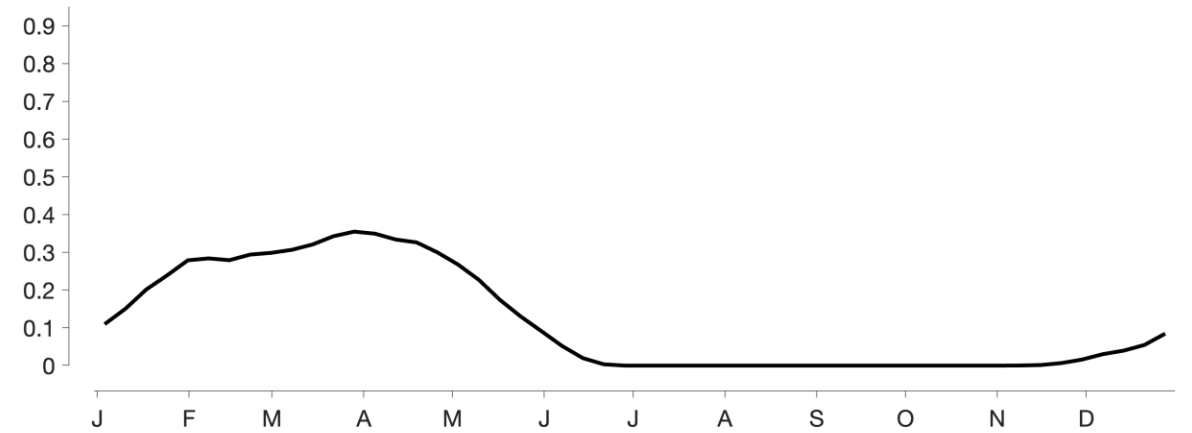
Time series



Distribution



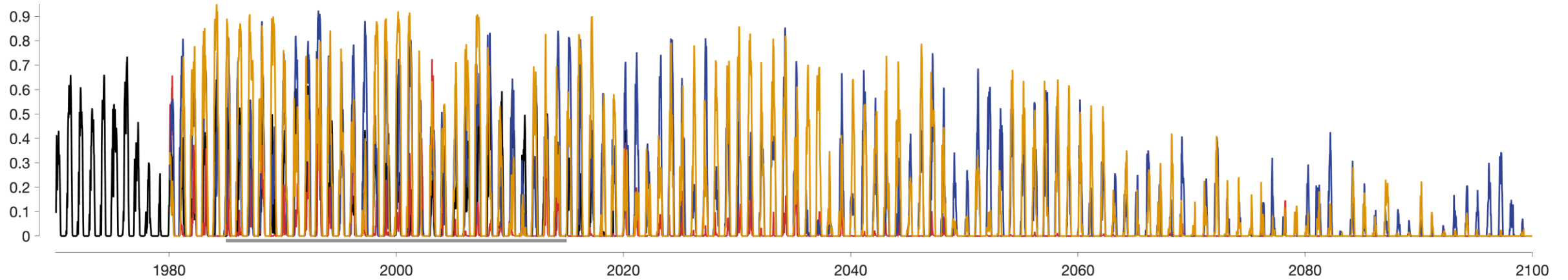
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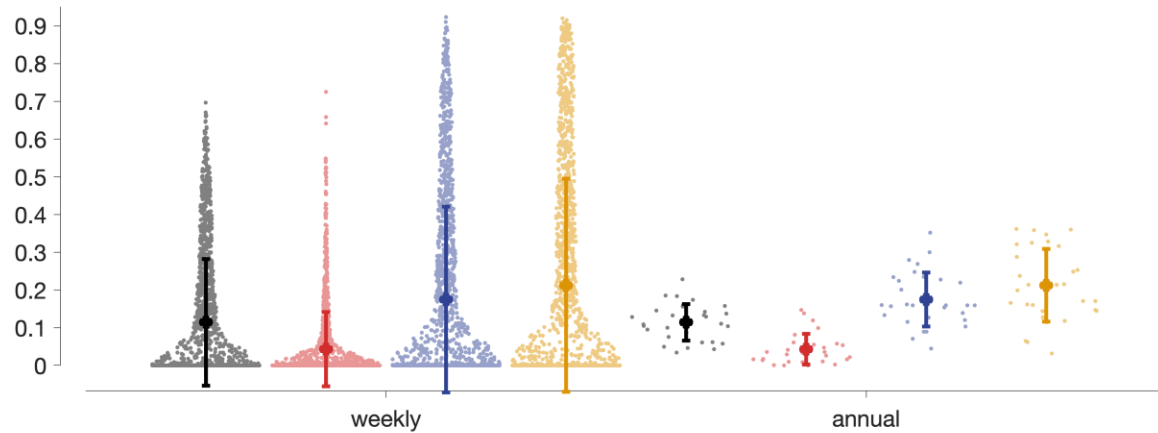
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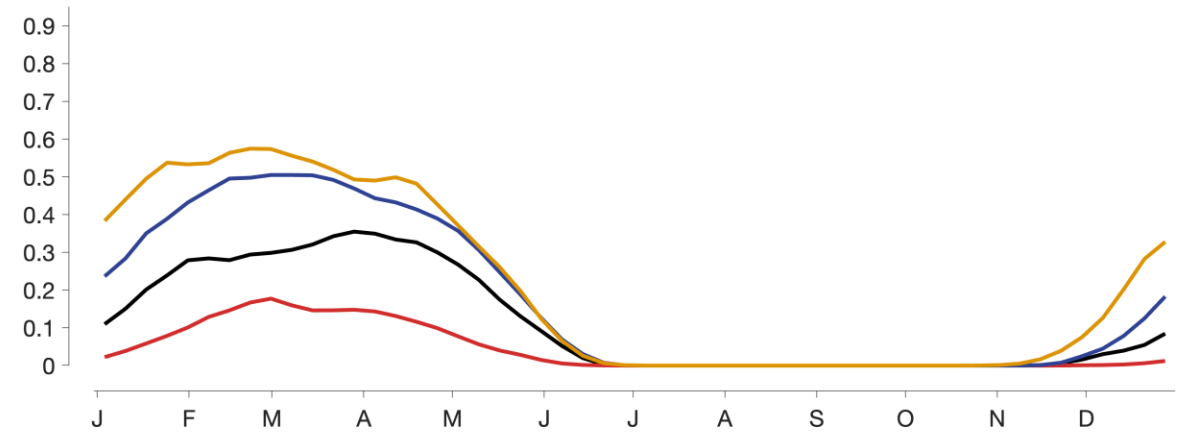
Time series



Distribution



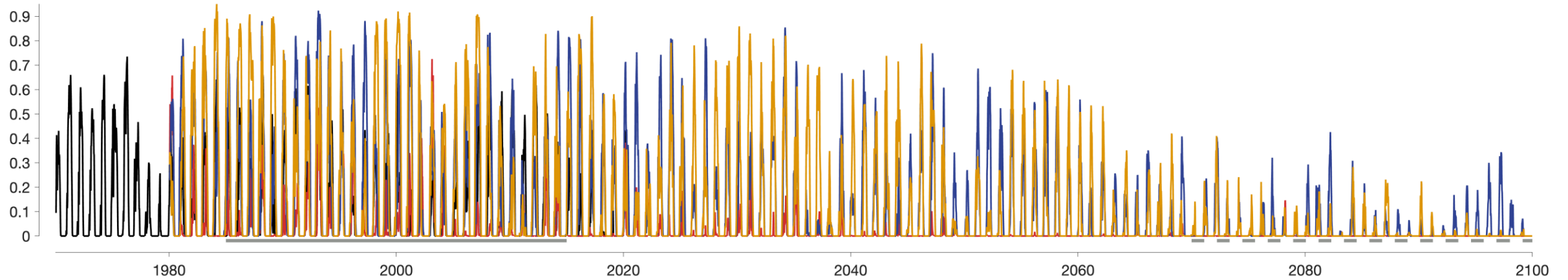
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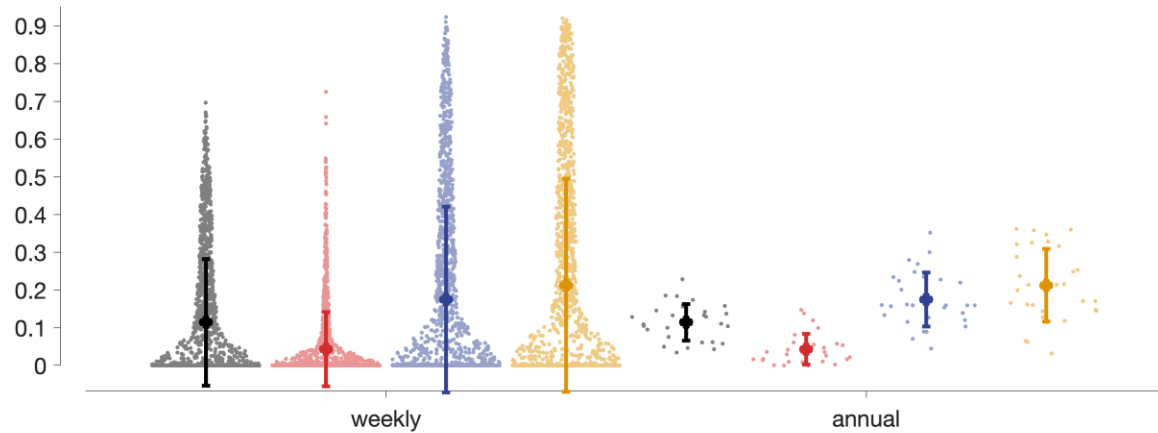
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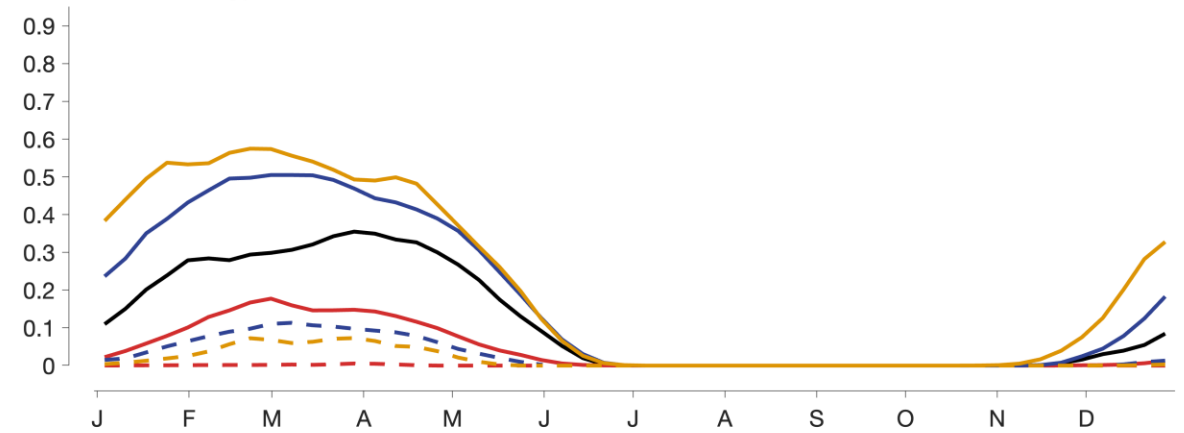
Time series



Distribution

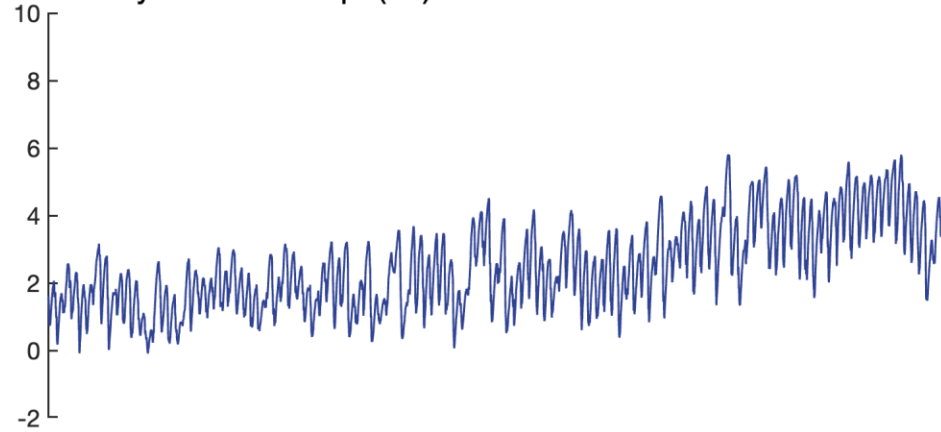


Climatology

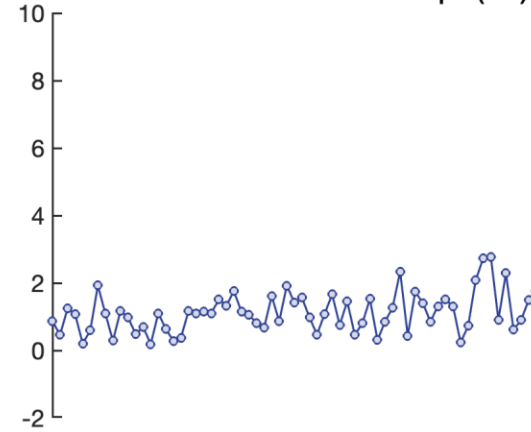


How to bias correct?

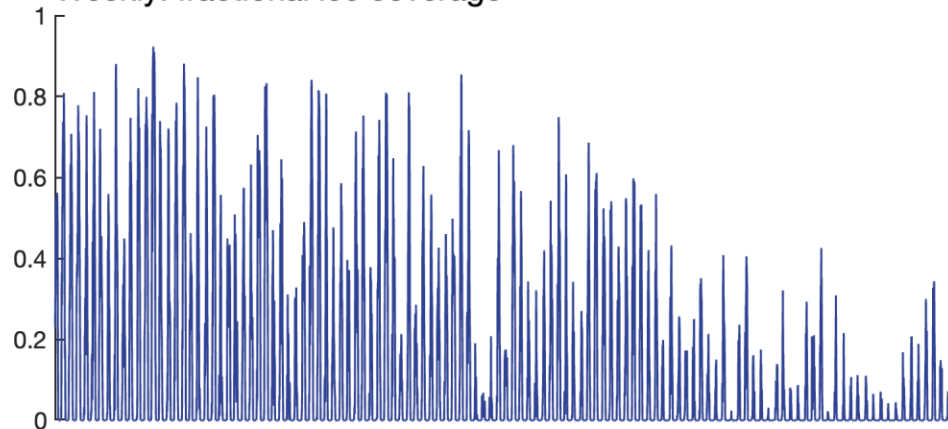
Weekly: Bottom temp. (°C)



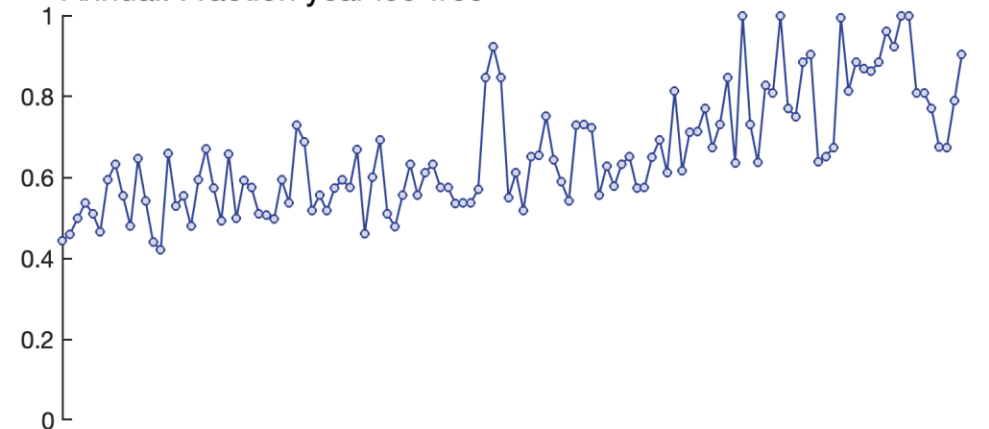
Annual: Winter bottom temp. (°C)



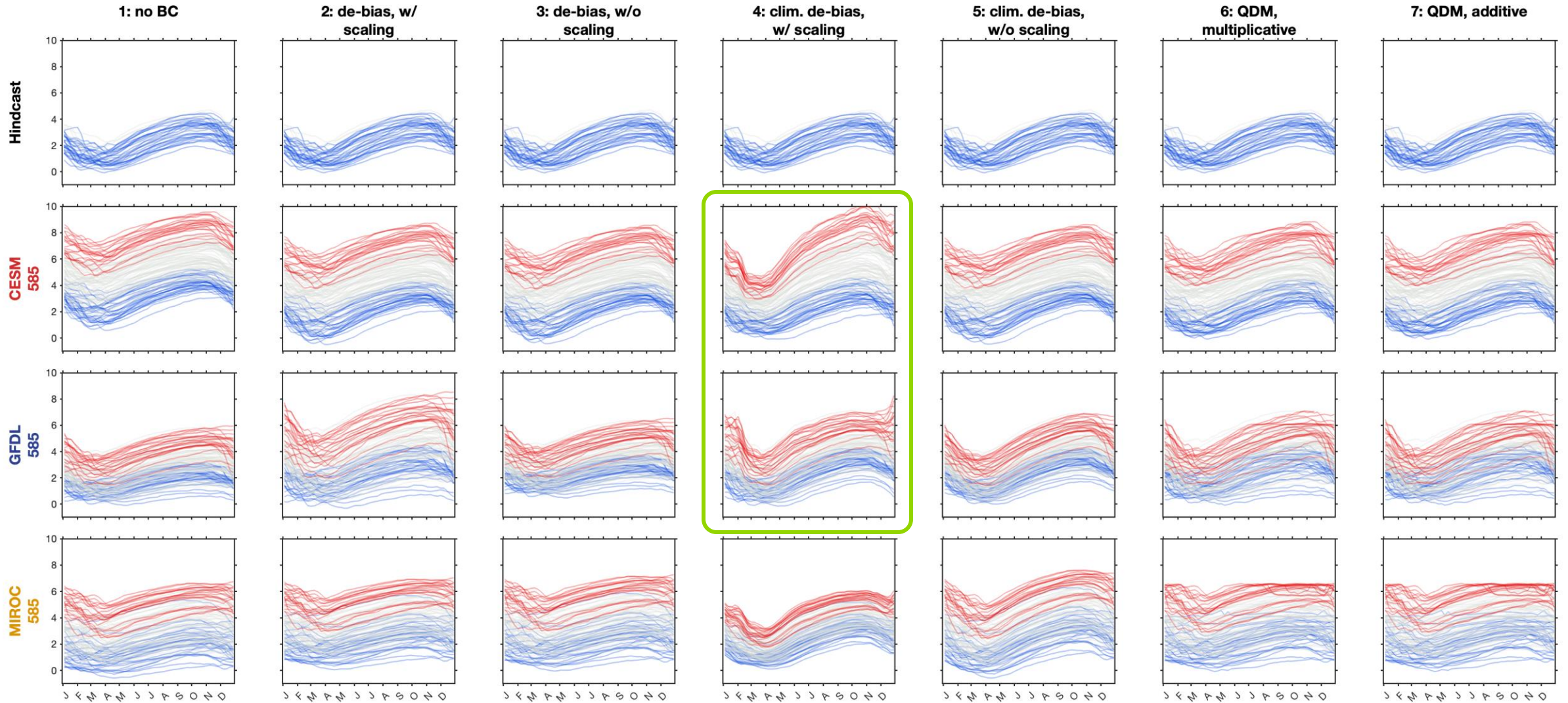
Weekly: fractional ice coverage



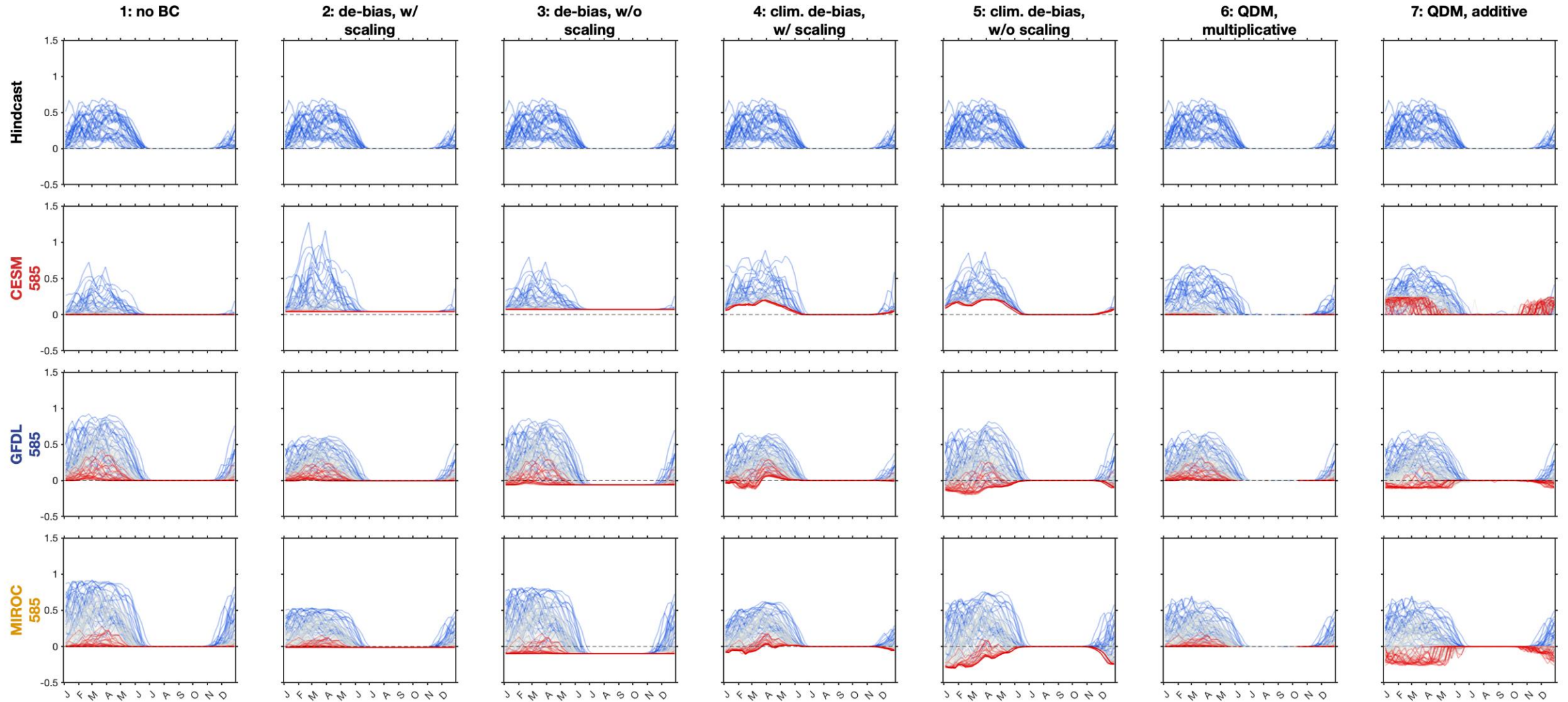
Annual: Fraction year ice-free



Impact of bias correction on weekly timeseries

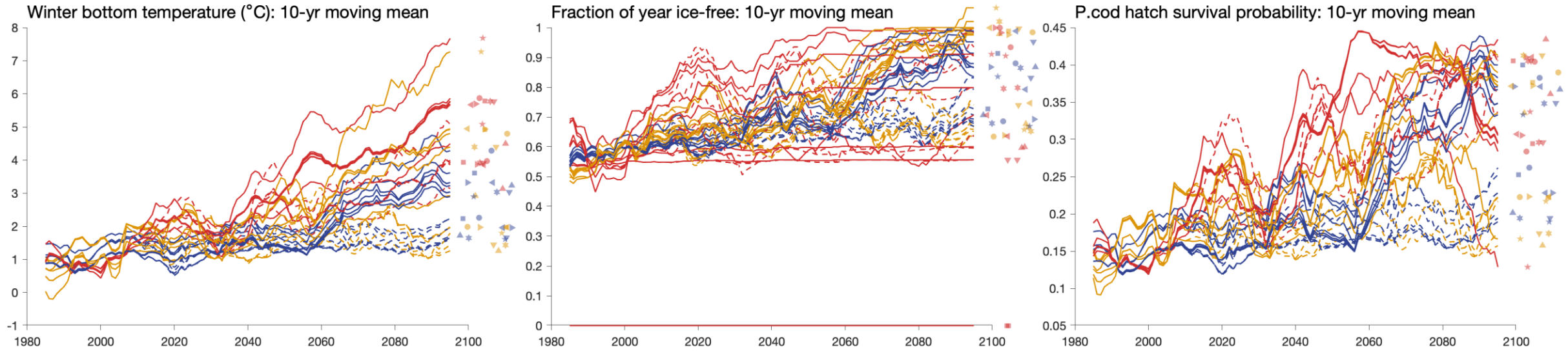


Impact of bias correction on weekly timeseries



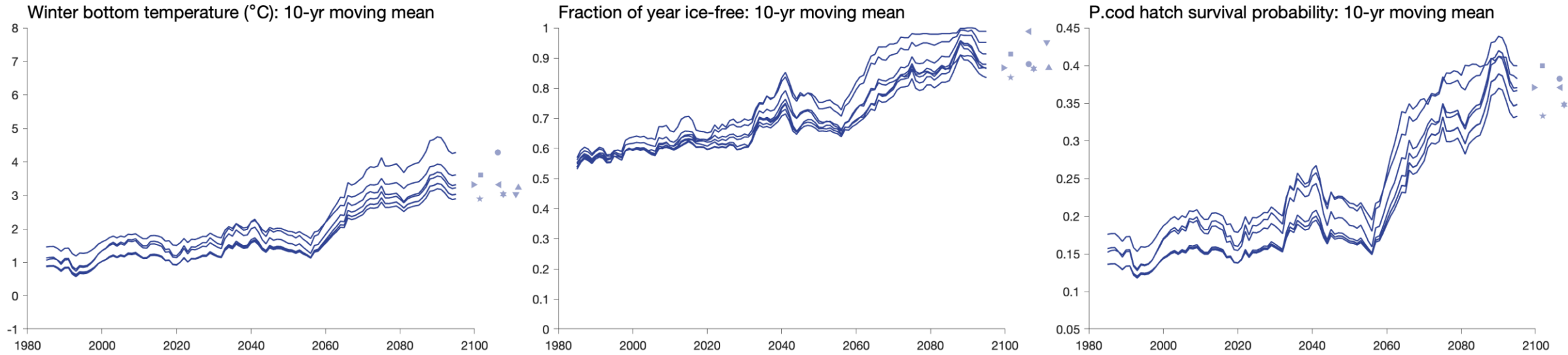
Impact of bias correction on annual indices

CESM GFDL MIROC
-- SSP1-2.5 — SSP5-8.5



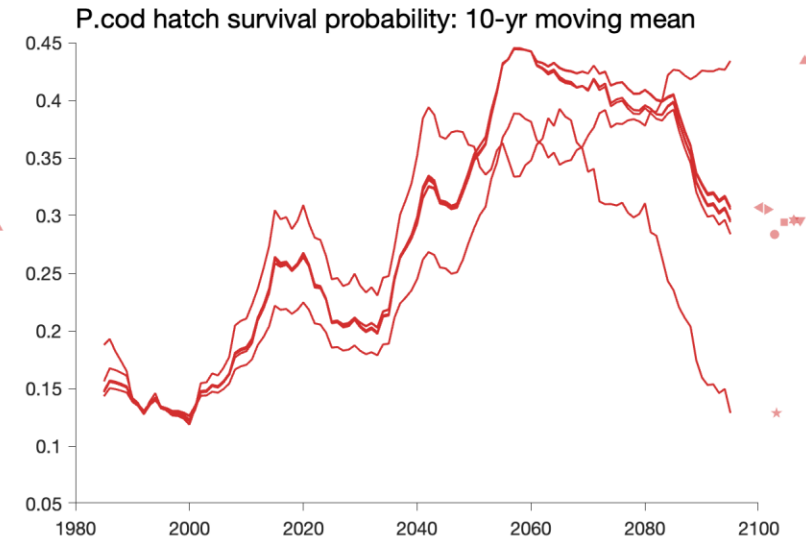
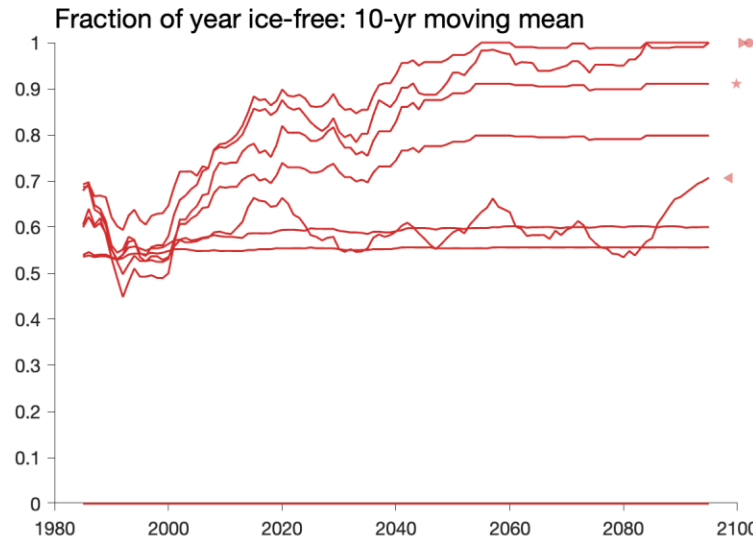
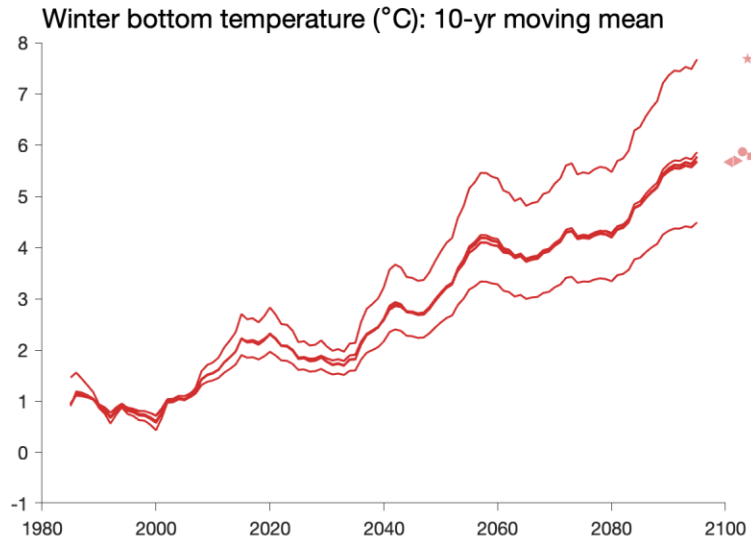
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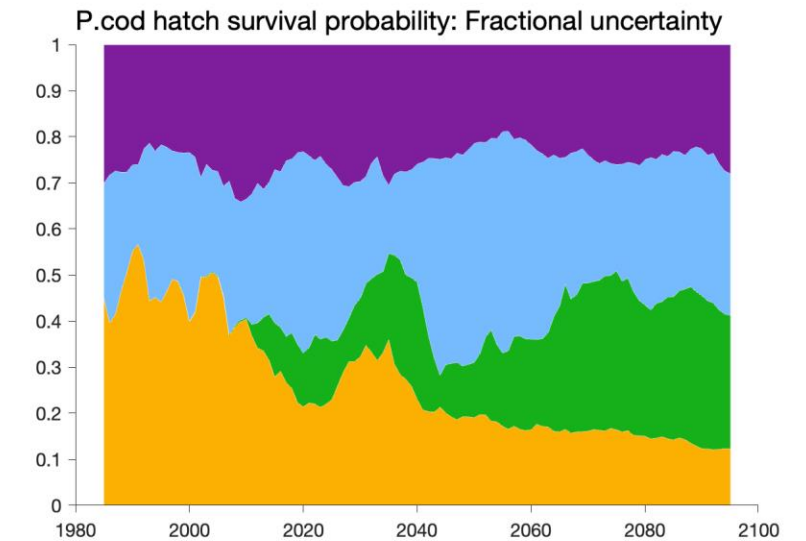
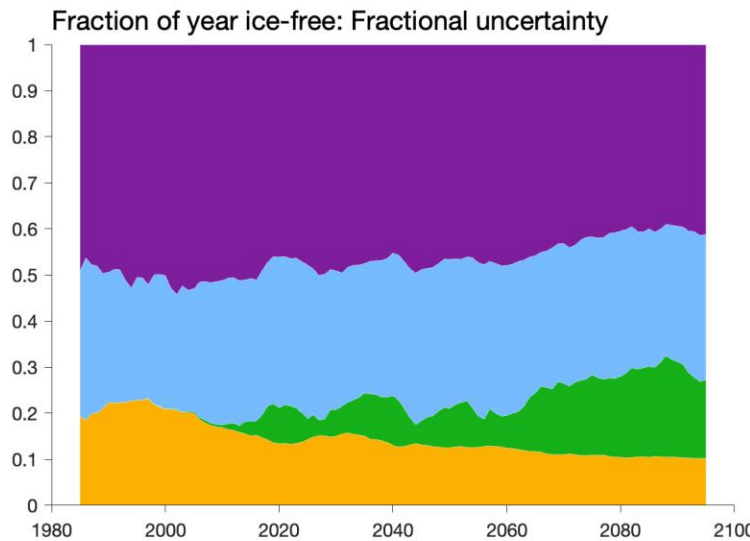
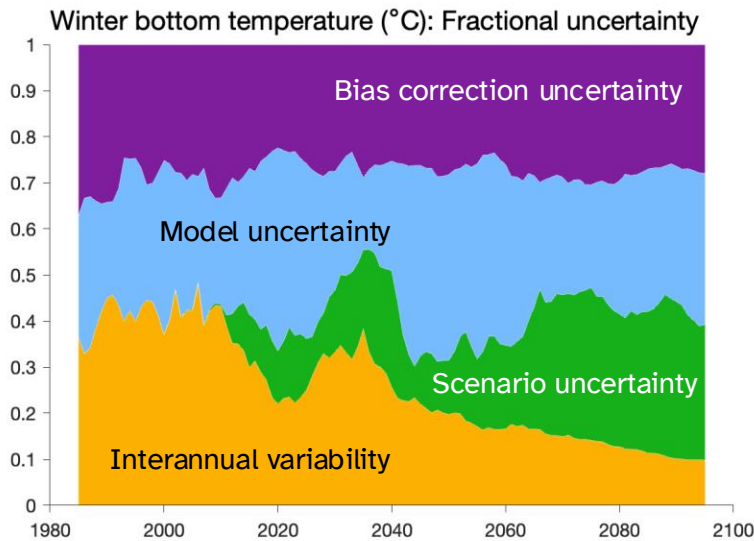
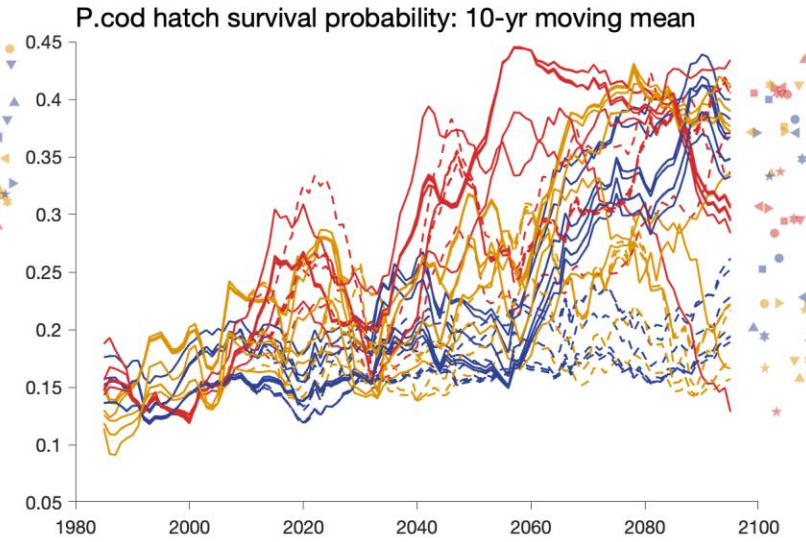
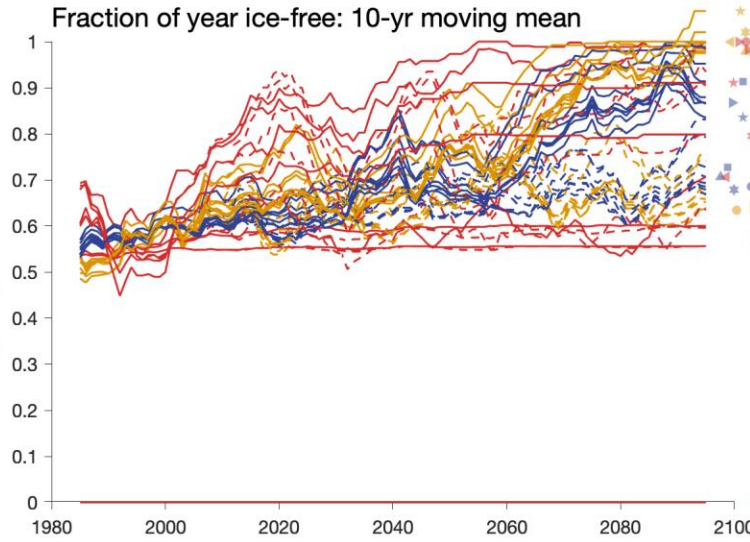
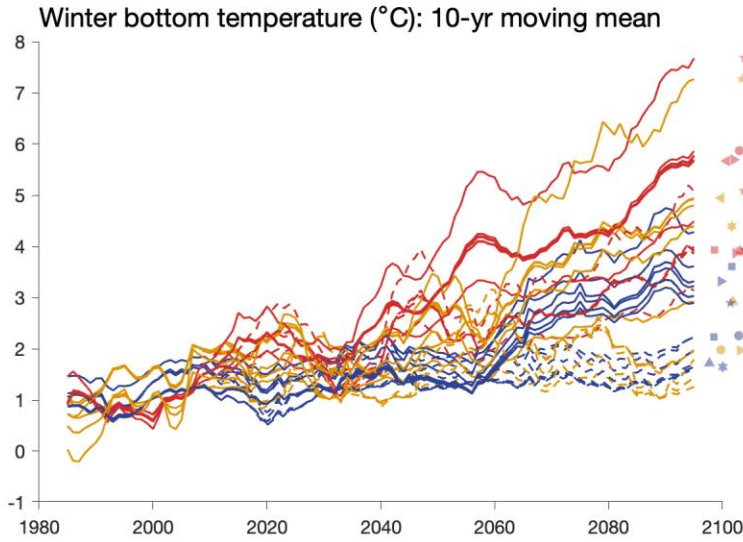
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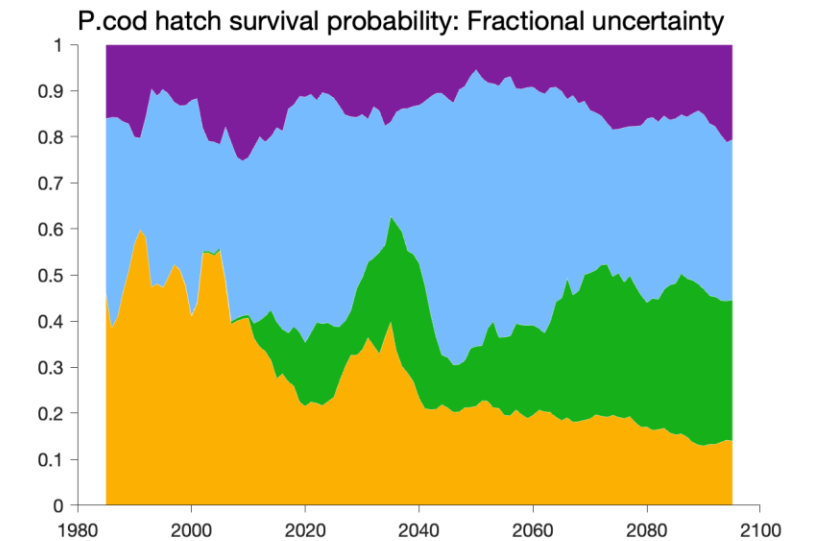
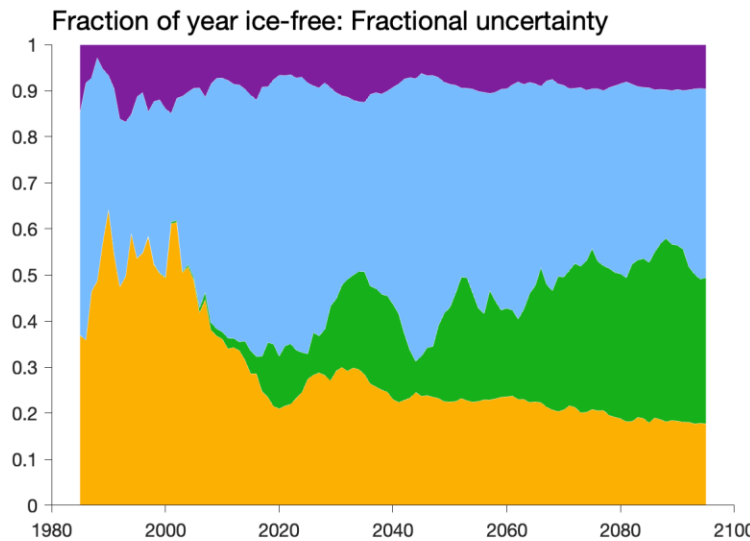
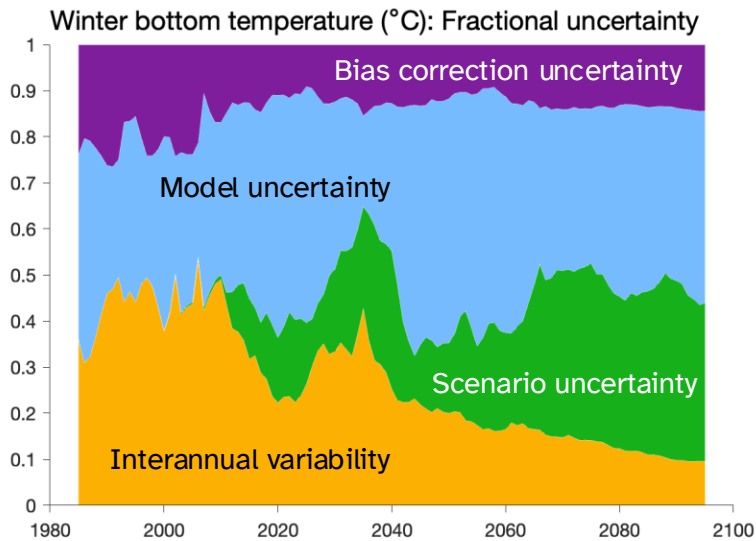
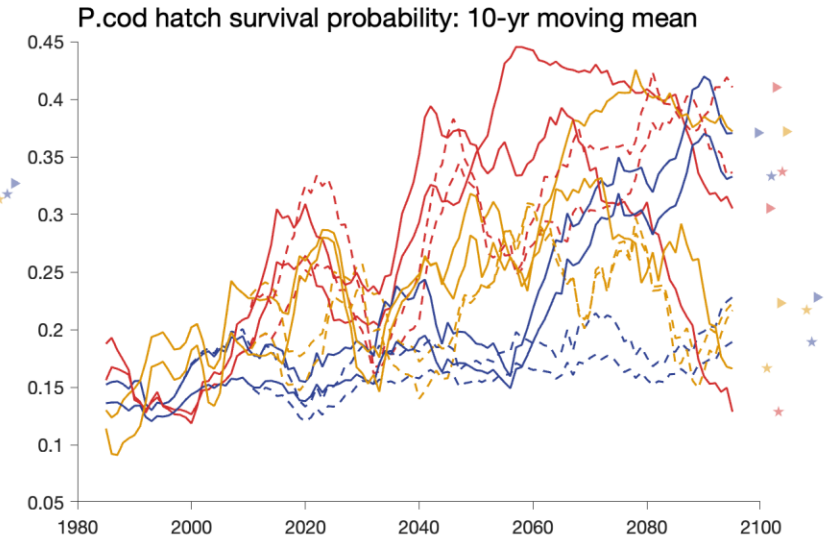
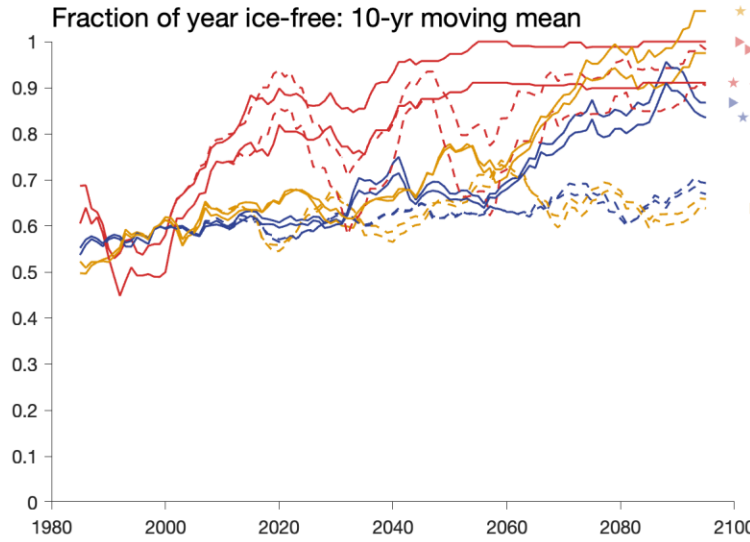
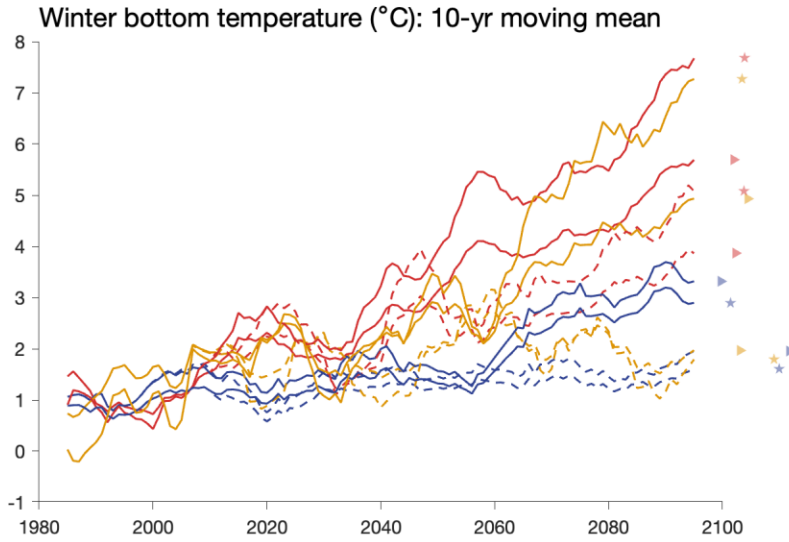
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Impact of bias correction on annual indices

CESM GFDL MIROC
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Conclusions

1

Bias correction matters!

When, how, across which temporal and spatial scales...

2

Common techniques can create un-physical artifacts if not applied carefully

Results should be carefully examined at different scales

3

“One size fits all” approaches may not exist

Different techniques suit certain ranges, distributions, scales of variability, etc.

4

Bias correction cannot fix all – or even most – tricky biases

Search out and correct for biases upstream where possible. Otherwise, it may make sense to rephrase the question.