

Supplement: A weighting scheme to constrain global temperature change from CMIP6 accounting for model independence and performance

Lukas Brunner¹, Angeline G. Pendergrass^{2,1}, Flavio Lehner¹, Anna L. Merrifield¹, Ruth Lorenz¹, and Reto Knutti¹

¹Institute for Atmospheric and Climate Science, ETH Zurich, Universitätsstrasse 16, 8092 Zurich, Switzerland

²National Center for Atmospheric Research, Boulder, Colorado, US

1 Summary

The supplementary material includes number of additional tables and figures supporting the findings presented in the main paper.

Supplement tables:

- 5 – **Table S1:** Table of performance shape parameter (σ_D) values as calculated by the weighting method.
- **Table S2:** Table of temperature and TCR statistics for the unweighted and weighted distributions.
- **Table S3 [external .csv file]:** List of all CMIP6 models and ensemble members used in this study as well as their institutions and DOIs.
- **Table S4 [external .csv file]:** List of all CMIP5 models used in the study.
- 10 – **Table S5 [external .csv file]:** List of all CMIP6 files used in the study including version date and tracking ID for tractability. Model issues are constantly updated and reported on the ES-DOC Errata page (<https://errata.es-doc.org/static/pid.html>). They can be accessed by searching for the tracking ID. For multiple version dates with the same tracking ID (in cases where more than one file exists for a given setting) the most recent version date is relevant.

Supplement figures:

- 15 – **Figure S1:** Extended figure 2 showing all CMIP5 models.
- **Figure S2:** Extended figure 3b showing all four combinations of scenarios and time periods.
- **Figure S3:** Extended figure 8a showing distributions from a bootstrap approach.

2 Tables

Table S1. Model performance shape parameter σ_D for different lead times (sub-tables), SSPs (rows), and trend importance (columns) as well as the respective mean values. The mean value of 50 % highlighted in bold font is used throughout the manuscript.

2041-2060	0 %	33 %	50 %	66 %	100 %	Mean
SSP126	0.64	0.60	0.58	0.63	0.93	0.68
SSP585	0.47	0.37	0.35	0.31	0.29	0.36
Mean	0.55	0.48	0.46	0.47	0.61	0.52

2081-2000	0 %	33 %	50 %	66 %	100 %	Mean
SSP126	0.55	0.44	0.39	0.42	0.32	0.42
SSP585	0.47	0.37	0.39	0.67	1.20	0.62
Mean	0.51	0.40	0.39	0.55	0.76	0.52

Mean	0 %	33 %	50 %	66 %	100 %	Mean
SSP126	0.60	0.52	0.48	0.52	0.62	0.55
SSP585	0.47	0.37	0.37	0.49	0.74	0.49
Mean	0.53	0.44	0.43	0.51	0.68	0.52

Table S2. Overview of statistics from figure 8. The change values for the two ranges are relative to the unweighted ranges in %, all other values are in °C.

SSP1-2.6 2041-2060	Mean	Median	66 % range	90 % range
Unweighted	1.07	1.08	0.75 - 1.50	0.61 - 1.61
Weighted	0.98	0.91	0.71 - 1.19	0.62 - 1.61
Change (relative)	-0.09	-0.17	−36.00 %	−0.99 %
SSP5-8.5 2041-2060	Mean	Median	66 % range	90 % range
Unweighted	1.73	1.70	1.29 - 2.08	1.17 - 2.55
Weighted	1.56	1.55	1.28 - 1.92	1.09 - 2.16
Change (relative)	-0.17	-0.15	−18.99 %	−22.46 %
SSP1-2.6 2081-2100	Mean	Median	66 % range	90 % range
Unweighted	1.17	1.03	0.68 - 1.62	0.60 - 1.98
Weighted	1.04	0.91	0.68 - 1.40	0.61 - 1.85
Change (relative)	-0.13	-0.12	−24.47 %	−9.42 %
SSP5-8.5 2081-2100	Mean	Median	66 % range	90 % range
Unweighted	4.05	3.98	3.09 - 4.87	2.76 - 5.82
Weighted	3.65	3.46	3.06 - 4.60	2.72 - 4.86
Change (relative)	-0.40	-0.52	−13.48 %	−29.84 %
TCR	Mean	Median	66 % range	90 % range
Unweighted	2.03	1.98	1.55 - 2.58	1.34 - 2.81
Weighted	1.88	1.80	1.55 - 2.11	1.37 - 2.73
Change (relative)	-0.15	-0.18	−45.63 %	−7.48 %

3 Figures

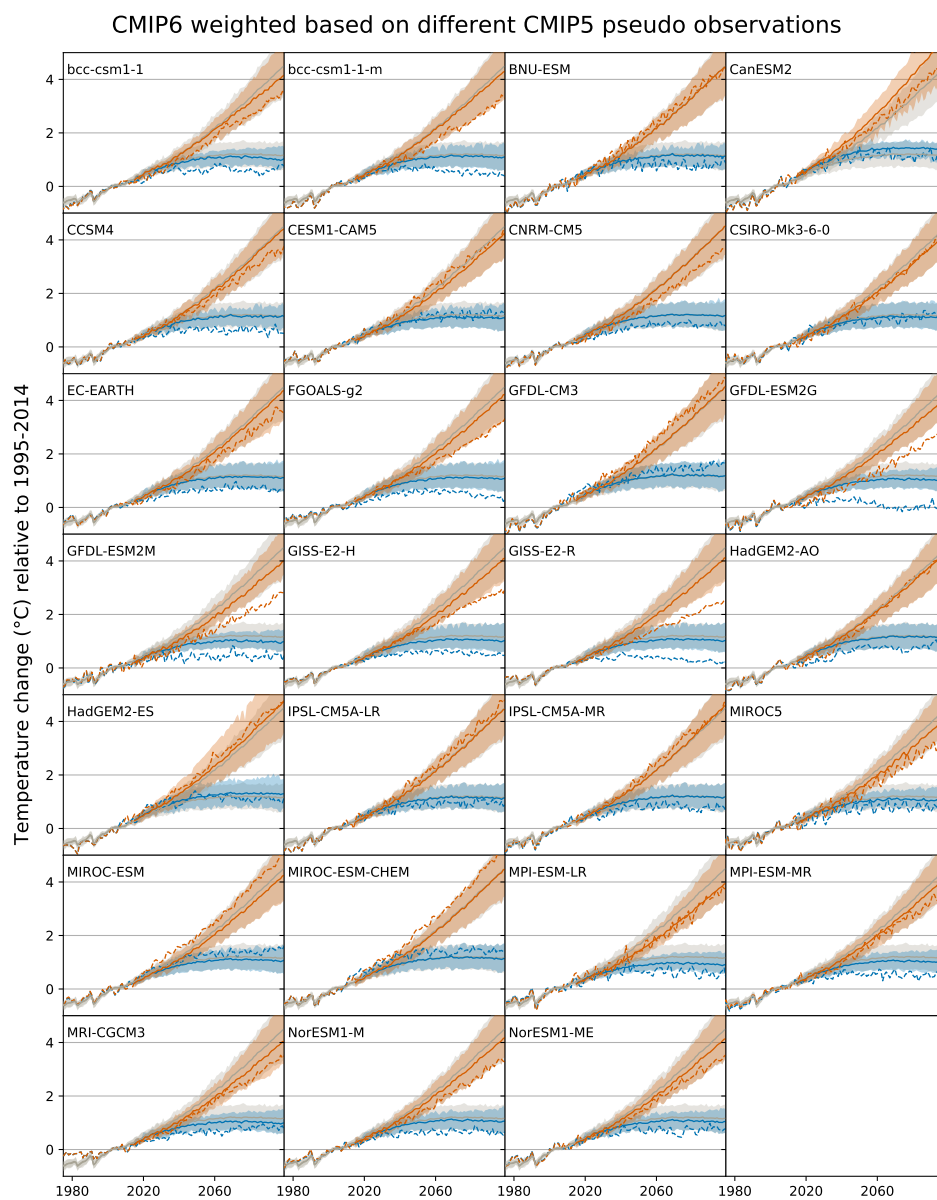


Figure S1. Similar to figure 2 but for all different pseudo-observations as given in the left top corner of each subplot.

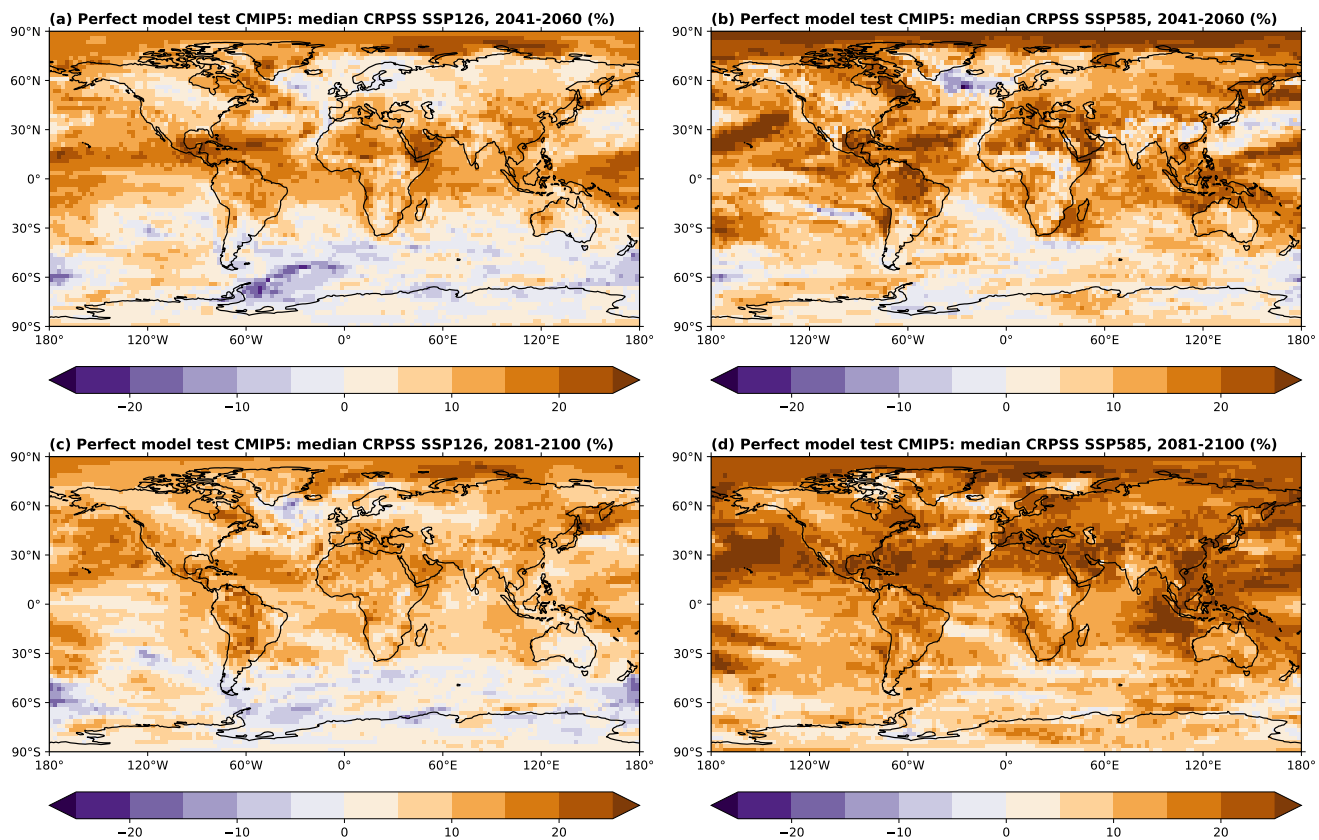


Figure S2. Same as figure 3b but for all four combinations of SSPs and time periods.

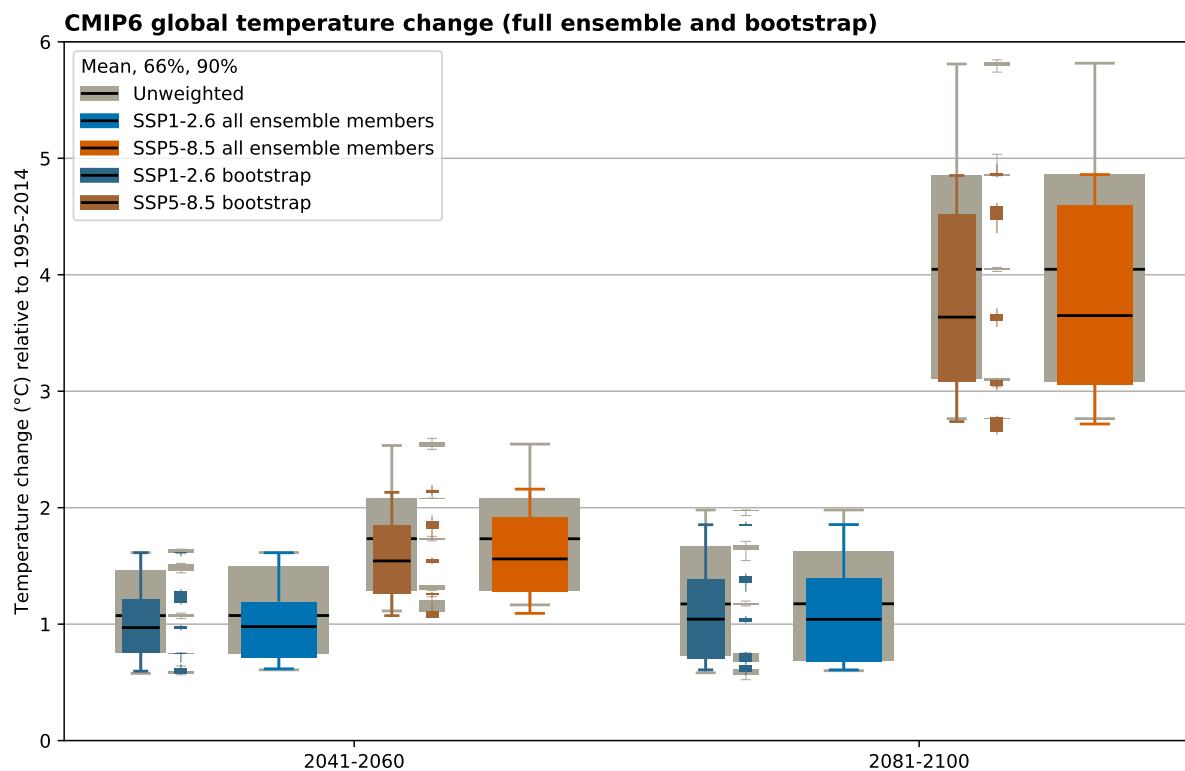


Figure S3. Unweighted (gray) and weighted (colors) temperature change for both periods and scenarios. The wide boxes show the same distributions as in figure 8a in the main paper based on all ensemble members. The larger narrow boxes show the median over all 100 bootstrap members. The tiny boxes show the uncertainty for each percentile.