

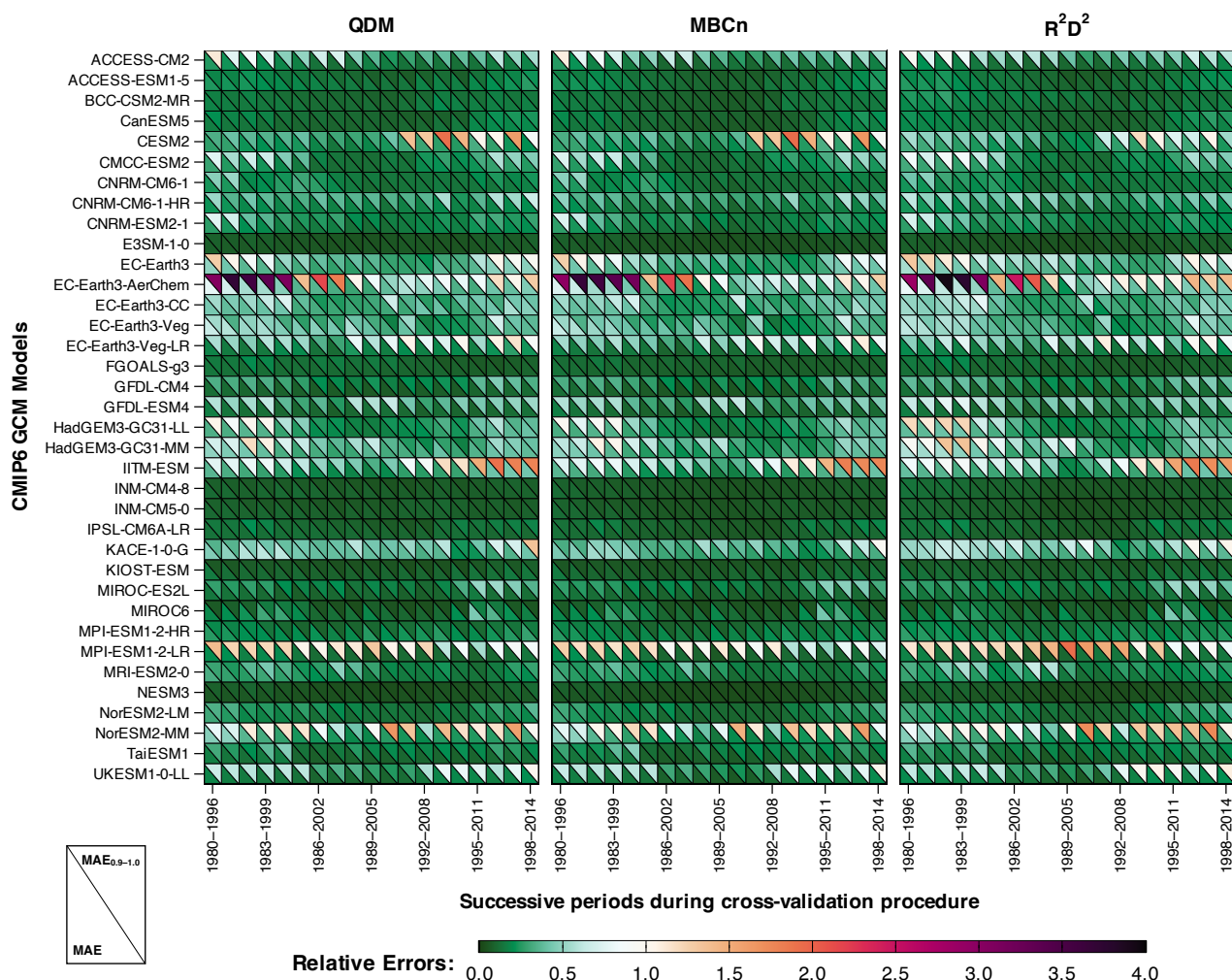
Supplementary Materials

Table S1 Details of the 36 CMIP6 GCMs used in this study, including model characteristics (origin, resolution, and grid coverage over the VMD) and scenario naming conventions

Model	Country	Horizontal resolution (lon. $\times$ lat.)	Number of grid cells selected	Scenarios SSPx-y.z* involved
ACCESS-CM2	Australia	$1.9^{\circ} \times 1.3^{\circ}$	3	1-2.6, 2-4.5, 3-7.0, 5-3.4, 5-8.5
ACCESS-ESM1-5	Australia	$1.9^{\circ} \times 1.2^{\circ}$	4	1-2.6, 2-4.5, 3-7.0, 5-3.4, 5-8.5
BCC-CSM2-MR	China	$1.1^{\circ} \times 1.1^{\circ}$	6	1-2.6, 2-4.5, 3-7.0, 5-8.5
CanESM5	Canada	$2.8^{\circ} \times 2.8^{\circ}$	2	1-1.9, 1-2.6, 2-4.5, 3-7.0, 4-3.4, 4-6.0, 5-3.4, 5-8.5
CESM2	USA	$1.3^{\circ} \times 0.9^{\circ}$	6	1-2.6, 2-4.5, 3-7.0, 5-8.5
CMCC-ESM2	Italy	$1.3^{\circ} \times 0.9^{\circ}$	6	1-2.6, 2-4.5, 3-7.0, 5-3.4, 5-8.5
CNRM-CM6-1	France	$1.4^{\circ} \times 1.4^{\circ}$	3	1-2.6, 2-4.5, 3-7.0, 5-8.5
CNRM-CM6-1-HR	France	$0.5^{\circ} \times 0.5^{\circ}$	10	1-2.6, 5-8.5
CNRM-ESM2-1	France	$1.4^{\circ} \times 1.4^{\circ}$	3	1-1.9, 1-2.6, 2-4.5, 3-7.0, 4-3.4, 4-6.0, 5-3.4, 5-8.5
E3SM-1-0	USA	$1^{\circ} \times 1^{\circ}$	5	5-8.5
EC-Earth3	Europe	$0.7^{\circ} \times 0.7^{\circ}$	8	1-1.9, 1-2.6, 2-4.5, 3-7.0, 4-3.4, 4-6.0, 5-3.4, 5-8.5
EC-Earth3-AerChem	Europe	$0.7^{\circ} \times 0.7^{\circ}$	8	3-7.0
EC-Earth3-CC	Europe	$0.7^{\circ} \times 0.7^{\circ}$	8	2-4.5, 5-8.5
EC-Earth3-Veg	Europe	$0.7^{\circ} \times 0.7^{\circ}$	8	1-1.9, 1-2.6, 2-4.5, 3-7.0, 5-8.5
EC-Earth3-Veg-LR	Europe	$1.1^{\circ} \times 1.1^{\circ}$	6	1-1.9, 1-2.6, 2-4.5, 3-7.0, 5-8.5
FGOALS-g3	China	$2^{\circ} \times 2.3^{\circ}$	2	1-1.9, 1-2.6, 2-4.5, 3-7.0, 4-3.4, 4-6.0, 5-3.4, 5-8.5
GFDL-CM4	USA	$2^{\circ} \times 2^{\circ}$	4	2-4.5, 5-8.5
GFDL-ESM4	USA	$1.3^{\circ} \times 1^{\circ}$	4	1-1.9, 1-2.6, 2-4.5, 3-7.0, 5-8.5

HadGEM3-GC31-LL	UK	$1.9^{\circ} \times 1.3^{\circ}$	3	1-2.6, 2-4.5, 5-8.5
HadGEM3-GC31-MM	UK	$0.83^{\circ} \times 0.55^{\circ}$	8	1-2.6, 5-8.5
IITM-ESM	India	$1.9^{\circ} \times 1.9^{\circ}$	3	1-2.6
INM-CM4-8	Russia	$2^{\circ} \times 1.5^{\circ}$	3	1-2.6, 2-4.5, 3-7.0, 5-8.5
INM-CM5-0	Russia	$2^{\circ} \times 1.5^{\circ}$	3	1-2.6, 2-4.5, 3-7.0, 5-8.5
IPSL-CM6A-LR	France	$2.5^{\circ} \times 1.3^{\circ}$	4	1-1.9, 1-2.6, 2-4.5, 3-7.0, 4-3.4, 4-6.0, 5-3.4, 5-8.5
KACE-1-0-G	South Korea	$1.3^{\circ} \times 0.9^{\circ}$	3	1-2.6, 2-4.5, 3-7.0, 5-8.5
KIOST-ESM	South Korea	$1.88^{\circ} \times 1.88^{\circ}$	3	1-2.6, 2-4.5, 5-8.5
MIROC-ES2L	Japan	$2.8^{\circ} \times 2.8^{\circ}$	2	1-1.9, 1-2.6, 2-4.5, 3-7.0, 5-3.4, 5-8.5
MIROC6	Japan	$1.4^{\circ} \times 1.4^{\circ}$	3	1-1.9, 1-2.6, 2-4.5, 3-7.0, 4-3.4, 4-6.0, 5-3.4, 5-8.5
MPI-ESM1-2-HR	Germany	$0.9^{\circ} \times 0.9^{\circ}$	7	1-2.6, 2-4.5, 3-7.0, 5-8.5
MPI-ESM1-2-LR	Germany	$1.9^{\circ} \times 1.9^{\circ}$	3	1-1.9, 1-2.6, 2-4.5, 3-7.0, 5-8.5
MRI-ESM2-0	Japan	$1.1^{\circ} \times 1.1^{\circ}$	6	1-1.9, 1-2.6, 2-4.5, 3-7.0, 4-3.4, 4-6.0, 5-3.4, 5-8.5
NESM3	China	$1.9^{\circ} \times 1.9^{\circ}$	3	1-2.6, 2-4.5, 5-8.5
NorESM2-LM	Norway	$2.5^{\circ} \times 1.9^{\circ}$	3	1-2.6, 2-4.5, 3-7.0, 5-8.5
NorESM2-MM	Norway	$0.9^{\circ} \times 1.3^{\circ}$	6	1-2.6, 2-4.5, 3-7.0, 5-8.5
TaiESM1	Taiwan	$1.3^{\circ} \times 1^{\circ}$	6	1-2.6, 2-4.5, 3-7.0, 5-8.5
UKESM1-0-LL	UK	$1.9^{\circ} \times 1.3^{\circ}$	3	1-1.9, 1-2.6, 2-4.5, 3-7.0, 4-3.4, 5-3.4, 5-8.5

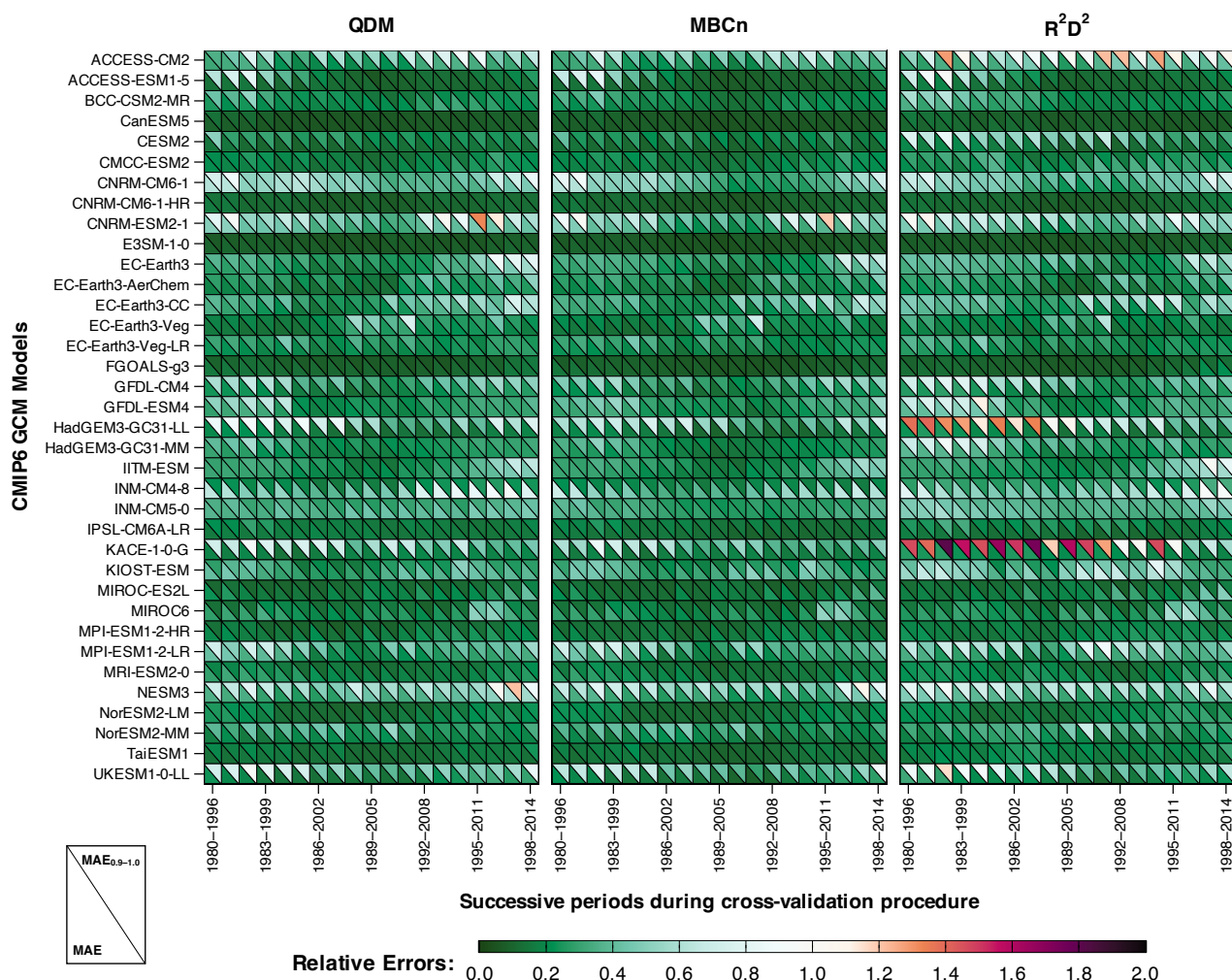
* The SSPx-y.z naming convention is defined as follows: x denotes one of five socioeconomic narratives, while y.z indicates the approximate radiative forcing level by 2100



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6 Figure S1. Evaluation of model performance in reproducing the marginal distribution of daily
7 maximum temperature based on successive cross-validation, averaged across ten meteorological
8 stations. The lower triangles show relative error values of the mean absolute error (MAE),
9 summarizing overall performance in terms of average testing errors. The upper triangles present MAE
10 values calculated for the upper tail of the distribution (0.9-1.0 quantile range; $MAE_{0.9-1.0}$), providing
11 a measure of model performance for high quantiles. Relative error values less than 1 indicate an
12 improvement relative to the raw (uncorrected) GCM outputs, whereas values greater than 1 indicate
13 a deterioration.

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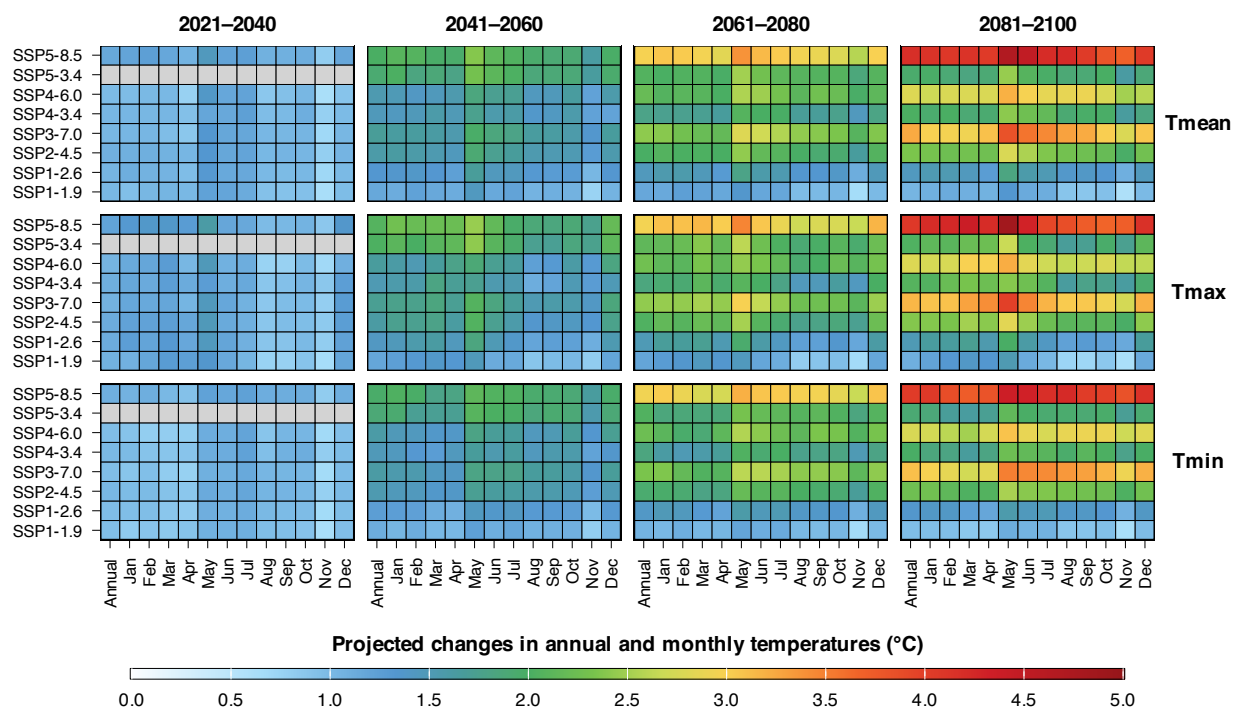


Figure S3. Projected changes in annual and monthly temperatures (°C), expressed as multi-model ensemble medians, for the periods 2021-2040, 2041-2060, 2061-2080, and 2081-2100 relative to the 1995-2014 baseline under eight SSP-based scenarios. Results are aggregated across all models and meteorological stations.

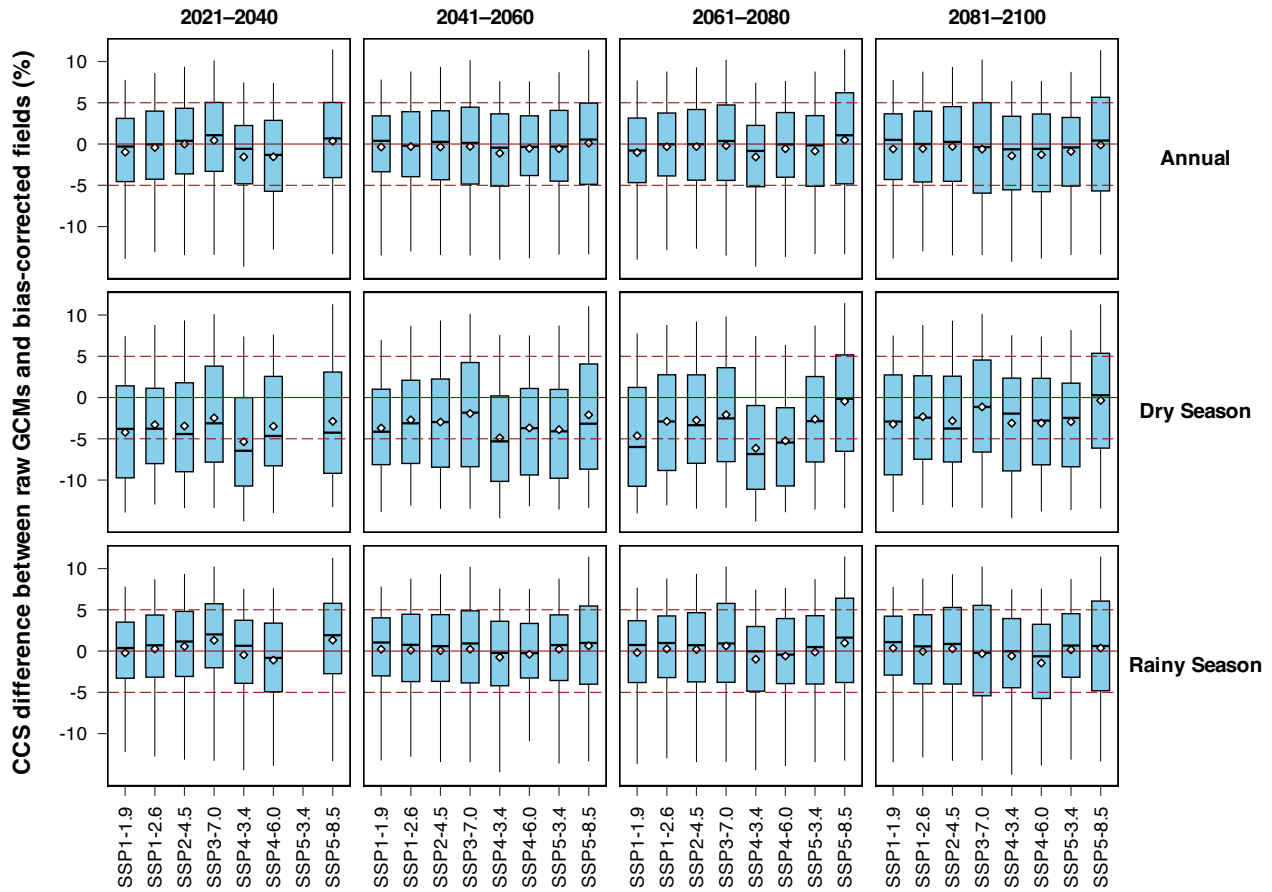


Figure S4. Modification of the climate change signal (CCS) by bias correction for annual and seasonal rainfall (%). Boxplots summarize the distribution of differences in projected change signals, defined as the difference between bias-corrected and raw (uncorrected) fields, for the periods 2021-2040, 2041-2060, 2061-2080, and 2081-2100 relative to the 1995-2014 baseline under eight SSP-based scenarios, across 10 meteorological stations. The boxes represent the interquartile range, covering the central 50% of the distribution. The horizontal lines within the boxes indicate the medians, while the diamond symbols denote the arithmetic means. Solid horizontal lines within each subpanel indicate perfect preservation of the raw CCS (i.e., zero difference), whereas dashed lines denote moderate modifications, defined here as within $\pm 5\%$ for annual and seasonal rainfall.

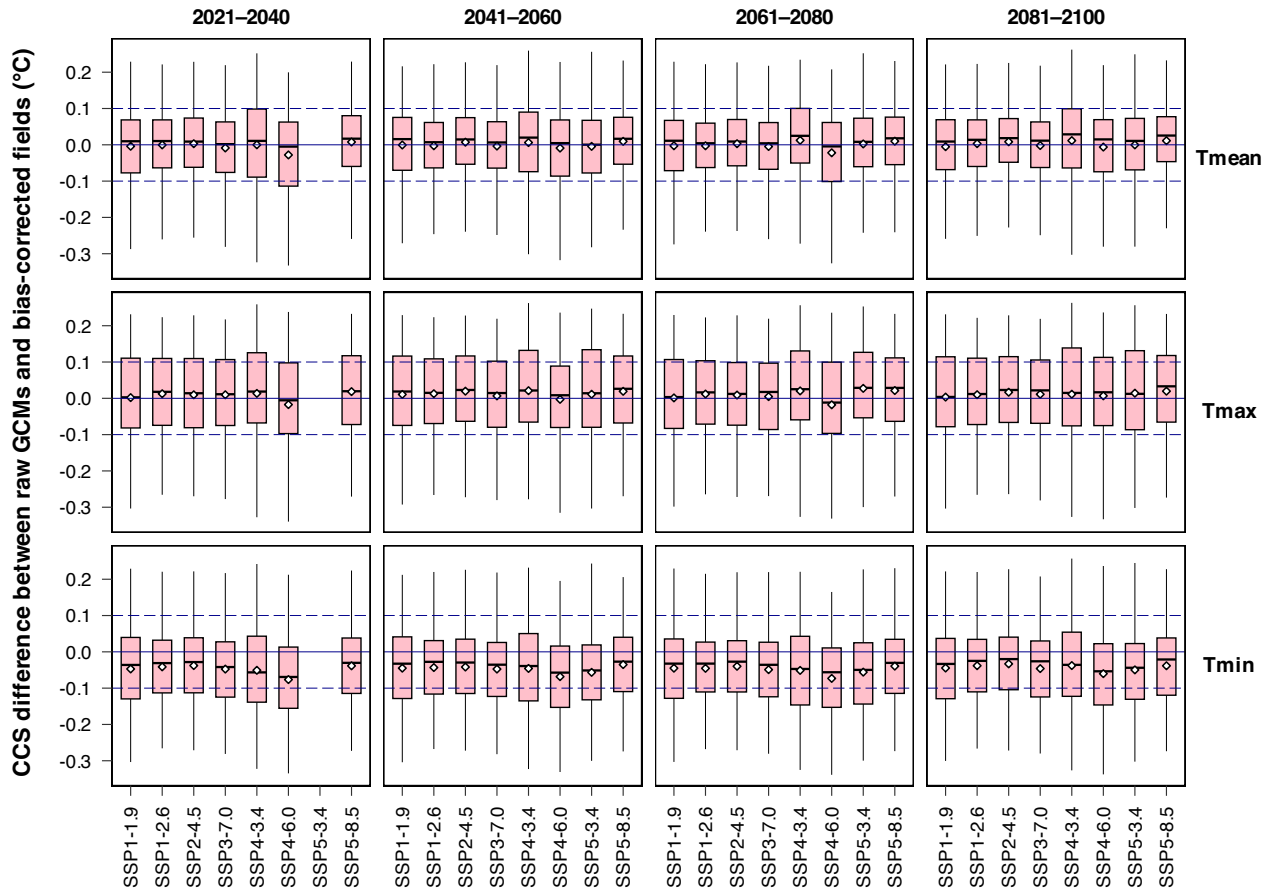


Figure S5. Modification of the climate change signal (CCS) by bias correction for annual temperature (°C). Boxplots summarize the distribution of differences in projected change signals, defined as the difference between bias-corrected and raw (uncorrected) fields, for the periods 2021-2040, 2041-2060, 2061-2080, and 2081-2100 relative to the 1995-2014 baseline under eight SSP-based scenarios, across 10 meteorological stations. The boxes represent the interquartile range, covering the central 50% of the distribution. The horizontal lines within the boxes indicate the medians, while the diamond symbols denote the arithmetic means. Solid horizontal lines within each subpanel indicate perfect preservation of the raw CCS (i.e., zero difference), whereas dashed lines denote moderate modifications, defined here as within ± 0.1 °C for annual temperature.