1   **Supplementary Information**

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3   **Anthropogenic land cover change impact on climate extremes during the**

4   **21st century**

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16 *Submitted to:* Environmental Research Letters

17 16th January 2020

18 *Content Type:* Letter

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Supplementary Figure and Table Captions

Supplementary Table S1 – Description of each of the 22 temperature and precipitation indices (T_{mean}, P_{mean} and 20 ETCCDI extreme indices) with acronyms, names and units.

Supplementary Table S2 – Regional relative contributions of future LCC to projections of 2 mean and 20 extreme weather indices (rows, %) in 26 IPCC regions and at global scale (columns), based on the same calculation as in Figure 3 (RCP8.5 scenario). A red font is chosen when regional changes are robust (i.e., multi-model regional mean significant at the 0.05 level and where four out of five models simulate the same regional change sign). For each extreme index row, final column corresponds to the Pearson correlation between the respective T_{mean} (P_{mean}) and the respective extreme temperature (precipitation) index. Colour scale in the final column is proportional to the value: red when positive and blue when negative. Star symbols are added when the correlation is significant: *** for p-value < 0.01, ** for p-value<0.05 and * for p-value<0.1.

Supplementary Table S3 - Earth system models used in the analysis with their resolution, physical components, plant functional types (PFT) description and vegetation setups.

Supplementary Figure S1 – Tree fraction cover (%) changes for RCP8.5 scenario between 2100 and 2006, as simulated by each LUCID-CMIP5 model. Red (green) contours are displayed for values <−5% (>5%).

Supplementary Figure S2 – Tree fraction cover (%) changes for RCP2.6 scenario between 2100 and 2006, as simulated by each LUCID-CMIP5 model. Red (green) contours are displayed for values <−5% (>5%). Only 3 LUCID-CMIP5 models made *treefrac* variable available, CanESM2 spatial patterns should be similar to IPSL-CM5A-LR.

Supplementary Figure S3 – Geographical domains of the 26 IPCC regions studied. The acronym for each region is displayed.

Supplementary Figure S4 – Similar to Figure 1 but for less impacted extreme temperature (upper panel) and precipitation (lower panel) indices (see *Methods*).

Supplementary Figure S5 – Similar to Figure 2 but for less impacted extreme temperature (upper panel) and precipitation (lower panel) indices (see *Methods*).

Supplementary Figure S6 – Similar to Figure 3 but for less impacted extreme temperature (upper panel) and precipitation (lower panel) indices (see *Methods*).

Supplementary Figure S7 – Similar to Figure 1 but for RCP2.6 scenario.

63   **Supplementary Figure S8** – Relation between extreme precipitation indices responses

64   (R1mm, left; R10mm, middle; PRCPTOT, right) in response to future LCC (Y-axis) and tree

65   fraction changes (X-axis, between 2100 and 2006) for all grid points of the five LUCID-

66   CMIP5 models together. For each variable, local polynomial regression fitting (LOESS fit

67   curves) with 95% confidence-intervals for boreal (blue envelope, |latitude|>50°), temperate

68   (orange, 20°N<latitude<50°N and 50°S<latitude<20°S), and tropical (red, |latitude|<20°)

69   regions are displayed for ΔTreeFrac > 0% and ΔTreeFrac < 0% separately.

70   **Supplementary Figure S9** – Similar to Figure 3 but for RCP2.6 scenario.

71   **Supplementary Figure S10–S13** – Similar to Figure 2 but for extreme temperature and

72   precipitation indices calculated at the seasonal scale for DJF, JJA, MAM and SON,

73   respectively.

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Supplementary Table S1

Index	Name	Description	Unit
TXx	Annual maxima of daily maximum temperature	Annual maxima value of daily maximum temperature	°C
TNx	Annual maxima of daily minimum temperature	Annual maxima value of daily minimum temperature	°C
TXn	Annual minima of daily maximum temperature	Annual minima value of daily maximum temperature	°C
TNn	Annual minima of daily minimum temperature	Annual minima value of daily minimum temperature	°C
TN10p	Cold nights	Percentage of days when daily minimum temperature<10th percentile	%
TX10p	Cold days	Percentage of days when daily maximum temperature<10th percentile	%
TN90p	Warm nights	Percentage of days when daily minimum temperature>90th percentile	%
TX90p	Warm days	Percentage of days when daily maximum temperature>90th percentile	%
WSDI	Warm spell duration indice	Annual number of days with at least 6 consecutive days when Tmax>90th percentile	days
CSDI	Cold spell duration indice	Annual number of days with at least 6 consecutive days when Tmin<10th percentile	days
Rx1day	Max 1-day precipitation amount	Annual maximum 1-day precipitation	mm
Rx5day	Max 5-day precipitation amount	Annual maximum consecutive 5-day precipitation	mm
R95p	Very wet days	Annual total precipitation from days>95th percentile	mm
R99p	Extremely wet days	Annual total precipitation from days>99th percentile	mm
R1mm	Wet days	Annual count when precipitation>1 mm	mm
R10mm	Heavy precipitation days	Annual count when precipitation>10 mm	mm
R20mm	Very heavy precipitation days	Annual count when precipitation>20 mm	mm
CDD	Consecutive dry days	Maximum number of consecutive days when precipitation<1mm	days
CWD	Consecutive wet days	Maximum number of consecutive days when precipitation≥1mm	days
PRCPTOT	Total precipitation in wet days	Annual total precipitation from days≥1mm	mm
T_{mean}	Mean temperature	Mean temperature value	°C
P_{mean}	Mean precipitation	Mean precipitation value	mm/day

Supplementary Table S2

Index	ALA	CGI	WNA	CNA	ENA	CAM	AMZ	NEB	WSA	SSA	NEU	CEU	MED	SAH
							IPCC Regions							
Temperature indices														
TXX	+0.21	−1.20	−0.15	+0.30	+1.47	+0.55	+2.59	−1.31	+2.30	−0.62	−2.74	−1.89	−0.64	−1.01
TNX	+1.37	−0.43	+1.47	+2.07	+1.46	+1.89	+2.55	+0.65	+4.39	0.92	−2.07	−0.32	+0.94	+1.21
TXN	+0.34	−1.33	−0.01	−0.26	+0.77	+0.01	+0.28	+1.45	+0.70	−3.11	−2.53	−3.94	−2.22	−0.79
TNN	+1.22	−0.61	+0.54	+0.20	+1.31	+0.78	+0.87	+0.19	+1.76	−1.37	−1.86	−3.27	−1.42	+0.05
TN10p	+0.29	+0.53	+0.24	+0.07	+0.07	−0.14	−0.04	+0.01	+0.11	+0.25	+0.22	+0.95	+0.35	+0.12
TX10p	+0.75	+0.86	+0.14	+0.11	+0.23	+0.03	+0.19	−0.01	+0.34	+0.64	+0.31	+1.16	+0.48	−0.13
TN90p	+0.27	−1.44	+0.69	+1.41	+0.89	−0.07	−0.14	−0.49	+1.49	−1.18	−1.01	−2.78	−0.67	−0.03
TX90p	−0.33	−2.60	−0.14	+0.64	+0.57	−0.41	+0.58	−0.24	+0.65	−2.58	−2.25	−3.54	−1.00	−1.05
WSDI	−0.15	−3.57	−0.27	+1.37	+0.80	−0.57	+0.82	−0.31	+0.92	−5.14	−2.85	−4.46	−1.53	−1.49
CSDI	+0.30	+0.34	+0.26	−0.81	−0.54	+0.01	−0.10	+0.01	+0.20	−0.04	−0.00	+0.36	+0.24	+0.05
Tmean	−0.23	−0.54	−0.86	+0.43	+0.79	+0.18	+0.99	−0.61	+1.34	−0.67	−2.41	−3.84	−1.57	−0.39
Precipitation indices														
Rx1day	+0.40	+2.79	+9.61	+1.56	+7.13	−43.45	−17.46	−14.86	+32.07	−0.54	+4.34	+5.86	+6.71	+56.99
Rx5day	−0.94	+0.10	+11.14	+6.36	+1.27	−14.54	−10.40	−11.40	+68.35	+0.04	+1.83	−1.54	−14.61	−27.42
R95p	+0.31	−0.46	+5.60	−7.39	+0.23	−20.64	−24.33	−21.38	+18.91	+4.22	+2.34	+0.72	−11.78	+68.96
R99p	+0.95	+1.40	+7.28	−5.11	+2.72	−10.75	+3.37	+13.38	+6.81	+0.56	+4.77	+3.38	−2.91	−16.21
R1mm	−4.34	−4.37	+19.41	+13.83	+1.06	−6.23	−4.38	−17.26	+5.95	+15.83	−6.51	+60.44	−0.62	+65.55
R10mm	+0.30	−2.26	+3.42	+68.52	+1.90	−14.37	−12.20	−70.50	−32.80	+18.30	+0.59	+1.19	−43.37	+71.48
R20mm	+0.58	+0.04	+5.99	−70.03	−3.86	−36.87	−70.30	−30.90	+28.69	+7.79	+5.51	+1.33	−20.88	−69.71
CDD	+3.86	+8.65	+4.04	−17.51	+6.91	−4.03	+1.18	−4.18	−11.84	−76.49	−69.32	−12.25	−6.24	+6.32
CWD	+3.76	−4.11	+33.33	+46.55	−68.90	−41.96	−11.38	−68.95	+17.06	+23.78	+9.24	−21.76	−0.72	+65.45
PRCPTOT	−1.17	−2.50	+9.18	+7.04	−8.83	−22.79	−5.89	−70.30	−13.15	+39.39	−0.04	+68.51	−5.03	+55.92
Pmean	−0.97	−3.04	+8.03	+4.28	−13.92	−20.07	−9.31	−75.43	−11.89	−9.57	−7.69	+70.62	+4.16	+14.32

Supplementary Table S2 (continuous)

Index	IPCC Regions												GLOBAL	r_spatial (Mean; Indices)
	WAF	EAF	SAF	NAS	WAS	CAS	TIB	EAS	SAS	SEA	NAU	SAU		
Temperature indices														
TXX	+1.25	+0.94	+0.56	−0.27	−0.18	+1.68	+1.55	+1.56	+1.11	+1.55	−7.49	+1.53	+0.15	0.75***
TNX	+2.04	+2.29	+2.11	+1.00	+1.57	+2.20	+1.97	+1.89	+1.49	+1.95	−0.24	+2.82	+1.42	0.81***
TXN	+0.43	−0.77	+0.17	−0.10	−1.80	−1.25	−0.94	−0.12	−0.90	+0.11	−2.02	+0.98	−0.64	0.73***
TNN	+0.75	+0.14	+0.11	+0.86	−0.91	−0.89	−0.61	+0.34	−0.21	+0.67	−0.78	+1.86	+0.01	0.75***
TN10p	+0.26	+0.06	+0.03	+0.00	+0.48	+0.47	+0.66	+0.08	+0.00	+0.02	+0.18	+0.05	+0.21	−0.49**
TX10p	+0.05	+1.36	+0.09	+0.16	+1.36	+0.78	+0.53	+0.18	+0.73	+0.13	+1.16	+0.15	+0.44	−0.40**
TN90p	−0.17	−0.22	−0.02	+0.75	−0.28	−0.02	+0.41	+0.47	−0.14	−0.10	−0.97	+1.23	−0.01	0.71***
TX90p	+0.32	−0.17	−0.04	−0.27	−1.17	−0.13	+0.82	+0.71	+0.01	+0.12	−1.67	+0.78	−0.37	0.80***
WSDI	+0.38	−0.23	−0.16	−0.44	−1.58	+0.48	+1.48	+0.80	−0.01	+0.16	−1.71	+1.45	−0.44	0.73***
CSDI	−0.15	+0.00	−0.01	+0.05	+0.57	+0.82	+0.54	+0.22	+0.04	+0.00	−0.04	+0.02	+0.14	−0.20
Tmean	+0.40	−0.13	+0.44	−1.85	−0.67	+0.29	+0.31	+0.72	−0.25	+0.28	−2.15	+0.62	−0.38	
Precipitation indices														
Rx1day	+1.96	−3.66	−39.91	+1.05	+72.50	+13.68	−3.35	+1.68	−12.79	+8.21	+4.65	−0.81	+0.54	0.09
Rx5day	−0.59	−7.47	−30.87	+3.25	+48.64	+37.91	−0.50	+0.70	−17.87	+6.24	+1.03	−6.02	−2.00	0.03
R95p	−2.19	−7.26	−32.04	+1.60	+11.95	+16.60	−2.39	+1.06	−38.32	+4.79	+8.38	−1.59	−1.47	0.29
R99p	+4.20	−6.85	−74.90	+2.27	+7.41	+10.67	−0.56	+3.24	−16.46	+18.53	+6.42	−2.55	−0.14	0.26
R1mm	−6.74	−28.90	−14.20	+0.33	−13.81	+5.14	−14.98	−12.08	+78.63	−9.76	+16.56	+0.39	−7.25	0.60***
R10mm	−13.04	−18.05	−78.20	+0.29	+18.31	+41.10	−3.67	+6.03	−64.29	−66.26	+13.36	−75.98	−21.79	0.26
R20mm	−10.77	−11.51	−43.92	+1.82	+11.34	+47.75	+2.47	−0.00	−5.43	−10.09	+27.37	+1.92	−4.98	0.21
CDD	+54.44	+8.80	+0.11	+4.45	−72.35	−8.50	+17.04	+2.12	+64.81	−14.13	−2.56	−2.03	−5.89	0.12
CWD	−10.94	−9.71	−76.02	+6.07	+16.57	−9.02	−17.30	−31.17	−11.13	−3.74	+8.14	+13.96	−5.49	0.38*
PRCPTOT	−7.99	−19.10	−51.55	+0.75	+21.53	+42.66	−10.71	+1.30	−7.52	−23.00	+25.64	+23.52	−16.00	0.68***
Pmean	−16.65	−72.30	−66.45	−0.68	−72.50	+8.02	−23.97	+0.80	+4.99	−3.90	+66.96	+33.98	−8.24	

Supplementary Table S3

Earth System Models	CanESM2	HadGEM2-ES	IPSL-CM5A-LR	MIROC-ESM	MPI-ESM-LR
Land Surface Model	CTEM	JULES	ORCHIDEE	SEIB-DGVM	JSBACH
Horizontal resolution (Lon x Lat)	2.8°x2.8°	1.9°x 1.3°	3.8°x1.9°	2.8°x2.8°	1.9°x1.9°
Dynamic vegetation	No	Yes	No	Yes	Yes
Number of Plant Functional Types (PFT)	9	5	13	13	12
Fire module	No	No	Yes	No	Yes
Crop PFT	Yes	No	Yes	No	No
Pasture PFT	No	Yes	No	Yes	Yes
Wood Harvest	No	No	No	No	Yes
Usage of land use transitions (Hurtt et al. 2011)	No	No	No	Yes	Yes
Reference	(Arora et al., 2011)	(Jones et al., 2011)	(Dufresne et al., 2013)	(Watanabe et al., 2011)	(Reick et al. 2013)

Supplementary Figure S1

RCP8.5 Tree fraction change (2100–2006)
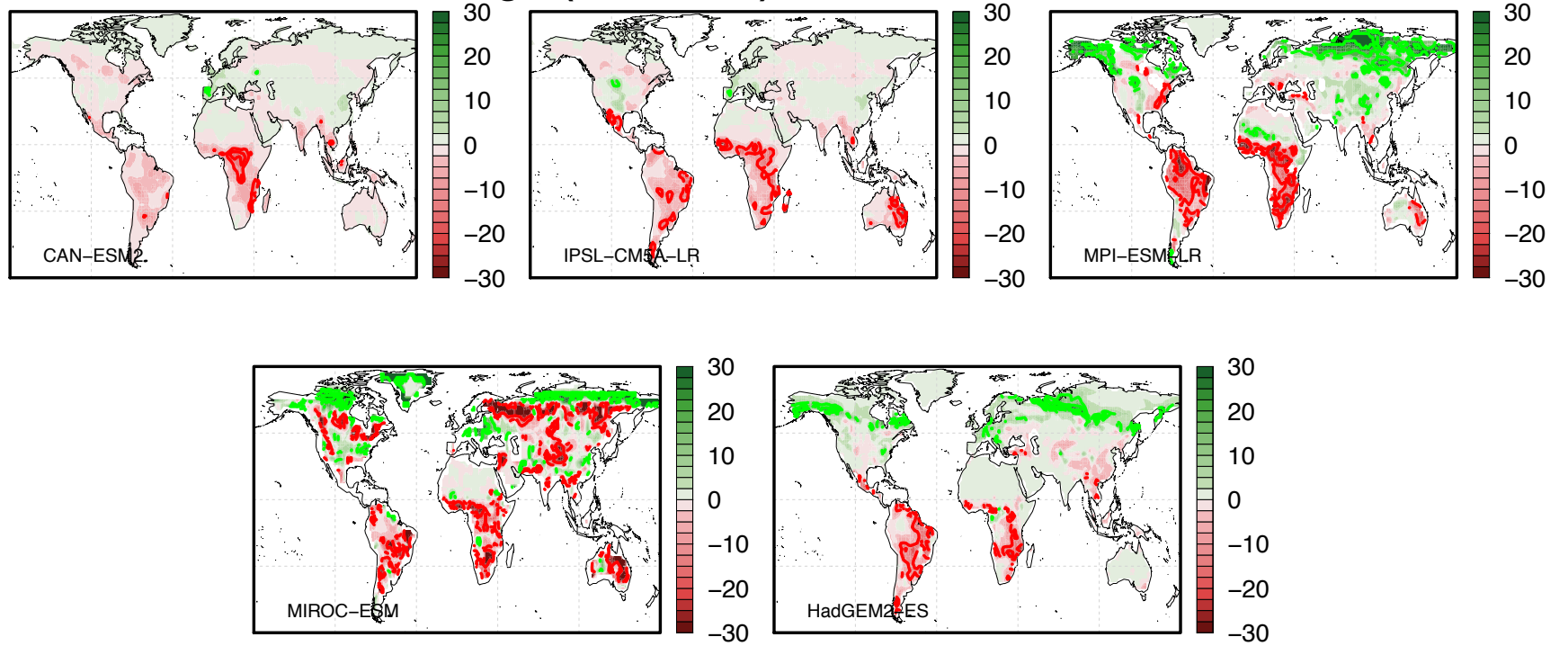
RCP2.6 Tree fraction change (2100−2006)
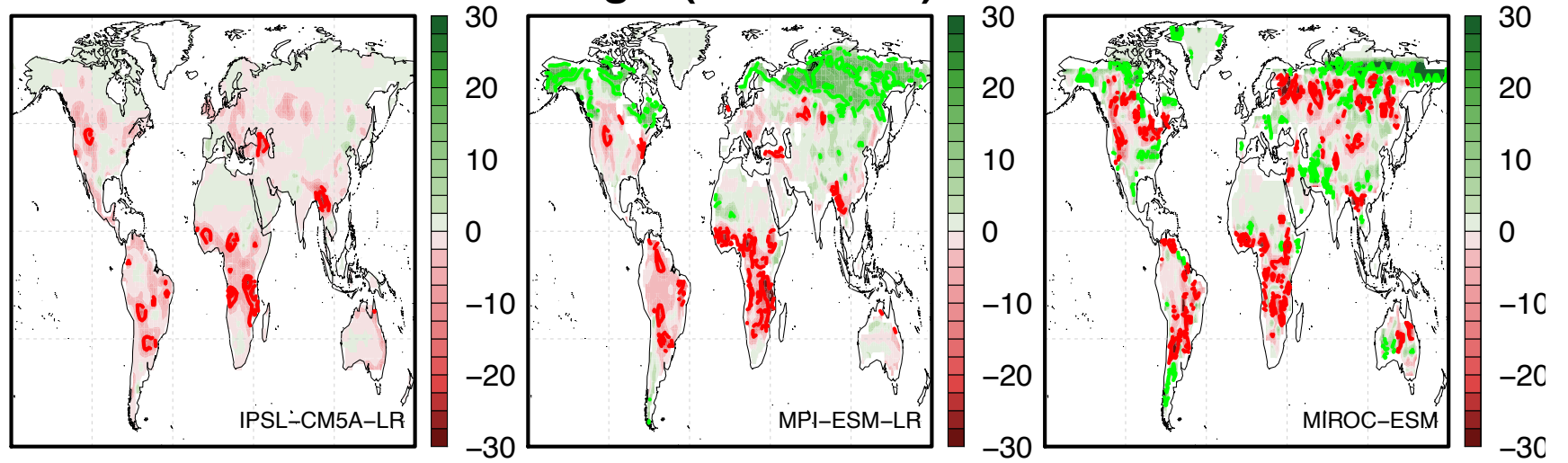
Supplementary Figure S3
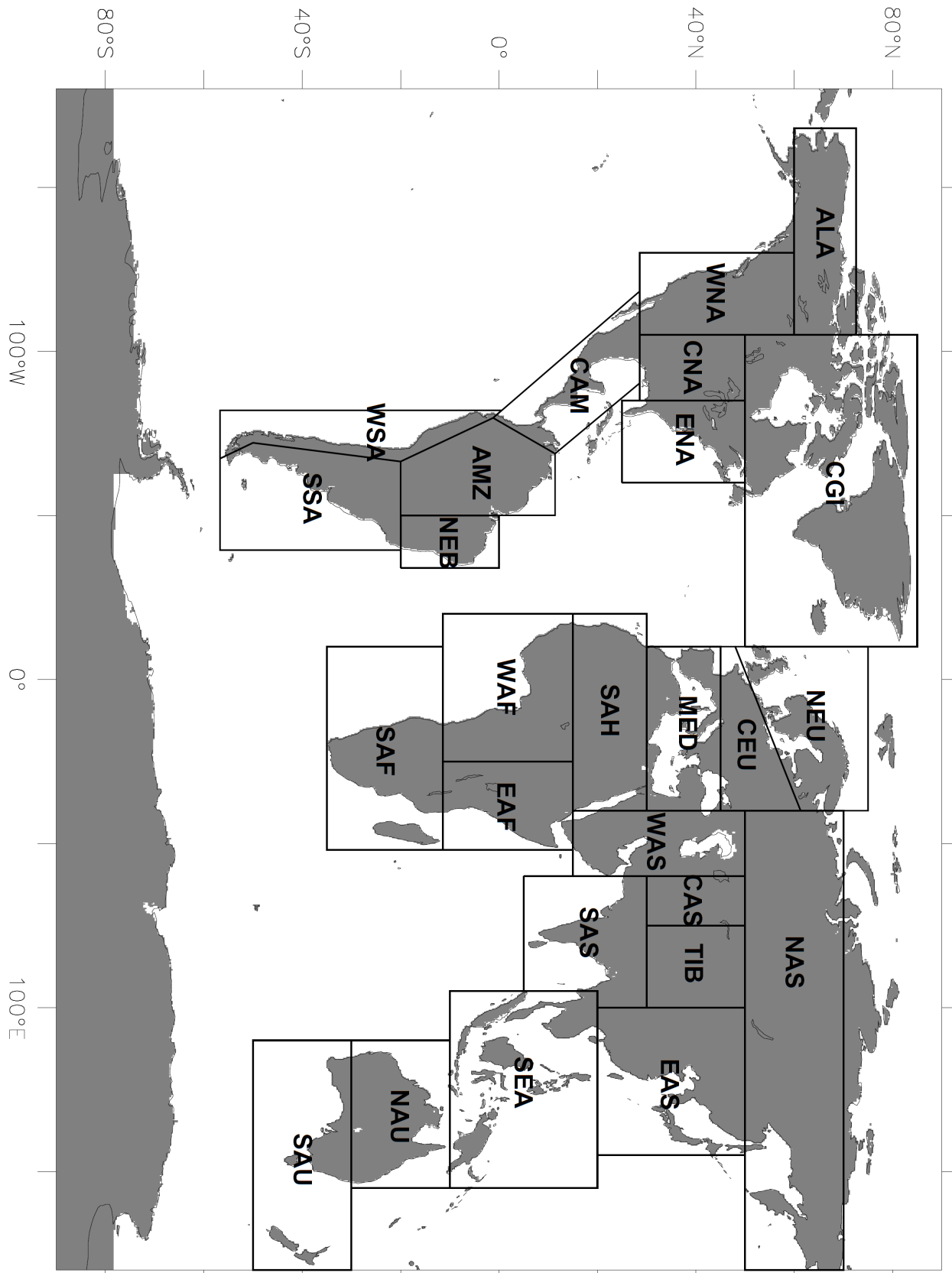
**Supplementary Figure S4**
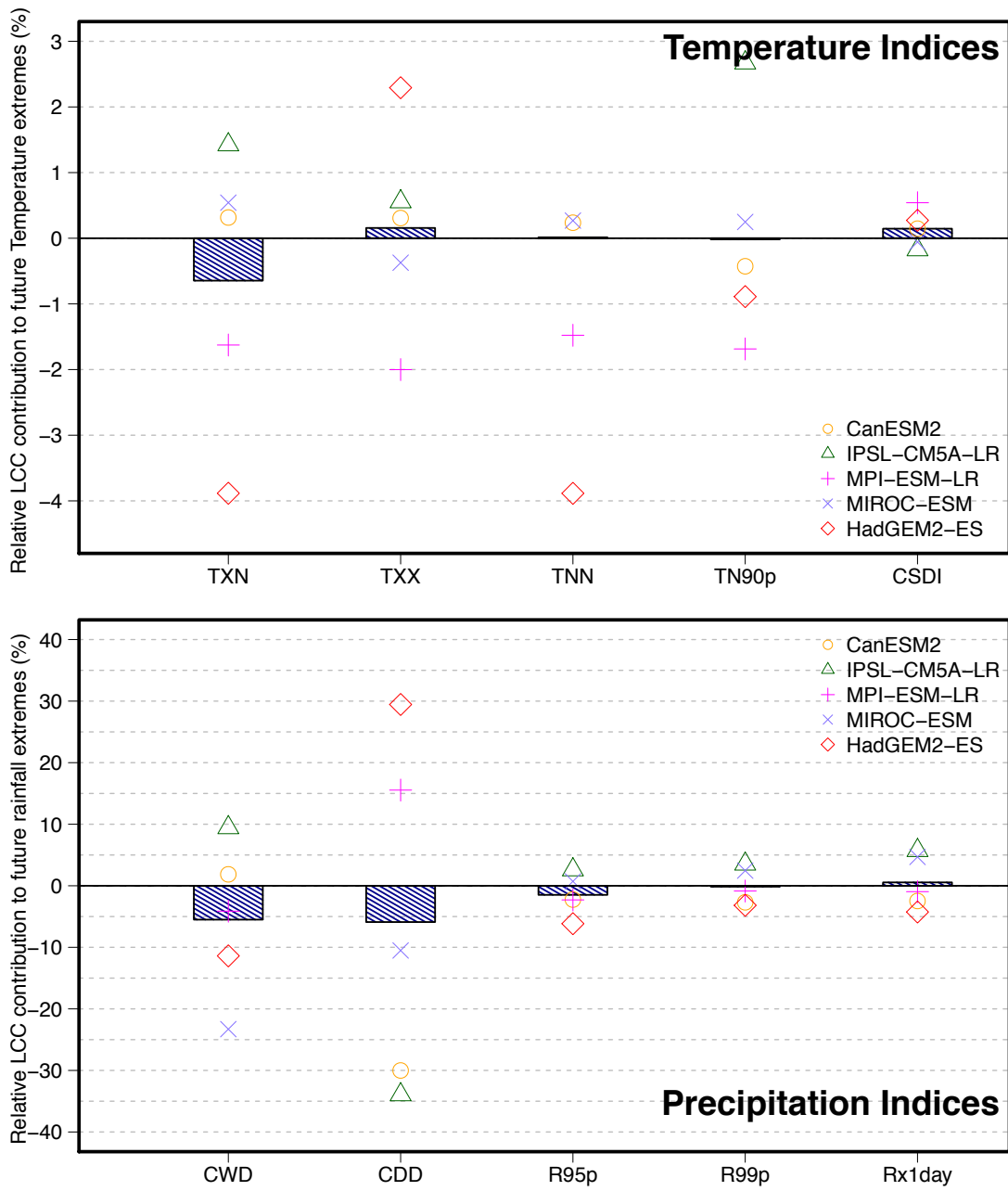
Supplementary Figure S5

(a) Temperature indices

TXX, TN90p, TXN, TNN, CSDI

(b) Precipitation indices

R95p, CDD, R99p, CWD, RX1Day

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Supplementary Figure S6

Temperature Indices

Precipitation Indices

26 IPCC Regions
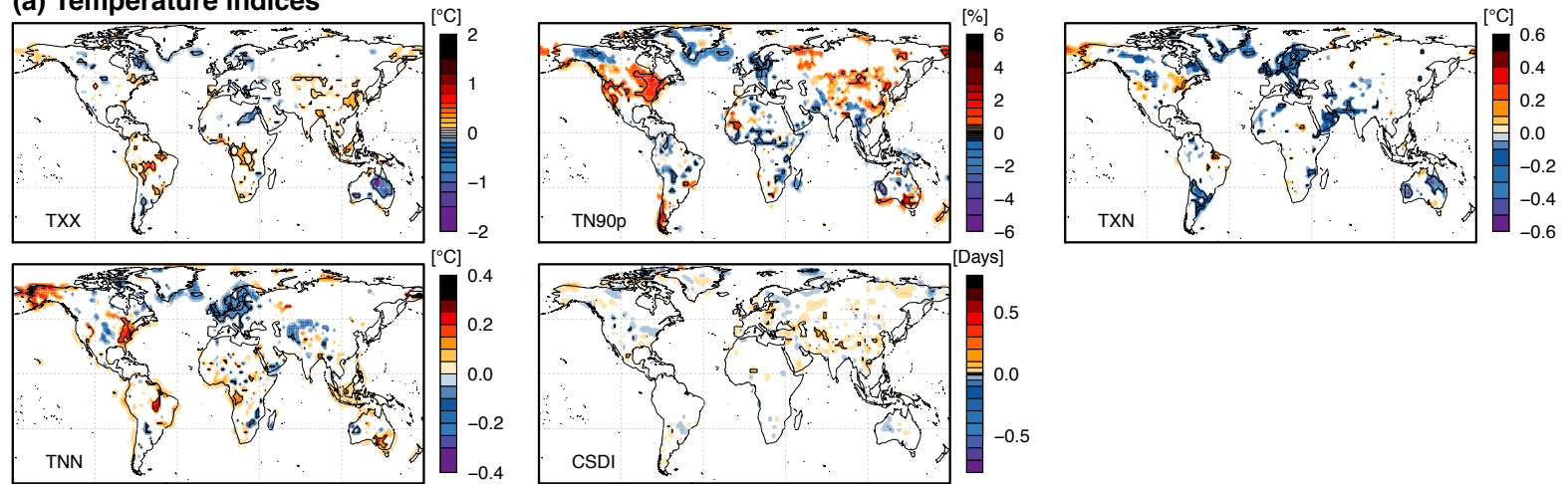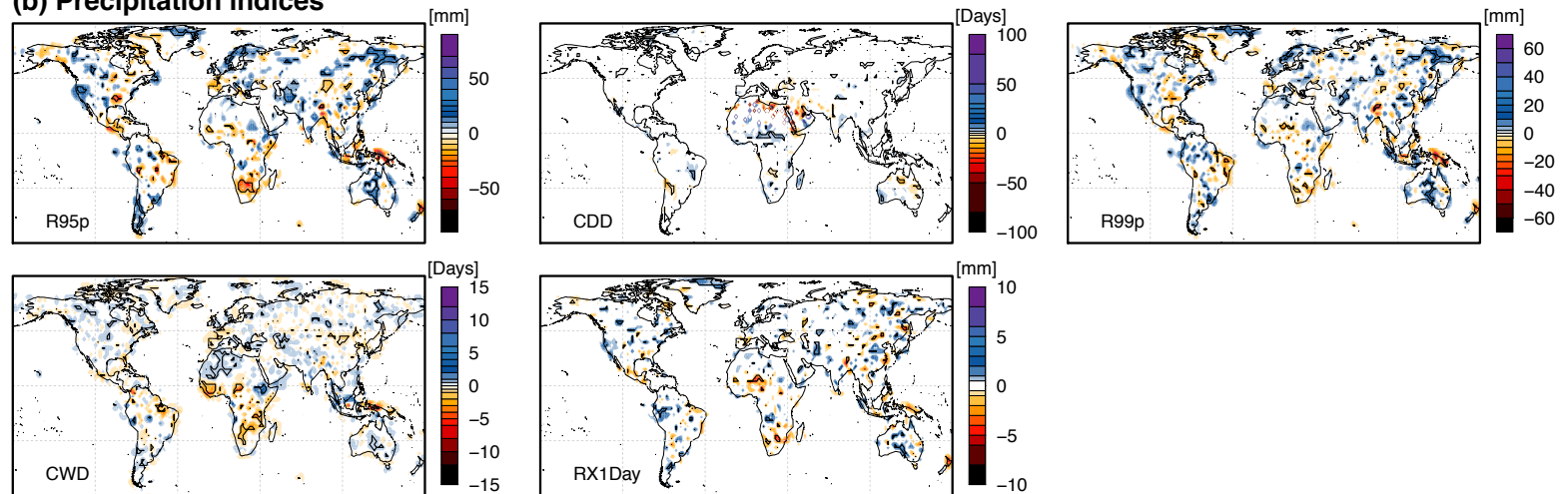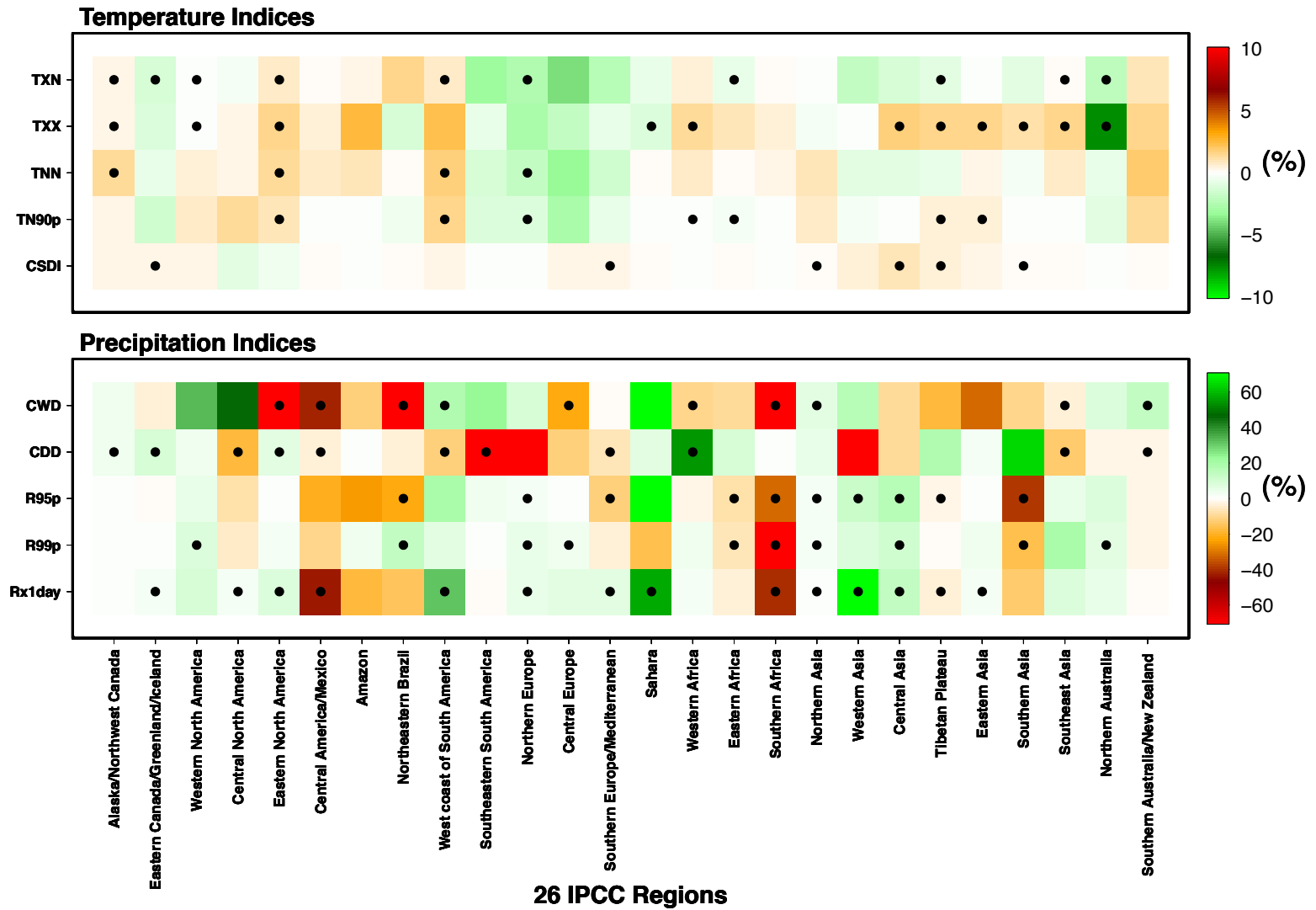
Supplementary Figure S7
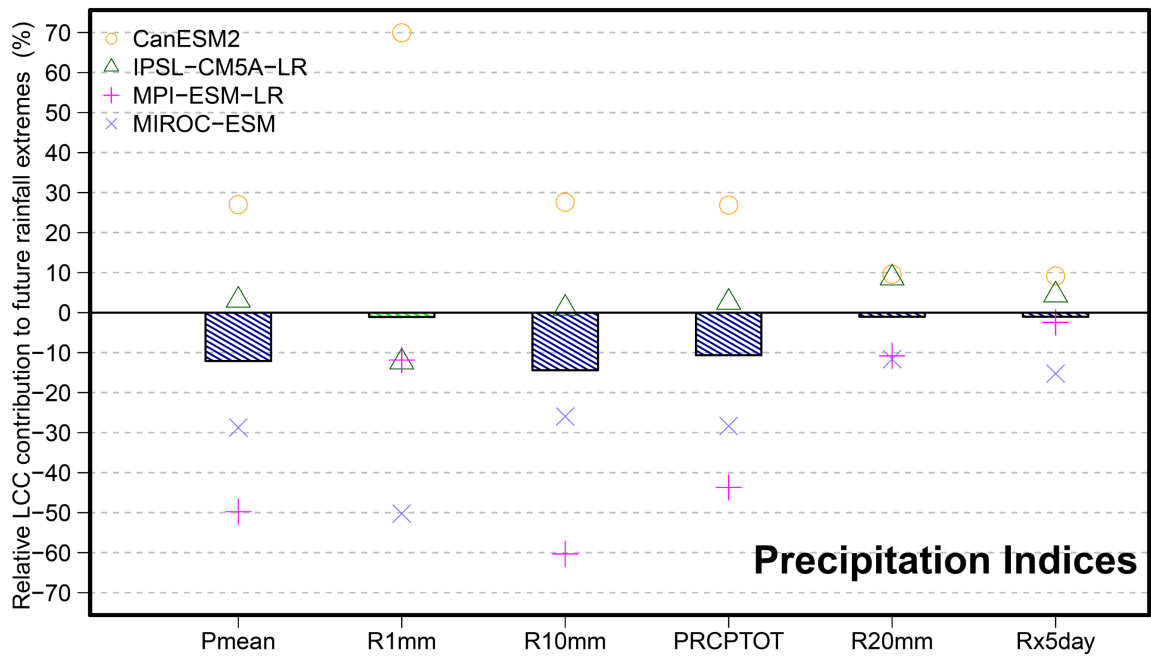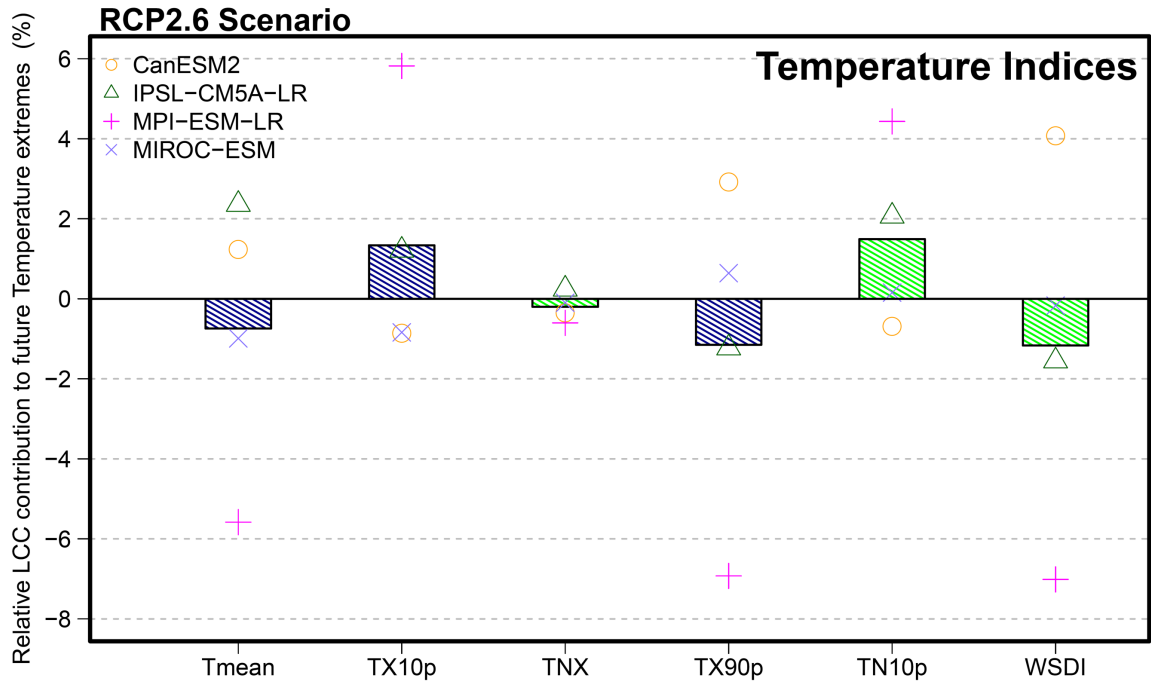
Supplementary Figure S8
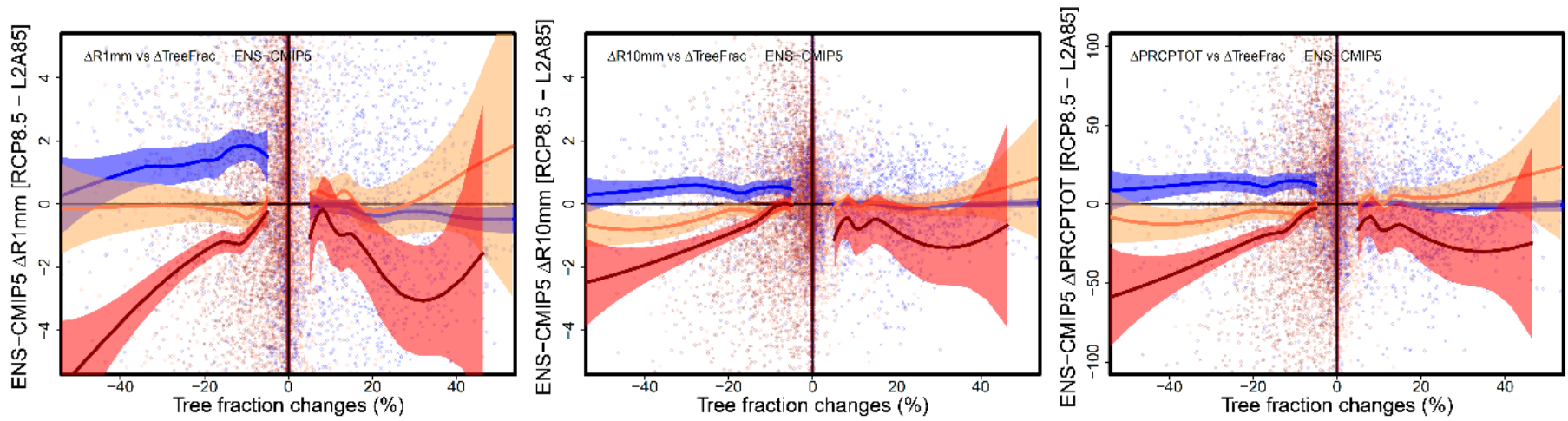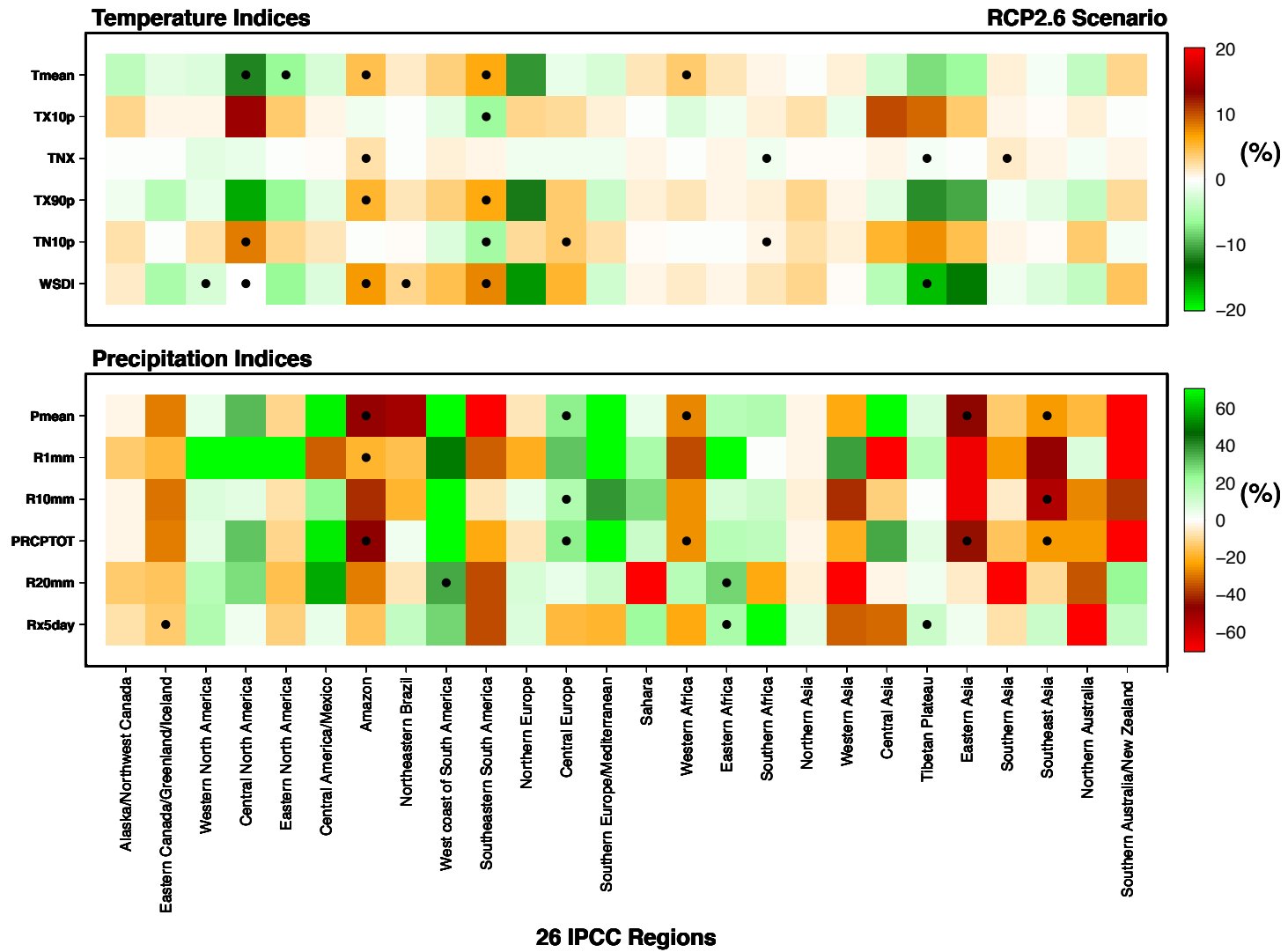
Supplementary Figure S10

(a) Temperature indices   (DJF)
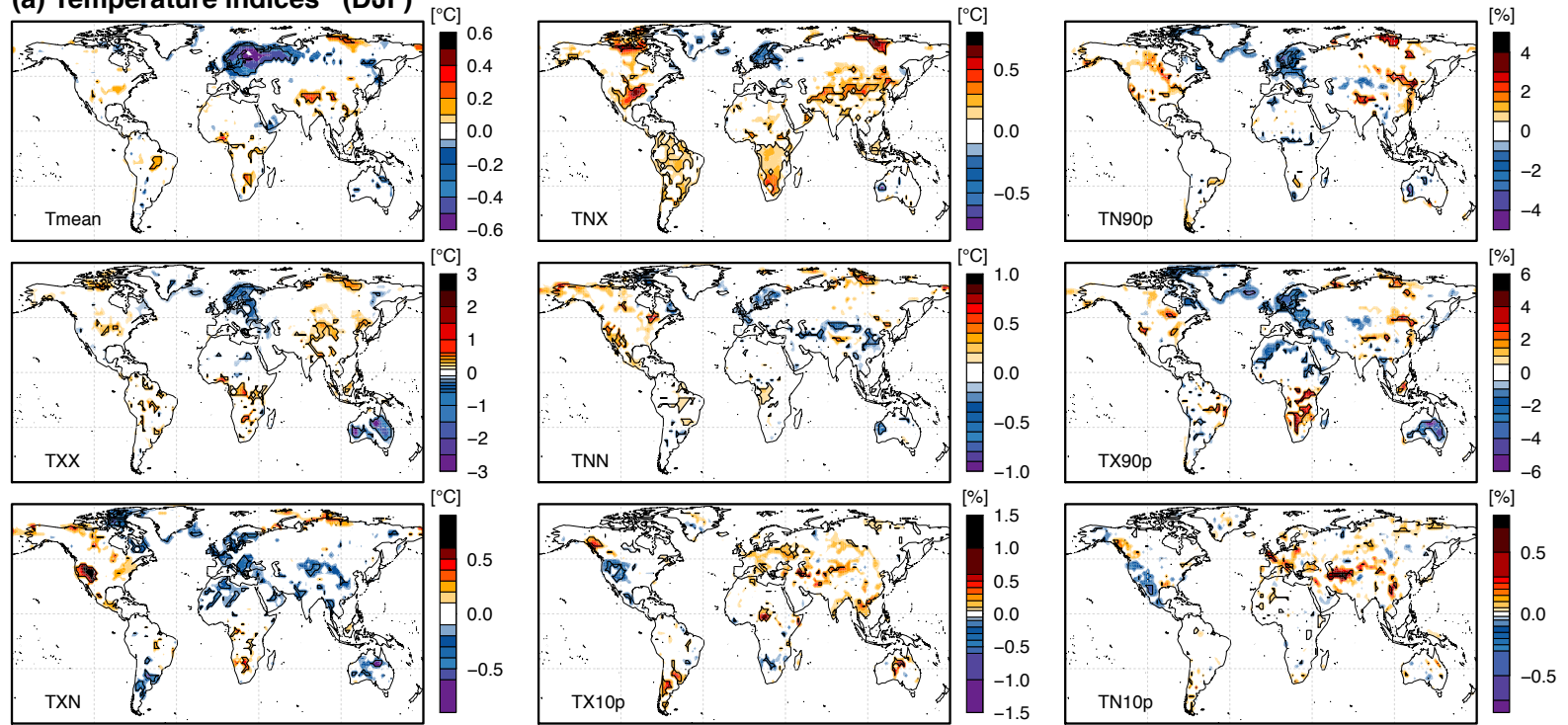
(b) Precipitation indices (DJF)
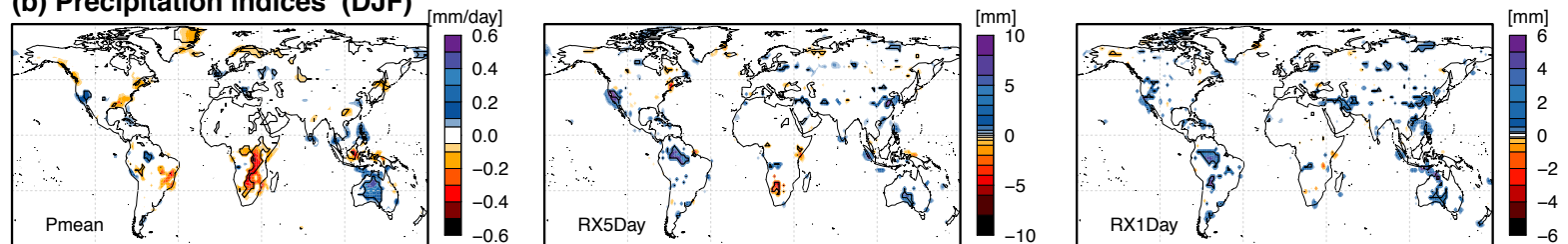
Supplementary Figure S11

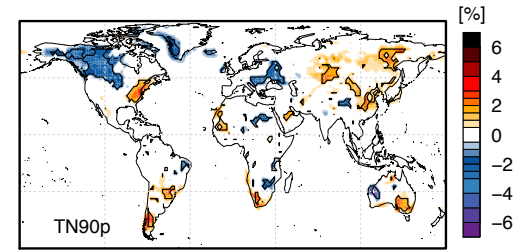
(a) Temperature indices   (JJA)

Tmean, TNX, TN90p, TXX, TNN, TX90p, TXN, TX10p, TN10p
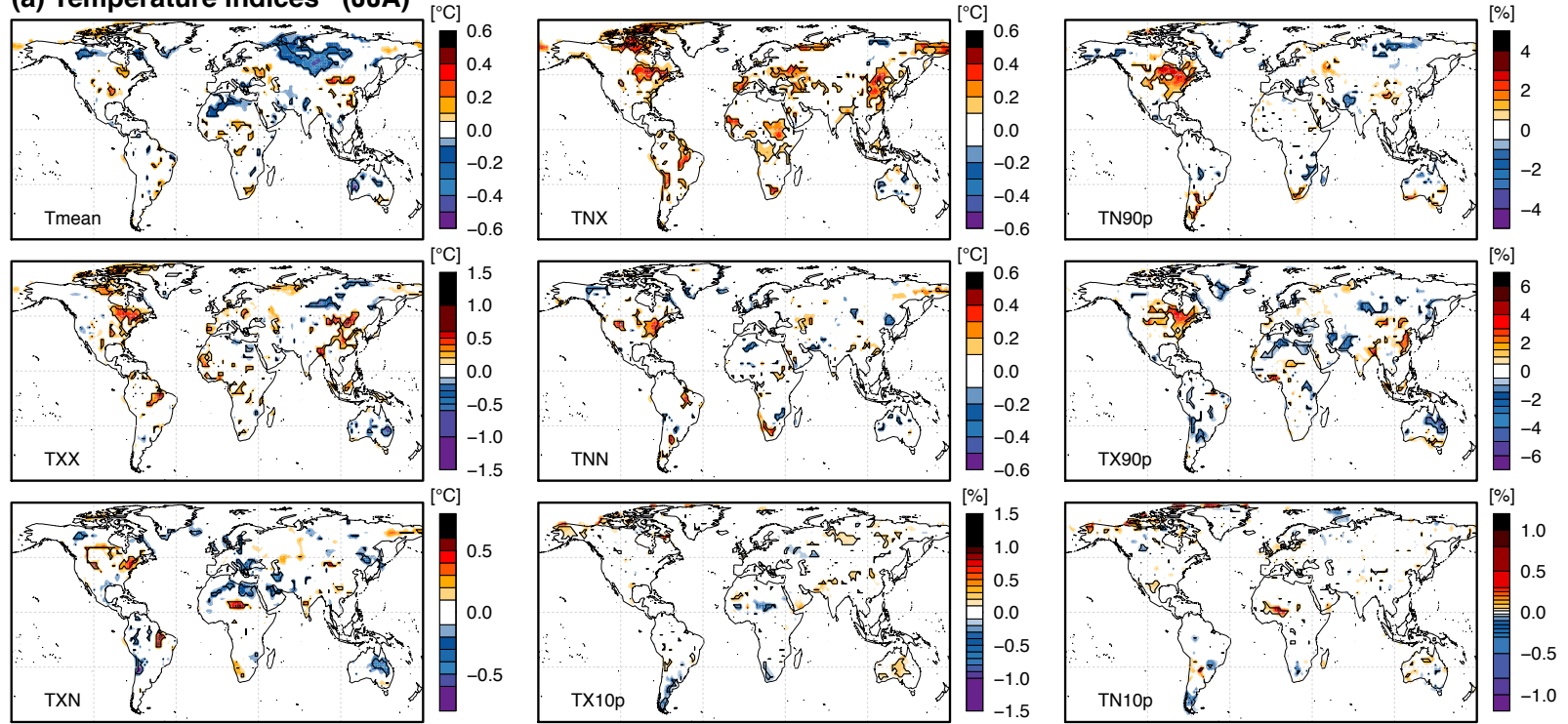
(b) Precipitation indices (JJA)
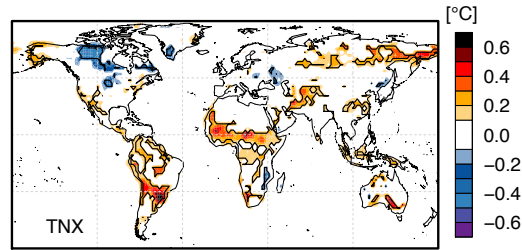
Pmean, RX5Day, RX1Day
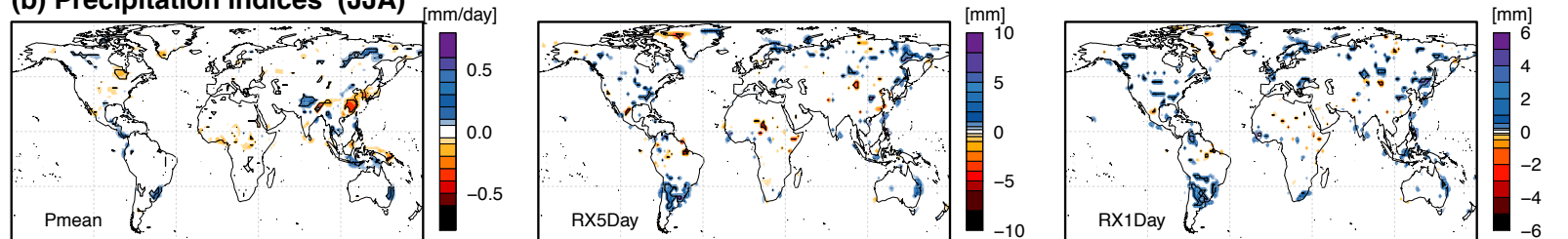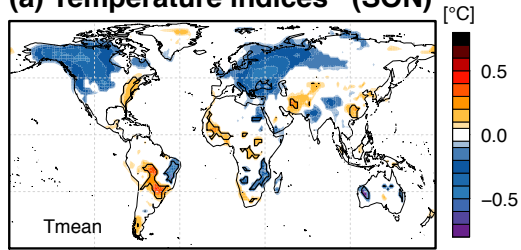
Supplementary Figure S12

(a) Temperature indices   (MAM)
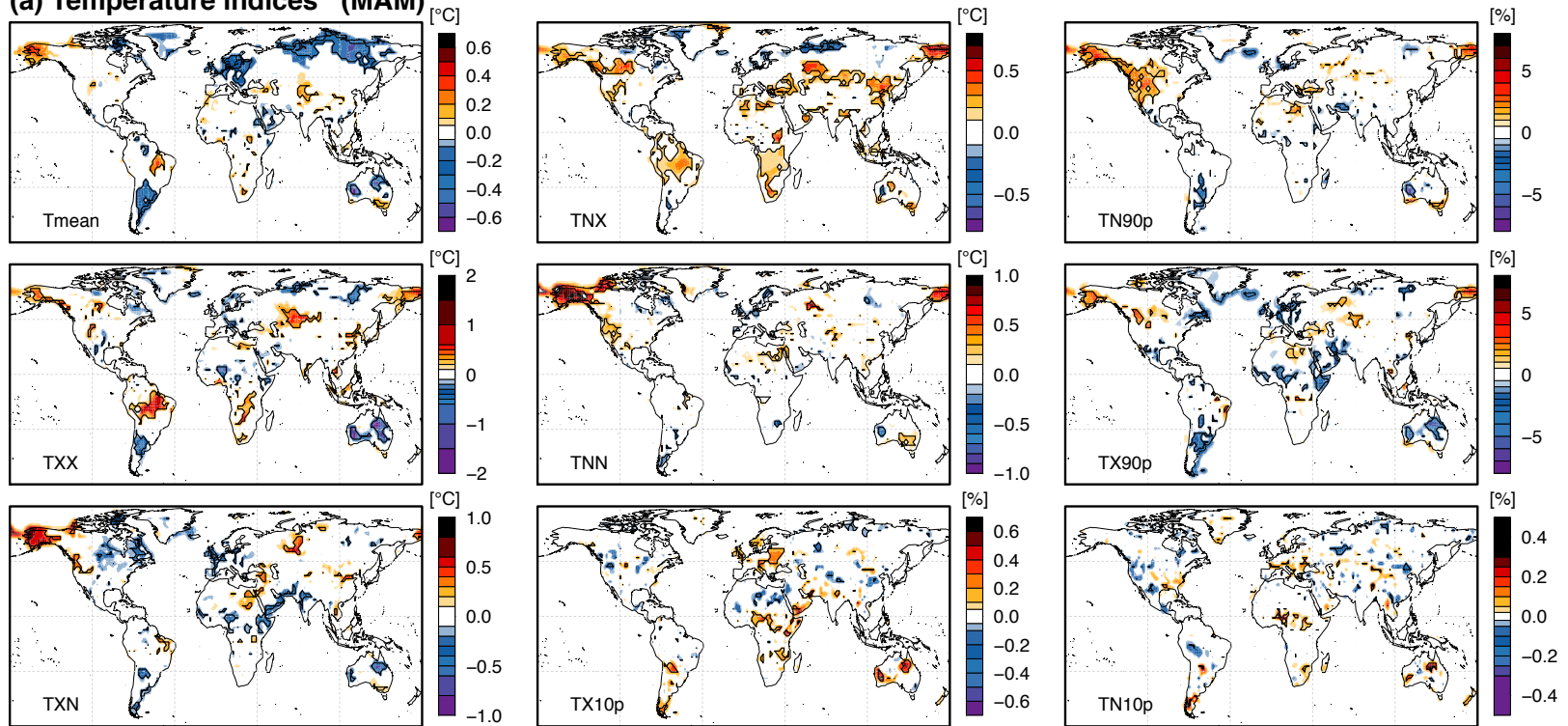
(b) Precipitation indices (MAM)

19
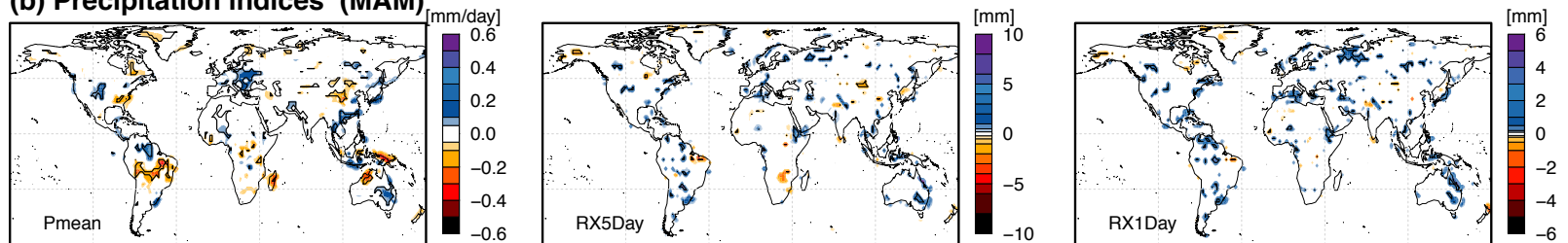
Supplementary Figure S13

(a) Temperature indices (SON)

Tmean, TNX, TN90p, TXX, TNN, TX90p, TXN, TX10p, TN10p
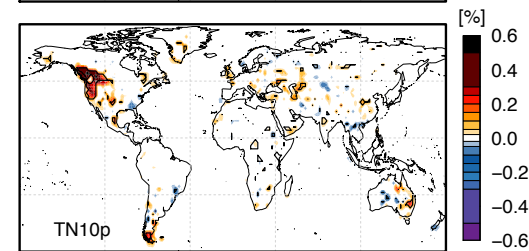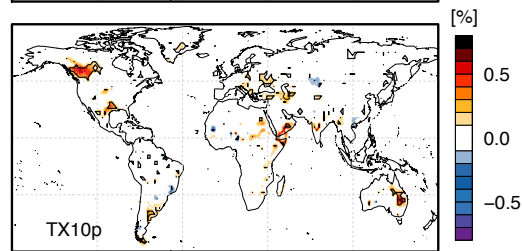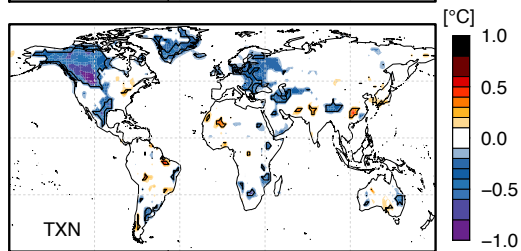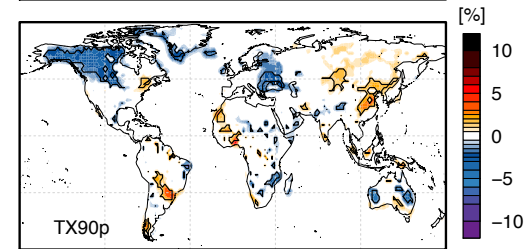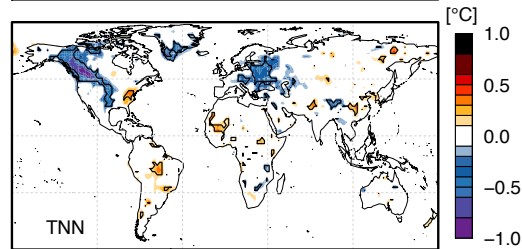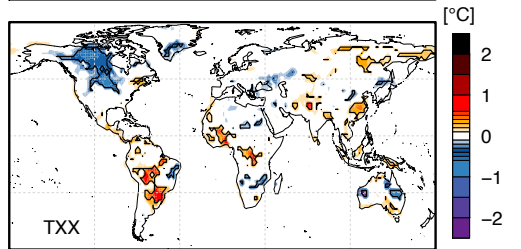
(b) Precipitation indices (SON)

Pmean, RX5Day, RX1Day
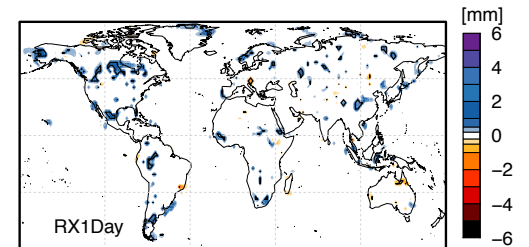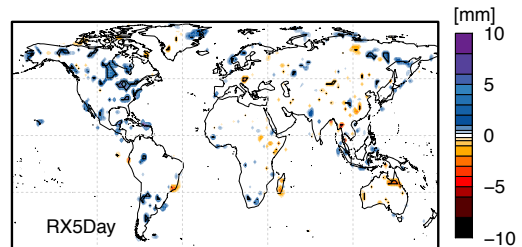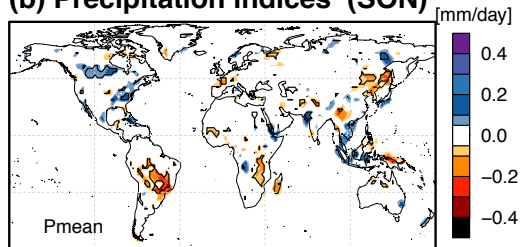
Supplementary References

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