



Supplement of

Projected increases in magnitude and socioeconomic exposure of global droughts in 1.5 and 2 °C warmer climates

Lei Gu et al.

Correspondence to: Jie Chen (jiechen@whu.edu.cn) and Jiabo Yin (jboyn@whu.edu.cn)

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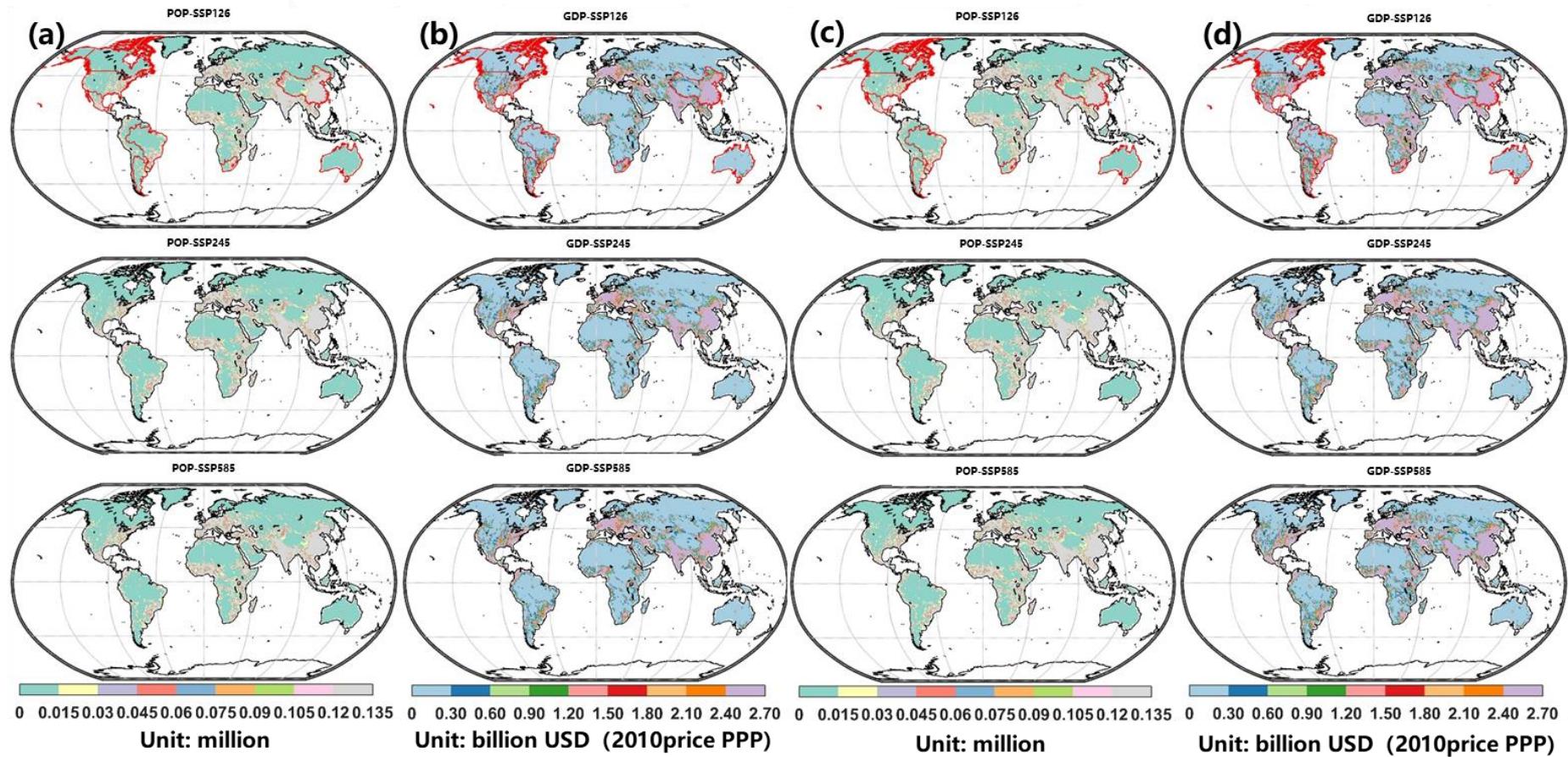


Figure S1 GDP and Population under the 1.5°C and 2.0°C target

Maps of the projected population (a,c) and GDP (b,d) scenarios for the 30-year 1.5°C warming period (a,b) and 2.0°C warming period (c,d) for the SSP126, SSP245, SSP585 scenarios. Red lines in the top panel mark the eight hotspot countries spanning over different socio-climatic regions in Section 3.5.

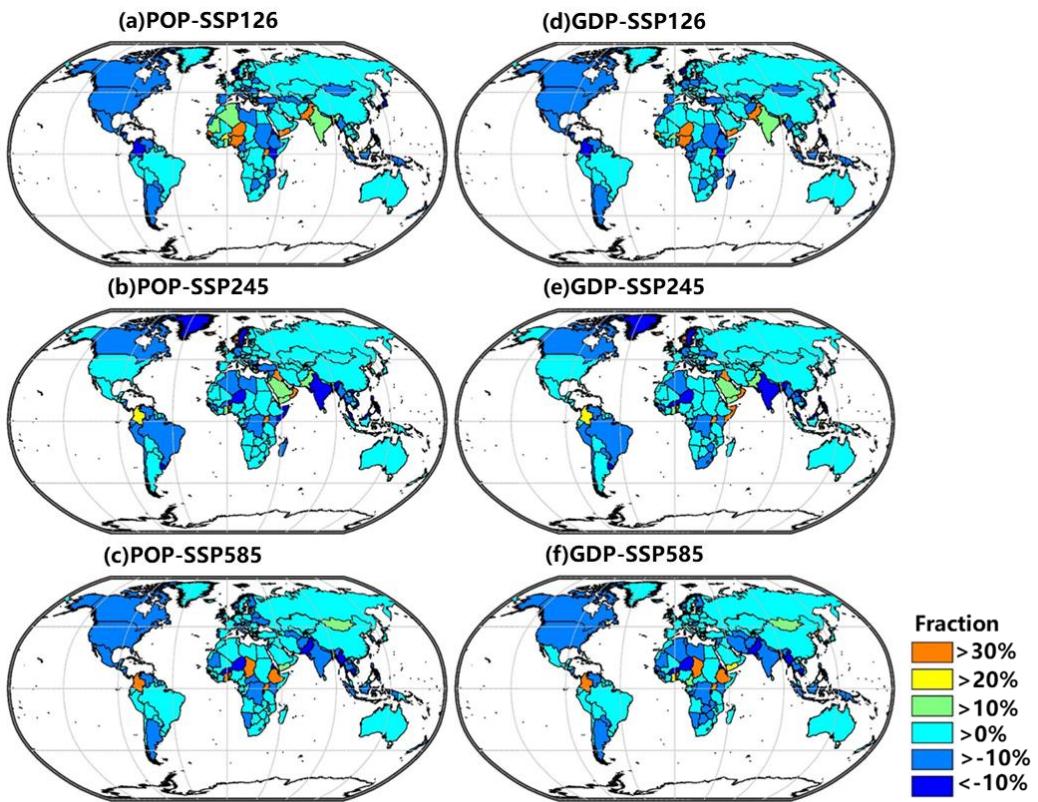


Figure S2 National population and GDP fraction exposing to more frequent severe droughts in 2.0°C relative to 1.5°C warming target.

Maps of relative population (a,c,e) and GDP (b,d,f) fractions that exposed to more frequent severe droughts at the national scale for SSP126, SSP245, SSP585 scenarios. The color-bar in the right side represents six ranks of the population and GDP fractions.

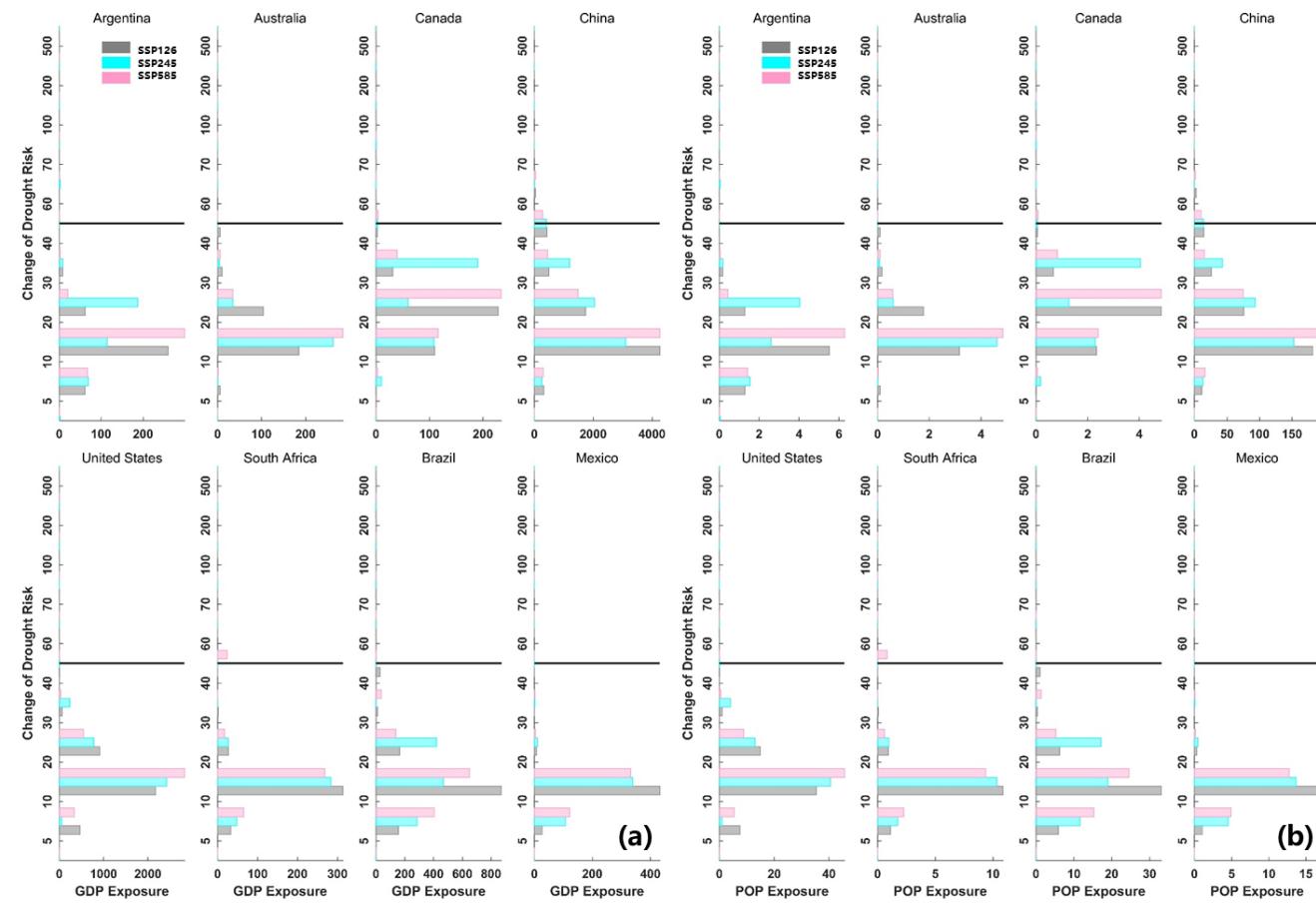


Figure S3 Drought exposures for 8 typical drought-prone countries under the 1.5 °C warming target

Projected GCMs median changes in joint 50-year return periods of droughts (duration and severity) as a function of GDP (a)/ POP (b) fraction for 8 typical countries suffering severe droughts from the historical period to the 1.5°C warming target under SSP126, SSP245, SSP585.

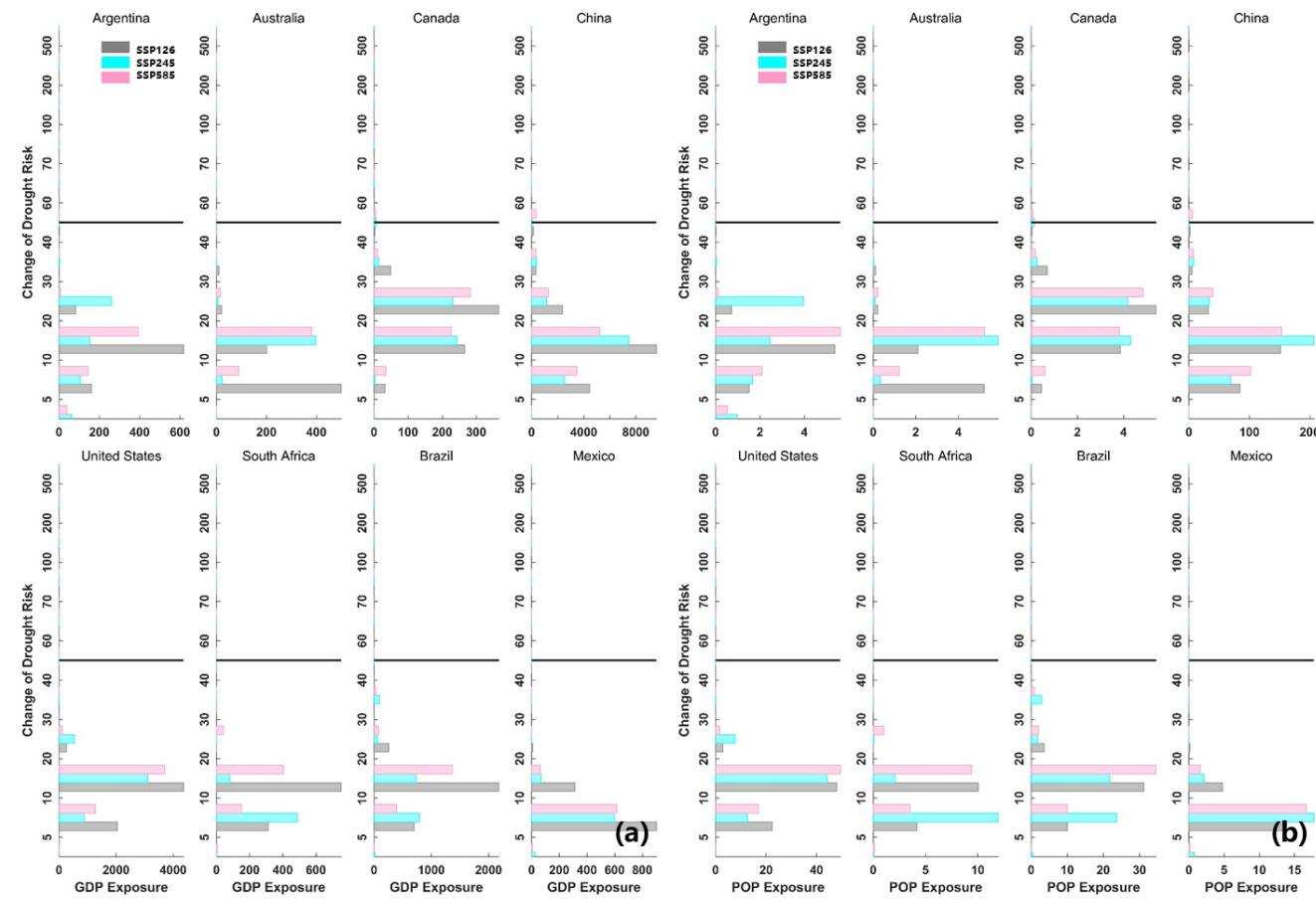


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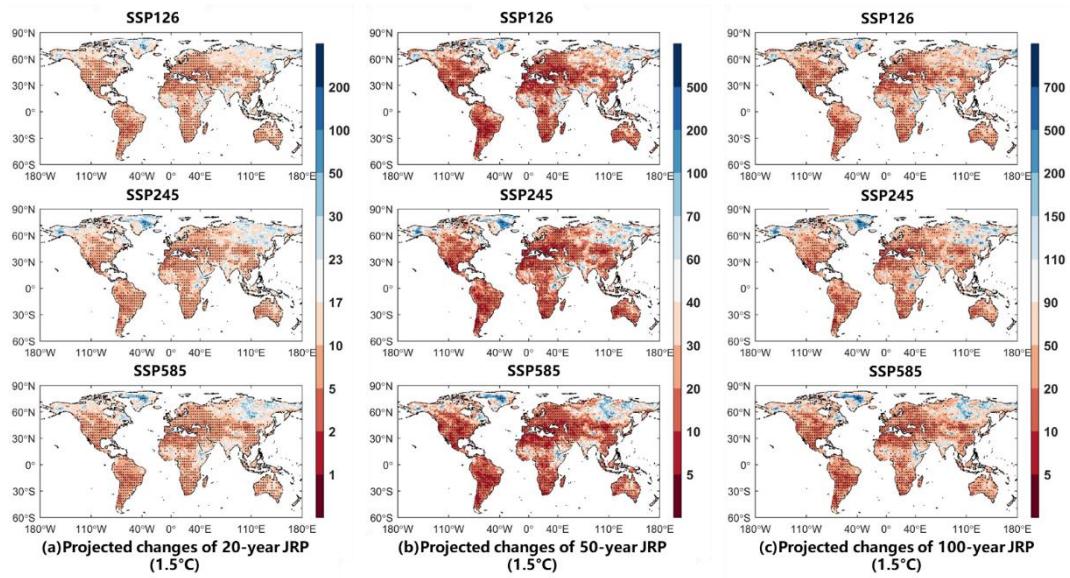


Figure S5 Projected changes of 20-, 50-, and 100-year joint return period of droughts under the 1.5°C warming level.

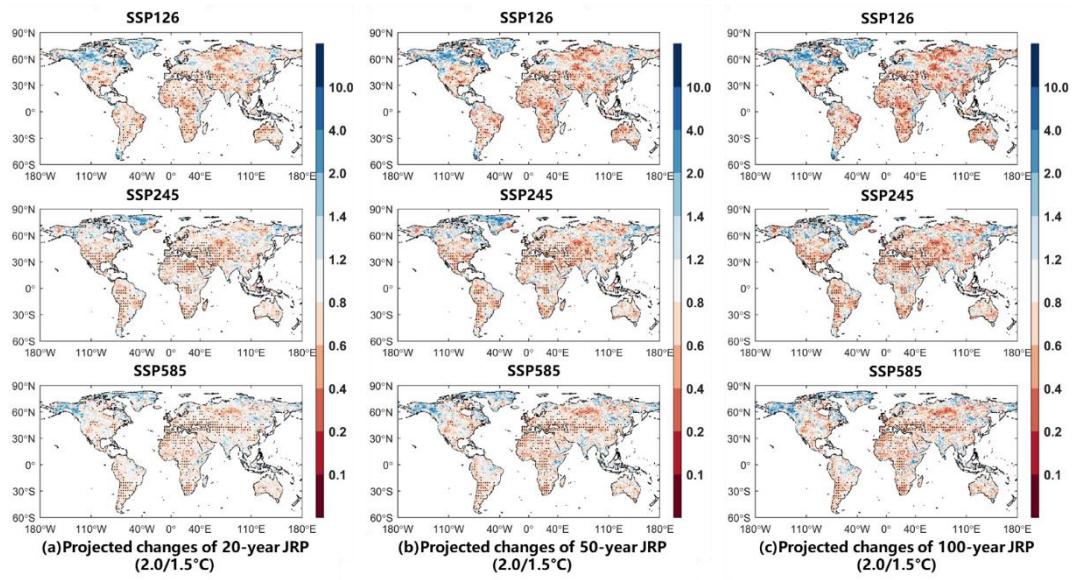


Figure S6 Projected changes of 20-, 50-, and 100-year joint return period of droughts between the 1.5°C and 2.0°C warming level.

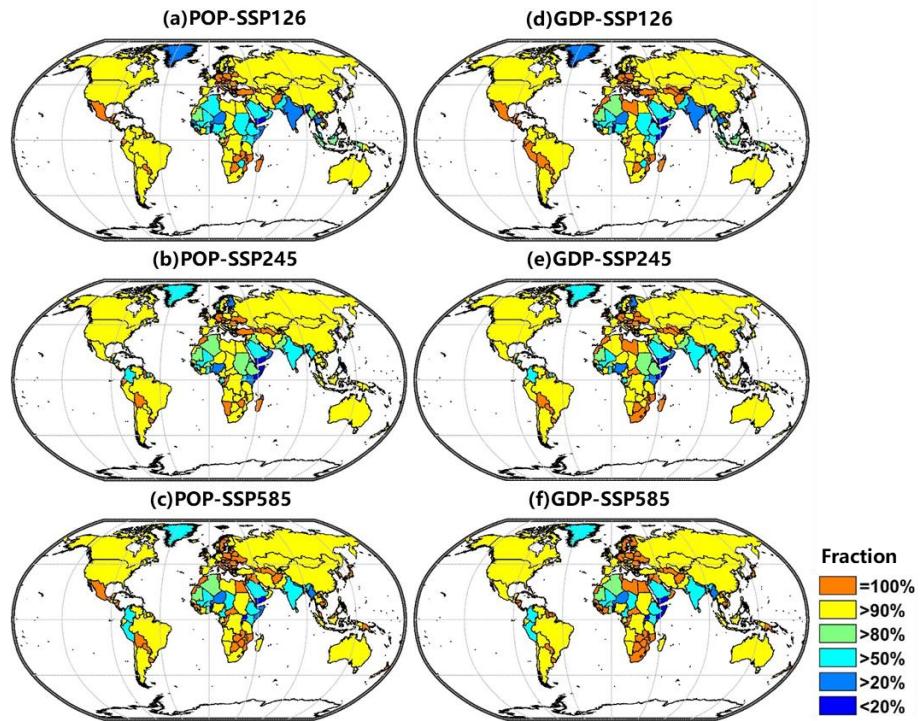


Figure S7 National population and GDP fraction exposing to more frequent severe droughts under the 1.5°C warming level (based on the -0.8 threshold)

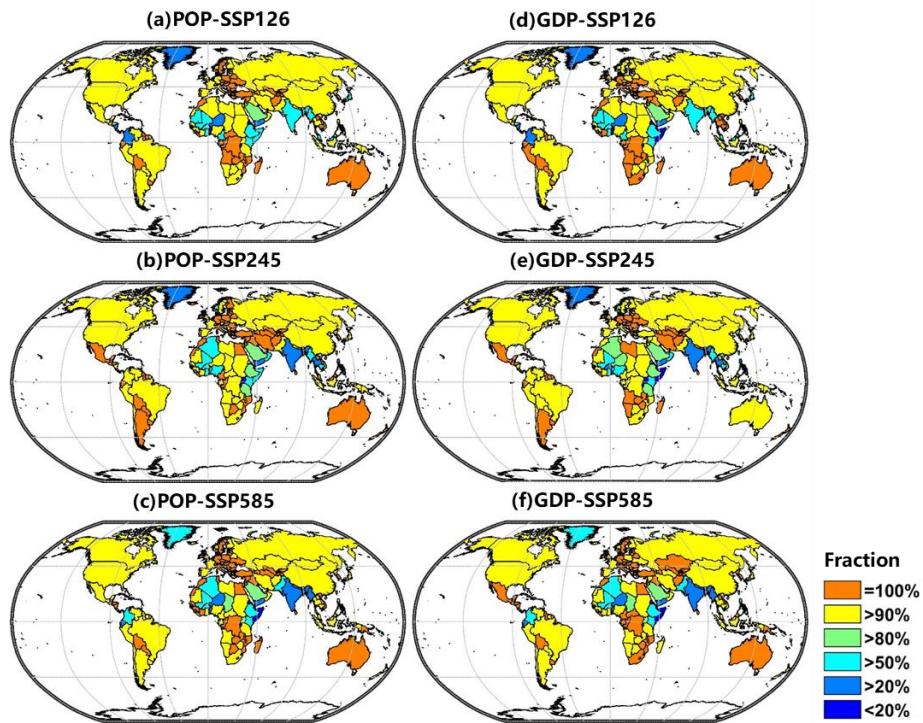


Figure S8 National population and GDP fraction exposing to more frequent severe droughts under the 2.0°C warming level (based on the -0.8 threshold)

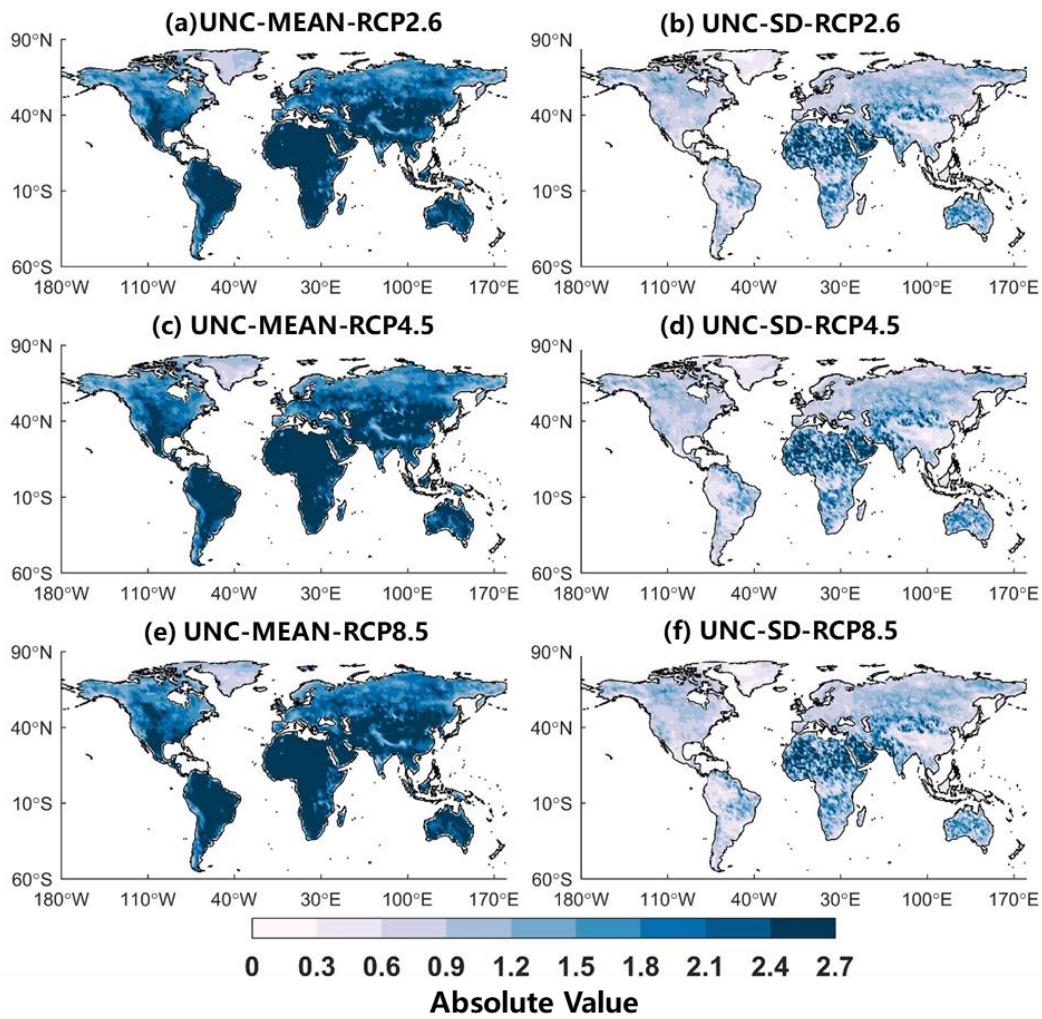


Figure S9 Uncertainty for SPEI-3 changes under the 1.5°C warming target

Maps of the projected uncertainty (measured by 5-95% confidence intervals) in SPEI-3 mean (MEAN) (a,c,e) and standard deviation (SD) (b,d,f) changes under the 1.5°C warming target relative to historical period (1976-2000) for RCP2.6, RCP4.5, RCP8.5 scenarios.

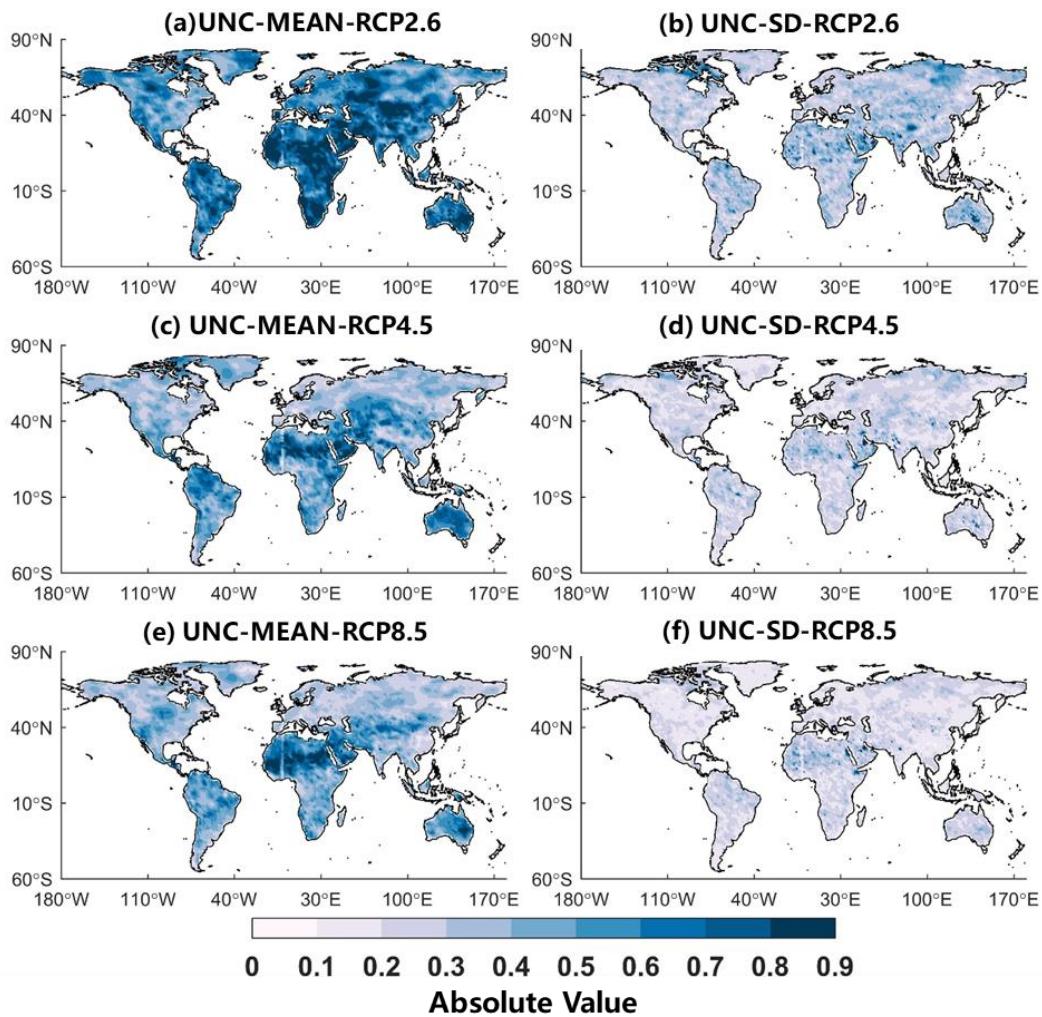


Figure S10 Uncertainty for SPEI-3 changes between the 1.5°C and 2.0°C warming target
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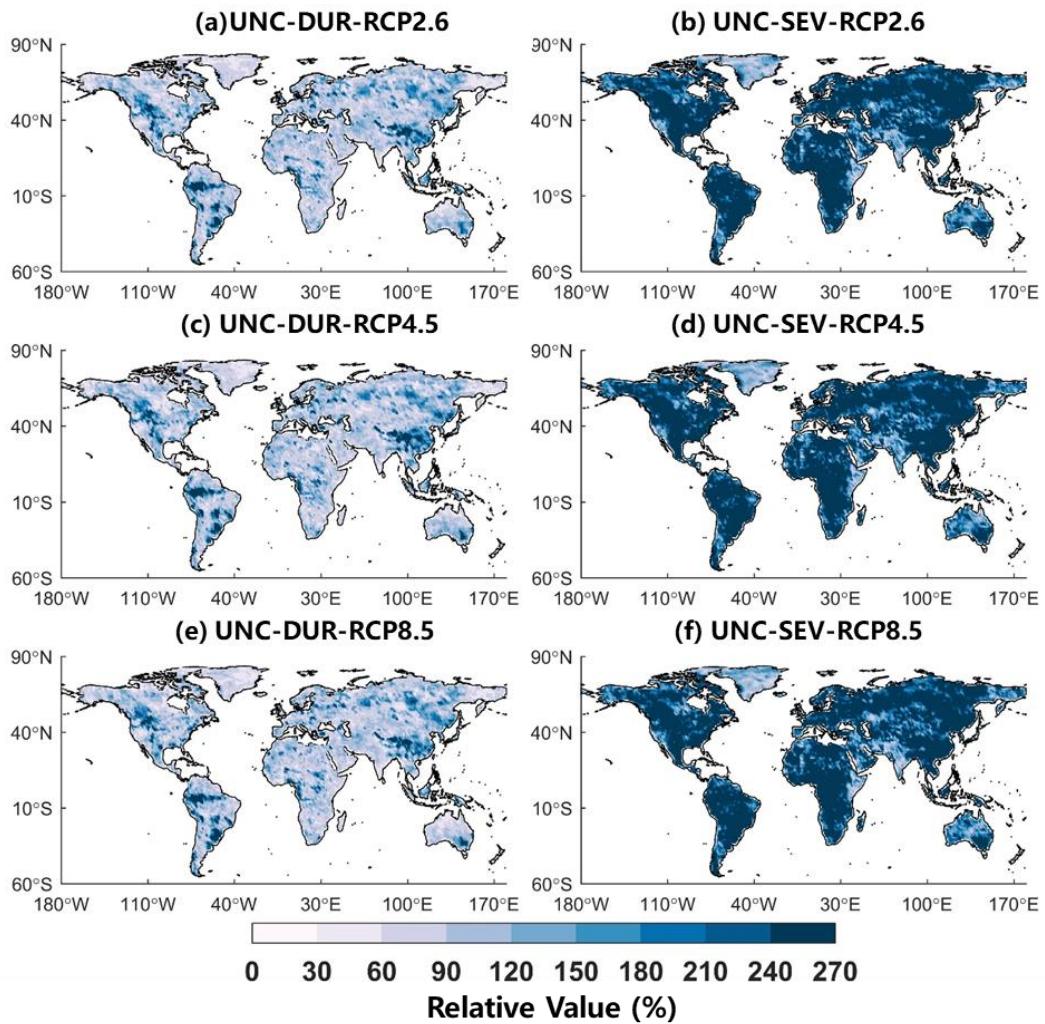


Figure S11 Uncertainty for drought duration and severity changes under the 1.5°C warming target

Maps of the projected uncertainty (measured by 5-95% confidence intervals) in drought duration (DUR) (a,c,e) and severity (SEV) (b,d,f) changes under the 1.5°C warming target relative to historical period (1976-2000) for RCP2.6, RCP4.5, RCP8.5 scenarios.

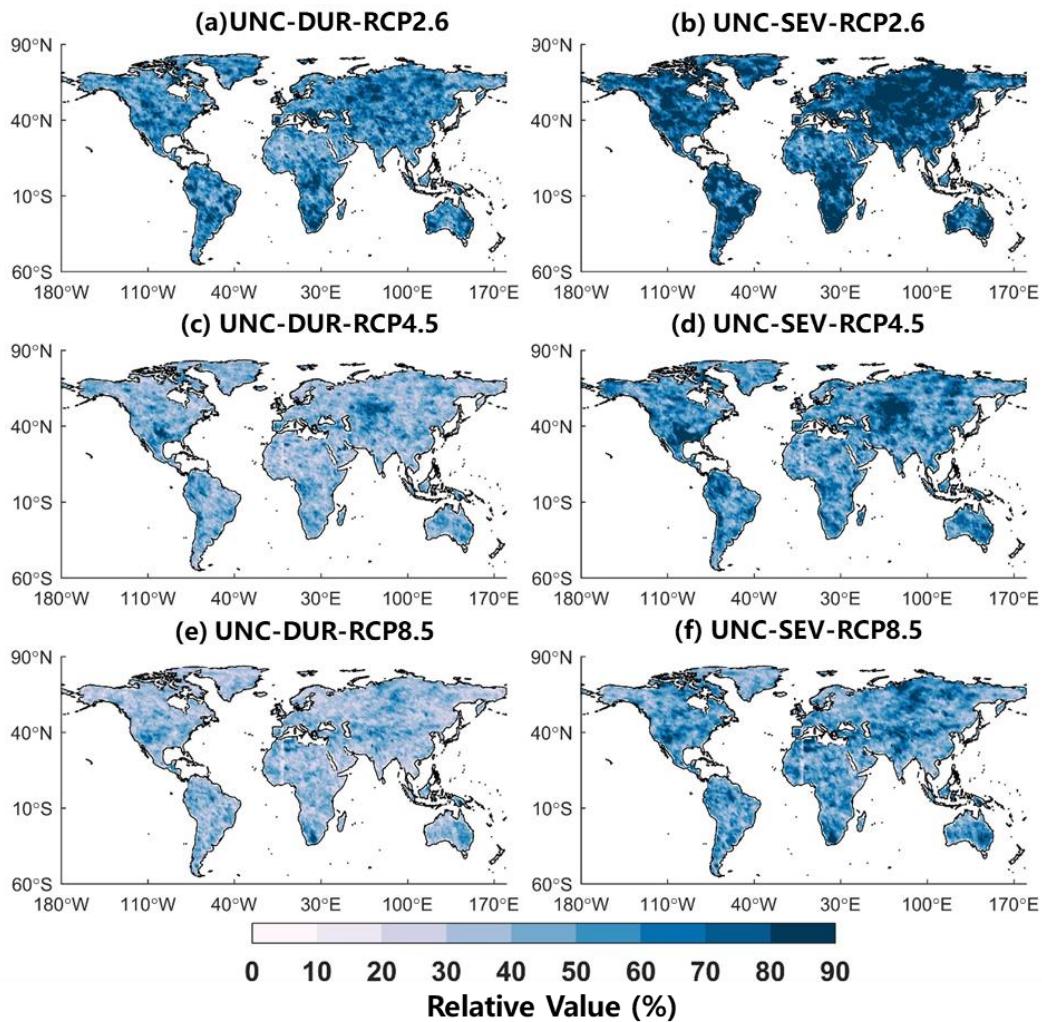


Figure S12 Uncertainty for drought duration and severity changes between the 1.5°C and 2.0°C warming target

Maps of the projected uncertainty (measured by 5-95% confidence intervals) in drought duration (DUR) (a,c,e) and severity (SEV) (b,d,f) changes under the 2.0°C warming target relative to 1.5 warming target for RCP2.6, RCP4.5, RCP8.5 scenarios.

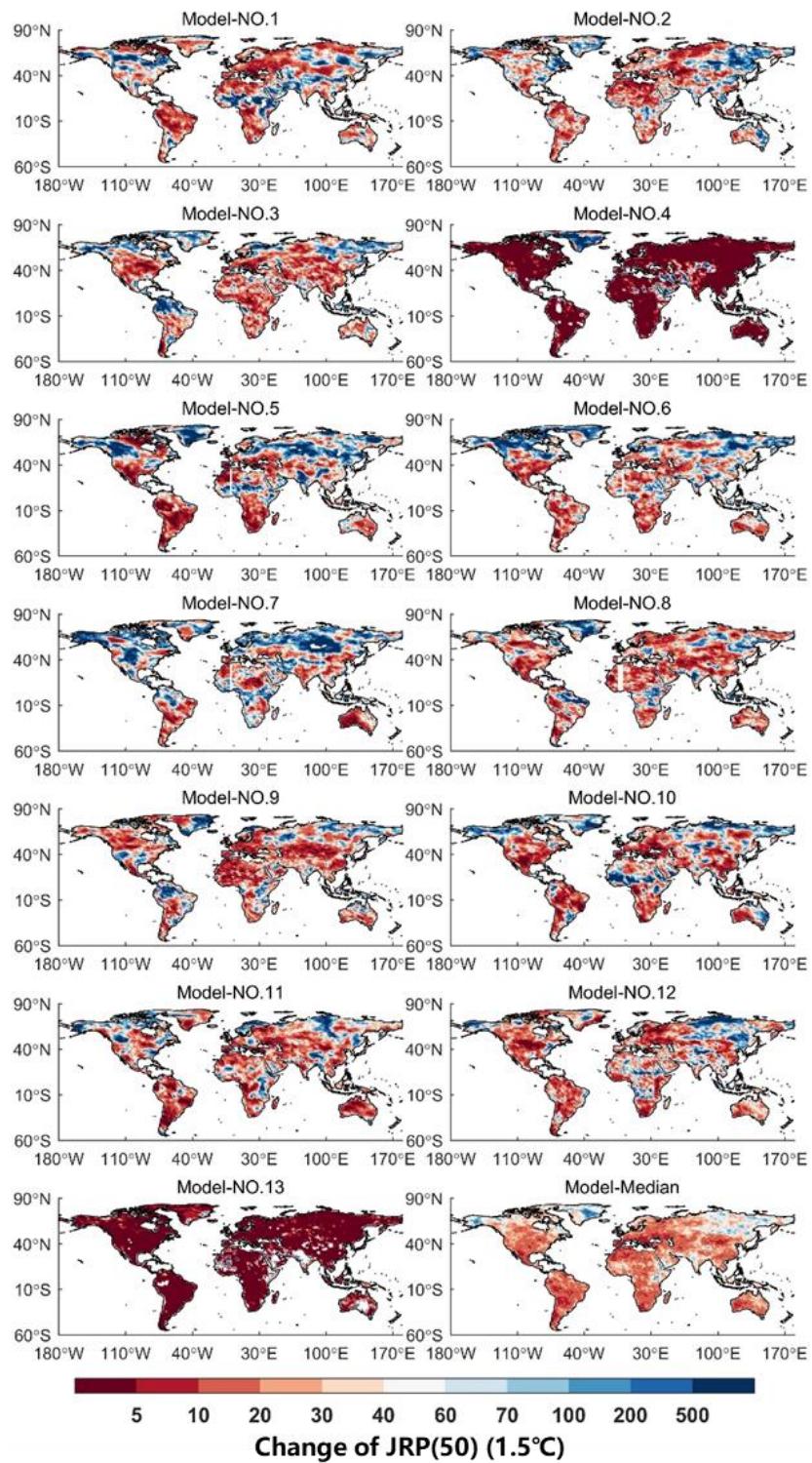


Figure S13 Model uncertainty for changes of 50-year joint return period (JRP) under the 1.5°C warming target

Maps of the single model (Model-NO.1-Model-NO.13) and multi-model ensemble median (Model-Median) changes of the historical (1976-2005) 50-year joint return period under the 1.5°C warming target for RCP4.5 scenario.

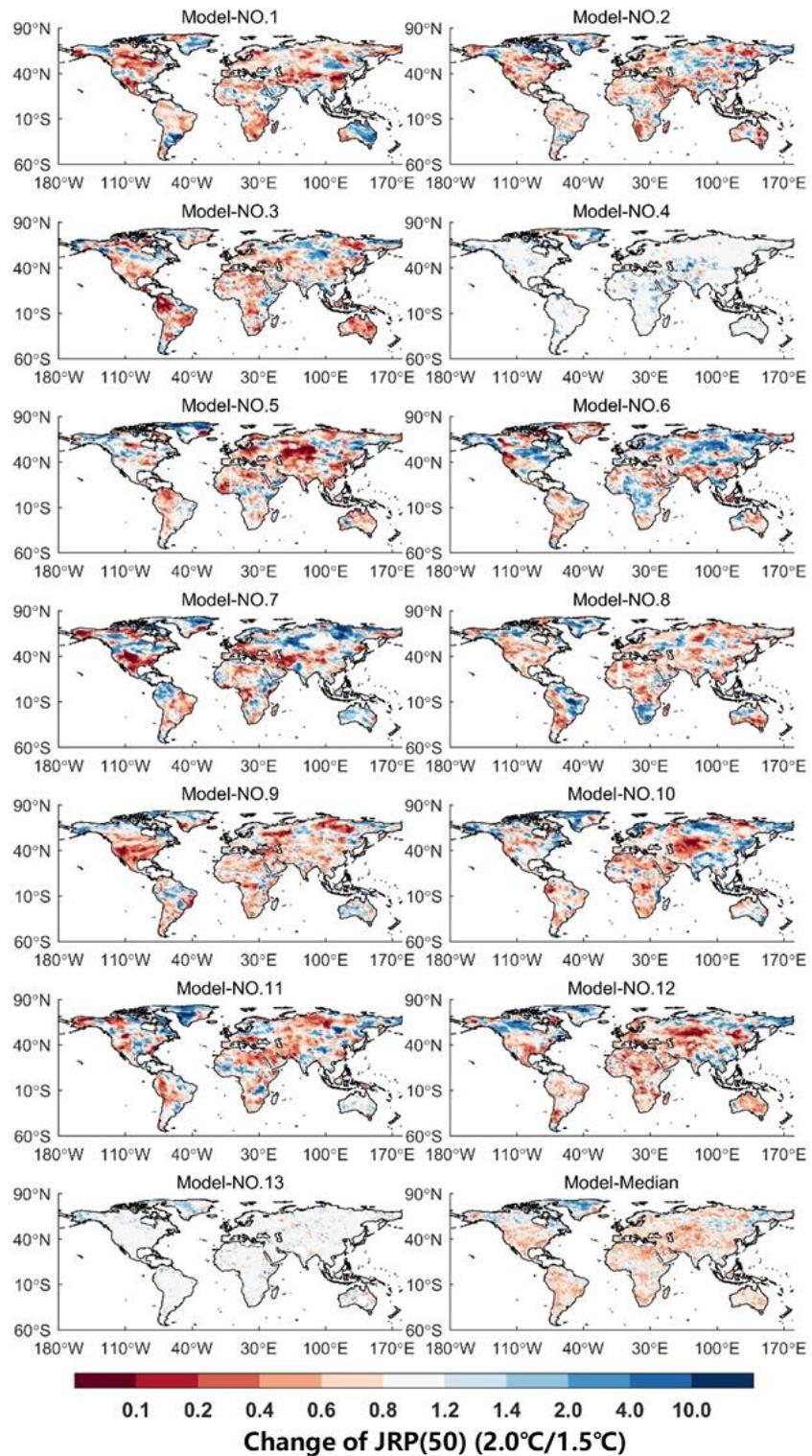


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Maps of the single model (Model-NO.1-Model-NO.13) and multi-model ensemble median (Model-Median) changes of the historical (1976-2005) 50-year joint return period under the 2.0°C warming target relative to 1.5°C warming target for RCP4.5 scenario.

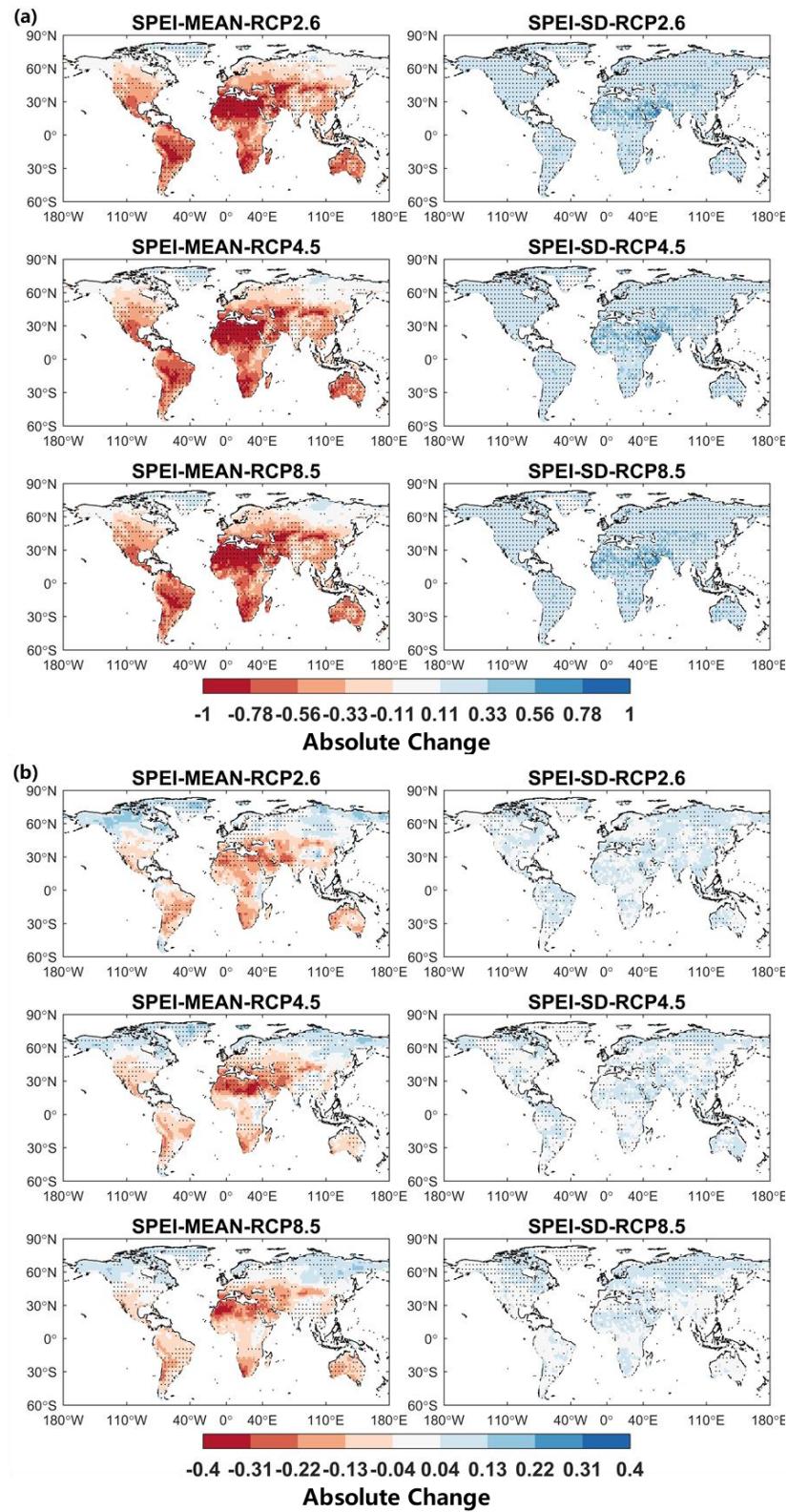


Figure S15 Projected changes in the mean and standard deviation of SPEI under the 1.5°C (a) and between the 1.5°C and 2.0°C (b) warming target at 2° spatial resolution

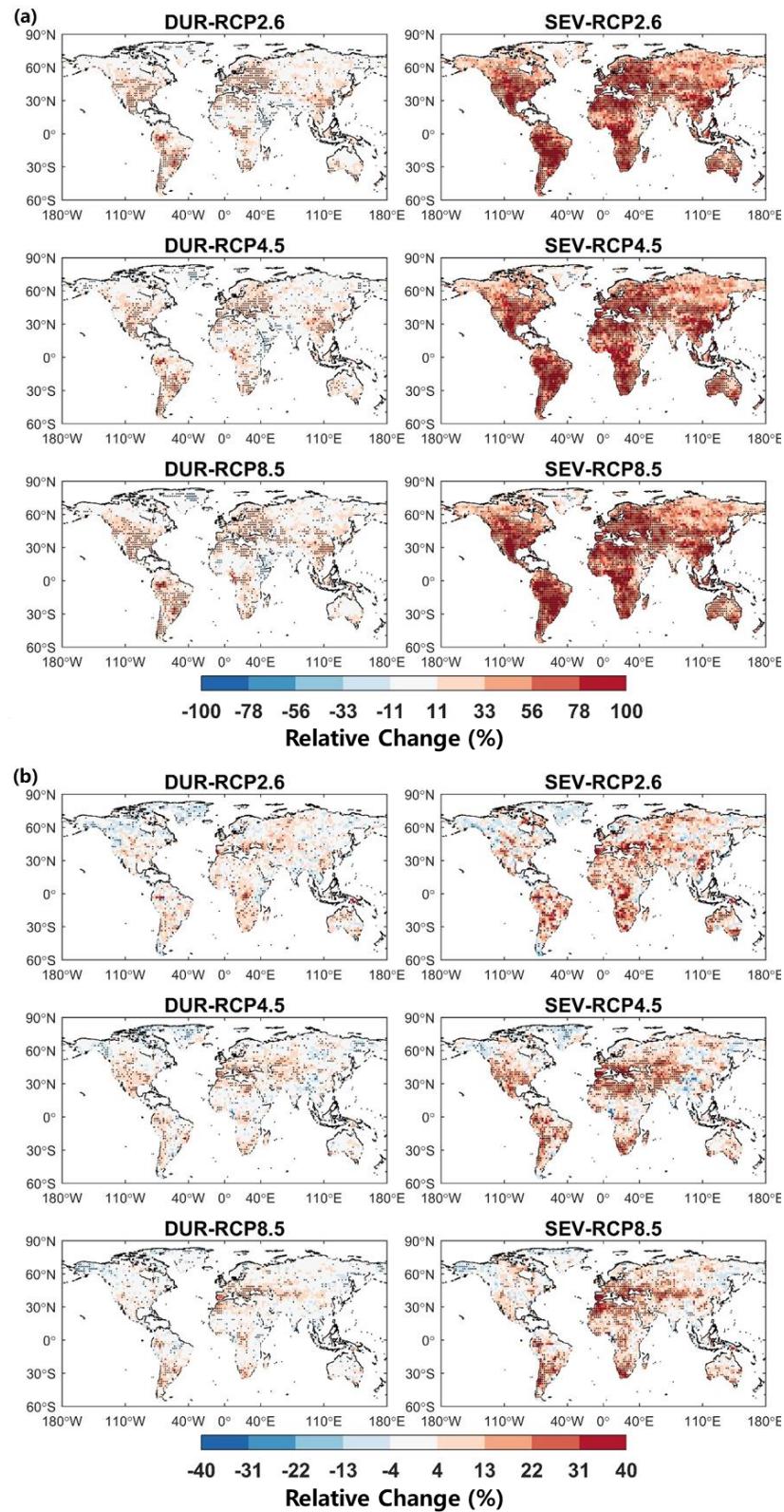


Figure S16 Projected changes in drought duration and severity under the 1.5°C (a) and between the 1.5°C and 2.0°C (b) warming target at 2° spatial resolution

Table S1 Summary statistic table for changes in major variables

Variable	Summary statistic		
		1.5°C	2-1.5(°C)⁽¹⁾
SPEI₃(Mean)	Percentage of continental areas for decreasing mean SPEI ₃	85%	58%
SPEI₃(SD)	Percentage of continental areas for increasing standard deviation of SPEI ₃	100%	95%
Drought duration	Percentage of continental areas for increasing mean drought duration	78%	65%
Drought severity	Percentage of continental areas for increasing mean drought severity	99%	84%
50-year JRP	Percentage of continental areas for increasing occurrence of 50-year drought events	88%	71%
GDP exposure	The number of countries exhibit a 100% fraction in GDP exposed to increasing drought risks	73	17
Population exposure	The number of countries exhibit a 100% fraction in population exposed to increasing drought risks	75	17

Notes:

(1) 2-1.5(°C) means differences in effects between the 1.5°C and 2.0°C warming levels.

Table S2 Several countries suffering decreasing population and GDP exposure

Land fraction exposing to more frequent droughts									
Country	1.5°C			2°C			2-1.5°C		
	SSP126	SSP245	SSP585	SSP126	SSP245	SSP585	SSP126	SSP245	SSP585
Canada	68.35%	68.82%	71.56%	55.58%	63.36%	66.92%	-12.77%	-5.46%	-4.63%
United States	86.17%	78.93%	86.89%	85.44%	80.02%	79.84%	-0.72%	1.08%	-7.05%
Colombia	85.71%	84.62%	79.12%	75.82%	93.41%	85.71%	-9.89%	8.79%	6.59%
Japan	62.16%	56.76%	62.16%	59.46%	62.16%	62.16%	-2.70%	5.41%	0.00%
Population (million)									
Country	1.5°C			2°C			2-1.5°C		
	SSP126	SSP245	SSP585	SSP126	SSP245	SSP585	SSP126	SSP245	SSP585
Canada	7.97	7.91	8.27	10.50	8.95	9.57	2.53	1.04	1.30
United States	59.13	58.82	60.75	73.56	64.86	68.20	14.43	6.05	7.45
Colombia	9.41	9.67	9.33	10.20	10.84	9.88	0.79	1.17	0.56
Japan	17.82	17.63	18.12	15.48	16.53	17.95	-2.34	-1.11	-0.17
GDP (billion USD, 2010 price PPP)									
Country	1.5°C			2°C			2-1.5°C		
	SSP126	SSP245	SSP585	SSP126	SSP245	SSP585	SSP126	SSP245	SSP585
Canada	373.60	373.74	398.99	719.26	499.22	563.41	345.67	125.48	164.41
United States	3639.14	3517.35	3759.94	6699.26	4554.66	5118.33	3060.12	1037.32	1358.38
Colombia	192.32	184.47	191.51	617.84	296.93	311.37	425.52	112.46	119.86
Japan	575.07	553.76	590.57	873.40	620.73	730.21	298.33	66.97	139.63
Population Exposure Fraction									
Country	1.5°C			2°C			2-1.5°C		
	SSP126	SSP245	SSP585	SSP126	SSP245	SSP585	SSP126	SSP245	SSP585
Canada	99.25%	98.88%	98.77%	99.14%	98.32%	98.70%	-0.11%	-0.56%	-0.07%
United States	99.84%	99.60%	99.85%	99.82%	99.85%	99.84%	-0.02%	0.26%	-0.01%
Colombia	84.83%	77.64%	46.20%	57.22%	98.90%	80.06%	-27.61%	21.26%	33.87%
Japan	99.72%	97.95%	99.78%	72.89%	98.65%	99.78%	-26.82%	0.70%	0.00%
GDP Exposure Fraction									
Country	1.5°C			2°C			2-1.5°C		
	SSP126	SSP245	SSP585	SSP126	SSP245	SSP585	SSP126	SSP245	SSP585
Canada	99.26%	98.89%	98.79%	99.15%	98.34%	98.72%	-0.11%	-0.55%	-0.07%
United States	99.84%	99.59%	99.85%	99.82%	99.85%	99.84%	-0.02%	0.26%	-0.01%
Colombia	84.85%	77.67%	46.27%	57.27%	98.90%	80.09%	-27.58%	21.23%	33.82%
Japan	99.72%	97.95%	99.78%	72.89%	98.65%	99.78%	-26.82%	0.70%	0.00%