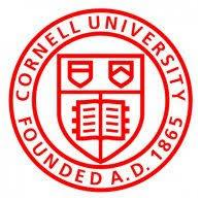
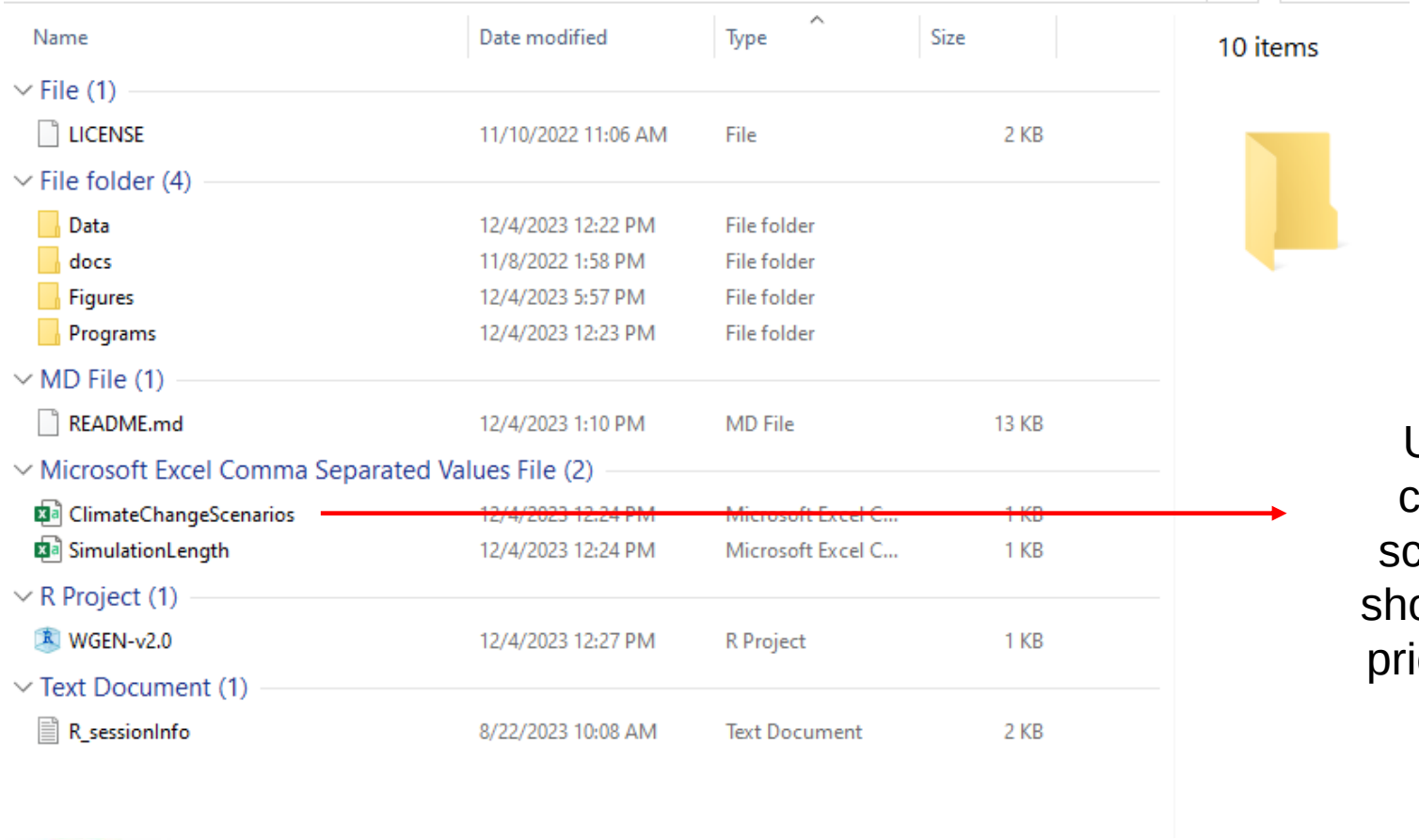
A stochastic weather generator for process-informed climate risk assessments of water resource systems in California

Climate Scenario Development



SPECIFYING CLIMATE SCENARIOS

Edit ./ClimateChangeScenarios.csv



User inputs for climate change scenarios. These should be adjusted prior to model run.

Edit ./ClimateChangeScenarios.csv

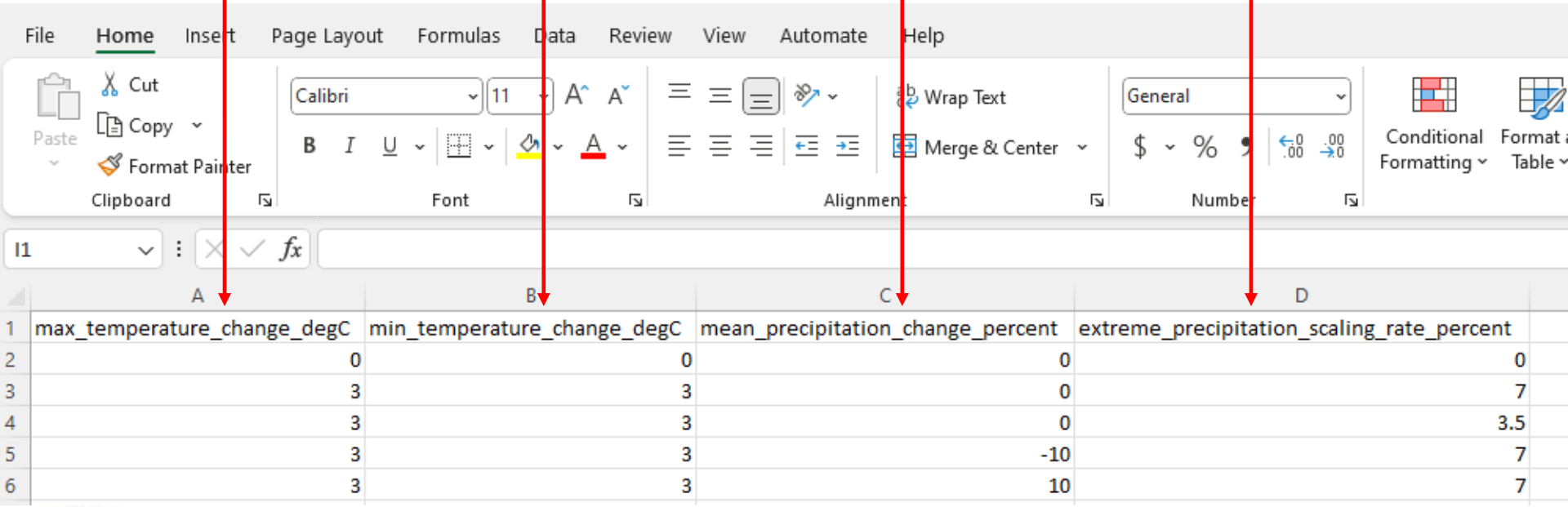
Primarily thermodynamic mechanisms of climate change

Temperature change [in °C] for Tmax

Temperature change [in °C] for Tmin

Mean precipitation change [in %]

Extreme precipitation scaling [in %]



	A	B	C	D
1	max_temperature_change_degC	min_temperature_change_degC	mean_precipitation_change_percent	extreme_precipitation_scaling_rate_percent
2	0	0	0	0
3	3	3	0	7
4	3	3	0	3.5
5	3	3	-10	7
6	3	3	10	7

Edit ./ClimateChangeScenarios.csv

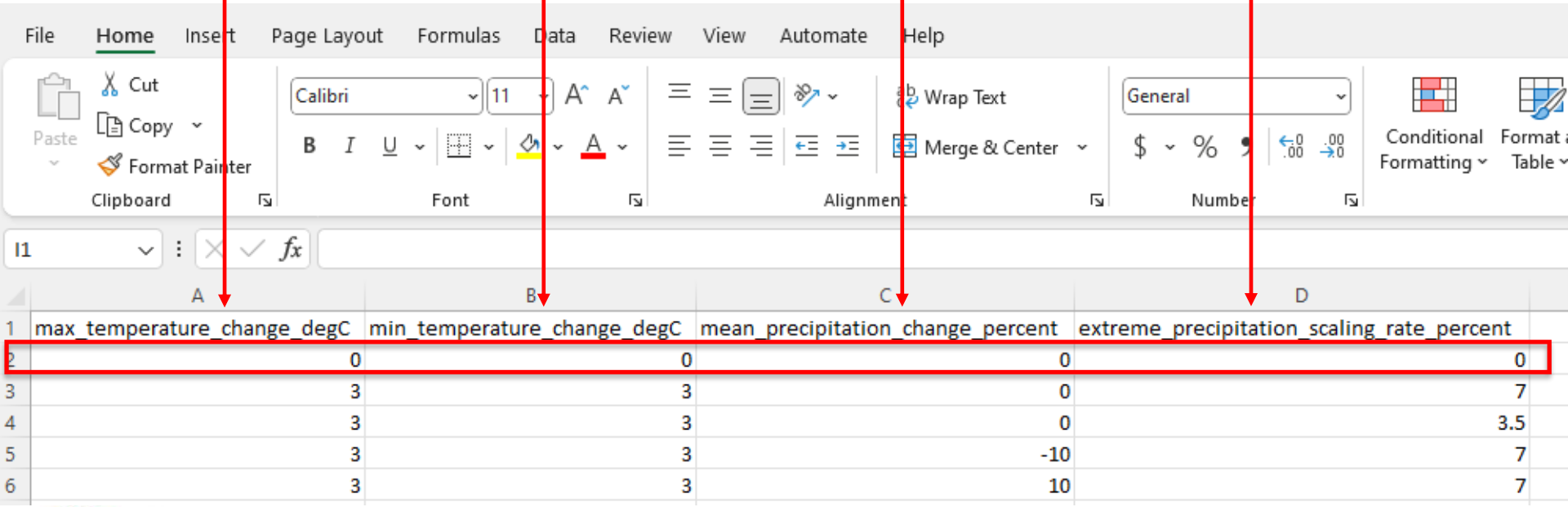
Primarily thermodynamic mechanisms of climate change

Temperature change [in °C] for Tmax

Temperature change [in °C] for Tmin

Mean precipitation change [in %]

Extreme precipitation scaling [in %]



	A	B	C	D
1	max_temperature_change_degC	min_temperature_change_degC	mean_precipitation_change_percent	extreme_precipitation_scaling_rate_percent
2	0	0	0	0
3	3	3	0	7
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5	3	3	-10	7
6	3	3	10	7

Edit ./ClimateChangeScenarios.csv

Primarily thermodynamic mechanisms of climate change

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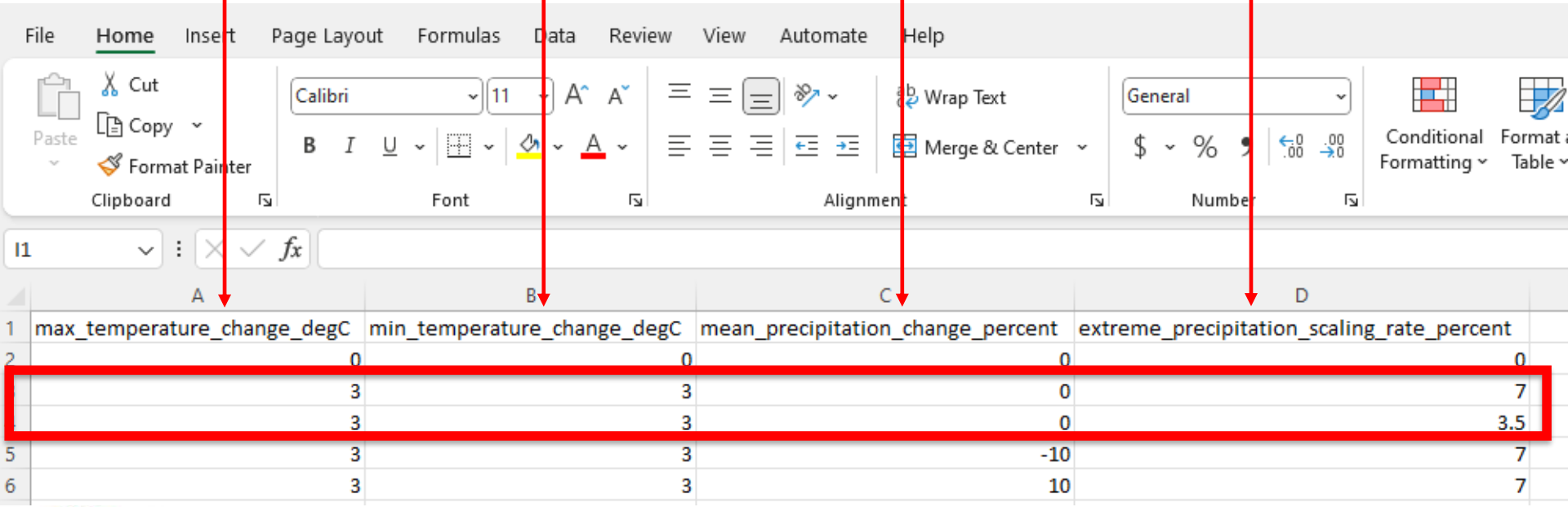
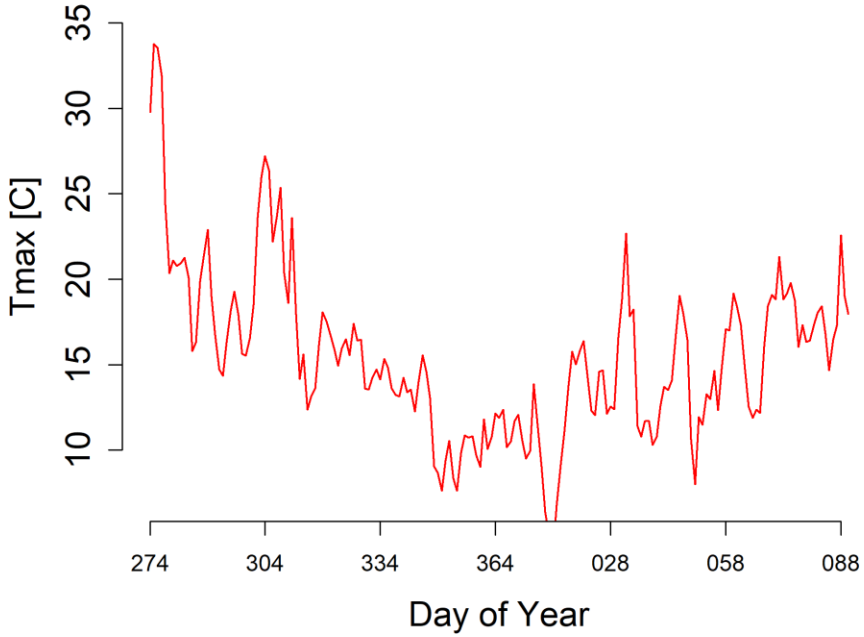
Extreme precipitation scaling [in %]

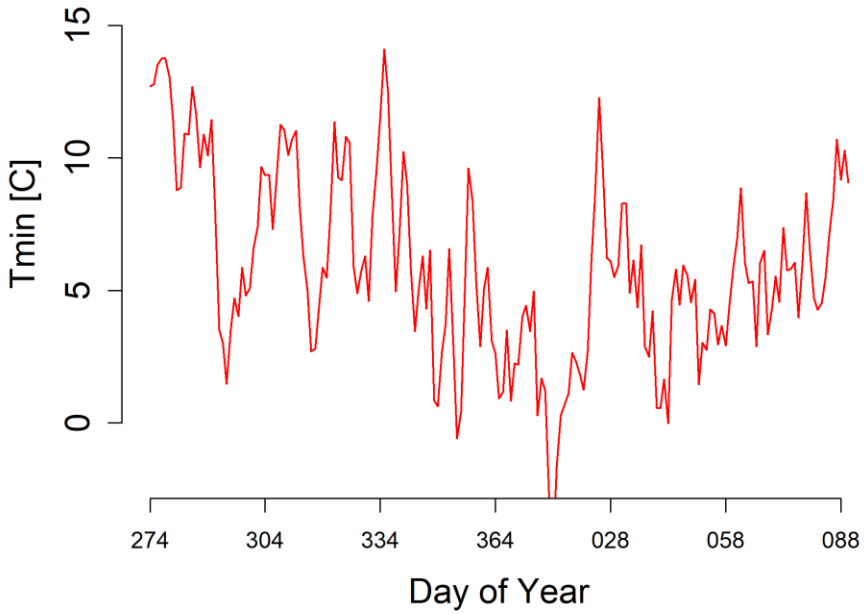


	A	B	C	D
1	max_temperature_change_degC	min_temperature_change_degC	mean_precipitation_change_percent	extreme_precipitation_scaling_rate_percent
2	0	0	0	0
3	3	3	0	7
4	3	3	0	3.5
5	3	3	-10	7
6	3	3	10	7

Temperature Warming

Original Simulation

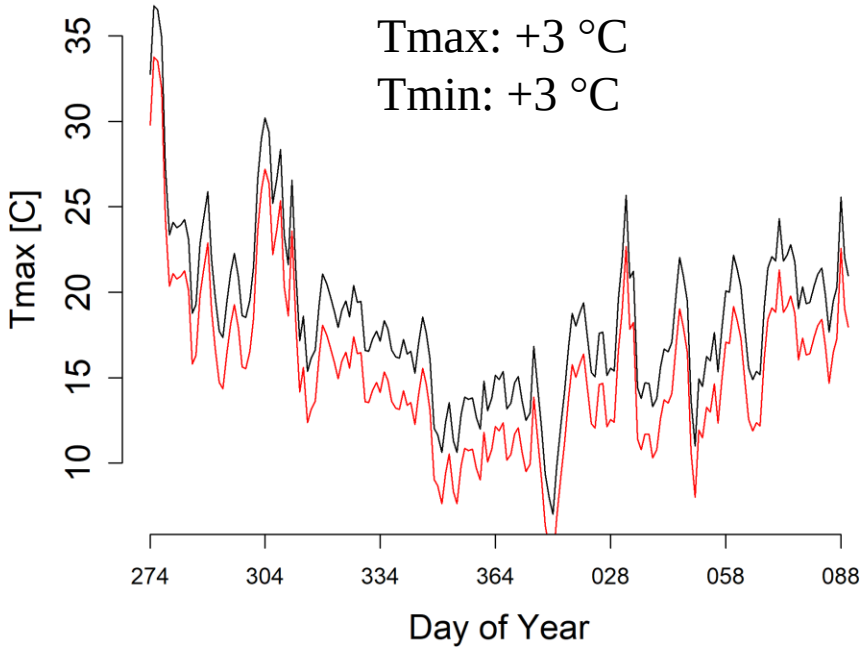


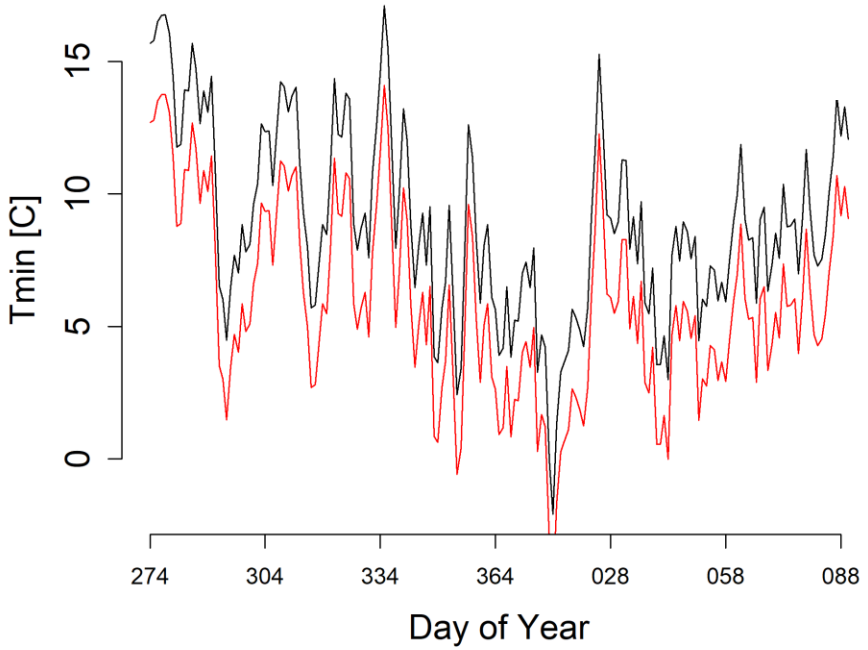


Temperature Warming

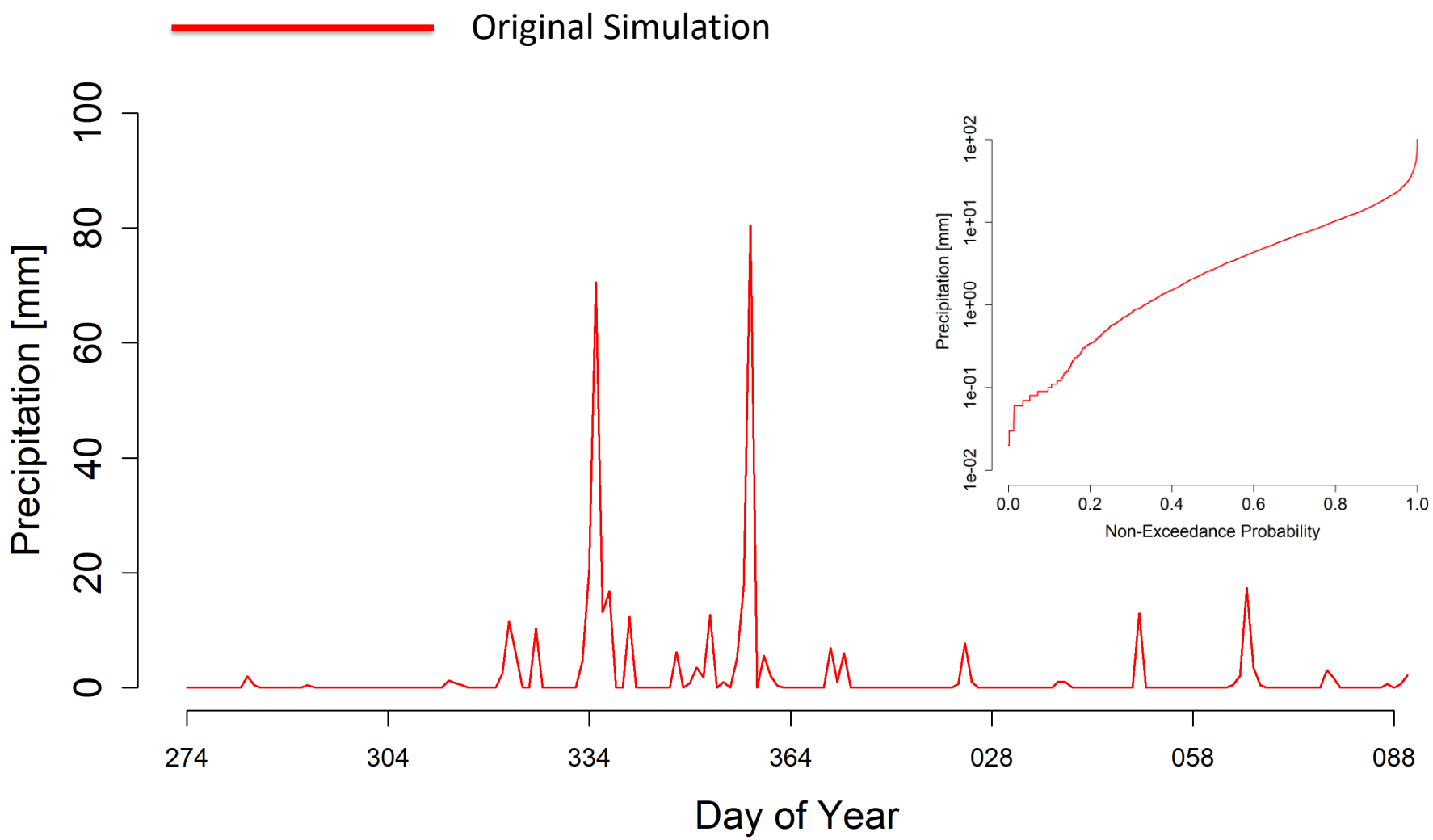
Original Simulation

Climate Change Adjusted Simulation

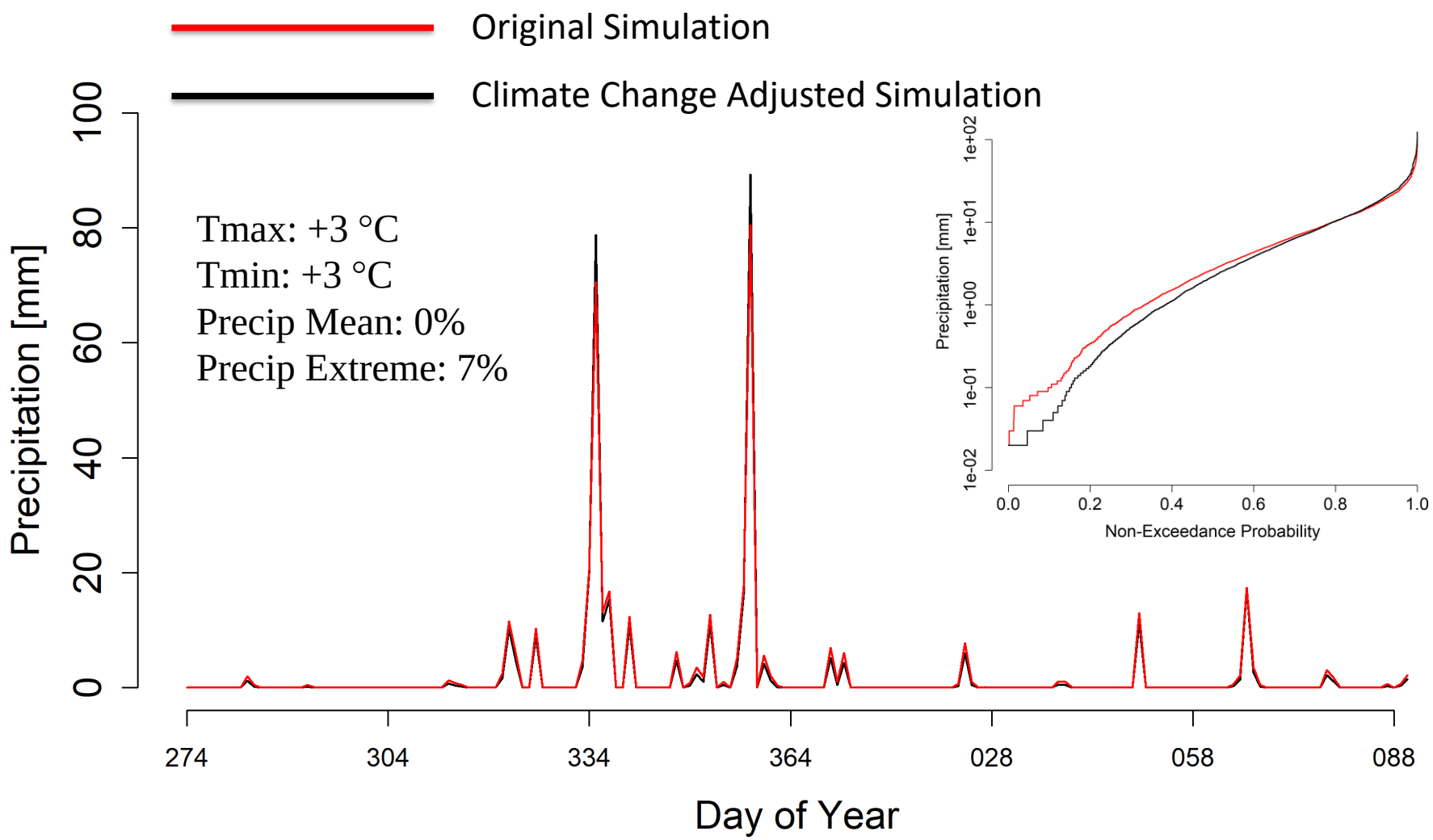




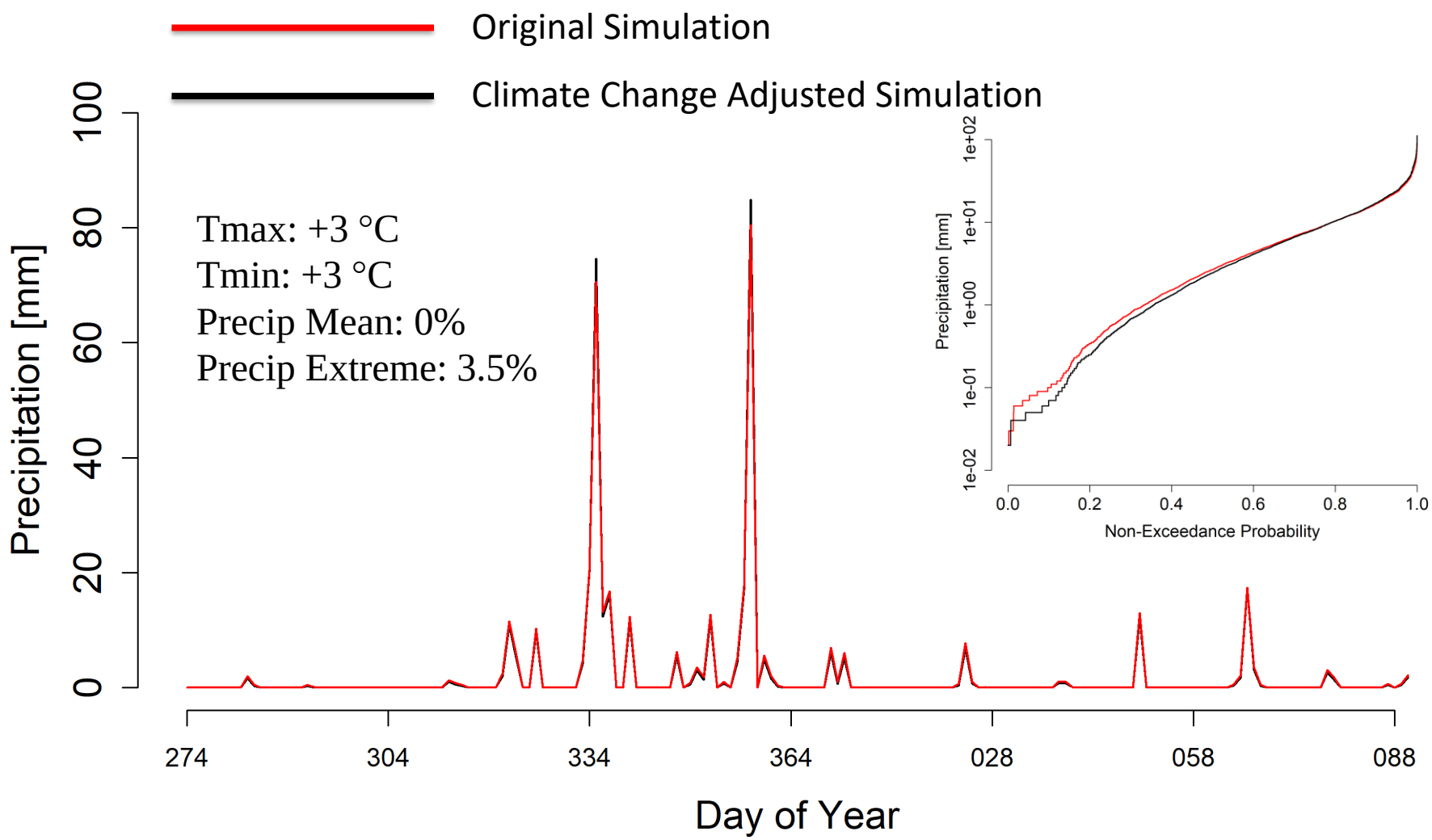
Extreme Precipitation Scaling



Extreme Precipitation Scaling



Extreme Precipitation Scaling



Edit ./ClimateChangeScenarios.csv

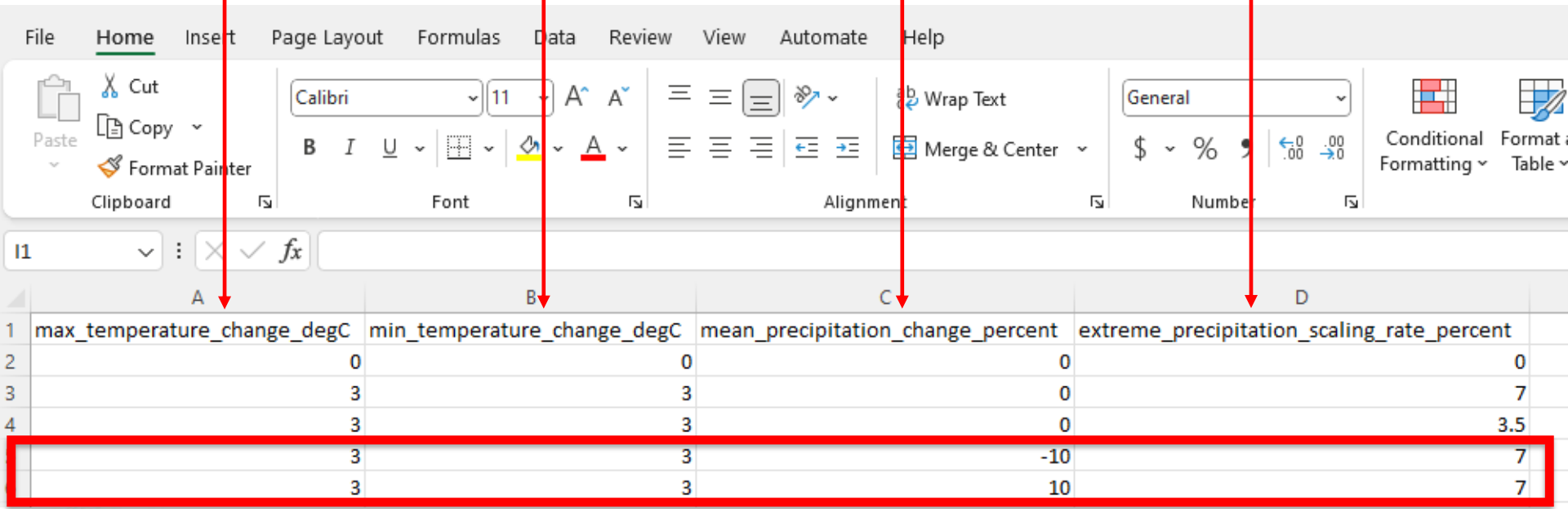
Primarily thermodynamic mechanisms of climate change

Temperature change [in °C] for Tmax

Temperature change [in °C] for Tmin

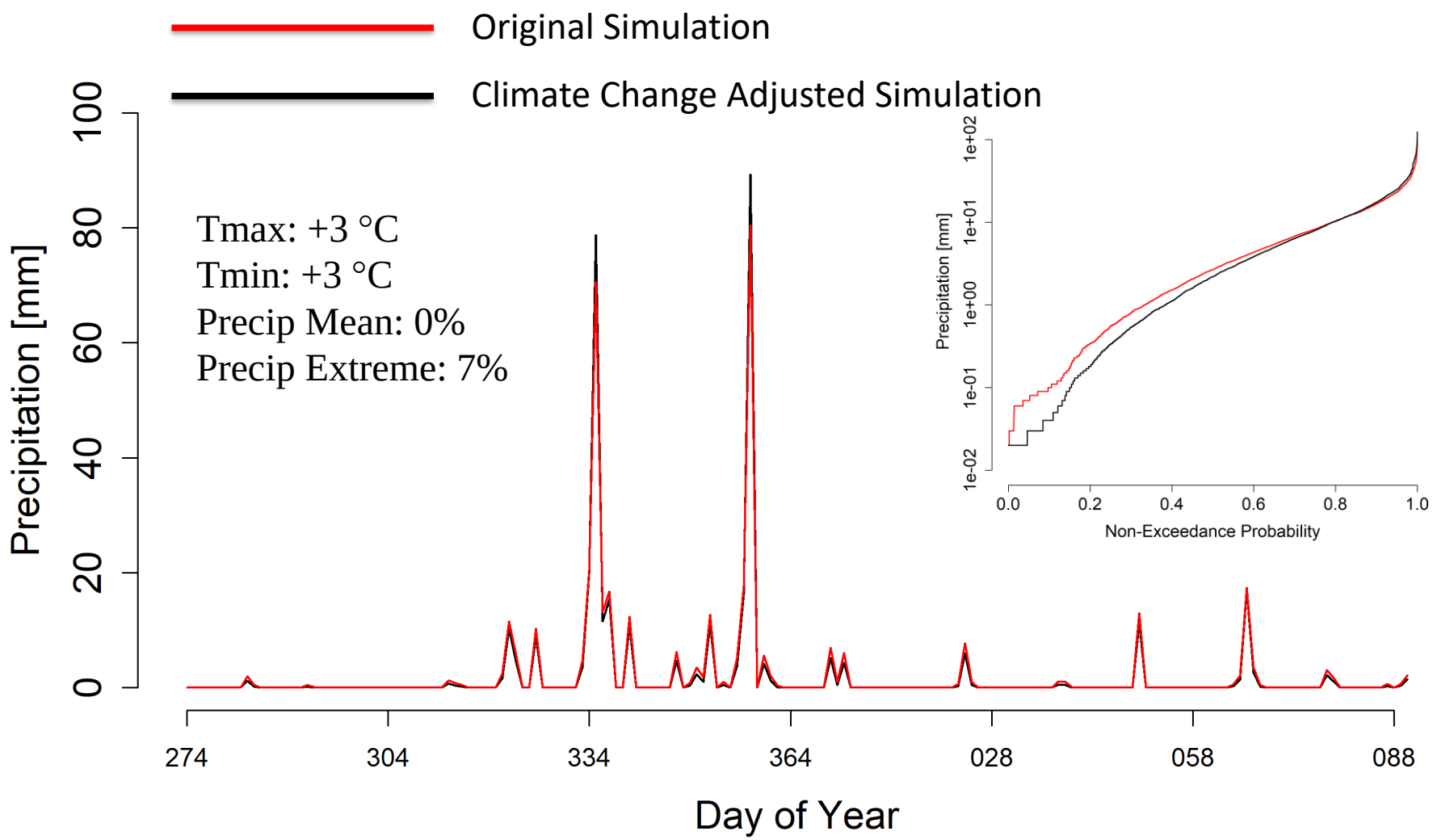
Mean precipitation change [in %]

Extreme precipitation scaling [in %]

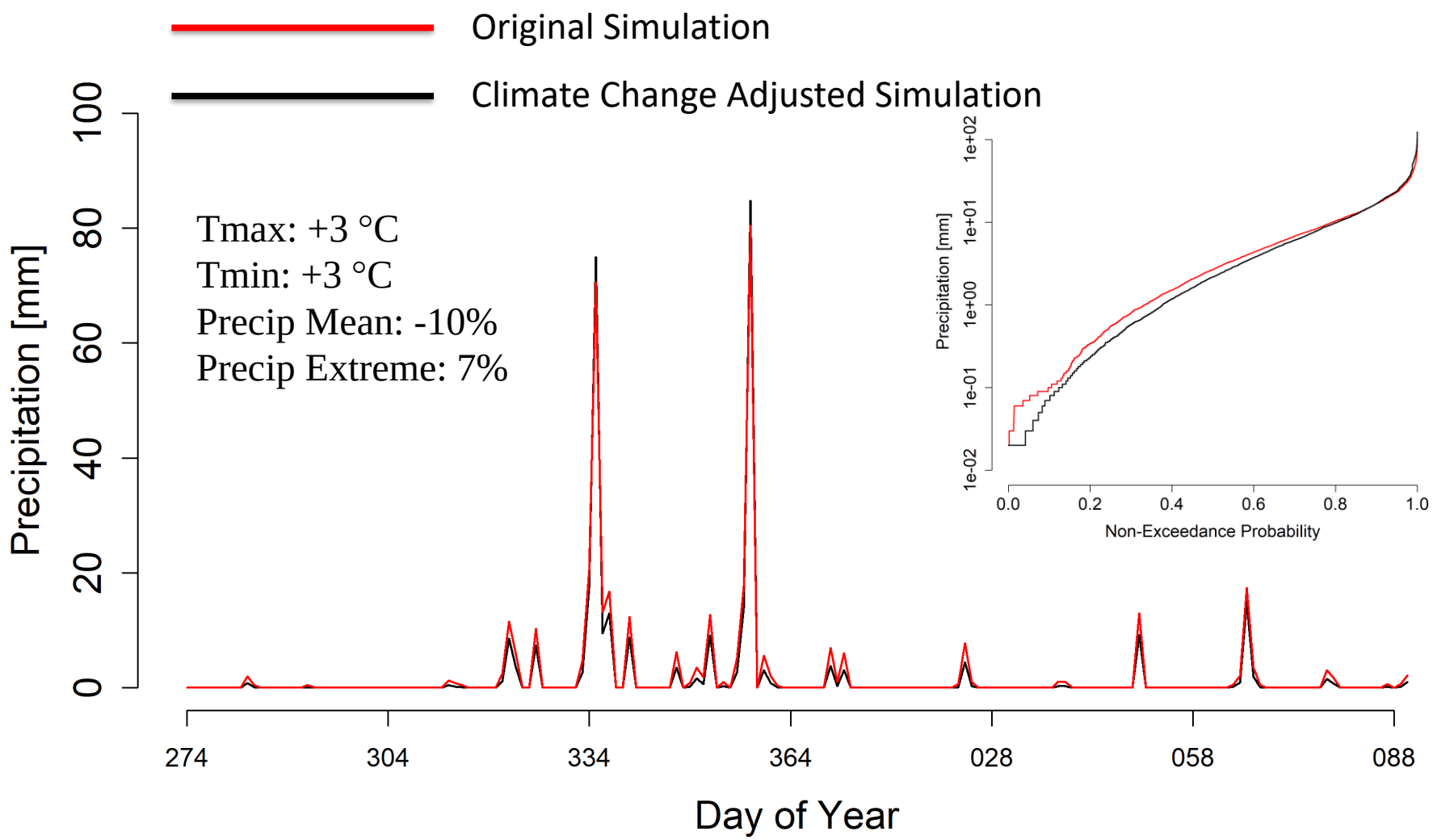


	A	B	C	D
1	max_temperature_change_degC	min_temperature_change_degC	mean_precipitation_change_percent	extreme_precipitation_scaling_rate_percent
2	0	0	0	0
3	3	3	0	7
4	3	3	0	3.5
5	3	3	-10	7
6	3	3	10	7

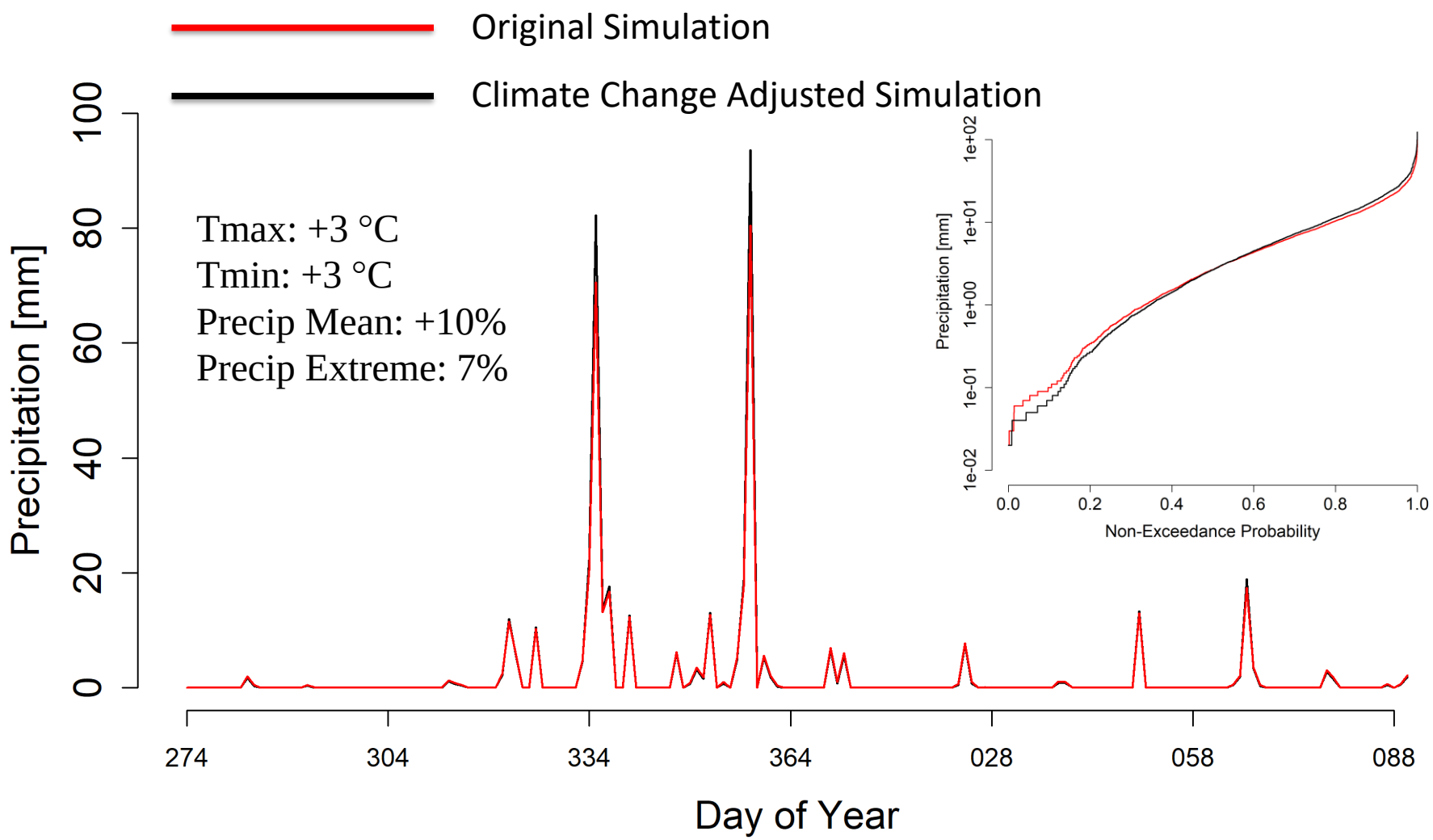
Changes in Mean and Extreme Precipitation



Changes in Mean and Extreme Precipitation

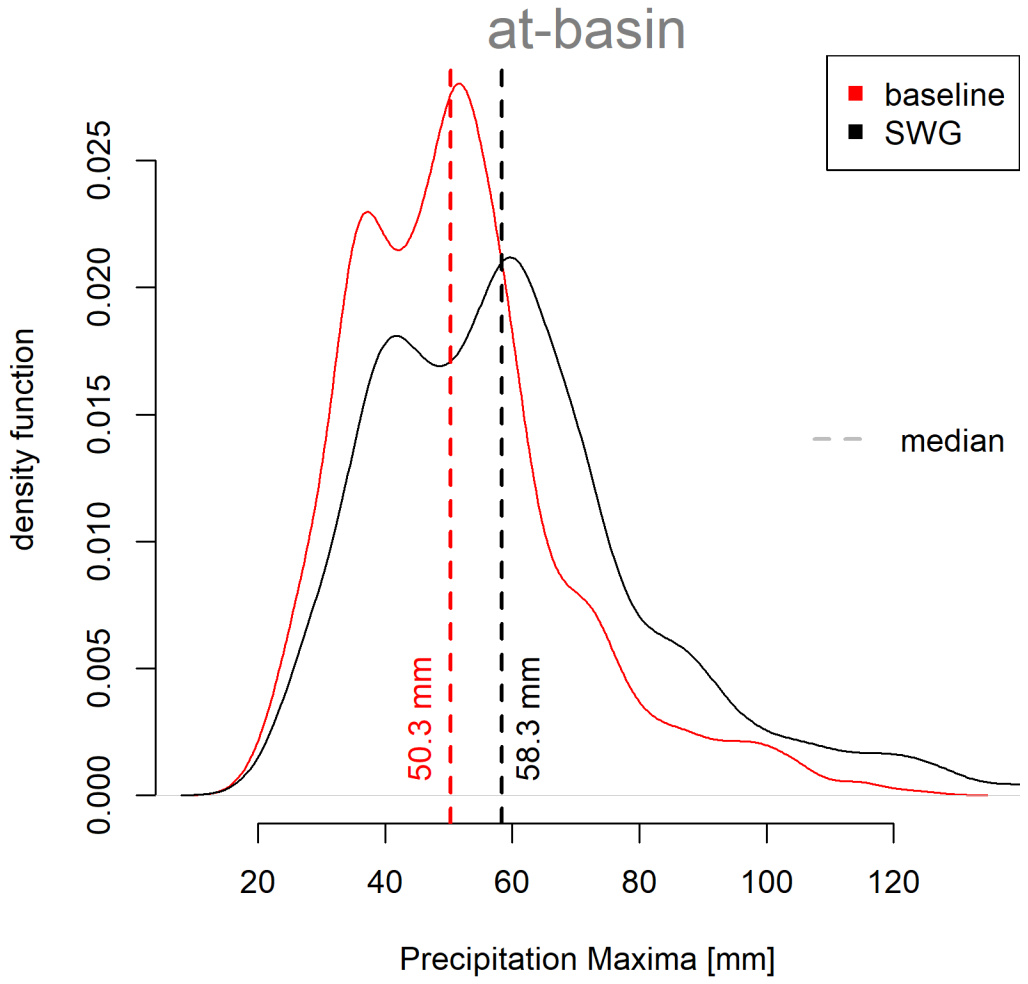


Changes in Mean and Extreme Precipitation



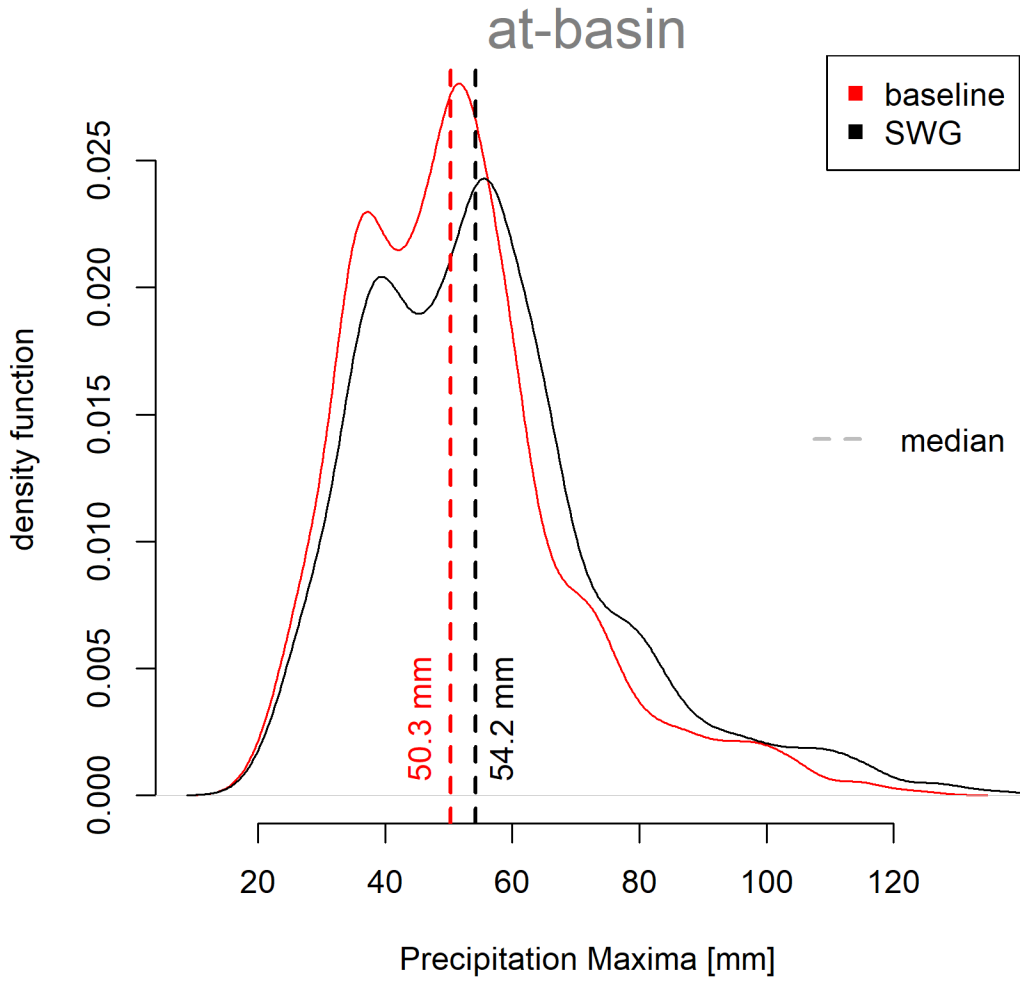
Resulting Changes in Annual Max Distribution

Tmax: +3 °C
Tmin: +3 °C
Precip Mean: 0%
Precip Extreme: 7%



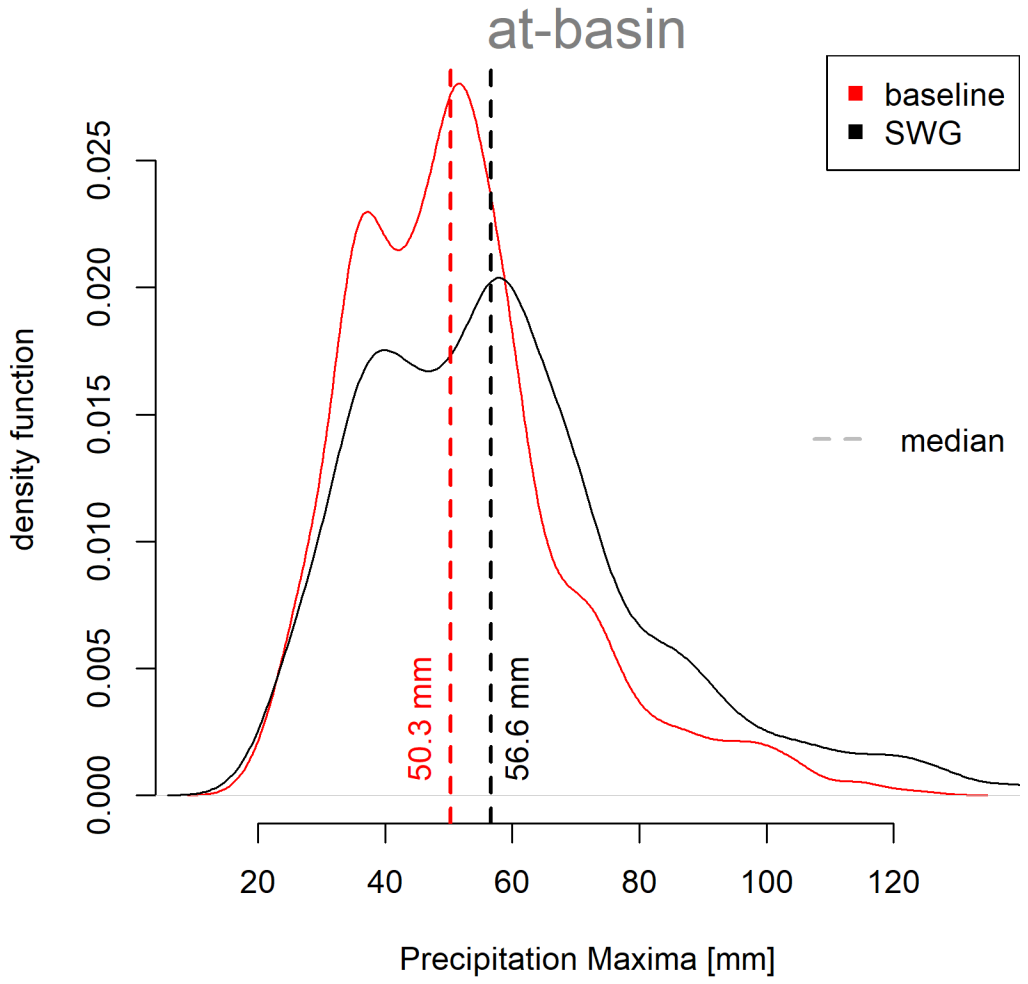
Resulting Changes in Annual Max Distribution

Tmax: +3 °C
Tmin: +3 °C
Precip Mean: 0%
Precip Extreme: 3.5%



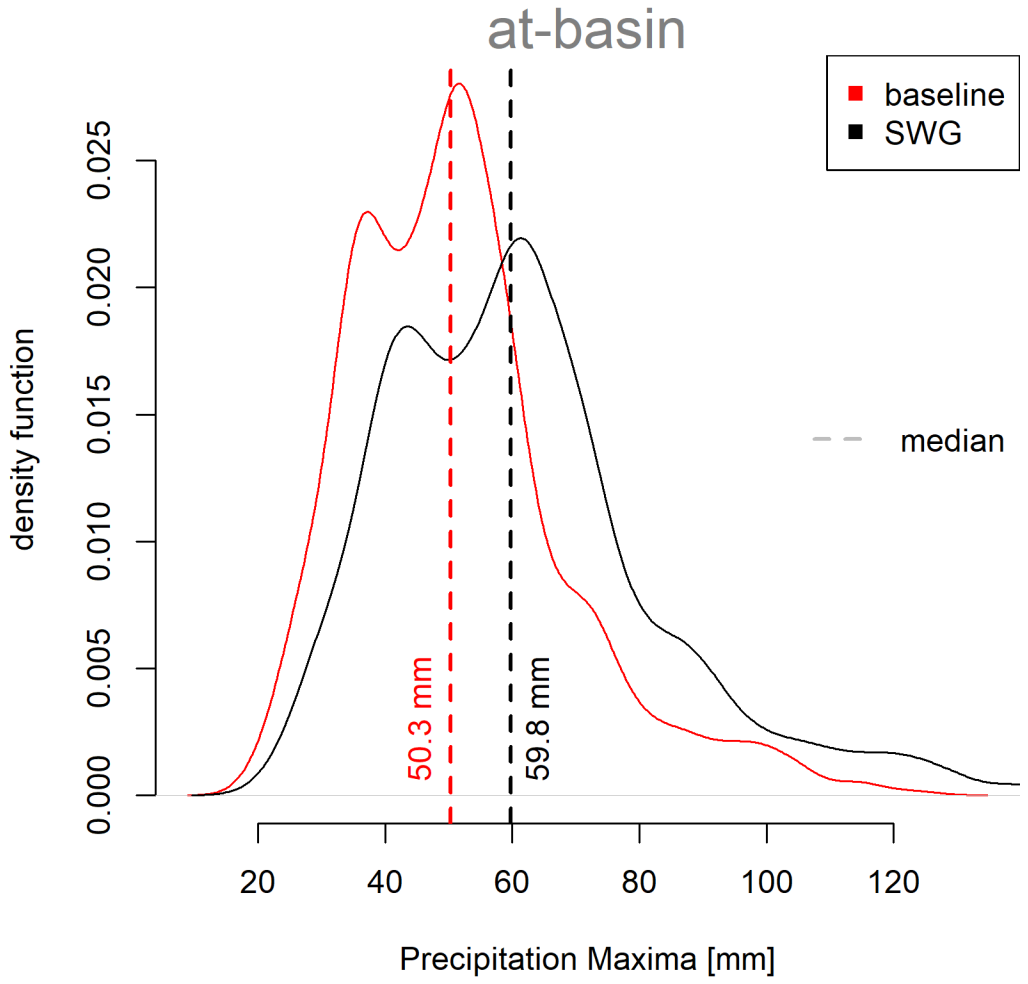
Resulting Changes in Annual Max Distribution

Tmax: +3 °C
Tmin: +3 °C
Precip Mean: -10%
Precip Extreme: 7%



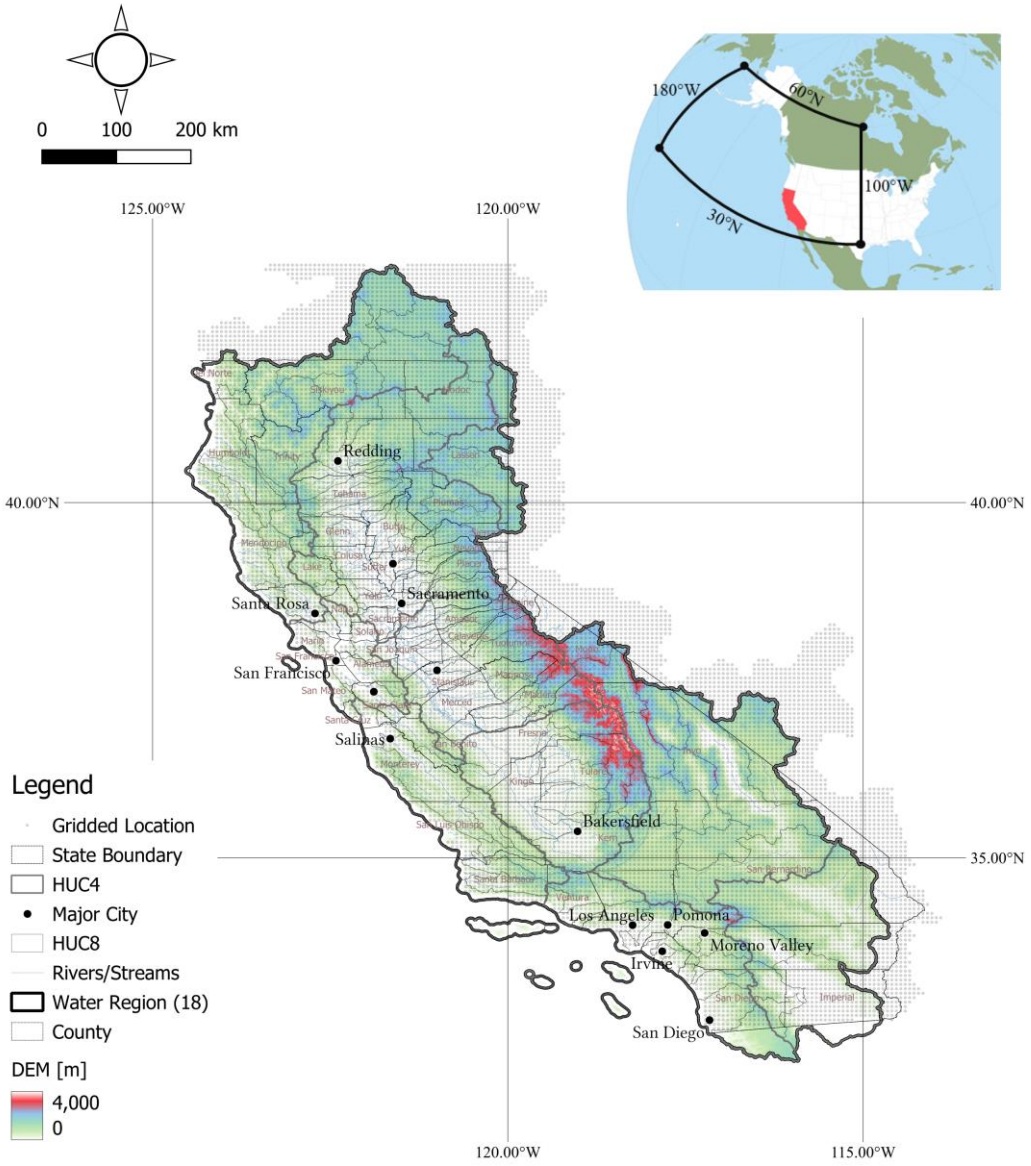
Resulting Changes in Annual Max Distribution

Tmax: +3 °C
Tmin: +3 °C
Precip Mean: +10%
Precip Extreme: 7%



DESCRIPTION AND ANALYSIS OF STATEWIDE SCENARIOS

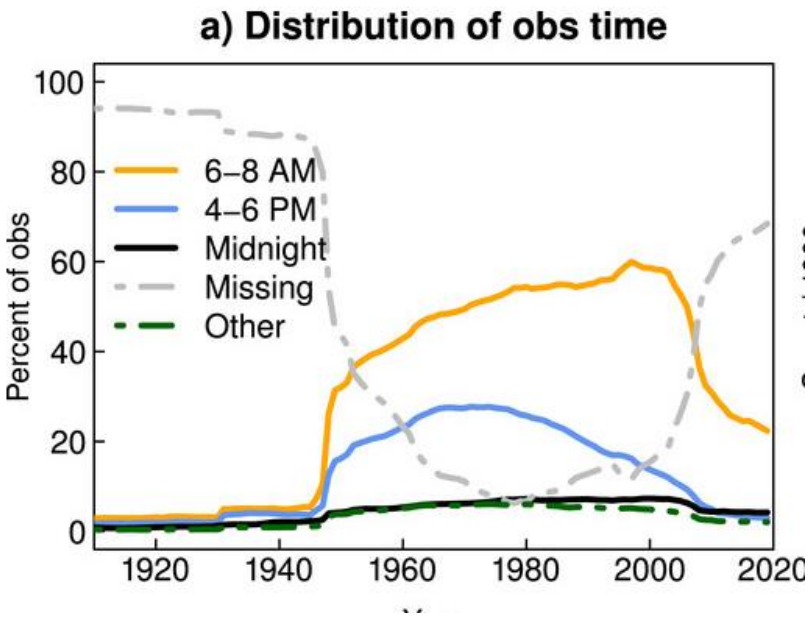
Data Coverage



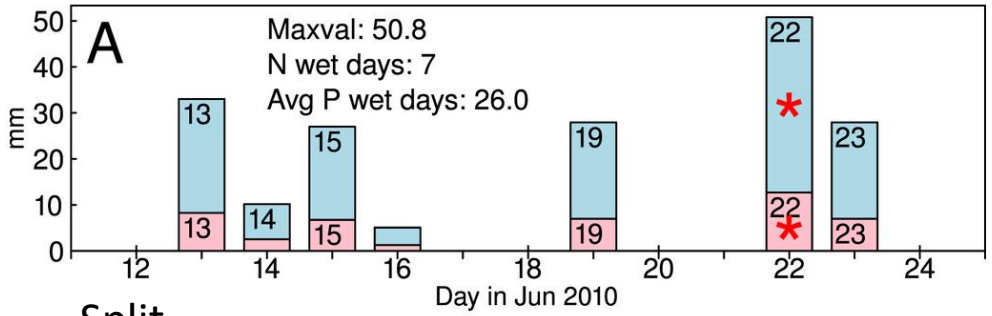
Data Products Used: Precipitation

An Extreme-Preserving Long-Term Gridded Daily Precipitation Dataset for the Conterminous United States (1915 – 2018)

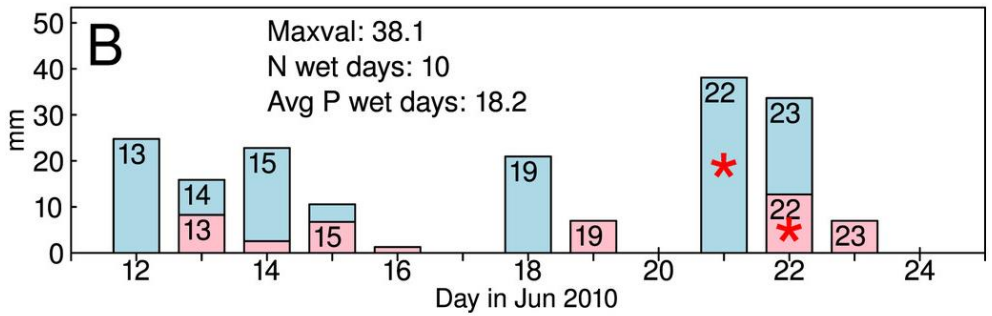
David W. Pierce, Lu Su, Daniel R. Cayan, Mark D. Risser, Ben Livneh, and Dennis P. Lettenmaier



Unsplit



Split



Data Products Used: Temperature

A Long-Term Hydrologically Based Dataset of Land Surface Fluxes and States for the Conterminous United States: Update and Extensions

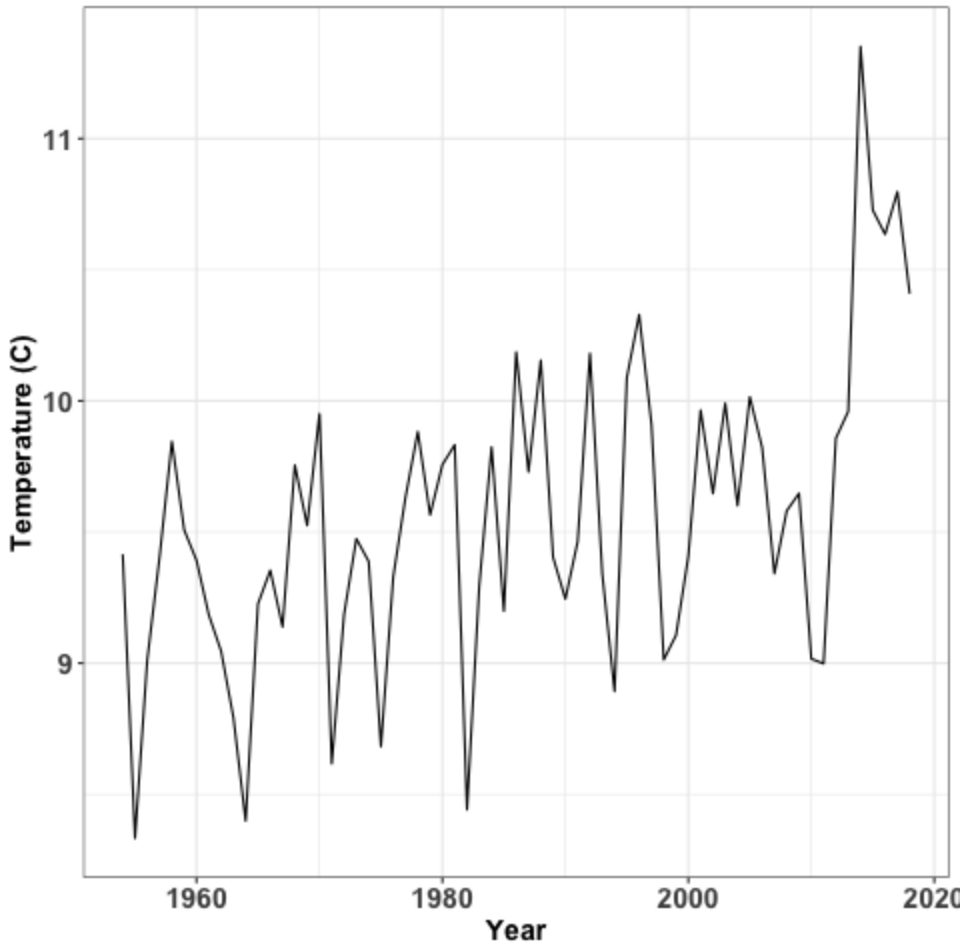
Ben Livneh, Eric A. Rosenberg, Chiyu Lin, Bart Nijssen, Vimal Mishra, Kostas M. Andreadis, Edwin P. Maurer, and Dennis P. Lettenmaier

(1915 – 2013)

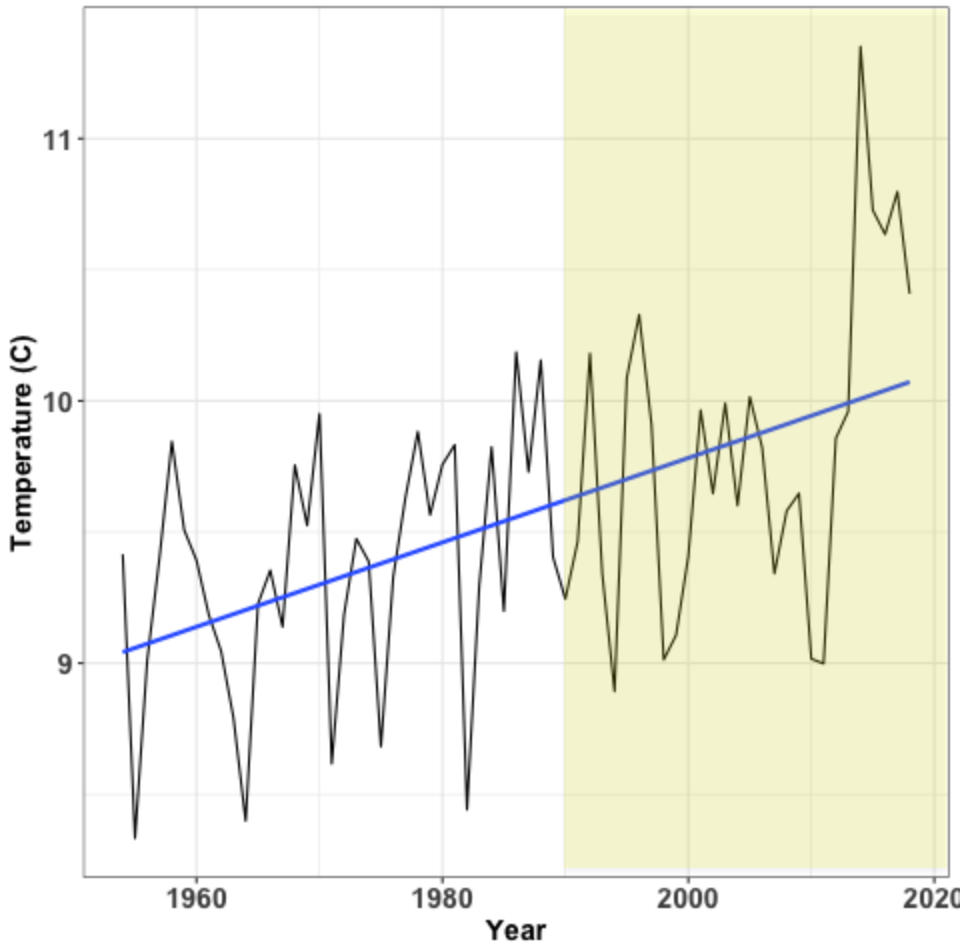
(2014 – 2018)

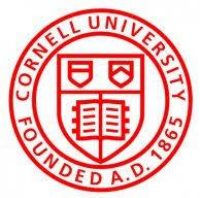
Monthly bias correction to synchronize two products

Data Products Used: Temperature Detrending

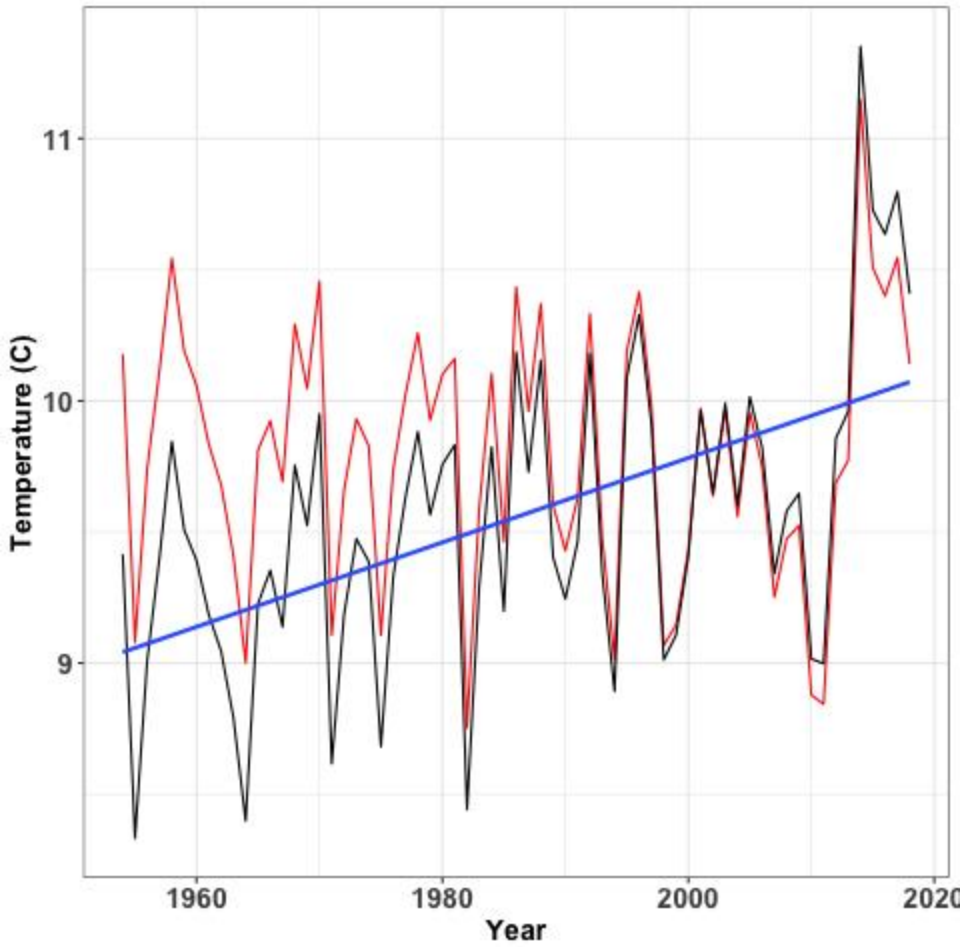


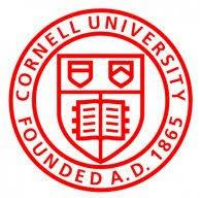
Data Products Used: Temperature Detrending



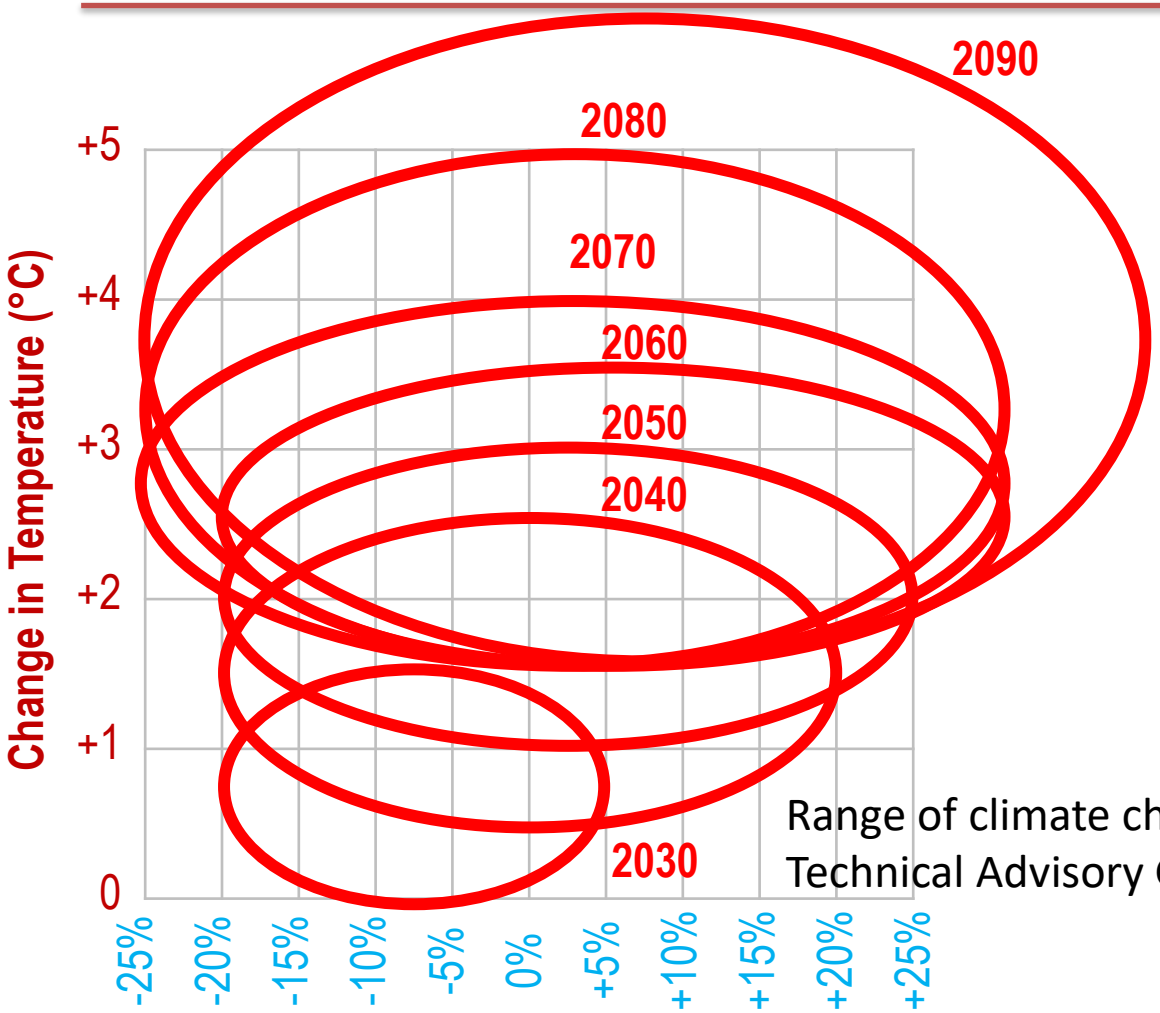


Data Products Used: Temperature Detrending



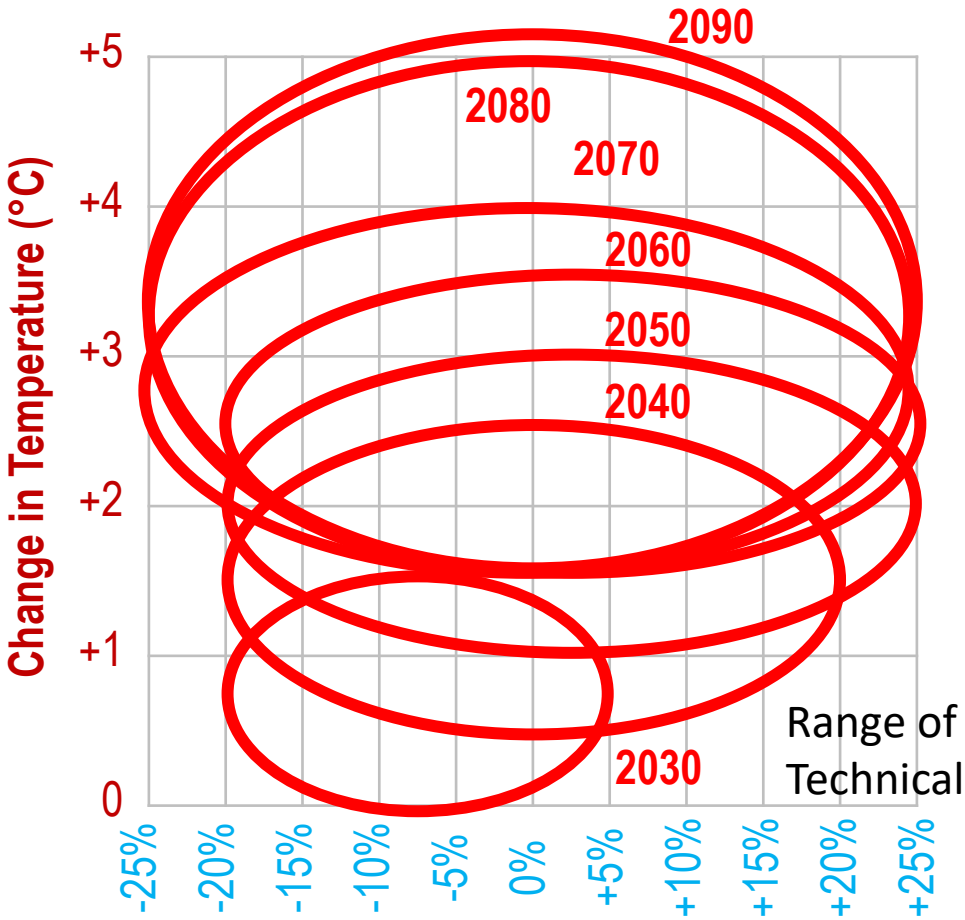


Climate Change Scenarios



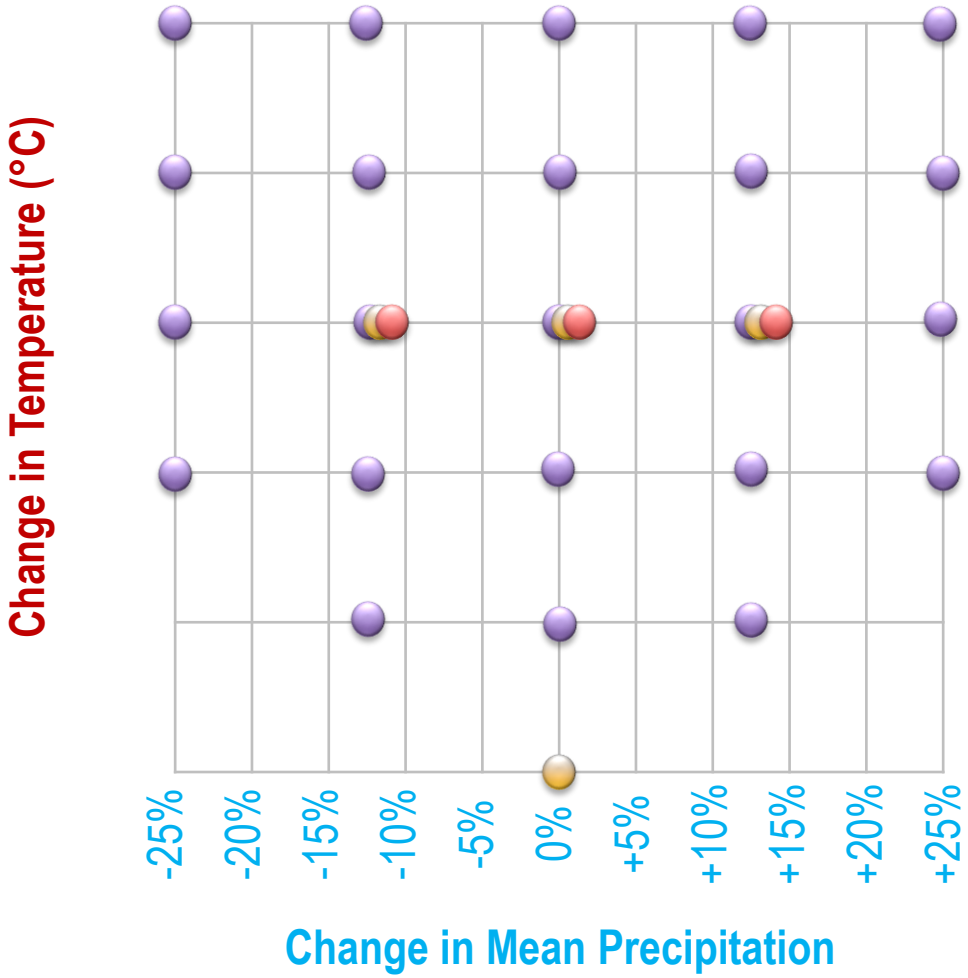
Range of climate changes from Climate Change Technical Advisory Group (CCTAG)

Climate Change Scenarios



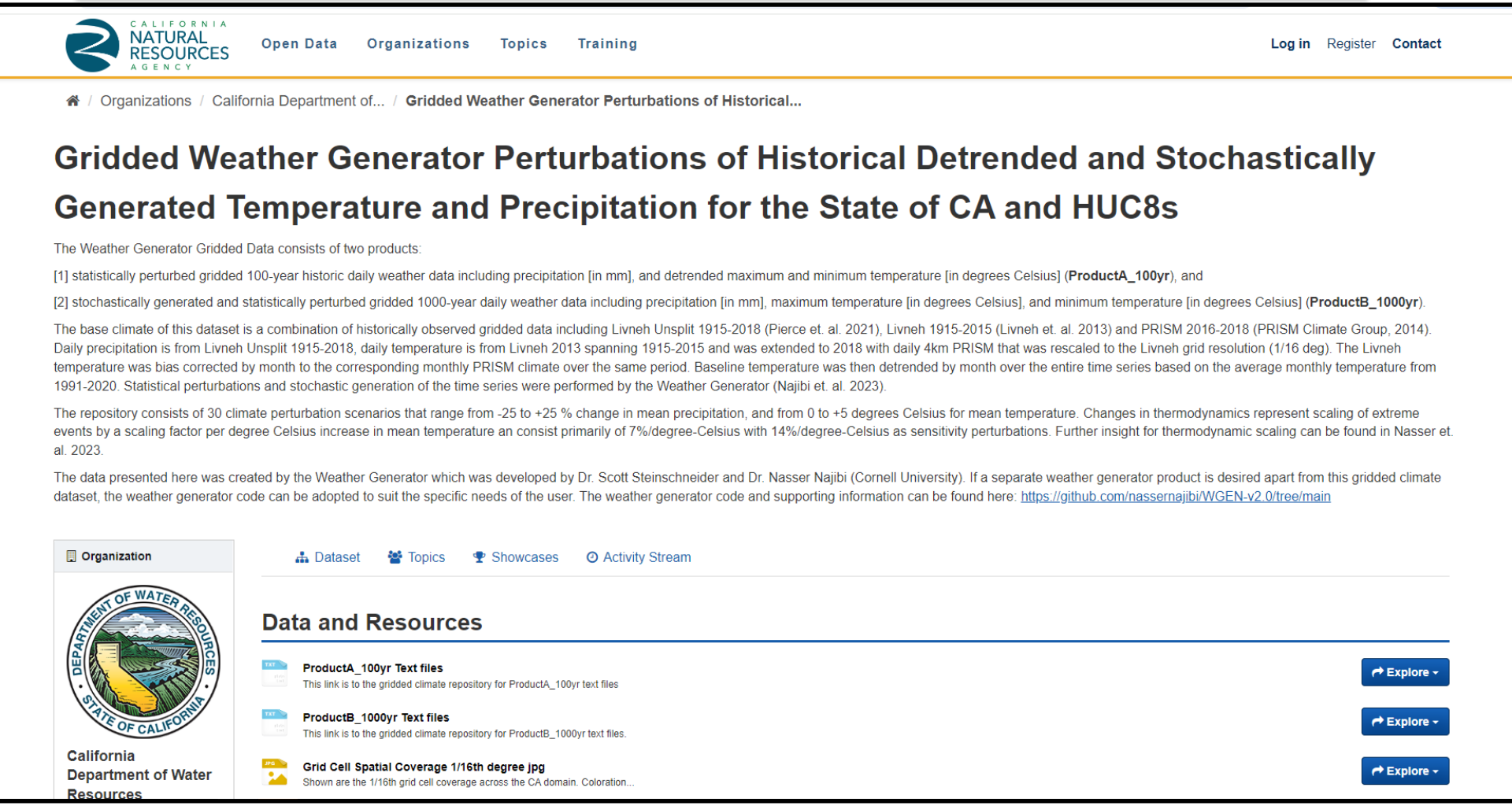
Range of climate changes from Climate Change Technical Advisory Group (CCTAG) – removing 1 model

Climate Change Scenarios



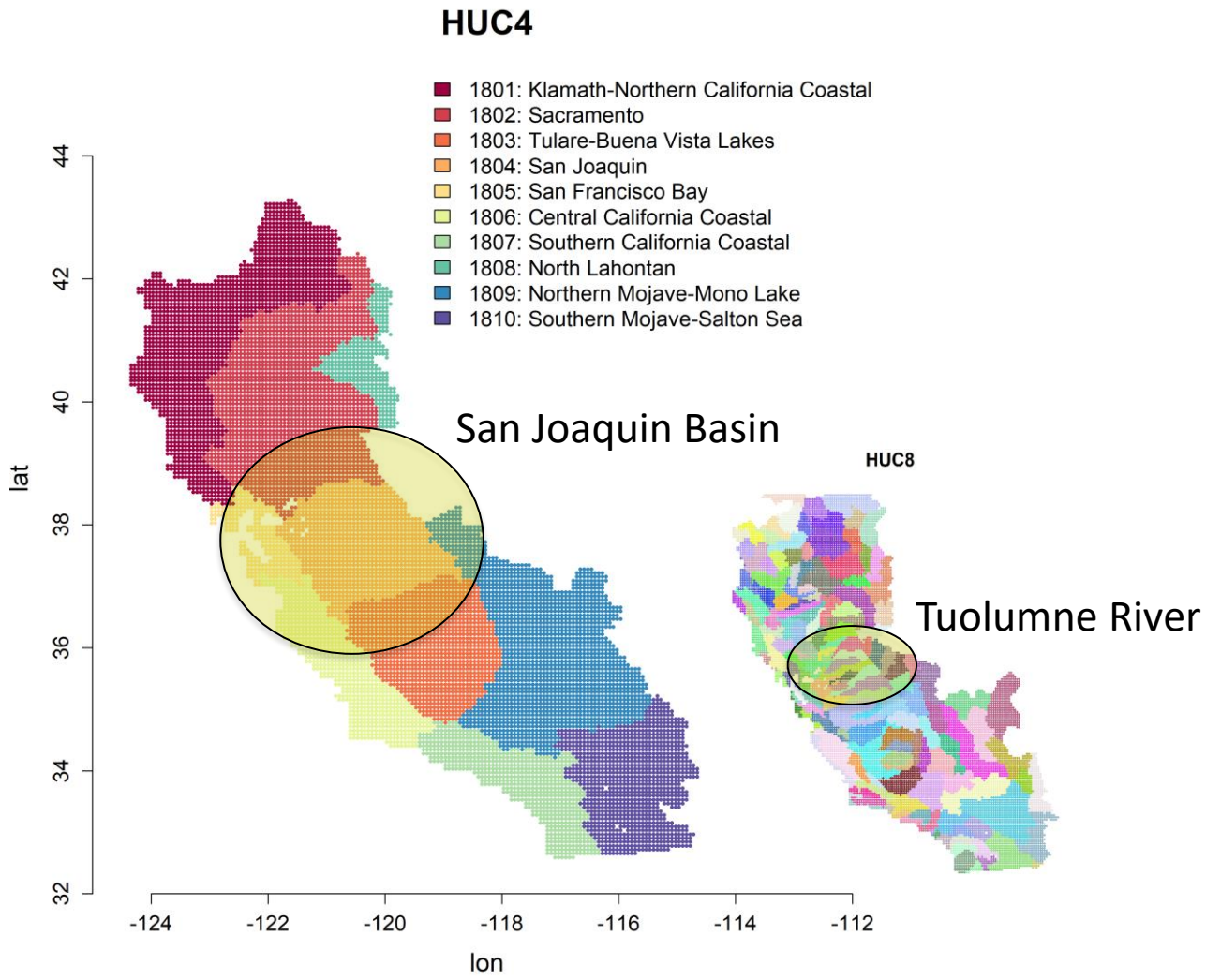
Change in Extreme Precipitation:
0% per °C
+7% per °C
+14% per °C

Climate Change Scenarios



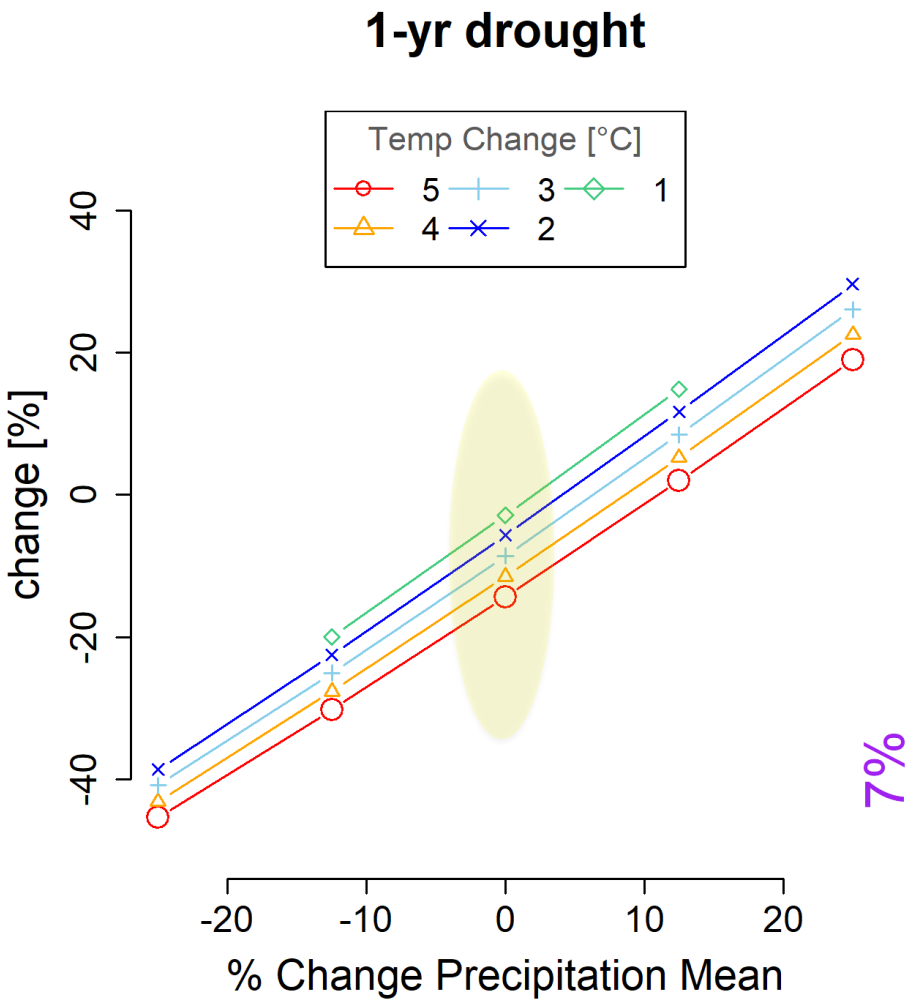
https://data.cnra.ca.gov/dataset/ca-weather-generator-gridded-climate-pr-tmin-tmax-2023

Evaluating Scenarios at the HUC4 and HUC8 Level



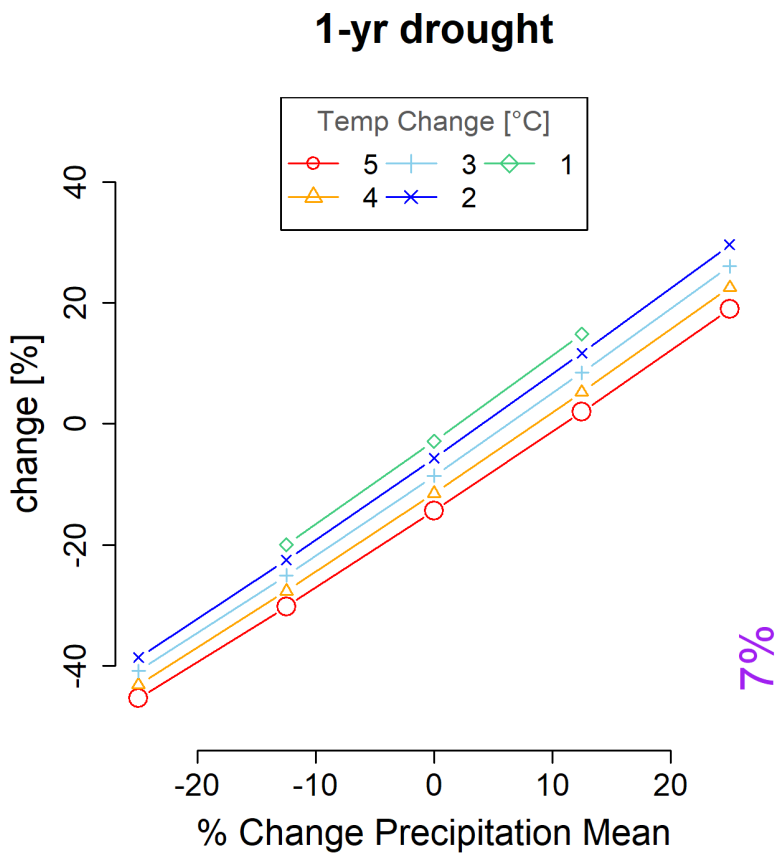
Basin-Wide Drought and Intensifying Precipitation Regime

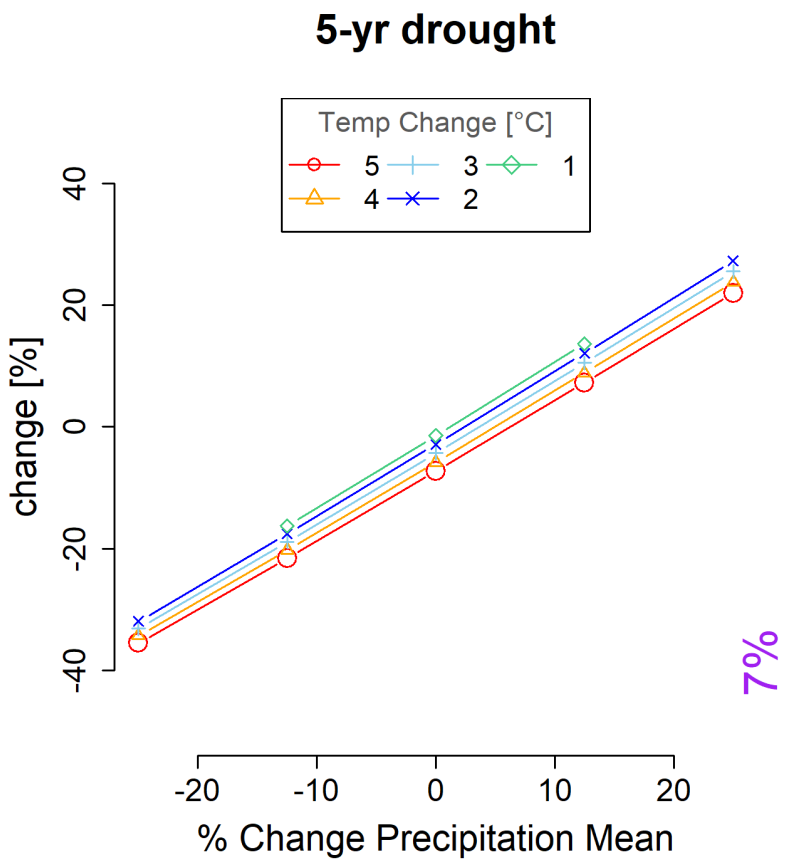
San Joaquin HUC 4 (1804)



Basin-Wide Drought and Intensifying Precipitation Regime

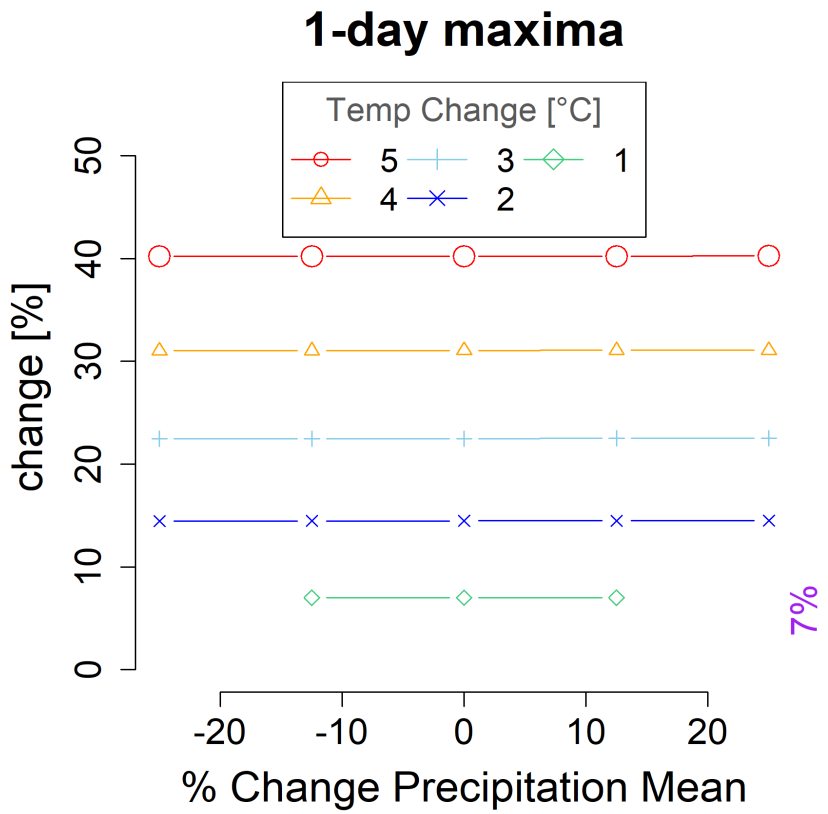
San Joaquin HUC 4 (1804)

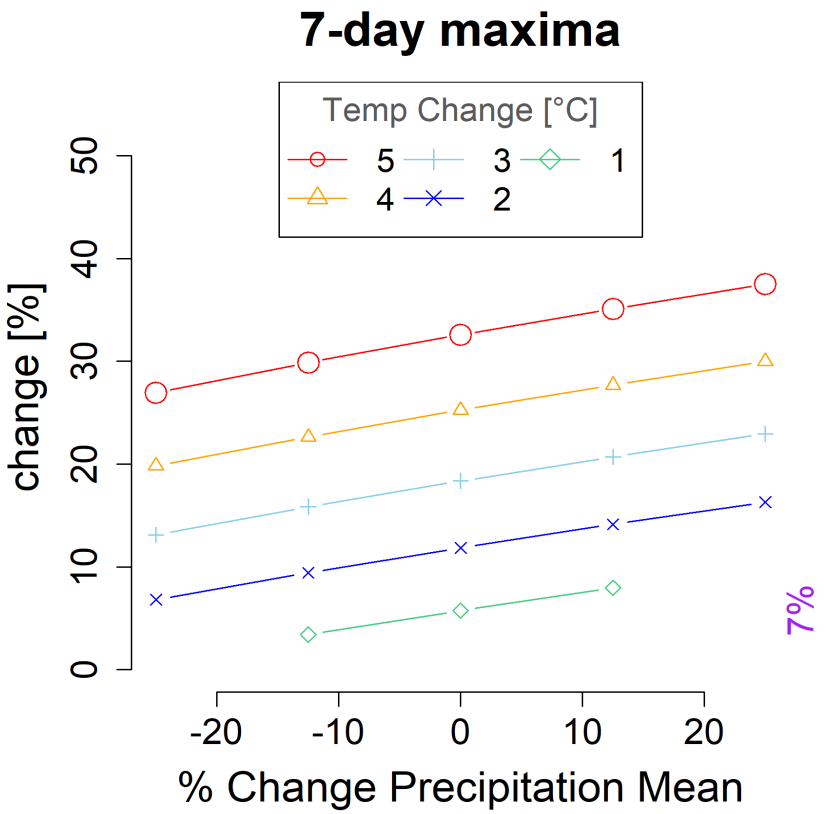




Extreme Precipitation Events

San Joaquin HUC 4 (1804)

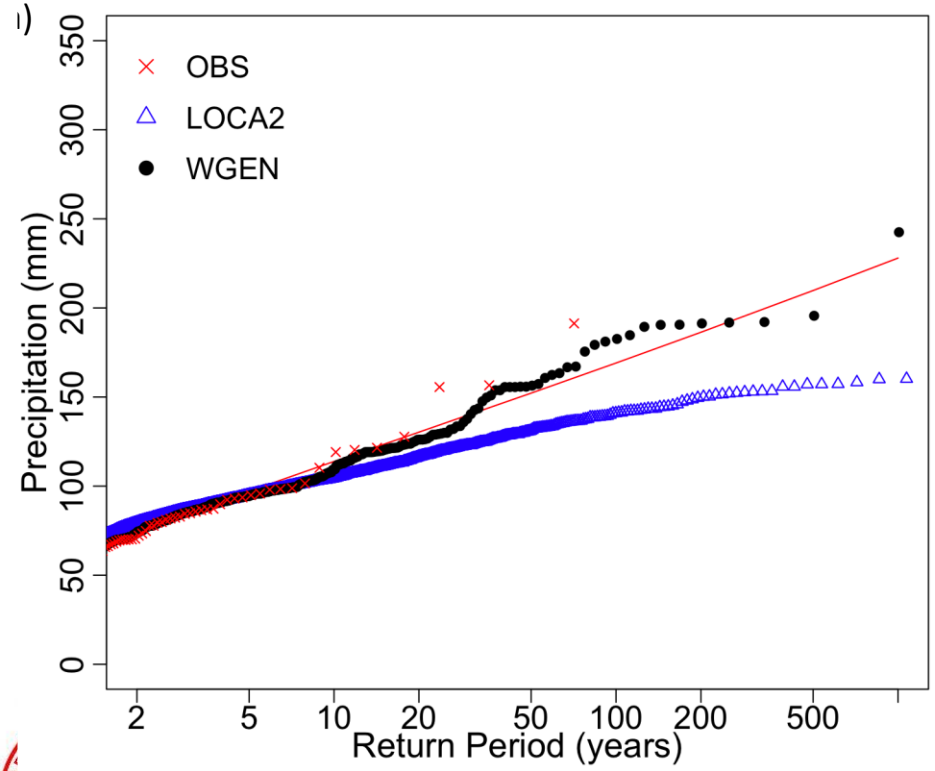




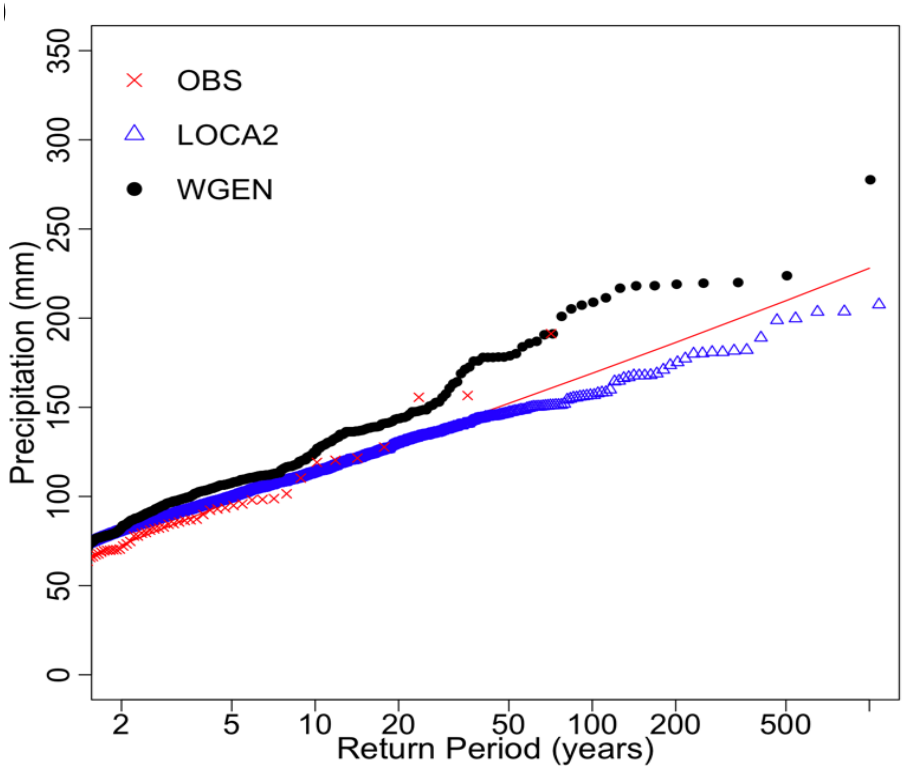
Extreme Precipitation Events

Upper Tuolumne River Basin

Historical



2°C Warmer

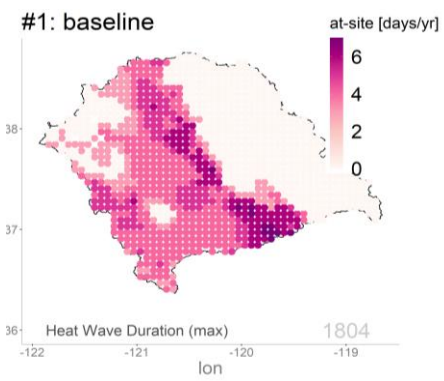


Extreme Heat

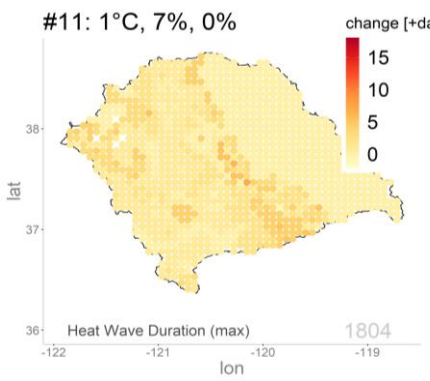
San Joaquin HUC 4 (1804)

Heat Wave Duration

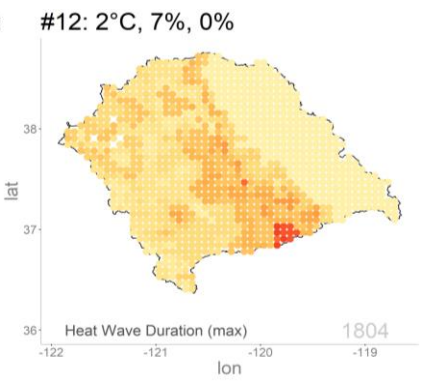
Baseline Values



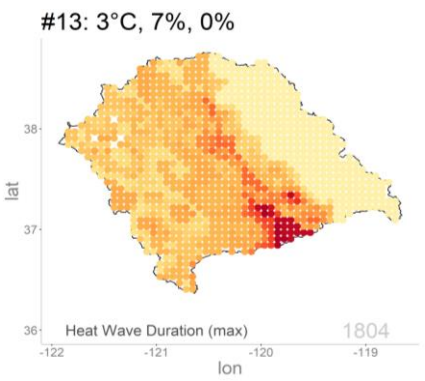
Change in Value (+1°C)



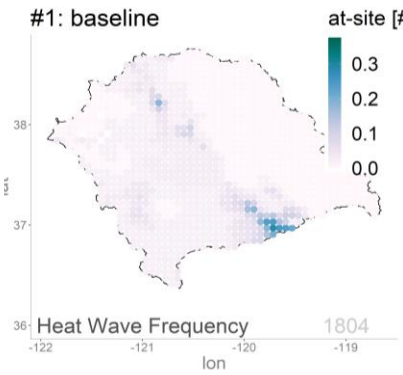
Change in Value (+2°C)

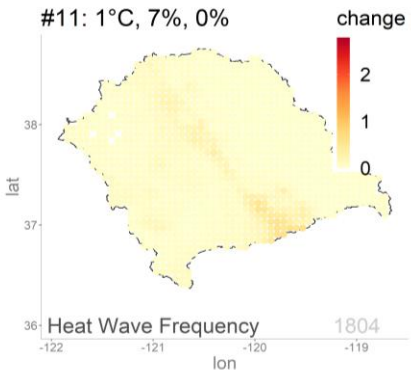


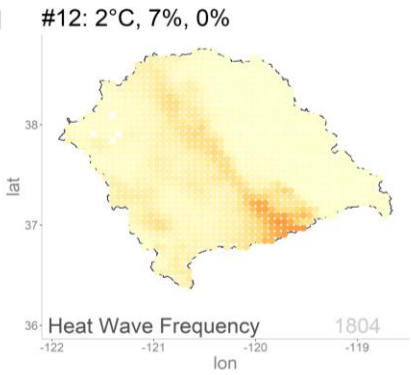
Change in Value (+3°C)

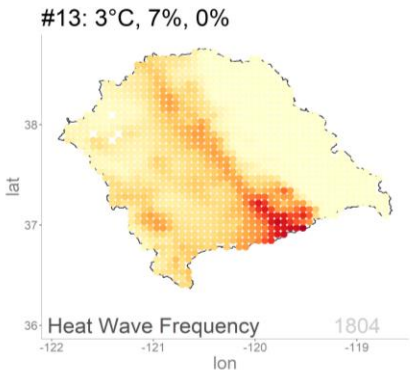


Heat Wave Frequency









THANK YOU