

New Views of Regional Climate Change: The advantages of a Superensemble

Christian McGillen

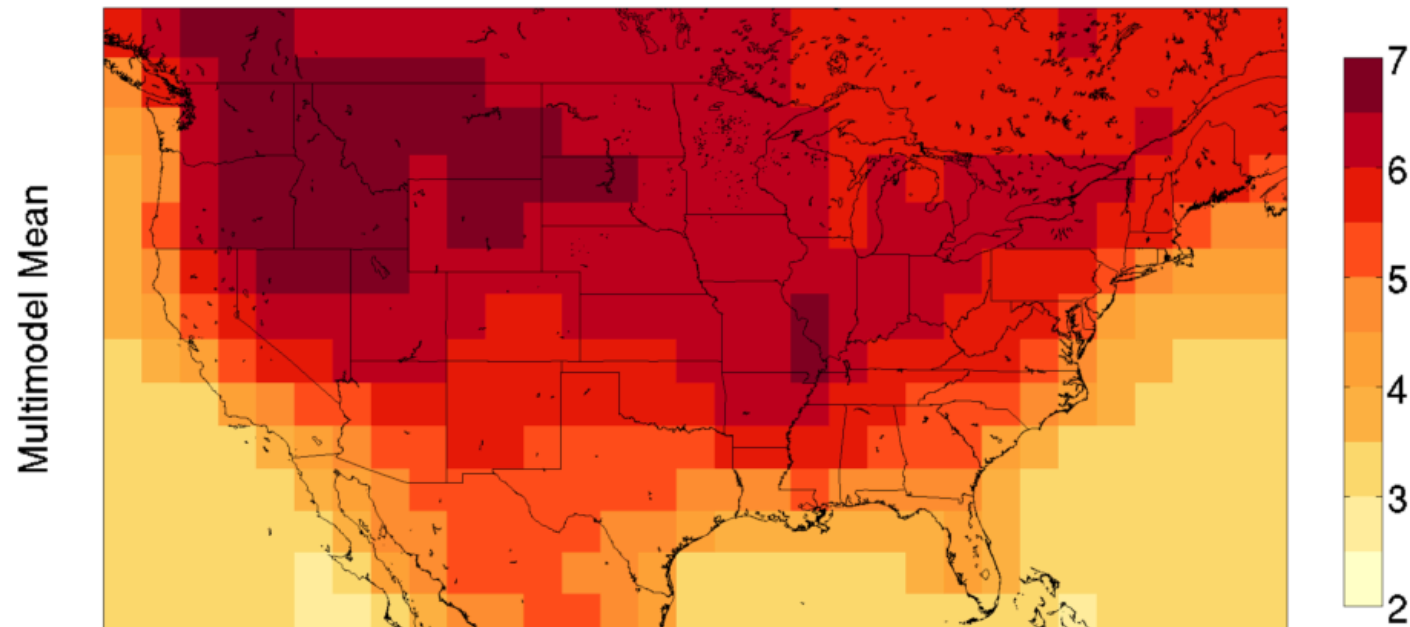
Virginia Tech

Philip Mote and David Rupp

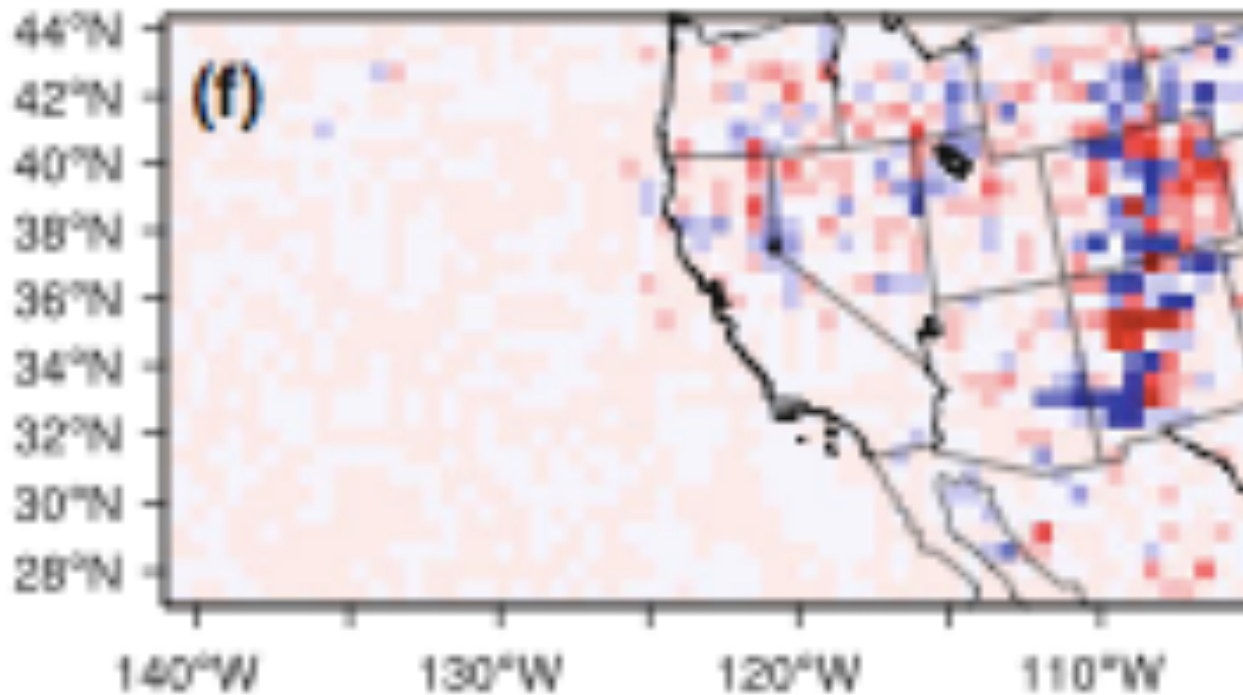
Oregon Climate Change Research Institute, Oregon State University



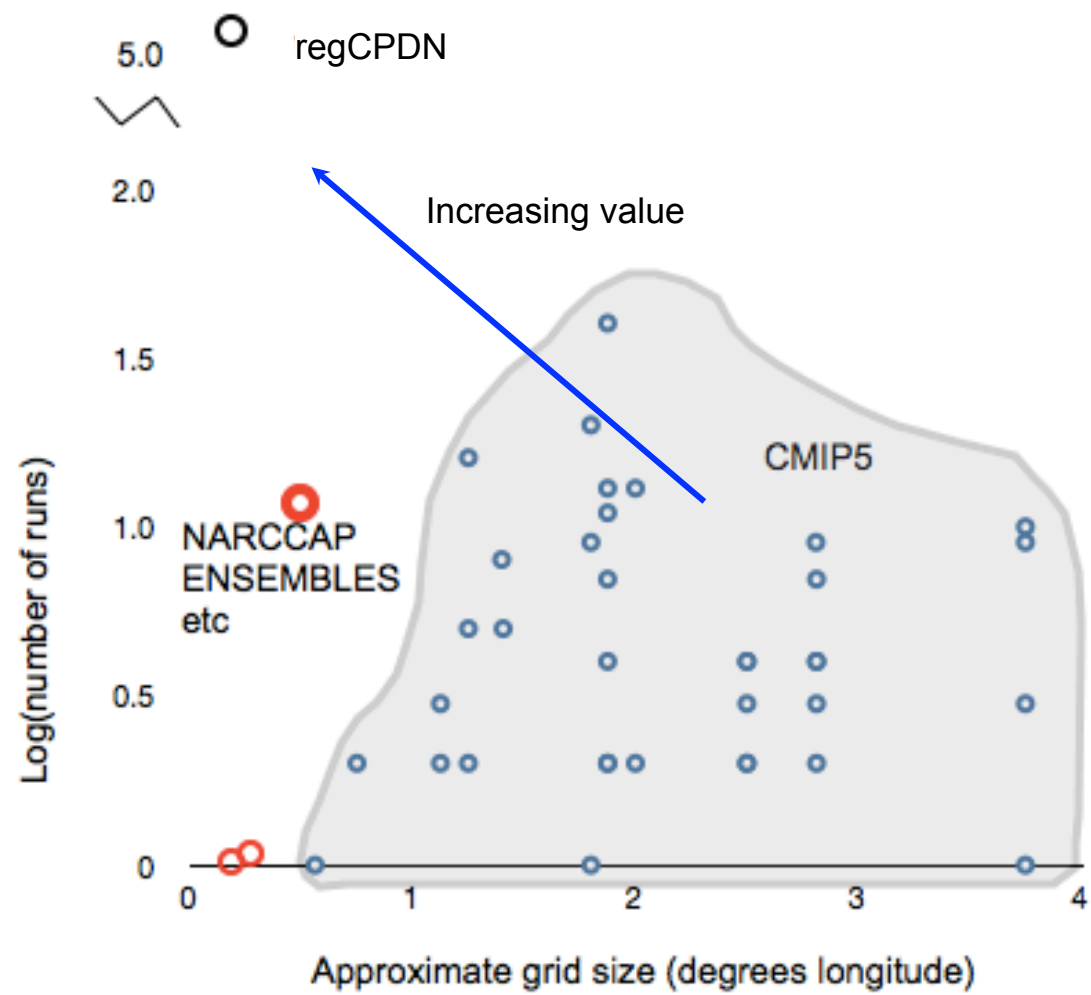
**Δ Maximum Temperature Jun-Aug
2070-2099 vs. 1950-2005, RCP8.5: Units= $^{\circ}\text{C}$**



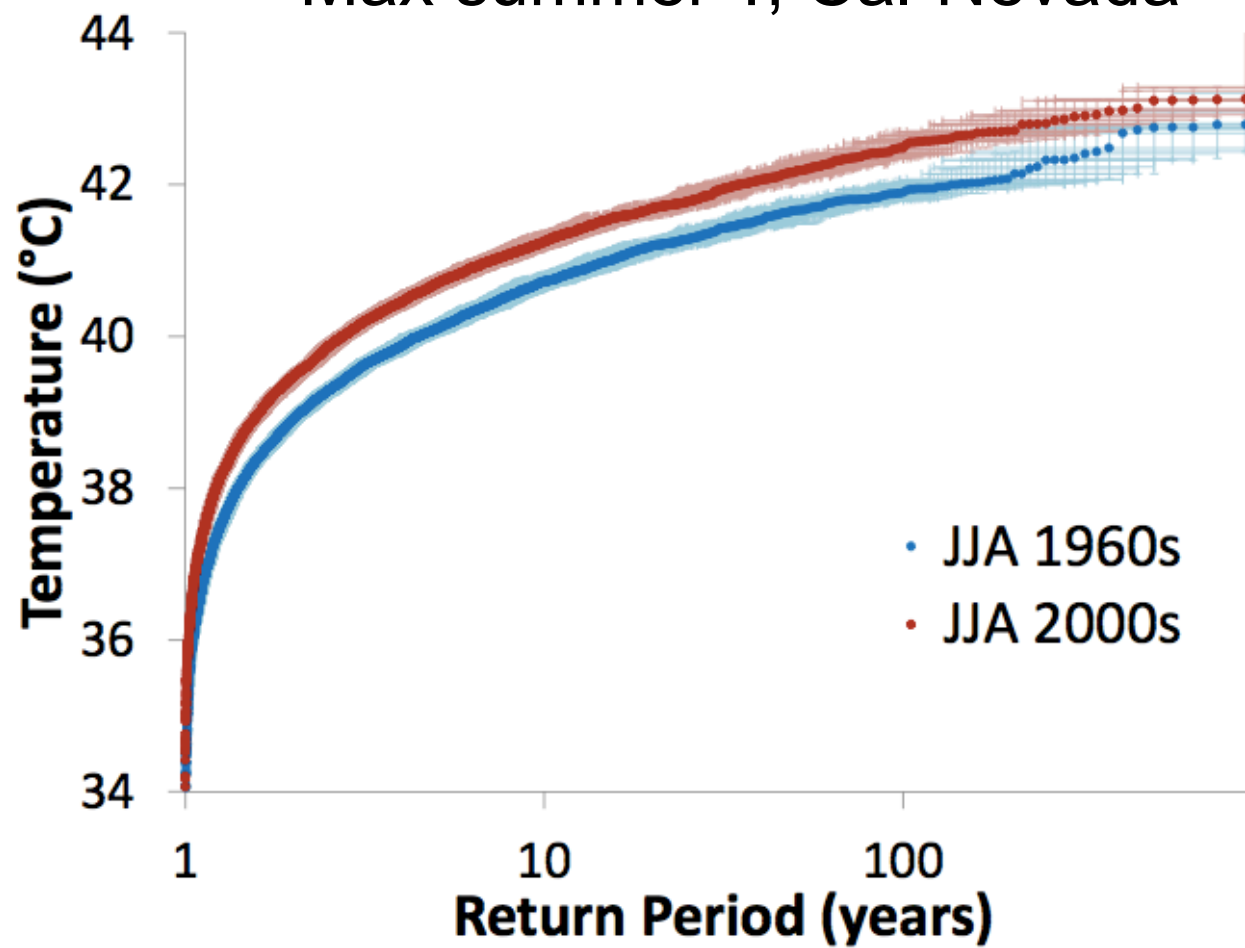
RCM: 1 ensemble member JJA difference in precipitation



O'Brien et al. 2011



Max summer T, Cal-Nevada



Mote et al, BAMS in review

Research Questions

Are robust patterns of climate change observed across regional climate models?

What physical processes explain those robust patterns?

What might account for differences among models?

Methods

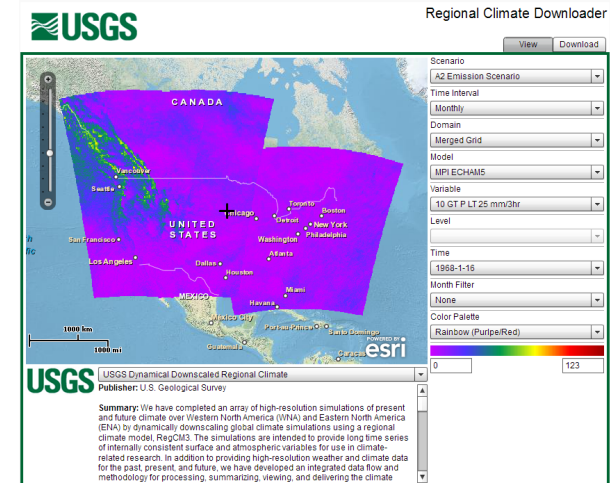
Focus on 4 Primary Variables

–Tmax,Tmin,Precip, snow water equivalent (SWE)

Focus on PNW domain

–spatial domain was not identical across all 3 models

Seasonal means



North American Regional Climate Change Assessment Program (NARCCAP)

The NARCCAP dataset contains high-resolution climate change scenario simulation output from multiple RCMs (regional climate models) nested within multiple AGCMs (atmosphere-ocean general circulation models) for 30-year current and future periods.

The RCMs are run at 50-km spatial resolution over a domain covering the conterminous United States and most of Canada; results are recorded at 3-hourly intervals. The driving AGCMs are forced with the A2 SRES emissions scenario in the future period. This dataset also includes output from two timeslice experiments and a set of 25-year RCM simulations driven with NCEP-2 reanalysis data. These simulation results are useful for impacts analysis, further downscaling experiments, and analysis of model performance and uncertainty in regional scale projections of future climate.

When publishing research based on NARCCAP data, please include a citation for the dataset itself, such as the following:

Mearns, L.O., et al., 2007, updated 2014. *The North American Regional Climate Change Assessment Program dataset*. National Center for Atmospheric Research Earth System Grid data portal, Boulder, CO. Data downloaded 2014-08-01. [[doi:10.5065/96933571](https://doi.org/10.5065/96933571)]

[NARCCAP Homepage](#)
[Model Information](#)

This dataset is open access. Registration is not required, but we encourage NARCCAP data users to share their research interests at the [NARCCAP User Directory](#).

RCM	Driving Model			
	NCEP	CCSM	CGCM3	GFDL HadCM3
CRCM	data	data	data	data
ECP2	data	data	data	data
HRM3	data	data	data	data
MM5	data	data	data	data
RCM3	data	data	data	data
WRF	data	data	data	data
Timeslice	data	data	data	data
ECPC	data	data	data	data
WRFP	data	data	data	data

[Download HadCM3 Boundary Condition Data](#)

Focused on 3 RCM experiments for Analysis

NARCCAP (1968–1999, 2038–2069)

- 50km resolution

- 10 GCM–RCM pairs

regCPDN (1985–2005, 2029–2049)

- 25km resolution

- 1 GCM–RCM pairing

- Super-ensemble (>100K runs as part of weather@home project)

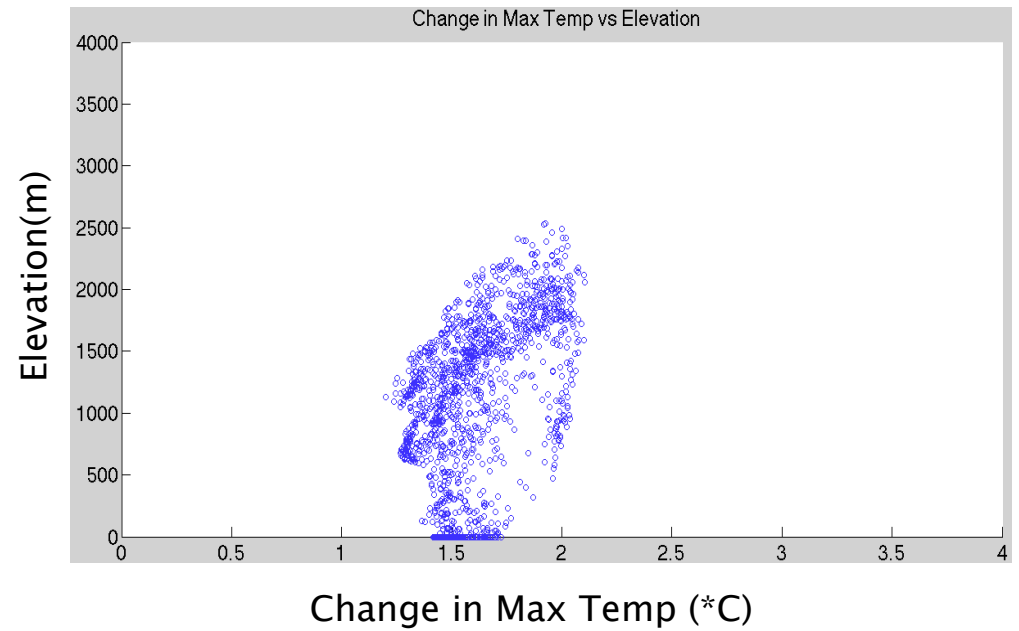
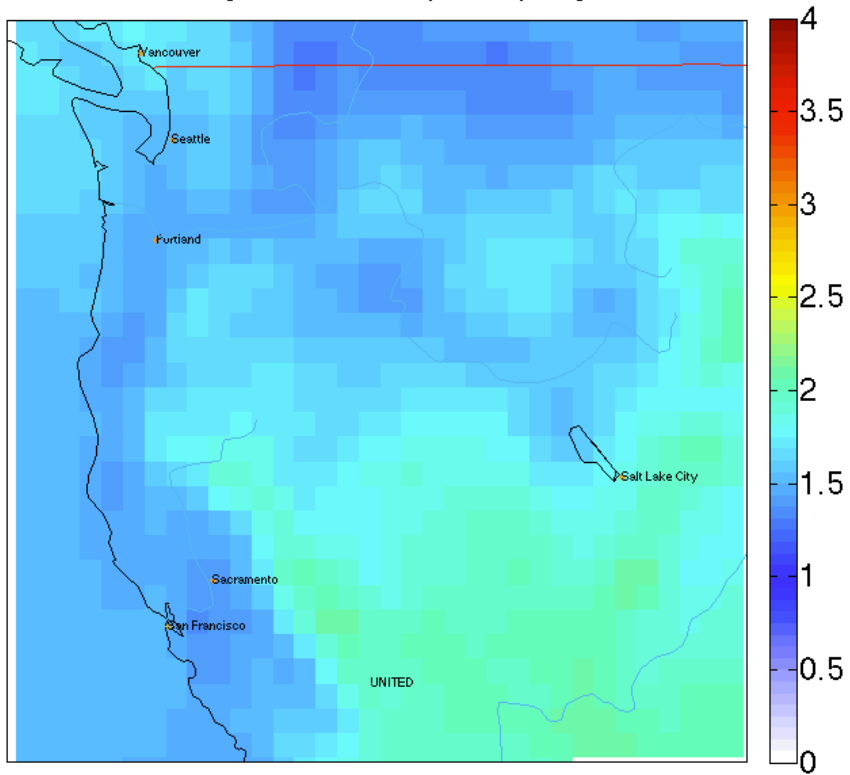
regCLIM (1969–1999, 2039–2069)

- 15km resolution

- 3 GCM–RCM pairing

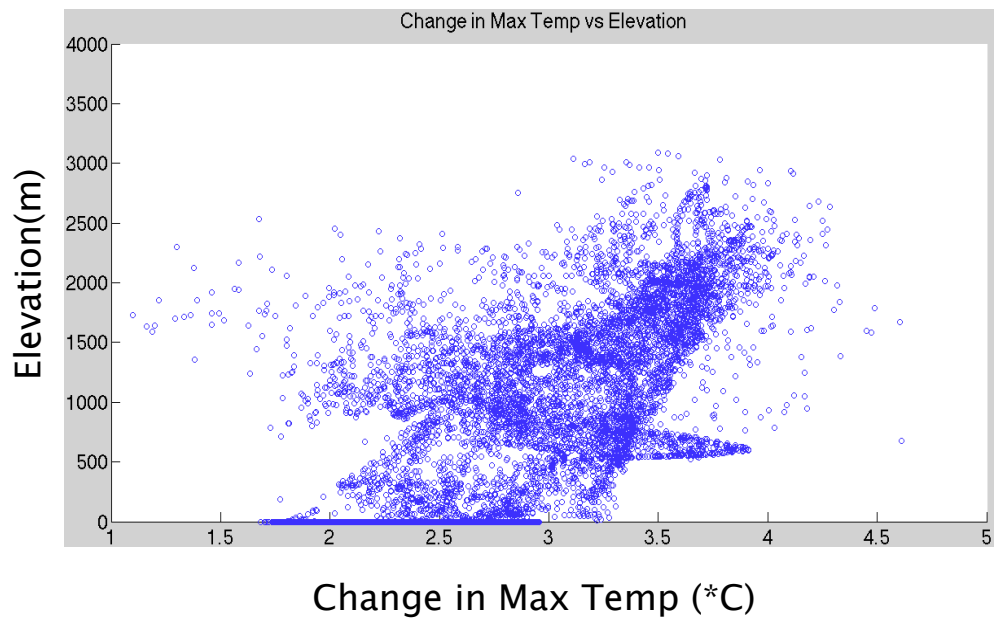
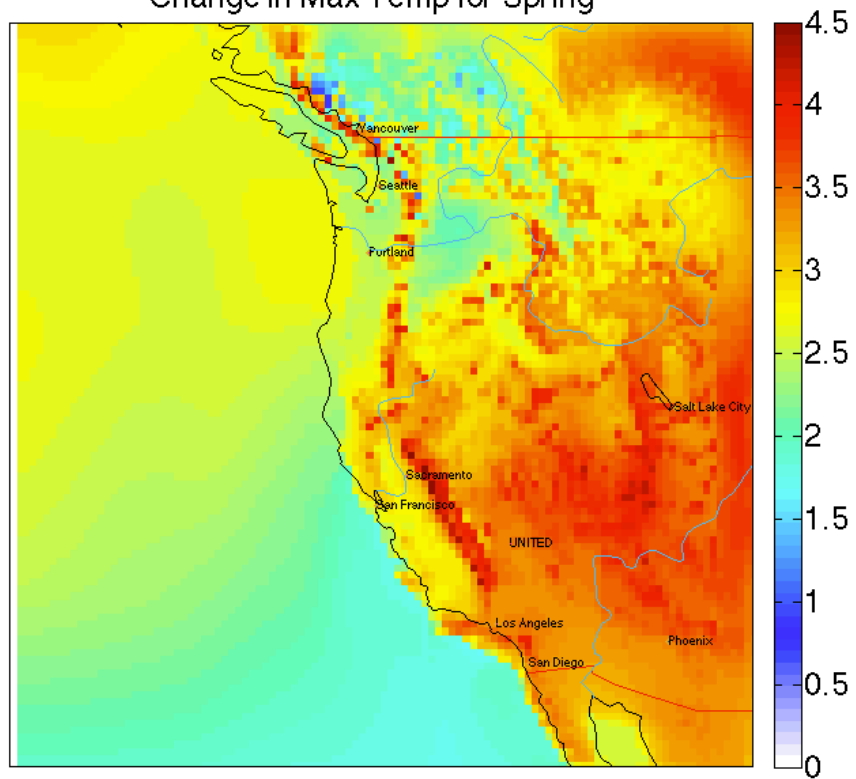
NARCCAP

Change in Max Temp for Spring



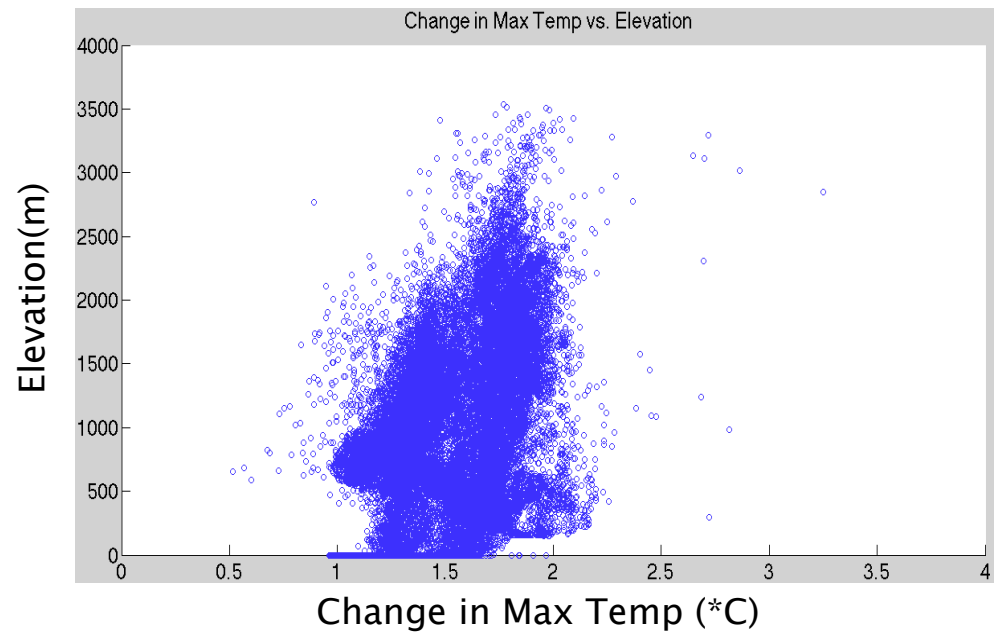
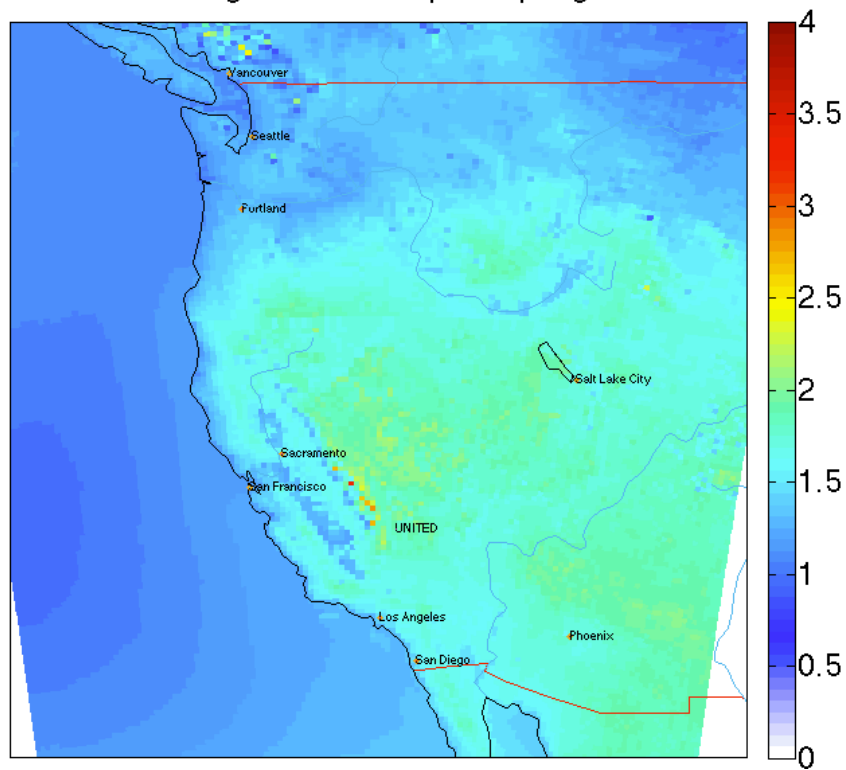
regCPDN

Change in Max Temp for Spring



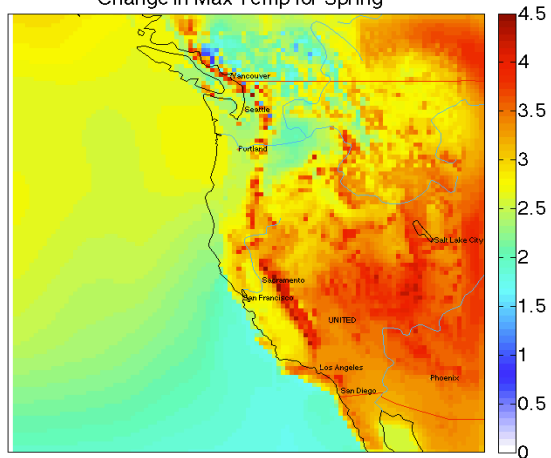
regCLIM

Change in Max Temp for Spring



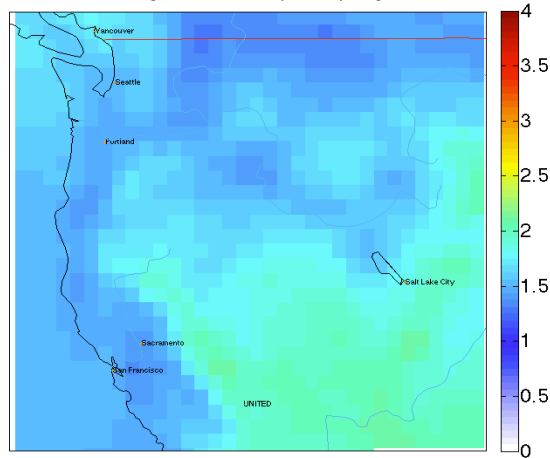
regCPDN

Change in Max Temp for Spring

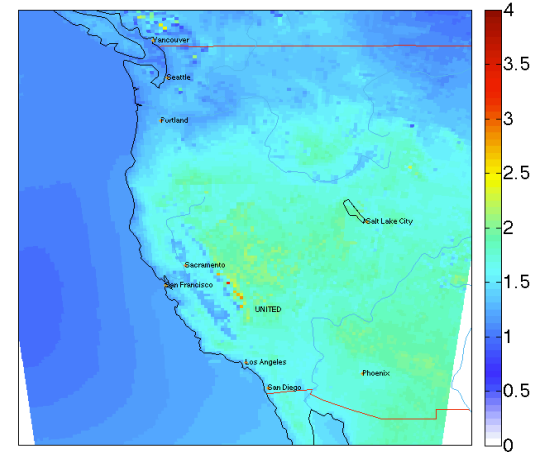


NARCCAP

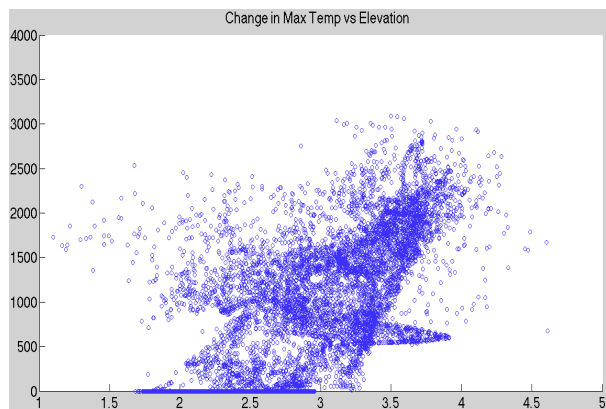
Change in Max Temp for Spring



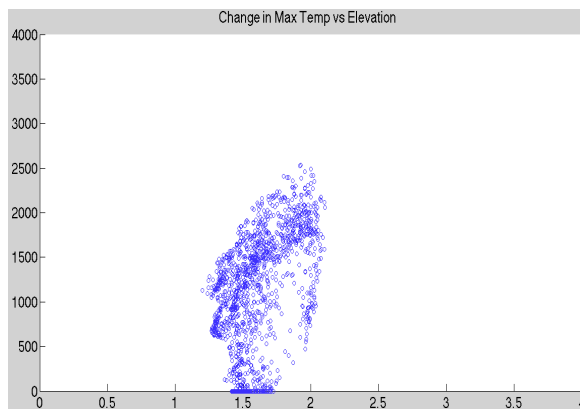
Change in Max Temp for Spring



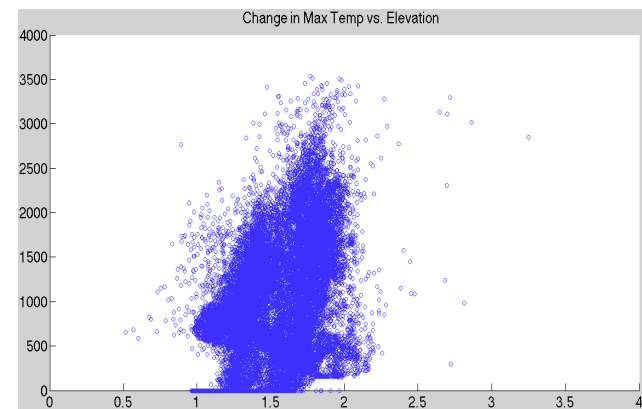
Change in Max Temp vs Elevation



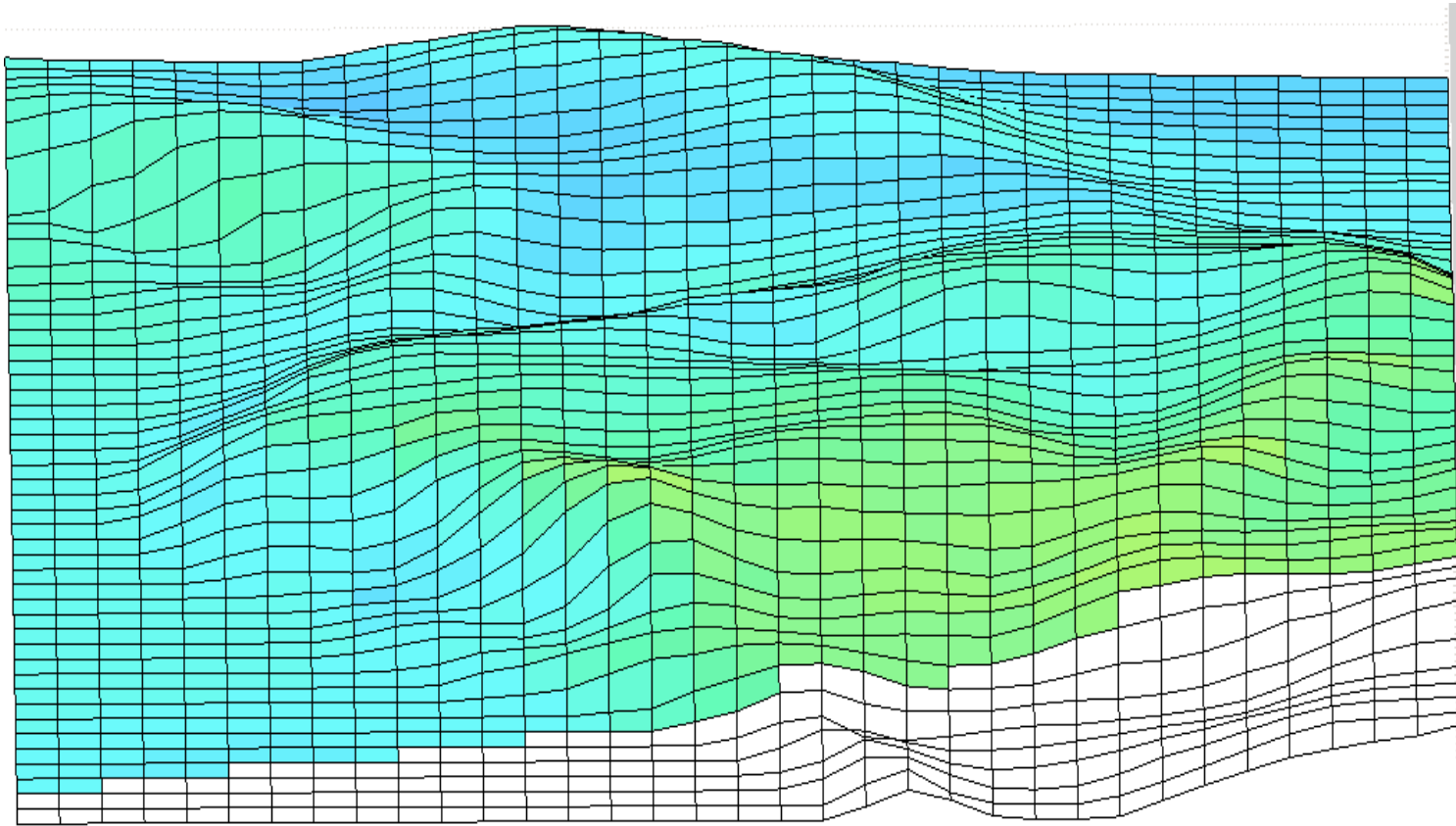
Change in Max Temp vs Elevation



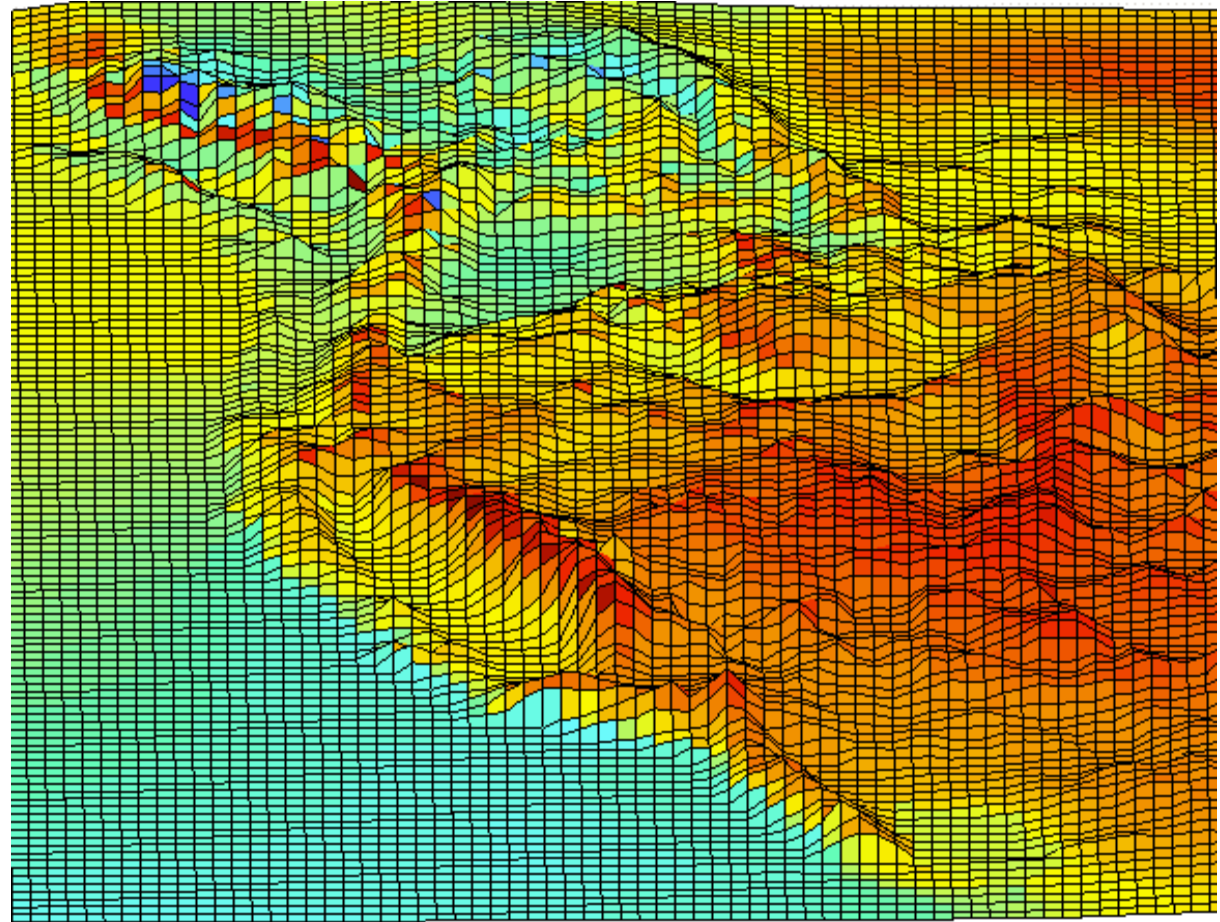
Change in Max Temp vs. Elevation



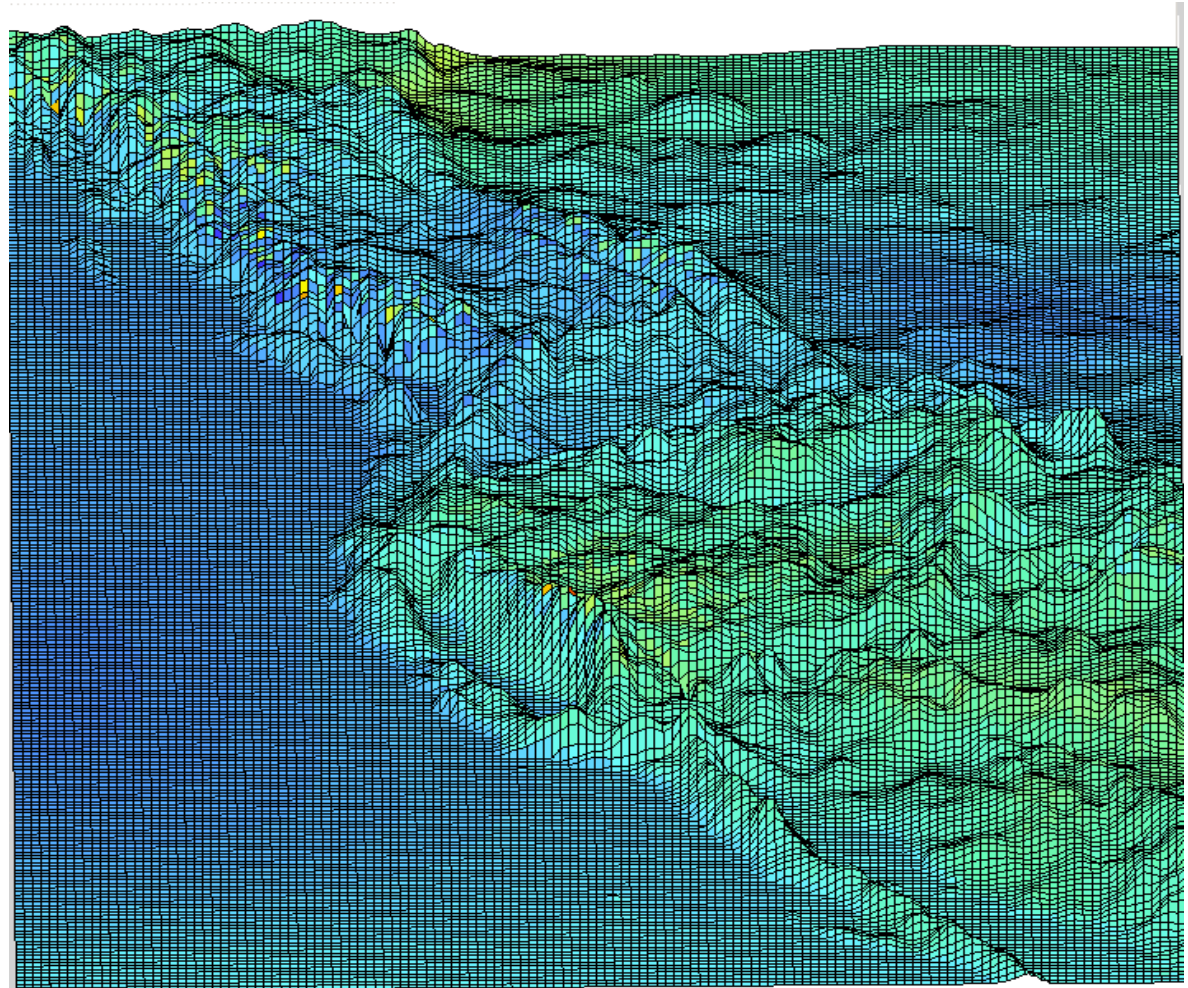
NARRCAP



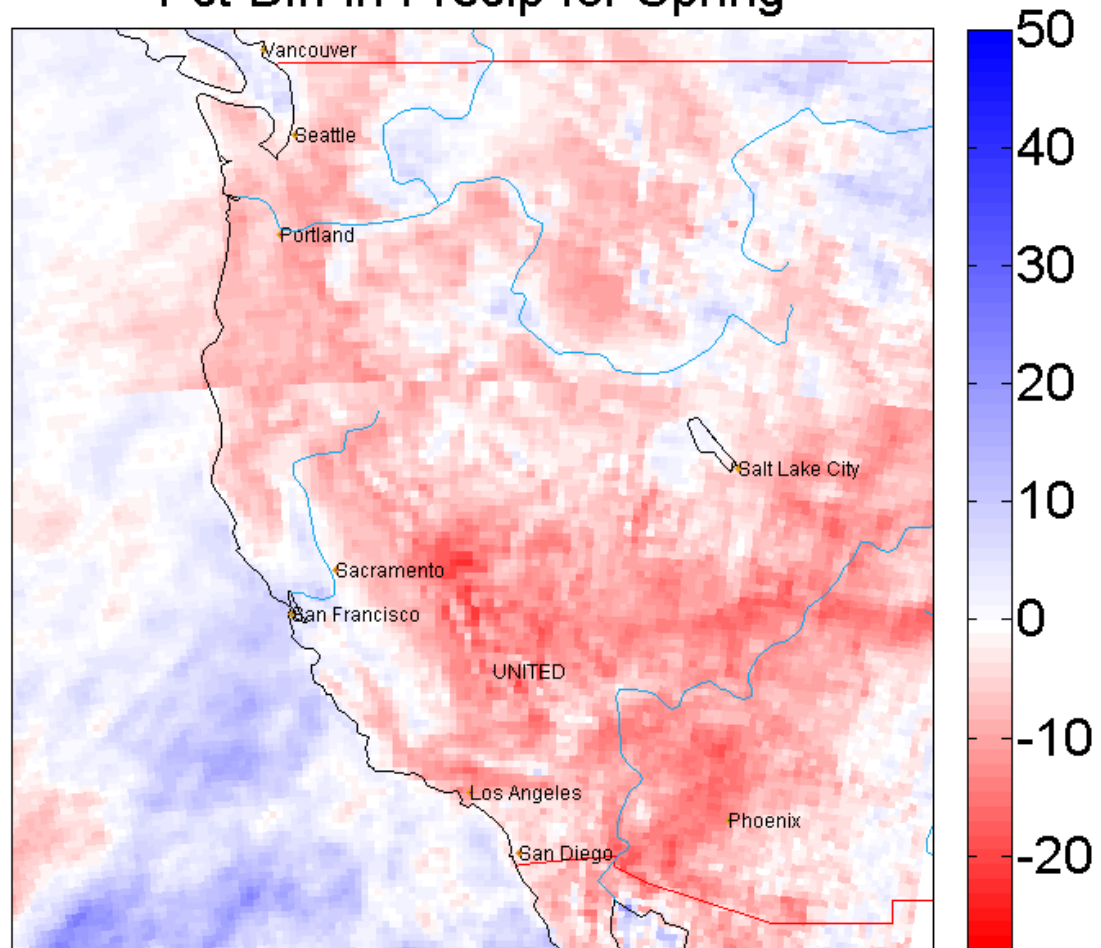
regCPDN



regCLIM

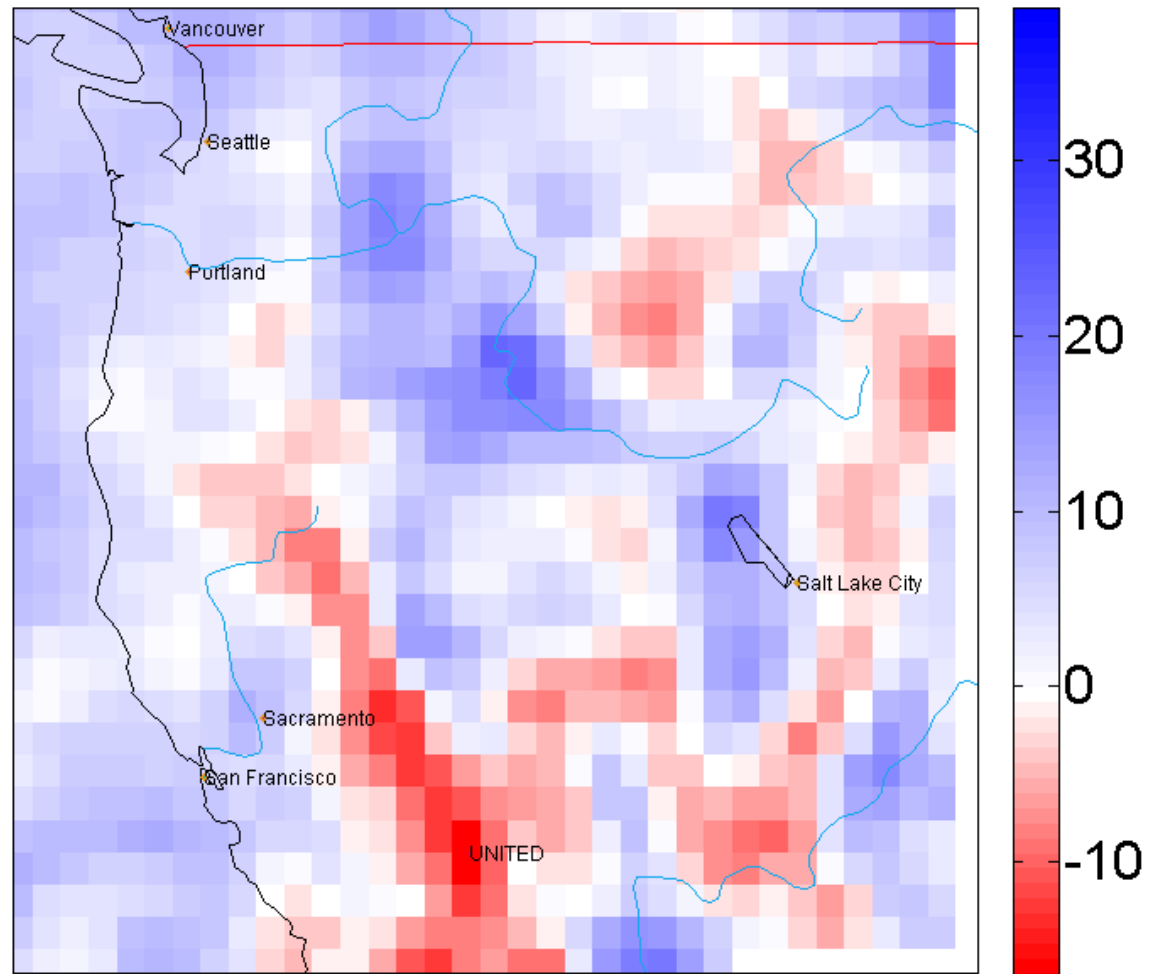


Pct Diff in Precip for Spring



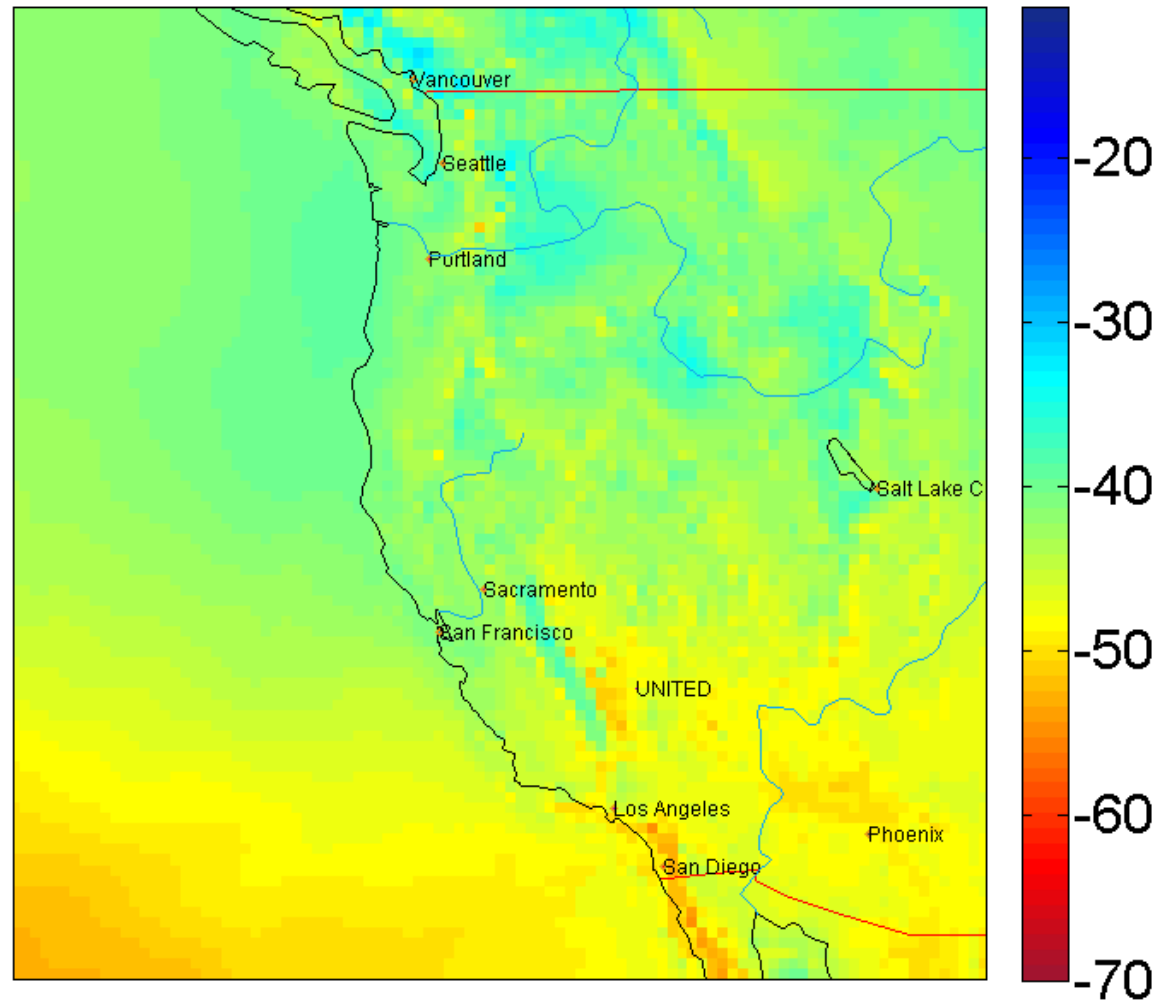
16

Pct Diff in Precip for Spring



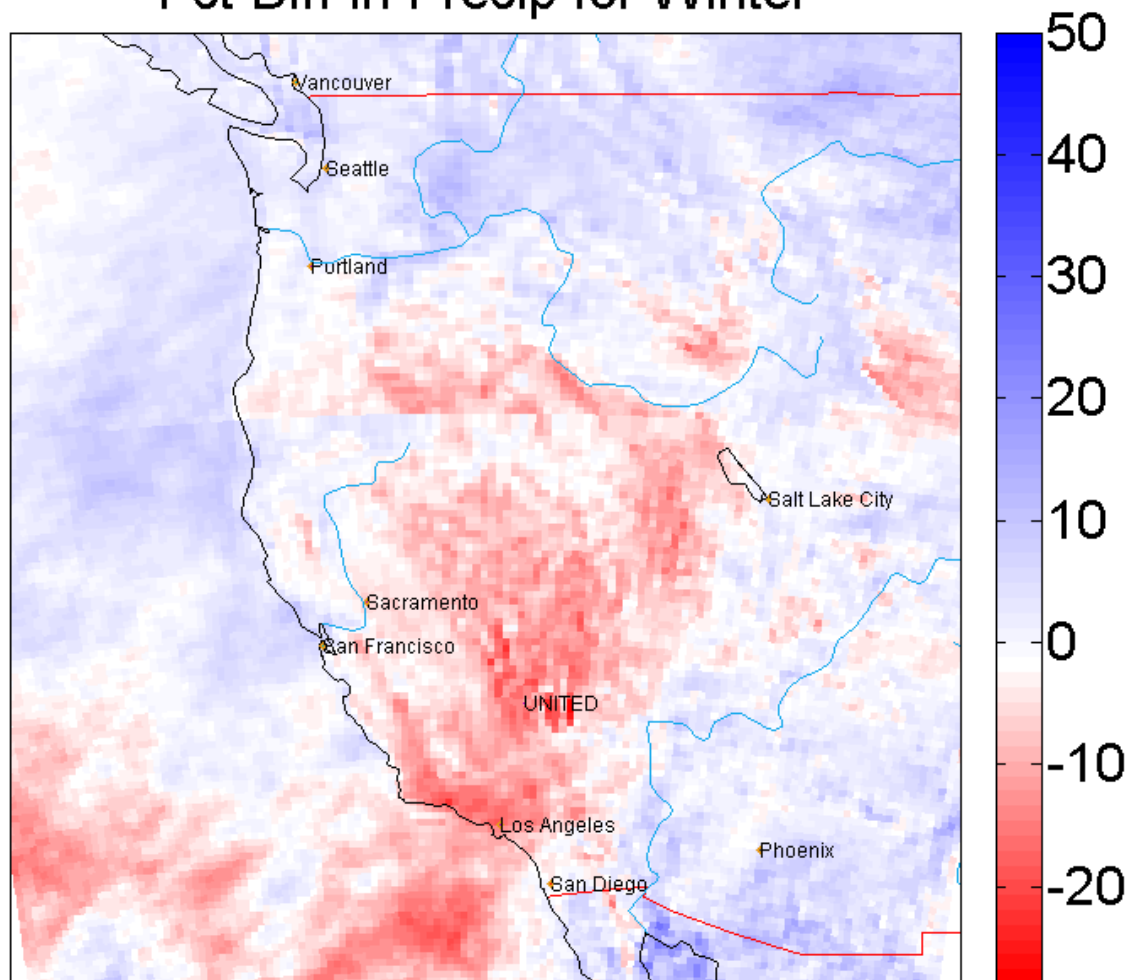
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Pct Diff in Precip for Spring



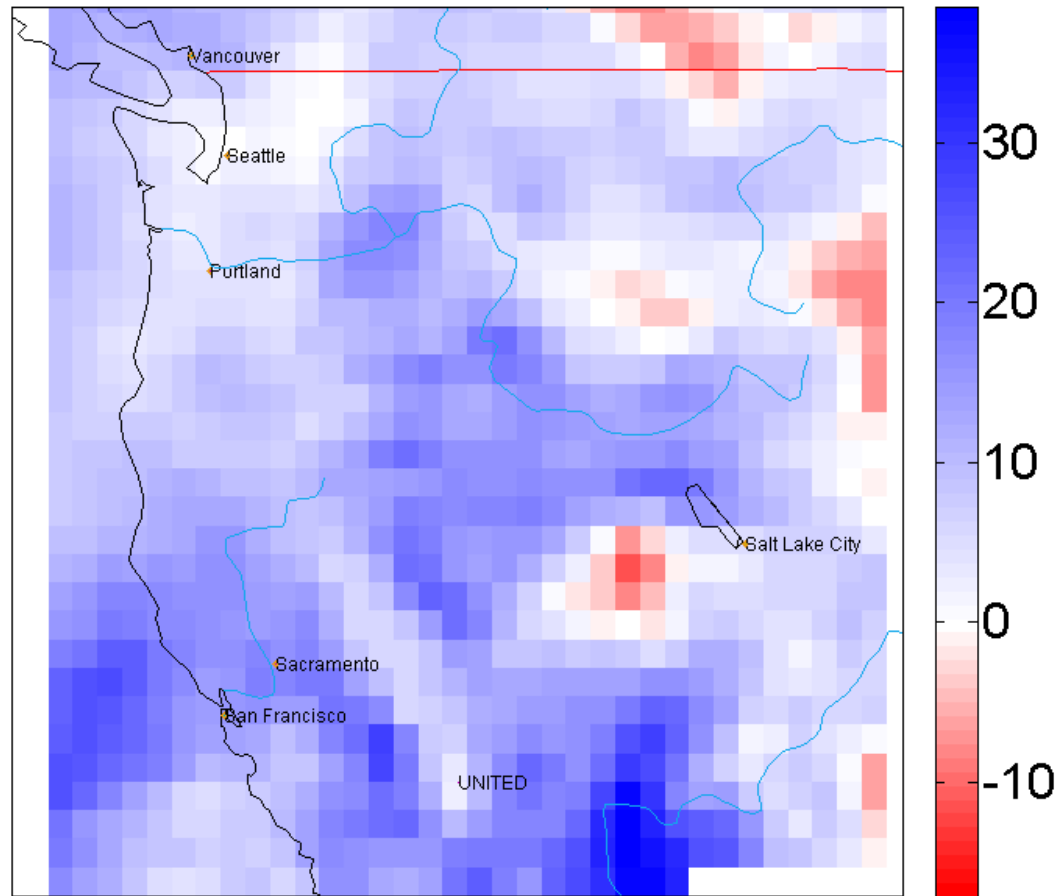
18

Pct Diff in Precip for Winter



19

Pct Diff in Precip for Winter



20

Conclusions

Most robust pattern: influence of elevation on temperature change in spring

Possible patterns: leeward/windward precip contrast (but different locations), coastal contrast in temp in spring only in California

Be very cautious when interpreting a single model simulation