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

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Virginia Tech

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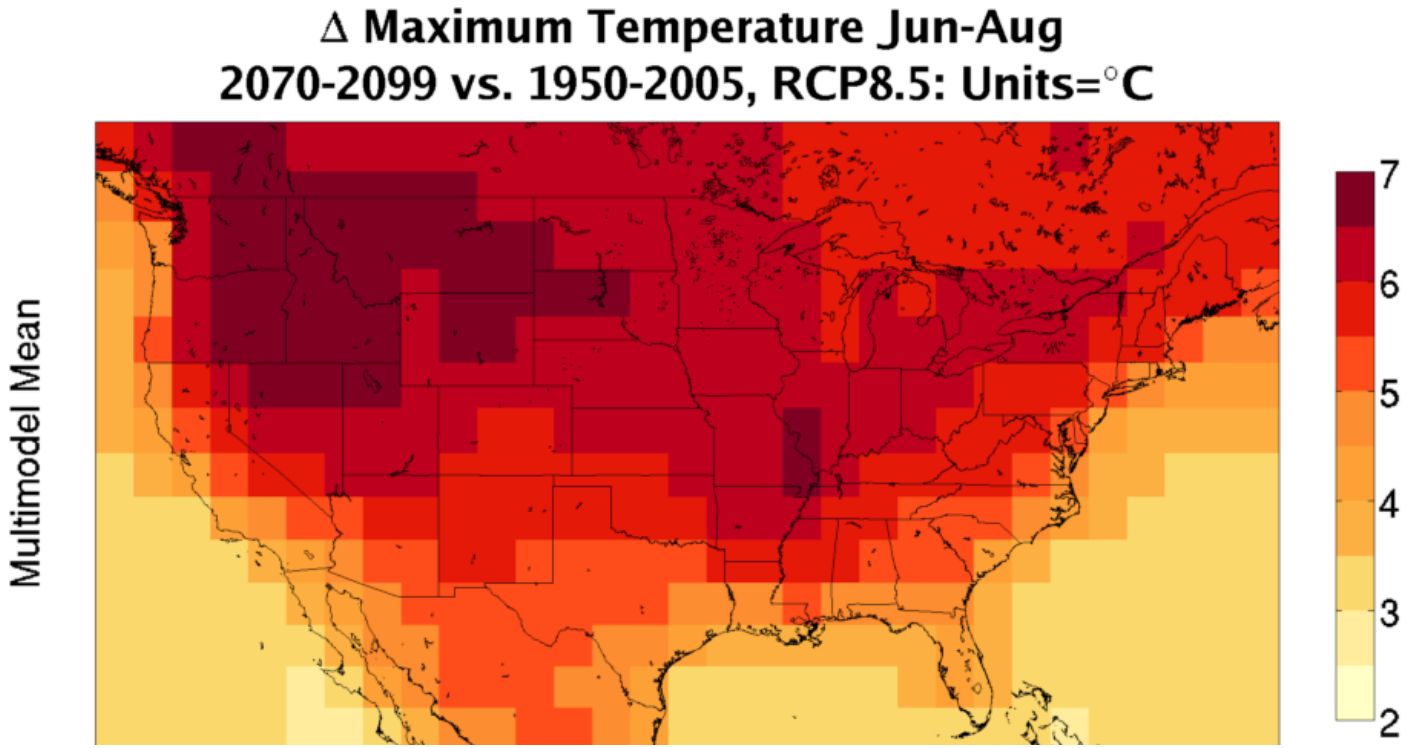
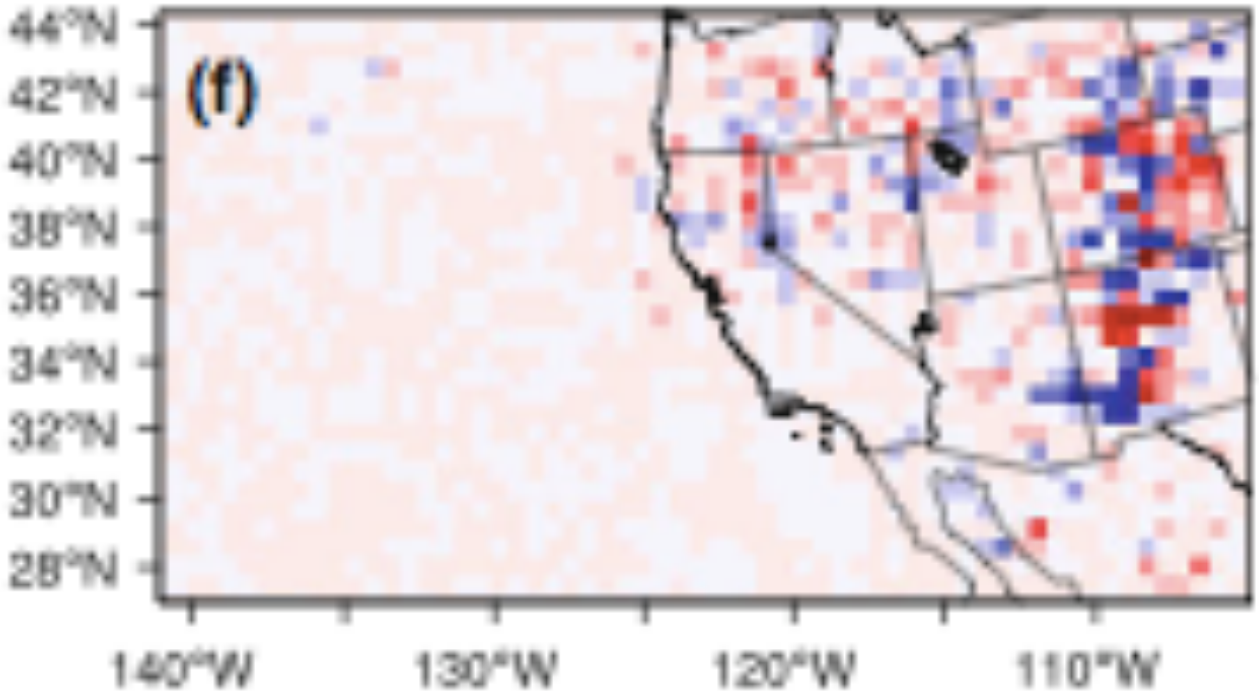
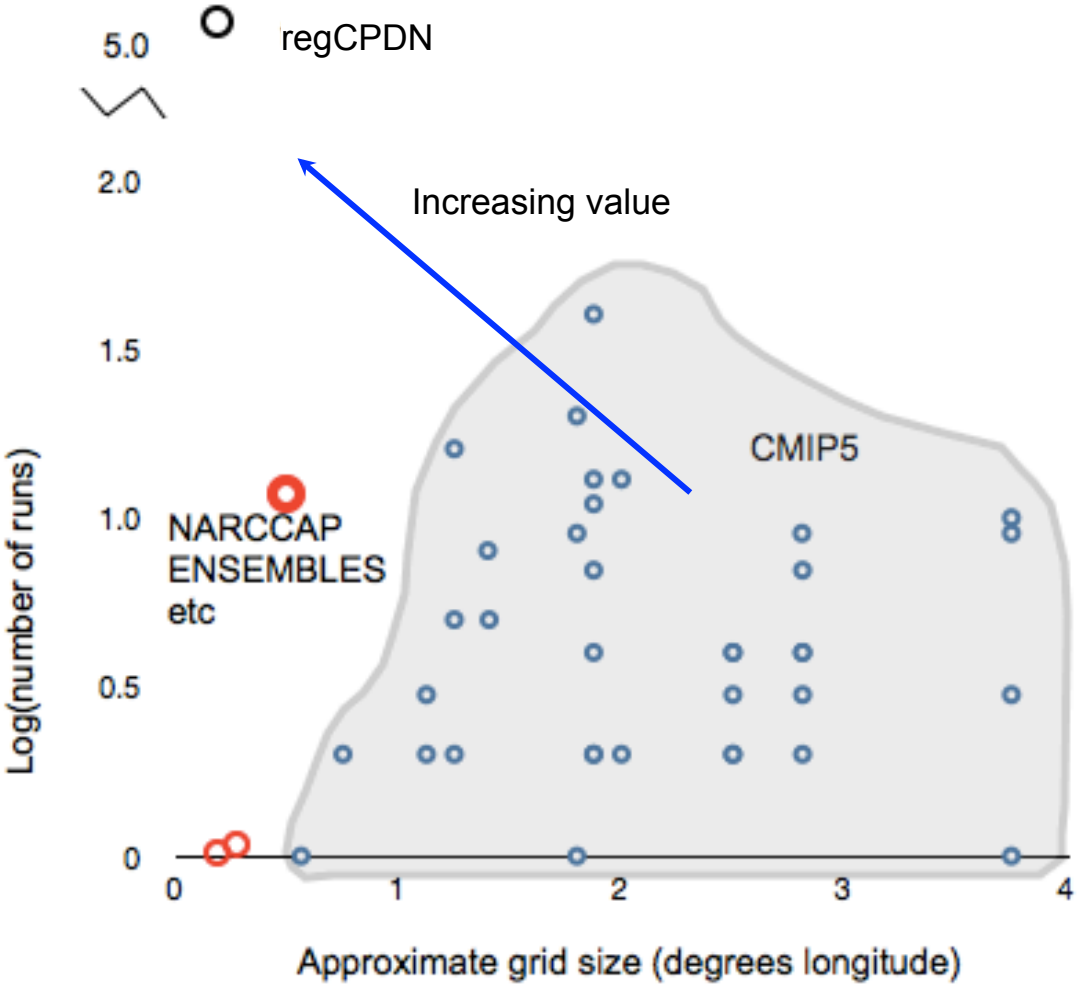
Oregon Climate Change Research Institute, Oregon State University


Δ Maximum Temperature Jun-Aug
2070-2099 vs. 1950-2005, RCP8.5: Units=°C
Multimodel Mean
7
6
5
4
3
2

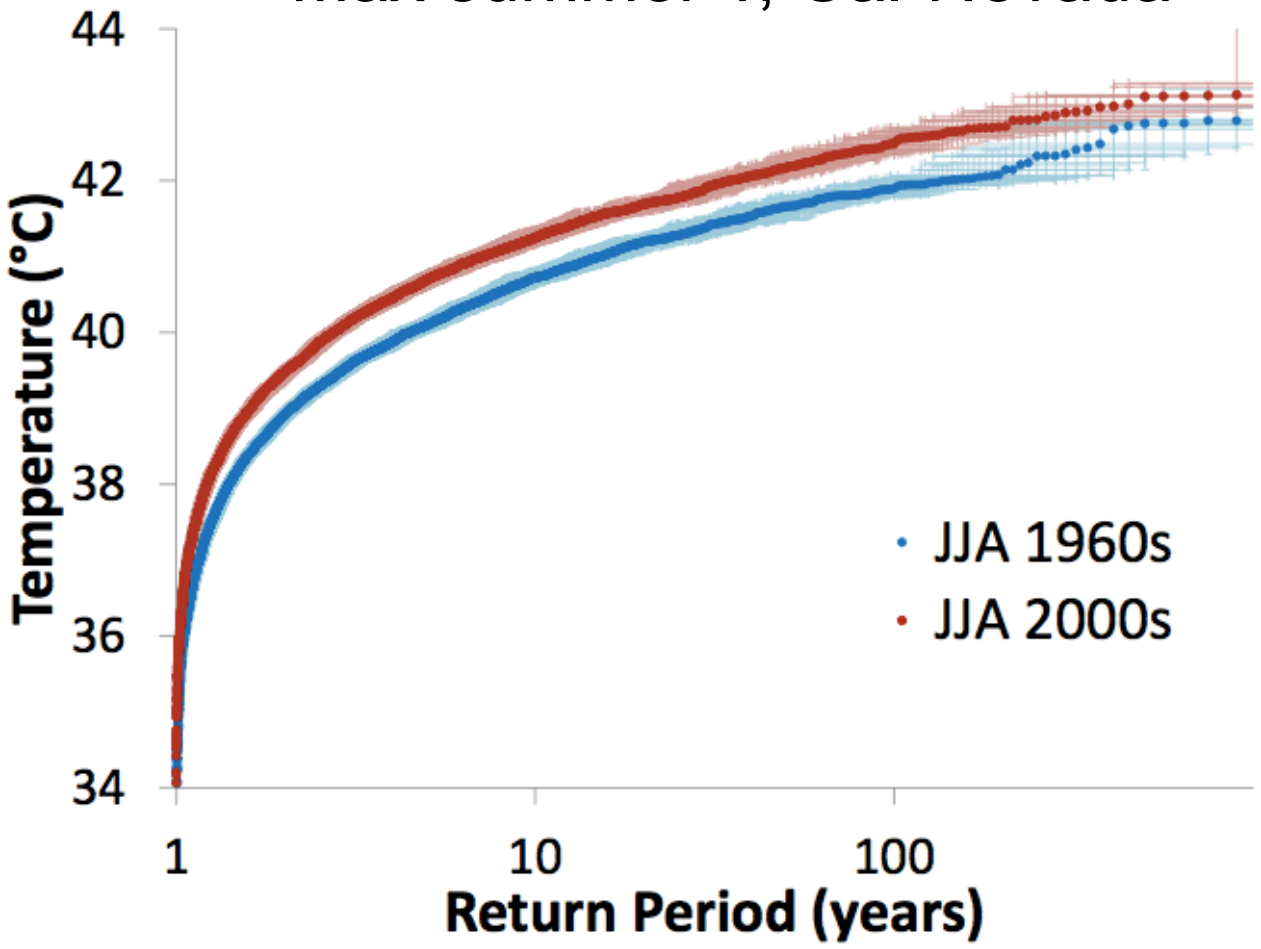
RCM: 1 ensemble member
JJA difference in precipitation



O'Brien et al. 2011


regCPDN
5.0
2.0
1.5
1.0
0.5
0
Increasing value
CMIP5
NARCCAP
ENSEMBLES
etc
Log(number of runs)
0
1
2
3
4
Approximate grid size (degrees longitude)

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?

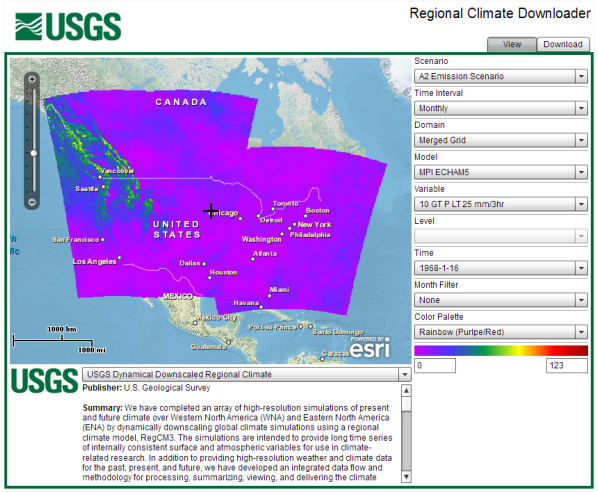
What might account for differences among models?

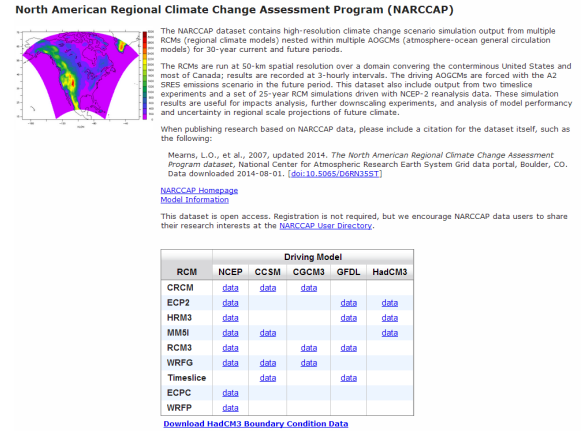
Methods

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





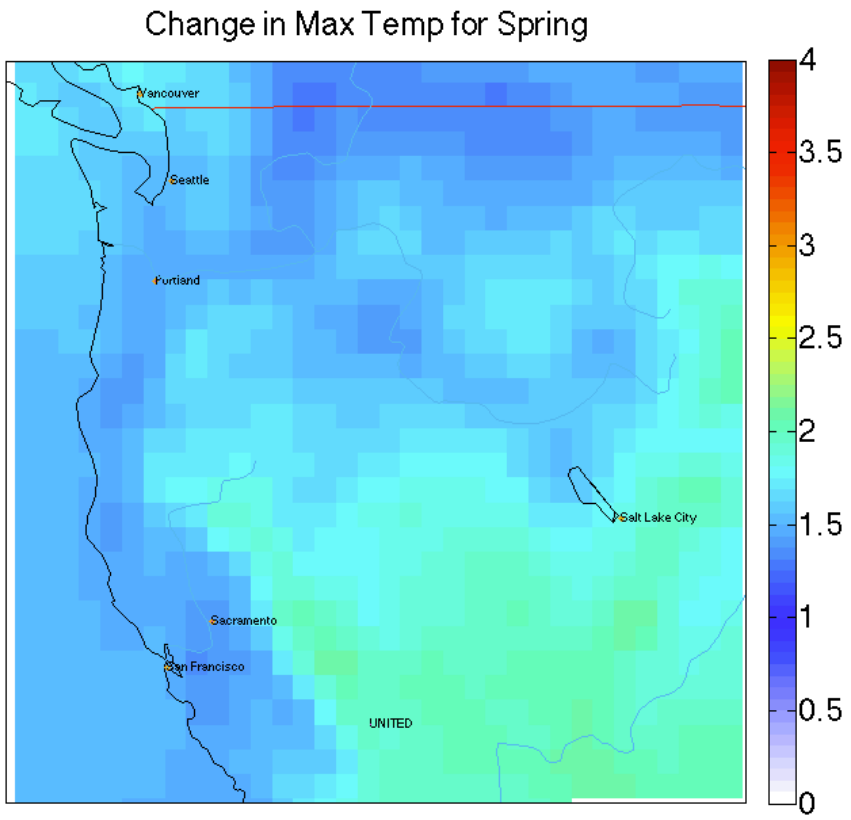
Focused on 3 RCM experiments for Analysis

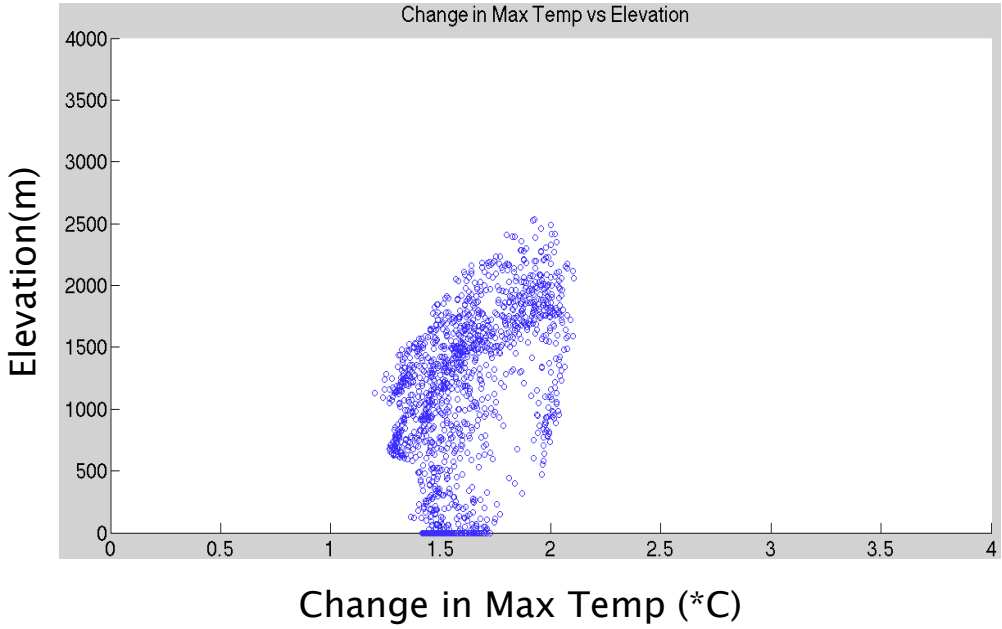
NARCCAP (1968–1999, 2038–2069)
- 50km resolution
- 10 GCM–RCM pairs

regCPDN (1985–2005, 2029–2049)
- 25km resolution
- 1 GCM–RCM pairing
- Super–ensemble (>100K runs as part of weather@home project)

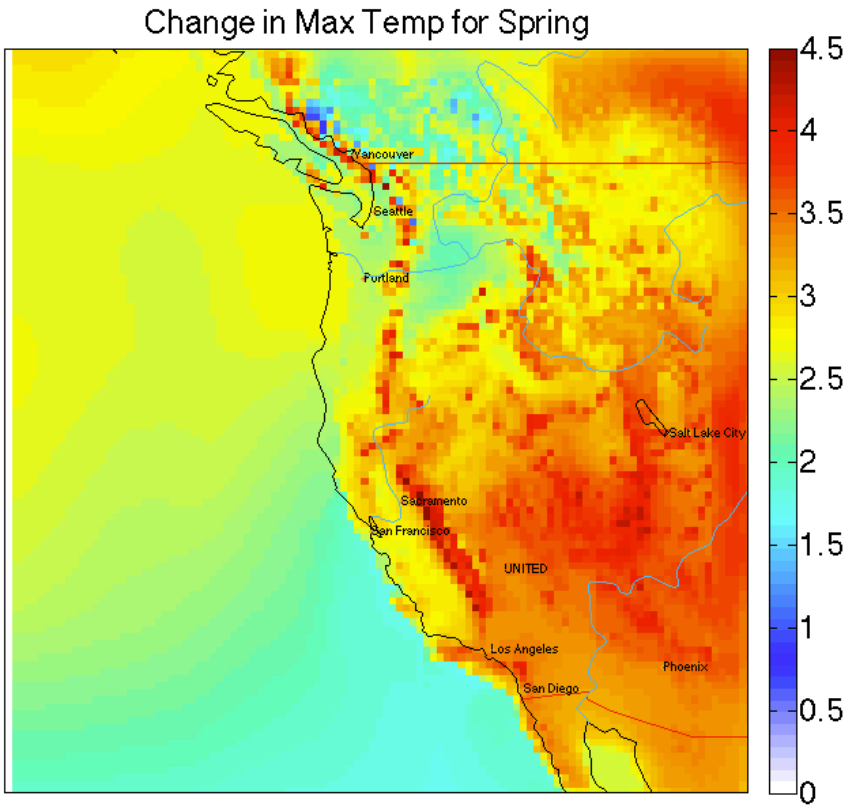
regCLIM (1969–1999, 2039–2069)
- 15km resolution
- 3 GCM–RCM pairing

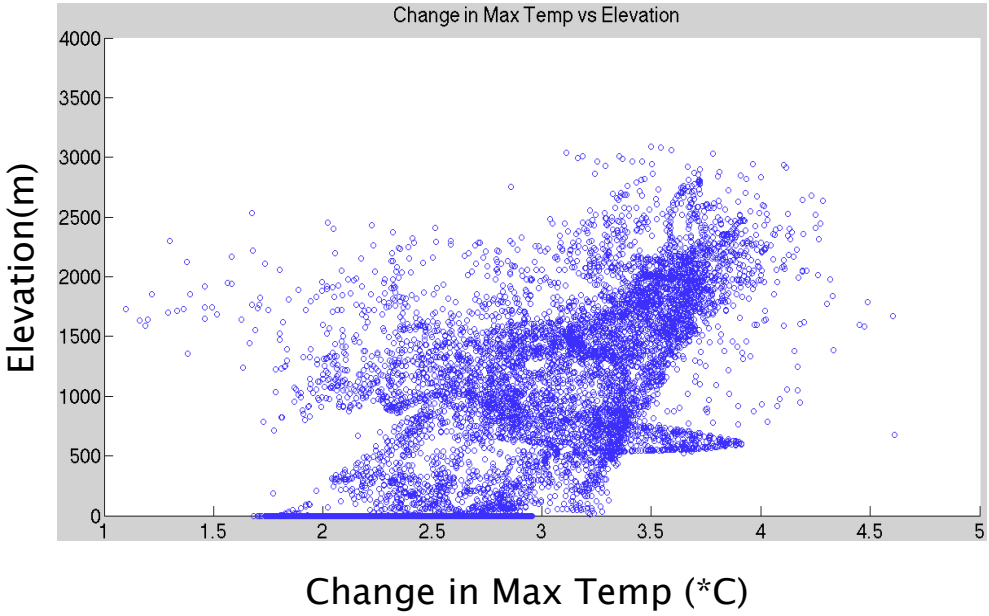
NARCCAP


Change in Max Temp for Spring
Vancouver
Seattle
Portland
Salt Lake City
Sacramento
San Francisco
UNITED
4
3.5
3
2.5
2
1.5
1
0.5
0

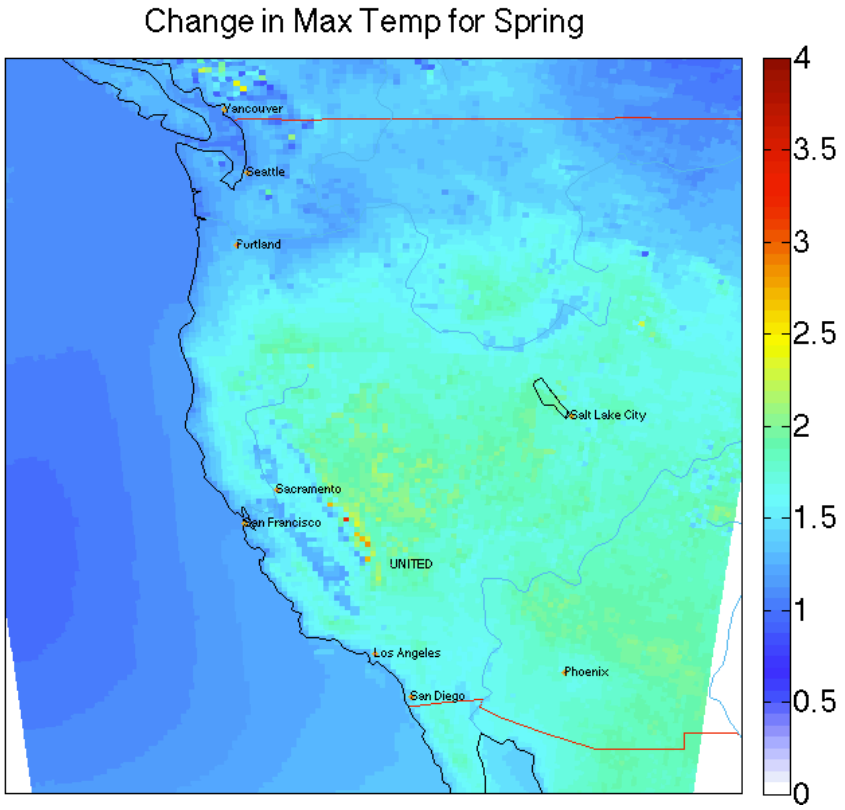

Change in Max Temp vs Elevation
Elevation(m)
4000
3500
3000
2500
2000
1500
1000
500
0
0
0.5
1
1.5
2
2.5
3
3.5
4
Change in Max Temp (*C)

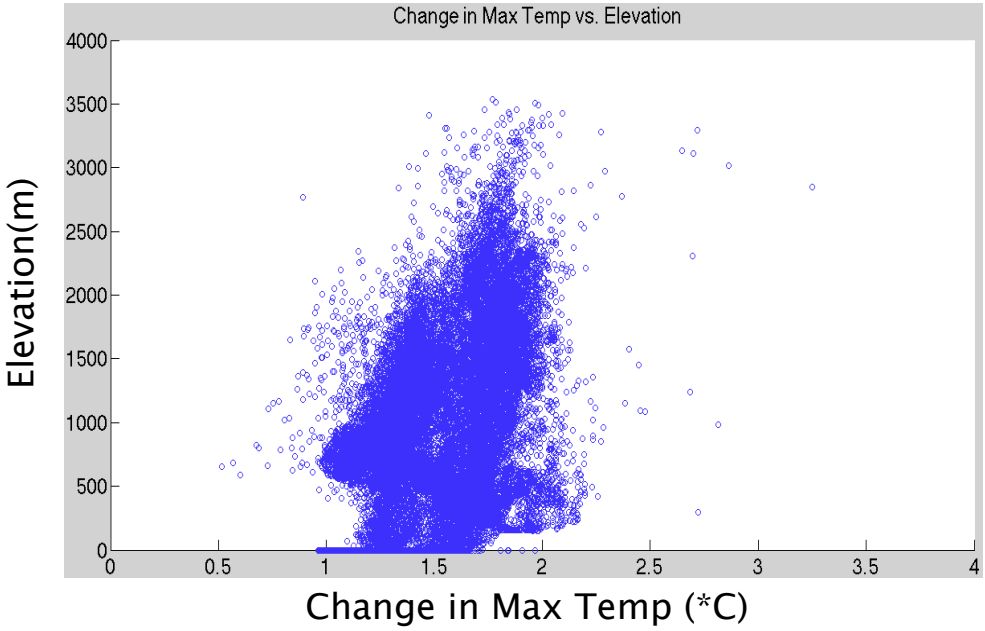
regCPDN


Change in Max Temp for Spring
Vancouver
Seattle
Portland
Salt Lake City
Sacramento
San Francisco
UNITED
Los Angeles
San Diego
Phoenix
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

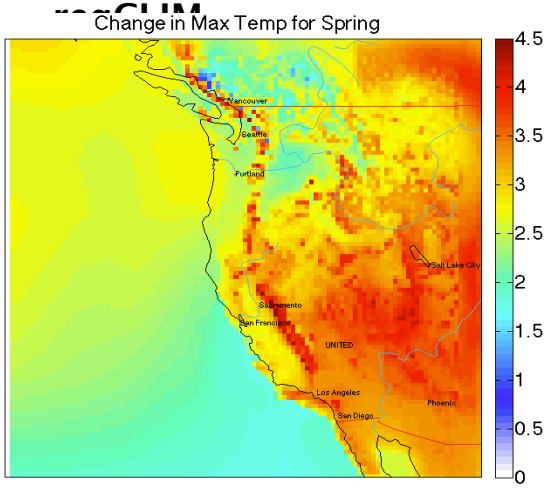

Change in Max Temp vs Elevation
Elevation(m)
4000
3500
3000
2500
2000
1500
1000
500
0
1
1.5
2
2.5
3
3.5
4
4.5
5
Change in Max Temp (*C)

regCLIM

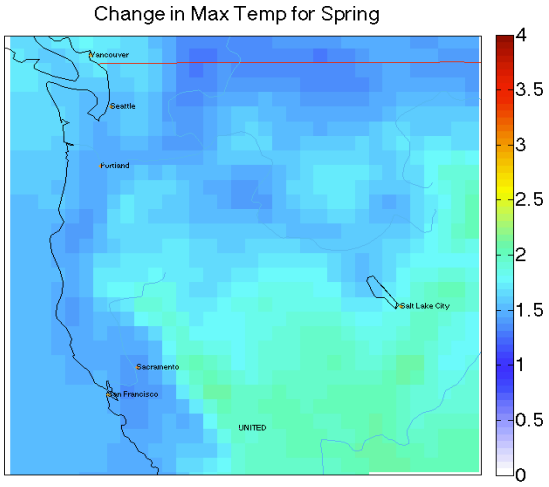

Change in Max Temp for Spring
Vancouver
Seattle
Portland
Salt Lake City
Sacramento
San Francisco
UNITED
Los Angeles
Phoenix
San Diego
4
3.5
3
2.5
2
1.5
1
0.5
0

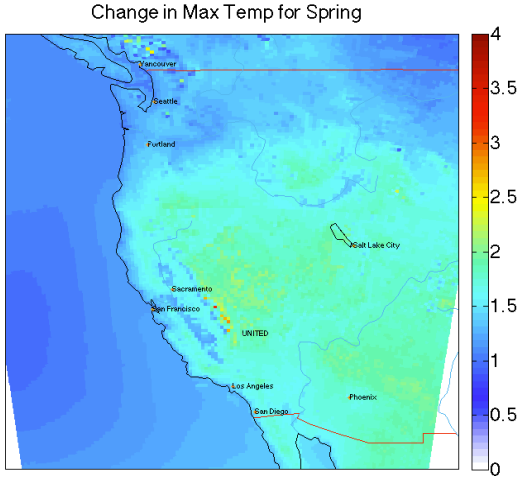

Change in Max Temp vs. Elevation
Elevation(m)
4000
3500
3000
2500
2000
1500
1000
500
0
0
0.5
1
1.5
2
2.5
3
3.5
4
Change in Max Temp (*C)

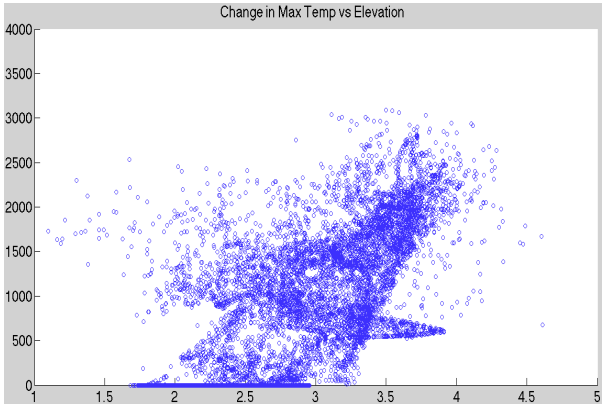
regCPDN

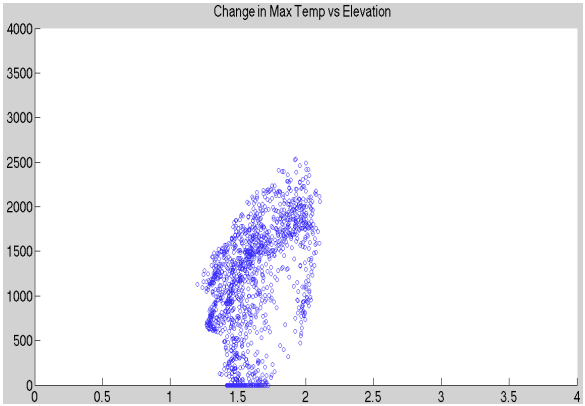


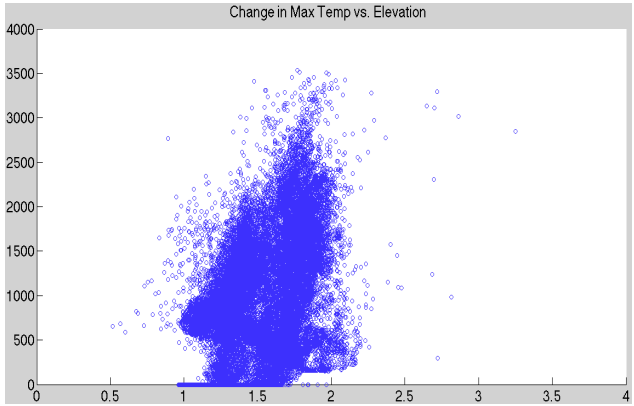
NARCCAP



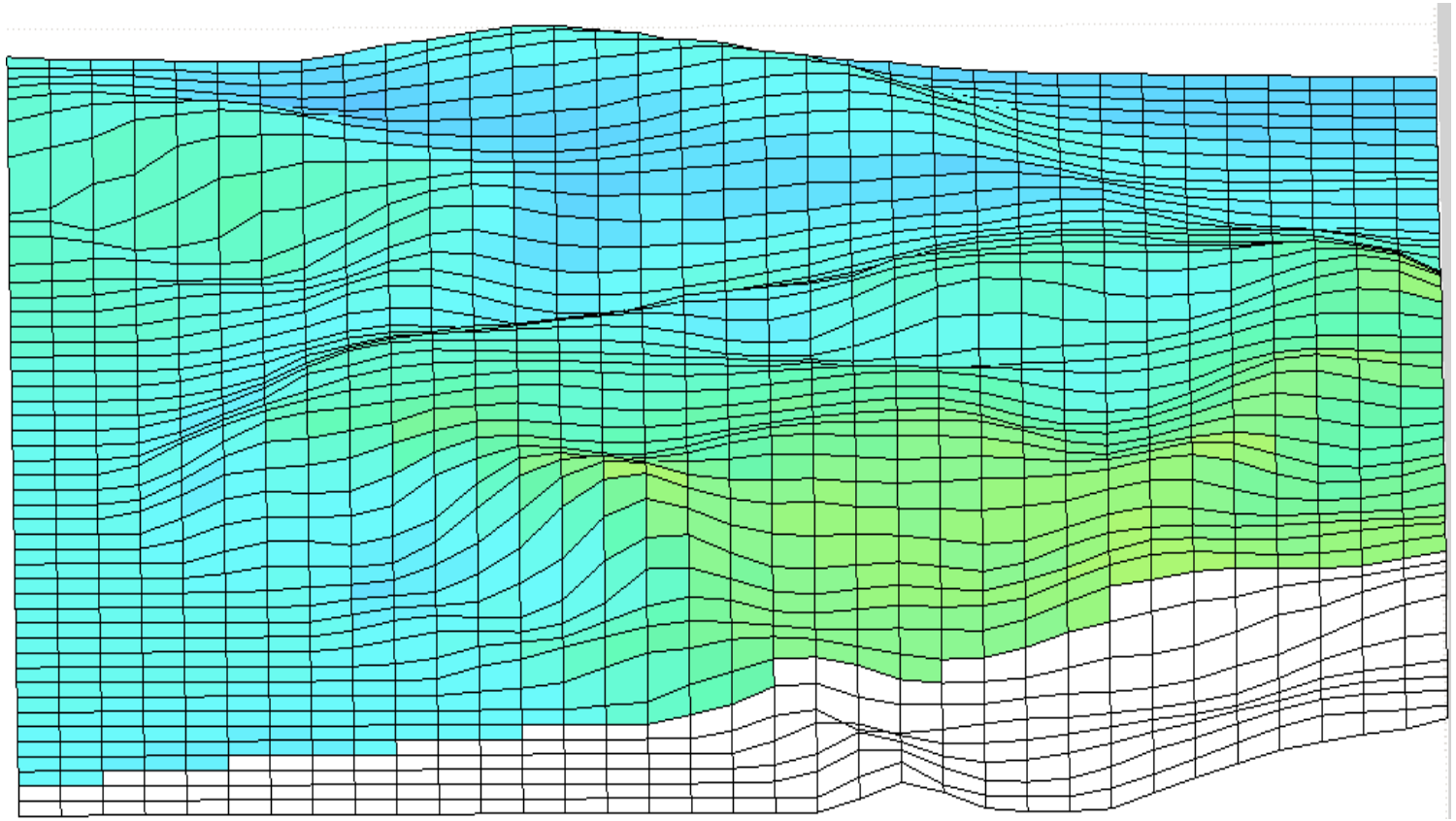




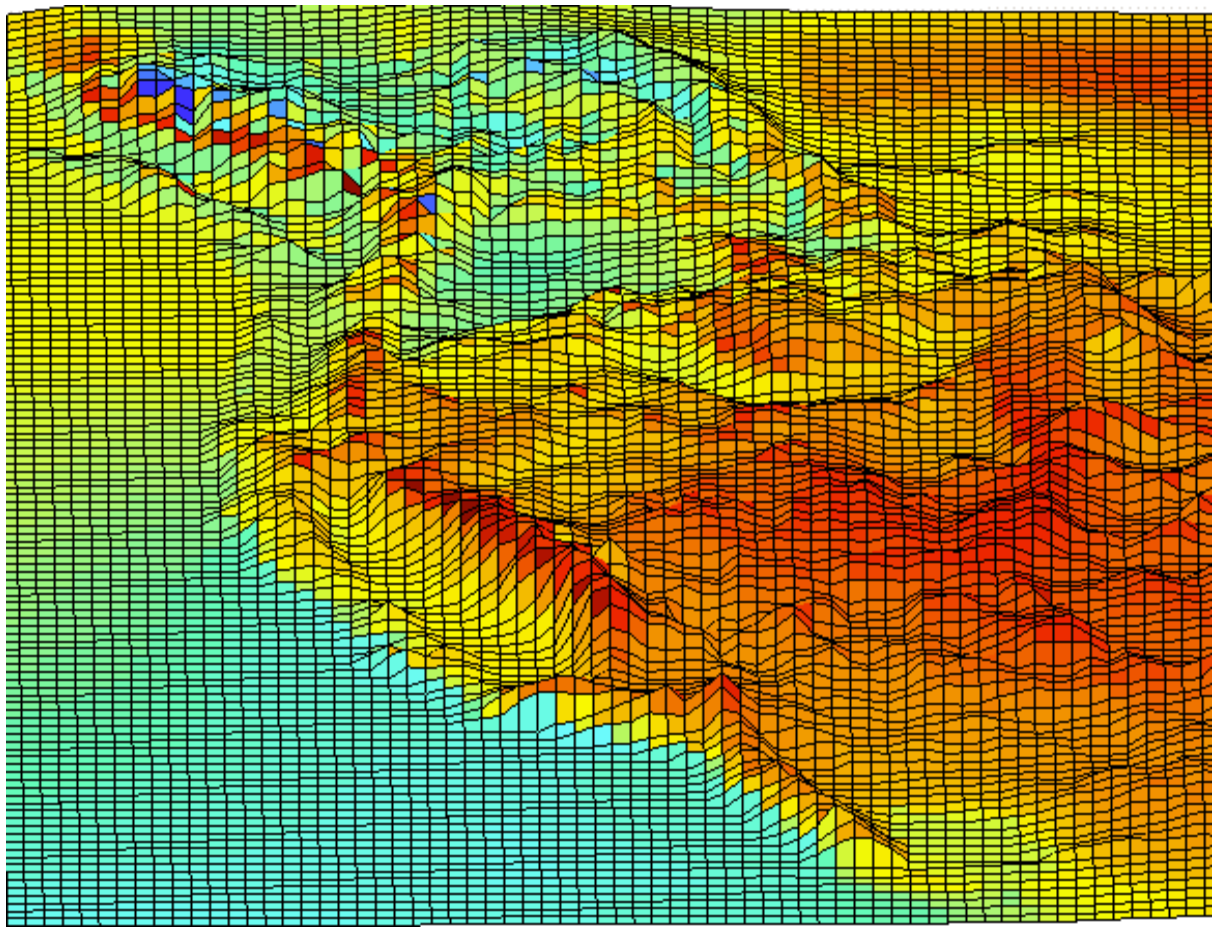




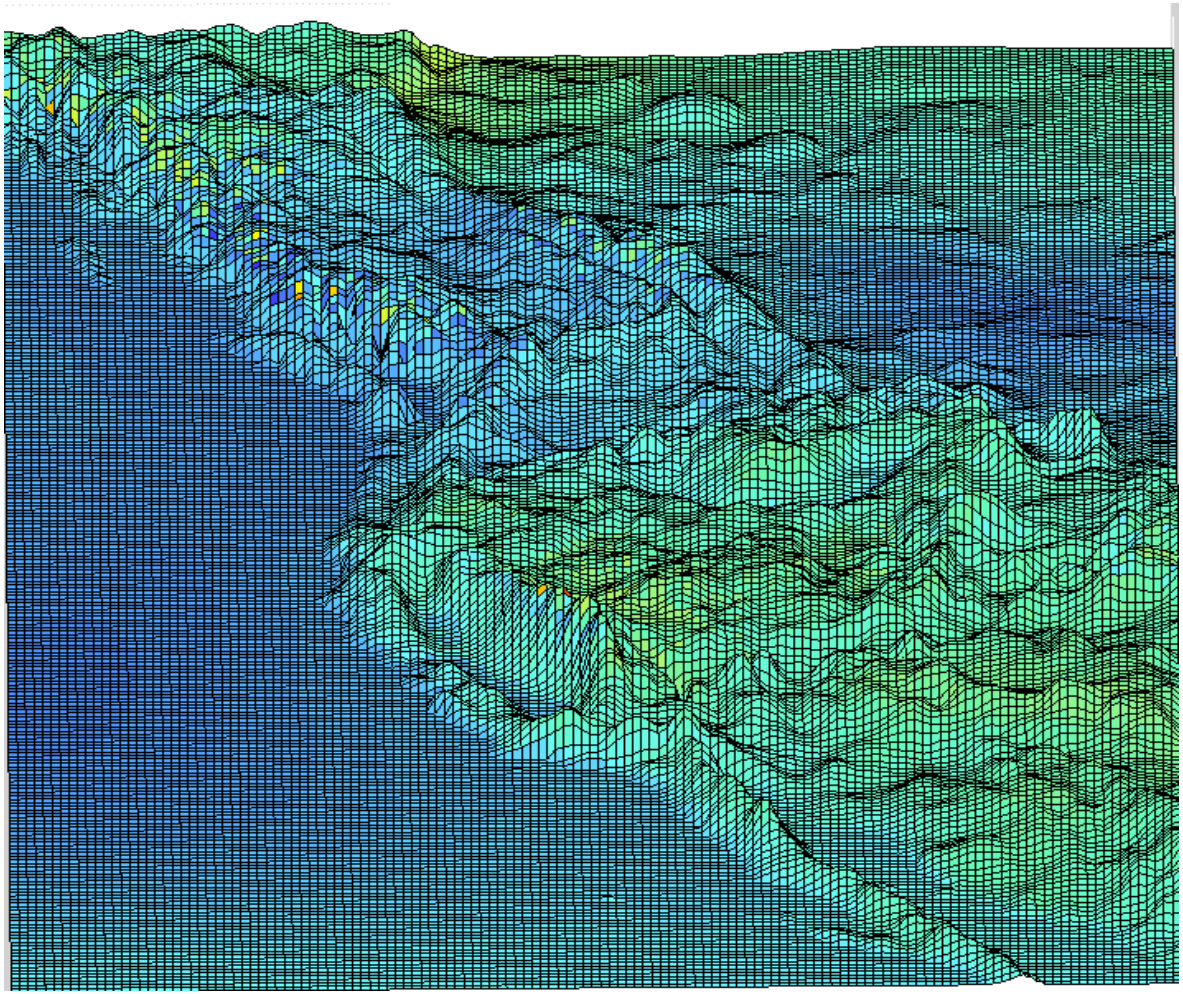
NARRCAP

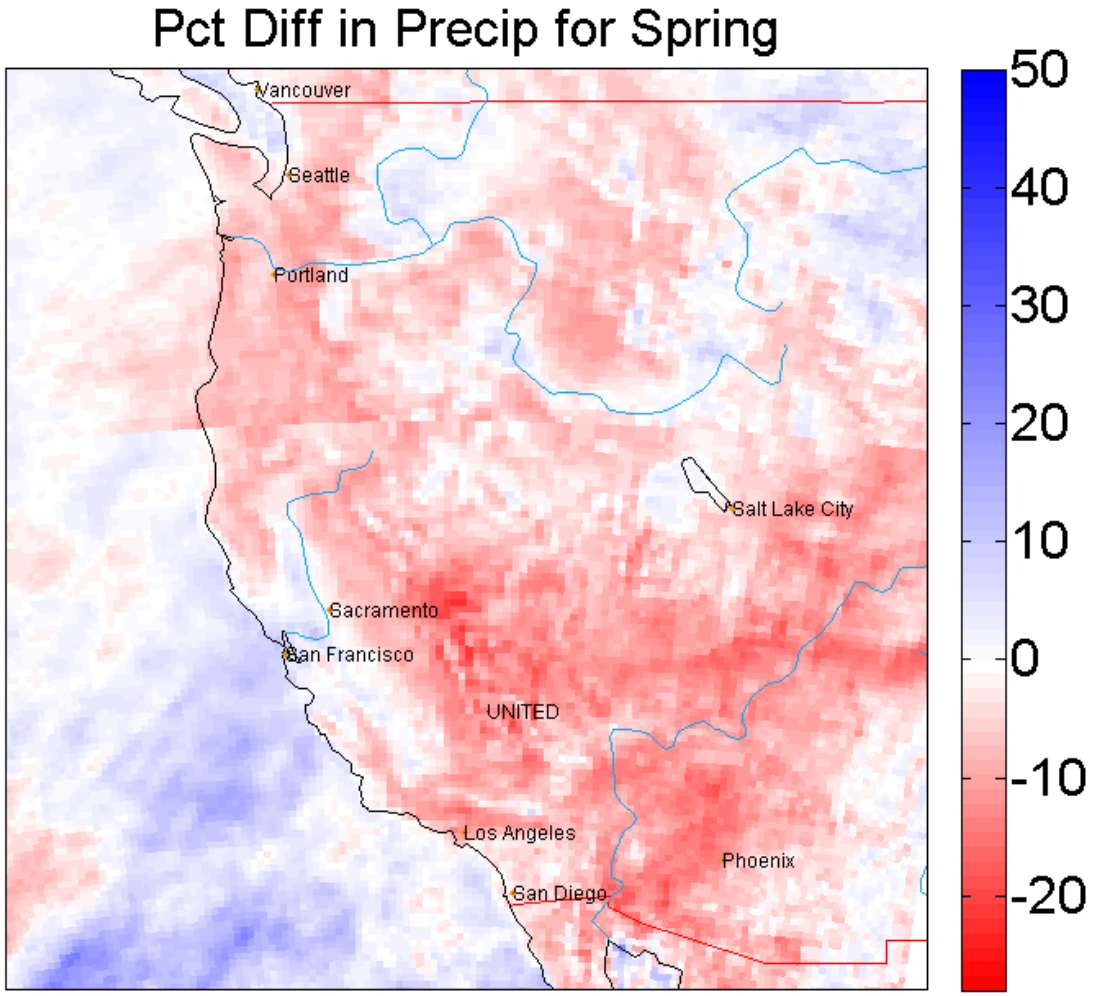


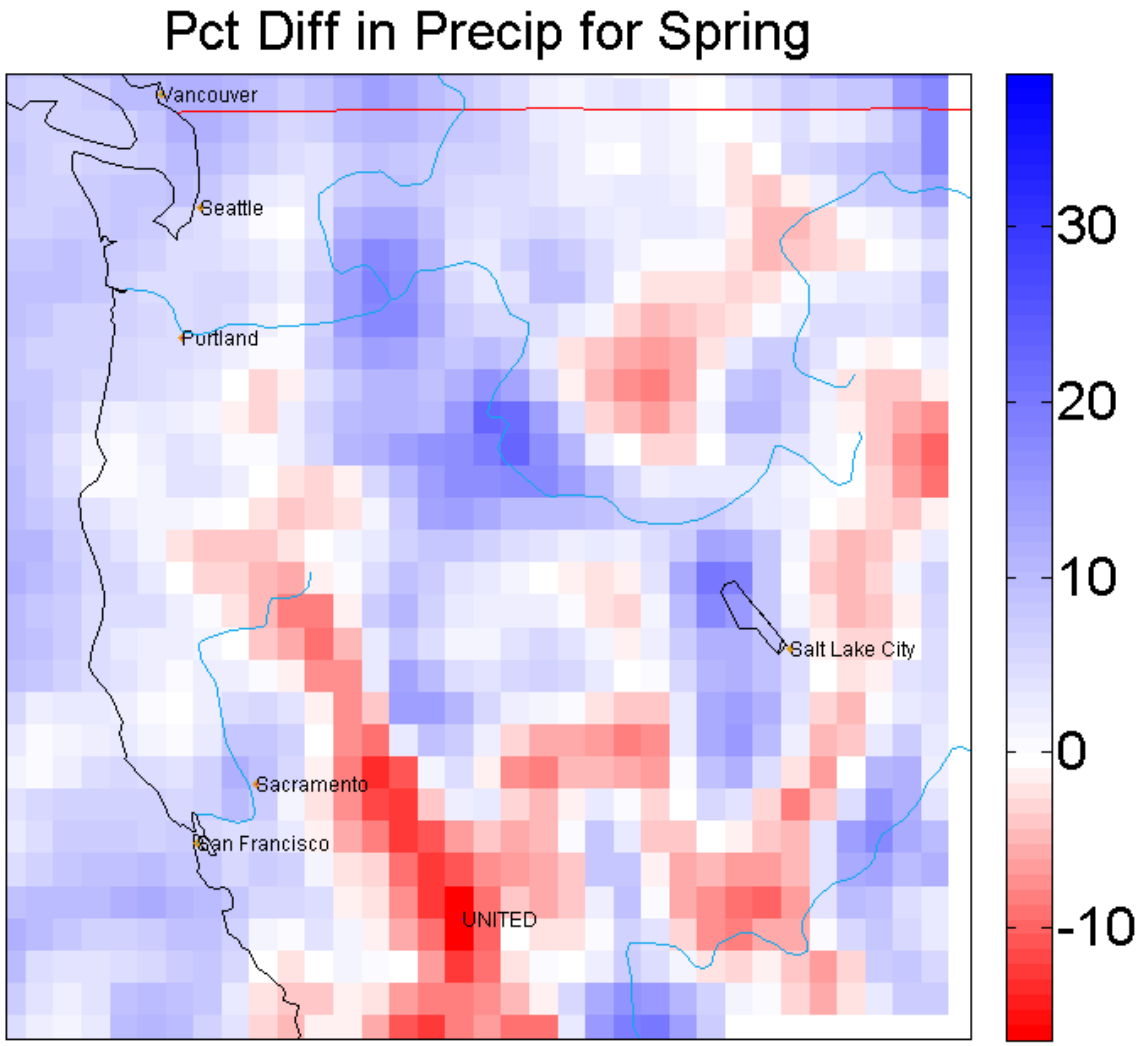
regCPDN

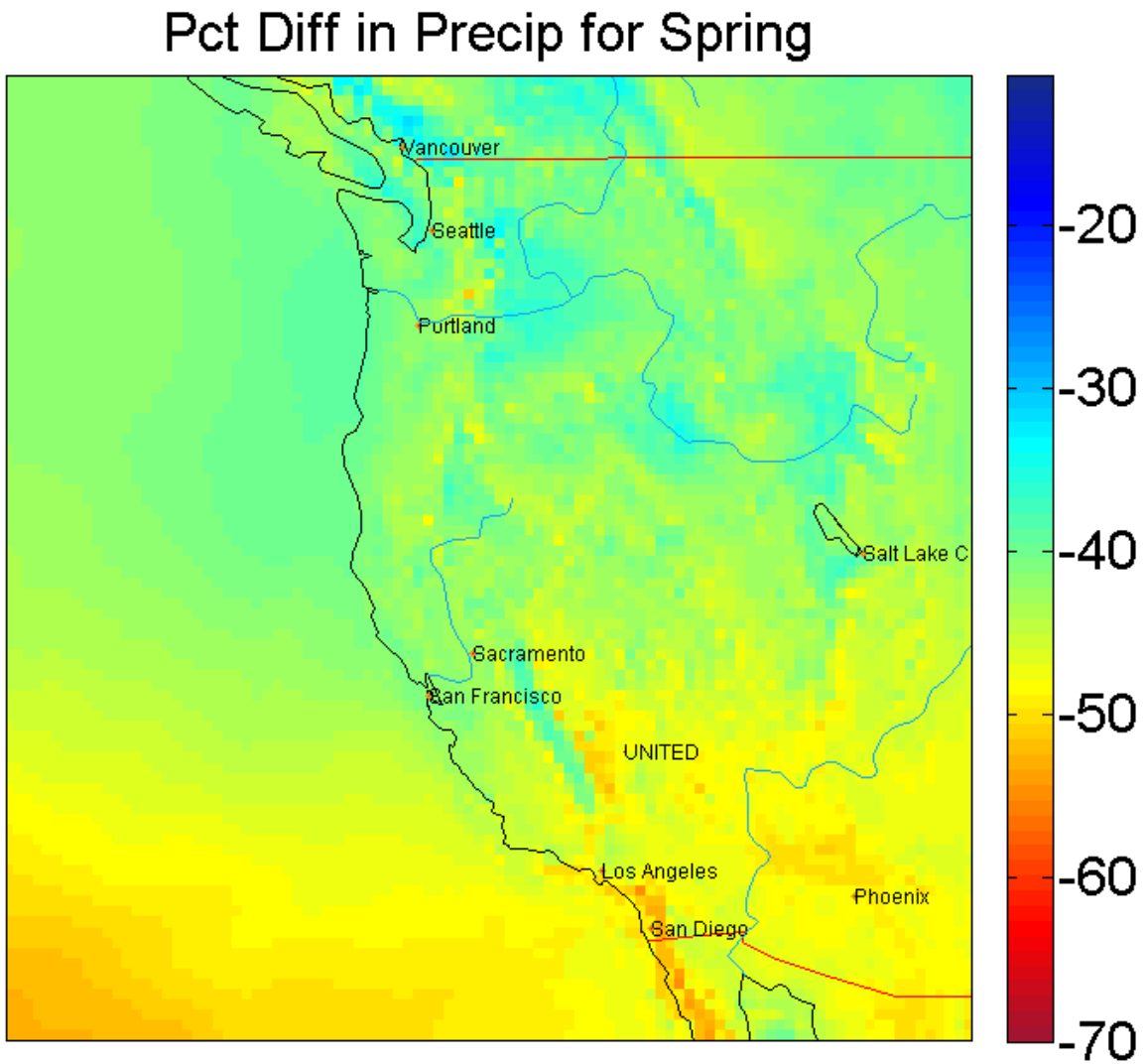


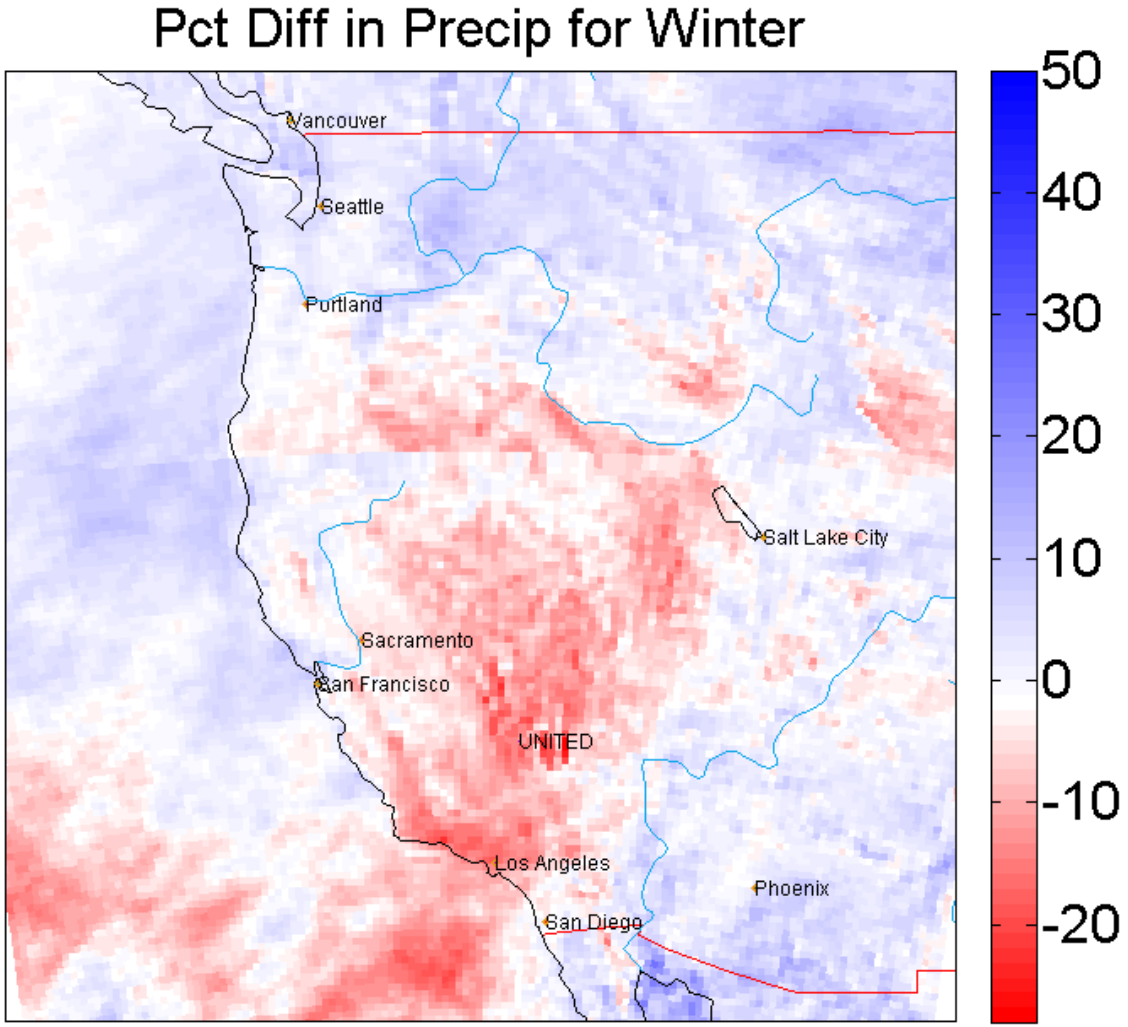
regCLIM

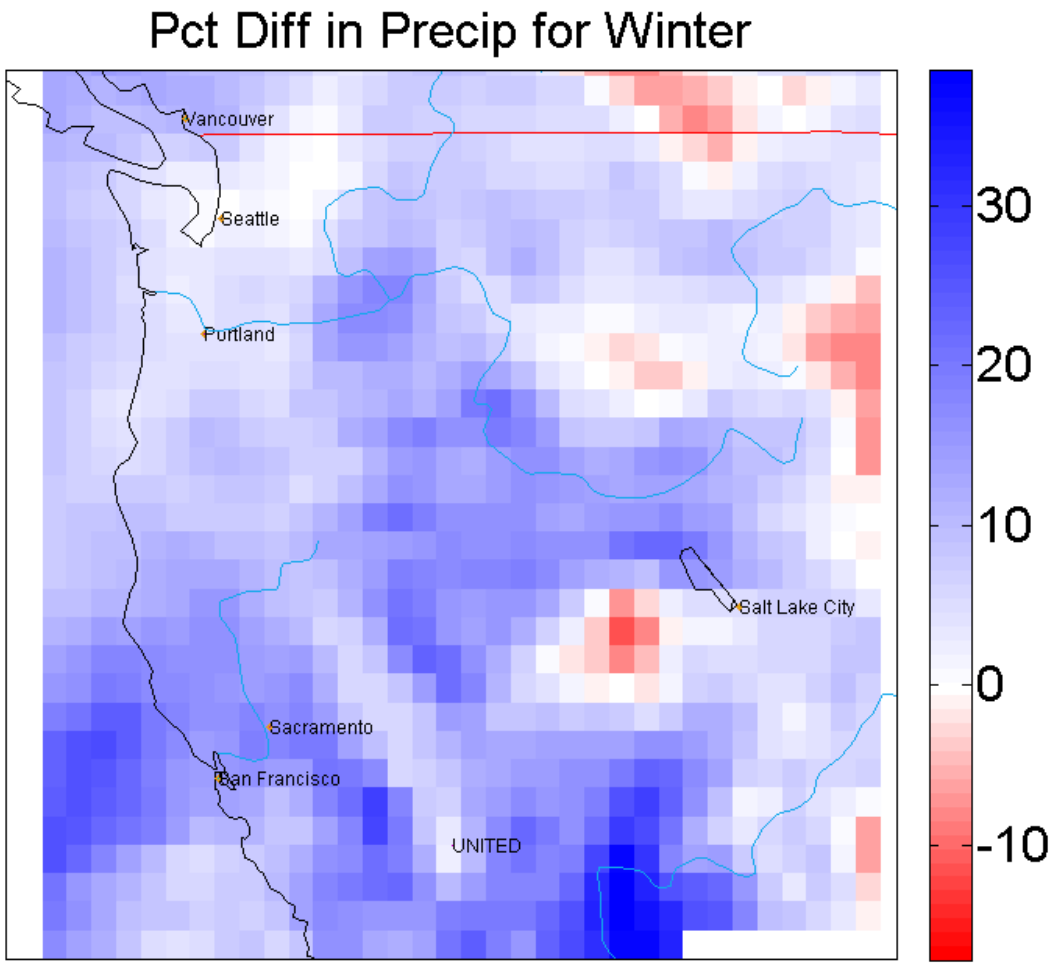



Pct Diff in Precip for Spring
Vancouver
Seattle
Portland
Salt Lake City
Sacramento
San Francisco
UNITED
Los Angeles
Phoenix
San Diego
50
40
30
20
10
0
-10
-20


Pct Diff in Precip for Spring
Vancouver
Seattle
Portland
Salt Lake City
Sacramento
San Francisco
UNITED
30
20
10
0
-10


Pct Diff in Precip for Spring
Vancouver
Seattle
Portland
Salt Lake C
Sacramento
San Francisco
UNITED
Los Angeles
Phoenix
San Diego
-20
-30
-40
-50
-60
-70


Pct Diff in Precip for Winter
Vancouver
Seattle
Portland
Salt Lake City
Sacramento
San Francisco
UNITED
Los Angeles
Phoenix
San Diego
50
40
30
20
10
0
-10
-20


Pct Diff in Precip for Winter
Vancouver
Seattle
Portland
Salt Lake City
Sacramento
San Francisco
UNITED
30
20
10
0
-10

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