Climate Trends in the Pacific Northwest

Strategic Response to Threat of Fusarium Head Blight (FHB) in Western US Barley Production

Hilton Garden Inn, Idaho Falls, ID
January 9, 2014

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CIRC
Climate Impacts Research Consortium

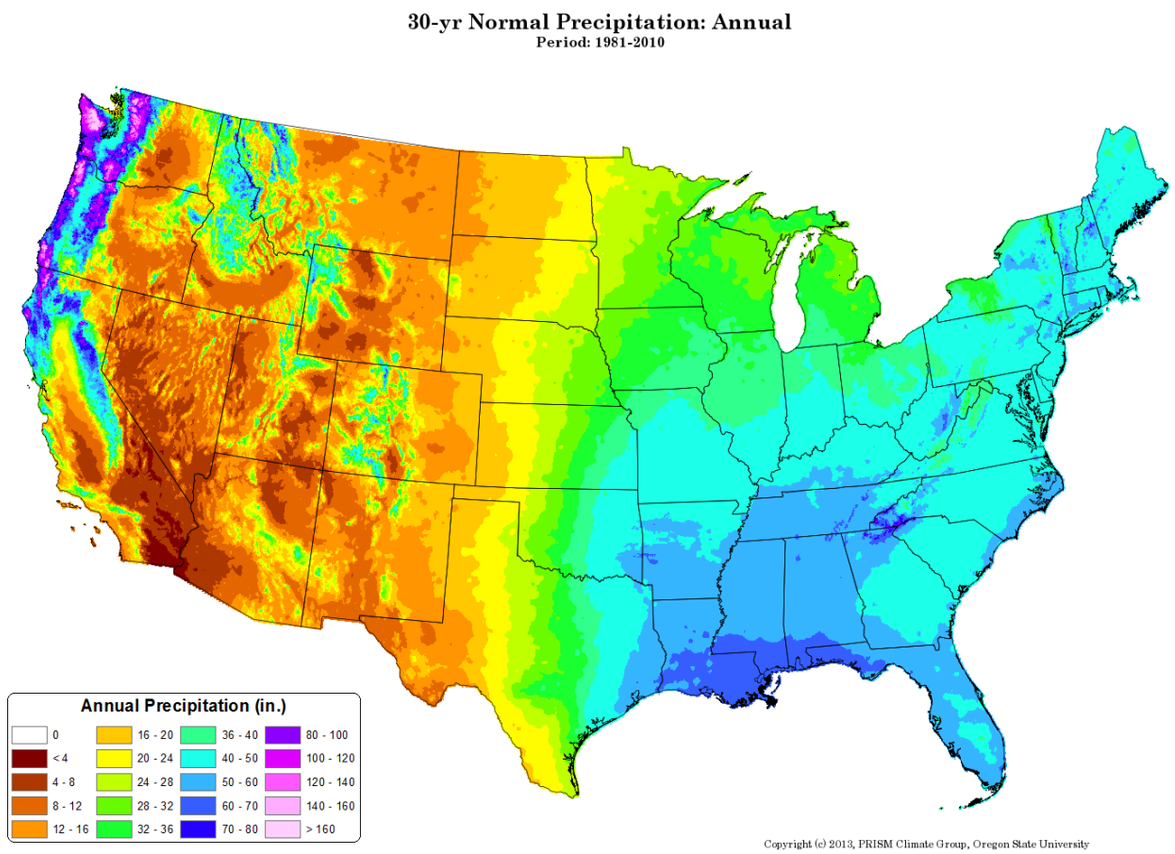
Overview

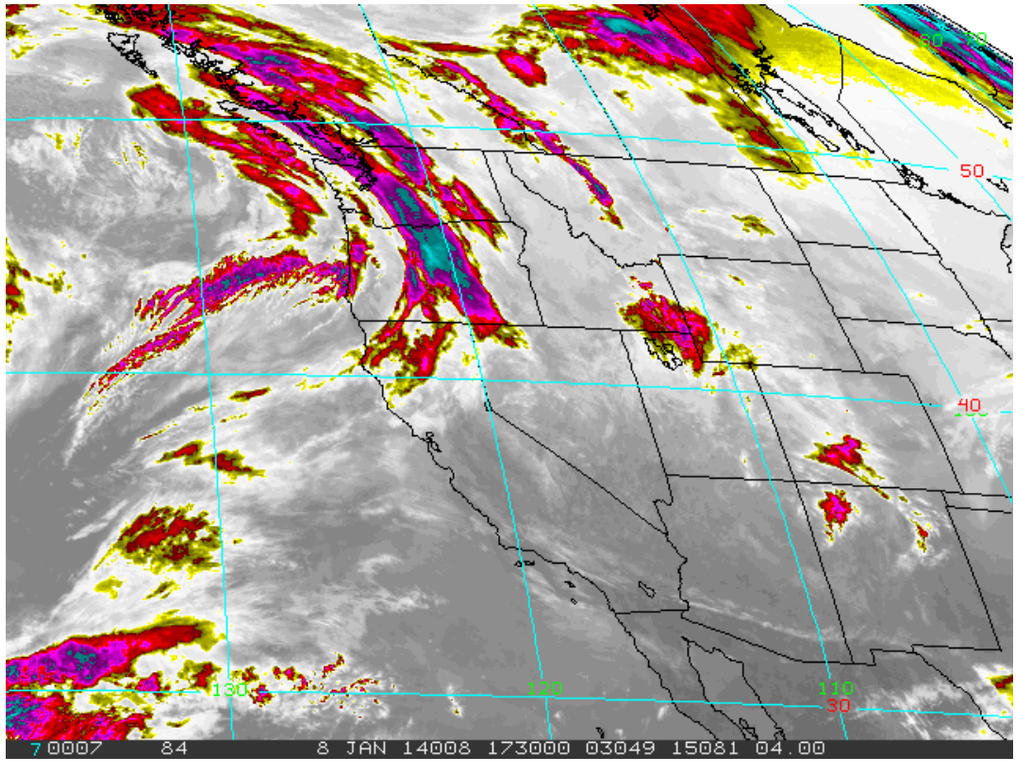
- Pacific Northwest Climate
  - Past Trends
  - Future Projections
- Ag. Reponses to Changing:
  - CO_2
  - Temperature
  - Moisture

Photo: Dag Endresen

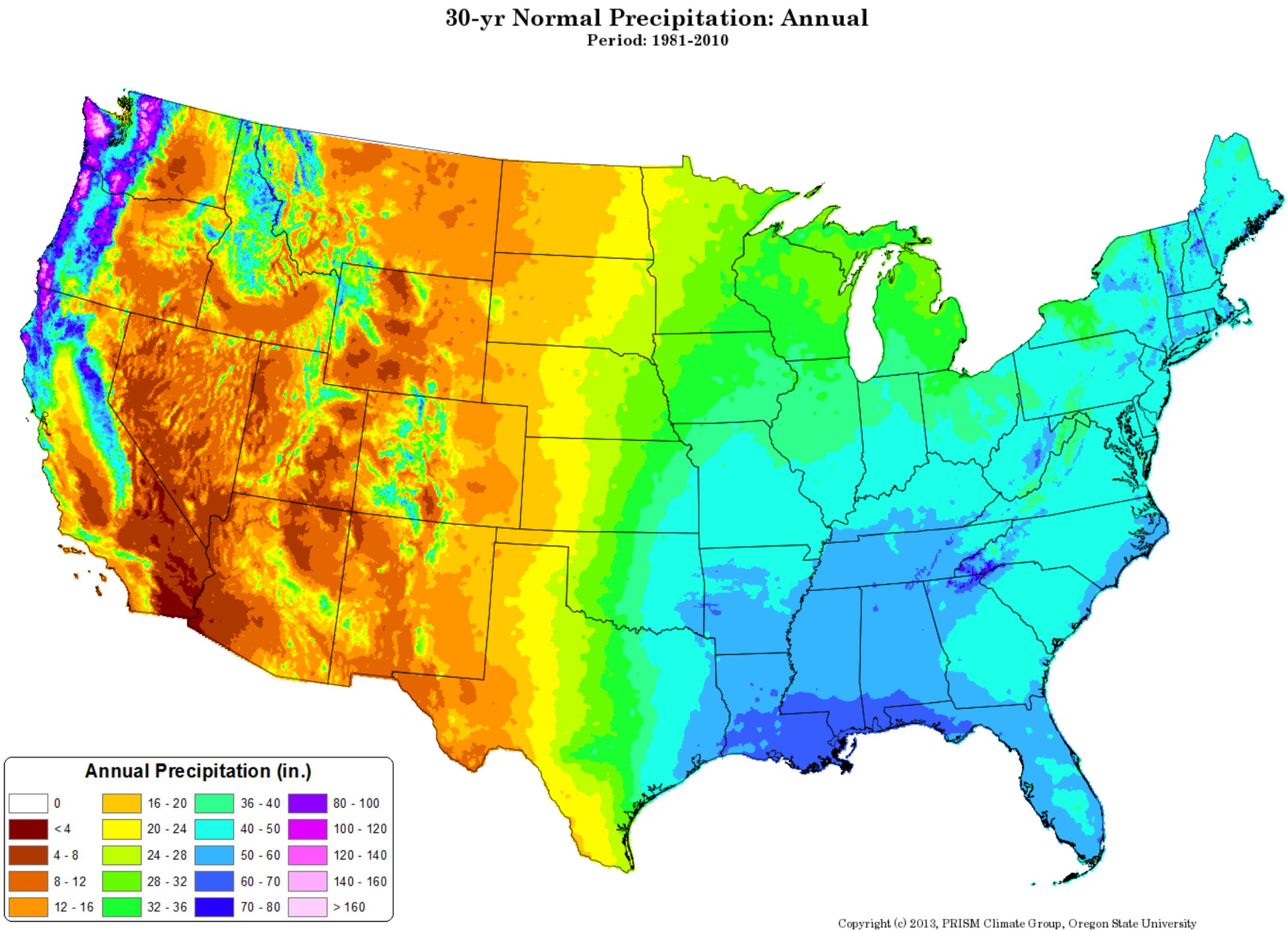
Weather or Climate?

Climate is what you expect…..
Weather is what you get

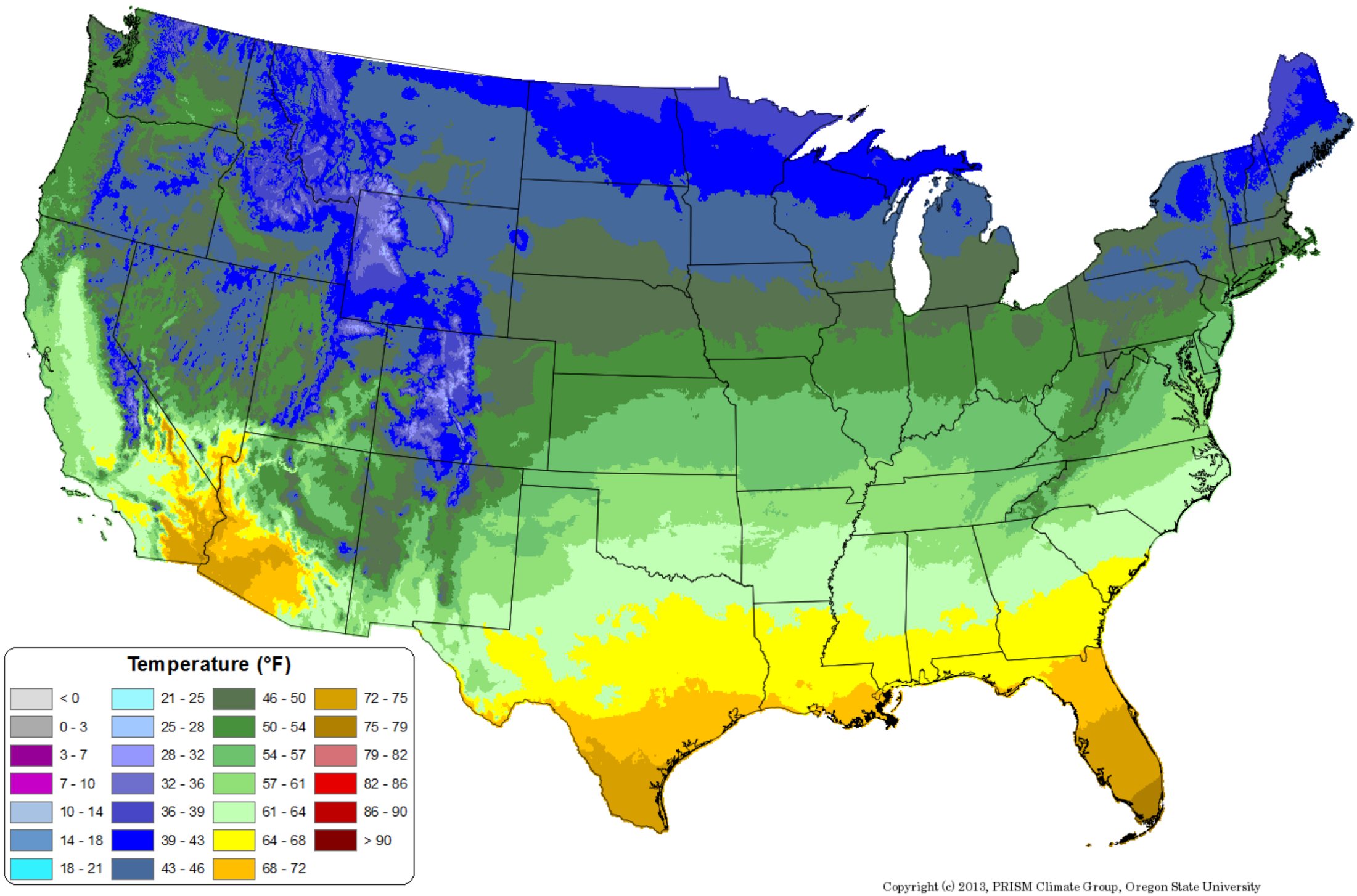




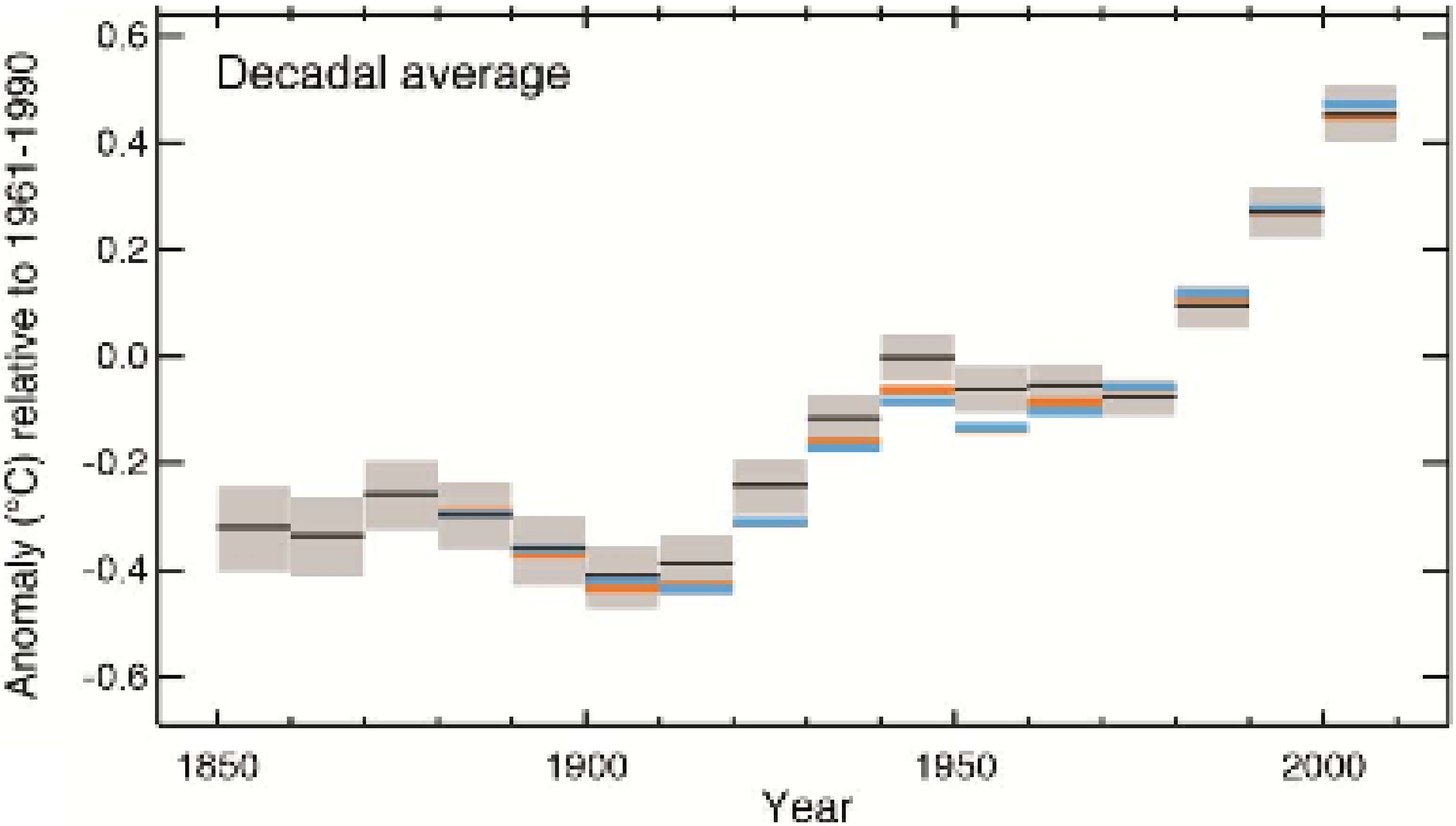
Current Climate



Current Climate

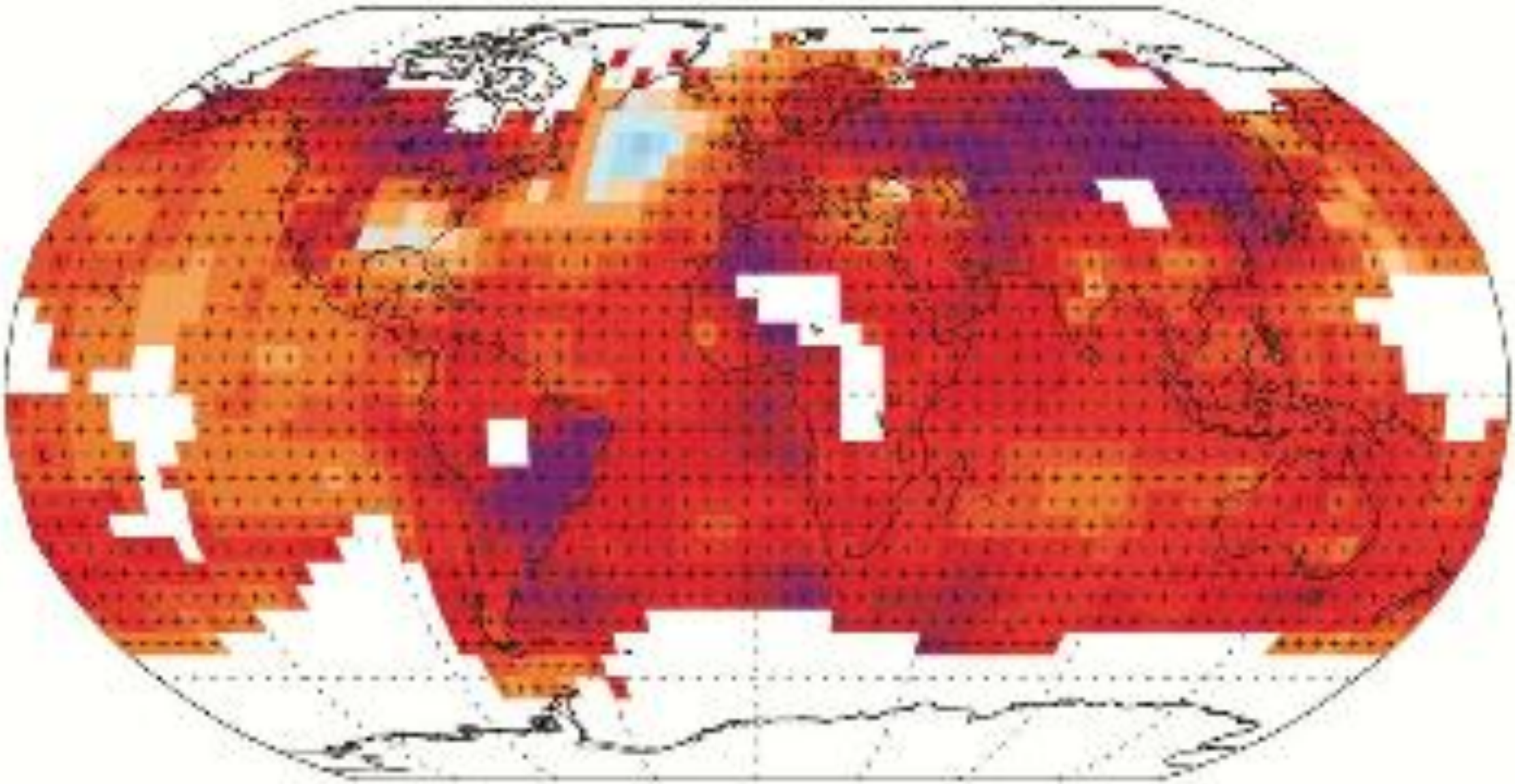


Past Climate Trends



ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

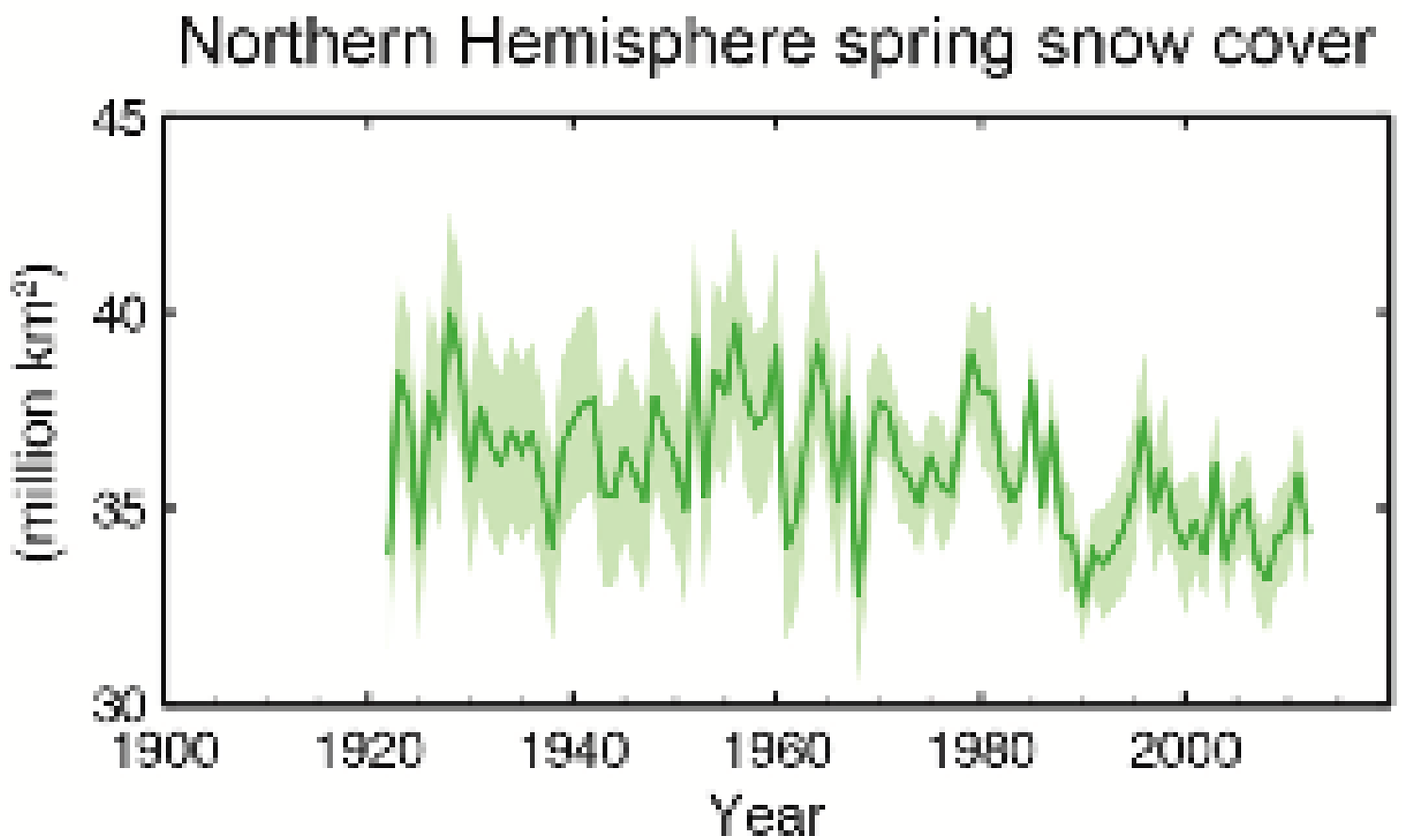
Observed change in average surface temperature 1901–2012

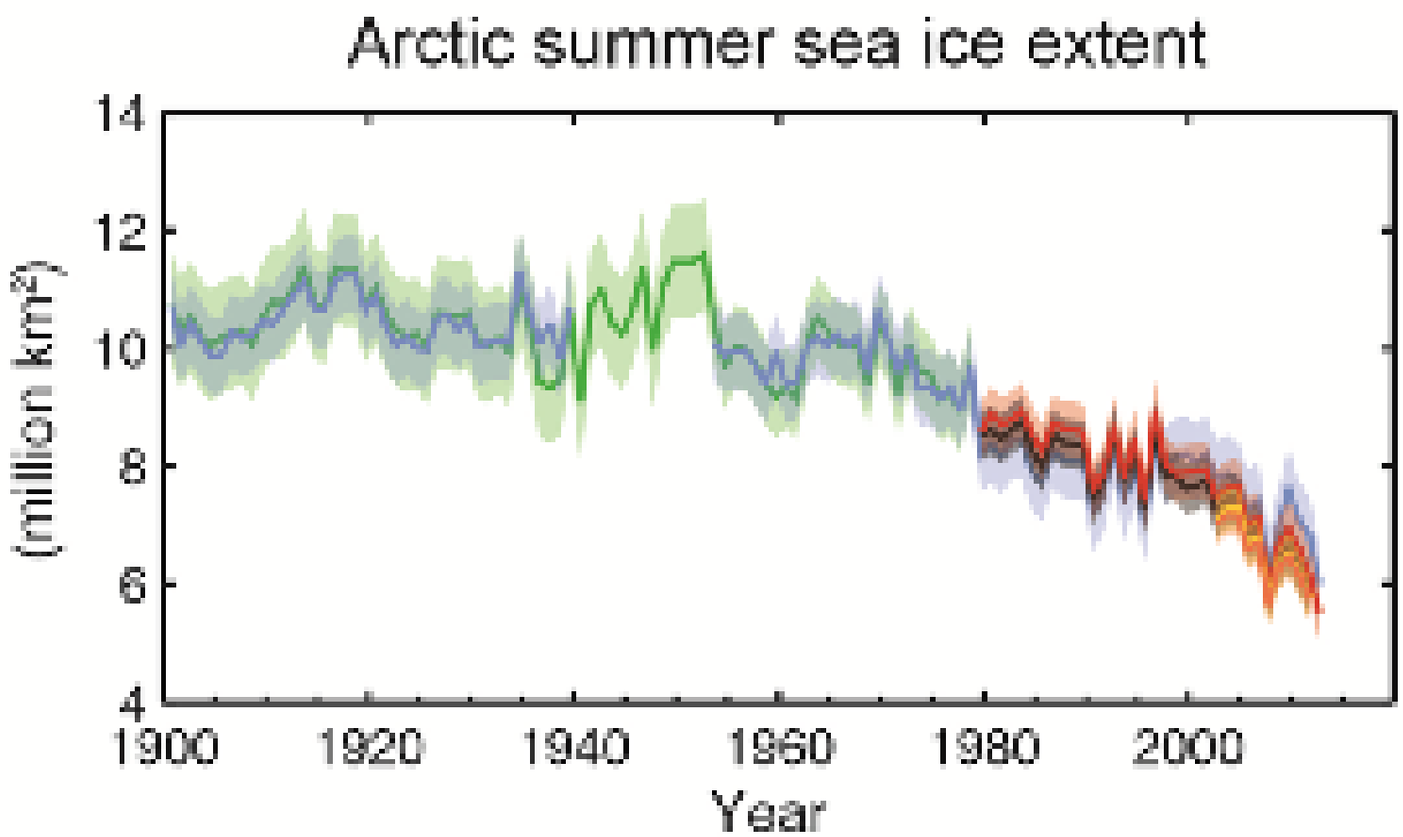


-0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 1.0 1.25 1.5 1.75 2.5

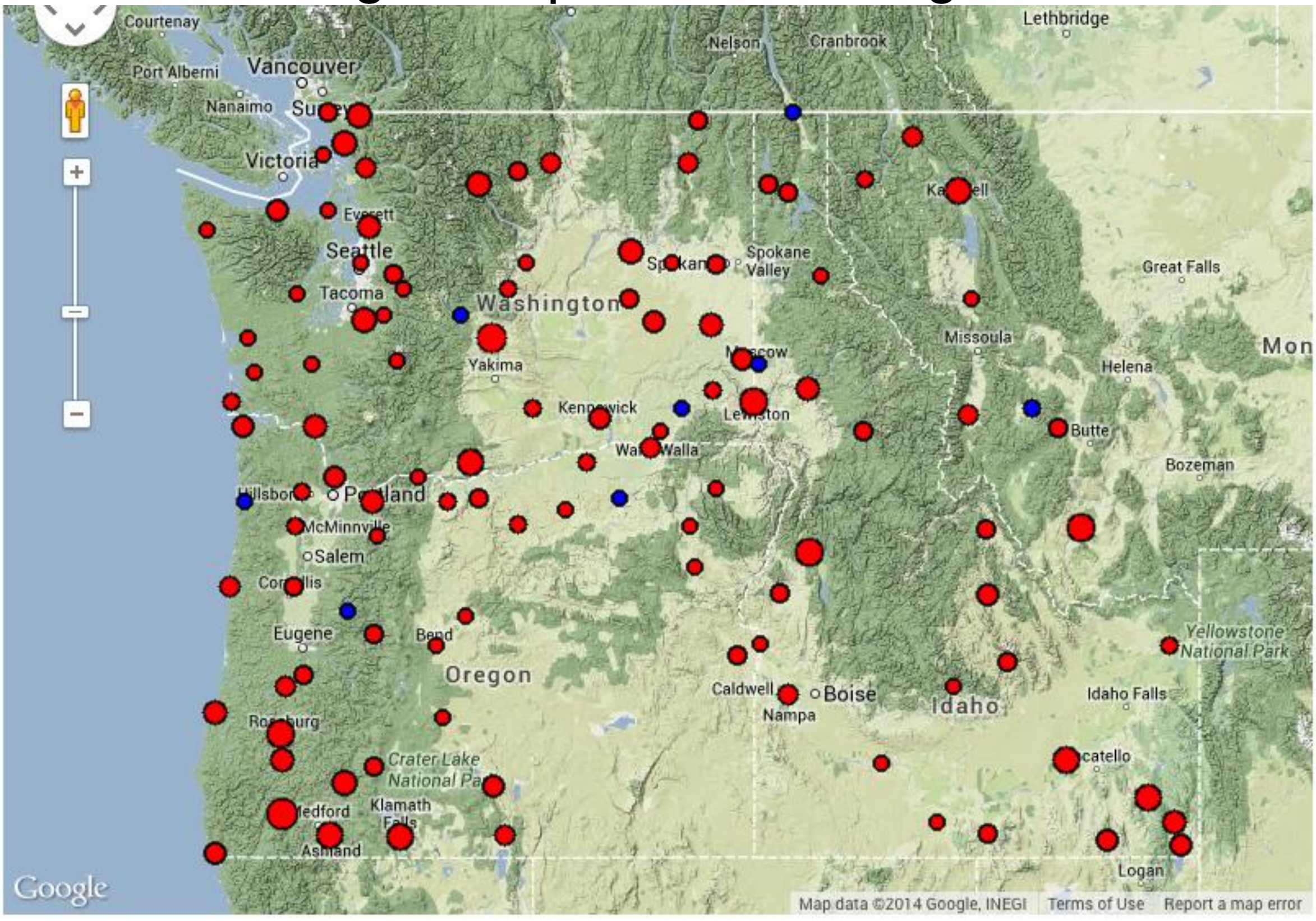
Trend (°C over period)

ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

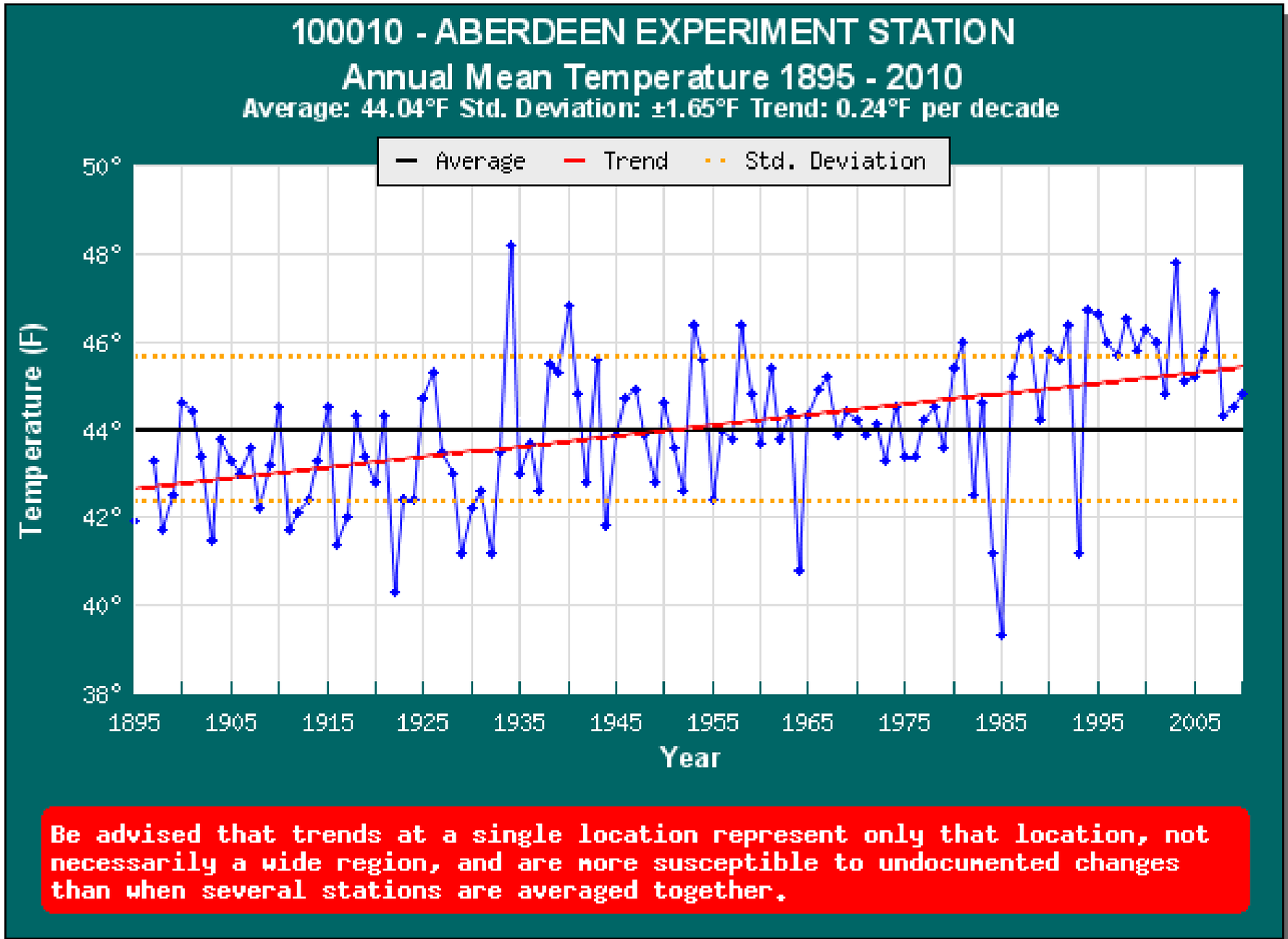

Northern Hemisphere spring snow cover
45
40
35
30
(million km²)
1900
1920
1940
1960
1980
2000
Year

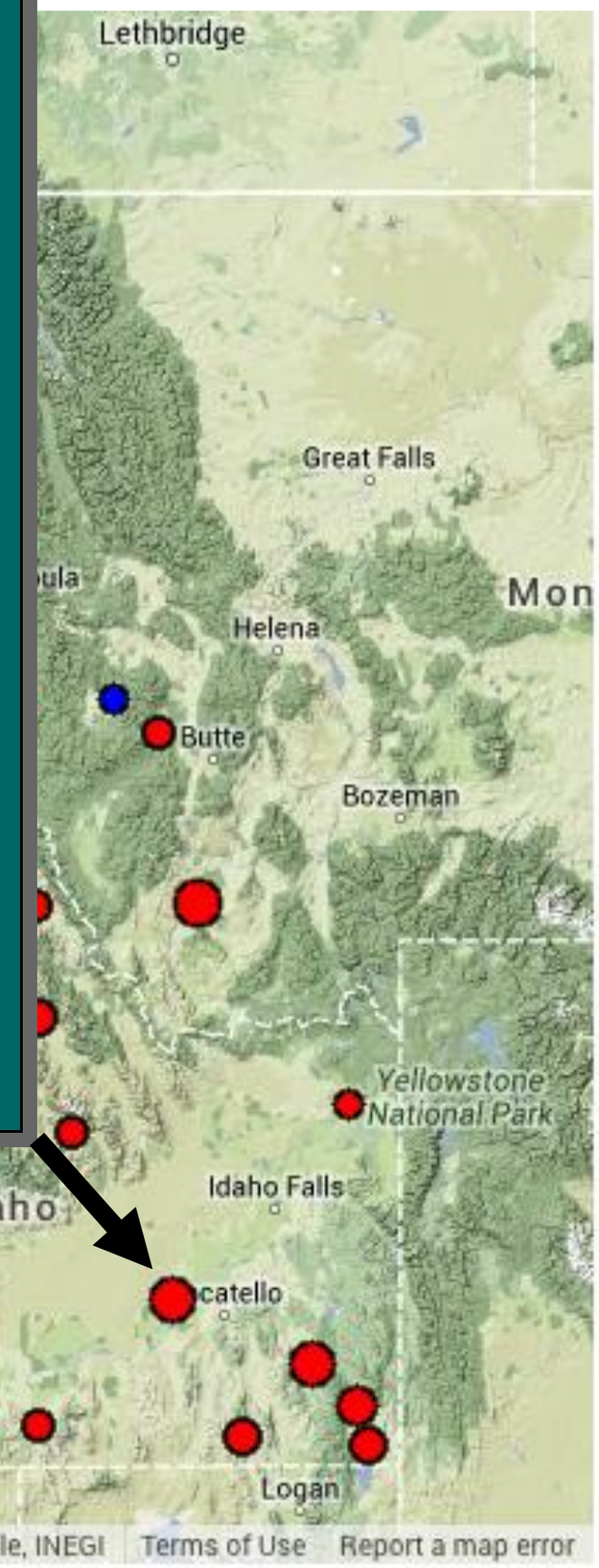

Arctic summer sea ice extent
14
12
10
8
6
4
(million km²)
1900
1920
1940
1960
1980
2000
Year

PNW Average Temperature Change 1895-2010



Source: http://www.climate.washington.edu/trendanalysis/

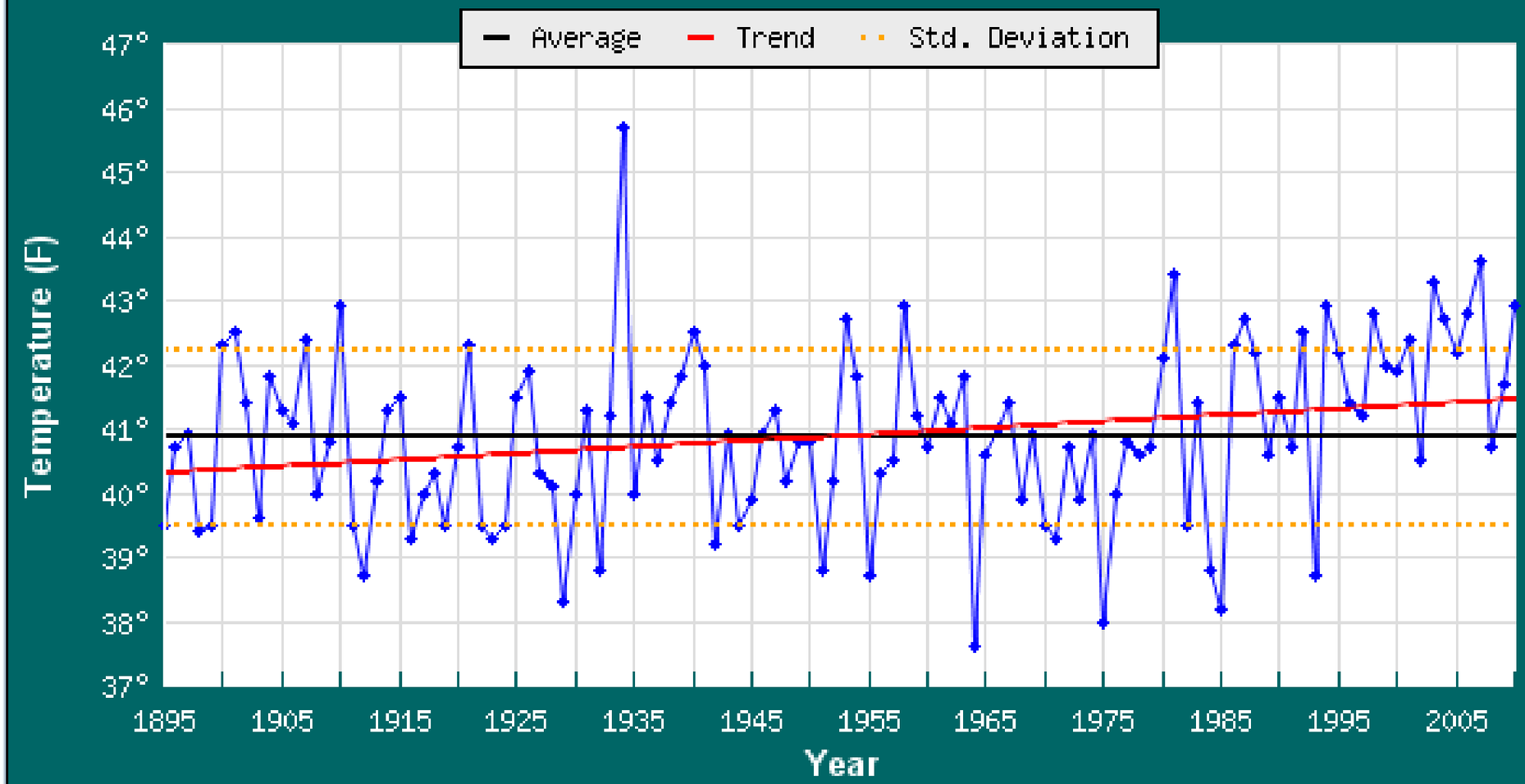

100010 - ABERDEEN EXPERIMENT STATION
Annual Mean Temperature 1895 - 2010
Average: 44.04°F Std. Deviation: ±1.65°F Trend: 0.24°F per decade
Average
Trend
Std. Deviation
Temperature (F)
50°
48°
46°
44°
42°
40°
38°
1895
1905
1915
1925
1935
1945
1955
1965
1975
1985
1995
2005
Year
Be advised that trends at a single location represent only that location, not necessarily a wide region, and are more susceptible to undocumented changes than when several stations are averaged together.


Lethbridge
Great Falls
Helena
Butte
Bozeman
Yellowstone National Park
Idaho Falls
Logan
Caldwell
Boise
Nampa
Idaho
Oregon
Crater Lake National Park
Klamath Falls
Ashland
Google
Map data ©2014 Google, INEGI
Terms of Use
Report a map error

100470 - ASHTON

Annual Mean Temperature 1895 - 2010

Average: 40.91°F Std. Deviation: ±1.37°F Trend: 0.1°F per decade



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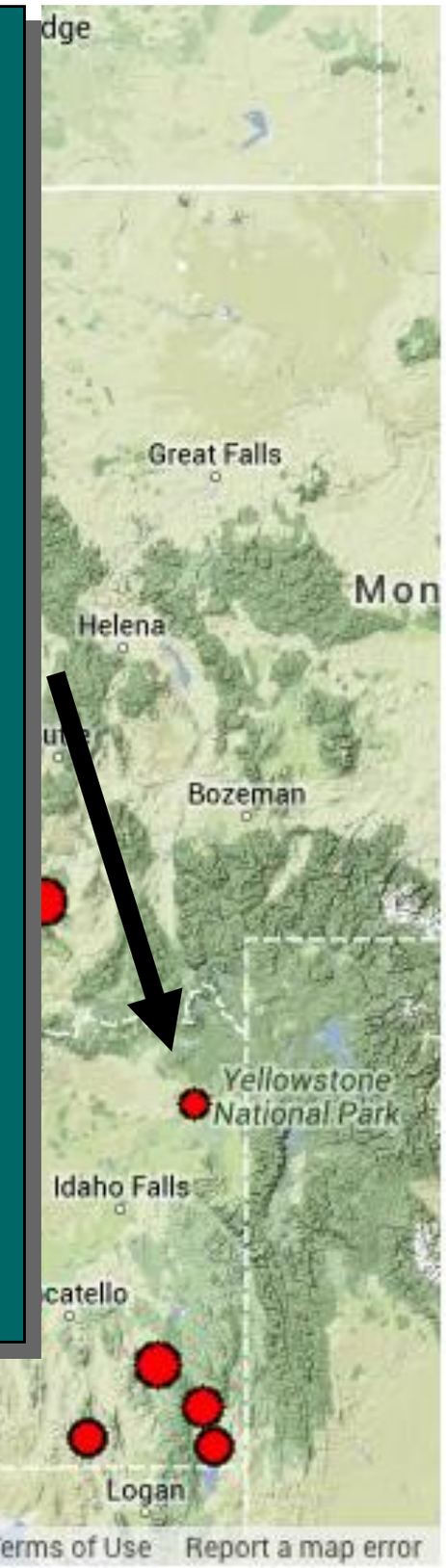
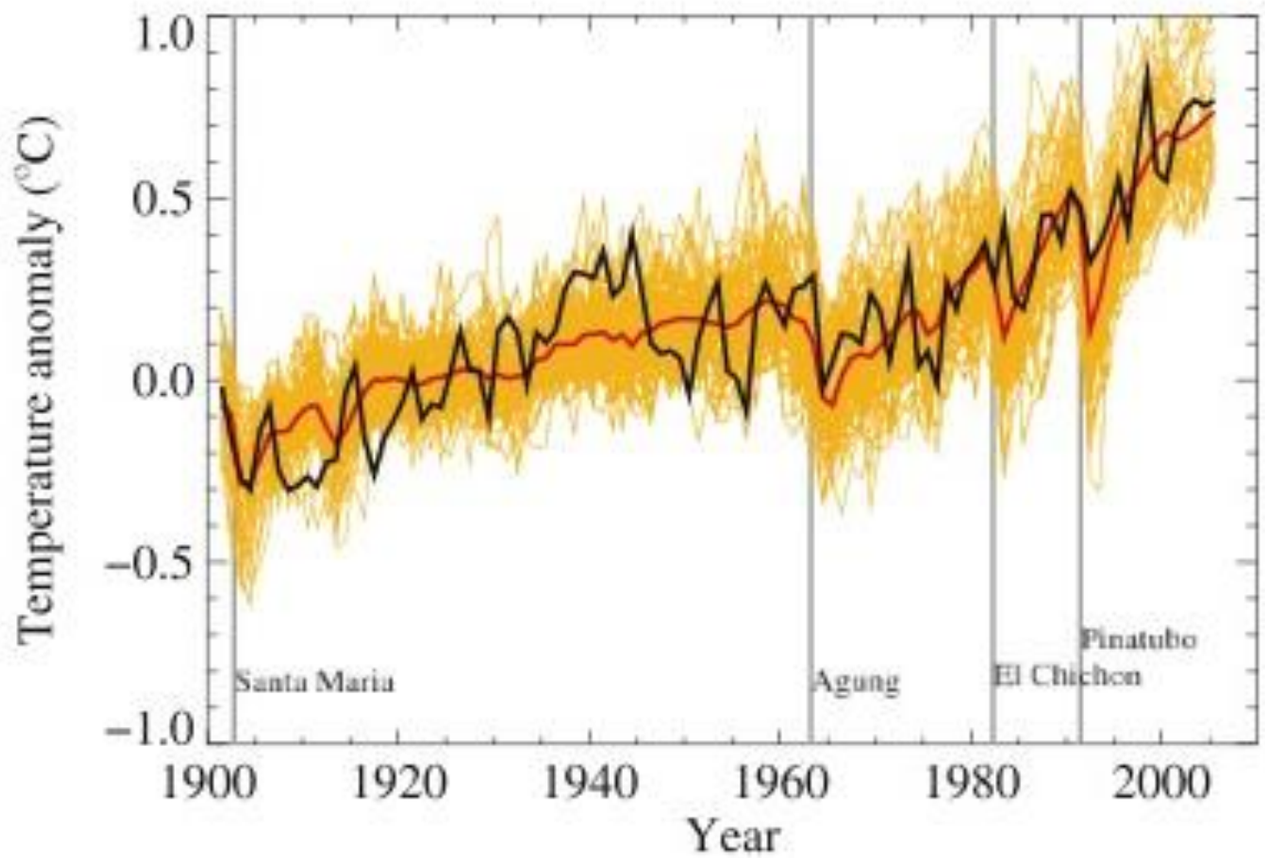
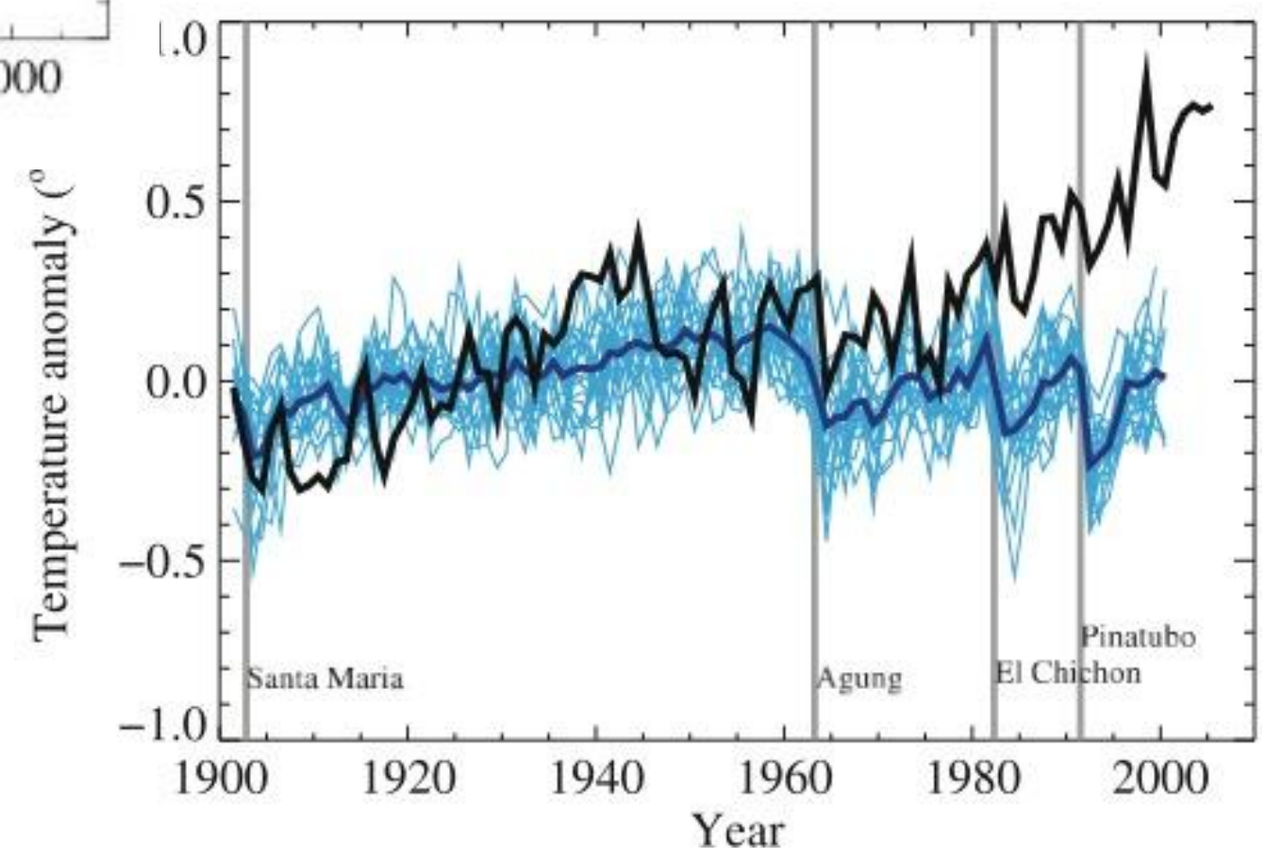


What's Driving the Change?

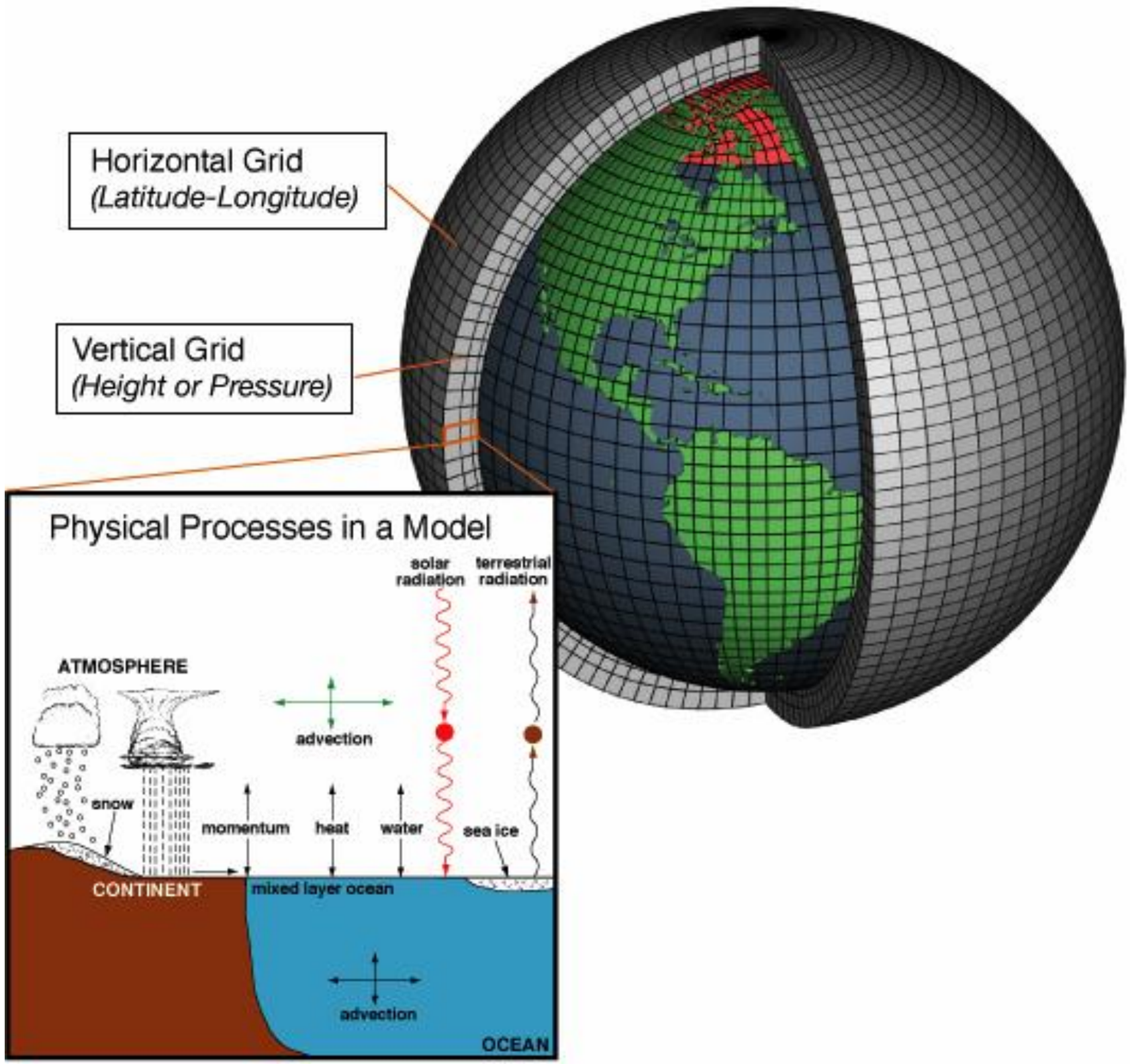


Modeled v. Observed Global Temp. Trend 19th Century

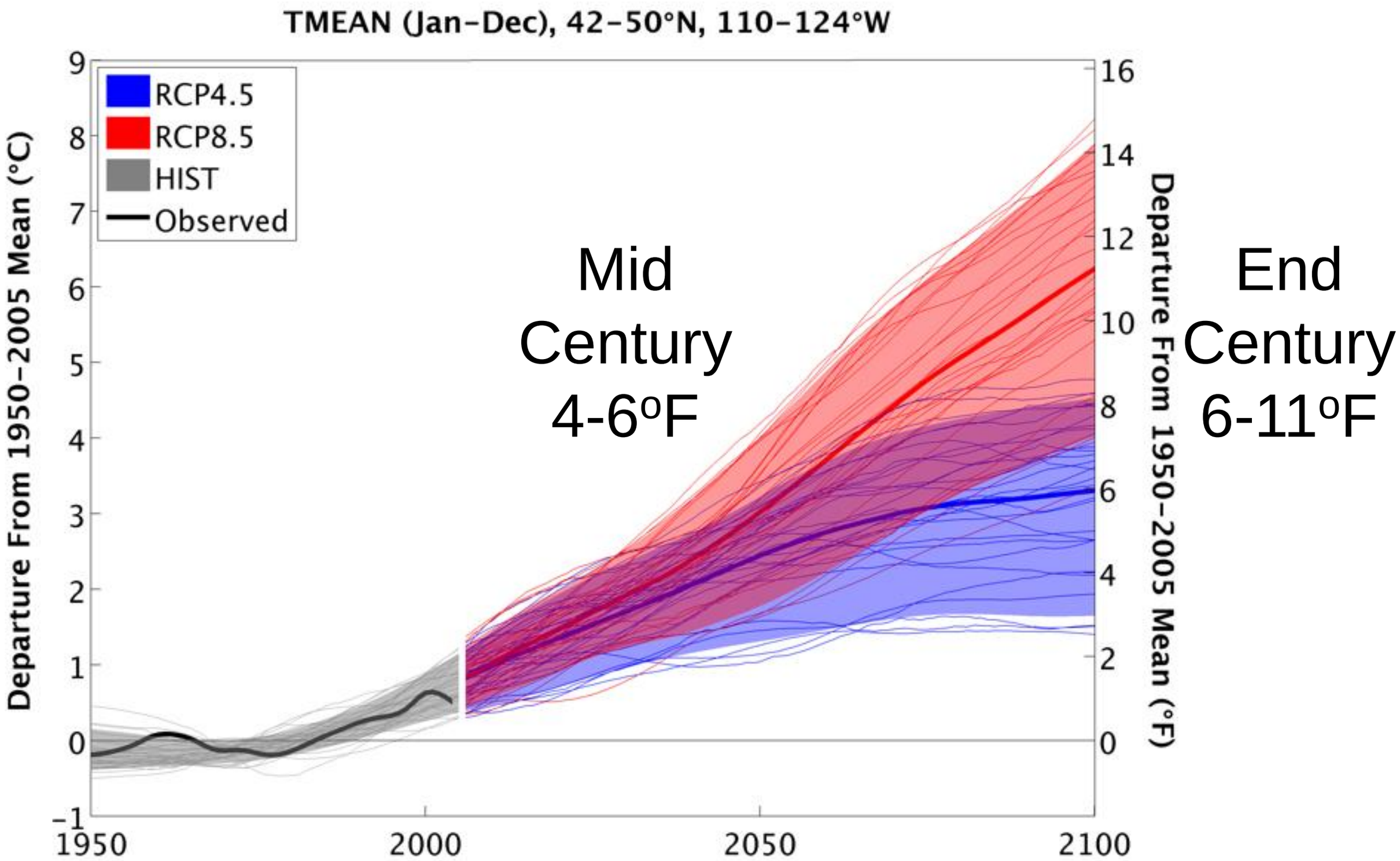


Future Climate Trends

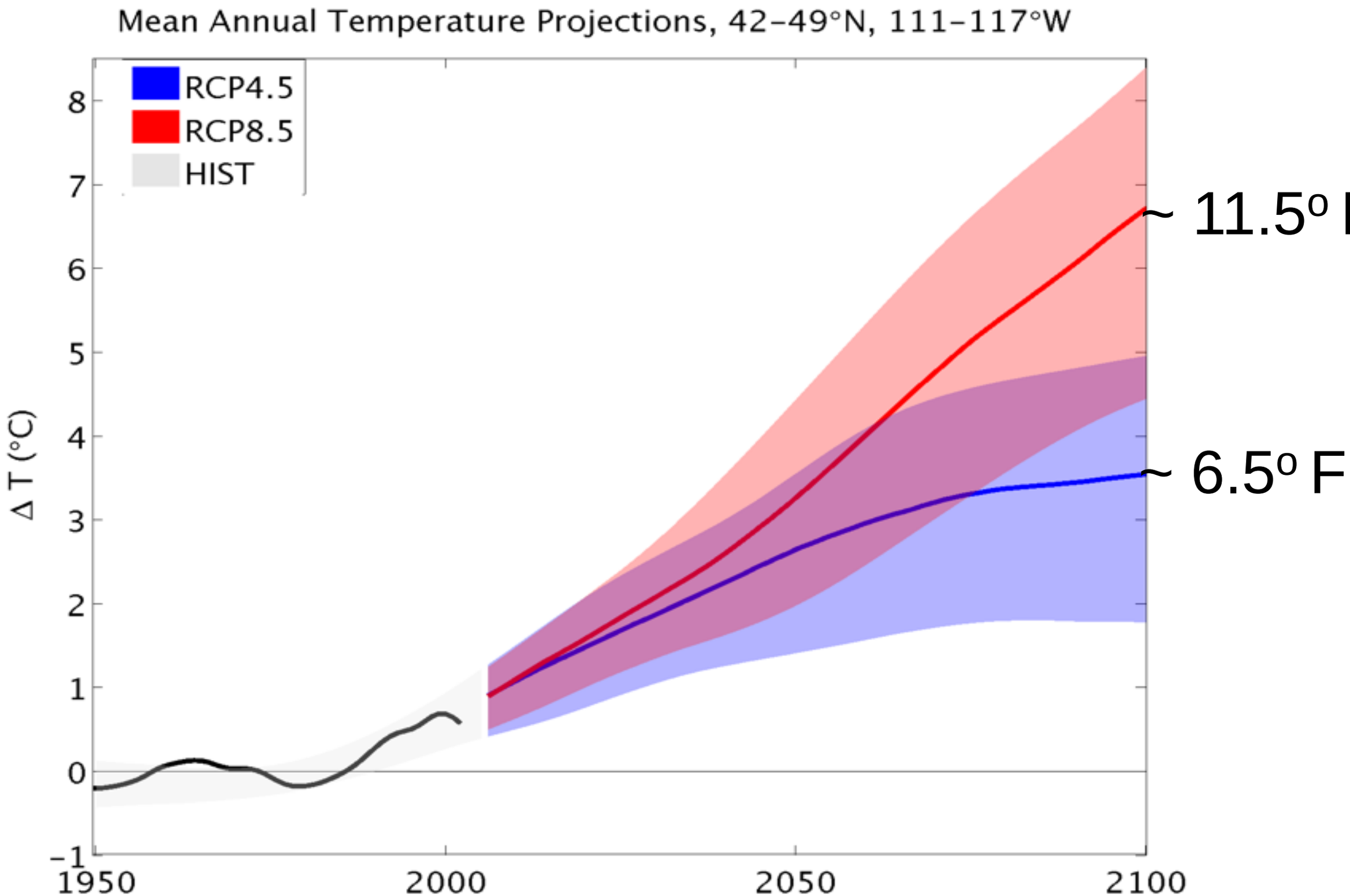
Climate Models as Tools



Temperature Project for Pacific Northwest

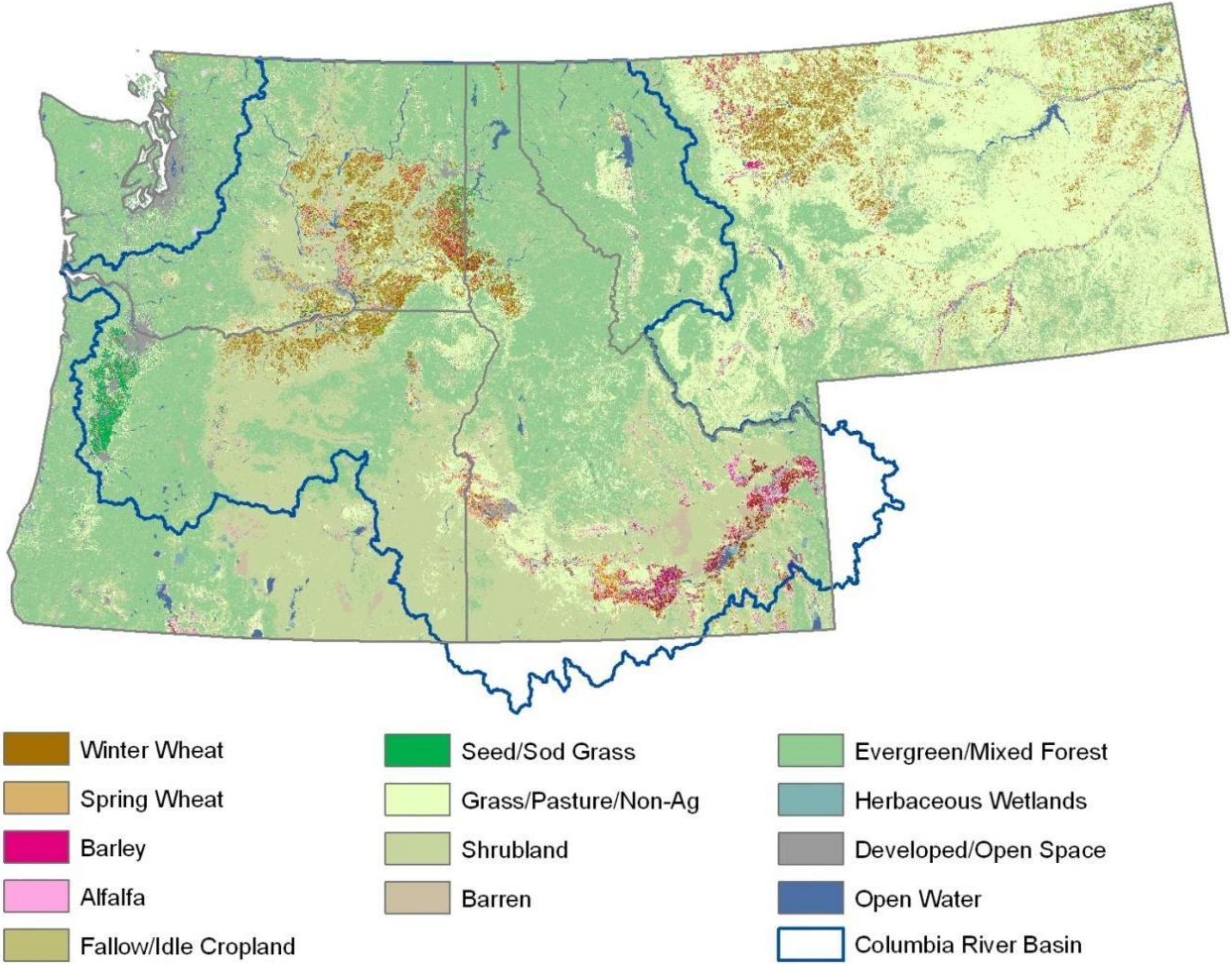


Temperature Project for East Idaho

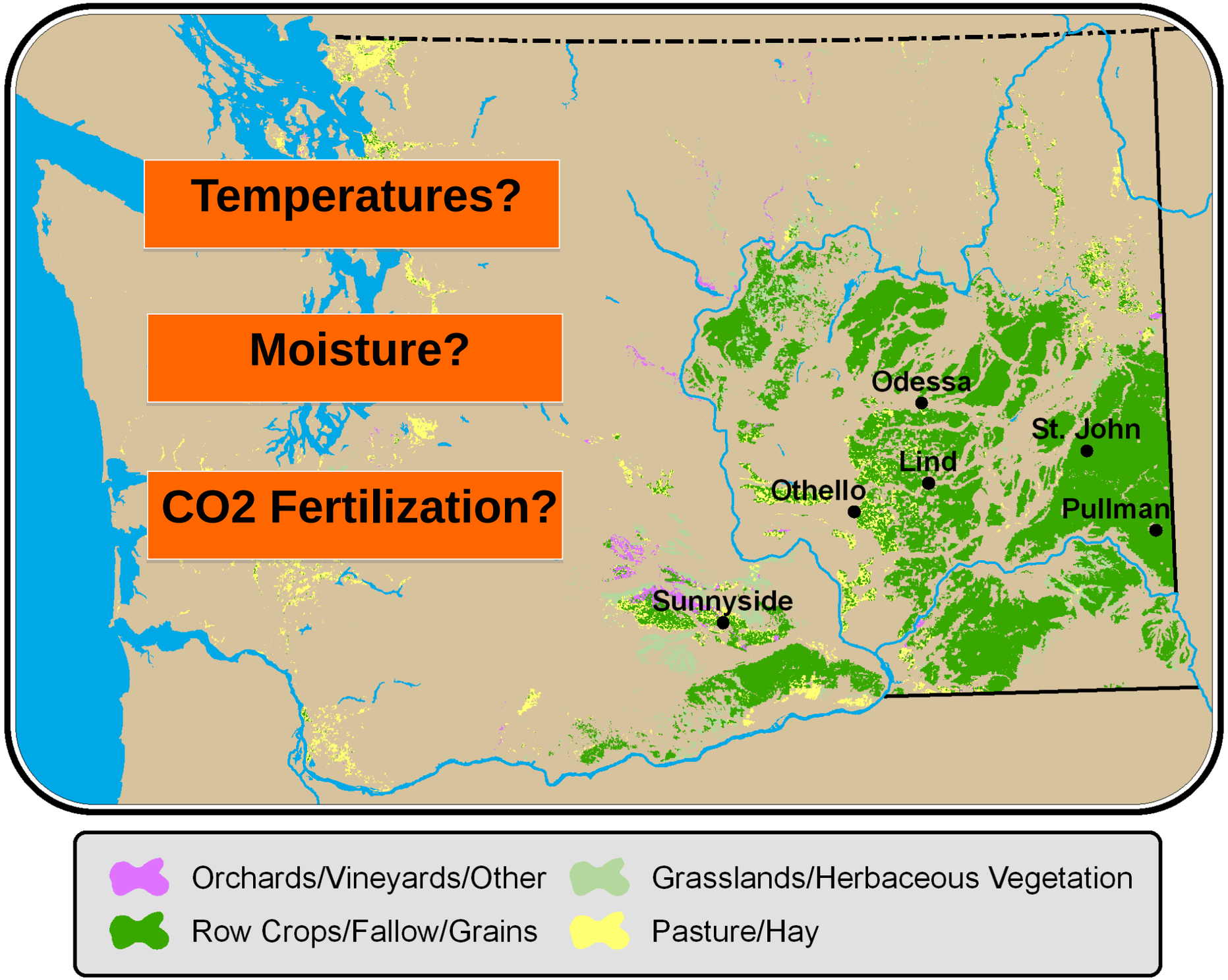


Future Climate and Agriculture Projection

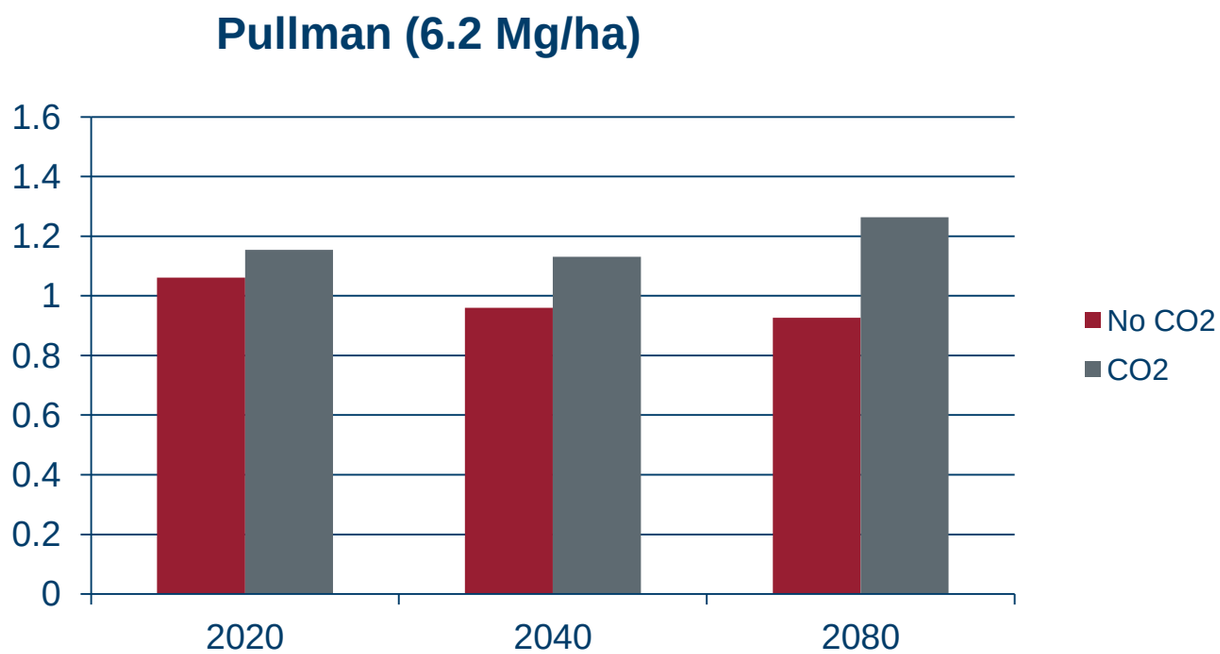
- CO_2 Fertilization?
- Pests?
- Moisture Requirements

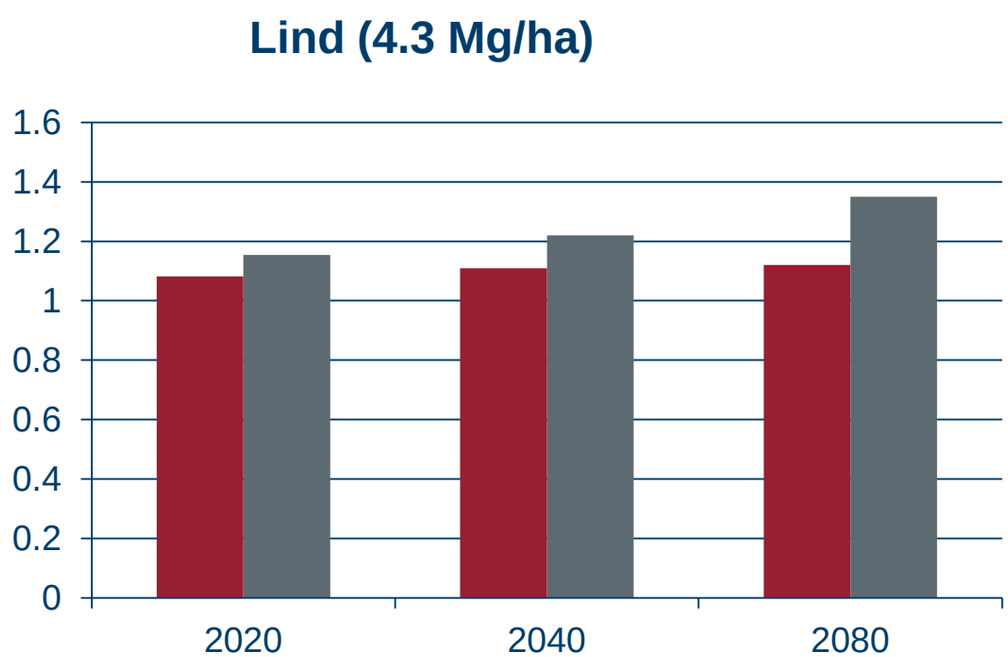

Winter Wheat
Spring Wheat
Barley
Alfalfa
Fallow/Idle Cropland
Seed/Sod Grass
Grass/Pasture/Non-Ag
Shrubland
Barren
Evergreen/Mixed Forest
Herbaceous Wetlands
Developed/Open Space
Open Water
Columbia River Basin

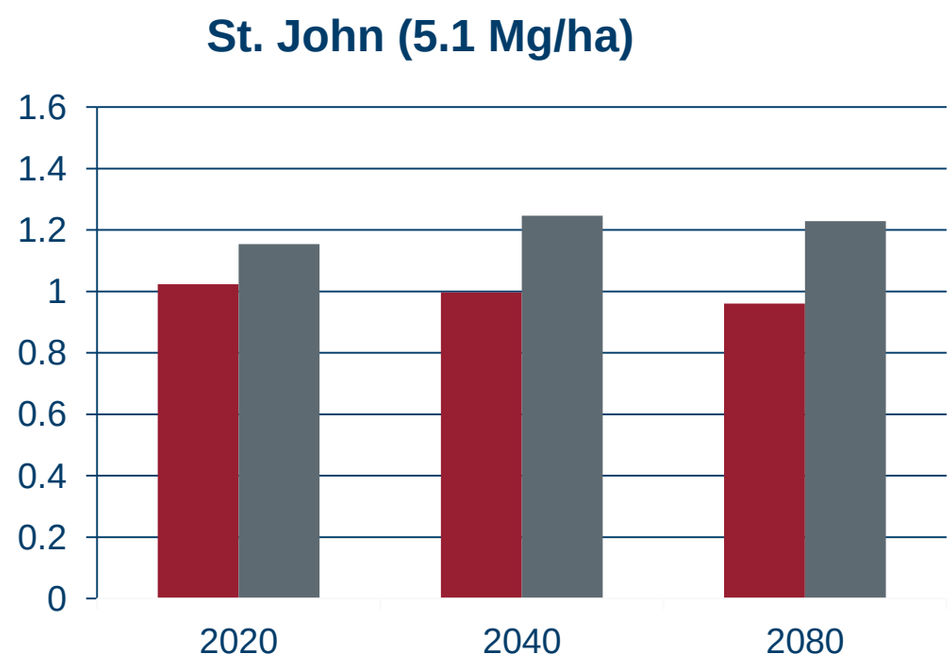
What Are Impacts on Agricultural Production?



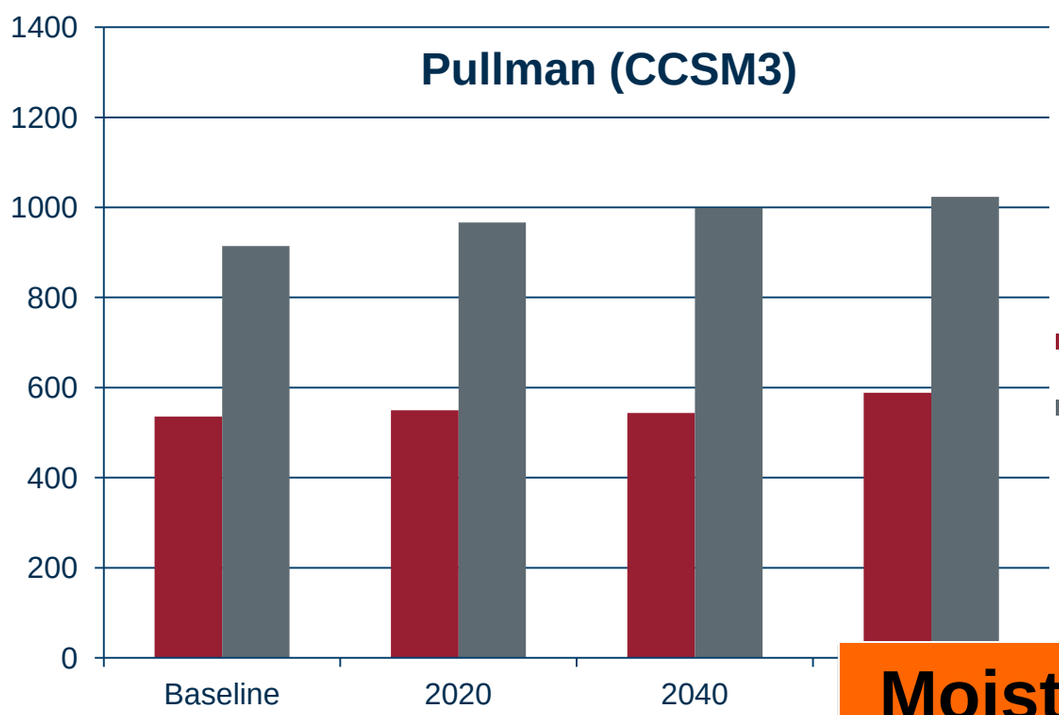
Project Results: Winter Wheat

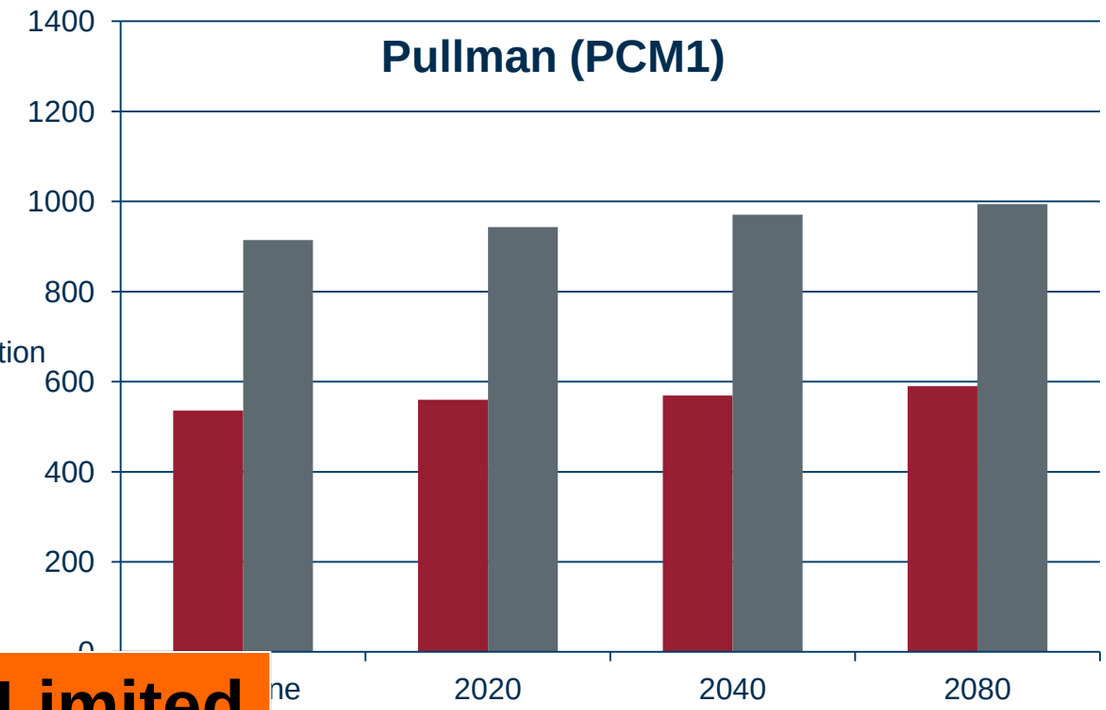






Annual Precipitation and Potential Evapotranspiration ETo (mm)

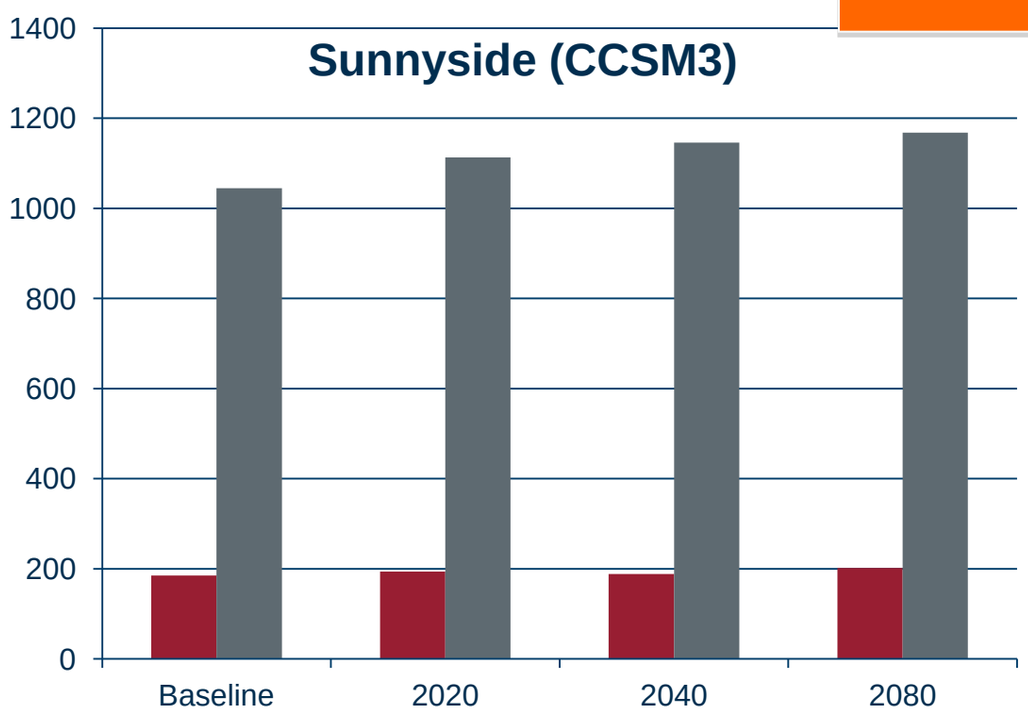


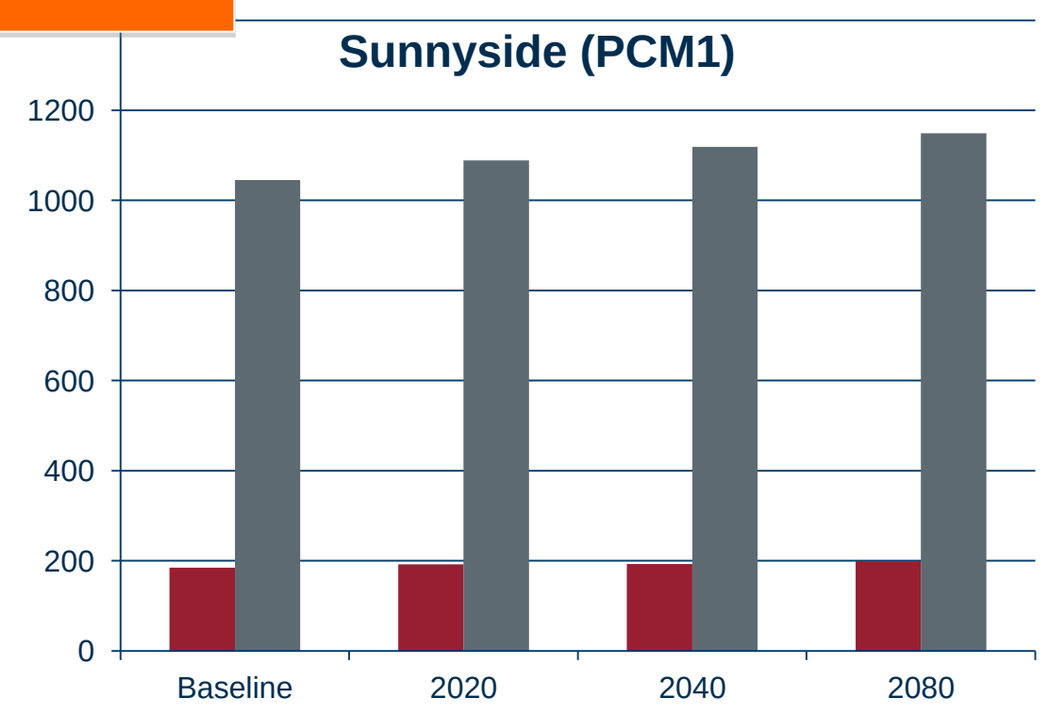


Precipitation

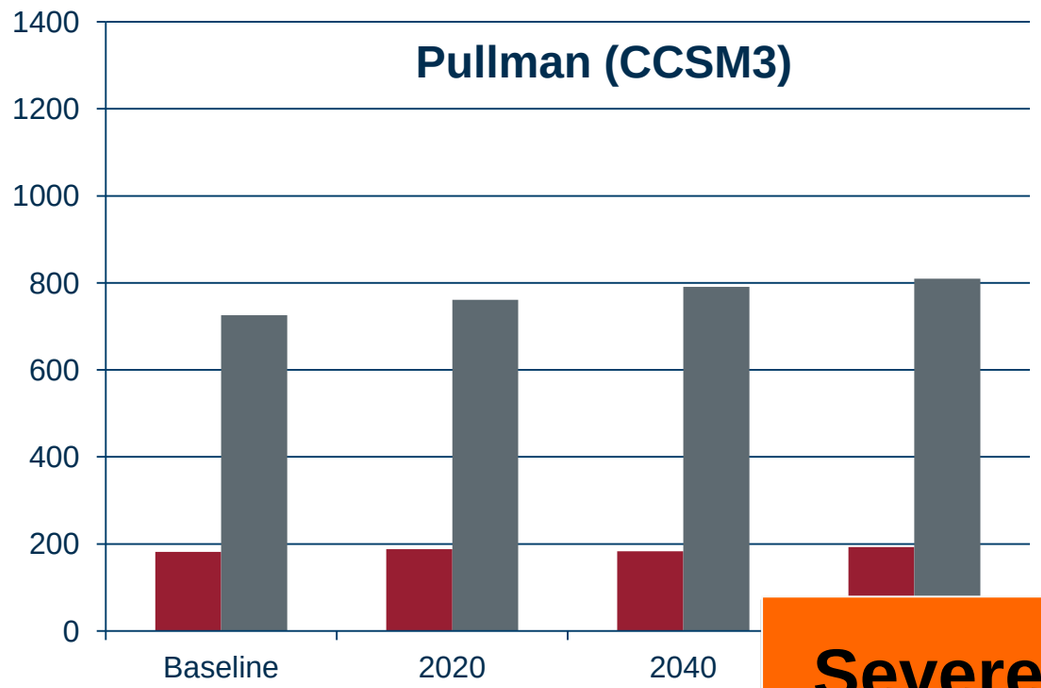
ETo

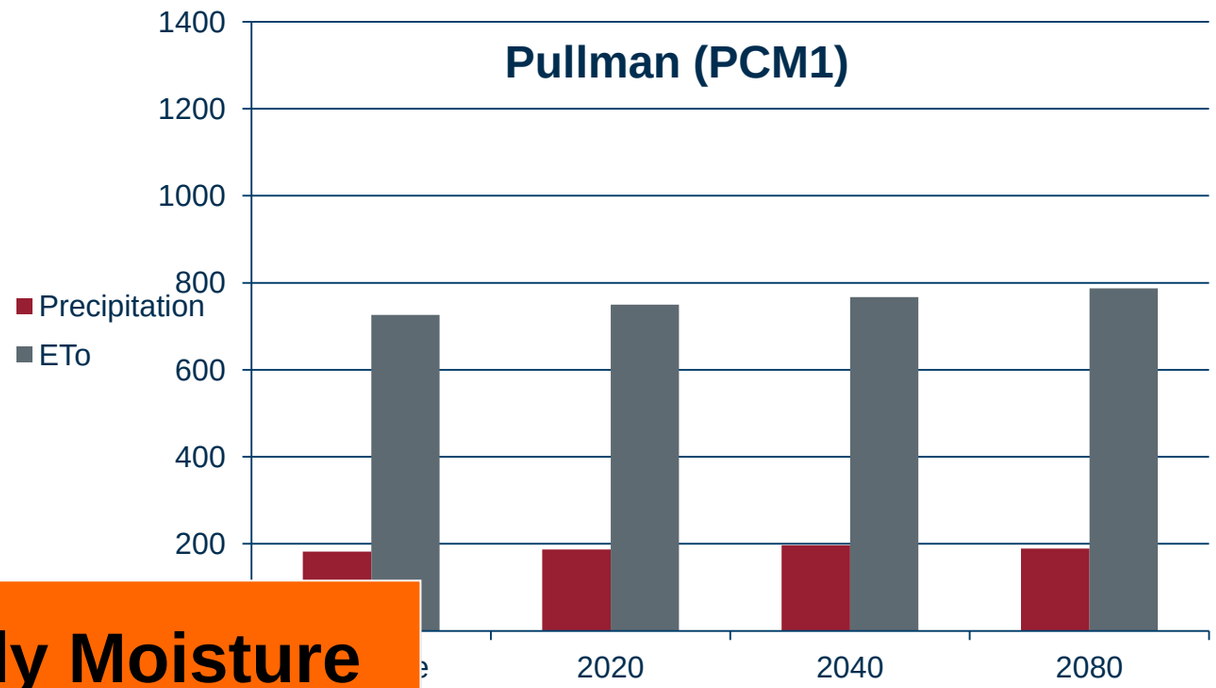
Moisture Limited



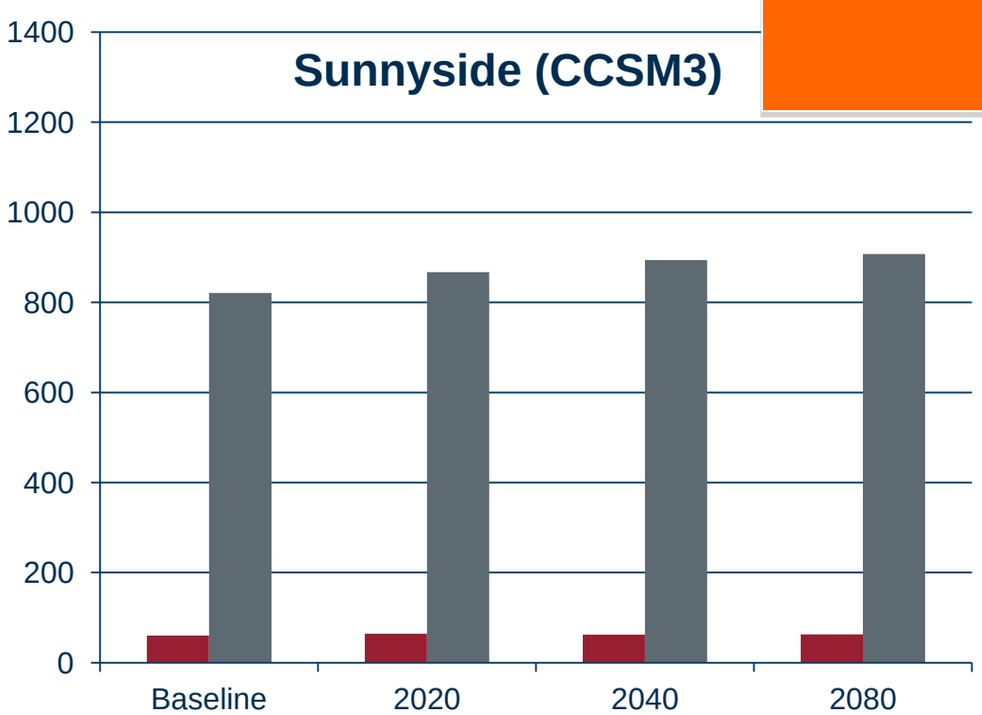


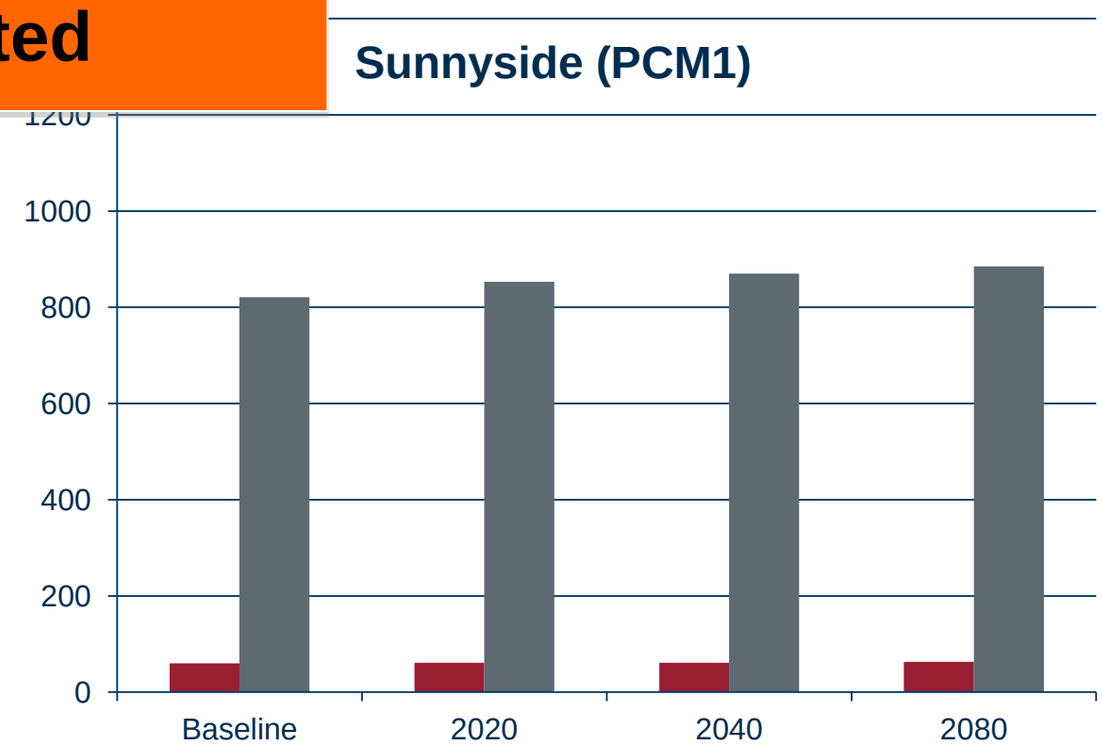
Seasonal (April 1- Sept 30) Precipitation and Potential Evapotranspiration ETo (mm)



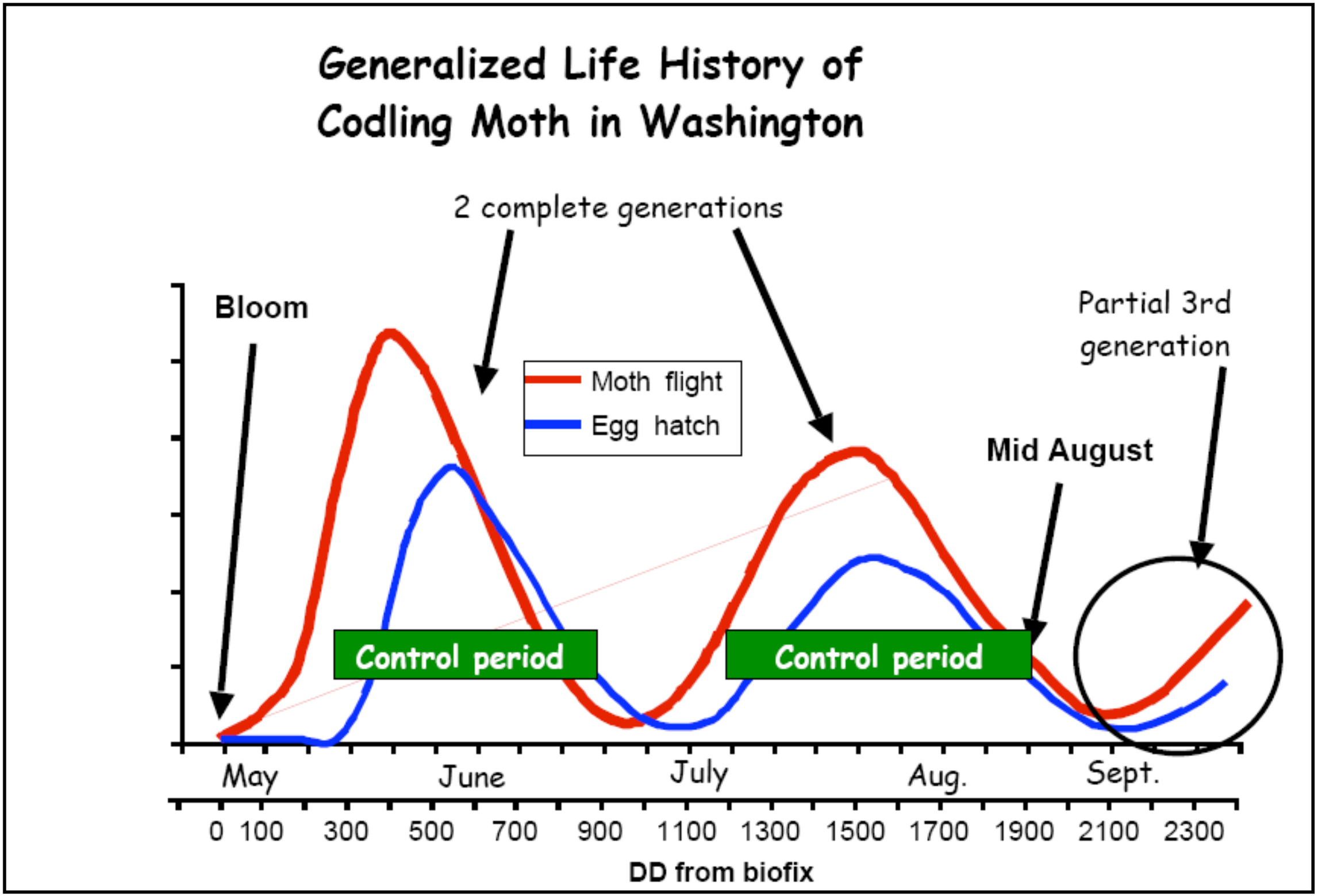


Severely Moisture Limited

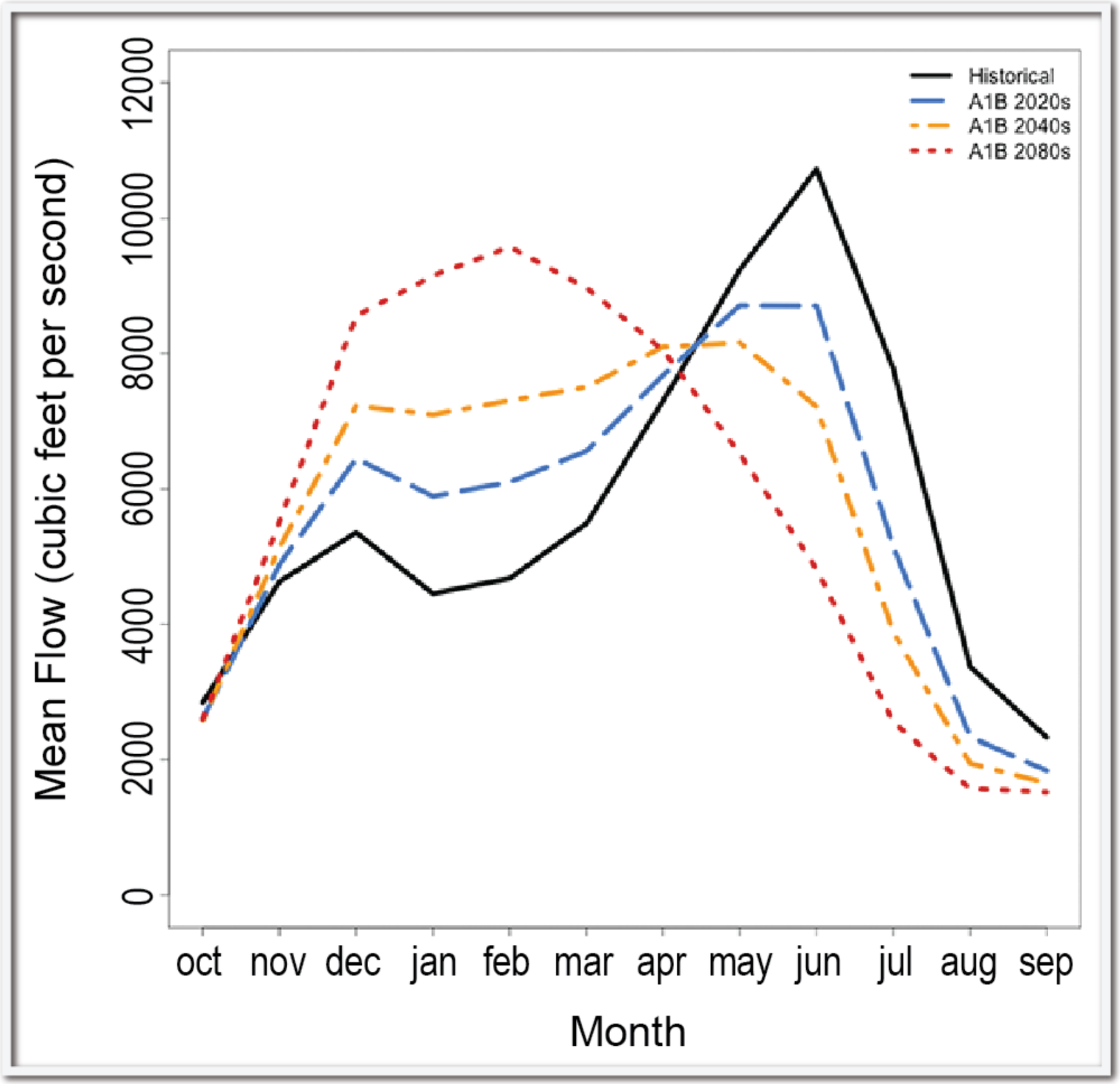




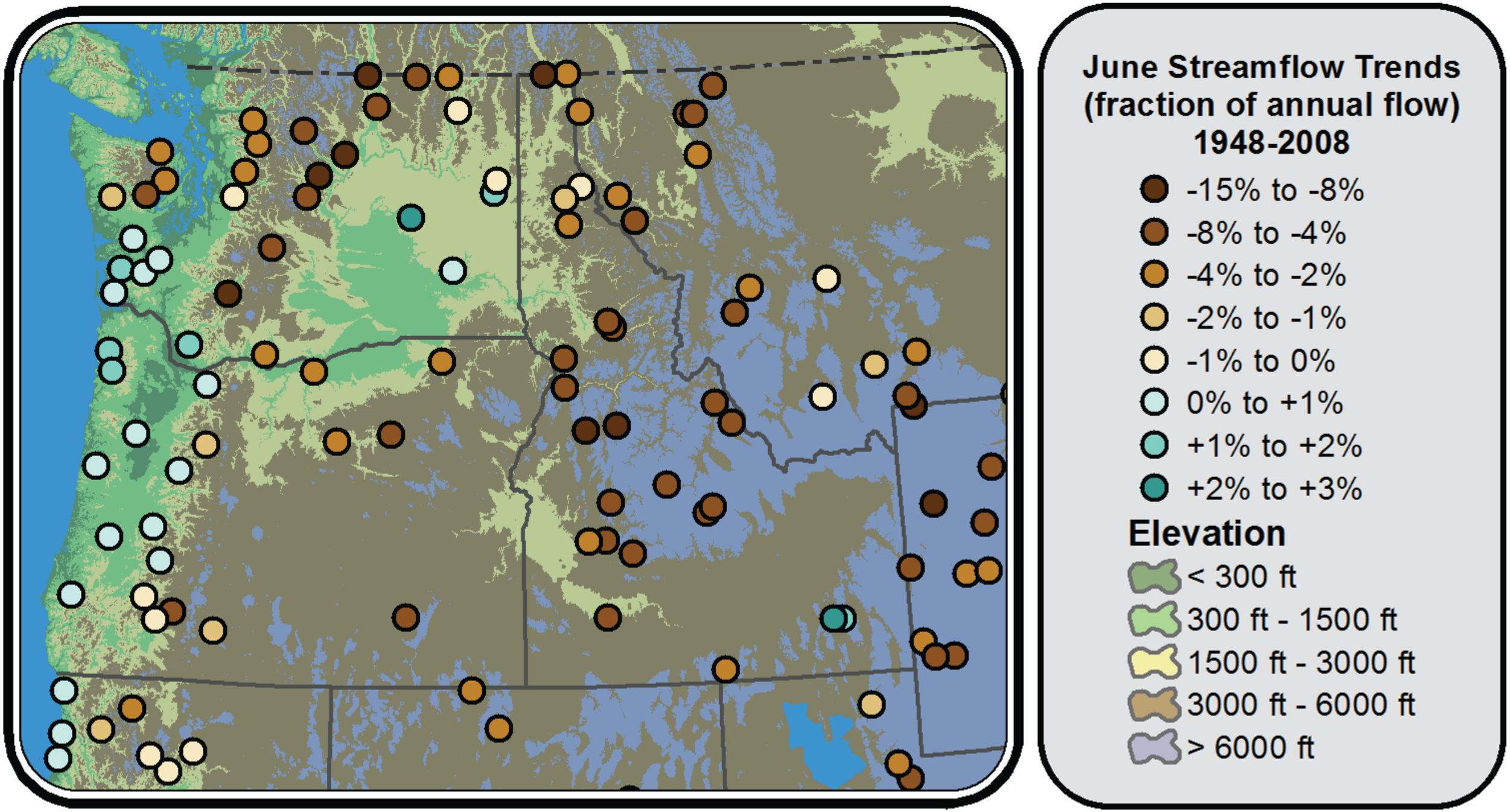
Climate Influence on Pests



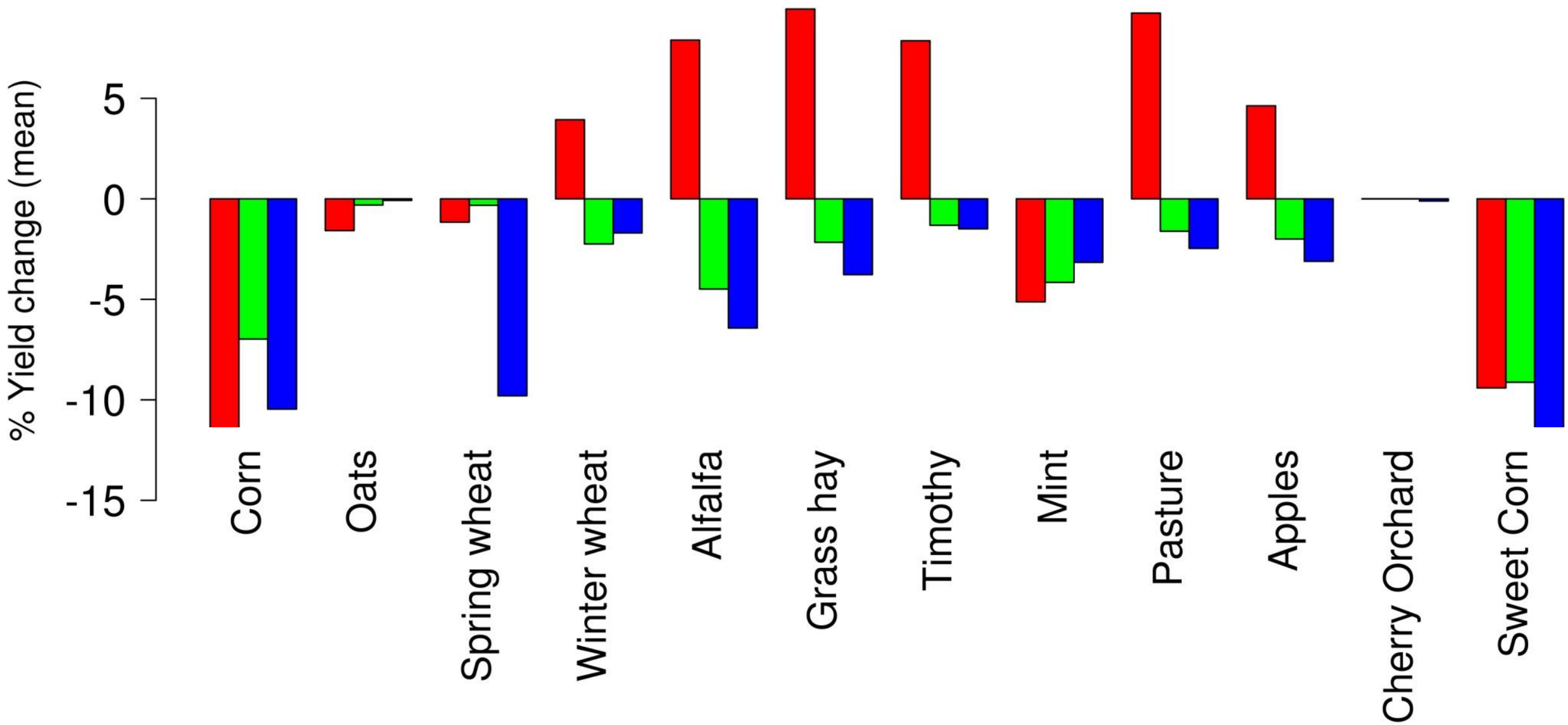
Future Shift in Timing of Stream Flows



Decreasing summer flow in snowmelt watersheds



Projected Climate Change Impacts on Crop Yield: Curtailment Columbia River Supply & Demand Forecast



Due to Climate
Historical Curtailment
Future Curtailment

Adam, et.al. In preparation

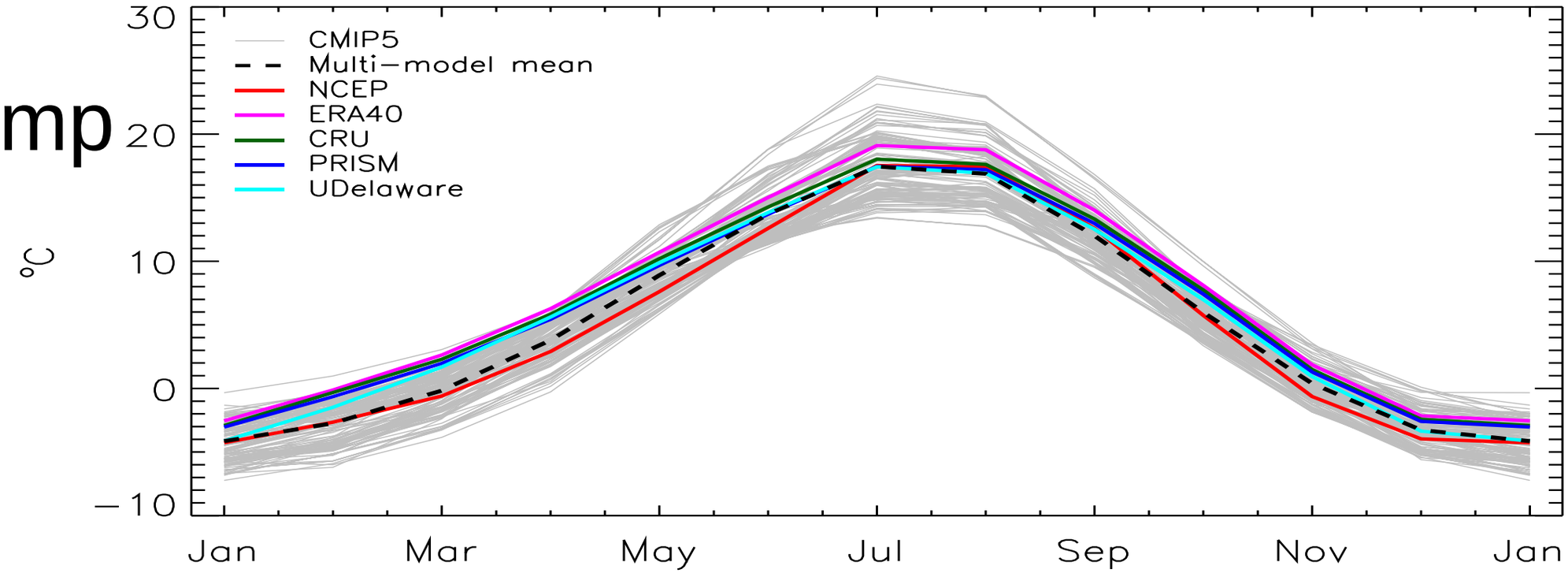
Conclusions

- Warming has occurred over 20th century and will continue through 21st century.
- There will be winner's and losers.
- Benefits of longer growing season and increasing CO_2 but ….
- Balanced against water and pests/disease considerations.

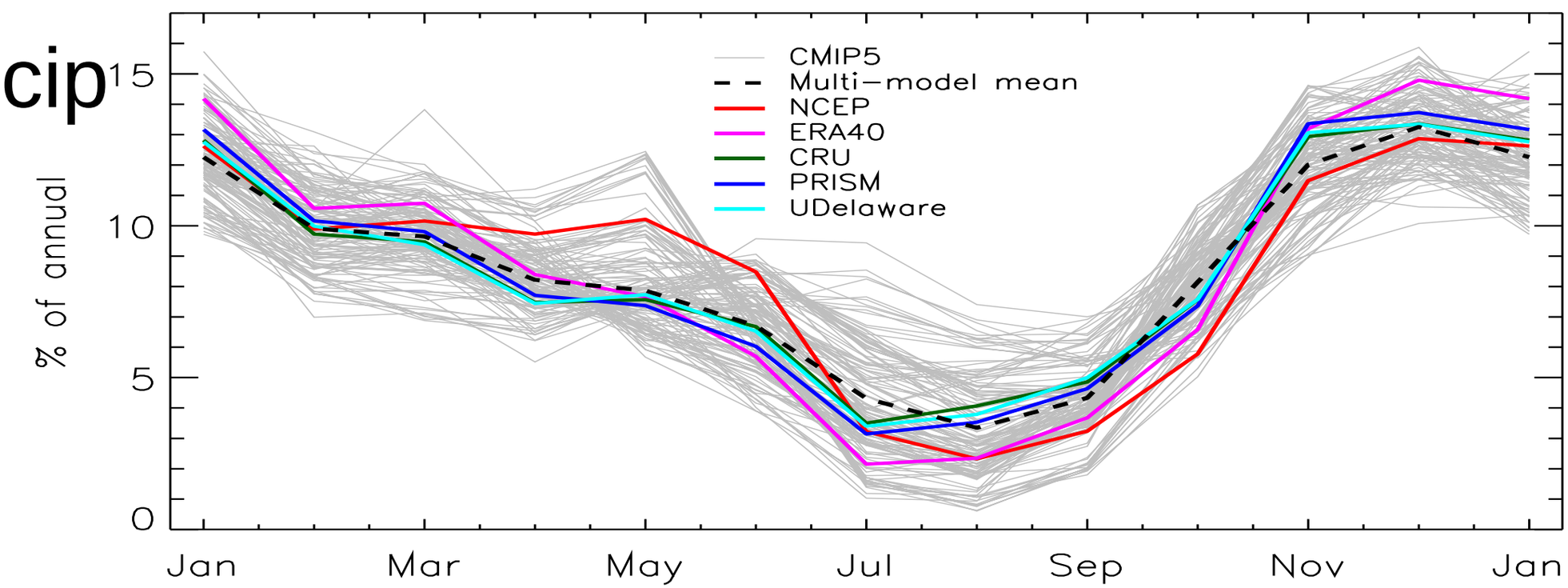
How Good are Climate Models?

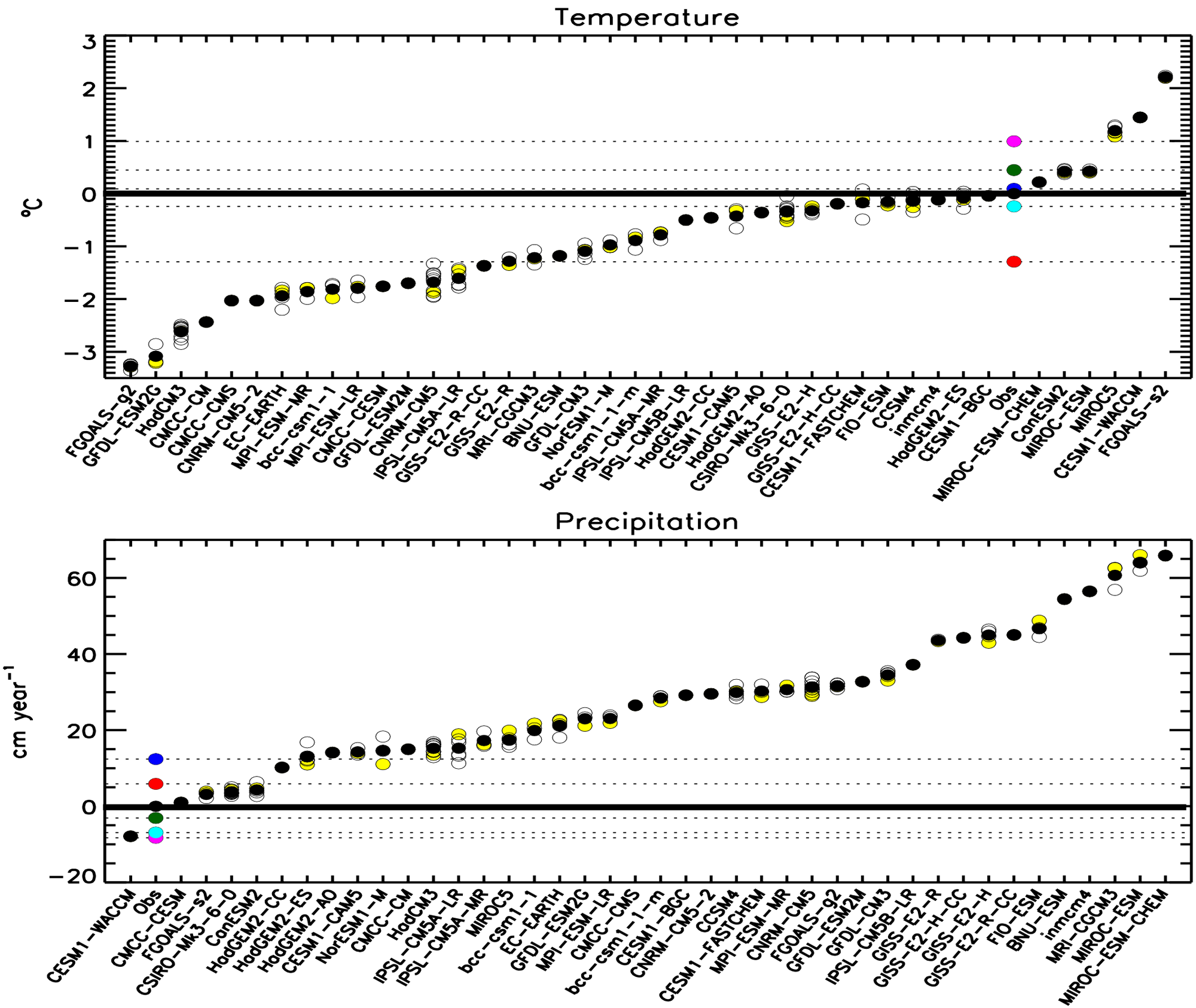
GCM Simulation of Past Climate in the PNW

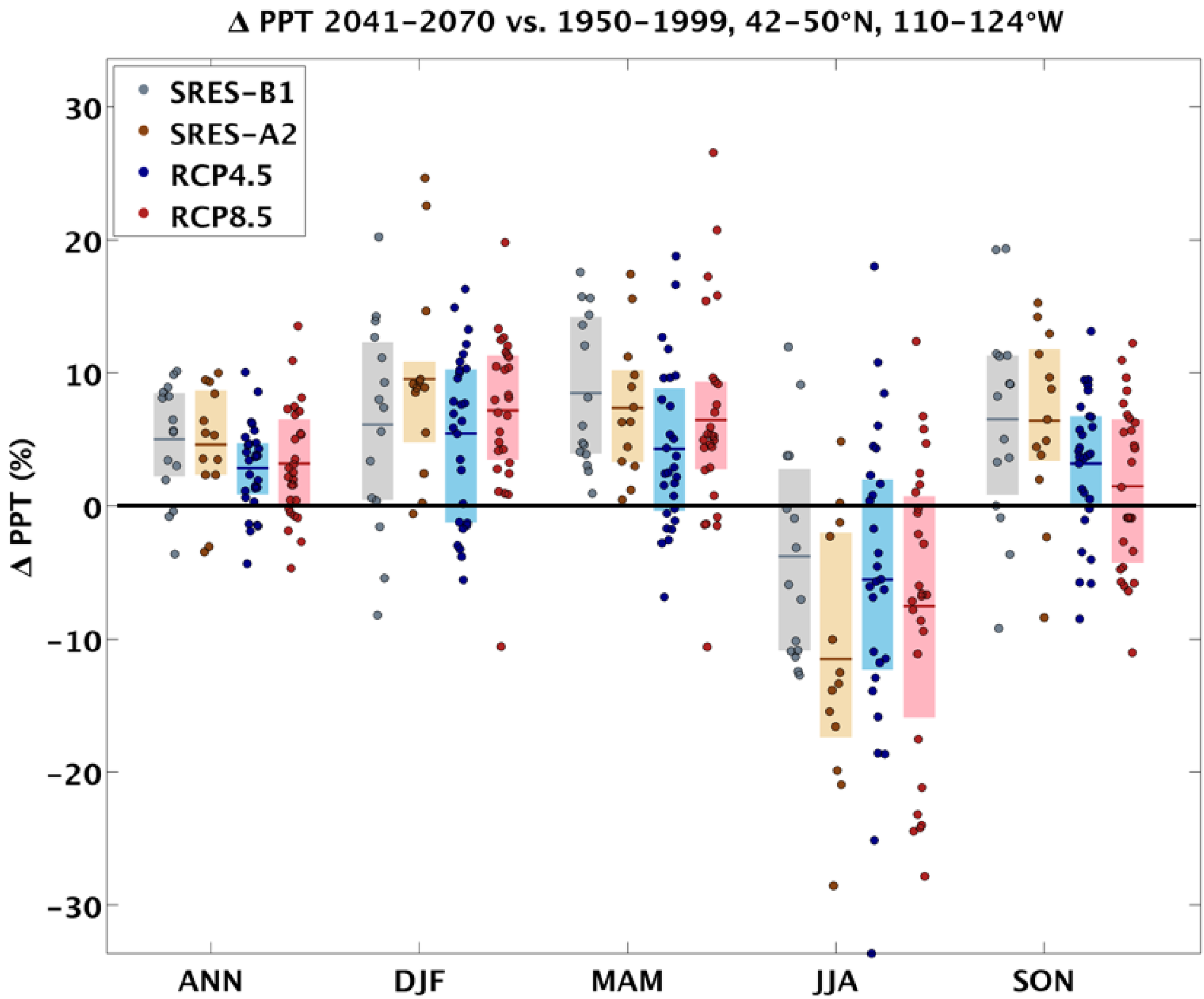
Temp

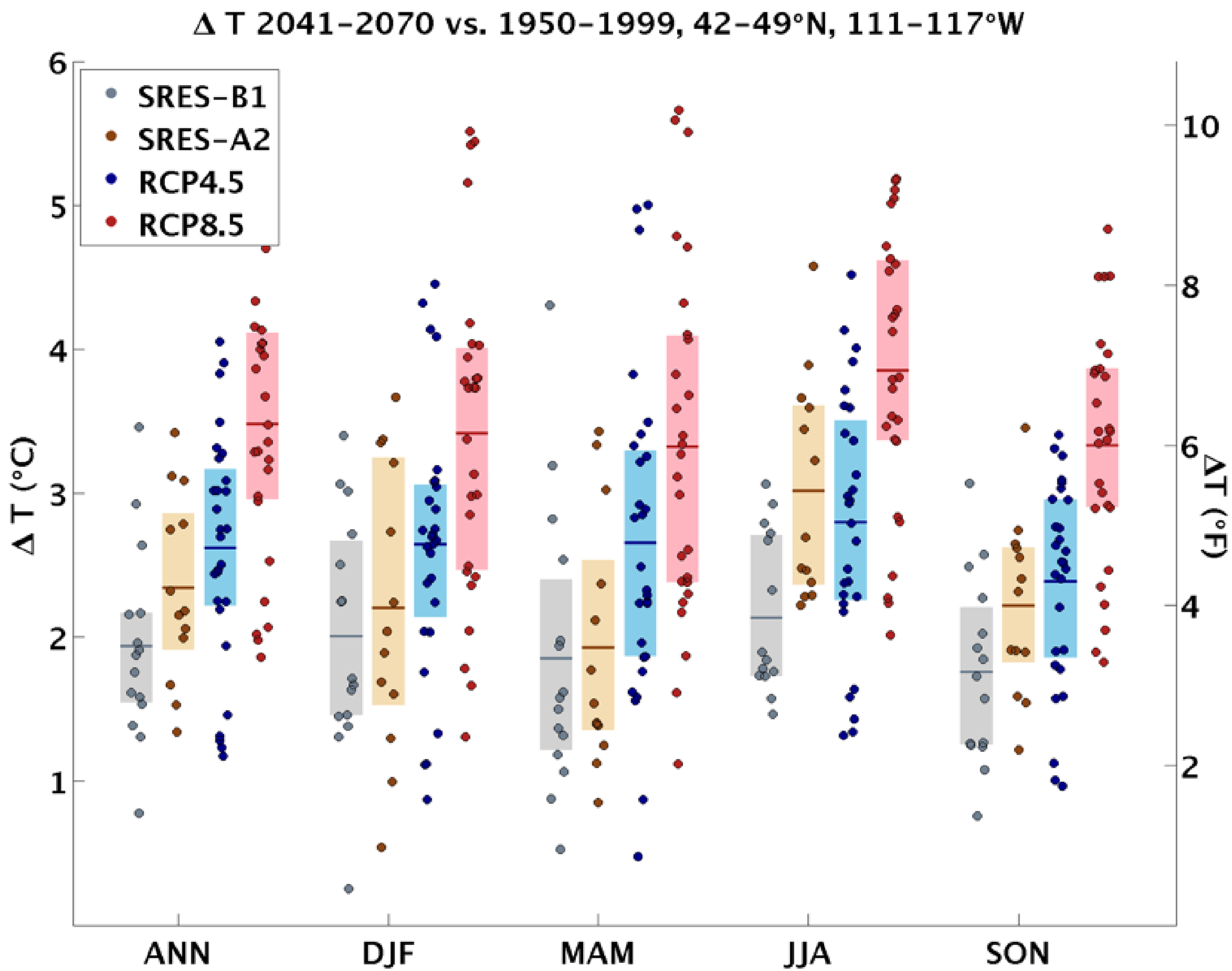


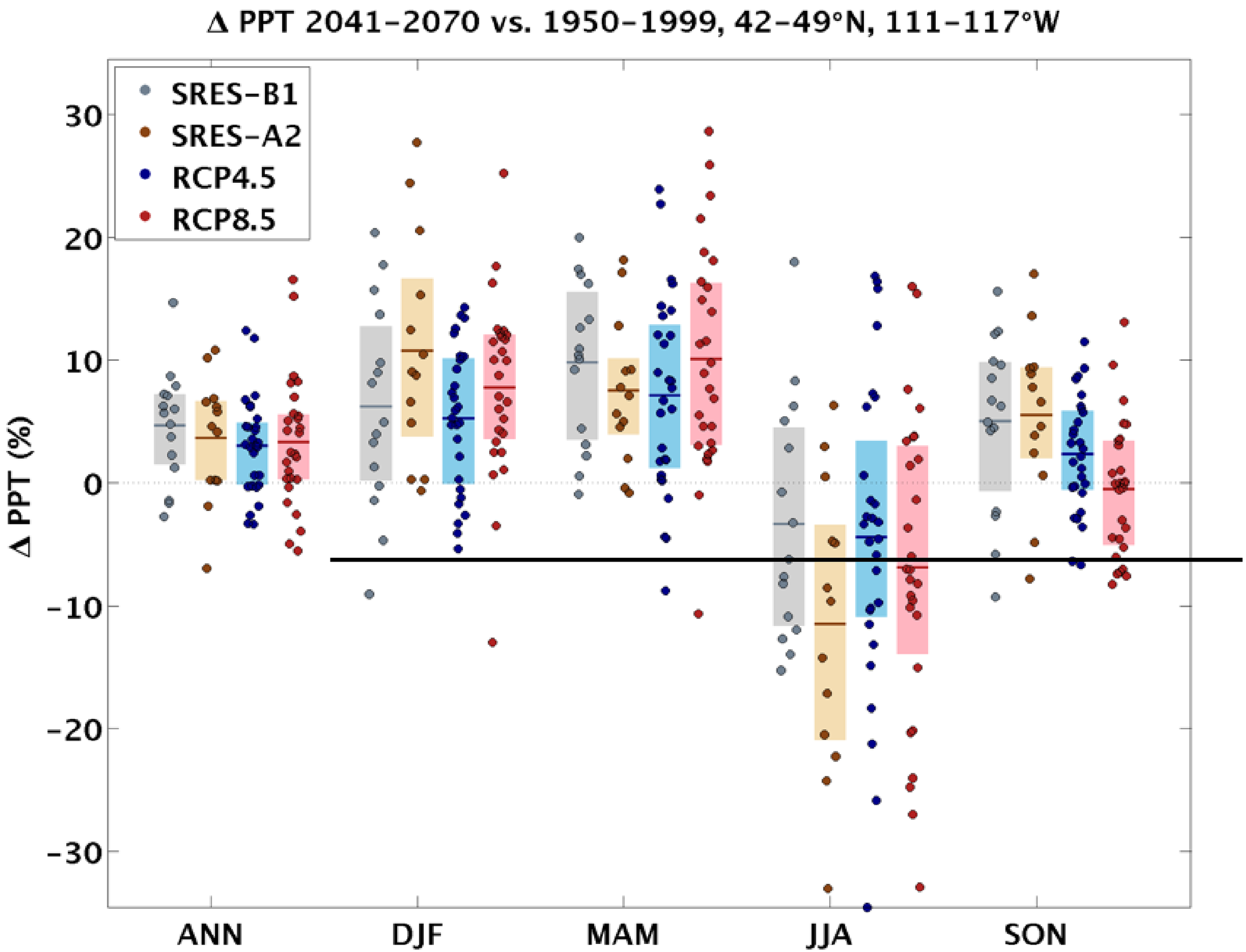
Precip




Temperature
°C
3
2
1
0
−1
−2
−3
FGOALS−g2
GFDL−ESM2G
HadCM3
CMCC−CM
CMCC−CMS
CNRM−CM5−2
EC−EARTH
MPI−ESM−MR
bcc−csm1−1
MPI−ESM−LR
CMCC−CESM
GFDL−ESM2M
CNRM−CM5
IPSL−CM5A−LR
GISS−E2−R−CC
GISS−E2−R
MRI−CGCM3
BNU−ESM
GFDL−CM3
NorESM1−M
bcc−csm1−1−m
IPSL−CM5A−MR
IPSL−CM5B−LR
HadGEM2−CC
CESM1−CAM5
HadGEM2−AO
CSIRO−Mk3−6−0
GISS−E2−H
GISS−E2−H−CC
CESM1−FASTCHEM
FIO−ESM
CCSM4
inmcm4
HadGEM2−ES
CESM1−BGC
Obs
MIROC−ESM−CHEM
CanESM2
MIROC−ESM
MIROC5
CESM1−WACCM
FGOALS−s2
Precipitation
cm year^{-1}
60
40
20
0
−20
CESM1−WACCM
Obs
CMCC−CESM
FGOALS−s2
CSIRO−Mk3−6−0
CanESM2
HadGEM2−CC
HadGEM2−ES
HadGEM2−AO
CESM1−CAM5
NorESM1−M
CMCC−CM
HadCM3
IPSL−CM5A−LR
IPSL−CM5A−MR
MIROC5
bcc−csm1−1
EC−EARTH
GFDL−ESM2G
MPI−ESM−LR
CMCC−CMS
bcc−csm1−1−m
CESM1−BGC
CNRM−CM5−2
CCSM4
CESM1−FASTCHEM
MPI−ESM−MR
CNRM−CM5
FGOALS−g2
GFDL−ESM2M
GFDL−CM3
IPSL−CM5B−LR
GISS−E2−R
GISS−E2−H−CC
GISS−E2−H
GISS−E2−R−CC
FIO−ESM
BNU−ESM
inmcm4
MRI−CGCM3
MIROC−ESM
MIROC−ESM−CHEM


Δ PPT 2041–2070 vs. 1950–1999, 42–50°N, 110–124°W
SRES-B1
SRES-A2
RCP4.5
RCP8.5
Δ PPT (%)
30
20
10
0
−10
−20
−30
ANN
DJF
MAM
JJA
SON


Δ T 2041–2070 vs. 1950–1999, 42–49°N, 111–117°W
SRES-B1
SRES-A2
RCP4.5
RCP8.5
Δ T (°C)
ΔT (°F)
1
2
3
4
5
6
2
4
6
8
10
ANN
DJF
MAM
JJA
SON


Δ PPT 2041–2070 vs. 1950–1999, 42–49°N, 111–117°W
SRES-B1
SRES-A2
RCP4.5
RCP8.5
Δ PPT (%)
30
20
10
0
-10
-20
-30
ANN
DJF
MAM
JJA
SON