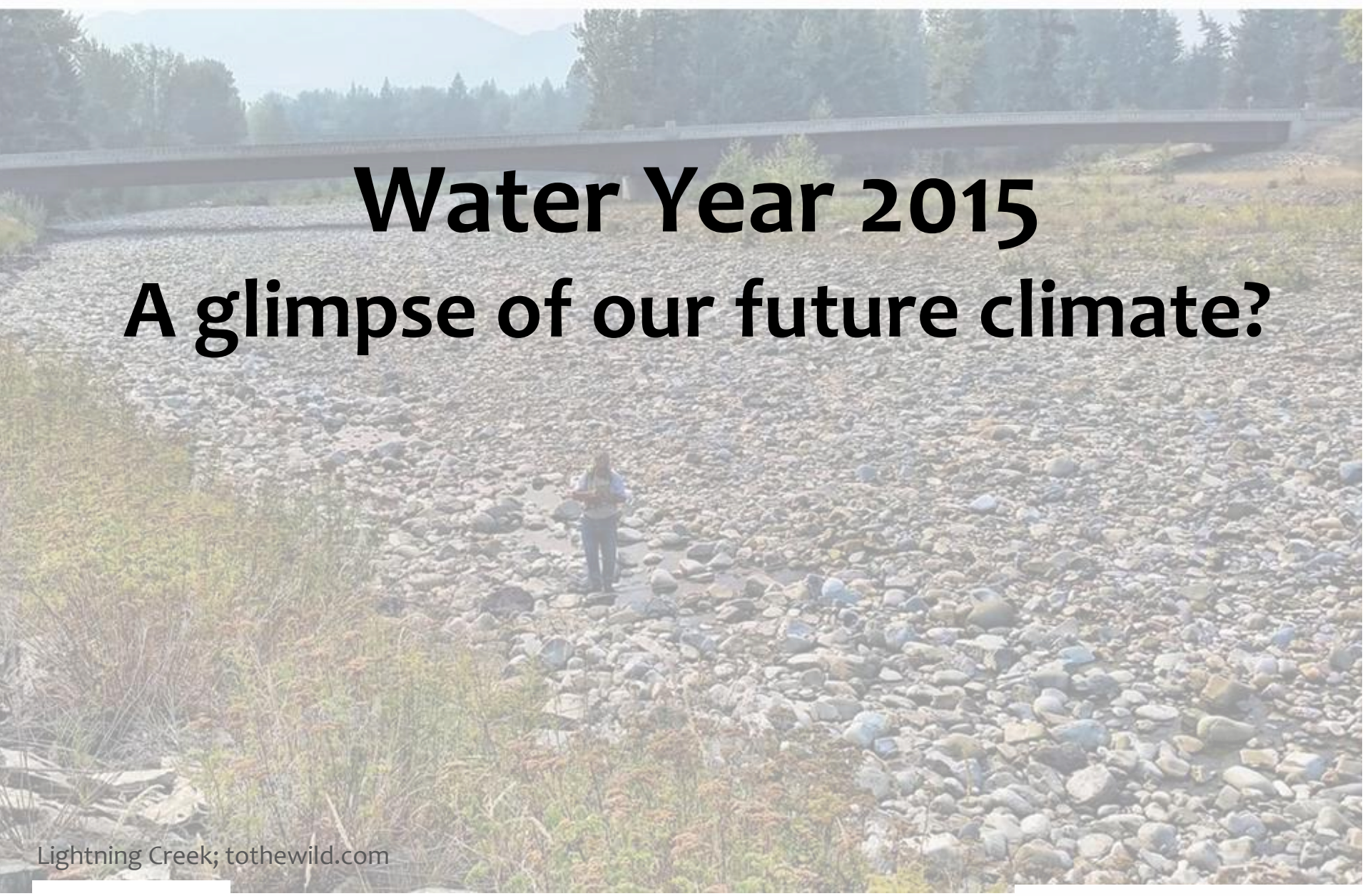
Water Year 2015
A glimpse of our future climate?



Lightning Creek; tothewild.com

John Abatzoglou
Associate Professor of Climatology
University of Idaho
CIRC
Climate Impacts Research Consortium
A NOAA RISA TEAM

Mt. Spokane Resort
Gonzaga Bulletin

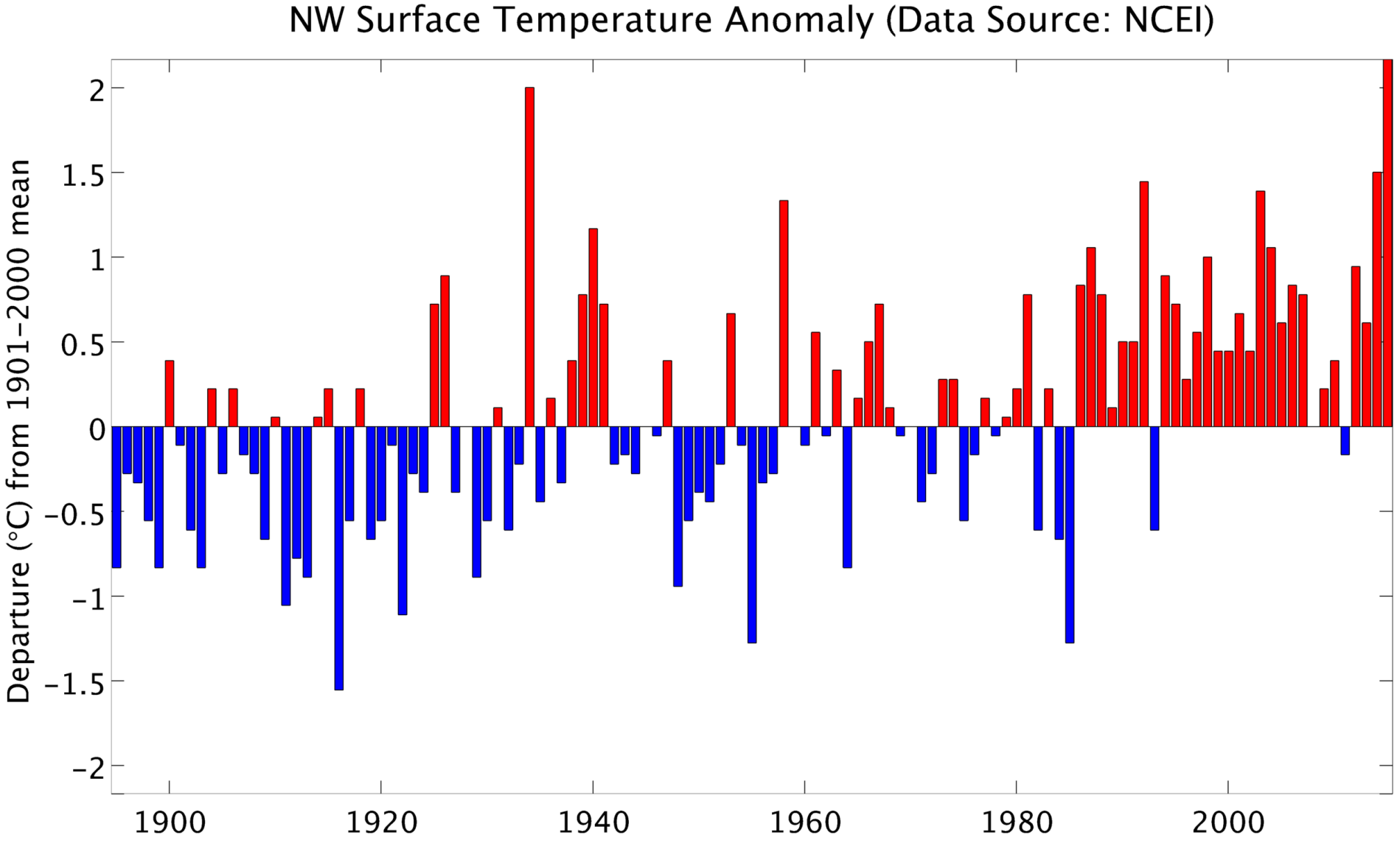
Moscow Mountain, Idaho

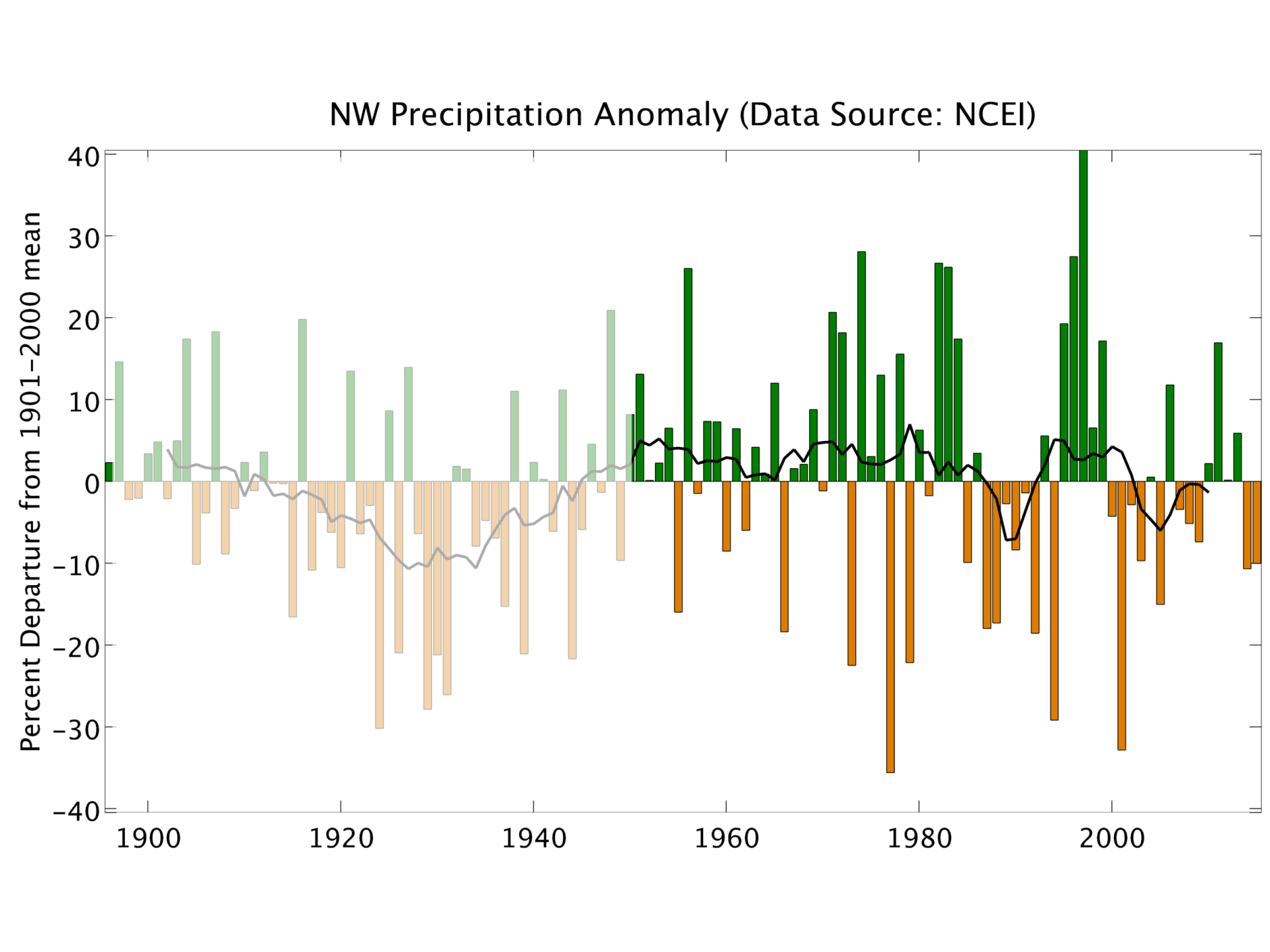

NASA MODIS, 8/23/15

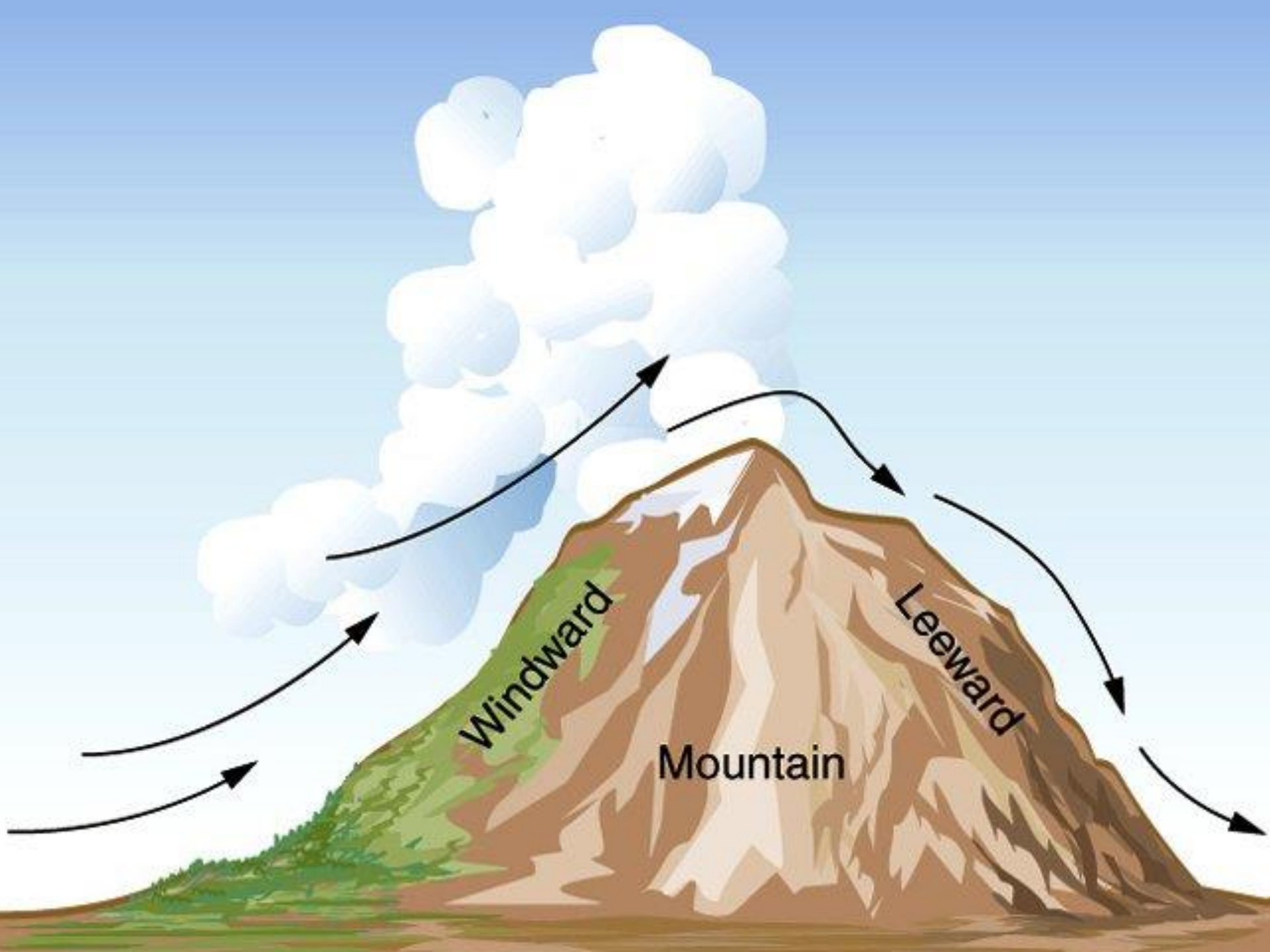
Weather vs. Climate

Weather is…	**Climate** is…
your mood	your personality
what you are wearing	your wardrobe
what you had for breakfast	what's in your fridge

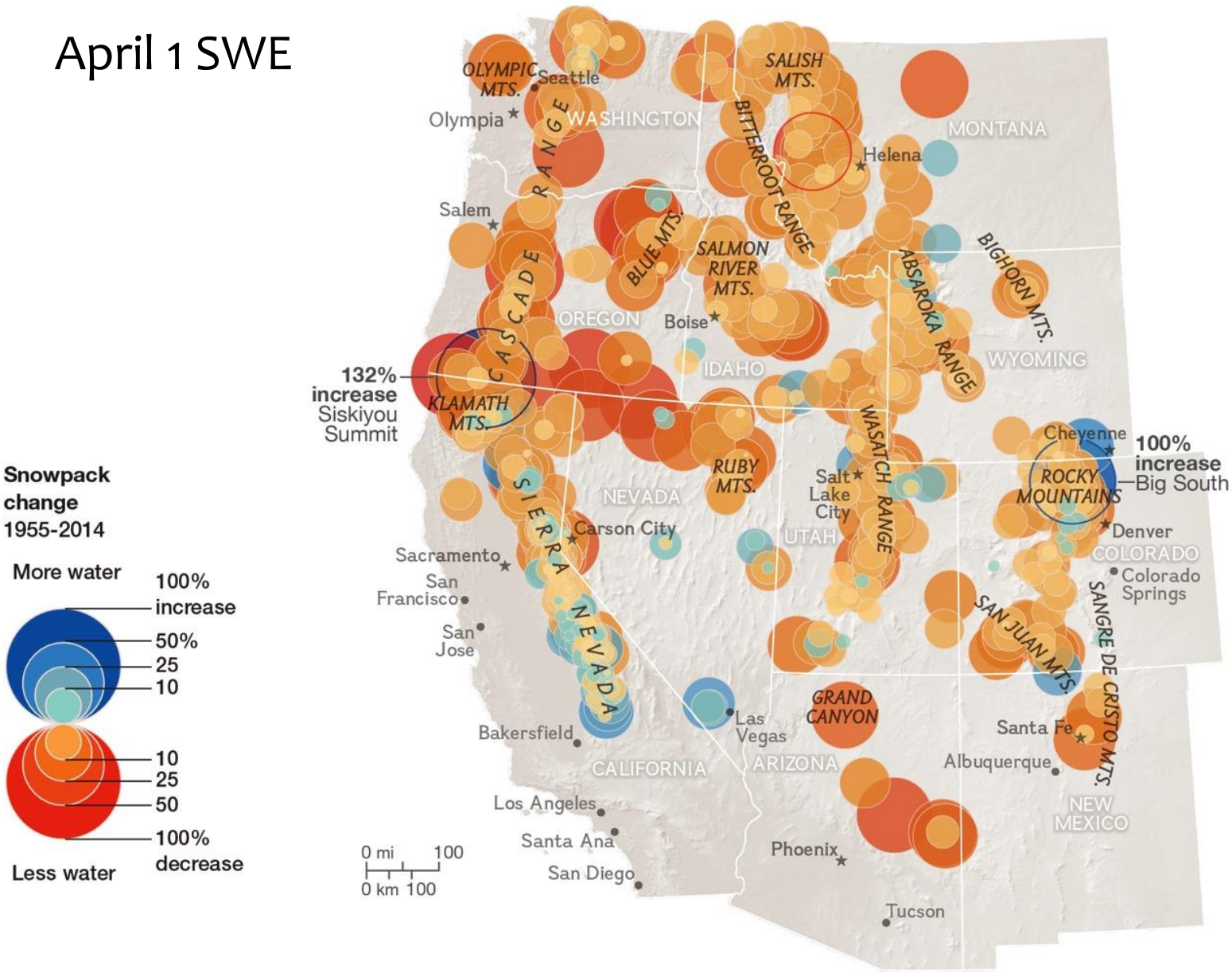

onlocationnorthidaho.blogspot.com


NW Surface Temperature Anomaly (Data Source: NCEI)
Departure (°C) from 1901–2000 mean
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
1900
1920
1940
1960
1980
2000


NW Precipitation Anomaly (Data Source: NCEI)
Percent Departure from 1901–2000 mean
40
30
20
10
0
-10
-20
-30
-40
1900
1920
1940
1960
1980
2000

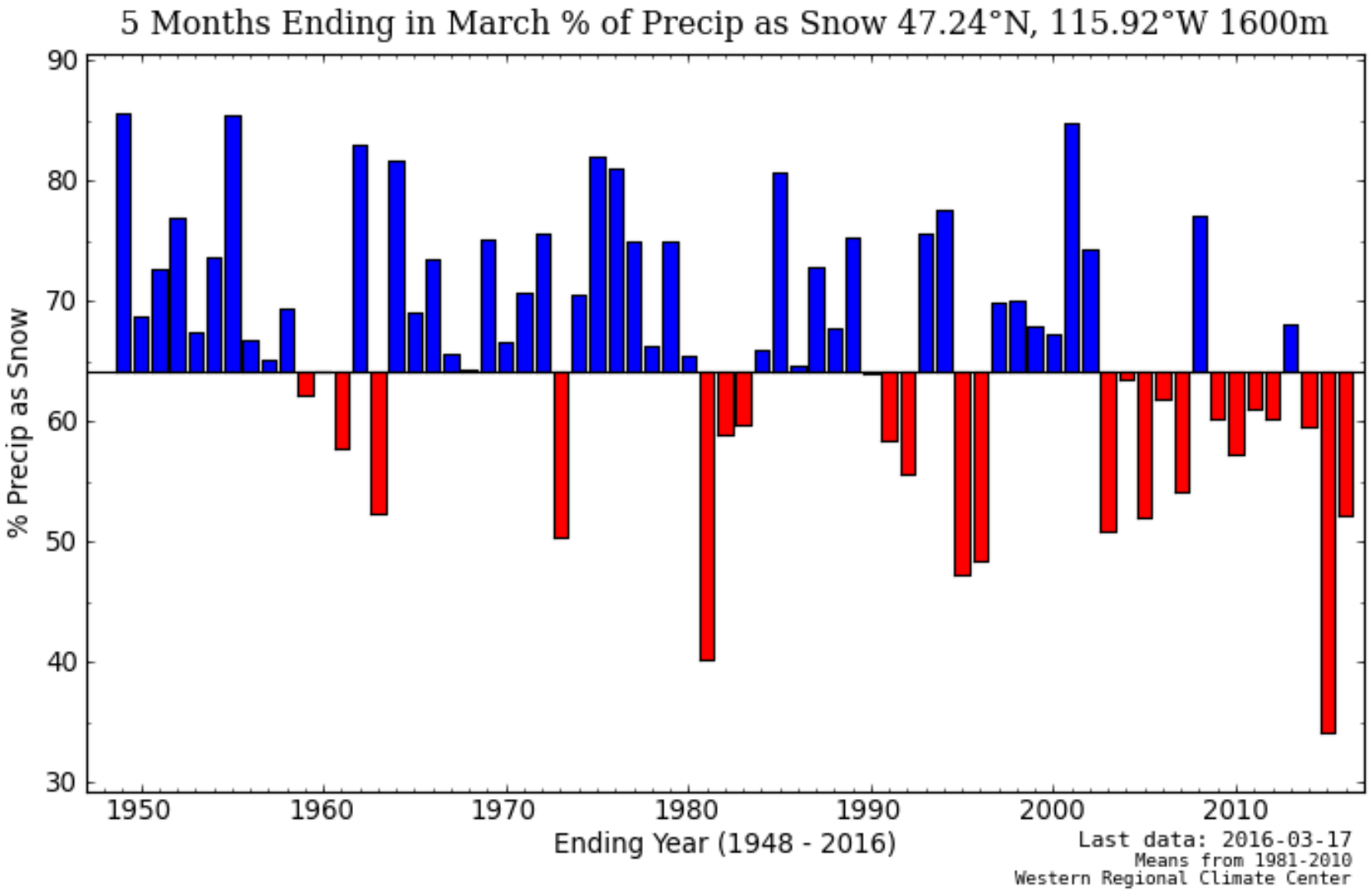

Windward
Leeward
Mountain

April 1 SWE

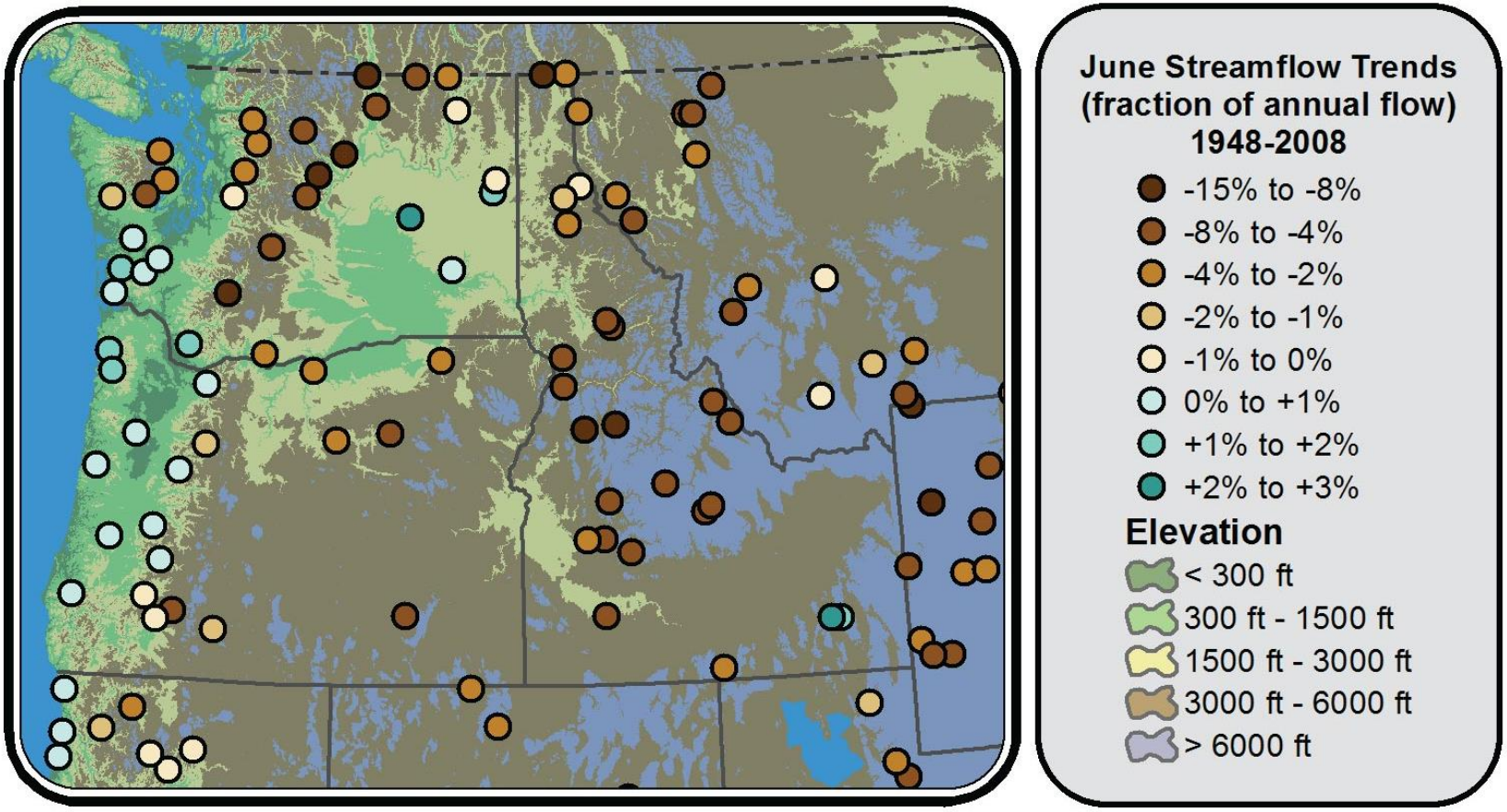


VIRGINIA W. MASON AND KELSEY NOWAKOWSKI, NGM STAFF. SOURCES: NATURAL RESOURCES CONSERVATION SERVICE; CALIFORNIA DEPARTMENT OF WATER RESOURCES; DARRIN SHARP AND PHILIP MOTE, OREGON STATE UNIVERSITY

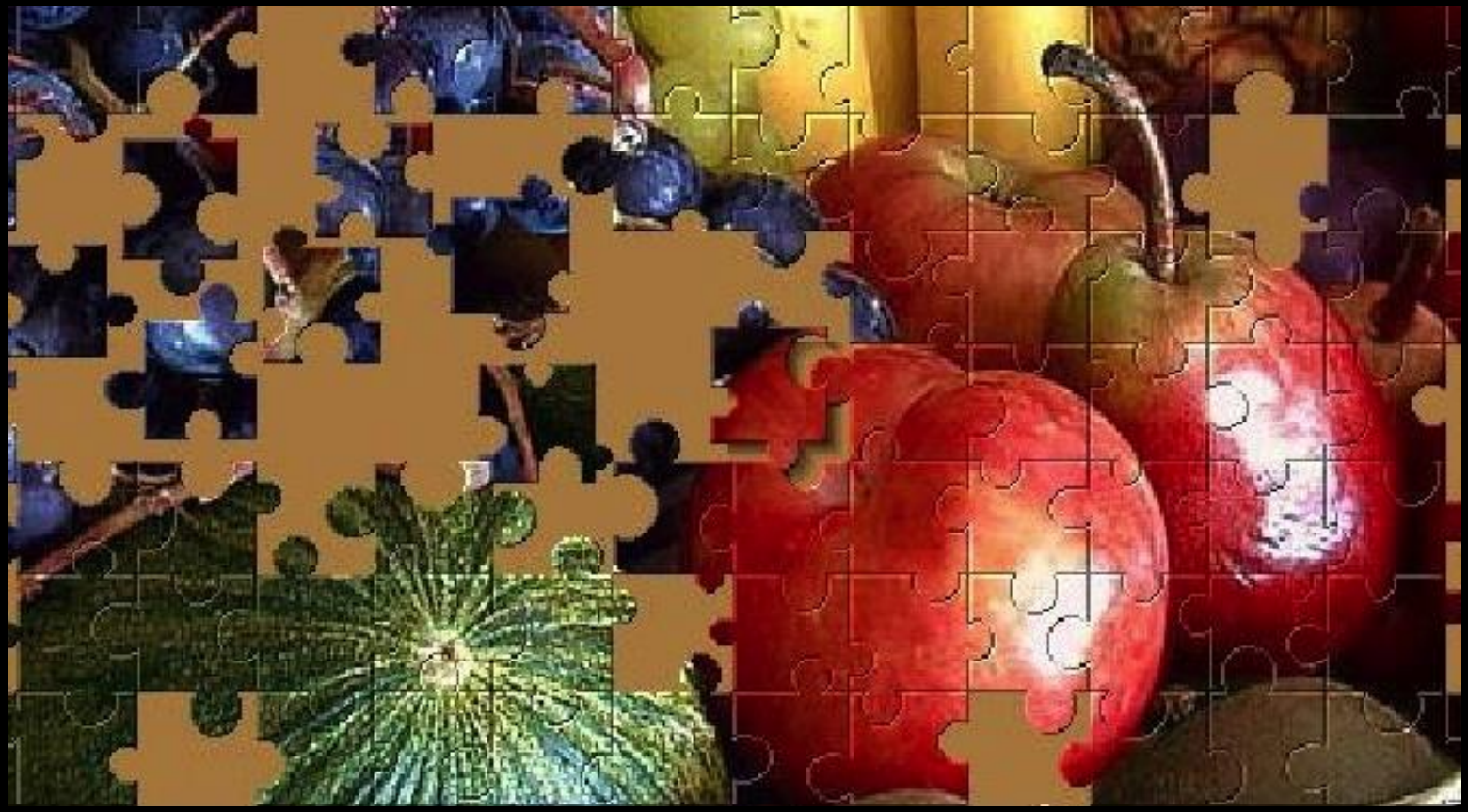
Less Precipitation falling as Snow



Less summer flow



Luce and Holden, 2009



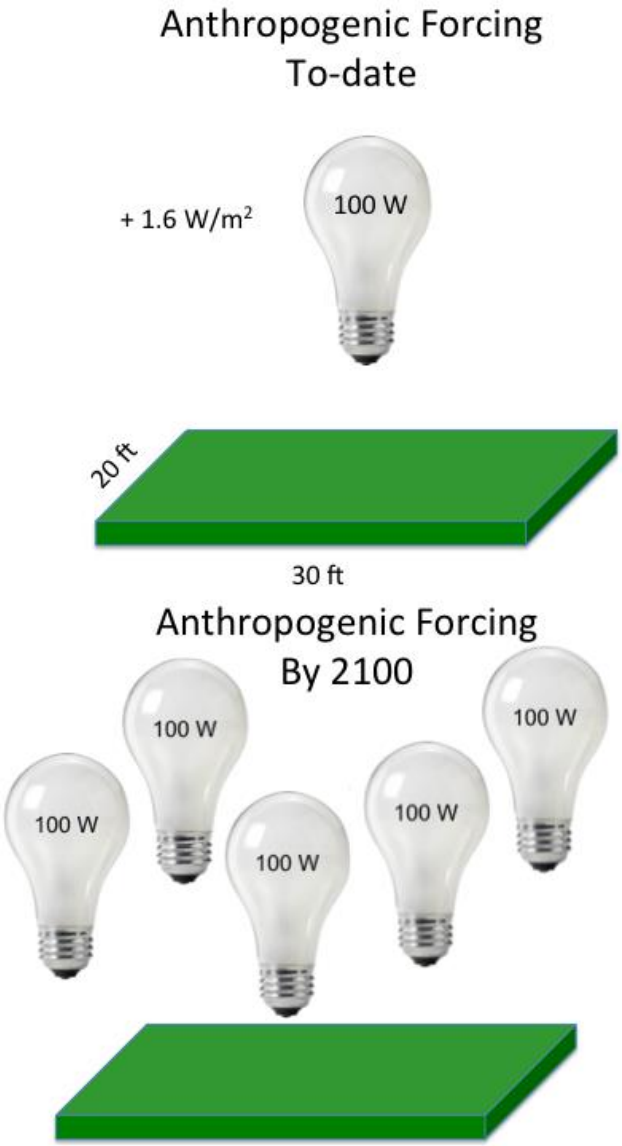
Future Pathways

RCP8.5: No climate policy future. Business as usual.

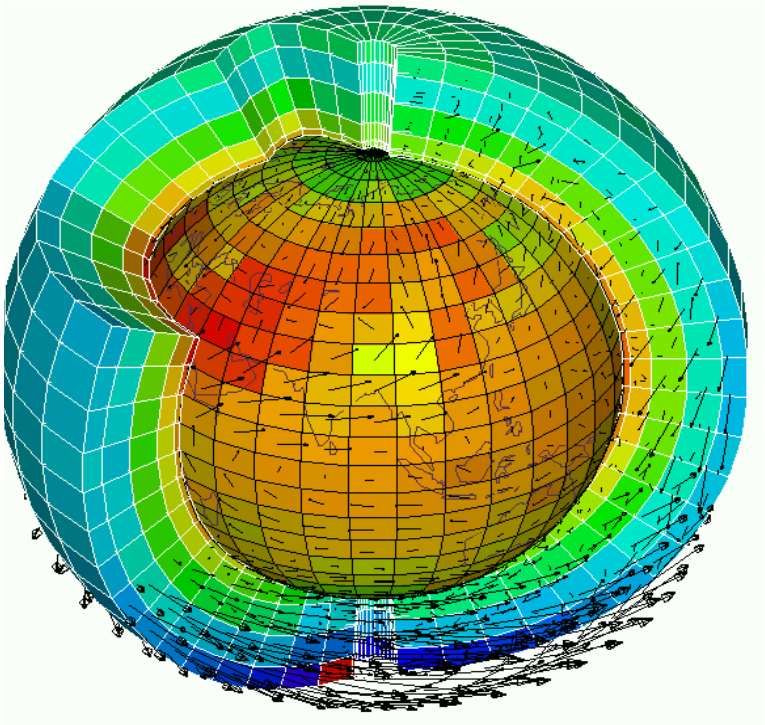
RCP6.0: Adapt to Risk

RCP4.5: Moderate Mitigation and Climate Policy

RCP2.6: Aggressive Climate Policy and Carbon Sequester and Capture Technology



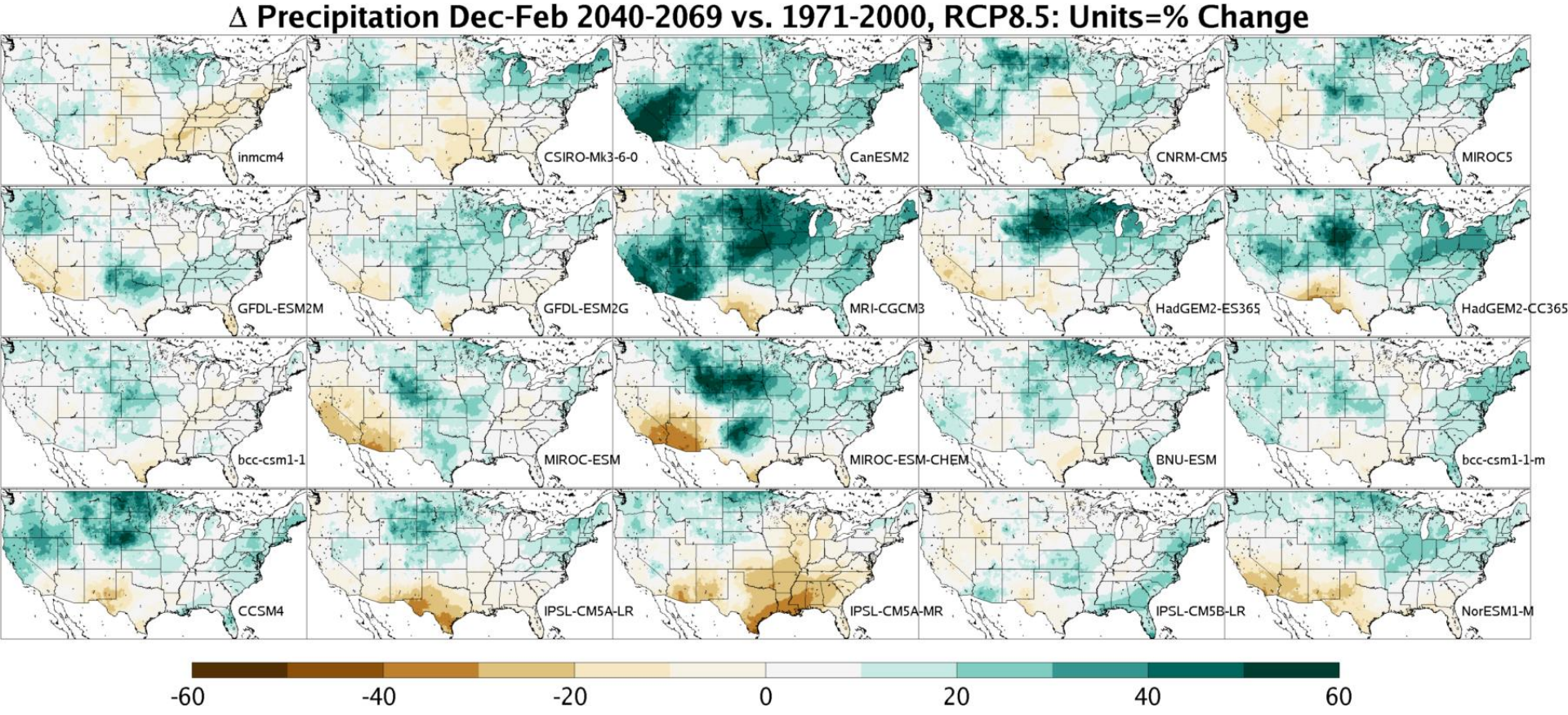
Global Climate Models



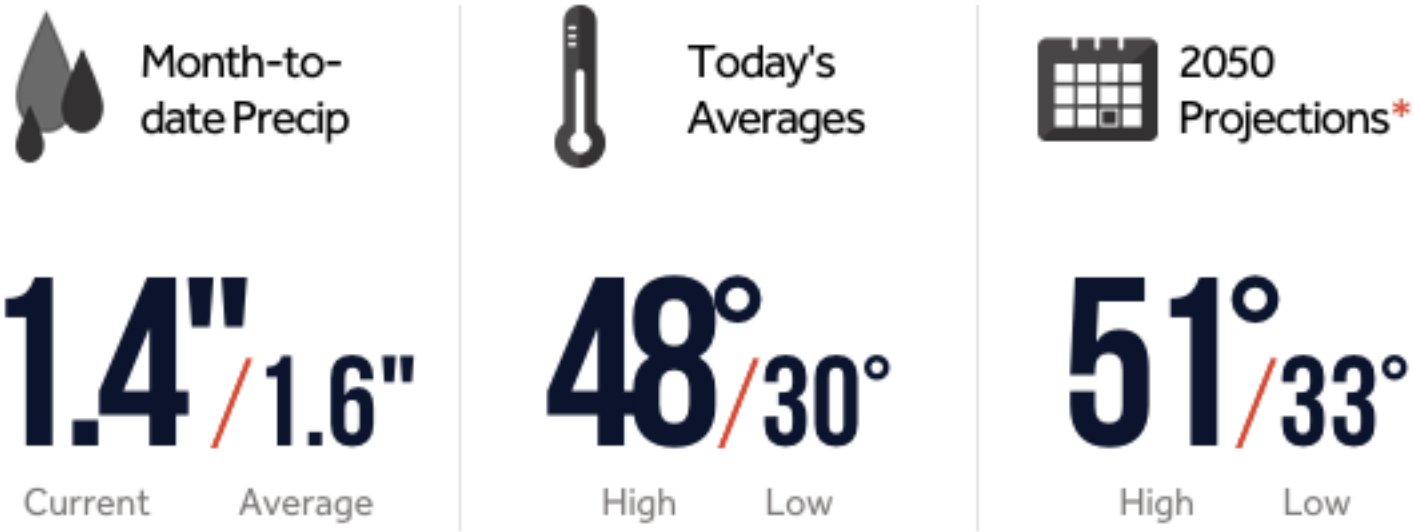
Models are:

- based on physical principals and laws
- tools, not answers, to improve decision making
- platform to conduct scientific experiments and test hypotheses

One experiment, many results



Your Local Forecast



- Climate models **can't** tell you what the weather will be like on March 23, 2060
- They **can** tell you a range of what climatological statistics of a March 23, 2060 day would look like

wxshift.com

Temperature

Difference from 1950-1999 average

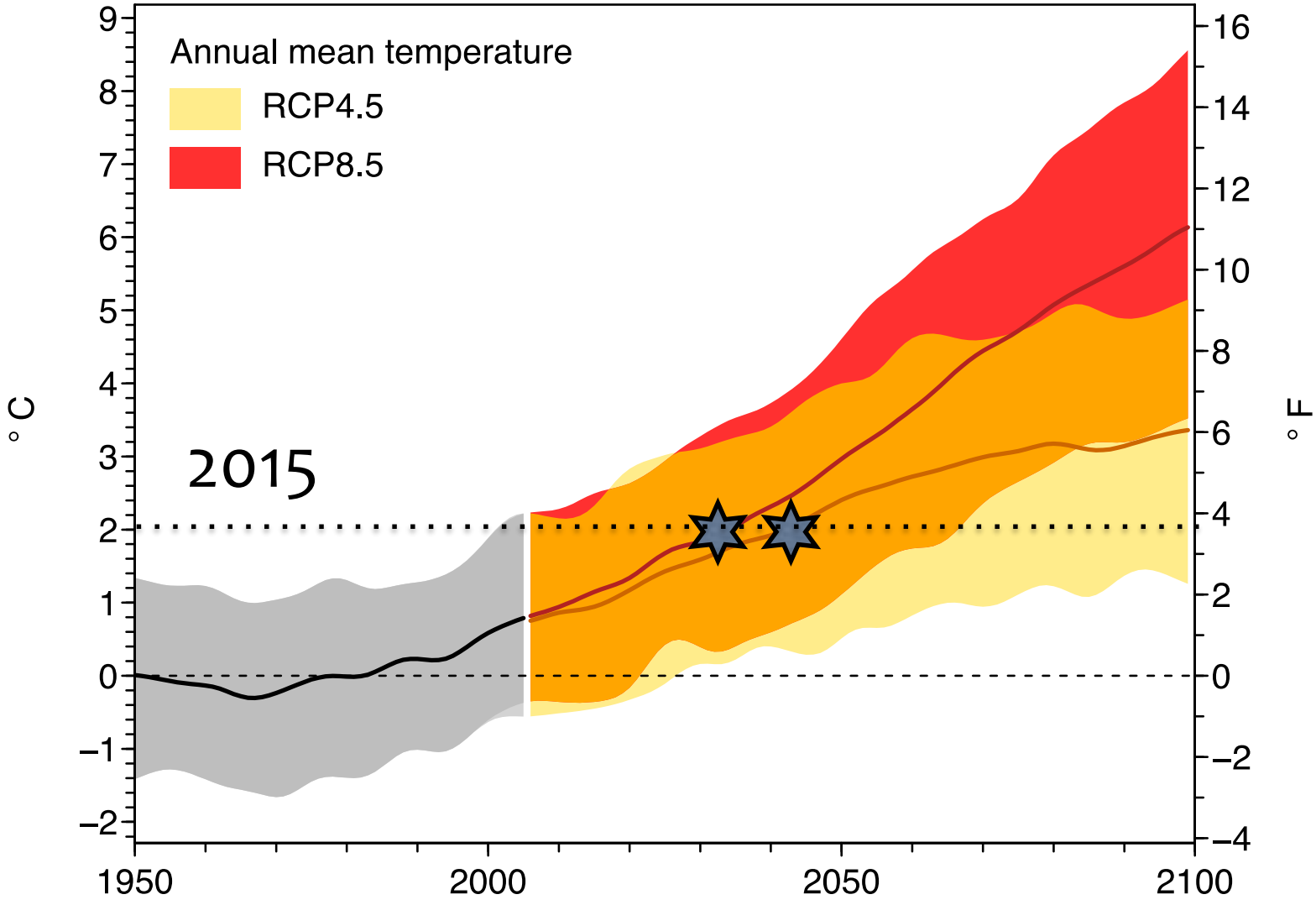
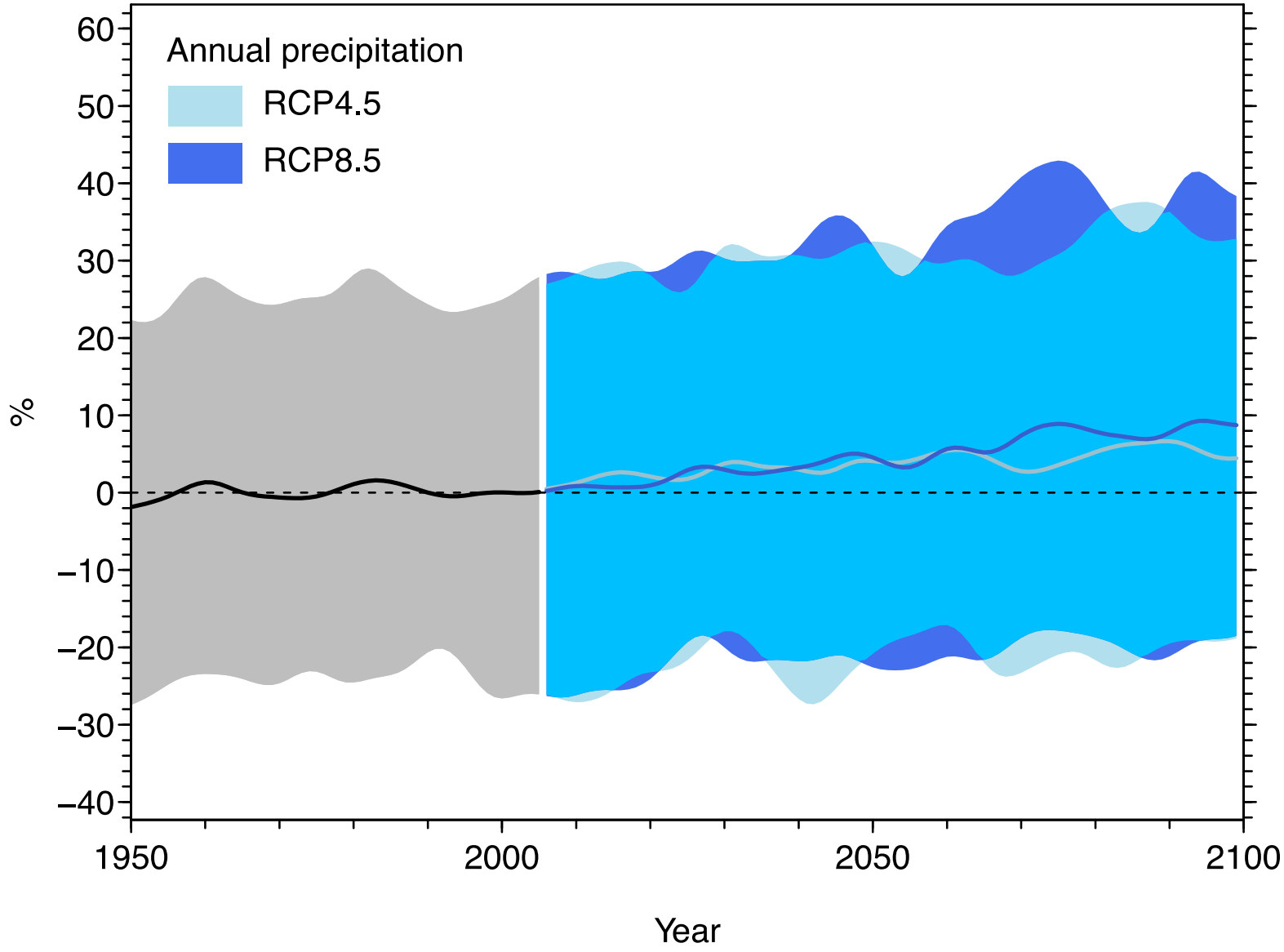


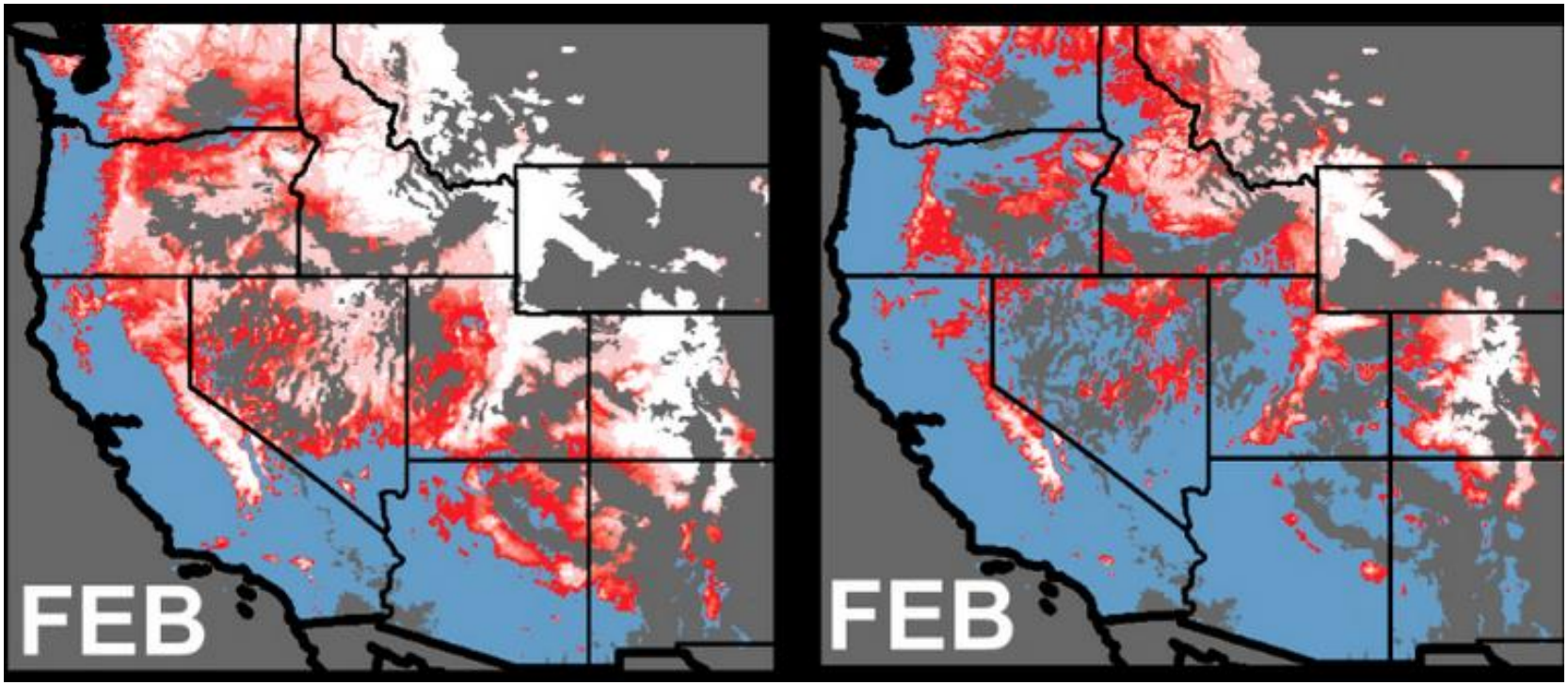
Fig: David Rupp + Phil Mote

Precipitation

Difference from 1950-1999 average



More rain, less snow



historic

snow probabilities

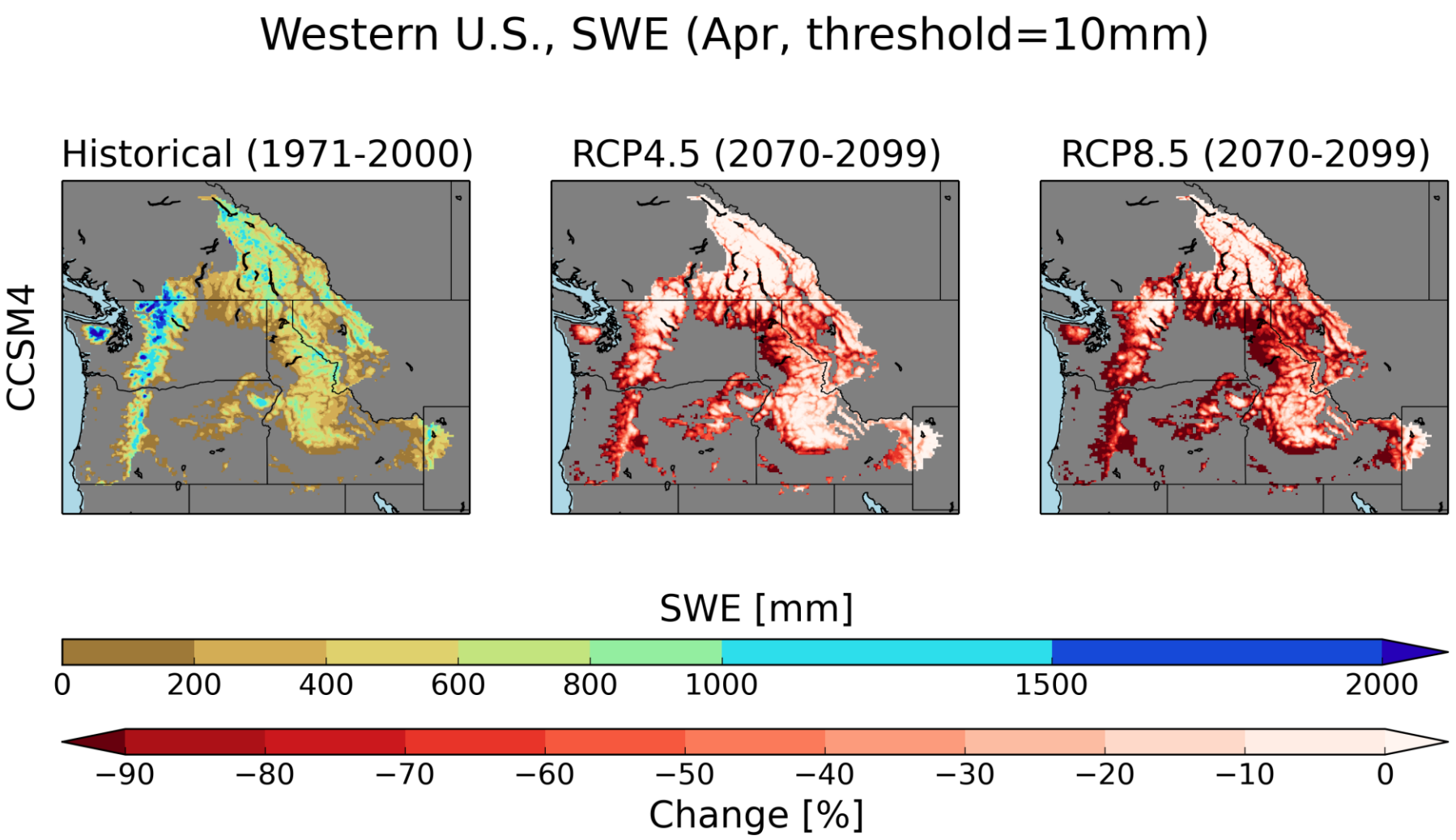
mid 21st century

0% (all rain)

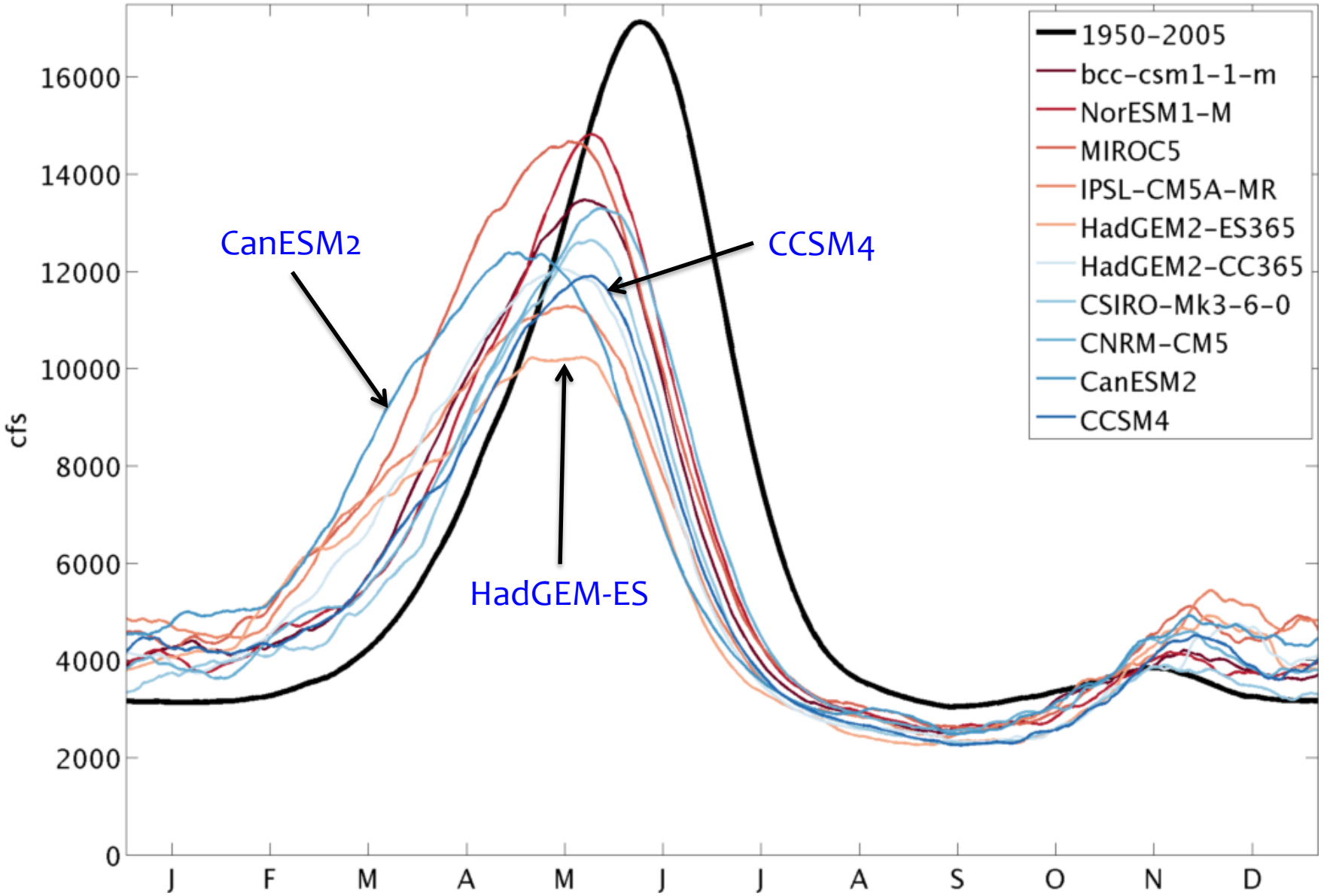
100%

Klos et al., 2015

Changes in Mountain Snowpack



Post Falls, Naturalized Runoff, 2041-2070



More than Means: Extreme Events

Happen without

es alter the

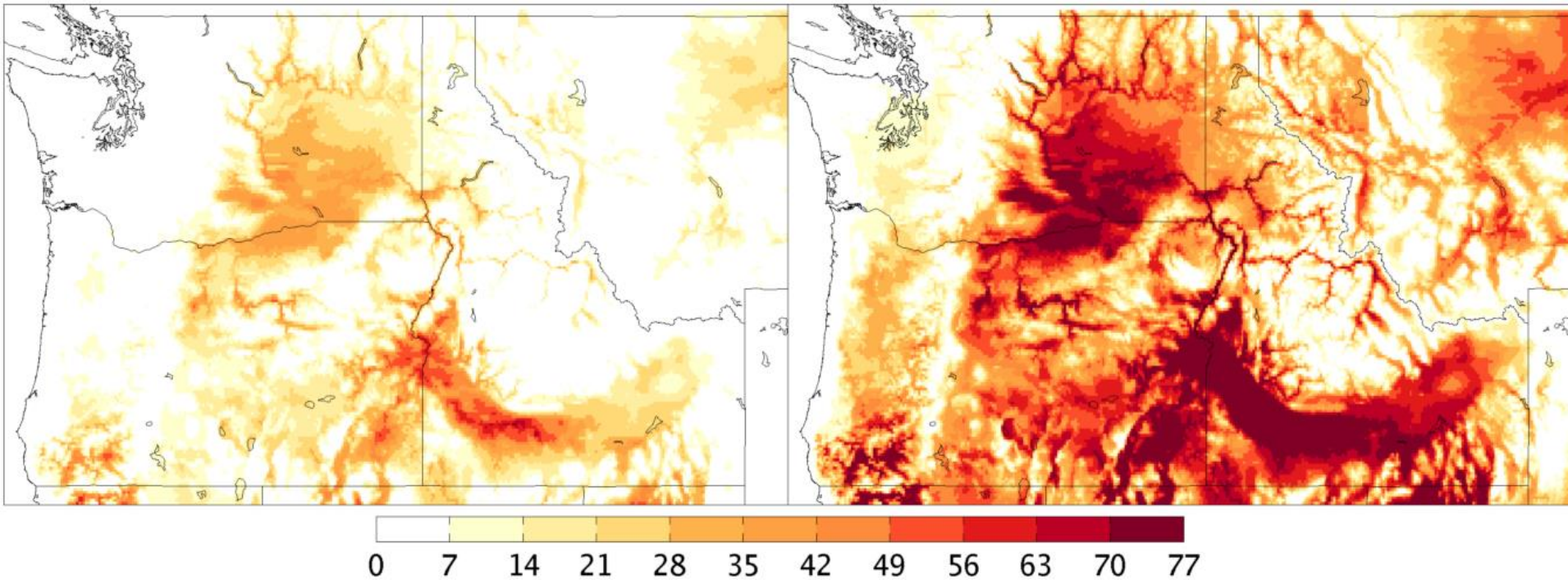
treme events

More Heat

Days per year ≥ 90° F

1971-2000

2040-2069 (RCP8.5)



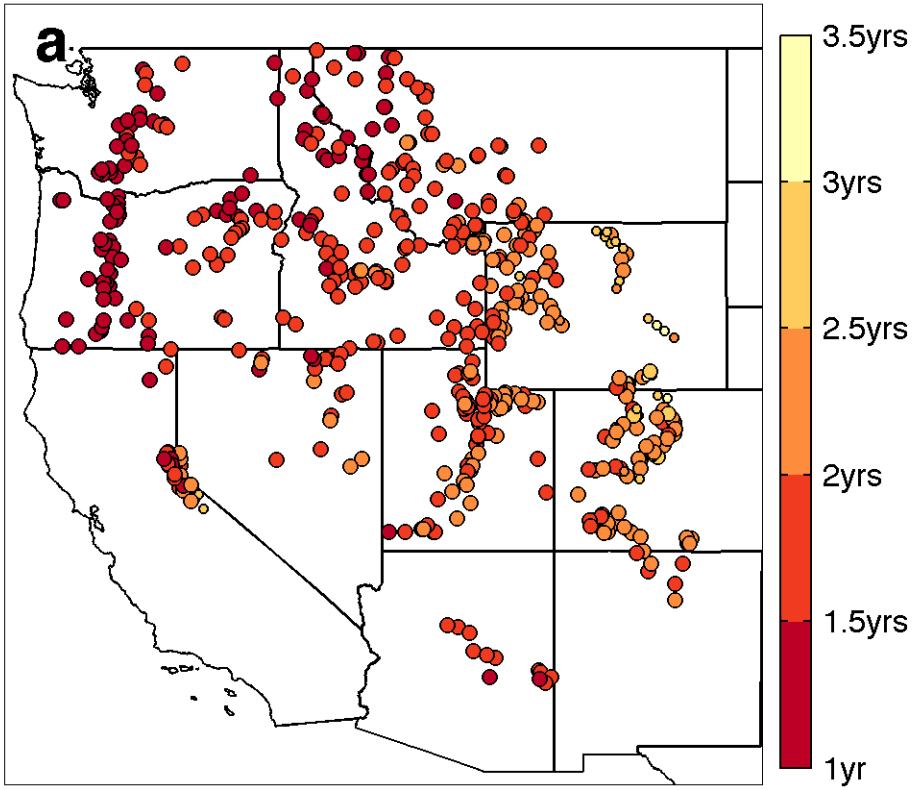
Spokane AP: 31 days at or above 90F in 2015

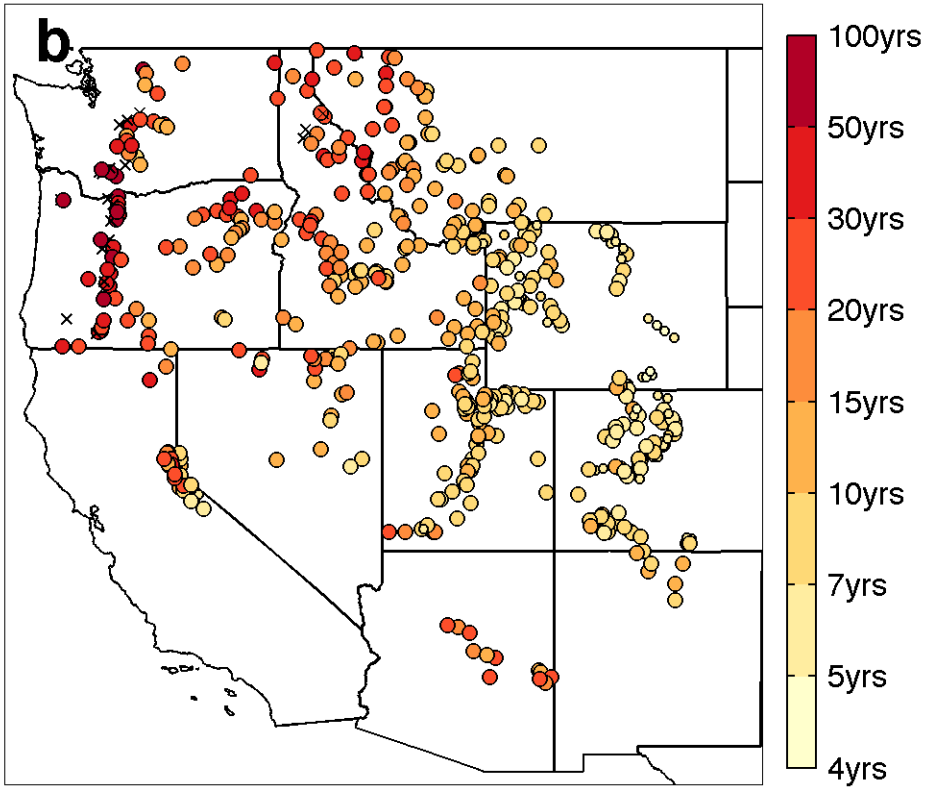
Changes in High and Low Snowfall Years

Multi-model mean return periods 2040-2069 RCP85

Historical Bottom Quartile

Historical Upper Quartile

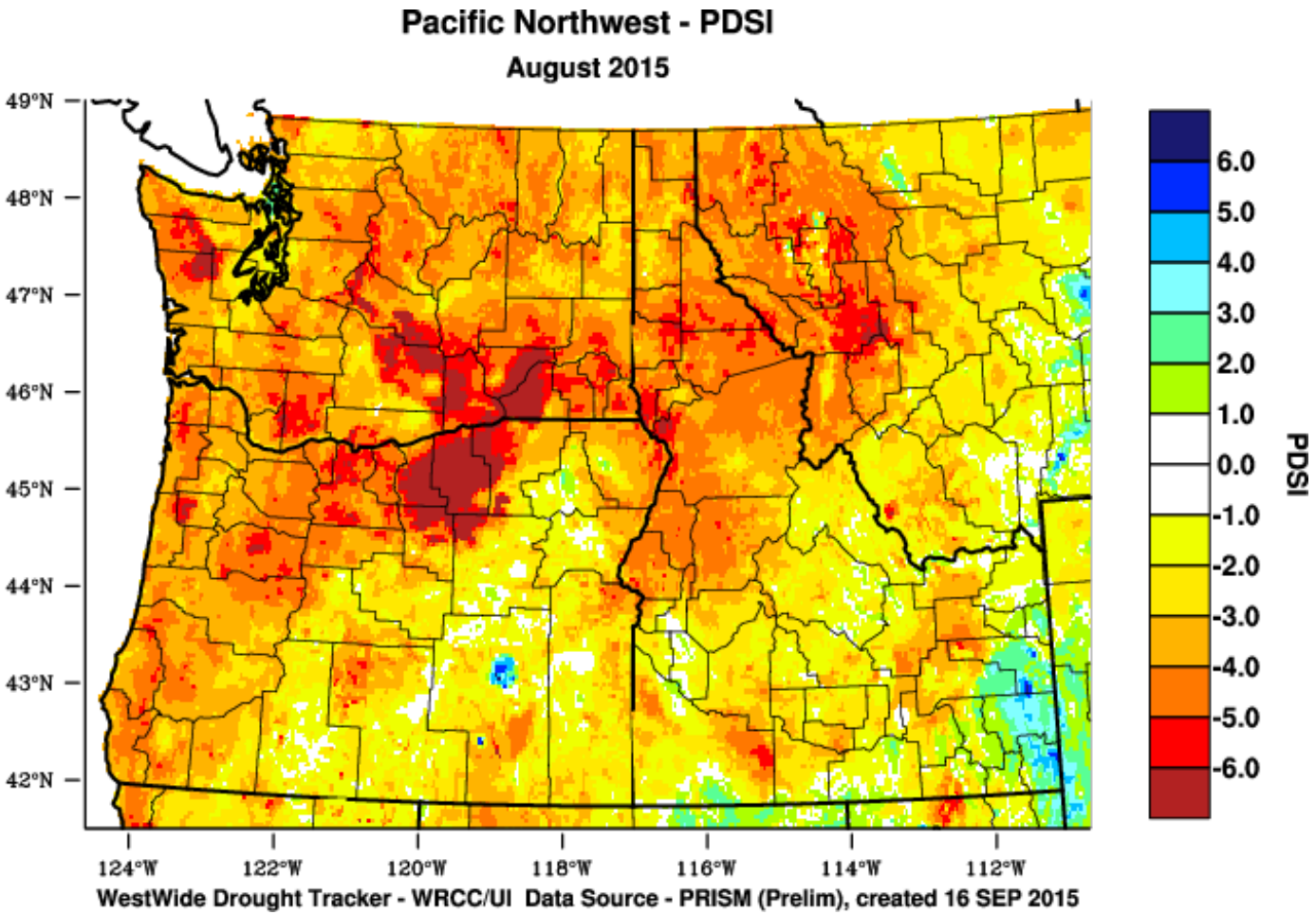




X denotes not a single model meeting threshold

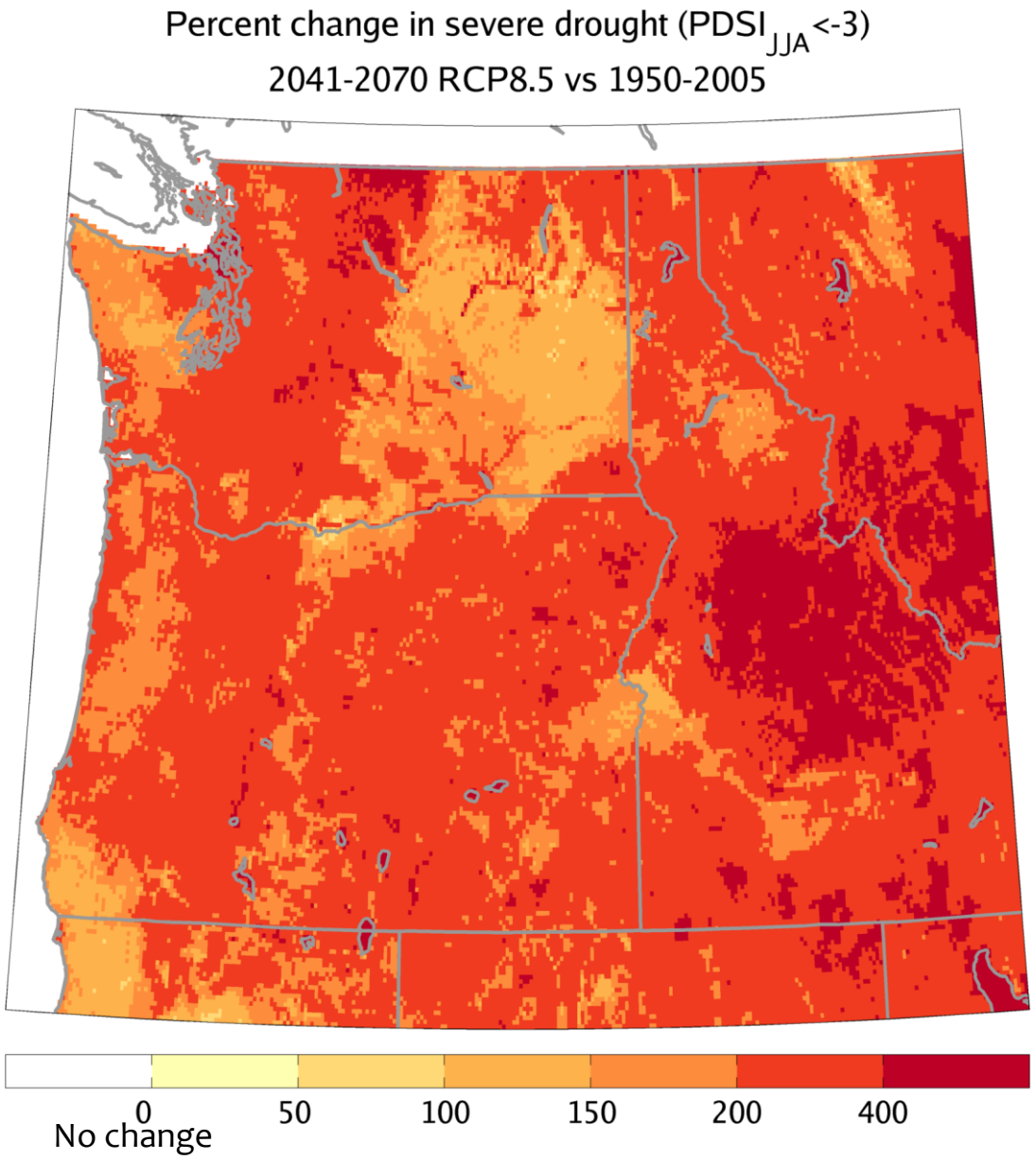
Lute et al., 2015

Drought of 2015



http://www.wrcc.dri.edu/wwdt/

Severe droughts 3x as likely



Recipe for building a large fire

and large fire season

☑ Abundant and contiguous vegetation

☑ Prolonged period of warm/dry conditions

Optional: low snowpack enables early season fire

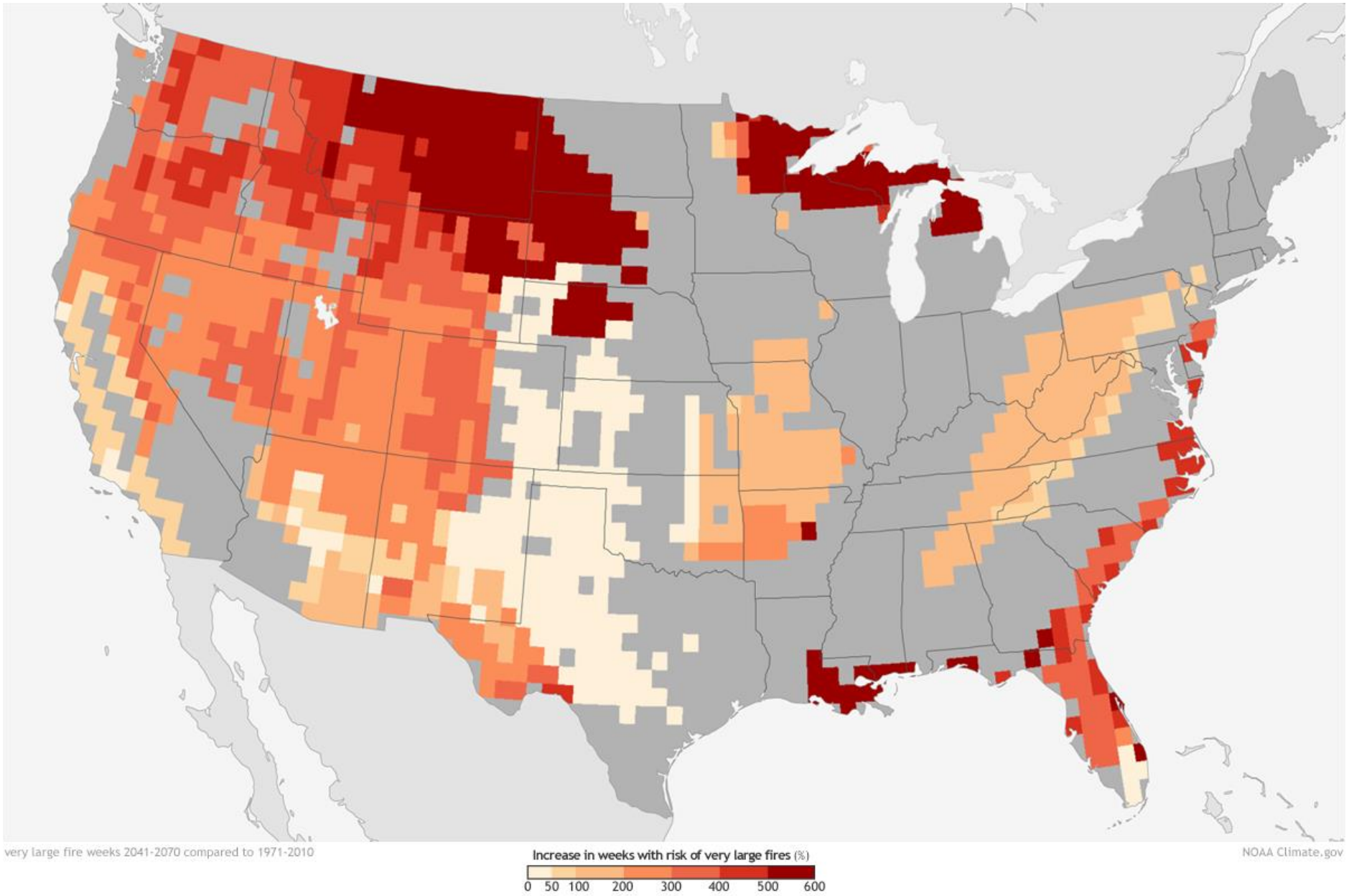
☑ Ignition sources

☑ Extended warm/dry conditions post-ignition

Optional: limited suppression resources

Optional: wind events

Percent Increase in Weeks with Very High Wildfire Potential



Barbero, Abatzoglou et al., 2015

The future looks…

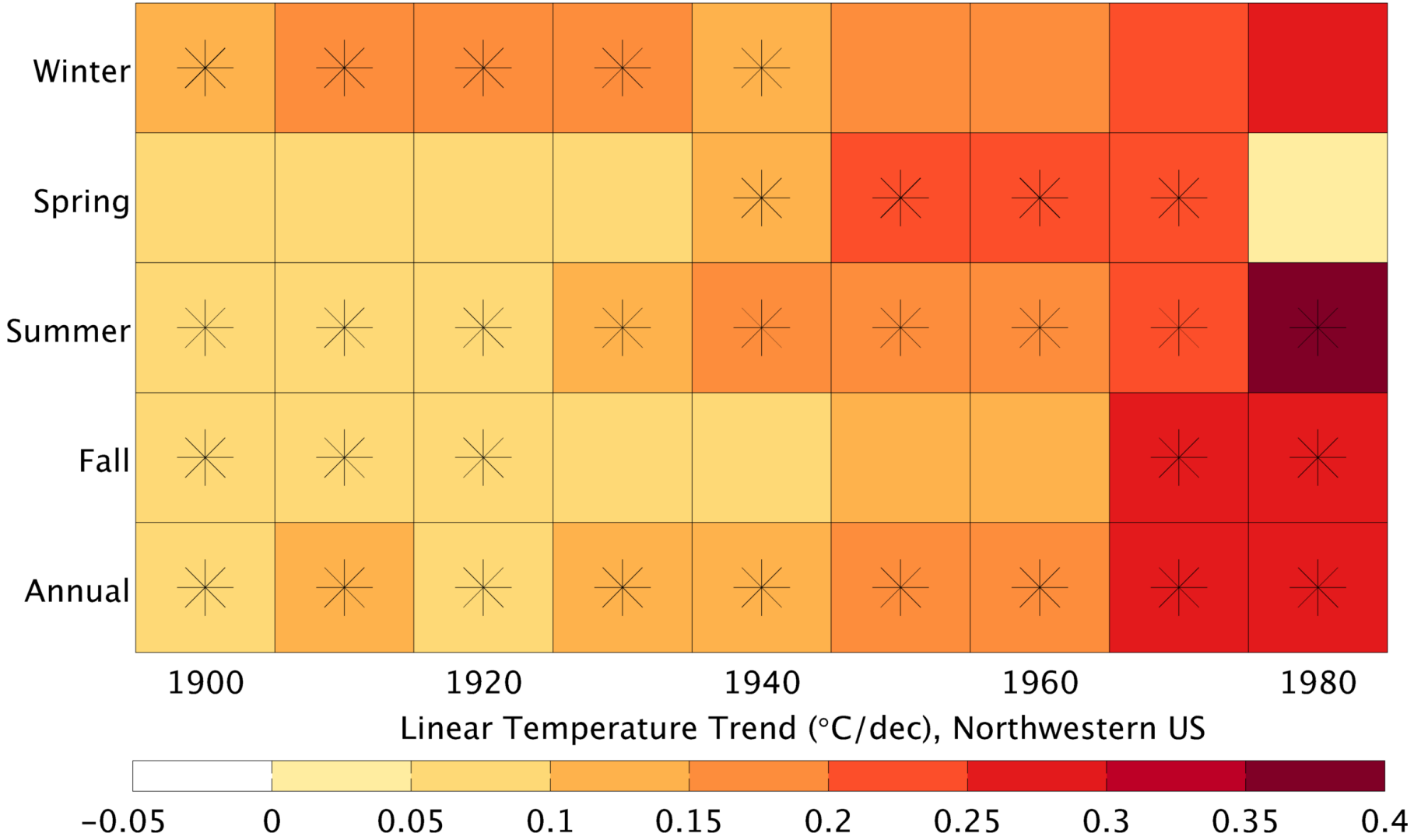
- **Much warmer** than we have seen historically
- About the same in terms of total precipitation but…
- More like it did **last summer** as summer drought, low flows and fire potential become more common
- Ripe for thinking **today** about adaptation and conservation

@climate_guy

Resources and tools: http://climate.nkn.uidaho.edu


Future
Present
Past

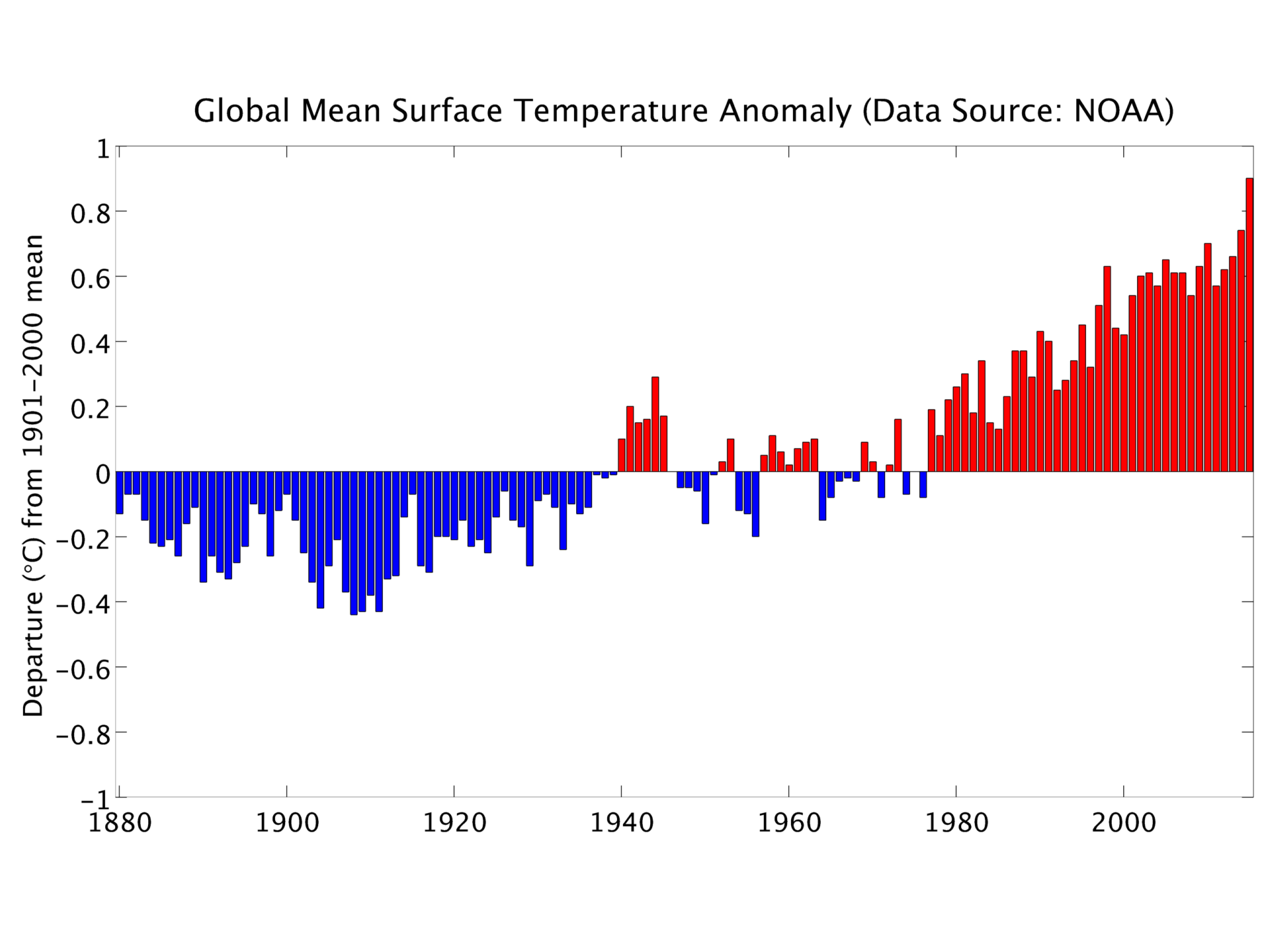
All Seasons have warmed

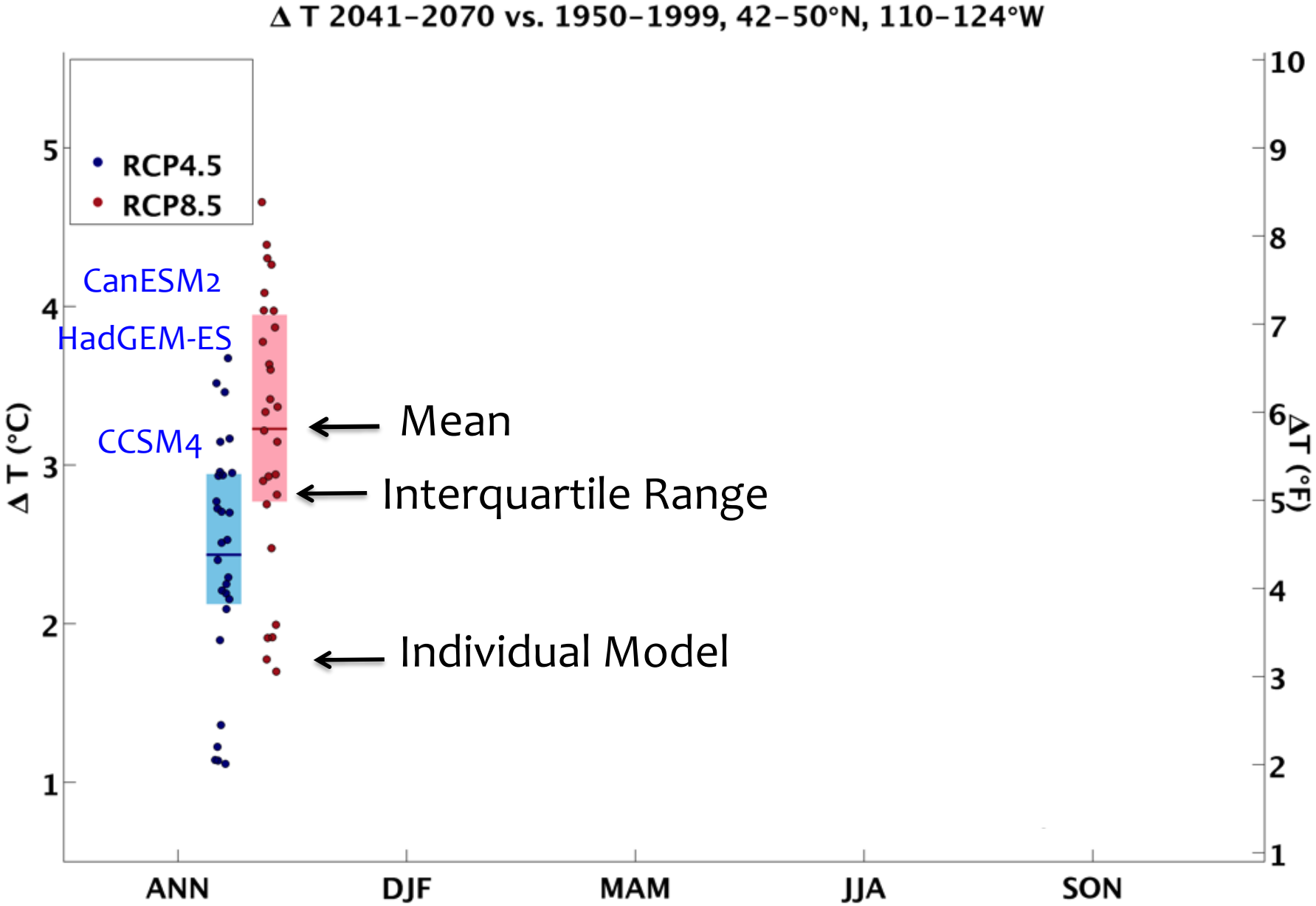


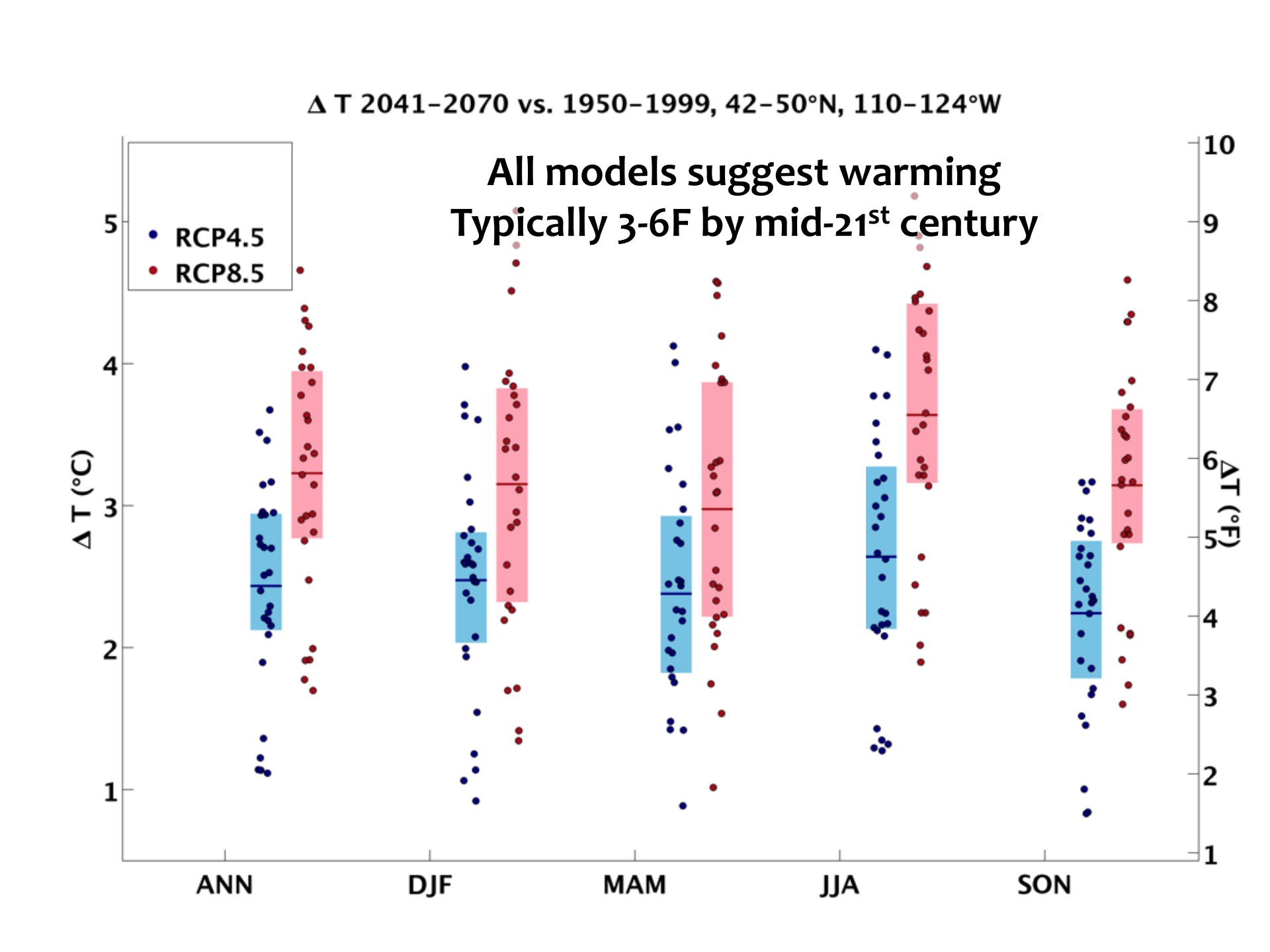
* Denotes statistically significant

Abatzoglou et al., 2014 JCLI

Idaho Magazine


Global Mean Surface Temperature Anomaly (Data Source: NOAA)
Departure (°C) from 1901–2000 mean
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
1880
1900
1920
1940
1960
1980
2000


Δ T 2041–2070 vs. 1950–1999, 42–50°N, 110–124°W
RCP4.5
RCP8.5
CanESM2
HadGEM-ES
CCSM4
Mean
Interquartile Range
Individual Model
Δ T (°C)
ΔT (°F)
1
2
3
4
5
6
7
8
9
10
ANN
DJF
MAM
JJA
SON


Δ T 2041–2070 vs. 1950–1999, 42–50°N, 110–124°W
All models suggest warming
Typically 3-6F by mid-21st century
RCP4.5
RCP8.5
Δ T (°C)
ΔT (°F)
1
2
3
4
5
6
7
8
9
10
ANN
DJF
MAM
JJA
SON

Rain on Snow

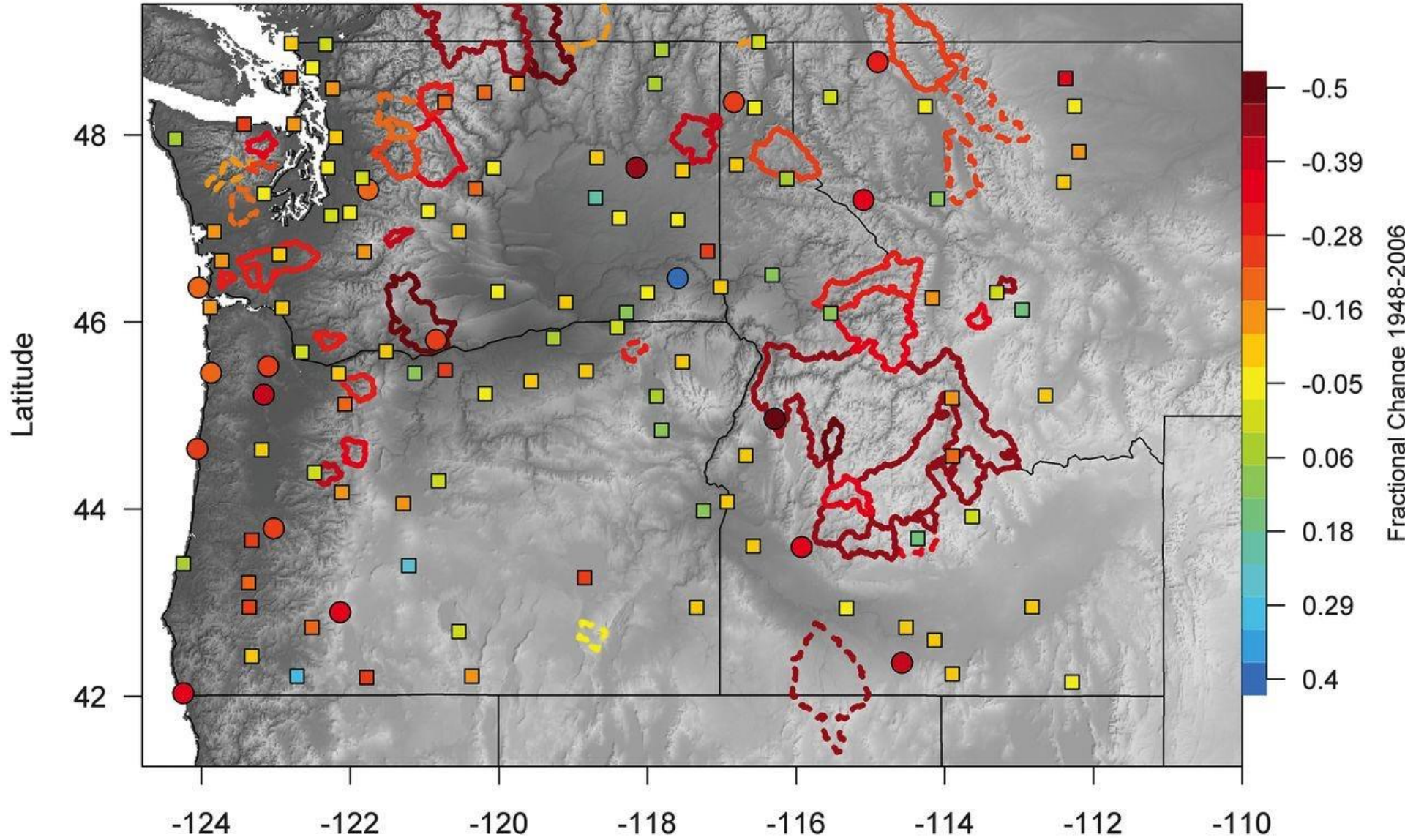
More precipitation as rain

+

Less snow-covered ground

Increase in mid-winter, decrease in shoulders months

Trends 1948-2006 (Fractional Change)



Solid lines + circles = significant trends

Luce et al., 2013