The past and future of water in the Northwest

Philip Mote
Oregon Climate Change Research Institute,
Oregon State University
@pwmote

†hanks to David Rupp, Dennis Lettenmaier, Sihan Li, Bart Nijssen, John Abatzoglou, Katherine Hegewisch, Kathie Dello, Rianne Becraft

photo: Philip Mote

FRACTION OF ANNUAL PRECIPITATION FALLING IN THE DAILY TEMPERATURE RANGE: -6C < Tavg < 0C

[from 1950-1999 VIC 1/8-degree INPUT DATA]

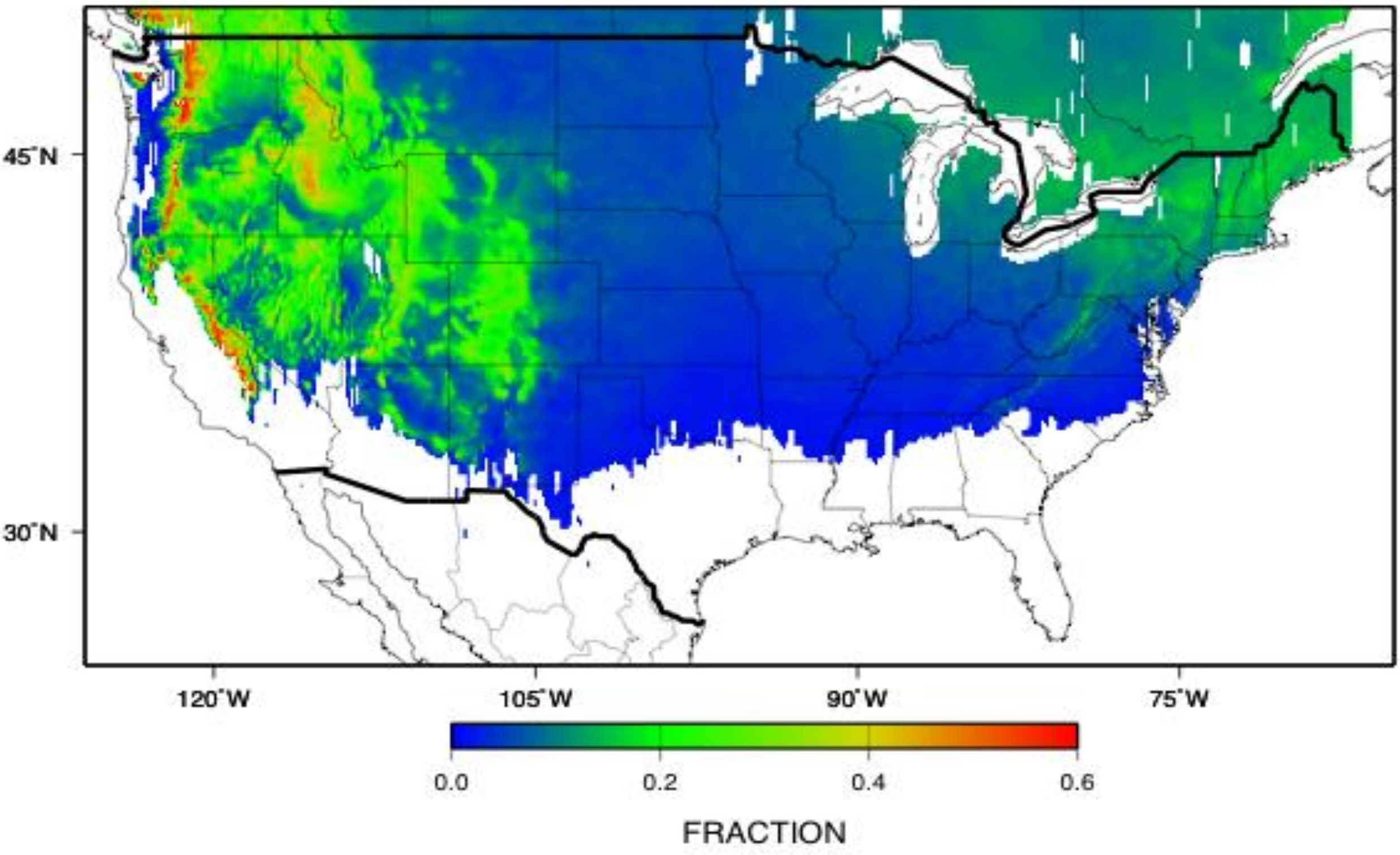
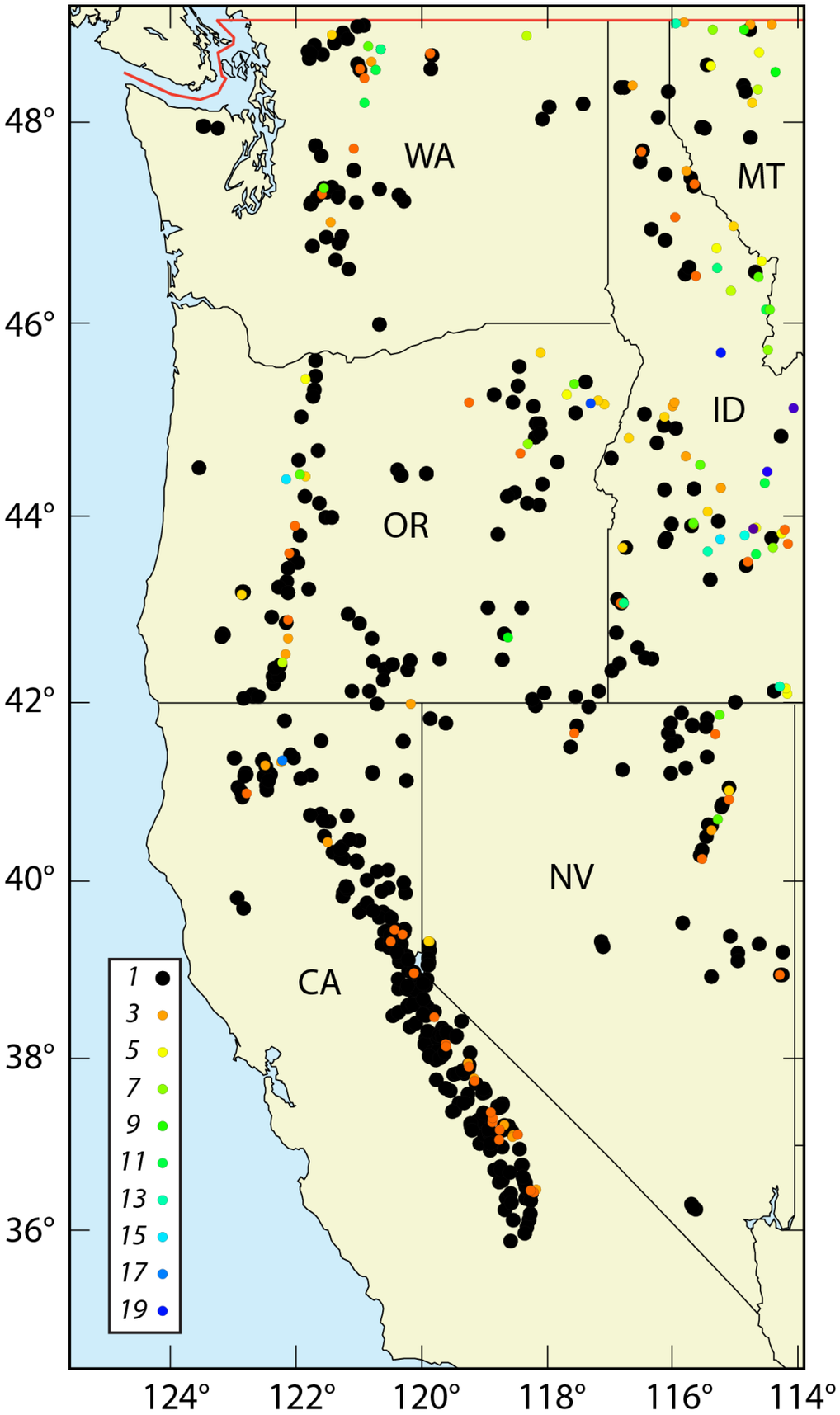


Figure by Mike Dettinger. See Bales et al. 2006

from Hoodoo web cam
February 23, 2015


SNOW COURSE
MARKER



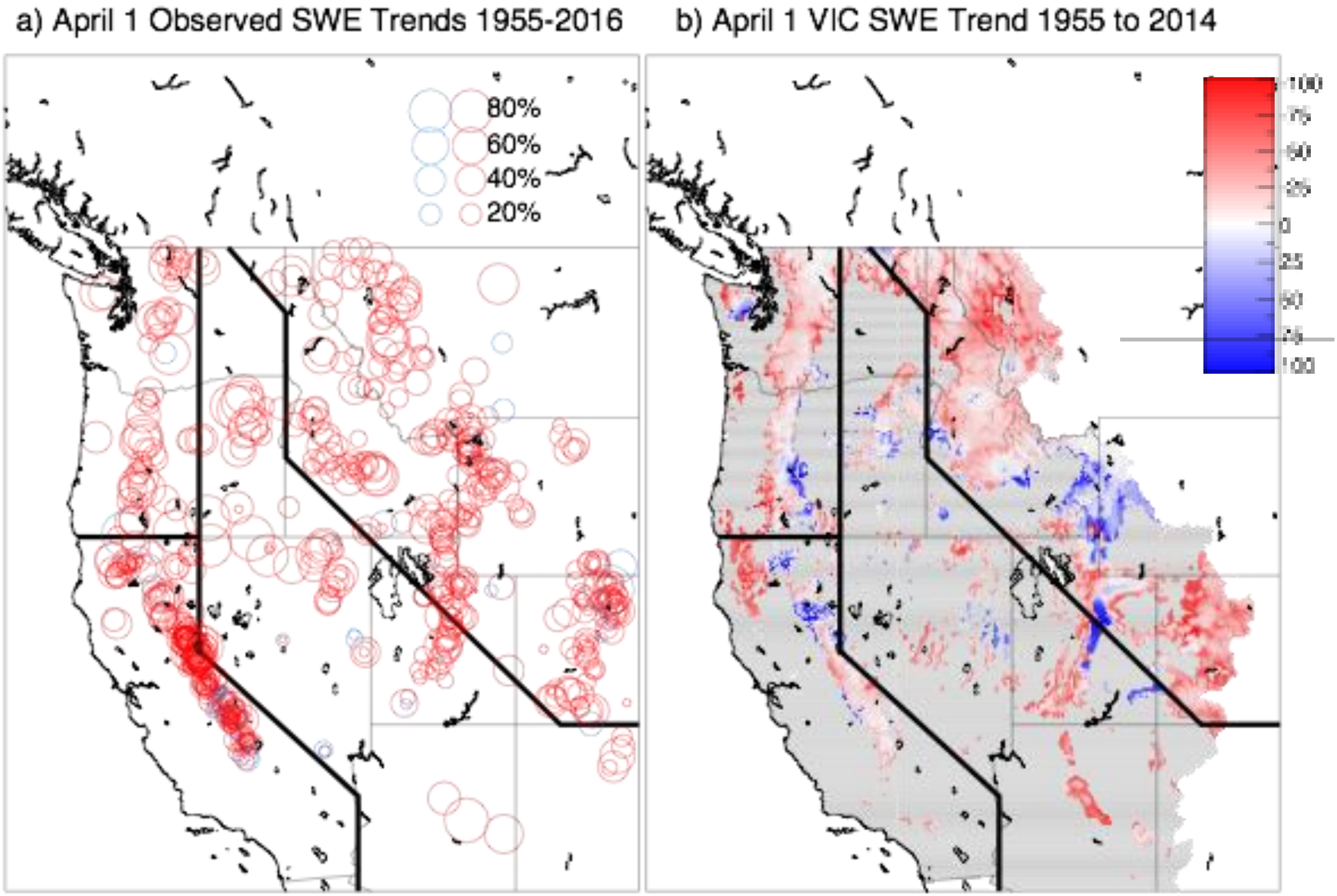
from Hoodoo web cam
February 23, 2015

2015 Snow drought:
Normal precipitation, ~5°F warmer than normal

Record low April 1 snow at ~80% of sites

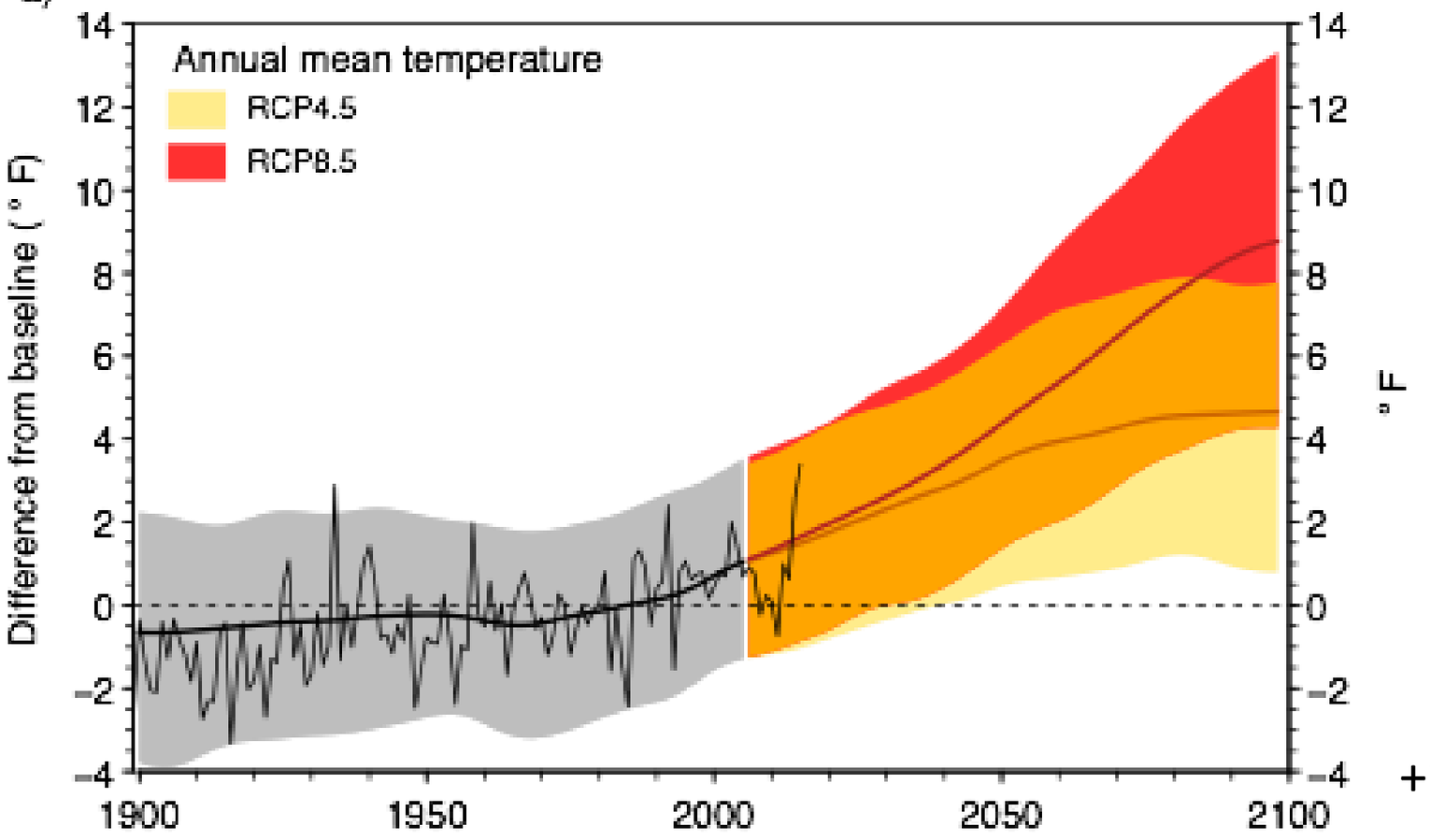
Mote et al. GRL 2016

Obs & model: 90% decline

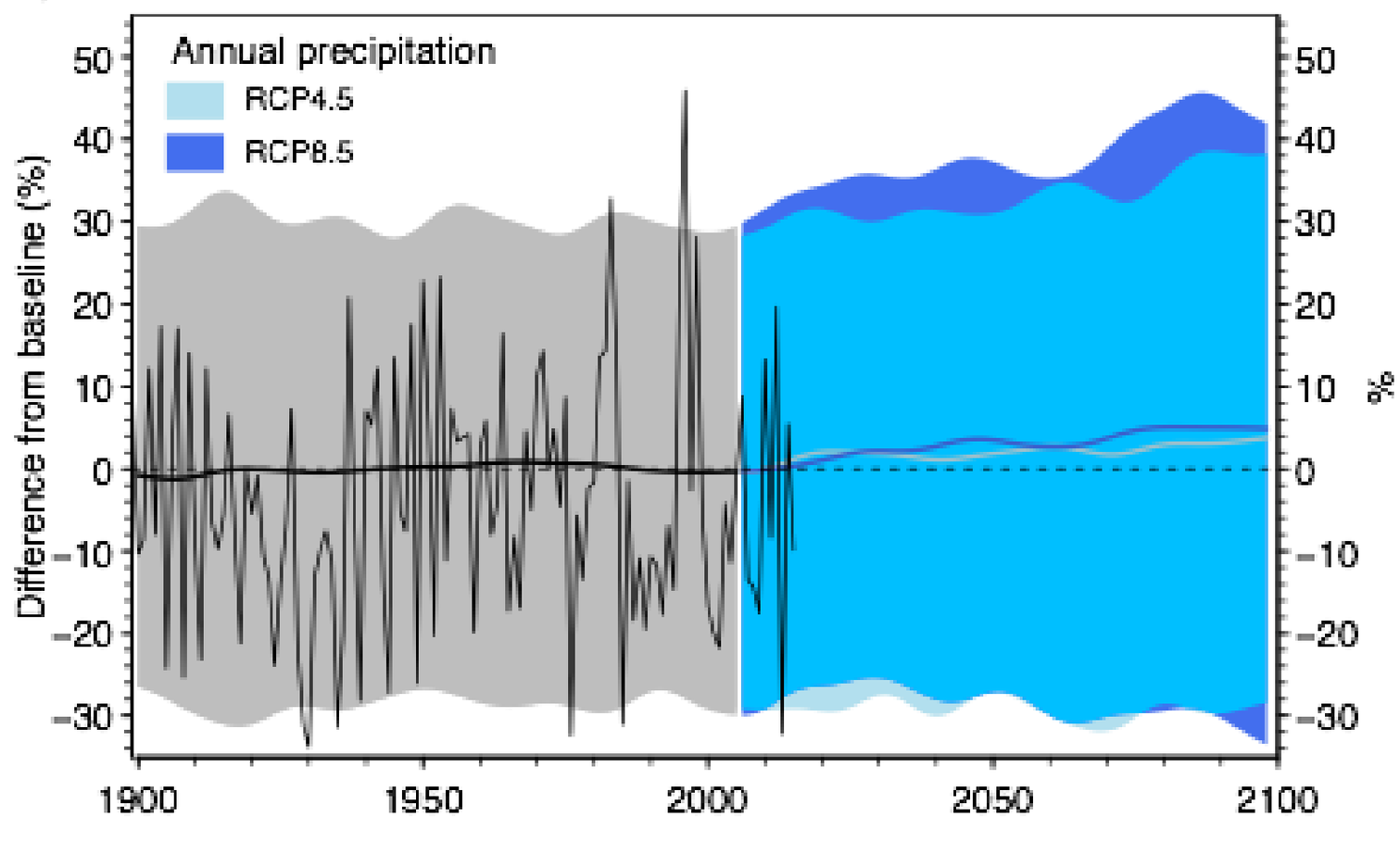



Oh, crap! Was that TODAY?
REGAN

a)



b)



NW climate past & future

+1.8° to +6.9°F by the 2050s

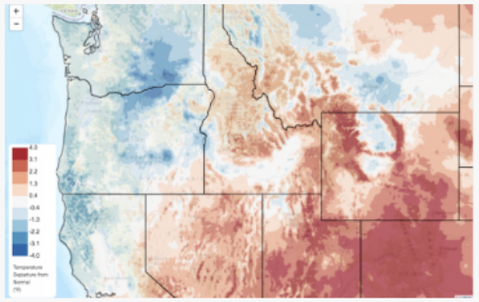
–6.0% to +11.4% by the 2050s

Source: Rupp et al. (2016), adapted for Oregon

WATER

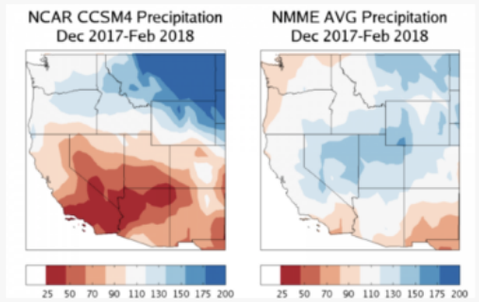
nwclimatetoolbox.org

Overview page about WATER-related tools.



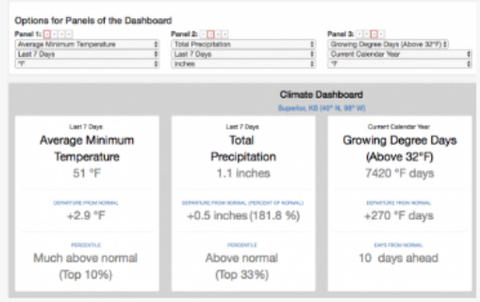
Climate Mapper
Explore current and future climate information across multiple sectors

Launch Tool



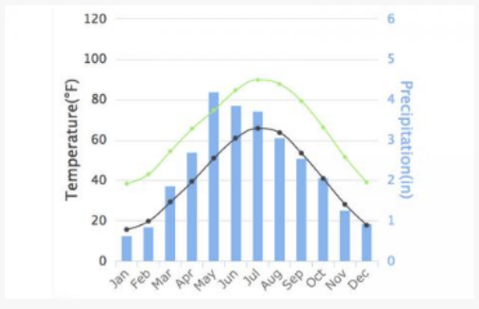
Seasonal Forecast Maps
Explore seasonal climate forecasts for the next 8 months over the US

Launch Tool

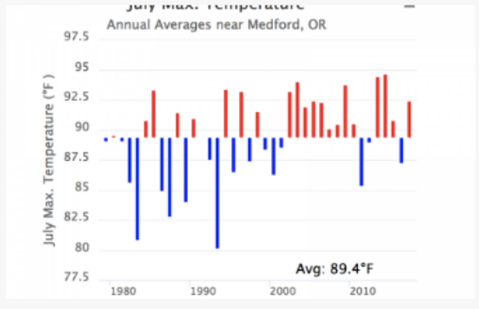


Climate Dashboard
Real-Time Climate Monitoring for selected location.

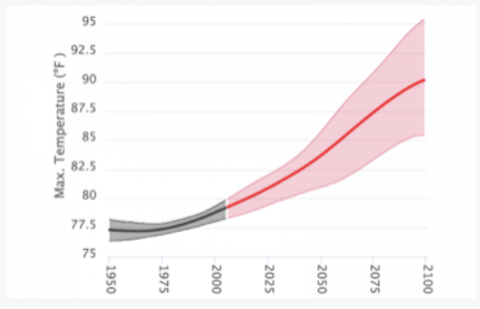
Launch Tool



Climate Normals
Visualize monthly average climate for a selected location.



Climate Tracker
Track historical climate variability for a selected location

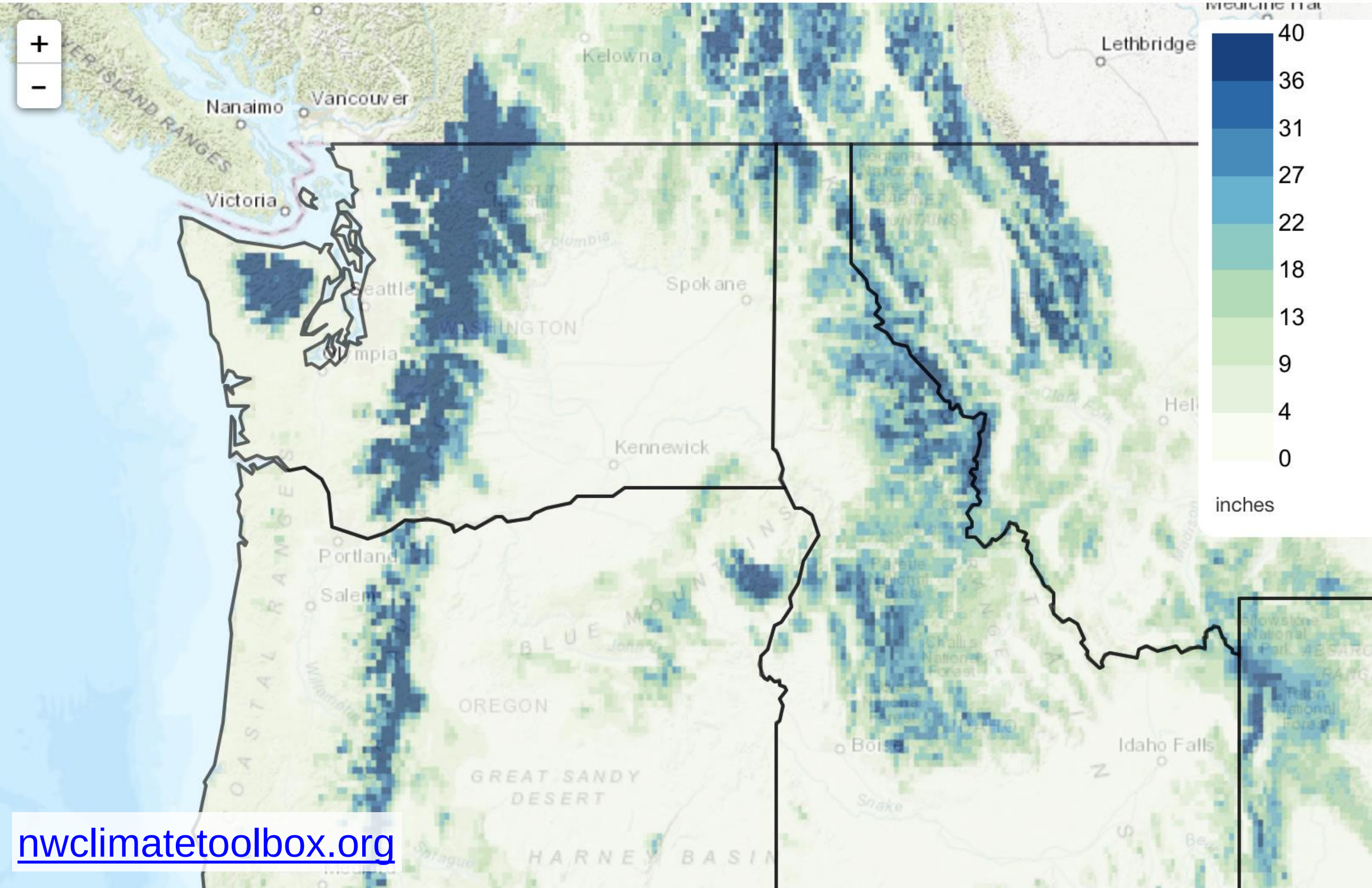


Future Time Series
Generate a time series of projected changes in climate for a selected location

Snow Water Equivalent, April 1st

Historical simulation, 1971-2000 mean

Multi-model (10 models) mean from VIC forced by downscaled models



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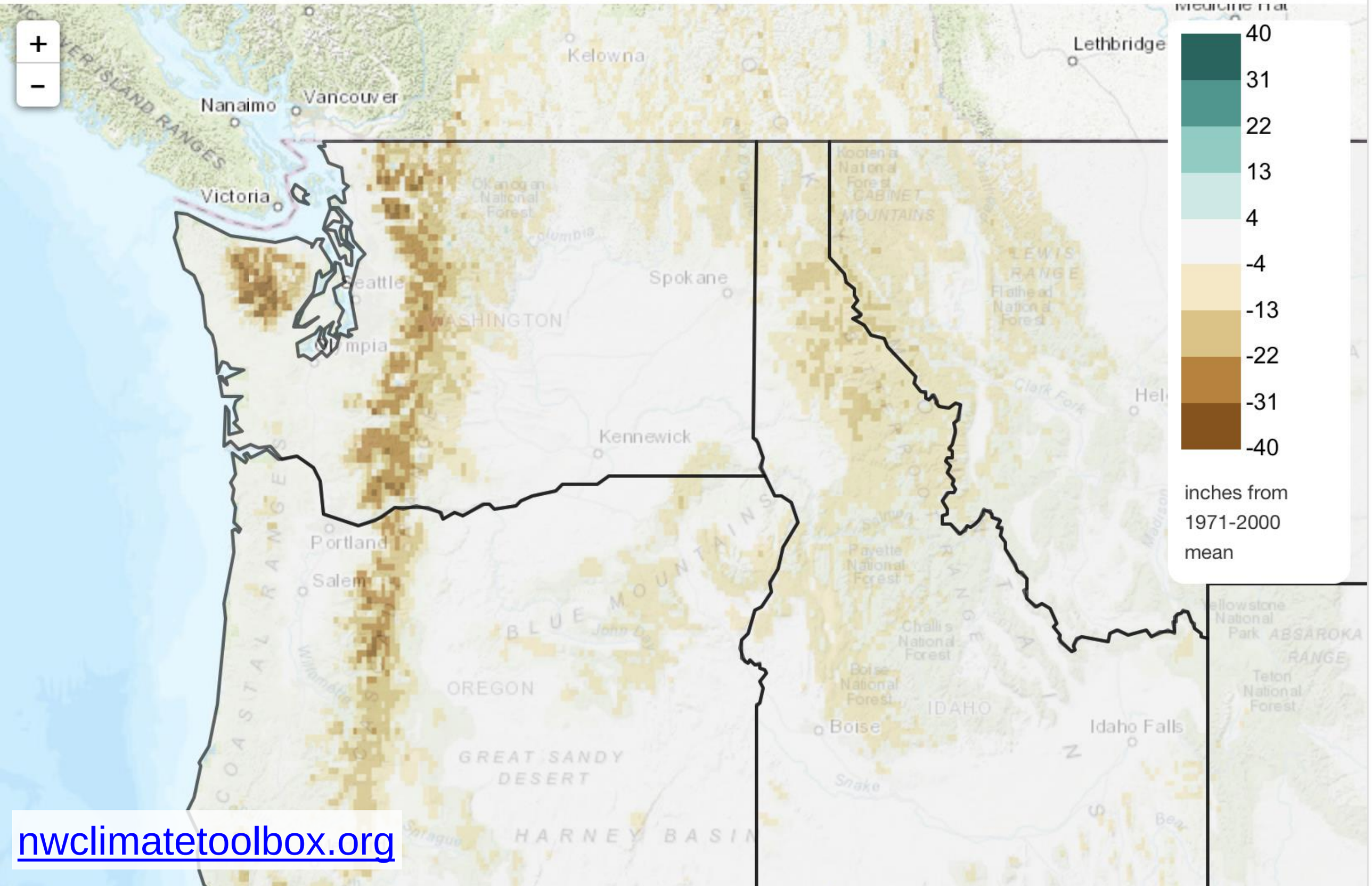
Projected Change in Snow Water Equivalent, April 1st

RCP4.5 2070-2099 vs. historical simulation 1971-2000, mean change

Multi-model (10 models) mean from VIC forced by downscaled models



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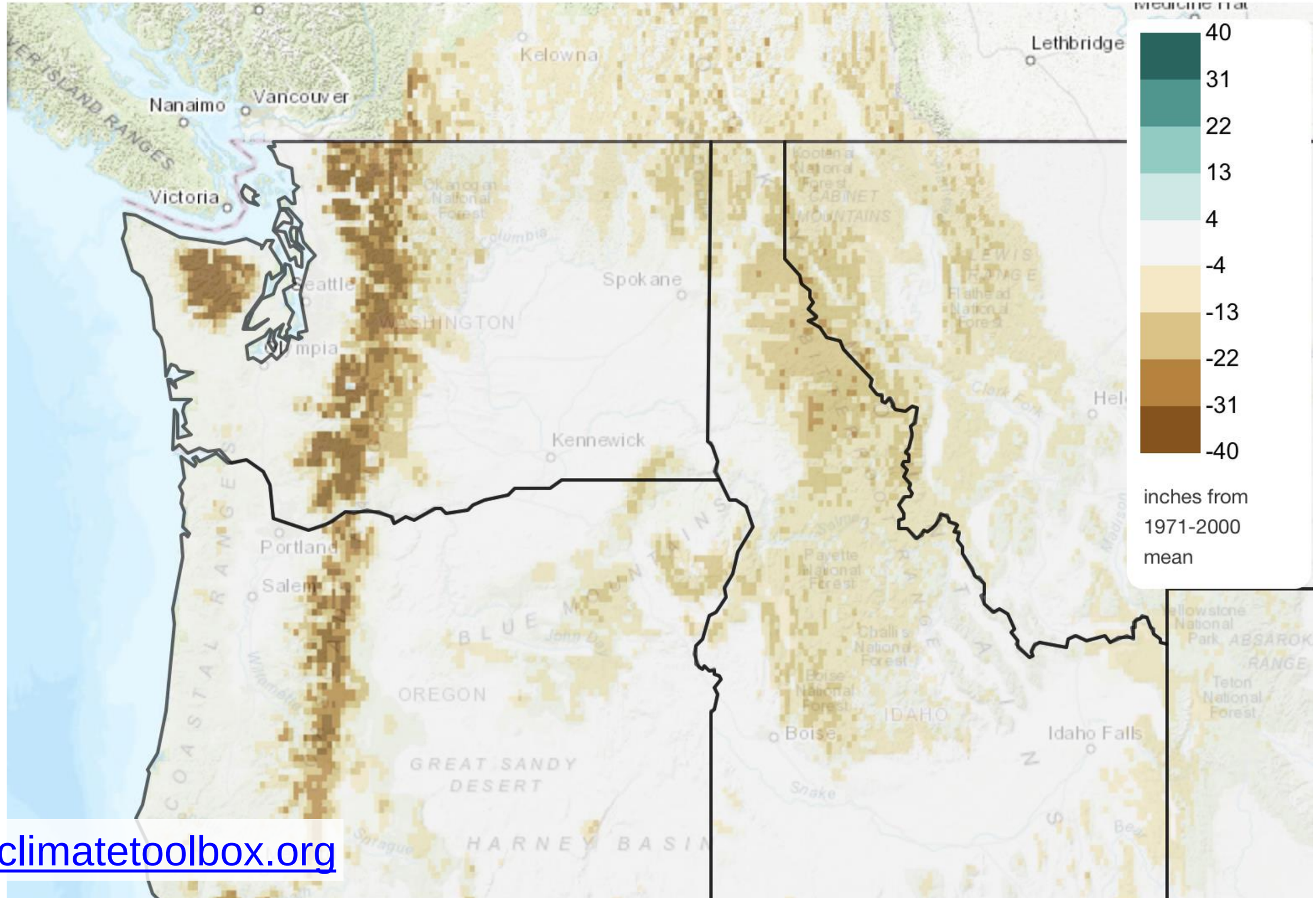
Projected Change in Snow Water Equivalent, April 1st

RCP8.5 2070-2099 vs. historical simulation 1971-2000, mean change

Multi-model (10 models) mean from VIC forced by downscaled models



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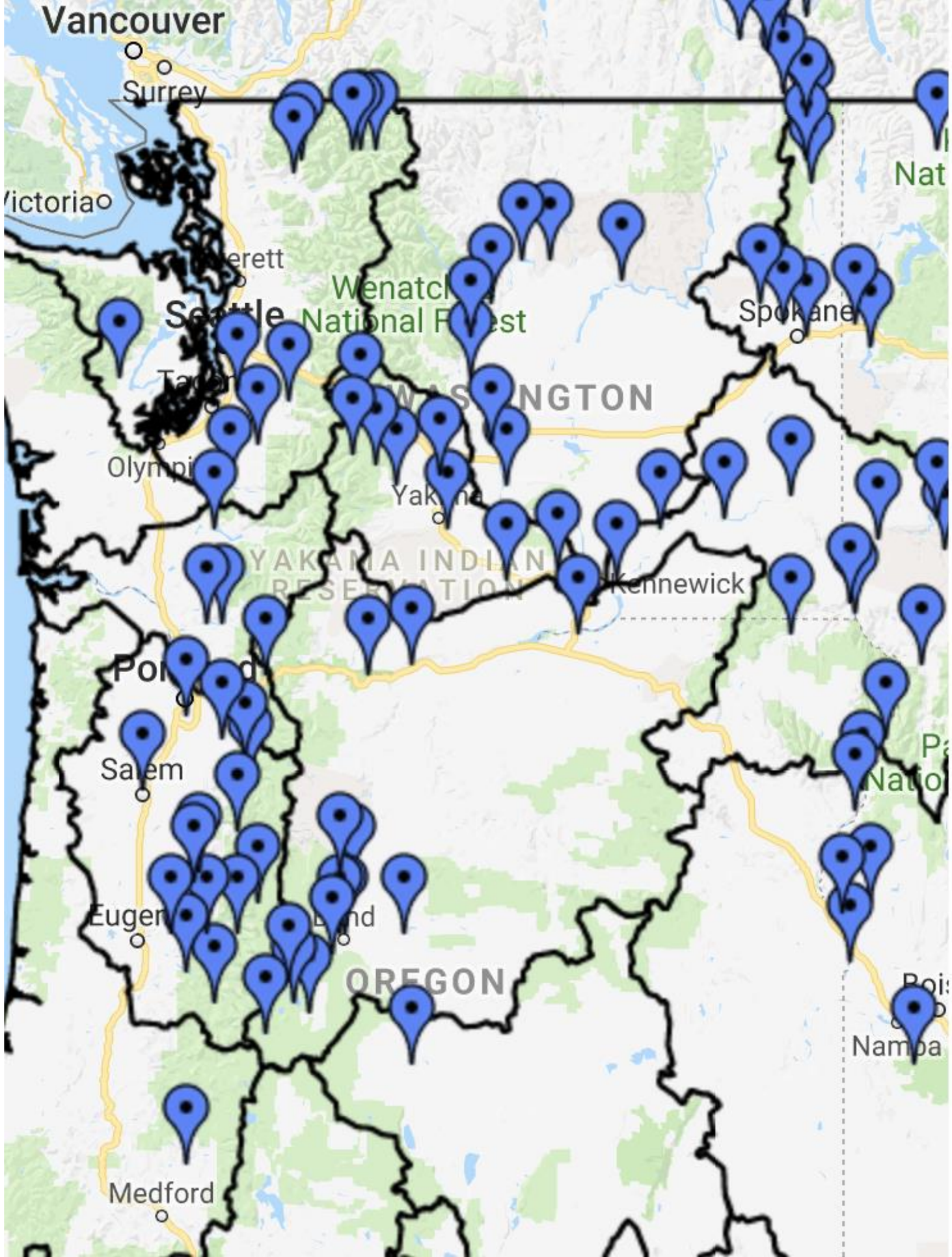
NW climate toolbox: simulated streamflows



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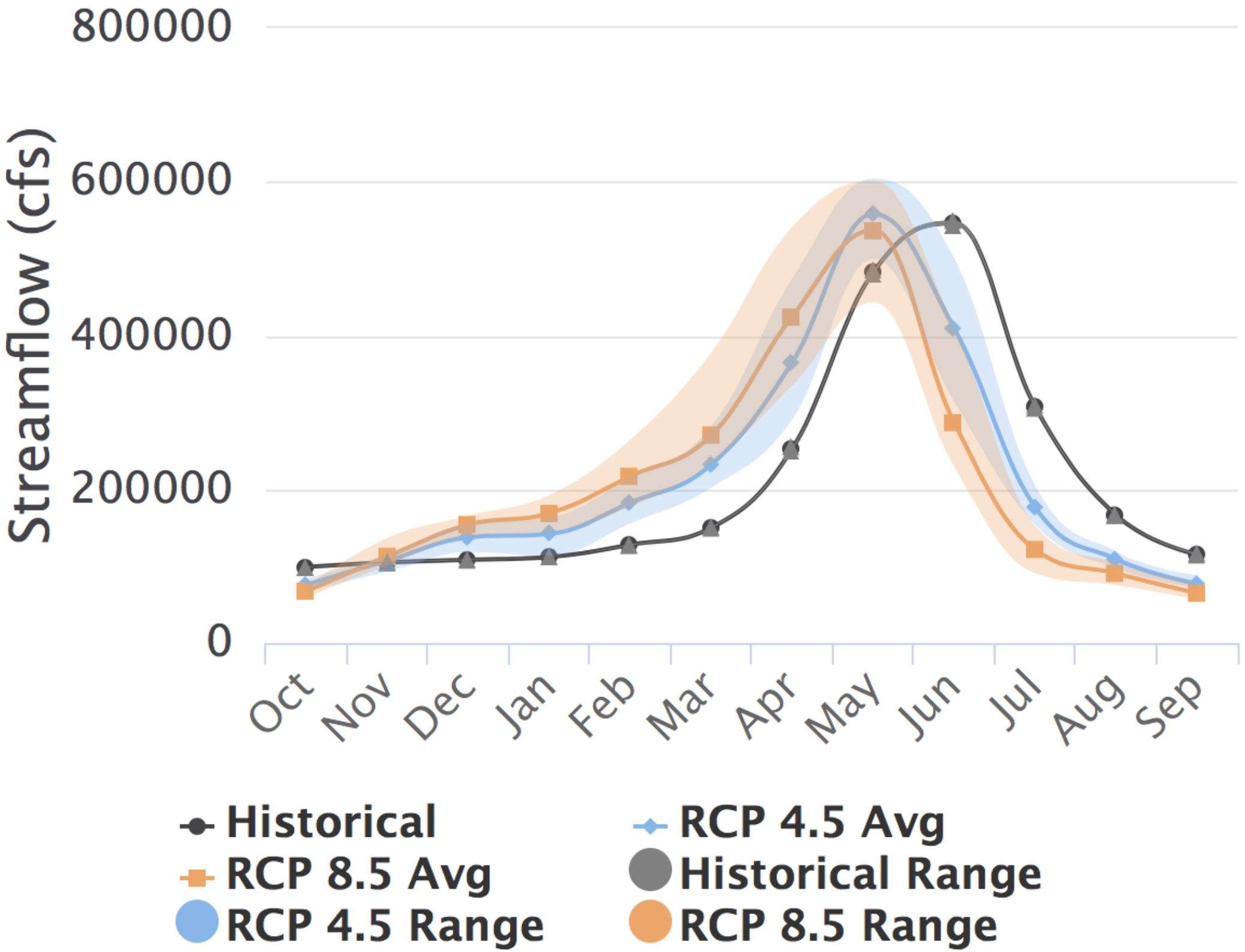
Projected Streamflow (2070-2099)

Columbia River at Bonneville, OR

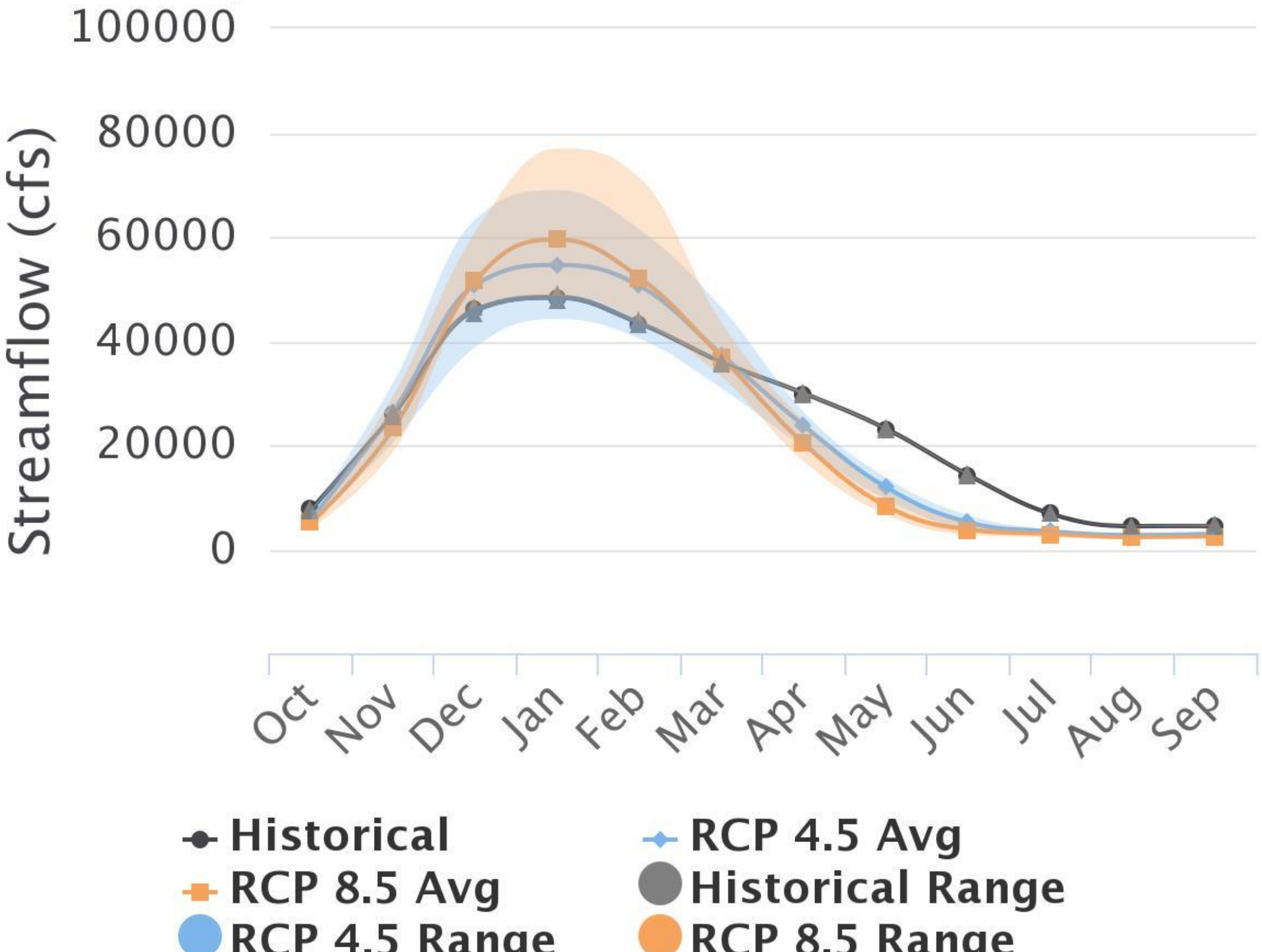
Source: Integrated Scenarios CMIP5-MACAv2LIVNEH-VIC Bias-Corrected



Projected Streamflow (2070-2099)

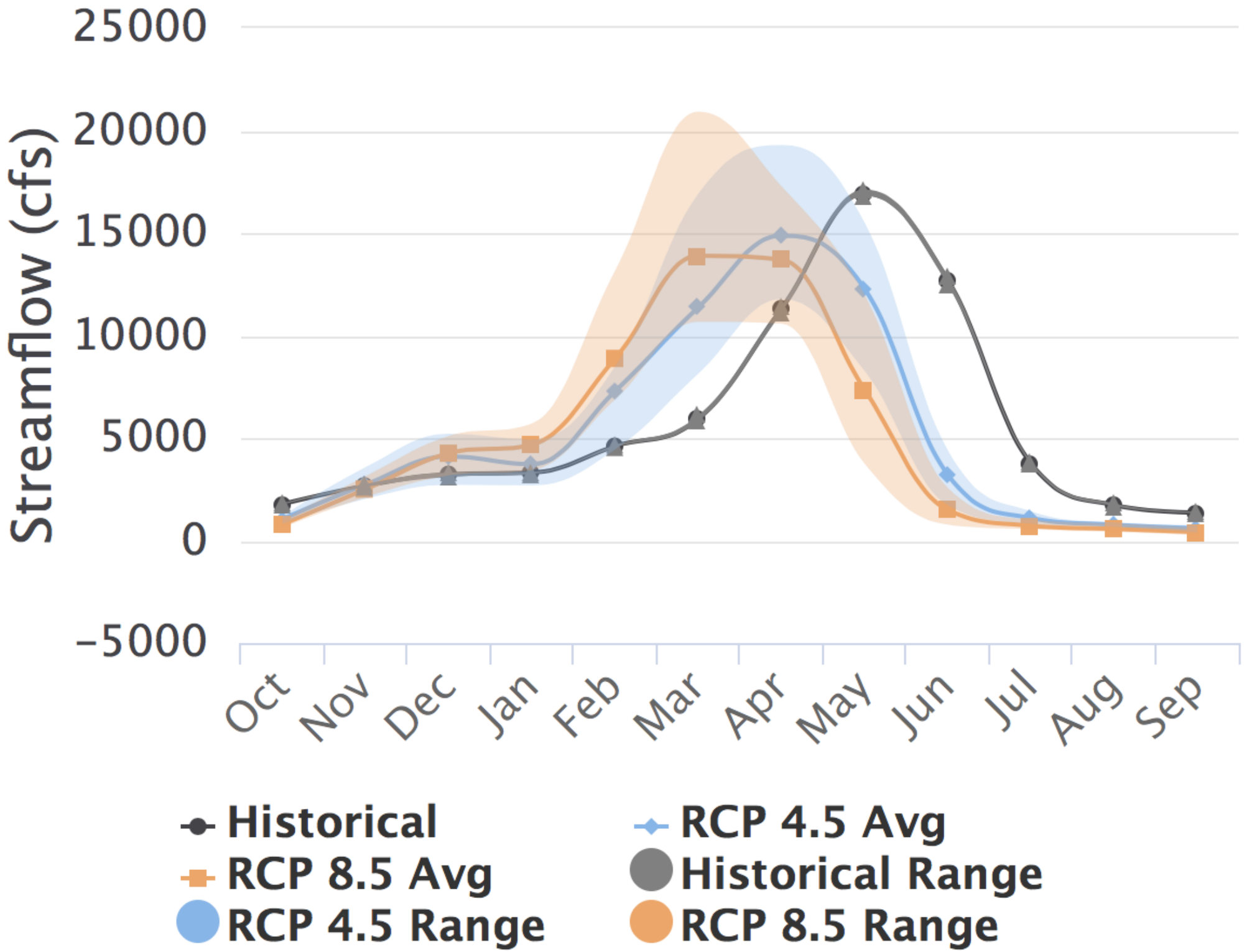
Willamette River at Salem, OR

Source: Integrated Scenarios CMIP5-MACAv2LIVNEH-VIC Bias-Corrected



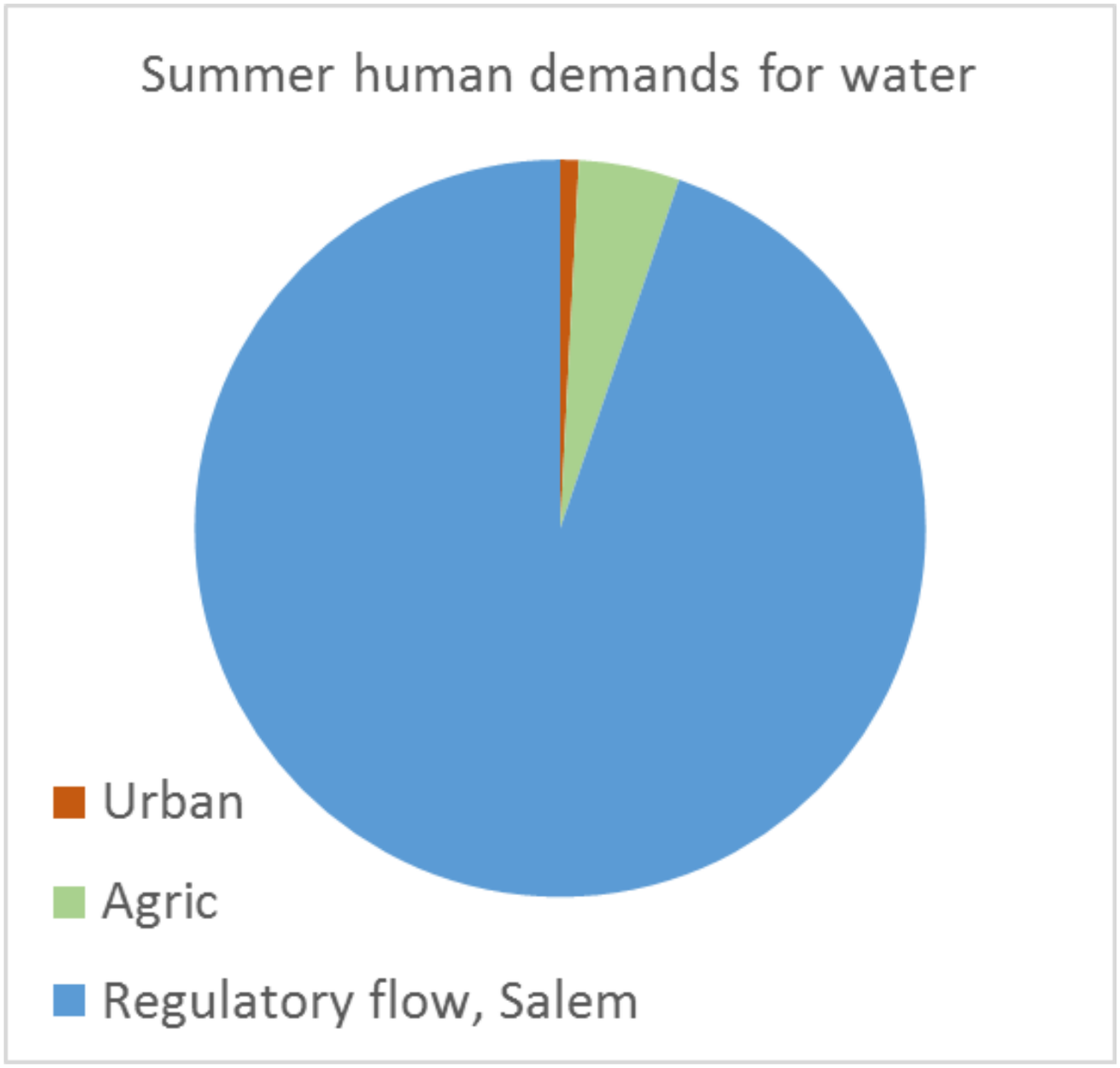
Projected Streamflow (2070-2099)
Dworshak, ID

Source: Integrated Scenarios CMIP5-MACAv2LIVNEH-VIC Bias-Corrected



https://climate.northwestknowledge.net/NWTOOLBOX

Willamette River demands



Reservoir operations play a key role in mitigating water scarcity

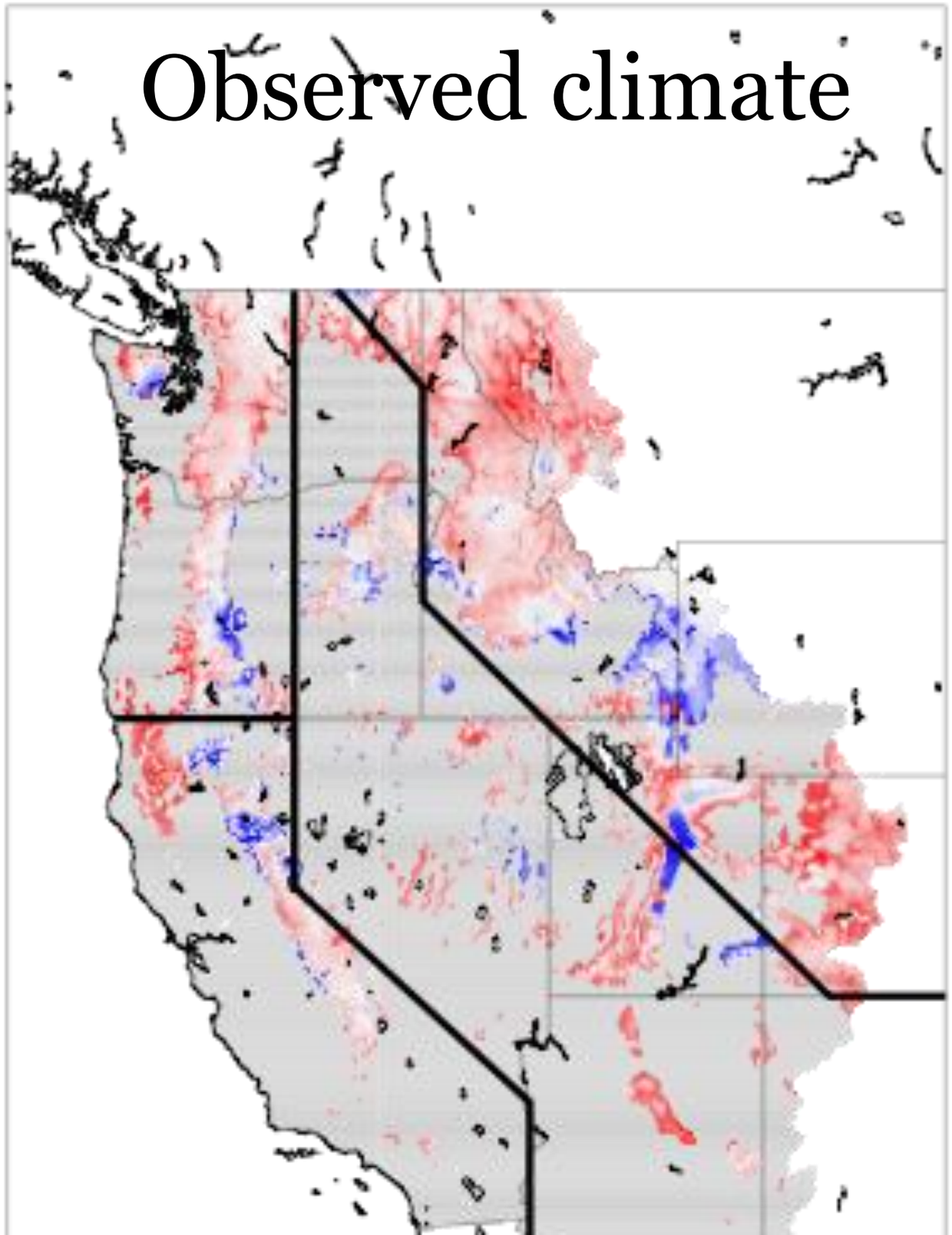
Conclusions

- Temperature-driven water shortages like the 2015 “snow drought” will become more common, how fast depends largely on global greenhouse gas emissions
- Impacts of climate change on water & drought will be highly localized and mostly through connected issues: increased flood risk, lower summer streamflow, lower summer soil moisture, higher water temperature, increased risk of fire, BiOps
- Portfolio of adaptation options including increased storage, increased efficiency, altering rule curves, being more creative with water use & reuse

Role of warming

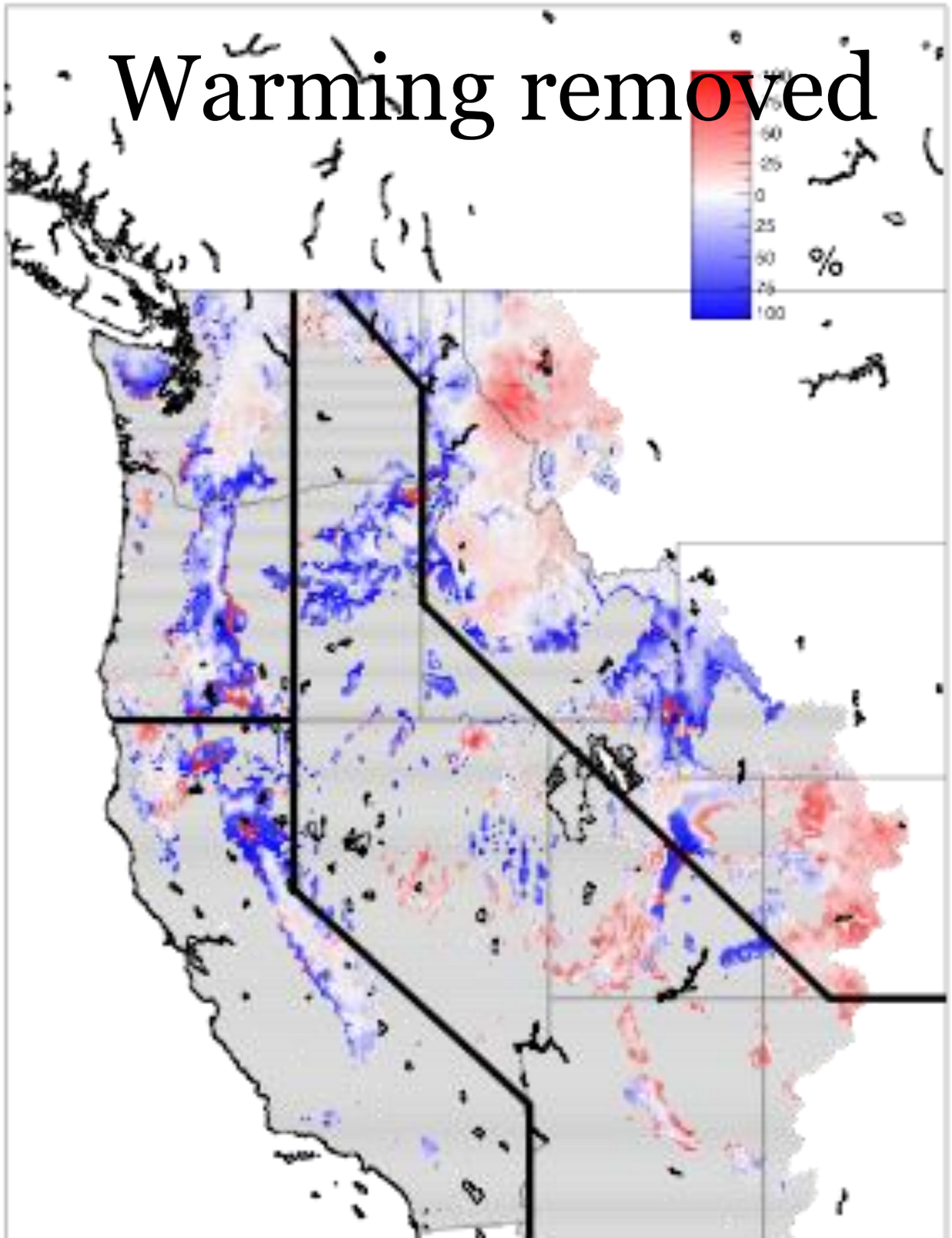
b) April 1 VIC SWE Trend 1955 to 2014

Observed climate



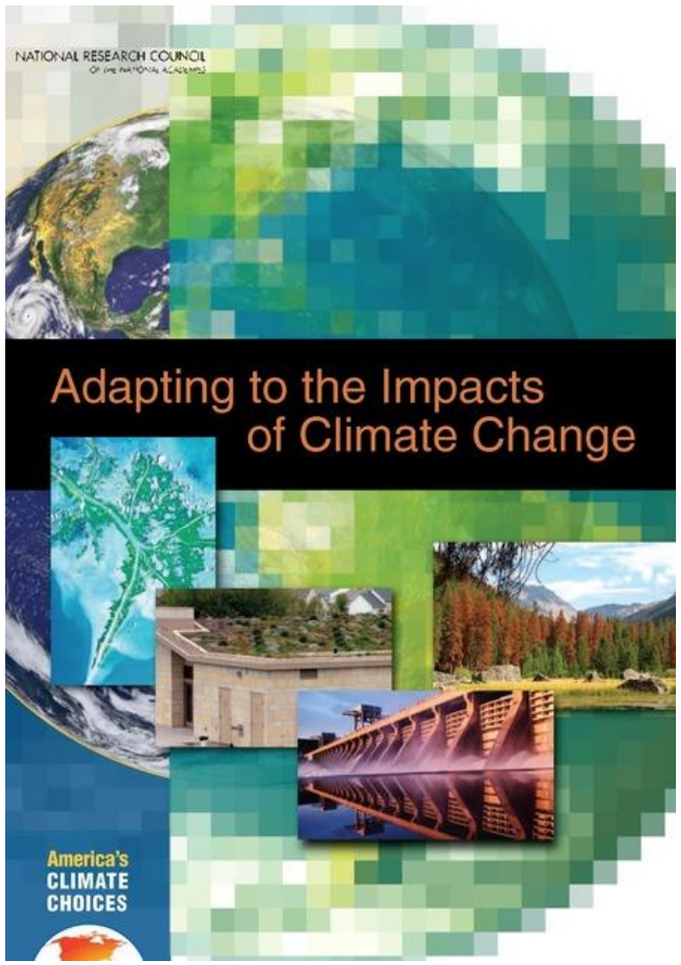
c) April 1 VIC SWE Trend(Detrended) 1955 to 2014

Warming removed



Adaptation

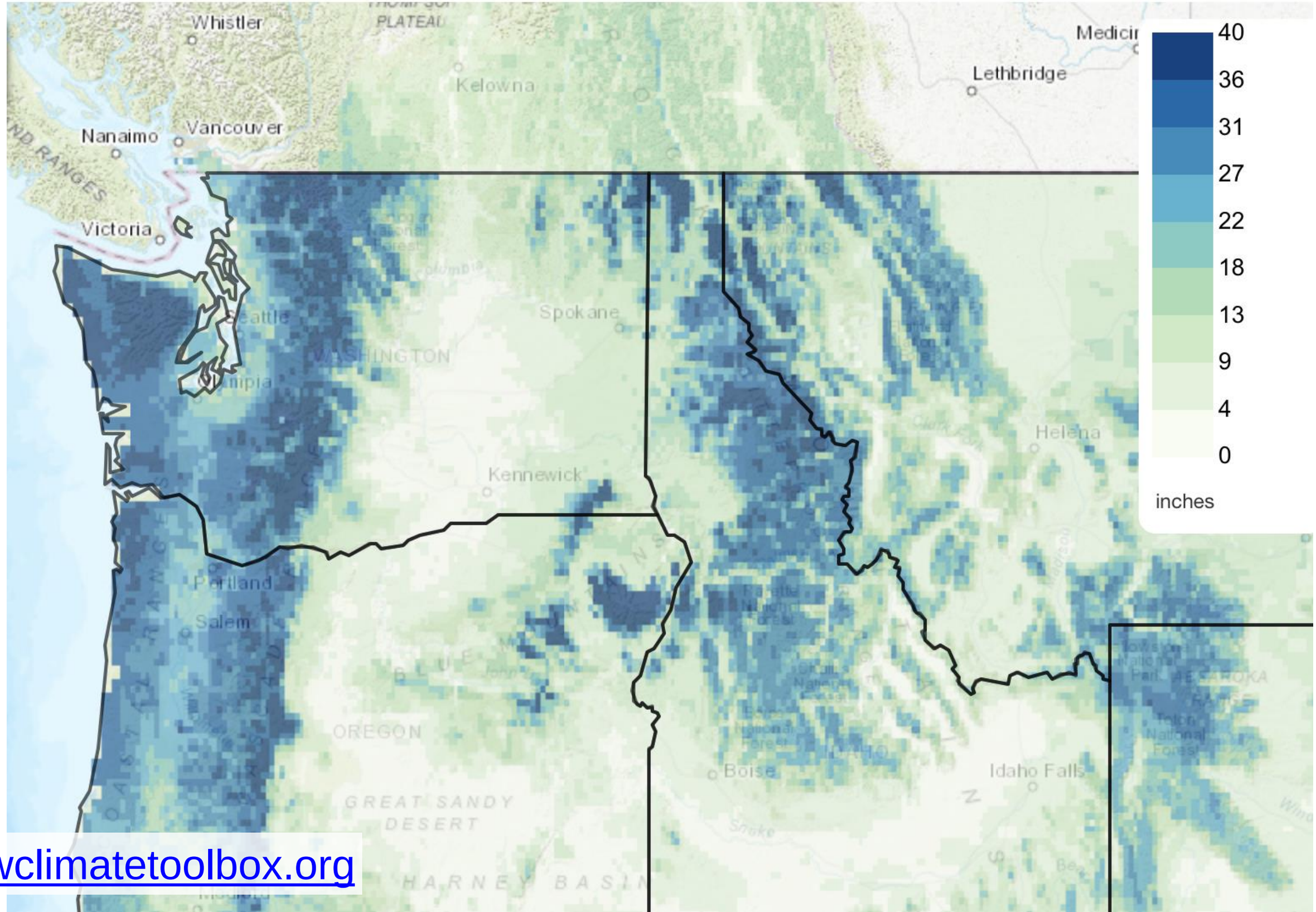
- Improving efficiency of water use
- Reducing evaporation (reservoirs, canals)
- Protecting/recharging groundwater
- Revising rule curves
- Coastal watersheds
- Reconsidering new water rights



Total Soil Moisture, Summer (Jun-July-Aug)

Historical simulation, 1971-2000 mean

Multi-model (10 models) mean from VIC forced by downscaled models



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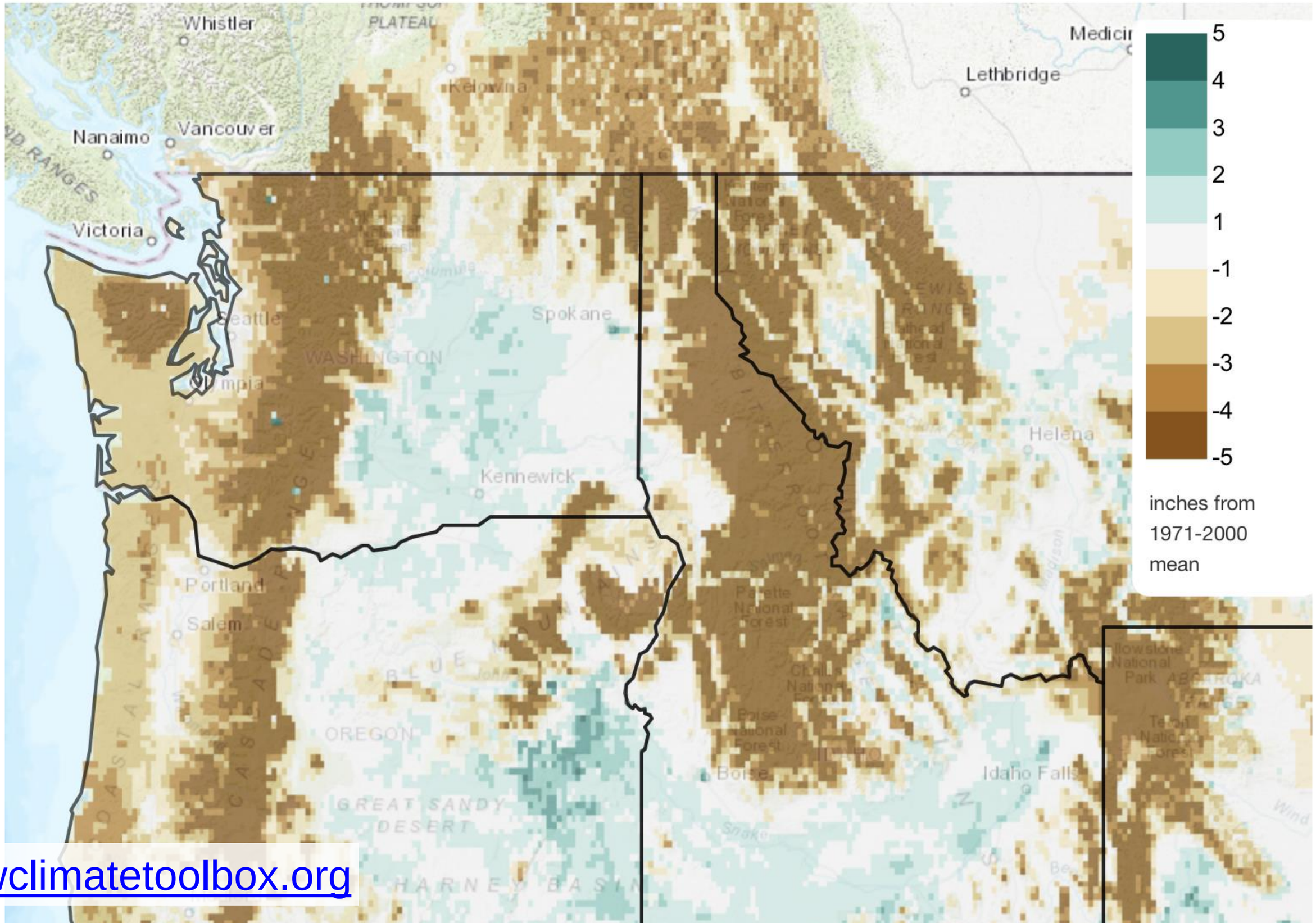
Projected Change in Total Soil Moisture, Summer (Jun-July-Aug)

RCP8.5 2070-2099 vs. historical simulation 1971-2000, mean change

Multi-model (10 models) mean from VIC forced by downscaled models



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