RECONSTRUCTING SIERRA NEVADA SNOWPACK:

The Western Cordilleran Snow Atlas

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Stephen T. Gray

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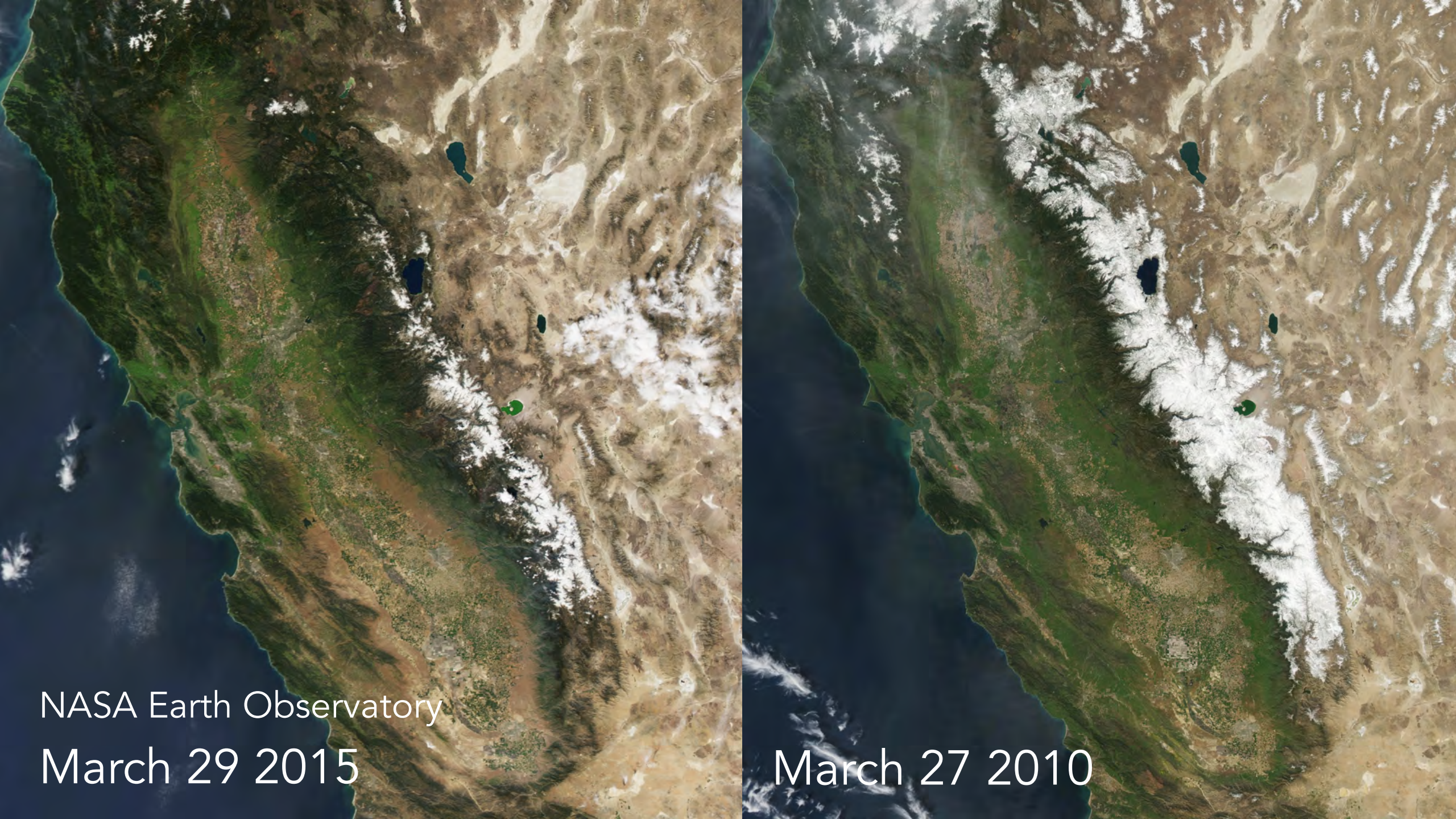
USGS

AK CSC Alaska Climate Science Center

Southwest Climate Science Center

LABORATORY OF TREE-RING RESEARCH UASCIENCE

THE PAST LANDSCAPES LAB


NASA Earth Observatory
March 29 2015
March 27 2010

Tree rings mainly used to reconstruct **drought, precip, runoff**
(incl. from snow melt)

Less often (but increasingly!) to reconstruct snow directly

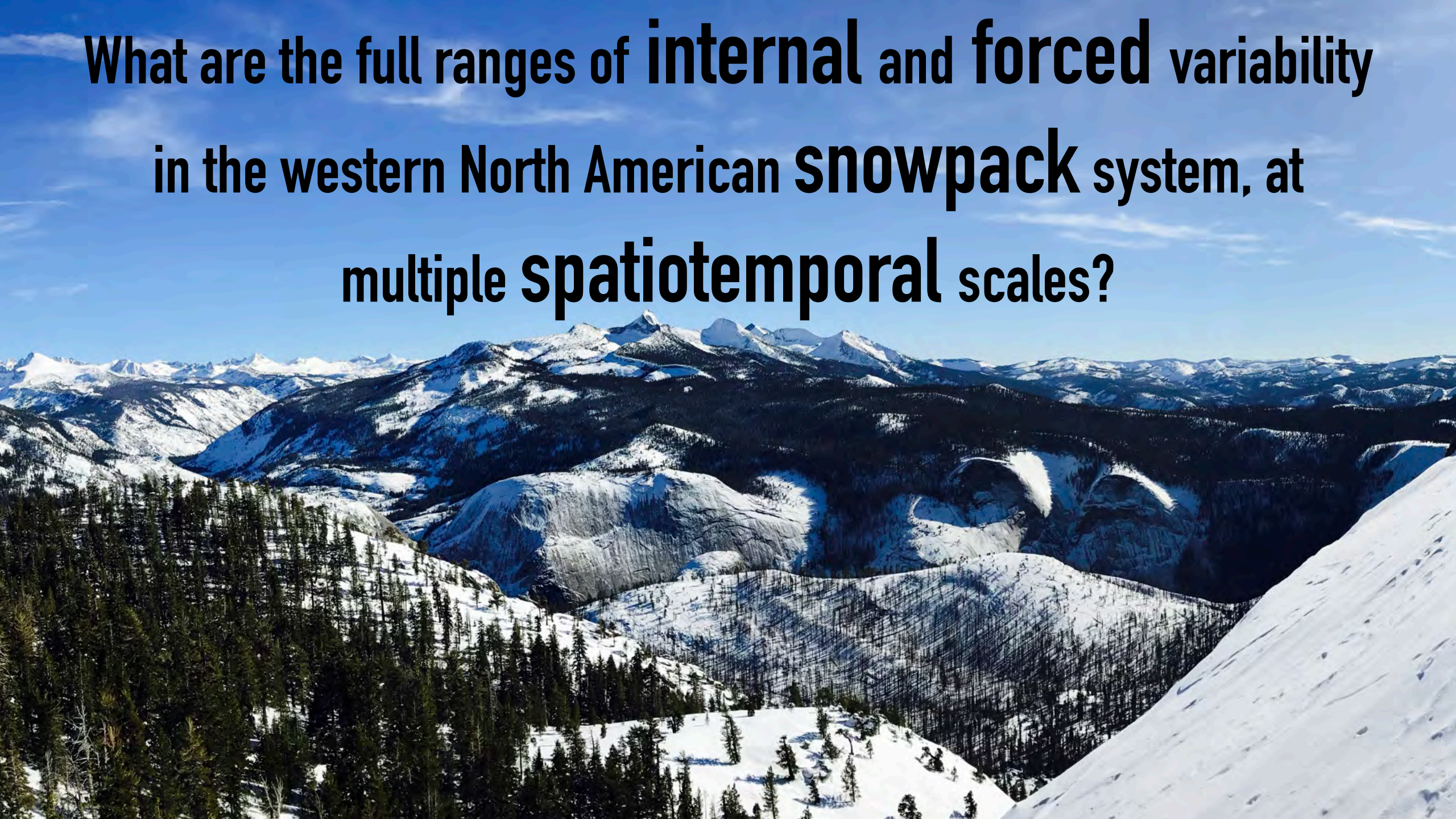
A 431-Yr Reconstruction of Western Colorado Snowpack from Tree Rings

CONNIE A. WOODHOUSE

NOAA Paleoclimatology Program, and Institute of Arctic and Alpine Research, University of Colorado, Boulder, Colorado

One new way to generate snowpack reconstructions…


GENERAL MAP
OF THE
UNITED STATES.


What are the full ranges of internal and forced variability
in the western North American snowpack system, at
multiple spatiotemporal scales?

Outline:

Introduce Snow Atlas product by way of methods

‘Drive’ the Snow Atlas

Where to find it and what’s next

Point-to-Point Regression for Climate Field Reconstruction

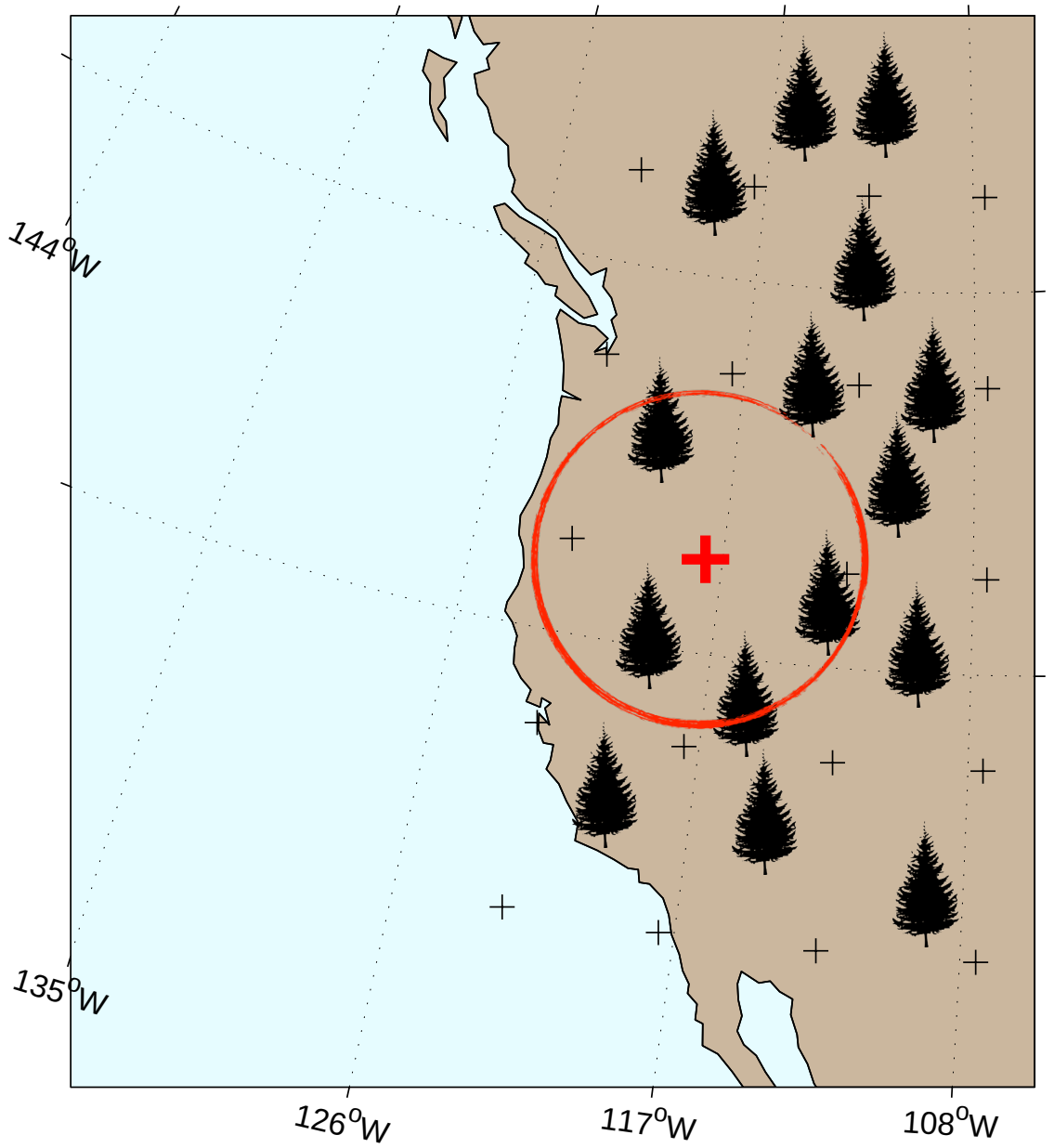
Cook et al. 1999, 2004, 2010, 2012

Large-scale network of **predictor** tree ring chronologies

+

Gridded **target** instrumental data field

Point-to-point **regression** model estimates of past values at every instrumental grid point from all the 'neighborhood' tree ring data



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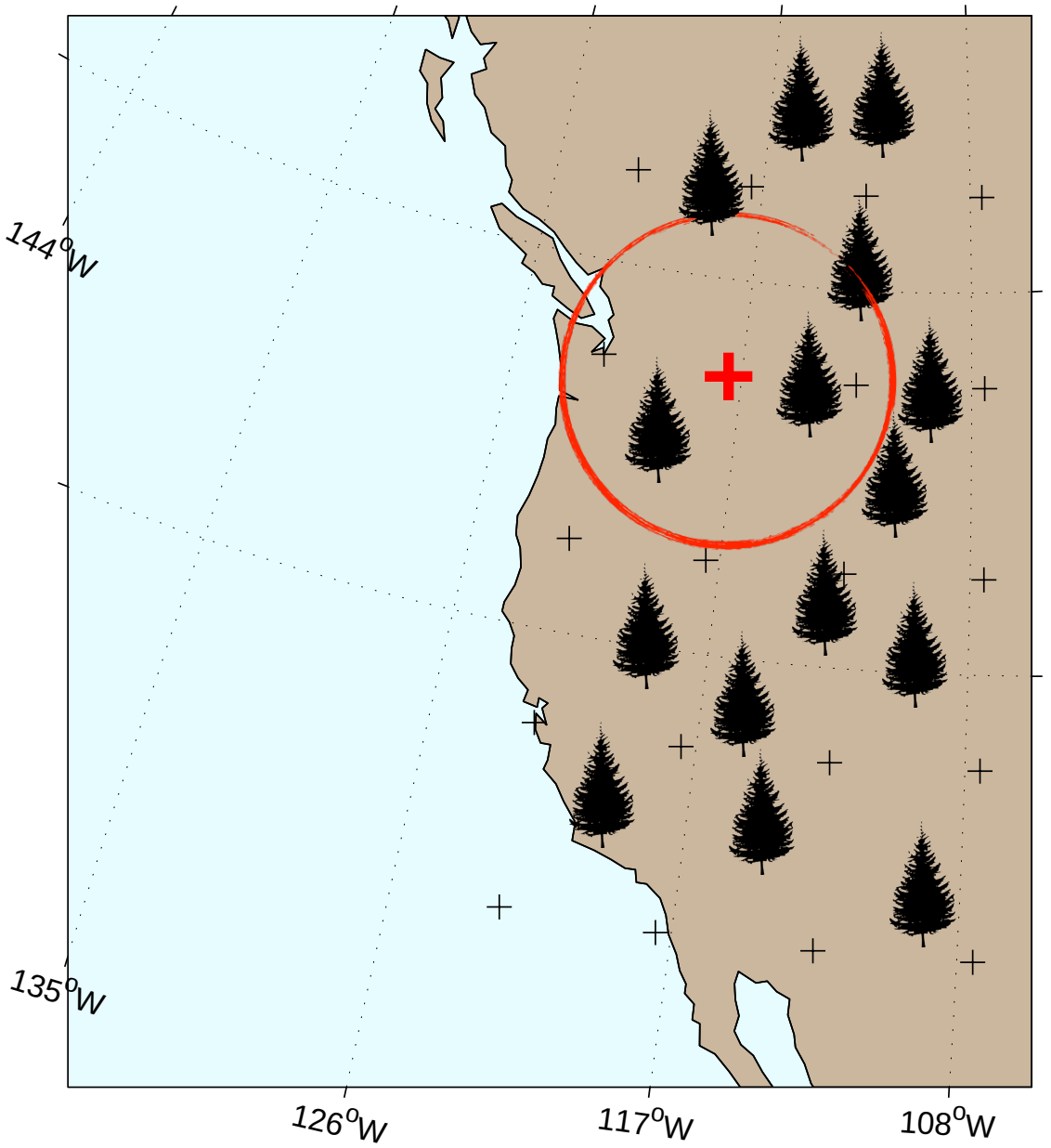

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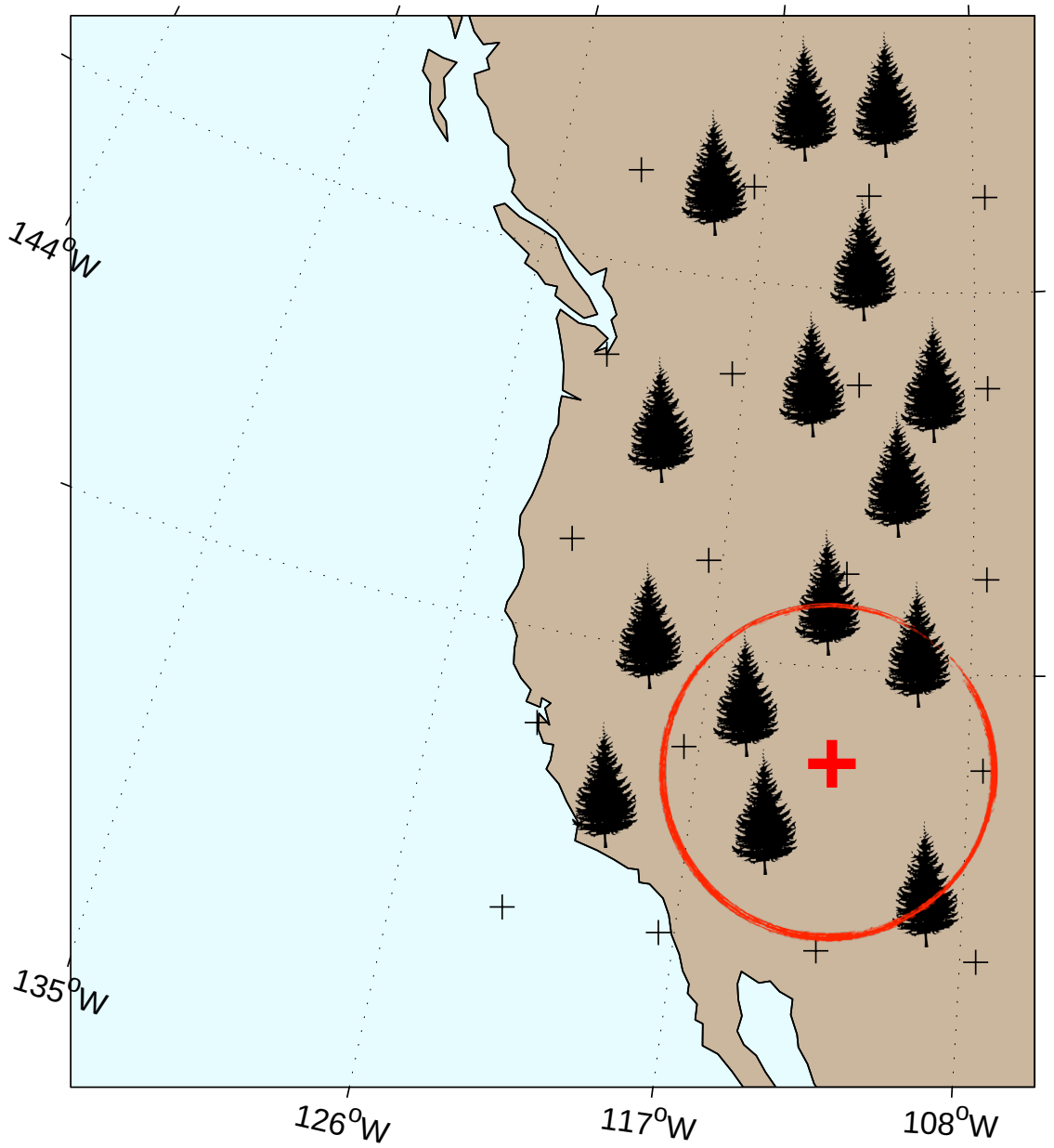


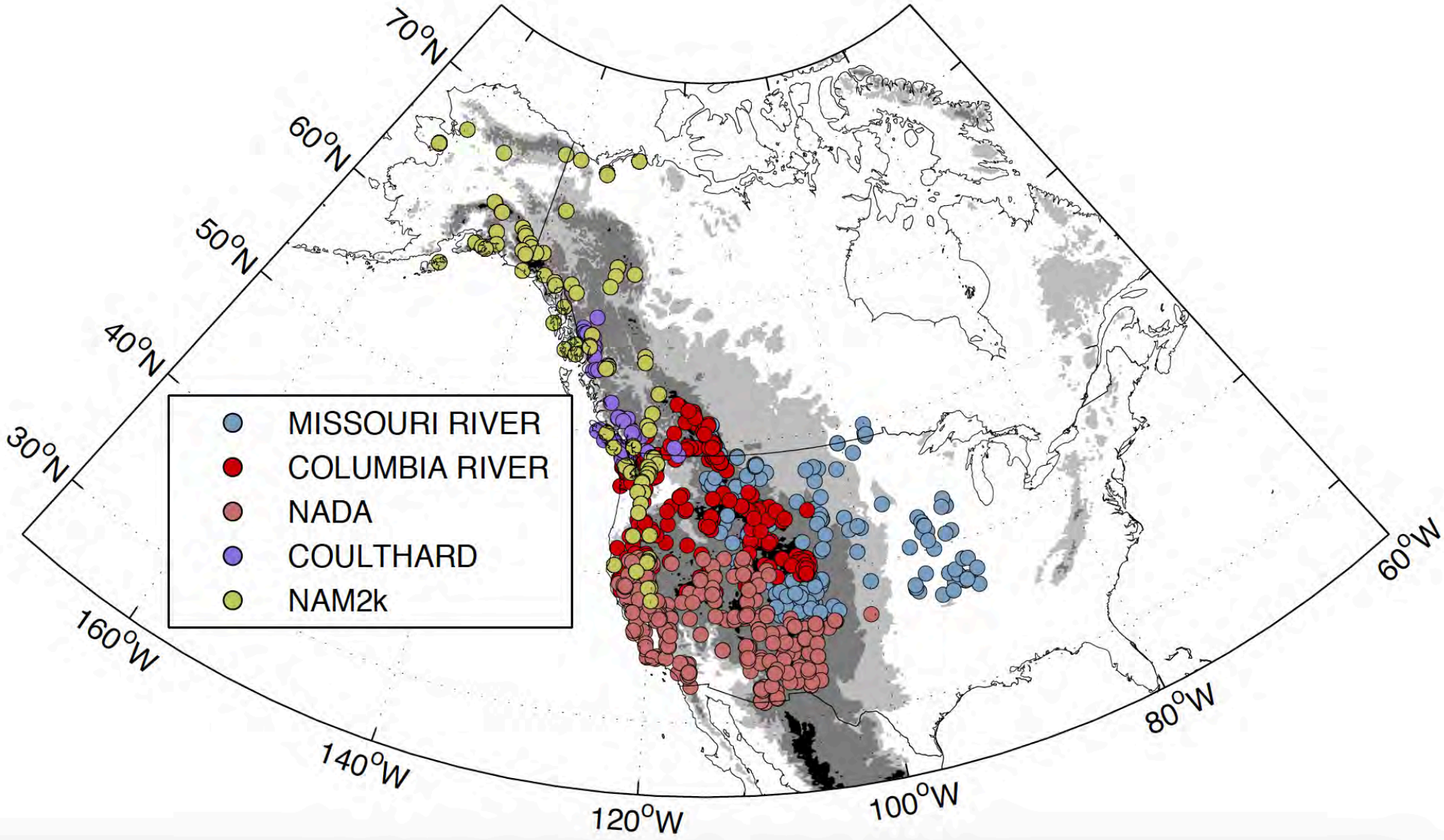
1816

WATER-STRESSED

1816

SNOW-STRESSED

North American Paleosnow Network



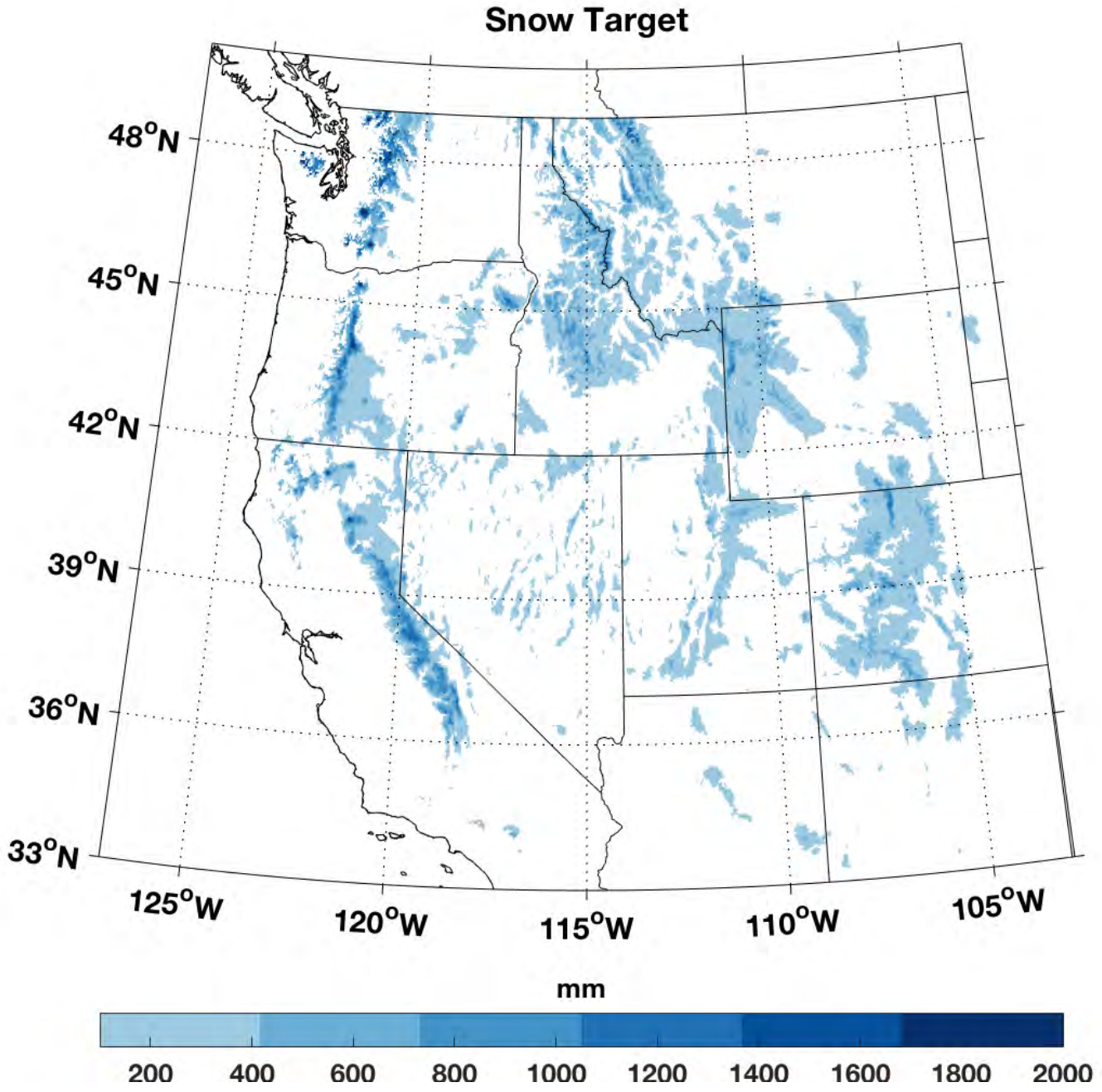
April 1
Snow Water Equivalent
Target

4x4 km

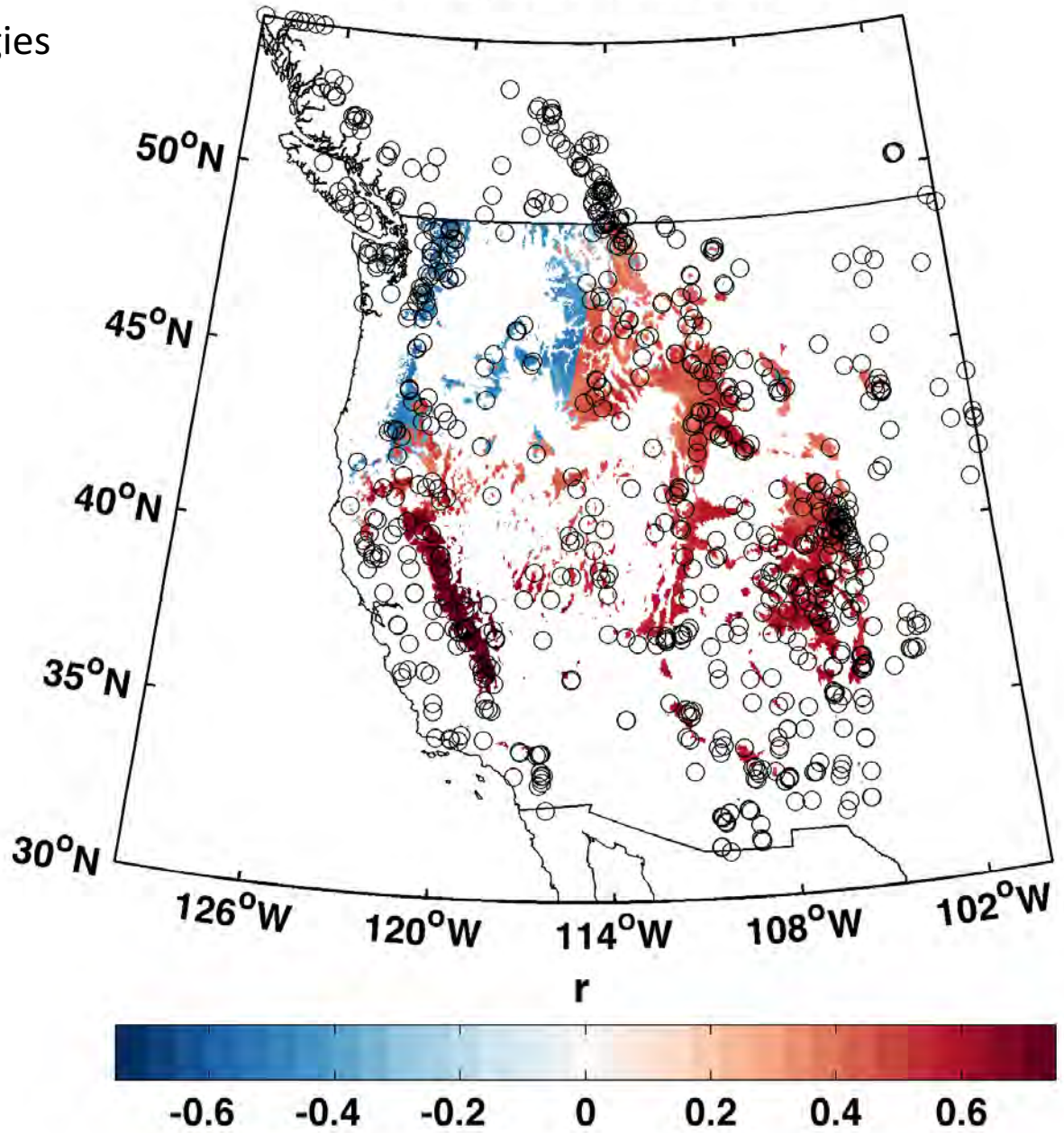
PRISM

CONUS

Hostetler & Alder 2016, WRR



Tree-ring chronologies

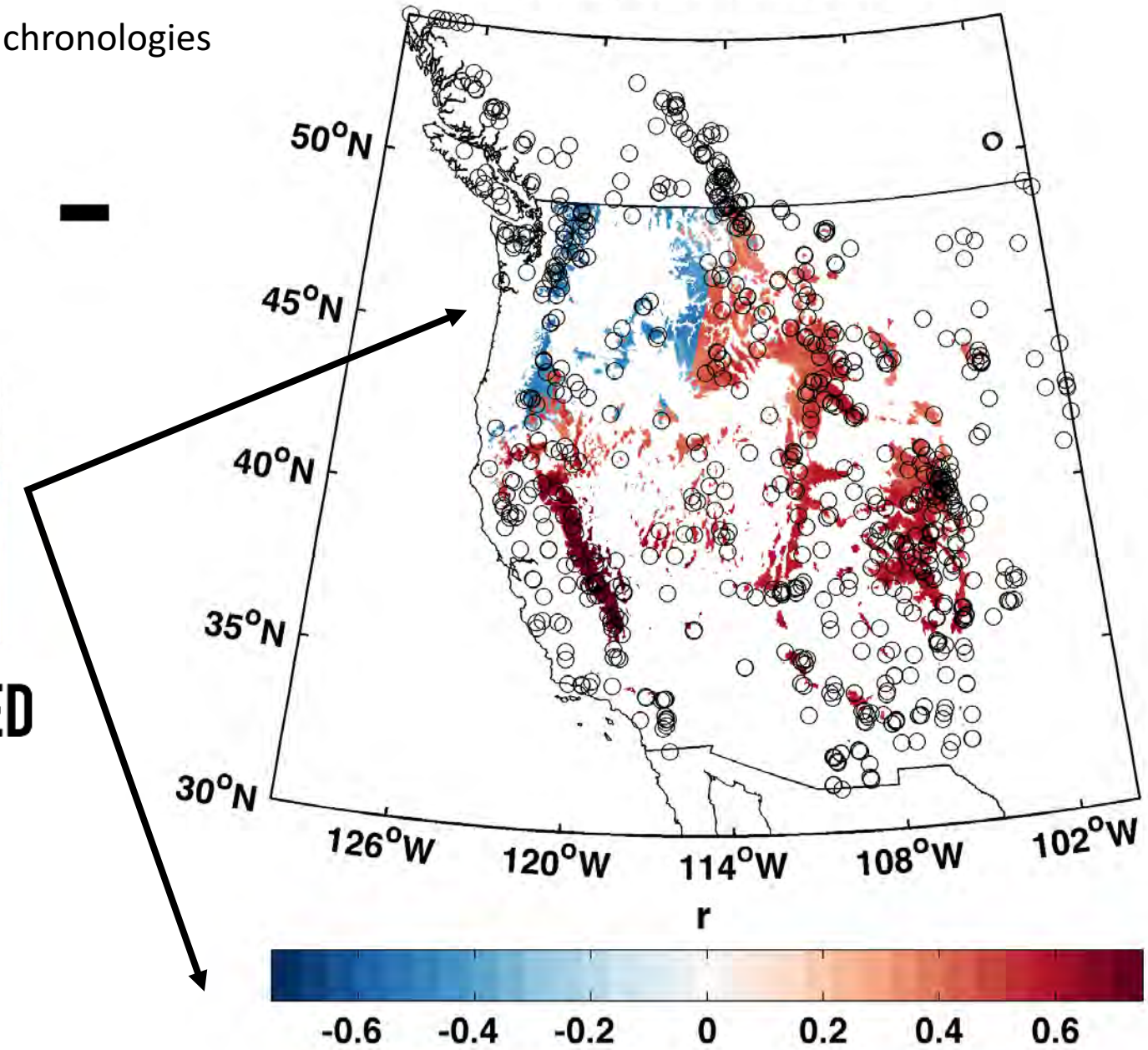


snow-stressed

water-stressed

Tree-ring chronologies

SNOW-STRESSED



snow-stressed

water-stressed

Tree-ring chronologies

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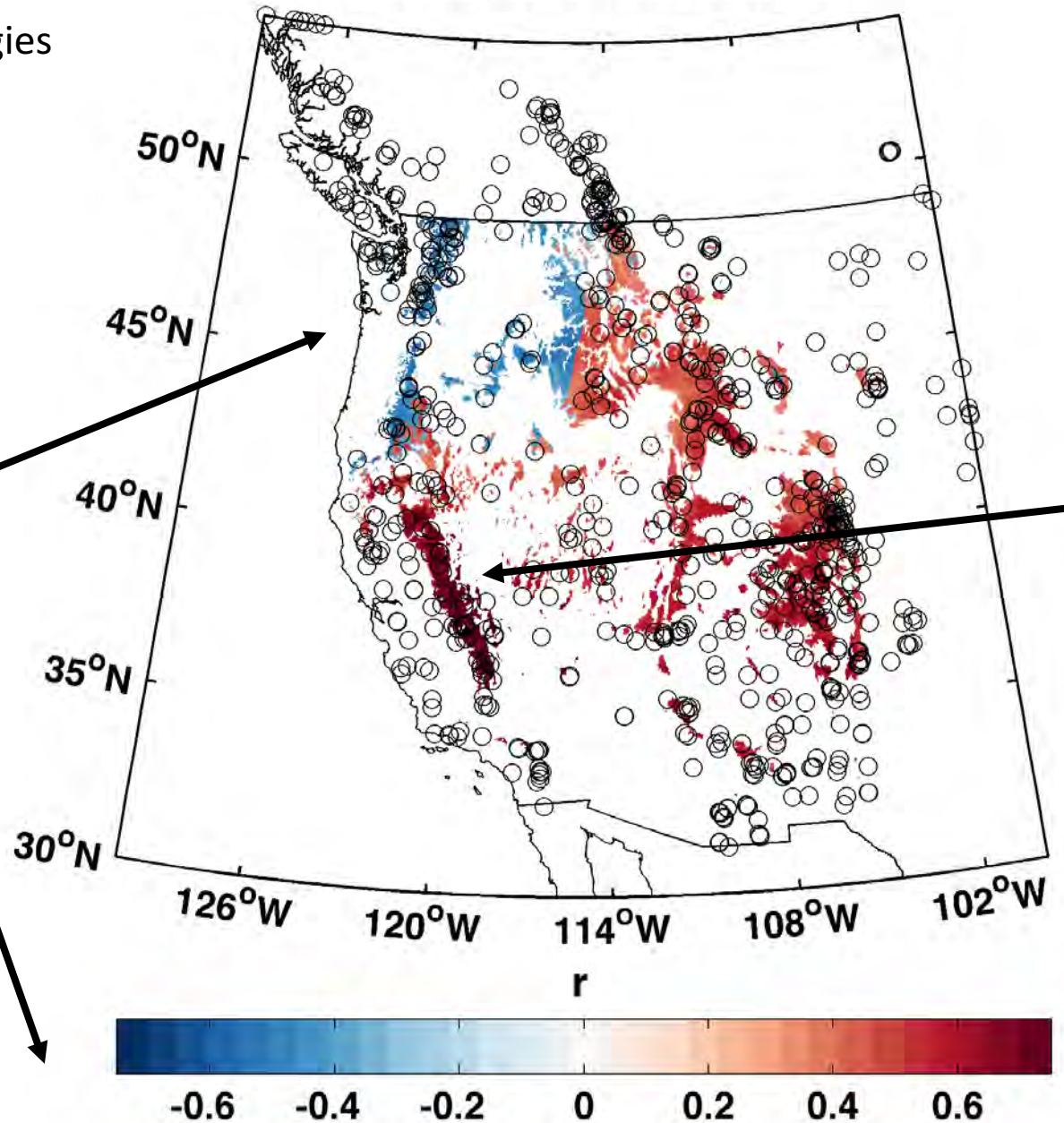


WATER-STRESSED

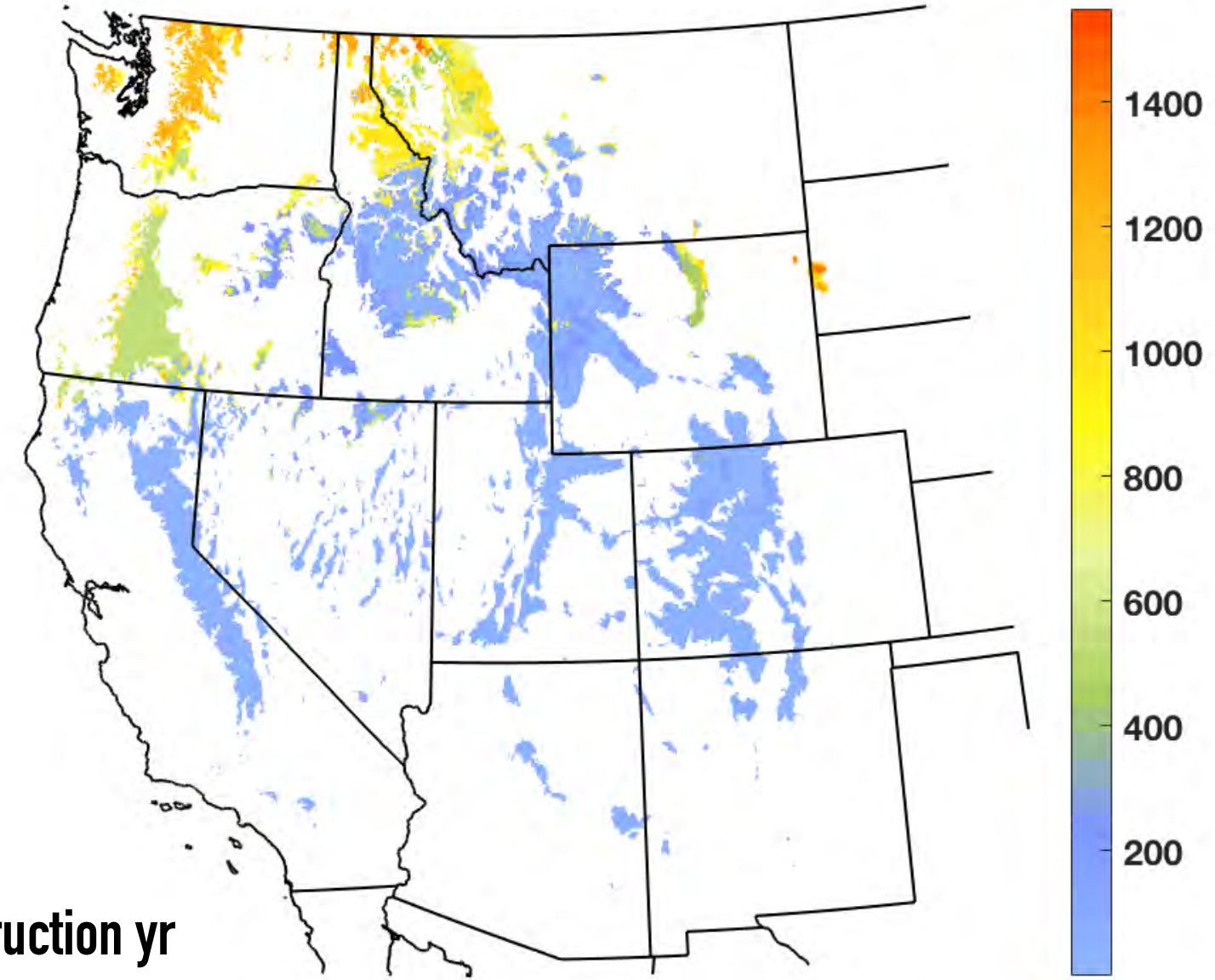
snow-stressed

water-stressed

>37,000 GRIDPOINTS
500 KM SEARCH RADIUS
2000 YEARS
MLR, PCA
NESTED RECONSTRUCTIONS

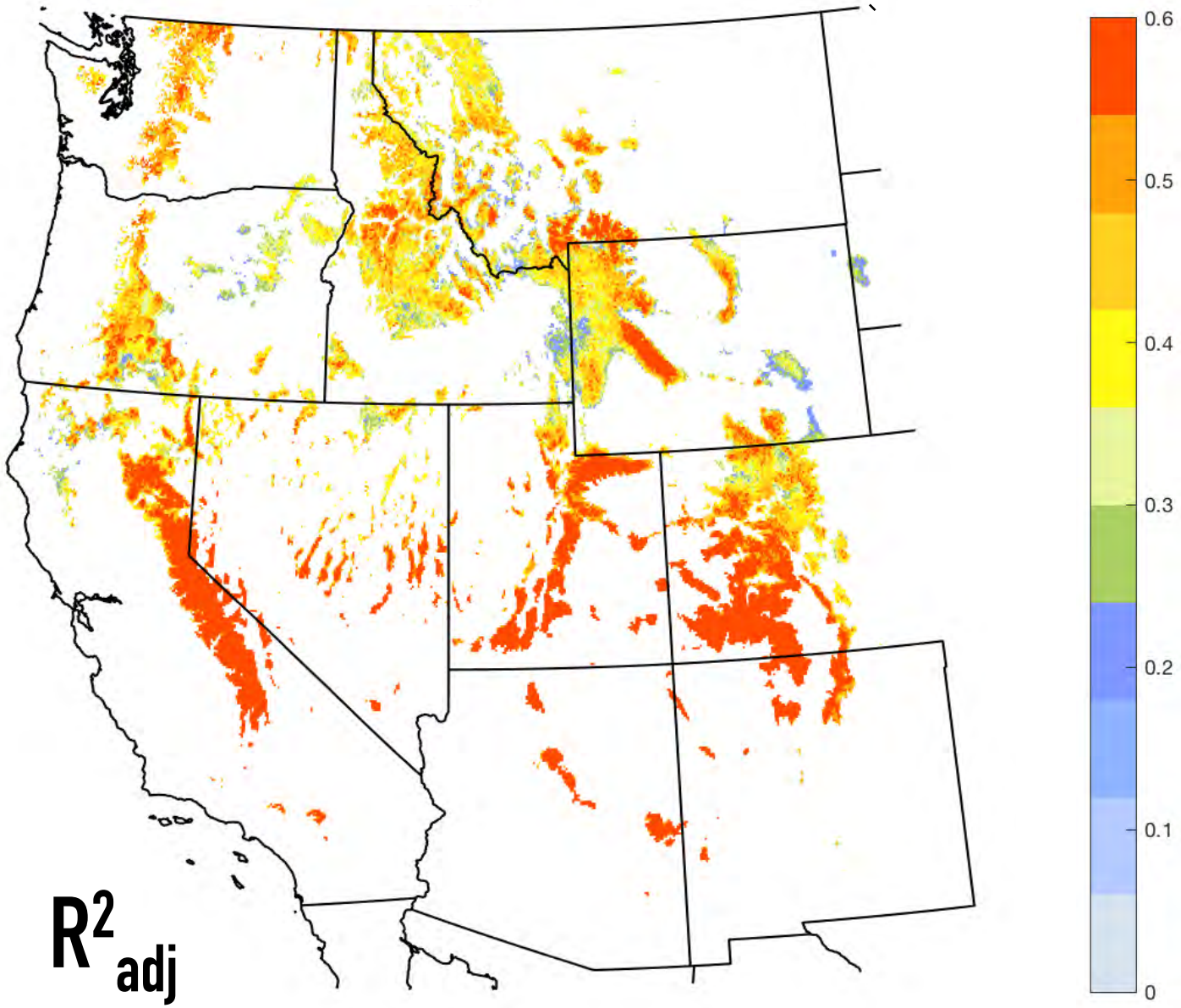
CALIBRATE 1931–1980
VALIDATE 1901–1931

Western Cordilleran Snow Atlas

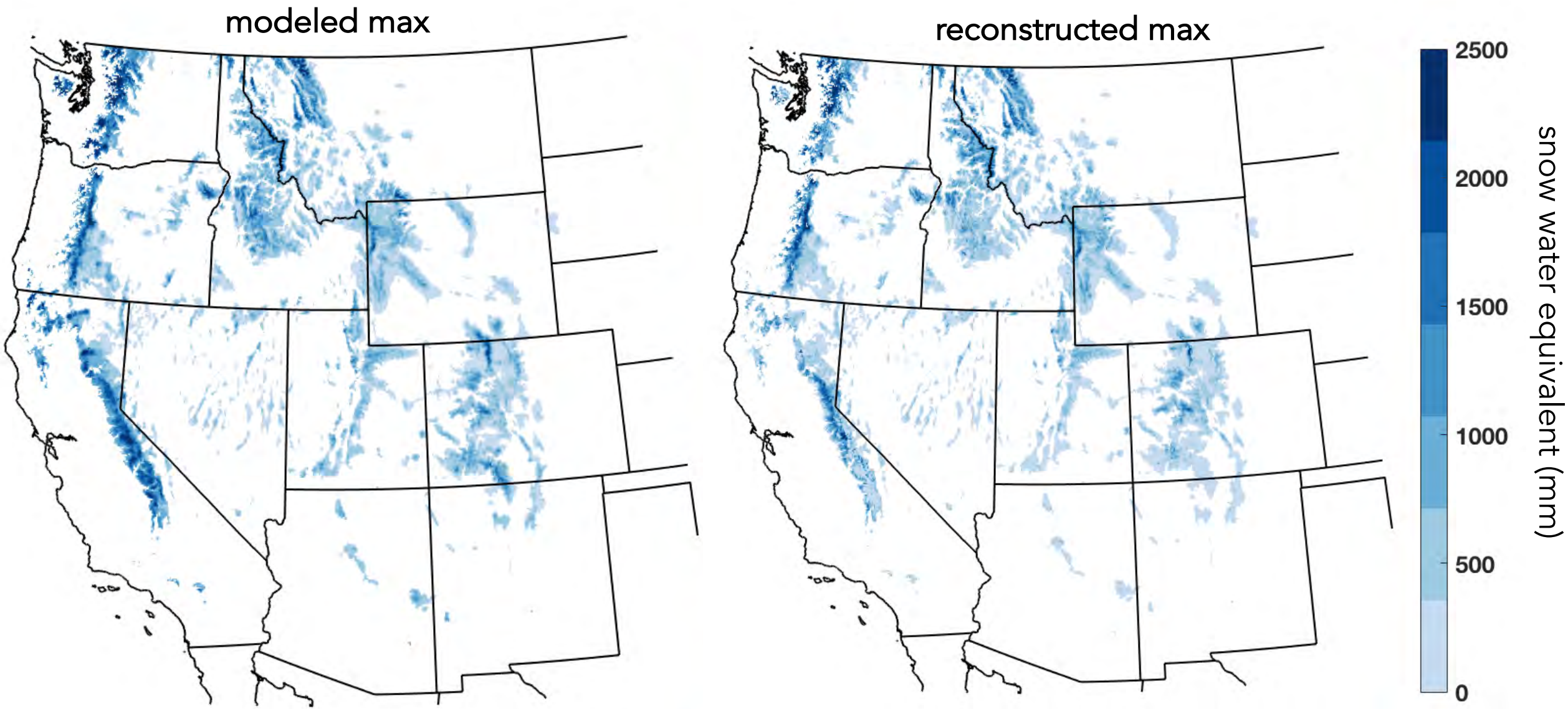


earliest reconstruction yr

Western Cordilleran Snow Atlas

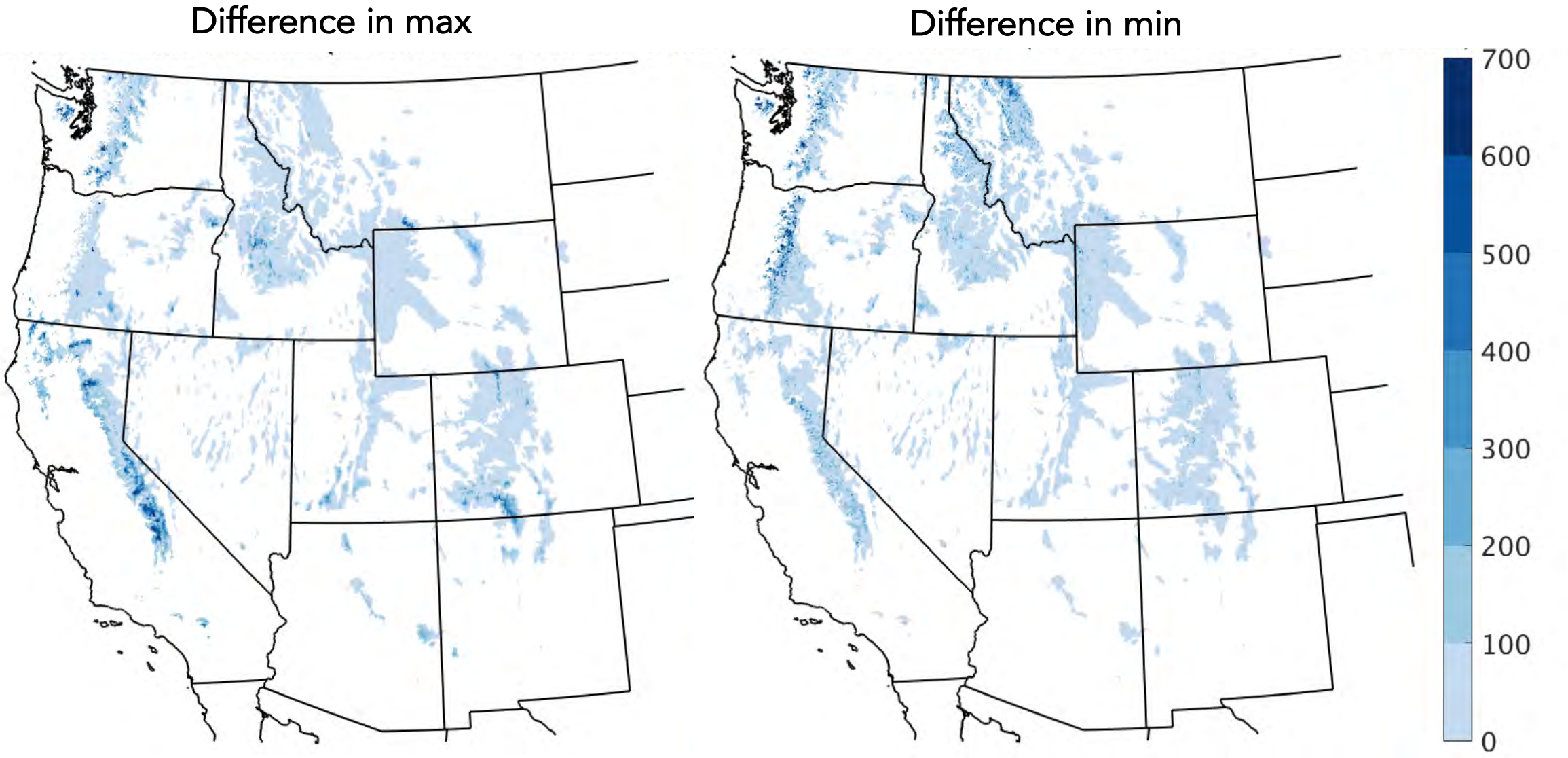


Western Cordilleran Snow Atlas



calculated over calibration period 1901-1980

Western Cordilleran Snow Atlas



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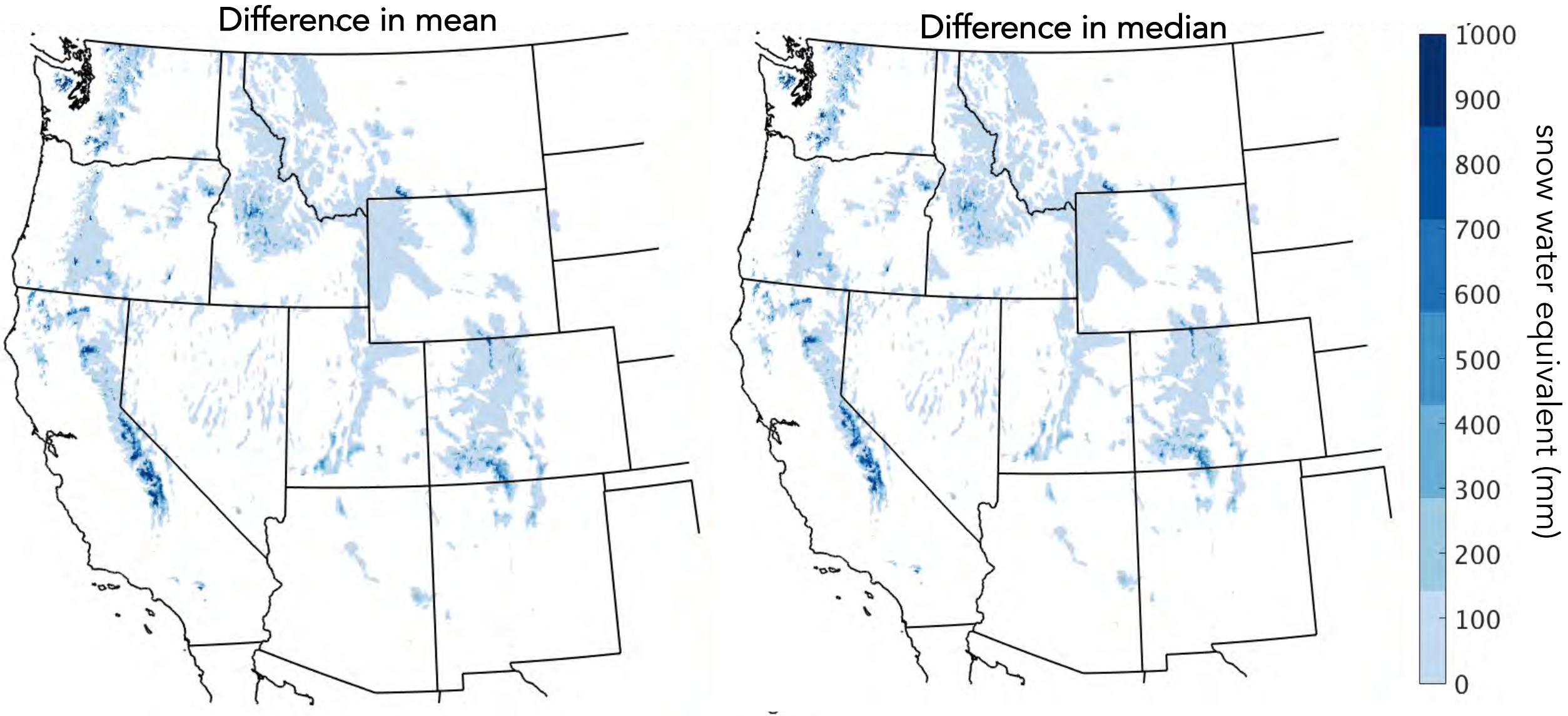

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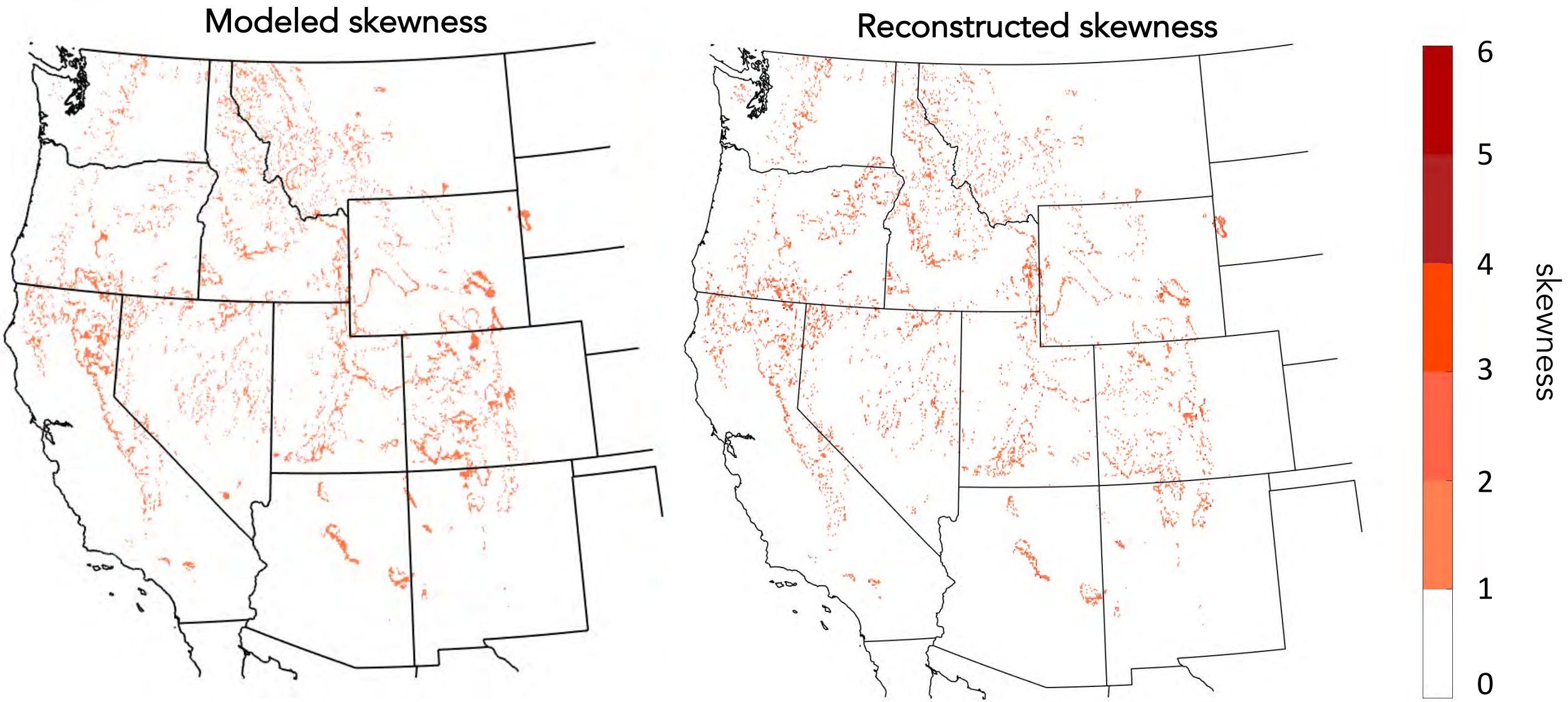
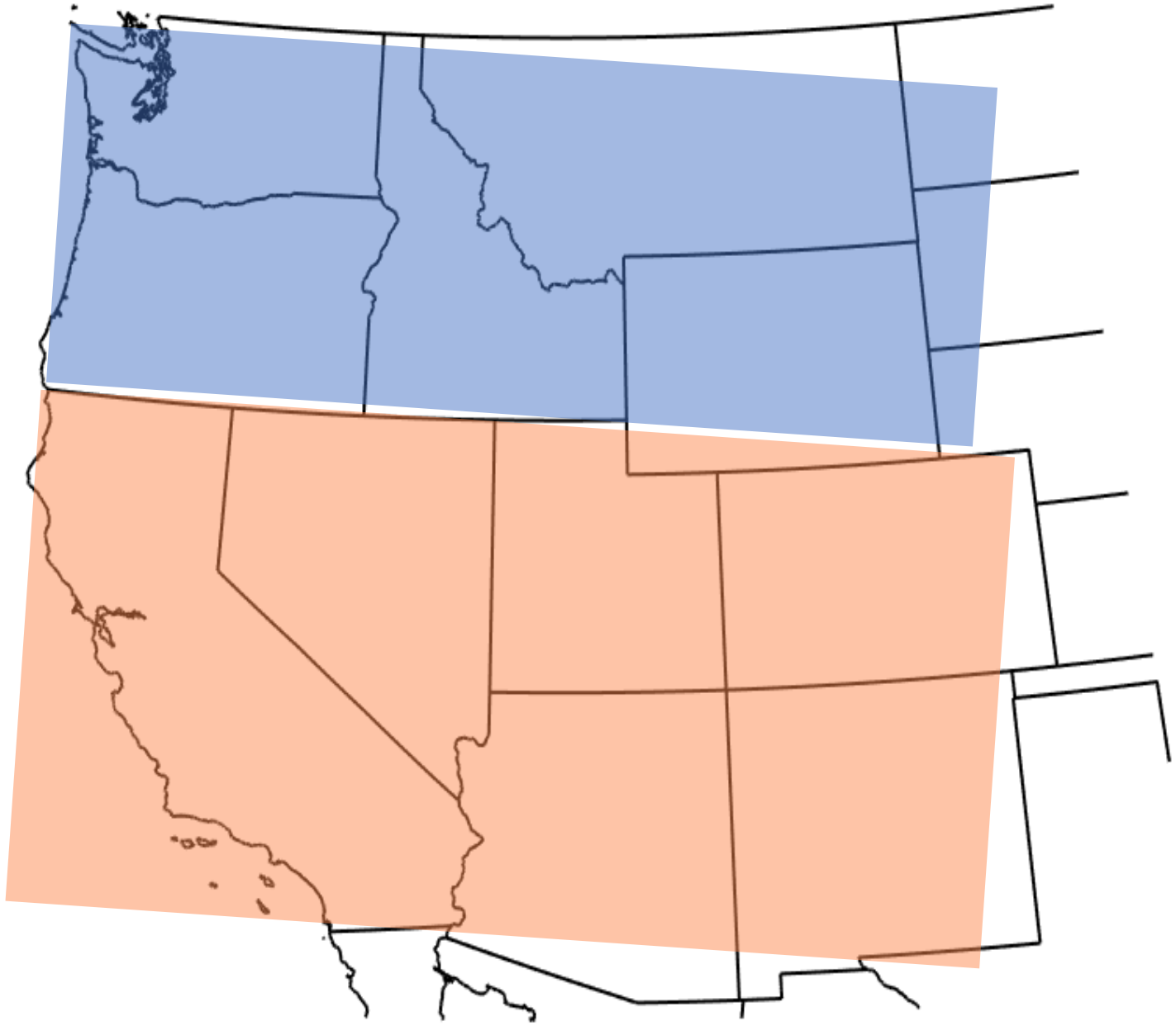
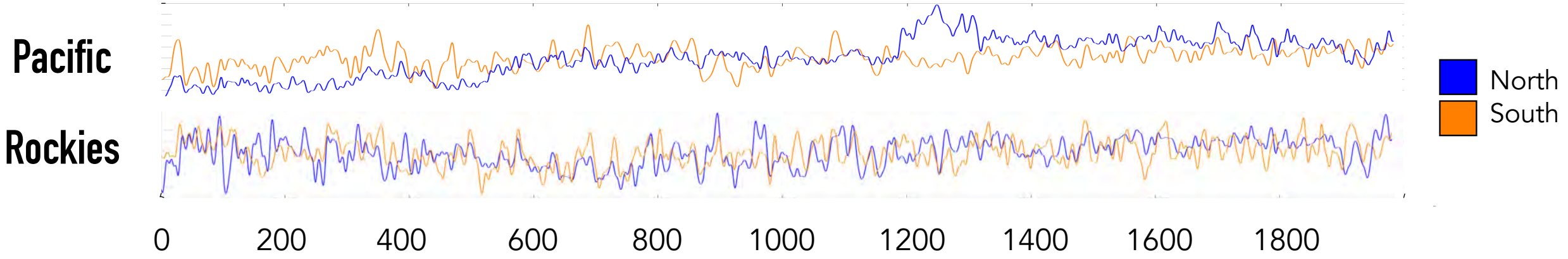
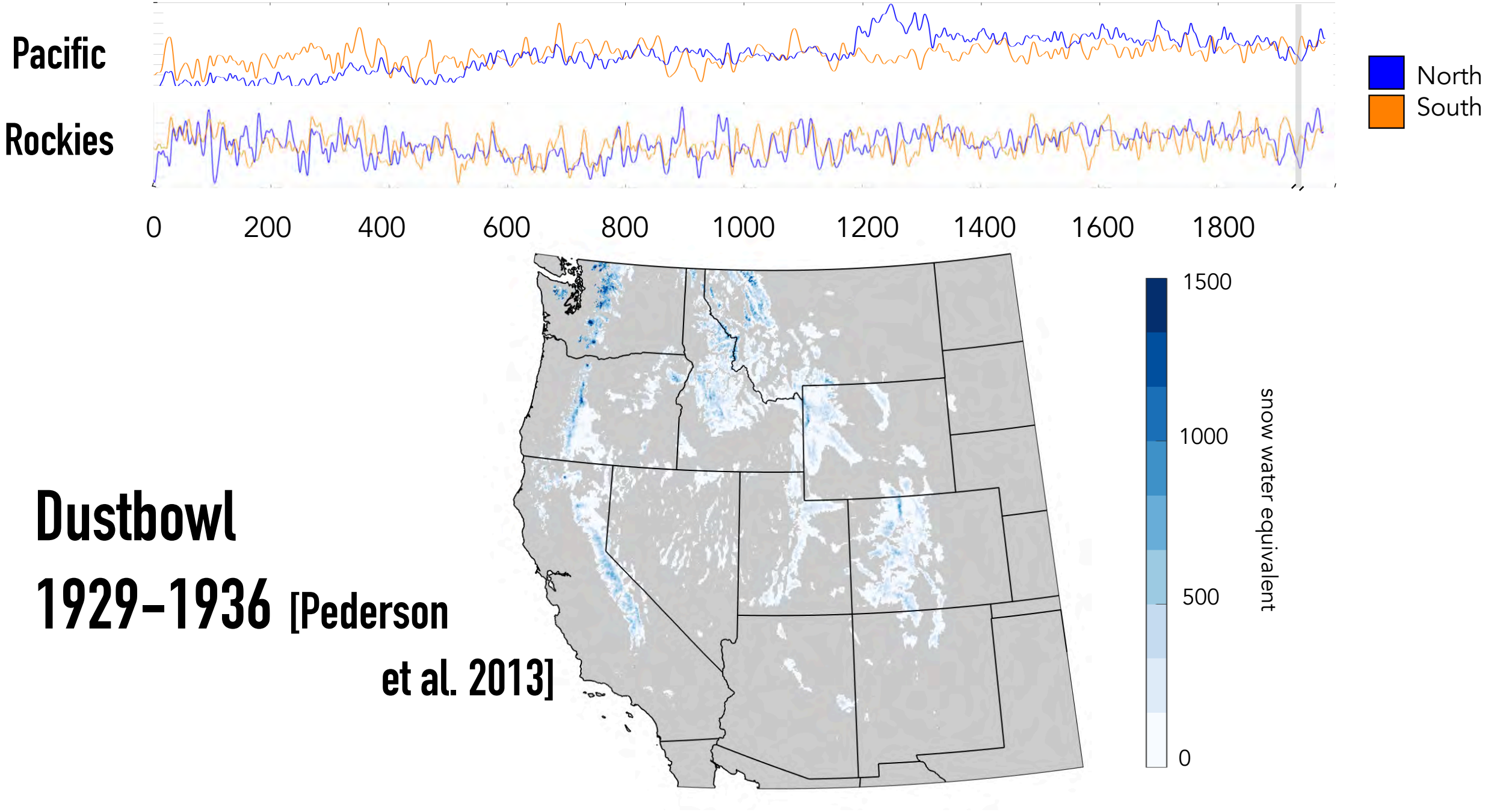


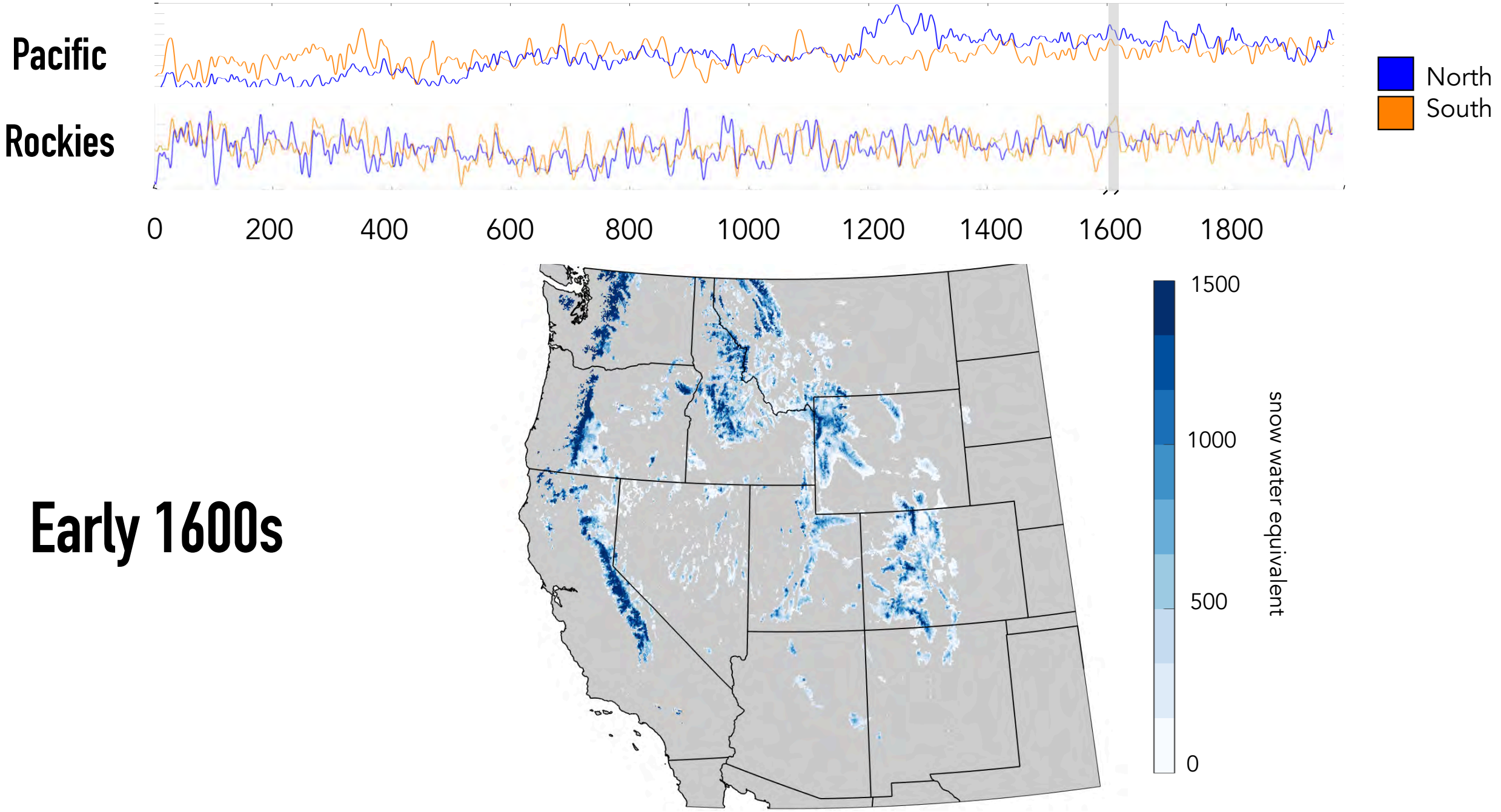
calculated over calibration period 1901-1980




Pacific
Rockies
North
South
0
200
400
600
800
1000
1200
1400
1600
1800



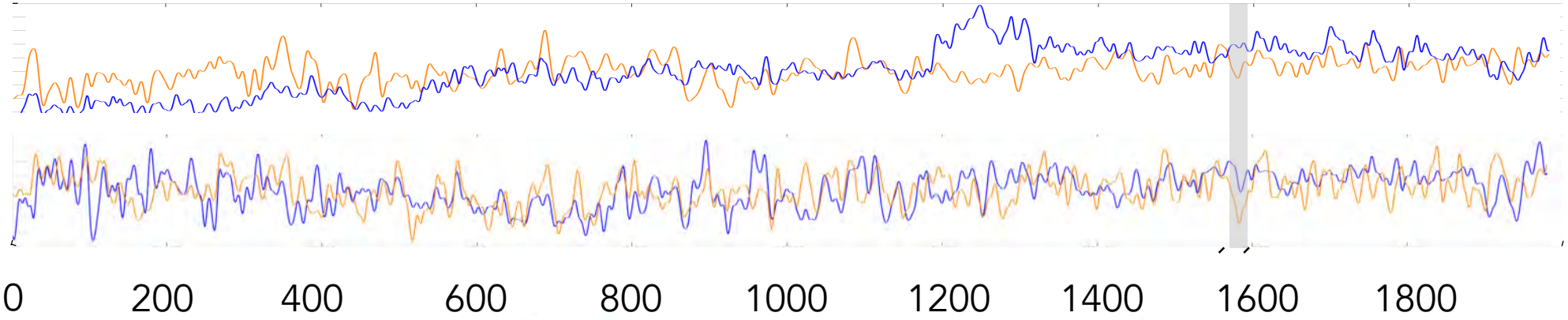
Dustbowl 1929–1936 [Pederson et al. 2013]


Pacific
Rockies
North
South
0
200
400
600
800
1000
1200
1400
1600
1800
1500
1000
500
0
snow water equivalent

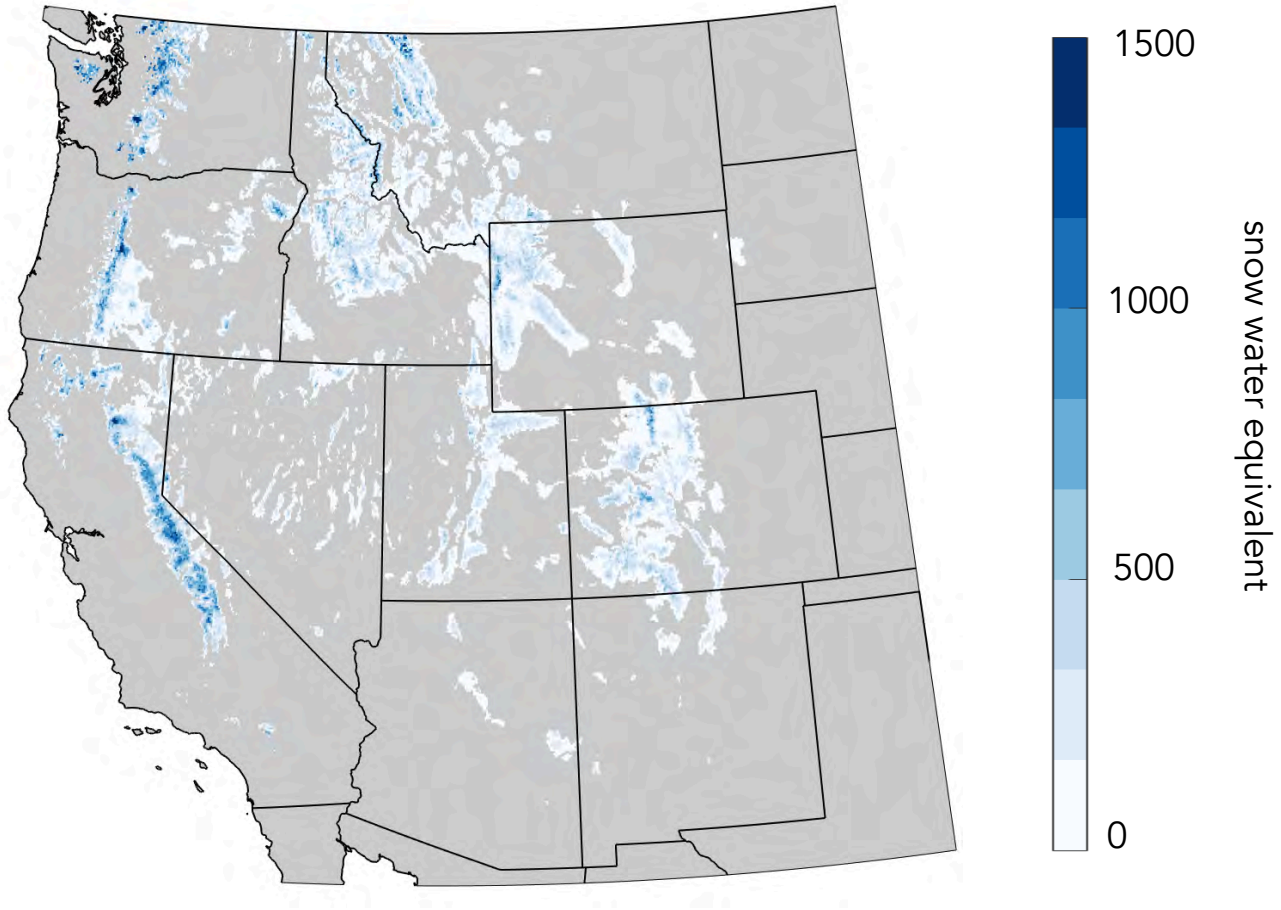
Early 1600s

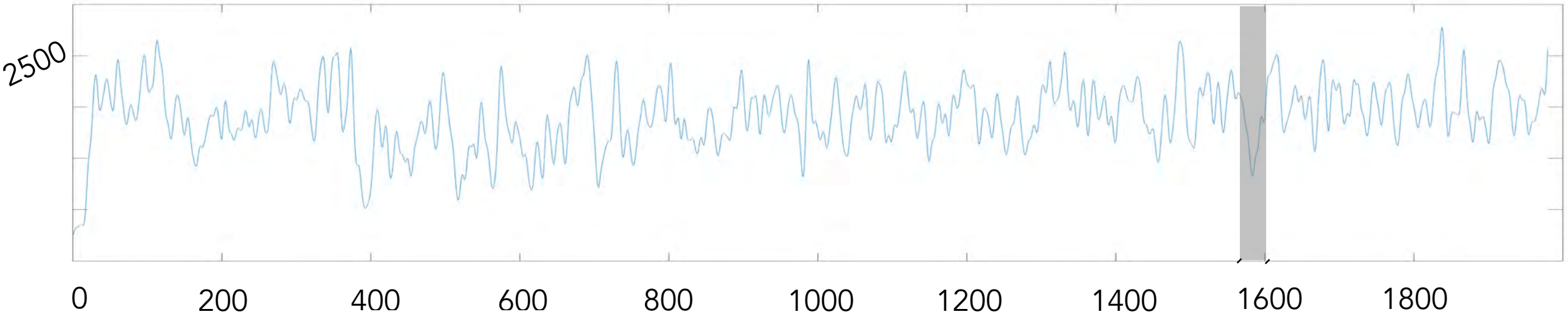
Pacific

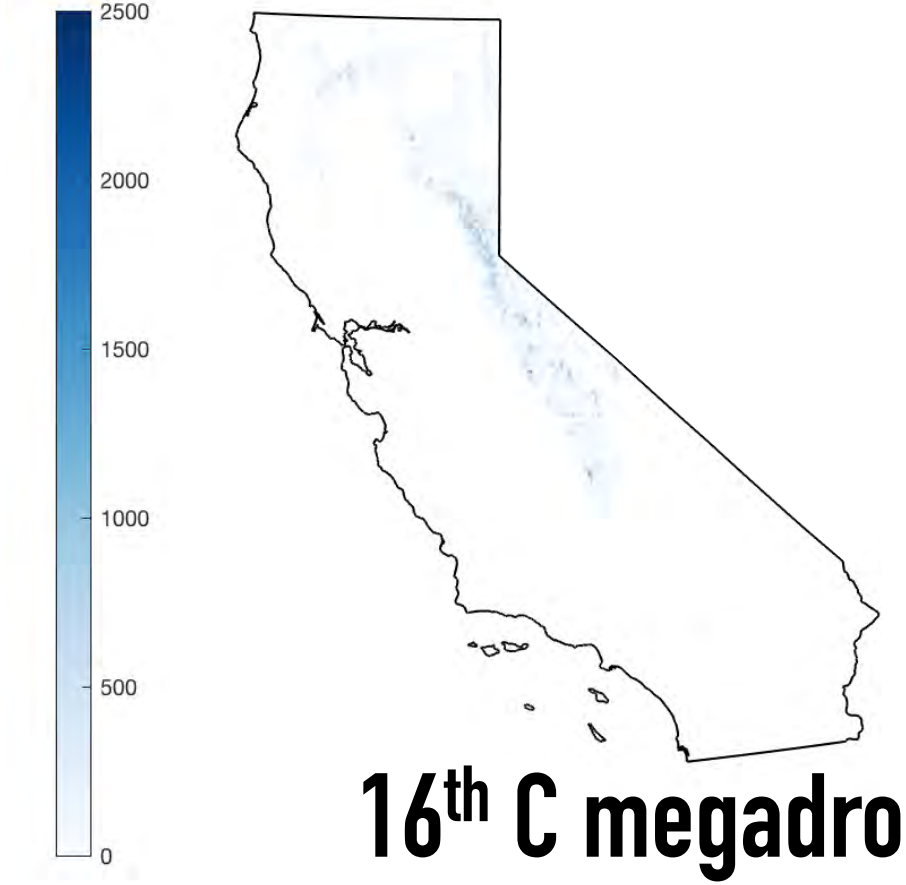
Rockies



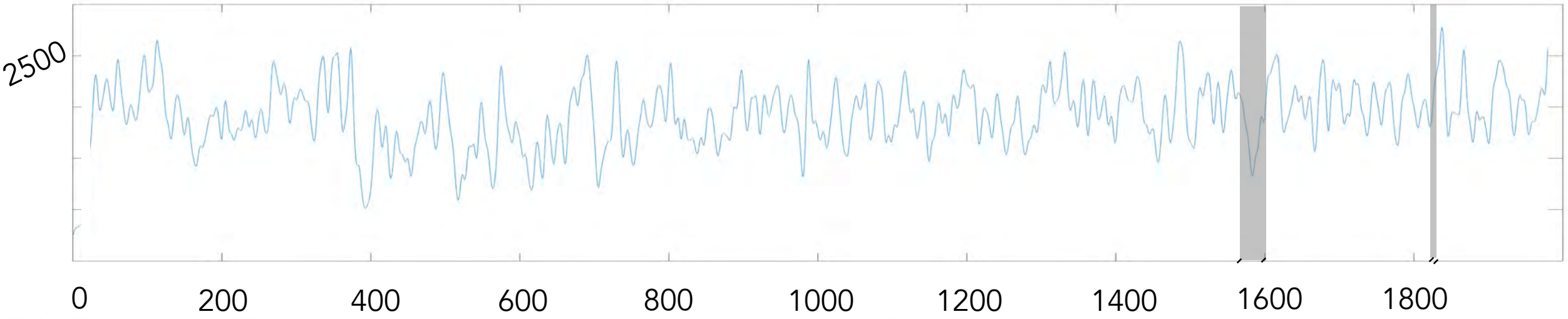
16th C Megadrought

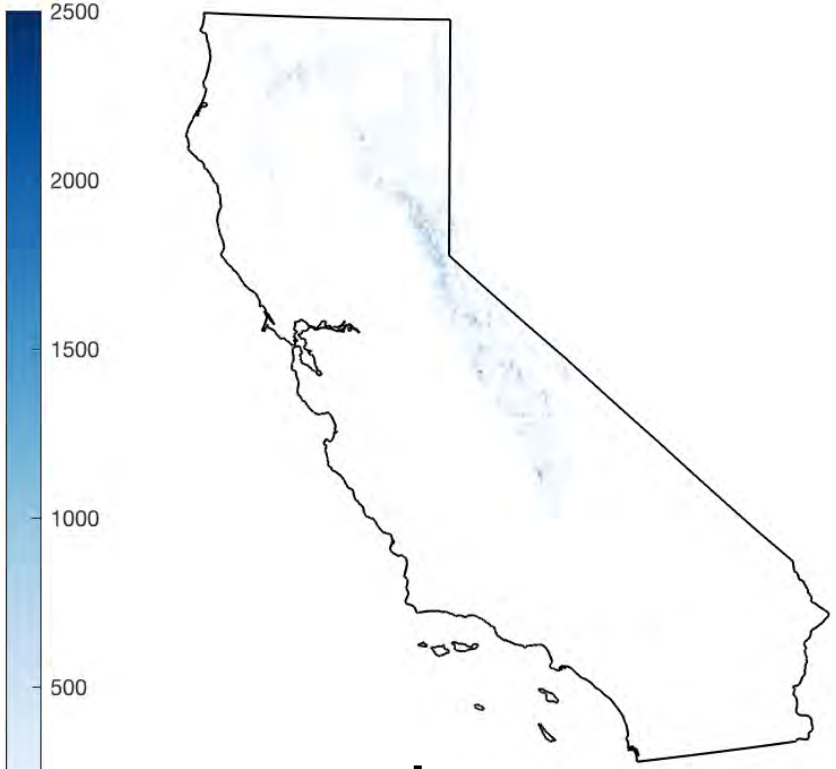


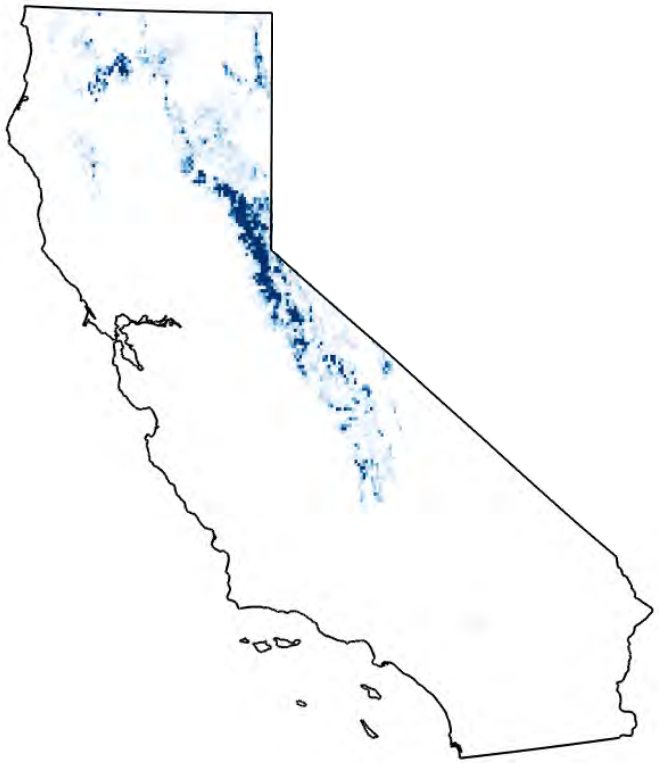




16th C megadrought

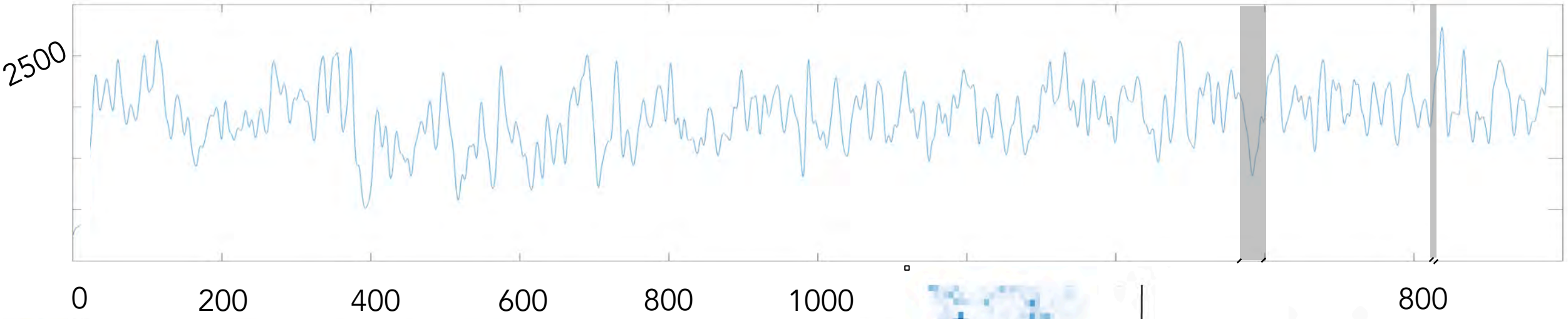


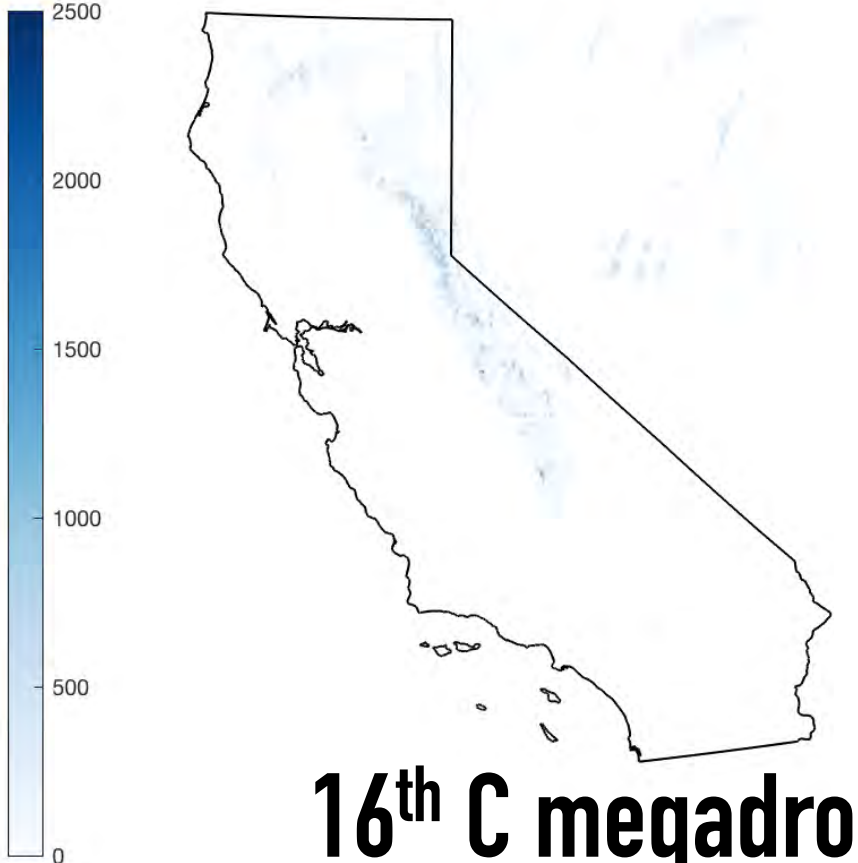


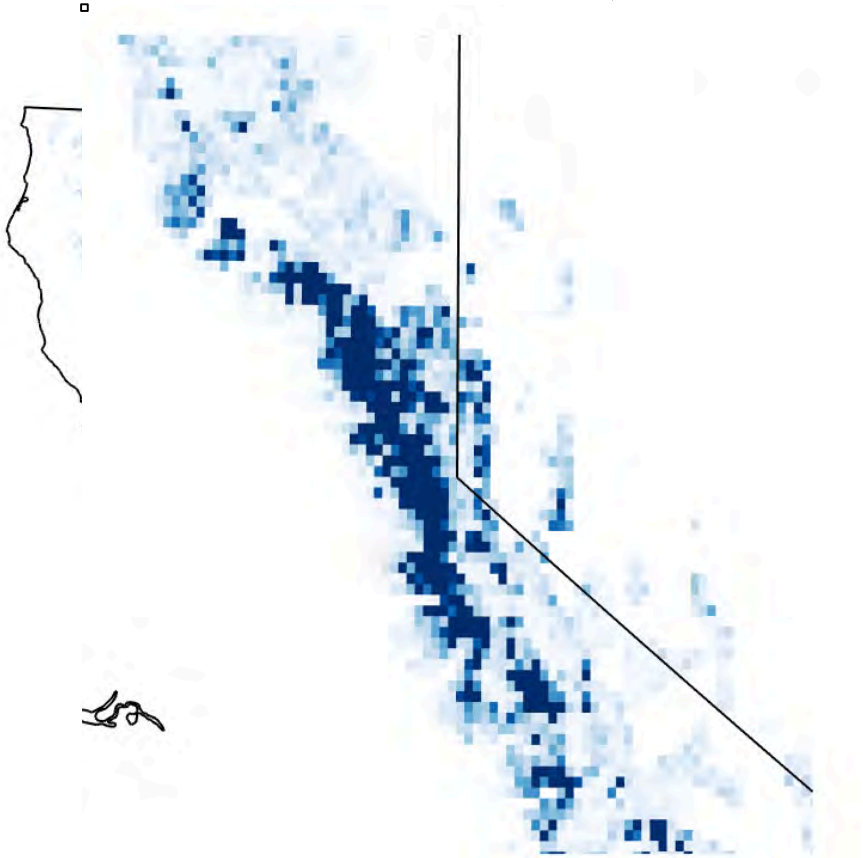


16th C megadrought

Year Without a Summer





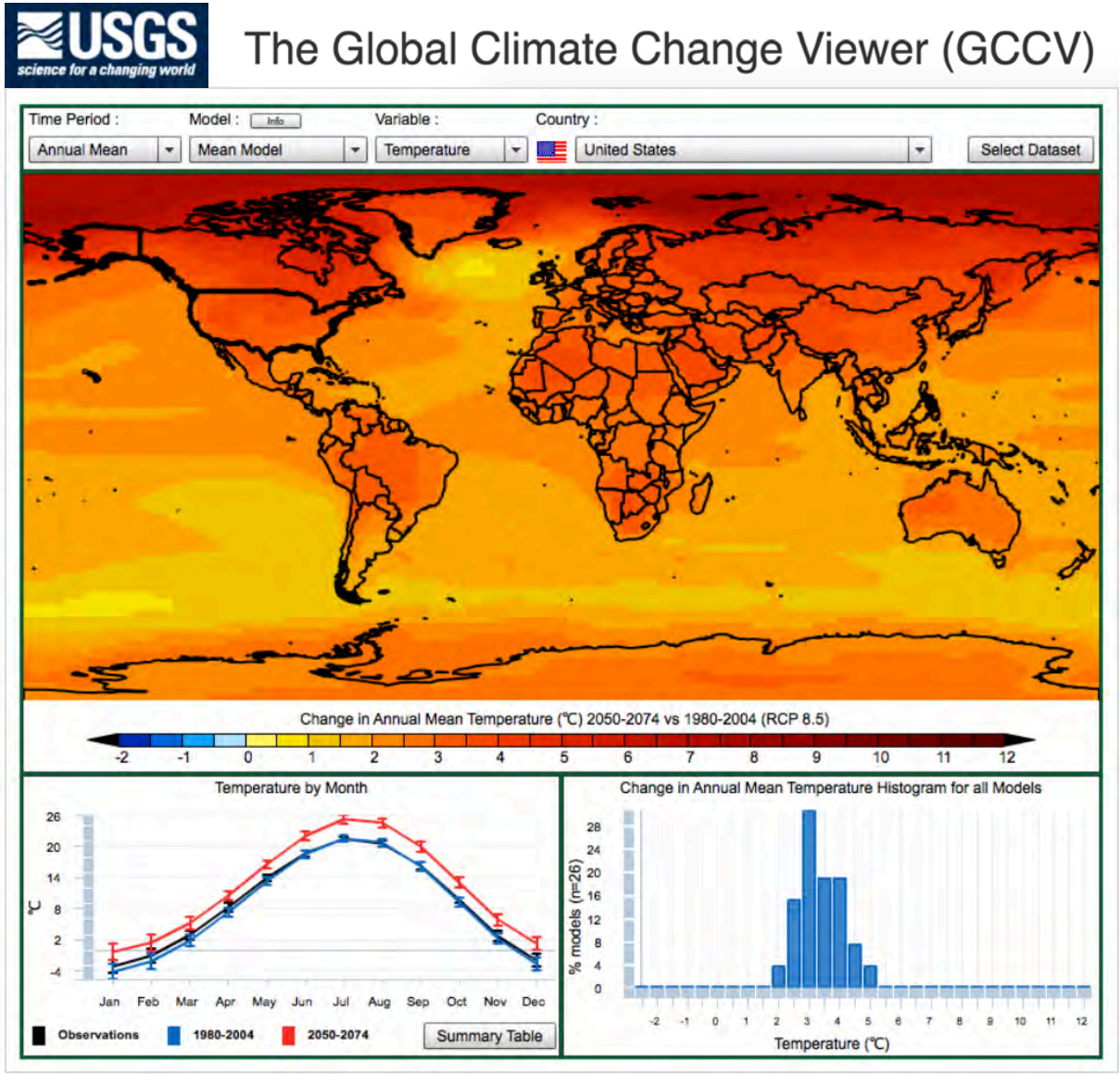


16th C megadrought

Year Without a Summer

Freely available

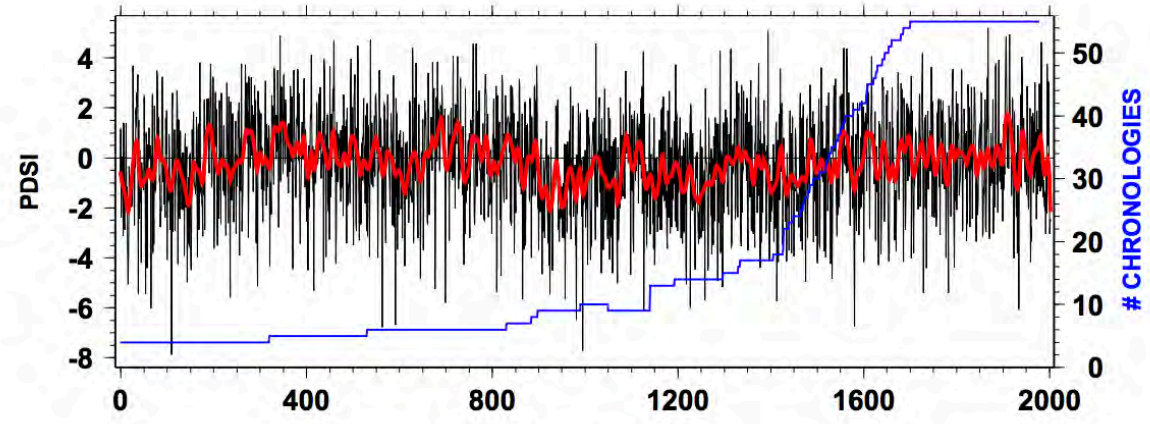
Users' manual
Introduction
Methods
Timseries data viewer
Annual maps viewer
Animations
Data & metadata download



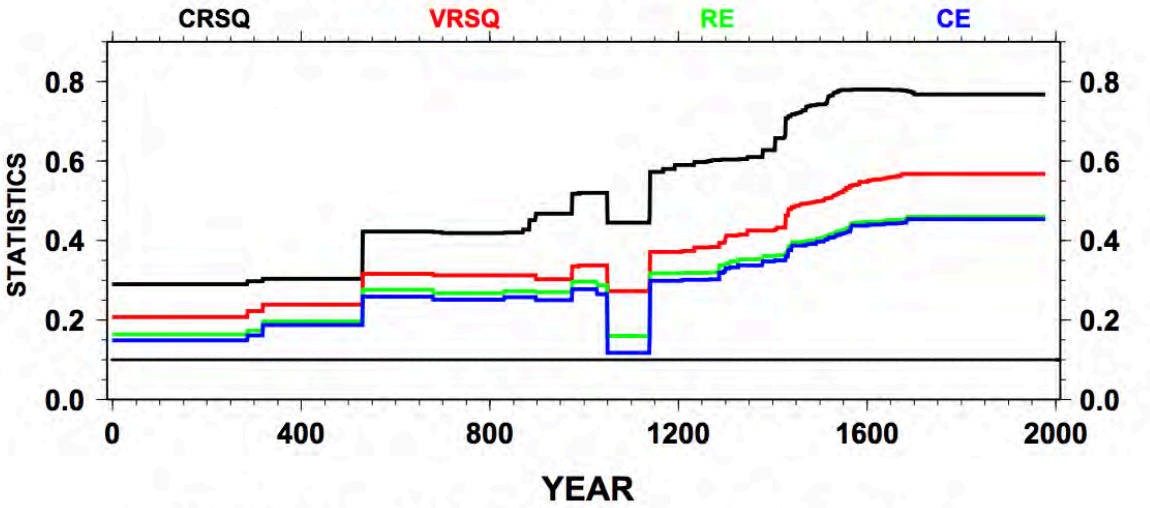
https://www.usgs.gov/software/global-climate-change-viewer-gccv

TREE-RING RECONSTRUCTED DROUGHT

GRID POINT: 058 117.5W 40.0N



CALIBRATION & VERIFICATION STATISTICS



CRSQ,VRSQ < 0.1 = p < 0.05

RE,CE < 0.0 = no skill

Where does it do what well?

Summary:

Snowpack reconstruction a frontier in dendrochronology

WCSA = new high-resolution space/time snowpack data product

Freely available through USGS

Hydroclimate insights coming soon…

Thank you!

Kevin J. Anchukaitis
Dan J. Smith
Gregory T. Pederson
Stephen T. Gray
Steven Jackson
Jay Alder
Stephen Hostetler
Ed Cook
Connie Woodhouse
David M. Meko

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NSF P2C2 PROGRAM

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