Regional Climate Trends and Weather Prediction

Tom Corringham

Scripps Institution of Oceanography

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cnap California Nevada ADAPTATION PROGRAM

Climate Adaptation Partnerships
Formerly RISA

Mission

To improve resilience in California and Nevada by providing decision makers usable information through integrating cutting edge physical and social science.

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www.dri.edu/cnap

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DRI

Center for Western Weather and Water Extremes

SCRIPPS INSTITUTION OF OCEANOGRAPHY
AT UC SAN DIEGO

Lake Sonoma, 25 March 2021

Vision

To increase the resilience of natural and socioeconomic systems to extreme weather events and their effects on water supply and flooding.

Mission

Provide 21st century water cycle science, technology, education, and outreach to support effective policies and practices that address the impacts of extreme weather and water events on the environment, people, and economy of western North America.

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Mission

Our goal is to bring large-scale climate information to human scales to improve understanding and predictability of the types of weather extremes that impact California and the western United States.

- Heat waves
- Santa Ana winds & wildfire
- Atmospheric rivers
- Marine layer
- Health and society

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weclima.ucsd.edu

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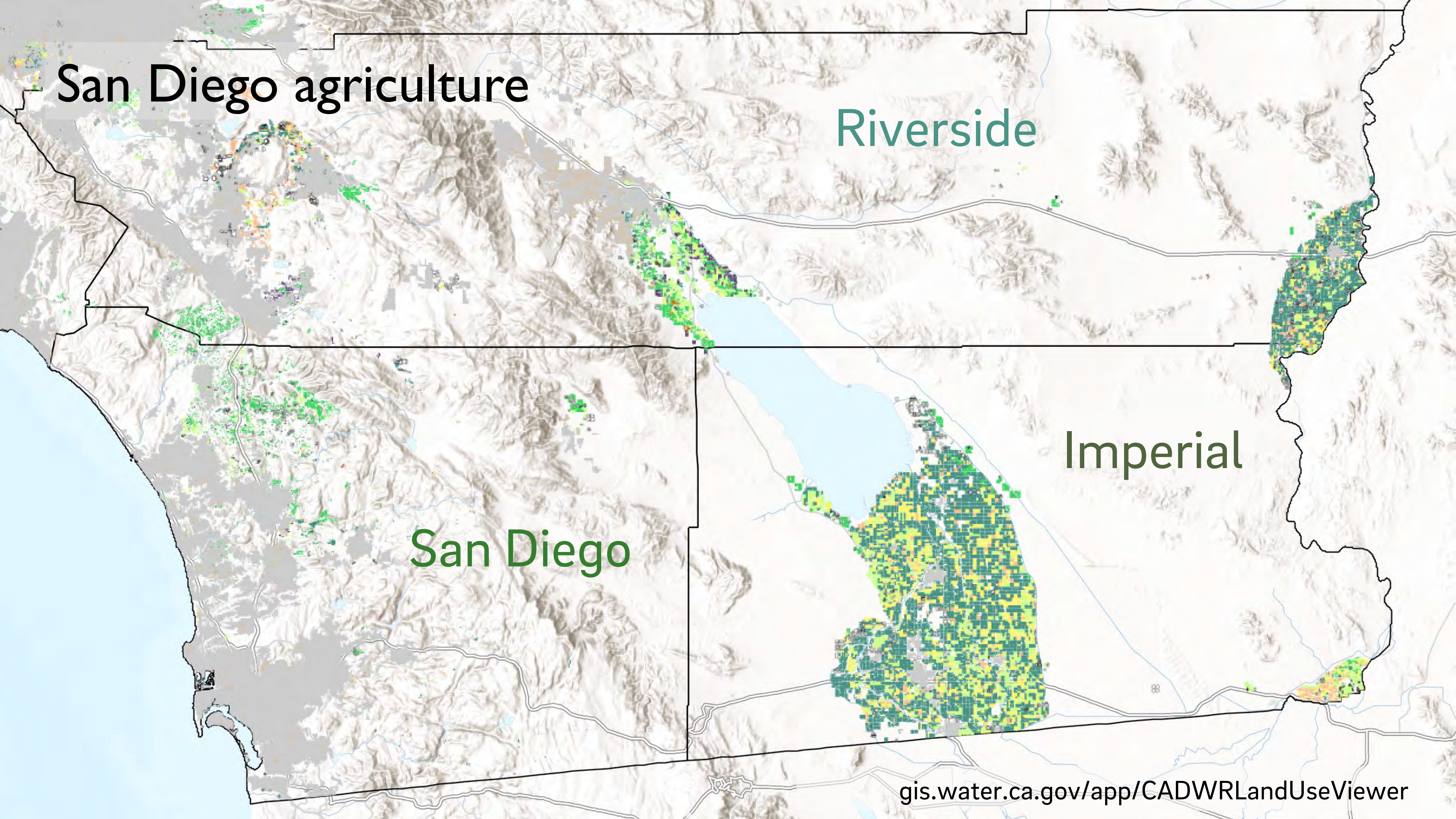
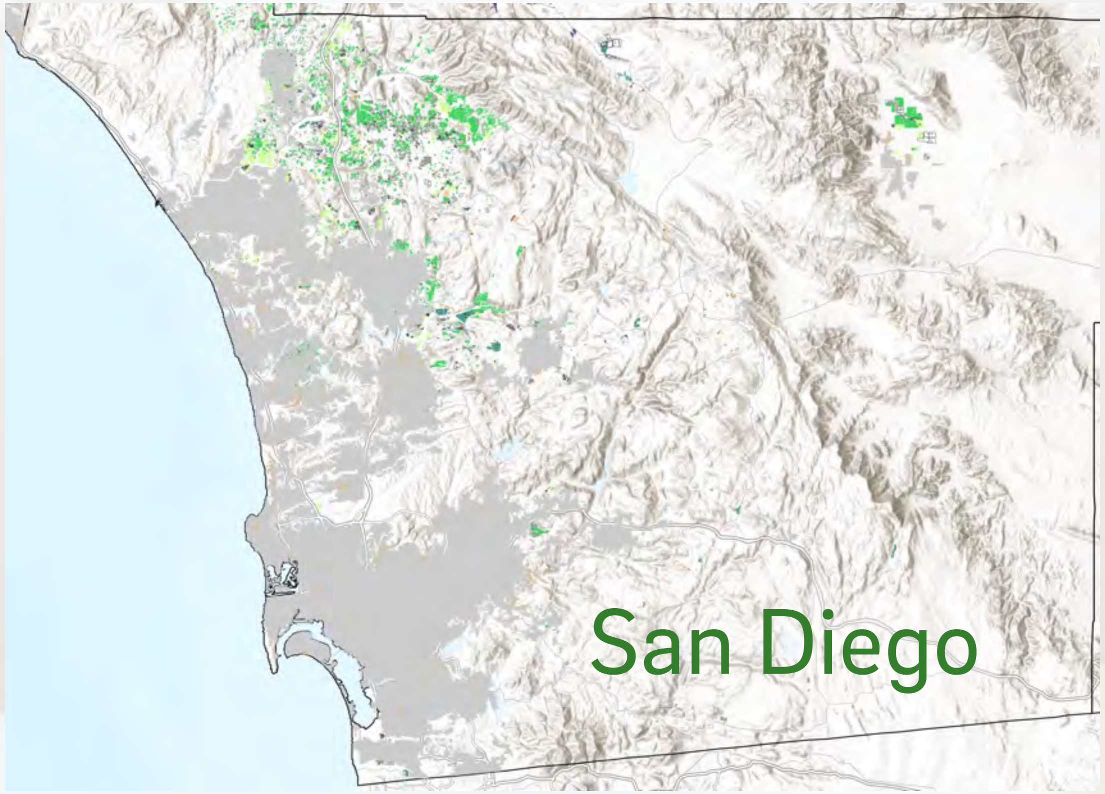
San Diego agriculture



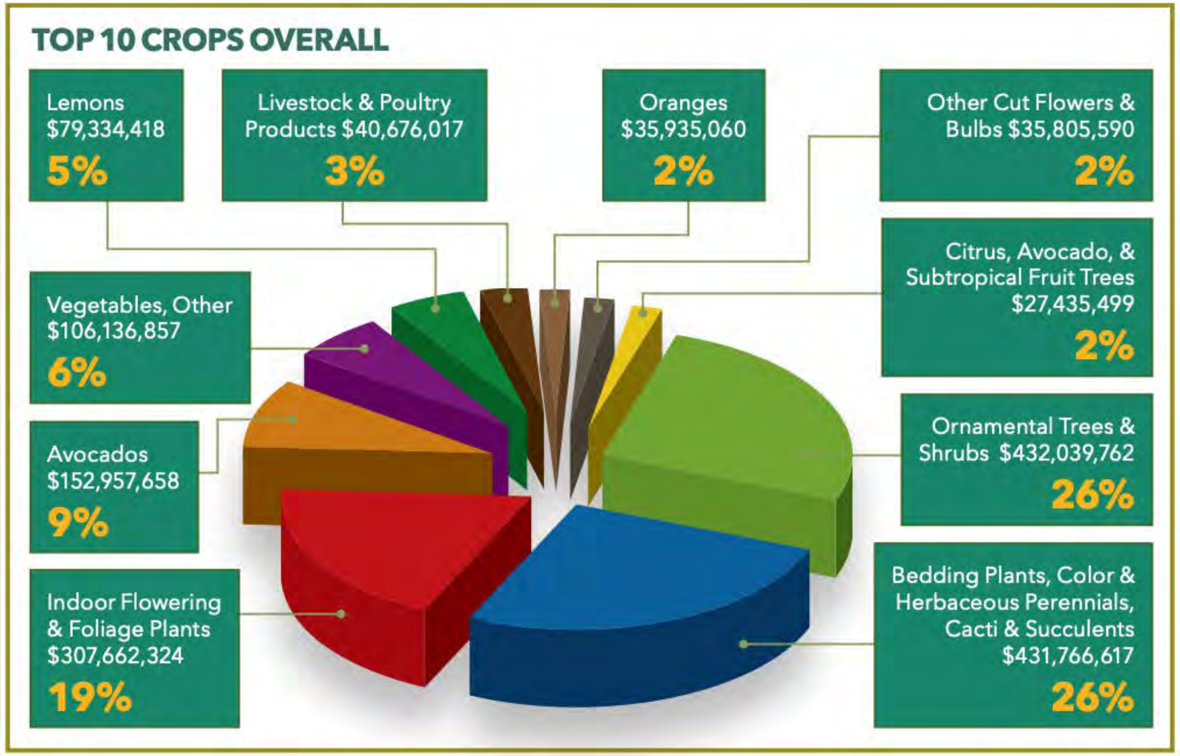
gis.water.ca.gov/app/CADWRLandUseViewer

San Diego agriculture



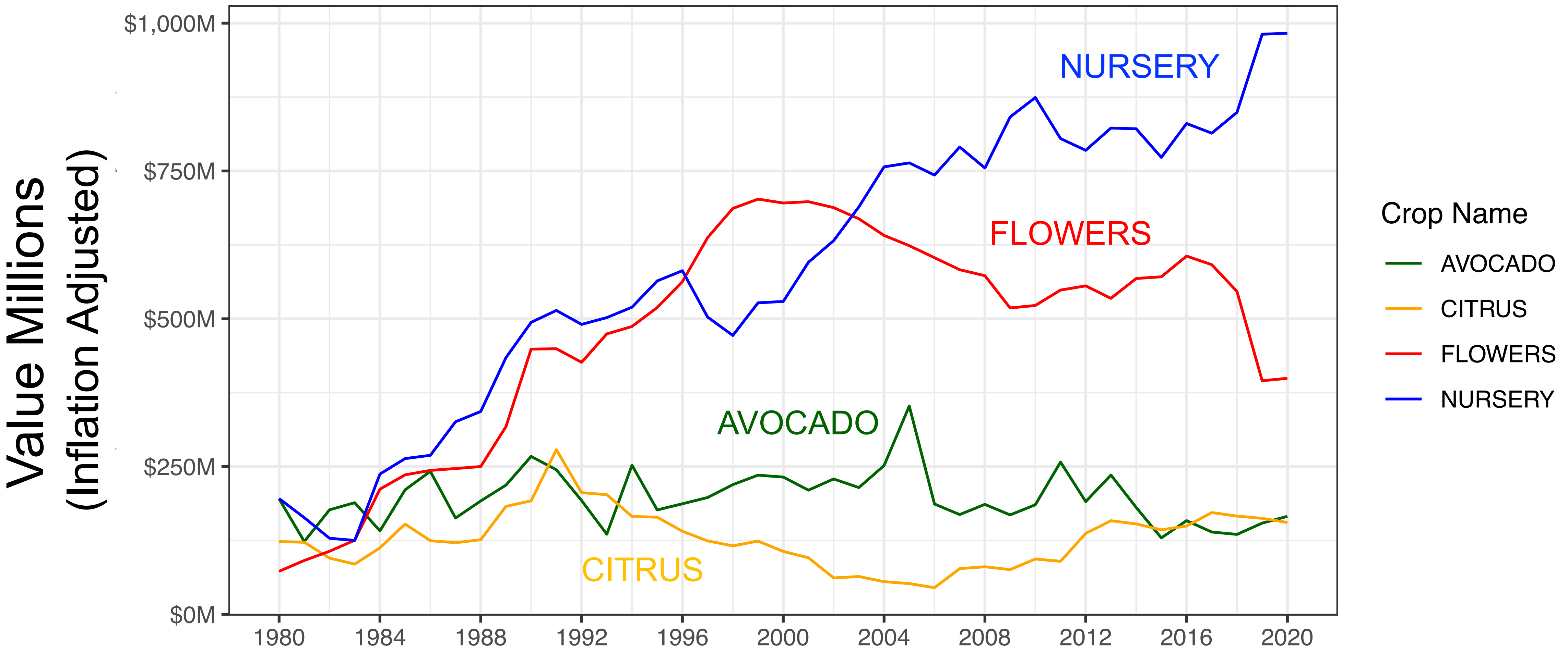
San Diego is the 12th largest farm economy in the nation with an estimated at a total value production of $1.7 billion on 251,000 acres.

San Diego agriculture



Nursery and cut flower products are the largest crops economically at 71% followed by avocados (9%), citrus (7%), and tomatoes (3%).

Annual Crop Value in San Diego County



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San Diego agriculture

San Diego County has more small farms than any other county in the United States, with a median size around four acres. (USDA, 2017)

climateassessment.ca.gov

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San Diego agriculture – climate impacts

Nursery and cut flower products are the largest crops economically at 71% followed by avocados (9%), citrus (7%), and tomatoes (3%).

San Diego agriculture – climate impacts

"There is surprisingly little research on the impacts of climate change on nursery and cut flowers."

tomc @ ucsd.edu

San Diego agriculture – climate impacts

Nursery and cut flower products are the largest crops economically at 71% followed by avocados (9%), citrus (7%), and tomatoes (3%).

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San Diego agriculture – climate impacts

Avocados are sensitive to climate change with an expected 15-45% decrease in crop yields by 2050 [1]. Avocados are most sensitive to

- Maximum daily temperature in August the year prior to harvest,
- May minimum temperatures, and
- October precipitation during the year of harvest [2].

[1] Lobell et al., 2006; [2] Lobell et al., 2007

San Diego agriculture – climate impacts

Oranges are projected to see a decline with increased temperature, though less so than avocados [1].

Extreme flooding may delay the harvesting of citrus [2].

[1] Lobell et al., 2006; [2] Pathak et al., 2018.

San Diego agriculture – climate impacts

Future climate: more frequent and intense drought with warmer temperatures will lower soil moisture and increase the evaporative demand in the region [1].

[1] Jennings et al., 2018

San Diego agriculture – climate impacts

This will increase irrigation demand. During the period of 2005–2015, 25% of orchard trees (1 million trees), were removed from production due, in large part, to the rising costs of water.

[1] Jennings et al., 2018

San Diego agriculture – climate impacts

Drought and higher temperatures also increases the susceptibility of plants to pest infestation [1], though there are not specifc examples of this for crops that are most important in San Diego.

[1] Pathak et al., 2018.

Regional Climate Trends

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Regional Climate Trends
Temperature

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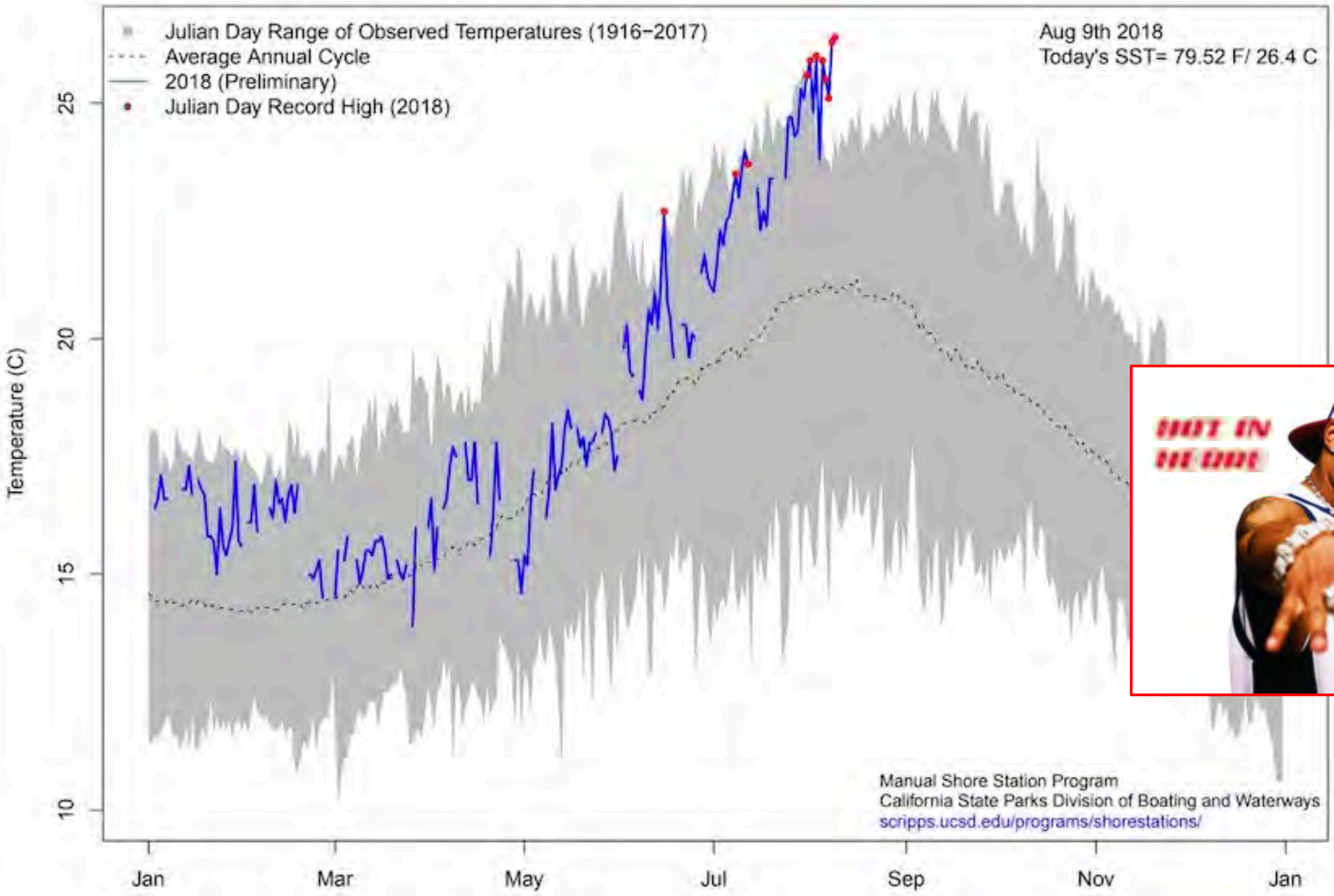
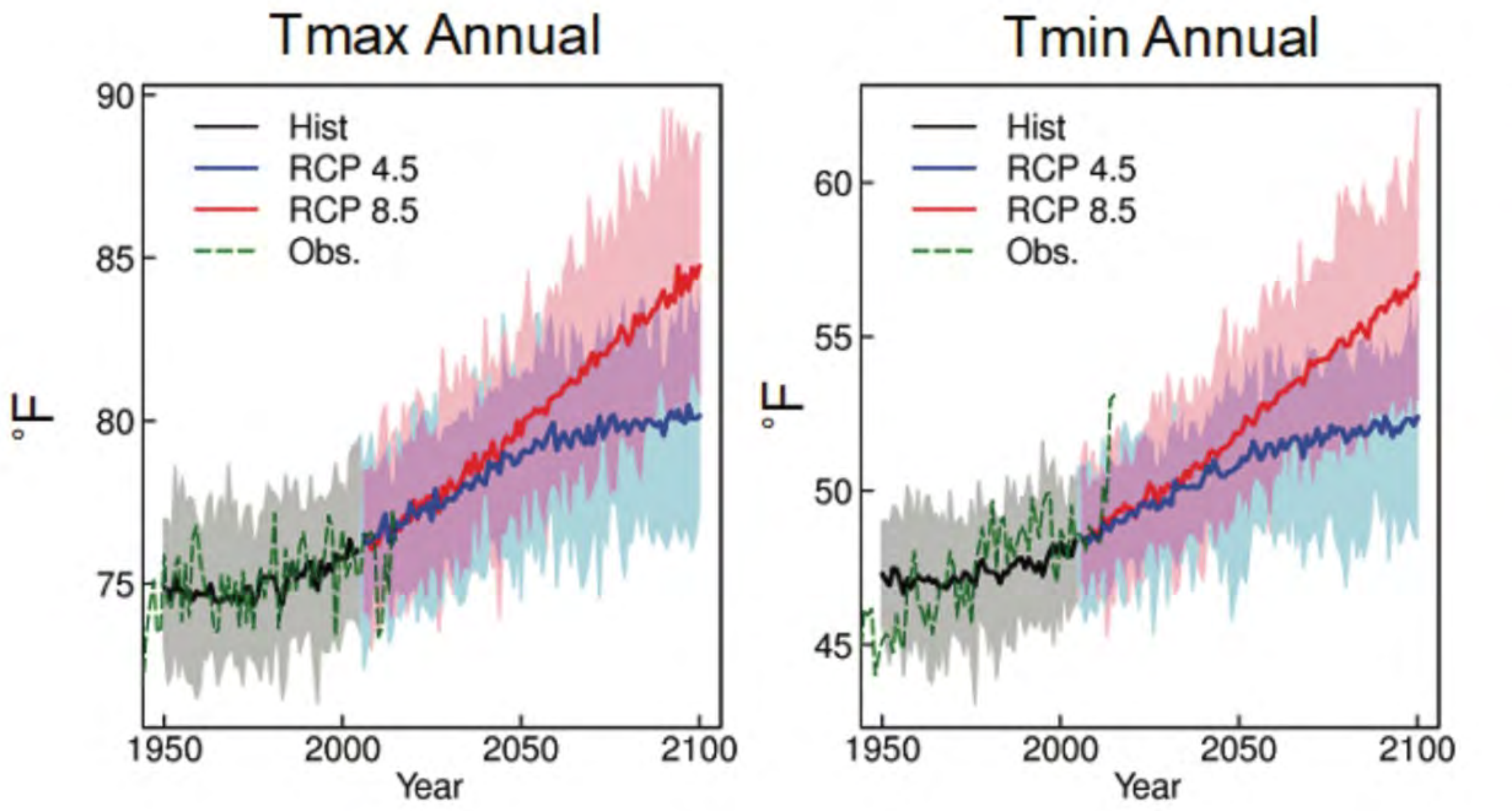
Scripps Pier SST (C) In 2018

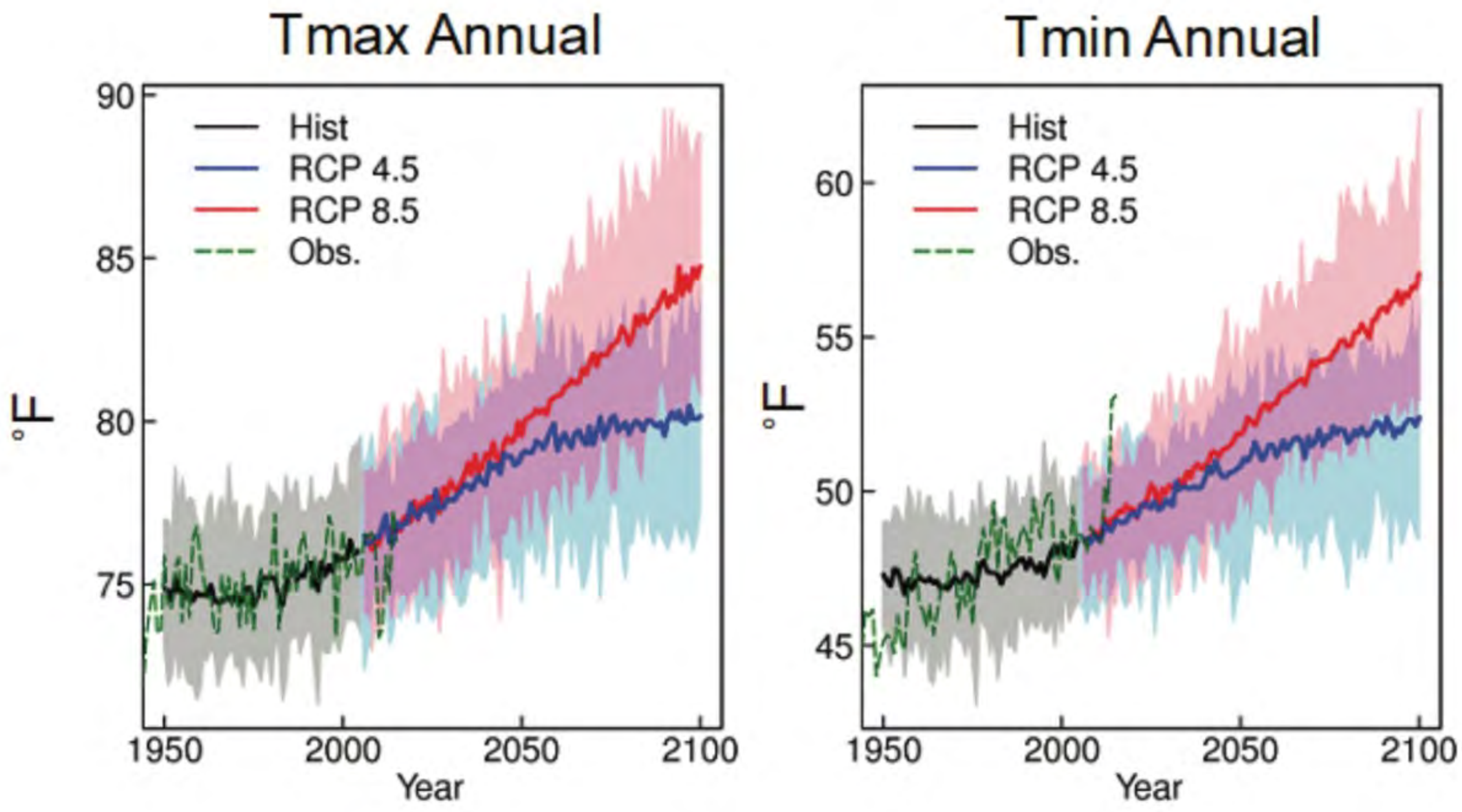


San Diego temperature projections



The annual average increase in maximum (max) and minimum temperature (min) averaged over San Diego County from Localized Constructed Analogs (Pierce et al., 2014; Pierce et al., 2018). The shading shows the range of models under historical (black), RCP 4.5 (blue) and RCP 8.5 (red) and the line shows the ensemble mean. The historical observations in the green dashed line are based on the Livneh et al. (2015) gridded data.

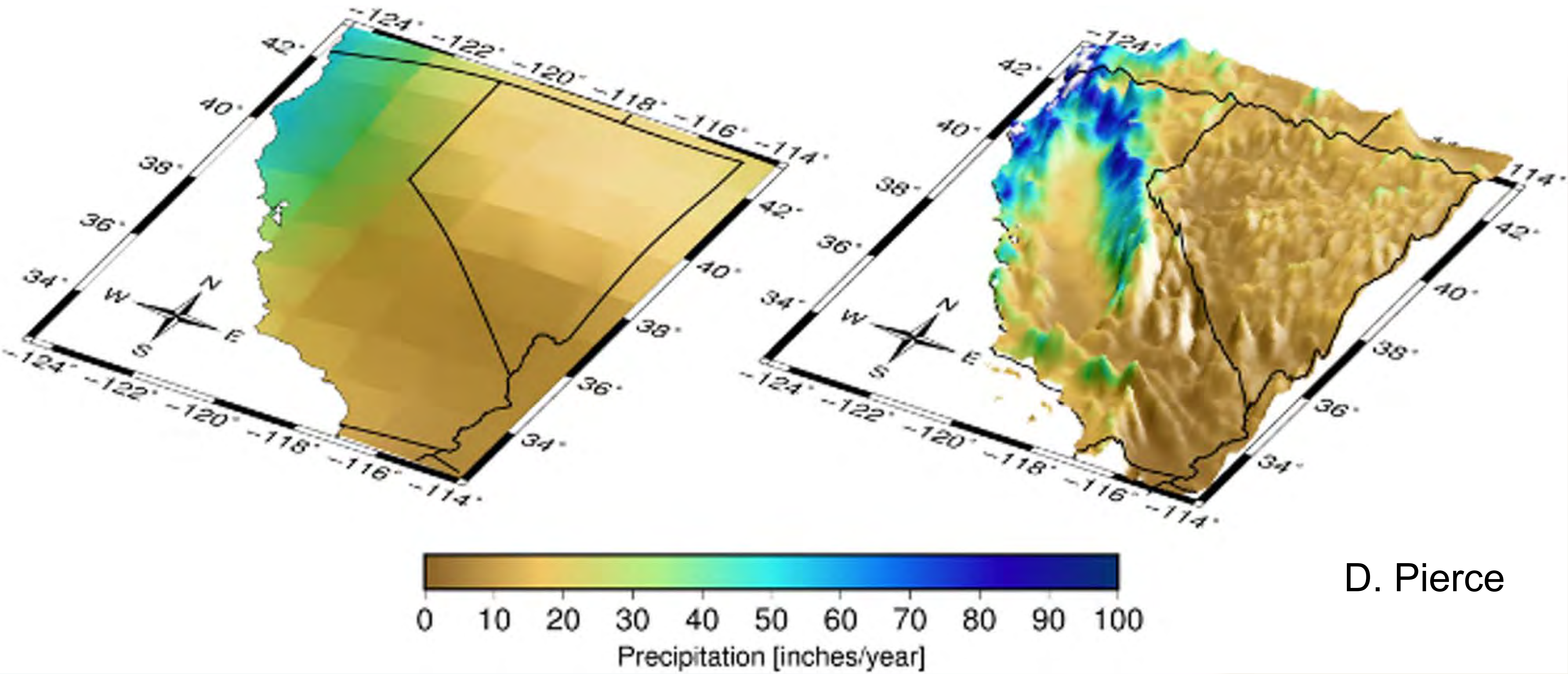
San Diego temperature projections



Representative Concentration Pathways (RCP)

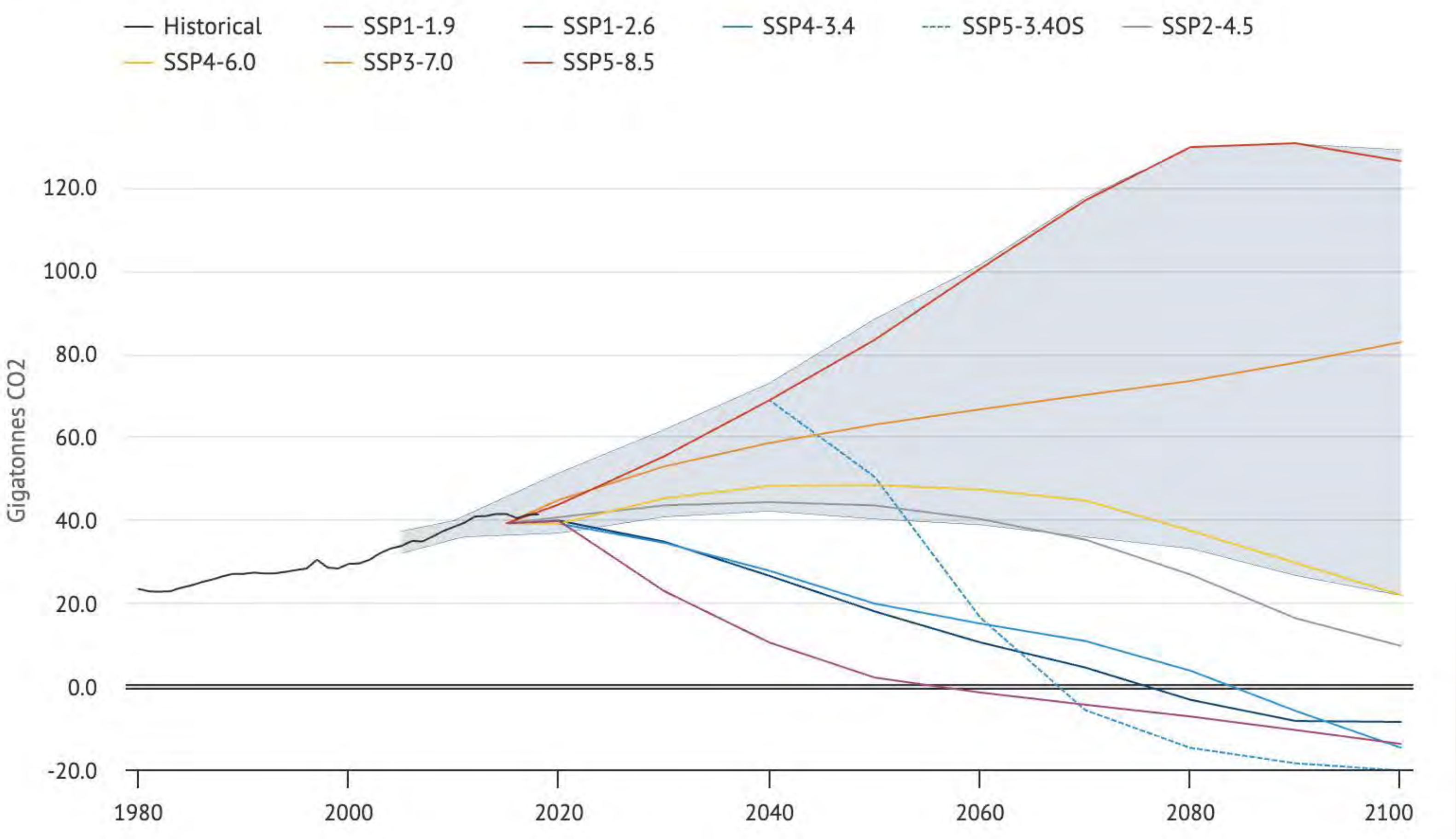
- RCP8.5: high emissions scenario
- RCP4.5: moderate emissions scenario

Downscaling global climate models



D. Pierce

CO_2 emissions in CMIP6 scenarios



https://www.carbonbrief.org/cmip6-the-next-generation-of-climate-models-explained/

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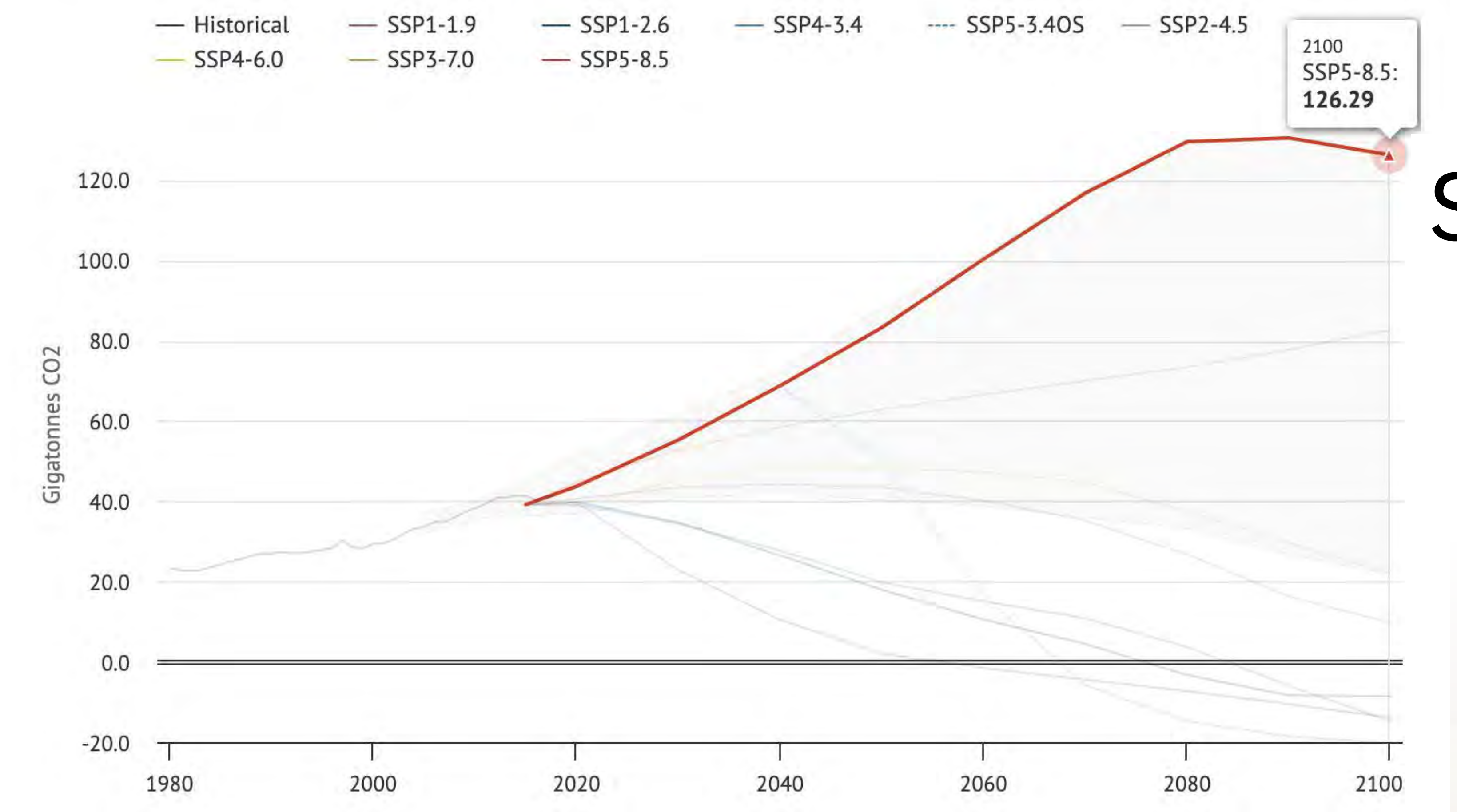
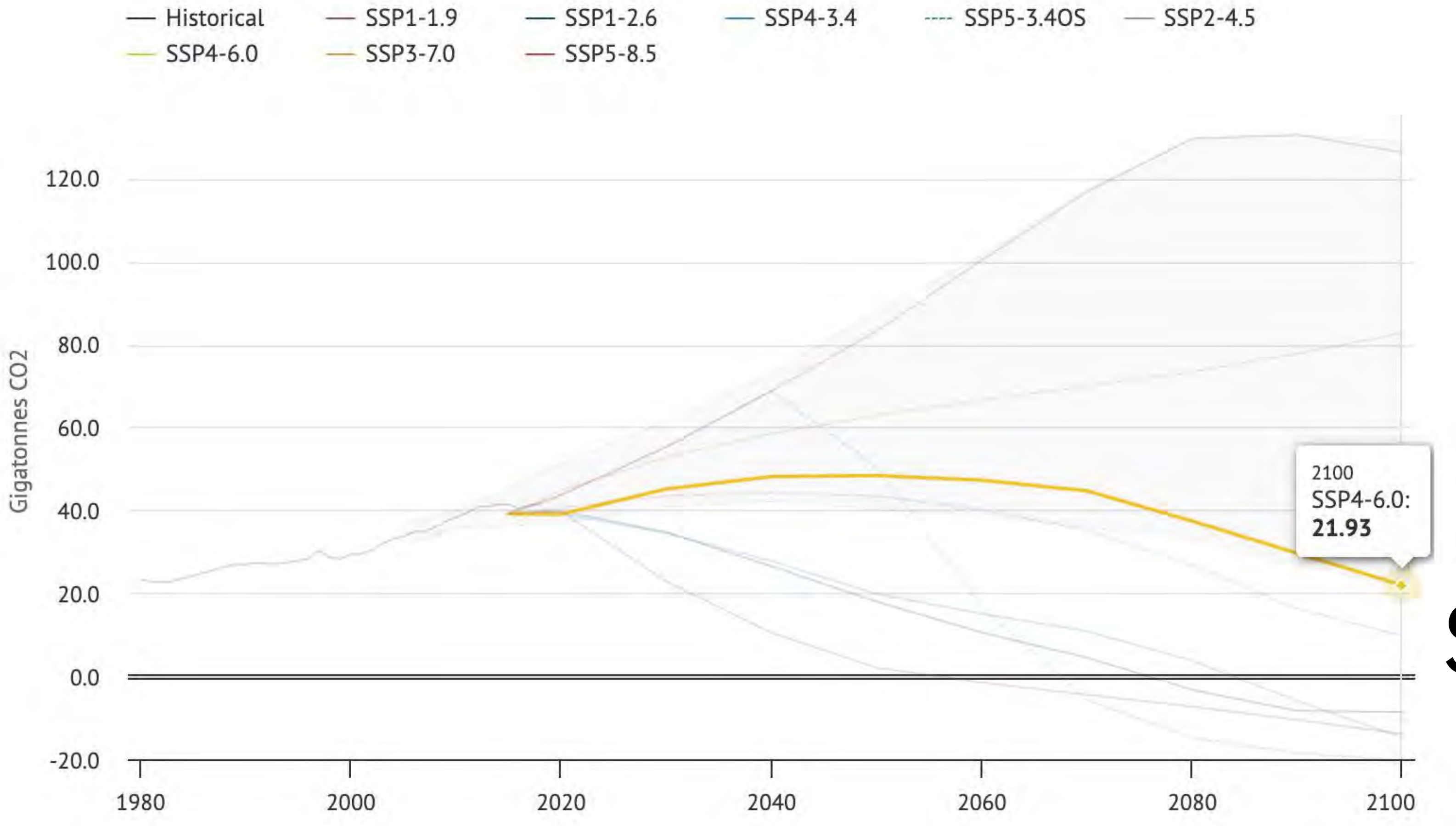


SSP5-8.5

https://www.carbonbrief.org/cmip6-the-next-generation-of-climate-models-explained/

CO_2 emissions in CMIP6 scenarios



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https://www.carbonbrief.org/cmip6-the-next-generation-of-climate-models-explained/

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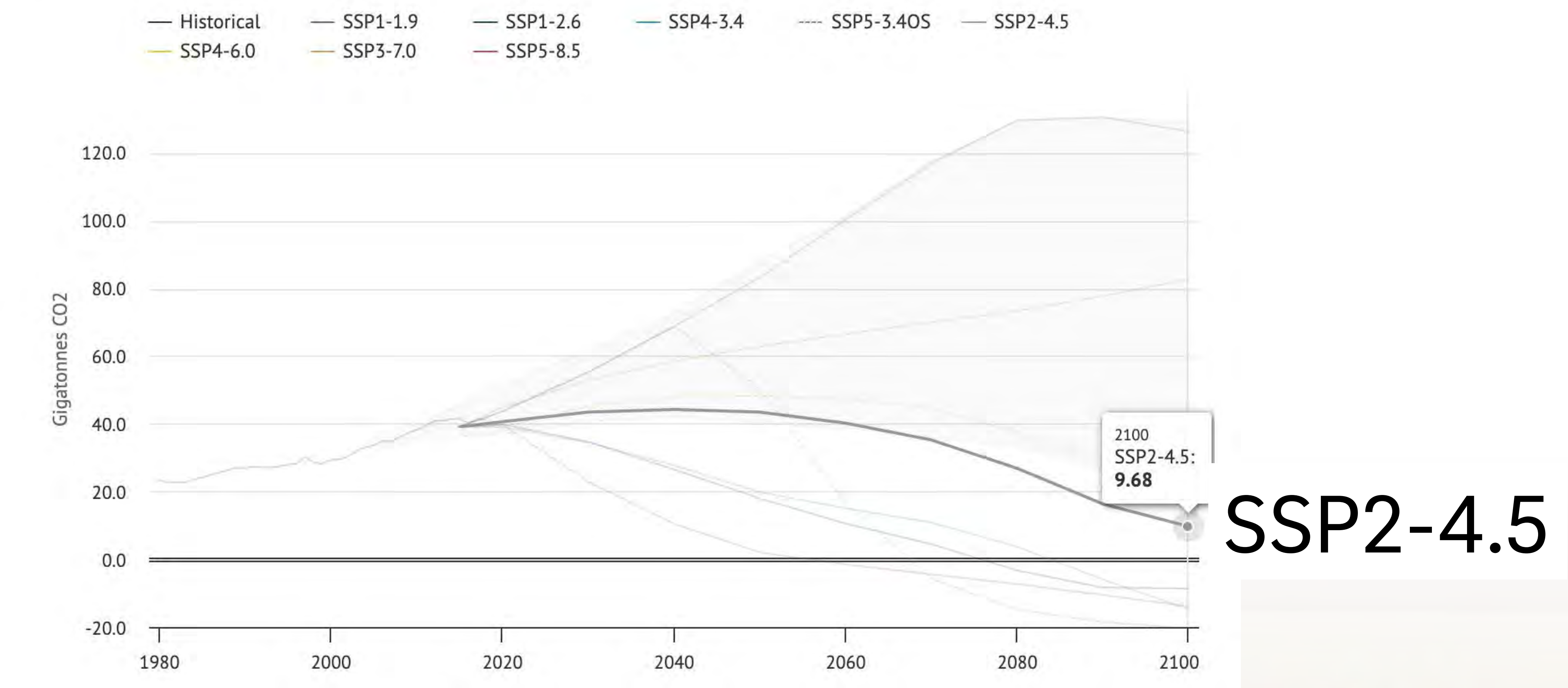

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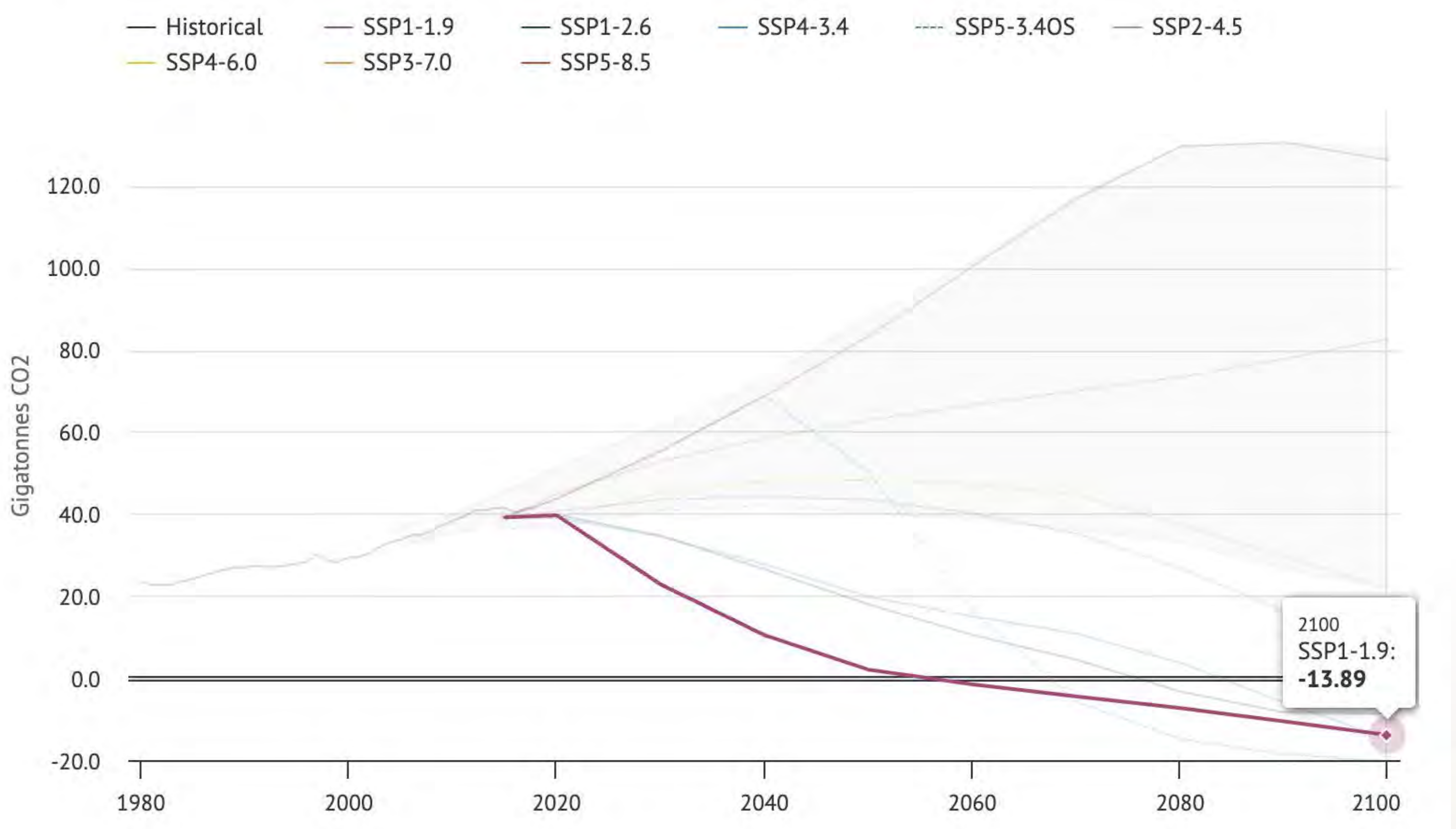
CO_2 emissions in CMIP6 scenarios



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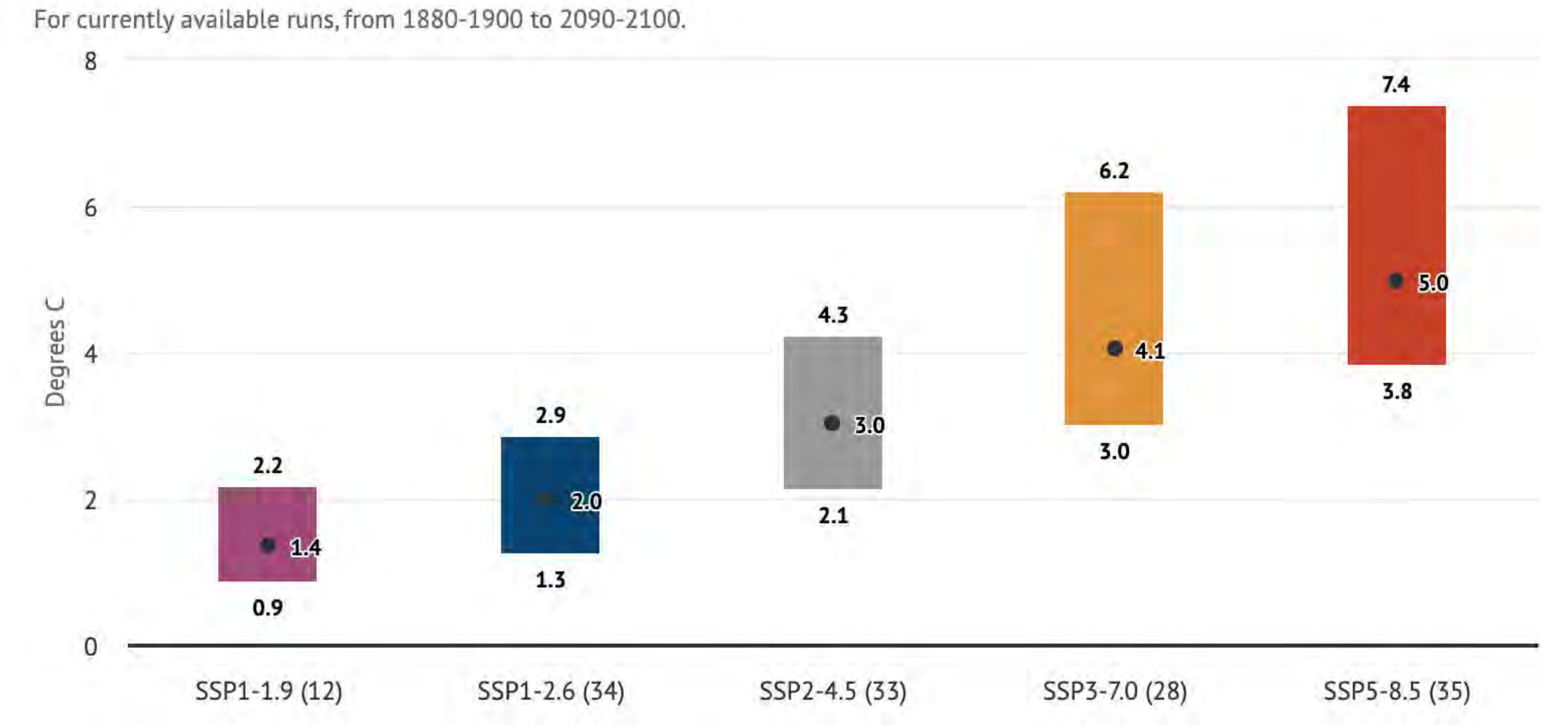
Warming in CMIP6 scenarios



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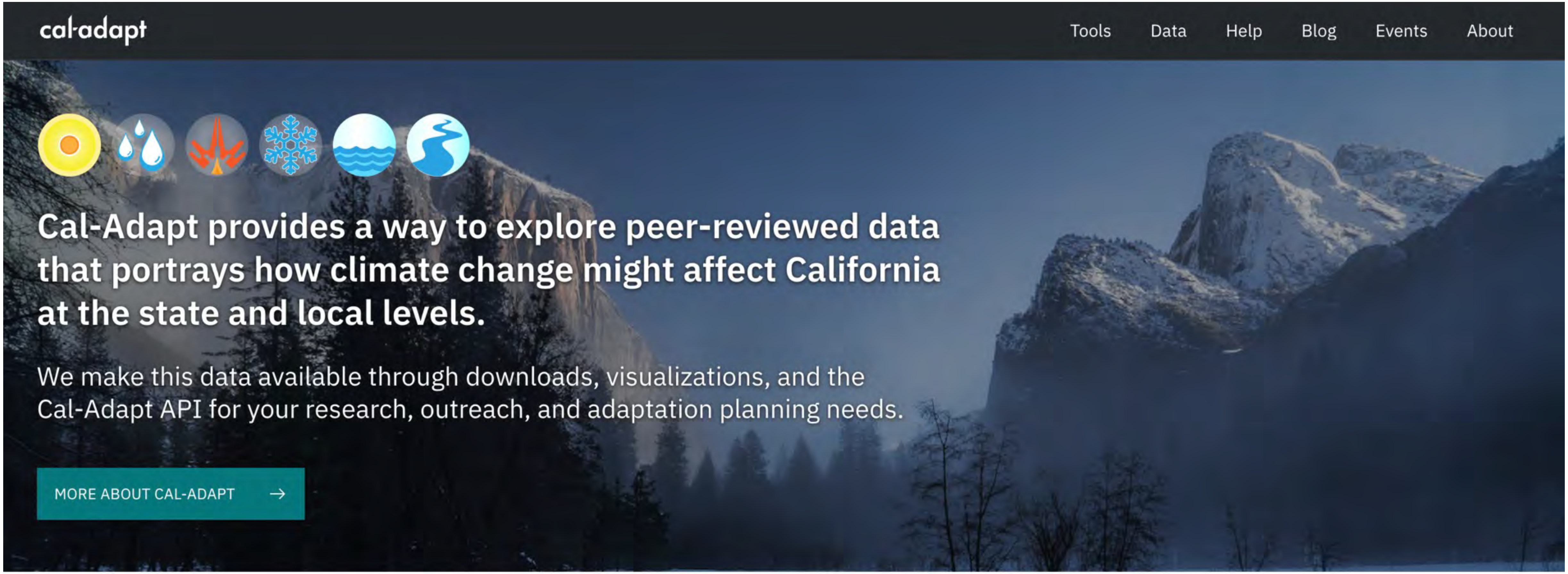

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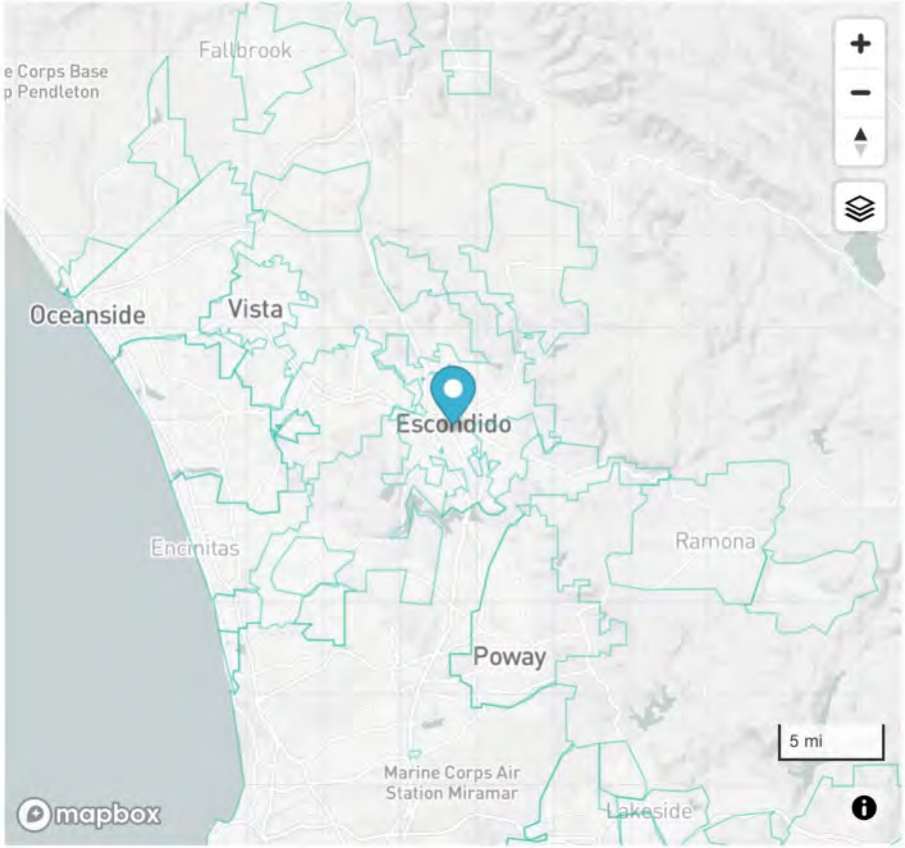
Local Climate Change Snapshot

Start by selecting a location. Search for address/zipcode or click on the map. To select an area, click on the County, City, Census Tract or Watershed options. Search by name/census tract number or click on the map.

Escondido, California, United States ×

- ○ Address
- ○ County
- ● City
- ○ Census Tract
- ○ Watershed (HUC10)

GENERATE SNAPSHOT



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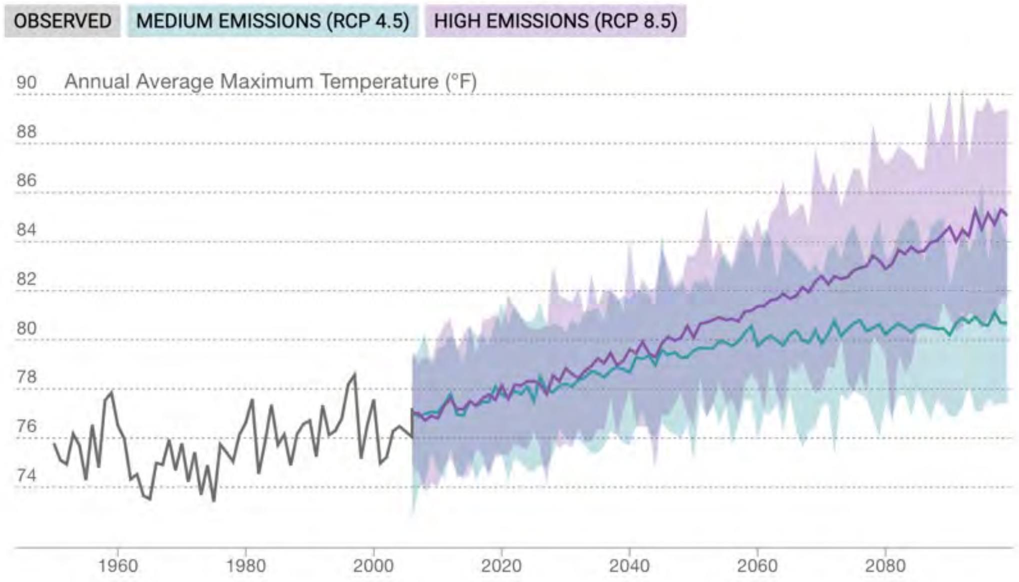
Annual Average Maximum Temperature

Average of all the hottest daily temperatures in a year.



Observed (1961-1990) 30yr Average: 75.3 °F

		30yr Average	30yr Range
Baseline (1961-1990)			
MODELED HISTORICAL	-	75.6 °F	75.3 - 76.0 °F
Mid-Century (2035-2064)			
MEDIUM EMISSIONS (RCP 4.5)	+3.9 °F	79.5 °F	77.5 - 81.8 °F
HIGH EMISSIONS (RCP 8.5)	+4.7 °F	80.3 °F	77.9 - 82.4 °F
End-Century (2070-2099)			
MEDIUM EMISSIONS (RCP 4.5)	+4.9 °F	80.5 °F	78.5 - 83.4 °F
HIGH EMISSIONS (RCP 8.5)	+8.1 °F	83.7 °F	80.8 - 87.1 °F

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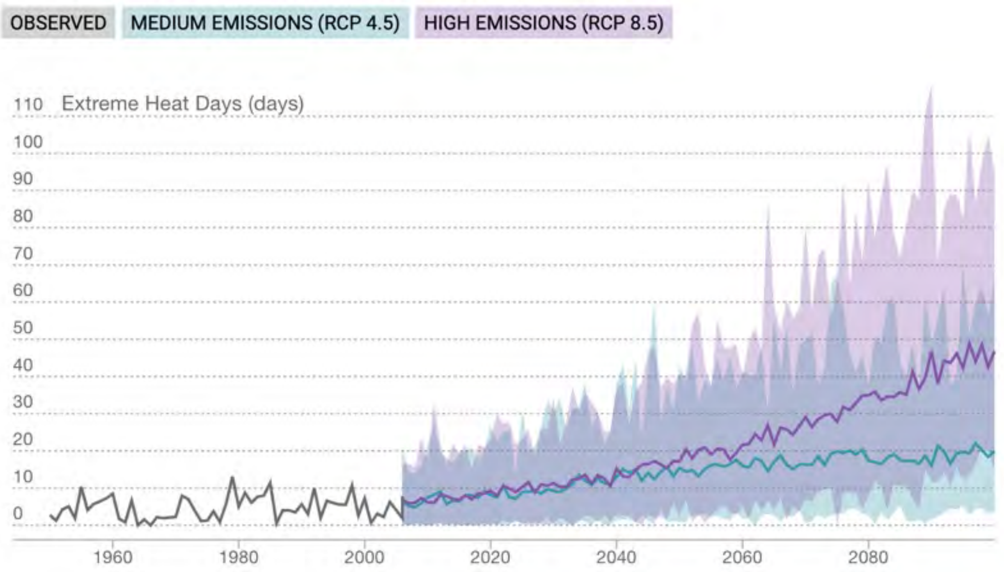
Extreme Heat Days

Number of days in a year when daily maximum temperature is above 97.6 °F



Observed (1961-1990) 30yr Average: 4 days

		30yr Average	30yr Range
Baseline (1961-1990)			
MODELED HISTORICAL	-	4 days	2 - 5 days
Mid-Century (2035-2064)			
MEDIUM EMISSIONS (RCP 4.5)	+10 days	14 days	8 - 32 days
HIGH EMISSIONS (RCP 8.5)	+14 days	18 days	10 - 38 days
End-Century (2070-2099)			
MEDIUM EMISSIONS (RCP 4.5)	+14 days	18 days	12 - 50 days
HIGH EMISSIONS (RCP 8.5)	+33 days	37 days	20 - 81 days

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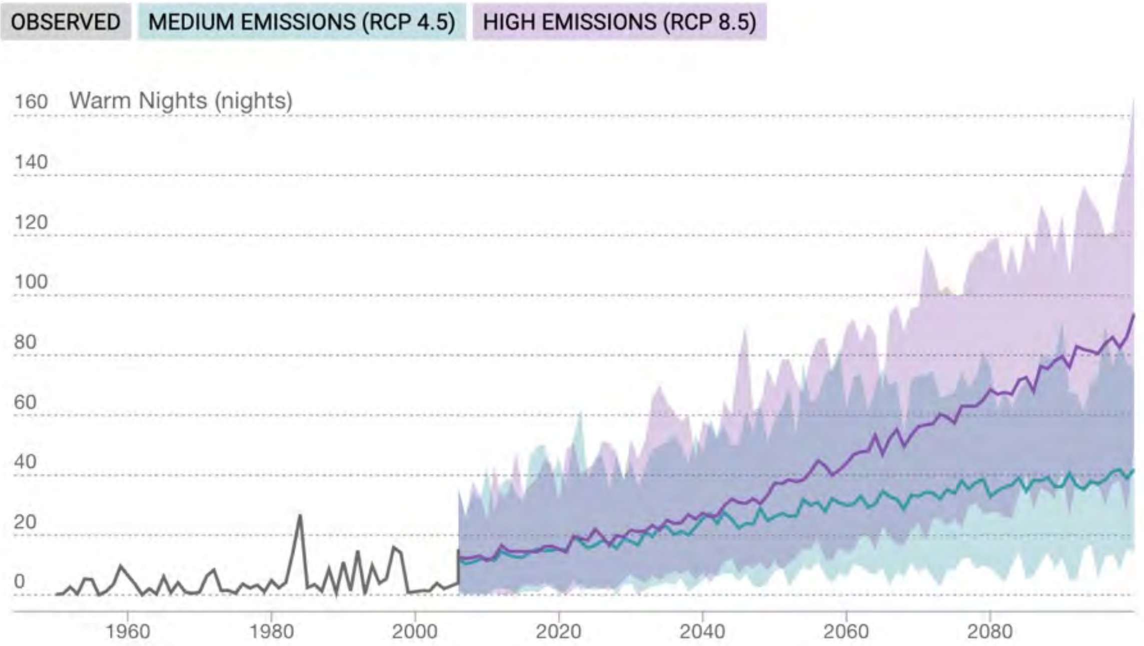
Warm Nights

Days with minimum temperature above 64.5 F



Observed (1961-1990) 30yr Average: 4 nights

		30yr Average	30yr Range
Baseline (1961-1990)			
MODELED HISTORICAL	-	7 nights	2 - 16 nights
Mid-Century (2035-2064)			
MEDIUM EMISSIONS (RCP 4.5)	+20 nights	27 nights	14 - 46 nights
HIGH EMISSIONS (RCP 8.5)	+28 nights	35 nights	20 - 58 nights
End-Century (2070-2099)			
MEDIUM EMISSIONS (RCP 4.5)	+30 nights	37 nights	20 - 59 nights
HIGH EMISSIONS (RCP 8.5)	+64 nights	71 nights	43 - 99 nights

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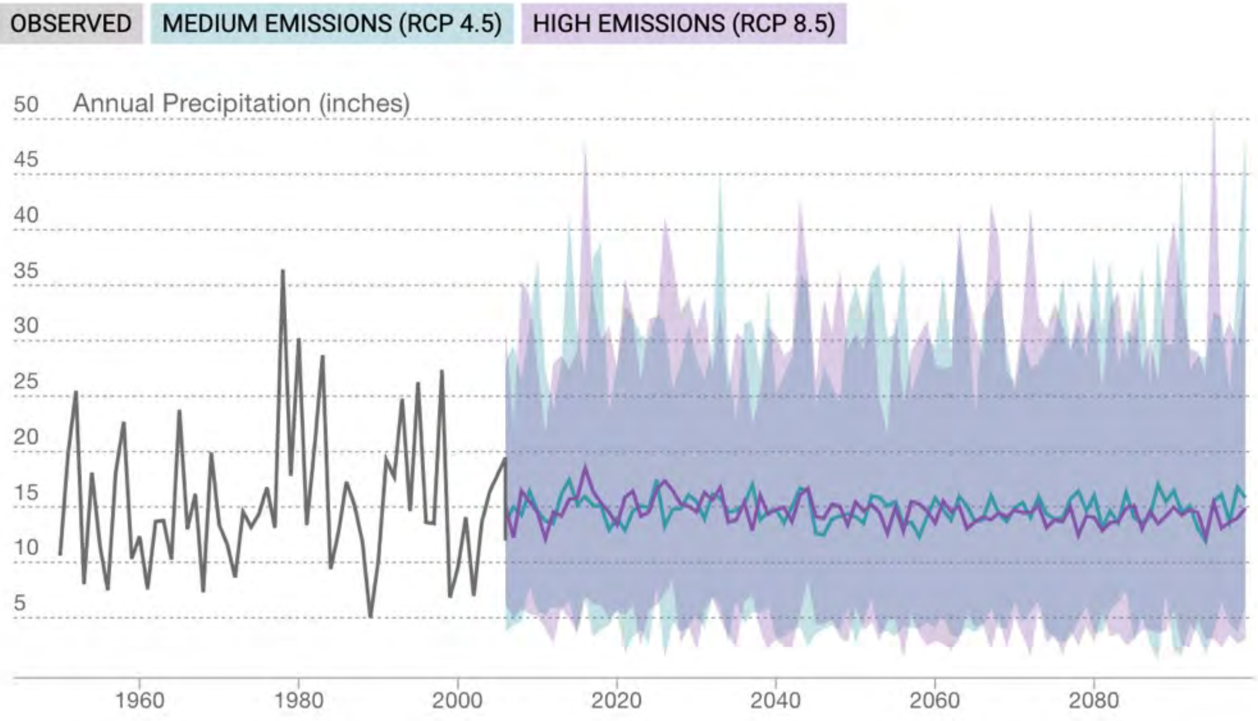
Annual Precipitation

Total precipitation projected for a year



Observed (1961-1990) 30yr Average: 15.3 inches

		30yr Average	30yr Range
Baseline (1961-1990)			
MODELED HISTORICAL	-	15.4 inches	13.4 - 16.8 inches
Mid-Century (2035-2064)			
MEDIUM EMISSIONS (RCP 4.5)	-0.8 inches	14.6 inches	11.4 - 18.7 inches
HIGH EMISSIONS (RCP 8.5)	-0.8 inches	14.6 inches	10.5 - 19.8 inches
End-Century (2070-2099)			
MEDIUM EMISSIONS (RCP 4.5)	-0.5 inches	14.9 inches	10.7 - 17.8 inches
HIGH EMISSIONS (RCP 8.5)	-1.3 inches	14.1 inches	9.3 - 19.3 inches

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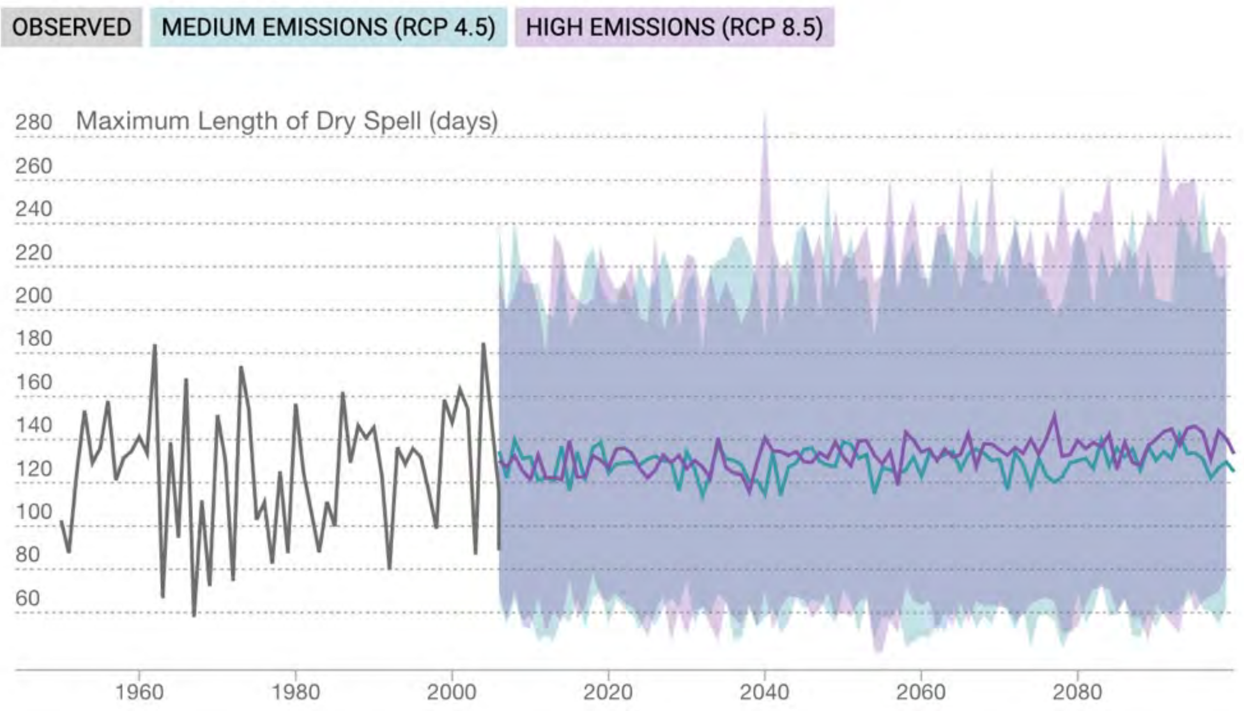
Maximum Length of Dry Spell



Observed (1961-1990) 30yr Average: 121 days

		30yr Average	30yr Range
Baseline (1961-1990)			
MODELED HISTORICAL	-	122 days	106 - 140 days
Mid-Century (2035-2064)			
MEDIUM EMISSIONS (RCP 4.5)	+7 days	129 days	103 - 160 days
HIGH EMISSIONS (RCP 8.5)	+10 days	132 days	109 - 161 days
End-Century (2070-2099)			
MEDIUM EMISSIONS (RCP 4.5)	+8 days	130 days	100 - 158 days
HIGH EMISSIONS (RCP 8.5)	+16 days	138 days	100 - 185 days

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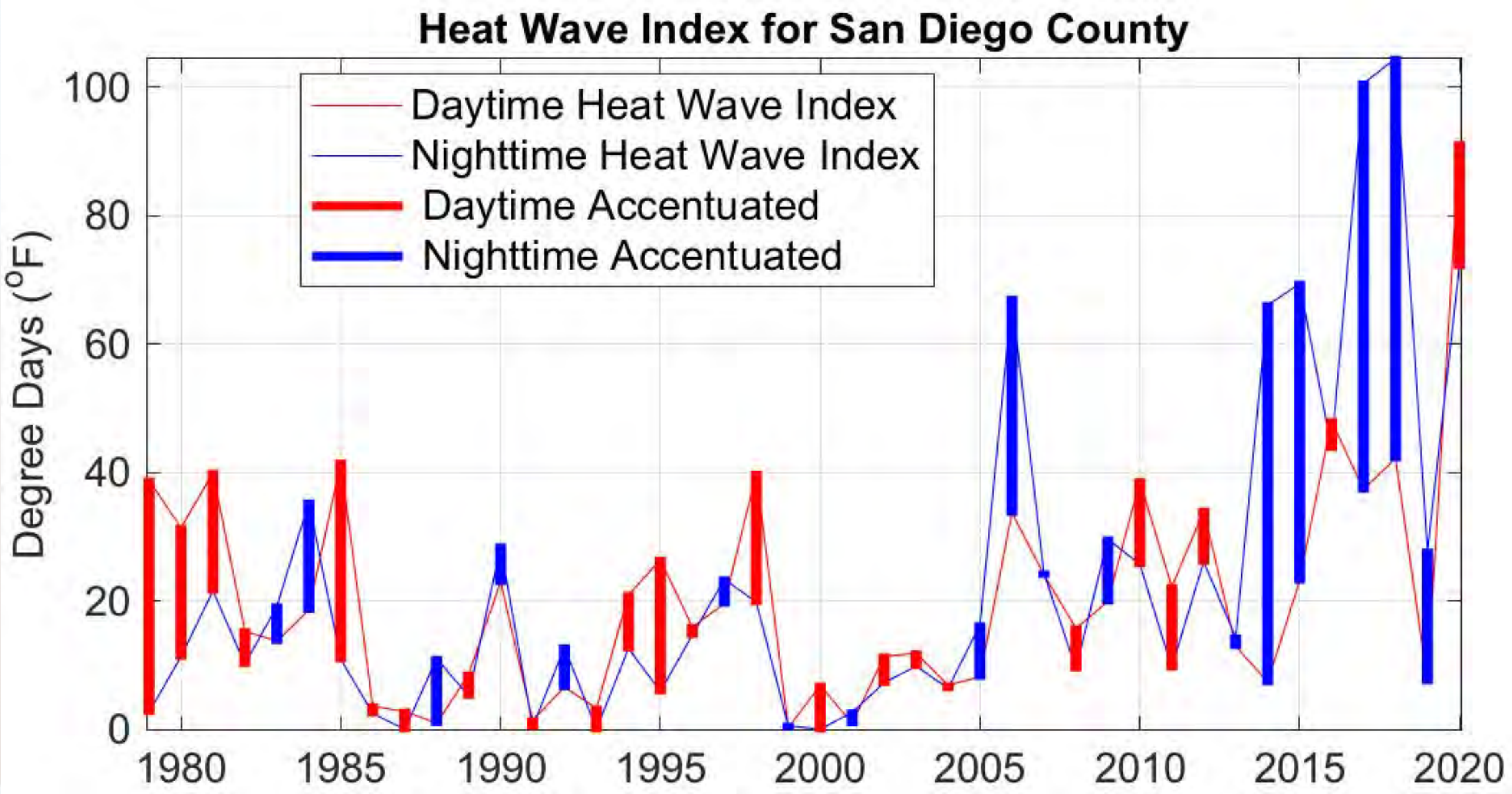

Gershunov et al., 2023

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Regional Climate Trends
Precipitation

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Whiskey is for drinking

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Whiskey is for drinking
Water is for fighting!

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Whiskey is for drinking
Water is for fighting!

– Mark Twain

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Water

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If climate change is a bear
Water is its teeth…..

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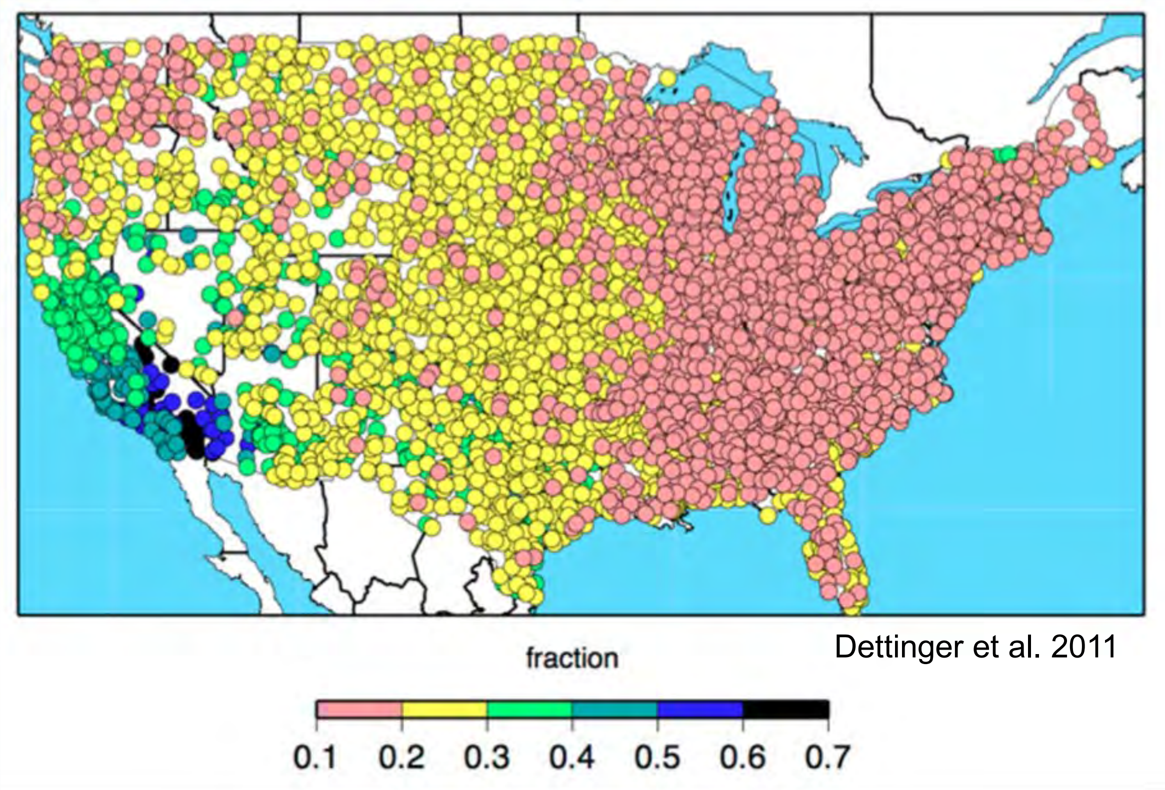
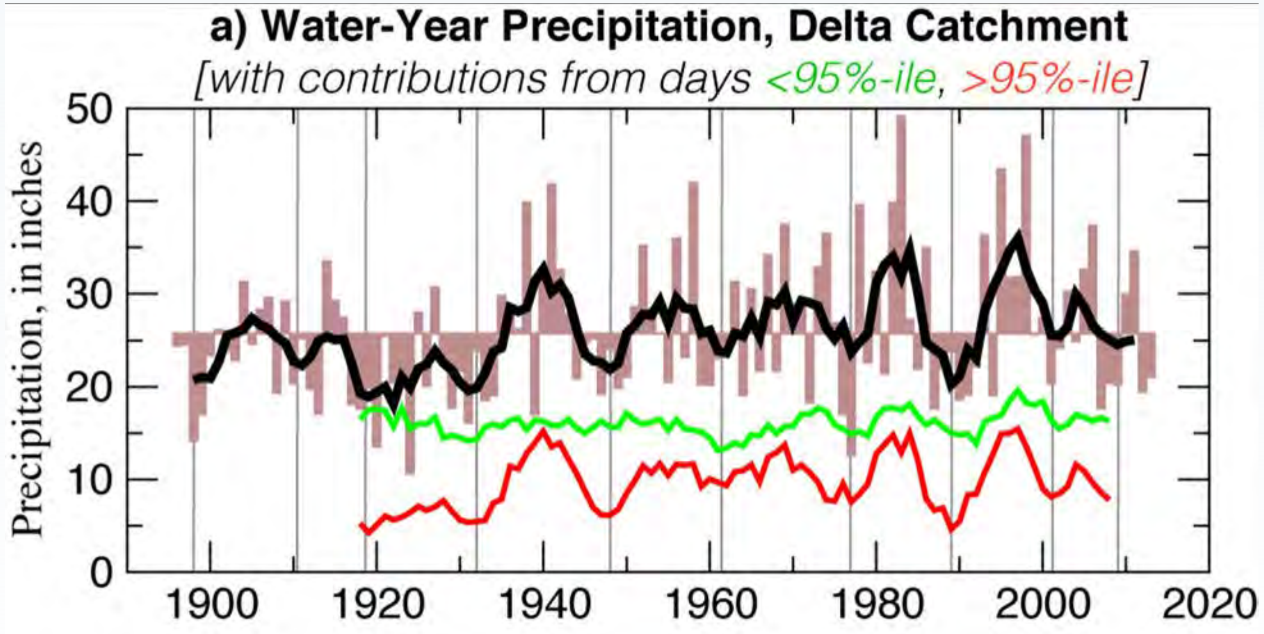
Variability of precipitation in California

Coefficient of variation for annual precipitation, 1950-2008

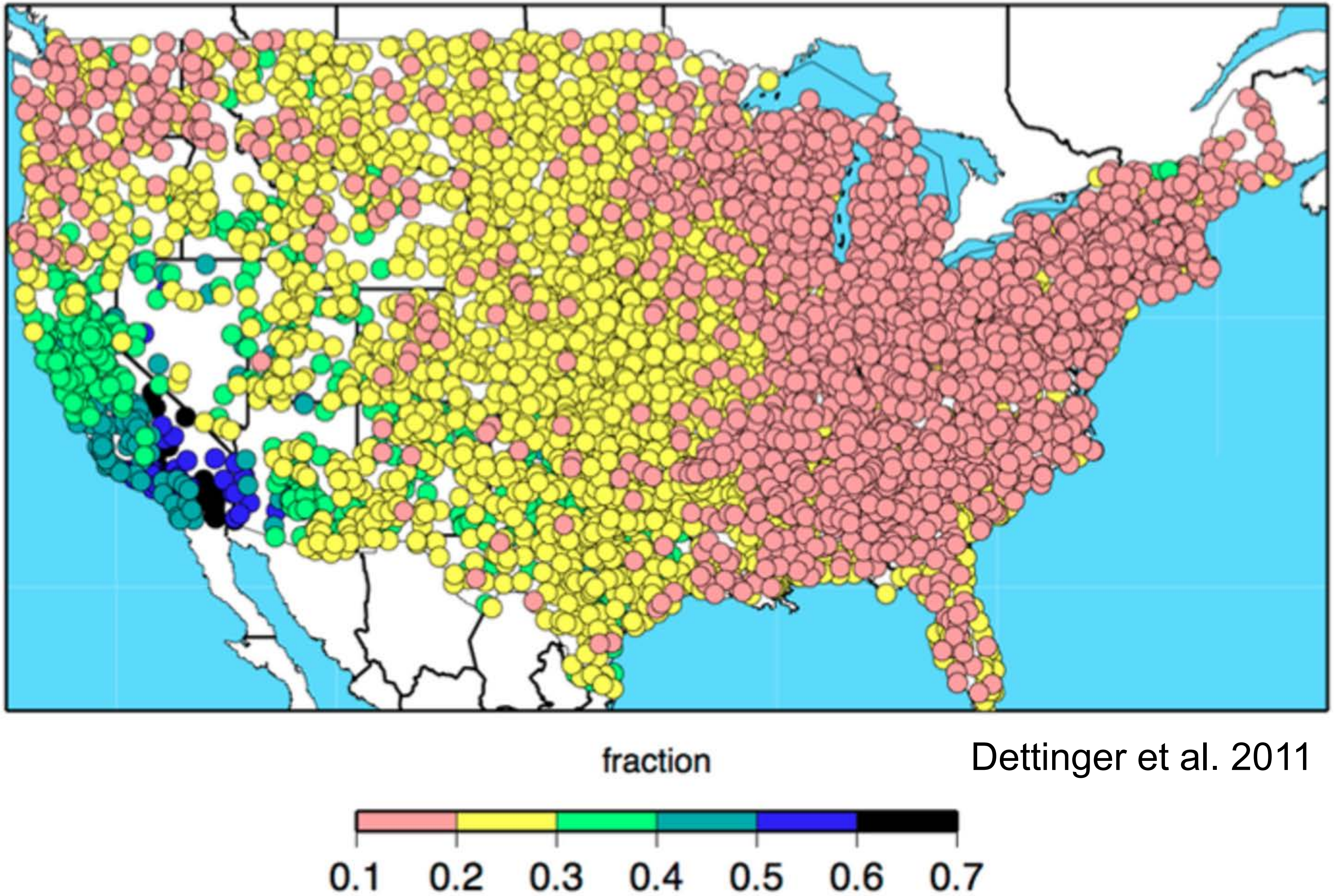


Dettinger et al. 2011



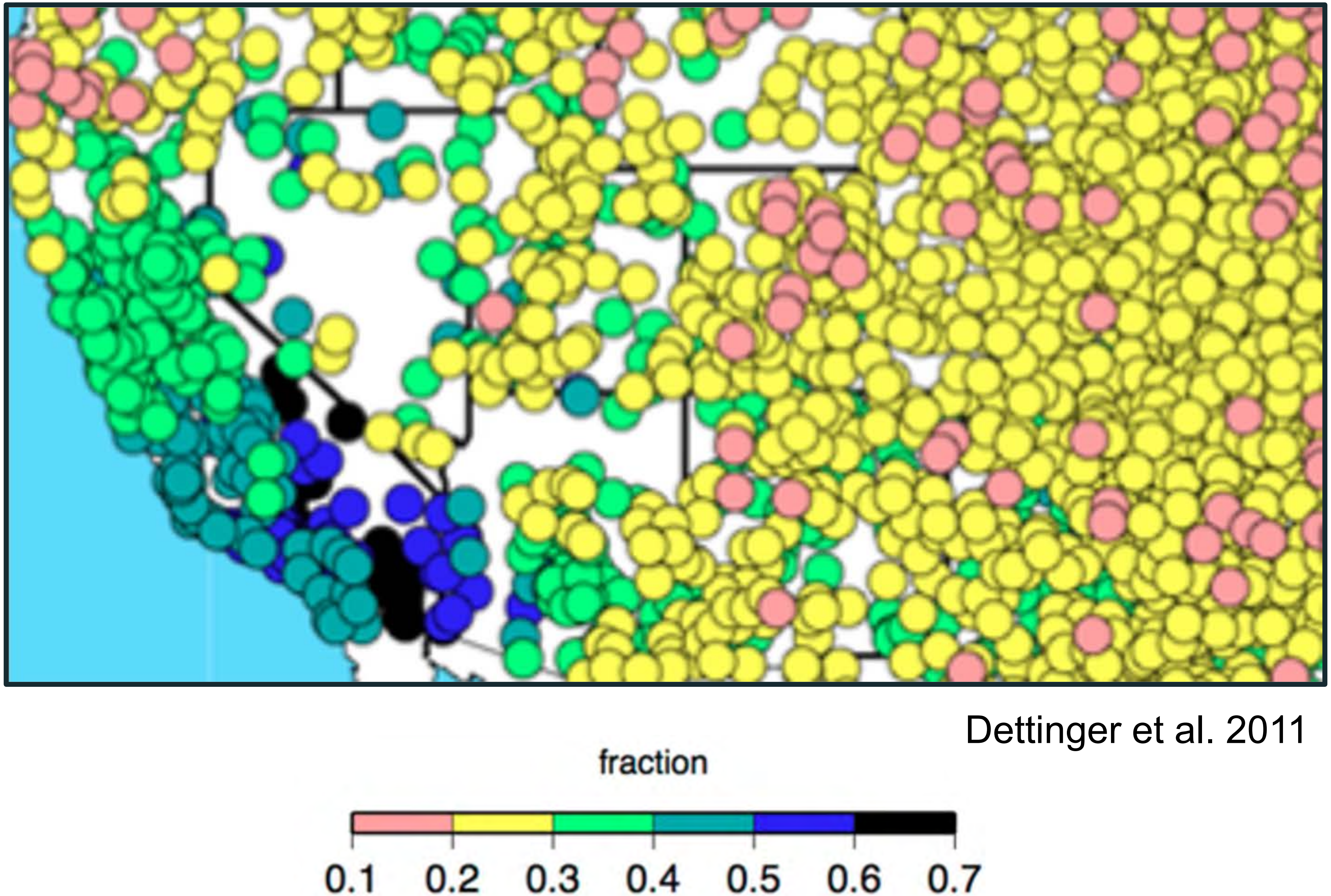
Dettinger and Cayan 2014

Coefficient of variation for annual precipitation, 1950-2008



Dettinger et al. 2011

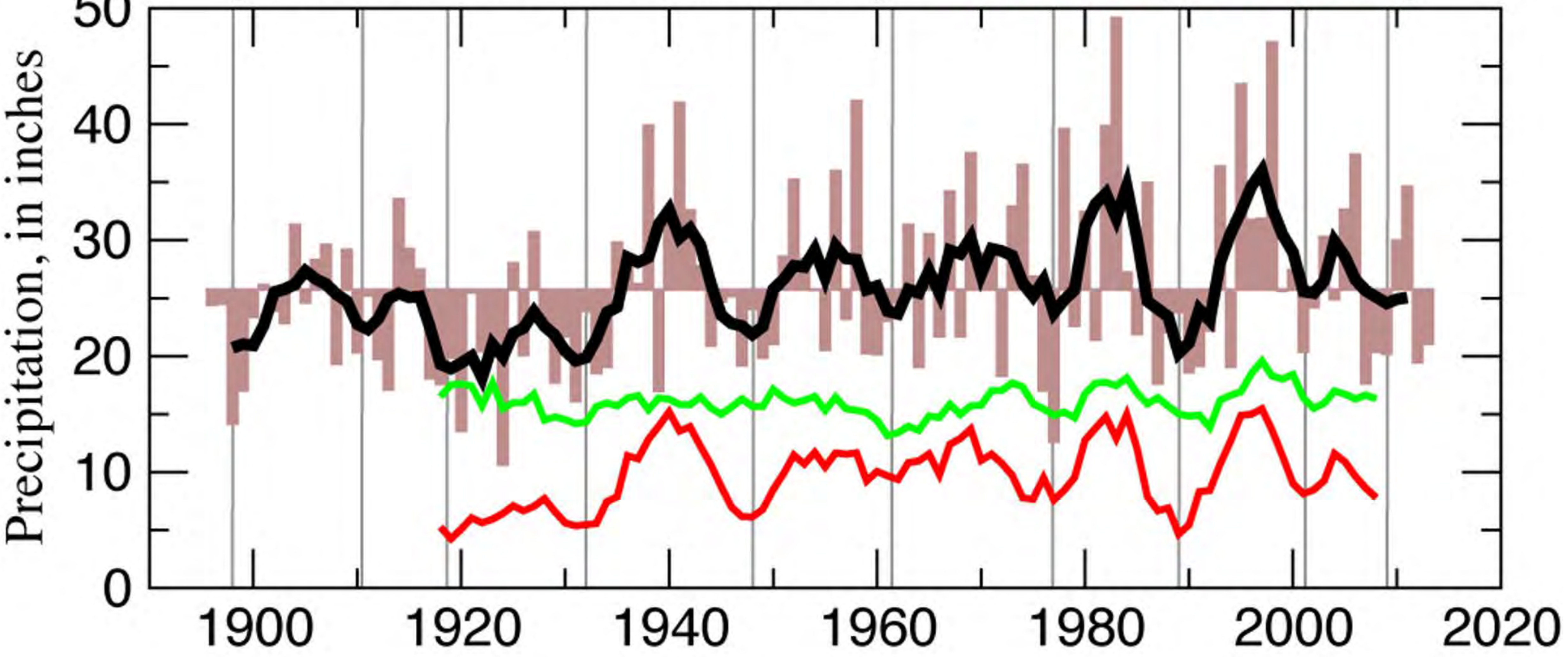
Coefficient of variation for annual precipitation, 1950-2008



Dettinger et al. 2011

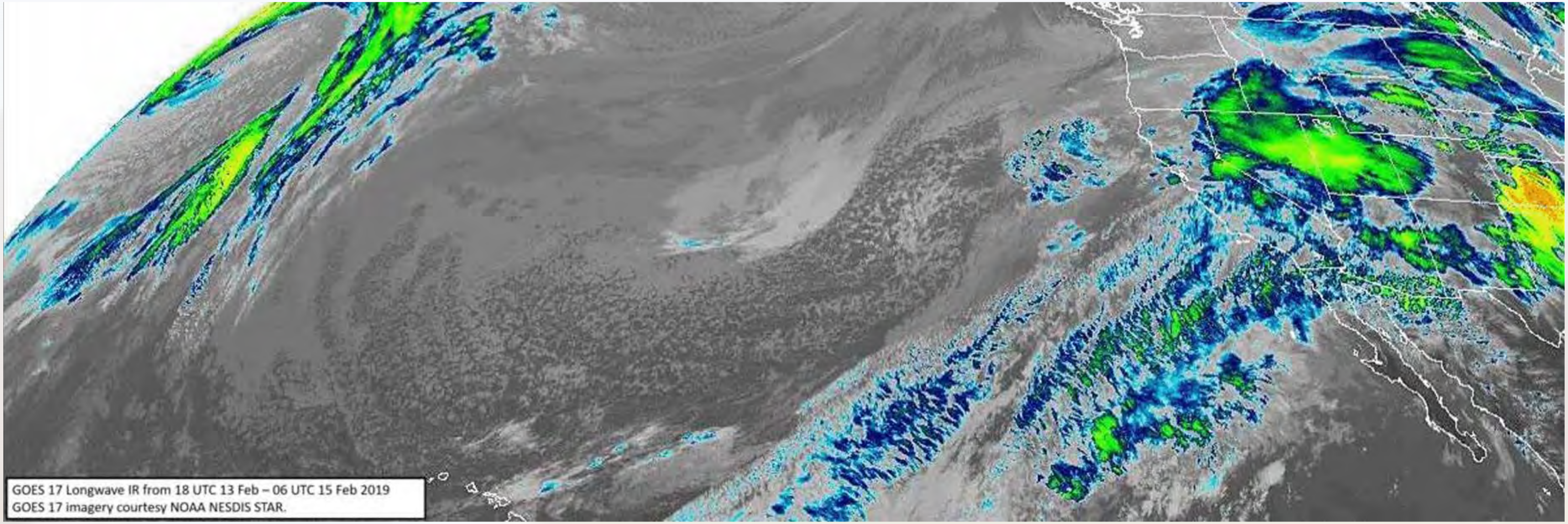
a) Water-Year Precipitation, Delta Catchment

[with contributions from days <95%-ile, >95%-ile]

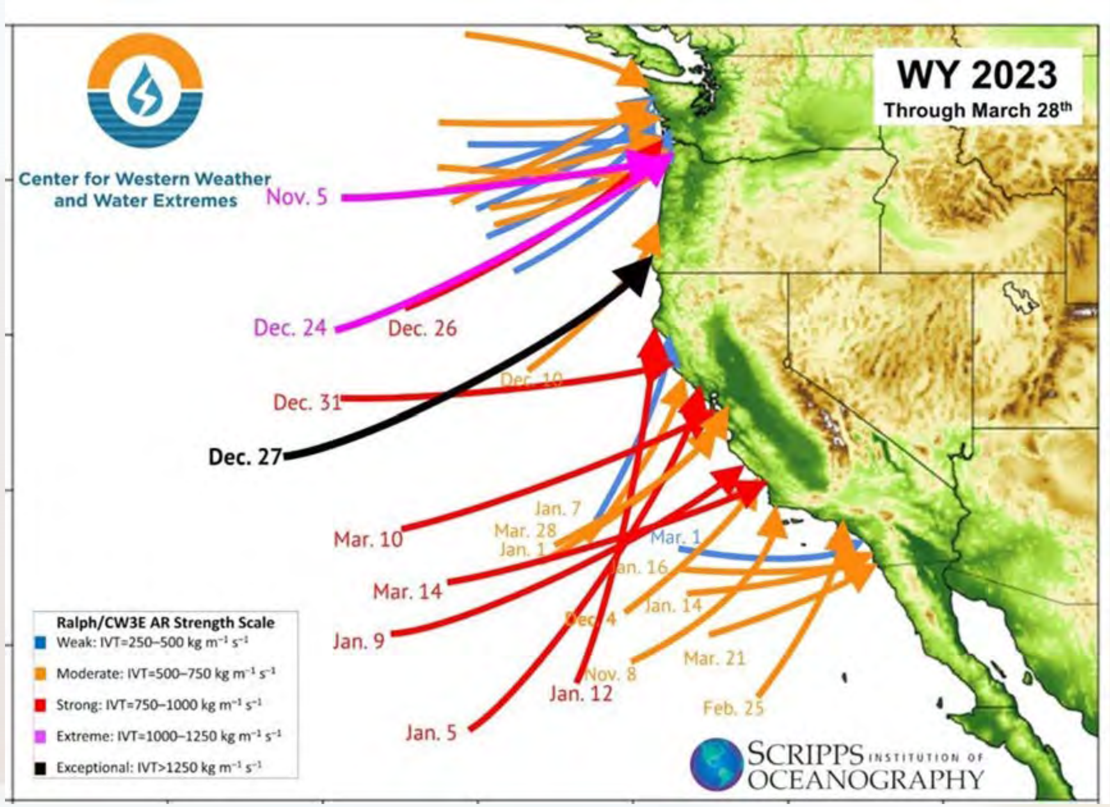


Dettinger and Cayan 2014

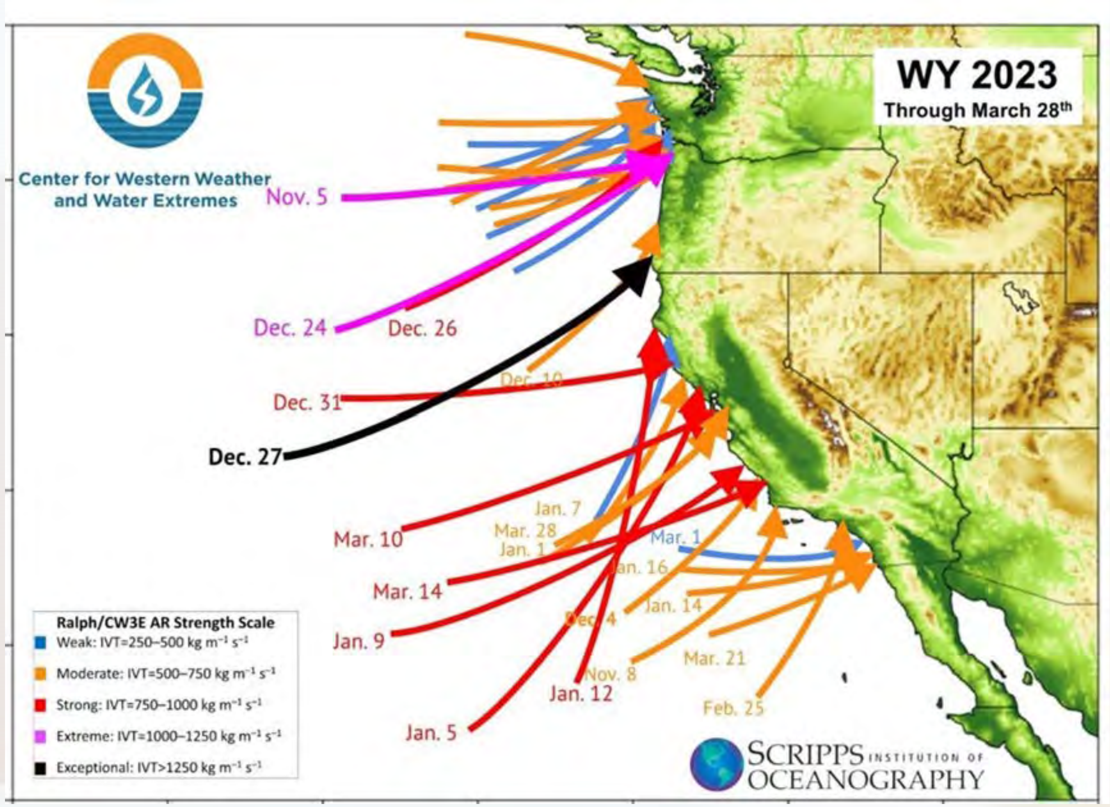
Atmospheric river: satellite image

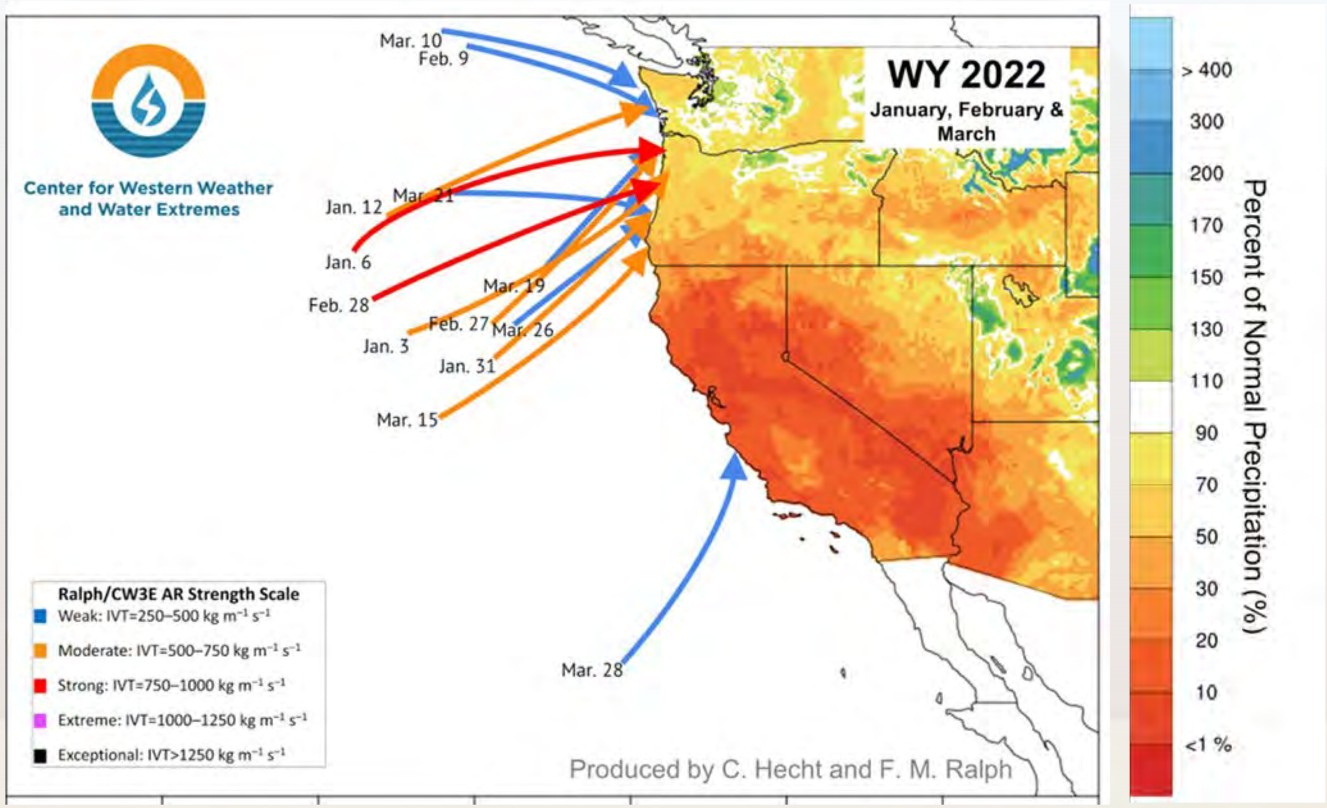


Interannual variability – water year 2023 – 17 atmospheric rivers



Interannual variability – water year 2022 – one atmospheric river





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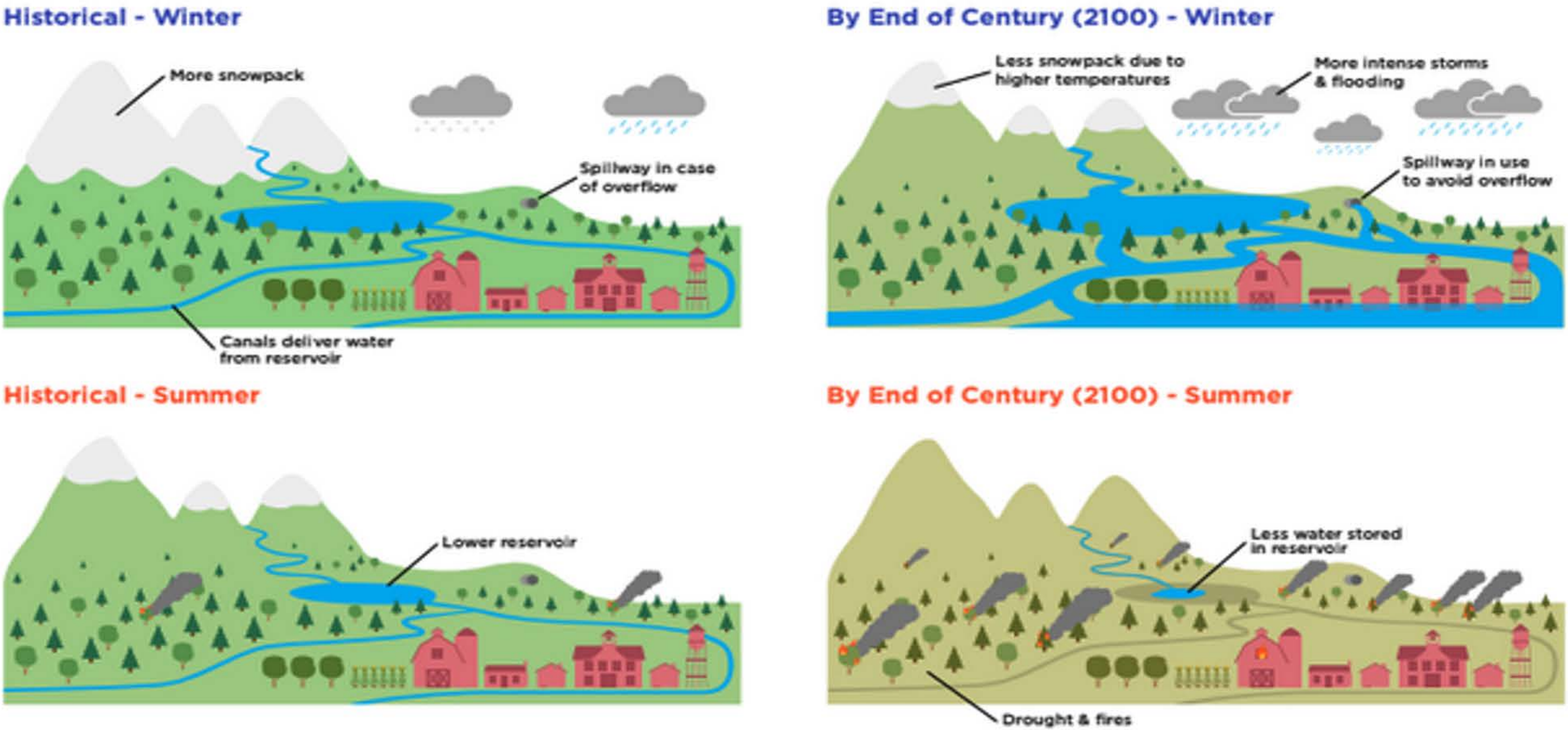
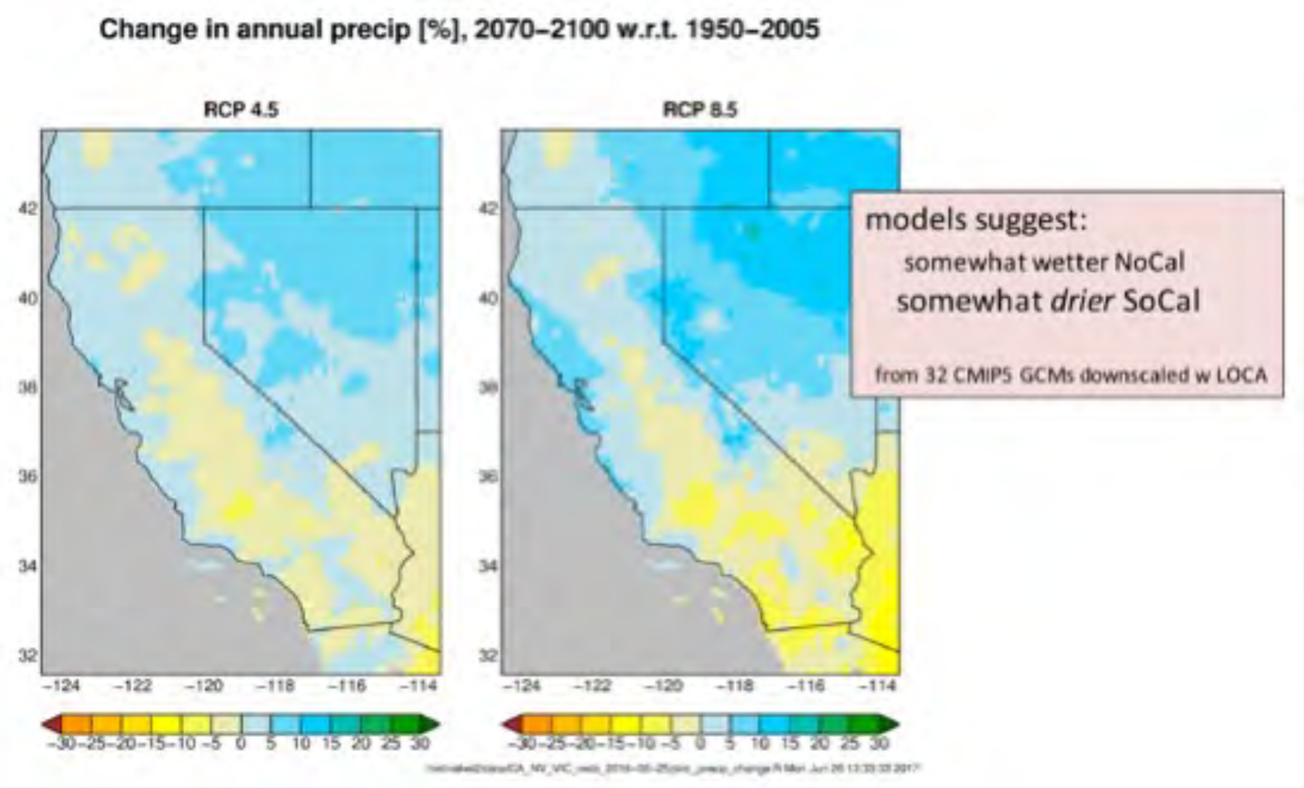
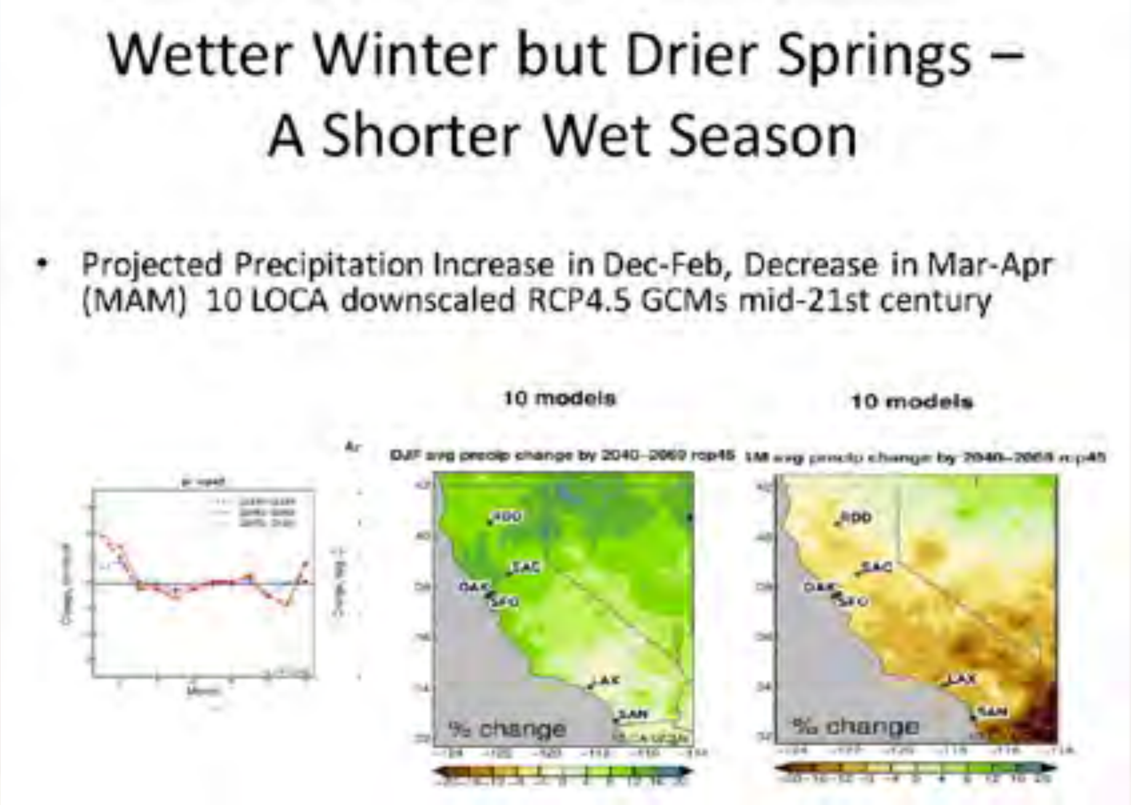
California: wetter or drier?



California: wetter or drier?





Pierce, Kalansky, Cayan, 2019

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Wetter, Drier, or Both?

INCREASING PRECIPITATION EXTREMES IN CALIFORNIA

California's climate has always featured wide swings between drought and flood. But in a warming world, precipitation will likely become even more volatile — with large increases in the frequency of extreme wet events, extreme dry events, and rapid transitions between them. These changes will pose major challenges for water, fire, and emergency management in 21st-century California.

Extreme Dry Years

Low November–March precipitation totals for these years resemble 2013–14 or 1976–77, the driest year in modern California history.

Extreme Wet Years

In these years, the November–March period is as wet as in 2016–17, when statewide precipitation was 54% greater than average.

Dry-to-Wet Whiplash

This scenario represents the transition from a very dry year to a very wet one, as occurred between 2015–16 and 2016–17.

Severe Storm Sequence

In this scenario, 40-day precipitation totals are similar to those during California's "Great Flood of 1862."

UCLA Center for Climate Science, 2018

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Water Supply Portfolio in Drought

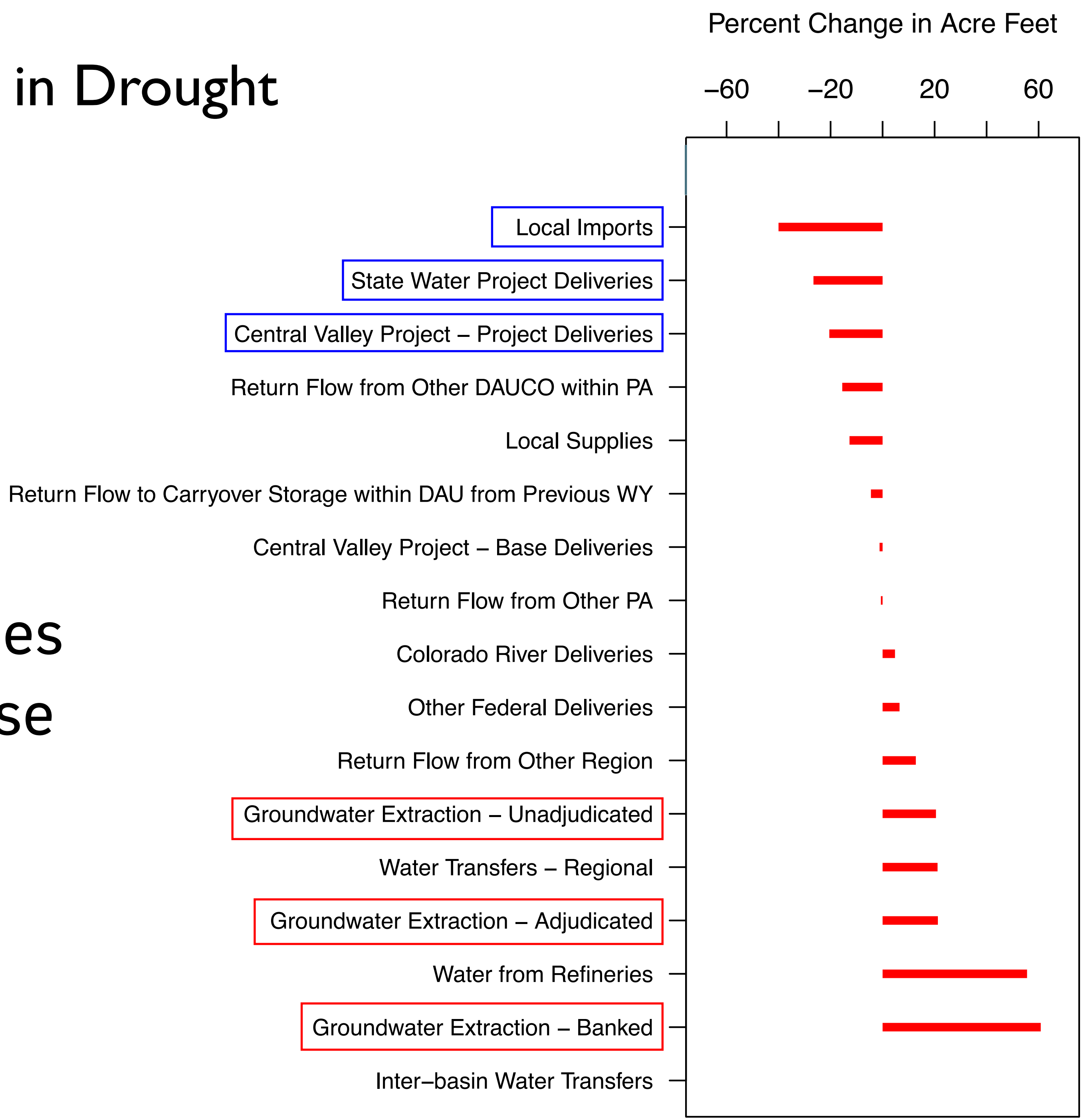
Local supplies fall in drought

CVP deliveries fall in drought

SWP deliveries fall in drought

Groundwater extraction increases

Colorado River deliveries increase



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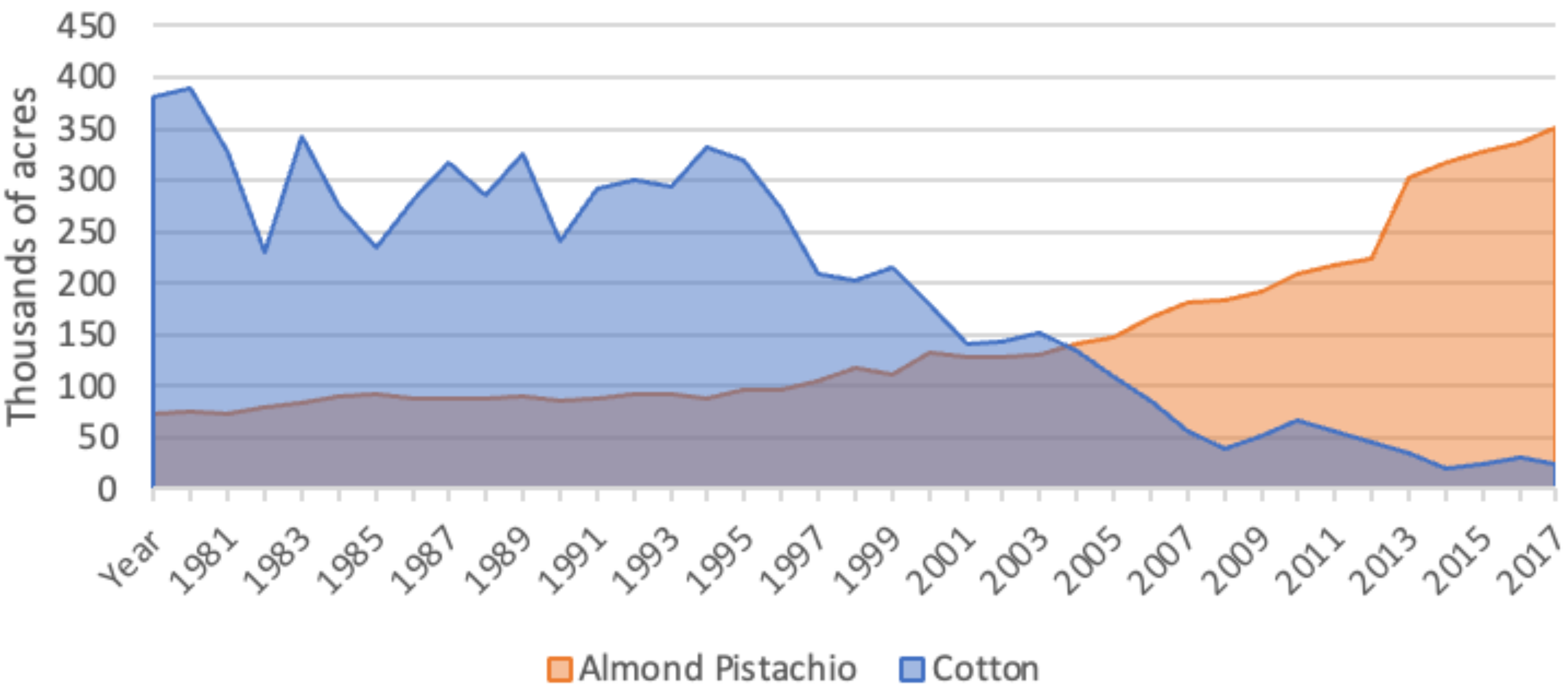
Kern County Crop Acreage over Time
Cotton vs Almonds and Pistachios



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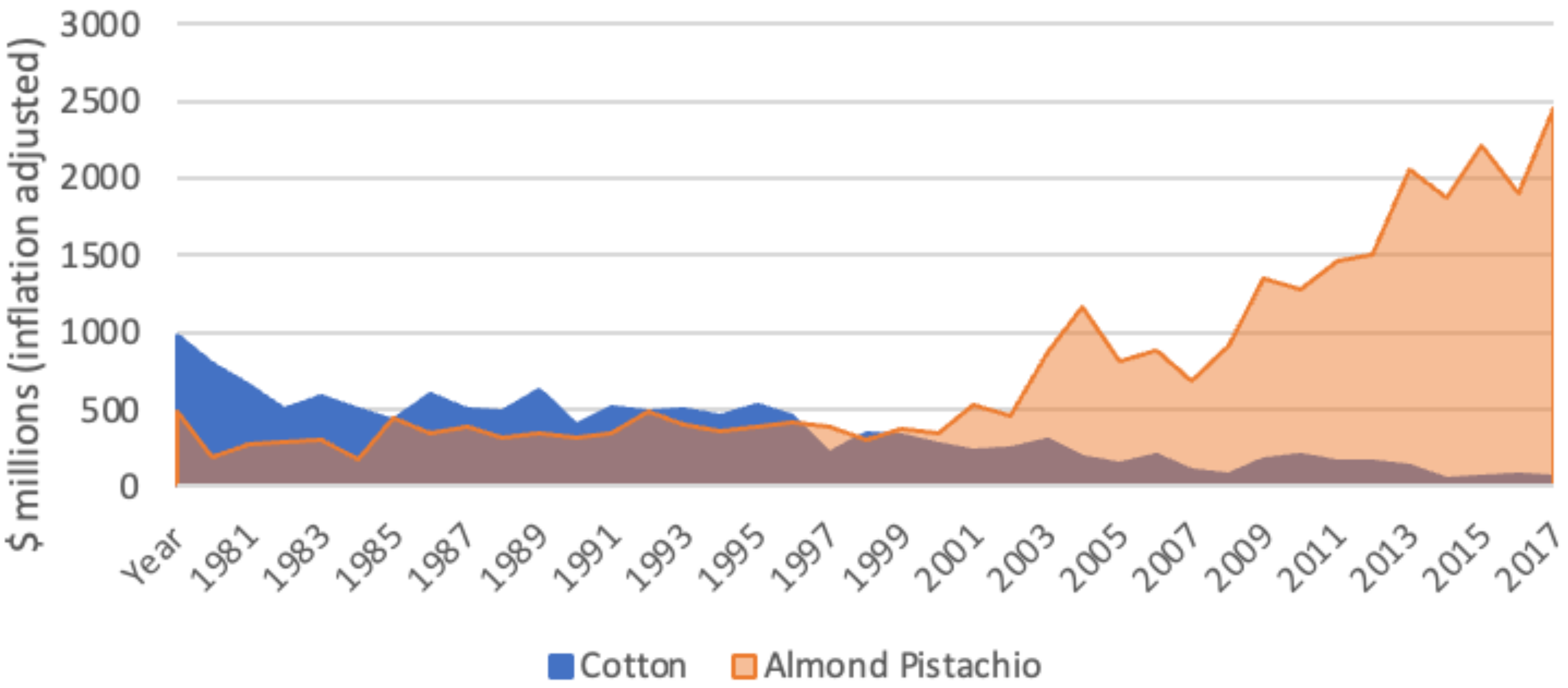
Kern County Crop Revenue over Time
Cotton vs Almond and Pistachios



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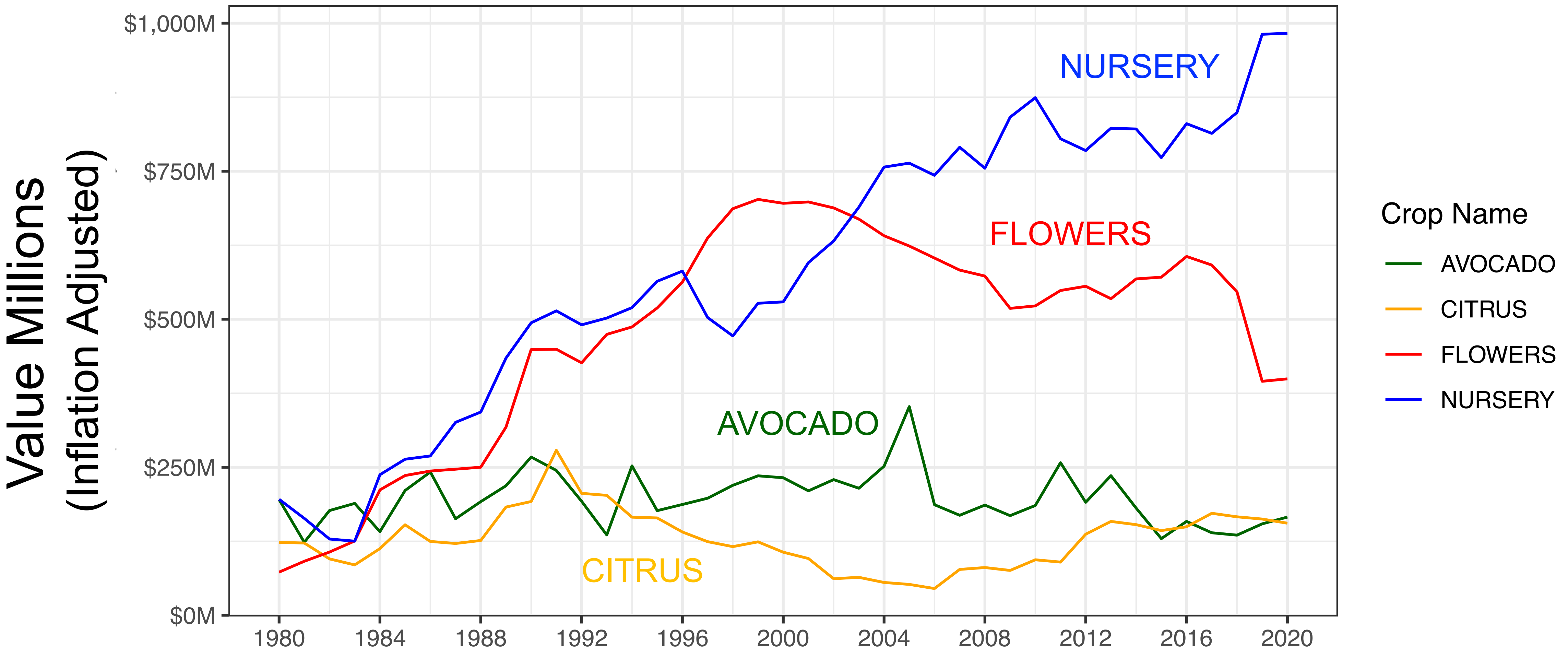
Annual Crop Value in San Diego County



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Climate Information and Forecast Tools

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The Climate Toolbox

A collection of web tools for visualizing past and projected climate and hydrology of the contiguous United States.

Applications

A collection of tools for addressing questions relating to Agriculture, Climate, Fire Conditions, and Water.

AGRICULTURE

CLIMATE

FIRE

WATER

climatetoolbox.org

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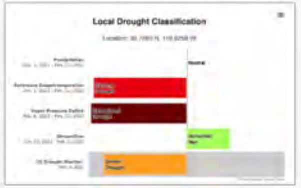
Tools

Variable Lookup
Find which tools in the Climate Toolbox have a certain variable

Launch Tool

Climate Mapper
Maps of historical and future climate information across multiple sectors

Launch Tool

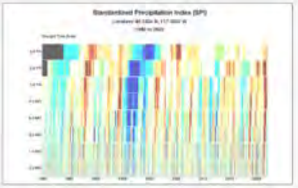


Historical Water Watcher
Maps of real-time water monitoring over the contiguous US

Launch Tool

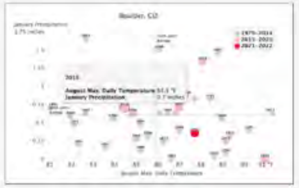
Historical Climate Tracker
Graphs and trend lines of historical climate variability for a location

Launch Tool



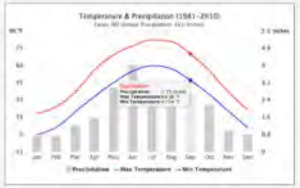
Historical Drought Stripes
Stripes of past short and long term droughts as a timeseries for a location

Launch Tool



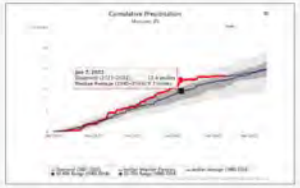
Historical Climate Scatter
Scatterplot graphs of two climate variables for a location

Launch Tool



Historical Climograph
Climographs of monthly average climate for a location

Launch Tool



Historical Seasonal Progression
Graphs of daily weather and forecasts for a location

Launch Tool

Historical Climate Dashboard
Dashboard of real-time climate for a location

Launch Tool

Subseasonal Forecasts
Graphs of climate forecasts for next 4 weeks for a location

Launch Tool

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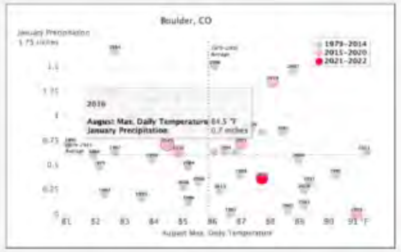
The Climate Toolbox

A collection of web tools for visualizing past and projected climate and hydrology of the contiguous United States.



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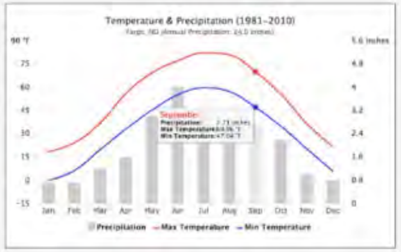
Scatterplot graphs of two climate variables for a location

Launch Tool



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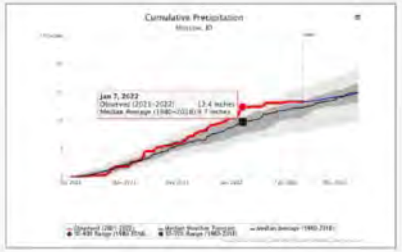

Historical Seasonal Progression
Graphs of daily weather and forecasts for a location

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Historical Climate Dashboard
Dashboard of real-time climate for a location

Launch Tool

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Graphs of climate forecasts for next 4 weeks for a location

Launch Tool

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1980s: Cold Hardiness Zone 9b

Documentation | Cite Tool | Take Tour

Future Cold Hardiness Zones

Explore maps of future cold hardiness zones over the contiguous USA.

Location: 46.7324° N, 117.0002° W

Choose Data

Time Period and Future Emission:

1971-2000, Historical Emissions

Change Mapping

Crop: Custom

Range of zones shown on map:

1a to 13b

Layers

- US States
- US Counties

Choose Location

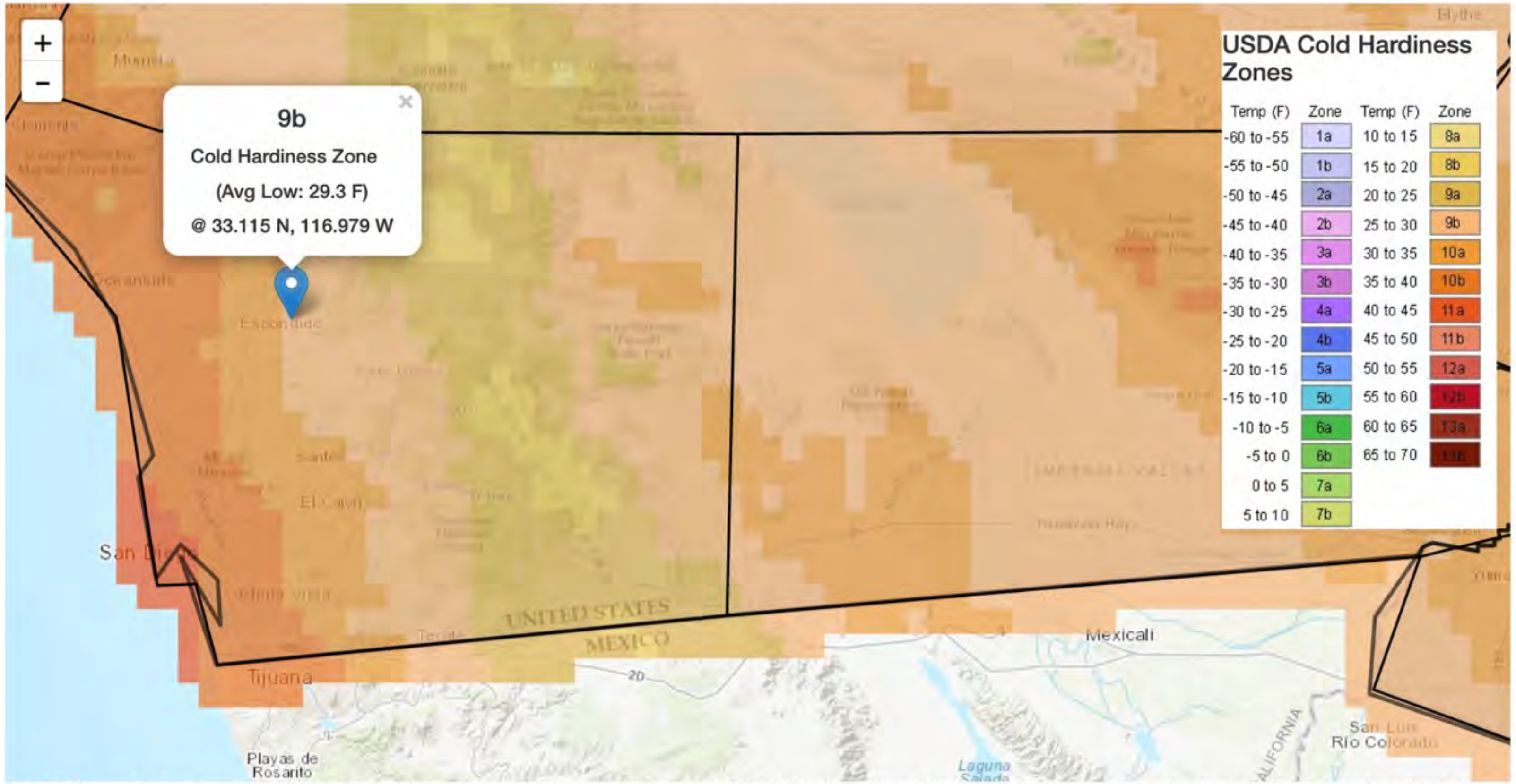
Select a point location to view data averaged over a 2.5 square mile grid cell.

CHOOSE LOCATION

Download Map

Cold Hardiness Zones

1971-2000, Historical Emissions



Leaflet | Powered by Esri |Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Climate Toolbox, Data: MACAv2-METDATA

2040s: Cold Hardiness Zone 10a

Documentation | Cite Tool | Take Tour

Future Cold Hardiness Zones

Explore maps of future cold hardiness zones over the contiguous USA.

Location: 33.1150° N, 116.9790° W

Choose Data

Time Period and Future Emission:

2040-2069, Lower Emissions (RCP 4.5)

Change Mapping

Crop: Custom

Range of zones shown on map:

1a to 13b

Layers

- [ ] US States
- [x] US Counties

Choose Location

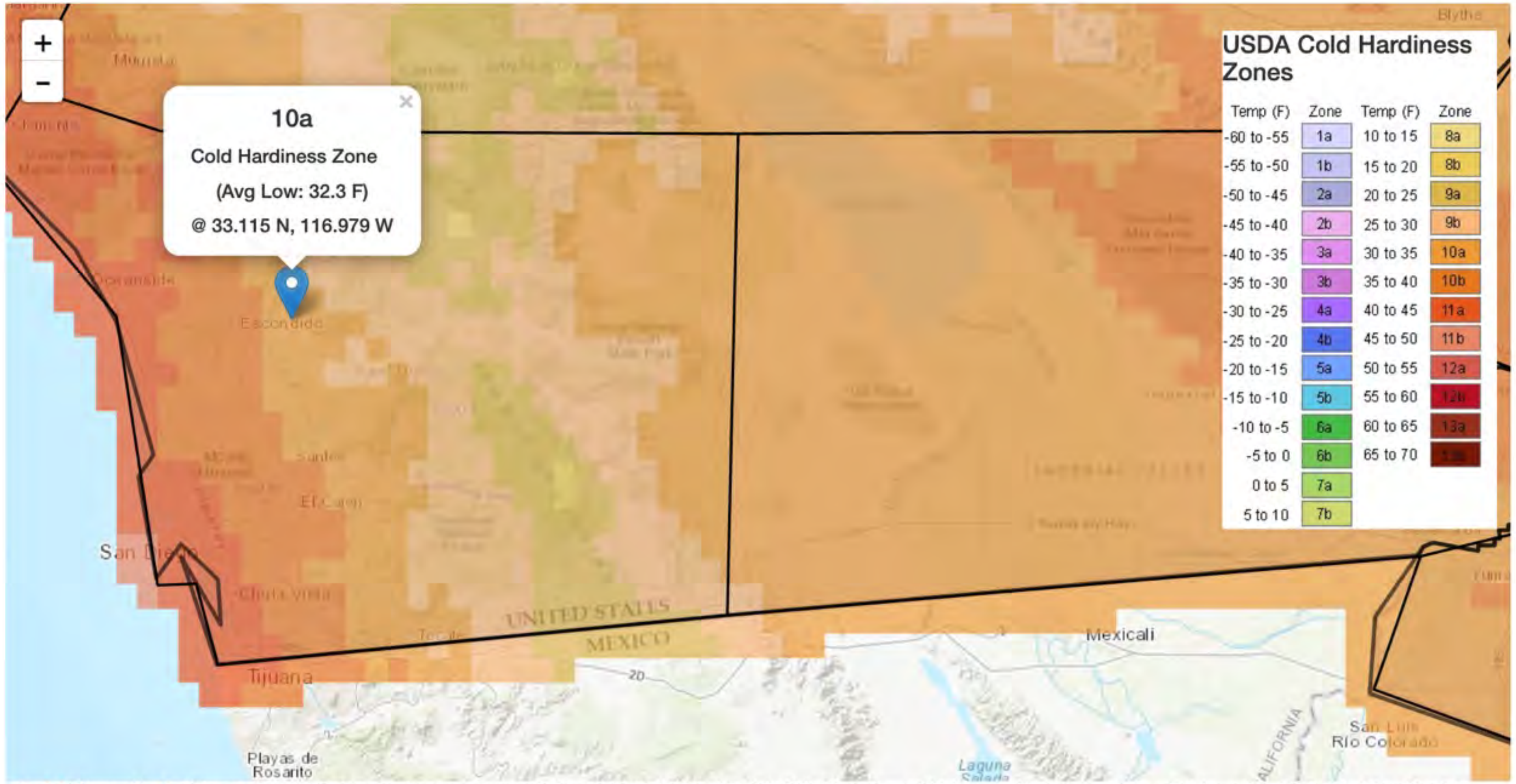
Select a point location to view data averaged over a 2.5 square mile grid cell.

CHOOSE LOCATION

Download Map

Cold Hardiness Zones

2040-2069, Lower Emissions (RCP 4.5)



Leaflet | Powered by Esri |Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Climate Toolbox, Data: MACAv2-METDATA

2080s: Cold Hardiness Zone 10b

Documentation | Cite Tool | Take Tour

Future Cold Hardiness Zones

Explore maps of future cold hardiness zones over the contiguous USA.

Location: 33.1150° N, 116.9790° W

Choose Data

Time Period and Future Emission:

2070-2099, Higher Emissions (RCP 8.5)

Change Mapping

Crop: Custom

Range of zones shown on map:

1a to 13b

Layers

- [ ] US States
- [x] US Counties

Choose Location

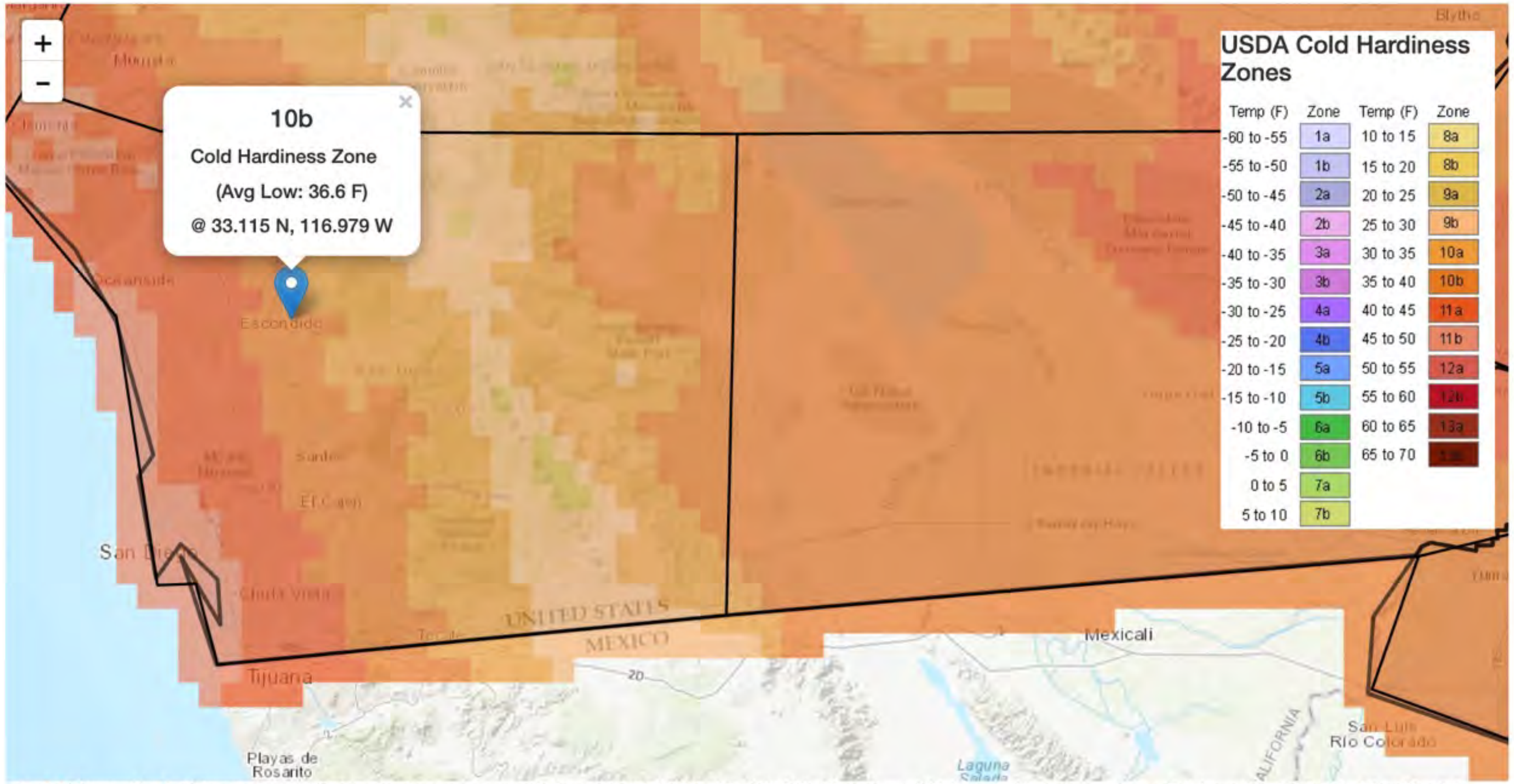
Select a point location to view data averaged over a 2.5 square mile grid cell.

CHOOSE LOCATION

Download Map

Cold Hardiness Zones

2070-2099, Higher Emissions (RCP 8.5)



Leaflet | Powered by Esri |Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Climate Toolbox, Data: MACAv2-METDATA

Documentation | Example | Summary | Cite Tool | Take Tour

Future Crop Suitability

Explore future climate suitability for specialty crops in the Western USA.

Location: 33.0868° N, 116.6081° W

Choose Analysis

Analysis:
- (●) Suitability
- ( ) Phenology
- ( ) Irrigation

Choose Data

Crop: Grapes (Chardonnay)

Time Period(s):
- [x] 1971-2000
- [ ] 2010-2039
- [x] 2040-2069

Future Emissions: Higher Emissions (RCP 8.5)

Choose Location

Change Map

Download Graph

Download Map

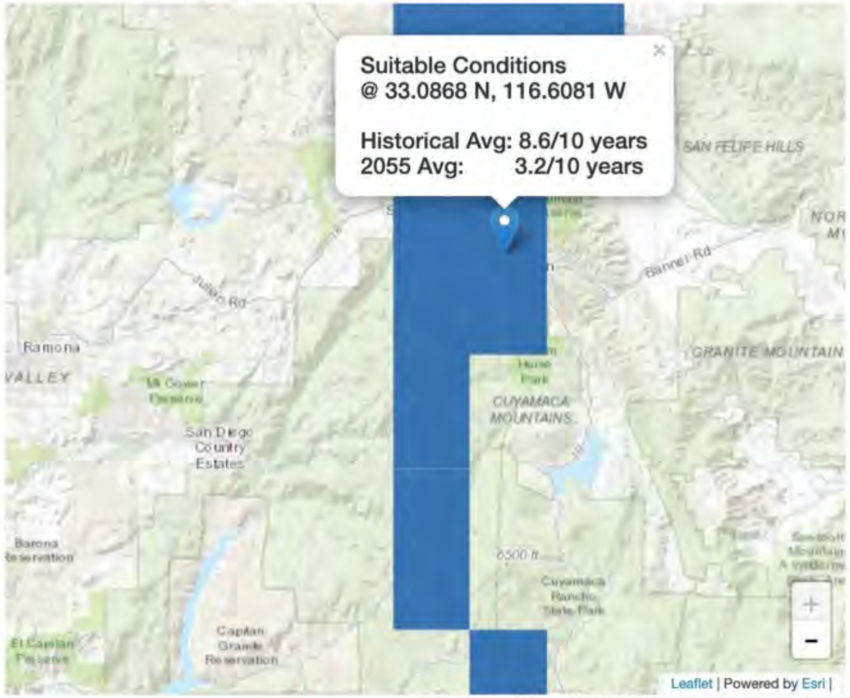
Regional Suitability

Crop Suitability Metric: Overall thermal suitability

Map Crop Risk: Desired crop suitability in at least 8 in 10 years

Locations Suitable for Grapes (Chardonnay) due to Overall thermal suitability

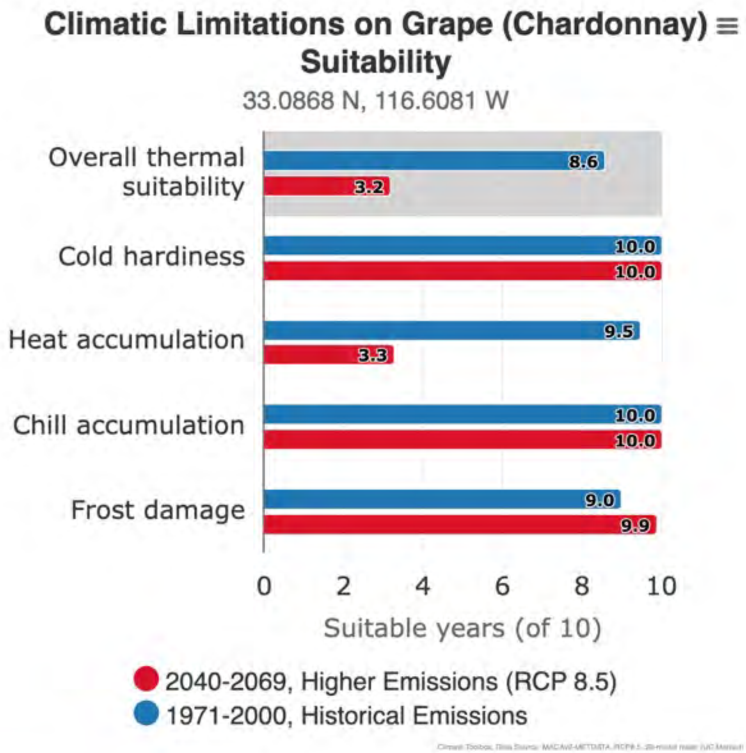
Shading indicates suitability in at least 8 of every 10 years



Climate Toolbox, MACAv2-METDATA,RCP8.5, 20-model mean (UC Merced)

- 1971-2000 (Historical Emissions)
- 2040-2069 (Higher Emissions (RCP 8.5))

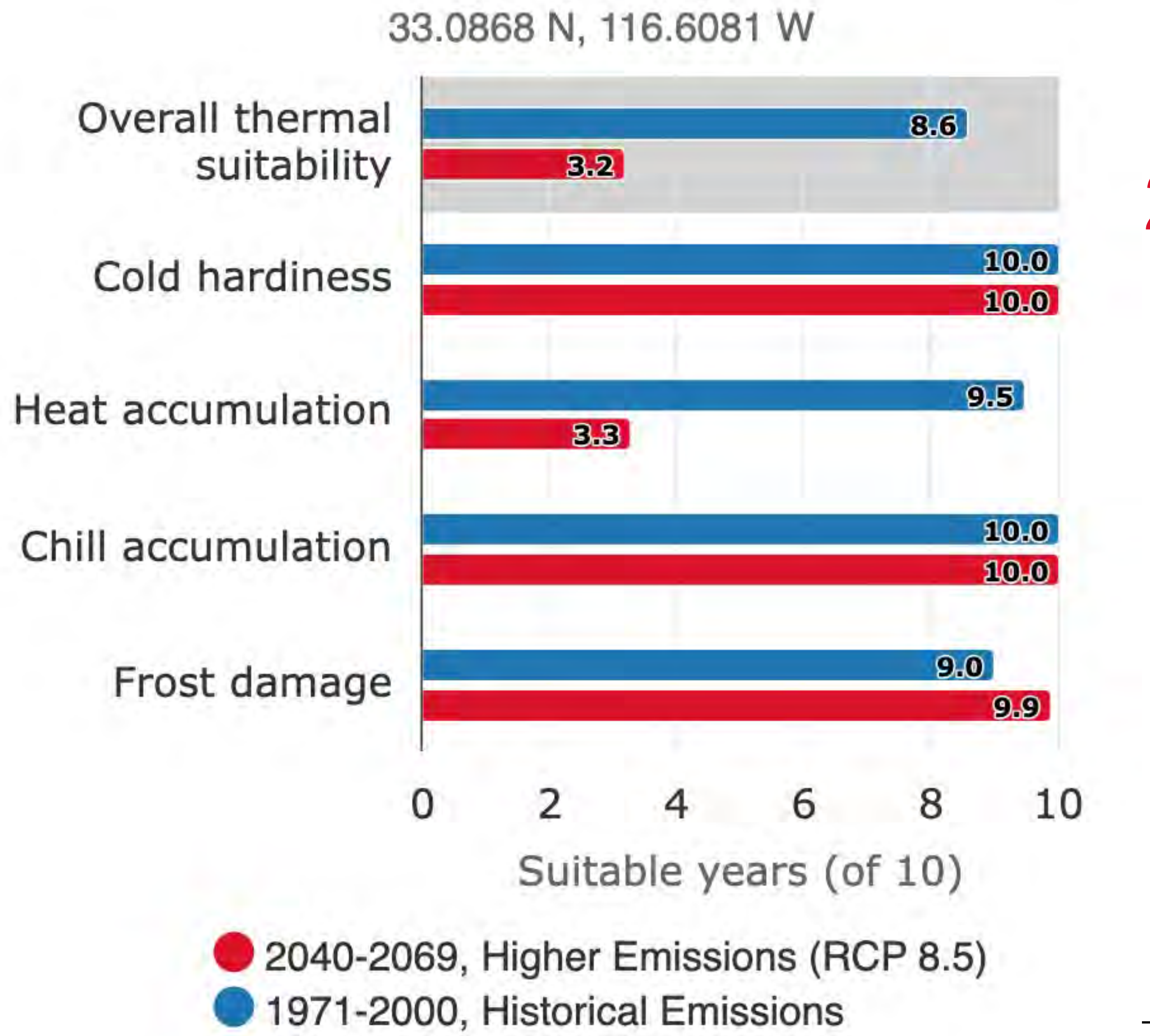
Location-Specific Suitability



Interpreting the Graph:

Overall thermal suitability is a composite metric incorporating the limiting factors of the other metrics shown. The limiting factor on the thermal suitability is the metric with the lowest value.

Climatic Limitations on Grape (Chardonnay) Suitability



1980s

2050s (RCP8.5)

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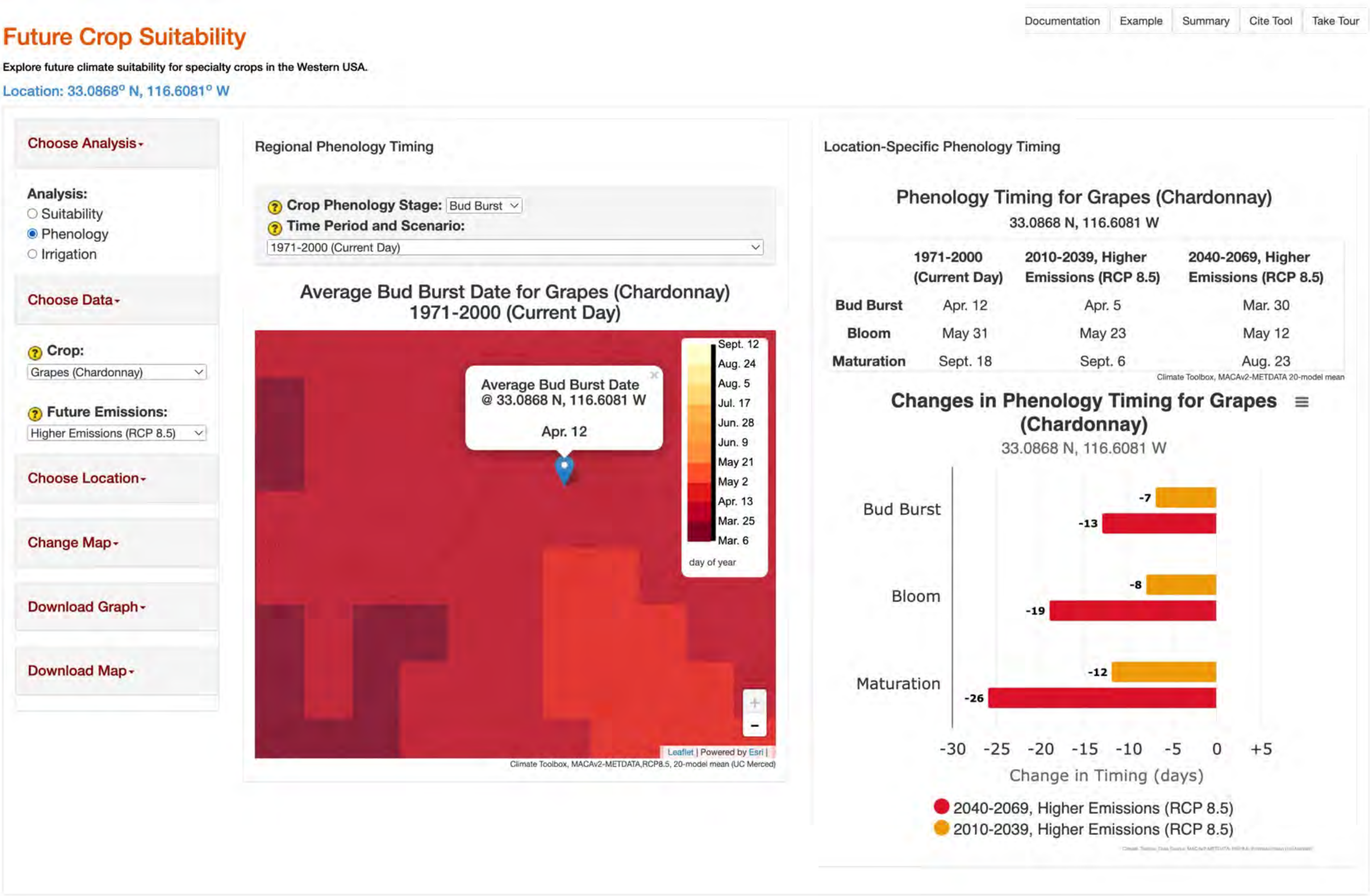
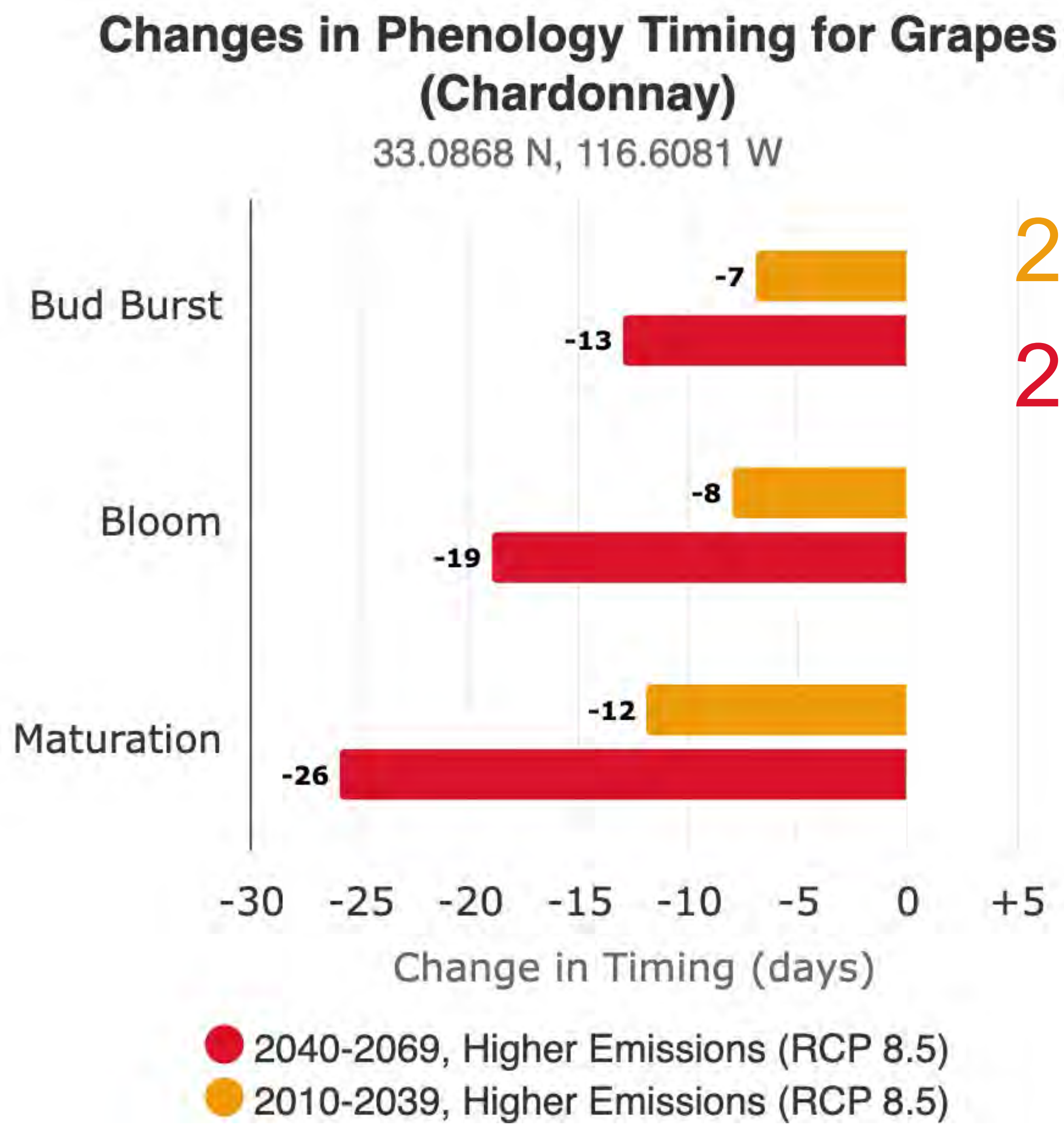

Documentation
Example
Summary
Cite Tool
Take Tour
Future Crop Suitability
Explore future climate suitability for specialty crops in the Western USA.
Location: 33.0868° N, 116.6081° W
Choose Analysis
Analysis:
Suitability
Phenology
Irrigation
Choose Data
Crop:
Grapes (Chardonnay)
Future Emissions:
Higher Emissions (RCP 8.5)
Choose Location
Change Map
Download Graph
Download Map
Regional Phenology Timing
Crop Phenology Stage: Bud Burst
Time Period and Scenario:
1971-2000 (Current Day)
Average Bud Burst Date for Grapes (Chardonnay)
1971-2000 (Current Day)
Average Bud Burst Date
@ 33.0868 N, 116.6081 W
Apr. 12
Sept. 12
Aug. 24
Aug. 5
Jul. 17
Jun. 28
Jun. 9
May 21
May 2
Apr. 13
Mar. 25
Mar. 6
day of year
Leaflet | Powered by Esri
Climate Toolbox, MACAv2-METDATA,RCP8.5, 20-model mean (UC Merced)
Location-Specific Phenology Timing
Phenology Timing for Grapes (Chardonnay)
33.0868 N, 116.6081 W
1971-2000 (Current Day)
2010-2039, Higher Emissions (RCP 8.5)
2040-2069, Higher Emissions (RCP 8.5)
Bud Burst Apr. 12 Apr. 5 Mar. 30
Bloom May 31 May 23 May 12
Maturation Sept. 18 Sept. 6 Aug. 23
Climate Toolbox, MACAv2-METDATA 20-model mean
Changes in Phenology Timing for Grapes (Chardonnay)
33.0868 N, 116.6081 W
Bud Burst
-7
-13
Bloom
-8
-19
Maturation
-12
-26
-30 -25 -20 -15 -10 -5 0 +5
Change in Timing (days)
2040-2069, Higher Emissions (RCP 8.5)
2010-2039, Higher Emissions (RCP 8.5)



2020s (RCP8.5)

2050s (RCP8.5)

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Historical Seasonal Progression

Documentation | Cite Tool | Take Tour

View the progression of climate over the days of a year for a location in the contiguous USA.

Location: Escondido, CA (33.1192° N, 117.0864° W)

Choose Location

Select a point location to view data averaged over a 2.5 square mile grid cell.

CHOOSE LOCATION

Choose Data

Variable: Precipitation Since Oct 1st

Units: inches

Past Year: 2022-2023

- (•) Show Past Year Only
- ( ) Show Past Year + 30-day Weather Forecasts
- ( ) Show past Year + 30-day Weather + 7-month Climate Forecasts

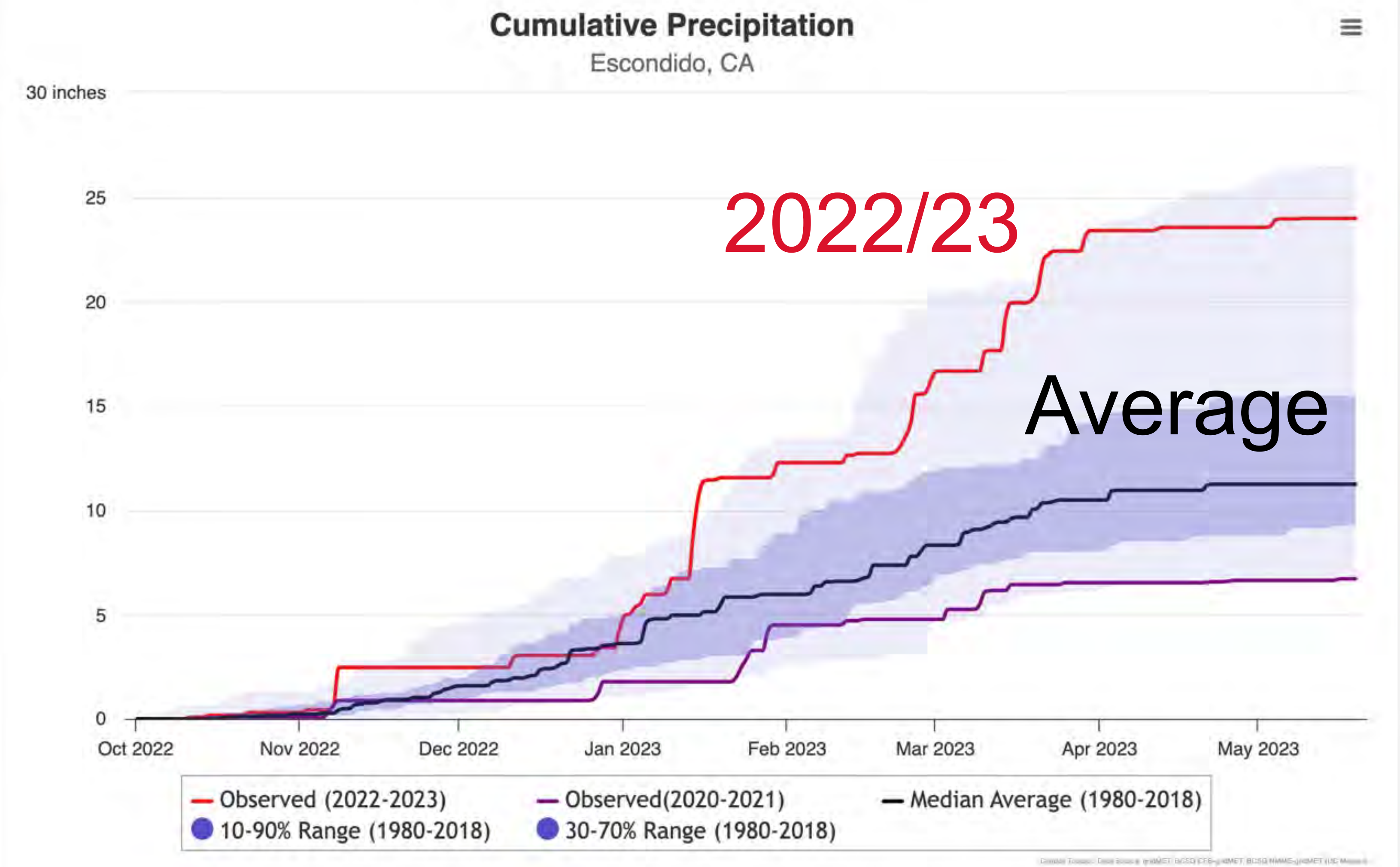
Extra Years:

- [ ] Add year: 2021-2022
- [x] Add year: 2020-2021

Change Graph

Default Unit Type: English Units (°F, inches)

Download



TIP

- Hover over labels in legend to see pieces of graph highlighted.
- Hover over lines on graph to see values.
- Position your mouse where you want the popup box to appear.
- Click on labels in legend to remove/add data series on graph.

Subseasonal Forecasts

Documentation | Cite Tool | Take Tour

View 48 experimental climate forecasts for a location in the contiguous U.S..

Location: Escondido, CA (33.1192° N, 117.0864° W)

Choose Location

Select a point location to view data averaged over a 2.5 square mile grid cell.

CHOOSE LOCATION

Choose Data

Variable: Cumulative Precipitation (from Tomorrow)

Units: inches

Choose Analysis

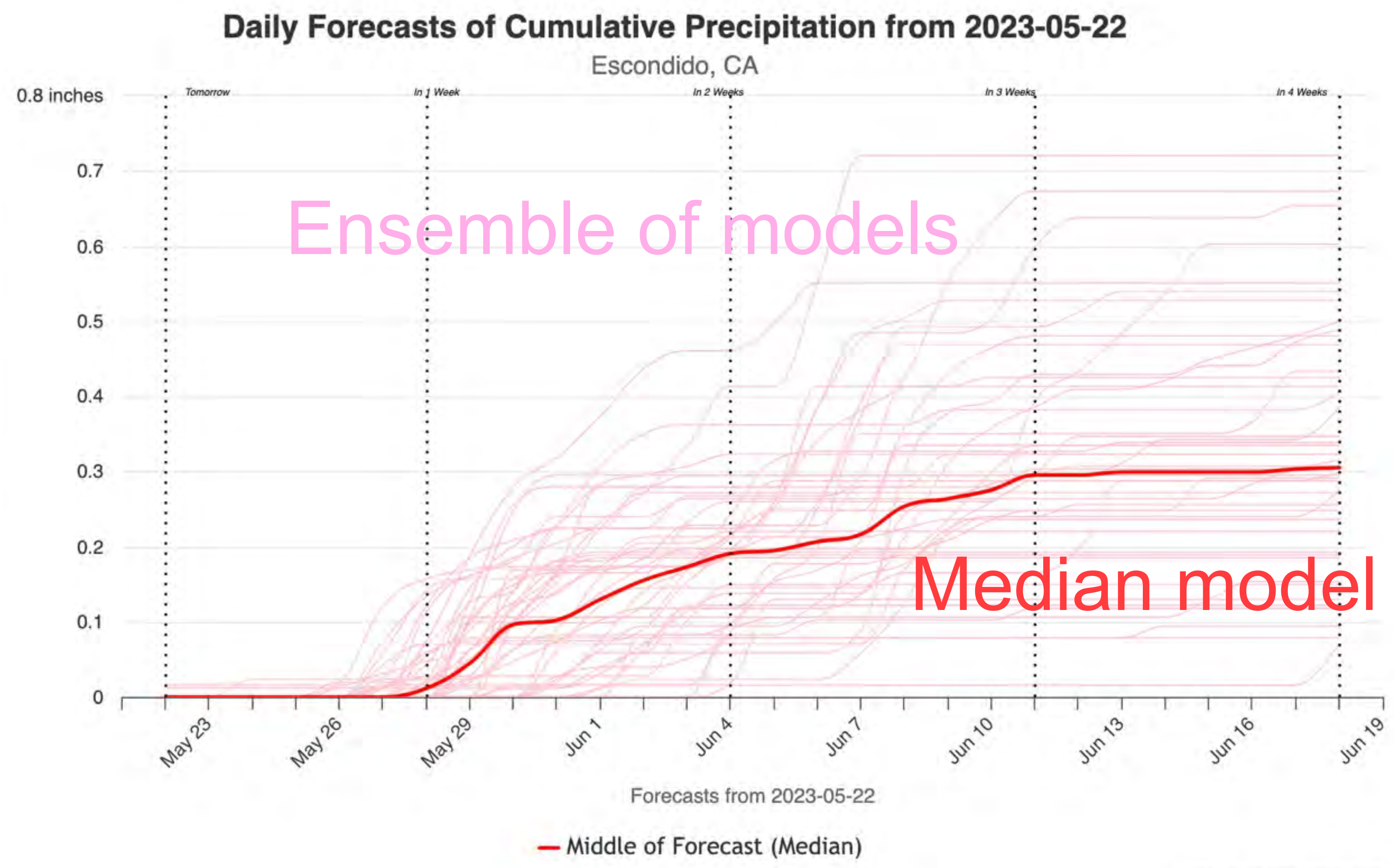
Show Graph of:

- Daily Forecasts
- Daily Categorical Forecasts
- Weekly Forecasts and Skill

Historical Percentiles:

- 10,30,50,70,90th percentiles based on day of year
- Fire danger classifications based on 50,80,90,97th percentiles from all days of year

Download

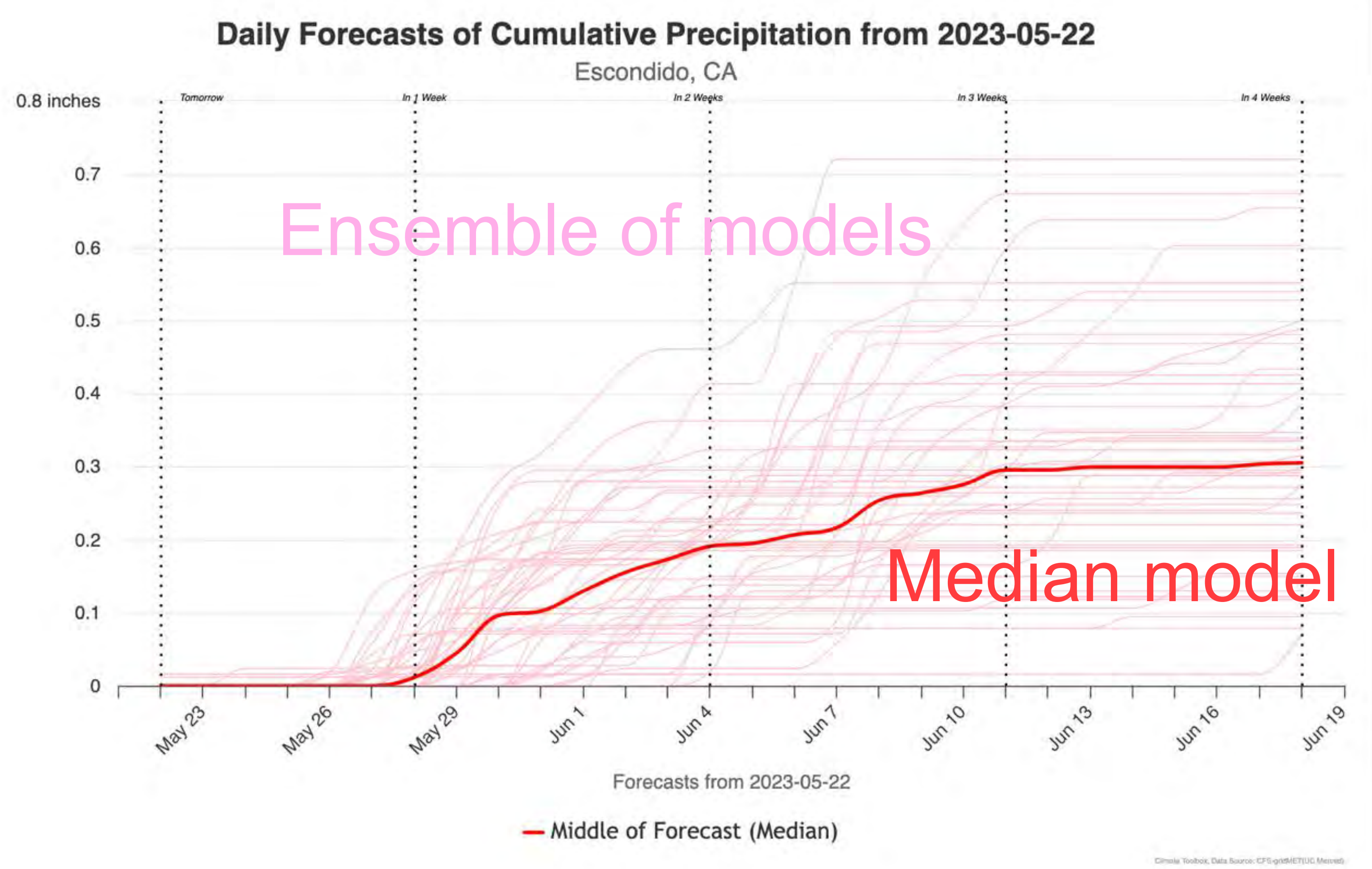


- For help with interpretation of these graphs, see the Documentation.
- Hover over symbols on graph to see values for symbols.
- Click on labels in legend to remove/add data series on graph.

Documentation | Cite Tool | Take Tour

Warning: Precipitation averages can be misleading:

we rarely, if ever, see the "average"



TIP

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Documentation | Cite Tool | Take Tour

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Choose Data

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Cumulative Precipitation (from Tomorrow)

Units: inches

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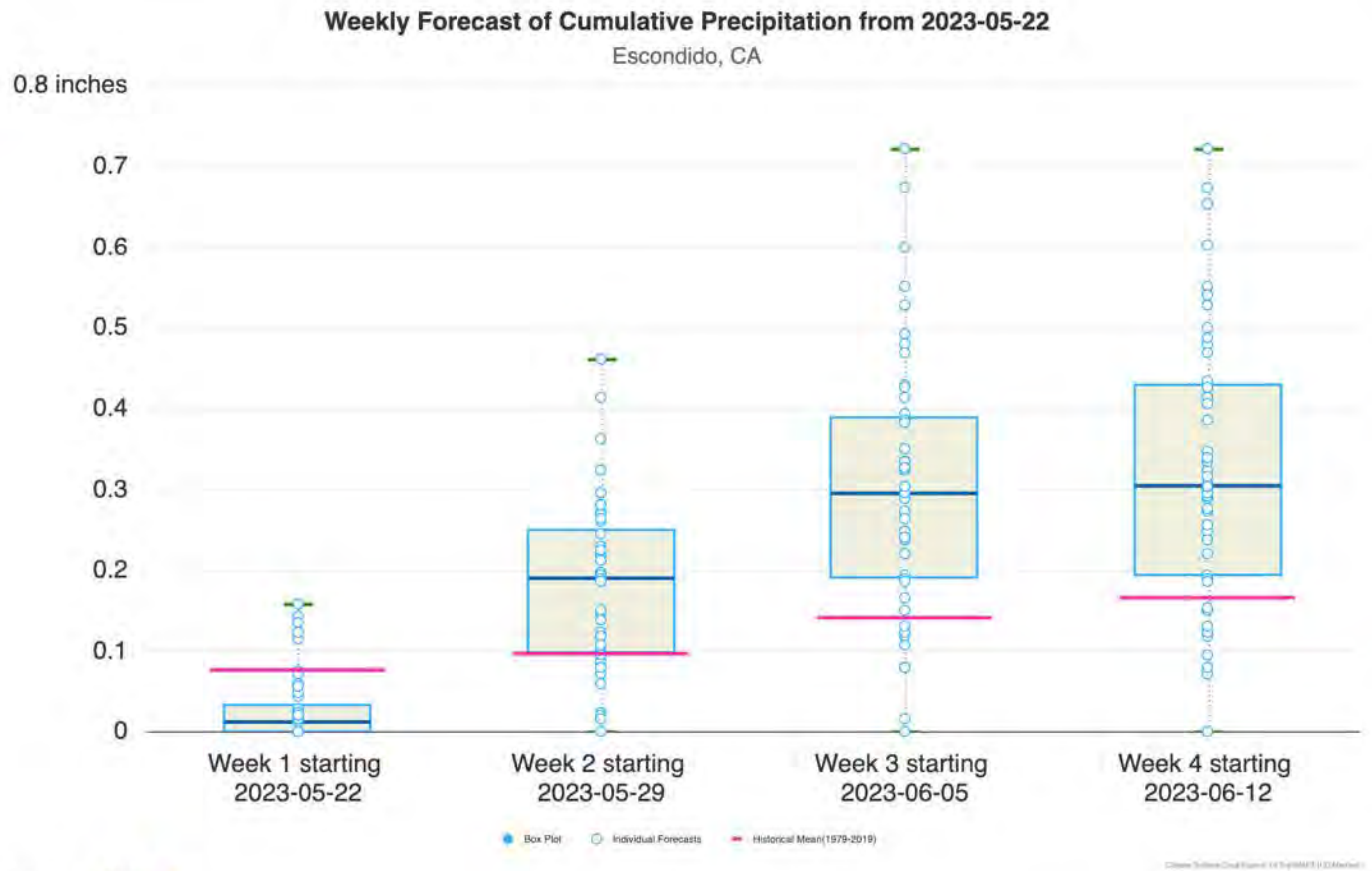
Show Graph of:

- Daily Forecasts
- Daily Categorical Forecasts
- Weekly Forecasts and Skill

Download



Forecast Skill

	Week 1	Week 2	Week 3	Week 4
Skill	Medium	Medium	None	None
Correlation r	0.55	0.54	0.09	0.11

TIP

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- Hover over symbols on graph to see values for symbols.
- Click on labels in legend to remove/add data series on graph.

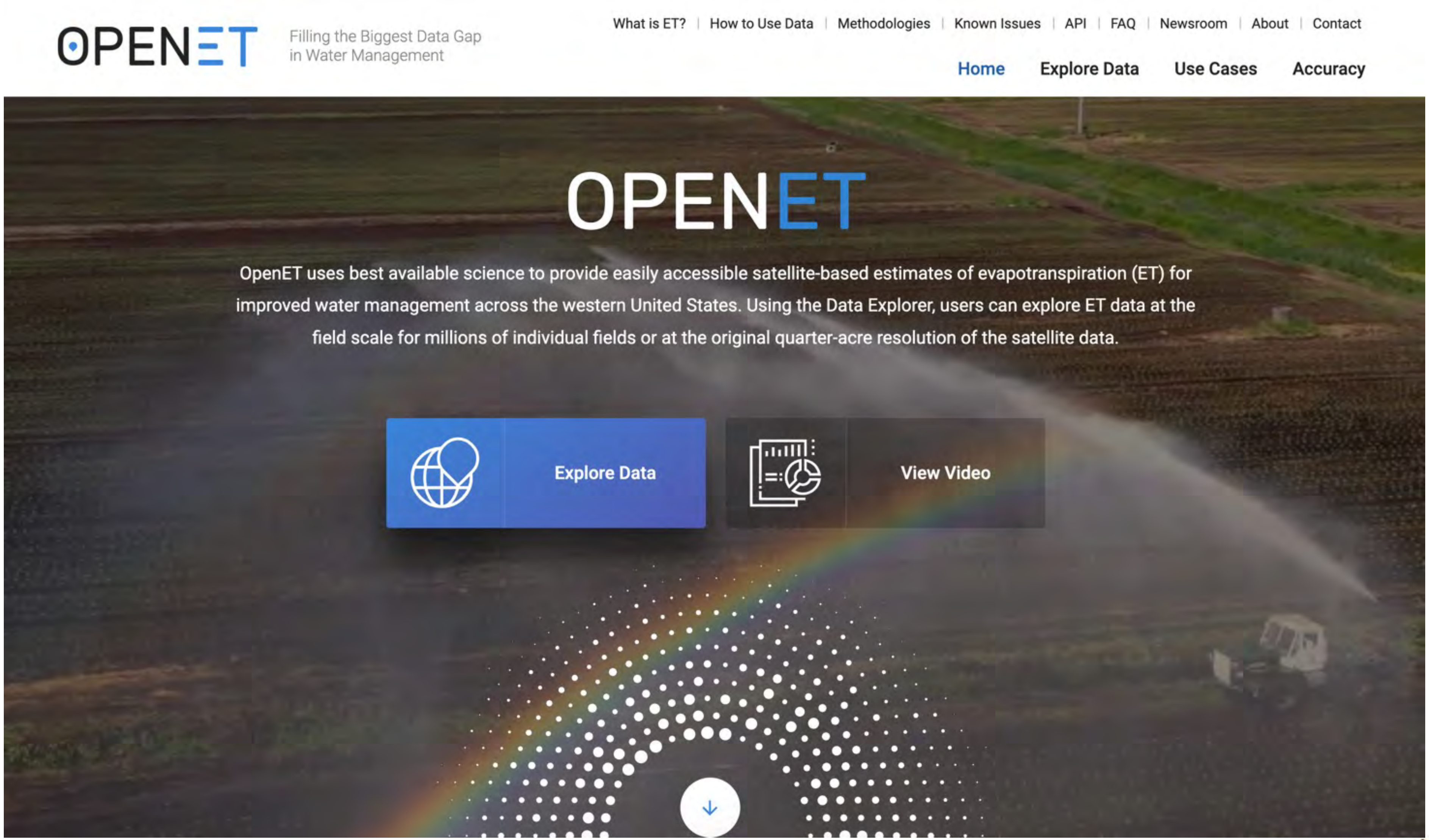
Forecast Skill

	Week 1	Week 2	Week 3	Week 4
Skill	Medium	Medium	None	None
Correlation r	0.55	0.54	0.09	0.11

TIP

- For help with interpretation of these graphs, see the Documentation.
- Hover over symbols on graph to see values for symbols.
- Click on labels in legend to remove/add data series on graph.

Warning: skill for 3–4 week predictions is still very low.



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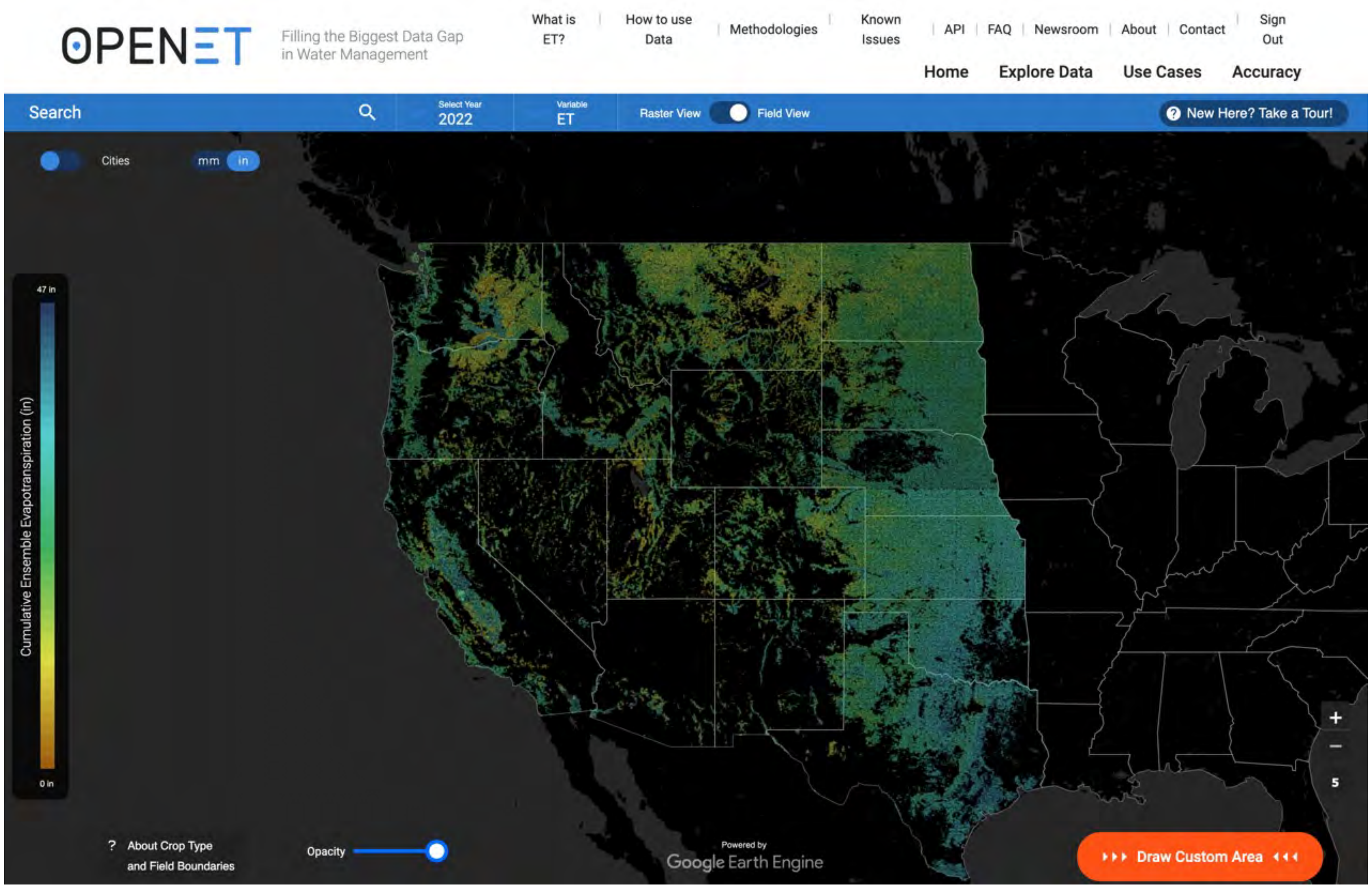

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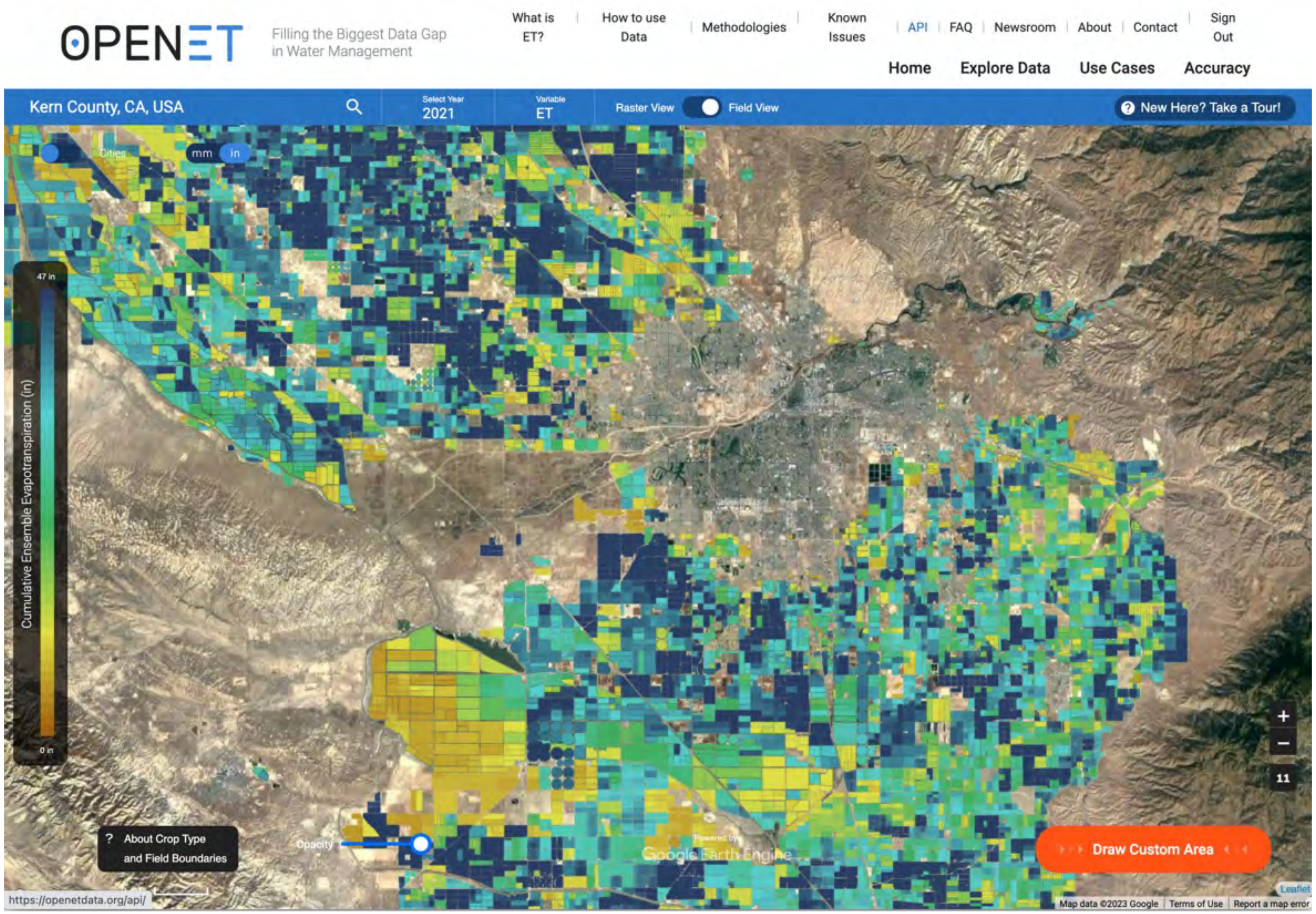

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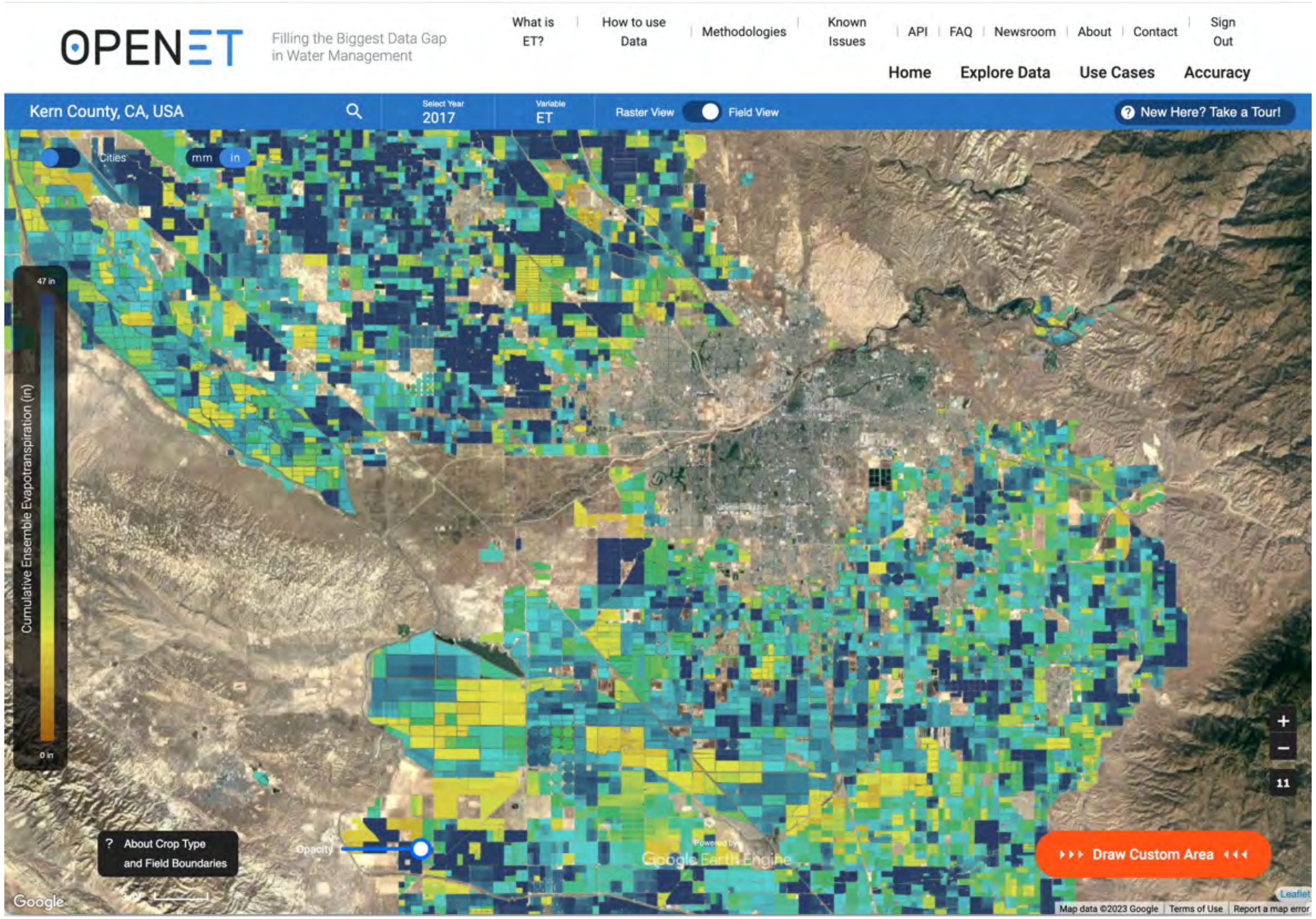

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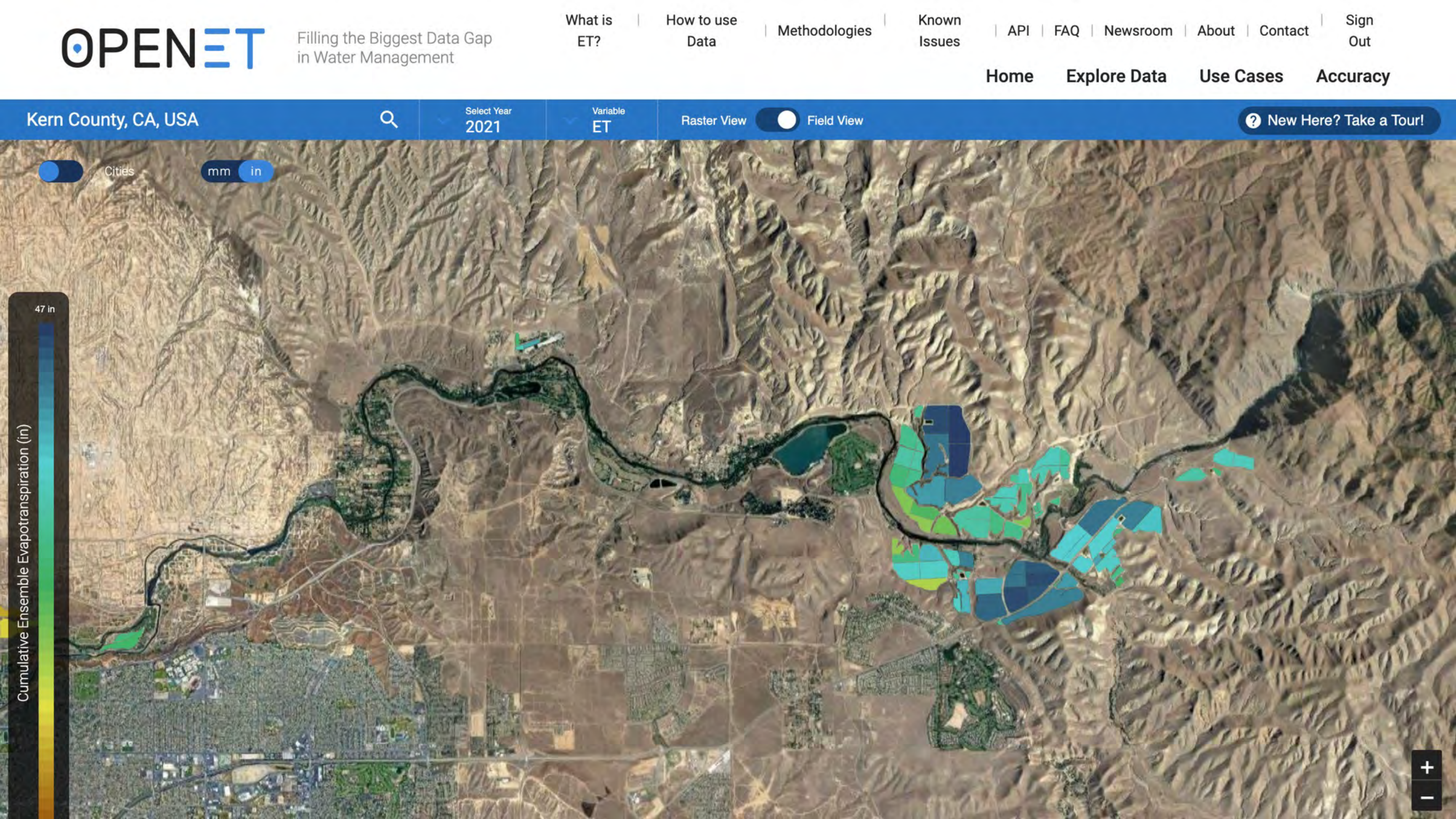
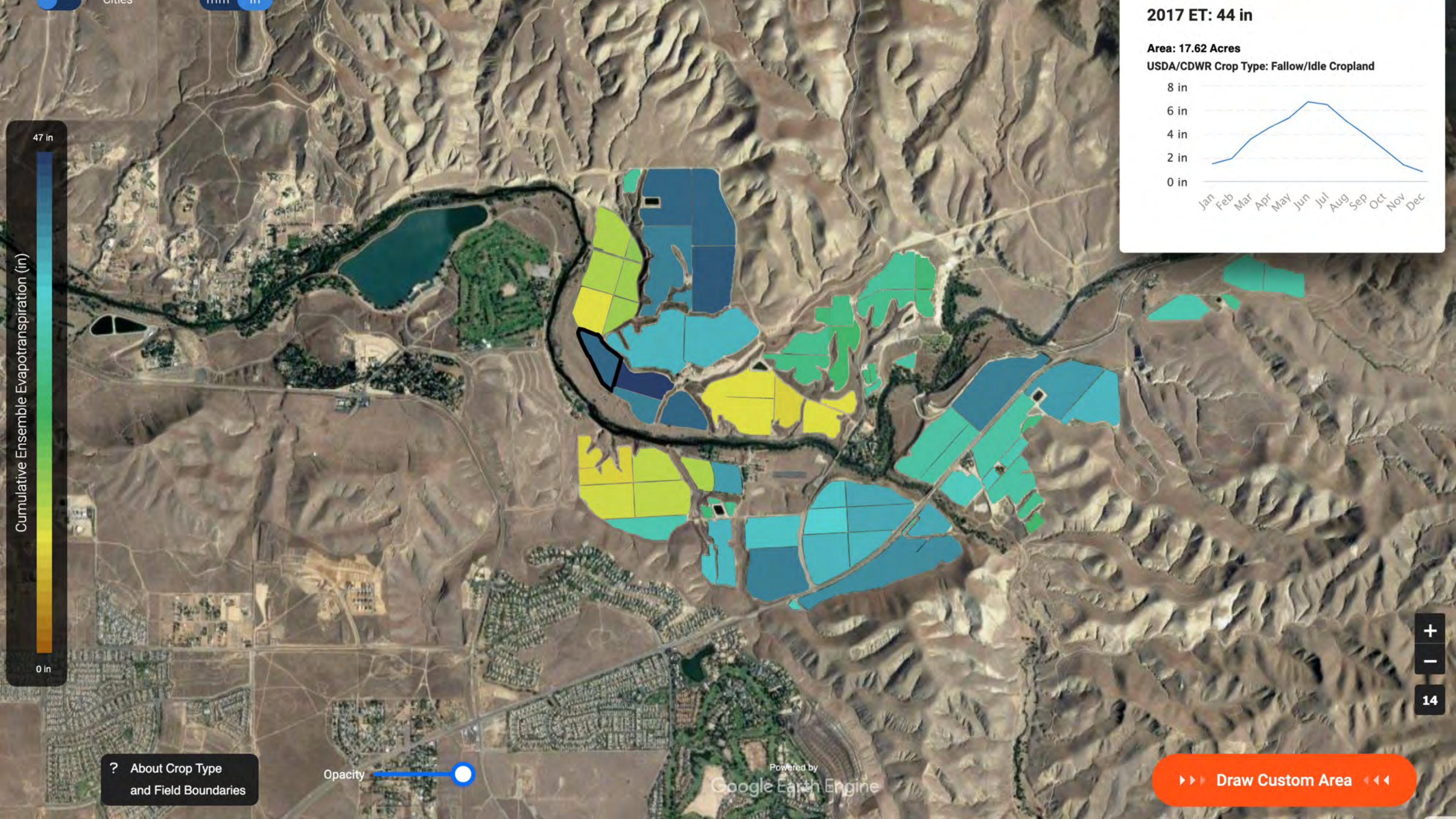
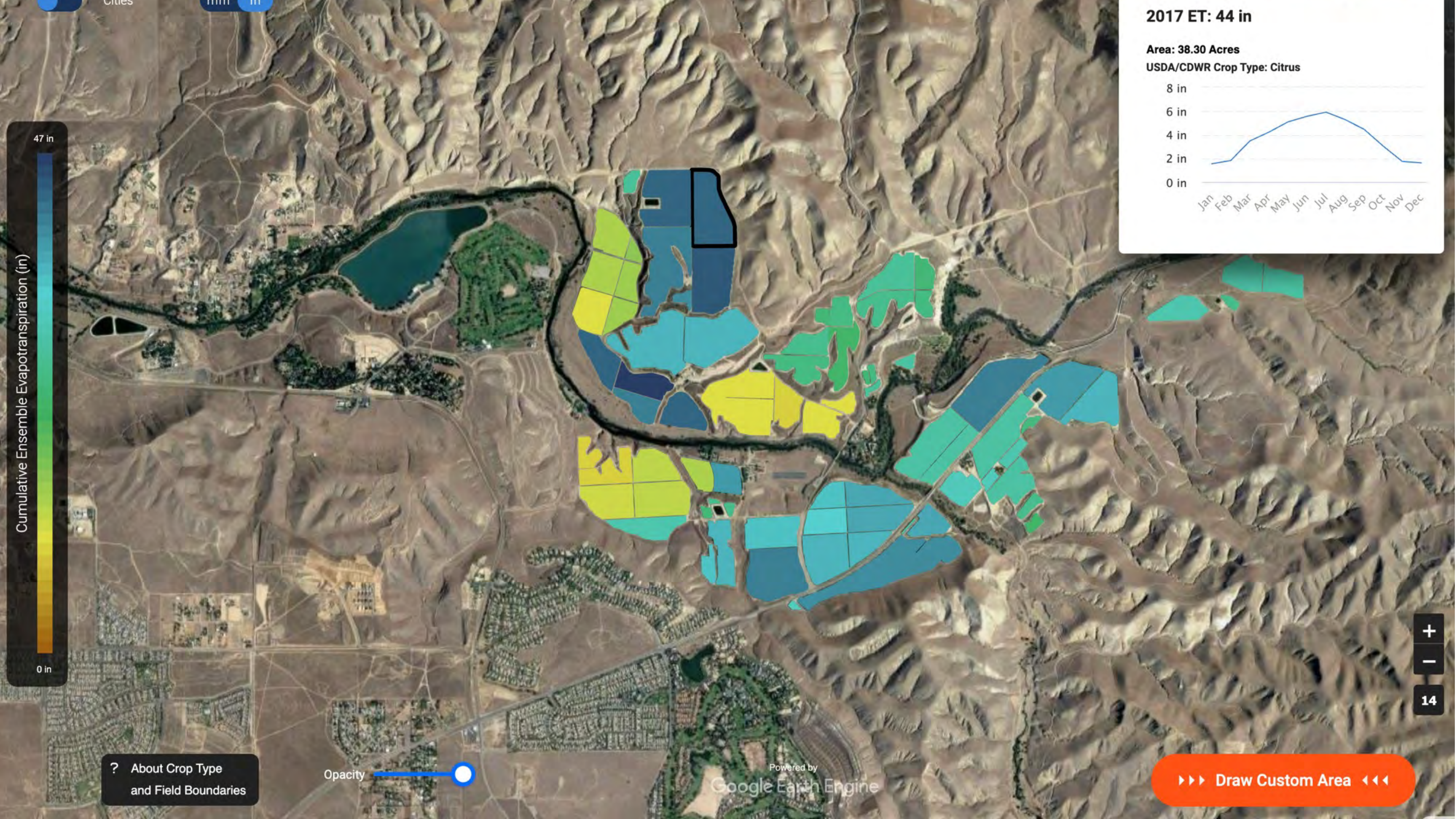
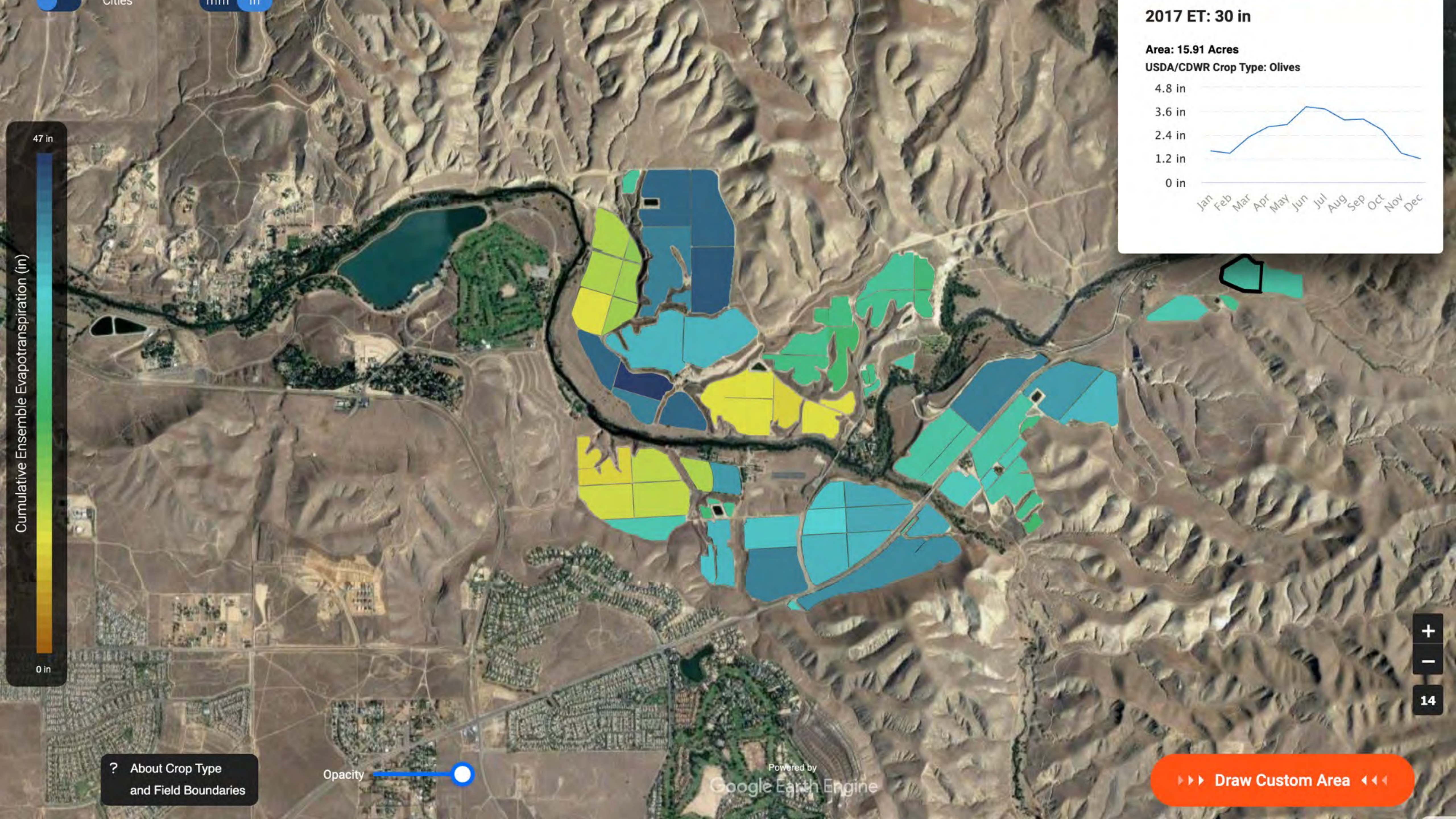

OPENET
Filling the Biggest Data Gap in Water Management
What is ET?
How to use Data
Methodologies
Known Issues
API
FAQ
Newsroom
About
Contact
Sign Out
Home
Explore Data
Use Cases
Accuracy
Kern County, CA, USA
Select Year
2021
Variable
ET
Raster View
Field View
New Here? Take a Tour!
Cities
mm
in
47 in
Cumulative Ensemble Evapotranspiration (in)



2017 ET: 44 in
Area: 17.62 Acres
USDA/CDWR Crop Type: Fallow/Idle Cropland
8 in
6 in
4 in
2 in
0 in
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
47 in
Cumulative Ensemble Evapotranspiration (in)
0 in
14
? About Crop Type and Field Boundaries
Opacity
Powered by Google Earth Engine
Draw Custom Area


2017 ET: 44 in
Area: 38.30 Acres
USDA/CDWR Crop Type: Citrus
8 in
6 in
4 in
2 in
0 in
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
47 in
Cumulative Ensemble Evapotranspiration (in)
0 in
14
? About Crop Type and Field Boundaries
Opacity
Powered by Google Earth Engine
Draw Custom Area


Cities
mm
in
2017 ET: 30 in
Area: 15.91 Acres
USDA/CDWR Crop Type: Olives
4.8 in
3.6 in
2.4 in
1.2 in
0 in
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
47 in
Cumulative Ensemble Evapotranspiration (in)
0 in
14
? About Crop Type and Field Boundaries
Opacity
Powered by Google Earth Engine
Draw Custom Area


47 in
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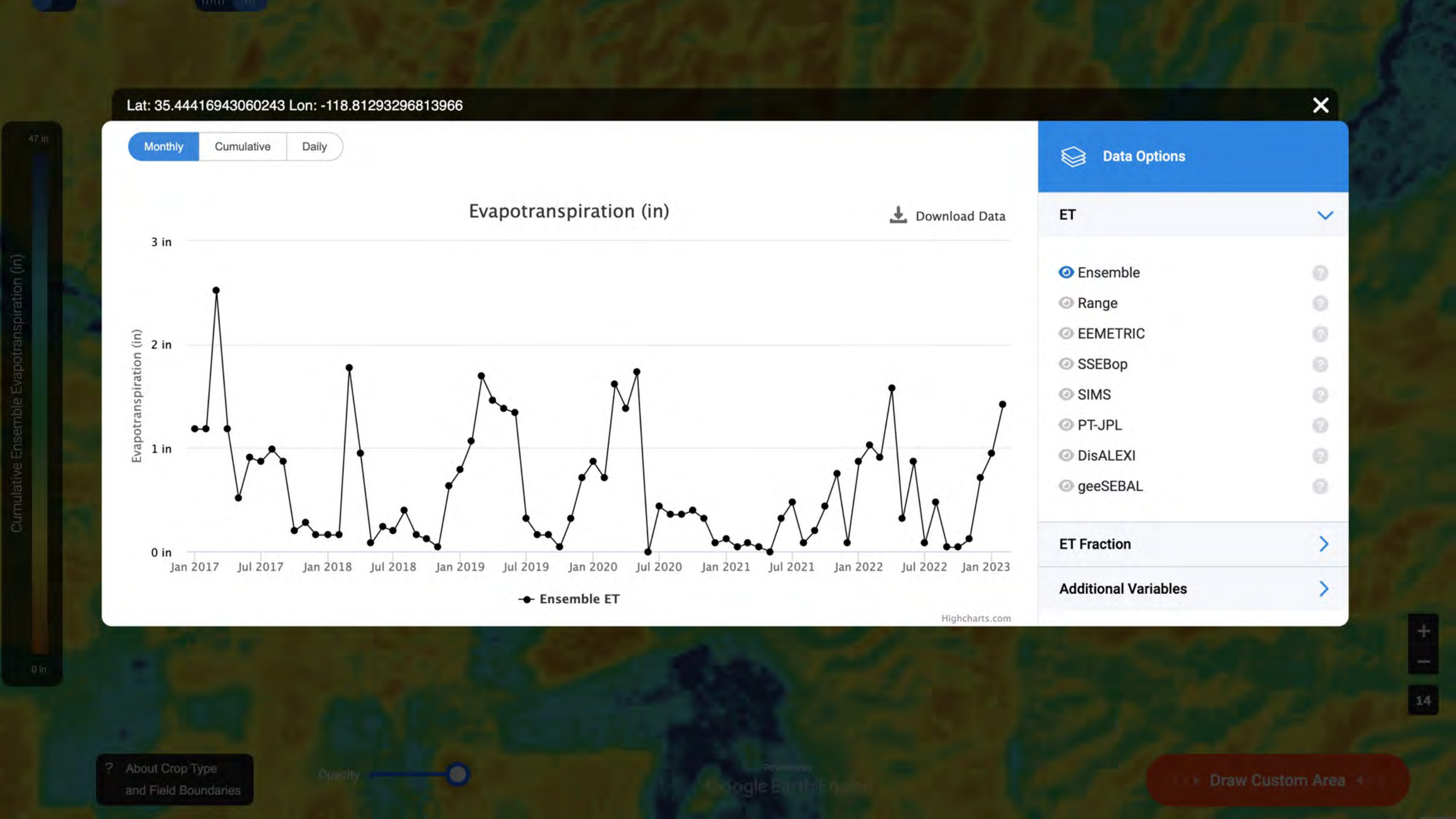
14



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El Niño Outlook

TOM CORRINGHAM → TOMC@UCSD.EDU

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EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

issued by
CLIMATE PREDICTION CENTER/NCEP/NWS

11 May 2023

ENSO Alert System Status: El Niño Watch

Synopsis: **A transition from ENSO-neutral is expected in the next couple of months, with a greater than 90% chance of El Niño persisting into the Northern Hemisphere winter.**

During April, above-average sea surface temperatures (SSTs) expanded slightly westward to the east-central equatorial Pacific Ocean [Fig. 1]. The latest weekly Niño-3.4 index value was +0.4°C, with the easternmost Niño-3 and Niño1+2 regions at +0.8°C and +2.7°C, respectively [Fig. 2]. Area-averaged subsurface temperatures anomalies continued to increase [Fig. 3], reflecting widespread positive temperature anomalies below the surface of the equatorial Pacific Ocean [Fig. 4]. Low-level wind anomalies were westerly during mid-April before switching back to easterly by the end of the month. Upper-level wind anomalies were westerly across most of the Pacific Ocean. Suppressed convection was observed over parts of Indonesia and anomalies weakened near the Date Line [Fig. 5]. While the warming near coastal South America remains striking, the basin-wide coupled ocean-atmosphere system remained consistent with ENSO-neutral.

The most recent IRI plume also indicates El Niño is likely to form during the May-July season and persist into the winter [Fig. 6]. The combination of a forecasted third westerly wind event in mid-late May, and high levels of above-average oceanic heat content, means that a potentially significant El Niño is on the horizon. While at least a weak El Niño is likely, the range of possibilities at the end of the year (November-January) include a 80% chance of at least a moderate El Niño (Niño-3.4 ≥ 1.0°C) to a ~55% chance of a strong El Niño (Niño-3.4 ≥ 1.5°C). It is still possible the tropical atmosphere does not couple with the ocean, and El Niño fails to materialize (5-10% chance). In summary, a transition from ENSO-neutral is expected in the next couple of months, with a greater than 90% chance of El Niño persisting into the Northern Hemisphere winter [Fig. 7].

This discussion is a consolidated effort of the National Oceanic and Atmospheric Administration (NOAA), NOAA's National Weather Service, and their funded institutions. Oceanic and atmospheric conditions are updated weekly on the Climate Prediction Center web site (El Niño/La Niña Current Conditions and Expert Discussions). Additional perspectives and analysis are also available in an ENSO blog. A probabilistic strength forecast is available here. The next ENSO Diagnostics Discussion is scheduled for 8 June 2023.

To receive an e-mail notification when the monthly ENSO Diagnostic Discussions are released, please send an e-mail message to: ncep.list.enso-update@noaa.gov.

https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/enso.shtml

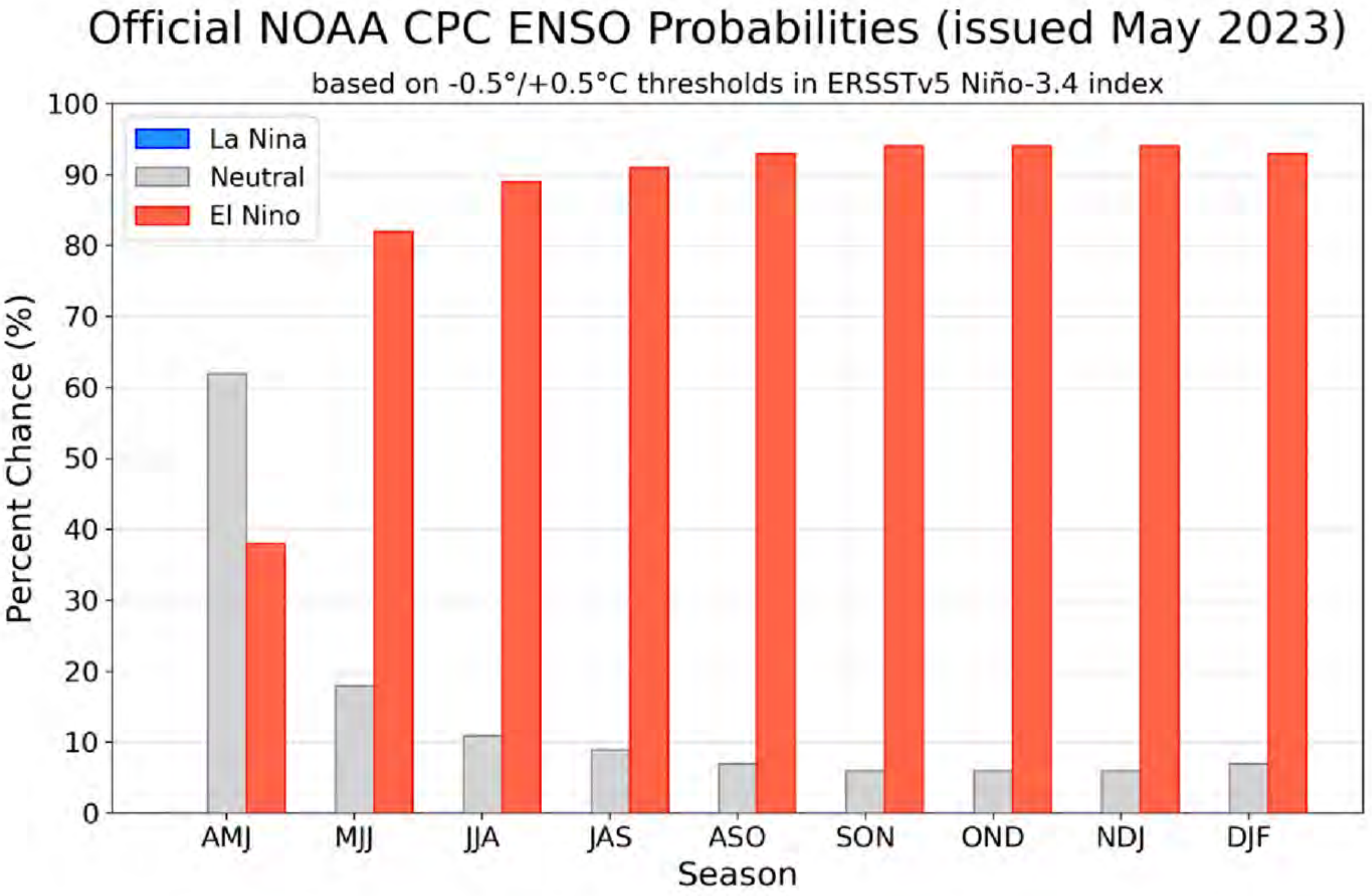
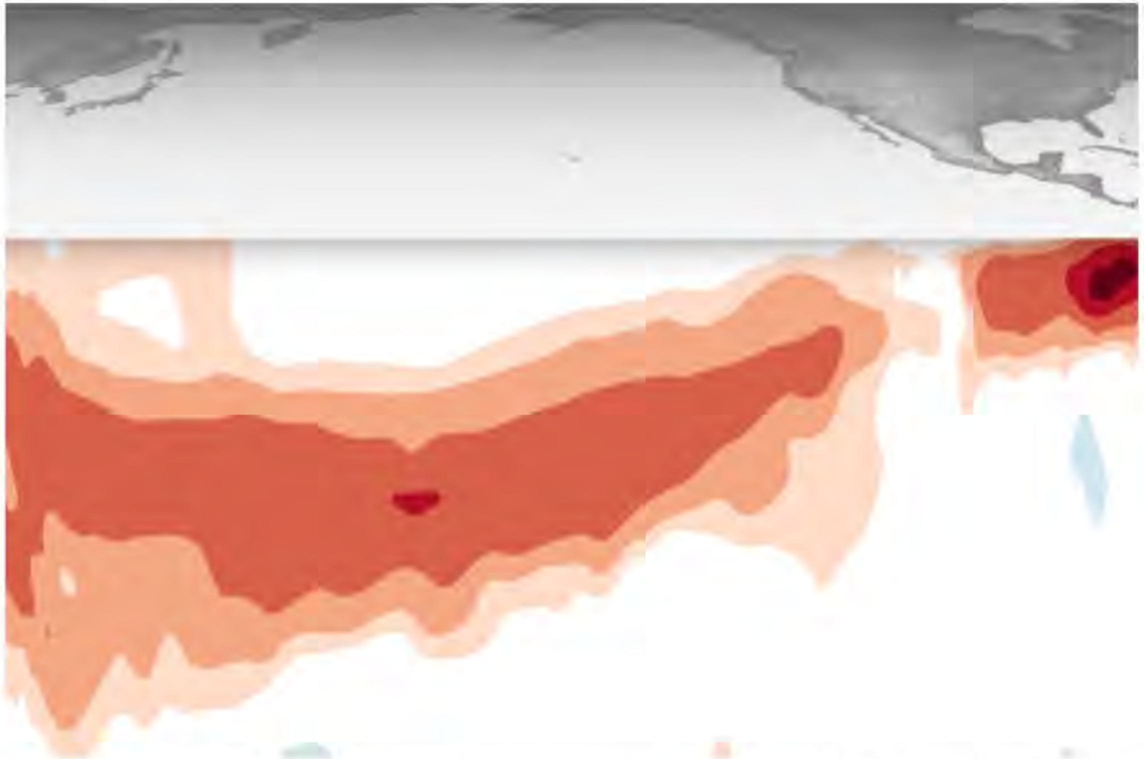


Figure 7. Official ENSO probabilities for the Niño 3.4 sea surface temperature index (5°N-5°S, 120°W-170°W). Figure updated 11 May 2023.

ENSO BLOG | APRIL 13, 2023 | COMMENTS: 58

April 2023 ENSO update: El Niño Watch

BY EMILY BECKER



Well, that was quick! Just two months ago I was writing about La Niña for what seemed like the 97th month in a row, and then by March La Niña had departed. Today we're hoisting an El Niño Watch, meaning that conditions are favorable for the development of El Niño conditions within the next 6 months. In fact, there's a 62% chance of El Niño conditions for the May–July period. Read on for the reasoning behind the outlook, thoughts about the potential strength of El Niño, and implications for global weather and climate. Let's run some numbers The March average sea surface temperature in the Niño-3.4 region, our primary monitoring region for ENSO (El Niño/Southern Oscillation, the whole El… Read article

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ENSO BLOG

A blog *mostly* about monitoring and forecasting El Niño, La Niña, and their regional and global impacts...but sometimes about other climate phenomena that influence seasonal climate.

DISCLAIMER

The ENSO blog is written, edited, and moderated by Michelle L'Heureux (NOAA Climate Prediction Center), Emily Becker (University of Miami/CIMAS), Nat Johnson (NOAA Geophysical Fluid Dynamics Laboratory), Tom DiLiberto (NOAA Office of Communications), and Rebecca Lindsey (contractor to NOAA Climate Program Office), with periodic guest contributors.

Ideas and explanations found in these posts should be attributed to the ENSO blog team, and not to NOAA (the agency) itself. These are blog posts, not official agency communications; if you quote from these posts or from the comments section, you should attribute the quoted material to the blogger or commenter, not to NOAA, CPC, or Climate.gov.

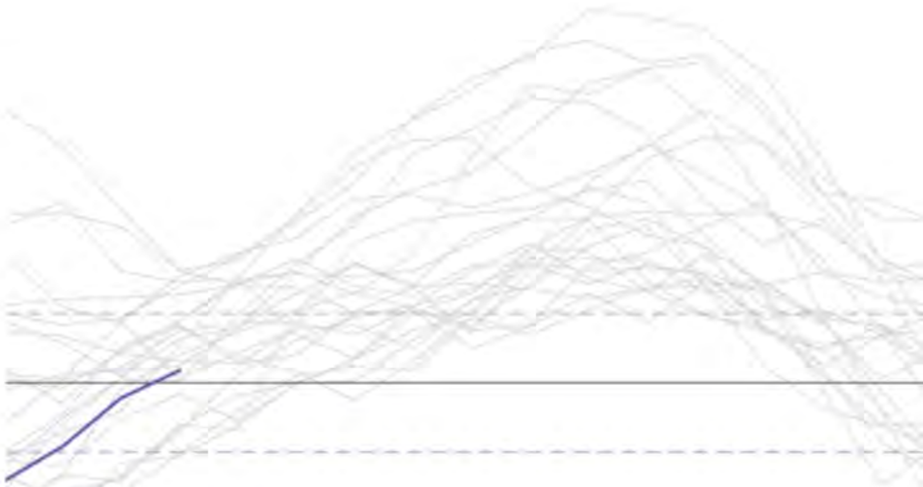
ENSO Blog

Sort by blog	Items per page	Sort by Date	
All Blogs	5	Descending	Apply

ENSO BLOG | MAY 11, 2023 | COMMENTS: 22

May 2023 ENSO update: El Niño knocking on the door

BY NAT JOHNSON



Drought Outlook

TOM CORRINGHAM → TOMC@UCSD.EDU

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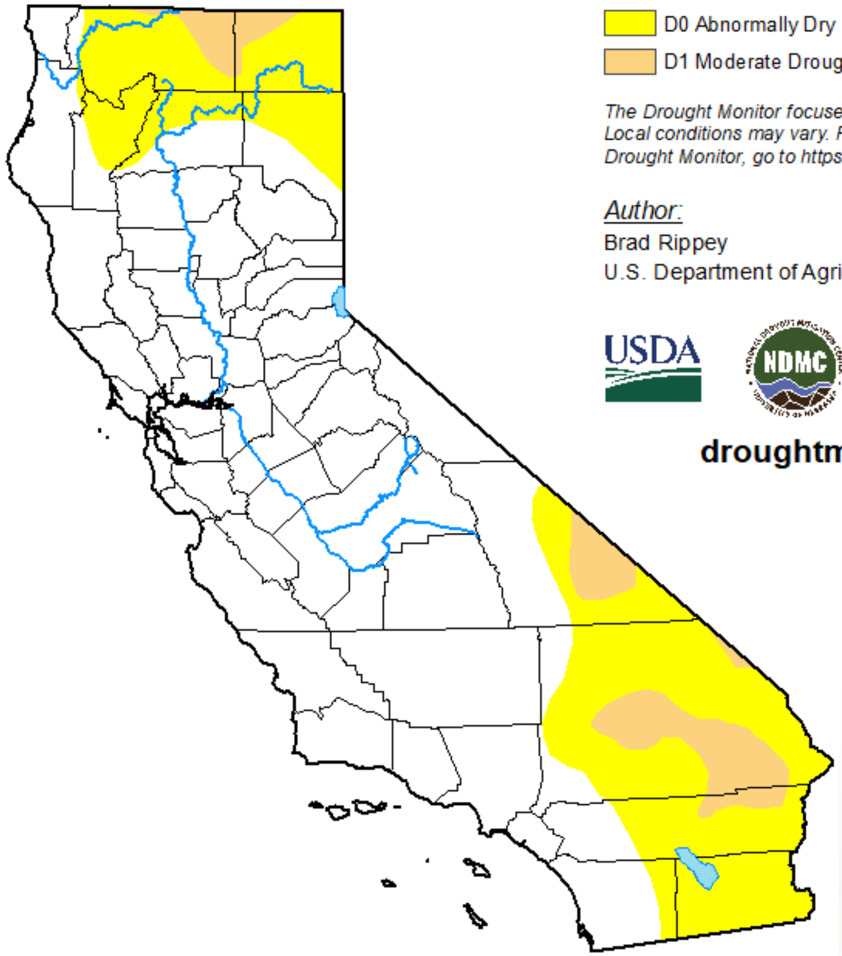

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:

Brad Rippey
U.S. Department of Agriculture

USDA NDMC NOAA

droughtmonitor.unl.edu

May 16, 2023

(Released Thursday, May. 18, 2023)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	68.02	31.98	5.95	0.00	0.00	0.00
Last Week *05-09-2023*	68.02	31.98	5.95	0.00	0.00	0.00
3 Months Ago *02-14-2023*	0.64	99.36	84.60	32.62	0.00	0.00
Start of Calendar Year *01-03-2023*	0.00	100.00	97.93	71.14	27.10	0.00
Start of Water Year *09-27-2022*	0.00	100.00	99.76	94.01	40.91	16.57
One Year Ago *05-17-2022*	0.00	100.00	99.86	95.14	59.81	0.18

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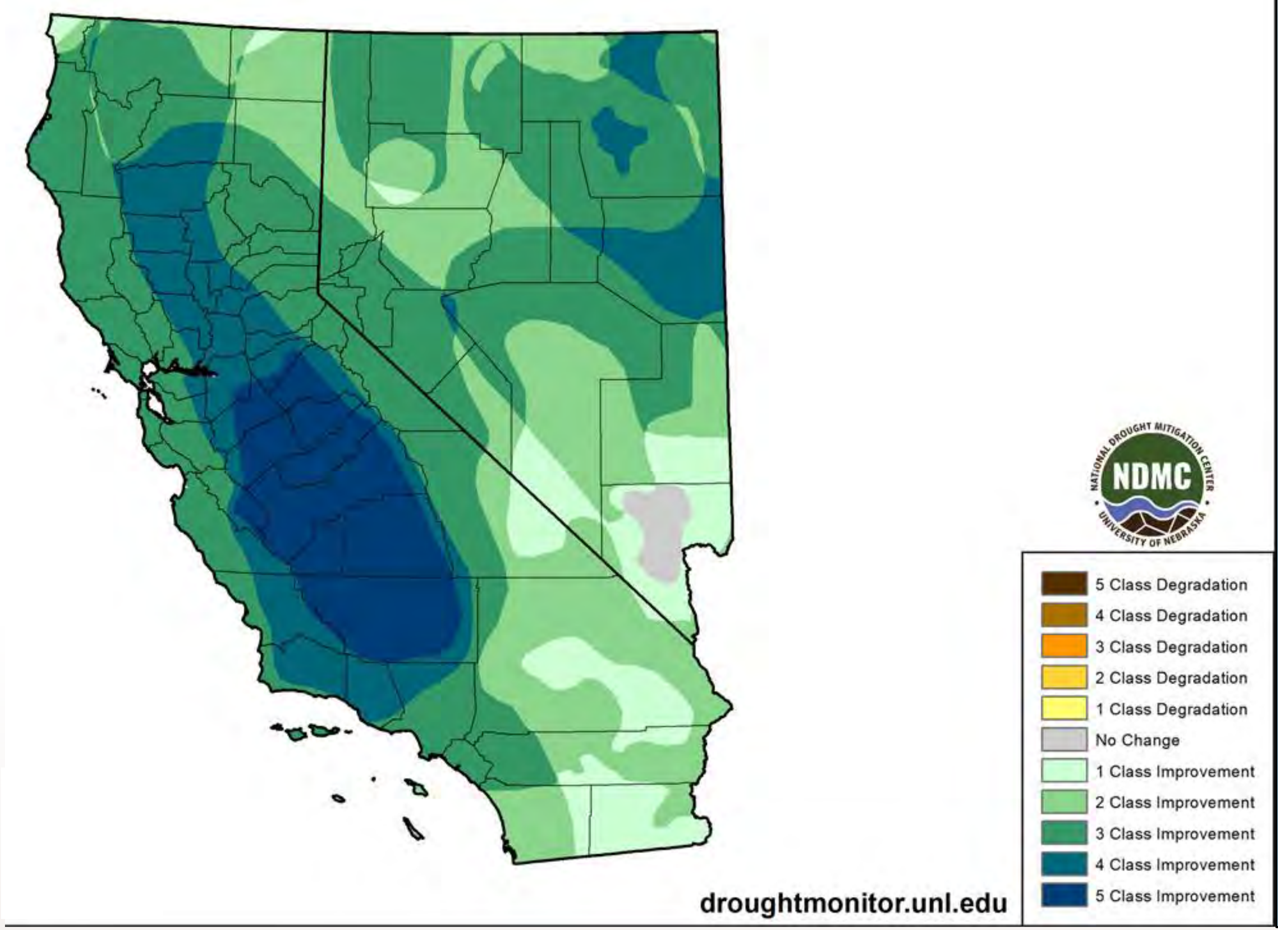

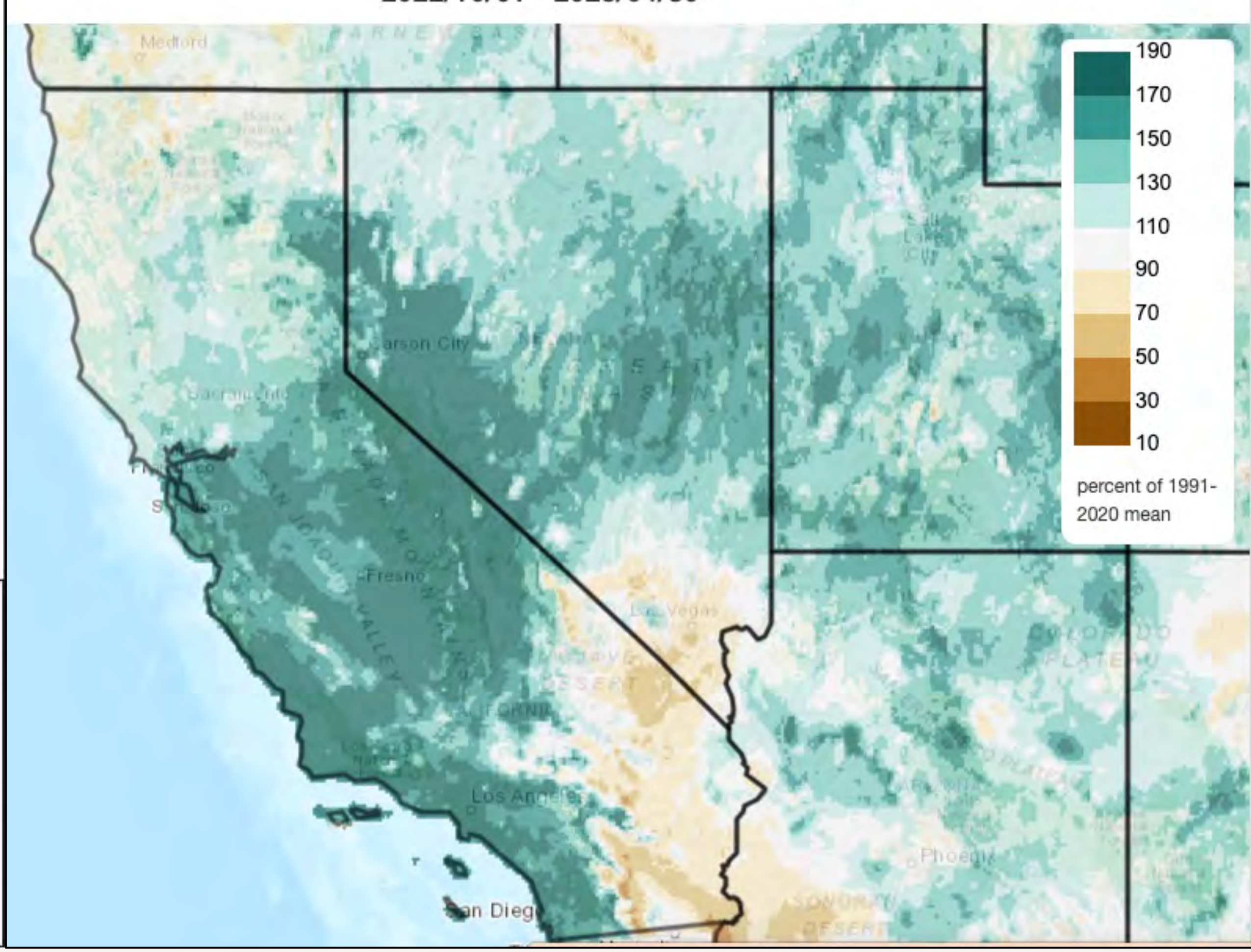

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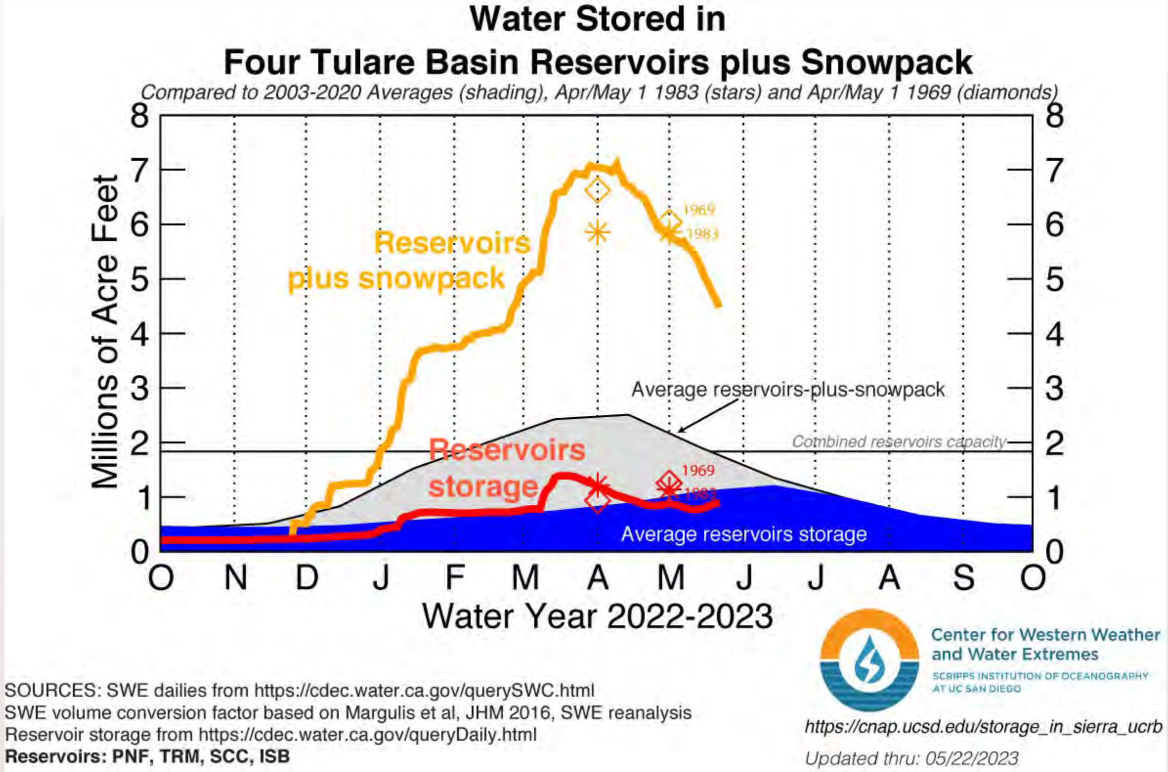
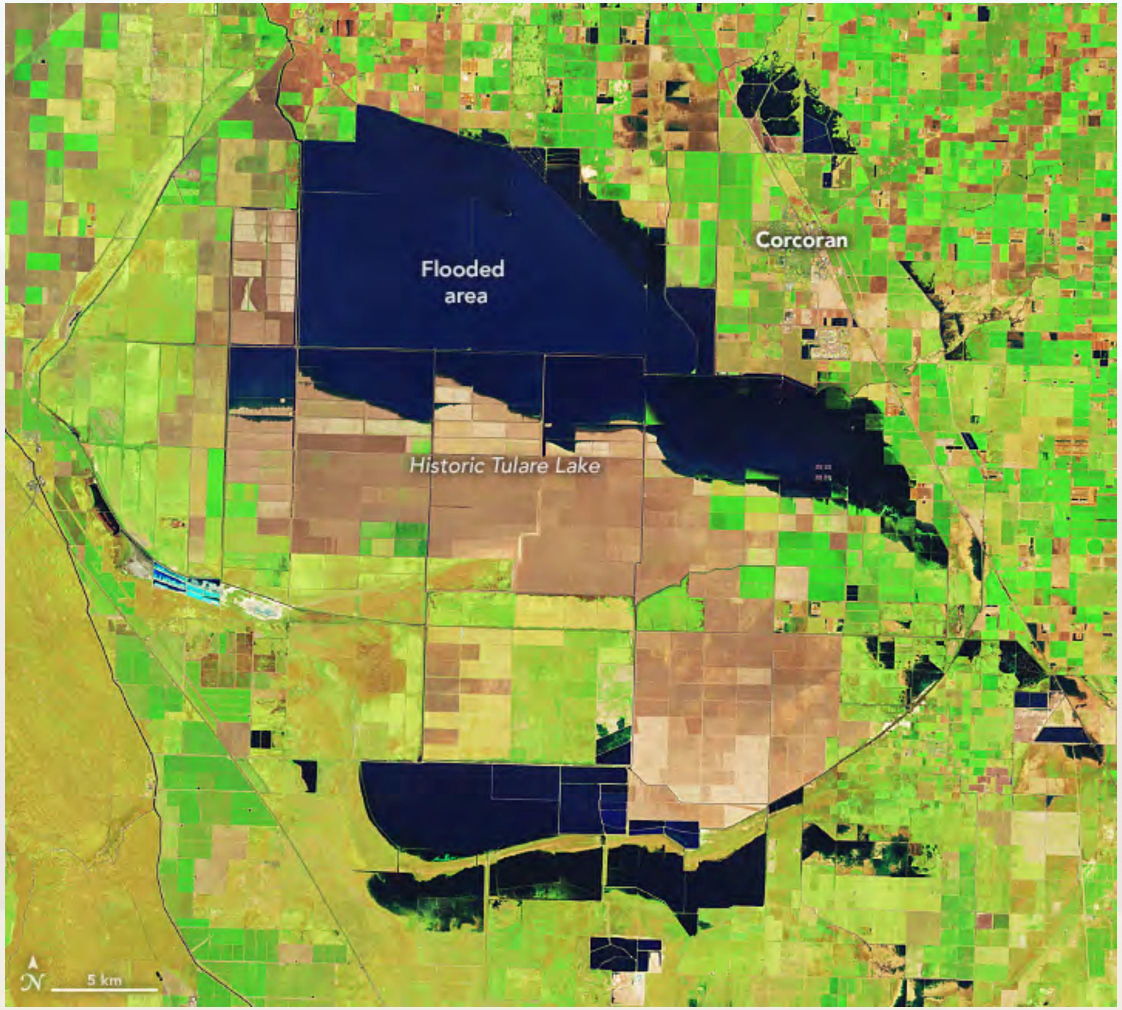
Tulare Lake





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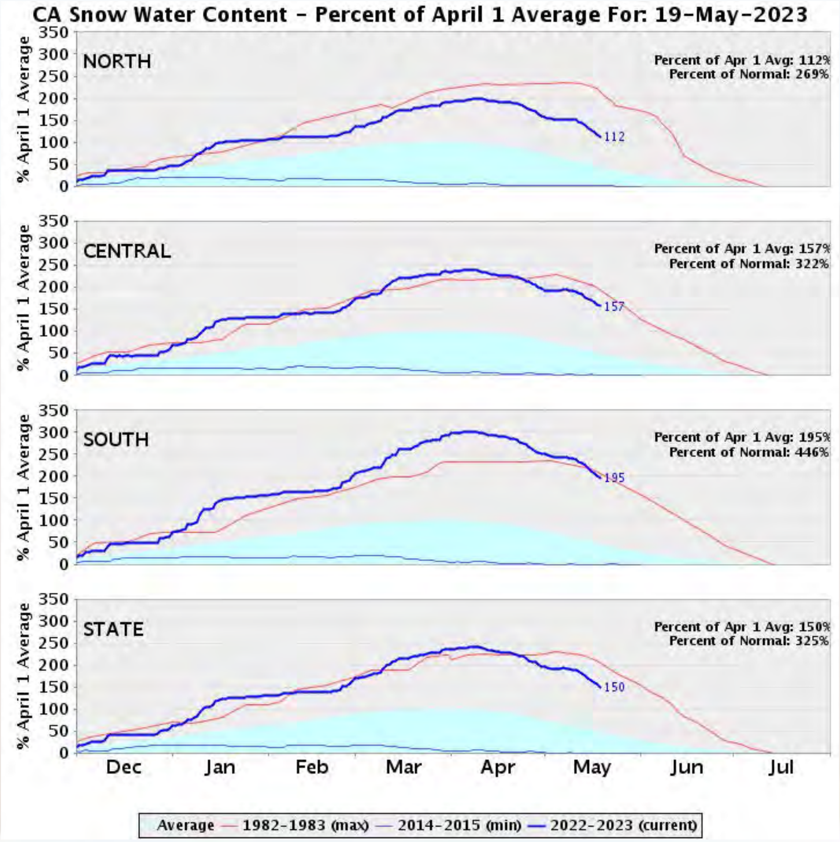
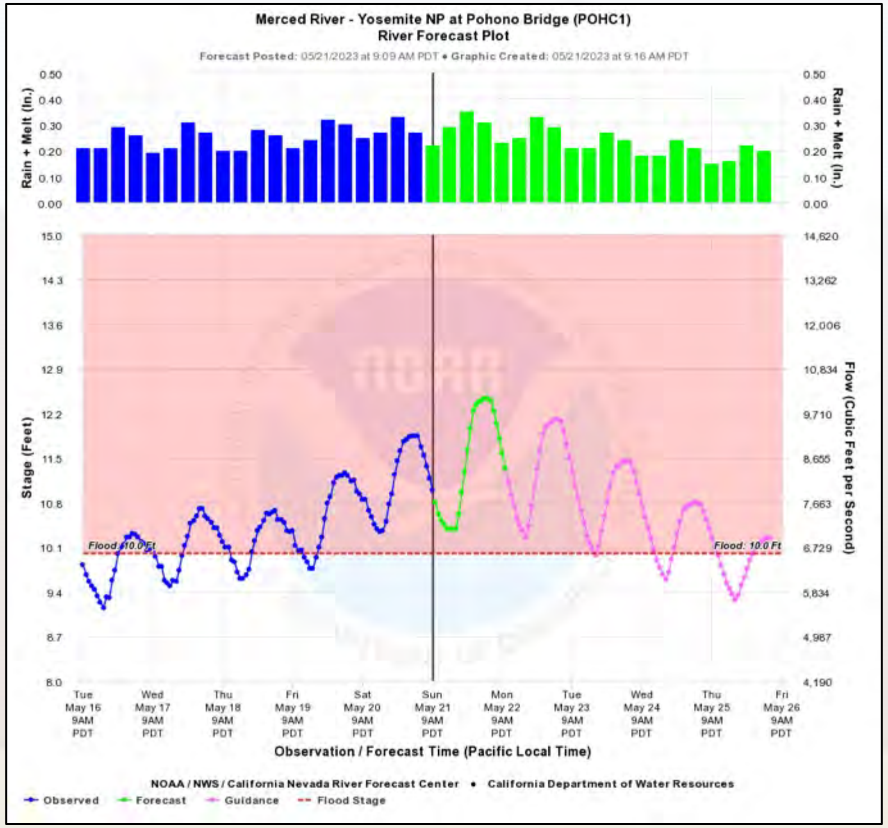
https://earthobservatory.nasa.gov/images/151284/tulare-lake-grows

Snow Melt Signals

cnrfc.noaa.gov





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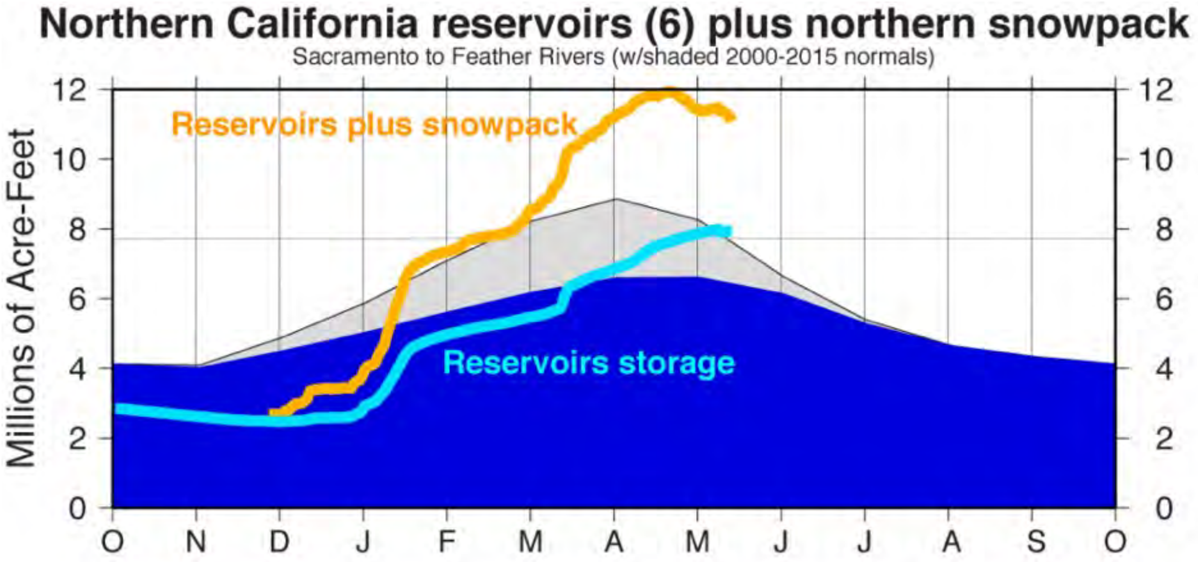
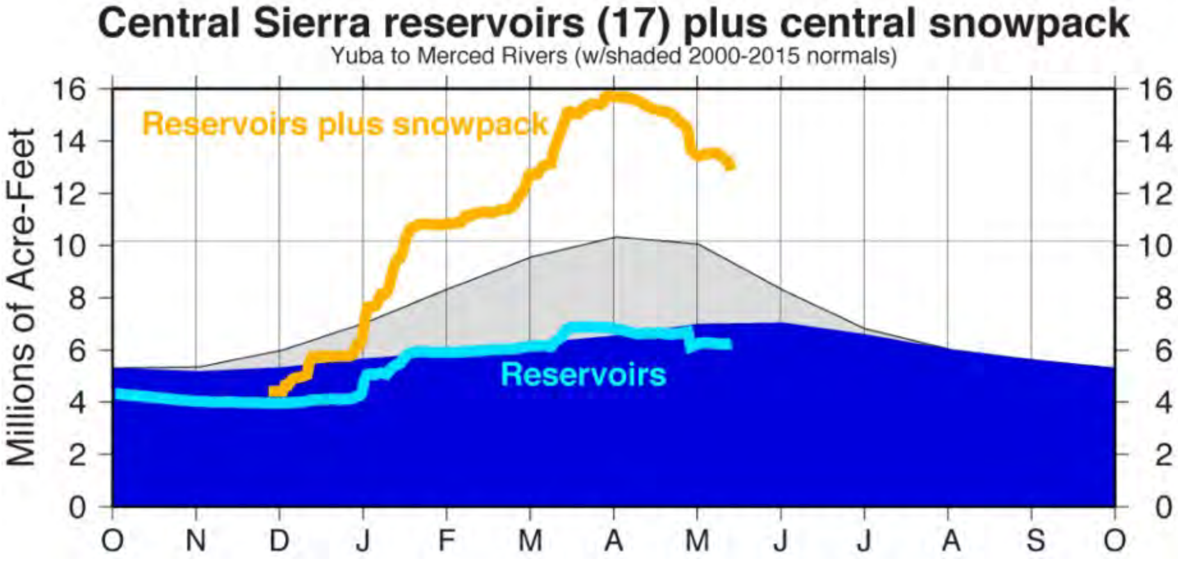
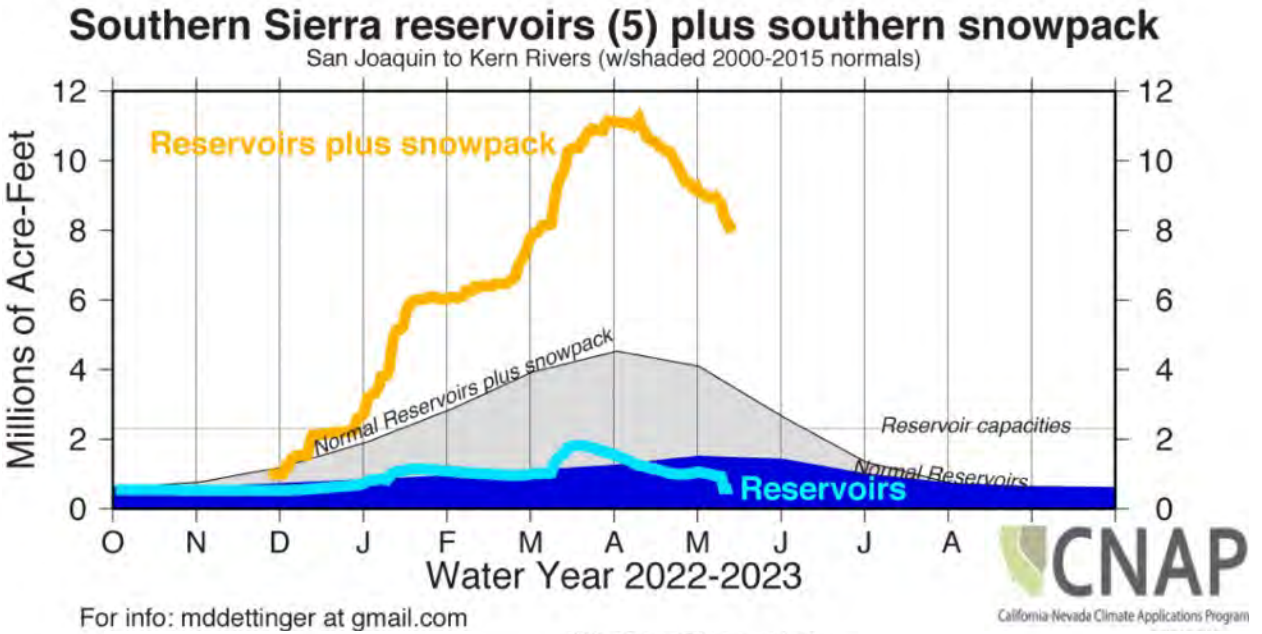
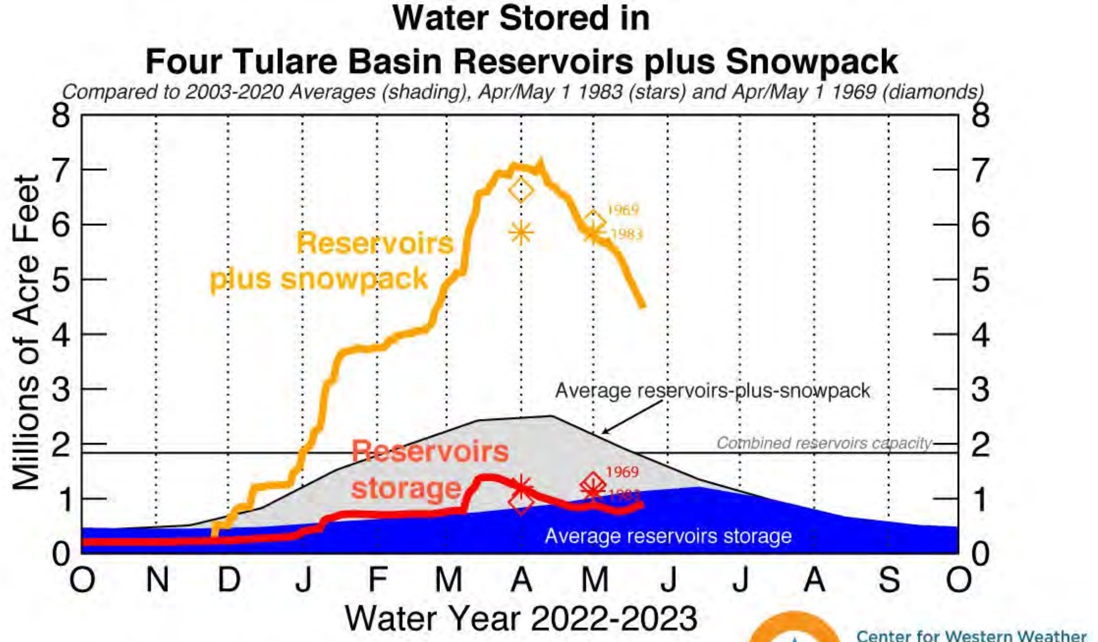
Snow Plus Reservoirs









SOURCES: SWE dailies from https://cdec.water.ca.gov/querySWC.html
SWE volume conversion factor based on Margulis et al, JHM 2016, SWE reanalysis
Reservoir storage from https://cdec.water.ca.gov/queryDaily.html
Reservoirs: PNF, TRM, SCC, ISB

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https://cnap.ucsd.edu/storage_in_sierra_ucrb
Updated thru: 05/22/2023

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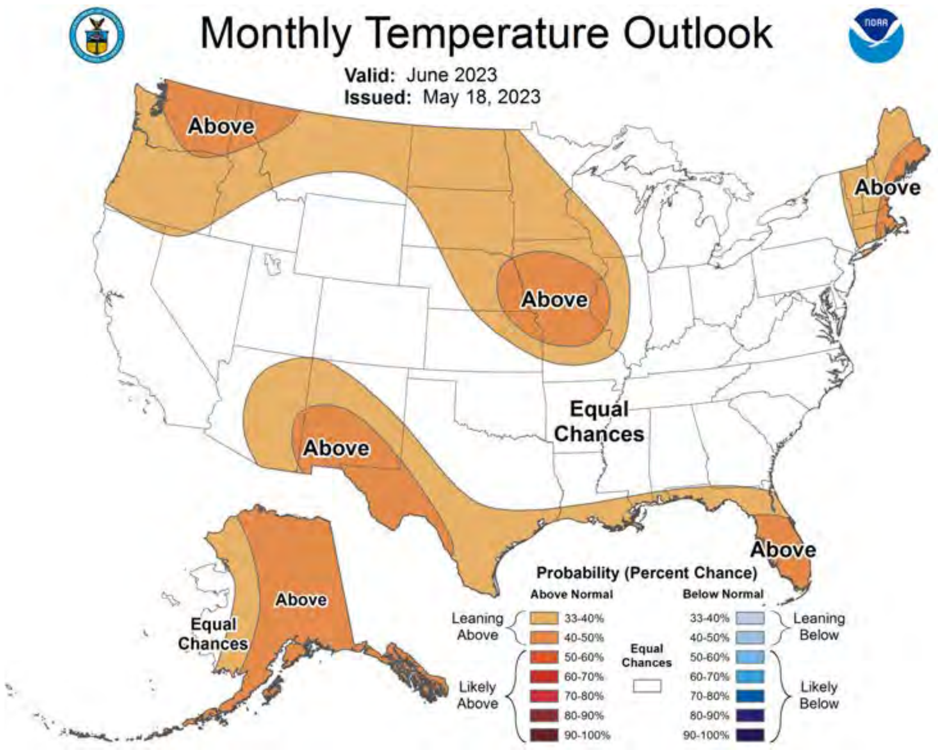
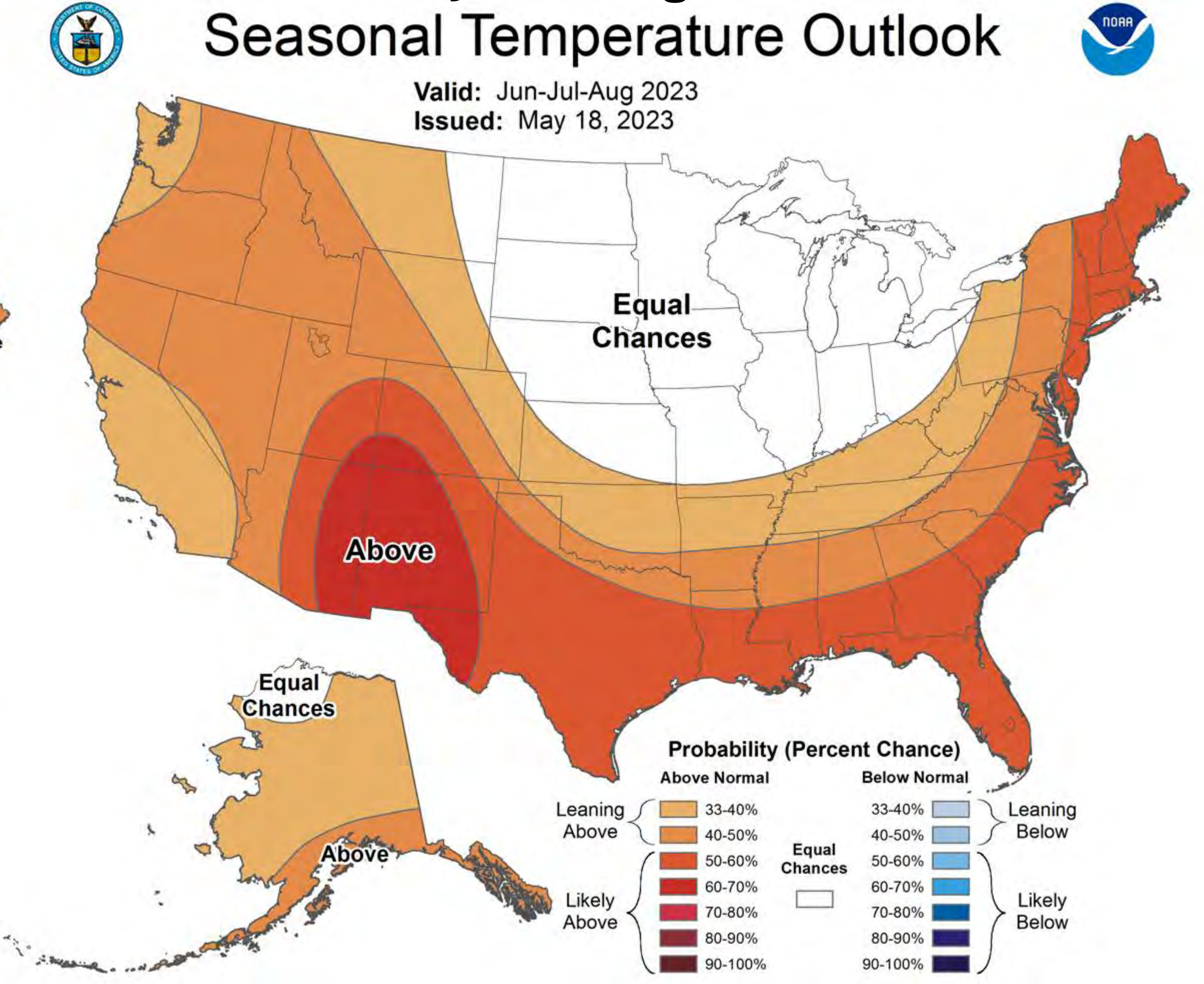
Temperature Forecast

June 2023



June - August 2023



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Thank you!

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The Climate Toolbox

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