Cal-Adapt and Resiliency Planning Efforts in California

NASEO/NGA State Summit on Energy Resilience & Funding

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California Energy Commission

Outline

- Early versions of Cal-Adapt: Uses and role in resilience policy & practice
- Critical needs to support energy sector resilience
- An expanded Cal-Adapt enterprise

Thanks to our research partners!

GEOSPATIAL INNOVATION FACILITY
Cutting-Edge Mapping Technology at UC Berkeley

Eagle Rock Analytics

UC San Diego | SCRIPPS INSTITUTION OF OCEANOGRAPHY

EARTH & ENVIRONMENTAL SCIENCES

Spatial Informatics Group

UCLA Center for Climate Science

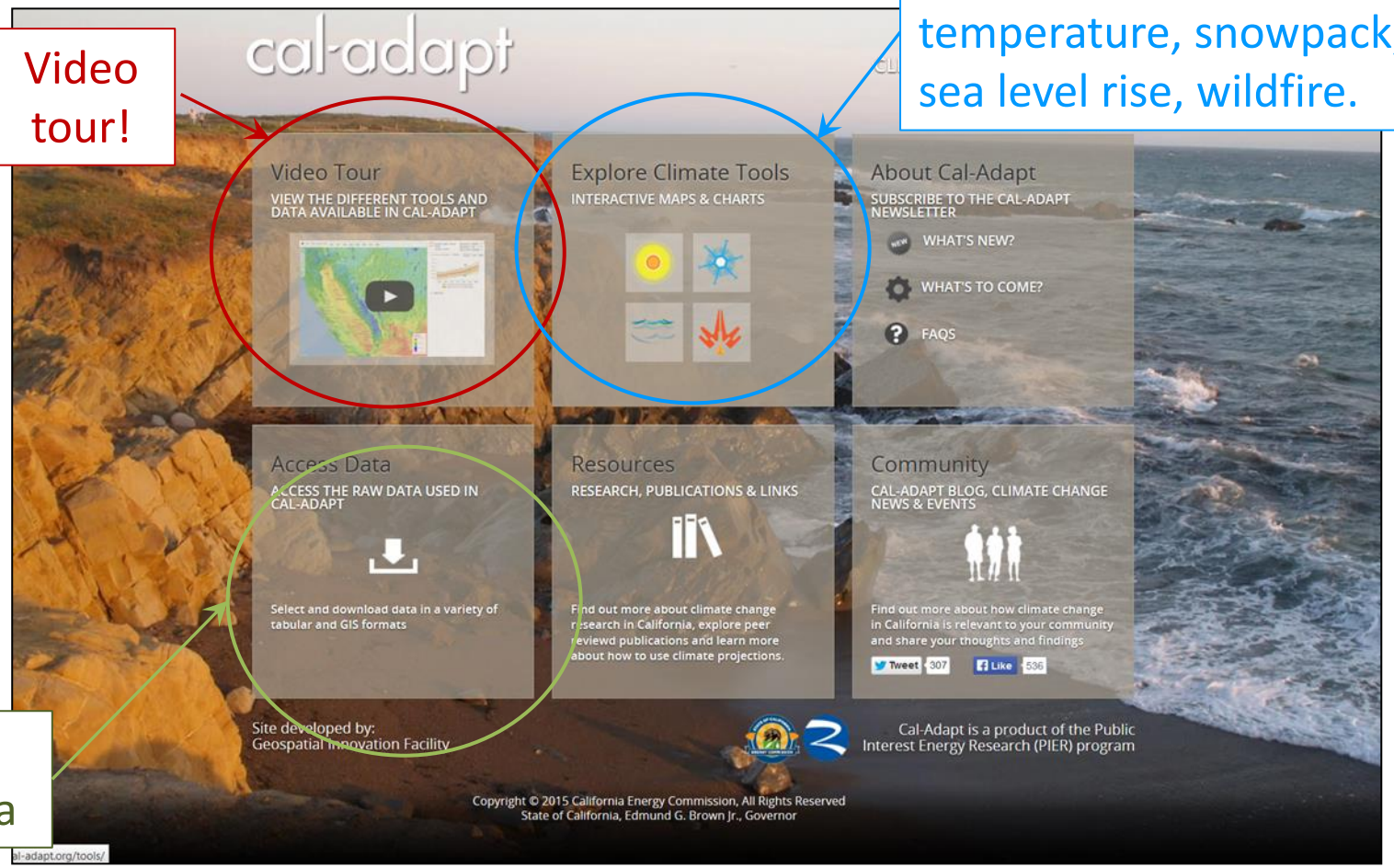
Cal-Adapt 1.0: Making regional climate projection data available

Released in 2011, as requested by then-Governor Schwarzenegger.

Three intended audiences:

- General public
- Practitioners of adaptation
- Scientific community

Cited by many adaptation plans.*



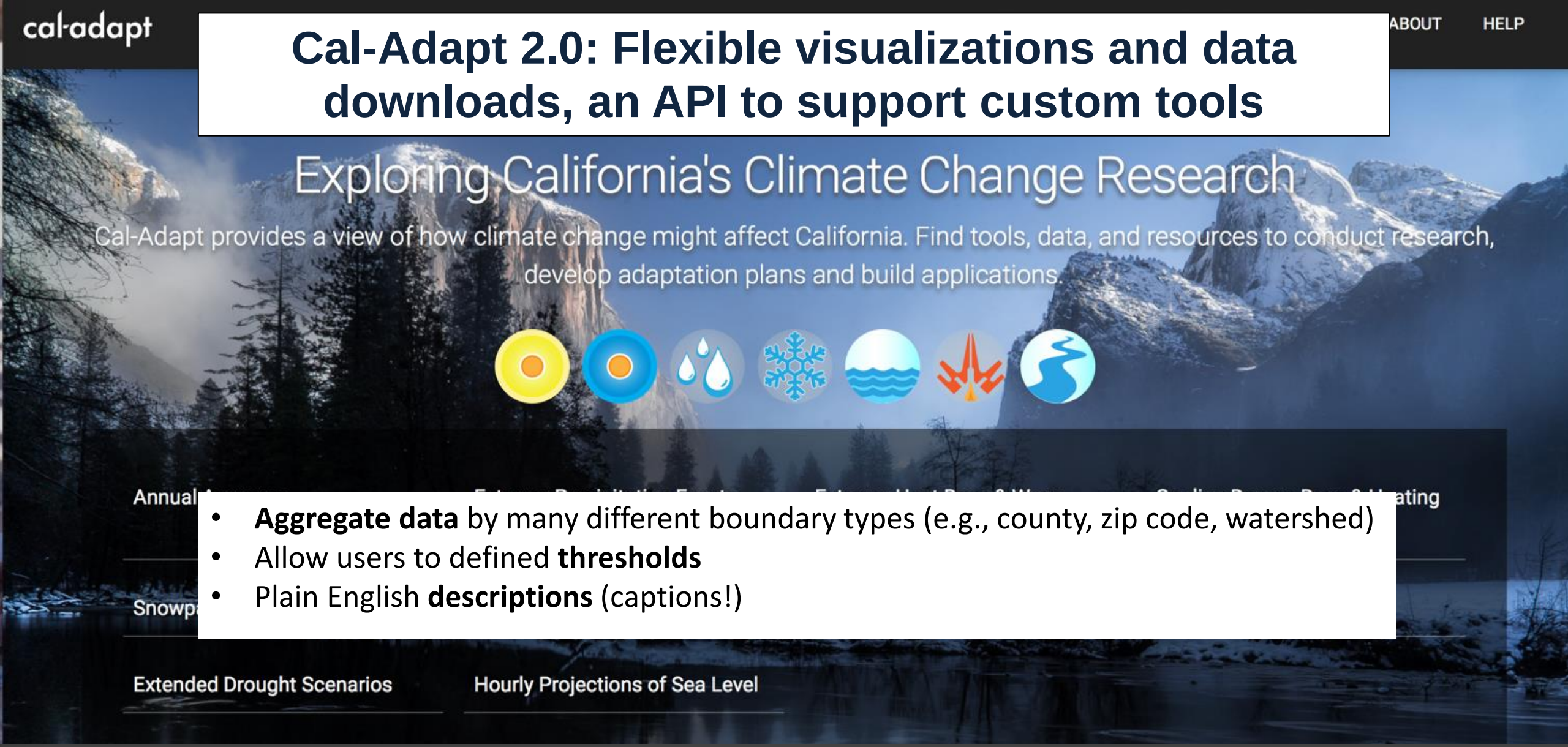
Video tour!

Tools for exploring temperature, snowpack, sea level rise, wildfire.

Access to primary data

* See, e.g., Santa Cruz Climate Adaptation Plan (2012), Sustainability Action Plan for Lake Tahoe (2012), Monterey Co. Hazard Mitigation Plan (2013).

Cal-Adapt 2.0: Flexible visualizations and data downloads, an API to support custom tools



- **Aggregate data** by many different boundary types (e.g., county, zip code, watershed)
- Allow users to defined **thresholds**
- Plain English **descriptions** (captions!)

New Tool

Data Download

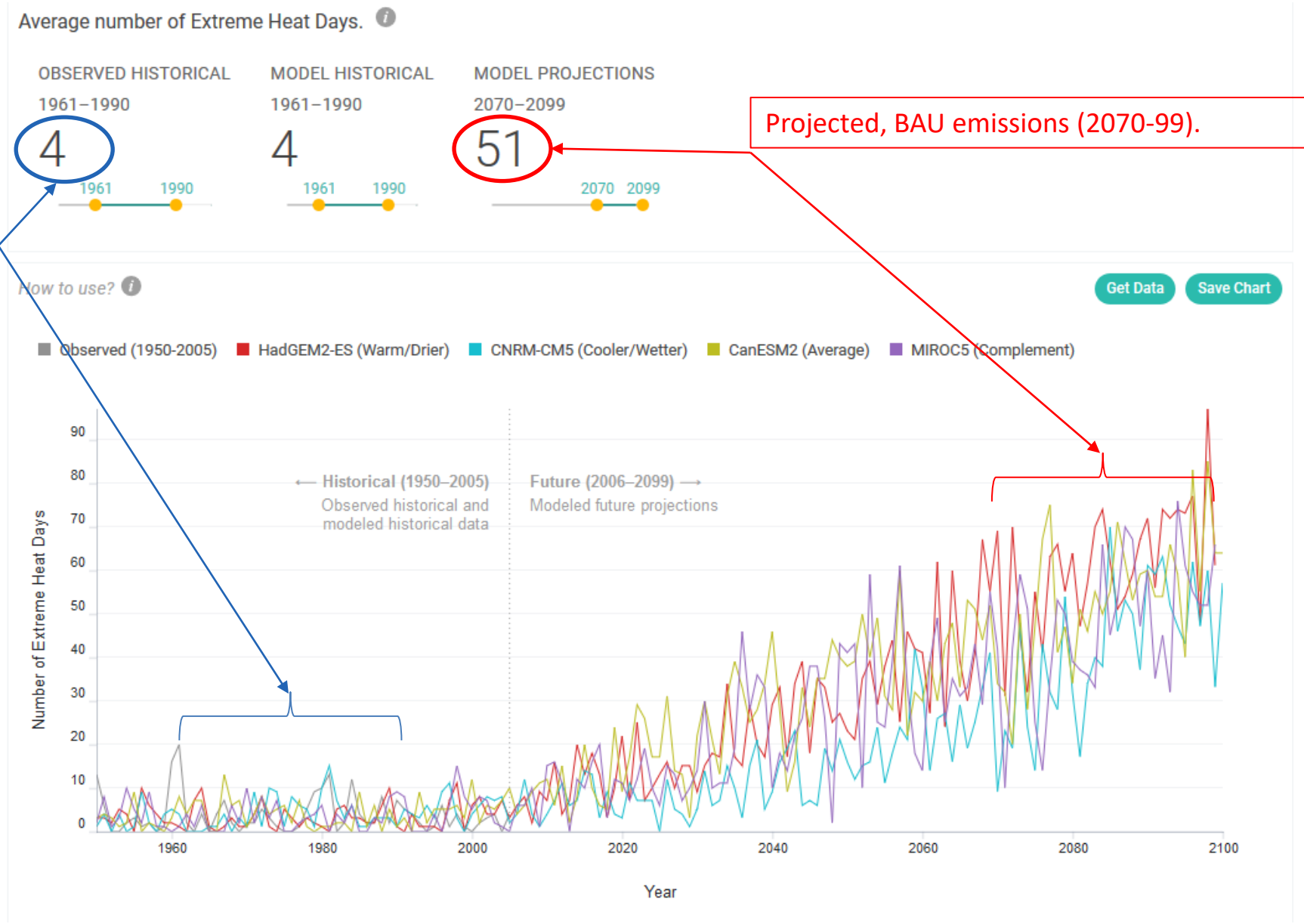
Search, select, subset, aggregate, and download climate data for a suite of projections

New Data

Wind Speed, Solar Radiation and Relative Humidity

LOCA downscaled data for daily wind speed, incoming solar radiation, minimum and

Projected annual number of extreme heat days in a Disadvantaged Community in Fresno



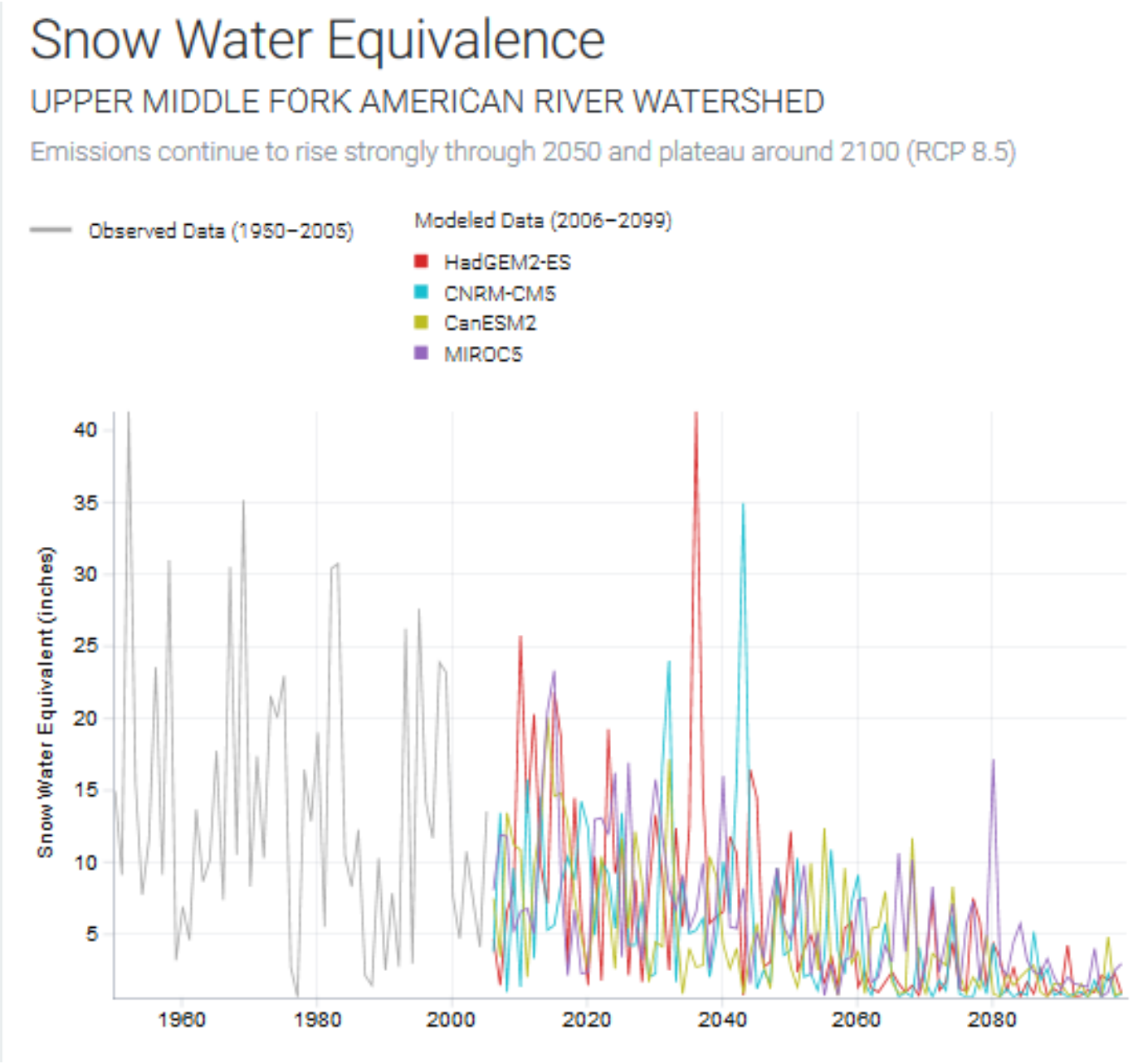
Historical (1961-1990)

Projected, BAU emissions (2070-99).

More than **10-fold increase in average annual number of very hot days** (*above 106.3 F*) in Fresno DAC.

Substantial Decline in End-of Century Snowpack: Upper Middle Fork of American River

Upper Middle Fork of American River Watershed: 75% to 93% decline in April snowpack by end of century (BAU scenario).



How has Cal-Adapt 2.0 been used?

Cal-Adapt has affected adaptation practice, policy, & planning in California.

- **Publicly available** and utilized by many stakeholders.
- **Recognized as a key resource** by legislation and guidance.
- **Supports climate policy** by providing a point-of-access for data adopted by the state.
- Provides a resource **used by government agencies**.
- **Investor-Owned Utilities** (IOUs) have used Cal-Adapt to support adaptation efforts (infrastructure design, siting).

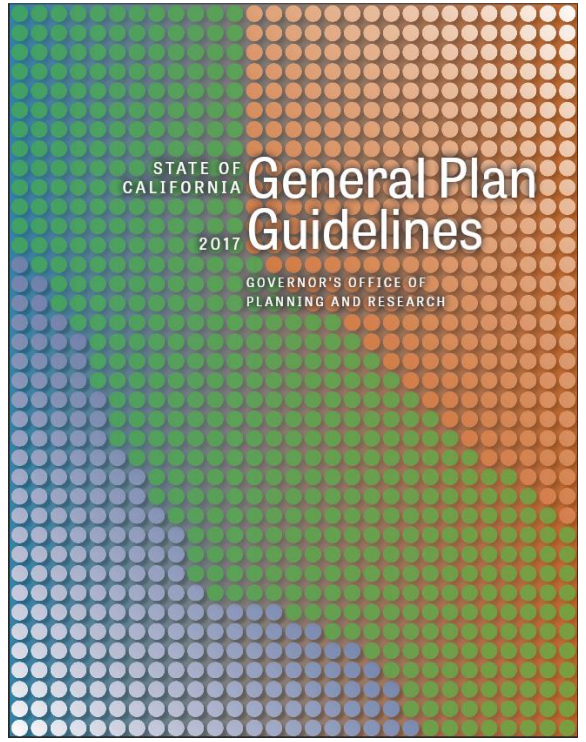


Figure: In 2017, California's Governor's Office of Planning and Research released updated General Planning Guidelines. Section 65302(g)(4) directs local governments to Cal-Adapt.

* Thomas, N., Mukhtyar, S., Galey, B., Kelly, M. (2018). (UC Berkeley). *Cal-Adapt: Linking Climate Science with Energy Sector Resilience and Practitioner Need*. California's Fourth Climate Change Assessment, California Energy Commission. Publication Number: CCCA4-CEC-2018-015.

Cal-Adapt as a Cornerstone of Energy Resilience Planning in California

CPUC's Decision on Phase 1 of Adaptation Rulemaking, issued Nov. 1, 2019*:

- Defines climate change adaptation for energy utilities in the state.
- Anchors acceptable data to California's Climate Change Assessments process, acknowledging the role of state in selecting recommended scenarios.
- Directs IOUs to Cal-Adapt as a source of data.
- Establishes criteria for acceptability of additional data or models.

Also sets expectations of climate data:

- "*Climate data should provide the geographical and temporal resolution required for the research or planning at hand.*" (p. 54)

* Decision 19-10-054, Rulemaking 18-04-019, Decision on Phase 1 Topics 1 and 2.
http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M319/K075/319075453.PDF

Transitioning to a Zero-Carbon Grid: Resilience Challenges and Opportunities

Challenges include:

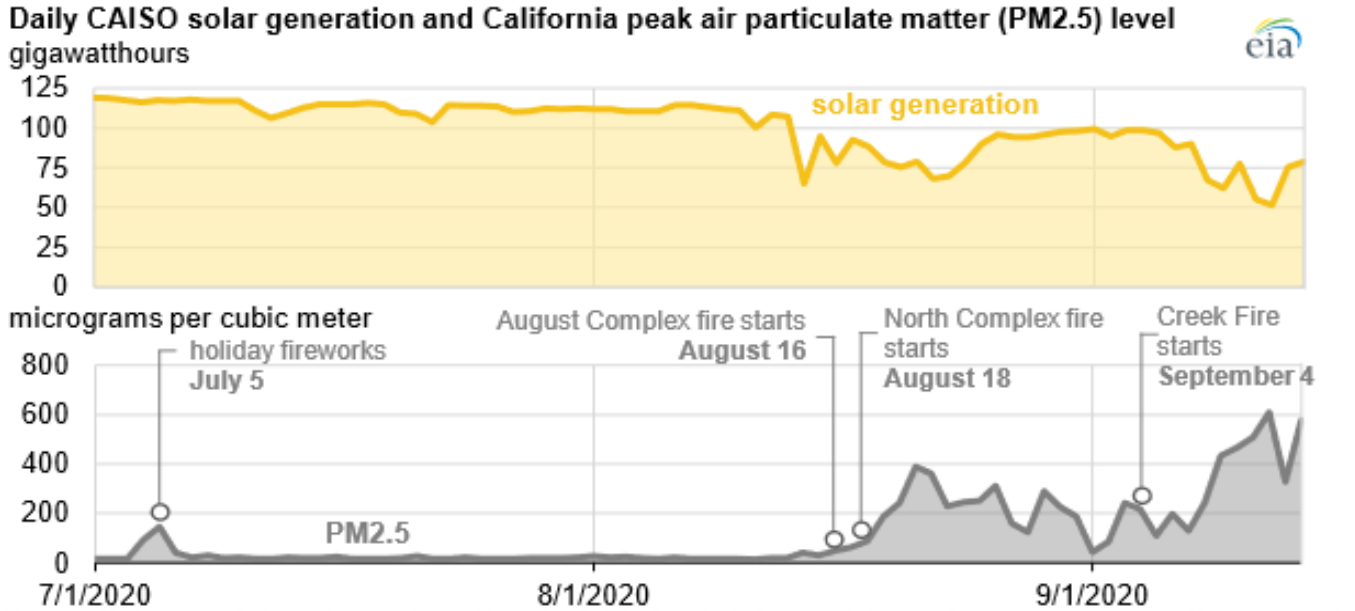
- Regional heat waves
- Attenuation of solar generation by smoke
- Wind “drought”
- Changing variability, timing, amount of hydroelectric resources
- Transforming data into actionable information that recognizes emerging relationships between climate, supply, and demand.

Opportunities:

- Incorporate resilience into grid in transition
- Prioritize investments in under-resourced communities

SEPTEMBER 30, 2020

Smoke from California wildfires decreases solar generation in CAISO



Source: U.S. Energy Information Administration, Hourly Electric Grid Monitor; California Air Resources Board, Air Quality and Meteorology System

Note: CAISO=California Independent System Operator.

CEC's Research Program Working to Address Critical Needs in Support of Energy Sector Resilience

Historical and projected data

- Higher-resolution data products (sub-daily, ca. 3 km by 3 km)
- Near real-time, quality-controlled historical data
- Open, transparent and reproducible data archive that provides a baseline reference product

Understanding and serving our stakeholders

- Vigorous, iterative stakeholder engagement (IOUs, CCAs, state agencies)
- Support for prioritization of resilience investments in Disadvantaged and Vulnerable Communities
- Guidance on selecting the right data and interpreting it
- Tractable set of recommended scenarios

Analytical support, including

- Computational resources and analytics to transform ~PB of data into model inputs, support for infrastructure investment and other decisions
- Probabilistic interpretations, including
  - Likelihood of extremes
  - Changing risks of compound events
  - Indicators of uncertainty, and how to deal with it

Key Elements of an Expanded Cal-Adapt Enterprise

Cal-Adapt.org
- Interactive, easy-to-use web application
- Designed for ~ 10 Tb data

Local governments and less technical users rely on an easy-to-use, interactive web application, the *front end*.

Next Generation Climate Projections
- Higher resolution
- Parameters of importance to a zero-carbon, high-renewable grid

Analytics Engine ***Analytics.Cal-Adapt.org (2022)***
- ~ 1 Pb data (*historical, near-real time, projected*)
- Analytics to transform climate and weather data into model inputs, decision support for infrastructure investment, etc.

Ongoing CEC-funded R&D efforts to develop next-generation projections and analytics engine to deliver data in stakeholder-informed ways. Responsive to IOU needs, CPUC's adaptation rulemaking.

See Docket Number: 19-ERDD-01, TN Number: 239123, "Follow-up on Staff Workshop Regarding Research to Support a Climate-Resilient Transition to a Clean Electricity System"
https://efiling.energy.ca.gov/GetDocument.aspx?tn=239123&DocumentContentId=72578

Invitation to Engage

Your Input Helps Shape Funding Opportunities and Resilience Research:

- Wednesday August 4th: EPIC 4 Investment Planning Workshop https://www.energy.ca.gov/event/workshop/2021-08/electric-program-investment-charge-2021-2025-investment-plan-scoping-draft
- September 27-28th (tentative): Workshop on Climate Data, Scenarios and Data Servicing for the Electricity Sector (hosted by Eagle Rock Analytics)
- Forthcoming solicitation ($3M): Research to Support a Climate-Resilient Transition to a Clean Electricity System https://www.energy.ca.gov/event/workshop/2021-03/staff-workshop-research-support-climate-resilient-transition-clean

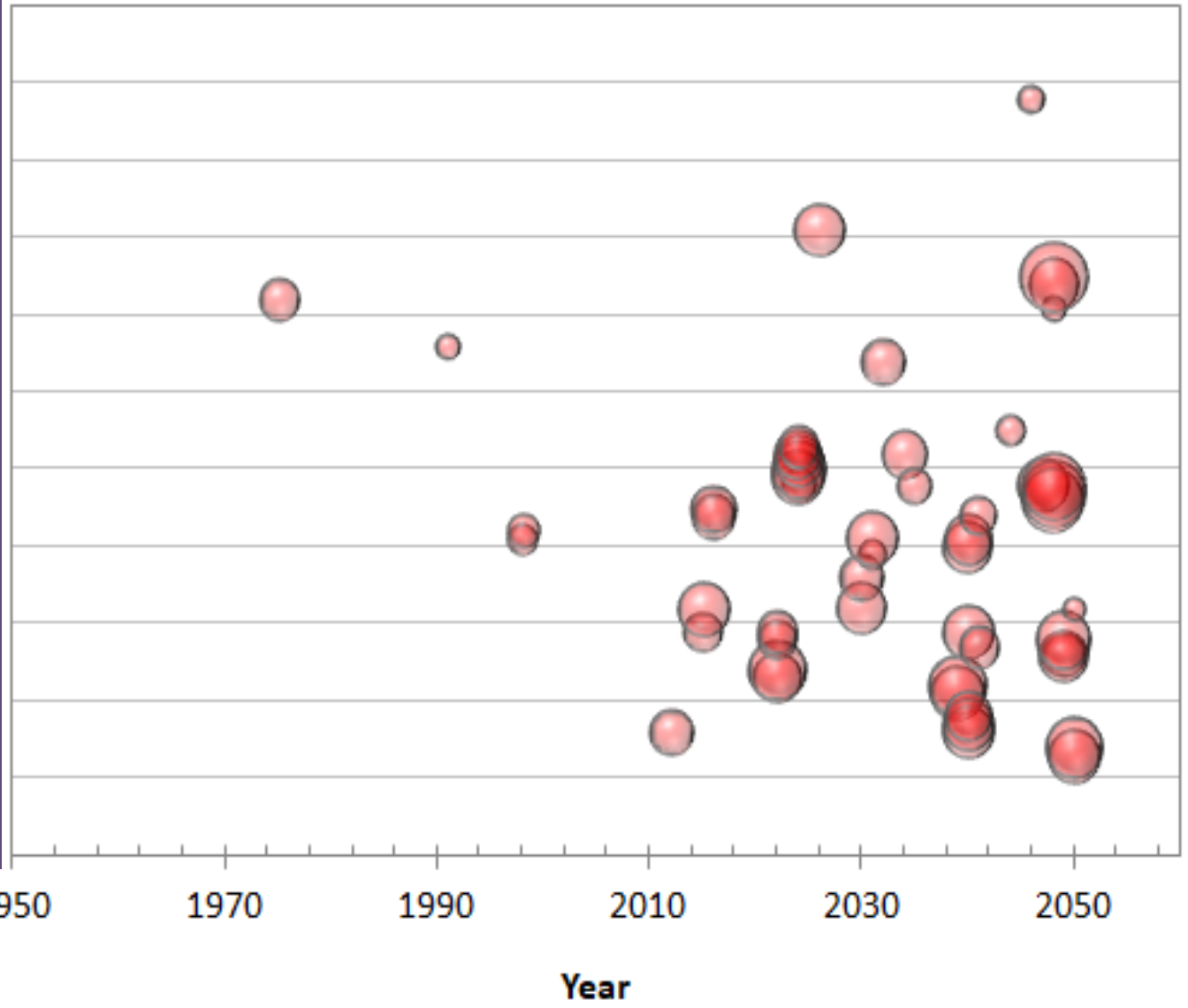
Questions? ***Susan Fischer Wilhelm,*** susan.wilhelm@energy.ca.gov, *916.776.0824*

Extras

Example: Statewide Heat Waves

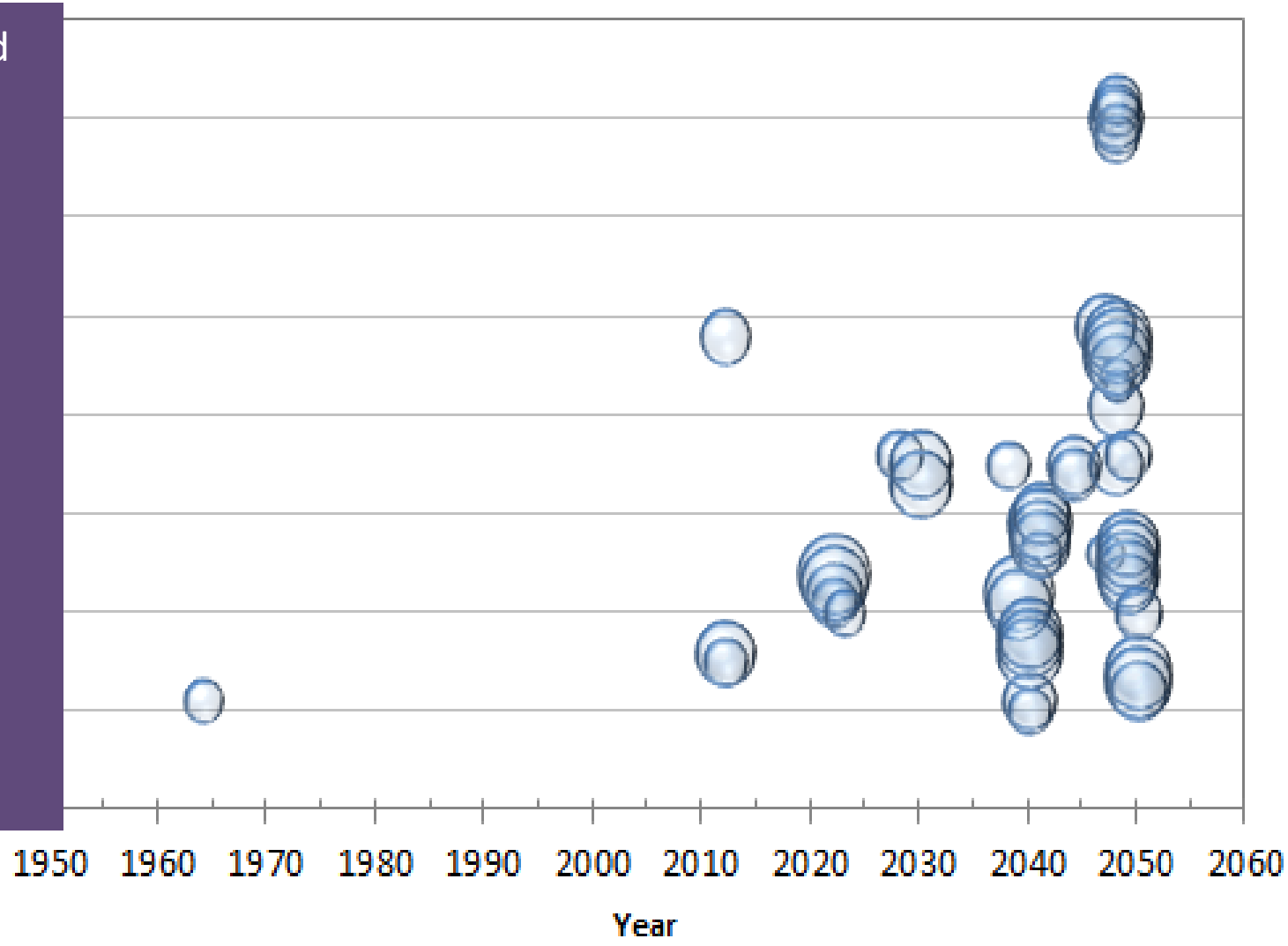
- Statewide heat waves arbitrarily defined here to occur when major cities in California **simultaneously** experience a daily maximum temperature exceeding the local historical 1 in 200-year threshold.

➢ Data source: Cal-Adapt (CANESM2, RCP8.5)



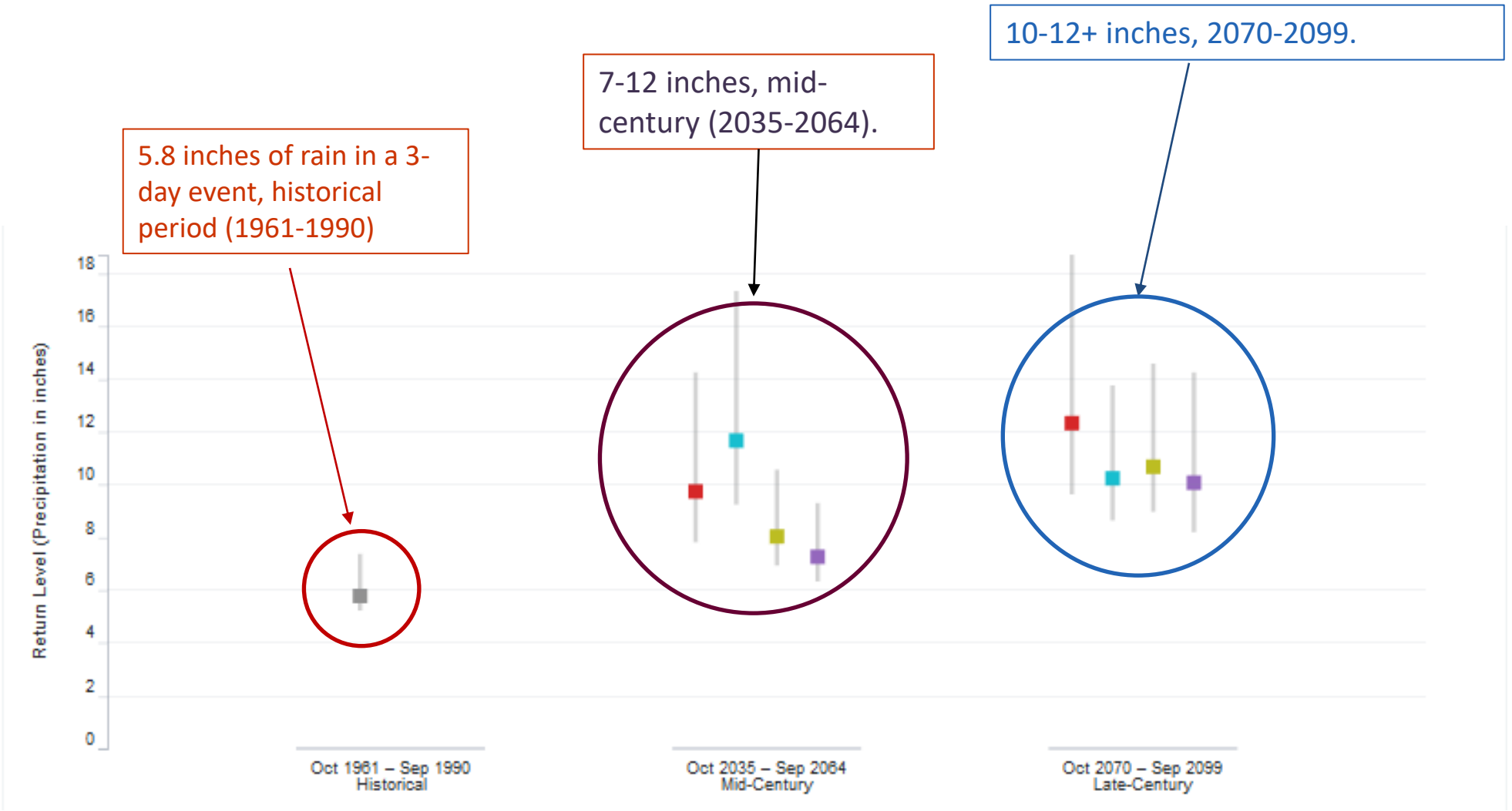
Example: Region-wide Heat Waves

- Region-wide heat waves arbitrarily defined here to occur when major cities in California, Arizona, Utah, and Nevada **simultaneously** experience a maximum daily temperature exceeding the local historical 1 in 50-year threshold.
  - Data source: Cal-Adapt (CANESM2, RCP8.5)



Projected doubling of rainfall in 3-day extreme precipitation event** in Eureka

*** Graph shows a "1-in-20" event, which has a 5% chance of happening each year*



Extreme precipitation tool represents uncertainty by calculating 95% confidence intervals (gray bars).

Examples of energy-related applications for available or forthcoming research products

- **Consideration of hourly solar and wind generation** profiles (e.g., SB 100 resource assessment and reliability analysis)
  - 11 years available now (EPC-16-063)
  - More available in April/October 2022 (EPC-20-006)
- **Support for demand forecasting** through publicly available, documented, peer-reviewed historical hourly temperature data at 39 weather stations throughout state
  - Data available on Cal-Adapt
  - All stations available from 1973 onward (some much earlier)
- Providing support for **understanding and planning for climate extremes**
  - Characterization of “cold” events to support natural gas reliability planning
  - Observed temperature extremes at weather stations contextualized in terms of past 30 years’ climatology
  - Characterization of regional extreme heat waves, based on historical data and climate projections
  - Anticipated evaluation of interactions between wildfire smoke, solar generation, and heat events