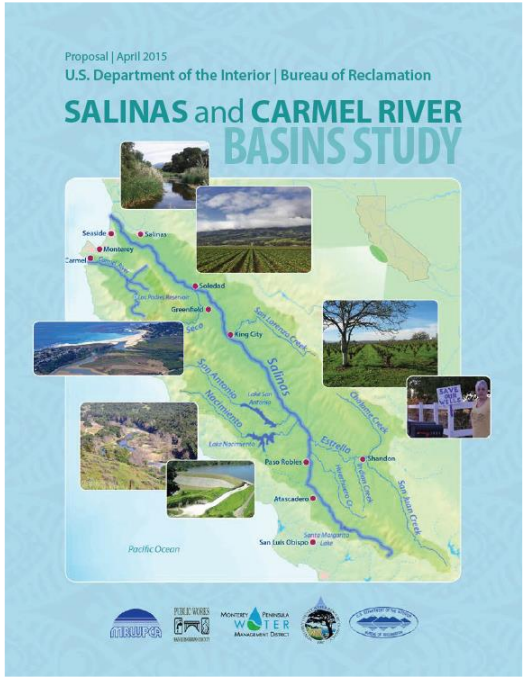
BUREAU OF RECLAMATION

Salinas and Carmel Rivers Basin Study

Monterey County Board of Supervisors Update

April 27, 2021



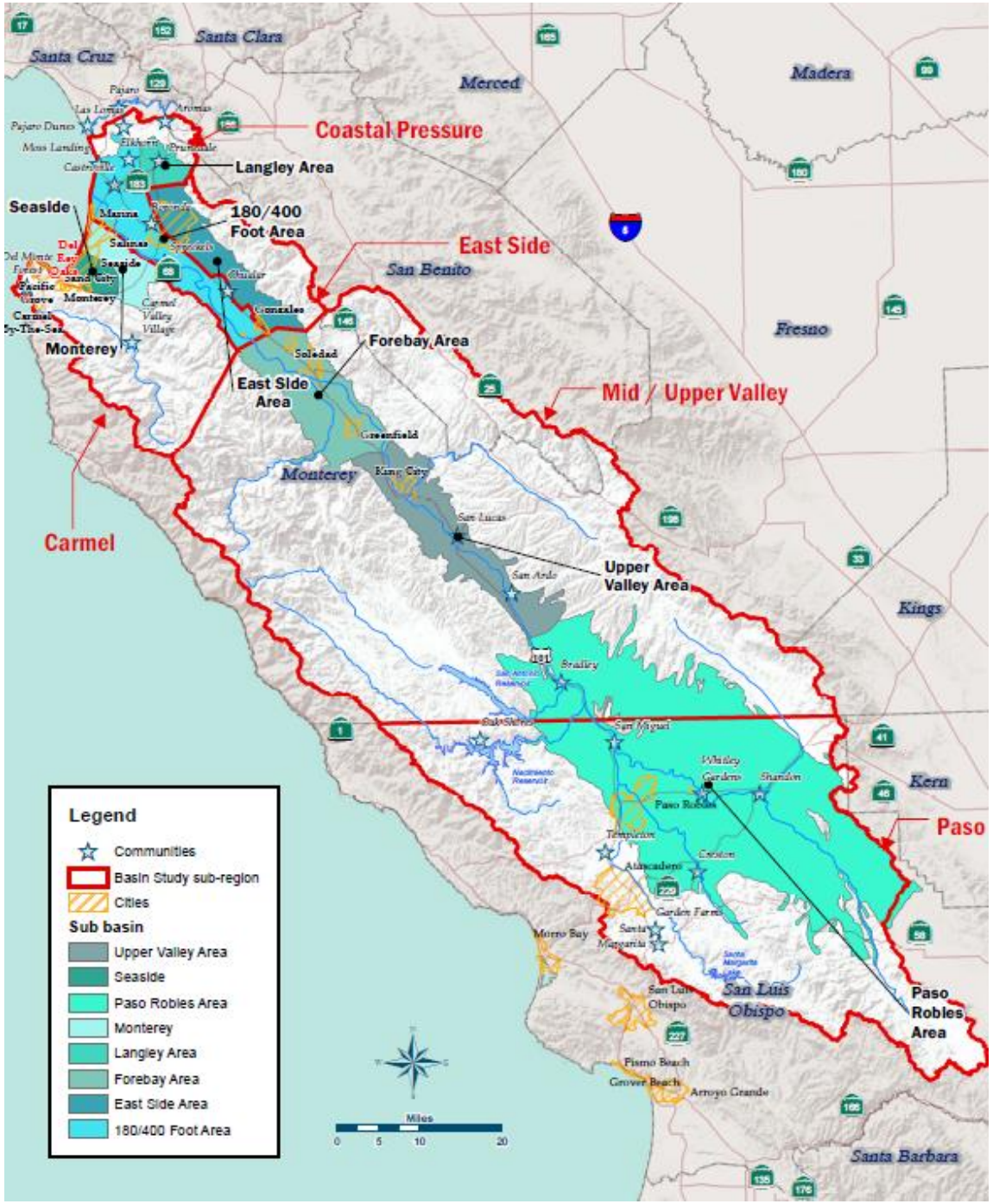
Agenda

- Study Area
- Study Team
- Basin Study Progress To-date and Schedule to Complete
- Climate Change Considerations and Approach
- Related and Integrated Activities

Study Area

Sub-Regions for modeling analysis:

- Coastal/Pressure
- Carmel
- East Side
- Middle and Upper Valley
- Paso Robles



Key Study Elements:

- Projections of future water supplies and demands, considering specific impacts from climate change
- Analysis of how existing infrastructure and operations will perform under projected future conditions (e.g., future climate, population, land use, etc.)
- Development of adaptation and mitigation strategies to address current and projected imbalance between supply and demand
- Analysis of adaptation and mitigation strategies, including the extent to which strategies minimize imbalance between supply and demand

Study Team

- Cost share partners:
  - Monterey Peninsula Water Management District
  - Monterey County Water Resources Agency
  - San Luis Obispo County, Department of Public Works
  - Monterey One Water
  - Bureau of Reclamation (USBR)
- Mike Dietl – USBR, Project Manager

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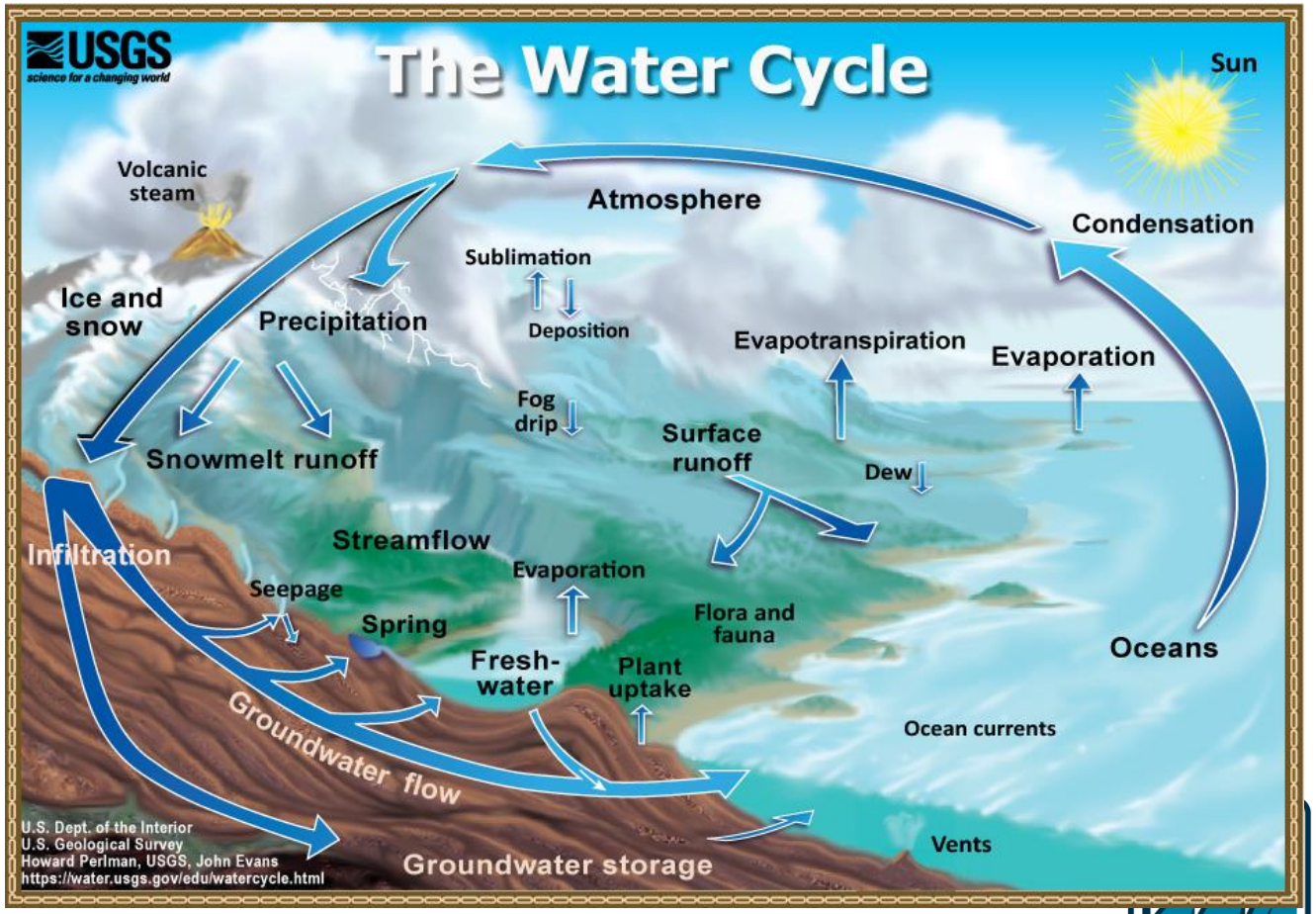
- Melanie Holton, PE – Brown & Caldwell, Consultant Team Lead

Progress To-Date and Schedule to Complete

- Complete:
  - TM 1. Study Metrics
  - TM 2. Future Climate and Sea Level Scenarios
  - TM 3. Socioeconomic Scenarios
  - TM 4. Model Tools and Inputs
- In Progress:
  - TM 5. Evaluate Water Supplies, Demands, and Operations
  - TM 6. Develop Adaptation and Mitigation Strategies
  - TM 7. Evaluate Adaptation and Mitigation Strategies
- Basin Study Summary Report/Executive Summary – Summer 2022

Climate Change

- Why consider climate change?
  - Climate is a major driver of water supply and demand
  - Overwhelming scientific consensus:
    - Climate is changing and will continue to change
    - Climate change will impact water supply and demand

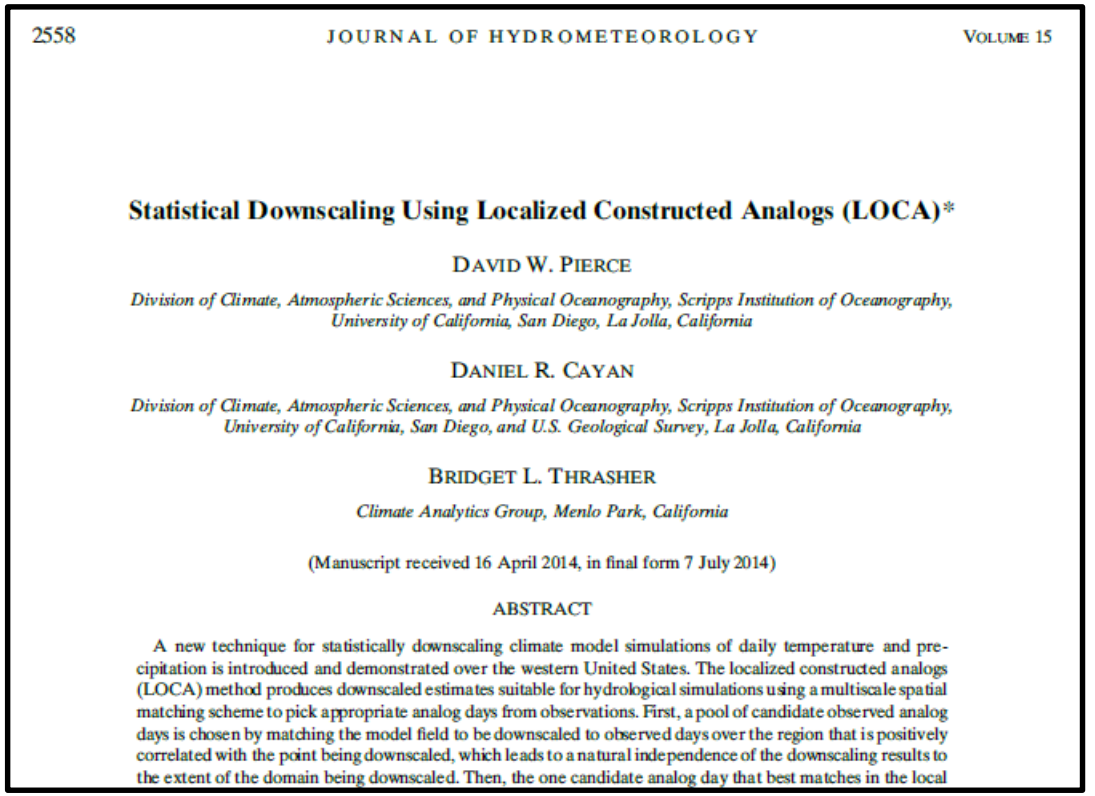


Climate Change

- Climate Projections

  Localized Constructed Analogs (LOCA)

  - Downscaled and bias-corrected GCM projections
  - 64 Projections
    - 32 GCMs
    - 2 Emissions Scenarios (RCP 4.5, RCP 8.5)
  - 1/16° (~6 km) grid resolution



Statistical Downscaling Using Localized Constructed Analogs (LOCA)*

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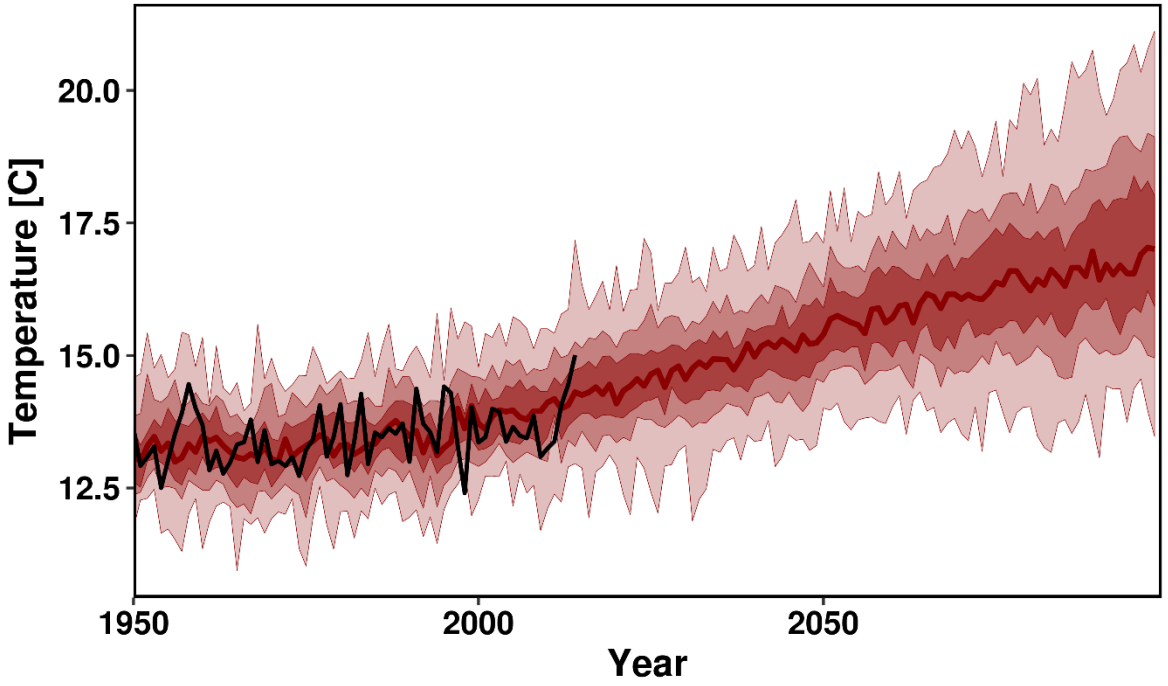
ABSTRACT

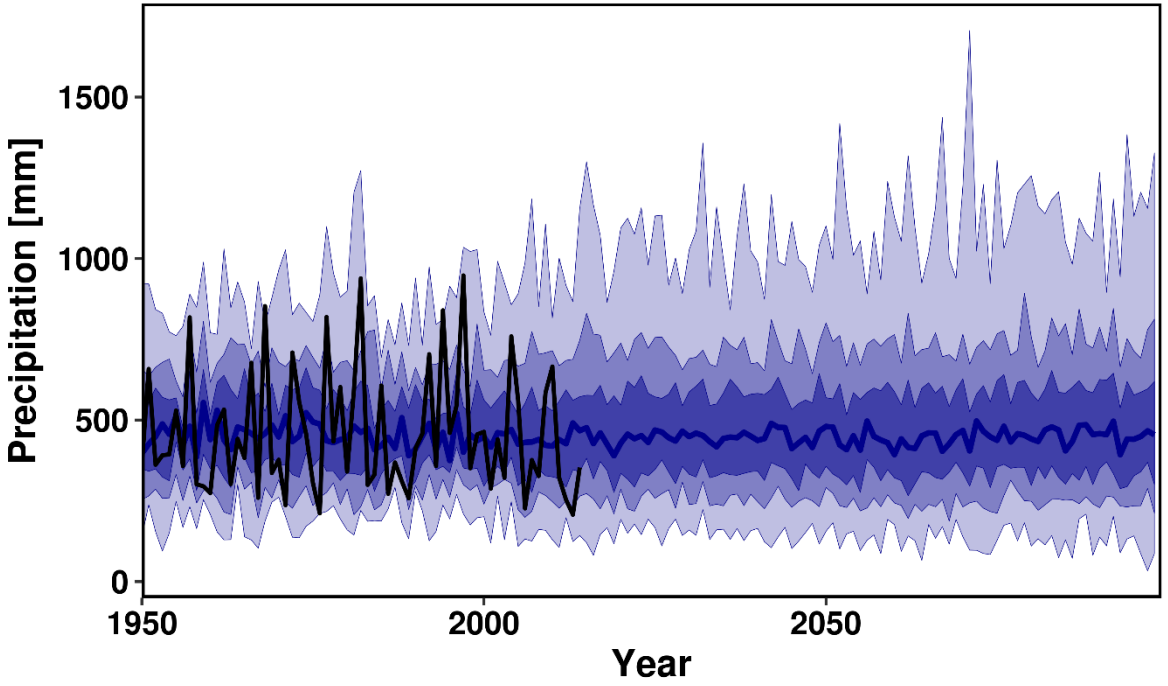
A new technique for statistically downscaling climate model simulations of daily temperature and precipitation is introduced and demonstrated over the western United States. The localized constructed analogs (LOCA) method produces downscaled estimates suitable for hydrological simulations using a multiscale spatial matching scheme to pick appropriate analog days from observations. First, a pool of candidate observed analog days is chosen by matching the model field to be downscaled to observed days over the region that is positively correlated with the point being downscaled, which leads to a natural independence of the downscaling results to the extent of the domain being downscaled. Then, the one candidate analog day that best matches in the local

Climate Change

- Climate Projections



- Strong consensus – increase under all projections
- Increase across all timescales (daily, monthly, seasonal, and annual means)
- Increase in variability and extremes
- Potential impacts on ***demand*** – esp. ag demand



- No clear consensus – some increase, some decrease
- Change in mean varies by timescales and seasons (e.g., increase in winter, decrease in summer)
- Increase in variability and extremes
- Potential impacts on ***supply*** – runoff and recharge

Climate Change

- Climate Scenarios

Objective: Distill large number of climate projections into a manageable number of scenarios for detailed analysis.

Approach: Combine *ensemble-informed* and *transient* methods

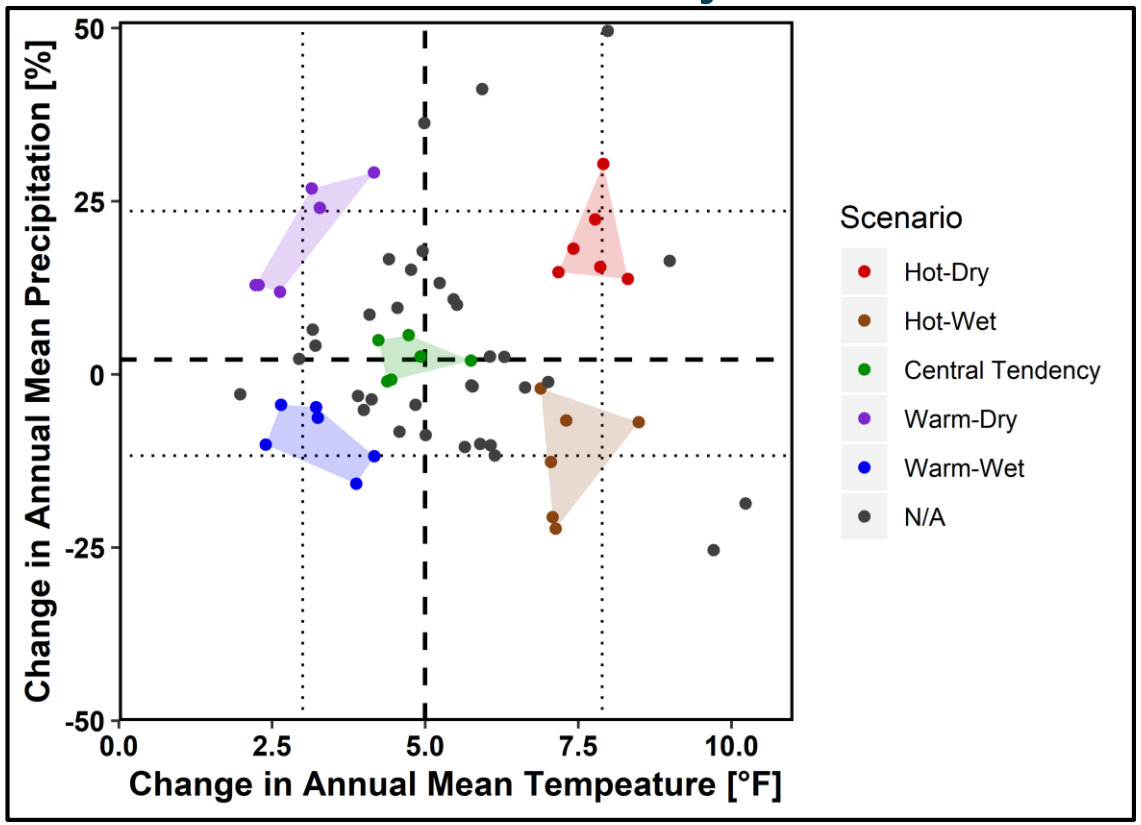
- Develop *time-varying (transient) climate change factors* from sub-set of LOCA ensemble
- Apply change factors to dataset of *observed historical climate*
- **Future Climate = Baseline Climate + Projected Change**

Climate Change

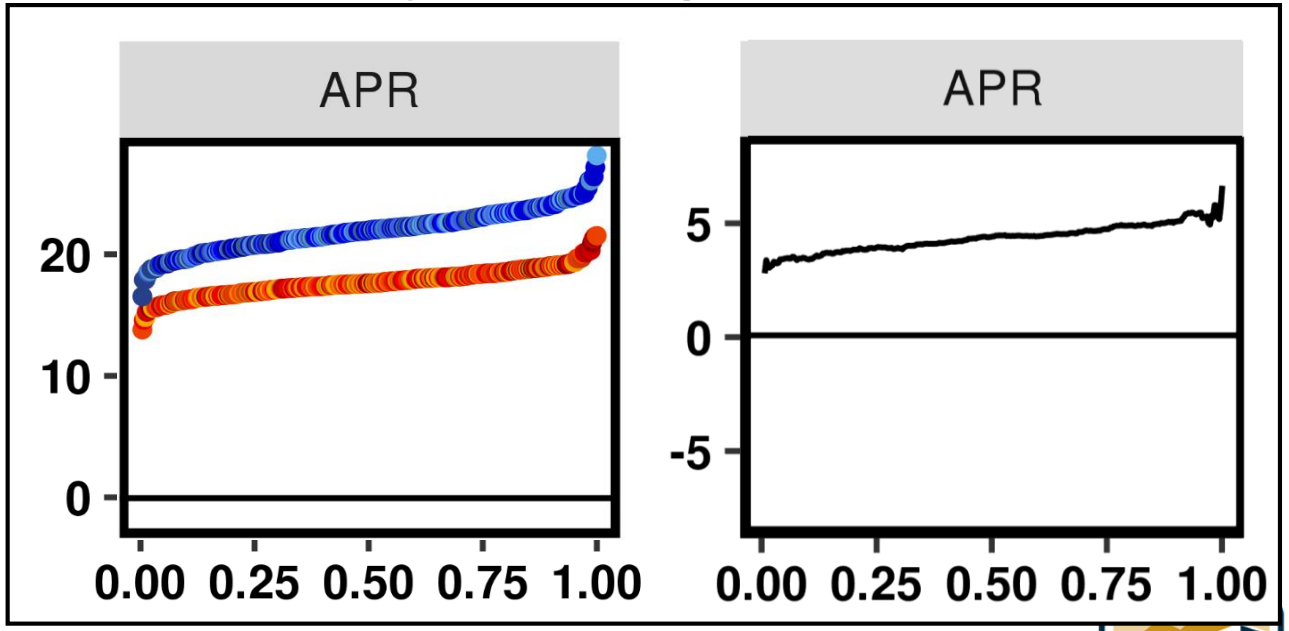
- Climate Scenarios

  Climate Change Factors

Select Climate Projections



Compute Change Factors



Climate Change

- Climate Scenarios

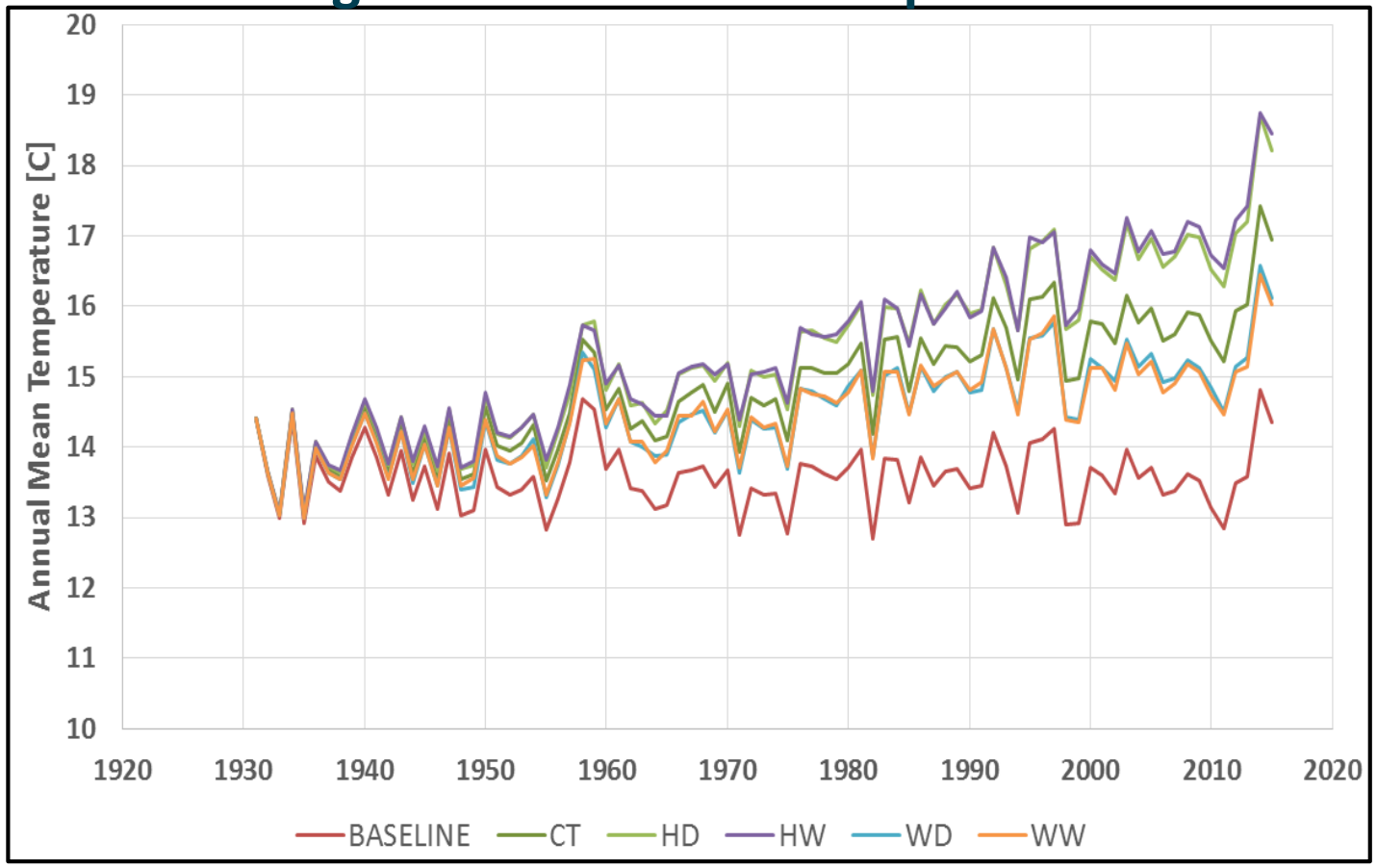
  Climate Change Factors

  - Change factors computed by decade
  - Interpolated to individual years
  - *Ensemble-Informed* → Reflects uncertainty in future climate based on ensemble of projections
  - *Transient* → Reflects temporal evolution of

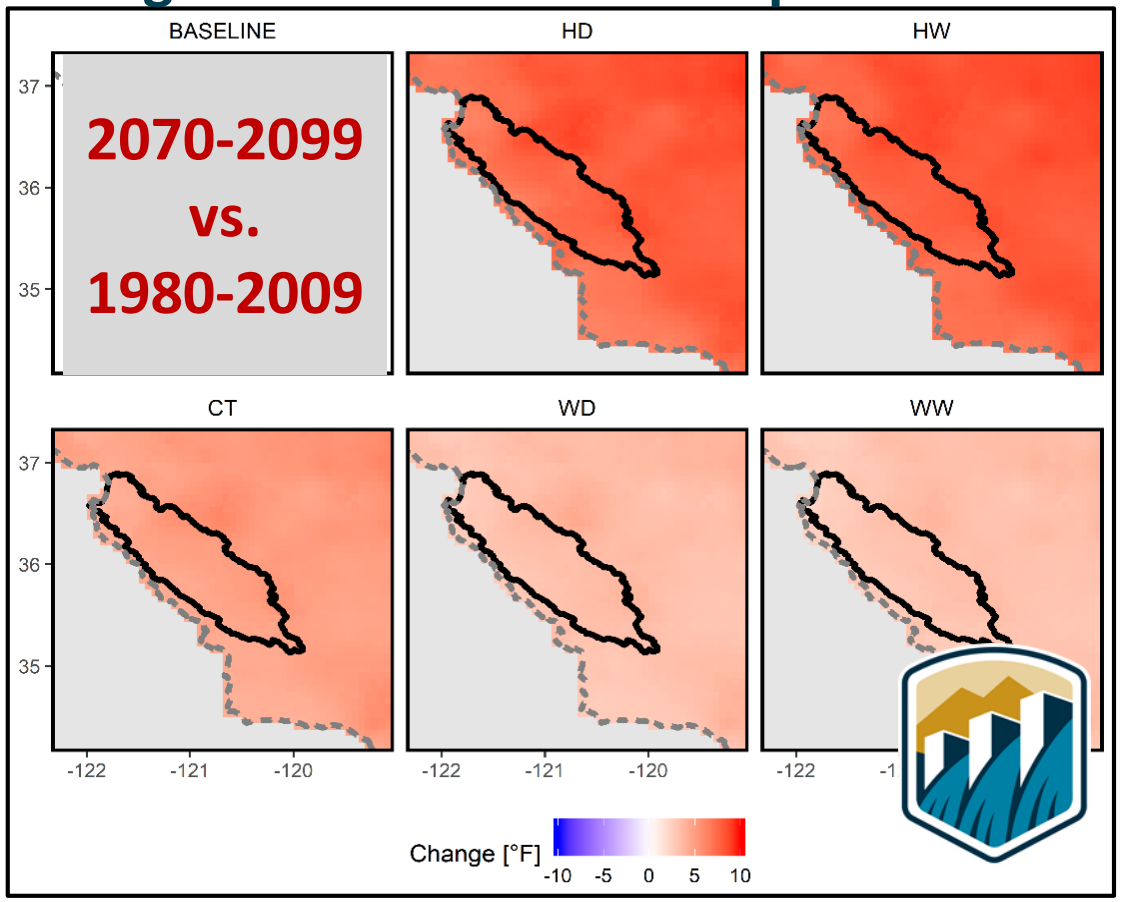
Climate Change

- Climate Scenarios

Basin-Averaged Mean Annual Temperature



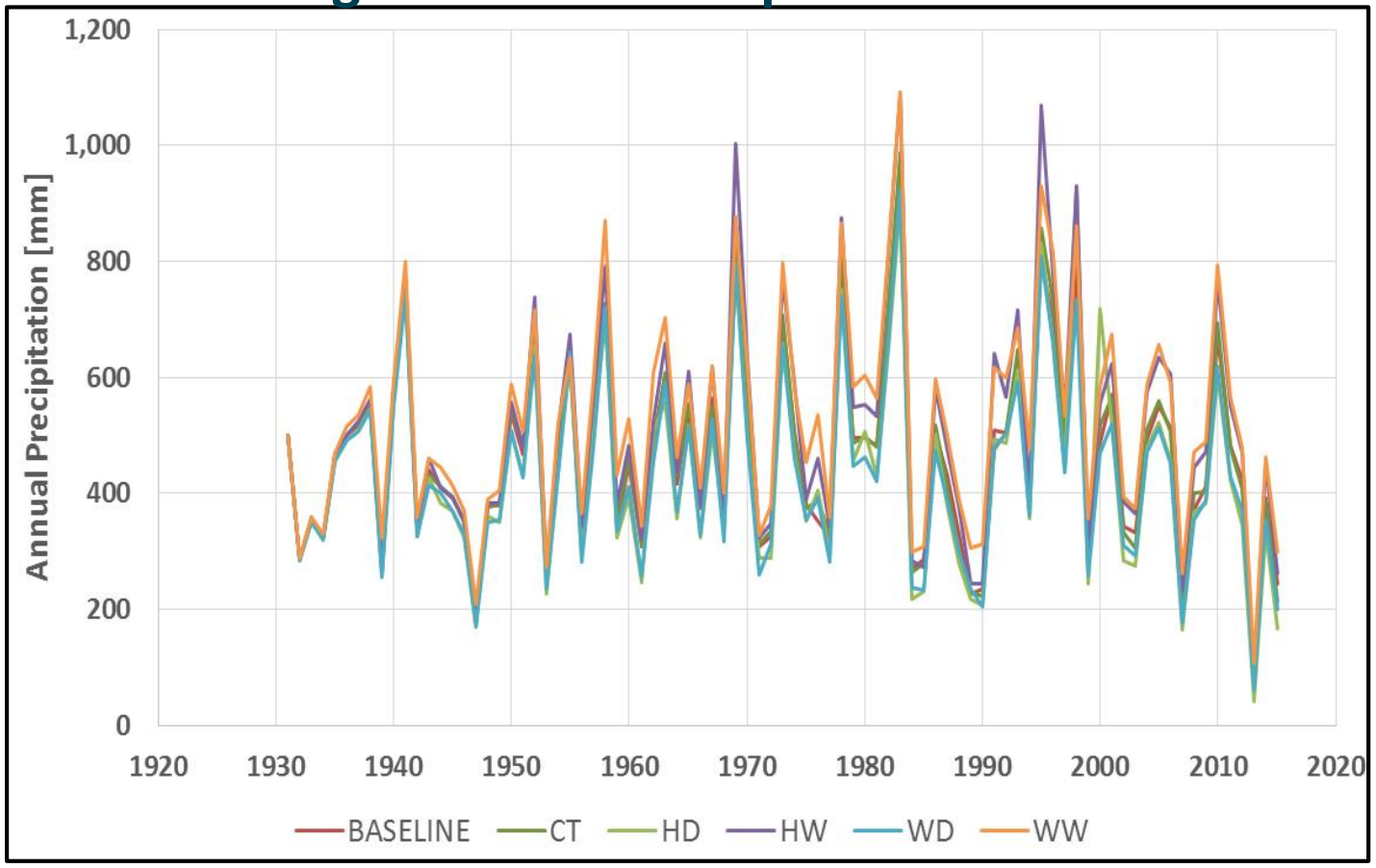
Change in Mean Annual Temperature



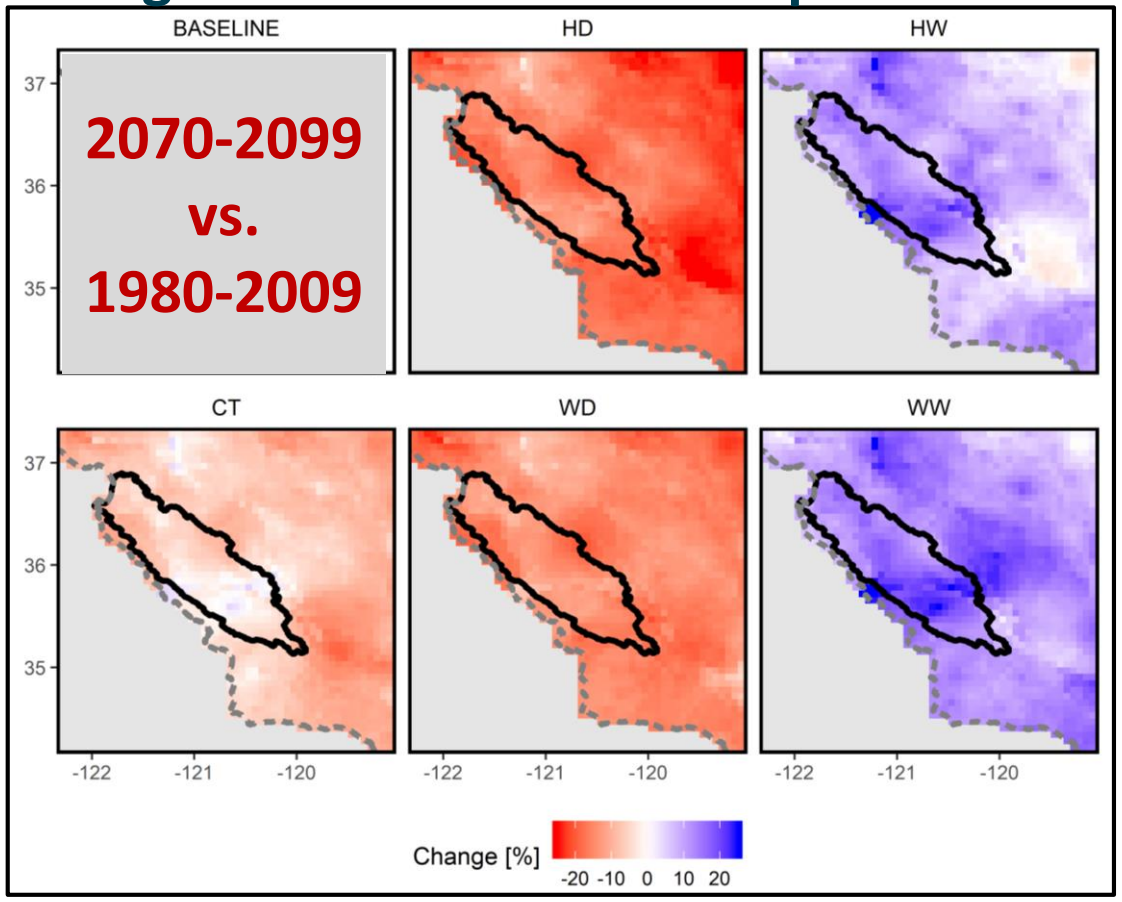
Climate Change

- Climate Scenarios

Basin-Averaged Annual Precipitation



Change in Annual Mean Precipitation



Climate Change

- Sea Level Rise

Objective: Identify a single representative sea-level rise (SLR) projection for use in the Basin Study

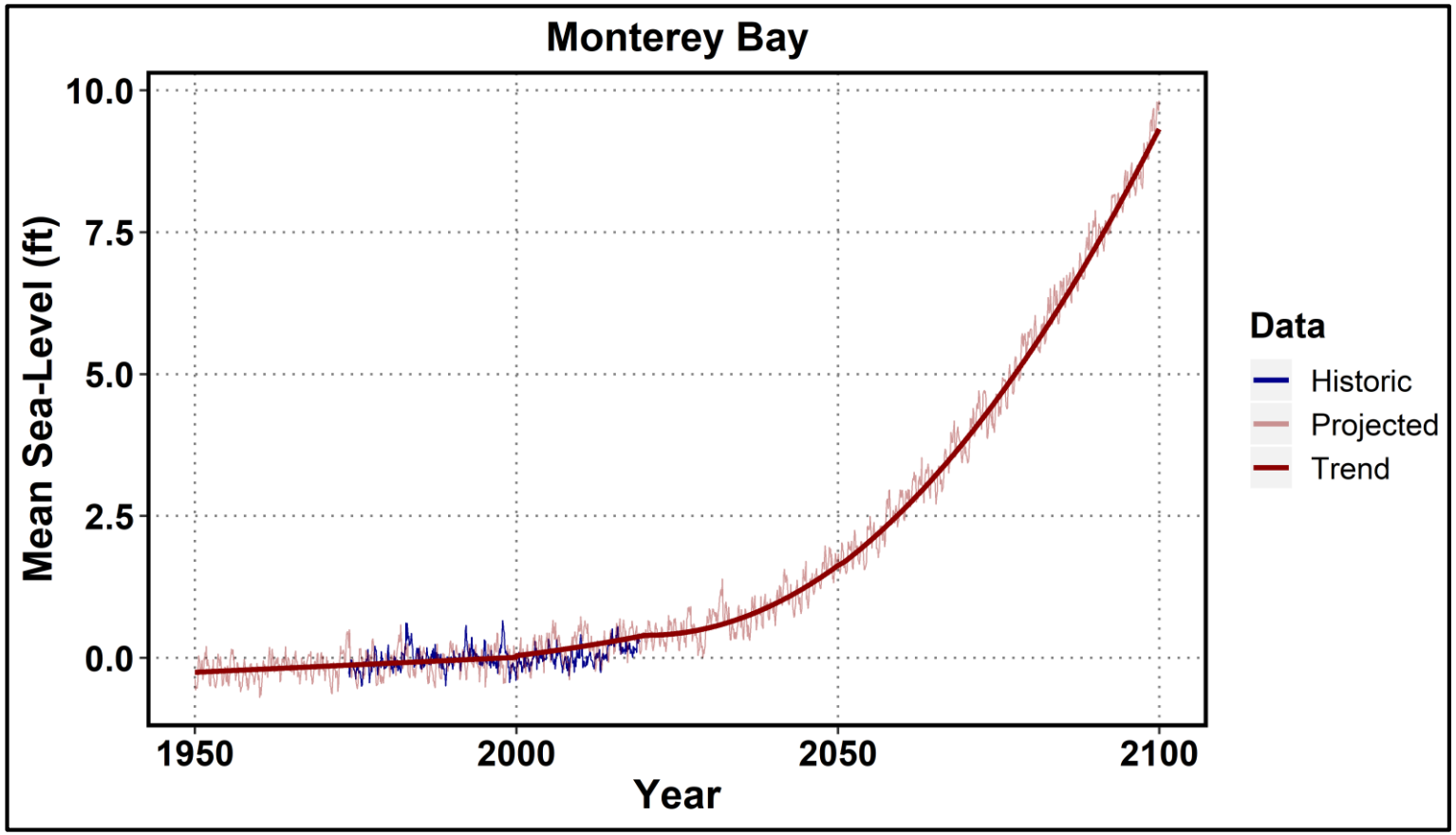
Approach: Literature review

- Review existing scientific literature, including California's latest Climate Change Assessment
- Select conservative (worst-case) scenario
- Pair single SLR scenario with all climate scenarios

Climate Change

- Sea Level Rise
  - CanESM2 99.9th percentile probabilistic projection
  - Selected based on:
    - CA Fourth Climate Change Assessment
    - "Worst case" scenario
    - Consistent with prior studies (e.g., Pajaro)

SLR Scenario CanESM2 99.9th percentile probabilistic projection



Climate Change

- Summary

Scenario	Projected Change in Annual Means by End of 21st Century (2070-2099 vs. 1980-2009)		
	Annual Average Precipitation	Annual Average Temperature	Annual Average Sea-Level
Hot-Wet	+ ~ 20%	+ ~7.5°F	+ 10.1 ft*
Hot-Dry	– ~10%	+ ~3.1°F	+ 10.1 ft*
Warm-Wet	+ ~20%	+ ~7.5°F	+ 10.1 ft*
Warm-Dry	– ~10%	+ ~3.1°F	+ 10.1 ft*
Central Tendency	+ ~ 1%	+ ~4.8°F	+ 10.1 ft*

** Change in sea-level provided in terms of equivalent freshwater head.*
Change reflects conservative (worst case) projection – high-risk upper end-member.