75 YEARS Sonoma Water

SERVING THE COMMUNITY SINCE 1949

Future Rainfall Database

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Zone 2A Advisory Committee Meeting

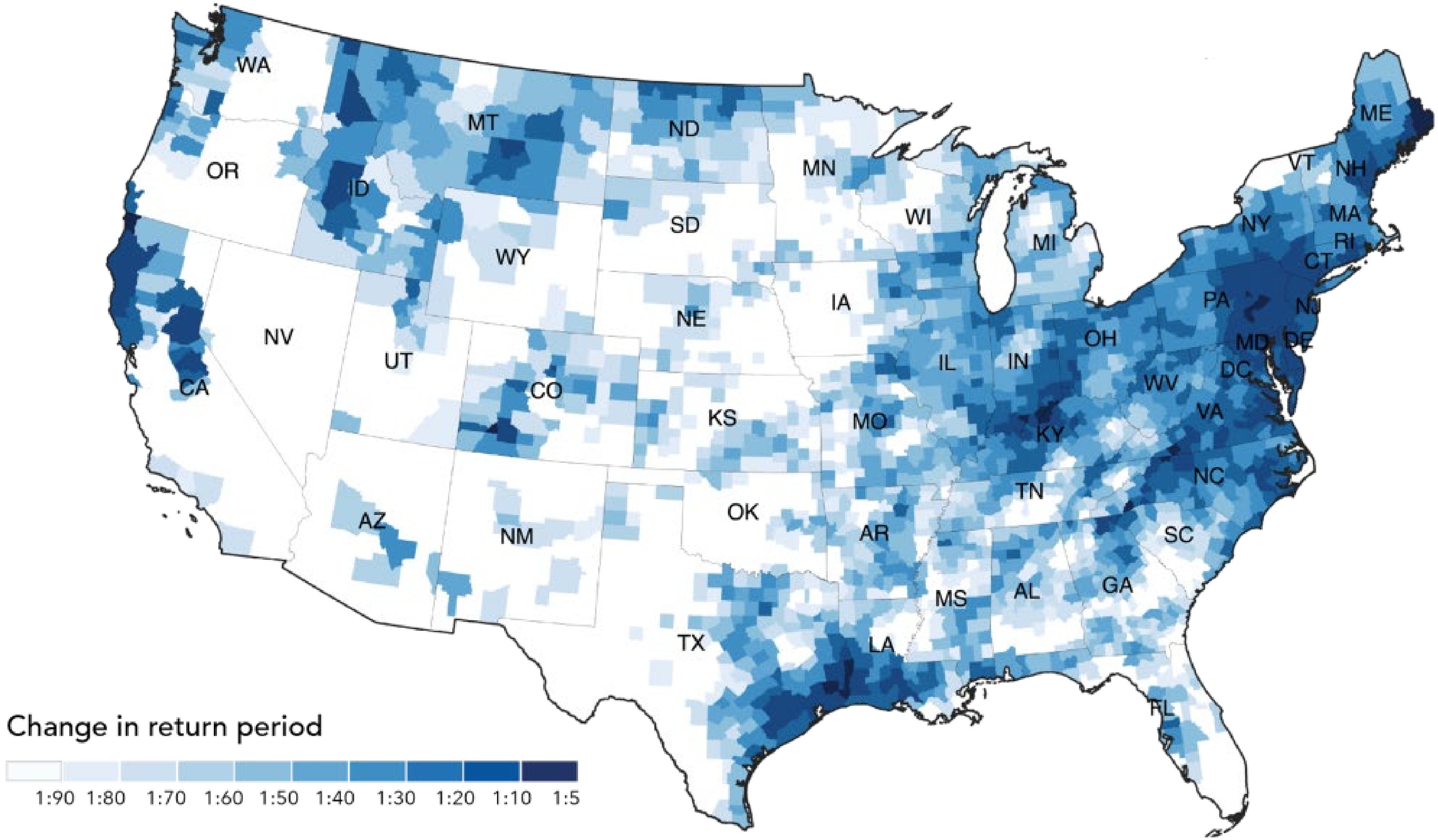
August 29, 2024

sonomawater.org

Agenda

I. Why do we need future climate data and what is it?
II. Future Rainfall Database overview
III. Sonoma Water's commitment
IV. External roll-out
V. Next steps and future needs

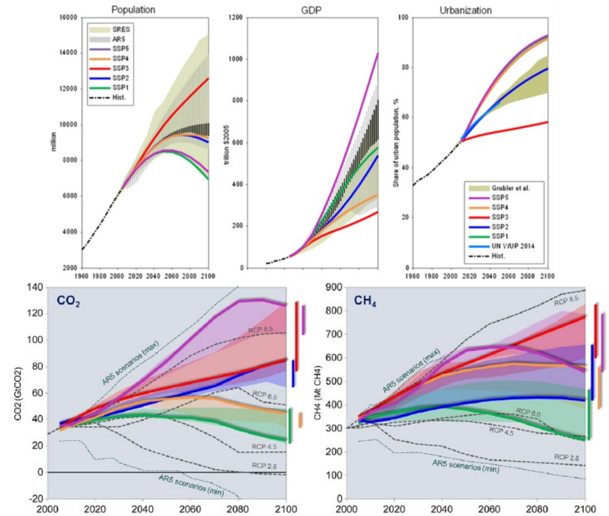
I. Why do we need future climate data?



What is future climate data?

Shared Socioeconomic Pathways (SSPs) and emissions scenarios

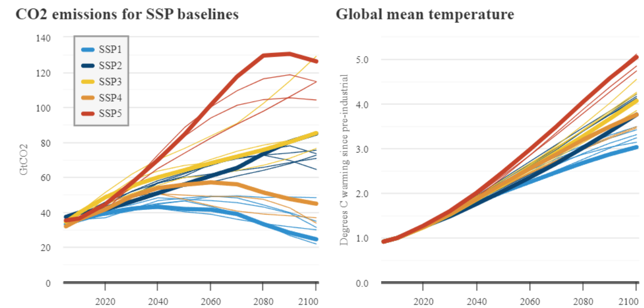
- The International Panel on Climate Change (IPCC) developed narrative scenarios (SSPs) of global development regarding population, policy, technological makeup, GDP, degree of urbanization, etc.
- SSPs are linked to emissions scenarios [Representative Concentration Pathways (RCP)].



SSP Variables

RCP emissions

https://climate-scenarios.canada.ca/?page=cmip6-overview-notes

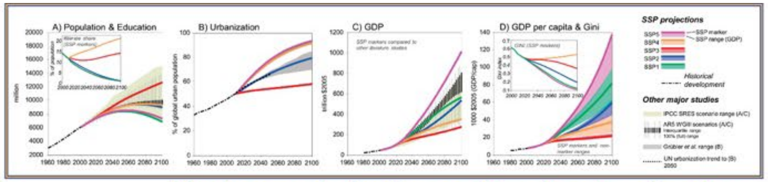


SSP outcomes

https://www.carbonbrief.org/explainer-how-shared-socioeconomic-pathways-explore-future-climate-change/

Global climate models and downscaling

SSP variables



https://downscaling.lbl.gov/data/

Global climate models and downscaling

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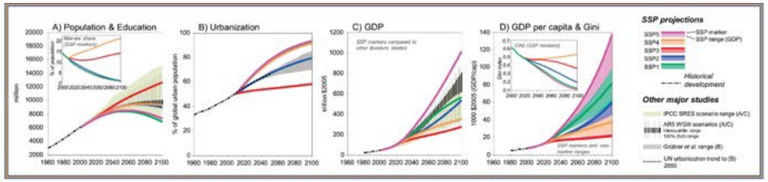
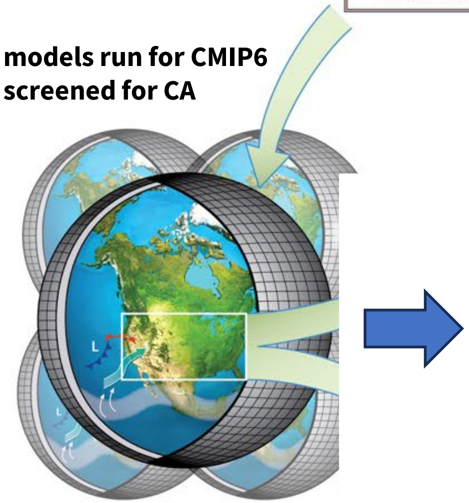
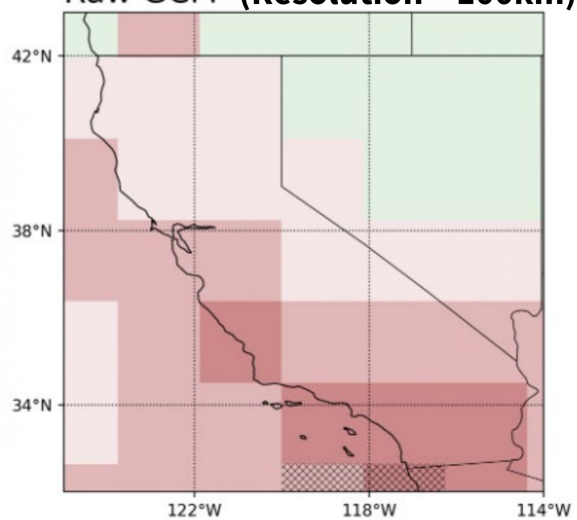


GCM
- **27 models run for CMIP6**
- **15 screened for CA**



(Resolution > 100km)



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Global climate models and downscaling

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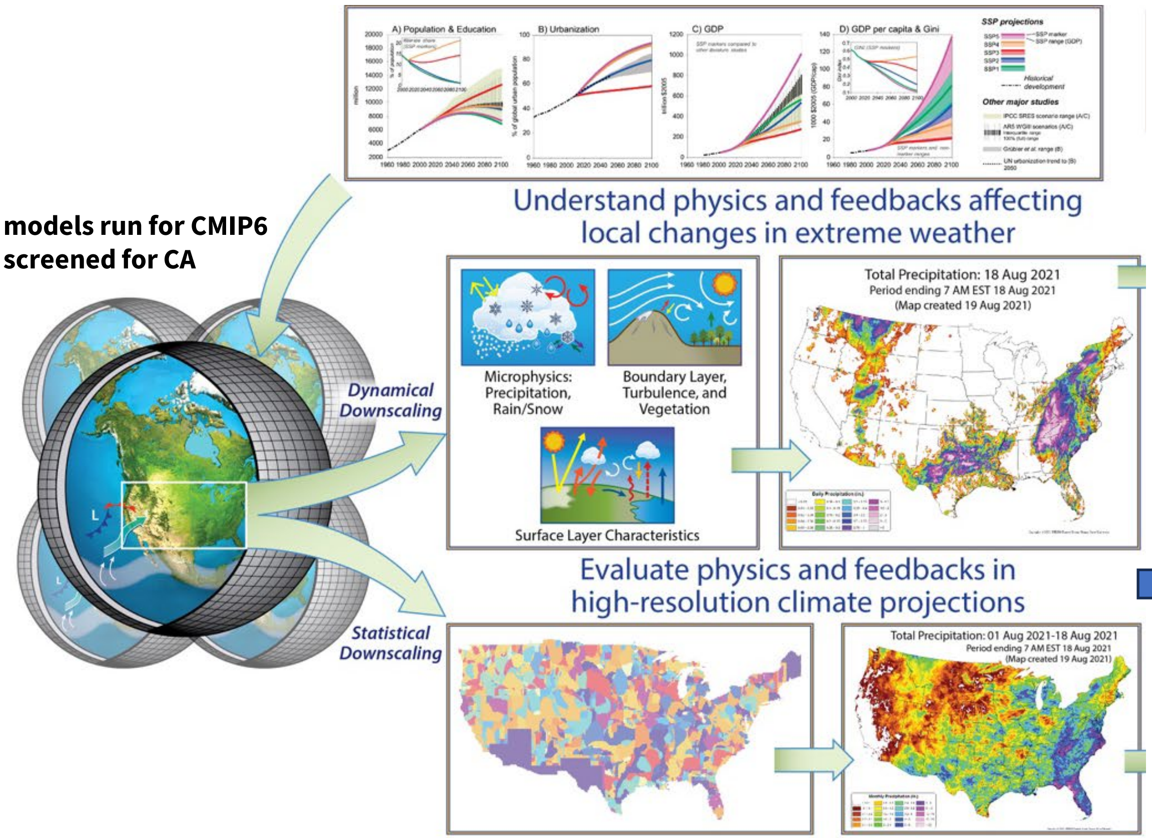
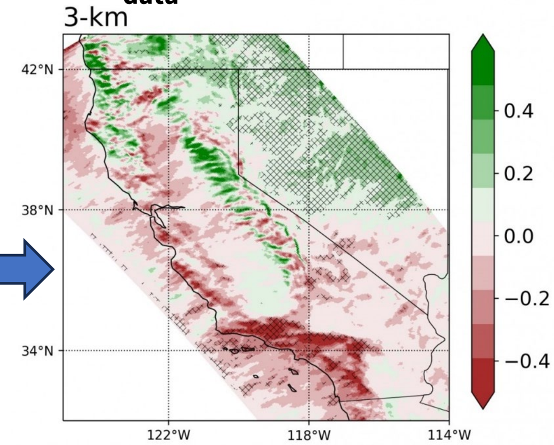


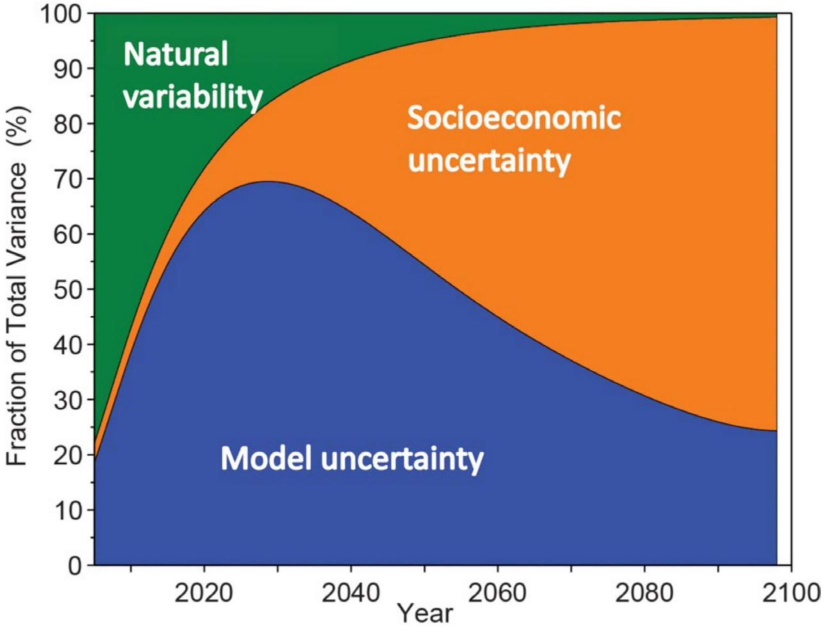
Latest California coverage for downscaled data



https://downscaling.lbl.gov/data/

Uncertainty: sources and considerations

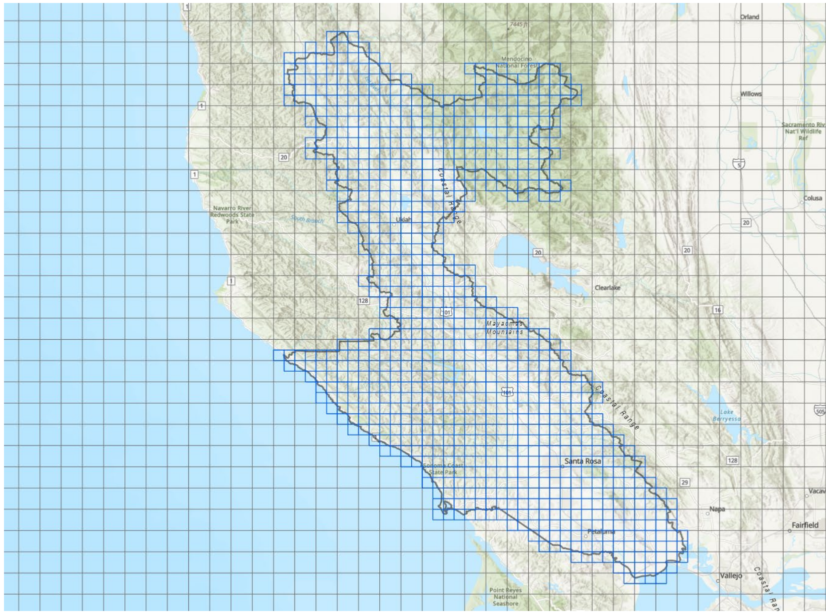
- Downscaling Methods: Uncertainties arise from the statistical downscaling methods used in LOCA2 to project high-resolution climate data.
- Historical Data Limitations: Both datasets may not fully account for future climate variations due to their reliance on historical precipitation records.
- Climate Model Projections: Inherent uncertainties in climate model projections can affect the accuracy of future precipitation predictions.
- Regional Variability: Both datasets might not accurately capture local microclimates or specific regional climate variations.
- Temporal Resolution: The datasets may have limitations in representing seasonal or short-term climatic changes, impacting rainfall frequency and depth estimates.



https://www.gyclimate.org/ch4

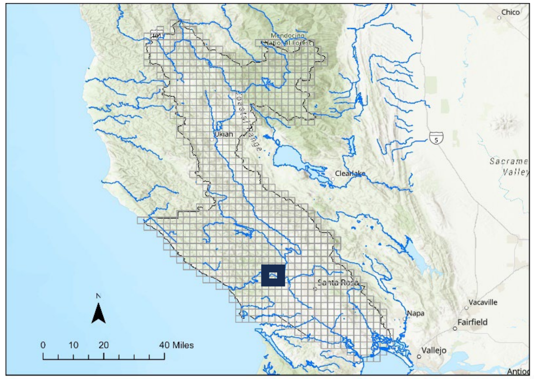
California downscaled data (LOCA2)

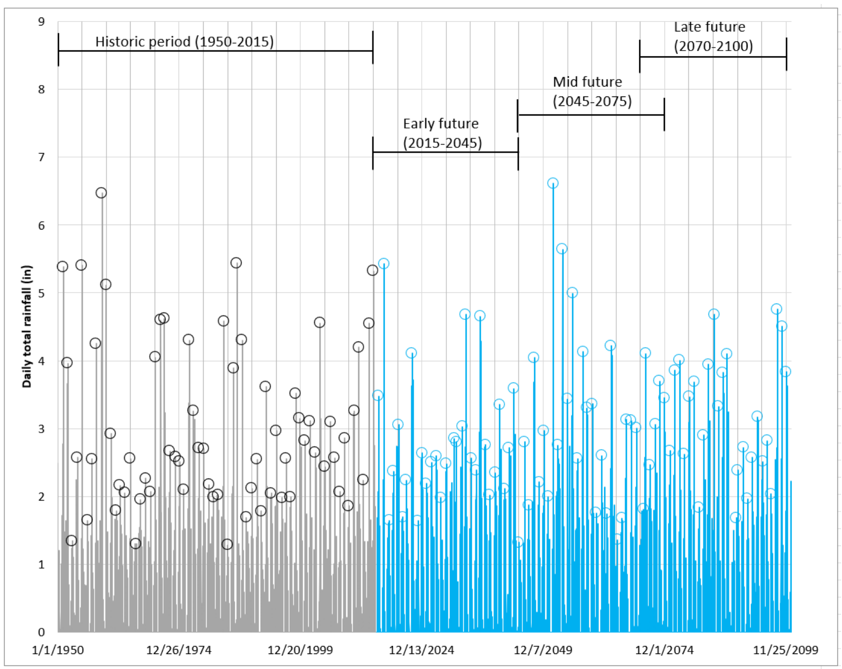
- For CA 5th climate assessment, Scripps downscaled climate data
- LOCA2 corrected LOCA1 (5/2022)
- Data contains daily precipitation and temperature for historic (1950-2015) and projected periods (2015-2100)
- Models were screened for 15 that perform best for CA climate
  - Only 13 had model runs for our selected SSPs



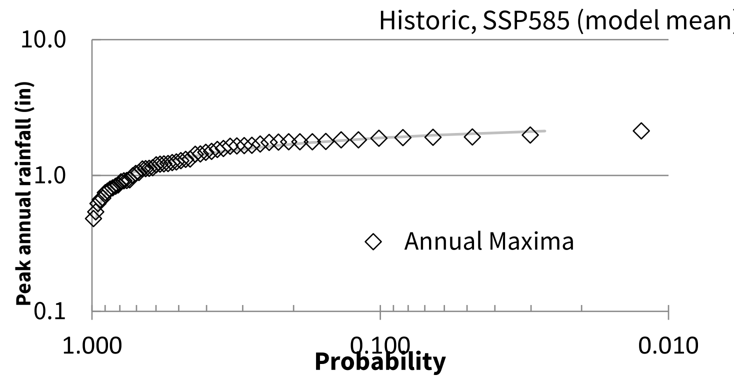
Methods – design rainfall

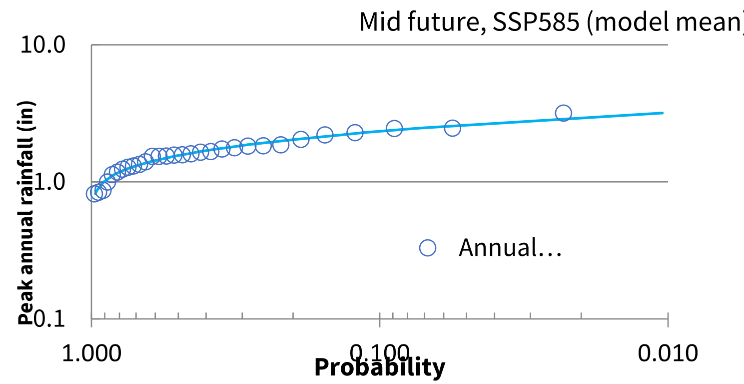
- Extract daily rainfall time series and annual maxima for water years 1950-2100





- Fit frequency curve to historic and future periods and calculate scalar for each future period and emissions scenario at each climate cell





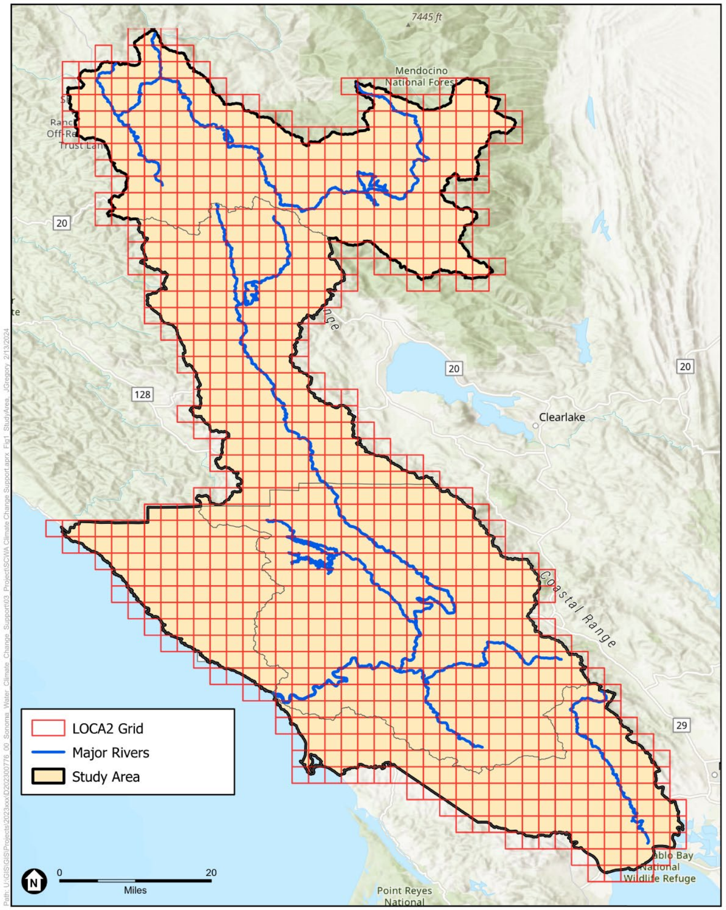
II. Future Rainfall Database Overview

- Geodatabase
- Technical Methods Memo
- User Guidance Report

Geodatabase

- LOCA2, 3-km grid
- 24-hour Design Storms for Sonoma County, Upper Russian, & Upper Eel
- Variety of climate scenarios, recurrence intervals, and model statistics
- Actionable: “off the shelf”
- Subset of database shared publicly

Geodatabase



SOURCE: ESA, 2024

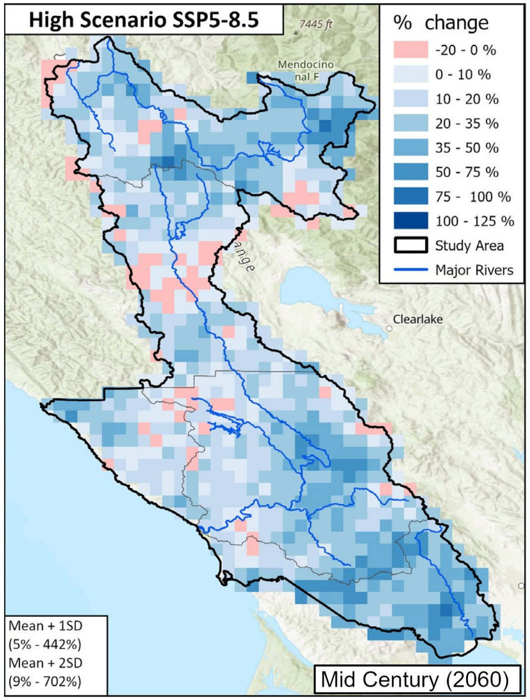
Sonoma Water Future Rainfall
Figure 1
Map of Study Area

TABLE 1. FUTURE RAINFALL DATABASE CONTENTS

Data type	Time Period	Emissions scenario	Variable	Climate model ensemble statistic
Geospatial Rasters (3km square scalars, 800m design depths)	Early century (2016-2045 basis, 2030 midpoint)	Medium-high (SSP2-4.5) High (SSP5-8.5)	24-hour depth for 1-, 2-, 5-, 10-, 25-, 50-, 100-, and 500-year return periods* Mean Annual Precipitation	Mean Mean + 1SD Mean + 2SD
	Mid century (2046-2075 basis, 2060 midpoint)	Medium-high (SSP2-4.5) High (SSP5-8.5)	24-hour depth for 1-, 2-, 5-, 10-, 25-, 50-, 100-, and 500-year return periods Mean Annual Precipitation	Mean Mean + 1SD Mean + 2SD
	Late century (2070-2099 basis, 2085 midpoint)	Medium-high (SSP2-4.5) High (SSP5-8.5)	24-hour depth for 1-, 2-, 5-, 10-, 25-, 50-, 100-, and 500-year return periods Mean Annual Precipitation	Mean Mean + 1SD Mean + 2SD

*Scalar rasters at 3km resolution and raw design depth rasters at 800m resolution provided for all return periods.

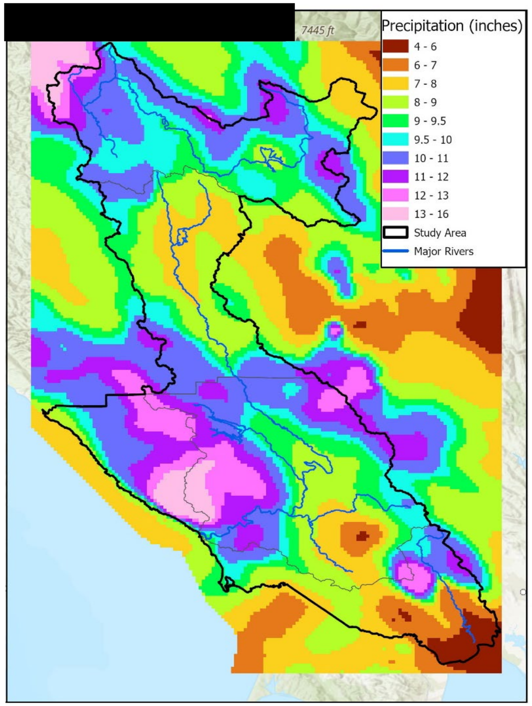
Methods – 100-year design rainfall



LOCA2 Scalar Raster

Future 100-yr rainfall % change

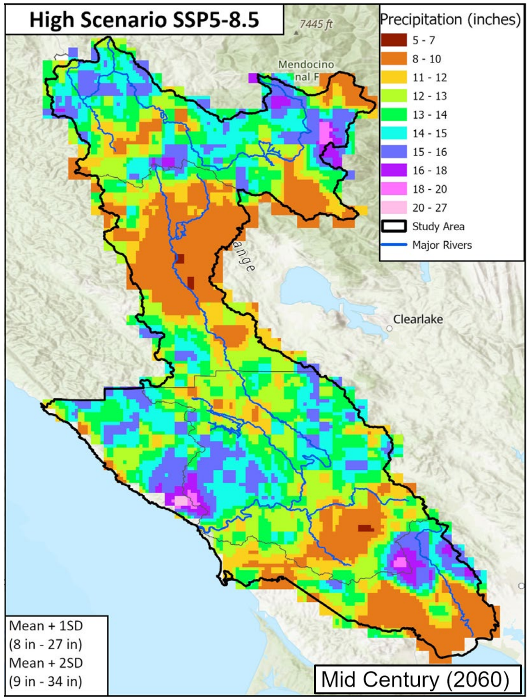
X



NOAA Atlas 14 Raster

Existing 100-Yr 24-hr rainfall depth

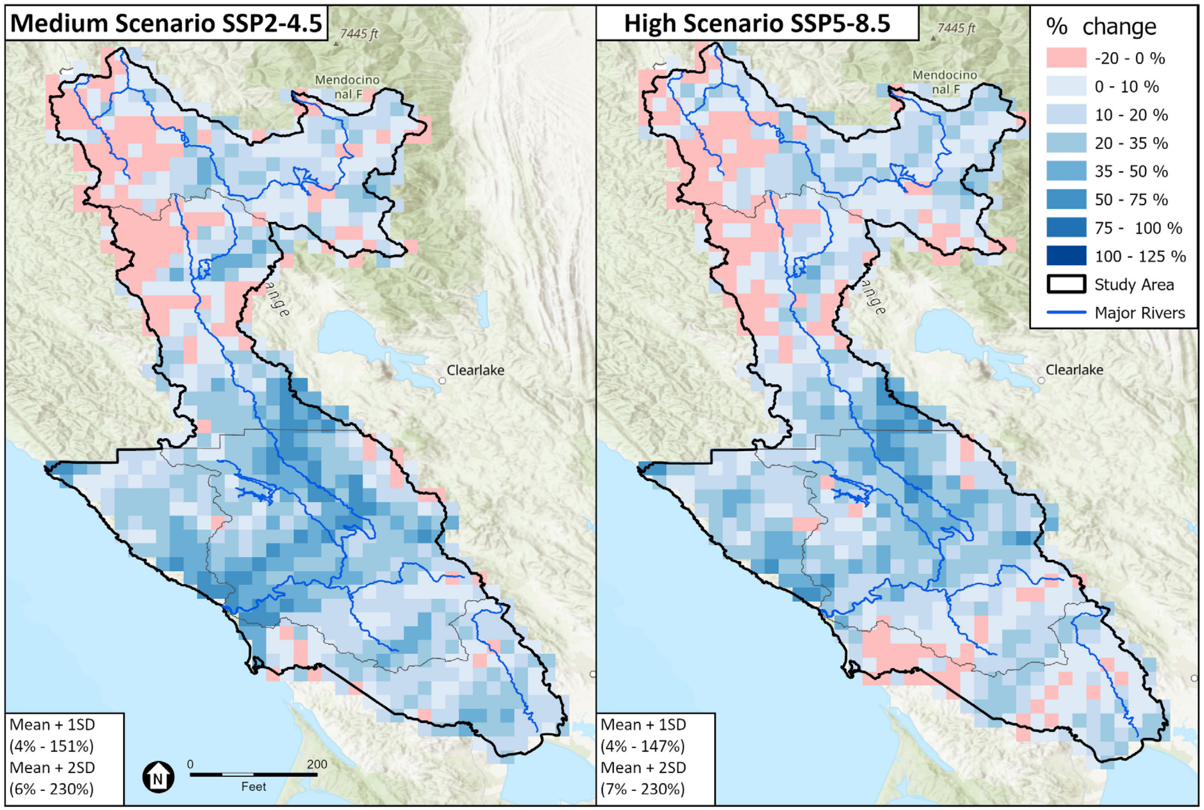
=



Scaled Design Rainfall Raster

Future 100-Yr 24-hr rainfall depth

100-year rainfall – Early century scalars



SOURCE: ESA, 2024

NOTE: Percent change is relative to the historic period (1950-2015)

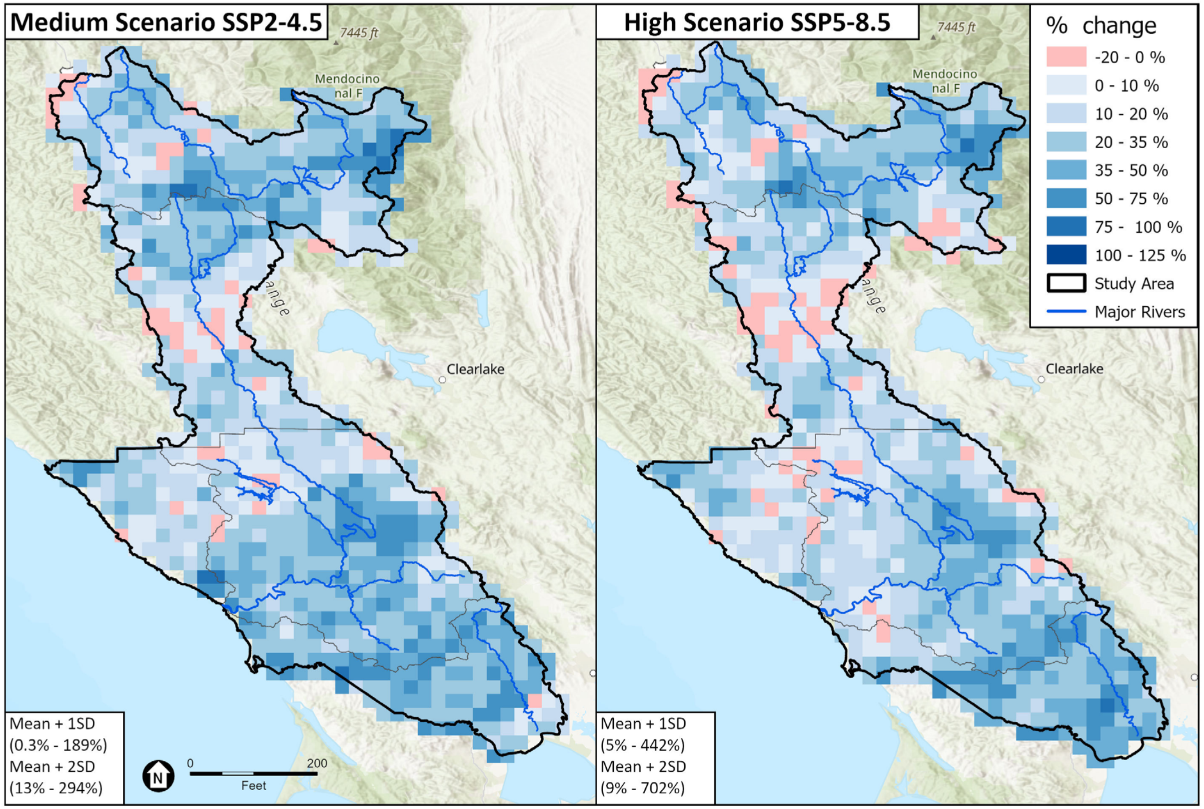
Sonoma Water Future Rainfall

Model Mean % Change in 100-year rainfall

Early Century (2030)

ESA

100-year rainfall – Mid century scalars



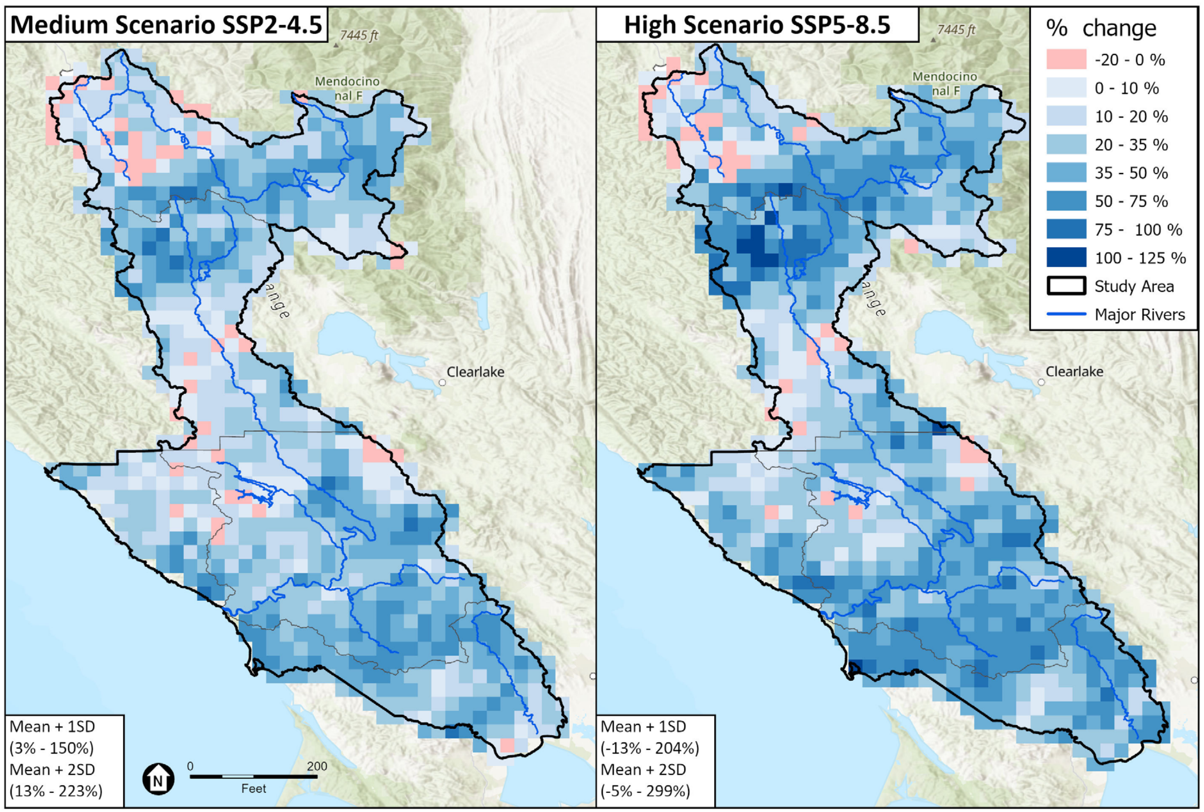
SOURCE: ESA, 2024

NOTE: Percent change is relative to the historic period (1950-2015)

Sonoma Water Future Rainfall
Model Mean % Change in 100-year rainfall
Mid Century (2060)

ESA

100-year rainfall – Late century scalars



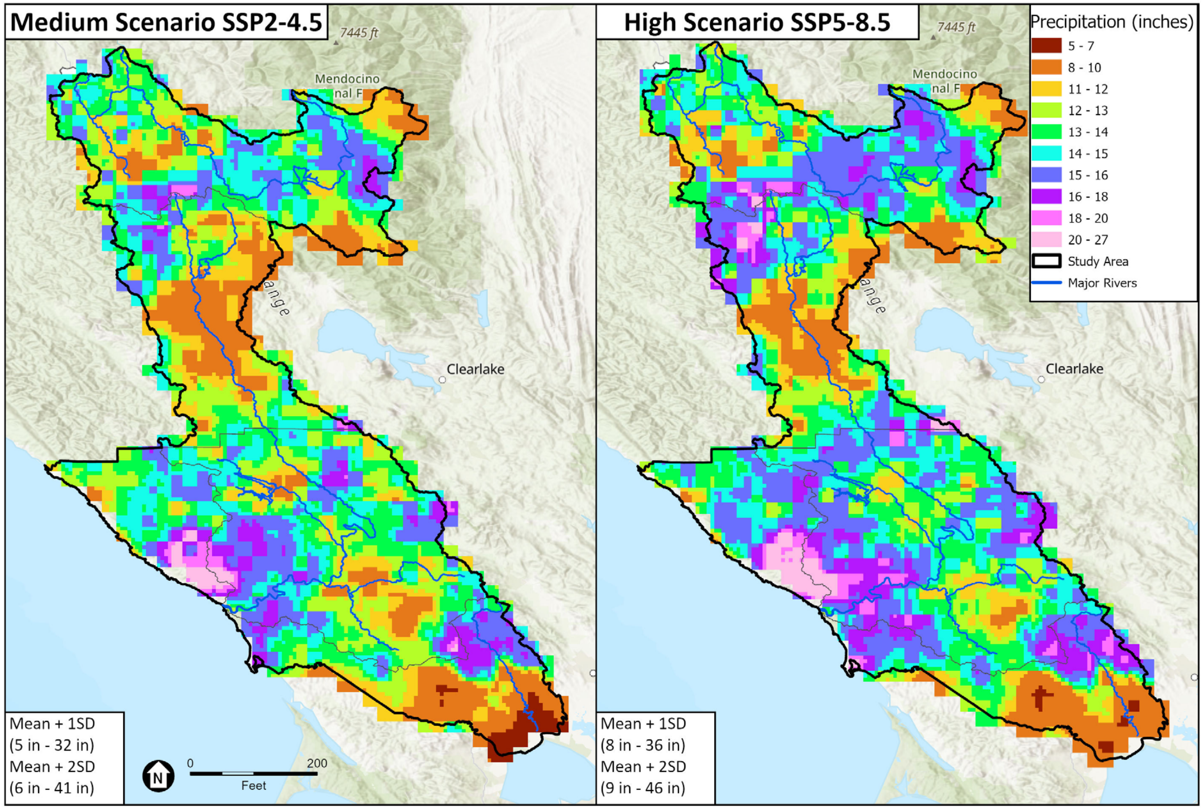
SOURCE: ESA, 2024

NOTE: Percent change is relative to the historic period (1950-2015)

Sonoma Water Future Rainfall
Model Mean % Change in 100-year rainfall
Late Century (2100)

ESA

100-year rainfall – Late century depths



SOURCE: ESA, 2024

Sonoma Water Future Rainfall

Model Mean of Precipitation Frequency Estimates for 100-yr 24-hr Rainfall

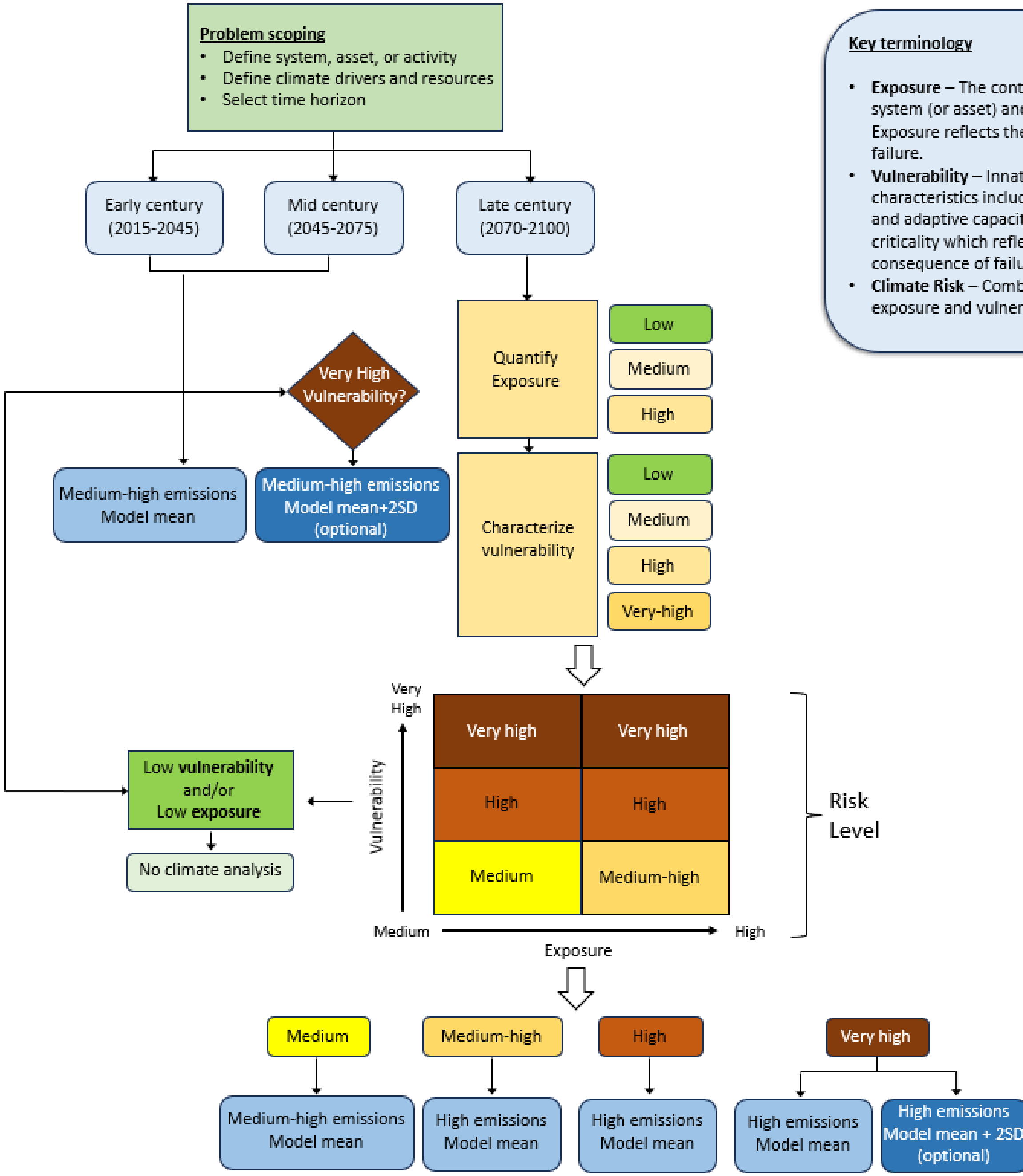
Late Century (2100)

ESA

III. Sonoma Water's commitment

(User Guidance Report, Section 2. Background and Purpose)

In recognition of California's rapidly changing climate and at the direction of Sonoma Water's Energy and Climate Resiliency Policy (2023) and Climate Adaptation Plan (Sonoma Water, 2021), Sonoma Water has committed to incorporating future climate data into studies, planning, design, and construction projects conducted by Sonoma Water **to the extent feasible and relevant**.



Key terminology

- **Exposure –** The contact between a system (or asset) and the climate. Exposure reflects the probability of failure.
- **Vulnerability –** Innate system characteristics including sensitivity and adaptive capacity, along with criticality which reflects the consequence of failure.
- **Climate Risk** – Combination of exposure and vulnerability.

75 YEARS

Accessing the data

- Data are available on the GIS server for internal use
- Data are available on Box for use by vendors under contract with Sonoma Water
- Data are available on County ISD for partners
- Anybody can have the Technical Report and User Guidance document

Learning as we go

- Best practice from analog agencies: retain flexibility and learn as you go
- Requirement to *study* future conditions, but maintenance and capital investment decisions always require careful evaluation of multiple criteria, including risk, cost, and level of service.
- Staff workshop was held in January 2024 and will be offered again in 2025.
- The climate resilience group is available for technical assistance.

Final thoughts or questions?

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