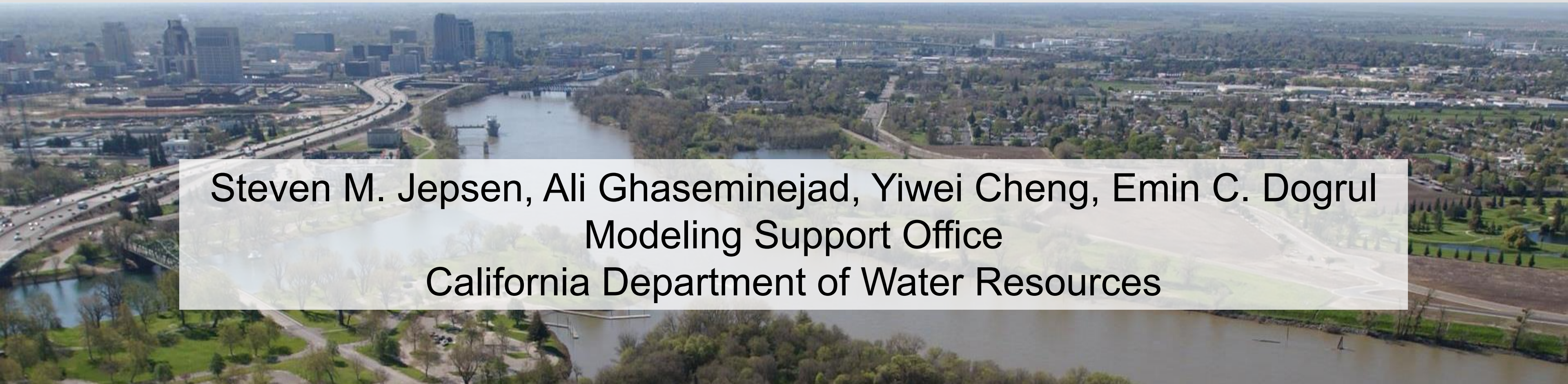


C2VSim 2025 Coarse Grid Calibration

CWEMF 2026 Annual Meeting

April 21, 2026

An aerial photograph of a city, likely San Francisco, showing a river (San Francisco Bay) flowing through the urban landscape. A major highway (Golden Gate Bridge area) is visible on the left, and the city skyline with various buildings is in the background. The foreground shows green spaces and a park area.

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Modeling Support Office
California Department of Water Resources

Acknowledgments

This work benefited by contributions from:

- Modeling Support Office, CA DWR
- Sustainable Groundwater Management Office, CA DWR
- Woodard & Curran
- S.S. Papadopoulos & Associates, Inc.
- Stantec
- John Doherty (SSP&A), Jeremy White (INTERA)



C2VSimCG Input Update



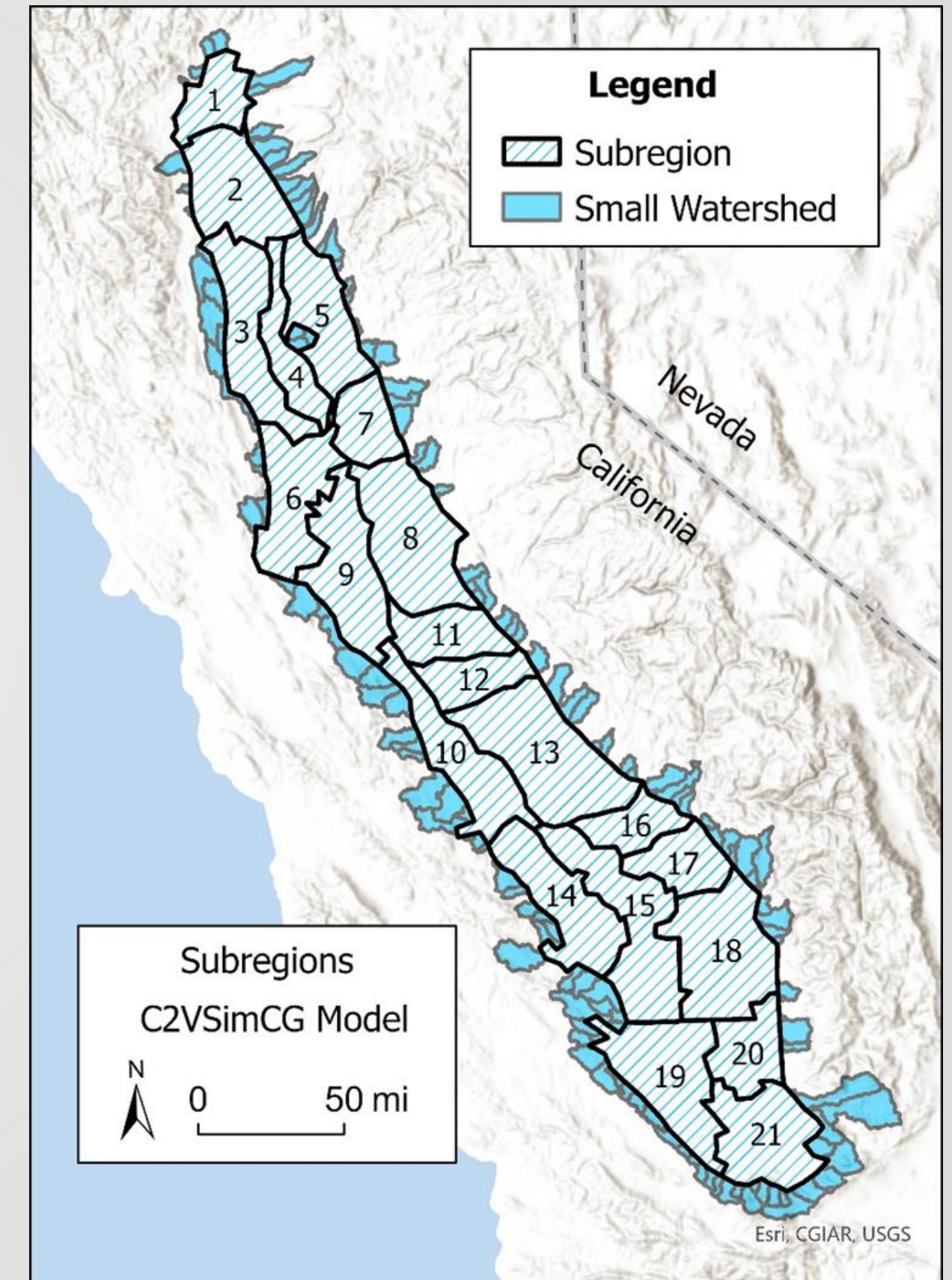
Precipitation and Small Watersheds

Precipitation

- PRISM 4x4 km monthly product (1974–2015)
- Monthly precipitation values for all 1,392 elements
- 6.7(Min) ,31.3 (Max) ,14.1(Mean) – in/year

Small Watersheds

- Revised configuration: 151 small watersheds
- Designed to align with CalSim 3 boundaries
- ~1.2 MAF/year surface inflow
- ~0.68 MAF/year subsurface inflow



Land Use Update

Data source : Fine Grid C2VSim model v1.5

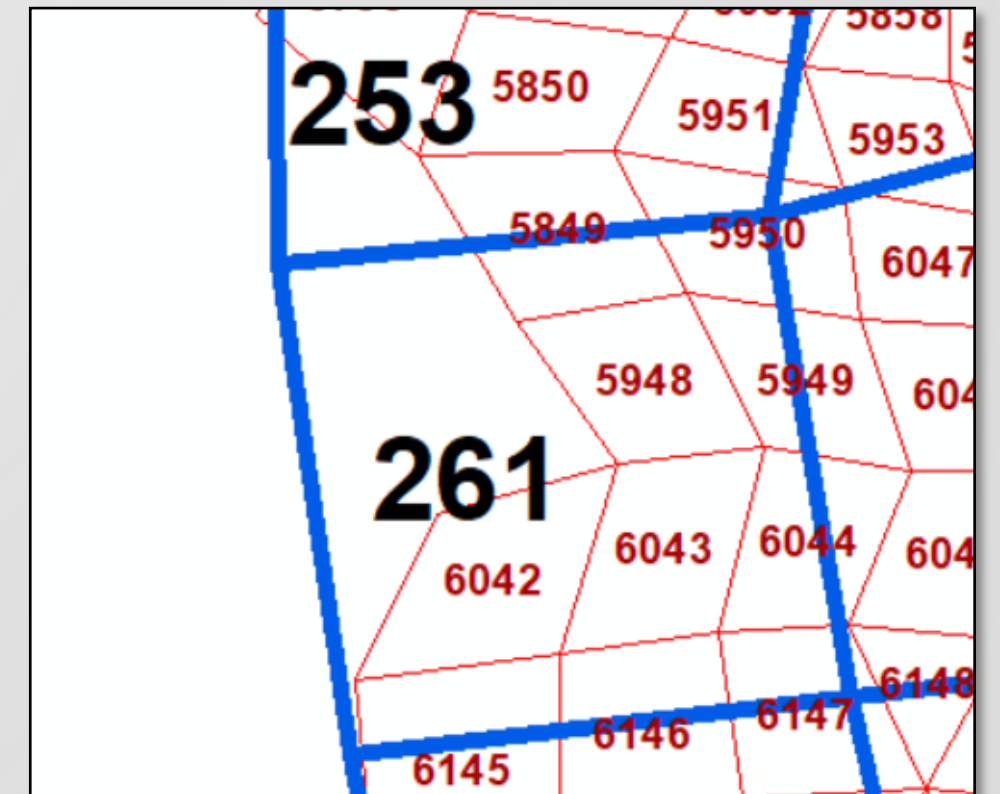
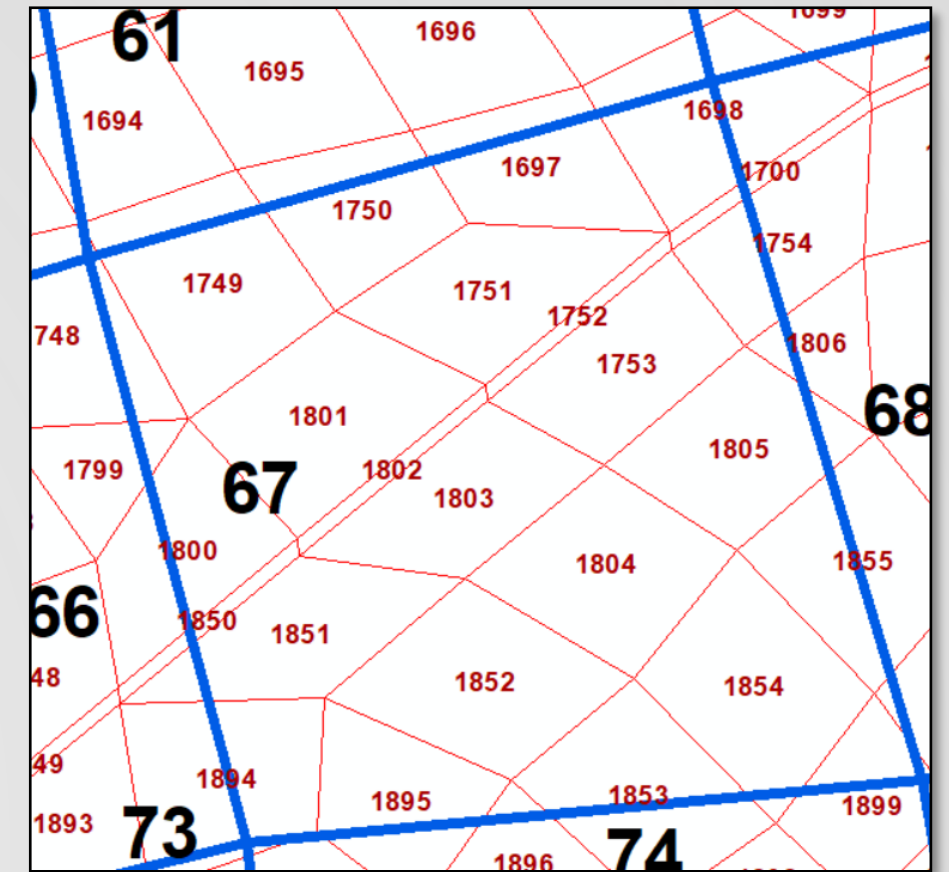
- USDA CDL, Landsat 5 and 8 ,land IQ
- DWR County Surveys, Water District

Methodology : Spatial Aggregation

- Land use fractions: area-weighted averaging of intersecting fine-grid elements

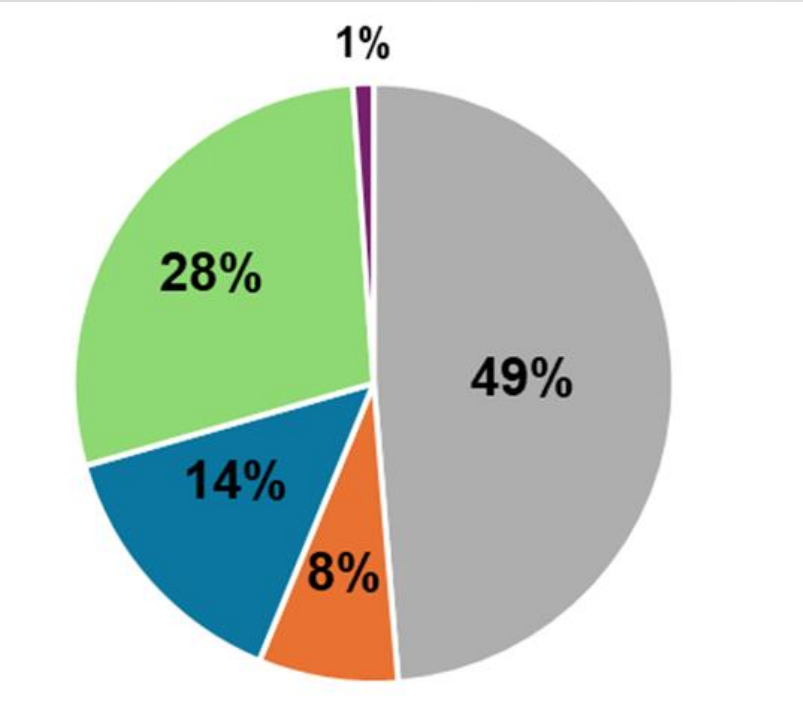
Assumptions

- Partially covered elements filled with native vegetation.
- Uniform distribution of land use across an element.

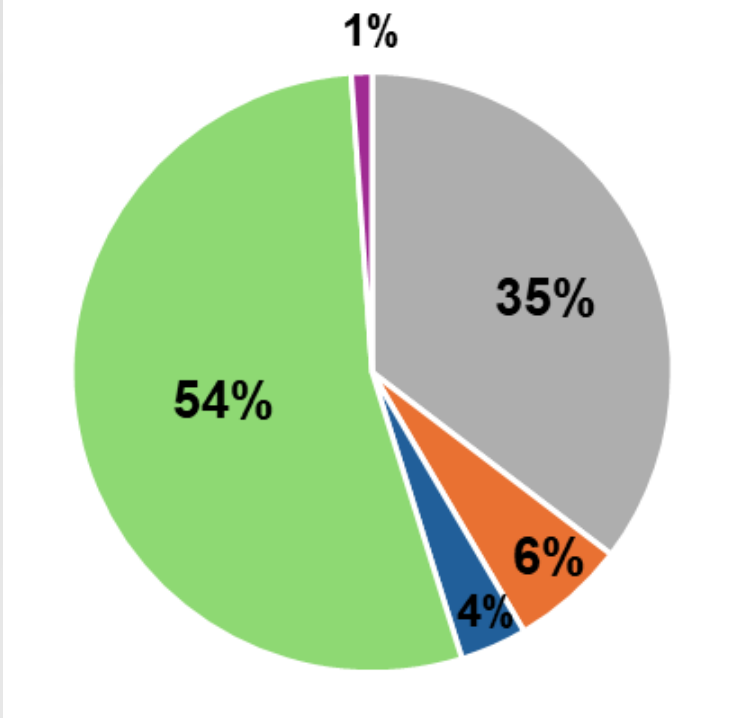


Land Use Update

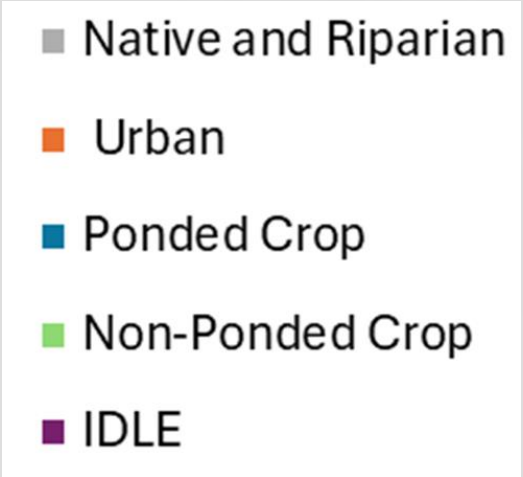
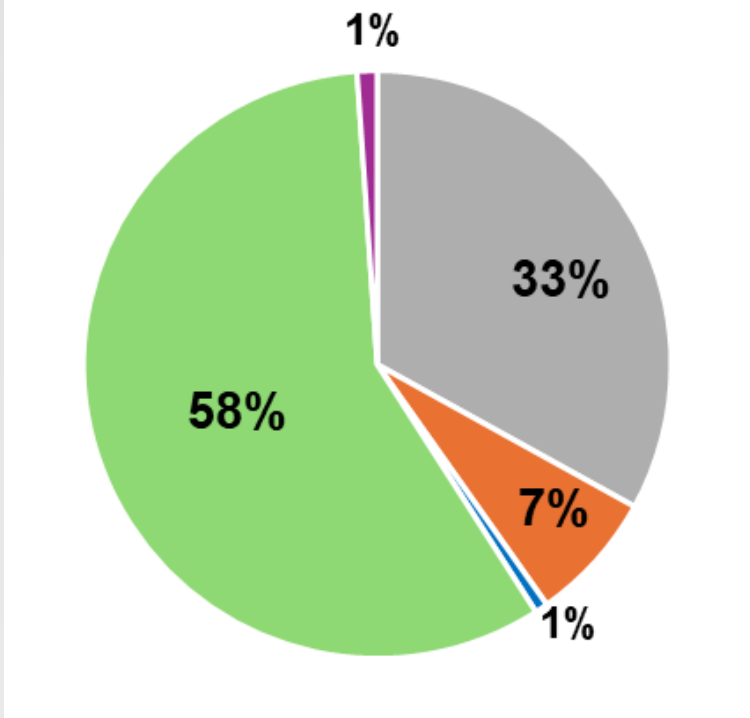
Sacramento



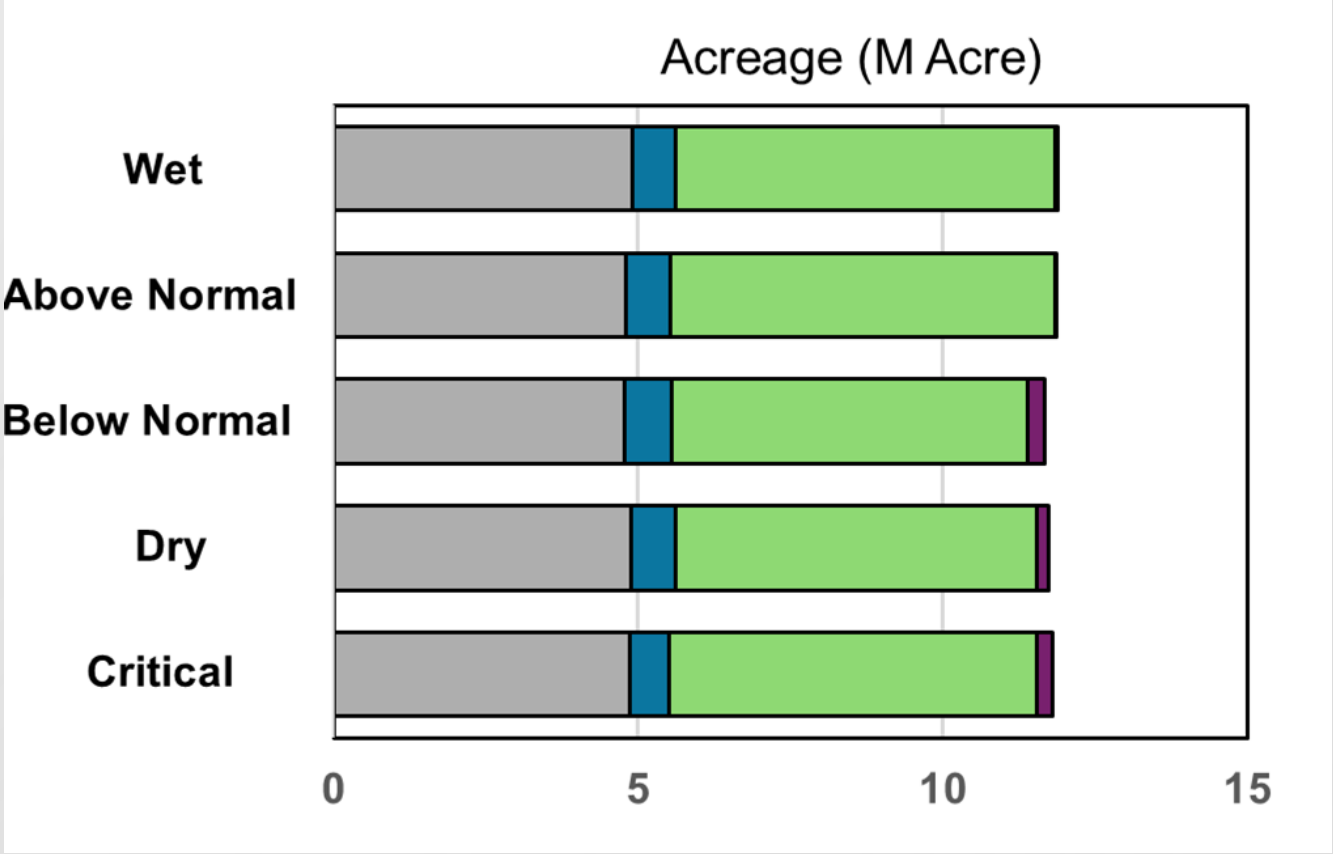
San Joaquin



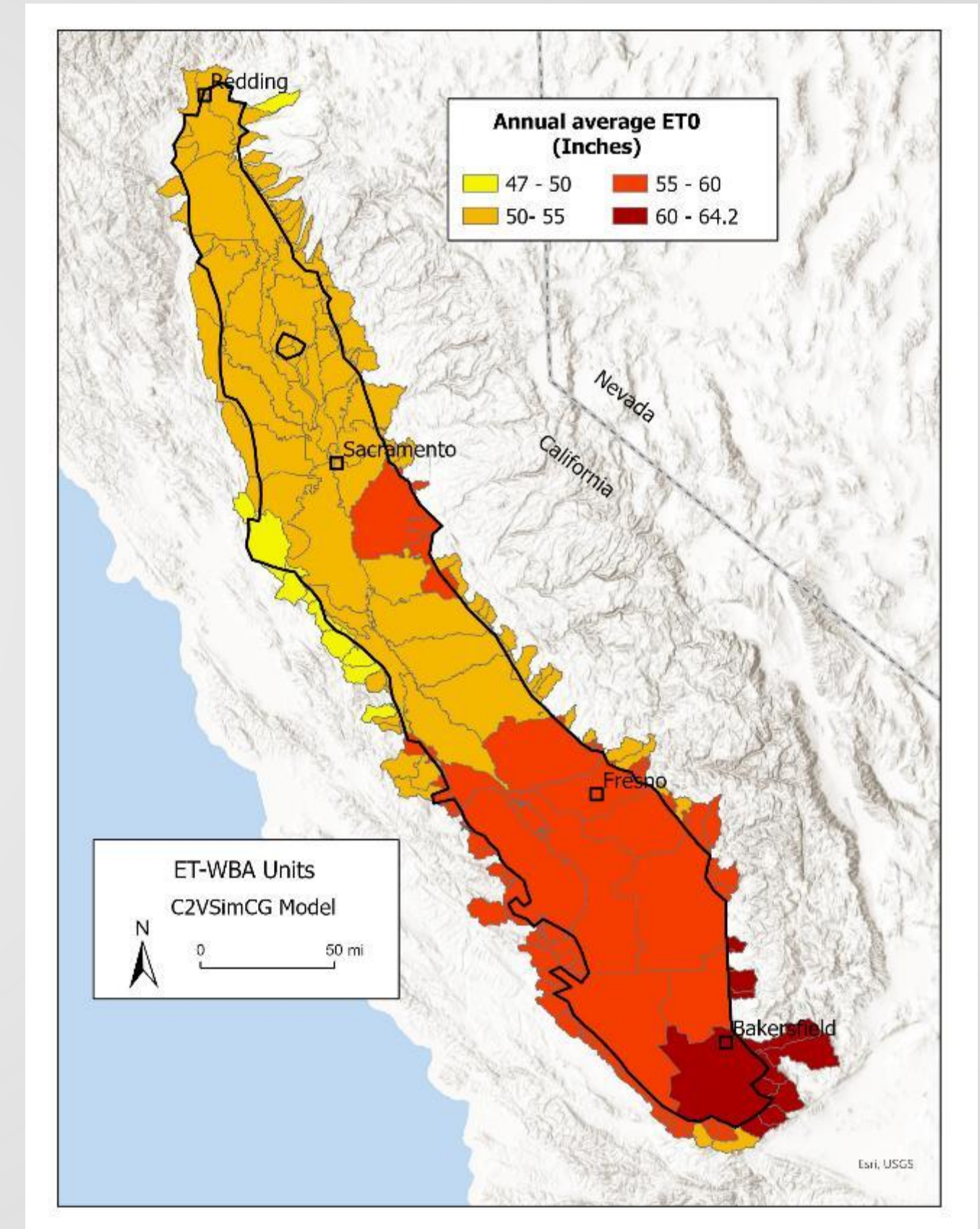
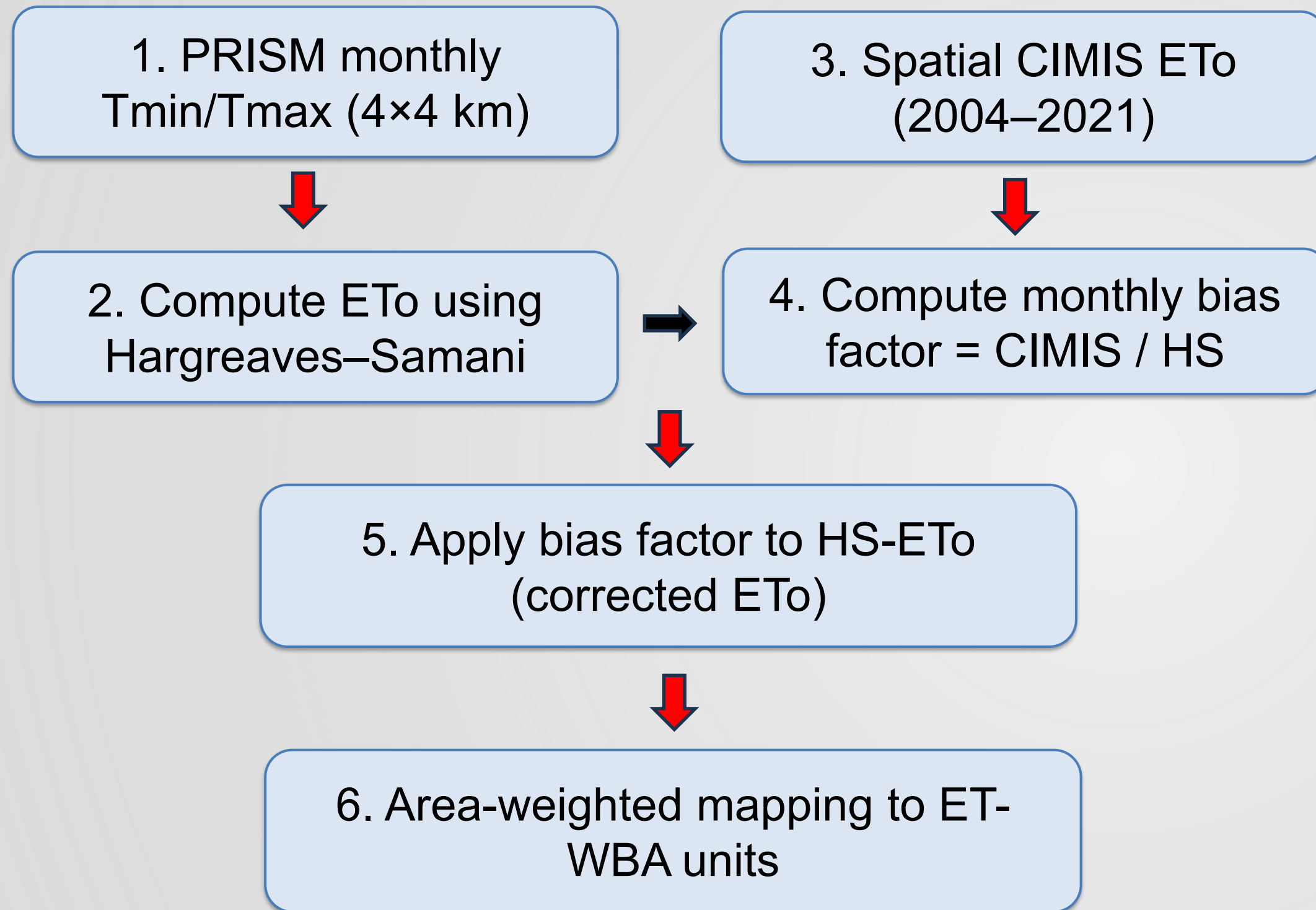
Tulare Basin



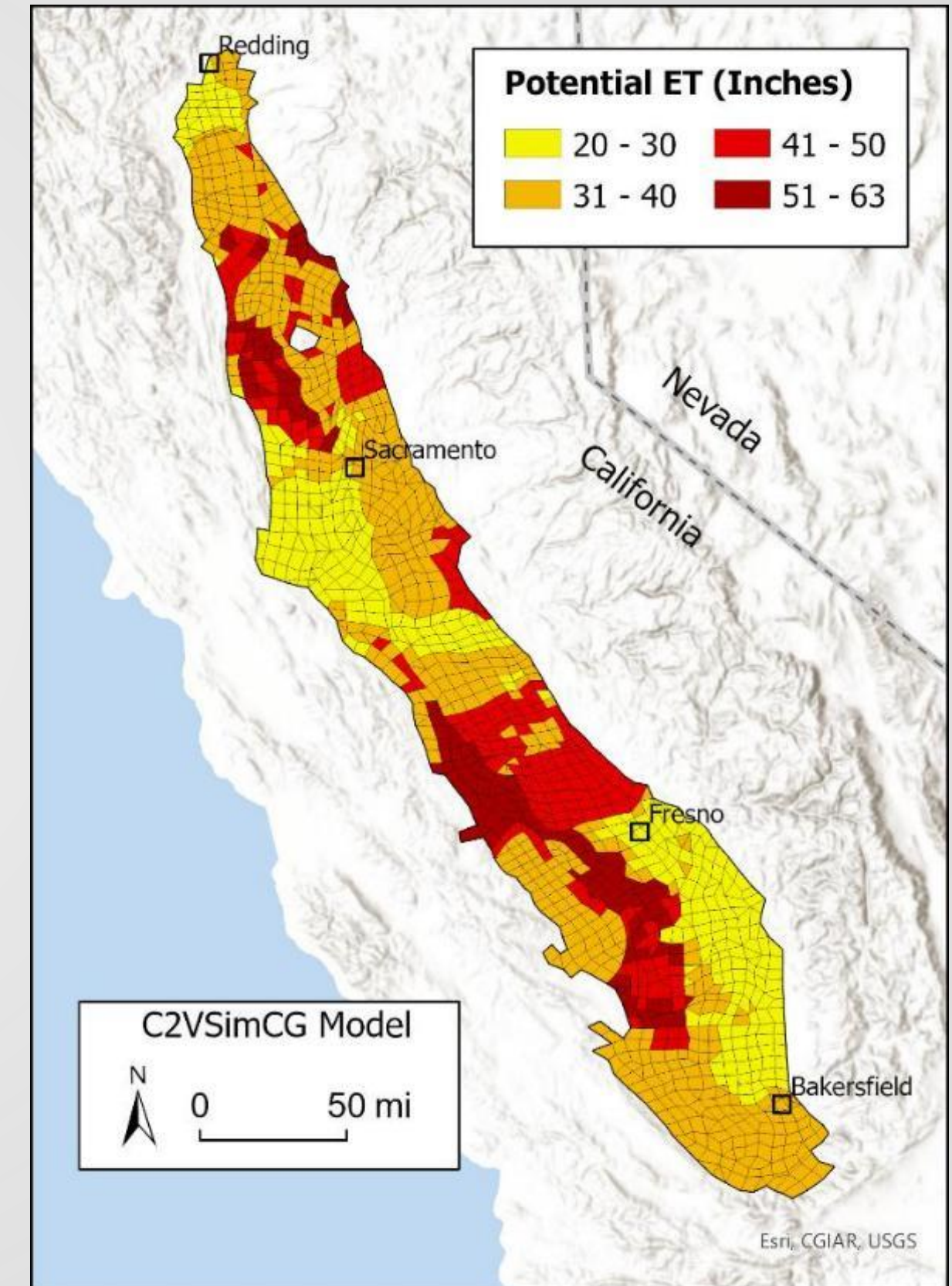
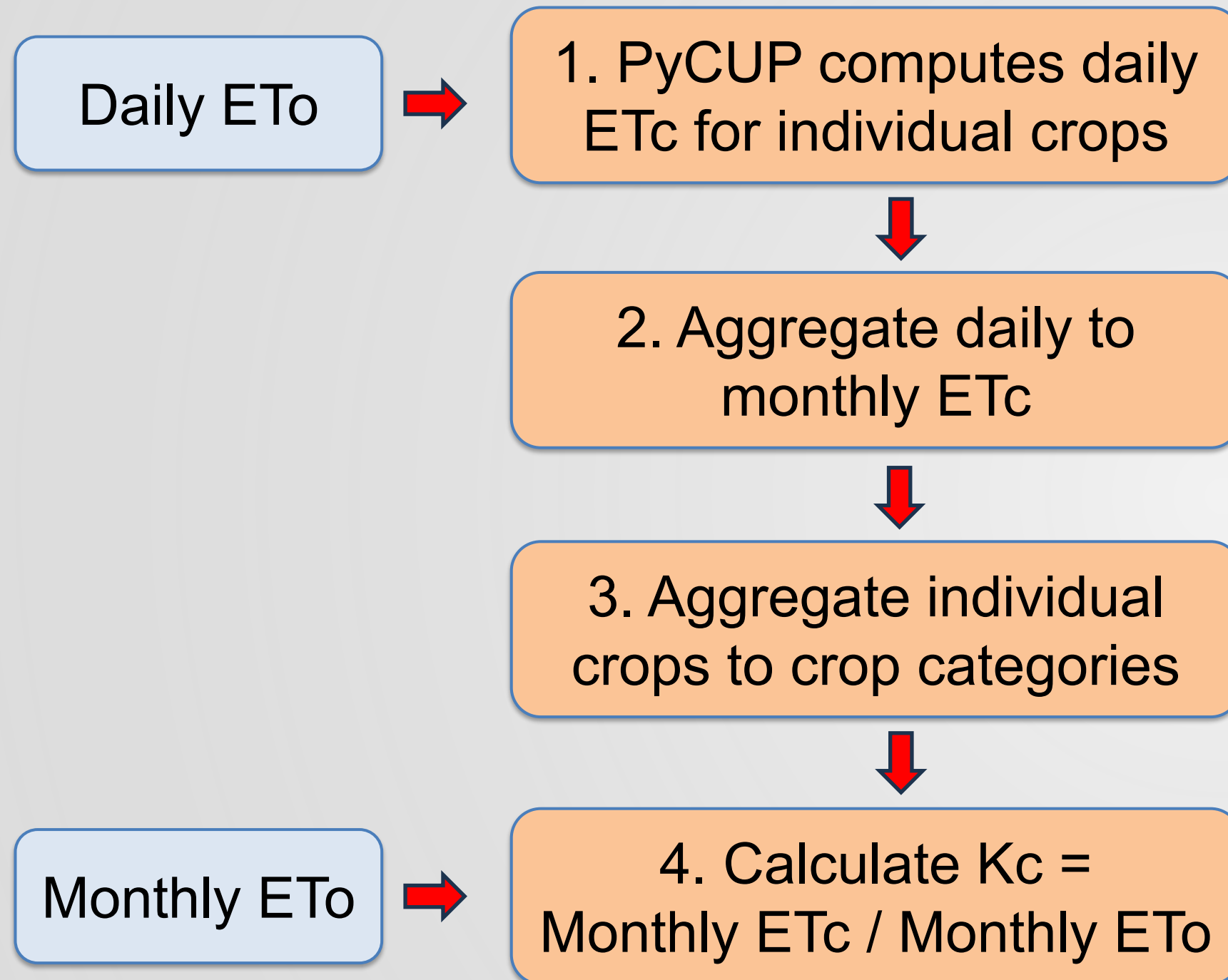
- N&R dominate the Sacramento Valley
- Smaller ponded crops proportion in the SJ and Tulare
- Slight changes in Land-use distribution in wet and dry years



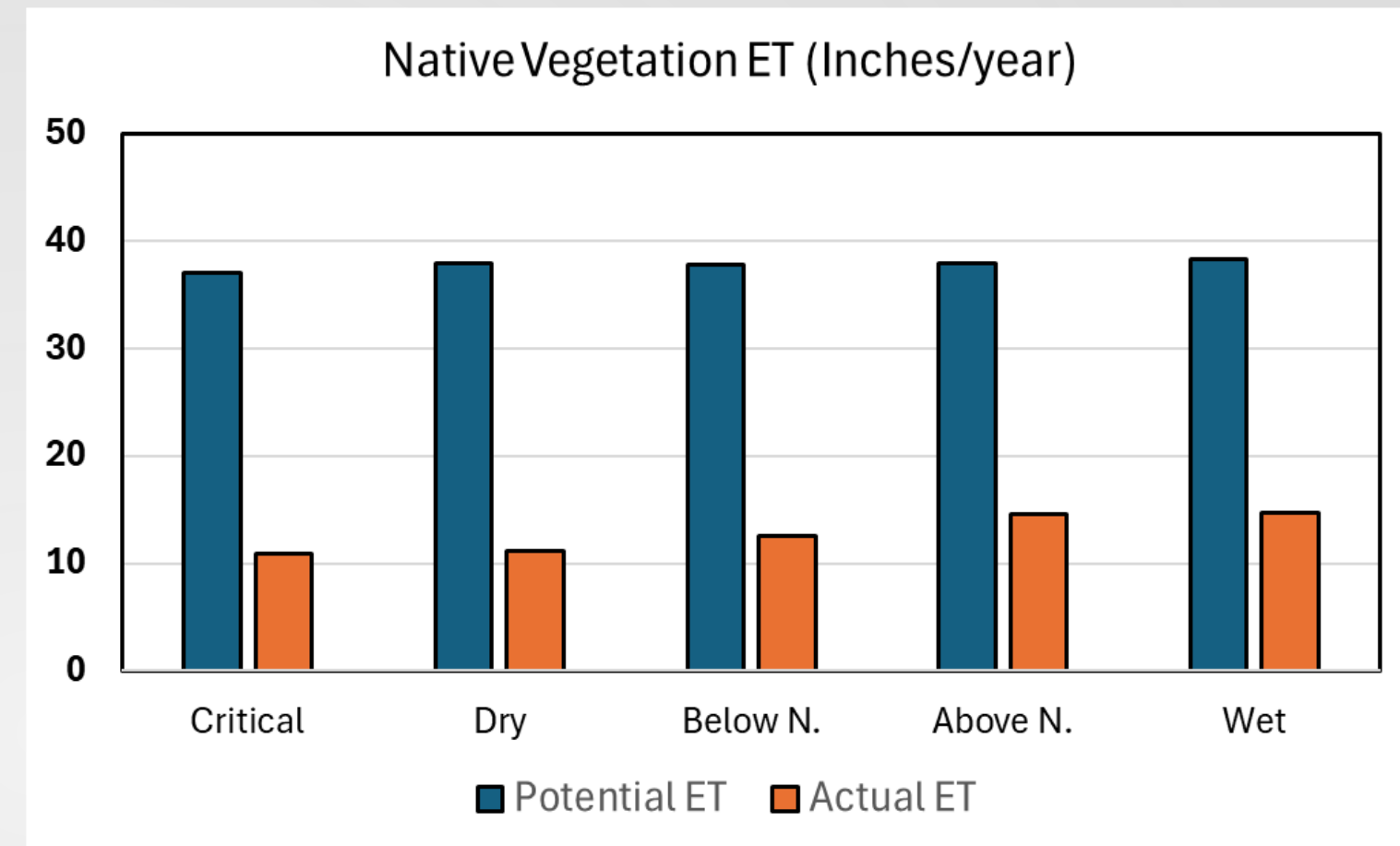
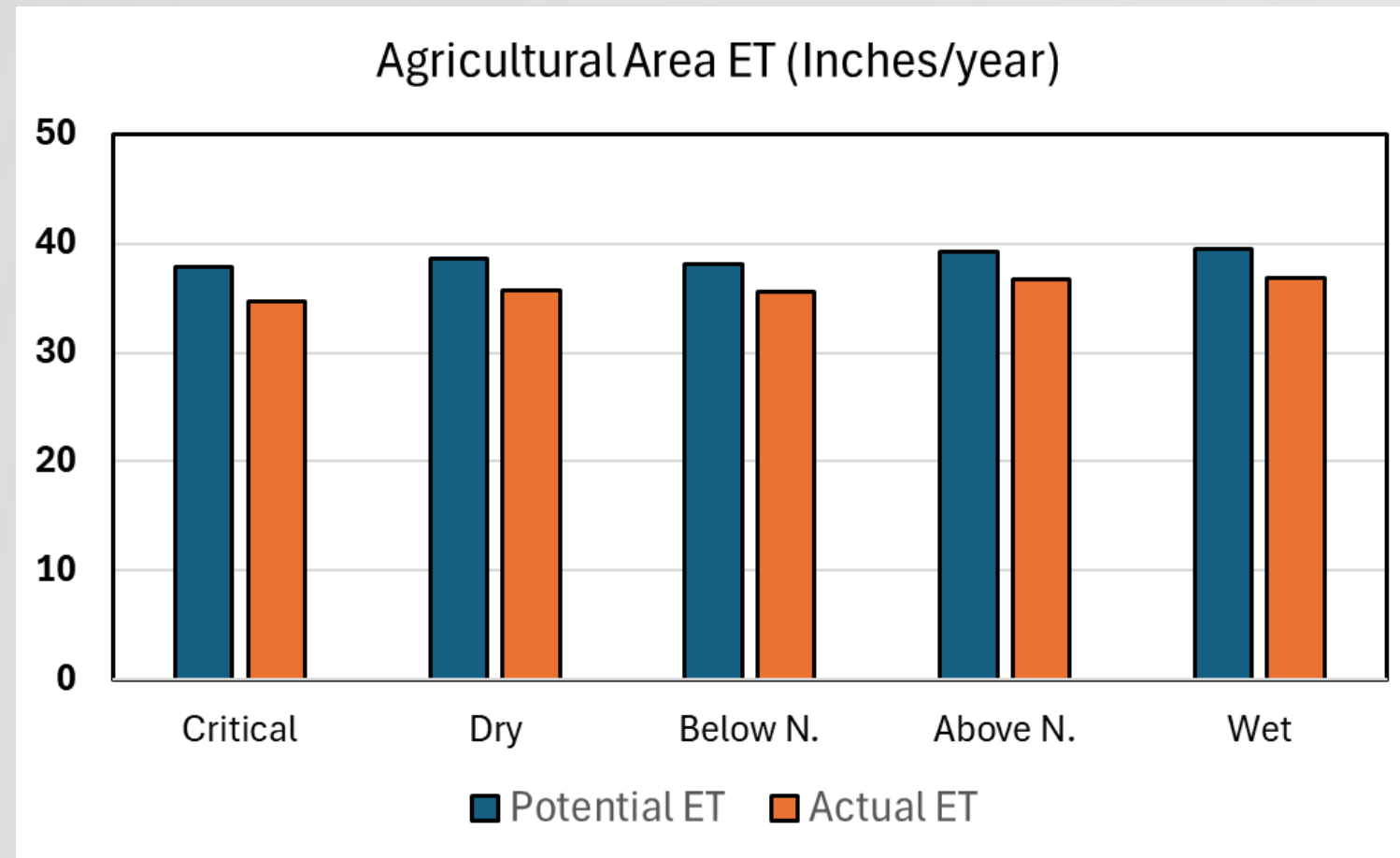
Evapotranspiration (Reference ET)



Evapotranspiration (Crop Coefficient)



Evapotranspiration (Actual ET)



- Ag Actual ET stays close to Potential ET due to irrigation
- Native vegetation has large ET deficits and is water-limited
- Small differences in Potential ET across all year types
- Native vegetation Actual ET increases in wetter years; Ag stays stable



C2VSimCG Calibration



Objective and Possible Uses of Calibration

- ❑ Objective: Capture historical response of model to hydrologic stresses
 - Example responses: GW levels, streamflows, subsidence
 - Example stresses: Boundary inflows, water demands, precipitation
- ❑ Parameters estimated that optimize fit of model to historical streamflows and GW levels (water years 1984–2015)
- ❑ Some or all parameters could potentially be used in the CalSim 3 planning model of State Water Project and Central Valley Project operations



Methods

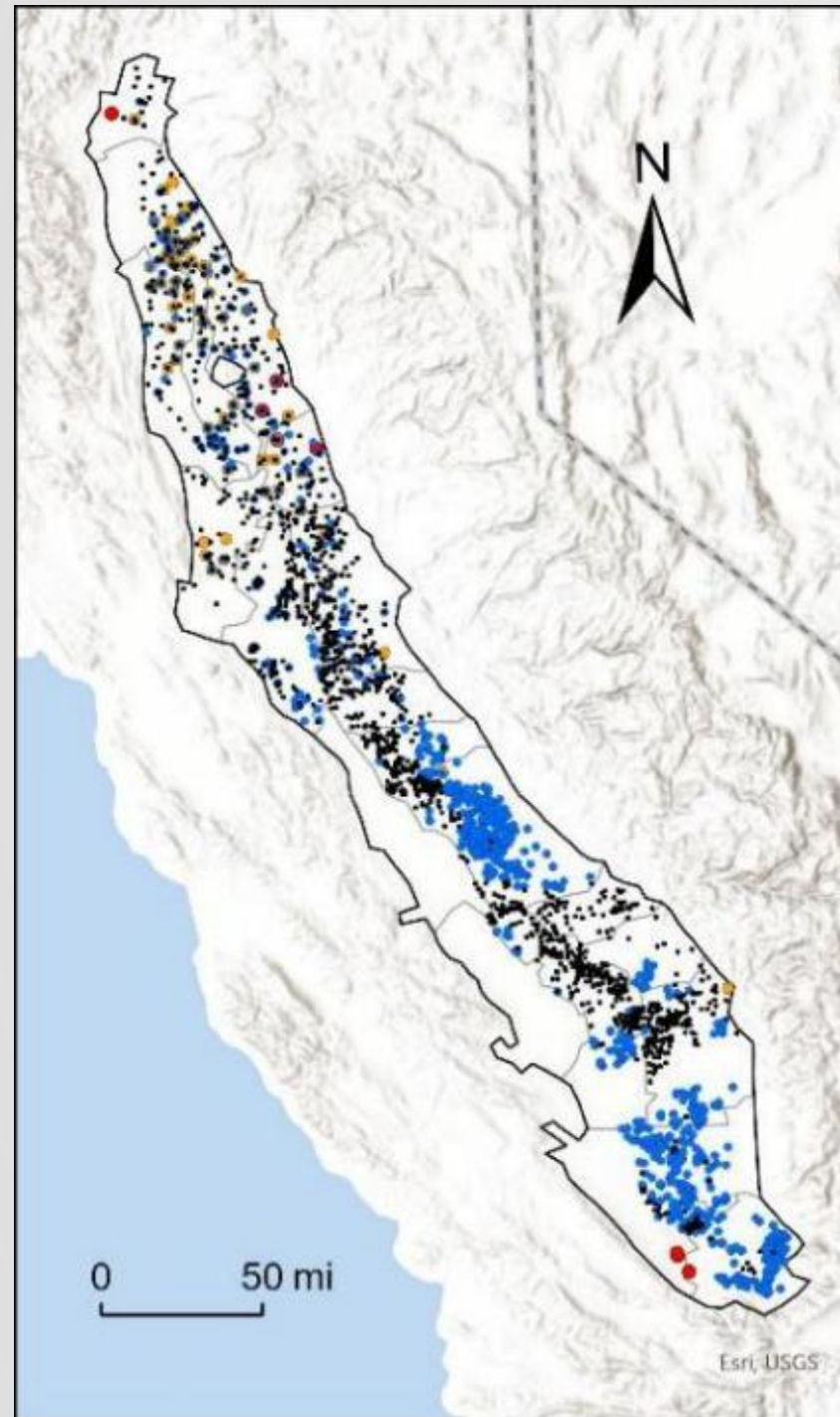
- ❑ All parameters estimated in same calibration run using PEST_HP
 - Because effect of any given parameter often depends on values of other parameters
 - Because is easier to reproduce and document
- ❑ Obtained expected values of parameters independent of calibration (“prior information”)
 - To initialize parameter values and provide centers of ranges
 - Can provide fall-back positions of insensitive parameters
- ❑ Most parameters are adjusted with scaling factors multiplied by initial values



Two Types of Observations Used for Calibration

Water levels 2,652 wells

Perforations in single layer of C2VSimCG

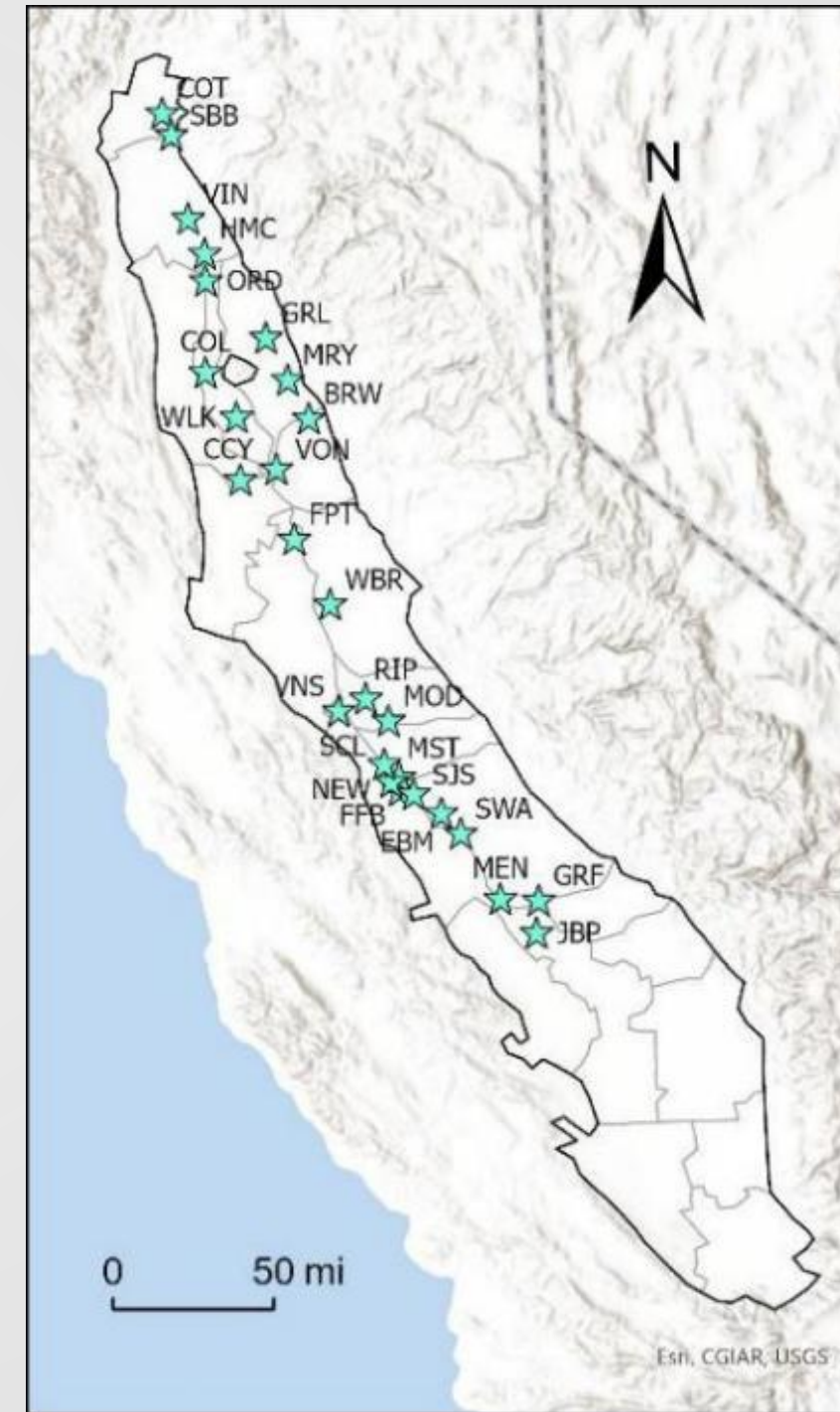


Aquifer
layer

- 1 • 3
- 2 • 4

List of wells
provided by
SGMO

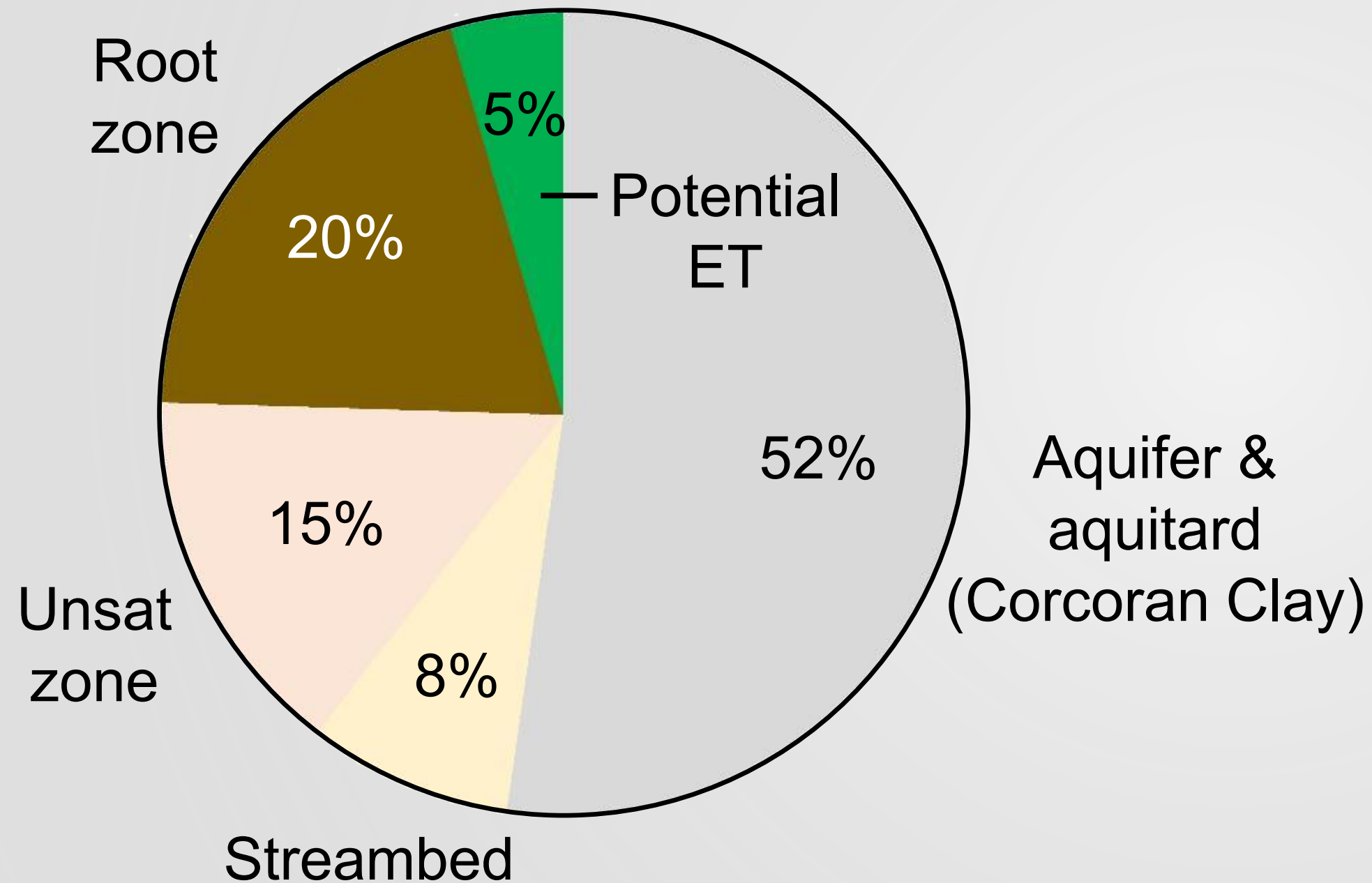
Streamflows at 27 gages



Parameter Types

Total adjustable parameters: 1261

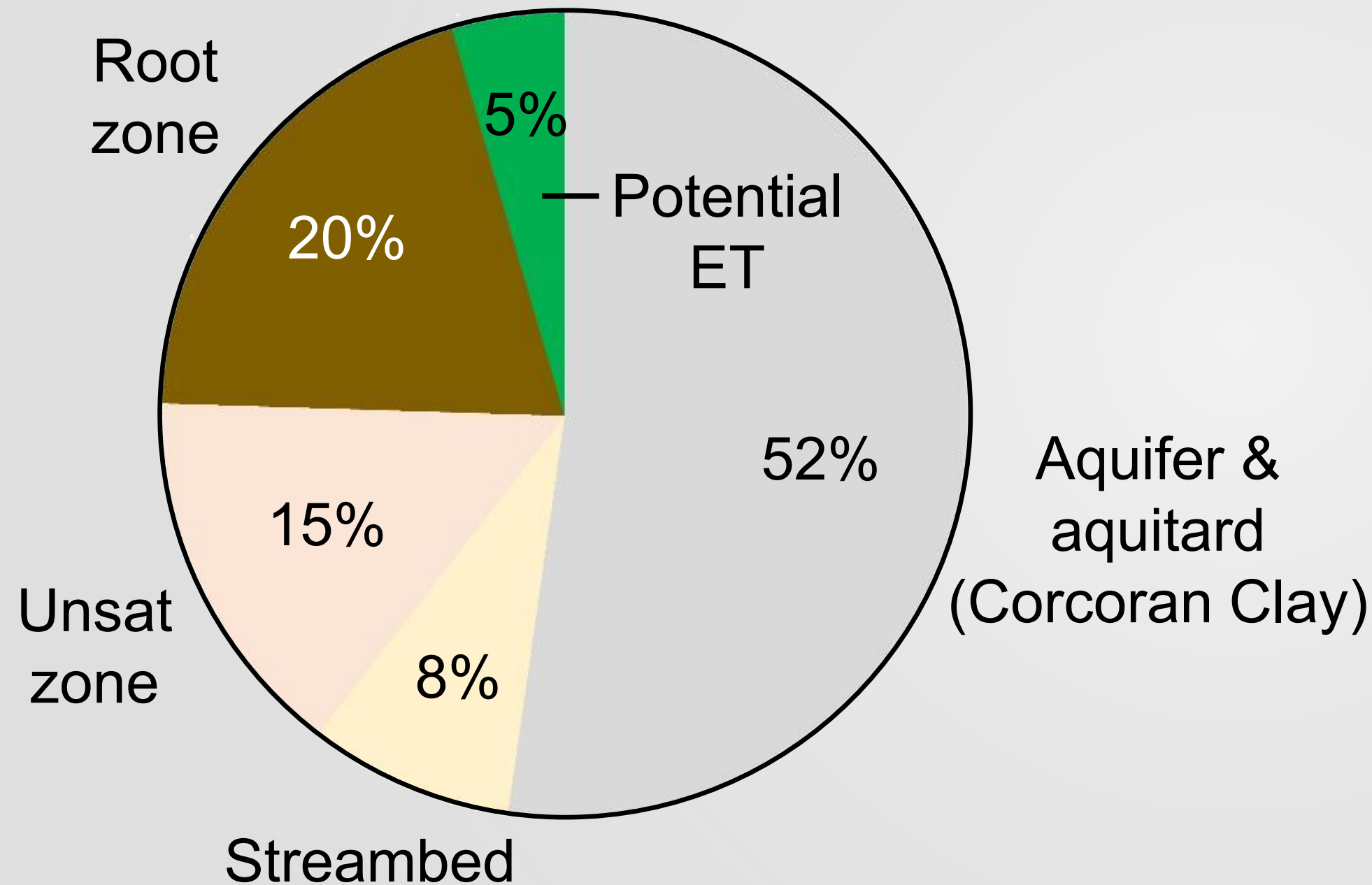
Distribution:



Parameter Types

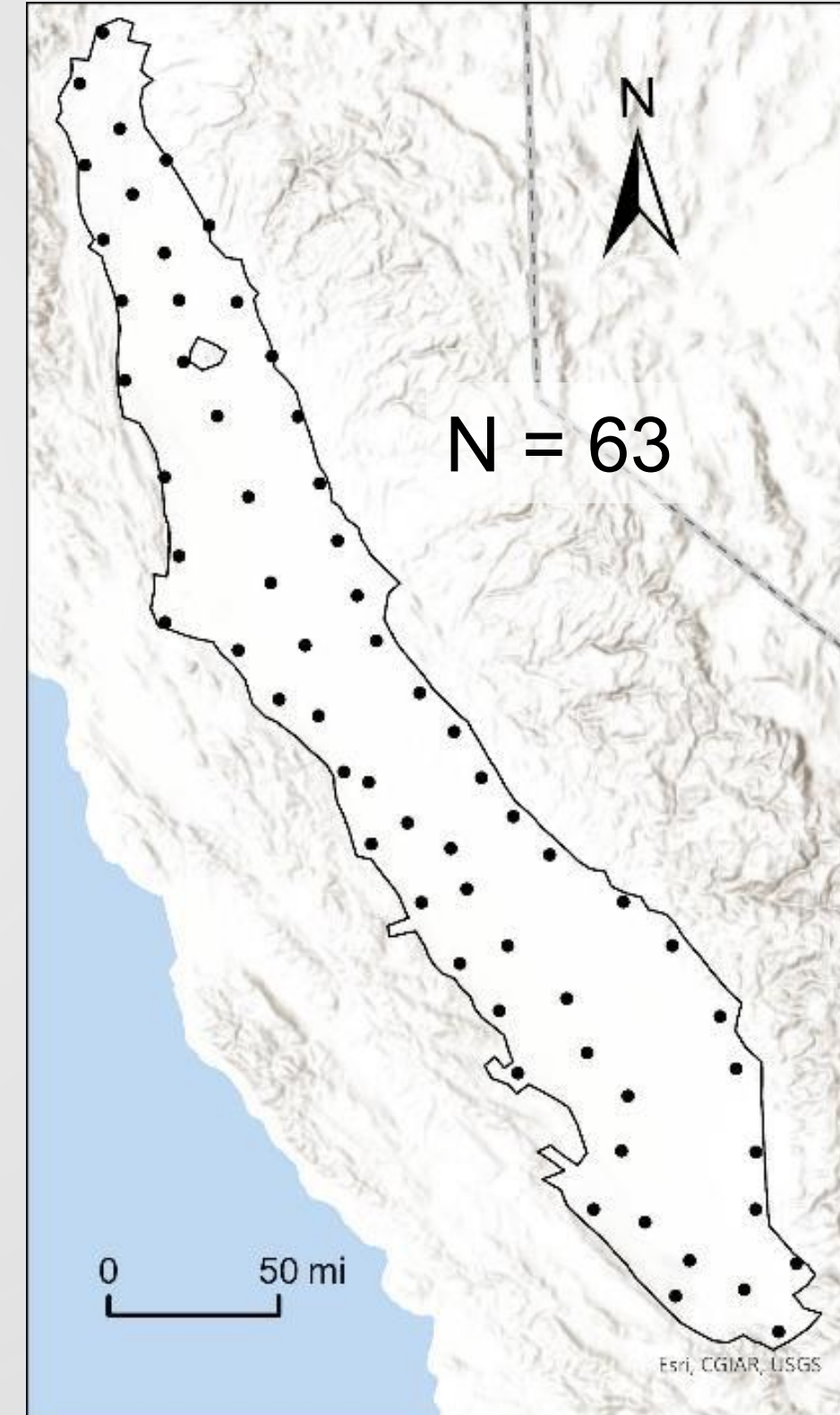
Total adjustable parameters: 1261

Distribution:



Parameter Estimation Locations

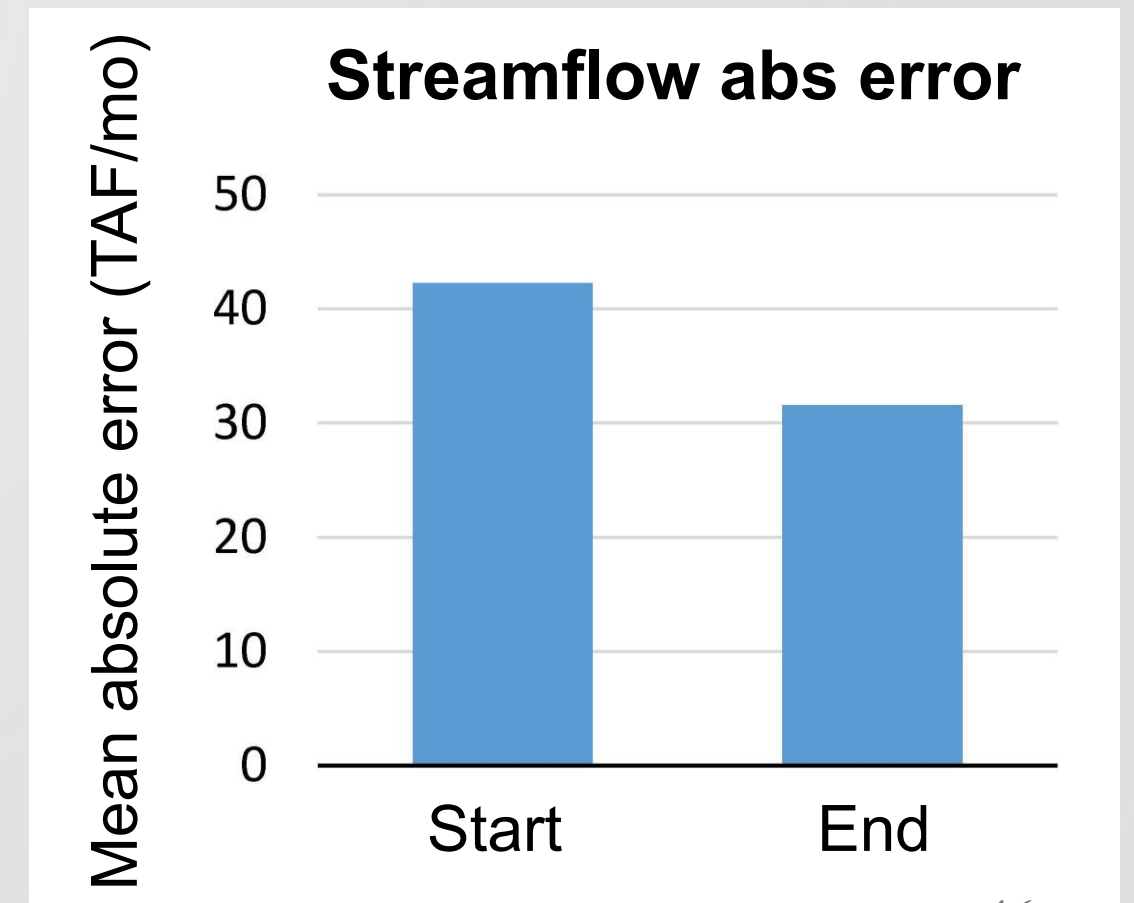
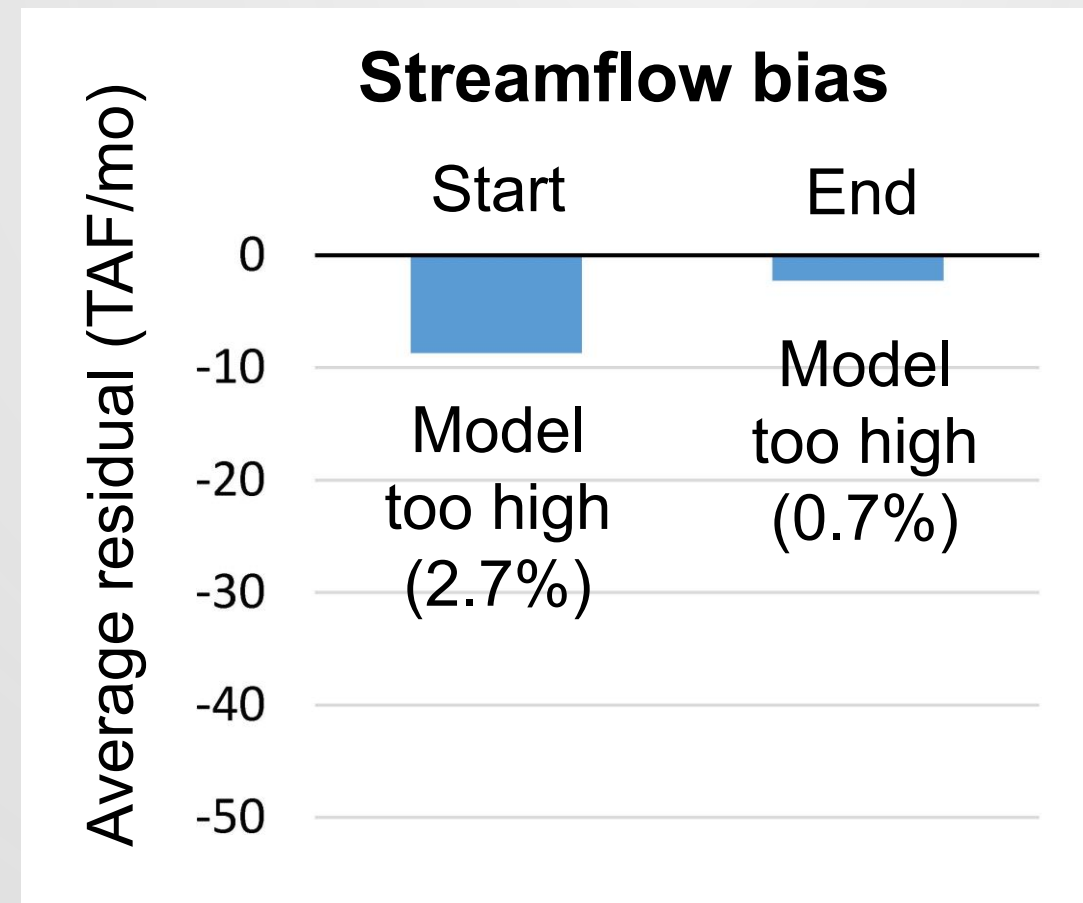
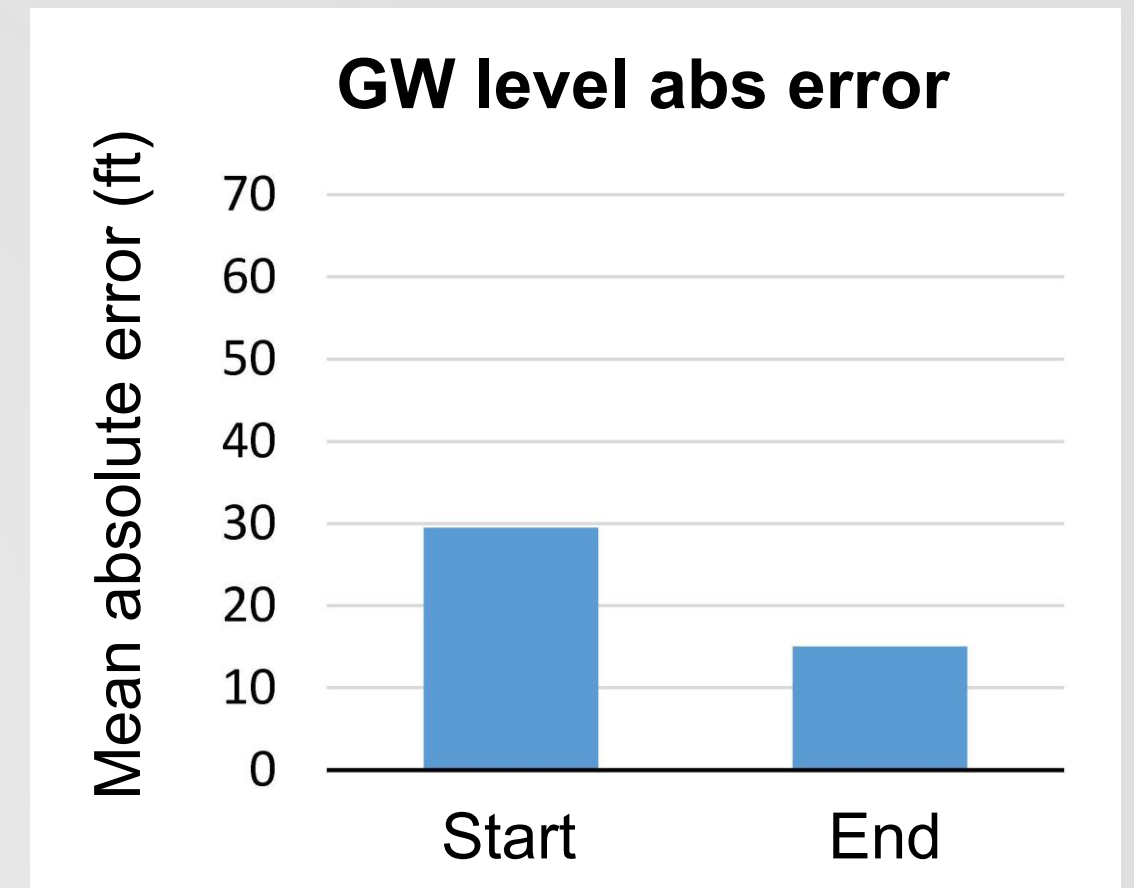
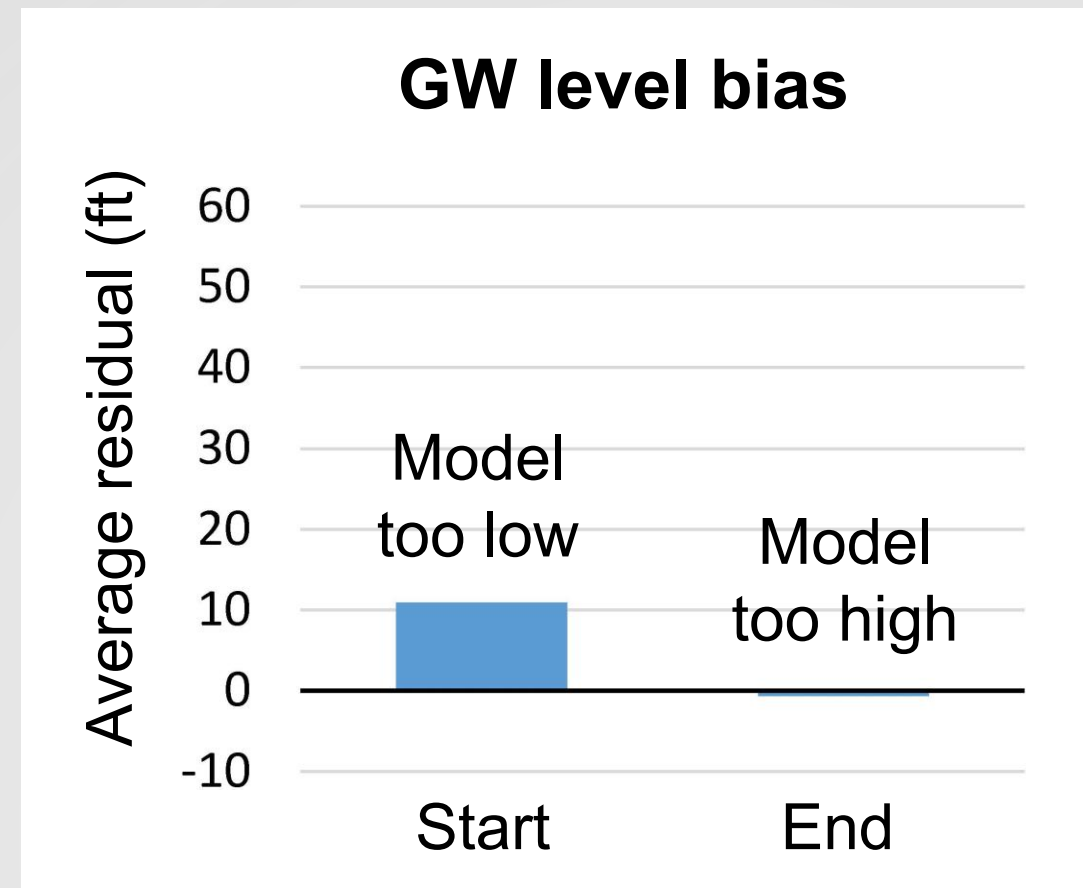
“Pilot points”



Provided by
Woodard &
Curran



Change in Model Errors at All Observation Sites

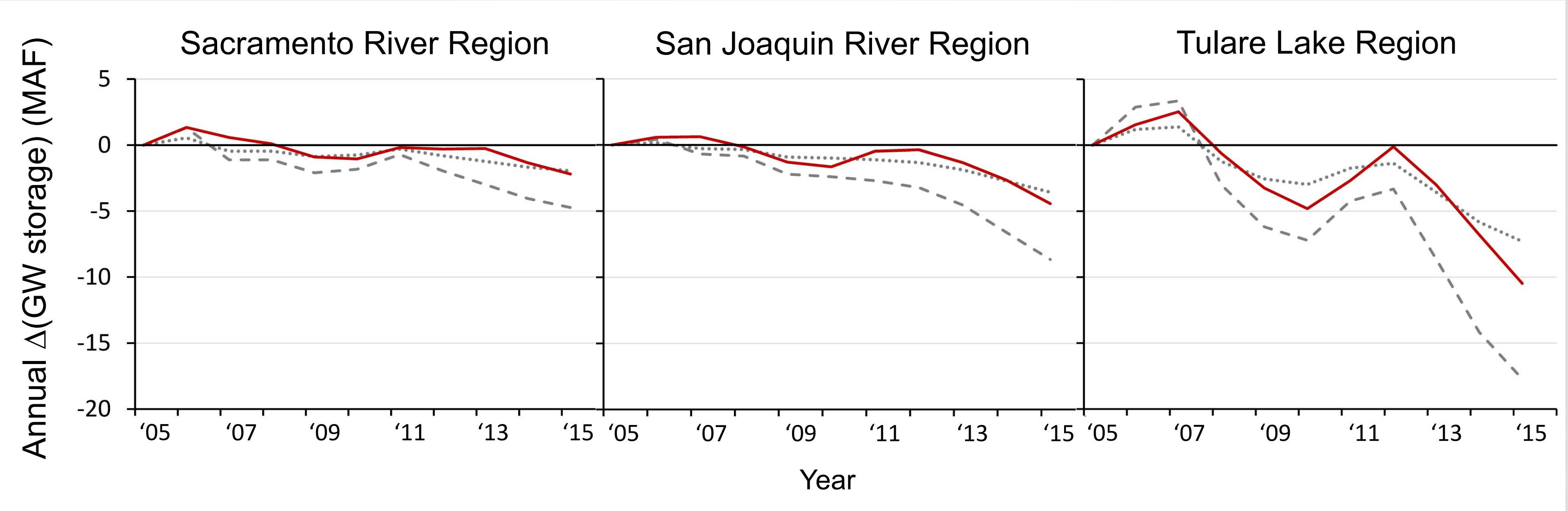


Cumulative Annual Δ (Groundwater Storage) Since 2005

Calibrated C2VSimCG

California's Groundwater Update (2020) (GWL method)

- Specific yield from C2VSimCG (2013)
- - - - - Specific yield from CVHM model



Possible Modifications to Calibration Method in Future

- ❑ Addition of small watersheds
- ❑ Addition of subsidence observations
- ❑ Implementation of parameter reduction (SVD-Assist or ENSI)
 - To automatically filter out less sensitive parameters
- ❑ Implementation of spatially variable observation weights to reduce clustering effects
 - For example, assign GW observation weights by subregion



Thank You

