

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Inferring South Delta salinity loads using a response-based inverse modeling method

May 2025



Zhenlin Zhang and Eli Ateljevich (DWR)

Motivation

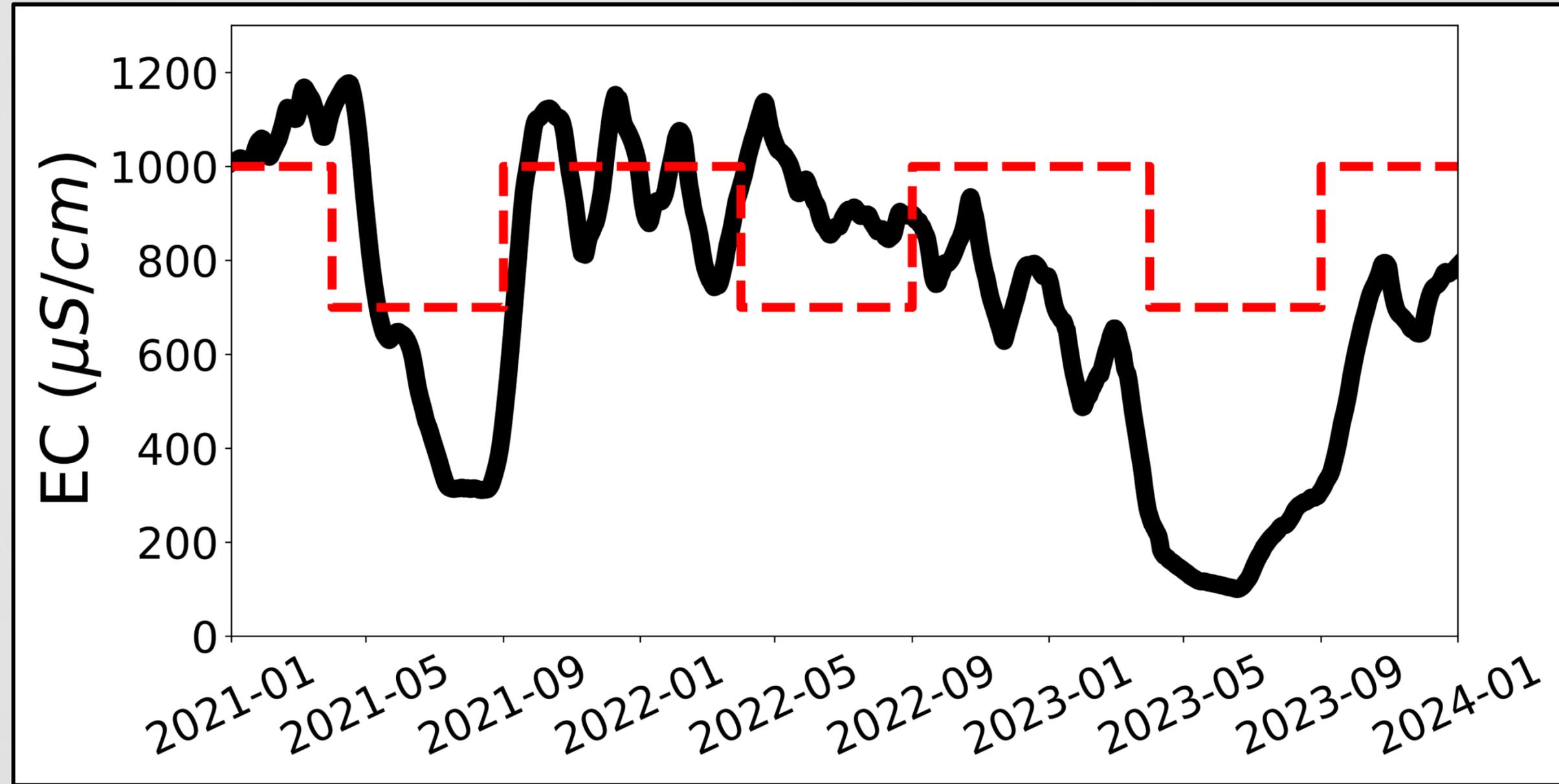
SWRCB “Monitoring Special Studies” (MSS) with the goals:

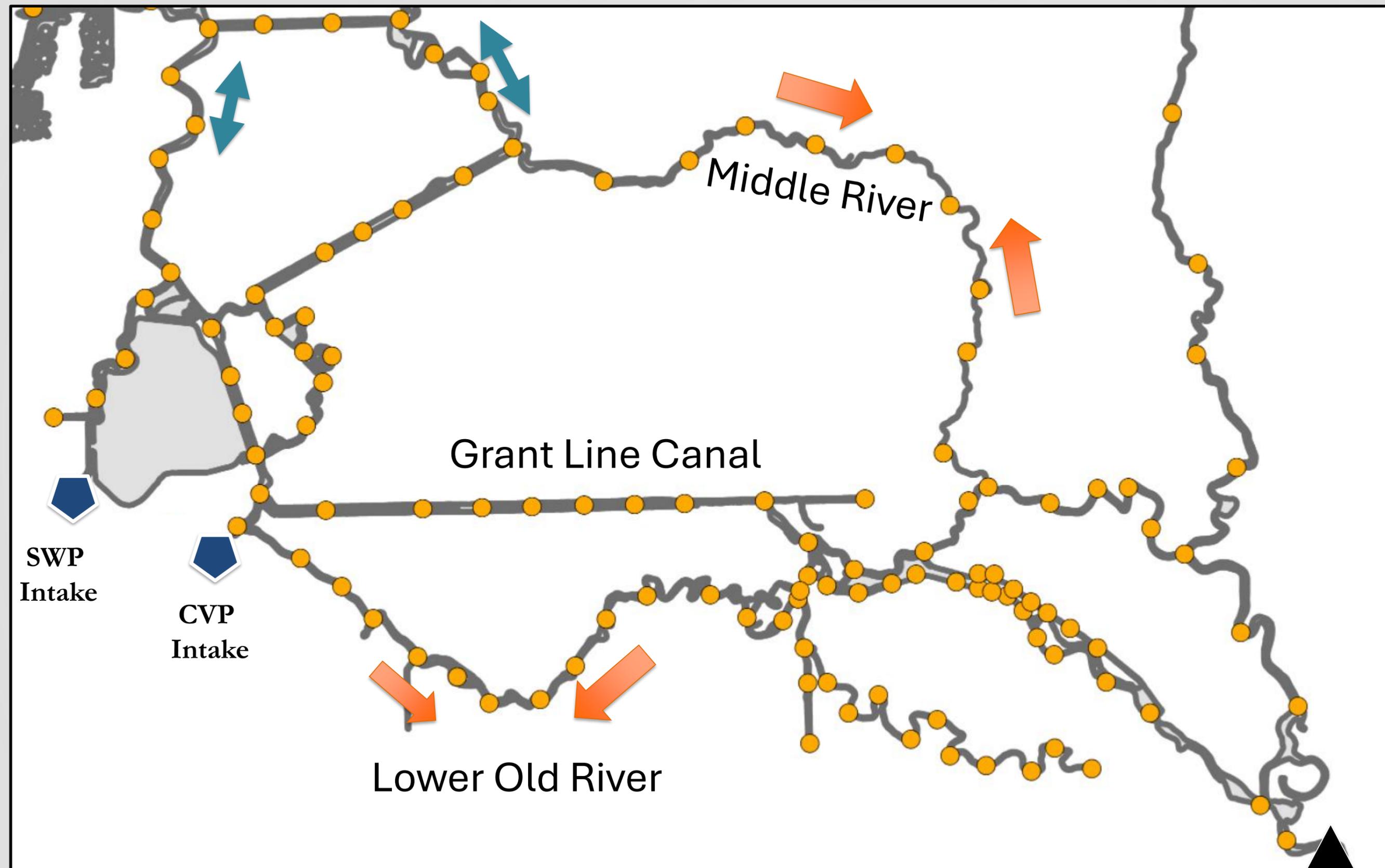
- characterize dynamics of water level, flow, and salinity.
- identify low- or null-flow conditions and concentration of local salt sources.
- inform a Long-Term Monitoring and Reporting Plan





- Old River at Tracy
- D1641





Known Drivers

-  Freshwater input
-  Tidal flow
-  Exports

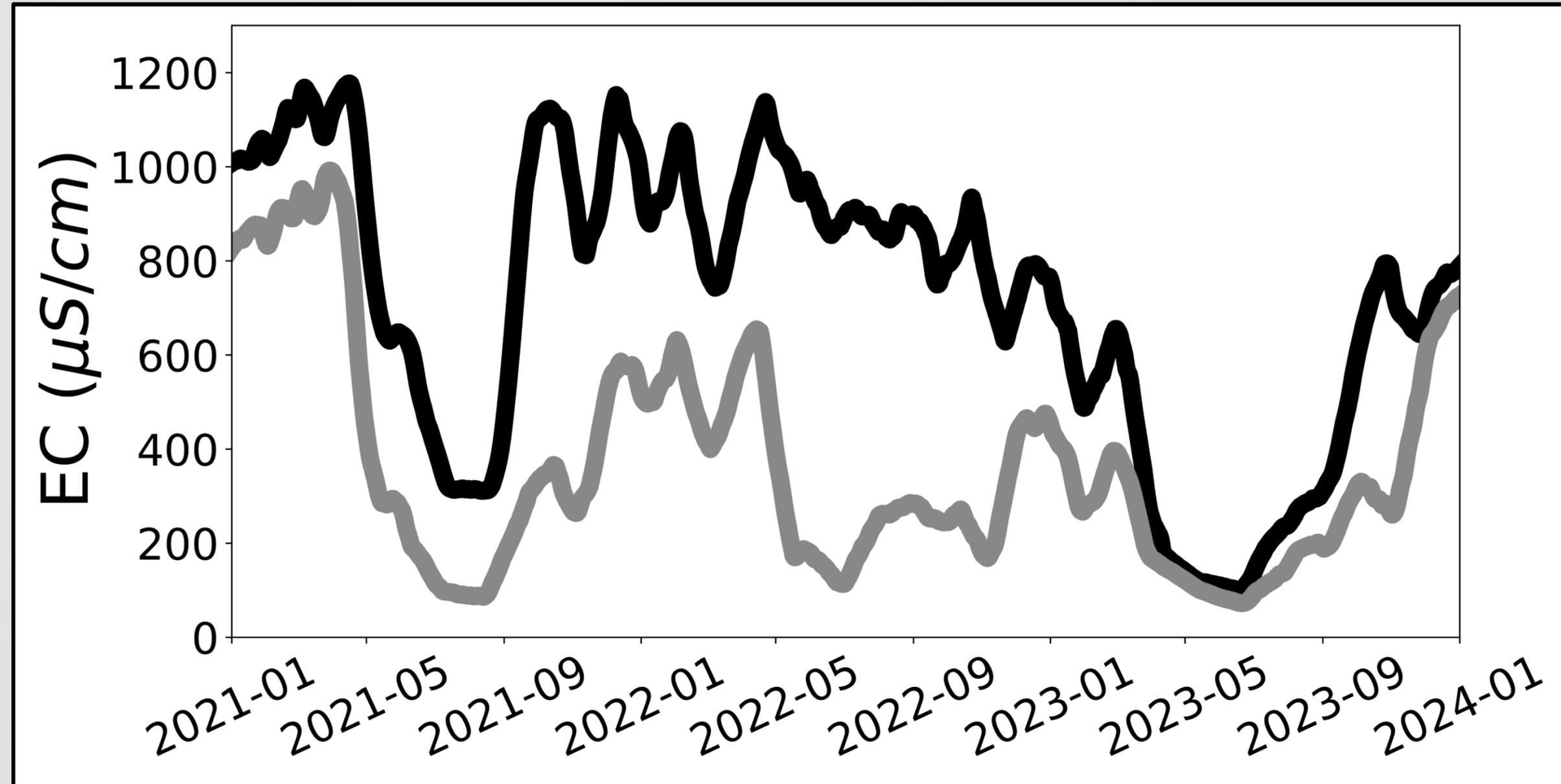
Uncertain drivers

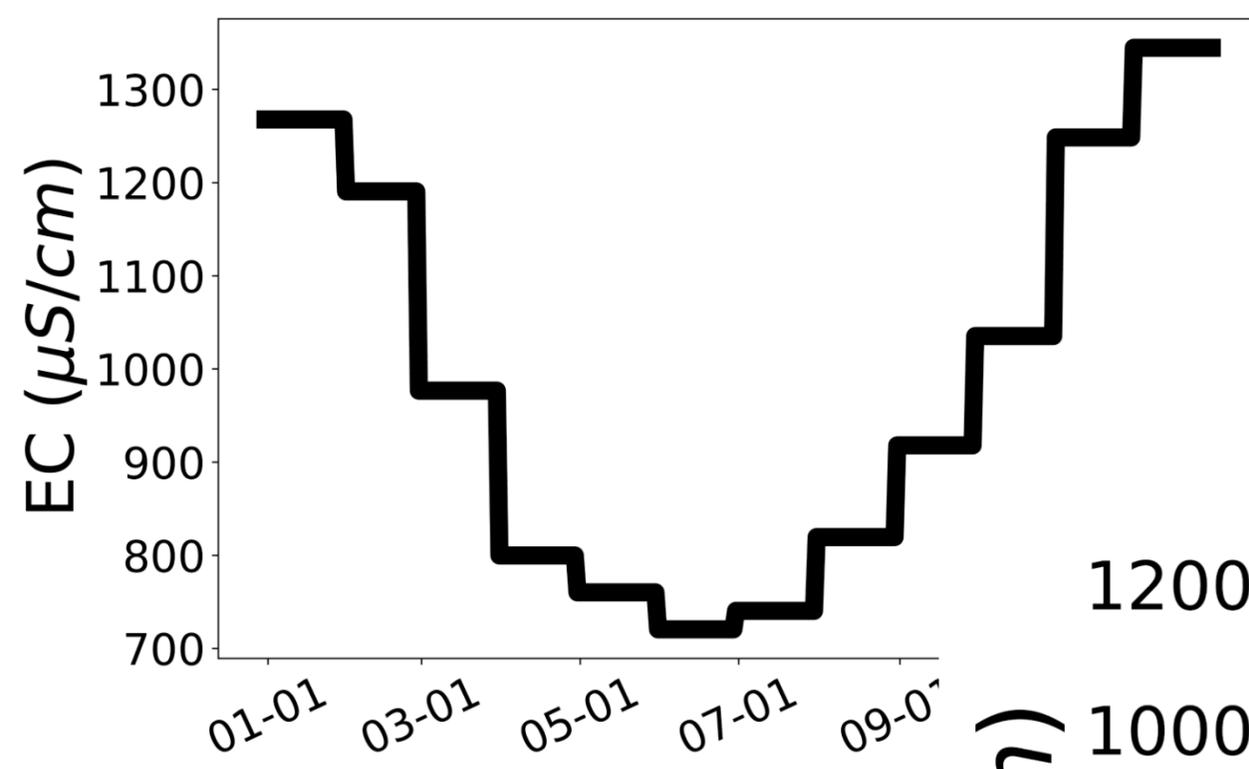
-  In-Delta source/sink
-  null zones

San Joaquin inflow



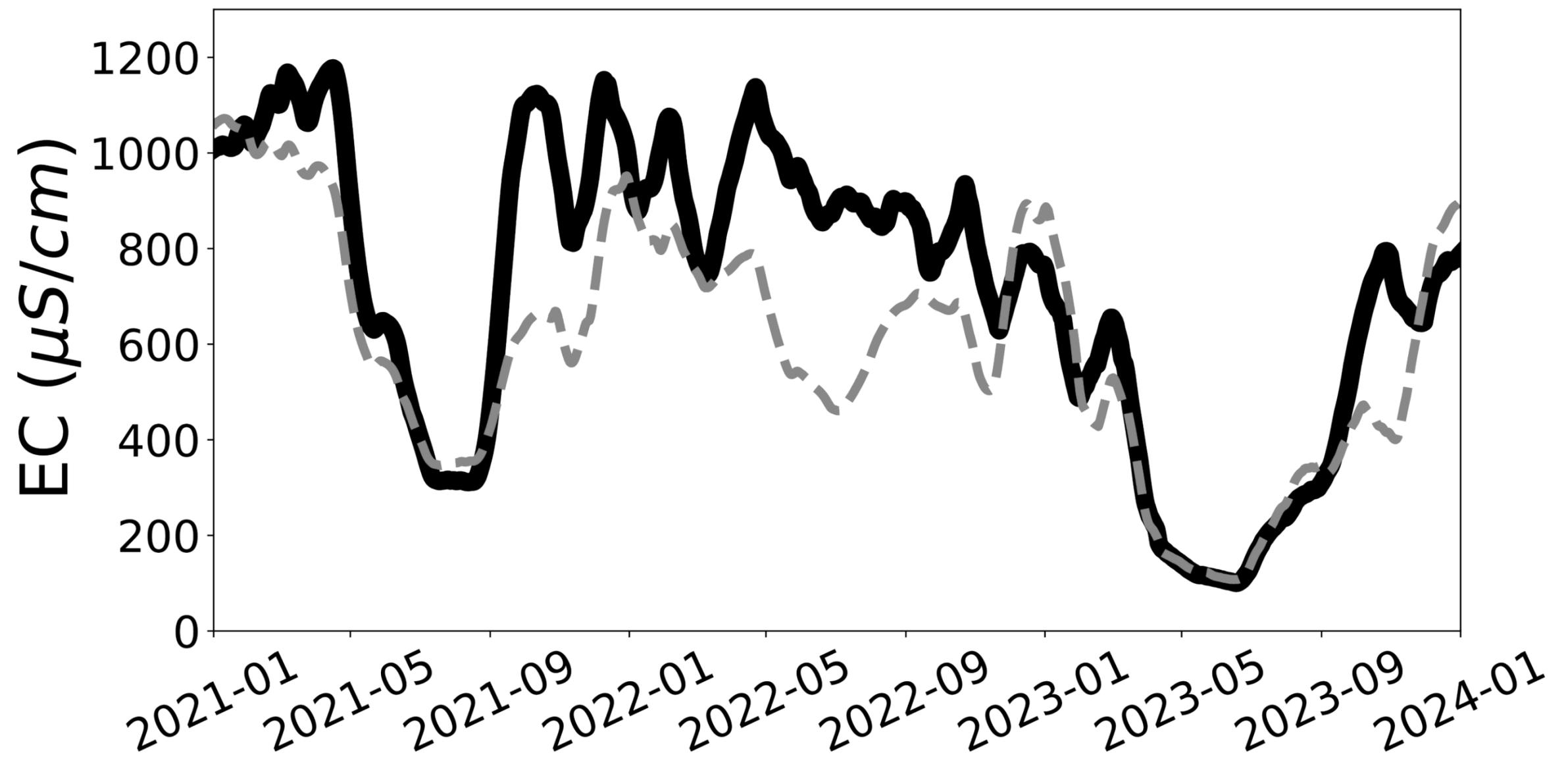
- Old River at Tracy
- San Joaquin

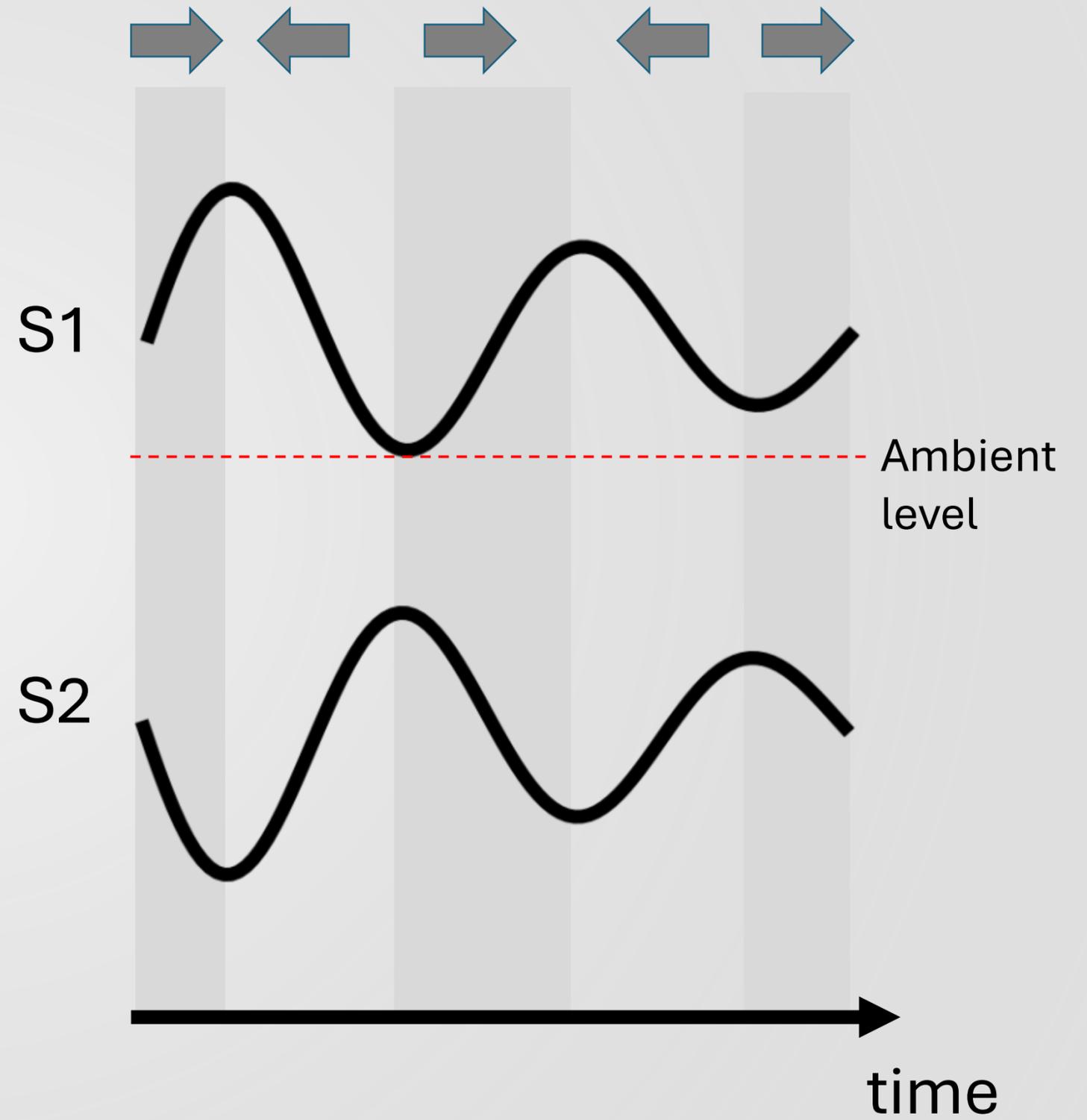
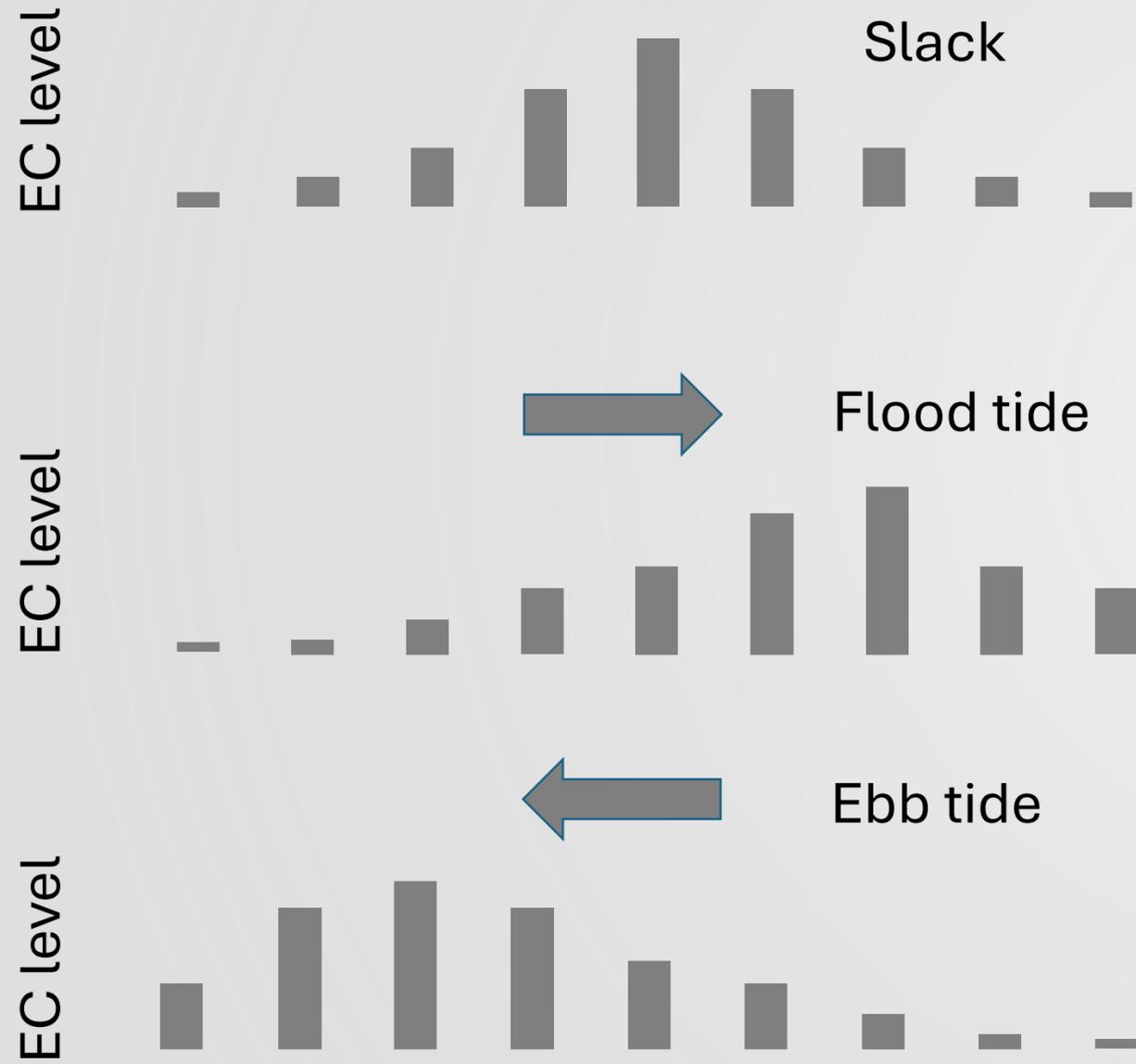




DCD EC: spatially uniform

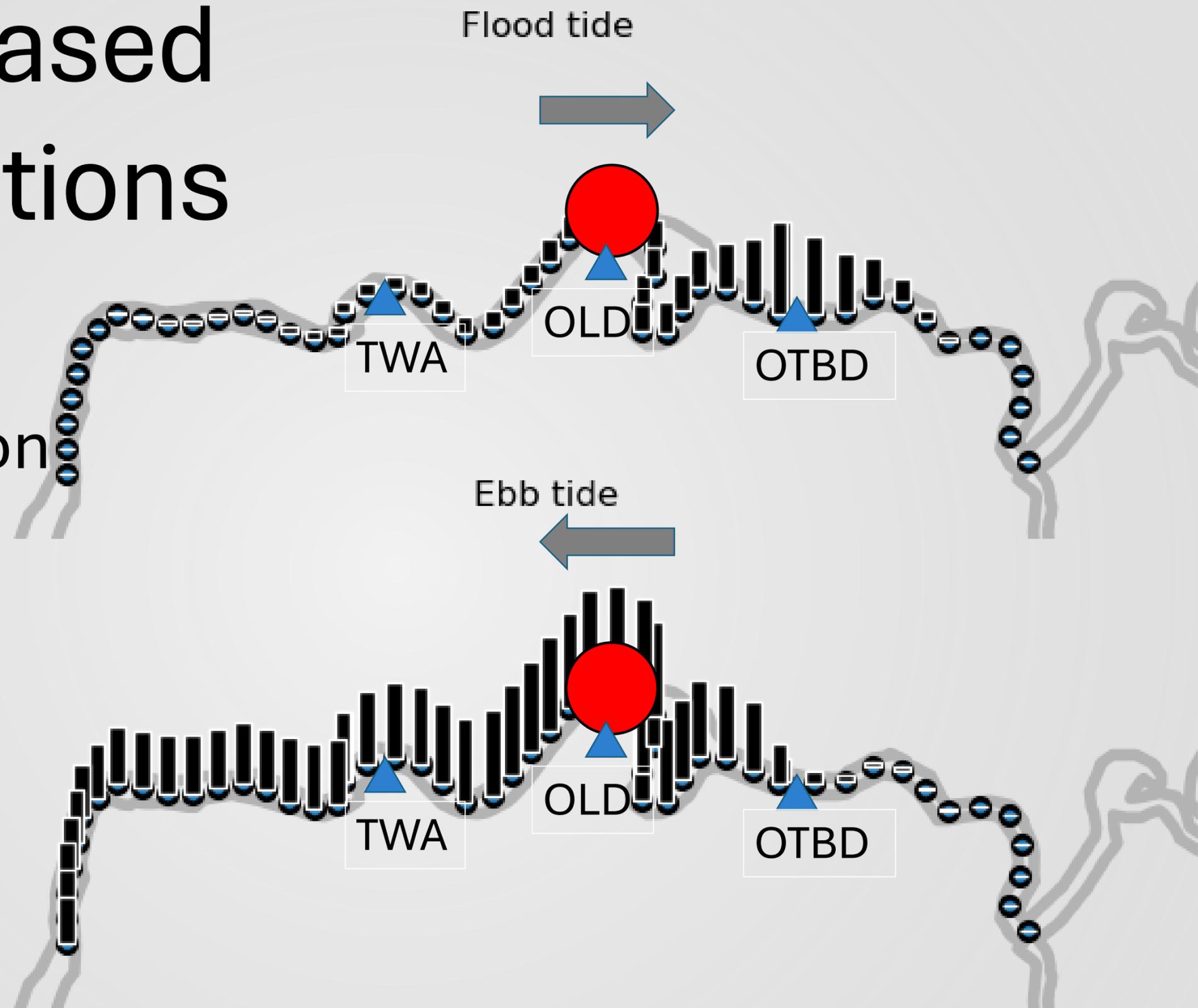
- Old River at Tracy
- Model with DCD EC





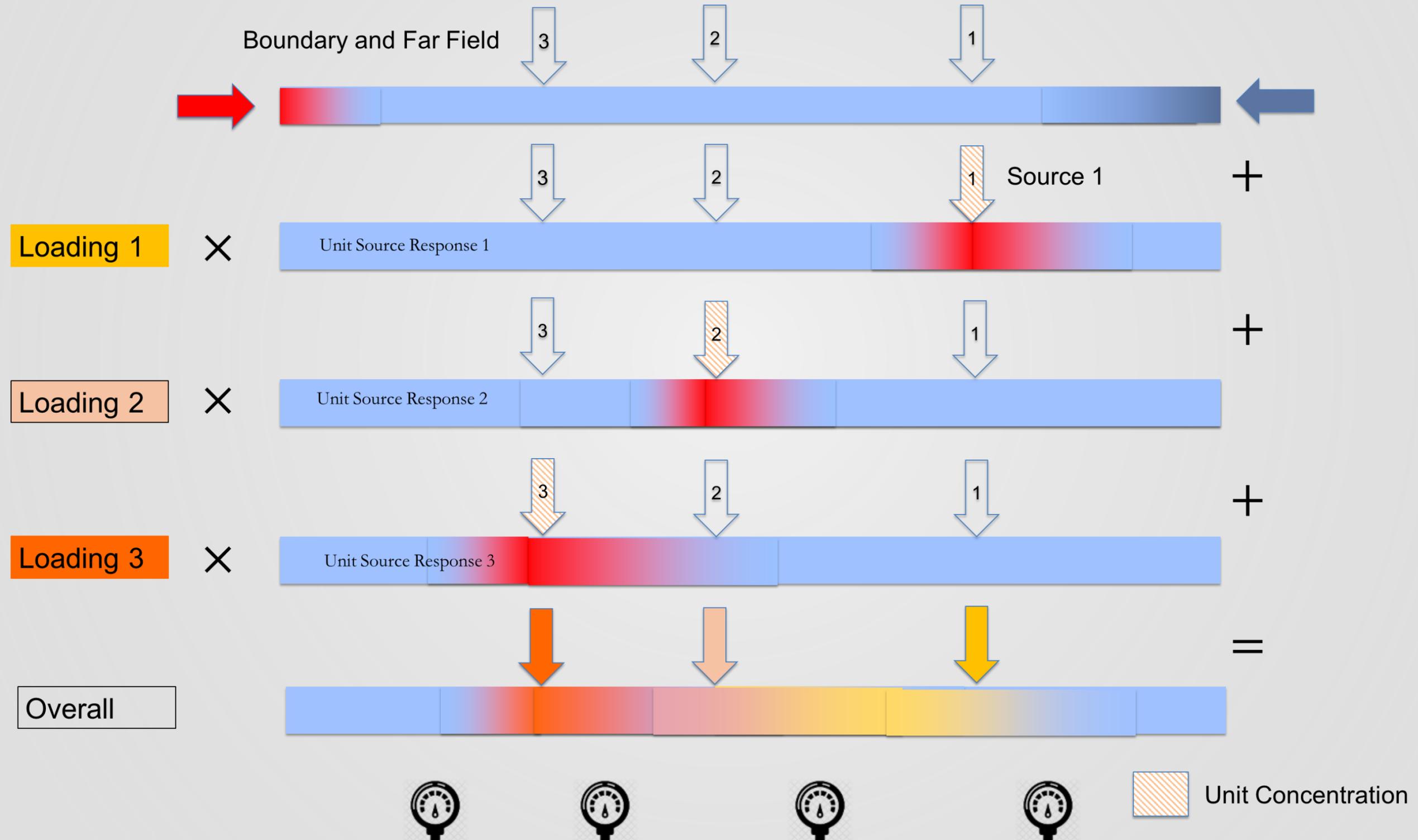
Response-based Greens Functions

- Source location
- ▲ EC Stations



DSM2 Unit Source Concentration response
Source sustained 120 days, this is on Day 1

Superposition of responses



Results: salt loads

Inferred Load

Load + DCD

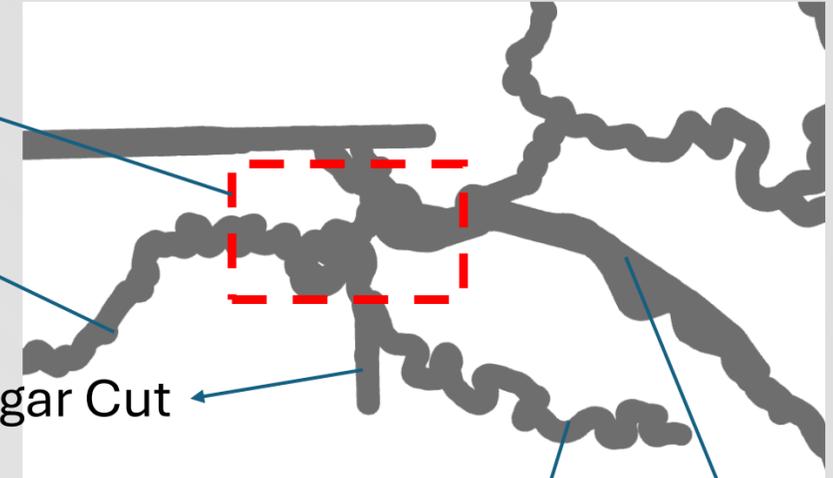
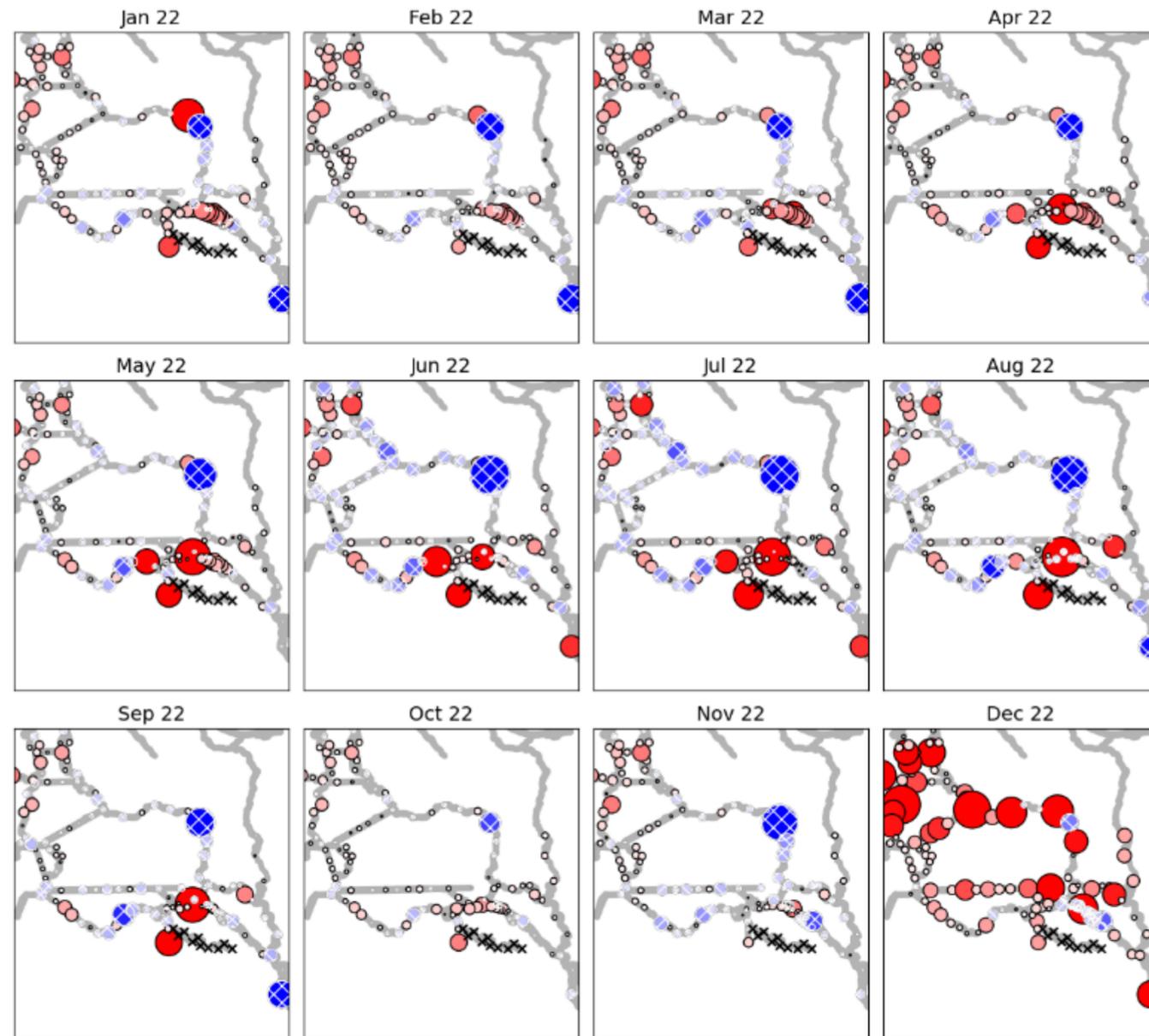
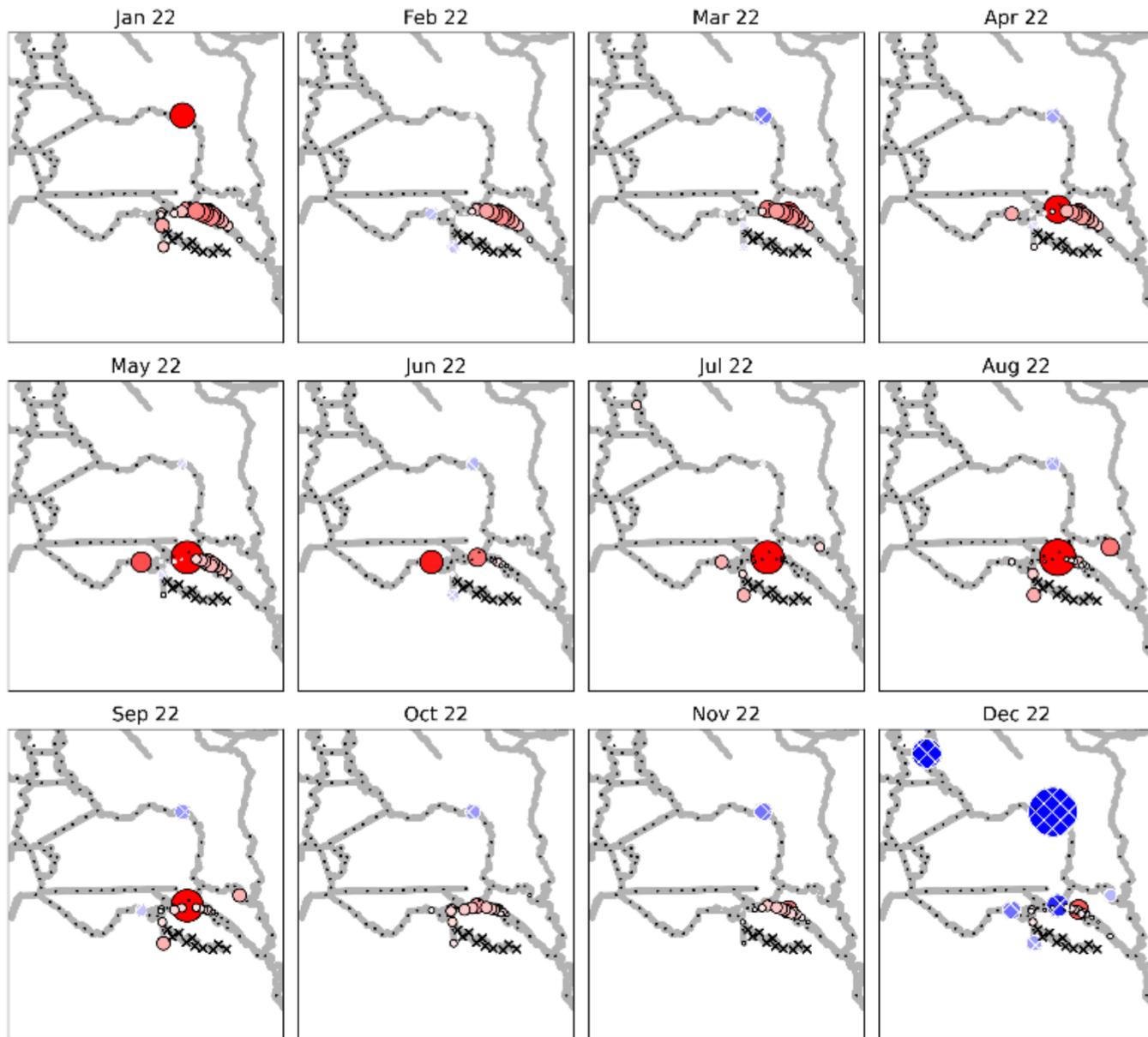
Five Point

Old River

Sugar Cut

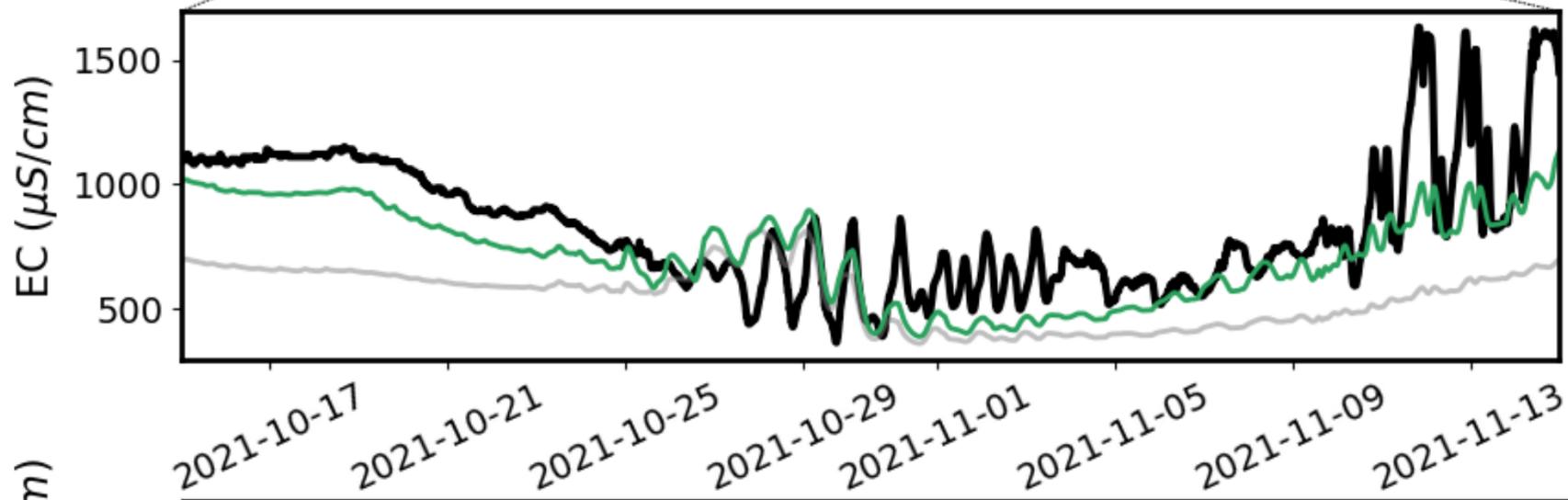
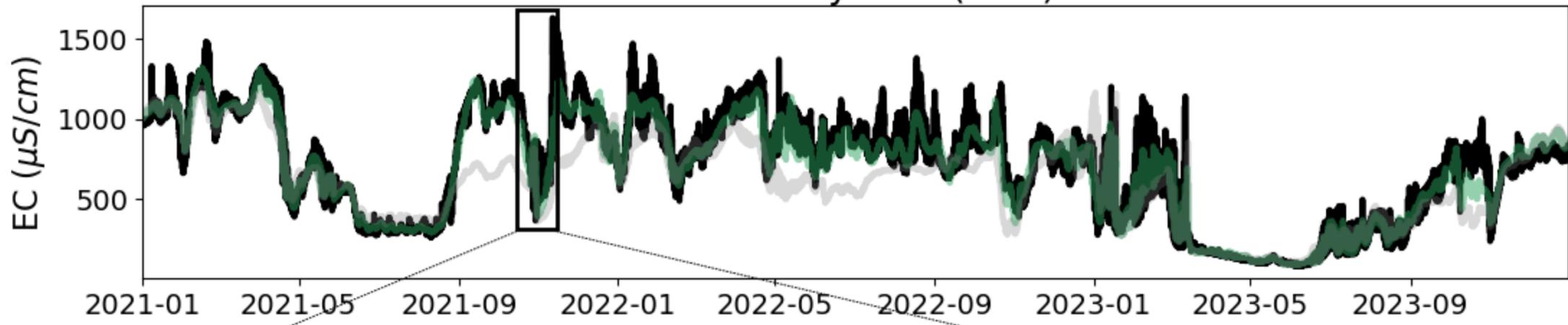
Paradise Cut

Tom Paine

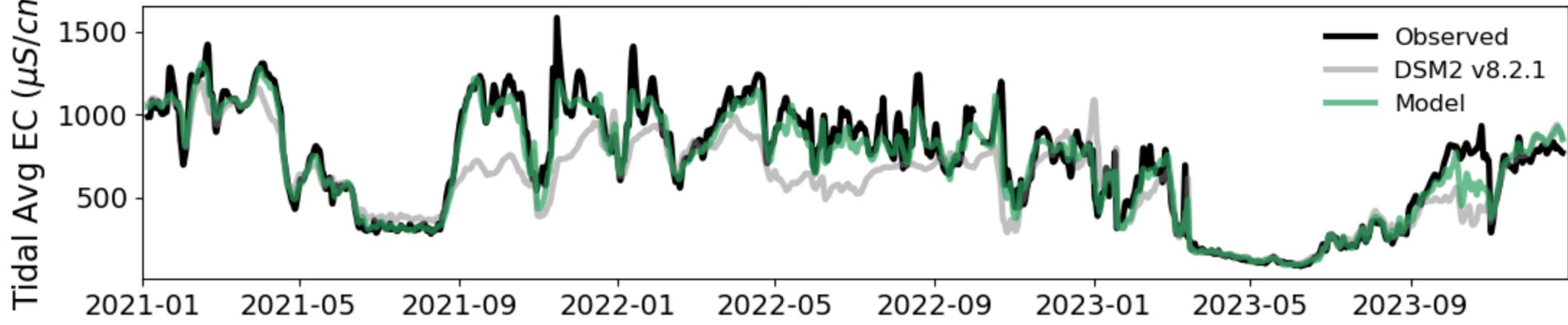




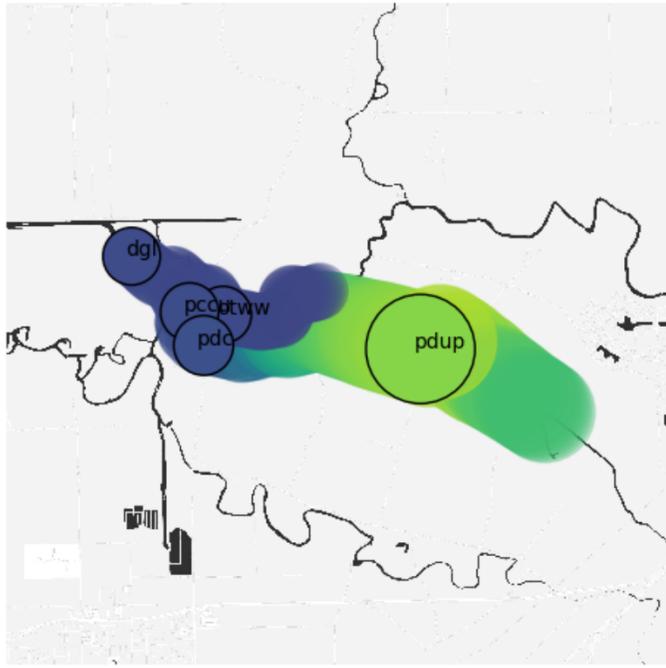
Old River at Tracy Blvd (OLD)



RMSE	93.64
Bias	-24.55
NSE	0.92
R ²	0.93

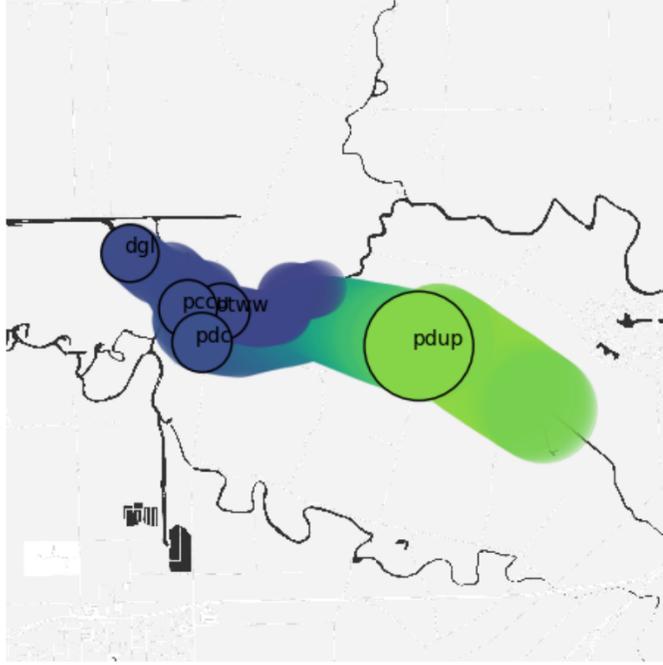


Observed

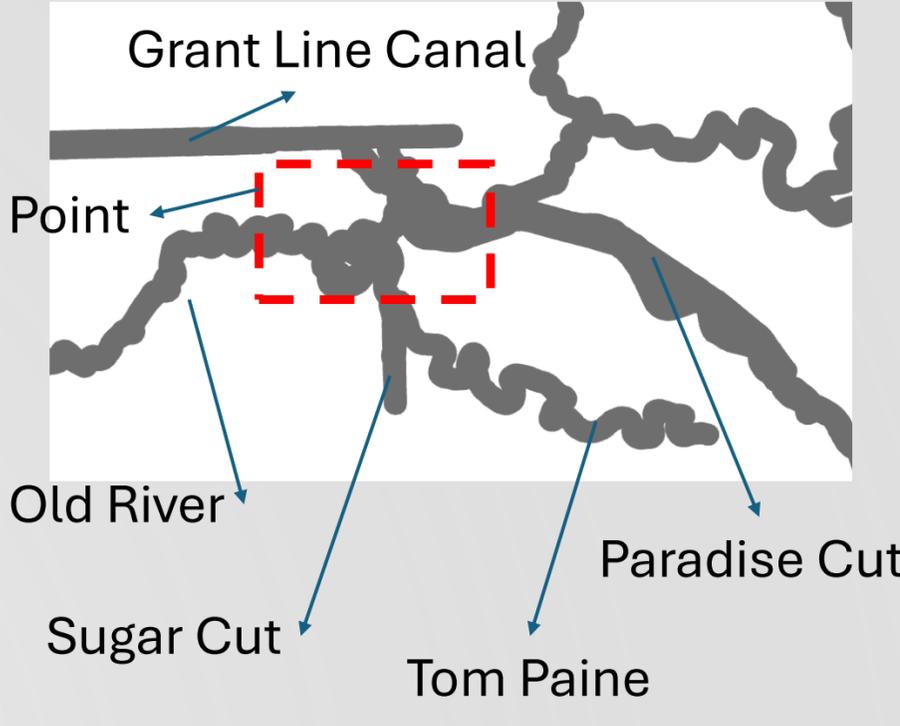
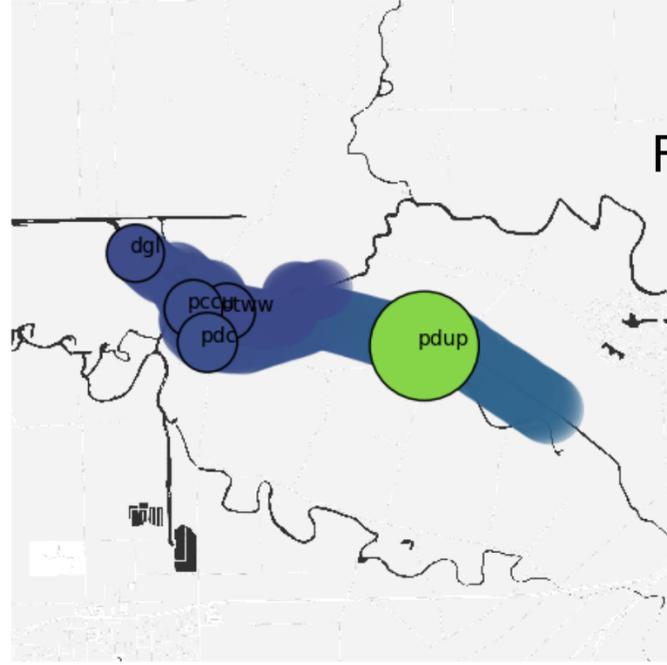


2022-03-31 Run 04

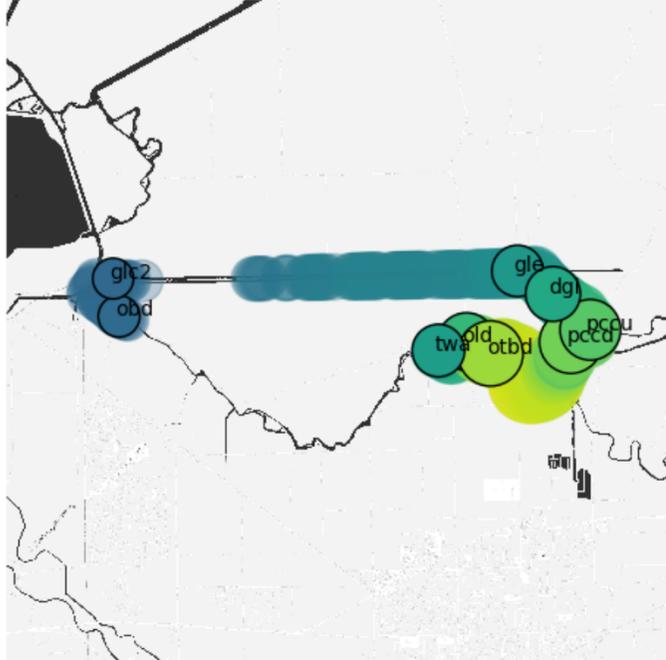
MSS model (with source inference)



DSM2 v8.2.1 (no source inference)

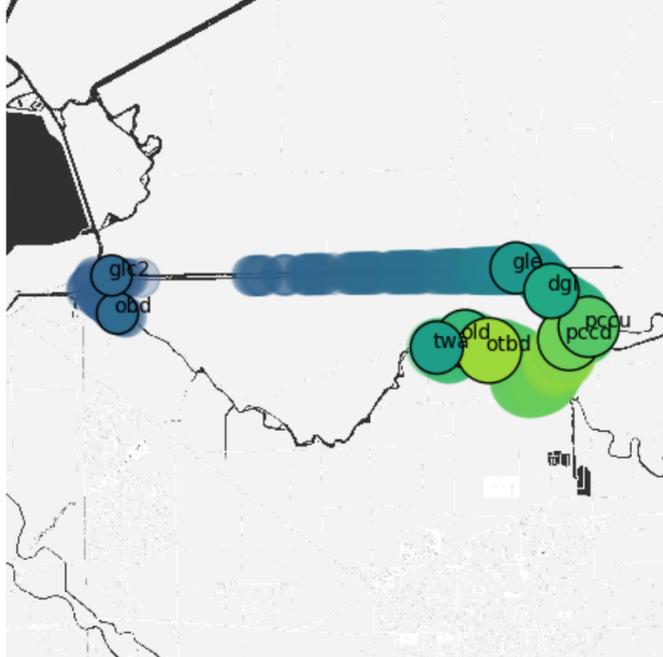


Observed

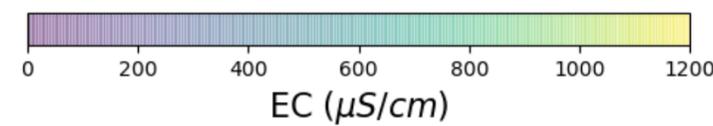
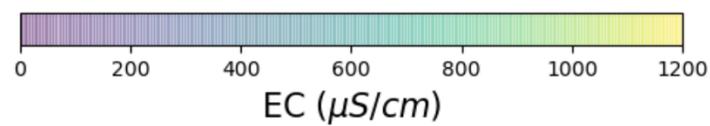
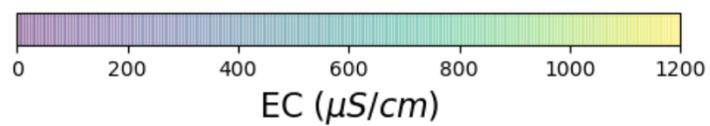
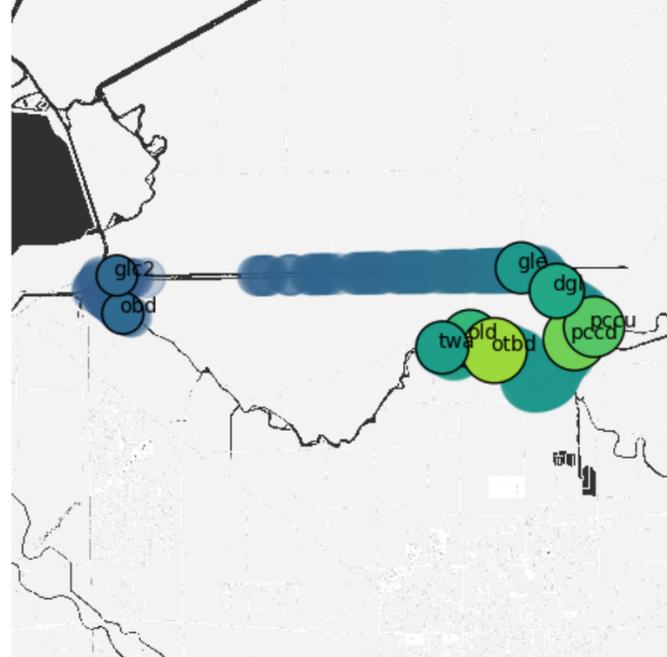


2022-08-24 Run 01

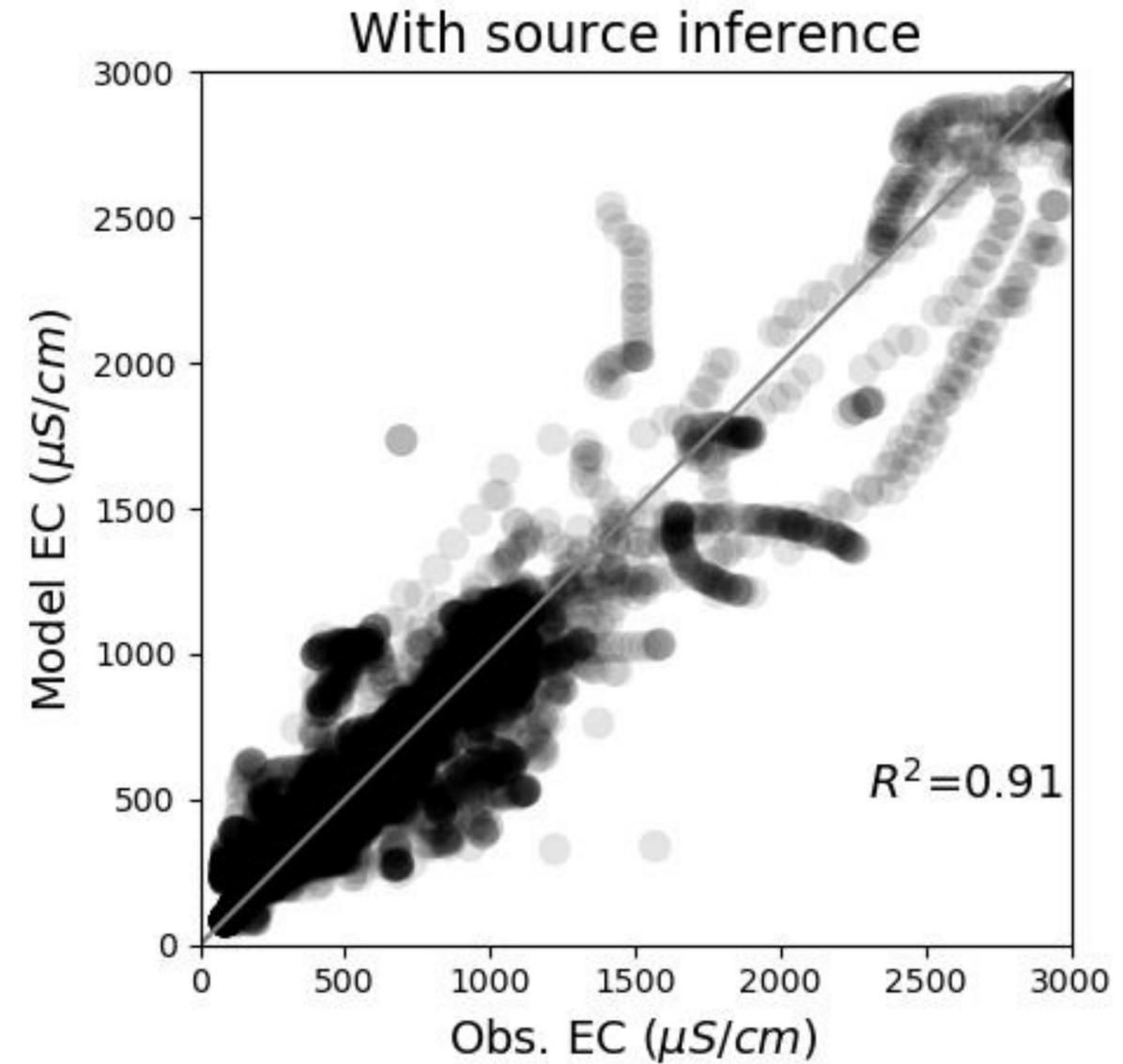
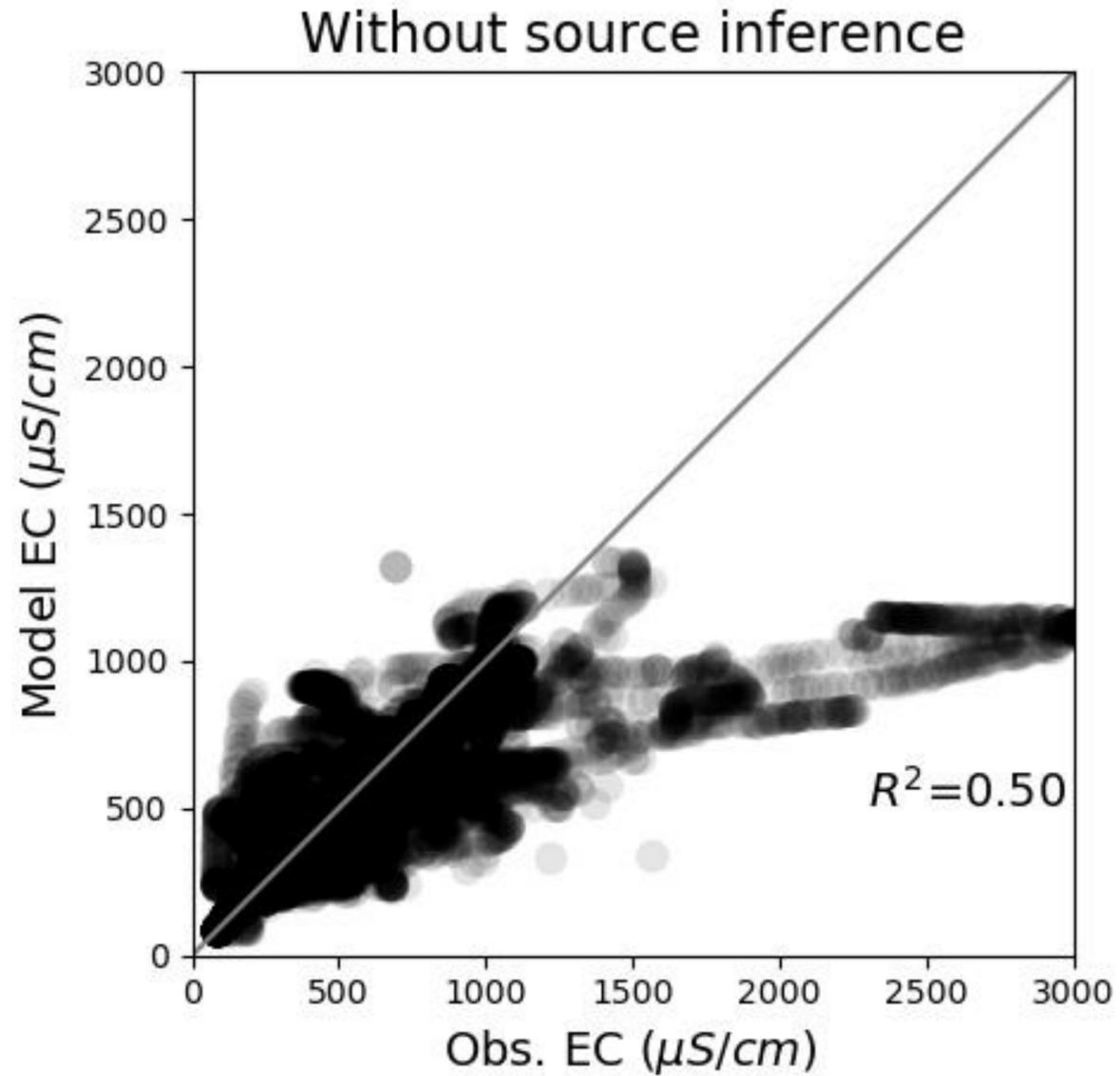
MSS model (with source inference)



DSM2 v8.2.1 (no source inference)



Validation: transect mapping data

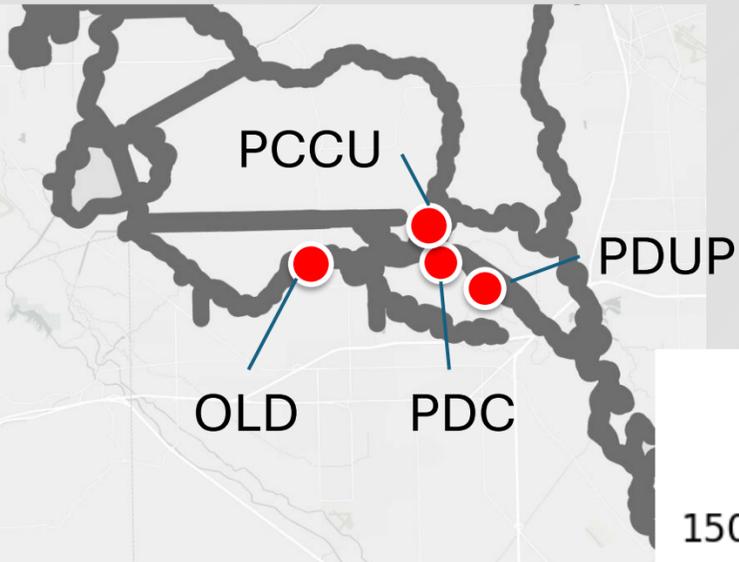


Climatology: extending to other years

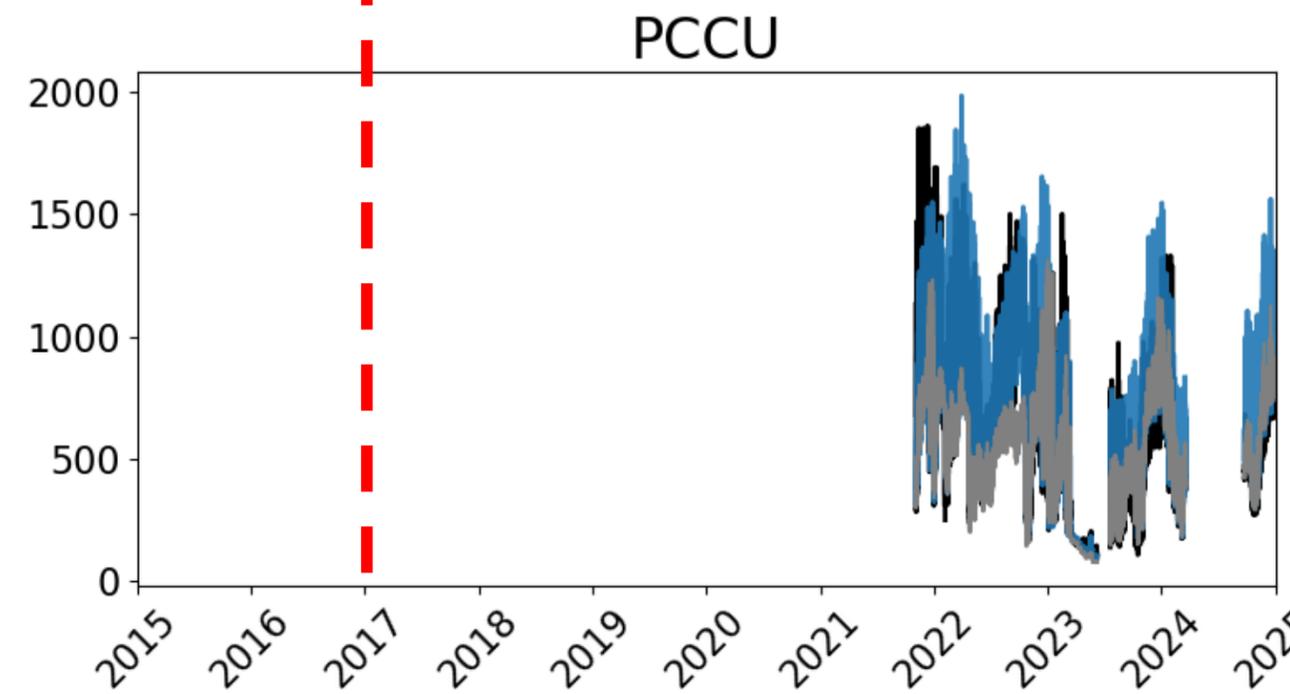
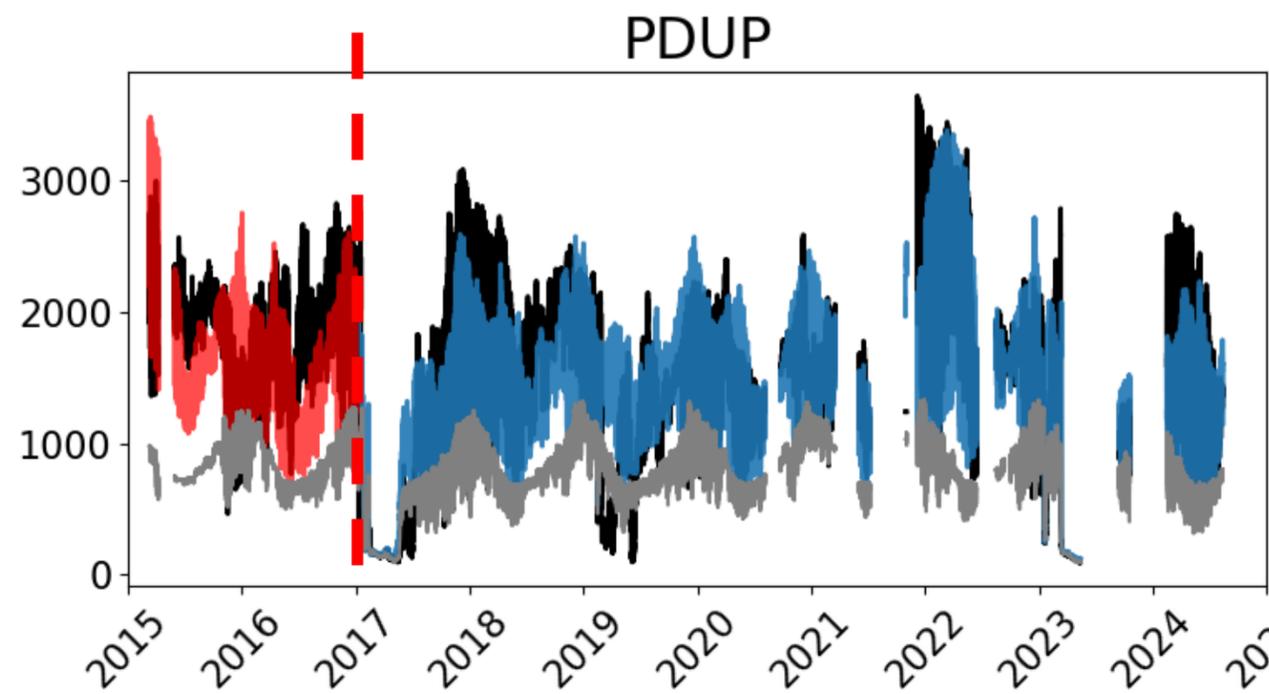
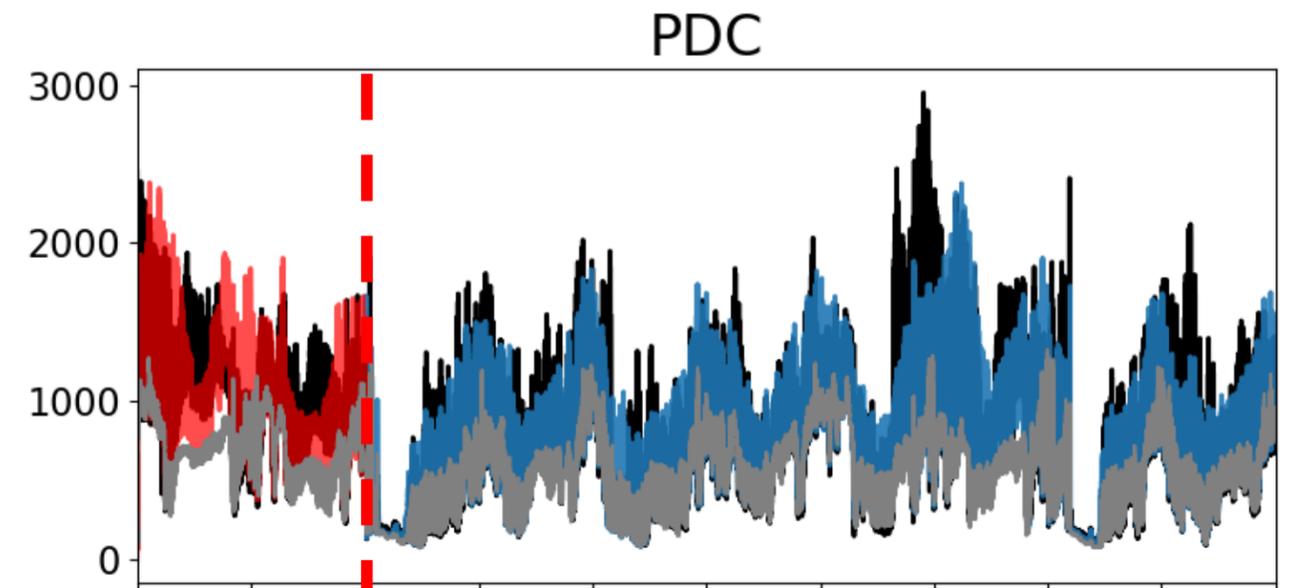
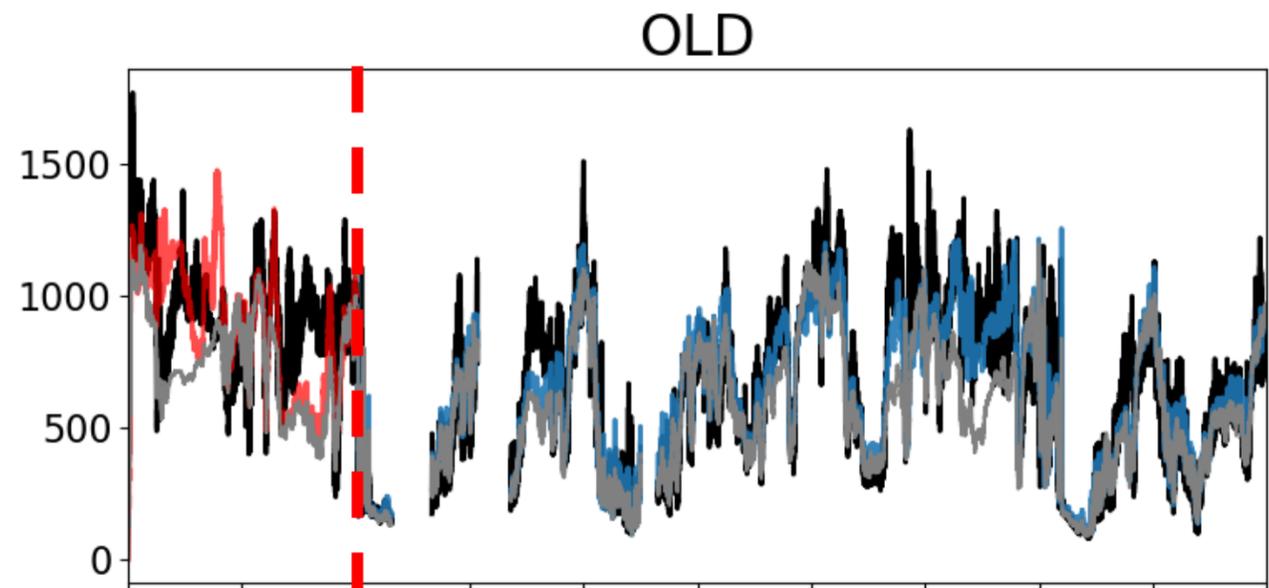
- **Goal:** extrapolate beyond MSS for longer historical and planning studies.
- **Why not apply MSS to other years?**
 - computationally expensive
 - lack of observed data.
- **Reduced resolutions**
 - Weekly (MSS) to ~ monthly (climatology)
 - Reduced the number of independent groups.



Cross-validation



EC ($\mu\text{S}/\text{cm}$)



— Obs — Train — Validation — Original DCD

Conclusions

- The modeled EC using inferred source EC matched well with observation in MSS.
- Extending the method for climatology application showed substantial improvement in modeled EC compared with those using the pre-MSS DCD EC.
- The new EC sources in South Delta will be released with the next version of DSM2.



Acknowledgment

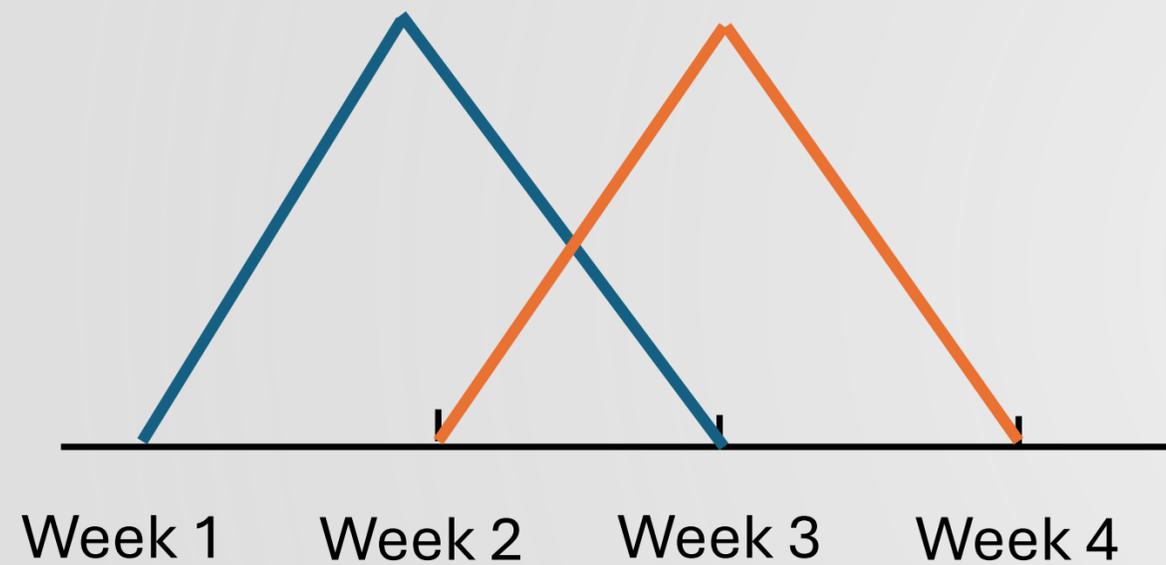
- Jared Frantzich, David Colvin, Dave Huston (NCRO, DWR)
- Kijin Nam, Bradley Tom, Prabhjot Sandhu (Nicky), Seshadri Rajagopal (Shey), and Sophie Munger (DMS, DWR)



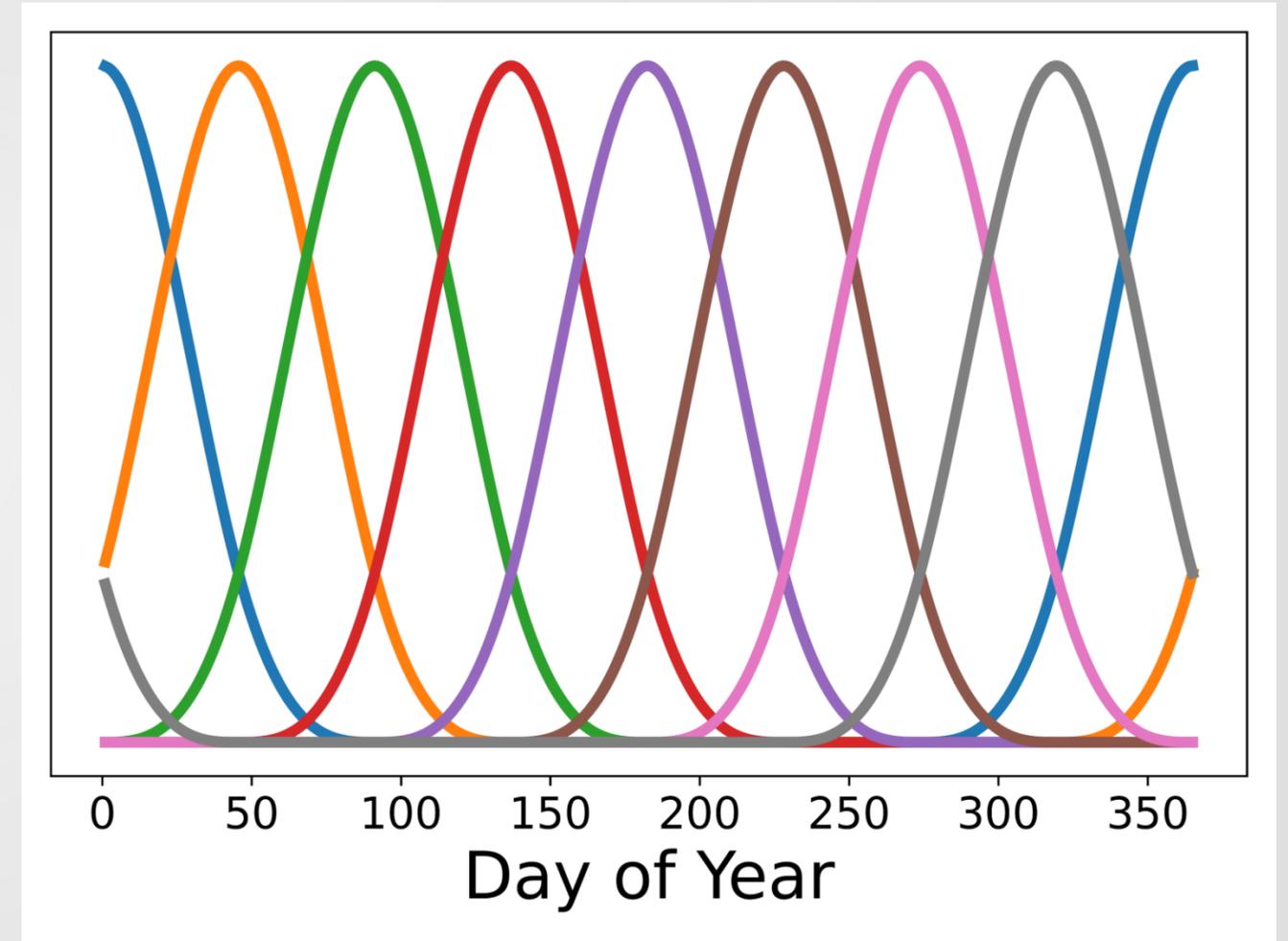
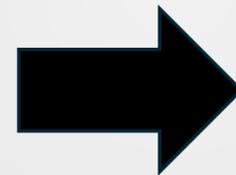
Questions?

- Zhenlin.Zhang@water.ca.gov
- Eli.Ateljevich@water.ca.gov

Climatology: extending to other years

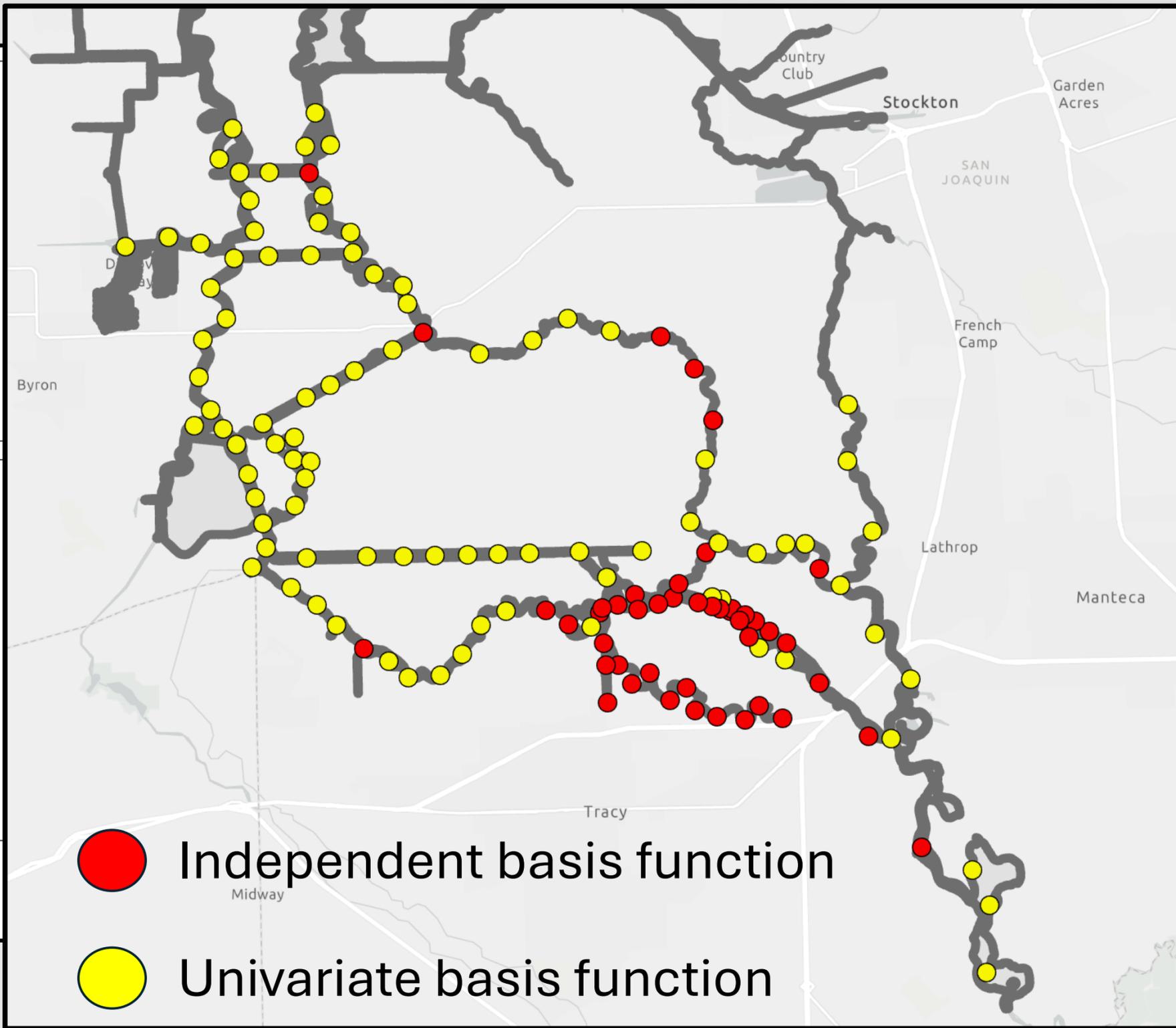
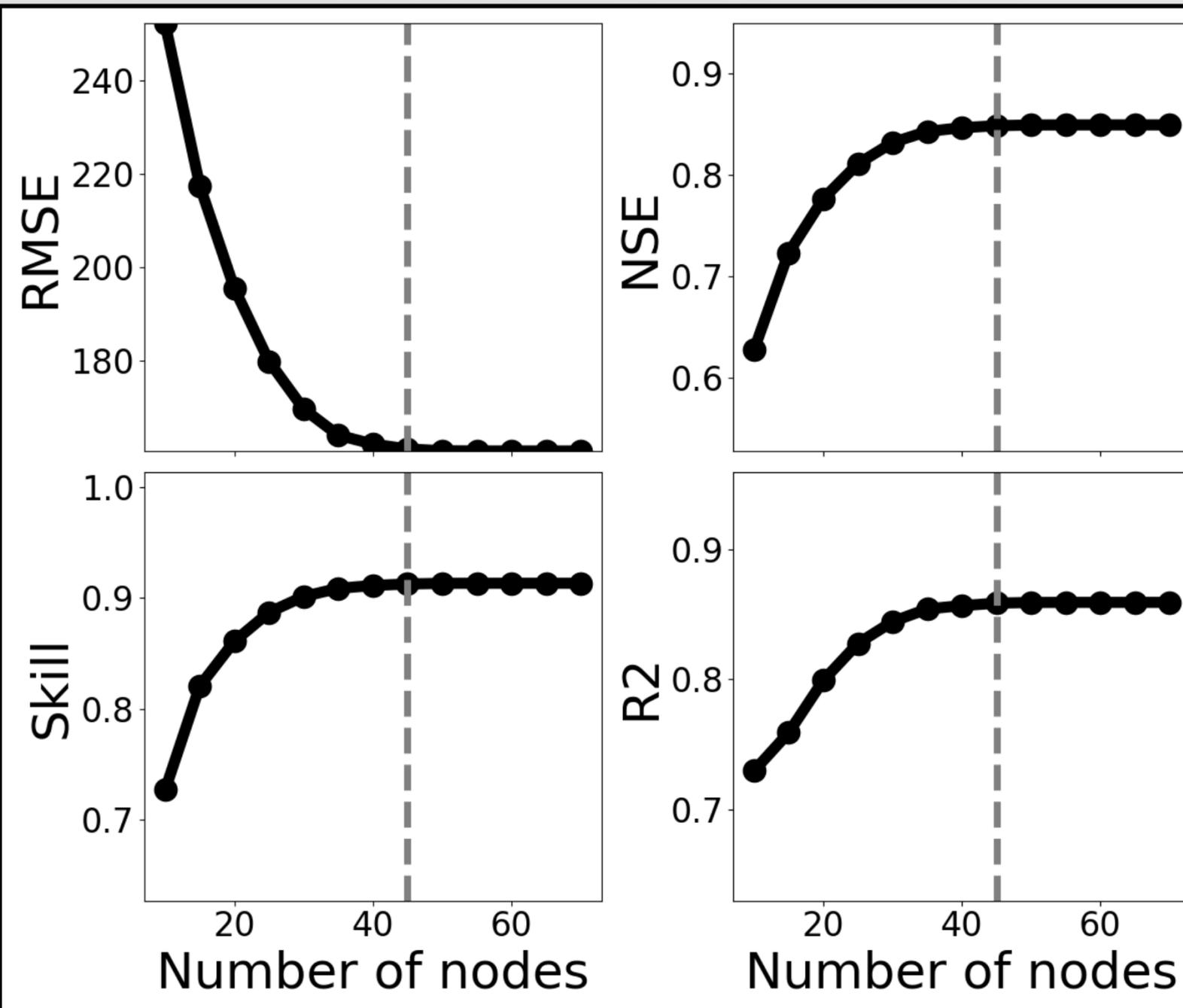


MSS

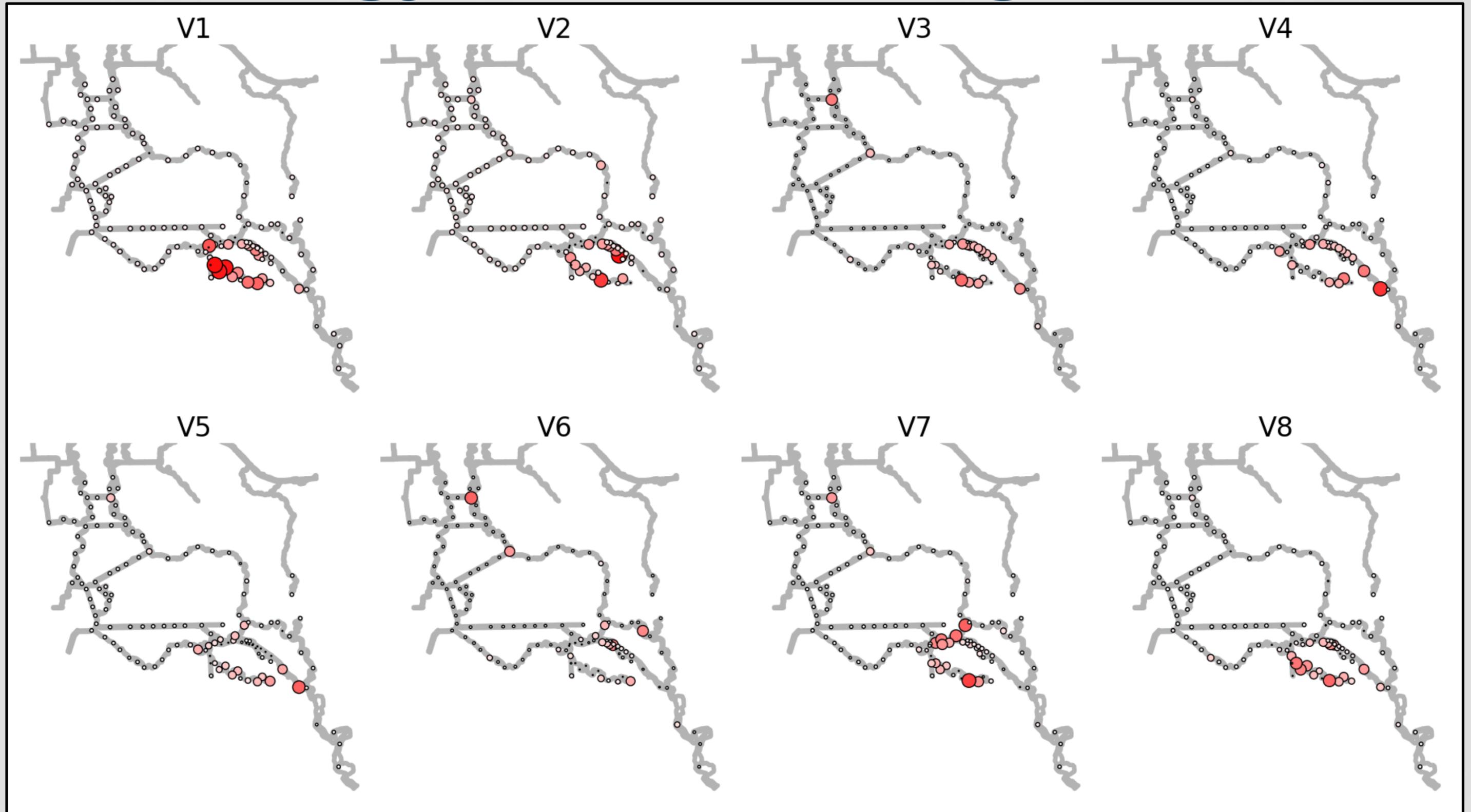


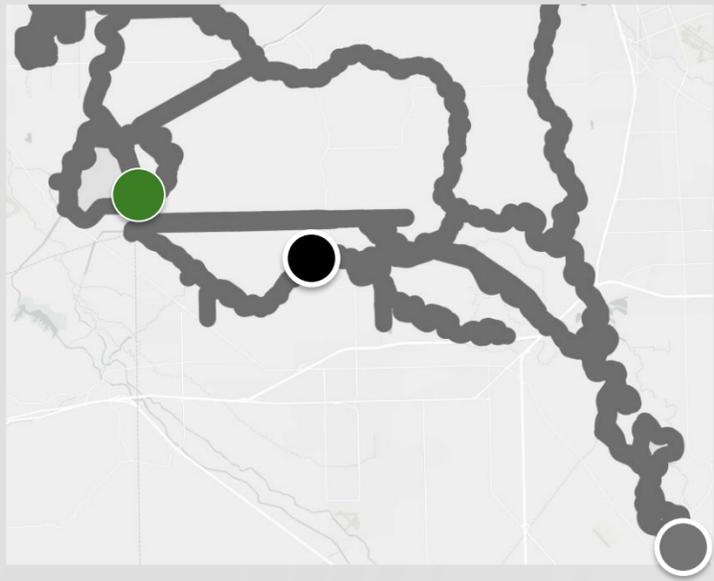
Climatology





Climatology: inferred weights





- Old River at Tracy
- San Joquin
- Old River Intake

