MSS Technical Group: Water Quality Data Integration (Data Assimilation)

Zhenlin Zhang, Eli Ateljevich, Bradley Tom, and Kijin Nam

2021-07-13

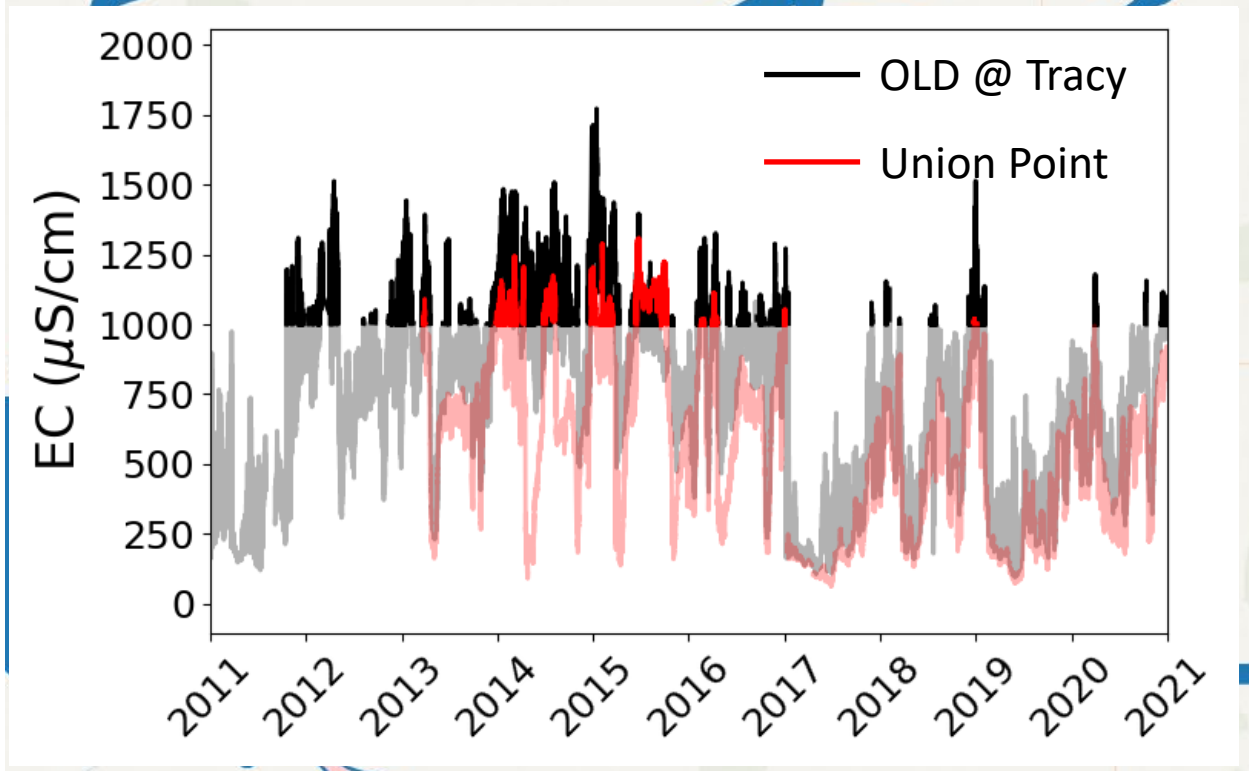
Outline

- Introduction to data assimilation and South Delta salinity issue.
- Idealized run with hypothetical sources
- Data assimilation with field observational data

Real-life Example of Data Assimilation

Weather Forecast

All modern weather forecast requires data assimilation



Union Point

Tracy

Old River

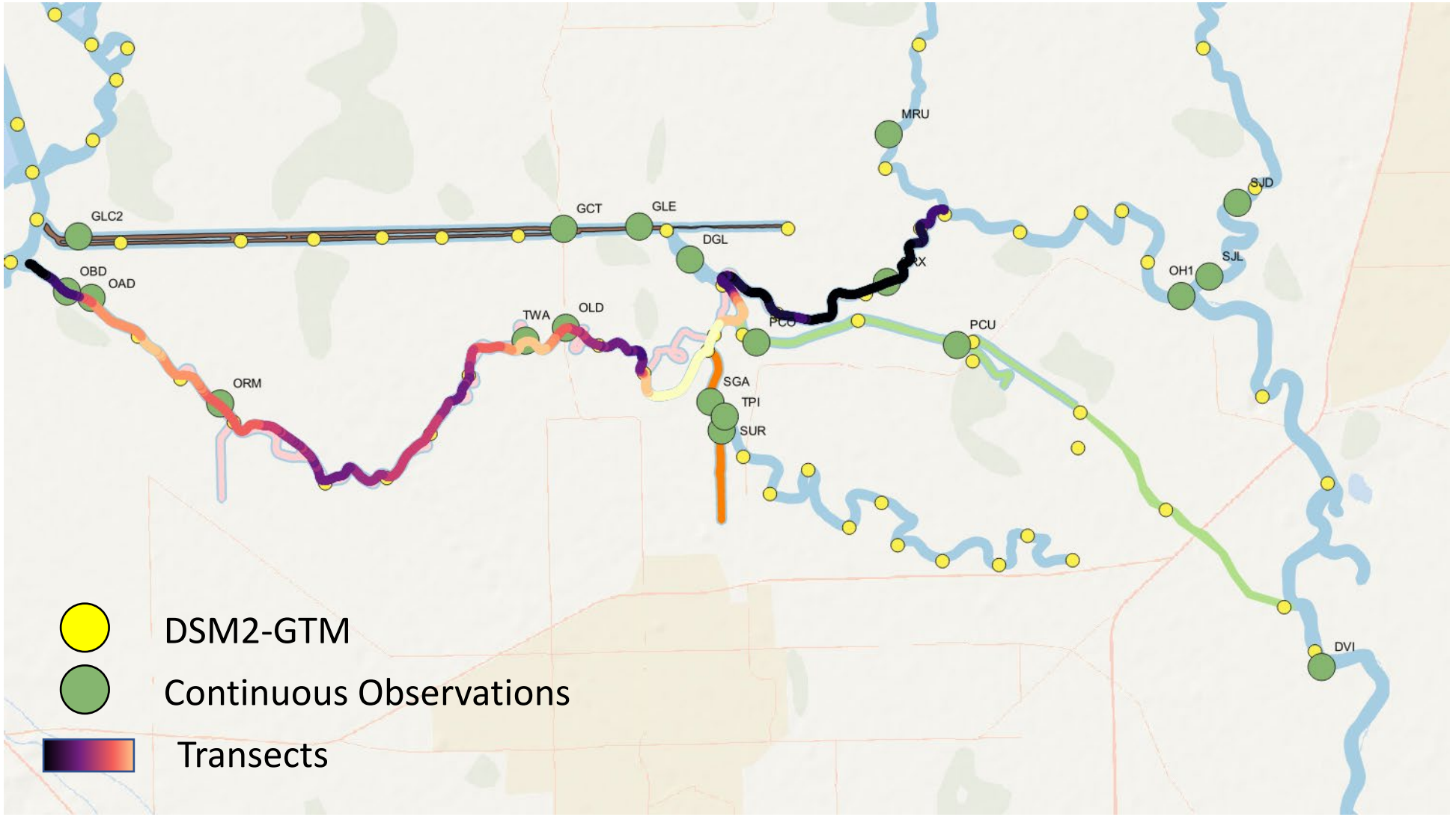
Old River

Old River

Sugar Cut

Paradise Cut

Tom Paine Slough



- **Fold together model and observations to improve EC modeling**
  - **more reliable hypothesis testing**
  - **better future predictions**
- **Infer salinity sources on Old River or upstream sloughs**

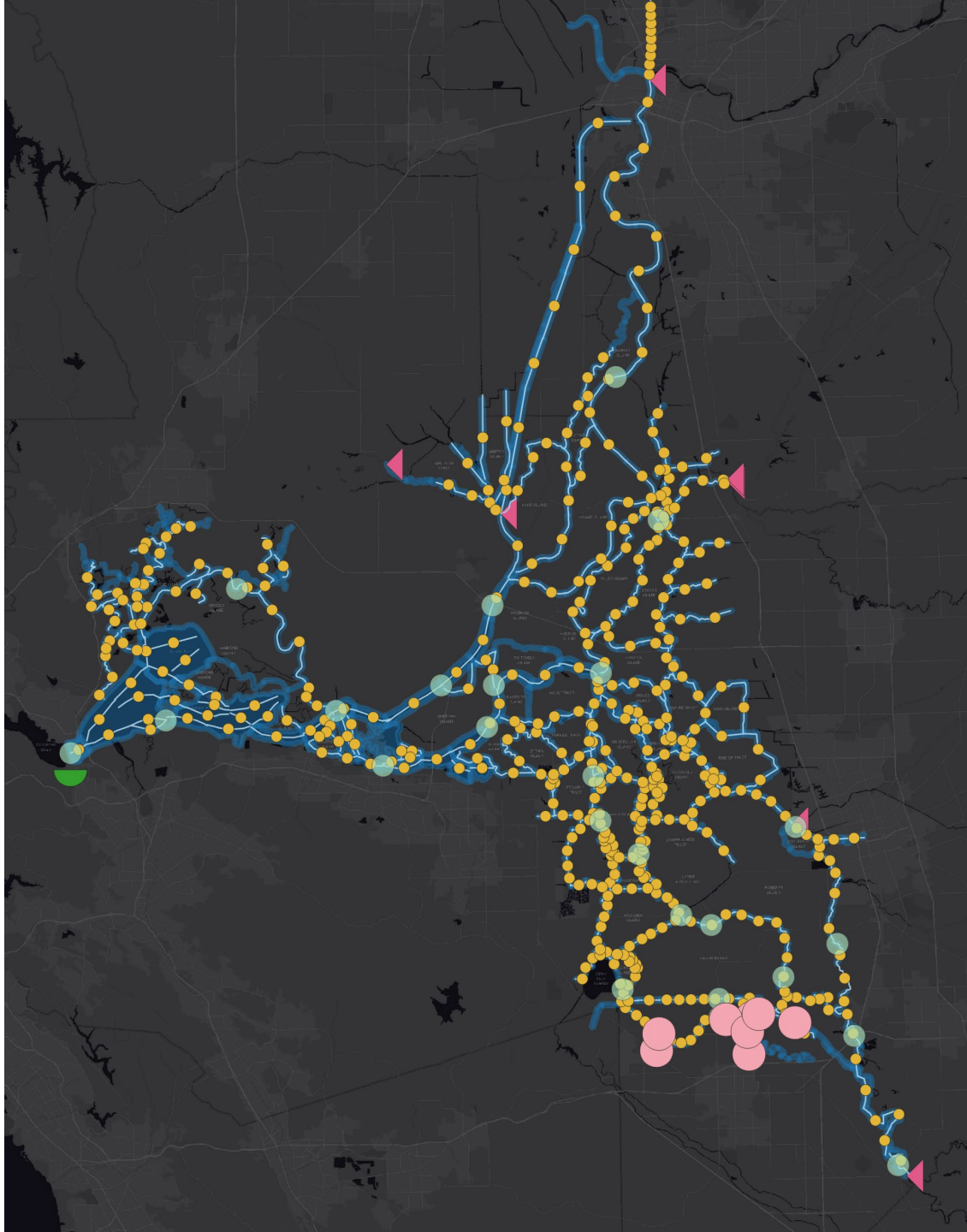
The model state (X)

X : salinity field

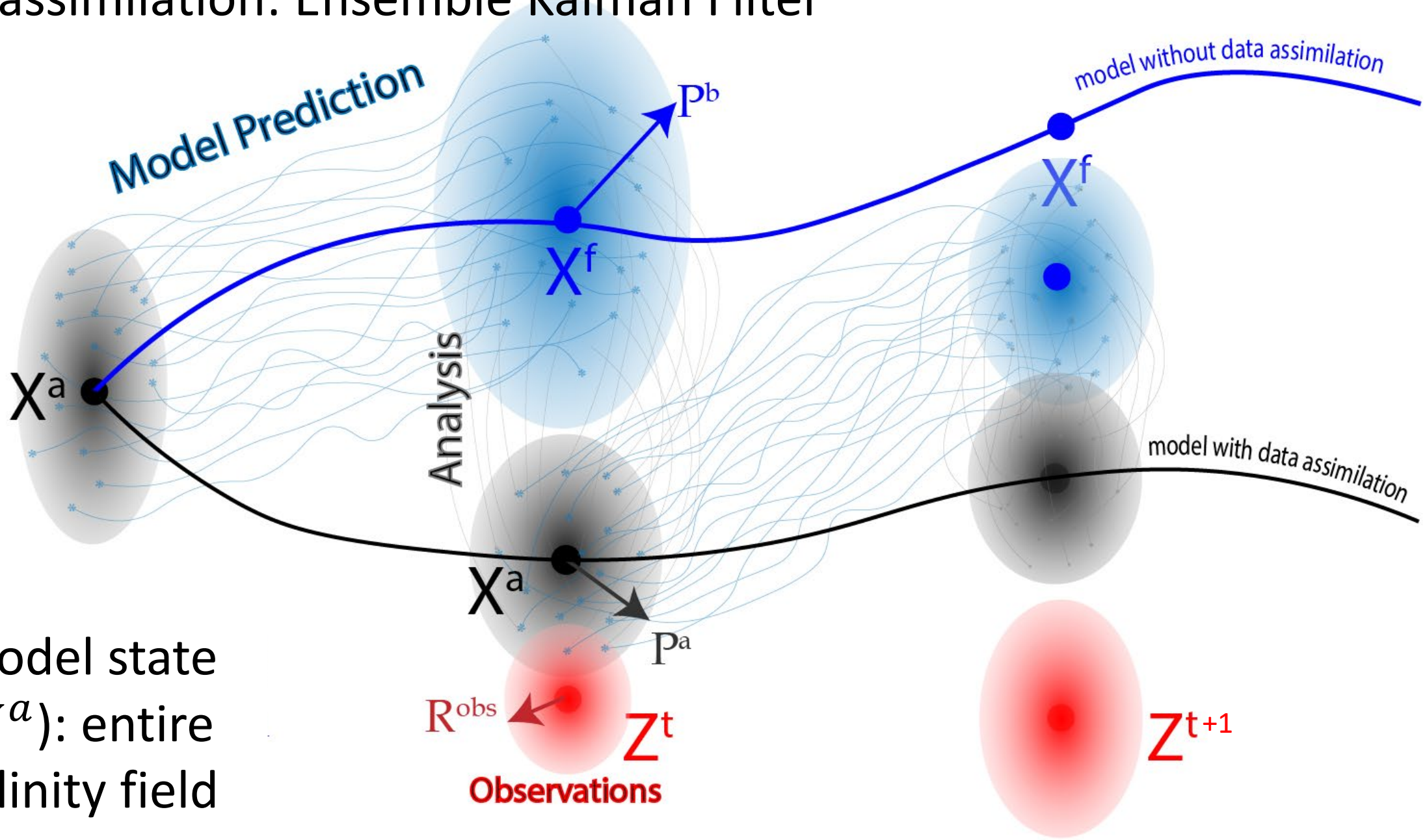
+ salinity sources

X: salinity field

Z: observed salinity



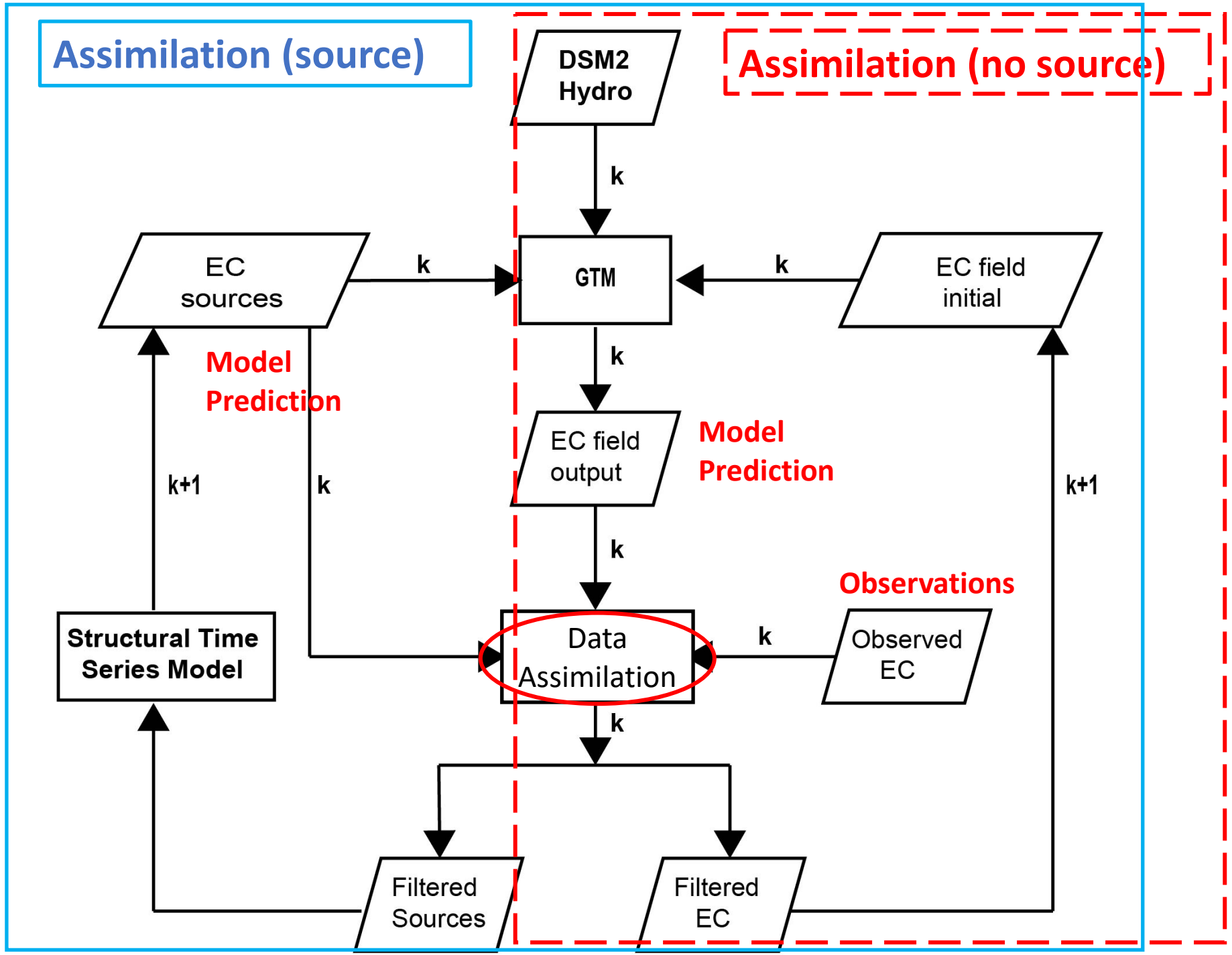
Data assimilation: Ensemble Kalman Filter



Model state (X^a): entire salinity field

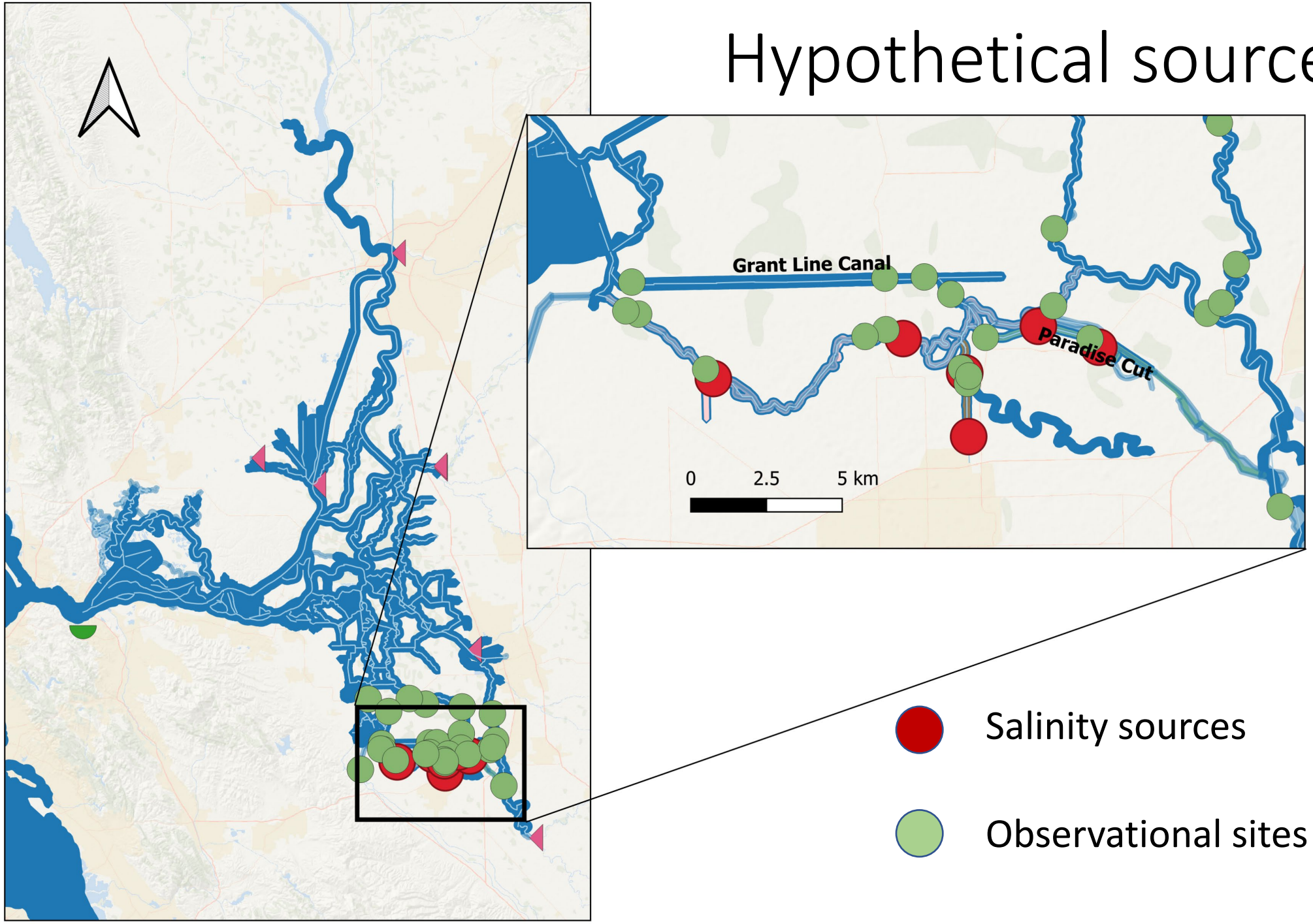
Approaches: online coupling between Data Assimilation and GTM

GTM:
Generalized Transport Model

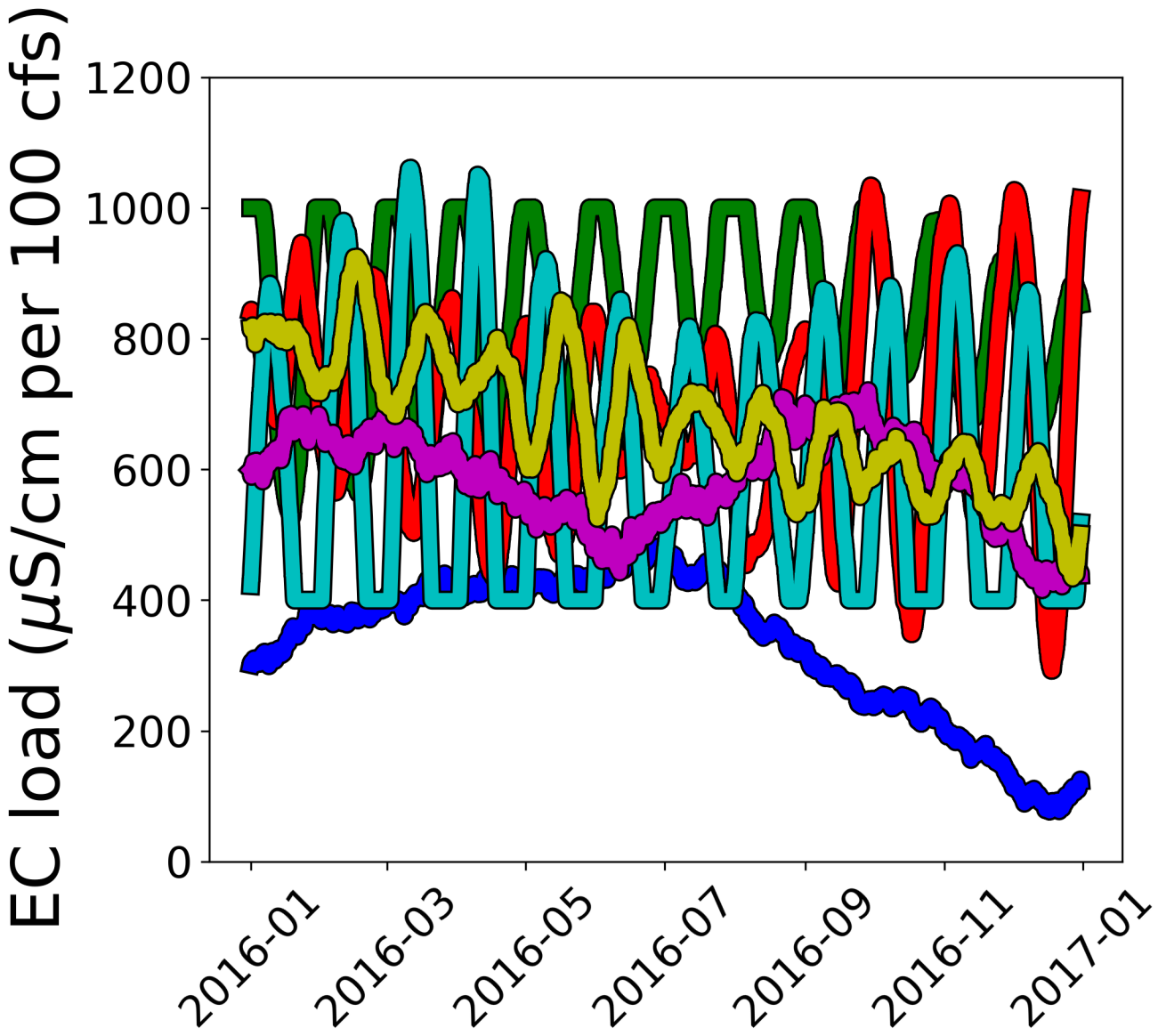


Test run with **hypothetical sources**

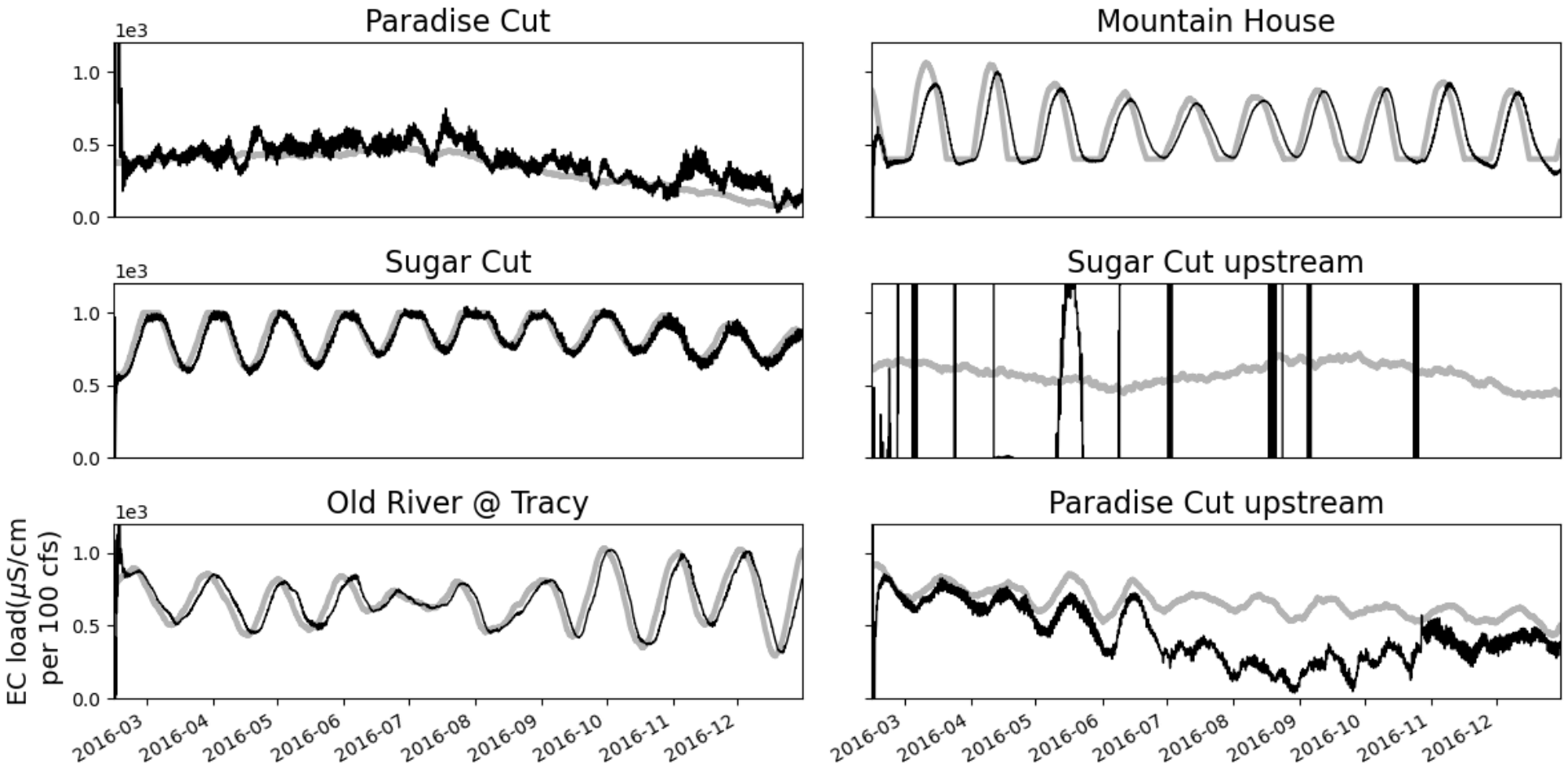
Hypothetical sources



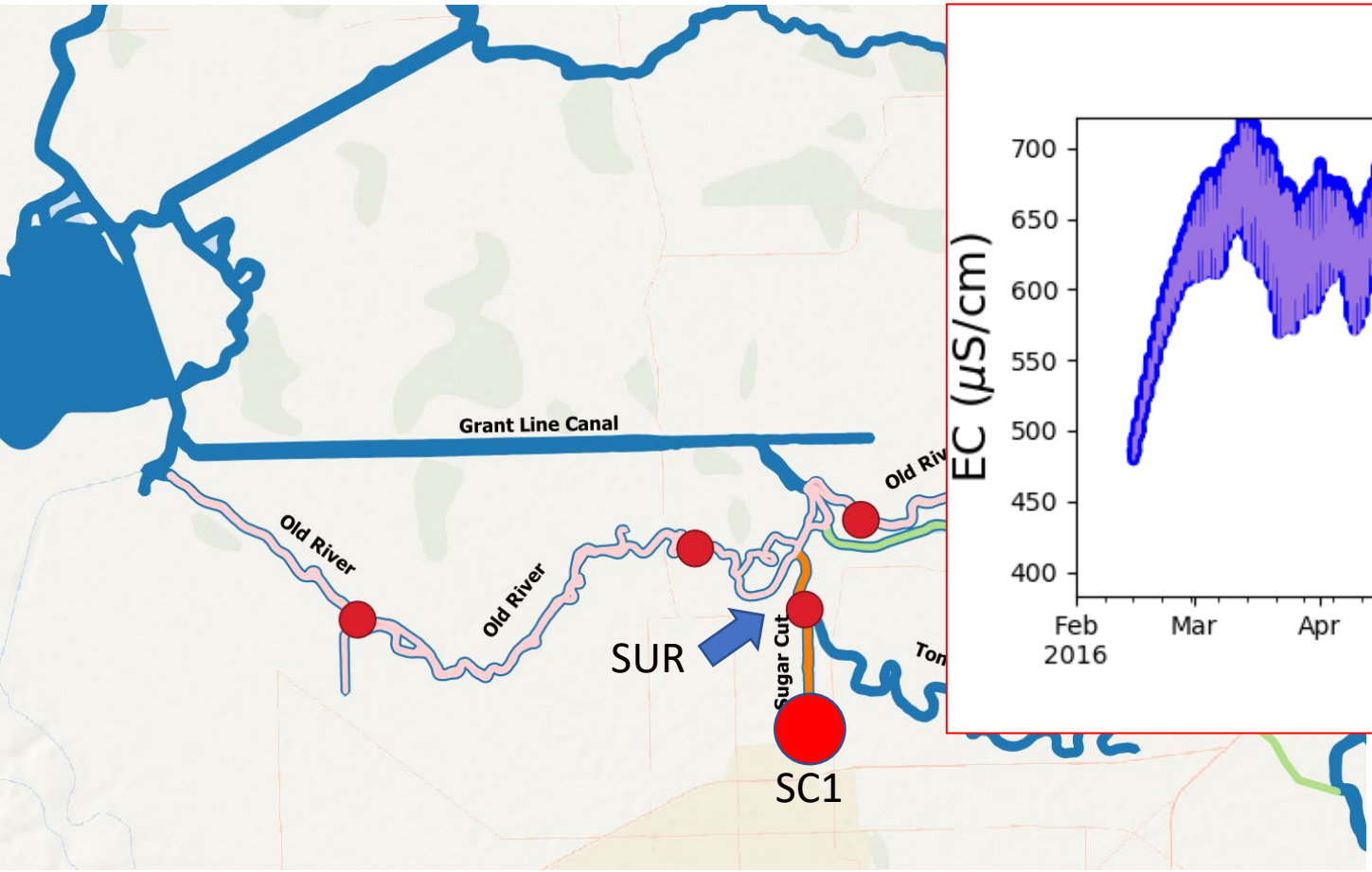
Hypothetical sources

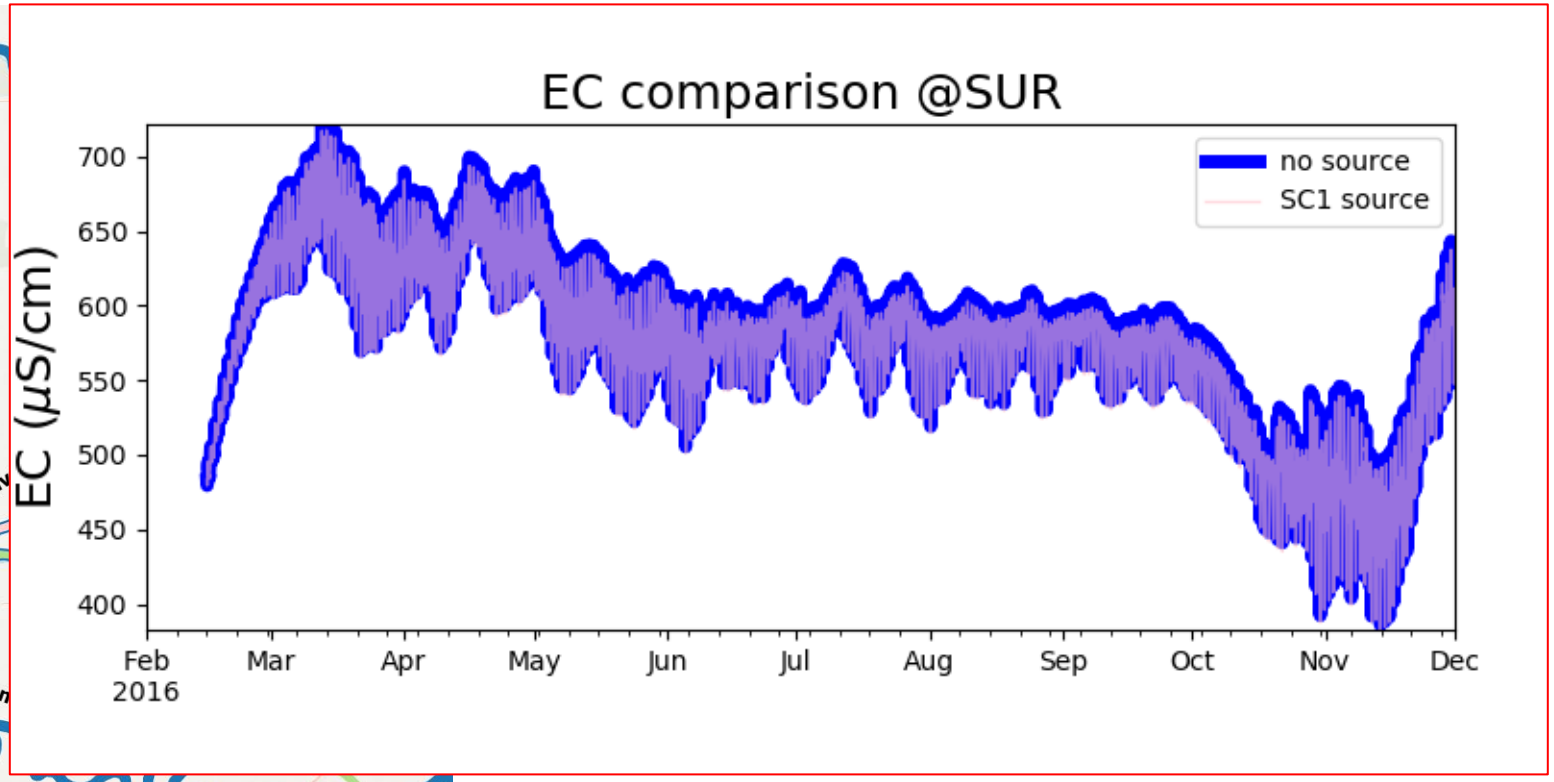


Results: inferred EC sources



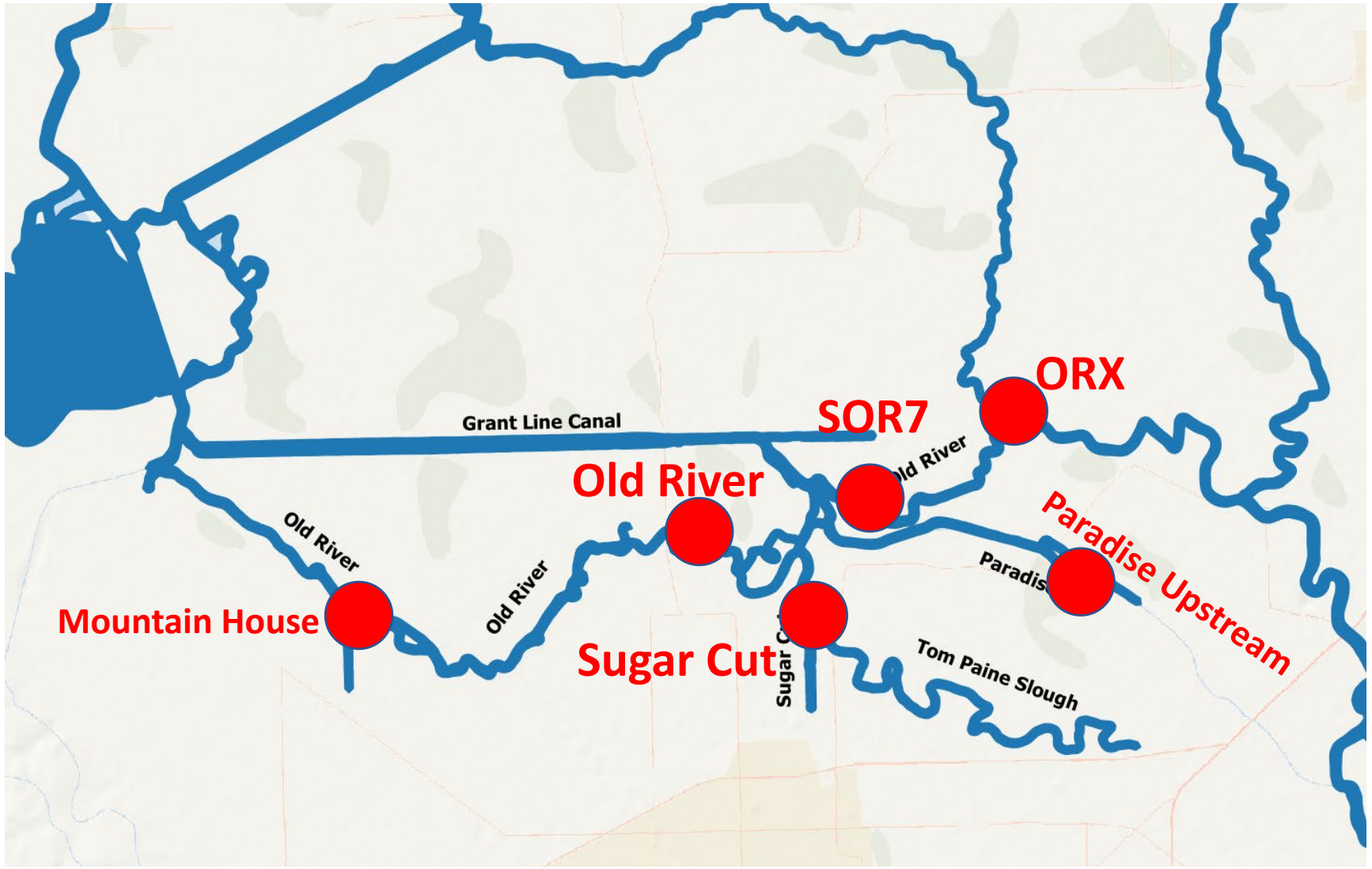
Discussion on discharges at SC1



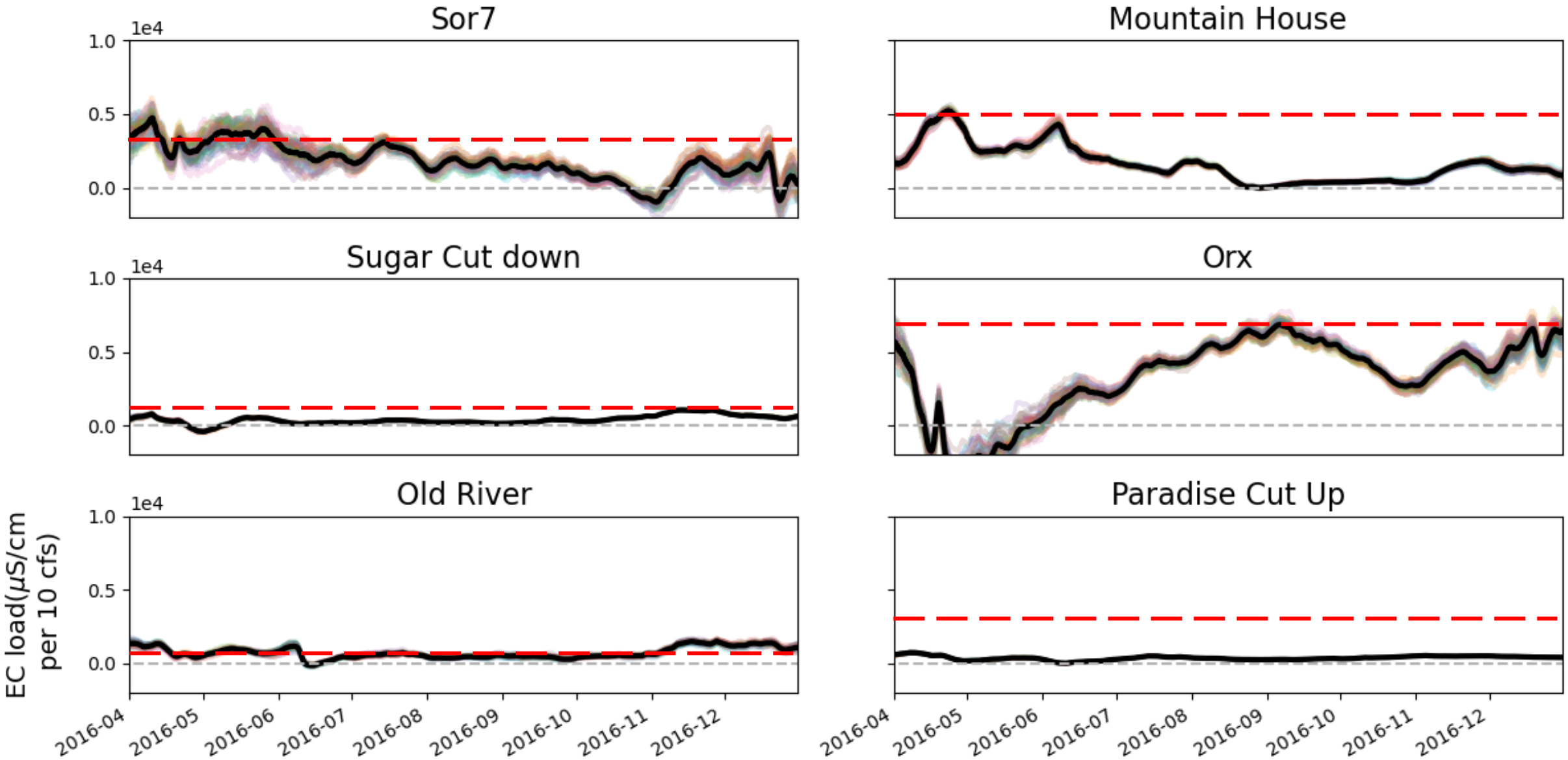


Application of data assimilation to the **real observational data** in the South Delta to infer salinity sources

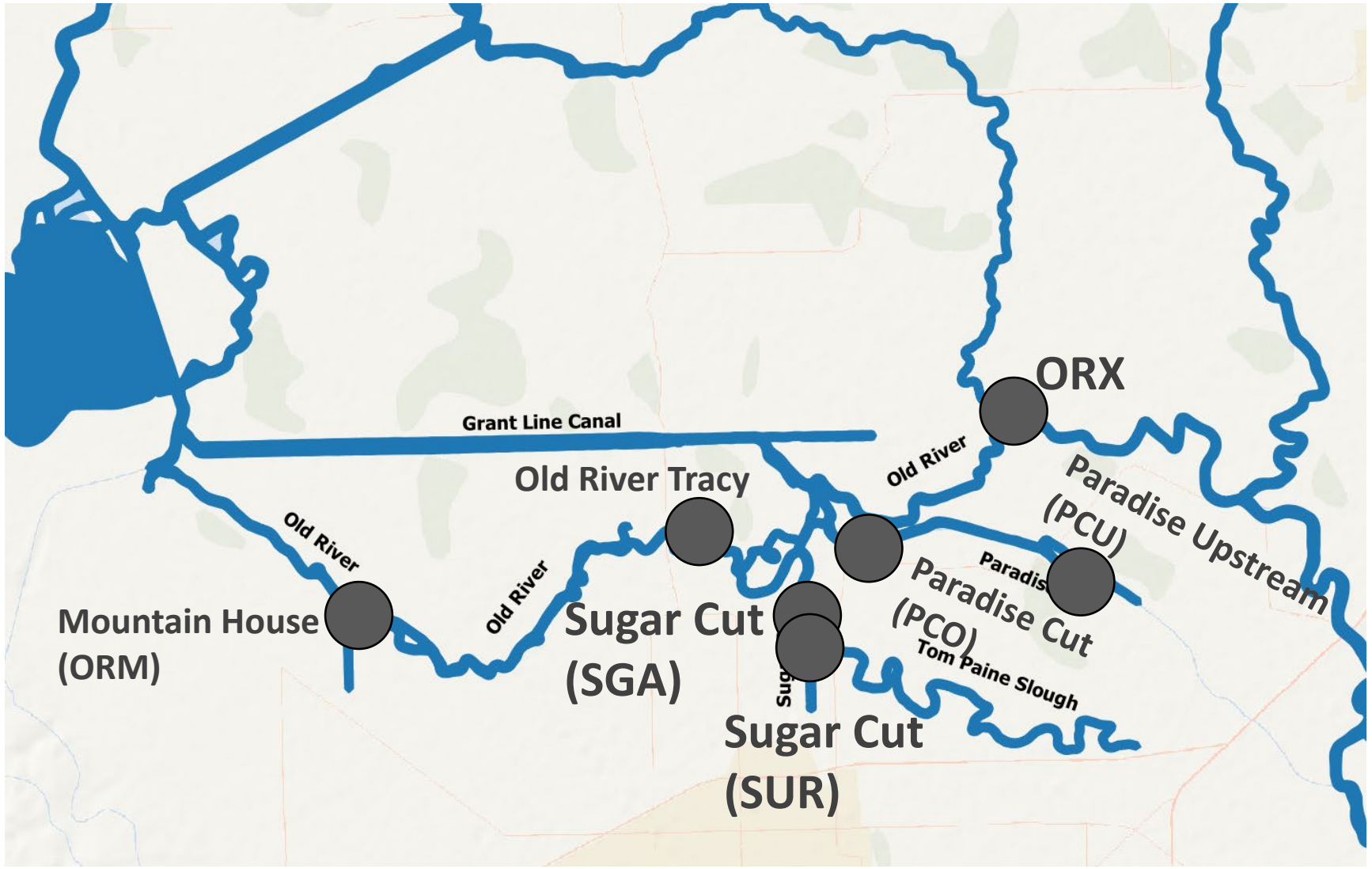
EC sources


Grant Line Canal
Old River
Old River
Old River
Old River
Paradis
Tom Paine Slough
ORX
SOR7
Old River
Paradise Upstream
Mountain House
Sugar Cut

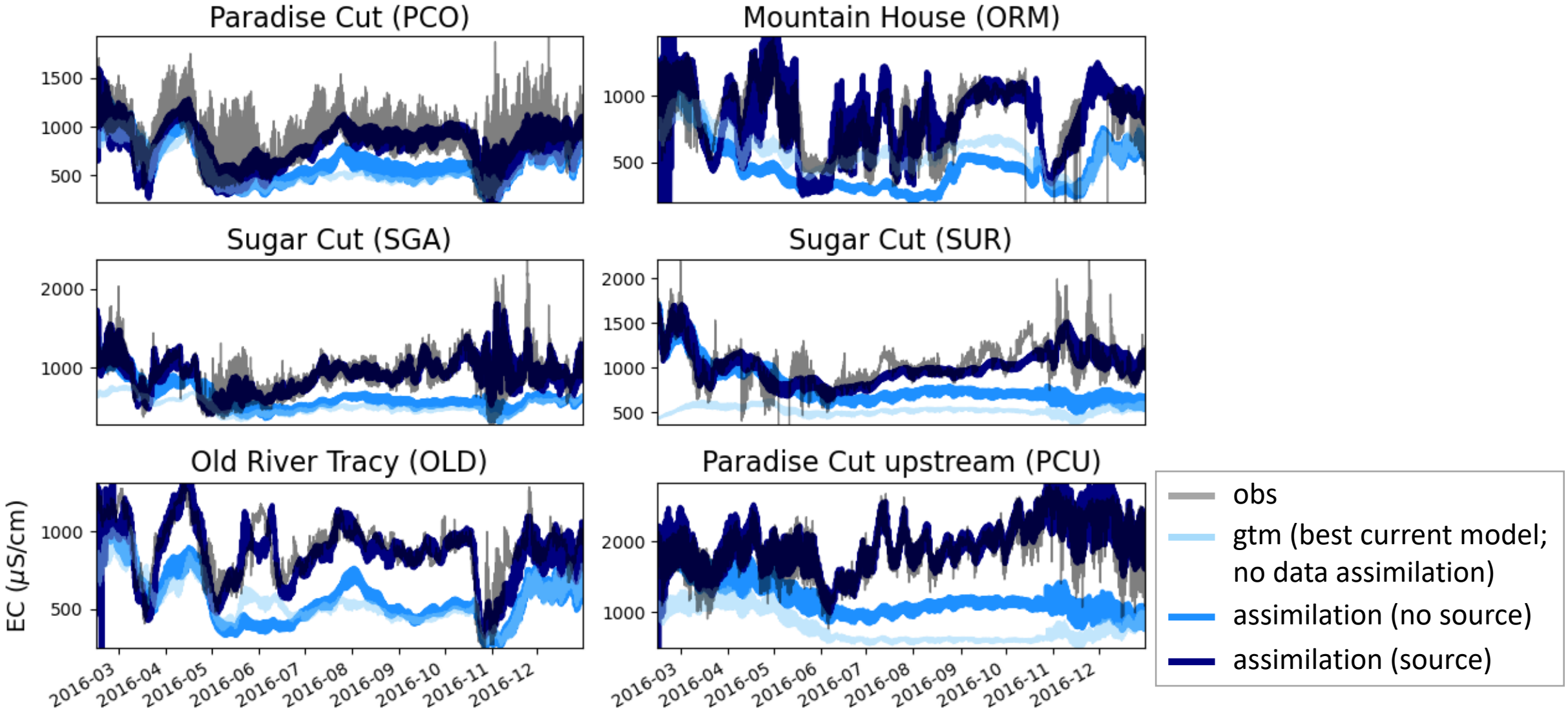
Inferred EC sources vs. maximum grab samples



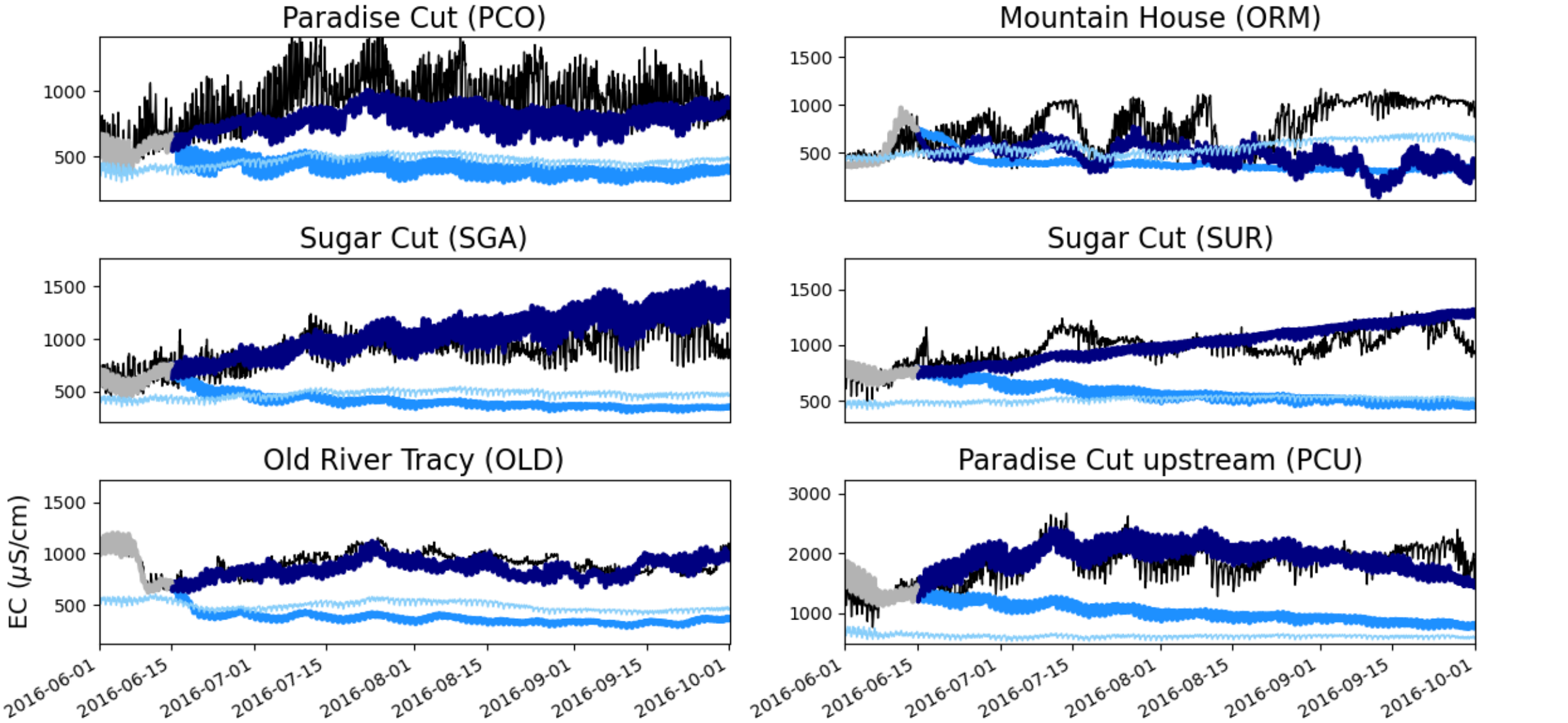
EC observations



Observed vs. Modeled EC



Improved predictive power by data assimilation



Conclusions

- Data assimilation improves salinity modeling in the South Delta.
- Data assimilation can infer salinity sources.
- Data assimilation discrepancies expose situations where:
  - The modeled flow direction is suspect.
  - Sources are not advected towards the instrument.

Comments and suggestions?

Zhenlin Zhang: zhenlin.zhang@water.ca.gov

Eli Ateljevich: Eli.Ateljevich@water.ca.gov