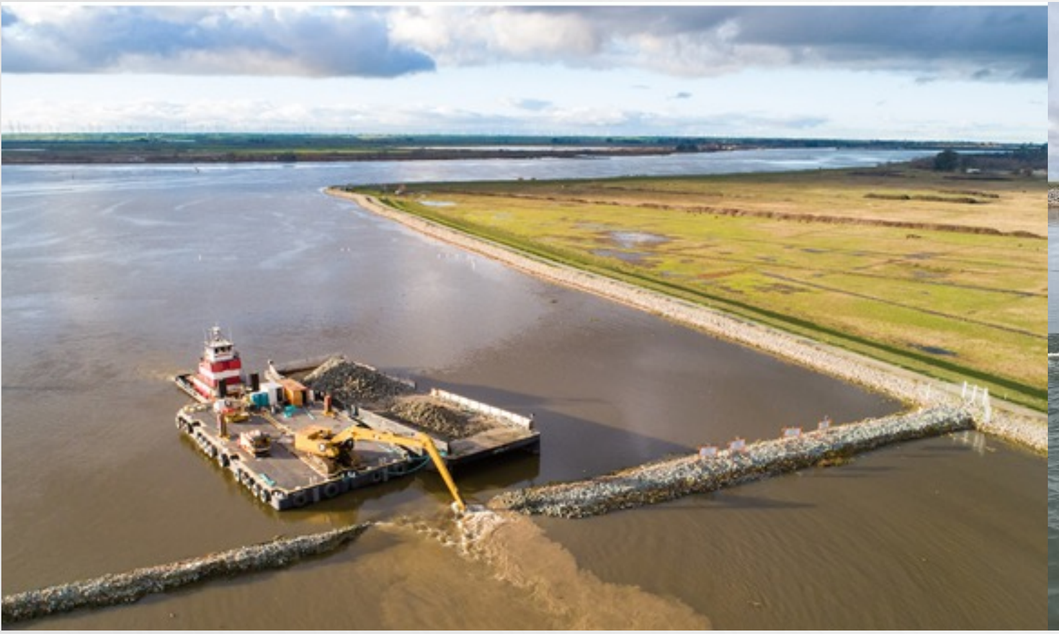
CALIFORNIA DEPARTMENT OF WATER RESOURCES

Modeling the Emergency Drought Barrier ... Again

April 6, 2022



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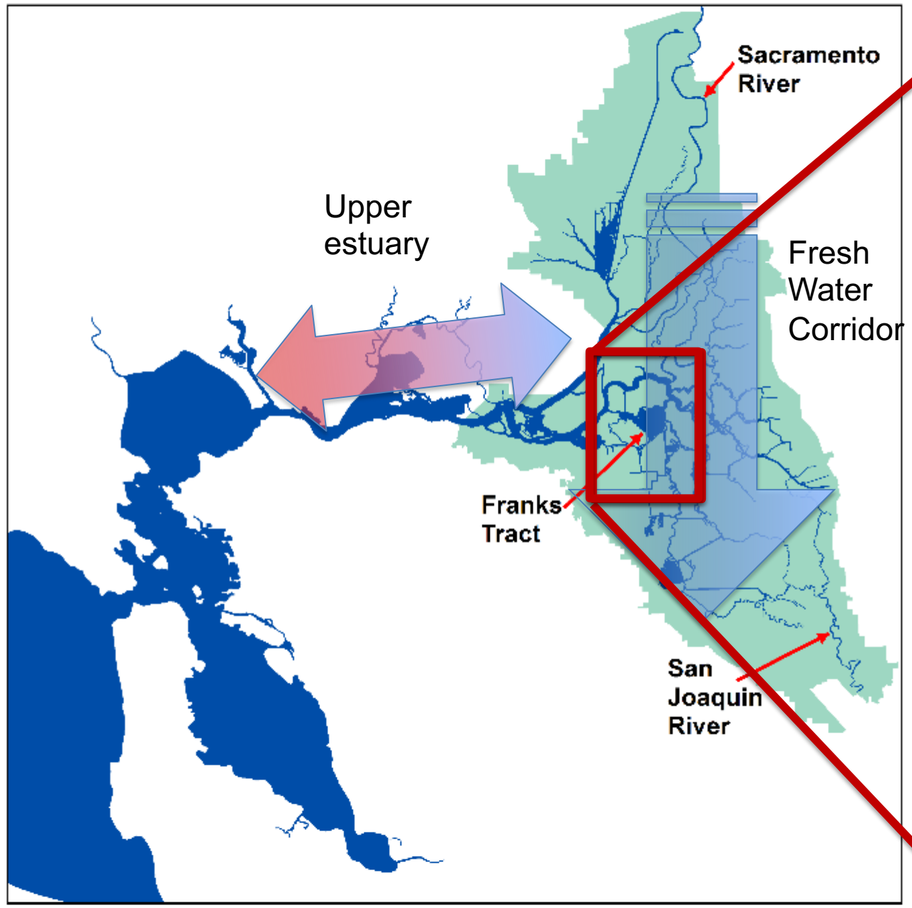
Qiang Shu, PE

Topics

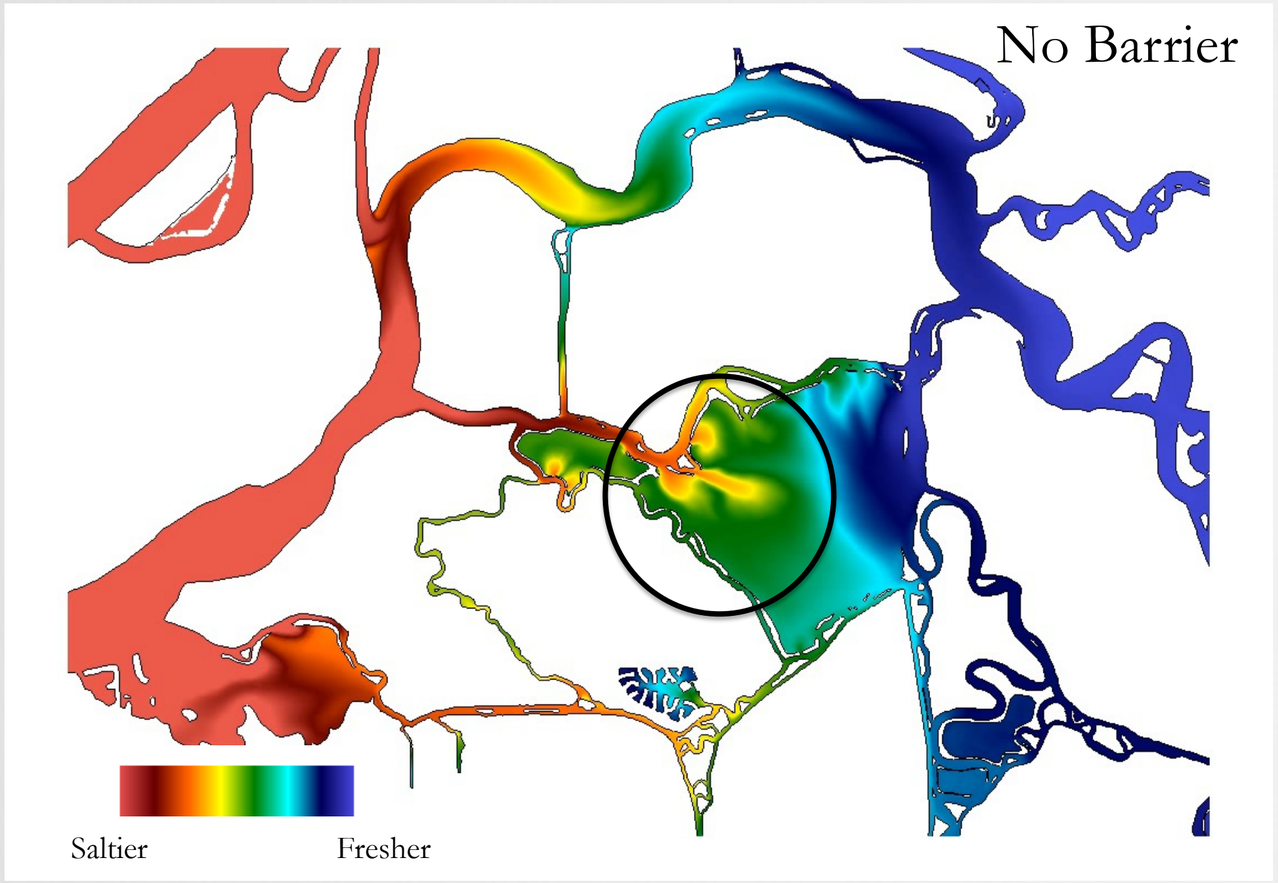
- Function and timeline of the Emergency Drought Barrier EDB
- Main hydrodynamic and salinity control effects
- Design and monitoring -- examples where modeling made a difference:
  - Harmful blooms: water age and temperature
  - Notching: notch design and velocity

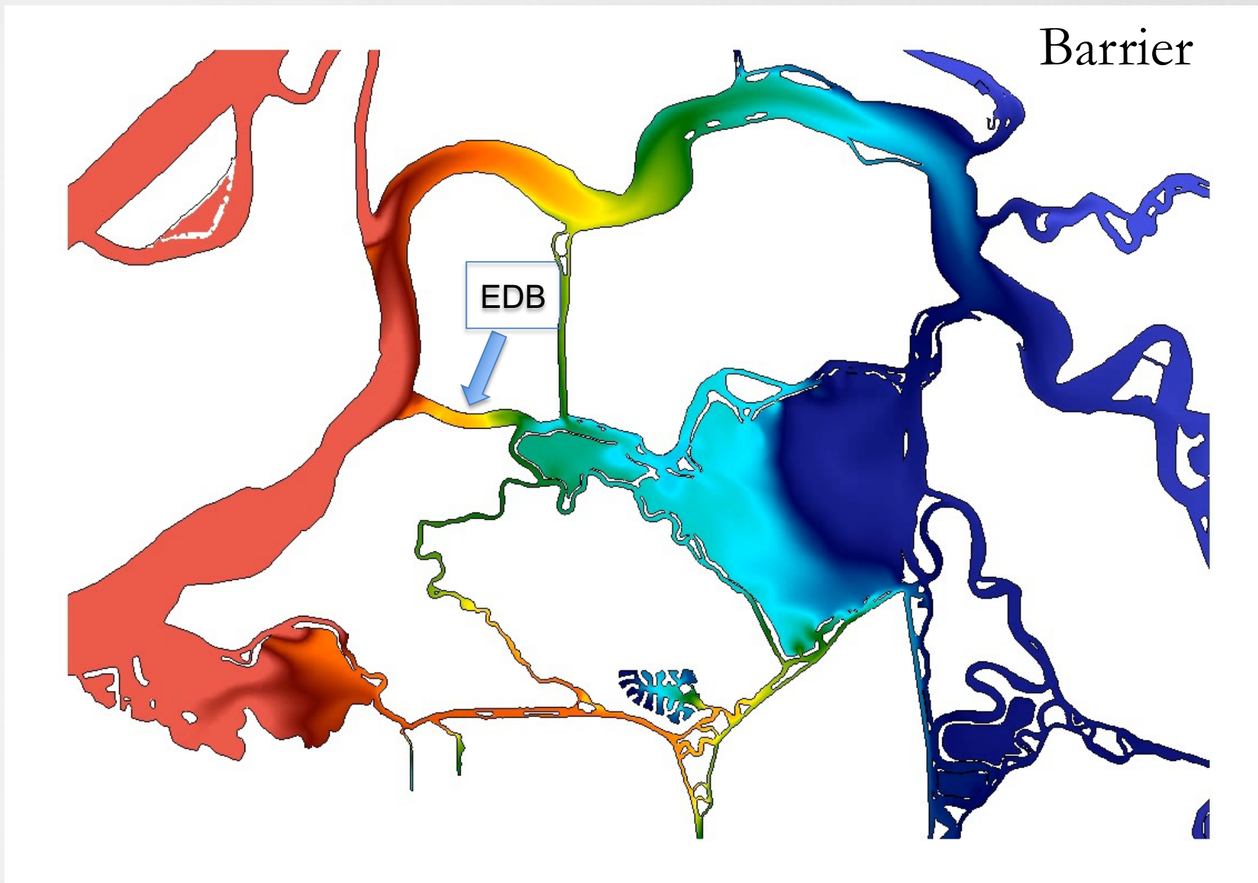


West False River Barrier

Mokelumne River near Highway 12
SJR at San Andreas
San Joaquin River at Twitchell Island
Threemile Slough
San Joaquin River
Fishermans Cut
Old River near Frank's Tract
San Joaquin River
False River
Old River
False River near Oakley
Frank's Tract near Russo's landing
False River
Prisoners Point
SJR at Jersey Point
Little Franks Tract
Piper Slough
Franks Tract
State Recreation Area
Old River
Piper Slough at Bethal Tract
Taylor Slough
Piper Slough
Dutch Slough below Jersey Is. Rd. at Jersey Is.
Holland Cut near Bethel Island
Dutch Slough
Mound Slough
Holland Cut
Connection Slough
Sand
Contra Costa Canal
Old River
Rock Slough Pumping Plant
Rock Slough Pumping Plant Intake
Rock Slough at Delta Road Bridge
Rock Slough
Holland Cut at Holland Marina
Bacon Island at Old River
Werner Dredger Cut near Palm Tract
Old River at Bacon Island
0 0.5 1 2 mi
0 0.5 1 2 km

Tidal Pumping and EDB Function



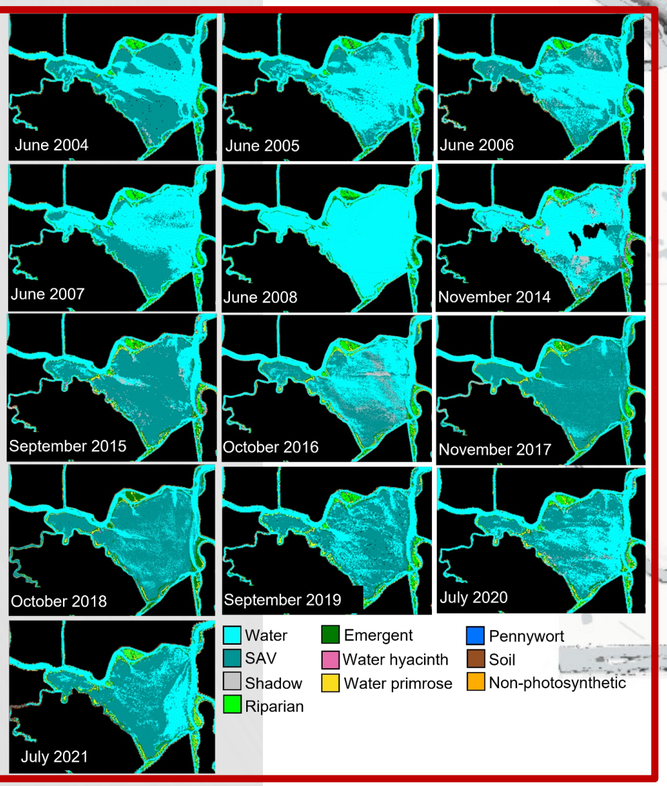


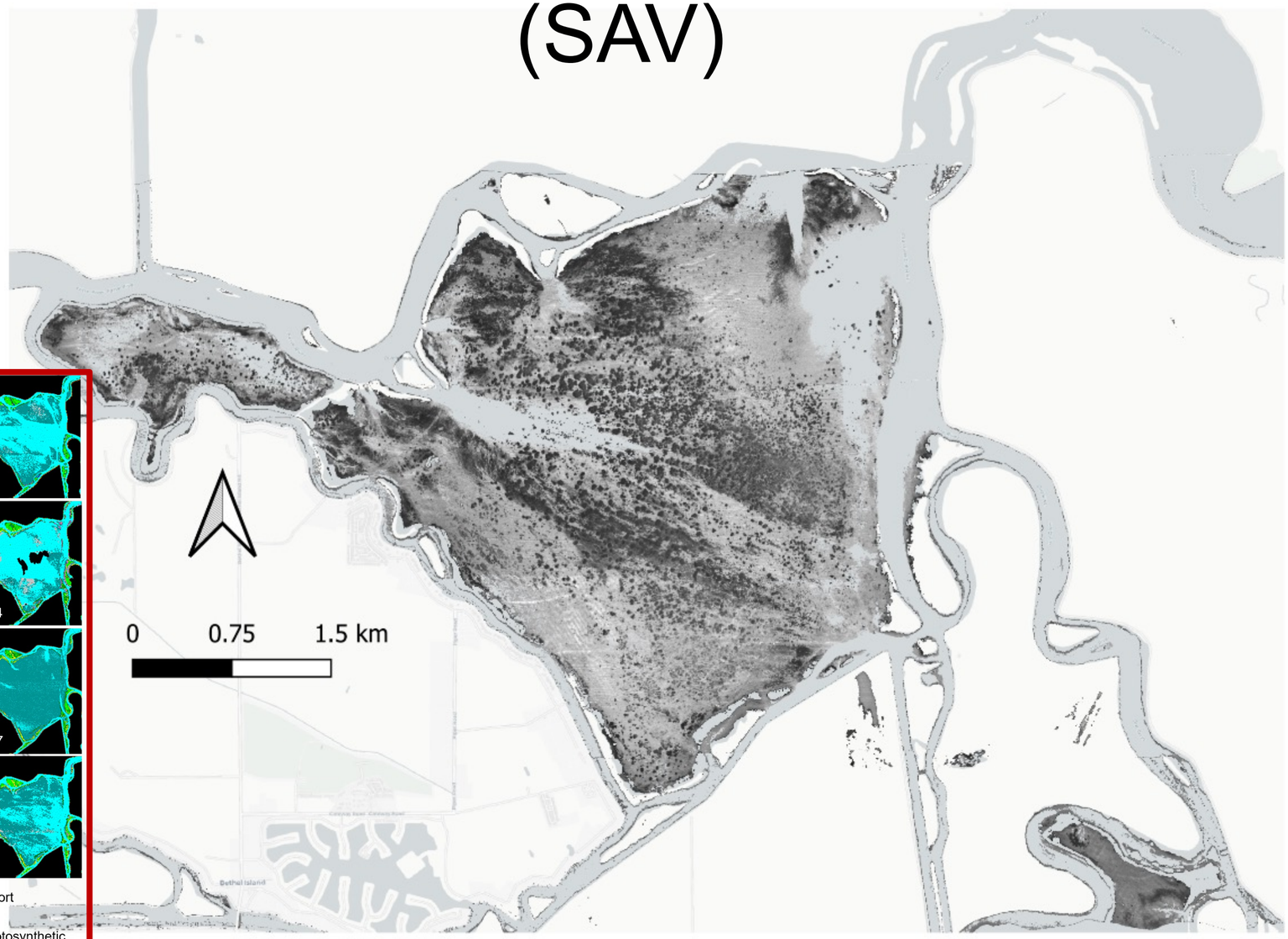
SCHISM simulated salinity based on Summer 2021

EDB = Emergency Drought Barrier

Submerged Aquatic Vegetation (SAV)

Historical NDVI

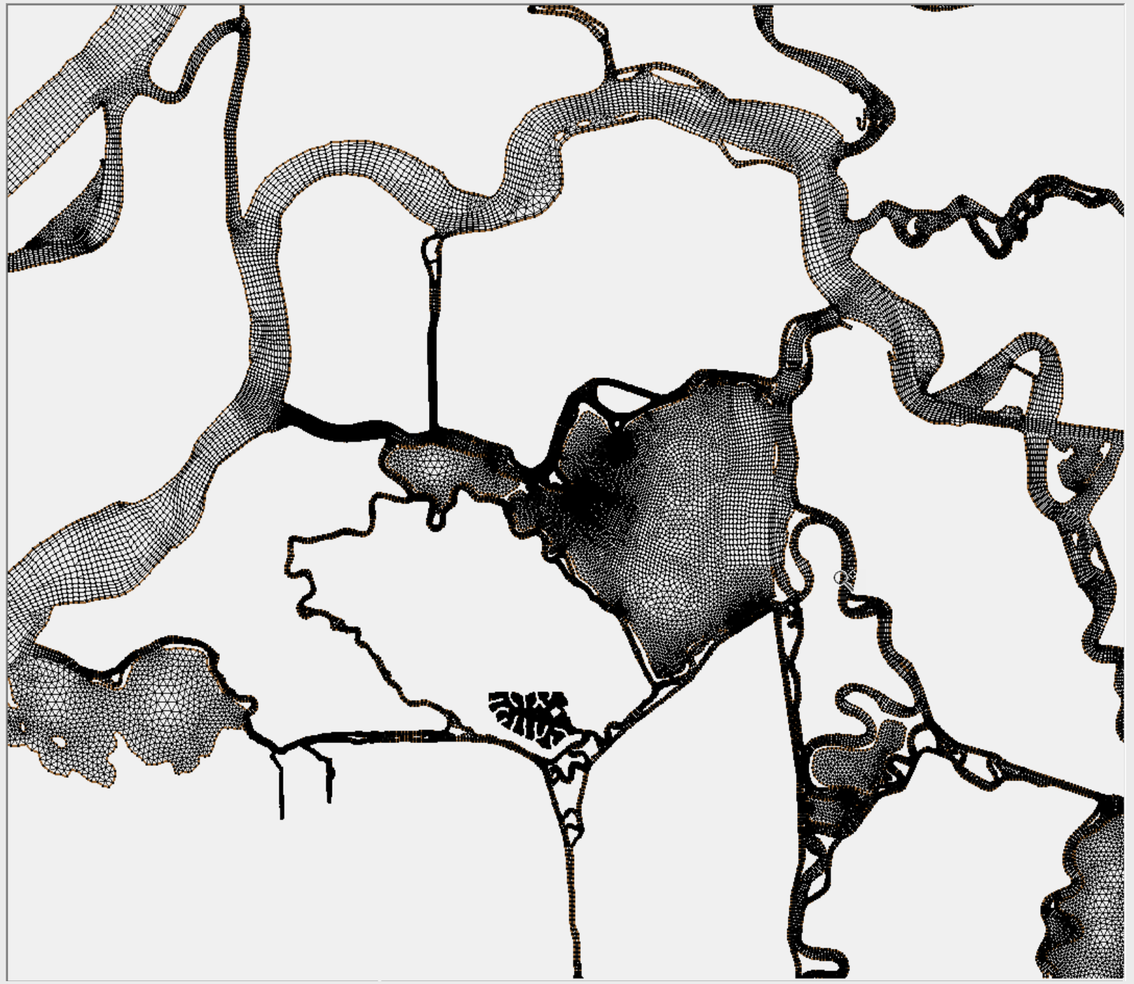




Normalized Difference Vegetation Index 2015
Credit: UC Davis Ustin lab

Bay-Delta SCHISM

- SCHISM model (VIMS, GitHub)
- Application on GitHub/CNRA Open Data
- Farallon to Vernalis/Knights Landing
  - 330,000 elements
  - 8-23 vertical layers
- Major flows, exports, structures, channel depletions
- Approximate run speed:
  ½ year per day on cluster
- Representation of SAV drag + turbulence



Ateljevich E, Nam K, Zhang Y, Wang R, Shu Q. 2014. “Bay Delta Calibration Overview.” In:*Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh. 35th Annual Progress Report*. Sacramento (CA): California Department of Water Resources.

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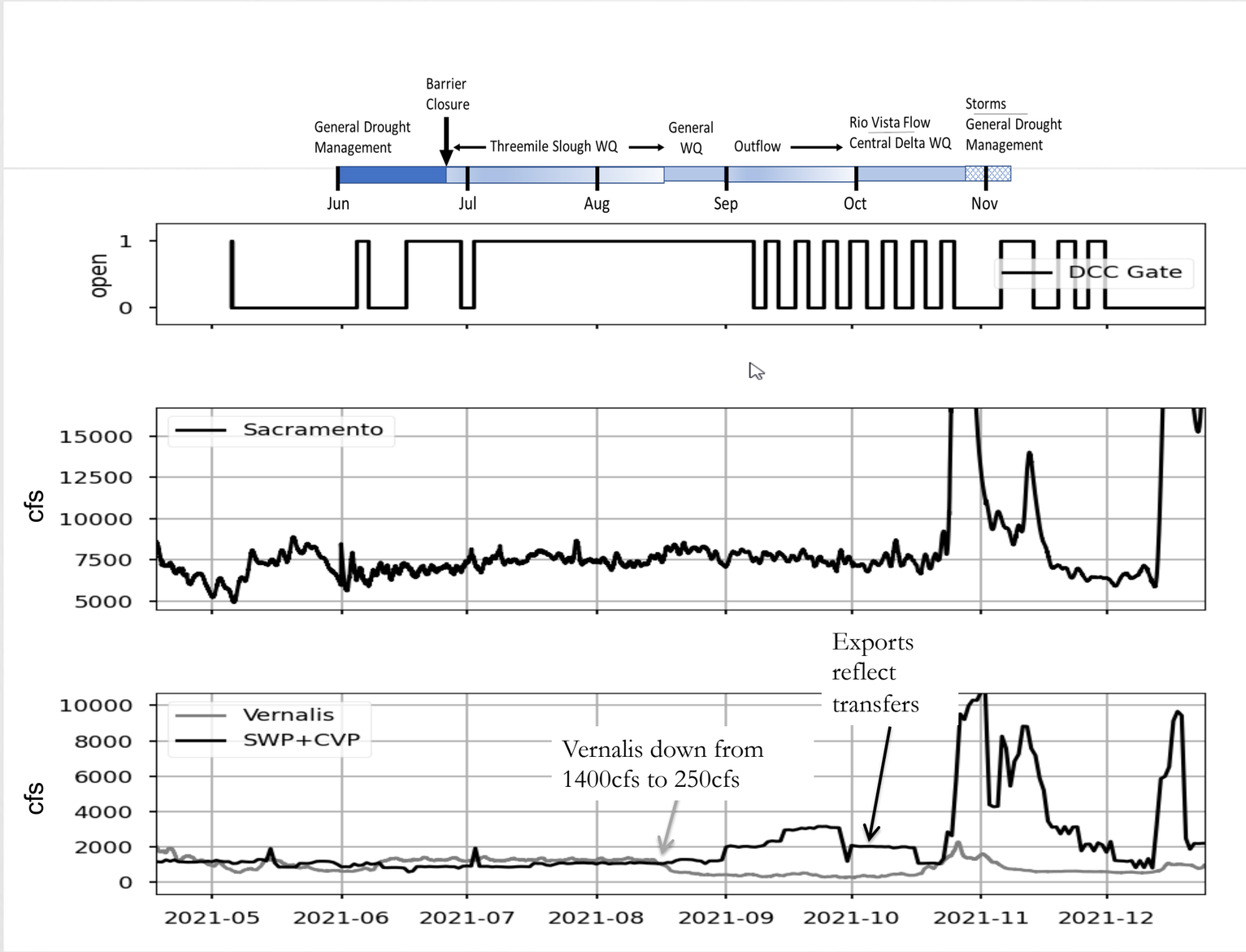
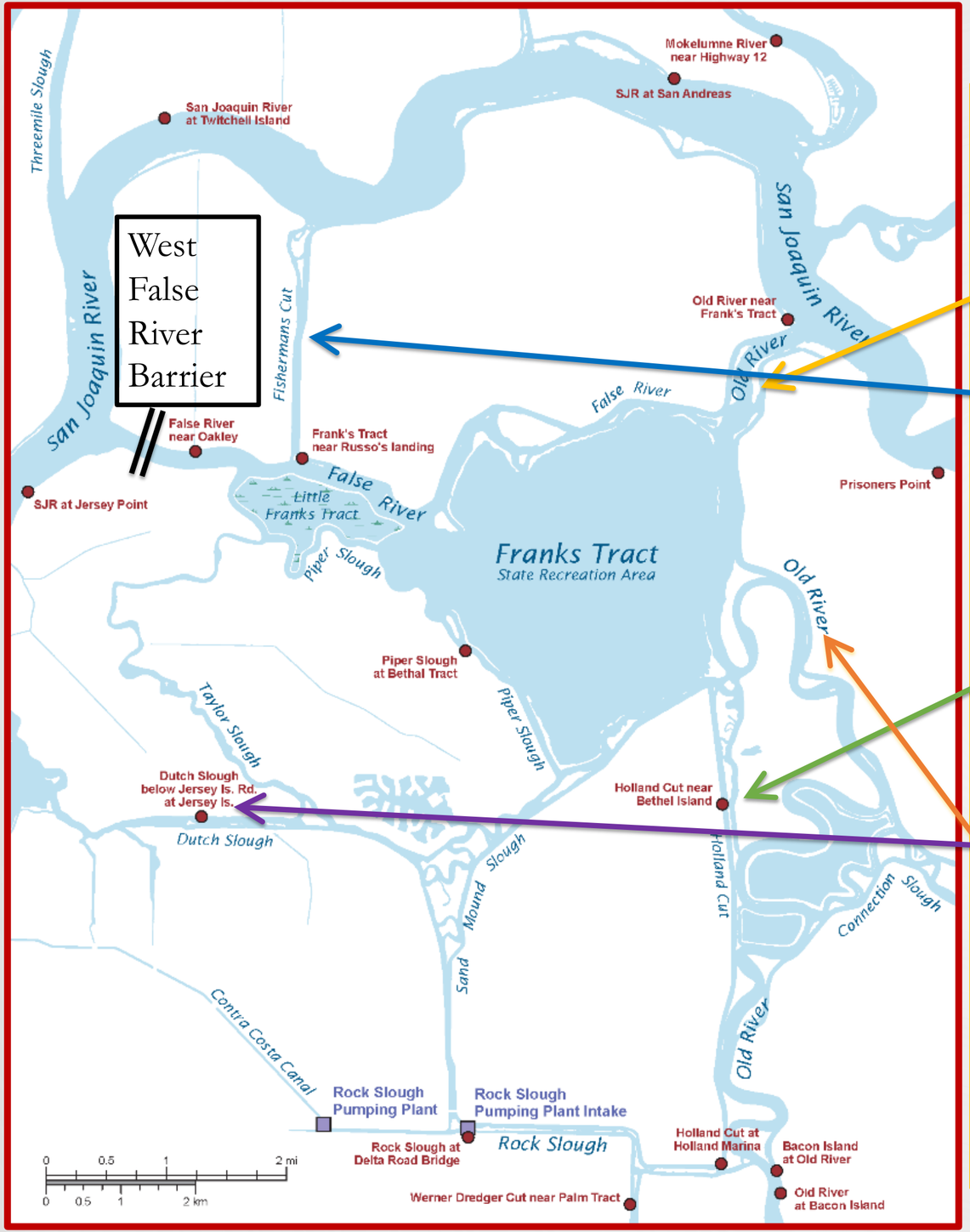
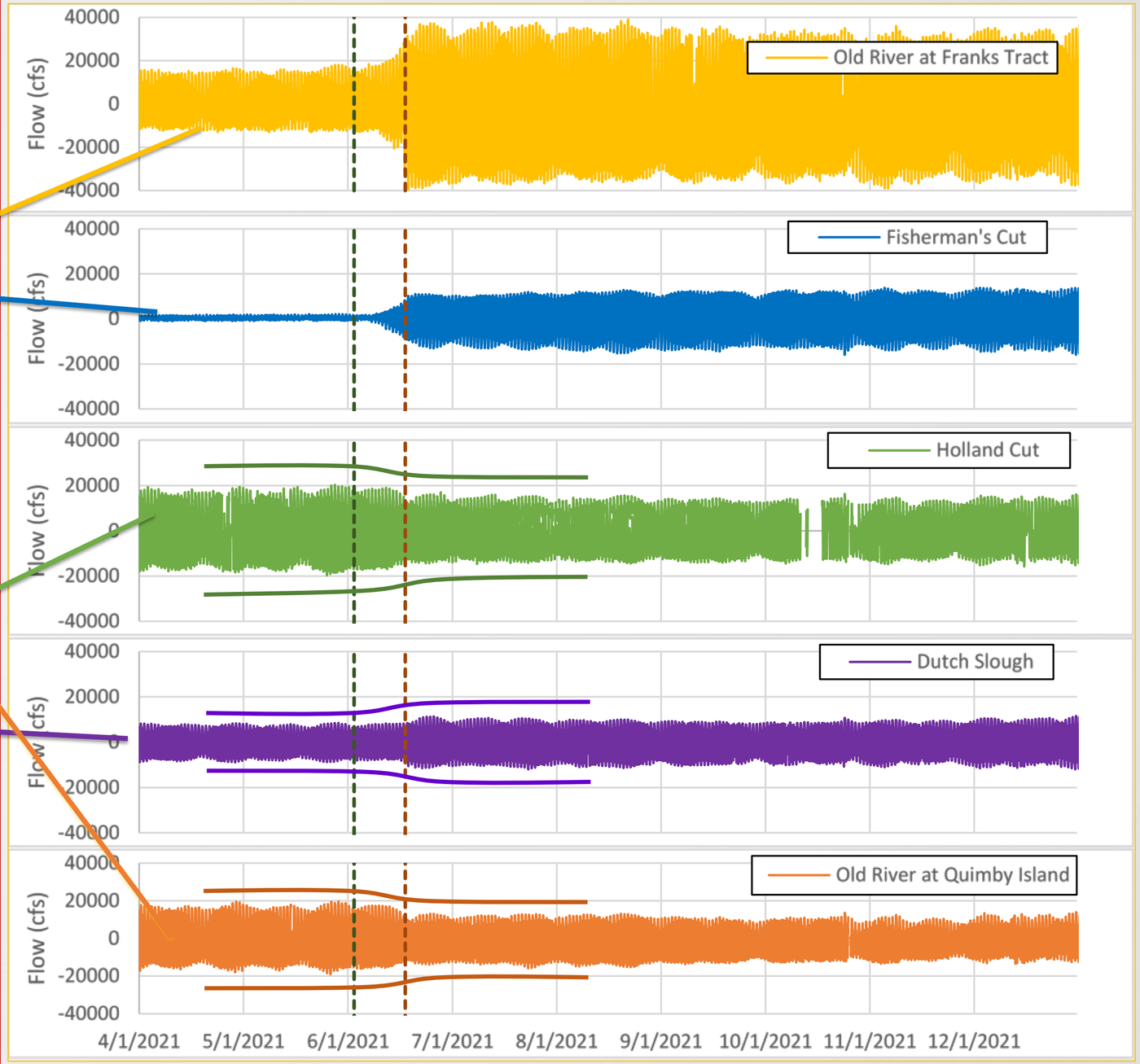
2021 Hydrology/Ops

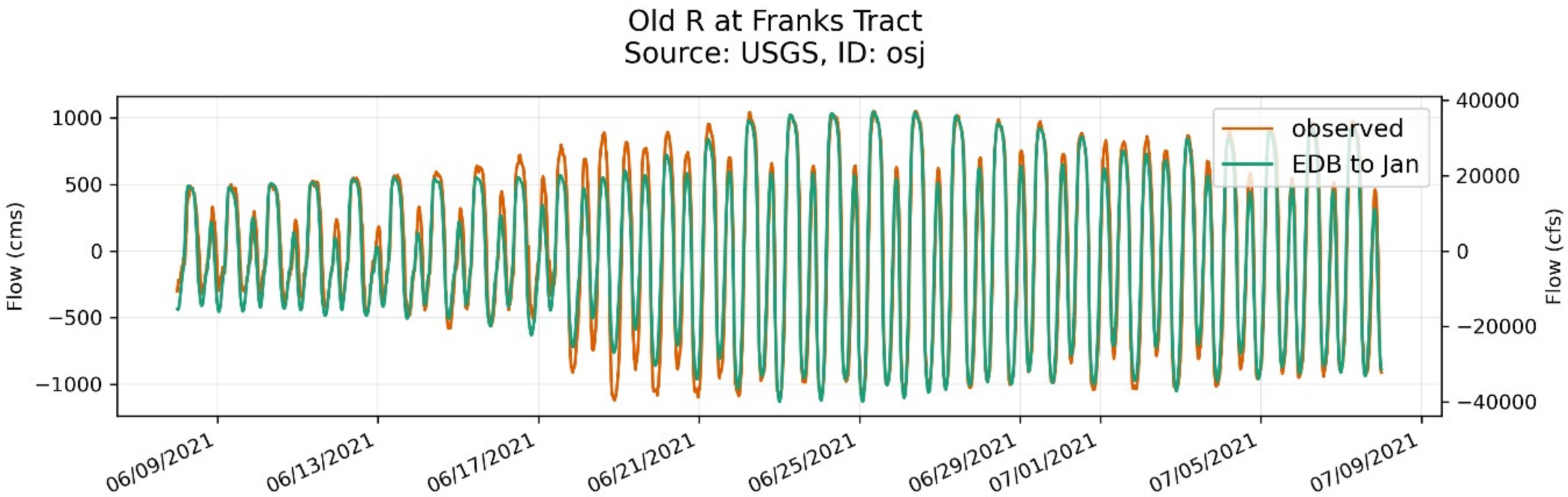


FLOW AND SALINITY EFFECTS

Observed Data 2021







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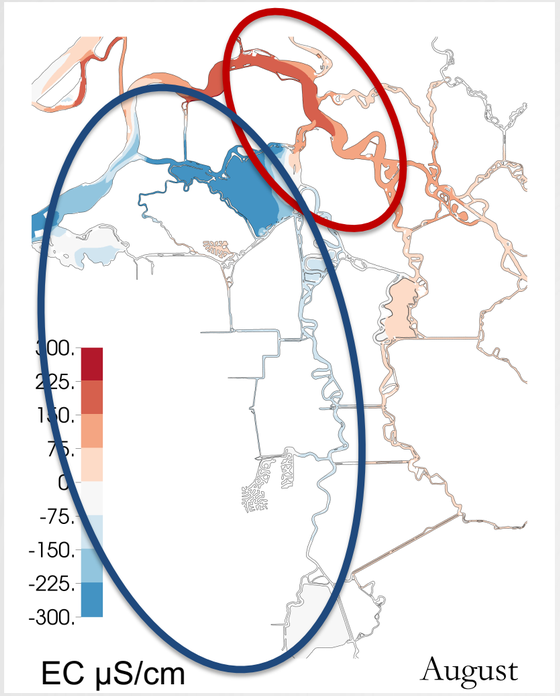
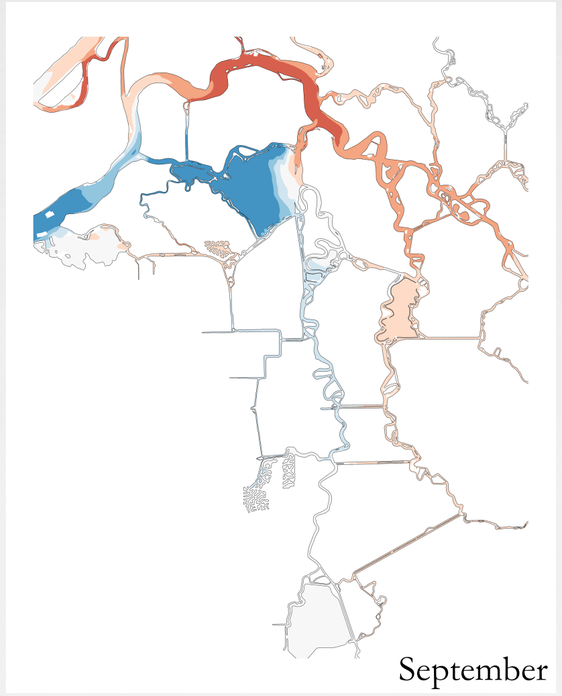
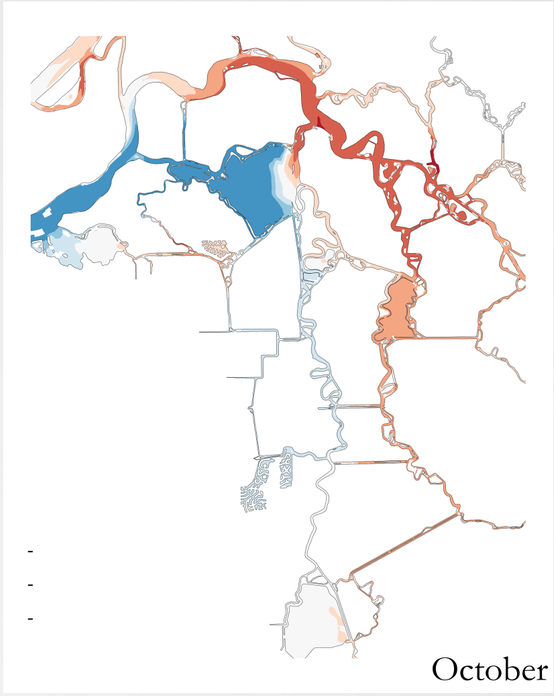
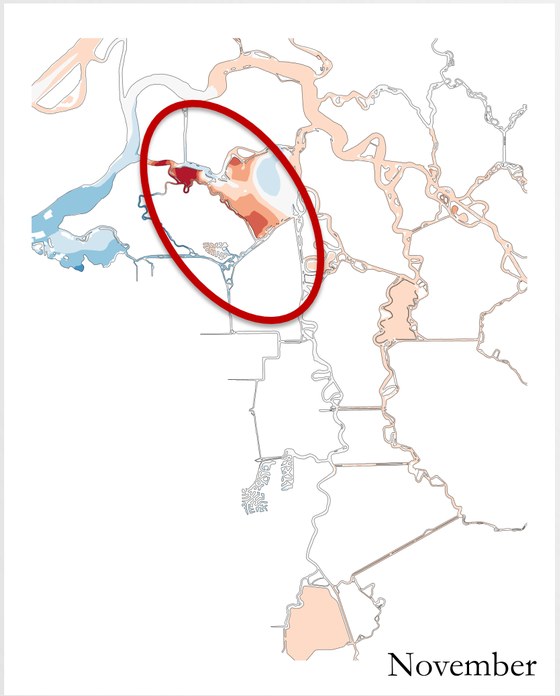
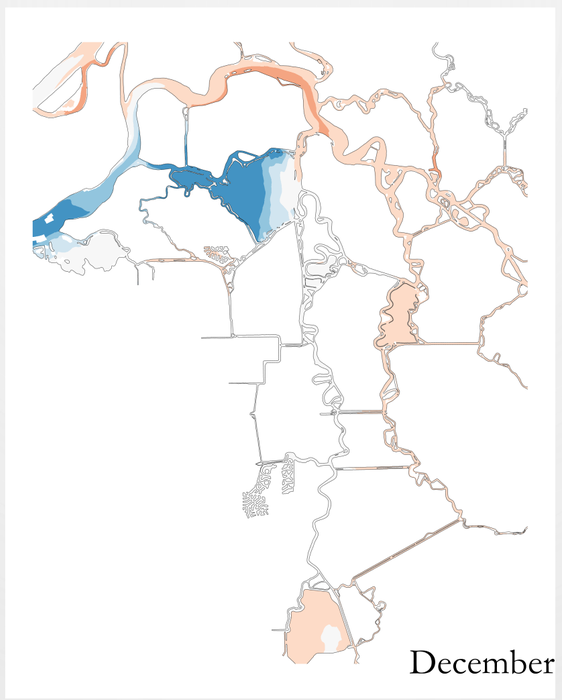








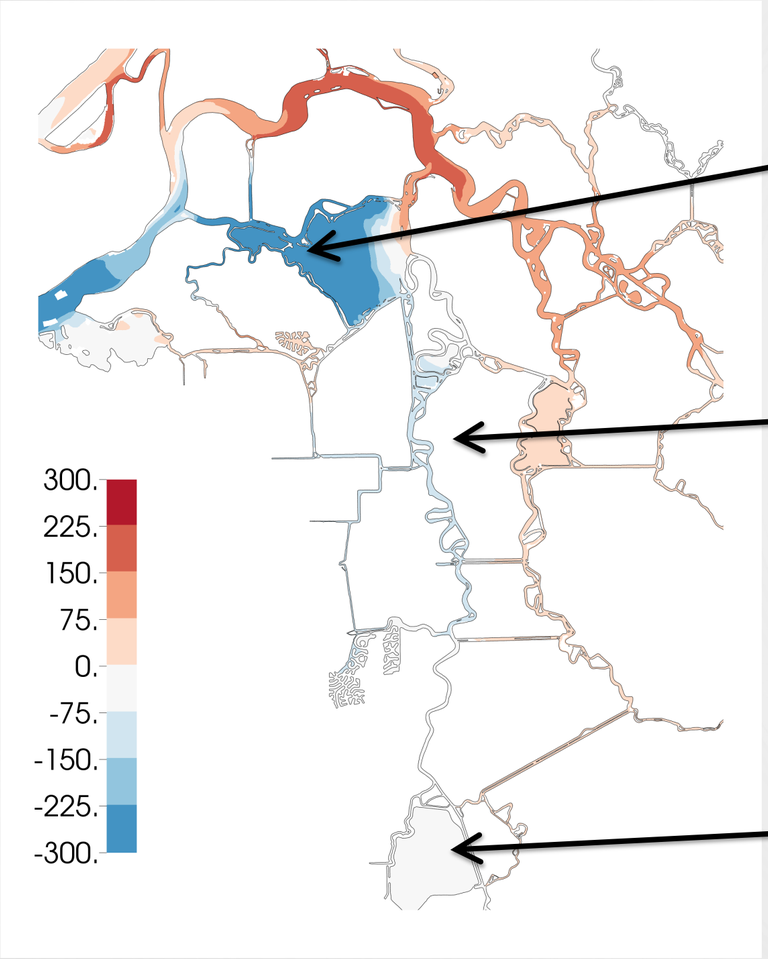


SCHISM Simulation 2021 Salinity Difference maps.

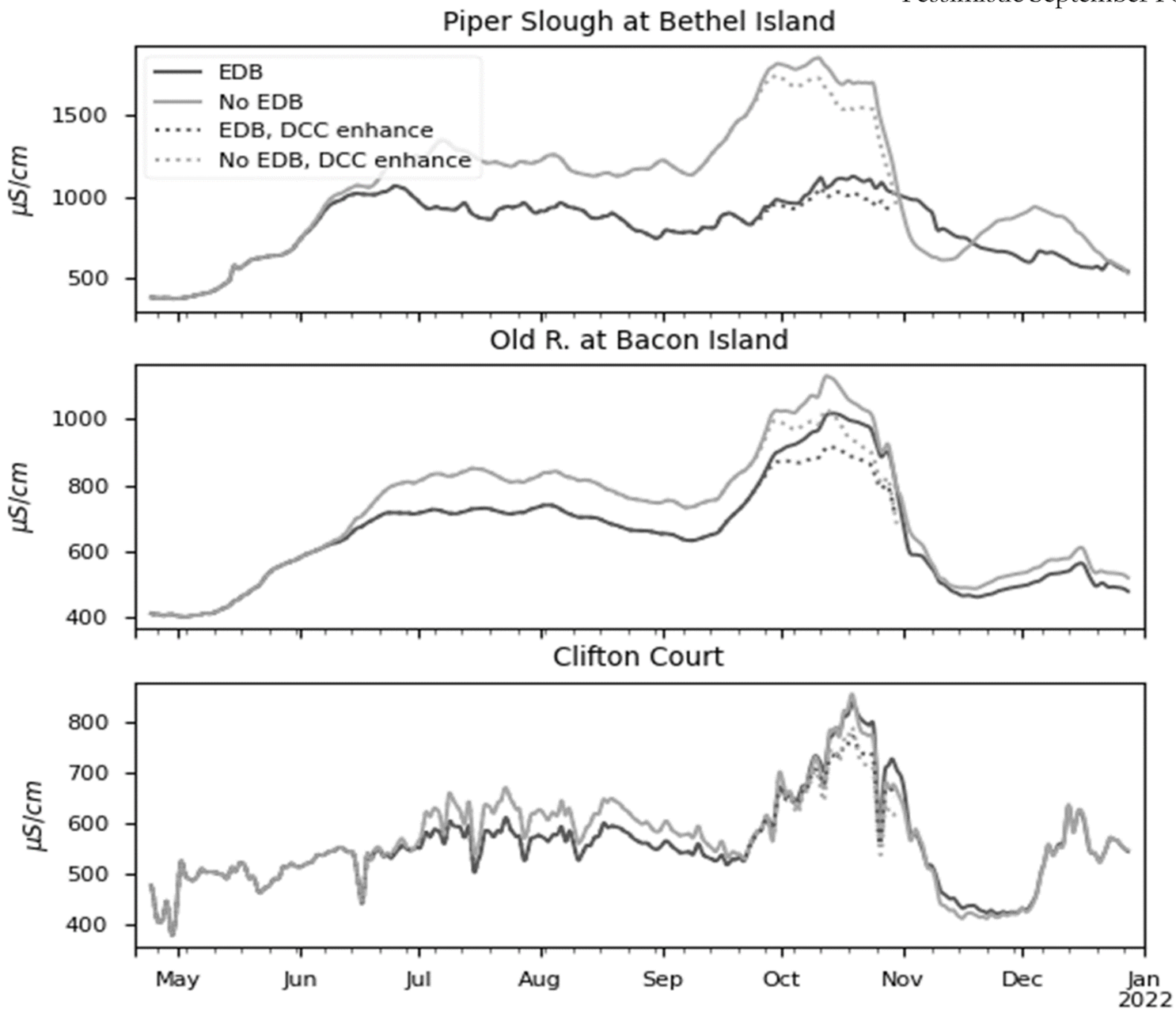
EDB – No EDB

Monthly and depth averaged

Delta Cross Channel



NOT HISTORICAL
Pessimistic September Forecast



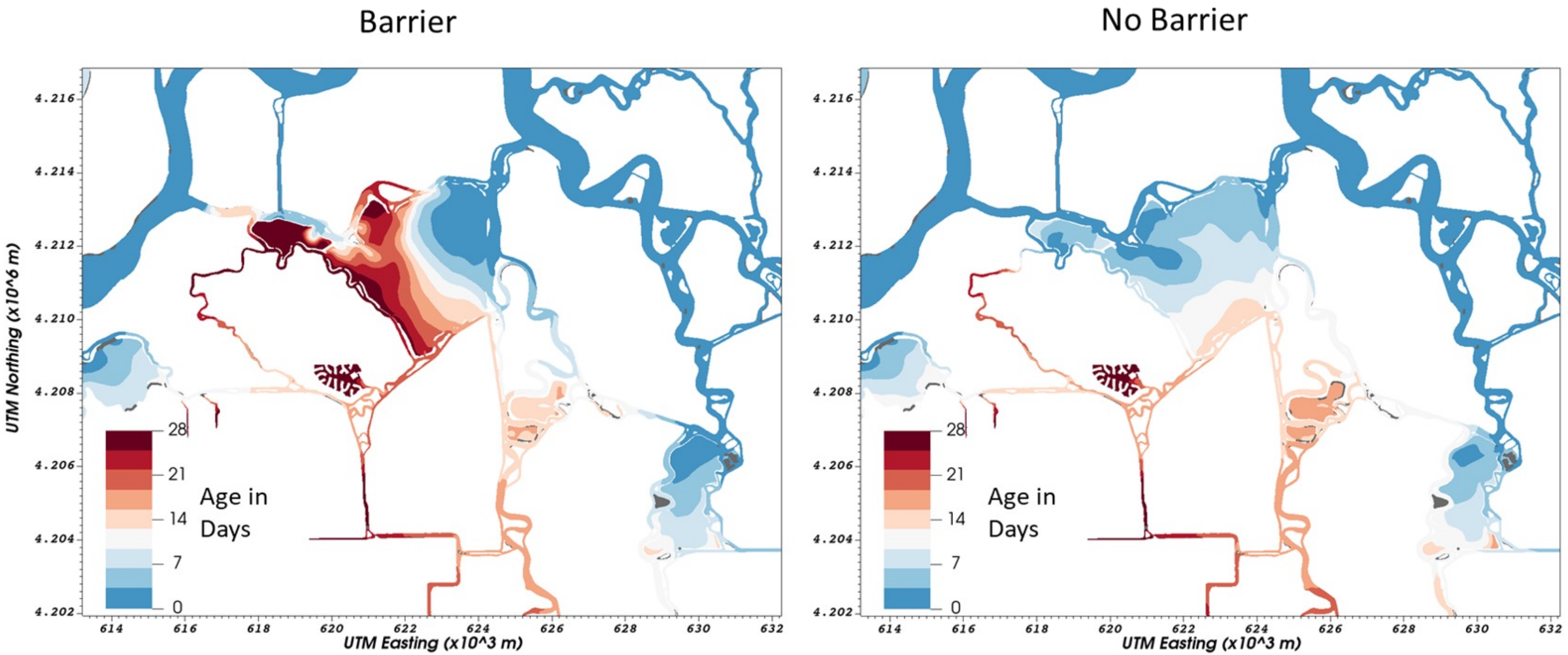
All results are SCHISM simulations
DCC Enhanced = 2 Extra Days per cycle
Unlikely to be compliant with Rio Vista flow objectives

DESIGN AND MONITORING

Harmful Algal Bloom Monitoring

- Items of interest through modeling:
  - Water age
  - Temperature
- Methodology for age:
  - Constituent oriented age and residence time (CART)
    - Uses two auxiliary transport constituents (Delhez 2014, Deleersnijder 2001)
  - In this case: age since last departure from San Joaquin

Water Age

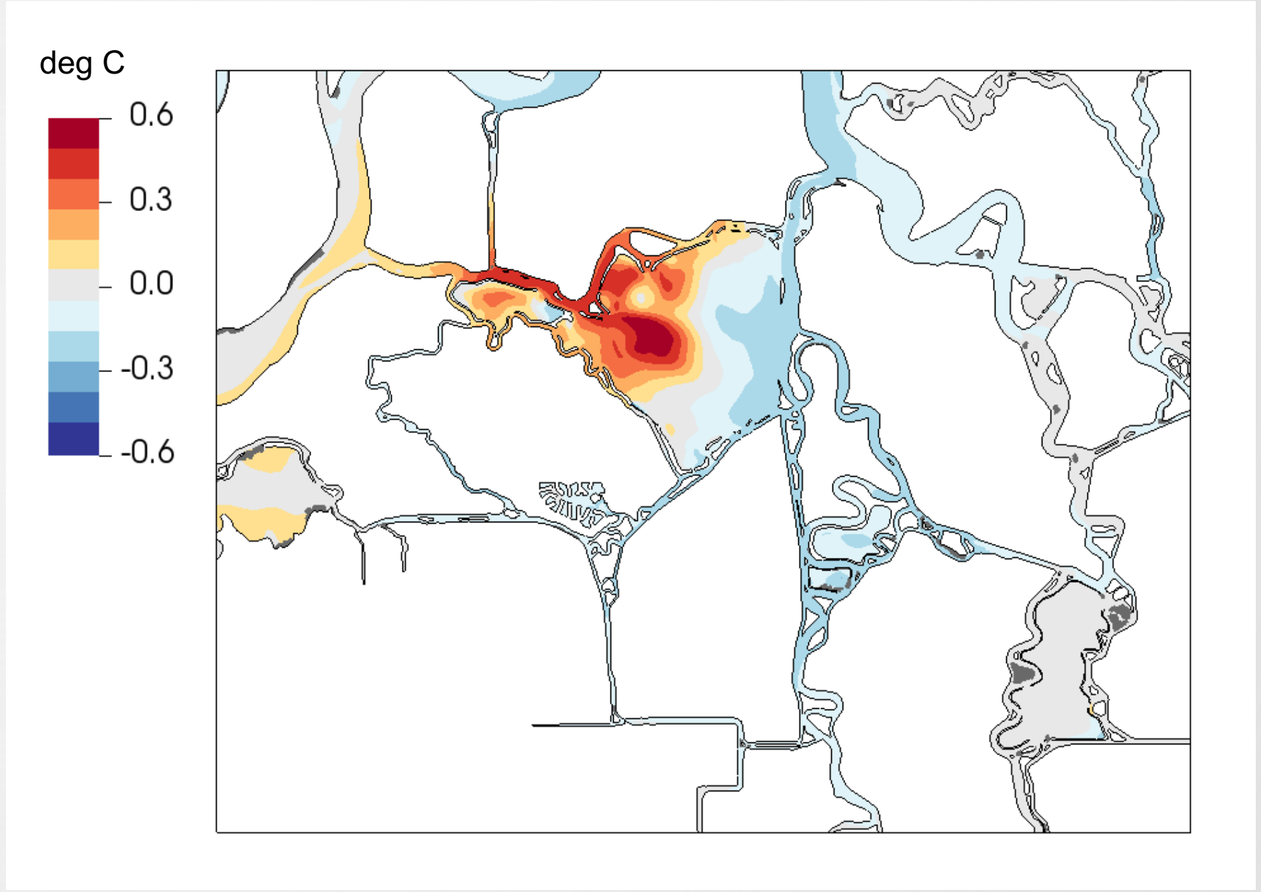


Averaged over August 17, 2022

Temperature Effects

- Generally < 0.1º C
- Larger at the False River jet location
- Small change consistent with long age:

~ heat balance prevails



Modeled differences in July monthly mean, depth averaged temperature. Typical temperatures in this period 23-24°C

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Where will this go?

- The EDB impacts water age significantly
- The EDB does not impact temperature much except at the “nozzle”
- Preliminary: Observed HABS does not coincide with the residence time gradient
  - Monitoring will track the gradient more in 2022

NOTCH DESIGN

Notch Design

- Notched Jan15 - April
- Items of interest/concern:
  - Velocity at notch (design)
  - Eddy structure (predation)
- Much higher resolution (3-5m) at barrier
- Design tide based on May 27-29.
- At the edge of the models assumptions

- We decided if it wasn't in-bounds for the model it wasn't all that hot for other criteria

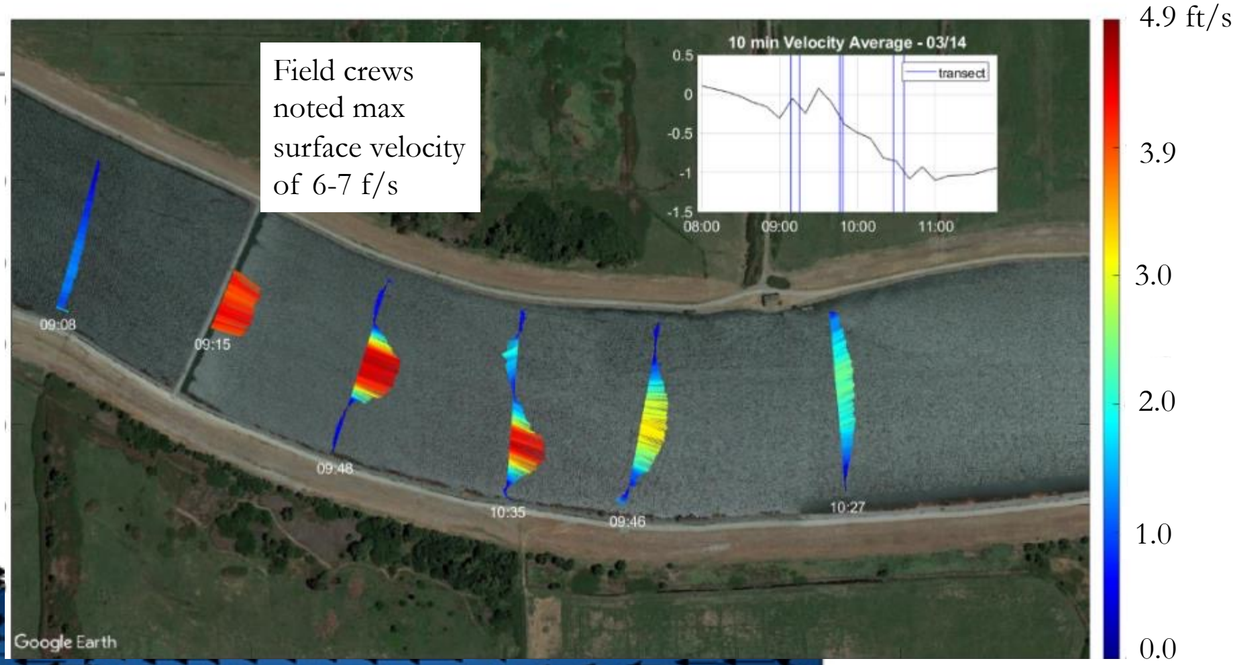
Notch Velocity

near-peak flood May 27, 2021
This date used as basis of study because of its high energy. Note the notch was not installed at this time

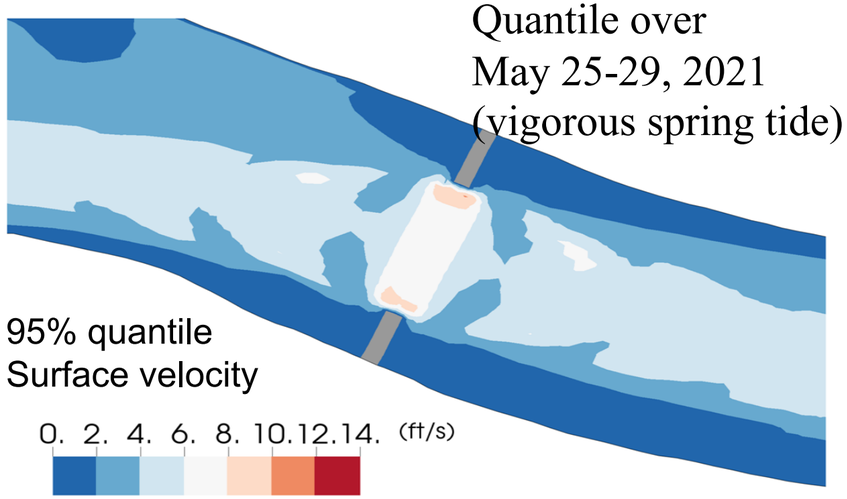
Surface Velocity Magnitude (ft/s)

0.0000 3.000 6.000 9.000 12.00

Observed (Depth Ave) Velocity



Quantile over
May 25-29, 2021
(vigorous spring tide)



More Information

- Eli.Ateljevich@water.ca.gov
- Forthcoming reports:
  - Barrier efficacy report for 2021
  - HABS report