Exploring primary production and nutrient cycling in the Delta using a coupled hydrodynamic-biogeochemical model

CALIFORNIA WATER AND ENVIRONMENTAL MODELING FORUM

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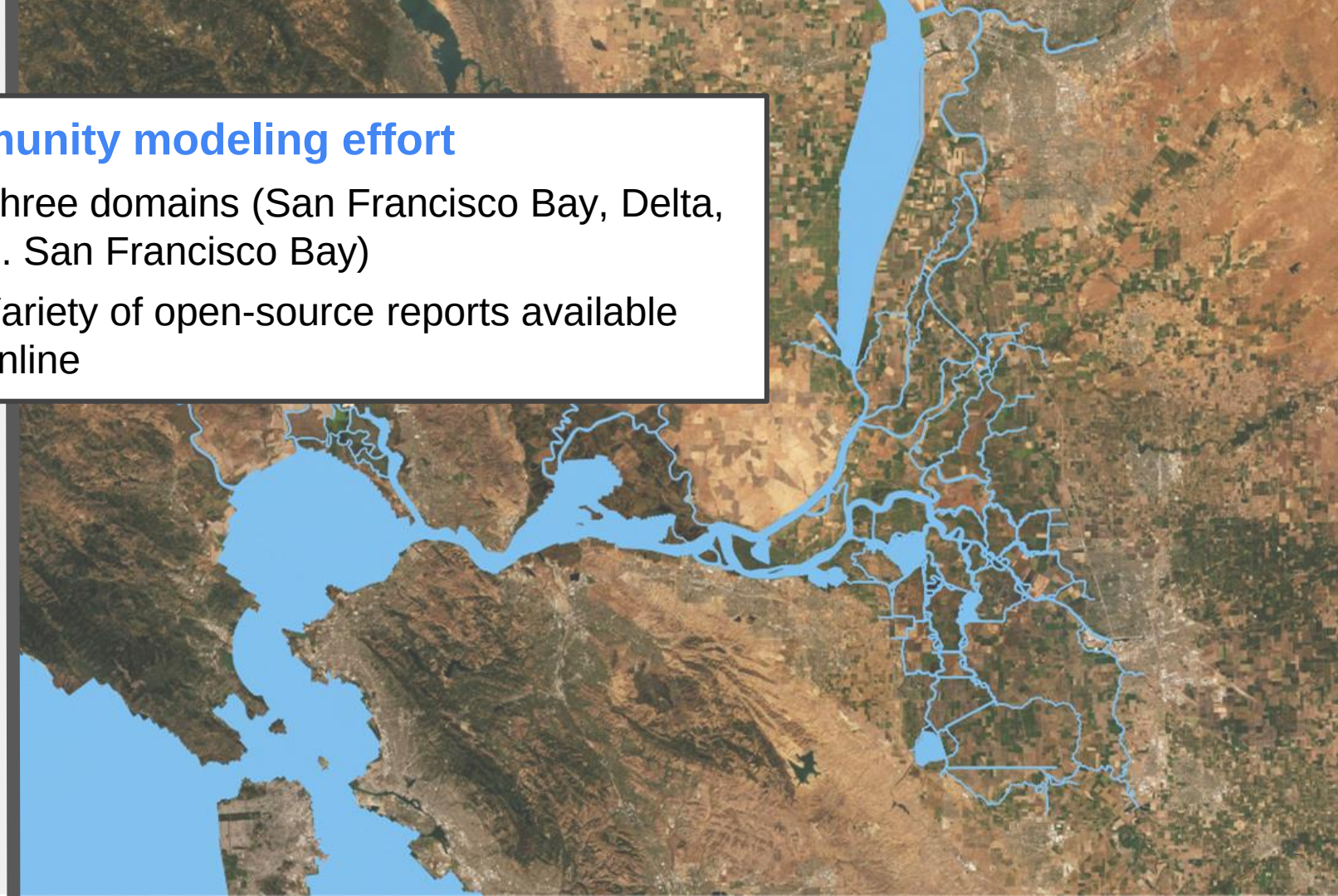
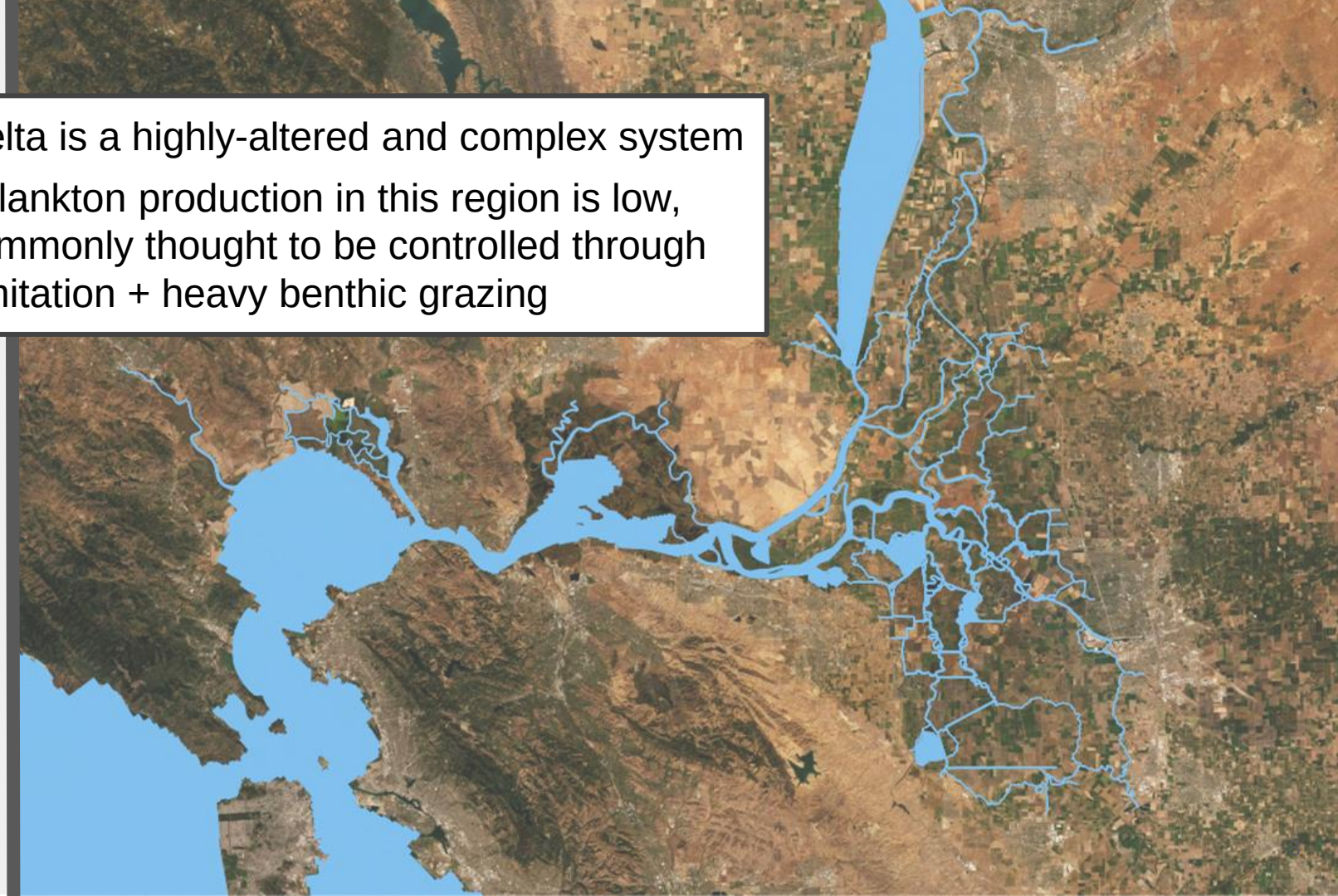
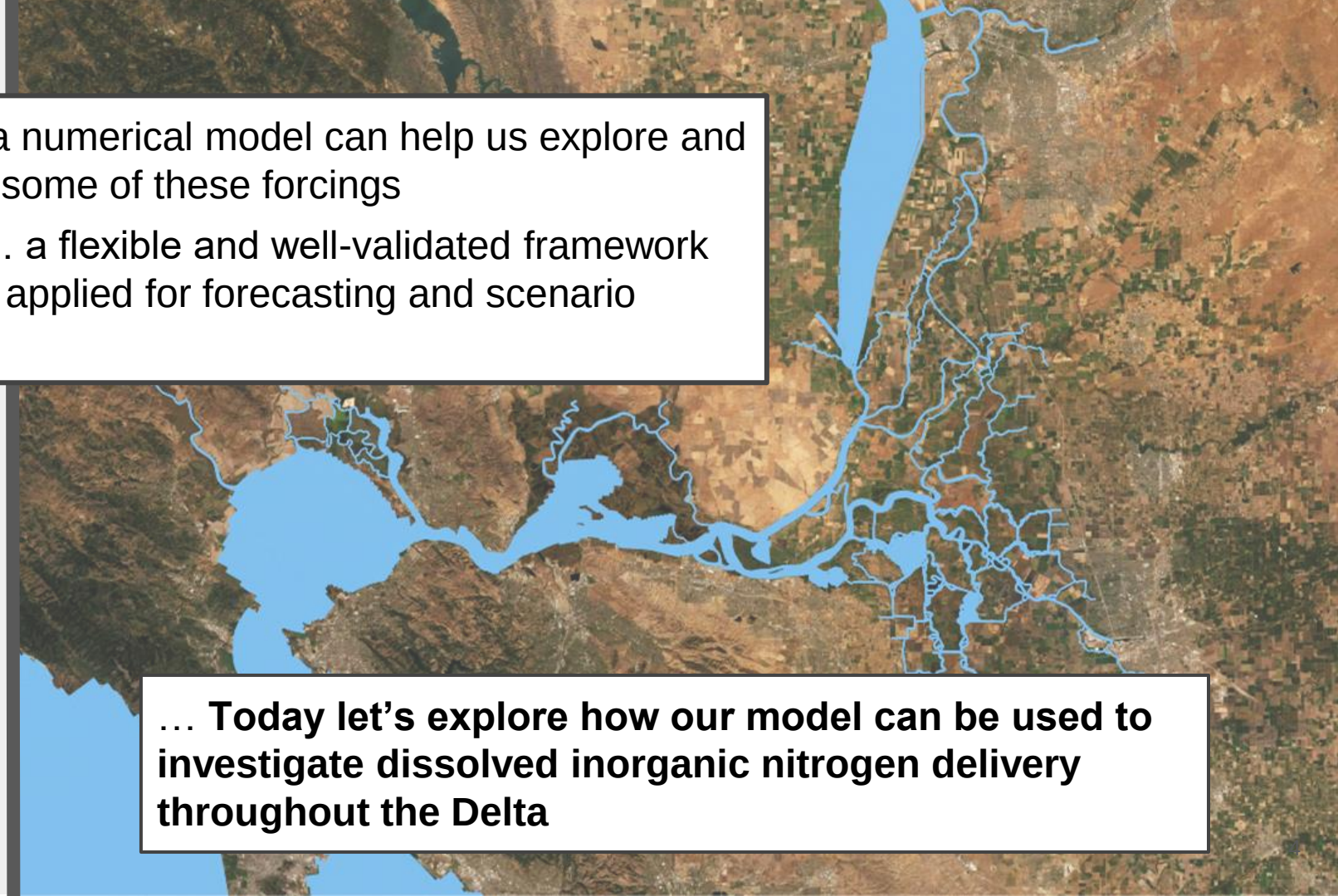


- **Community modeling effort**
  - Three domains (San Francisco Bay, Delta, S. San Francisco Bay)
  - Variety of open-source reports available online



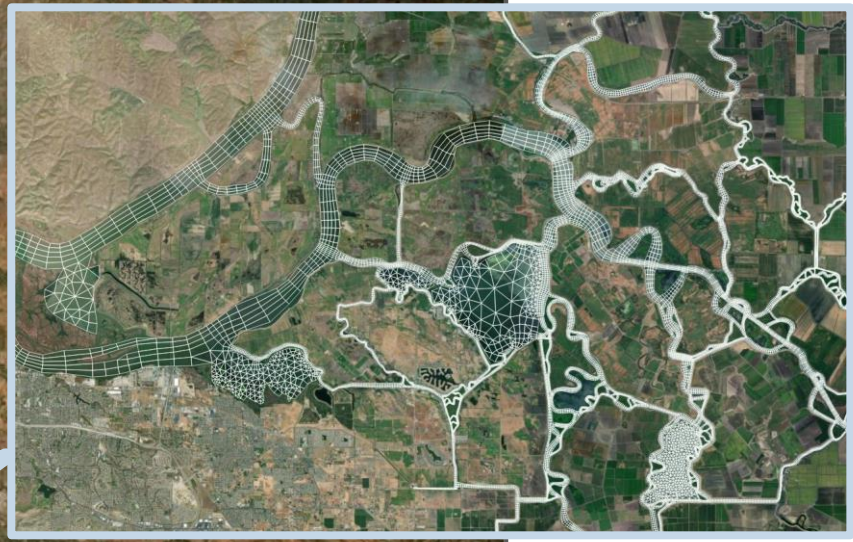
- The Delta is a highly-altered and complex system
- Phytoplankton production in this region is low, and commonly thought to be controlled through light limitation + heavy benthic grazing



- Using a numerical model can help us explore and isolate some of these forcings
- Also! … a flexible and well-validated framework can be applied for forecasting and scenario studies

… **Today let's explore how our model can be used to investigate dissolved inorganic nitrogen delivery throughout the Delta**

Our model set-up (DFLOW-FM + DELWAQ)

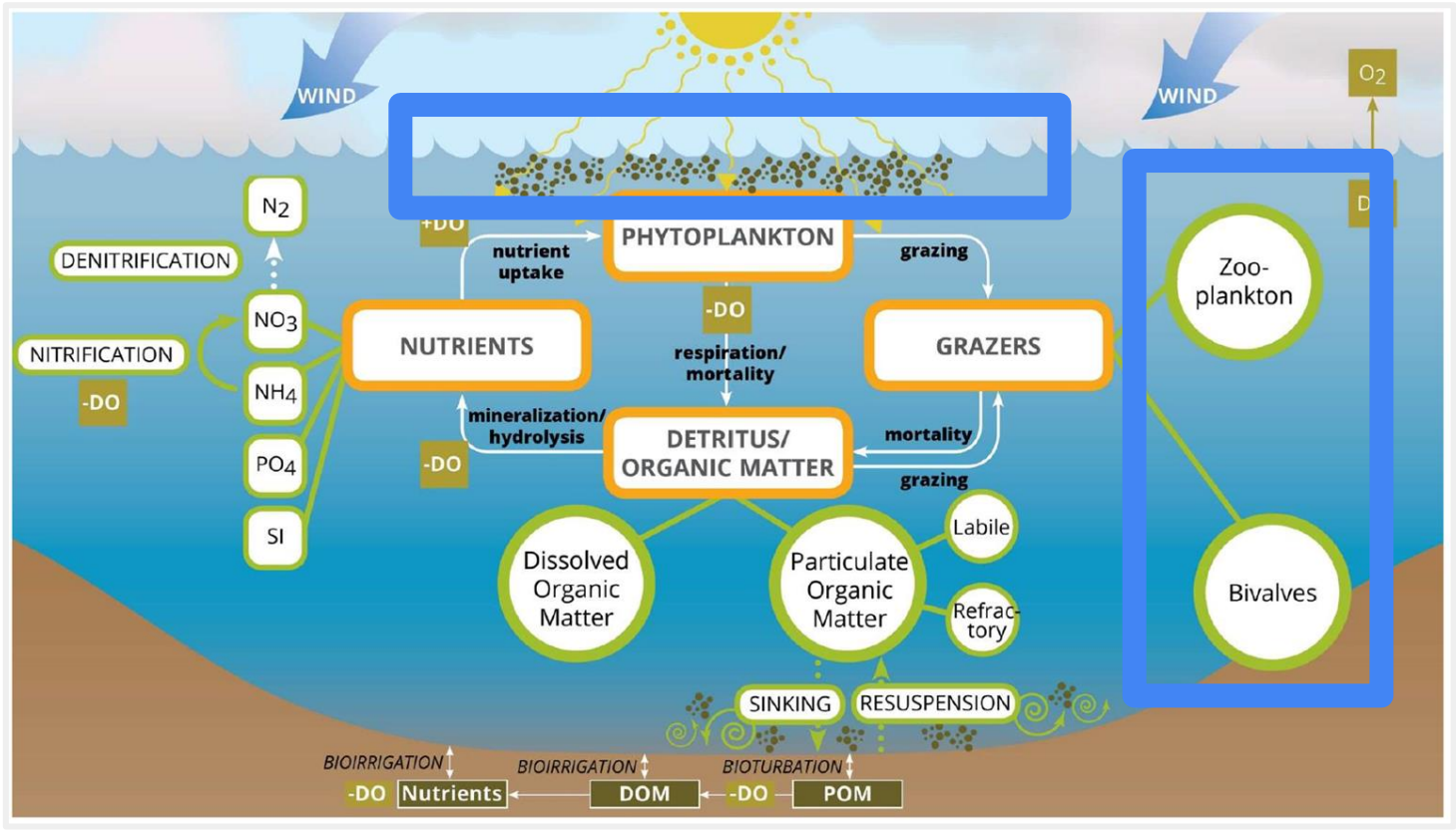


Model domain:
Delta, San Francisco Bay, coastal ocean

Model grid:
~75,000 horizontal cells,
10 vertical layers

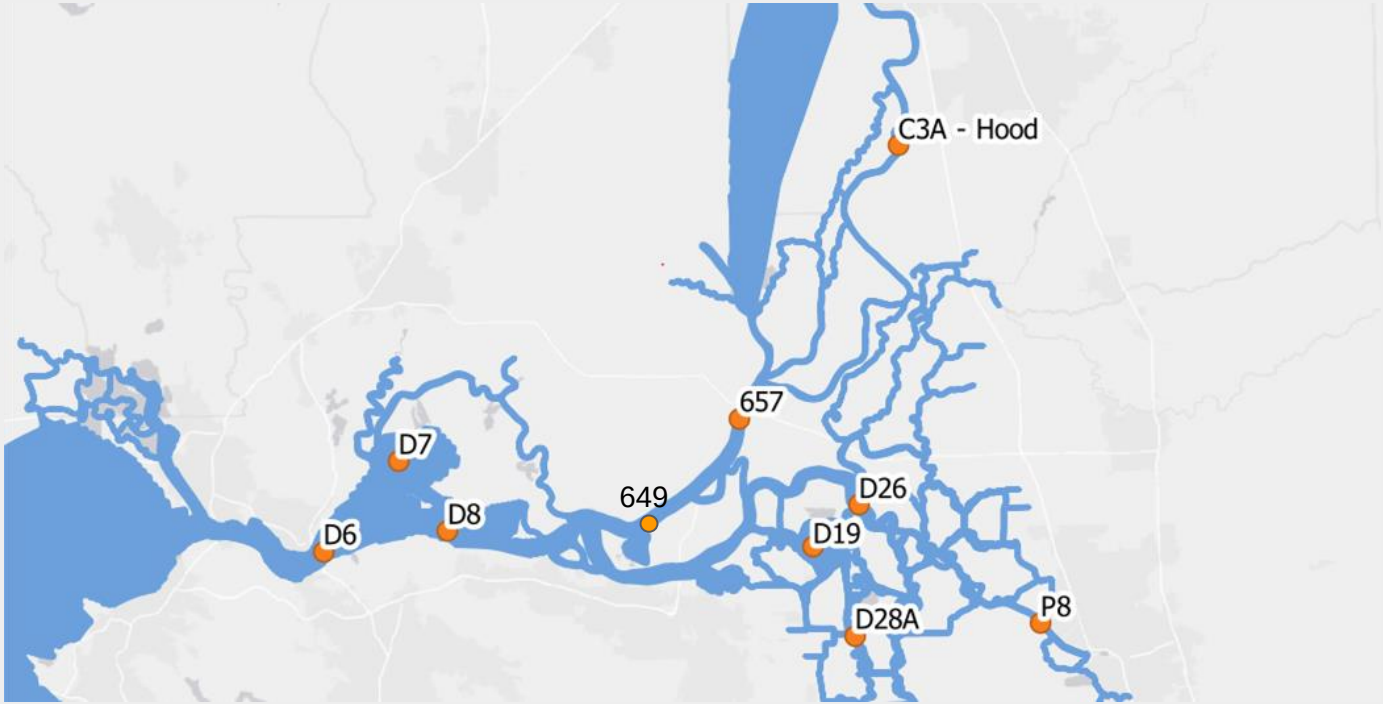
Water years simulated:
WY2011, WY2016

Key processes represented in our biogeochemical model



Biogeochemical Model Validation:

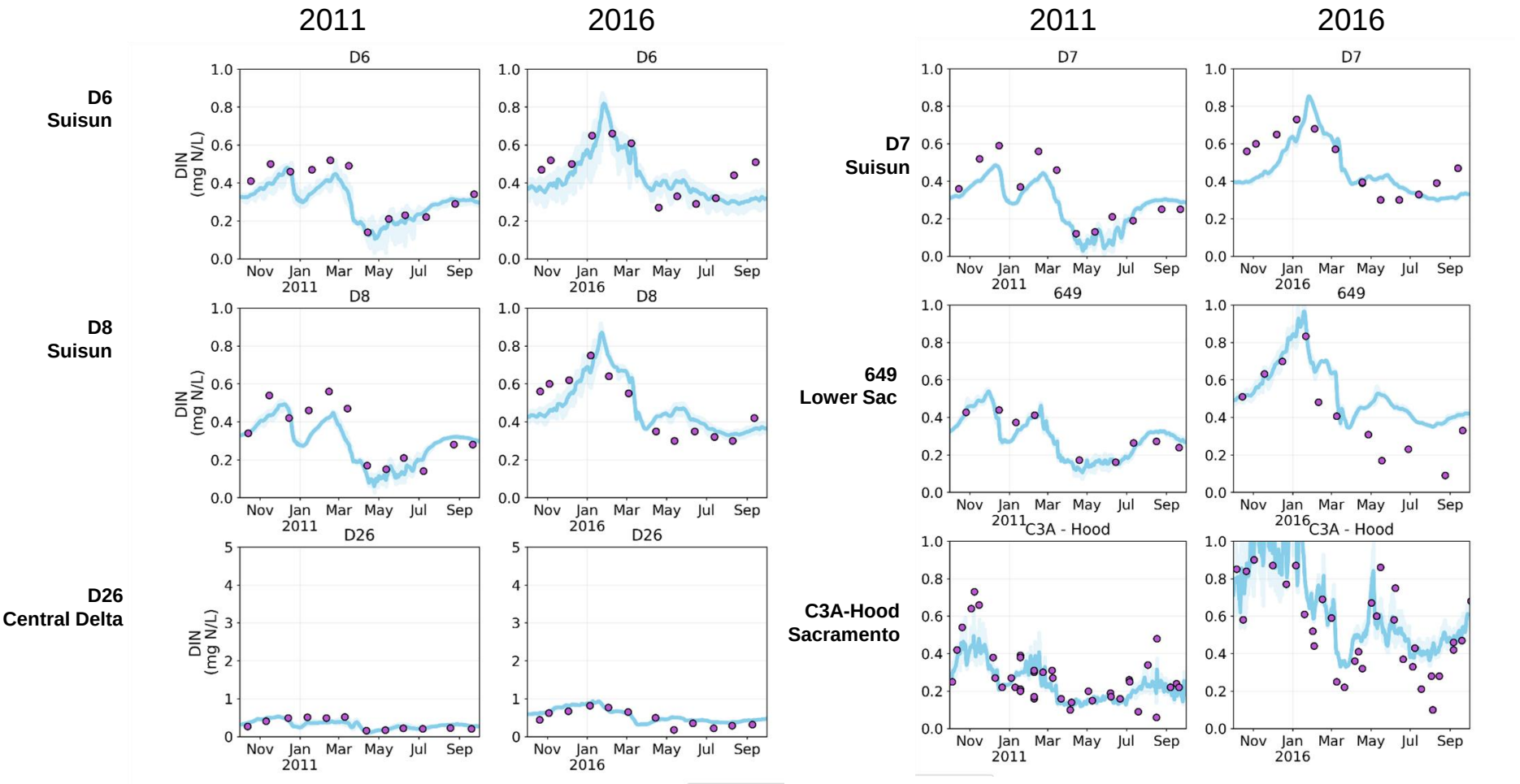
Discrete monthly data (EMP + USGS)

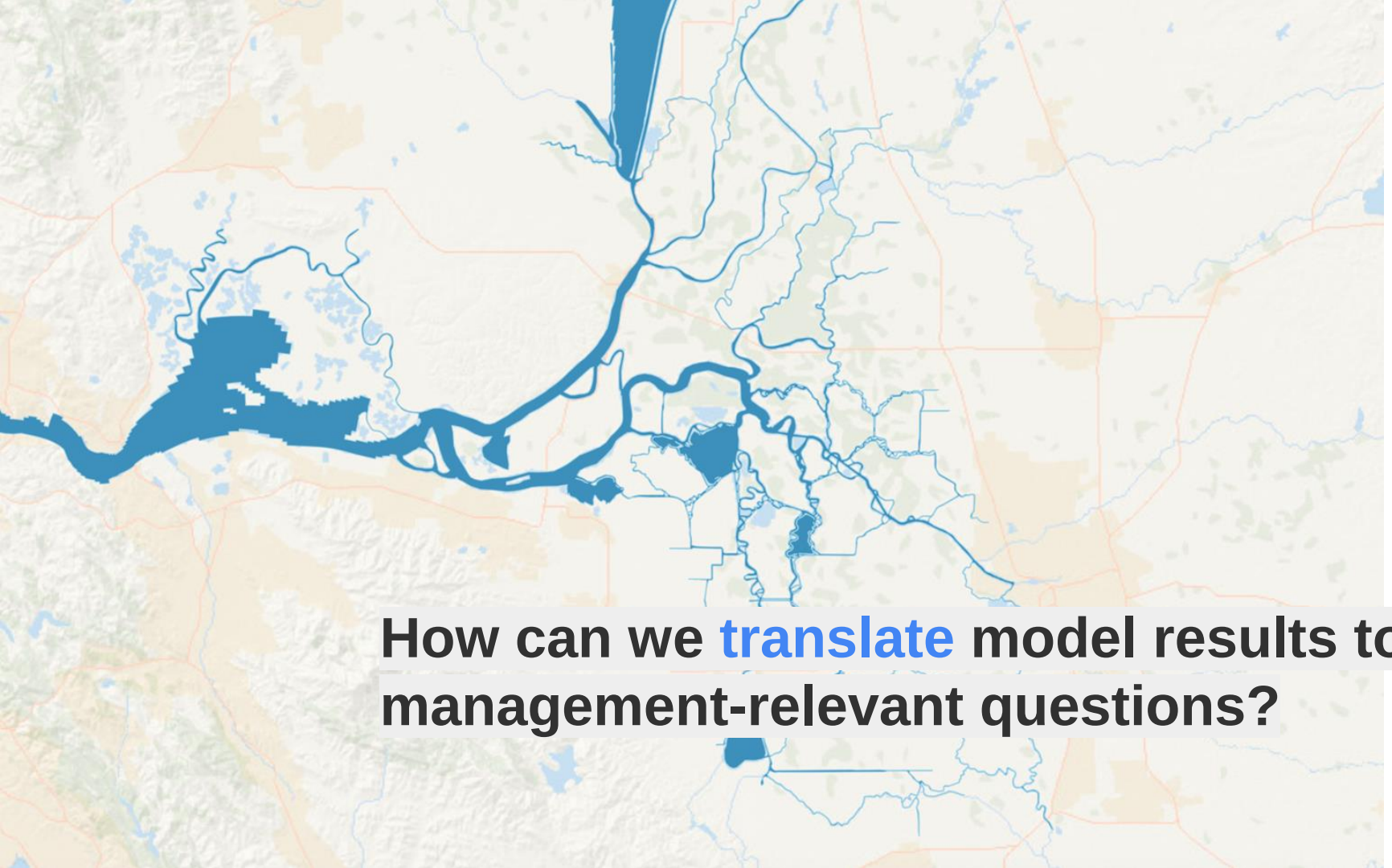


DWR Environmental Monitoring Program (EMP, Interagency Ecological Program; M. Martinez et al. 2020) &
USGS San Francisco Bay Water Quality Program (Schraga and Cloern 2017; Schraga et al. 2020)

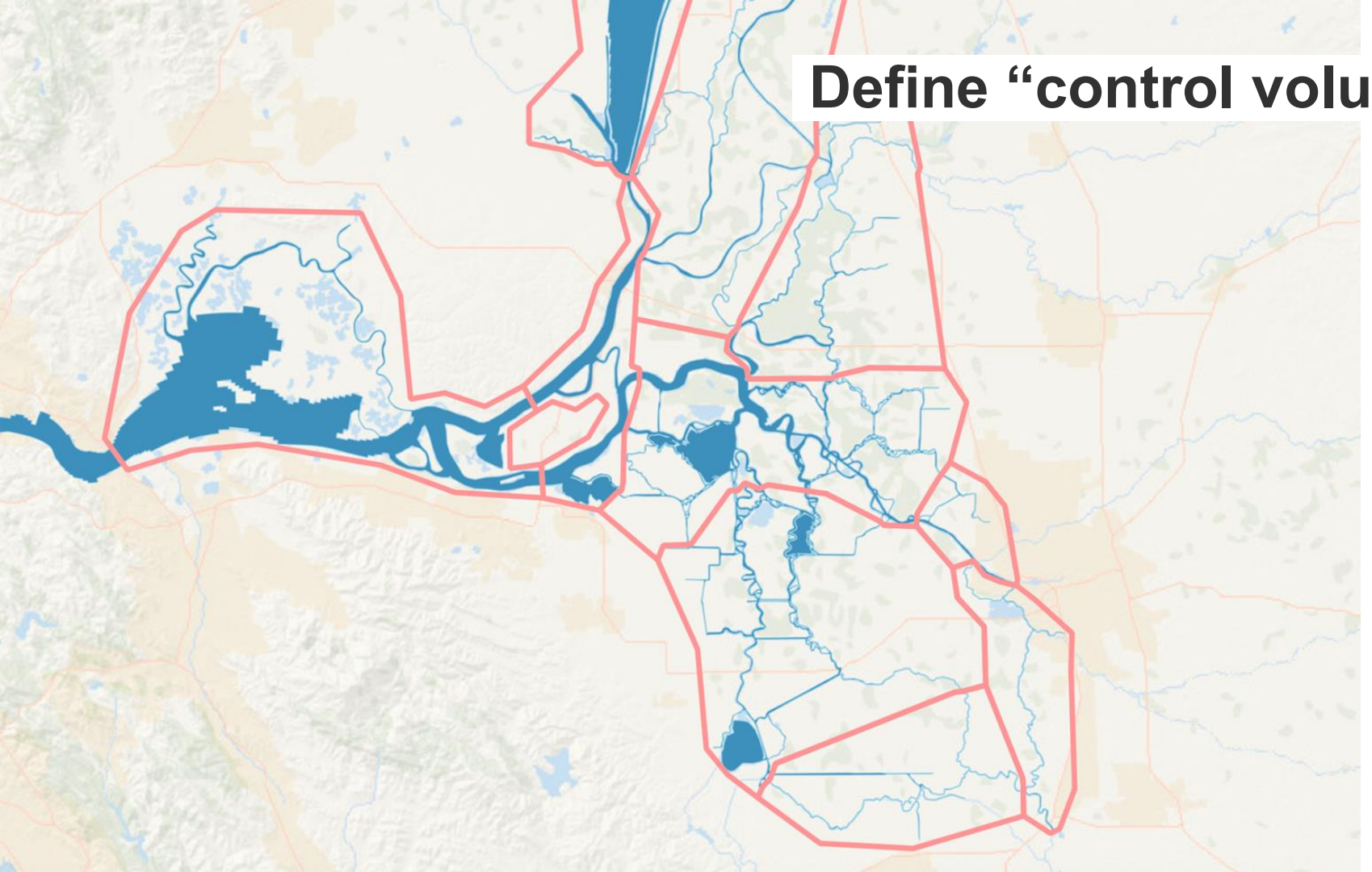
DIN: WY2011 + WY2016, subset of stations

*** DIN = NO3 + NH4**

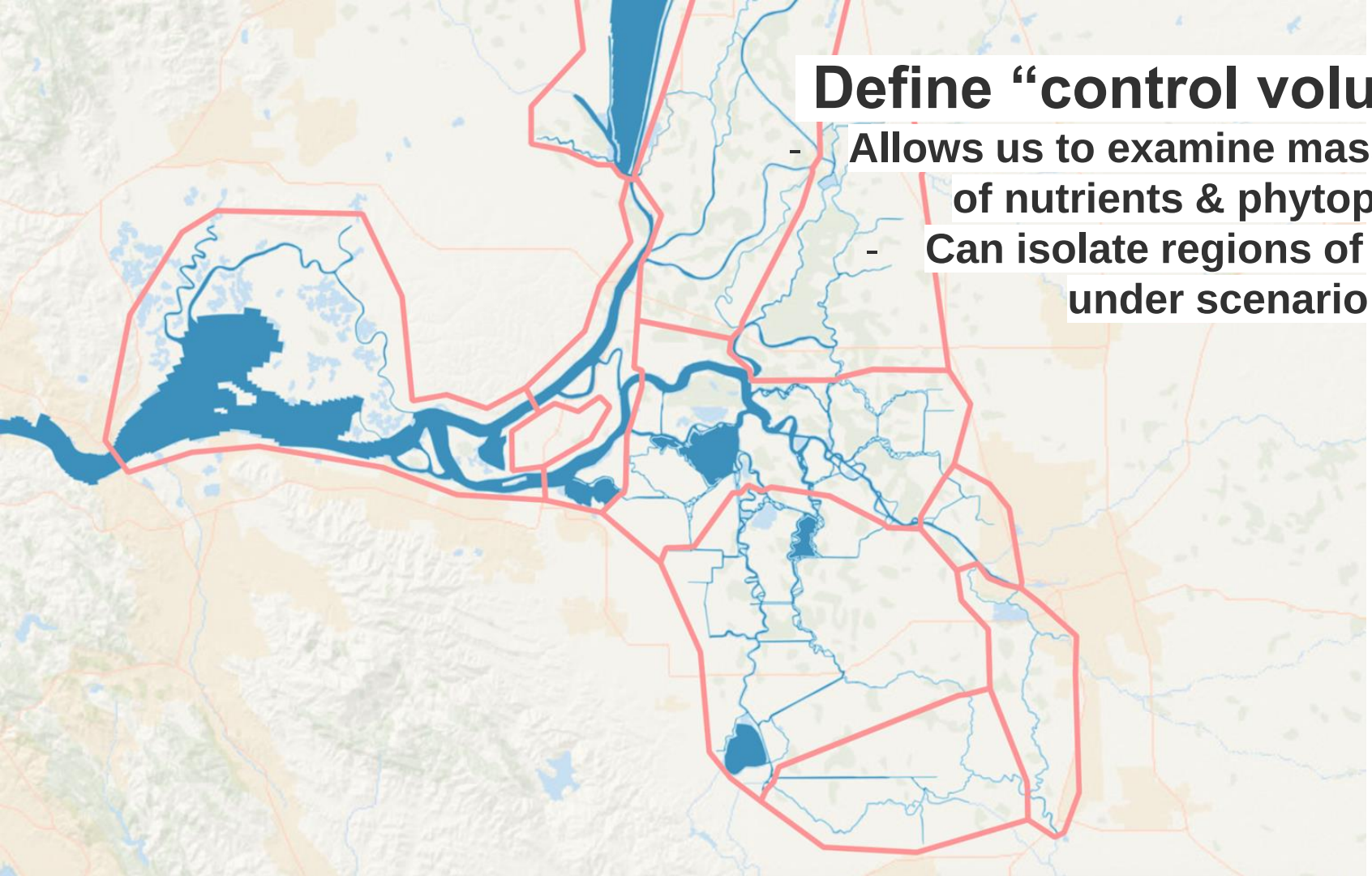




How can we translate model results to management-relevant questions?

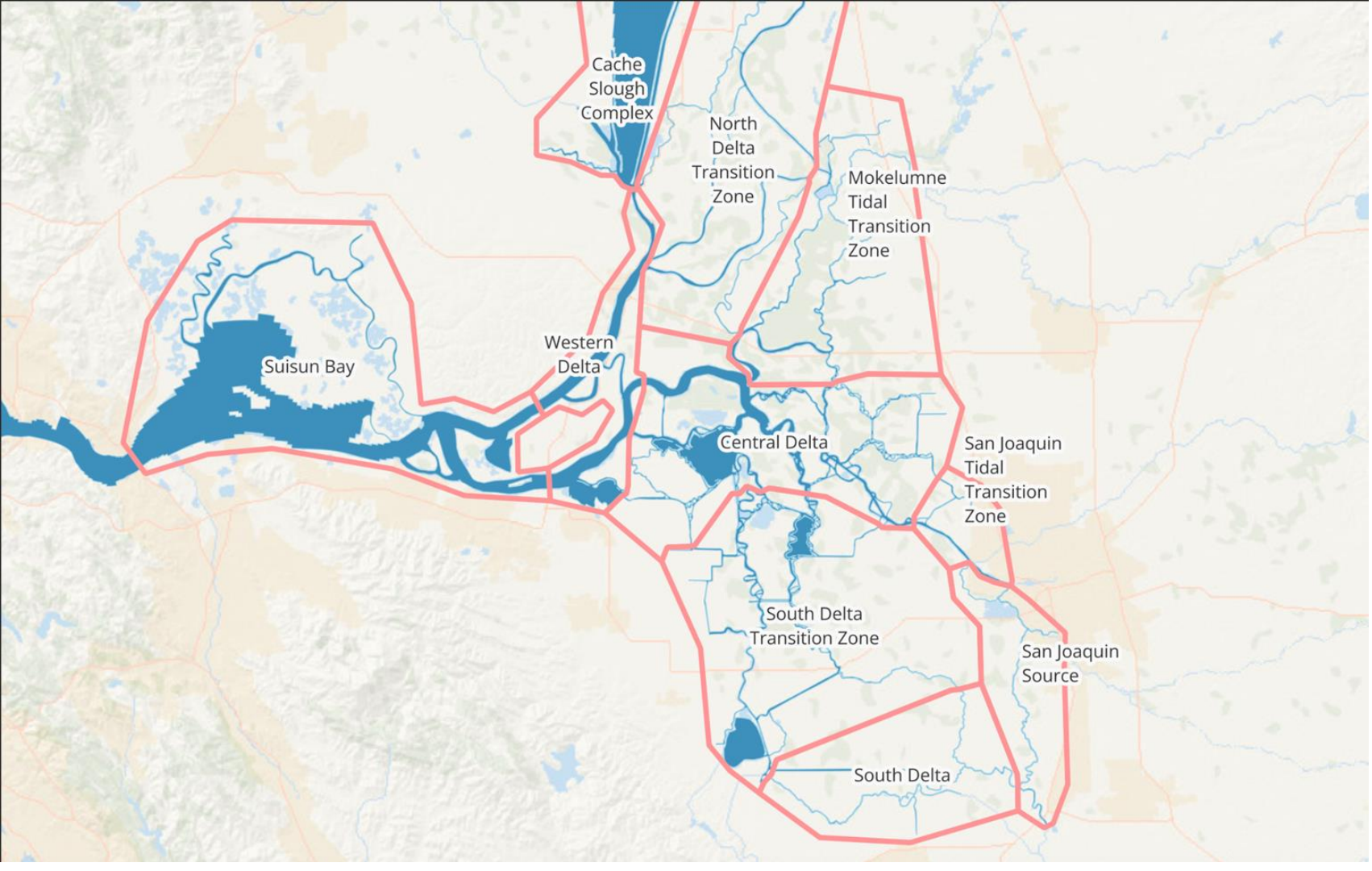


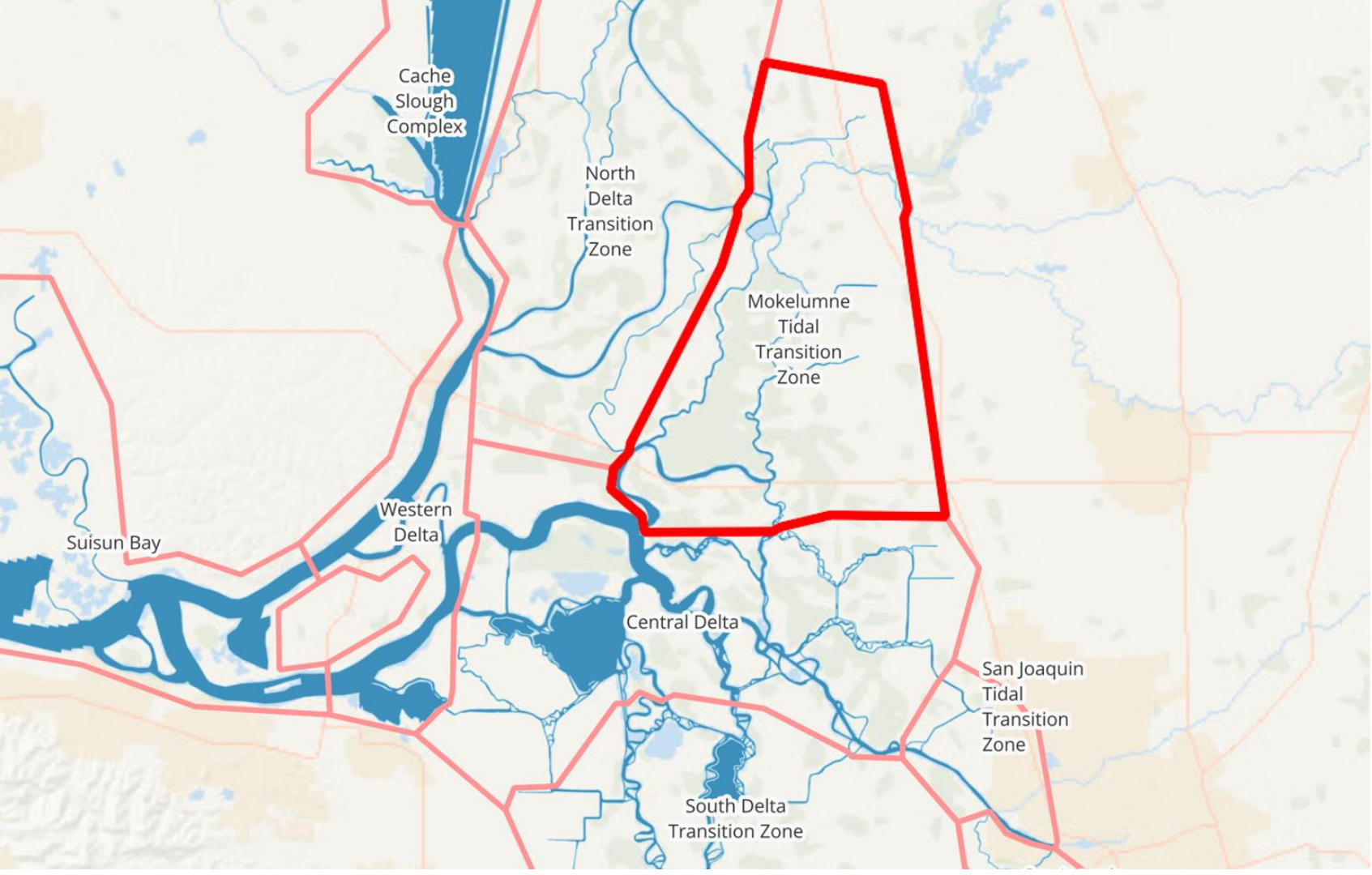
Define “control volumes”



Define “control volumes”

- Allows us to examine mass fluxes of nutrients & phytoplankton
- Can isolate regions of interest under scenario studies


Cache Slough Complex
North Delta Transition Zone
Mokelumne Tidal Transition Zone
Suisun Bay
Western Delta
Central Delta
San Joaquin Tidal Transition Zone
South Delta Transition Zone
San Joaquin Source
South Delta


Cache
Slough
Complex
North
Delta
Transition
Zone
Mokelumne
Tidal
Transition
Zone
Western
Delta
Suisun Bay
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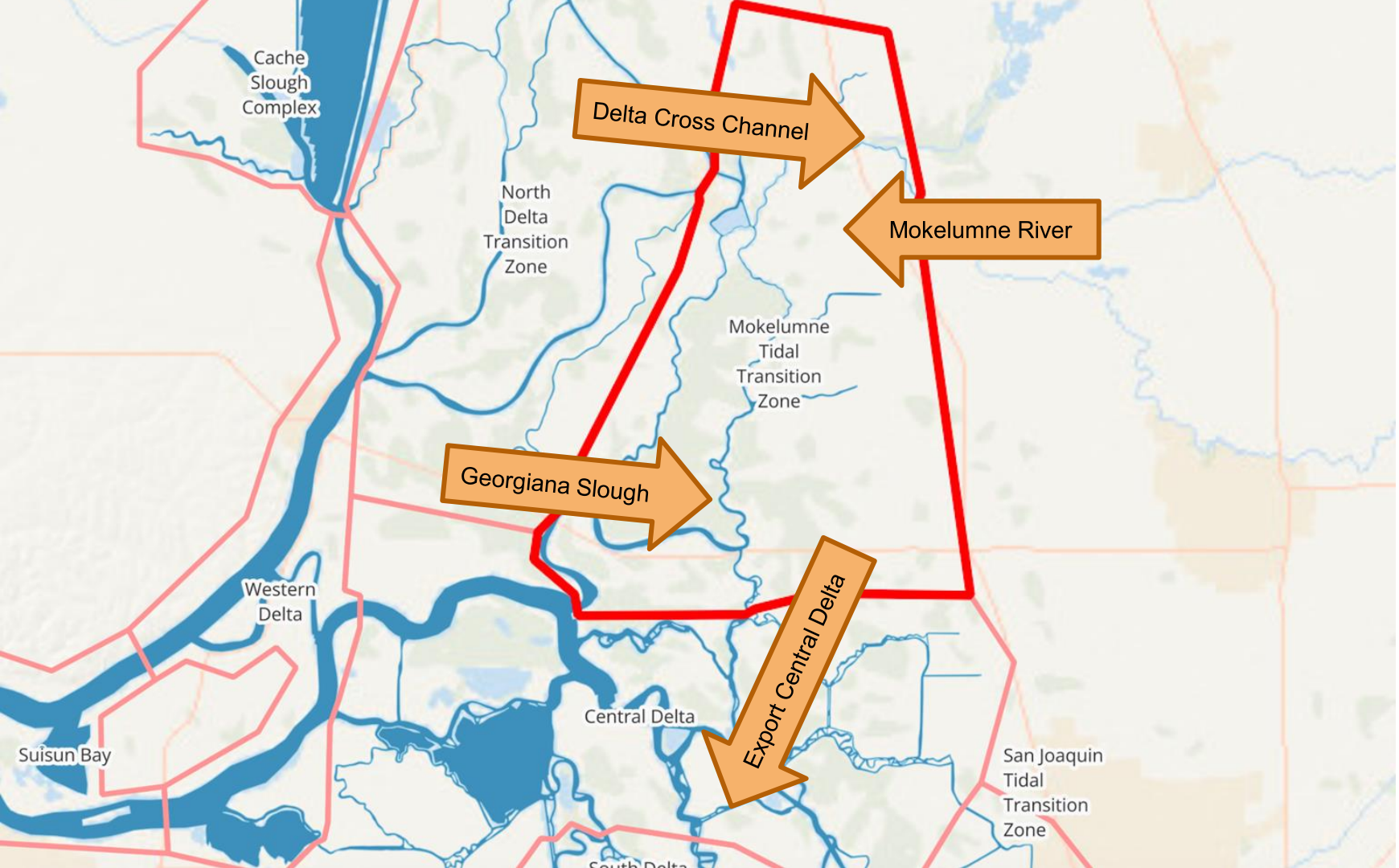
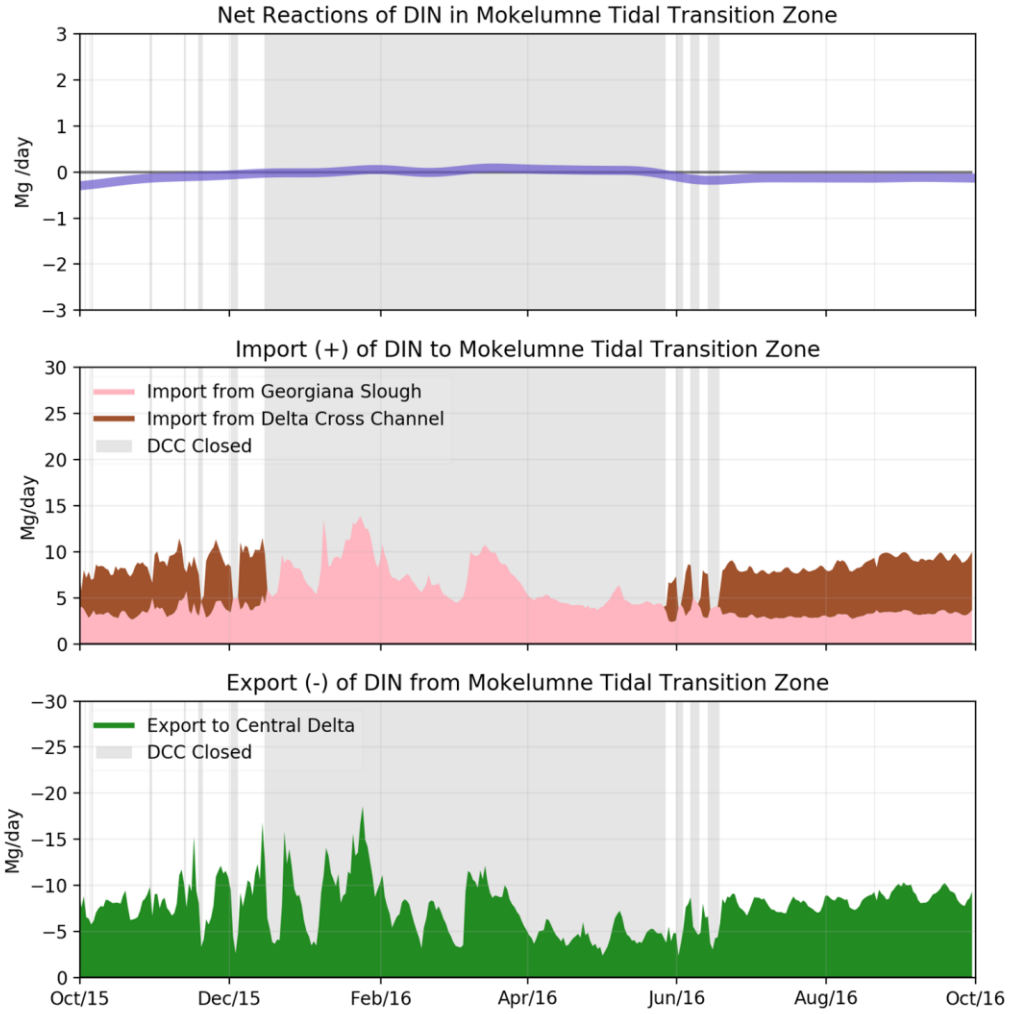
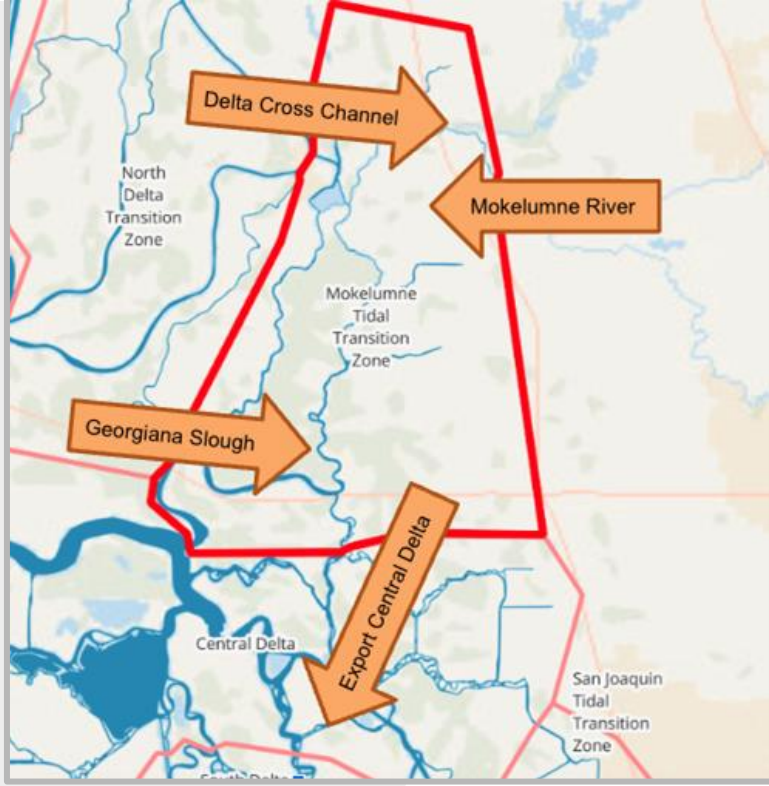
San Joaquin
Tidal
Transition
Zone
South Delta
Transition Zone

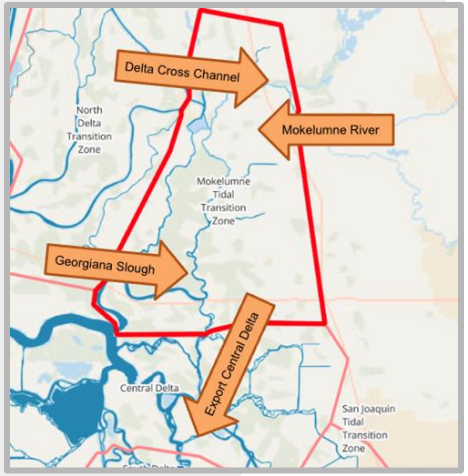

Cache Slough Complex
North Delta Transition Zone
Delta Cross Channel
Mokelumne River
Mokelumne Tidal Transition Zone
Georgiana Slough
Export Central Delta
Western Delta
Central Delta
Suisun Bay
San Joaquin Tidal Transition Zone

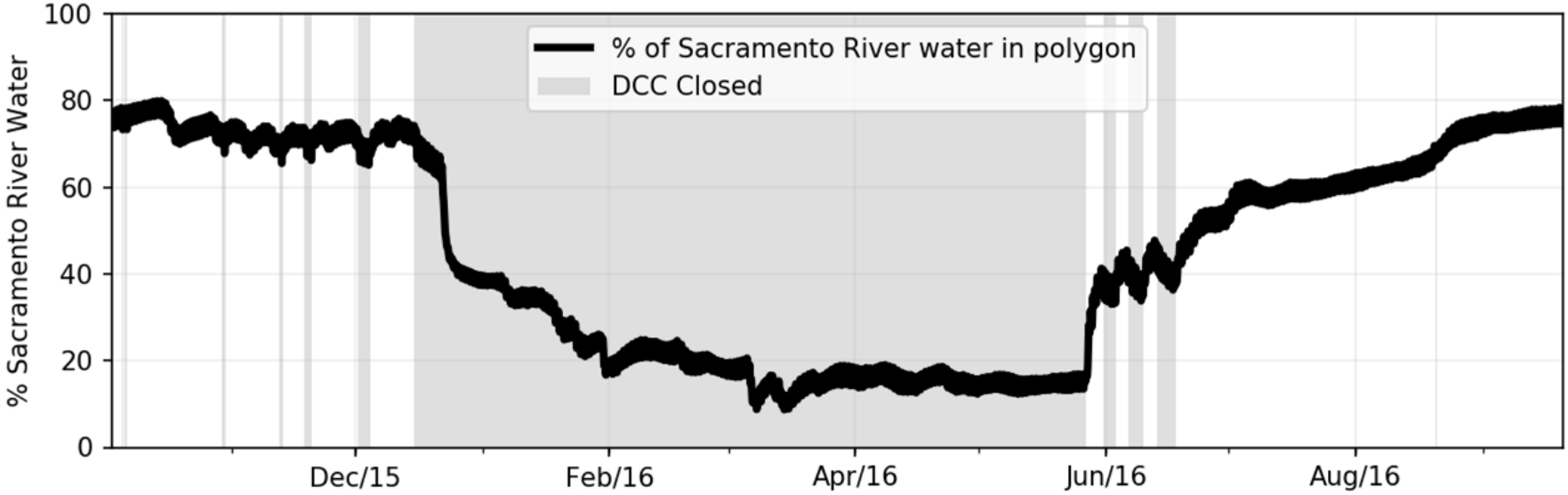




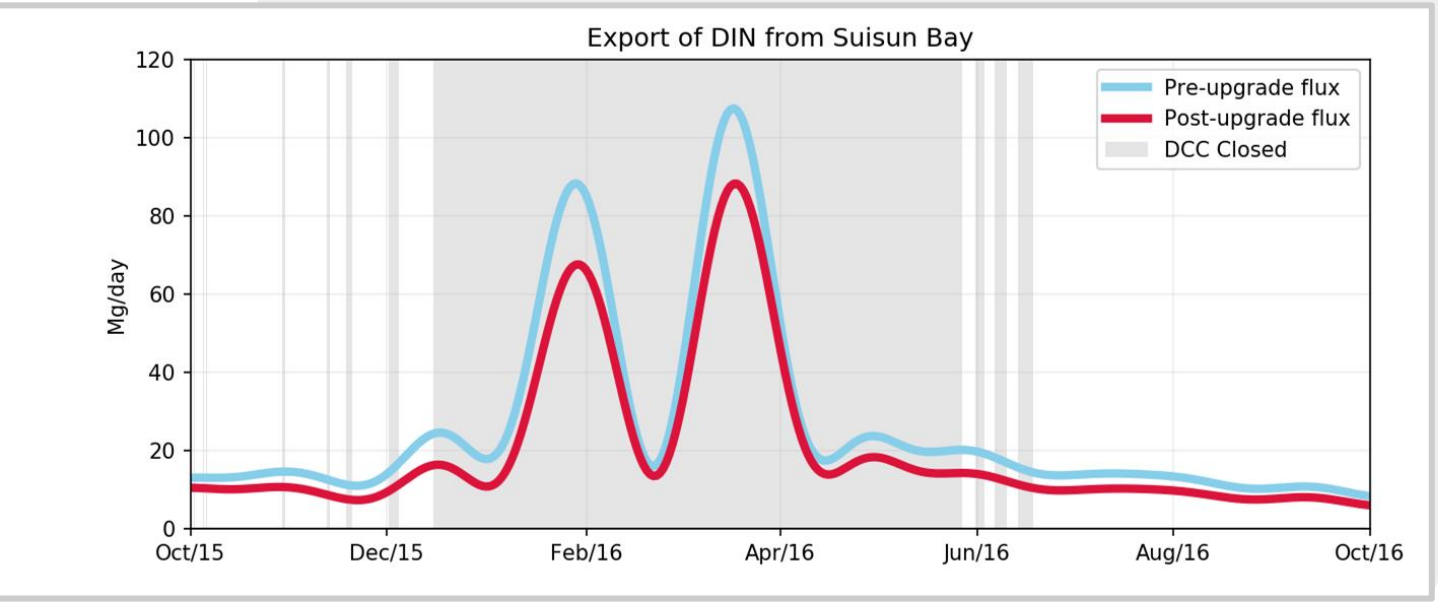
→ We can examine how operational changes affect nutrient delivery to regions of the Delta

→ Quantify how the Delta Cross Channel affects circulation throughout the interior Delta





…. Or how system upgrades like Regional San affect net export from the Delta



Two “bigger questions” to think about …

1 - How can we validate a numerical model for management-related questions?

2 - How can we translate model results to be relevant for management questions?

1 - How can we validate a numerical model for management-related questions?

→ Validate across a range of time scales with different data

→ Important to be critical of models and investigate that you're not getting the "right" output for "wrong" reasons.

2 - How can we translate model results to be relevant for management questions?

→ Relating model results to mass fluxes + system-level transport

→ Other thoughts?

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Thank you!

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DELTA Regional Monitoring Program

CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

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