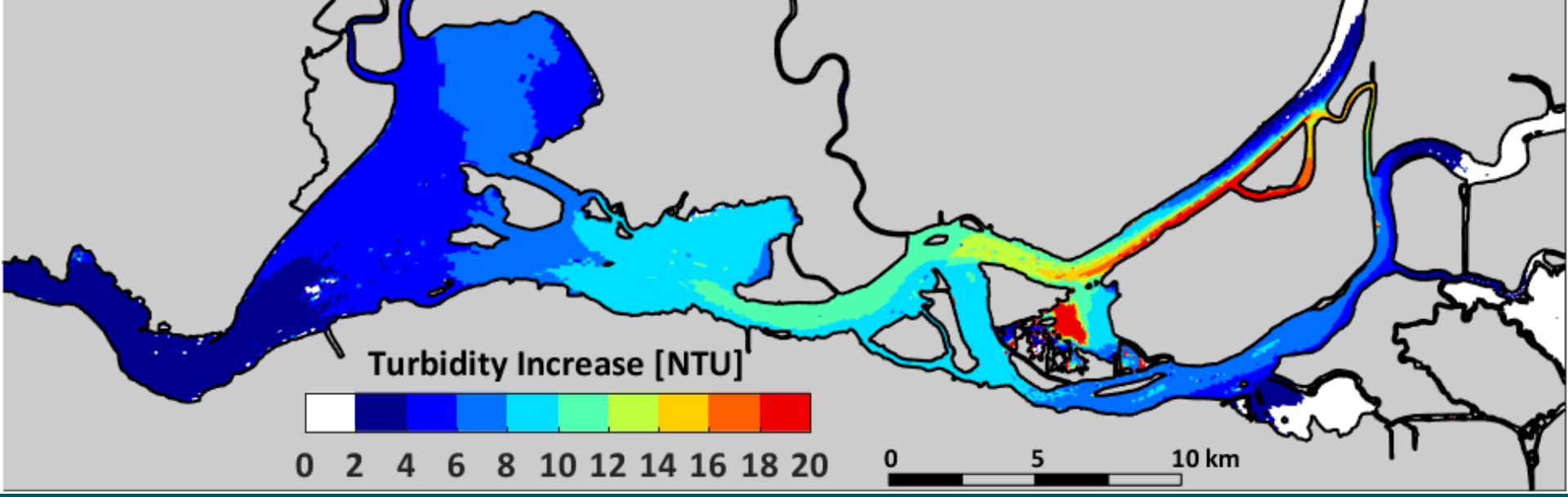

Evaluation of Sediment Supplementation in the Low Salinity Zone

ANCHOR QEA

CWEMF 2018 Annual Meeting

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Motivation for Sediment Supplementation

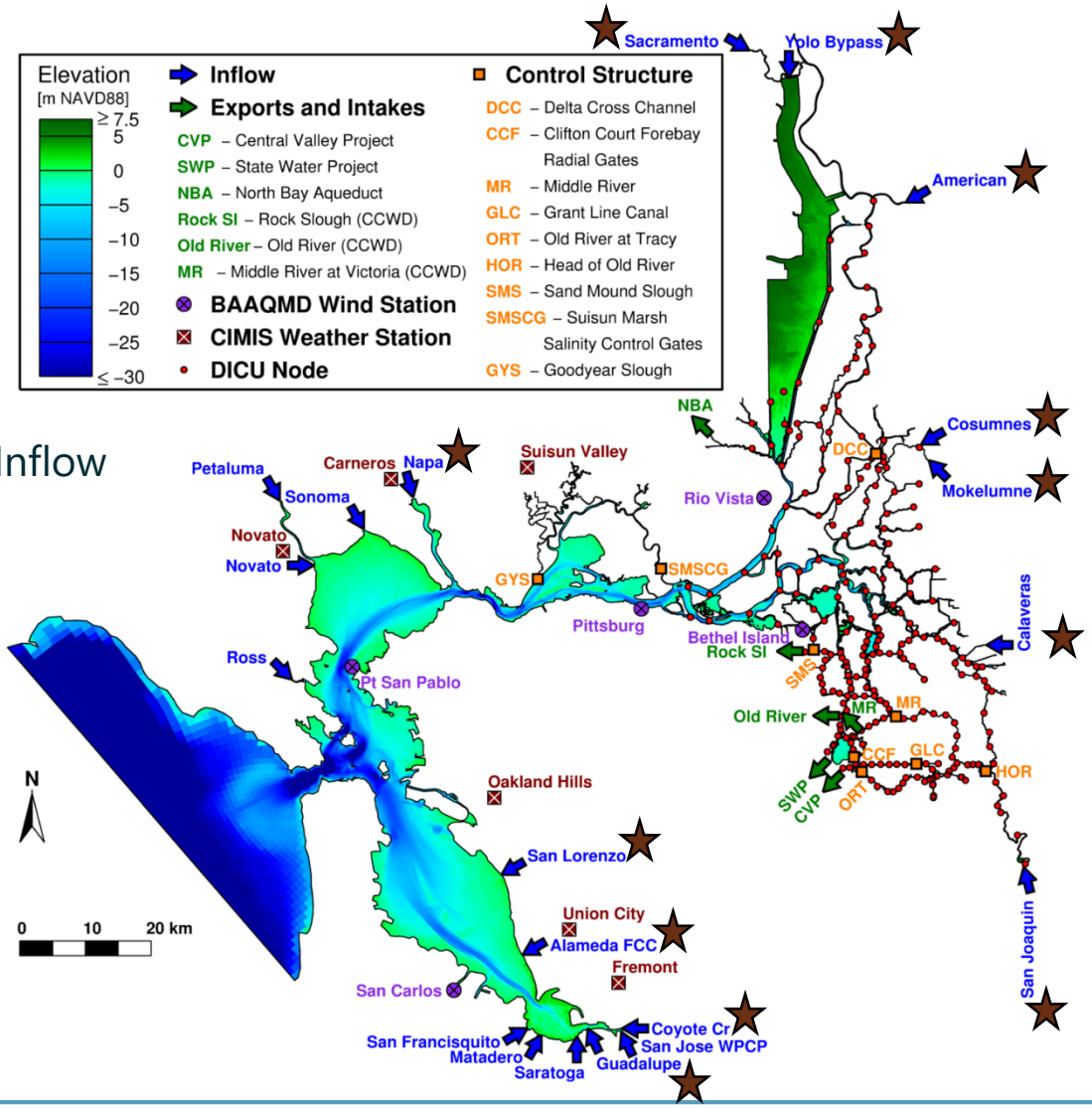
- Delta Smelt are more likely to be caught in relatively high turbidity water, yet the turbidity in the Bay-Delta has been decreasing
- The Delta Smelt Resiliency Strategy identified increasing turbidity by adding sediment near the Low Salinity Zone (LSZ) as a possible action to improve Delta Smelt habitat

Study Questions:

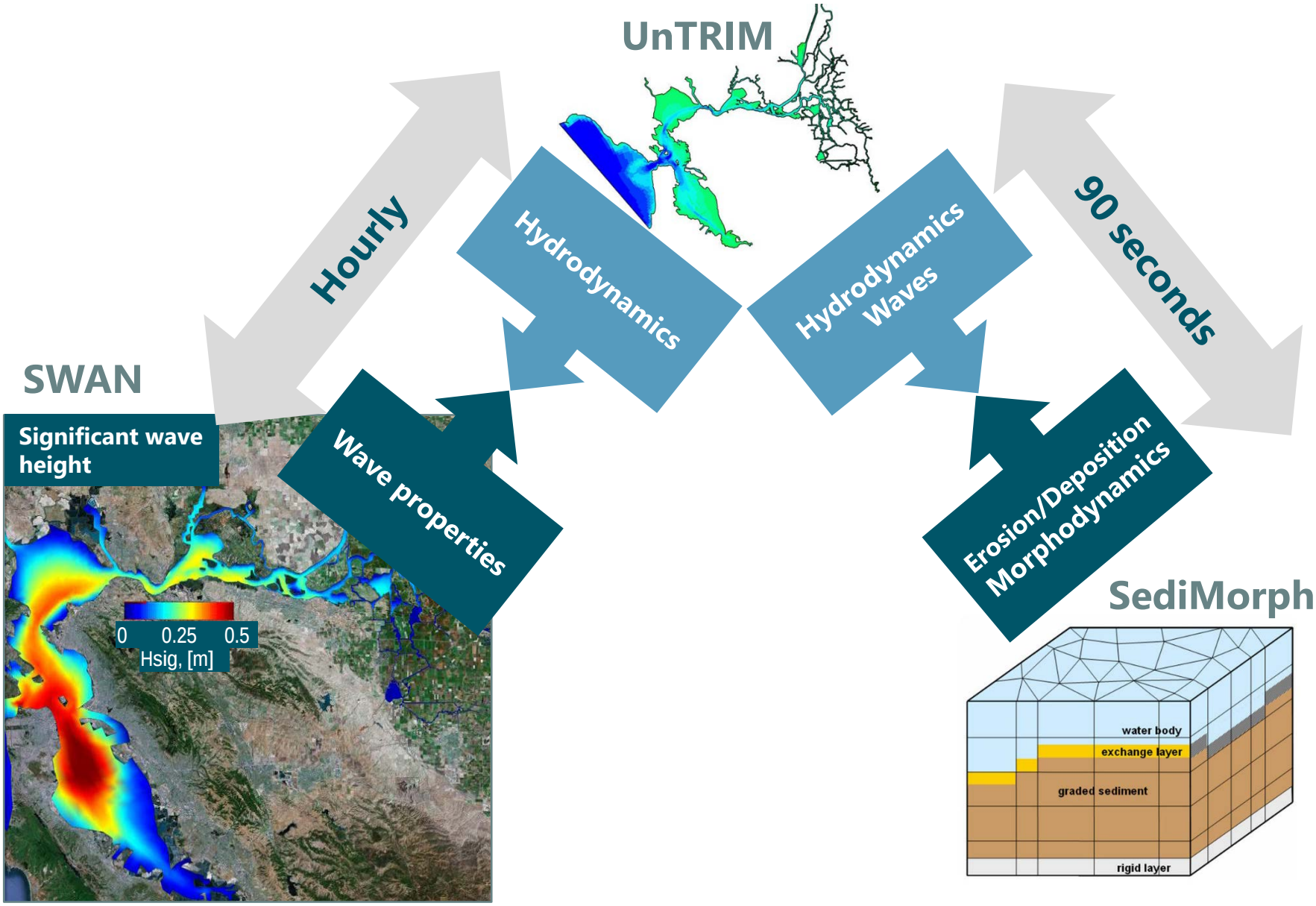
1. Is sediment supplementation a feasible action to effectively increase turbidity in the LSZ?
2. What magnitude of sediment supplementation would be required in order to have a measurable effect on turbidity in the LSZ?
3. Over what spatial and temporal extent would sediment supplementation influence turbidity?
4. Is sediment supplementation likely to significantly increase shoaling rates in federal navigation channels?

UnTRIM San Francisco Bay-Delta Model

★ Sediment Inflow



UnTRIM-SWAN-SediMorph Model Coupling

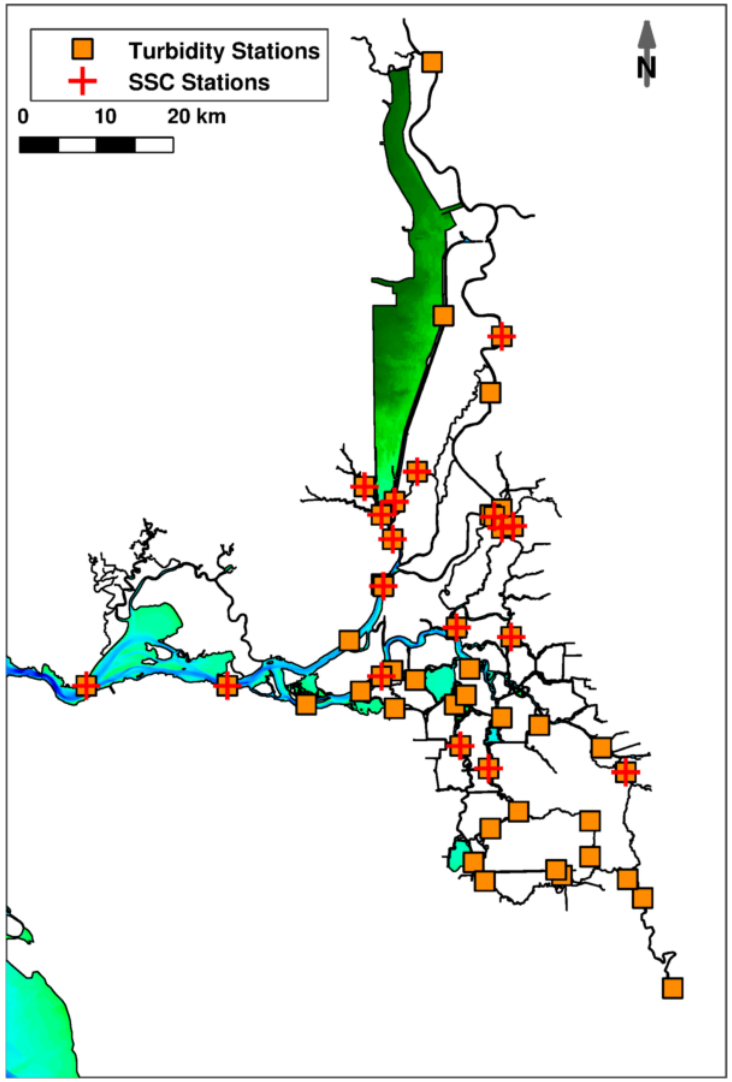


Suspended Sediment vs. Turbidity

- Suspended Sediment
  - Mass in suspension
  - Samples & lab analysis
  - Conservative
  - Can be modeled based on physics
  - Physics-based equations for settling, deposition, re-suspension from wind waves and currents
- Turbidity
  - Optical property
  - Easy to measure
  - Not conservative!
  - Often modeled as a decay term
  - No physics-based equations for deposition or re-suspension from currents or waves

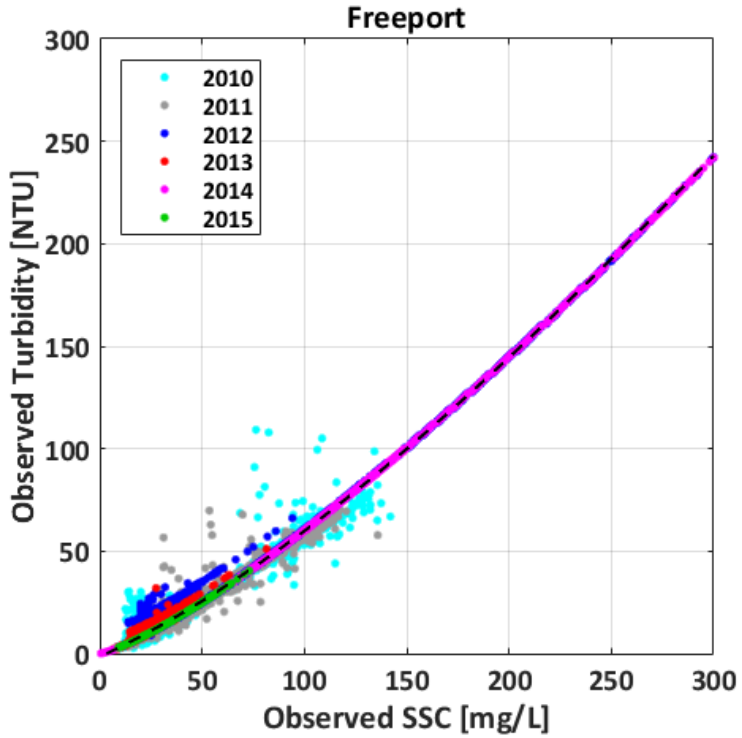
Conversion of SSC to Turbidity

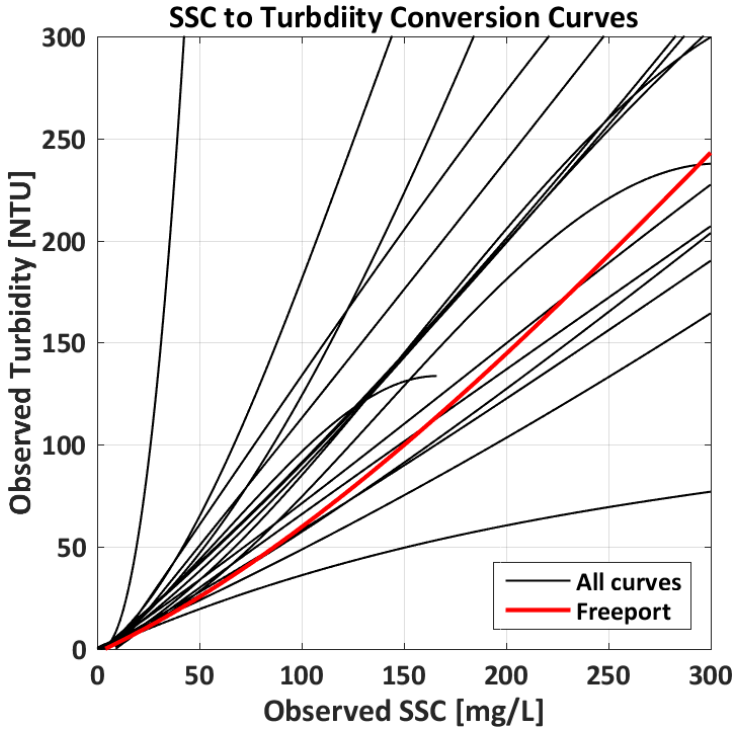
- Observed SSC time-series are developed based on rating relationships between turbidity and SSC from samples
- Modeled SSC can be converted back to turbidity using these same relationships
- However, relationship between SSC and turbidity varies spatially throughout the Delta



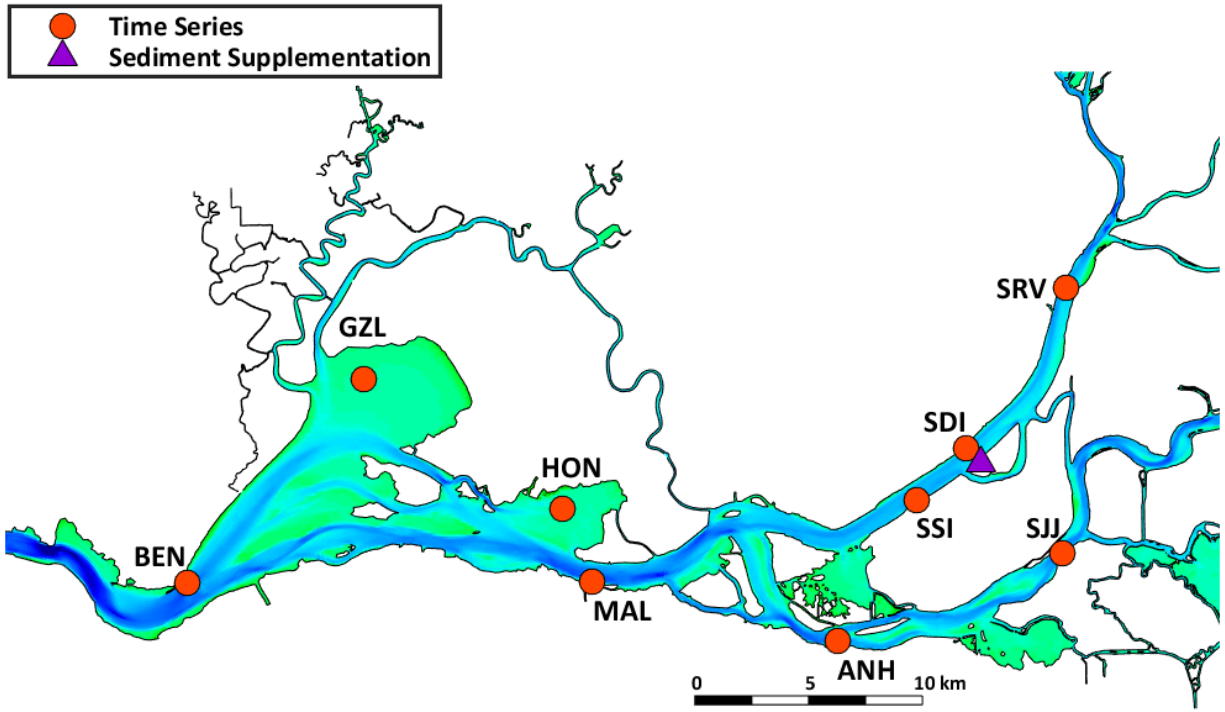
Conversion of SSC to Turbidity

- Conversions based on all available USGS data from 2010 to 2015
- Total SSC converted to turbidity (not individual classes)
- Spatially varying conversion



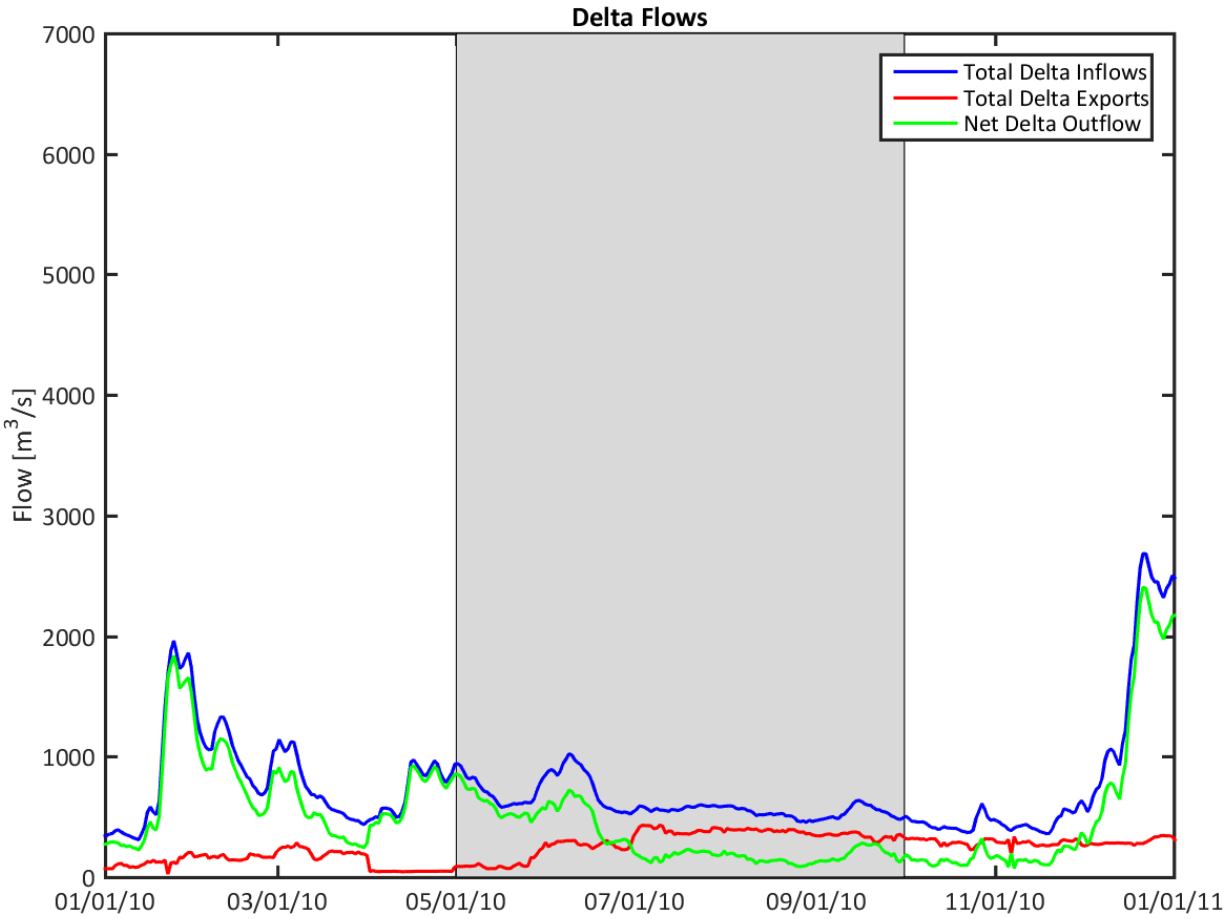


Sediment Supplementation Location

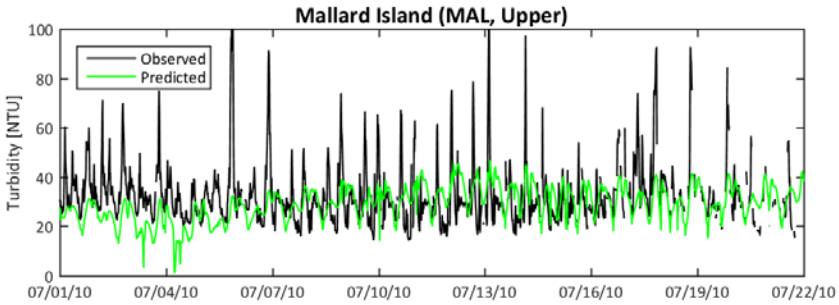


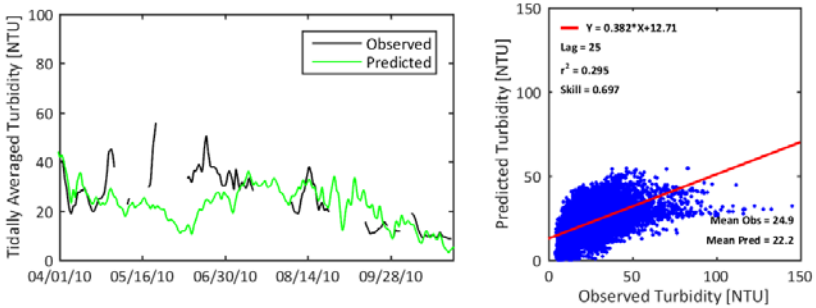
Benicia Bridge (BEN)
Grizzly Bay (GZL)
Honker Bay (HON)
Mallard Island (MAL)
Sacramento River at Sherman Island (SSI)
Sacramento River at Decker Island (SDI)
Sacramento River at Rio Vista (SRV)
San Joaquin River at Antioch (ANH)
San Joaquin River at Jersey Point (SJJ)

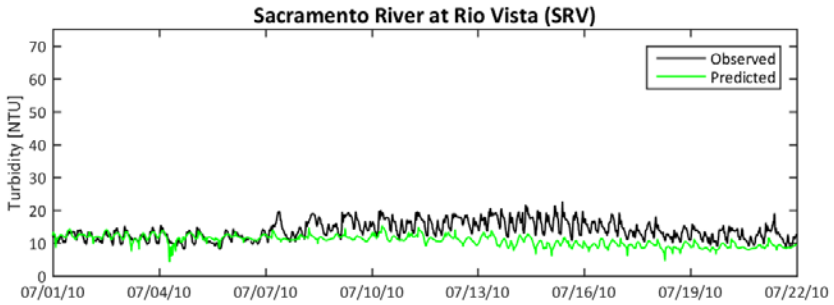
Sediment Supplementation Period

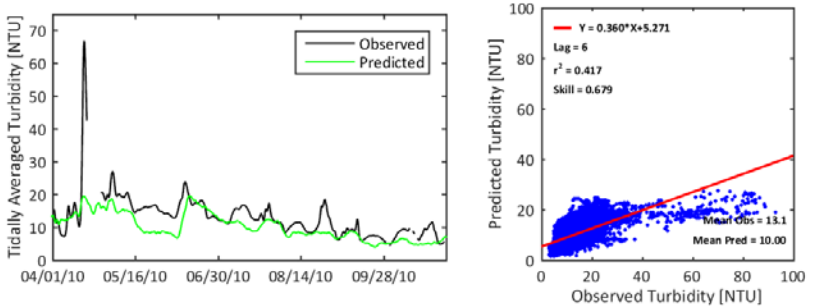


Turbidity Validation During Supplementation Period





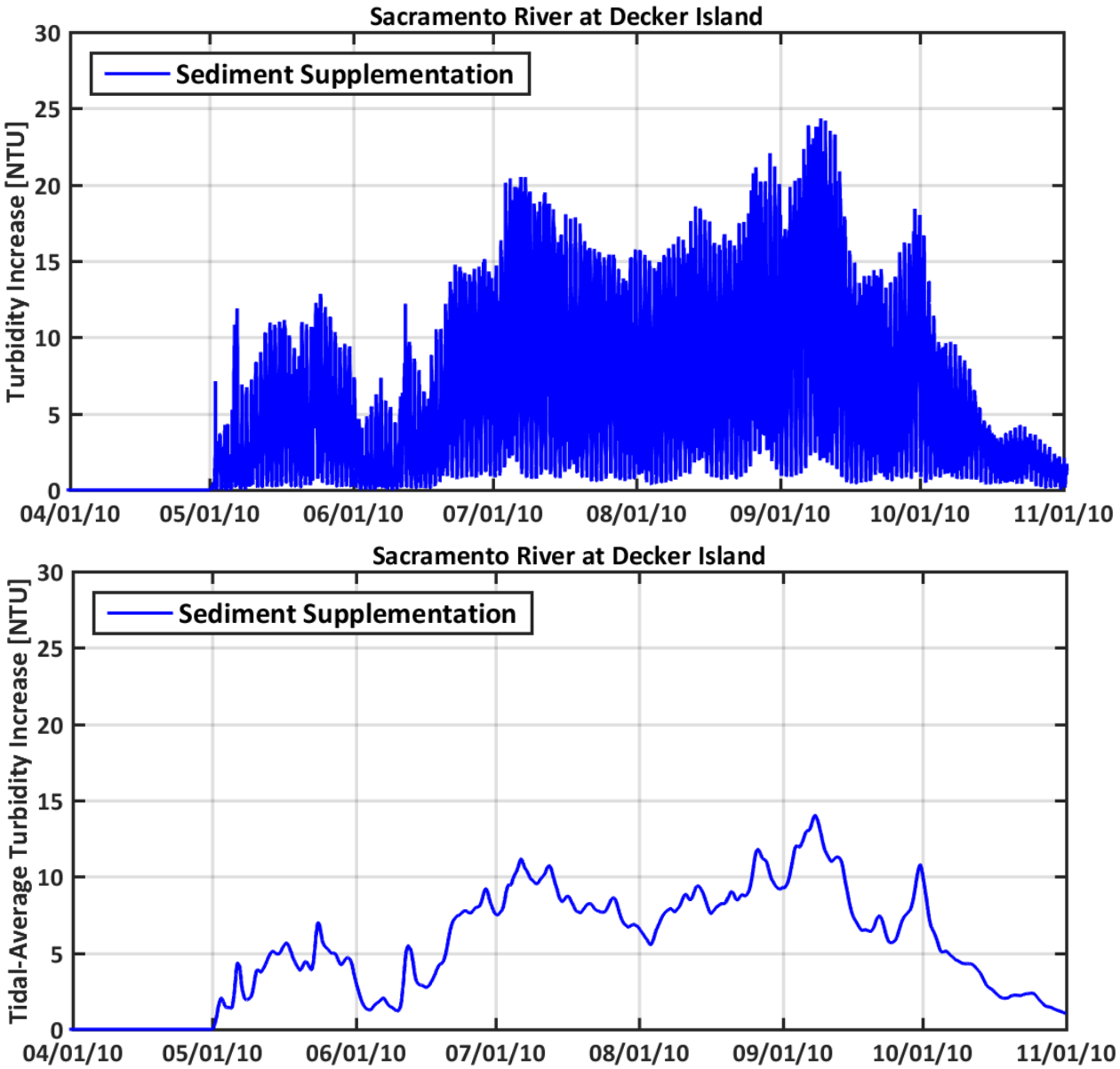




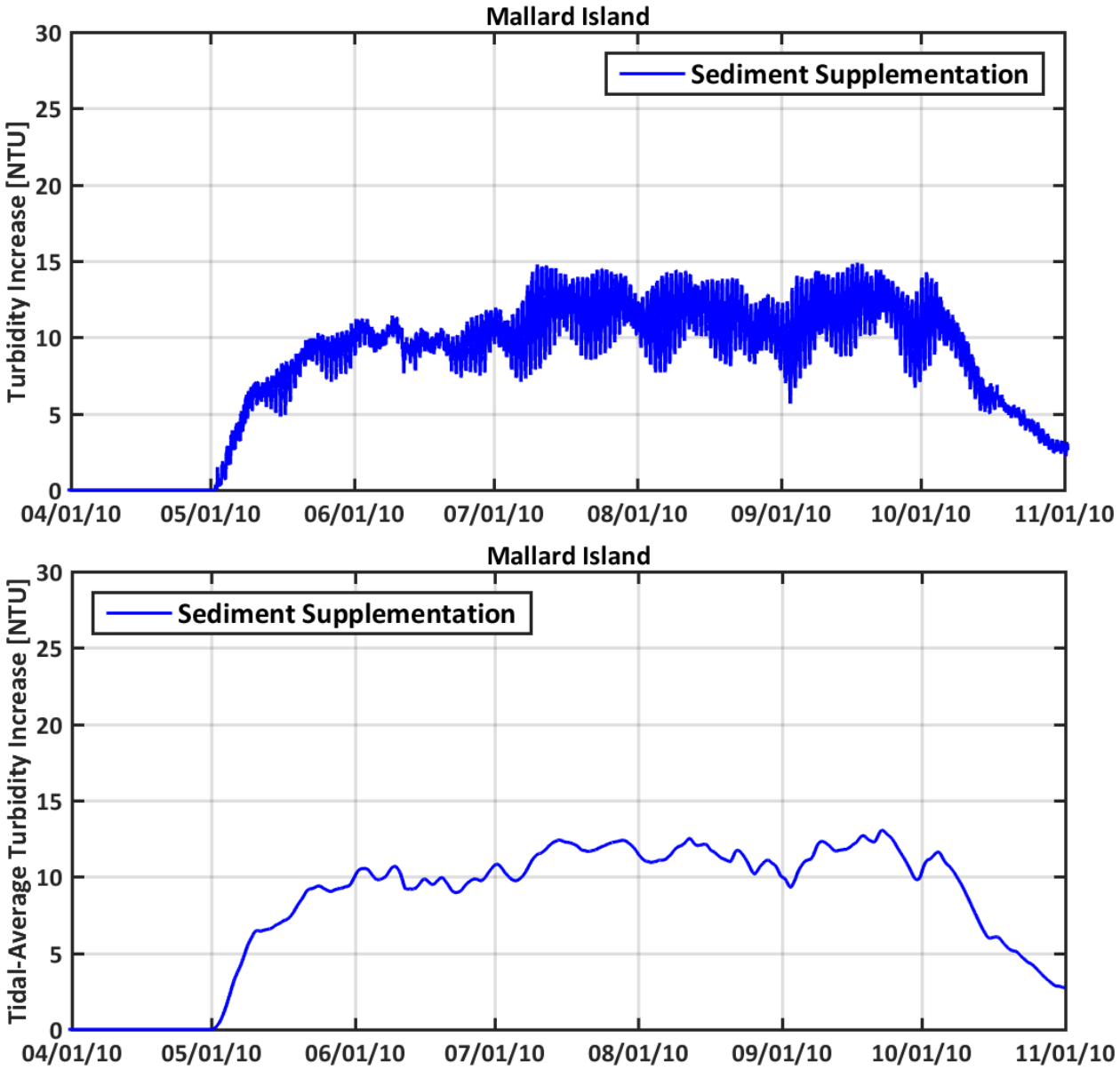
Sediment Supplementation Assumptions

- Sediment Supplementation Target:
  - Achieve a 10 NTU increase between Emmaton and Mallard Island
  - Sediment Supplementation from May 1 through September 30
- Scenario Parameters
  - Dredged material composed of 49% unfloculated silt, 49% flocculated material, 2% sand
  - Continuous batch sediment slurry with flow rate of 5 m^3/s (176.6 cfs)
  - Outflow suspended sediment concentration of 2,500 mg/L
  - 1.08 million kg per day to achieve 10 NTU increase
    - 3,552 cubic yards per day based on typical density and porosity
    - 543,000 cubic yards from May through September

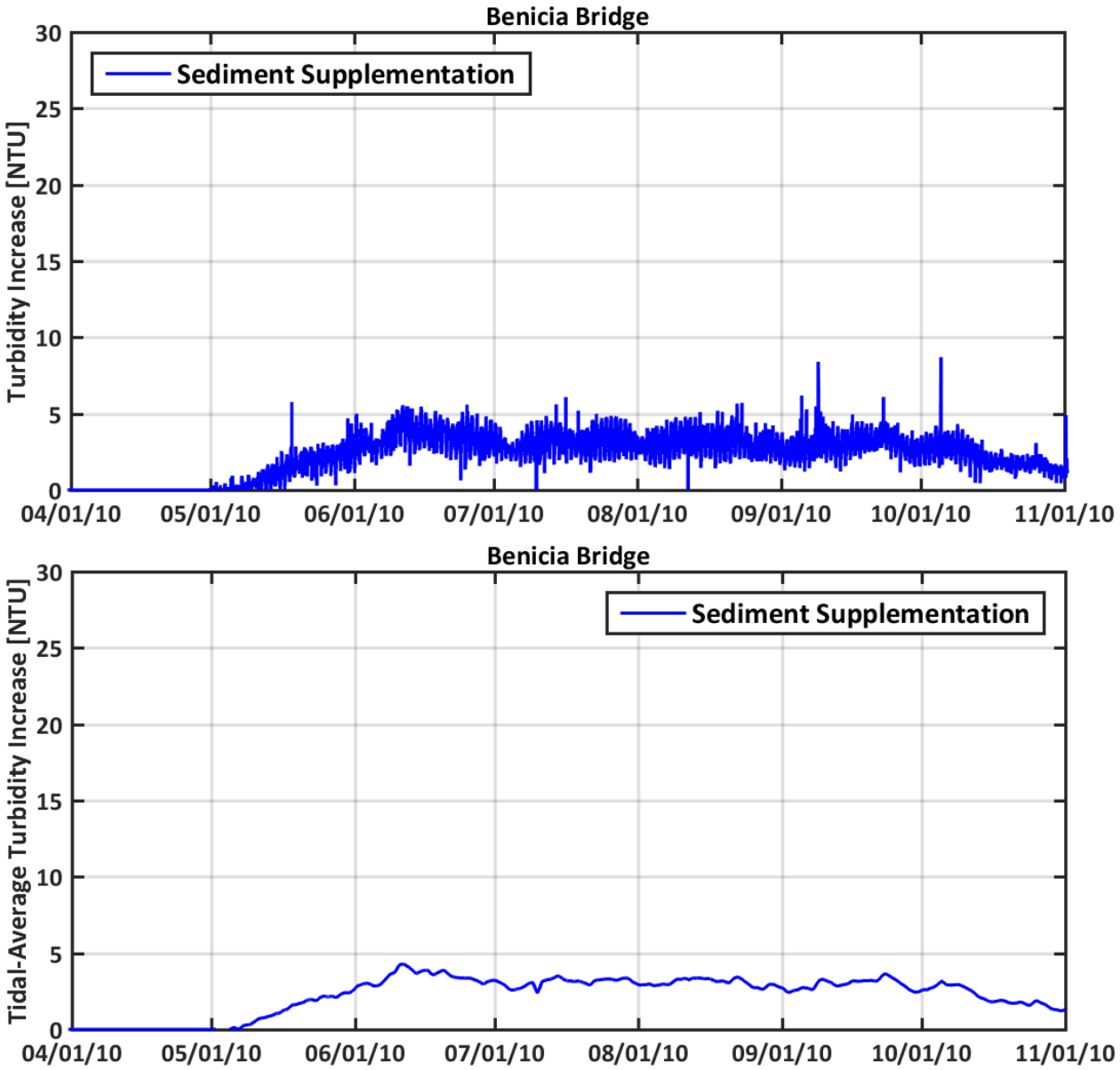
Sediment Supplementation Effects on Turbidity



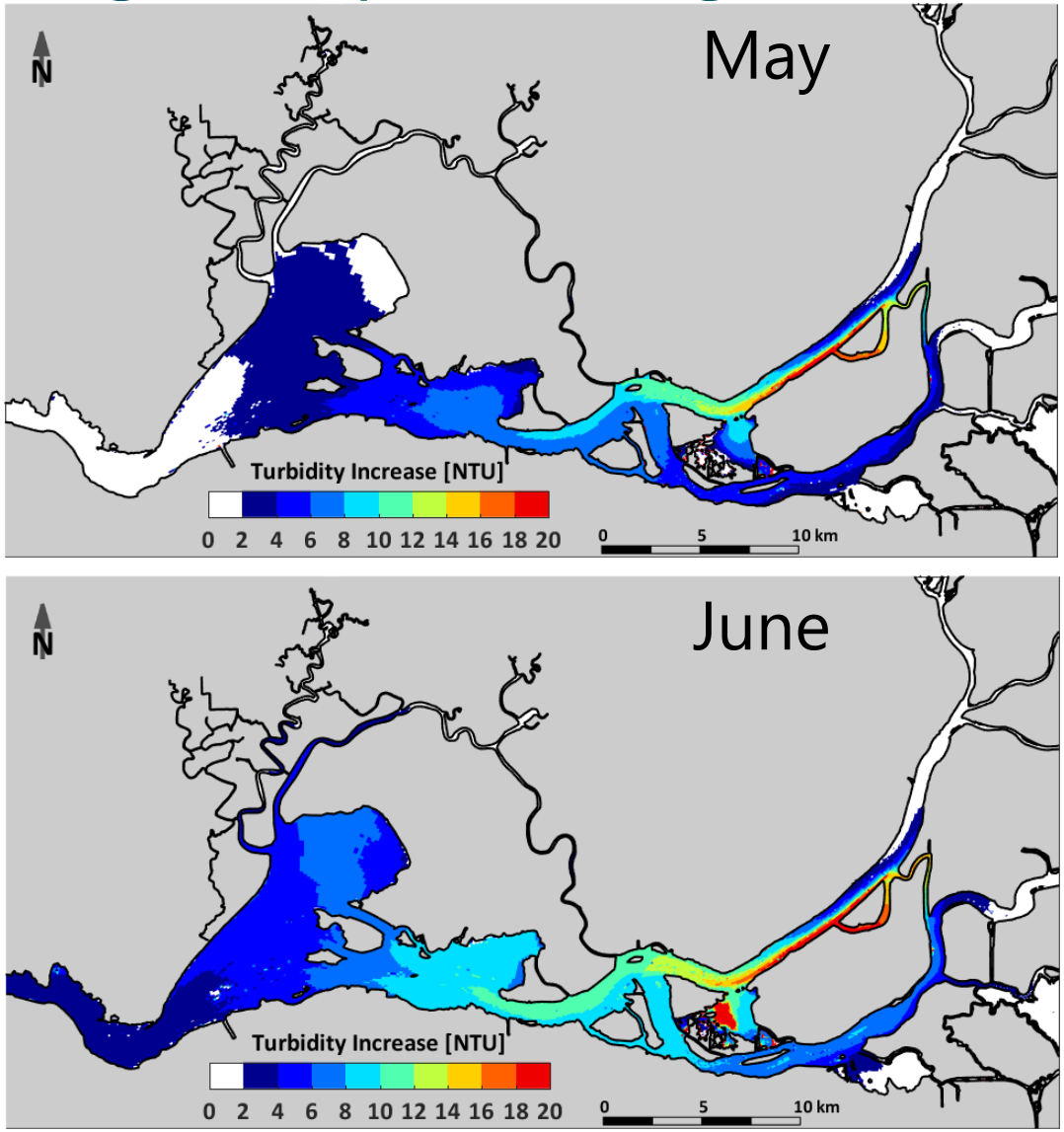
Sediment Supplementation Effects on Turbidity



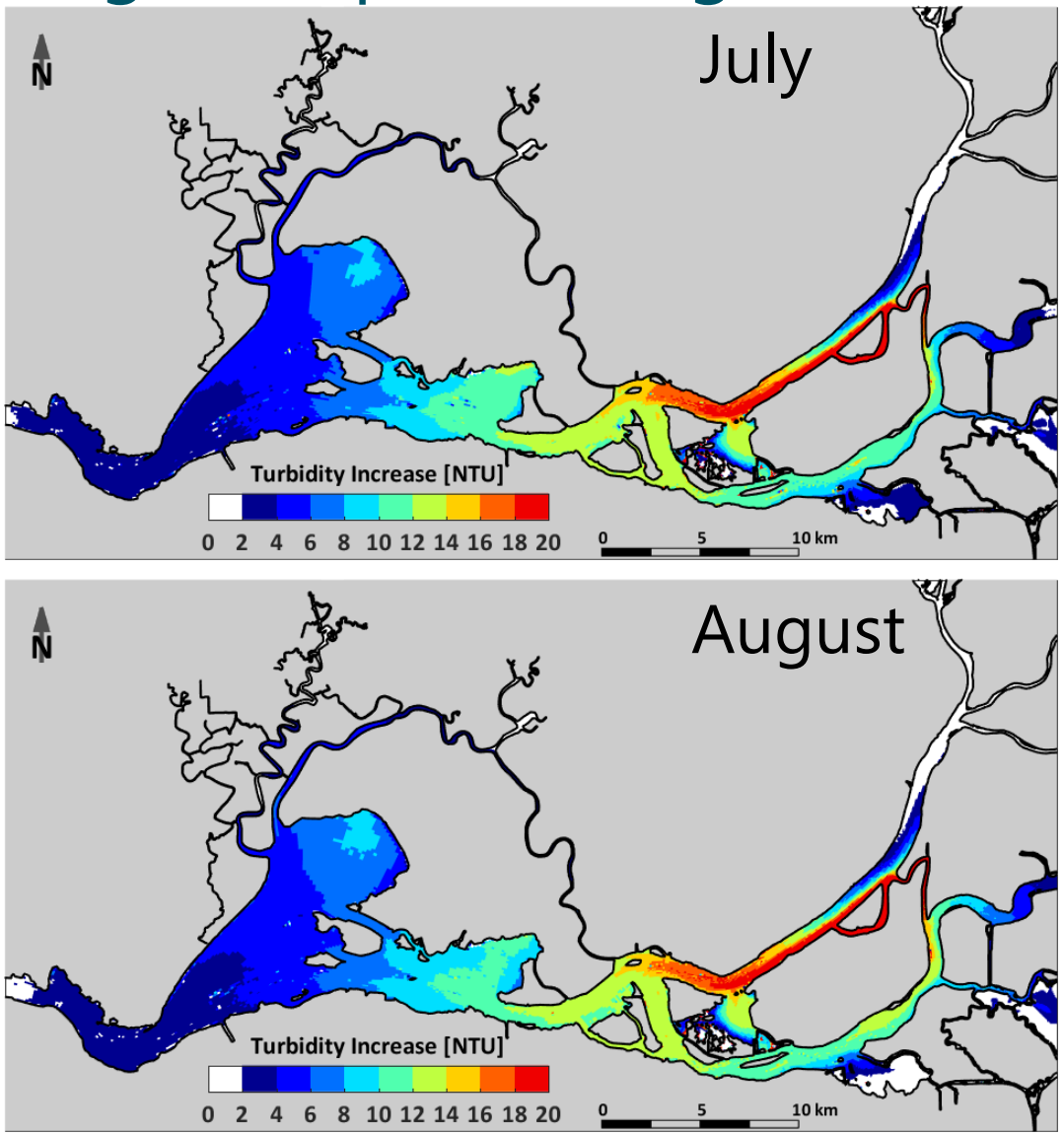
Sediment Supplementation Effects on Turbidity



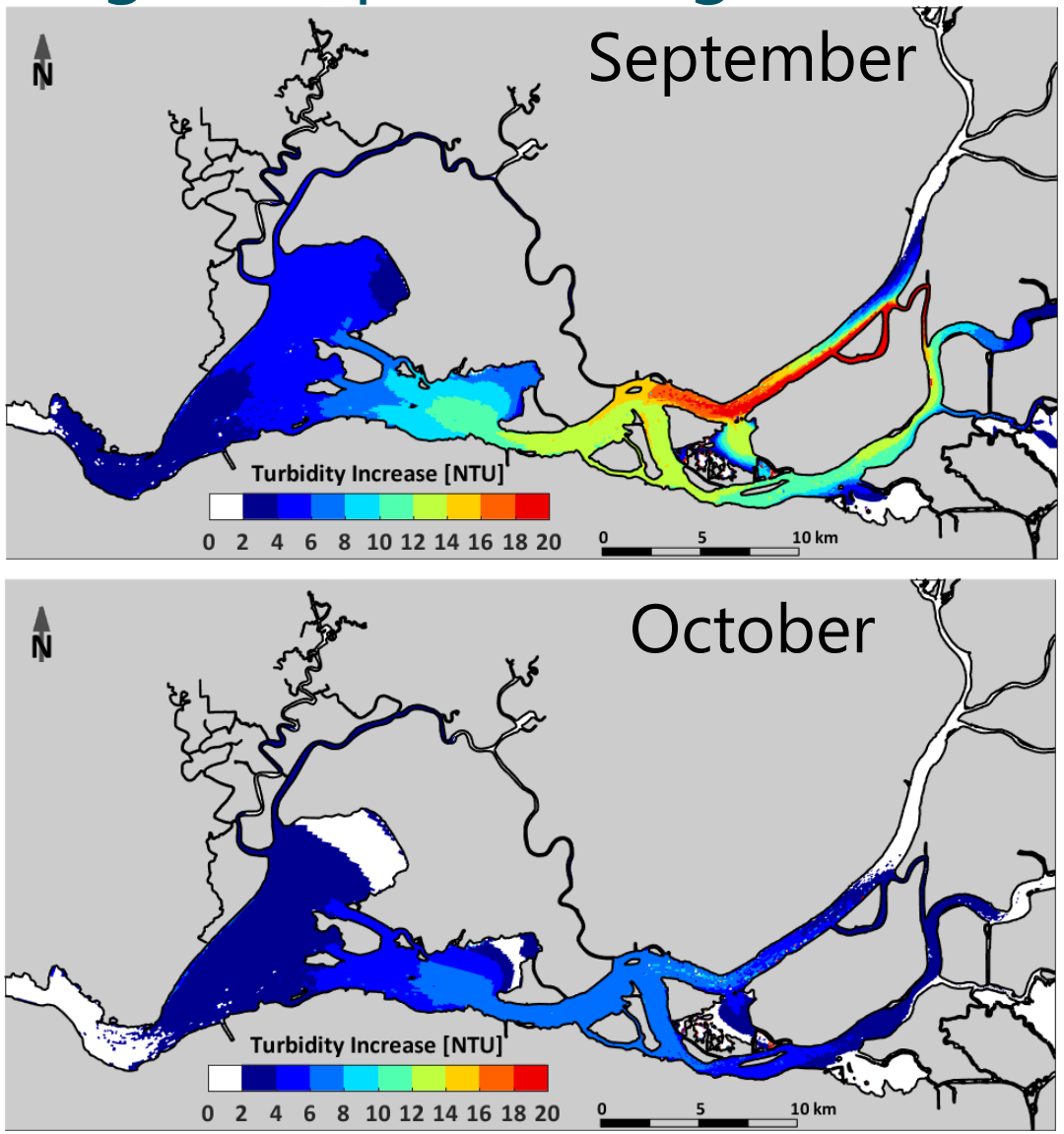
Sediment Supplementation Effects on Monthly-averaged Depth-averaged Turbidity



Sediment Supplementation Effects on Monthly-averaged Depth-averaged Turbidity



Sediment Supplementation Effects on Monthly-averaged Depth-averaged Turbidity



Conclusions

- Study provides an order of magnitude estimate of sediment supplementation rate required to achieve 10 NTU increase.
- Significant assumptions regarding sediment composition (silt/floc), effectiveness of slurry at achieving suspension, and other dredged material properties.
- The amount of sediment needed to increase turbidity by 10 NTU from Emmaton to Mallard Island was estimated to be 3550 cubic yards per day.
- At lower outflow the effectiveness of the sediment supplementation is increased

Questions/Discussion