

# Influence of the 2016 Yolo Bypass flood event on suspended sediment in Little Holland Tract

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**Understanding the physical and biological processes that  
influence aquatic habitat quality for native fish  
populations**

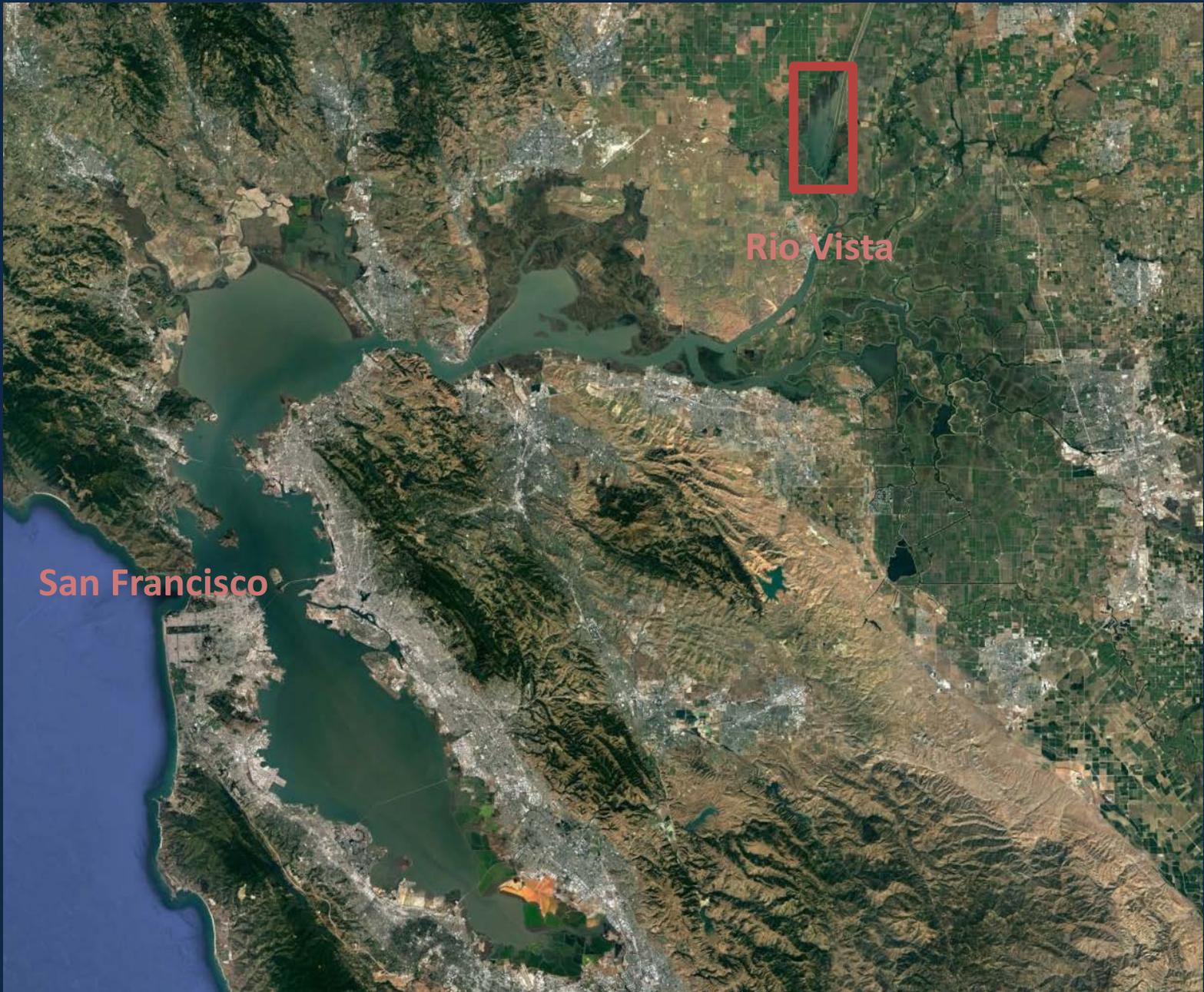
**USGS & USBR**

# Motivation

- Are sites like Little Holland Tract (LHT) potential habitat for Delta Smelt?
- Delta Smelt seek high turbidity waters.
- Develop an understanding of flow and sediment dynamics in LHT.



**Delta Smelt, Adult (swimming)**  
Giordano, Dave. 2008.  
California Fish Species, UC Davis Fish  
Conservation and Culture Lab.

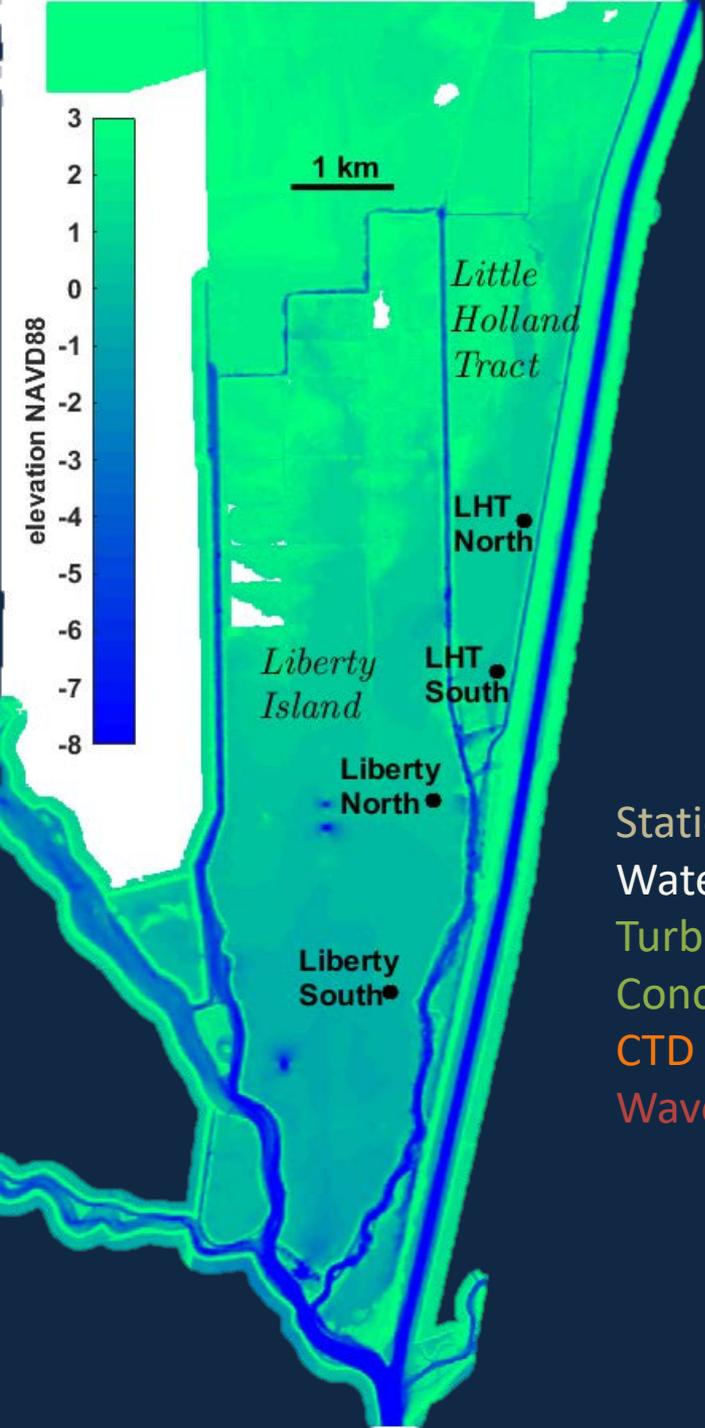


San Francisco

Rio Vista



- Two flooded agricultural fields.
- Many breaches along old levees.
- LHT and Liberty are connected through channels.

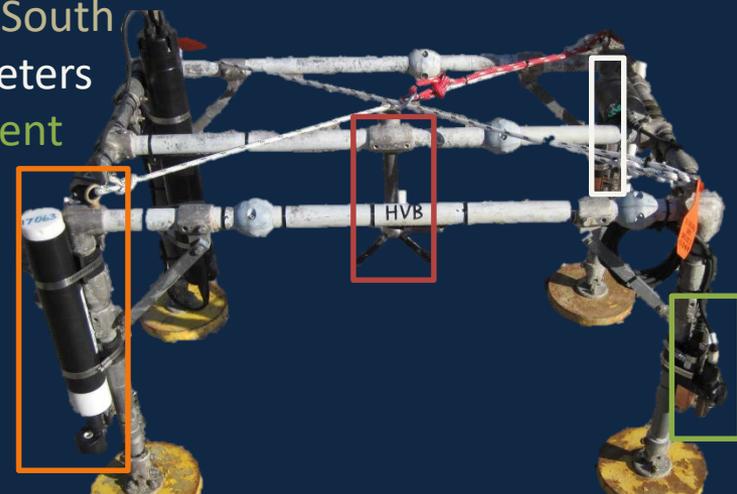


Stations: Liberty North, LHT North  
Water Surface, Wave Parameters  
Turbidity (Suspended Sediment  
Concentration)

Stations: Liberty South, LHT South  
Water Surface, Wave Parameters  
Turbidity (Suspended Sediment  
Concentration)

CTD

Wave and Current Velocity

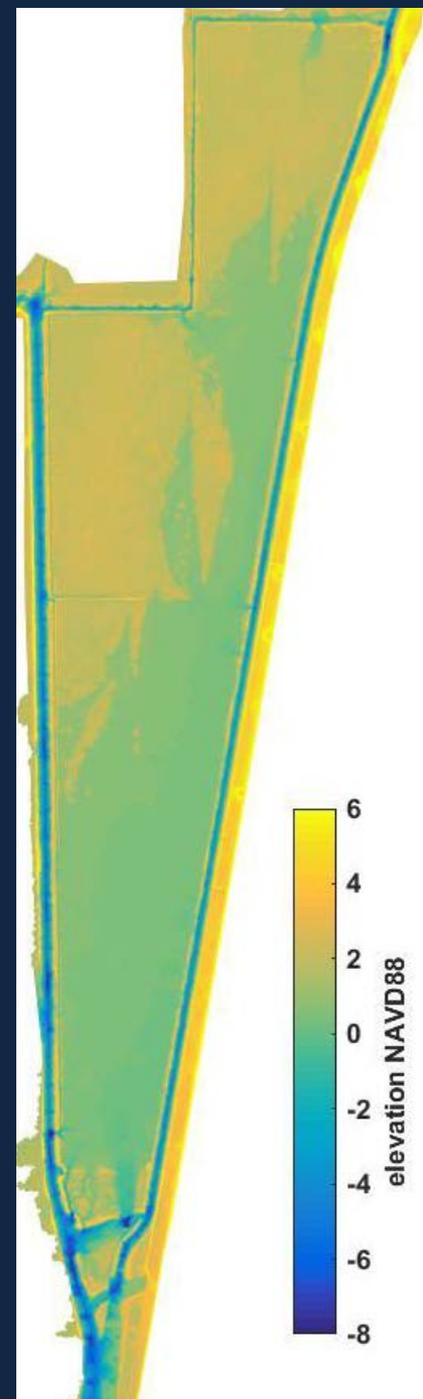


## Digital Elevation Model (DEM) of LHT

- 1 m grid resolution
- DEM and associated data available online

## Sediment Sampling

- 14 short cores – Summer 2014
- 17 short cores – Summer 2016
- Sediment grabs taken every other month since August 2015.

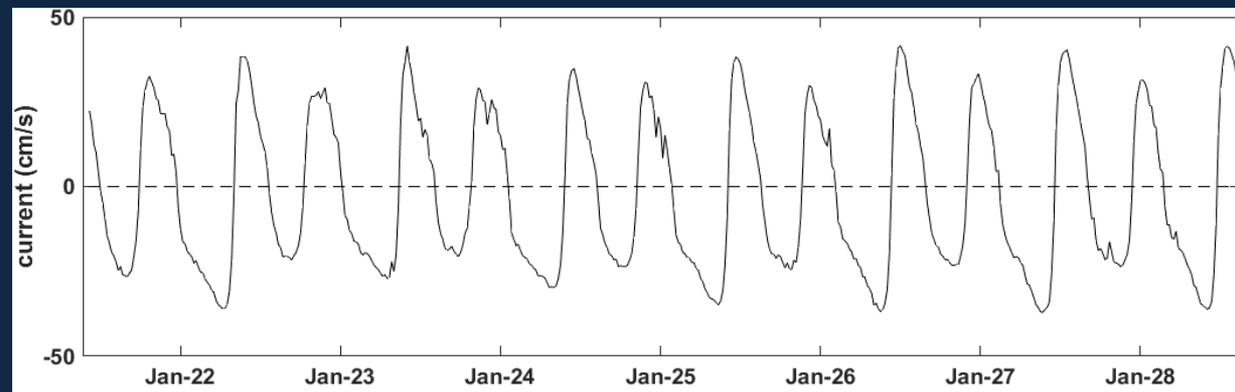


# Outline

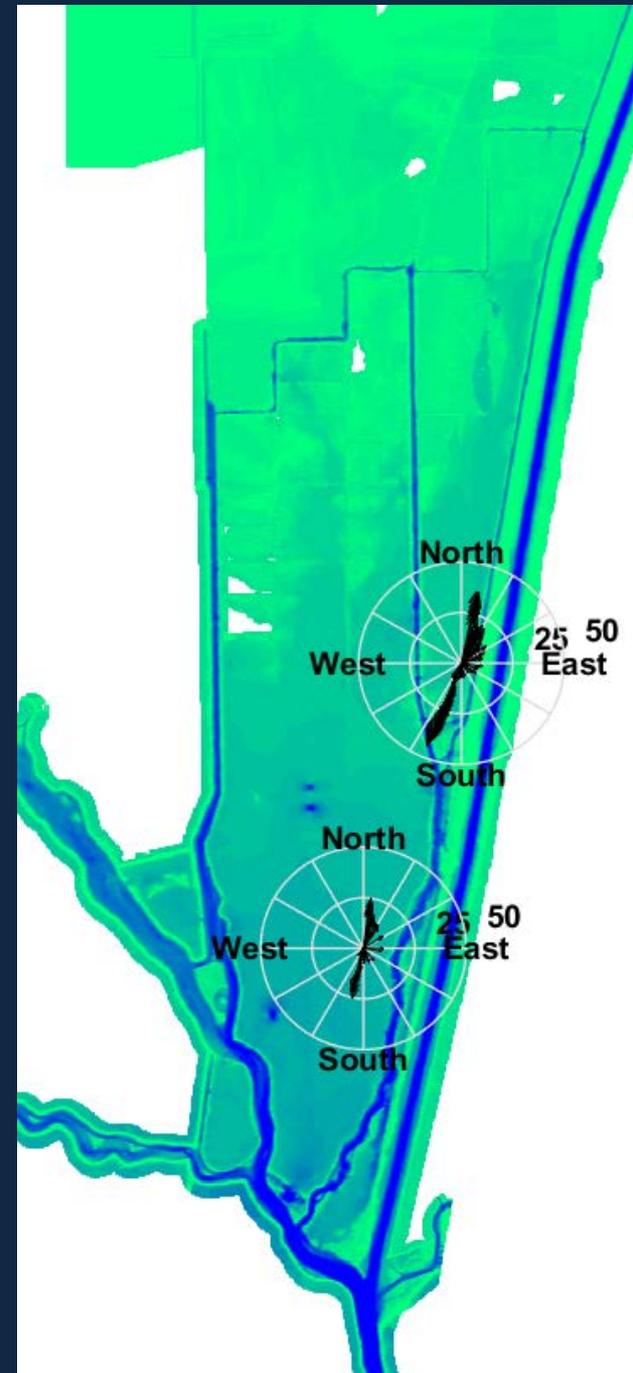
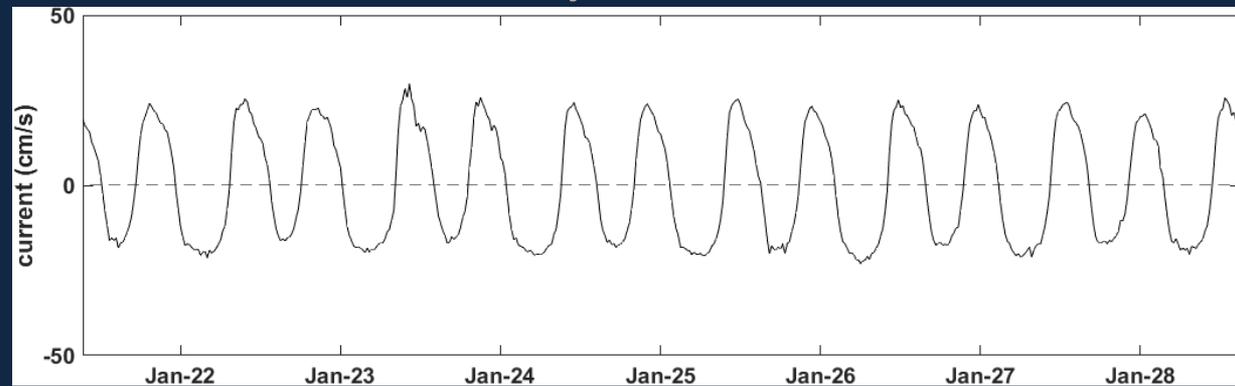
- Tidal currents of LHT & Liberty Island
- LHT's inter-tidal zone
- Observed wave climate and why it matters
- SSC observations of LHT & Liberty Island
- Effects of Yolo bypass flood event of winter 2016
- Conclusions
- Products

# Tidal Currents

## Little Holland Tract

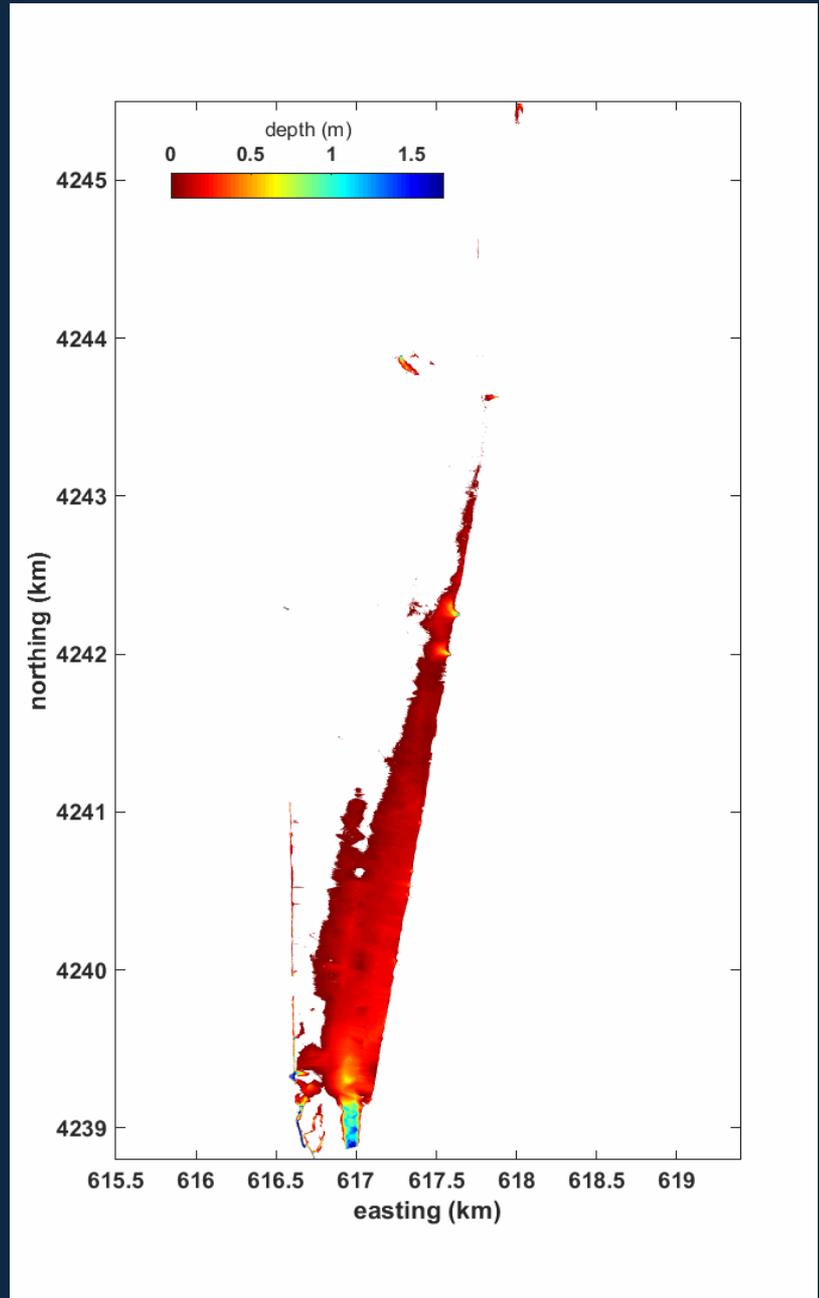


## Liberty Island

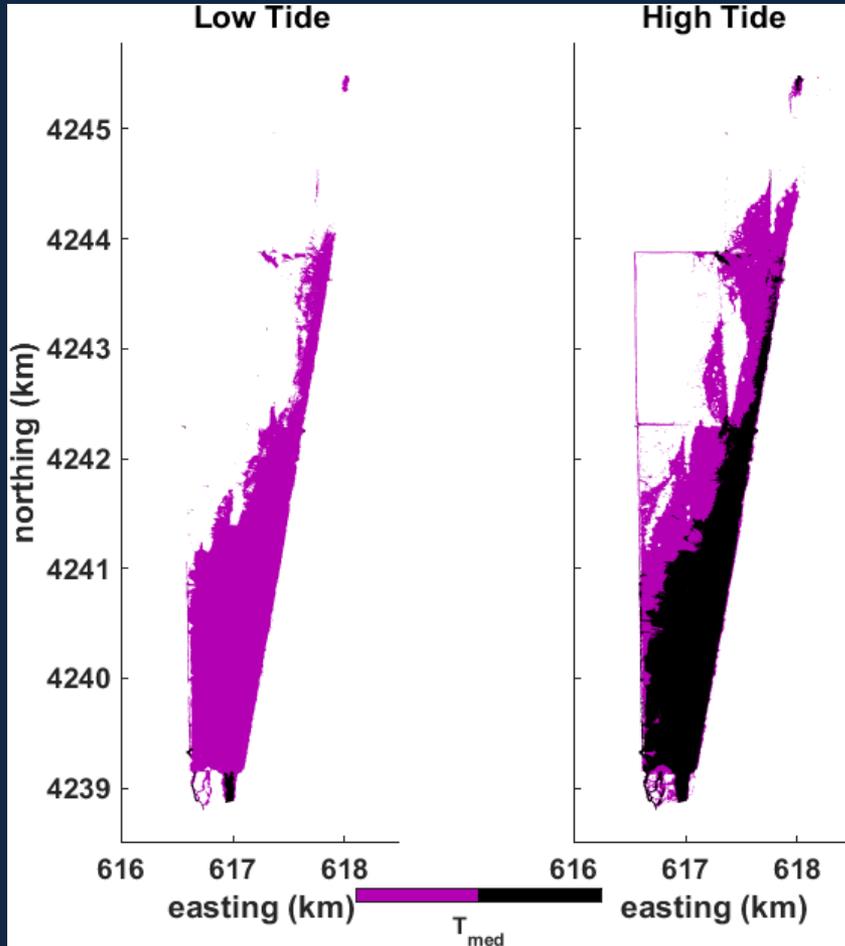


# LHT Inter-Tidal Zone

- High Tide:  
865 submerged acres
- Low Tide:  
594 submerged acres



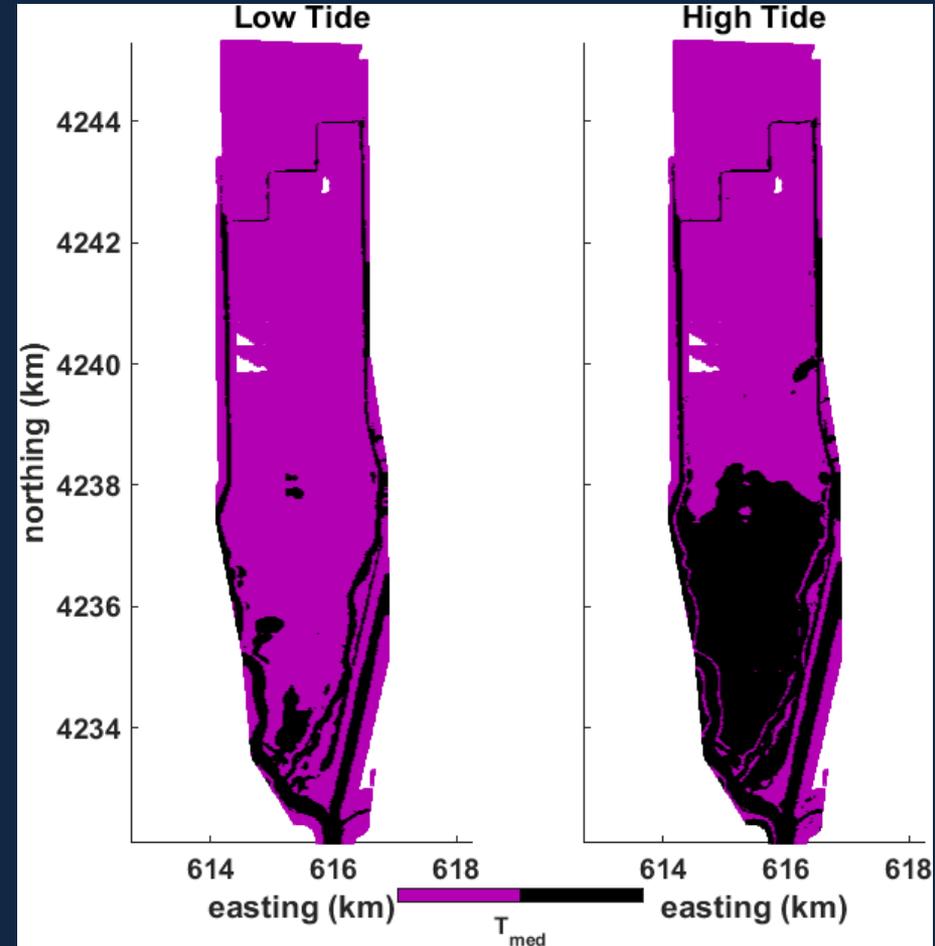
# Wave Climate



$$T_{median} = 1.24 \text{ s}$$

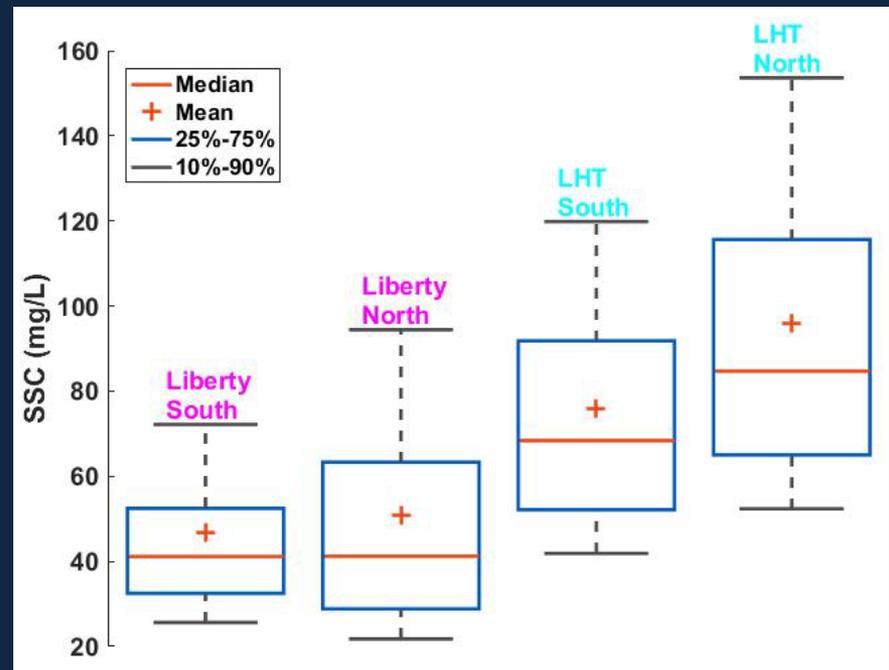
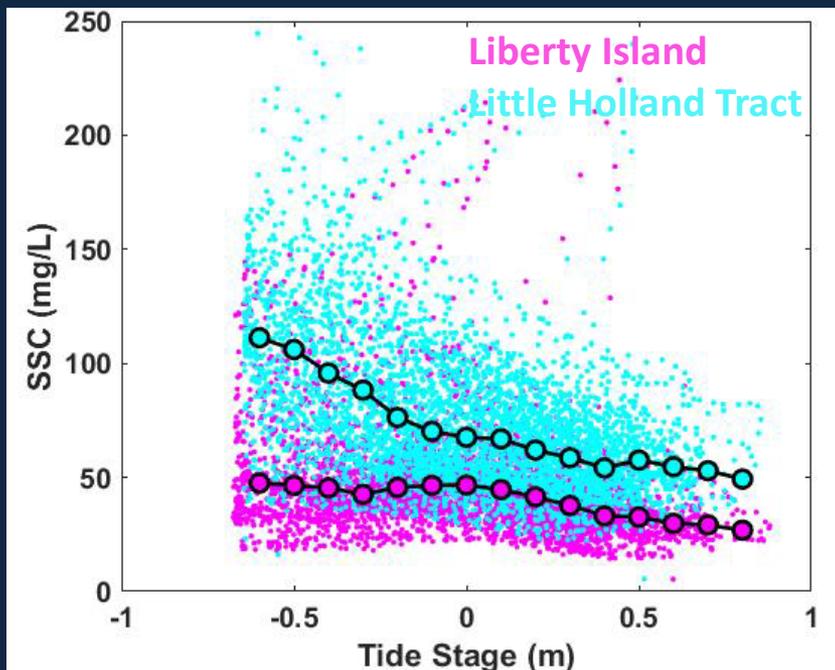
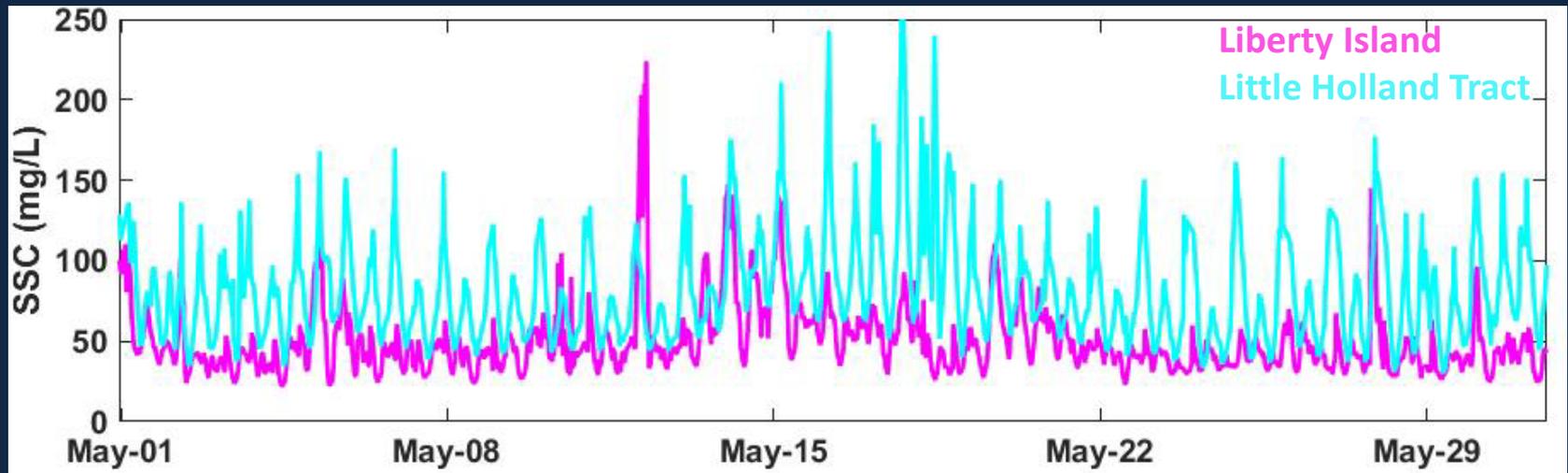
*Pink:  $T_{median} > T_{penetration}$*

*Black:  $T_{median} < T_{penetration}$*



$$T_{median} = 1.52 \text{ s}$$

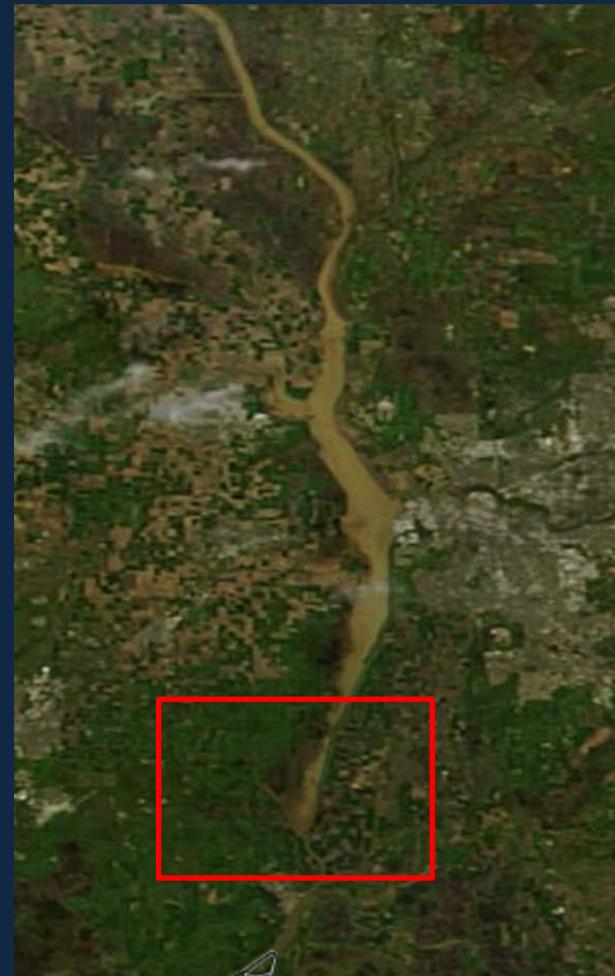
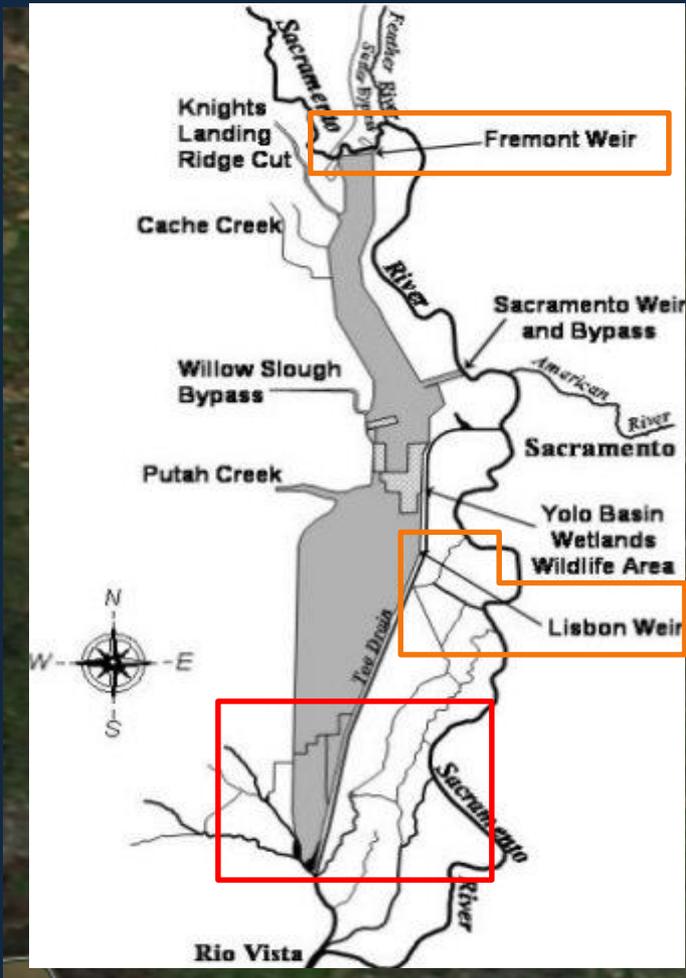
# Suspended Sediment Concentrations



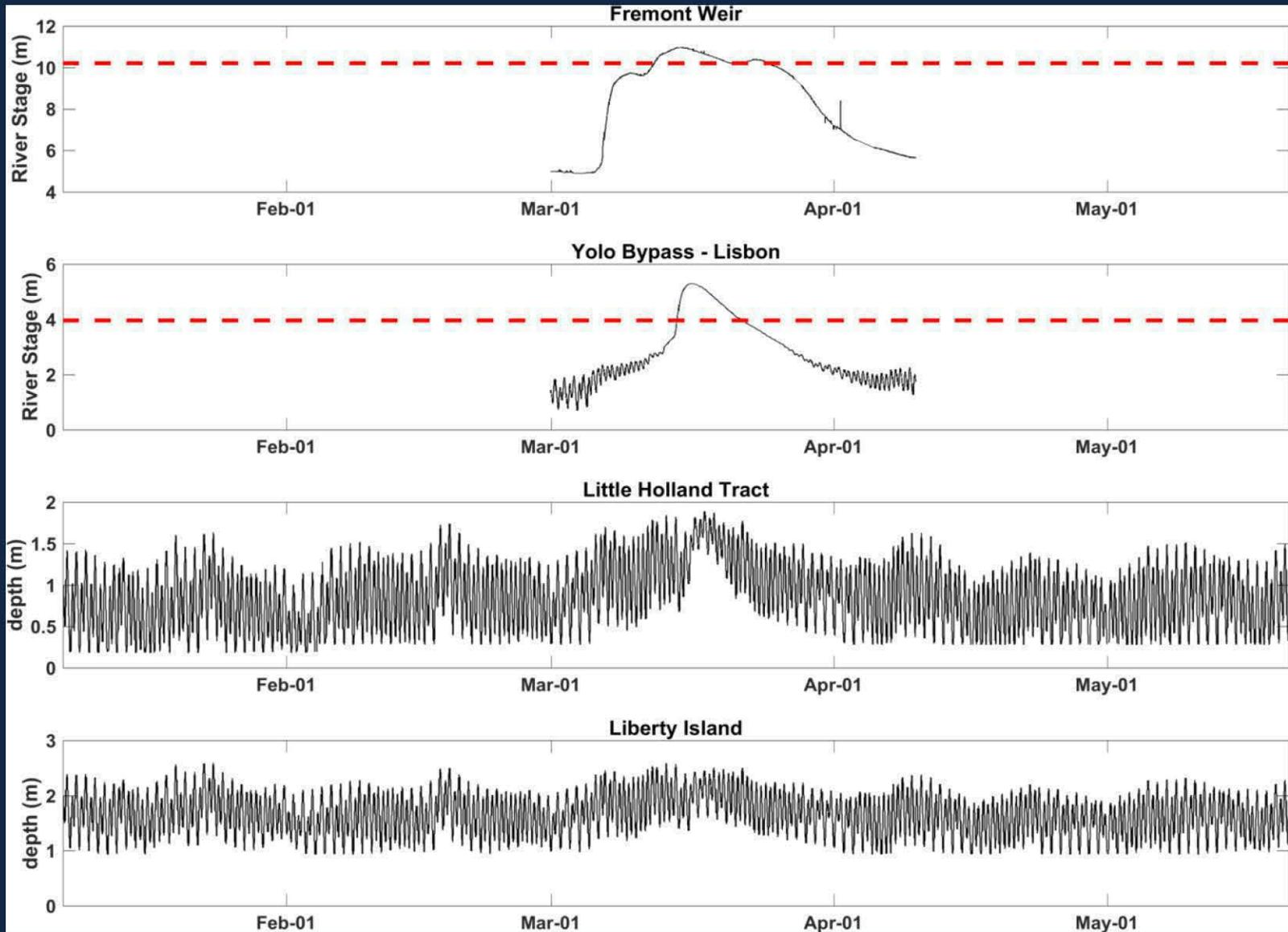
# Yolo Bypass System

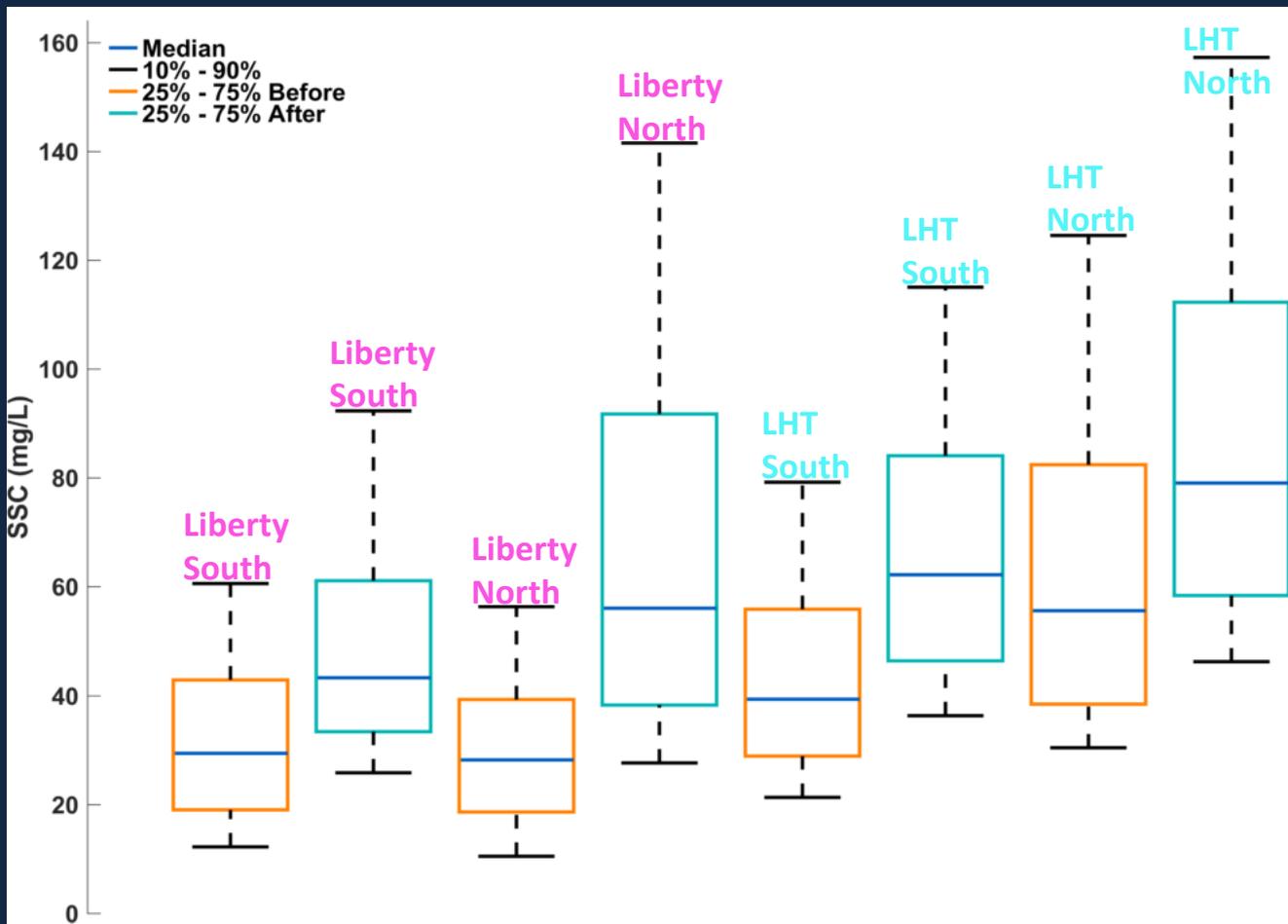
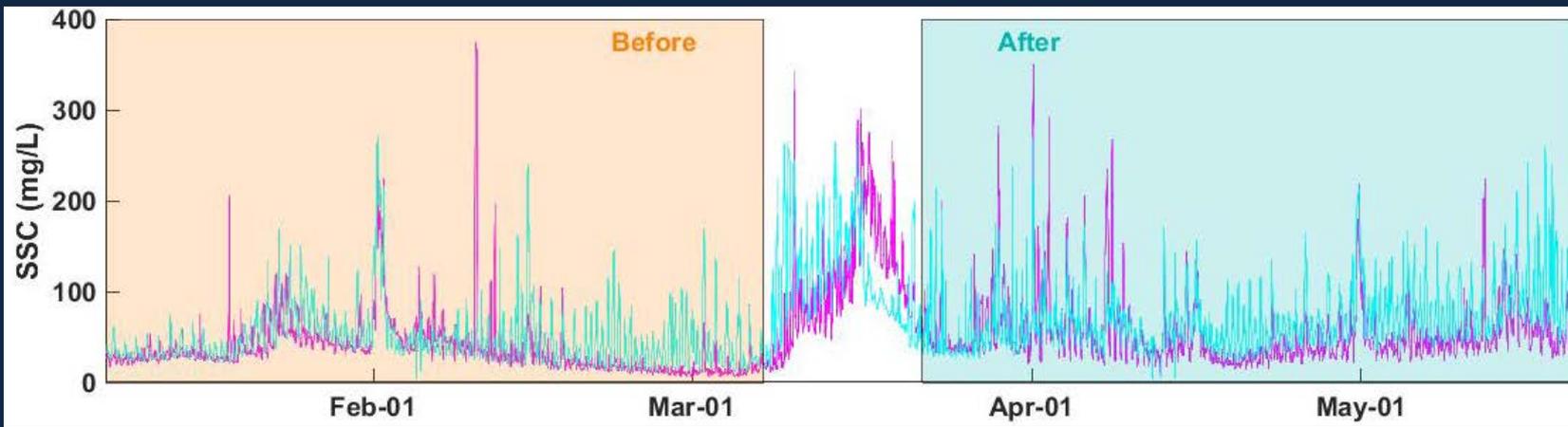
February 8, 2016

March 15, 2016



# 2016 Yolo Bypass Flood Event





# Shear Stress Estimate

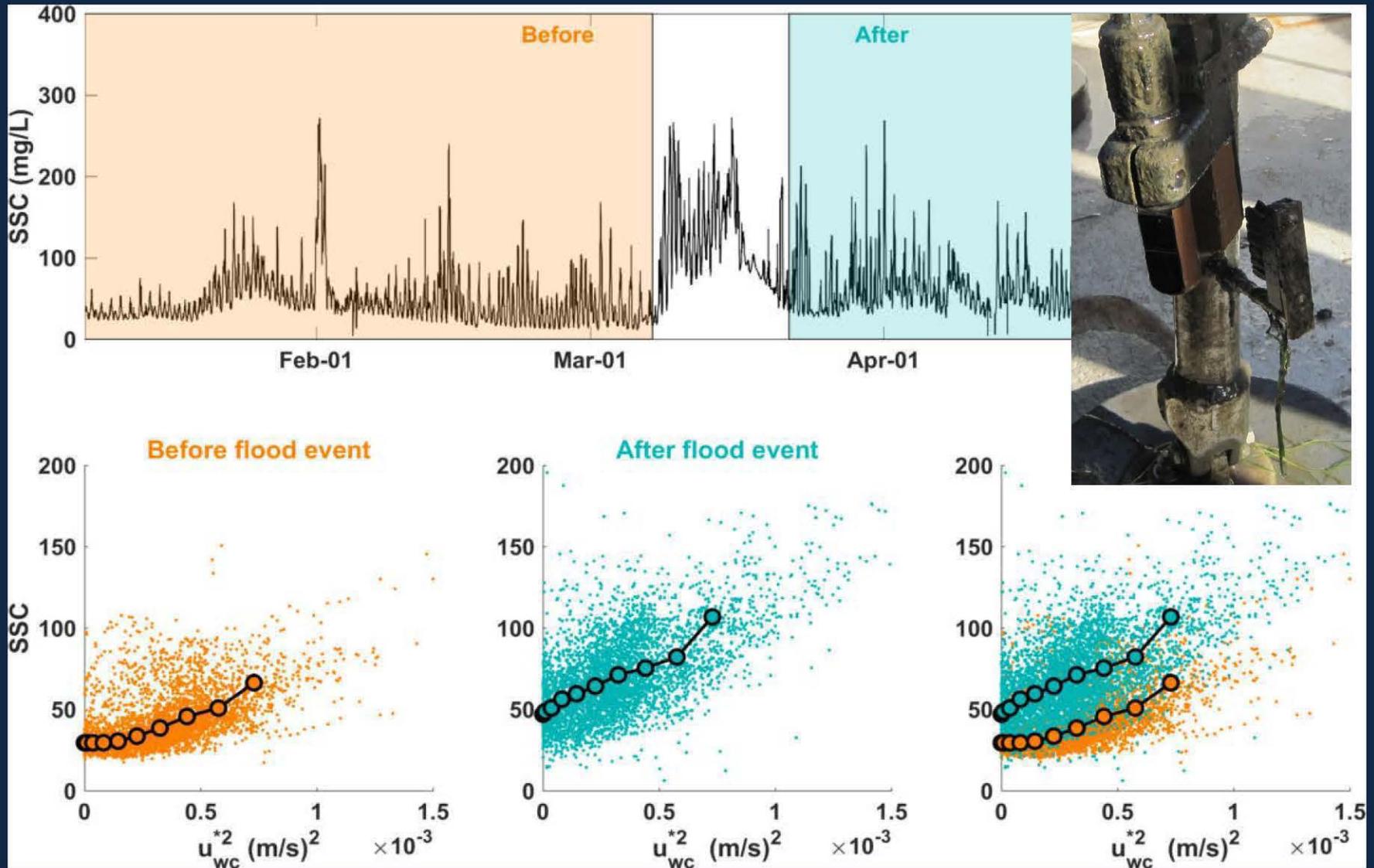
- Combined wave and current shear velocity:

$$u_{*r}^2 = \frac{1}{\rho} |\tau_{wr} + \tau_c|$$

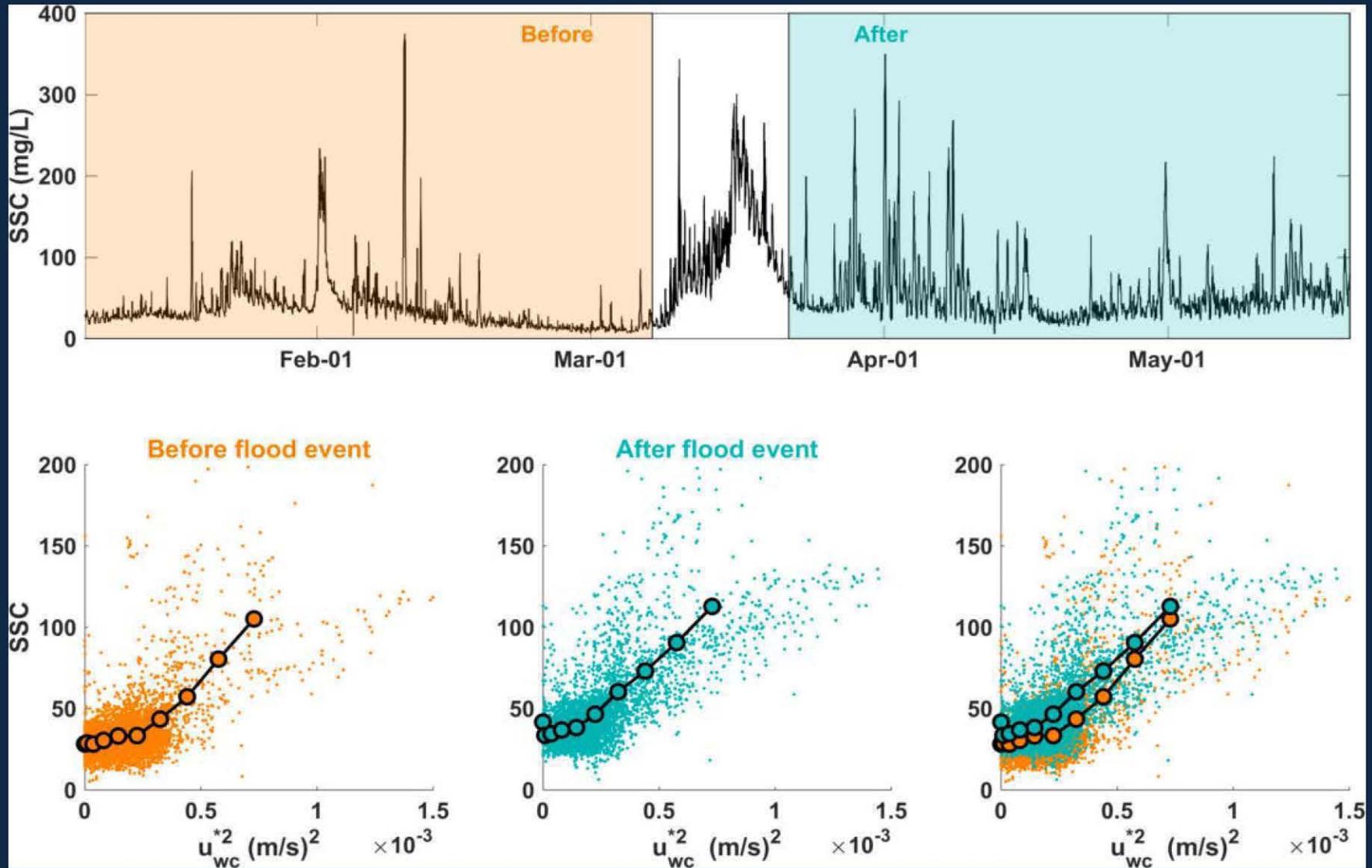
Madsen (1994) eqn. 19

- $\tau_{wr}$  determined from spectral analysis of wave bursts

# Turbidity Response - LHT



# Turbidity Response - Liberty



# Conclusions

- LHT is more turbid than Liberty Island.
- Wind waves have the potential to mobilize sediment in LHT and Liberty.
- LHT has very large inter-tidal zone.
- Flows through the Yolo bypass may be important sediment supply source for LHT and Liberty.
- Increased turbidity after flooding
  - Increased sediment supply to the system?
  - Reduced compaction due to high flows?

# Products

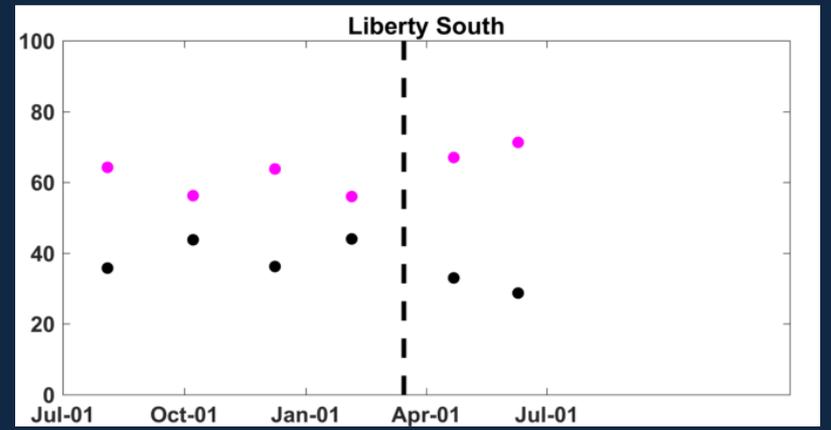
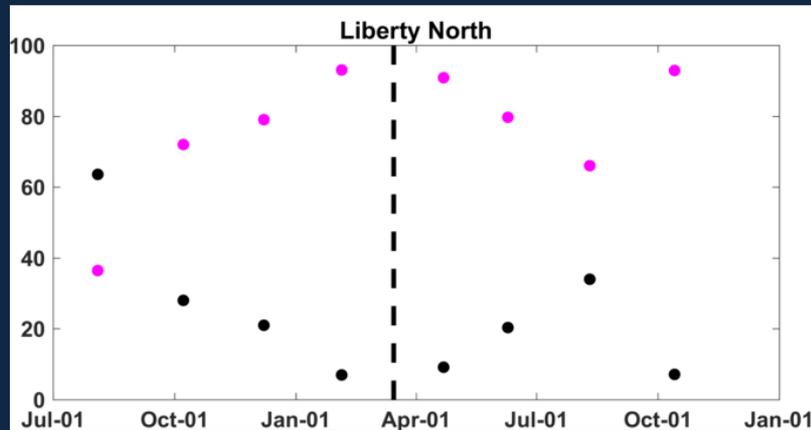
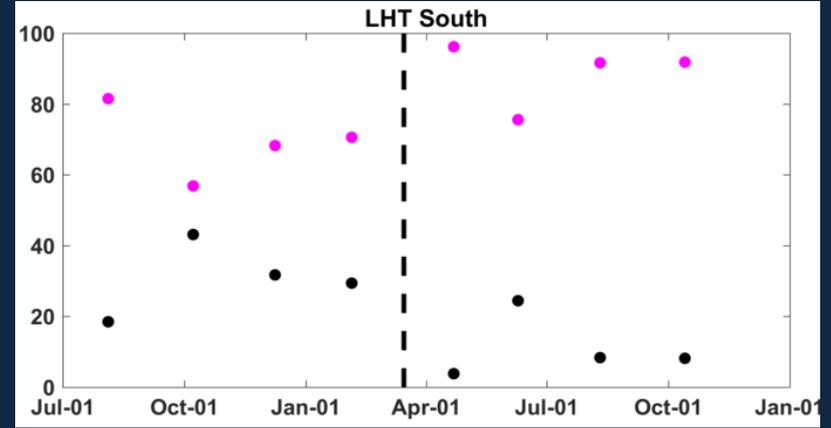
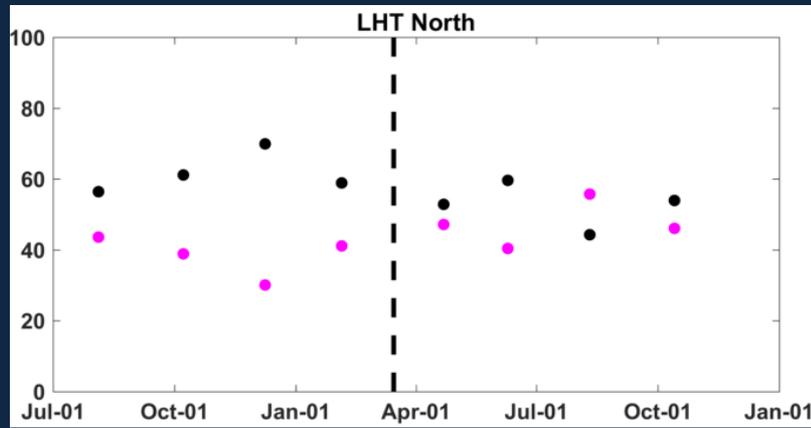
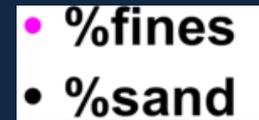
- Digital Elevation Model of Little Holland Tract  
<https://www.sciencebase.gov/catalog/item/564bafdce4b0ebfbef0d3322>
- Open File Report on data collection for DEM:  
<https://pubs.er.usgs.gov/publication/ofr20161093>
- Coming soon: Data release of time series since August 2015  
<https://www.sciencebase.gov/catalog/item/5787eb08e4b0d27deb377b6f>

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# Grain Size Analysis

- Sediment is mixture of sand and fines.
- Vertical black line indicates timing of flood.
- Fines increased after flood event.



# Characteristics of LHT

- More turbid than surrounding waters
- High current velocities at main channel entrance
- Highly asymmetric tides
- Large inter-tidal zone
- Shallow depths
- Small period waves