# Linking Turbidity to Suspended Sediment - Implications for Modeling in the Delta

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# Background

The USGS has recently initiated a new study of sediment transport in the Delta, the objectives are as follows:

1) Collect data to support numerical modeling of sediment transport (and turbidity), so that modeling can be used to evaluate management scenarios for Delta turbidity

2) Learn more about Delta sediment transport processes, and use this information to inform modeling efforts

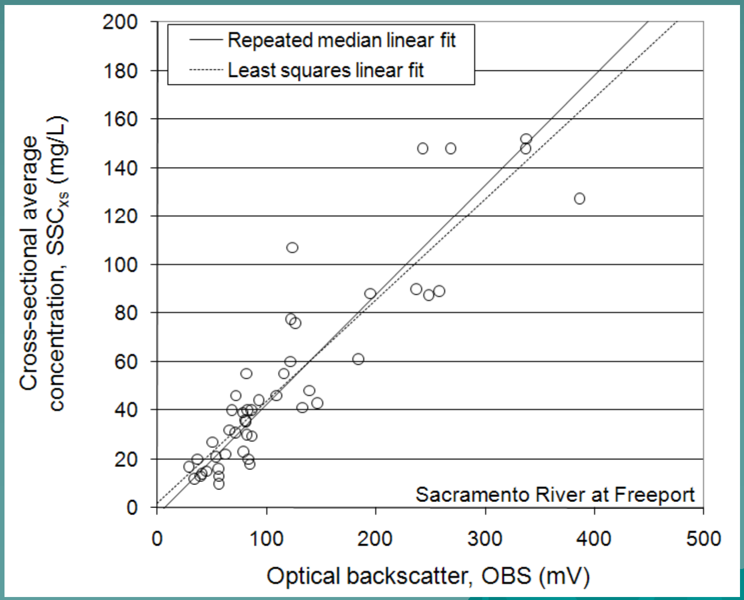
This talk summarizes the studies that will be performed

# Why?

Turbidity is an ancillary measure of water clarity, there are no governing equations of “turbidity transport”, thus, turbidity can’t be modeled directly

Suspended sediment causes turbidity and is subject to mass conservation and force balance equations that can be modeled

Relations between turbidity and SSC can be used to “back out” turbidity from a sediment transport model

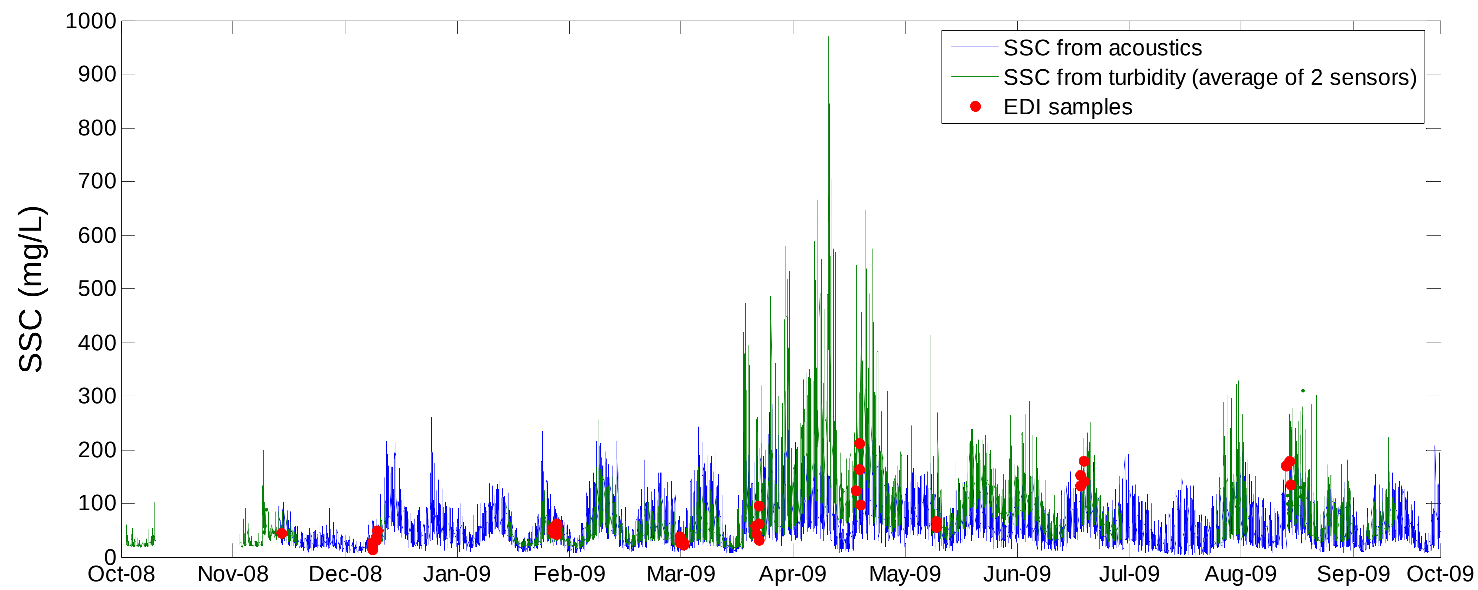



# Task 1 – Suspended Sediment

Collect periodic measurements of SSC in order to correlate with turbidity (and, potentially, acoustic backscatter)

Compute continuous SSC and sediment flux records at the monitoring sites (shown on next slide)

Provides necessary boundary conditions for numerical model, and calibration/validation data within the Delta

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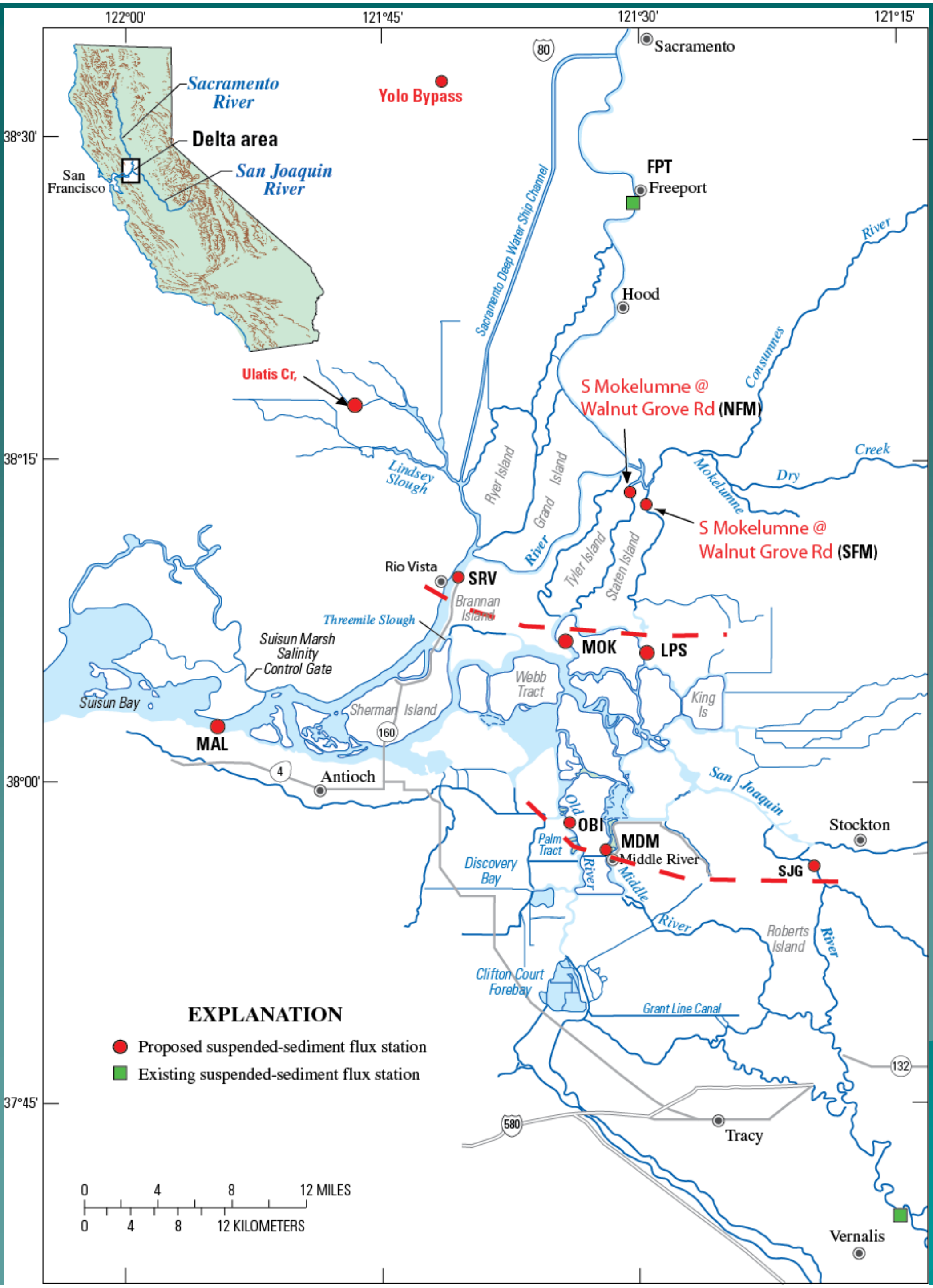
Monitoring locations will allow us to construct sediment budgets for the North, Central, and South Delta, as well as the Cache Slough complex and Yolo bypass

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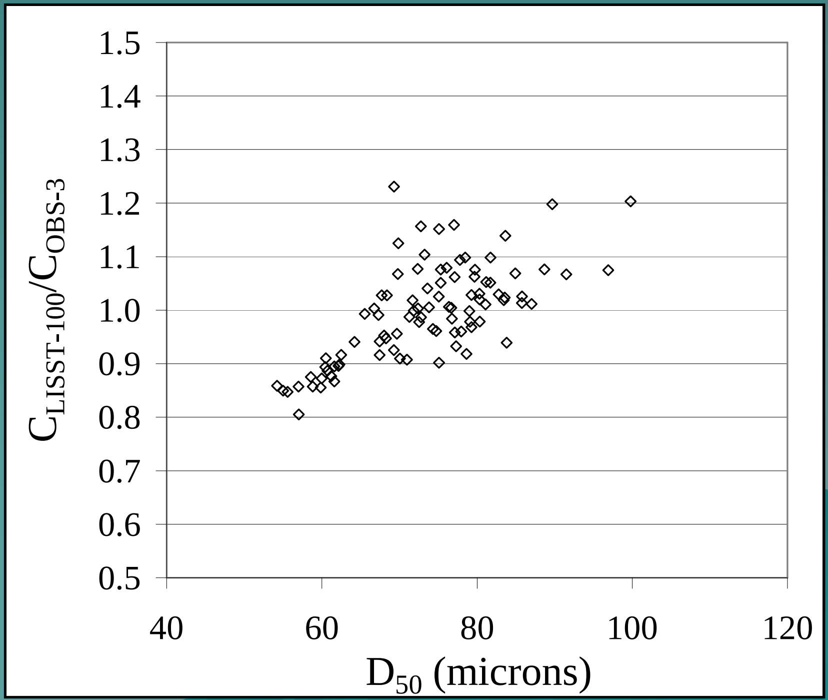
# Task 1 – Suspended Sediment

Collect in-situ, continuous particle size data, on a rotating basis, at the monitoring sites

SSC-turbidity relations are dependent on particle size

Numerical modeling of suspended sediment is highly sensitive to particle size (especially with flocculation)

# Task 2 – Modeling parameters

Key to modeling suspended sediment is the local balance between erosion and deposition – this provides the linkage between sediment in suspension and sediment on the bed

Models require parameterization of equations for sediment deposition and erosion rates

This tasks consists of in-situ measurements of erodibility, settling velocity, and bed sediment properties

bed elevation

Deposition rate

$$(1-\lambda_p)\left[ f_{Ii}\frac{\partial \eta_b}{\partial t} + \frac{\partial}{\partial t}(L_a F_i)\right] = D_{bi} - E_{bi}$$

fraction of given size

Erosion rate

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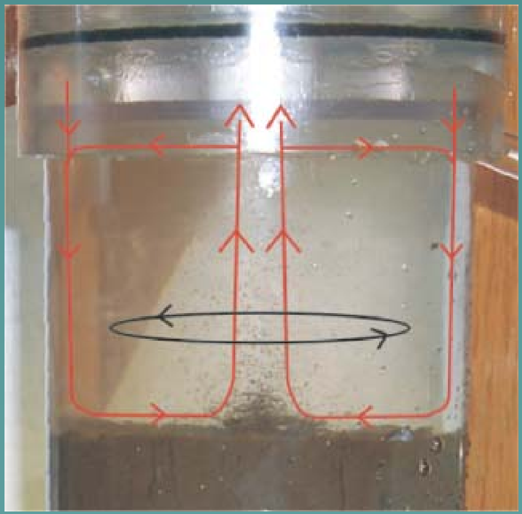
# Task 2 – Modeling parameters

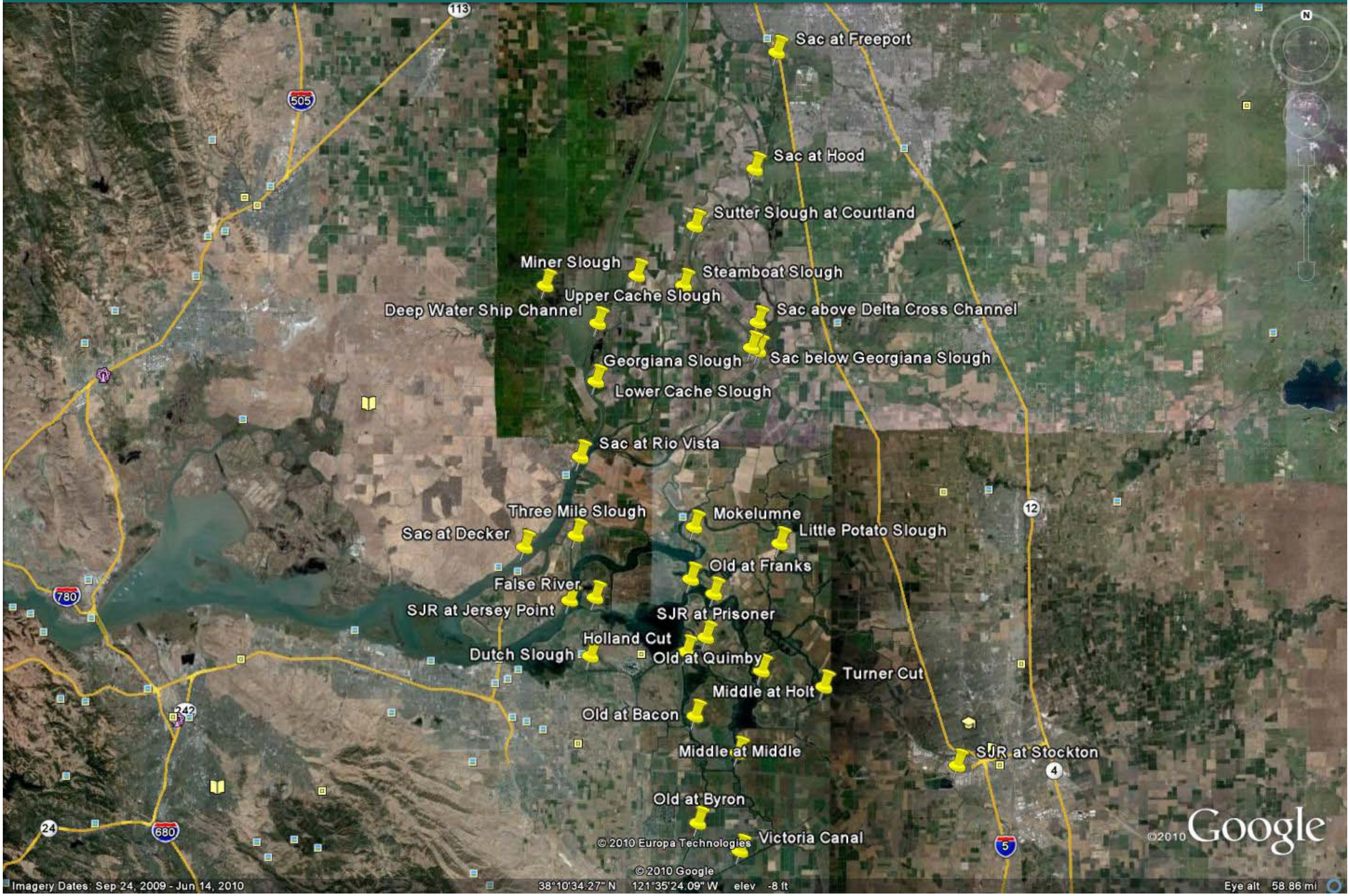
Erodibility will be measured using cores and an “erosion chamber” – applies increasing shear stress, measures rate of erosion from the core, in the field

Settling velocity will be measured with a “floc camera” – video of settling particles and image processing – in the field

Bed sediment will be monitored with grab samples, and potentially, high resolution imagery of the bed - seasonally



# Bed sediment collection sites – Sep 2010



# Expected products

1. Relationships between turbidity and SSC (and, potentially, particle size) at monitoring sites

2. Continuous (15-min) time series of SSC, turbidity, and sediment flux at monitoring sites

3. Seasonal changes in bed sediment properties (e.g. particle size distributions) within the Delta

4. Delta-wide measurements of suspended sediment particle size, settling velocity, and bed sediment erodibility

5. Annual data reports, journal articles and presentations

# Timeline

Starting SSC sampling this month, will focus on first flush and high flows

Settling velocity and erodibility measurements beginning this winter and/or spring

Bed sediment measurements repeated in the spring following high winter flows, and again in the fall

Should have more to say next year!

# Questions?

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