Sediment flux in the southern reach of San Francisco Bay: Implications for habitat restoration

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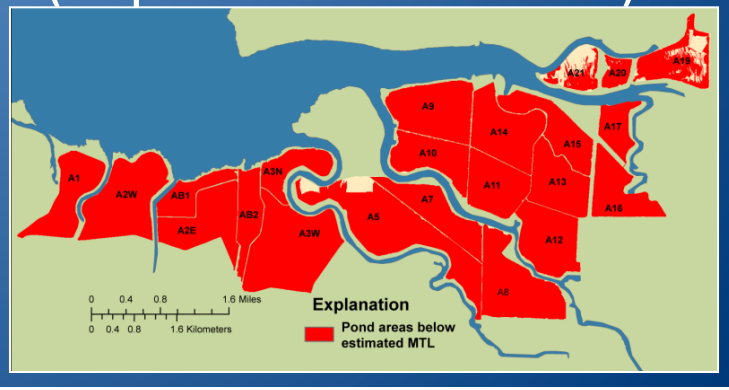
Motivation

- Subsidence in South Bay (mainly Alviso ponds)
  - –32 million m^3 sediment needed to fill subsided ponds to MTL
- Direction of sediment flux unknown for far south SFB
  - –Jaffe *et al.* suggest it is generally to the south in this reach
- SFB sediment conventional wisdom
  - –Winter input (wet season)
    - Two local tributaries (important on decadal-scale)
    - Sacramento & San Joaquin Rivers (importance unknown)
  - –Summer redistribution (windy)
    - Extensive mudflats



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Study Design

- **Flux:** Dumbarton Bridge (15-min. interval)
  - ADCP for index velocity, stage, and backscatter
  - Two turbidity probes: 4’ and 25’ above bottom
  - Barometer
- **Flux:** Boat-based discharge and EDI sediment sampling for calibration (monthly/quarterly)
- **Input:** Sediment measured on 2 major tributaries (daily)
- **Processes:** Adjacent mudflat (15-min. interval)
  - High-accuracy pressure transducer for waves
  - CTD + turbidity

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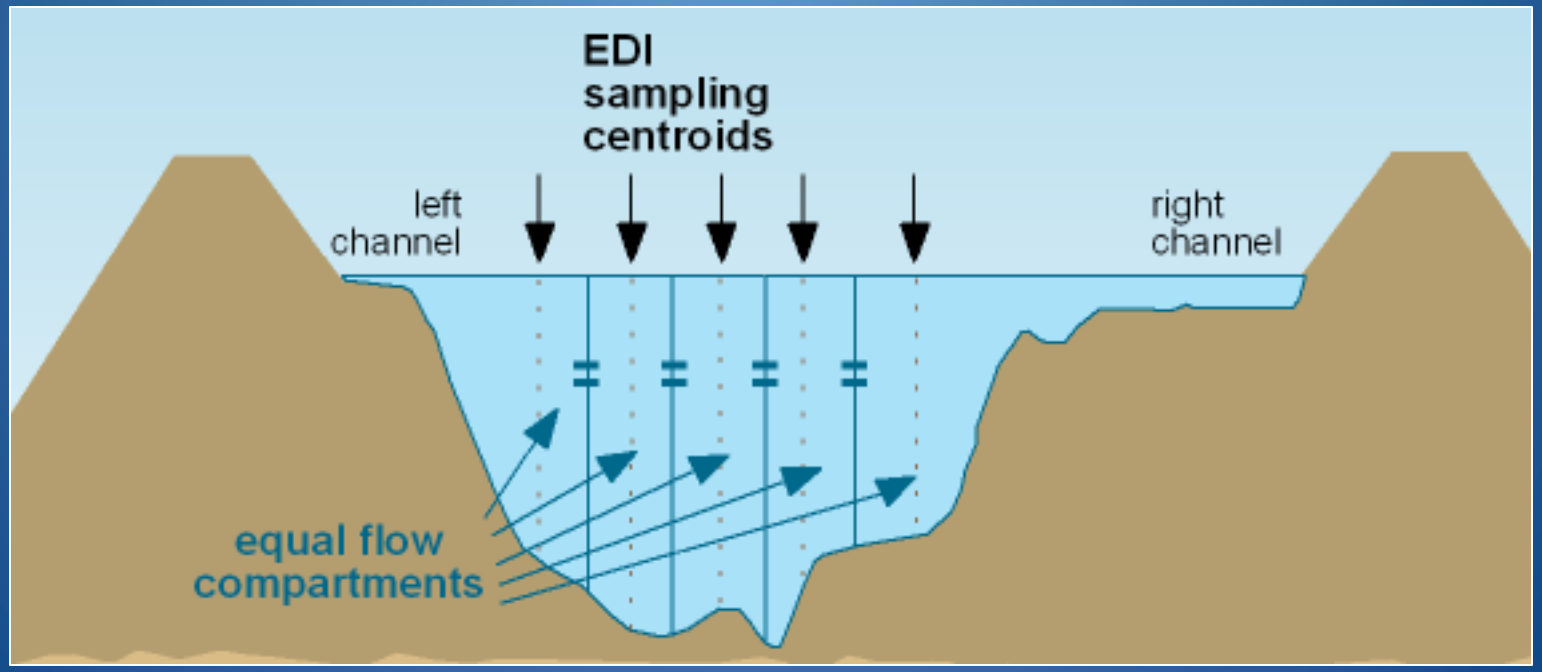
Equal Discharge Increment (EDI) Sampling

- Flow centroids determined for channel cross-section
- Depth-integrated sediment samples collected from middle of each centroid



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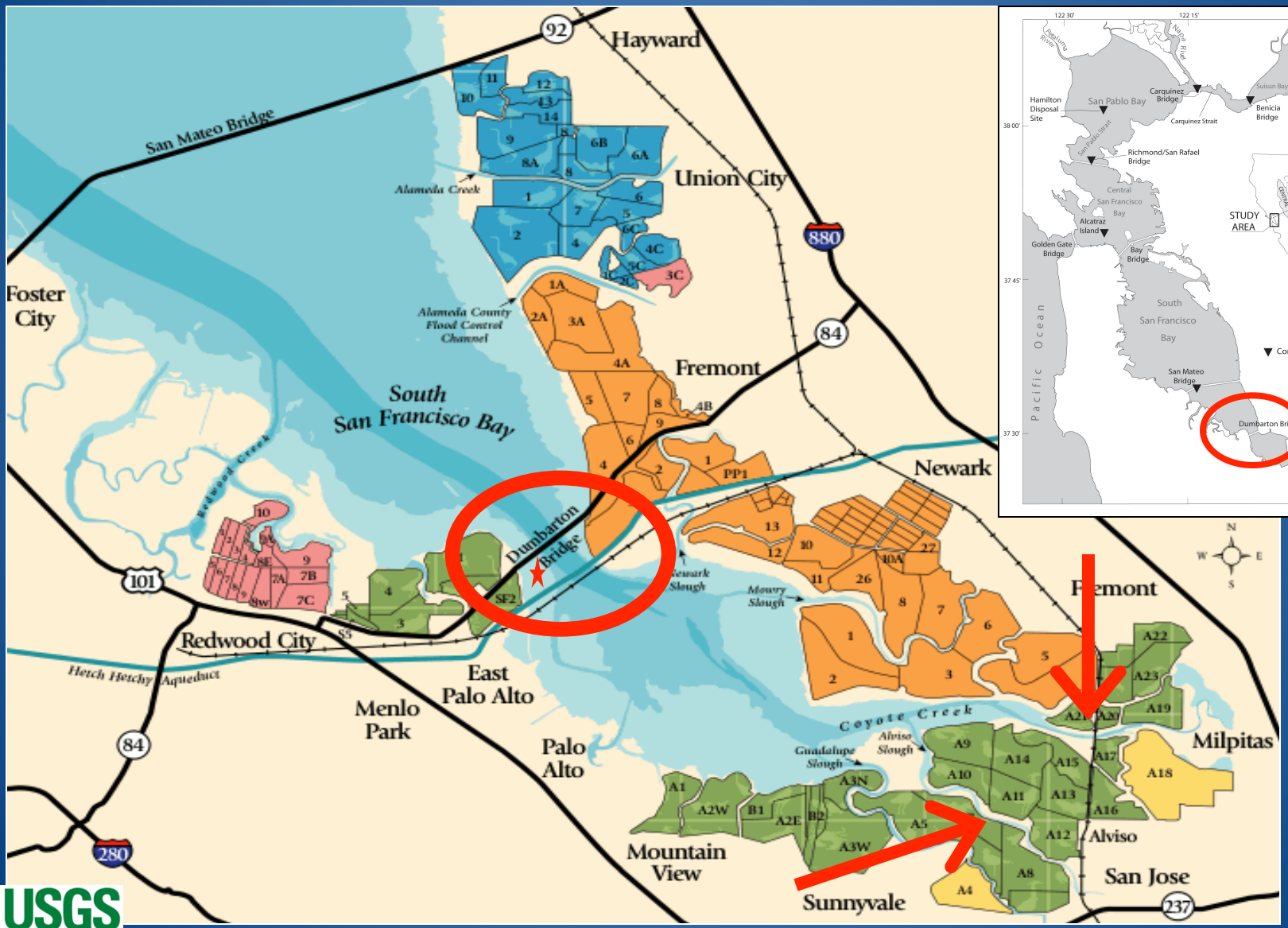
Study Area



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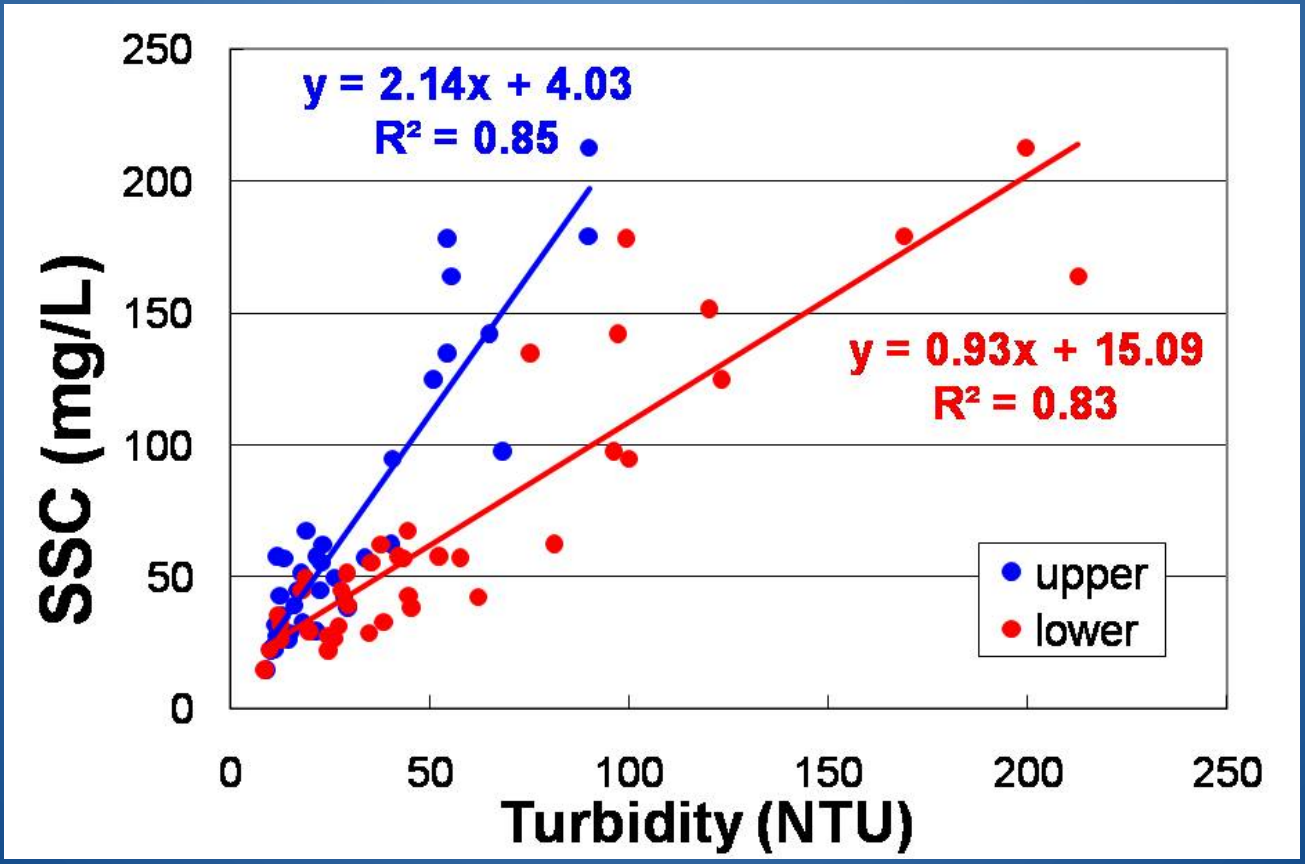
Results - Calibration

- Discharge (bridge vs. boat): y = 0.983 X - 26.7 r^2=0.984
- Suspended-sediment concentration (SSC, from EDI):



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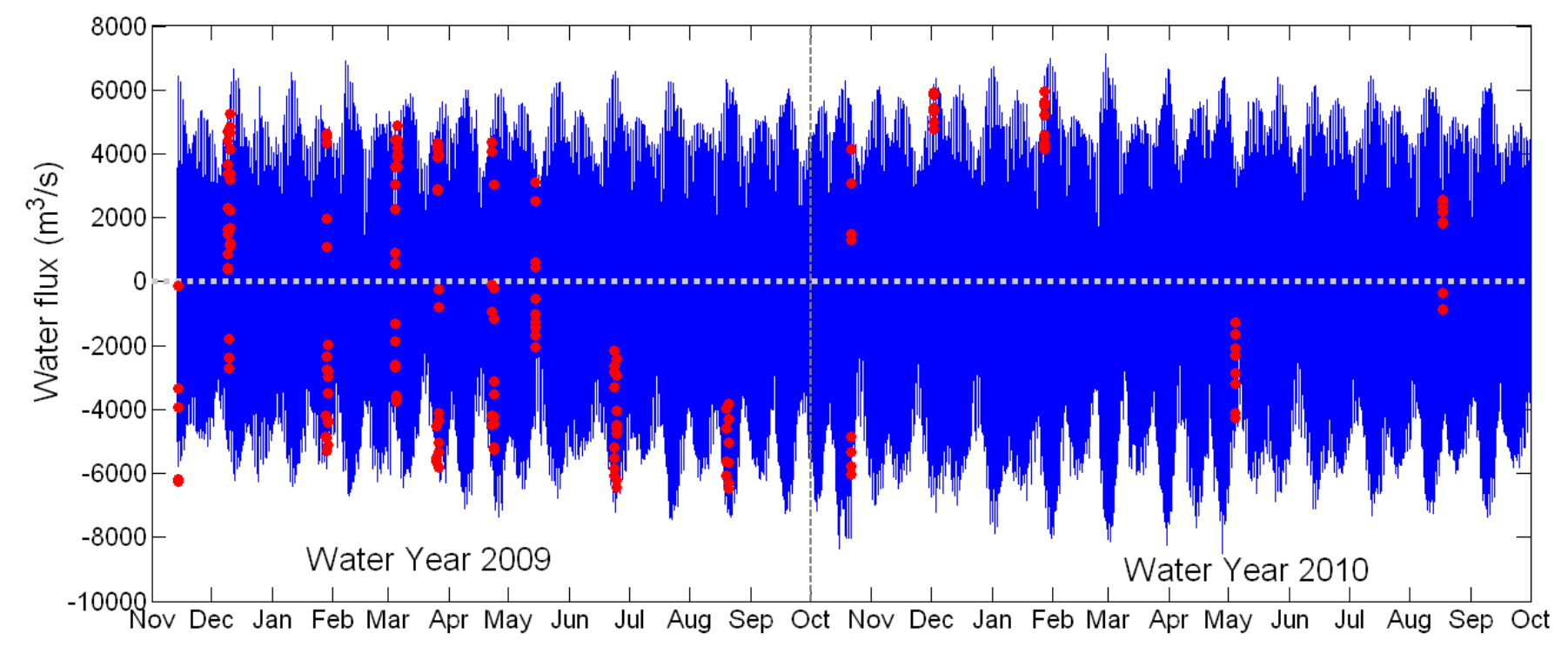
Results – Continuous Discharge

- Positive is ebb tide direction



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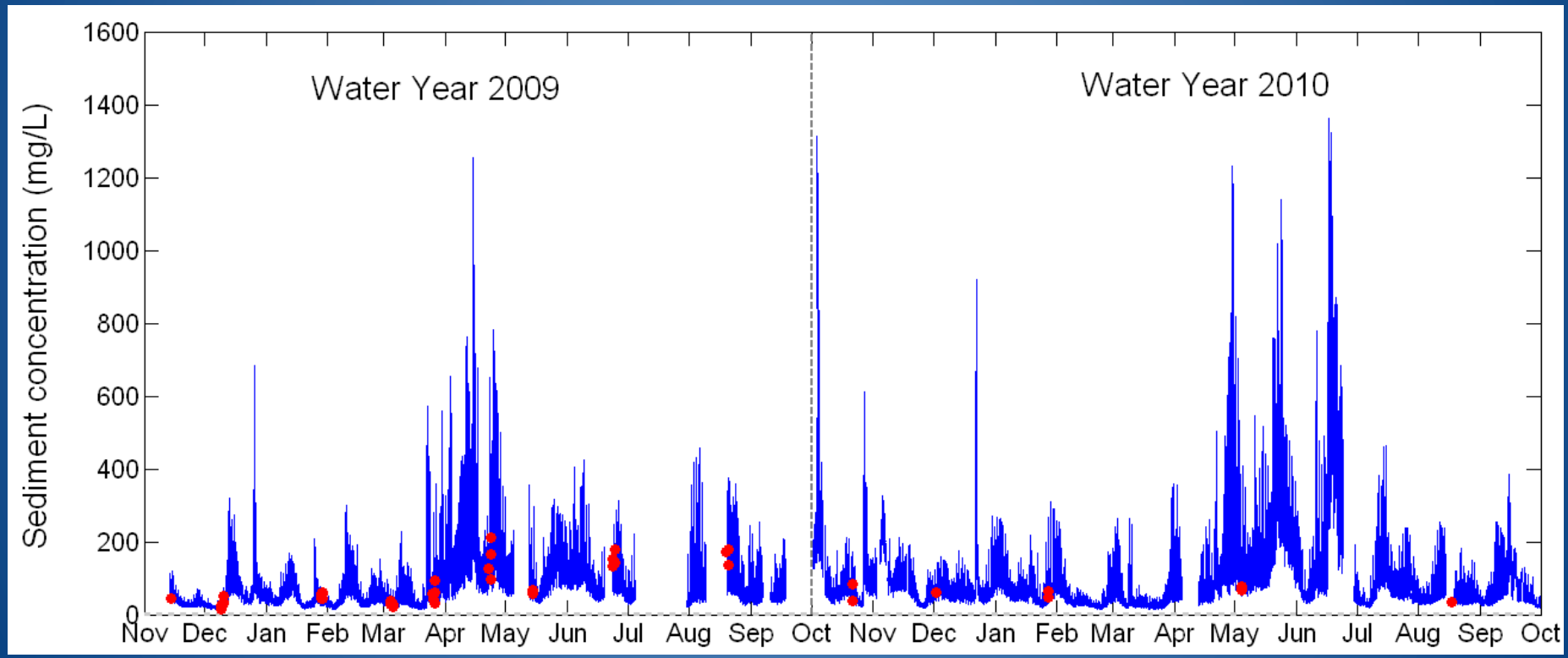
Results – Continuous SSC



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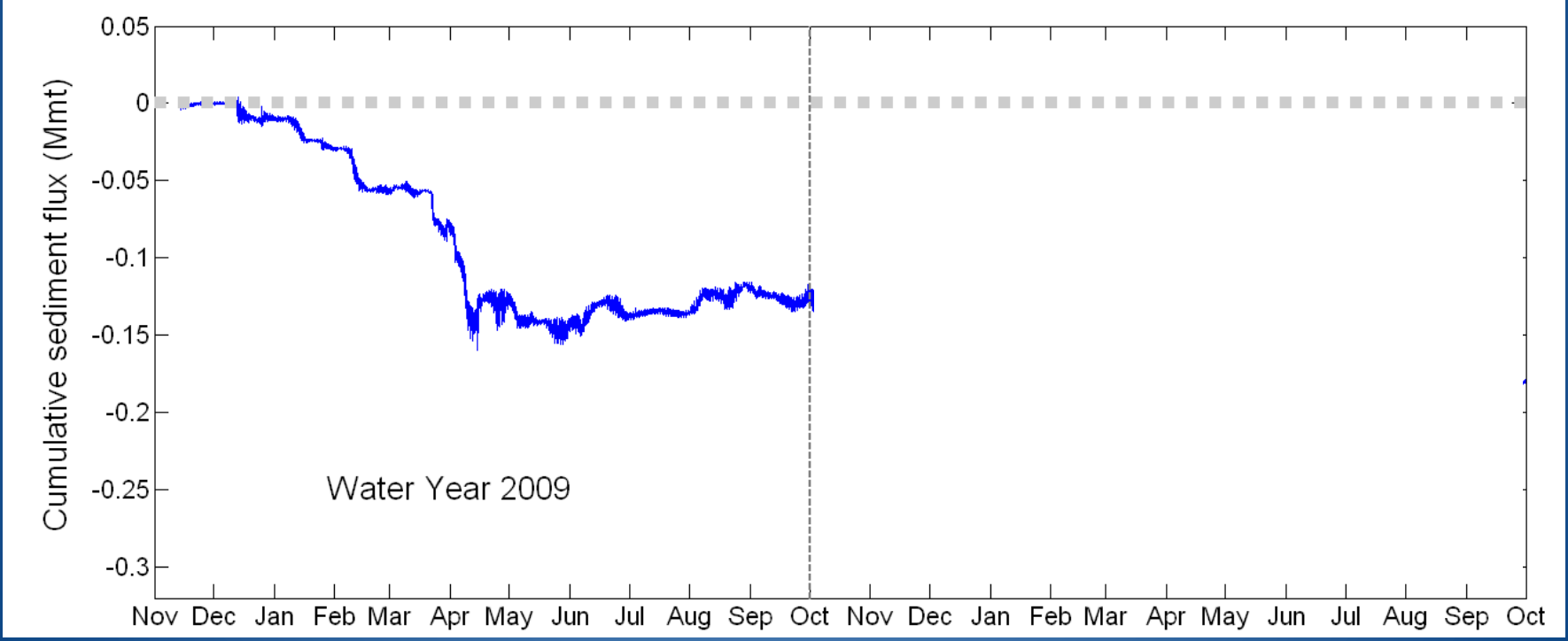
Results – Cumulative Sediment Flux

- Negative is flood direction (into far south SFB)



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Results – Cumulative Sediment Flux

- Negative is flood direction (into far south SFB)

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Results – Spring Flux (2009)

- Positive salinity gradient
- Density flow to the South
- SSC flux to the South

Results – Spring Flux (2010)

- Negative salinity gradient
- Density flow to the North
- SSC flux to the North

Results – Time for Restoration

- Preliminary suspended-sediment flux
  - –Tributary input: 20,000 m^3/yr
  - –Past Dumbarton: -200,000 m^3/yr for WY09
    -80,000 m^3/yr for WY10
- Approximate time to fill subsided volume (32 Mm^3)
  - –Tributaries input: ~1,600 yrs
  - –Past Dumbarton: ~200 yrs

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Future Work

- Further explore effect of physical processes on suspended sediment flux using existing data (*e.g.,* wind and waves)
- Study the relationship between the spring bloom and increased SSC
- Maintain flux station to quantify and understand yearly differences in flux

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