Modeling Turbidity for the Delta Smelt Biological Opinion

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- MWD: Paul Hutton
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- Disclosures
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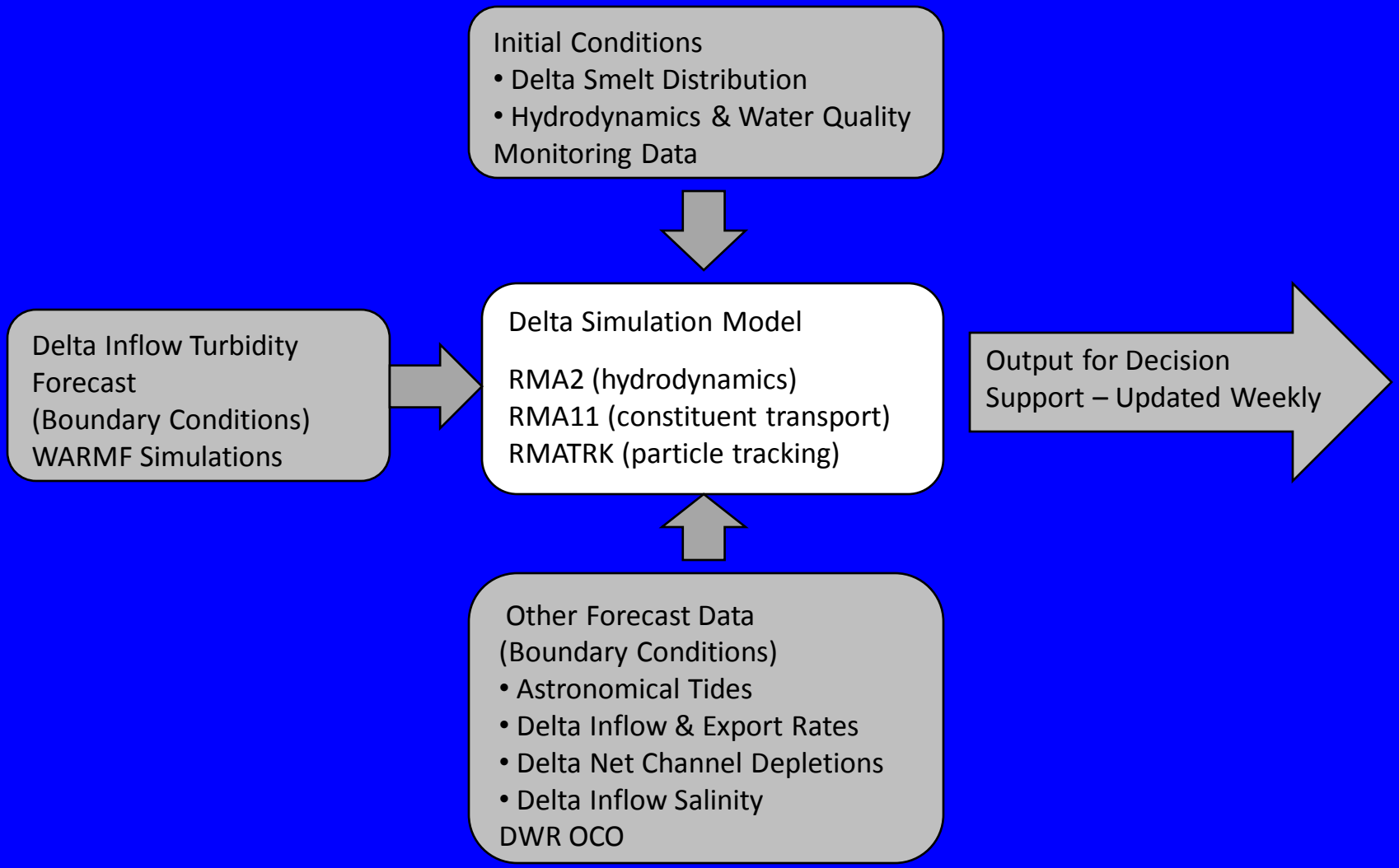
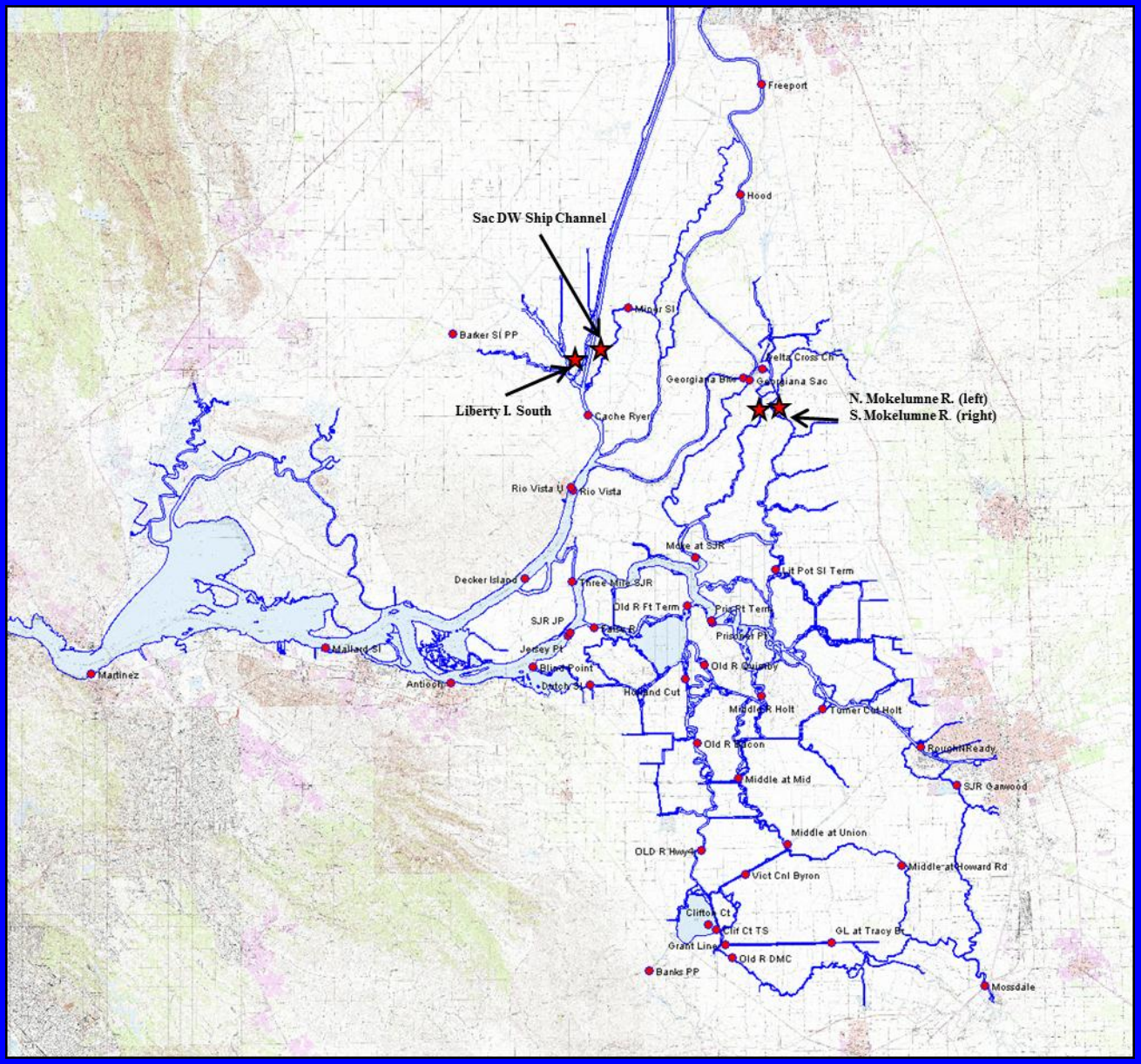
Background

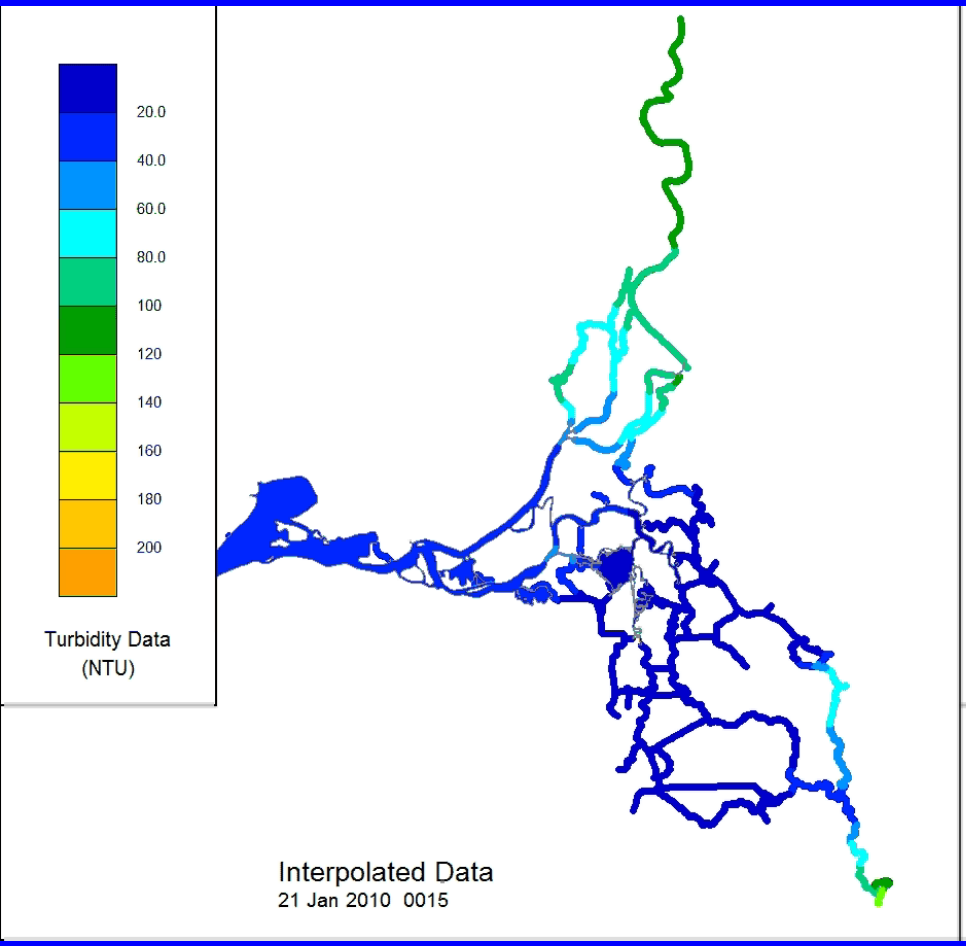
- Adult delta smelt hypothesized to respond to turbidity cues during peak winter “pulse flows” by moving to desired turbidity range, putting them in danger of becoming “salvage”
- Changes in Delta operations may be used to control the location of the turbidity field desired by delta smelt
- How? Using modeling, can predict location of turbidity field under different operational scenarios:
    - Turbidity transport model developed using RMA 2-D models
    - Output can be supplied to SWG (Smelt Working Group) weekly, with 3 week forecast
    - Adult delta smelt behavioral particle tracking model used to predict location of delta smelt

Plan for Turbidity Forecasting to Support Smelt Working Group



Turbidity Measurement Locations 2010/2011

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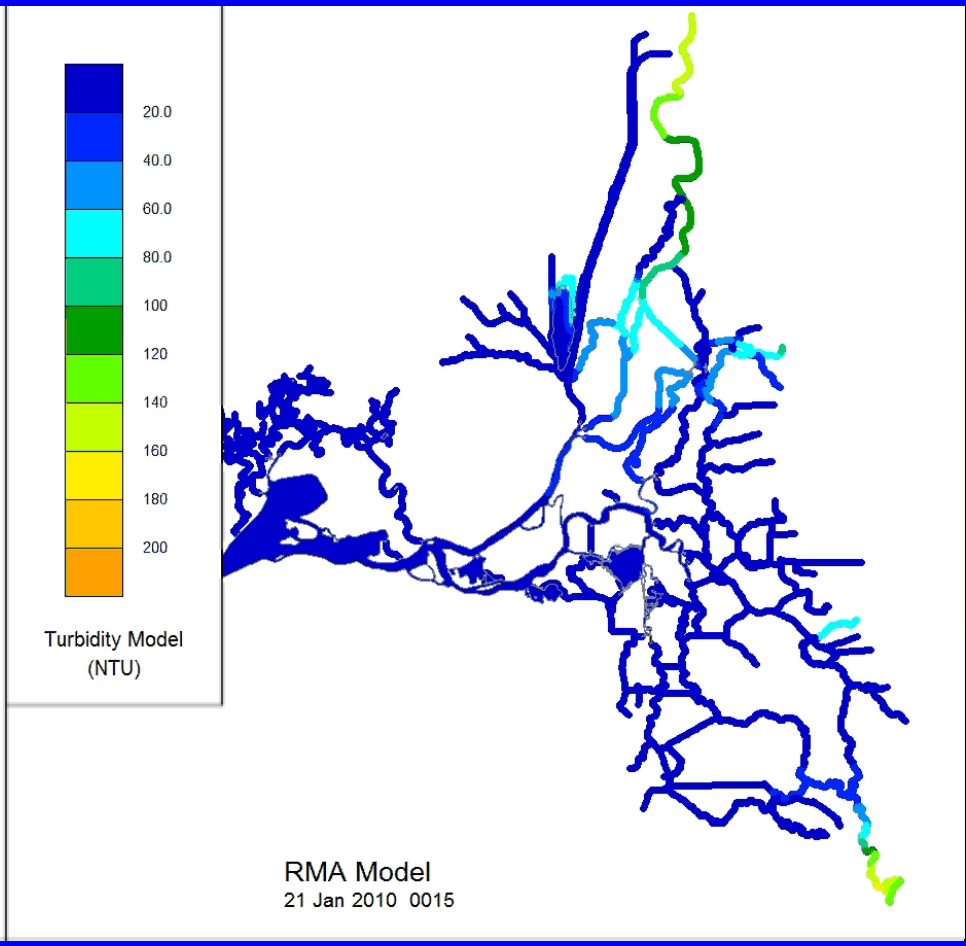
Turbidity Data
(NTU)
Interpolated Data
21 Jan 2010 0015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Turbidity Model
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RMA Model
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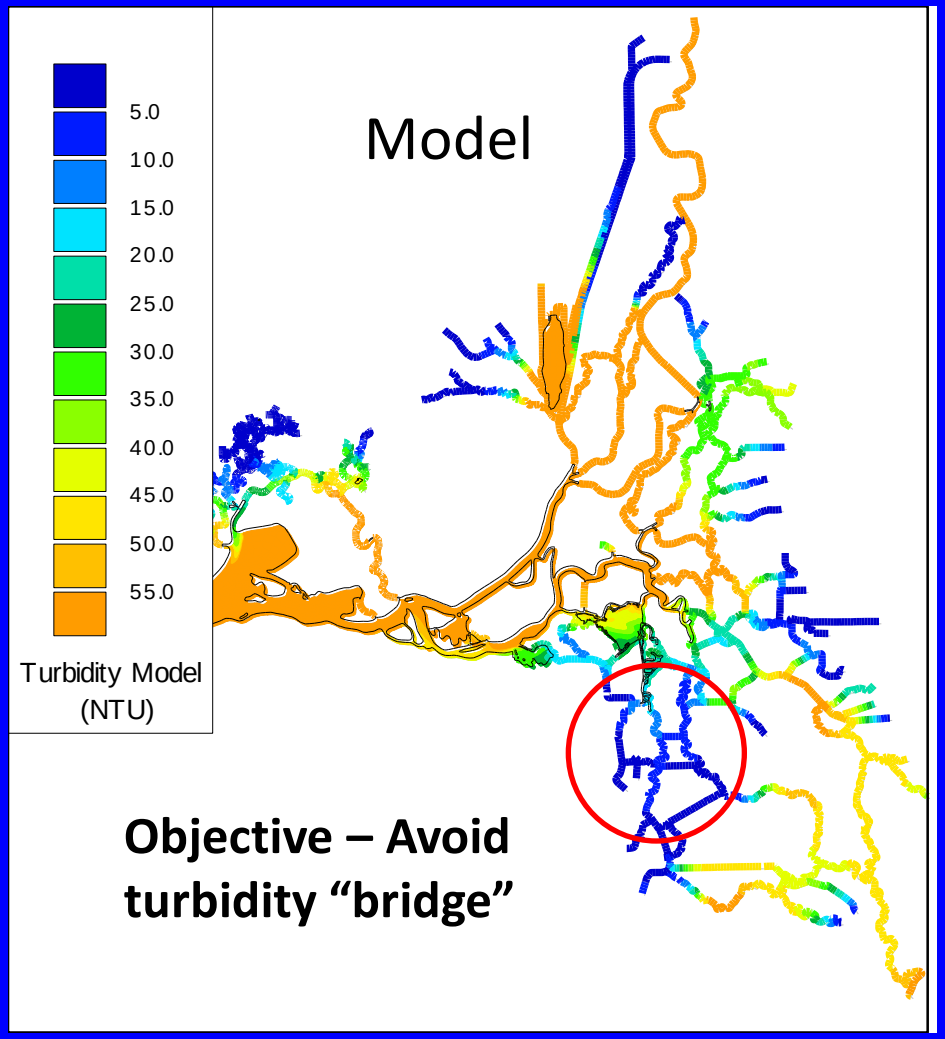
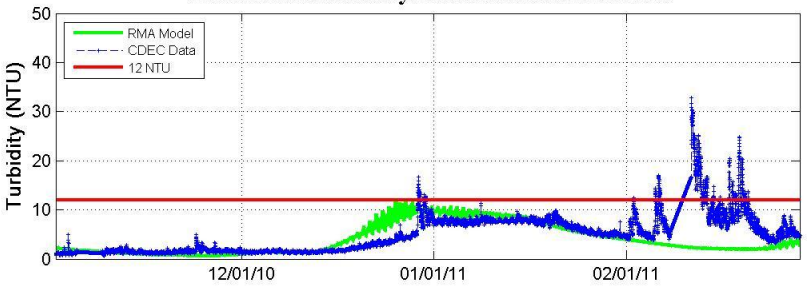
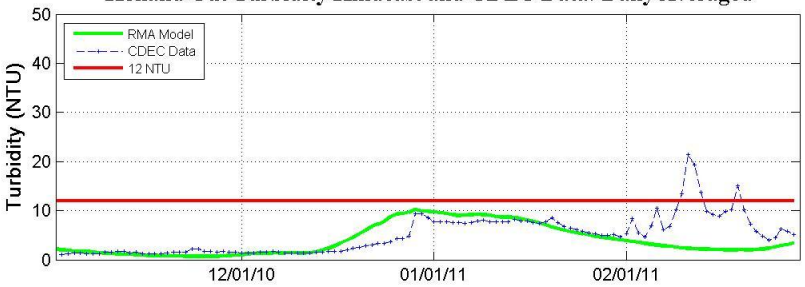


Holland Cut Turbidity Hindcast and CDEC Data



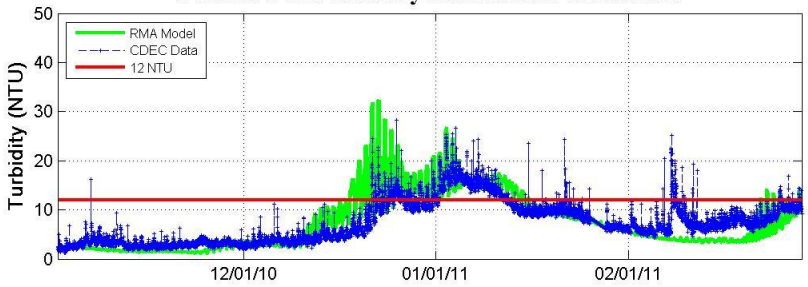
Holland Cut Turbidity Hindcast and CDEC Data: Daily Averaged



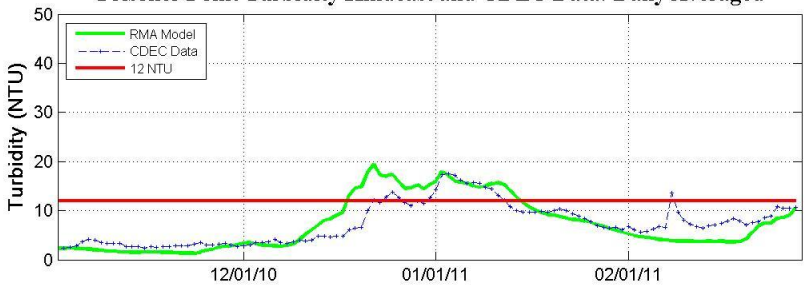
Creation Date: 15-Apr-2011

Holland Cut_MD_NTUPlot mguerin

Prisoner Point Turbidity Hindcast and CDEC Data



Prisoner Point Turbidity Hindcast and CDEC Data: Daily Averaged



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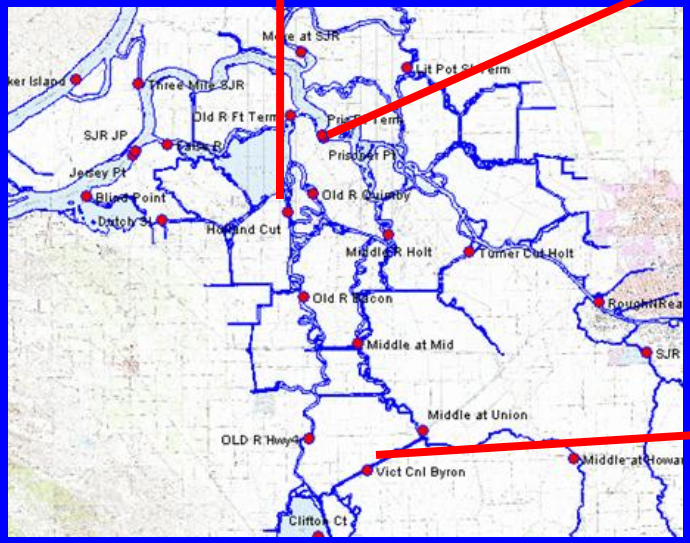
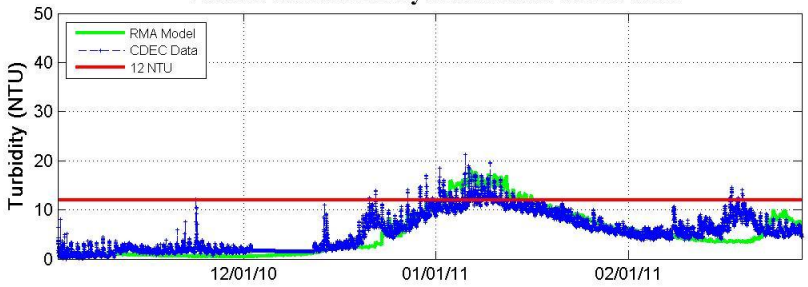
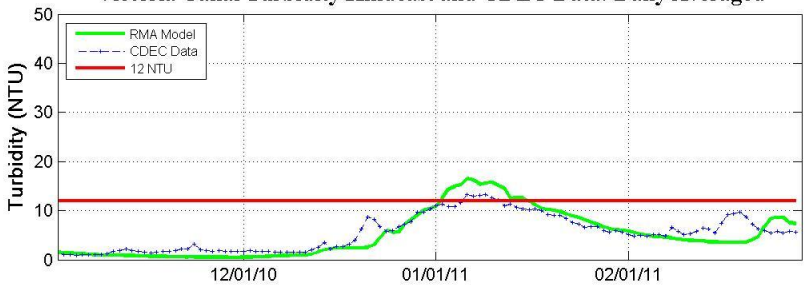


Victoria CanalTurbidity Forecast and CDEC Data



Victoria Canal Turbidity Hindcast and CDEC Data: Daily Averaged



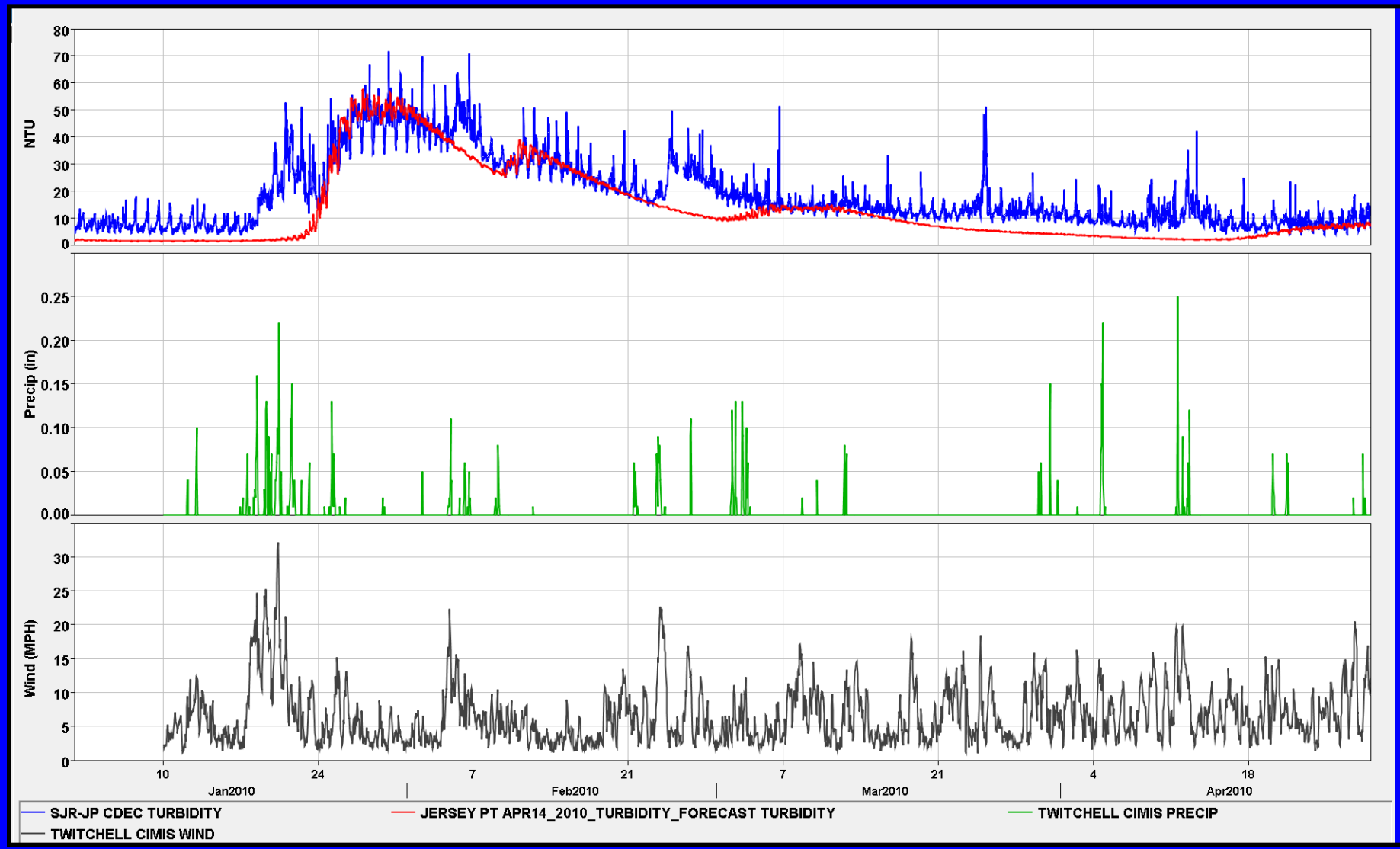
Creation Date: 15-Apr-2011

Victoria Canal_MD_NTUPlot mguerin

Complications:

- Turbidity modeled as a non-conservative constituent with decay in RMA 2-D model
- Modeling issues:
  - Turbidity modeling - not physically-based
  - Suspended sediment – there are governing equations for mass conservation and force balance for SS
    - Data needs to parameterize SS models numerous, not yet available
- Measurement issues:
  - Delta smelt known to respond to turbidity, not SS
  - Turbidity can be measured in real-time (automated)
  - SS concentrations need to be related empirically to turbidity

Modeled turbidity at Jersey Point, and elsewhere, influenced by wind, rain, runoff



Summary

- Turbidity "calibration" established in RMA-2D water quality model using three-region, decay coefficient
- Turbidity forecasting methodology demonstrated for rainy period of WY 2010, 2011
- Data needs, issues identified
  - Turbidity modeling is "event-driven" but data collection is not
  - Turbidity model is missing effect of wind re-suspension of sediment, sediment settling in some regions
  - Suspended sediment model parameters not yet available
  - Delta smelt experiments measure response to turbidity, not suspended sediment

Thank-you!