Forecasting Turbidity in the Sacramento-San Joaquin Delta

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  - Dave and Amye Osti and their staff, 34 North and DeepBlu

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Forecasting Objectives

- Use recent observed data, DWR and CNRFC forecasts, and watershed model output to generate three week forecasts of EC, Turbidity, and adult delta smelt (particle) distribution.
- Provide weekly forecasts for MWD, Fish and Wildlife Service, Smelt Working group, and others between December and March.
- Provide tools for evaluating alternate operations.
- This is the third year of the real-time modeling effort.
Data Sources

- California Data Exchange Center (CDEC)
  - Recent monitoring data
- California-Nevada River Forecasting Center (CNRFC)
  - 5-day flow forecast
- DWR Operations and Maintenance (O&M) group
  - DSM2 3-week forecast input files
- CIMIS meteorological data
  - Daily and hourly data received weekly
Models and Tools

- WARMF – Watershed Analysis Risk Management Framework (WARMF) Central Valley developed and operated by Joel Herr and Scott Scheeder, Systech
- HEC-DSS Tools for Time Series Management
- RMA Delta Model – Hydrodynamics, EC, Turbidity
- RMA Adult Delta Smelt Particle Model
- Information Dissemination through Bay Delta Live developed and managed by Dave Osti and staff, 34North
Process

- **Thursday Afternoon**
  - Receive DWR DSM2 forecast files
  - Receive WARMF forecast results
  - QA and Merge recent monitoring data with forecast information

- **Friday**
  - Delta Simulation Model
    - RMA2 (hydrodynamics)
    - RMA11 (transport)
    - Adult smelt model (particle tracking)

- **Monday Morning**
  - Review Results
  - Post results to Bay Delta Live
  - Prepare and submit forecast Summary
Managing Time Series

- Time Series stored in HEC-DSS format
- Automated download from CDEC web site though “plug-in” utility in HEC-DSSVue*
- QA with HEC-DSSVue Graphical Editor
- Merging of Time Series records with custom software tool
- RMA is a lead software development contractor for the USACE Hydrologic Engineering Center and has contributed extensively to the development of HEC-DSSVue

DSSVue Graphical Editor
Merging Time Series

![Image of software interface for merging time series data]
Turbidity Model

- Simulation of turbidity in the Delta as a function of tributary loading
- Uses a simple first order decay to represent averaged deposition/resuspension of suspended sediments or decay of organics
- An interim approach until a full sediment model is available (work is underway)
- Originally calibrated for 2007 conditions, updated for 2011 conditions

2011 Turbidity Hindcast Results
2011 Turbidity Hindcast Results
Adult Delta Smelt Particle Model

- All movement is accomplished by “surfing” the tidal flows
- Move away from high EC (representing desire to move upstream)
- Move toward higher (favored) turbidity
- Randomly explore region of acceptable habitat

Comparison of Adult Delta Smelt Particle Entrainment (CVP+SWP) to Observed Salvage (Normalized Weekly counts)
Forecast Products

- **Summary Assessment**
  - Pre-Forecast
  - Turbidity 3-Stations Performance and Summary
  - Smelt (Particle) Movement Summary

- **Forecast Boundary Conditions**
  - Tributary Inflows and Turbidity
  - Exports
  - Tidal Boundary

- **Simulation Output**
  - Turbidity time series at 3 compliance stations, SWP, and other in-Delta locations
  - Smelt (particle) distribution at three times during simulation period and time series of estimated particle entrainment at SWP/CVP
Turbidity Forecast Results
Sac River at Rio Vista

January 26, 2012 Forecast

February 16, 2012 Forecast
Turbidity Forecast Results
Little Potato Sl. At Terminous

January 26, 2012 Forecast

February 16, 2012 Forecast
Turbidity Forecast Results
Grant Line Canal

January 26, 2012 Forecast

February 16, 2012 Forecast
Turbidity Forecast Results
Three Compliance Locations

Prisoner Point Turbidity Forecast and CDEC Data

Holland Cut Turbidity Forecast and CDEC Data

Victoria Canal Turbidity Forecast and CDEC Data

Victoria Canal Turbidity Forecast and CDEC Data: Daily Averaged
Turbidity Forecast Results

Three Compliance Locations

- Prisoner Point Turbidity Forecast and CDEC Data
- Holland Cut Turbidity Forecast and CDEC Data
- Victoria Canal Turbidity Forecast and CDEC Data

Map showing locations: Freeport, Rio Vista, Prisoner’s Point, Holland Cut, Victoria Canal, Vernalis
Kodiak Trawl Survey and Particle Distribution Maps

Delta Smelt Distribution Maps

<table>
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<tr>
<th>Year</th>
<th>Survey</th>
<th>Report Type</th>
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To view station details, move mouse over center of pie chart.

Spring Kodiak Trawl Survey #2 of 2012 Distribution of Female Delta Smelt
(2/13/2012 - 2/16/2012)

www.dfg.ca.gov/delta/data/skt/DisplayMaps.asp
Comparison of DFG export salvage data and simulated particle entrainment
Bay Delta Live – Color Contour Map Display
www.baydeltalive.com
Bay Delta Live – Supporting Documents
www.baydeltalive.com

Model Methodology And Assumptions
Model Calibration Report Links
Smelt Distribution Map
Forecast Summary (shown)
Conclusions

- Successfully implemented a near real-time forecasting procedure for flow, EC, turbidity, and particle distribution
- Excellent progress integrating with the WARMF model for improved forecasting
- Produced weekly reports and results for dissemination through the Bay Delta Live web site

Future efforts
- Working toward transition to sediment modeling for turbidity simulation
- RMA has performed temperature modeling with DSM2 and RMA Delta model for BDCP that could be included as part of real-time work
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