Delta Simulation Model 2
improvements/extension for sediment & mercury

DSM2 User Group
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REED-HARRIS
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Delta Mercury Total Maximum Daily Load (TMDL)

- **1990** Sacramento-SJ Delta listed as impaired for fish consumption due to mercury [Clean Water Act 303 (d) list]

- **2010** Regional Water Quality Control Board adopted amendments to the Sacramento River and San Joaquin River Basin Plan to establish the Delta Mercury Control Program which establish Total Maximum Daily Loads (TMDL) for mercury in the Delta

- **2011** US EPA approved the TMDL and DWR is required to comply with the TMDL

Adapted from DiGiorgio, DWR
What areas are affected by the TMDL?

What areas require load reductions?

Adapted from DiGiorgio, DWR
Modeling Objectives to Support Hg TMDL

- Two models are being developed
  - Yolo Bypass
  - Delta Open Waters
- Goal: assess impacts of current & proposed operational changes on mercury methylation potential
  - Water management
  - Flood conveyance
Modeling Approach

Conceptual Models
- Understand processes

Numerical Model Development
- Identify key processes
- Prioritize key processes
- Represent processes in DSM2

Simulate Existing Conditions
- Obtain available field data
- Identify data gaps
- Calibration/validation
- Sensitivity testing

Scenario Testing
- How would changes in operations affect mercury methylation potential?
Extending DSM2 for Sediment & Mercury

DWR Delta Modeling Staff
- Upgrade DSM2 water quality with new GTM (General Transport Model)
  - Add Sediment Transport
  - Add new Water Quality constituents if needed
- Link GTM with Mercury Cycling Model

Reed Harris Environmental Ltd
- Develop Mercury Cycling Code
- Test Calibrate Apply
Previously planned Sediment Transport Model may not cover all important processes for mercury.

**Sediment Transport**
- Advection (go with flow)
- Reaction
  - None for sands
  - Flocculation for clays
- Dispersion (mixing)
- Settling
- Resuspension
- Bed load

**Mercury Model**
- Transport
  - Sorbed to sediment
  - Dissolved in water
- Reaction
  - Mercury cycle including methylation
- Dispersion (mixing)

**Bed Representation**
- Deposition/scour
- Anoxic conditions
- MeHg production
- Release of MeHg to water column

Add Organics
Initial Model Development: focus on Water Column

Well mixed suspended sediment concentration for:
- Fines (silt/clay & organics) Hg binds to fines
- Sand Hg does not bind to sand

Assume no bed load

Bed interactions represented as boundary fluxes estimated from data/literature

Flow (cfs)
Tributary concentrations (mg/l)
Channel Geometry
Dispersion & rate coefficients
Additional parameters for erosion/deposition (TBD)

Concentrations every 15 min

Water Column
Bed (sediment compartment)
DSM2 Sediment and Mercury Model Status

Where we are now
- Hg Coding & Testing
- GTM Coding & Testing
- Sediment Planning, Coding & Testing
- Water Quality Planning, Coding & Testing

Where we are going
- Model Integration
- Calibration/Validation

Research & code development
Thank You!

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