DOER Dredged Material Management (DMM) Focus Area

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Jacksonville, FL
24-26 May 2011

US Army Corps of Engineers
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Dredged Material Management (DMM) Focus Area

- **<u>Situation</u>**: Management of dredged material is rapidly becoming more of a challenge (environmentally, economically) to USACE in achieving its navigation mission

- **<u>Barriers</u>**: Existing knowledge of dredged material processes is not sufficiently refined to address current issues, and current dredged material management techniques and technologies can be improved, or innovative ones developed, to meet this challenge and increase beneficial use.

- **<u>Solution</u>**: Support sound environmental management and engineering practice by advancing the science, engineering, and technology applied to navigation dredging operations regarding both short and long-term management of sediment.
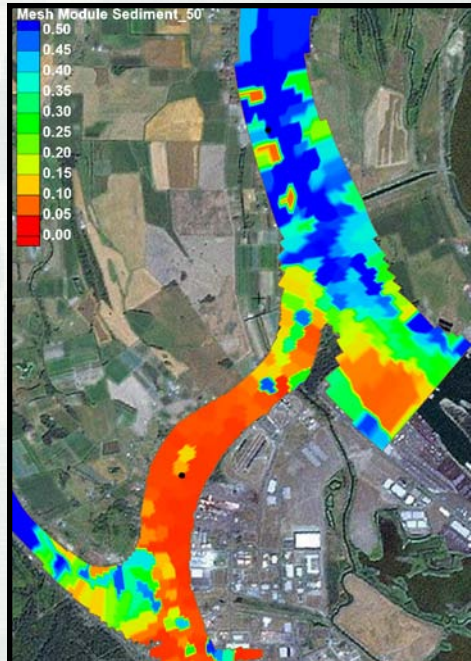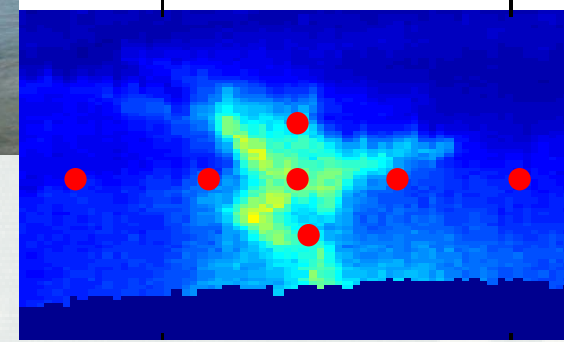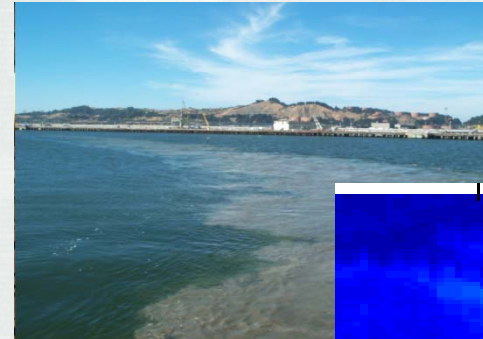
SDP and DMM Products
Everything is Connected!

- **Process Studies**
  - ► Wave/current erosion
  - ► Sediment- Fluid Interactions
  - ► Settling Velocity
  - ► Sedimentation
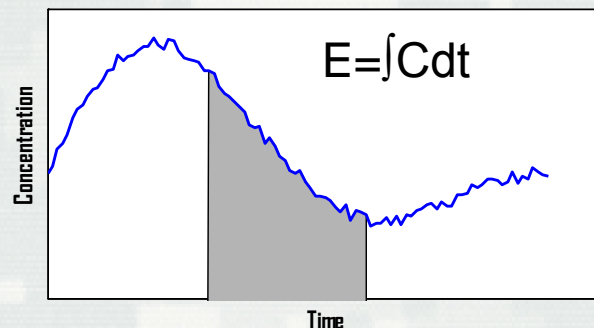
- **Near-field algorithms and models**
  - ► STFATE
  - ► Plume dynamics
  - ► Dredge Source Terms

- **Far Field Models**
  - ► PTM
  - ► LTFATE
 - ► Sediment Budgets
  - ► SMS Tools for exposure

Support Risk, Effects, Habitat, DMMP, Feasibility Studies

$$E = \int C\,dt$$

CE-Dredge Application

- Problem
    - Dredging data stored in multiple locations/formats
    - Information/data difficult to access, visualize, analyze in timely manner
    - Access to nat'l/regional information/data is limited
    - Redundant data entry for multiple uses
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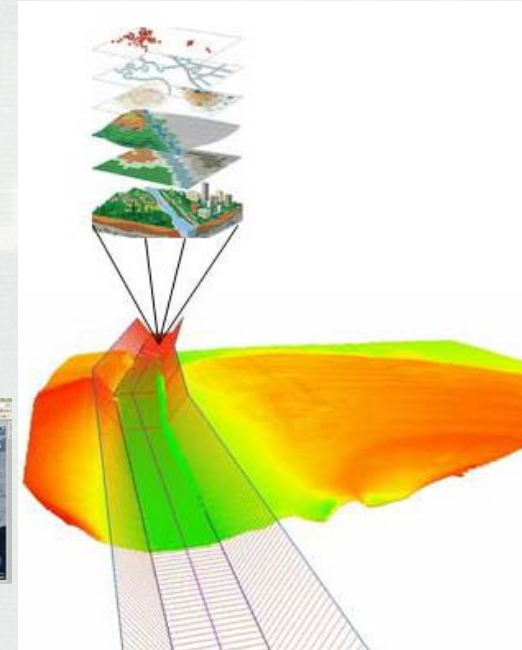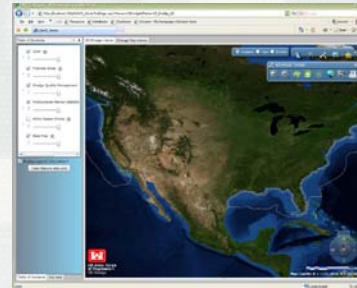
- Objective
    - Integrated web-based system to access, visualize, archive nat'l &- regional dredging data/info
    - Standardize tools improve efficiency, planning & mgmt ongoing projects
    - Improve forecasting budgets, schedules, volumes, capacities
    - Facilitate maintaining institutional knowledge

- Approach
    - Establish field guidance PDT
    - ID field needs and, business processes
    - Coordinate w/build on existing dredging tools/services/databases
   - Design, develop, field test, document, deploy, train

Scoping of Data Streams for Support of Near-Realtime Decision Making

- Problem
  - Dredging project decisions oftentimes must be made on short suspense despite the numerous factors warranting consideration.
  - Vast amounts of dredging-related data are currently available in real and near-real time, but these data streams may not be presently utilized to their fullest extent

- Objective
  - Scope functional requirements and level of need for a dredging decision-support tool providing critical data streams to Corps dredge managers
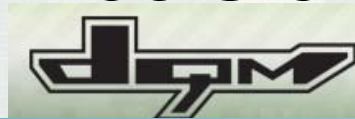
- Approach
  - Survey Corps dredge managers and decision makers concerning data needs, existing sources, and current practices
  - Identify online data sources, especially through other federal data collection and sharing initiatives
 - Scope functional requirements

SMS Framework for DMM Tools

- Problem
  - DMM tools have no common interface or interconnectivity
  - Presently, it is complex and time consuming to transfer data between tools
  - This results in less use of tools

- Objective
  - Incorporate dredging models and tools into SMS
  - Integrate dredge models with other USACE large domain models
  - Integrate dredge models with SMS data sources
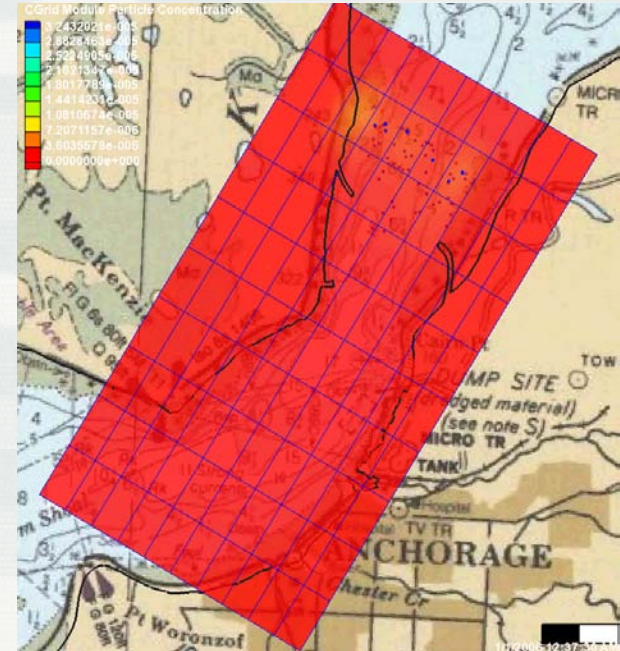
- Approach
  - PTM and LTFATE in SMS
  - Near-field FATE models in SMS
 - GIS data for DM models
  - Workshops/Tech transfer

Models for Dense Fluid Dynamics

- Problem
  - Current models for placement dynamics are idealized and limited in breadth of application
  - Cannot address increasingly complex Corps applications with these models

- Objective
  - Develop new generation of placement models for discrete and continuous discharge (barge and pipeline placement)
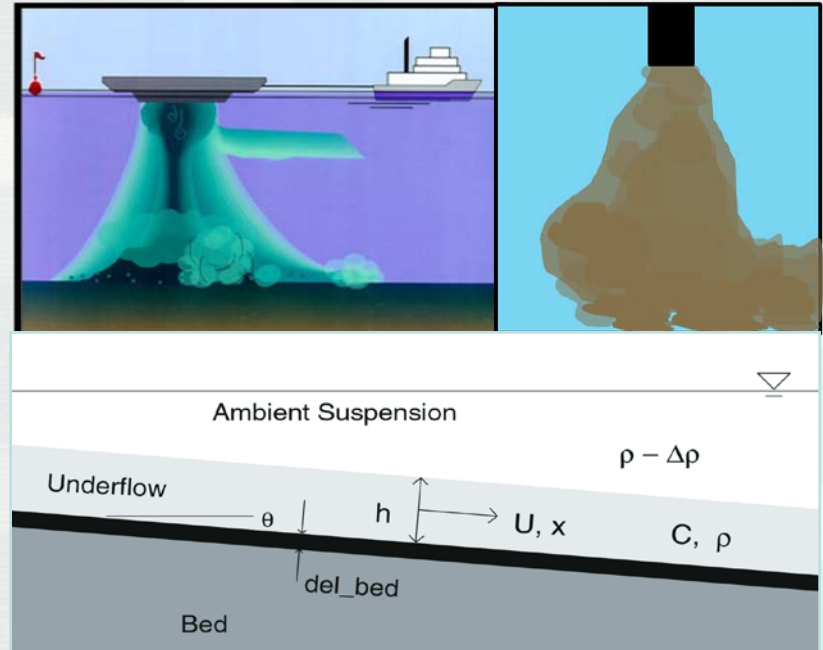
- Approach
  - Investigate existing models
  - Literature review
  - Develop new 2-phase flow algorithms
 - Validation of new models at Corps site

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Nearshore and Wetland Placement Tools

- Problem
  - WwN, BU, RSM, and sustainable solutions will require placement of DM in complex environments
  - Lack of understanding of how DM transports through these environments

- Objective
  - Develop guidance documents and tools for placement in nearshore and wetland locations
  - Methods to optimize natural distribution of DM in these environments
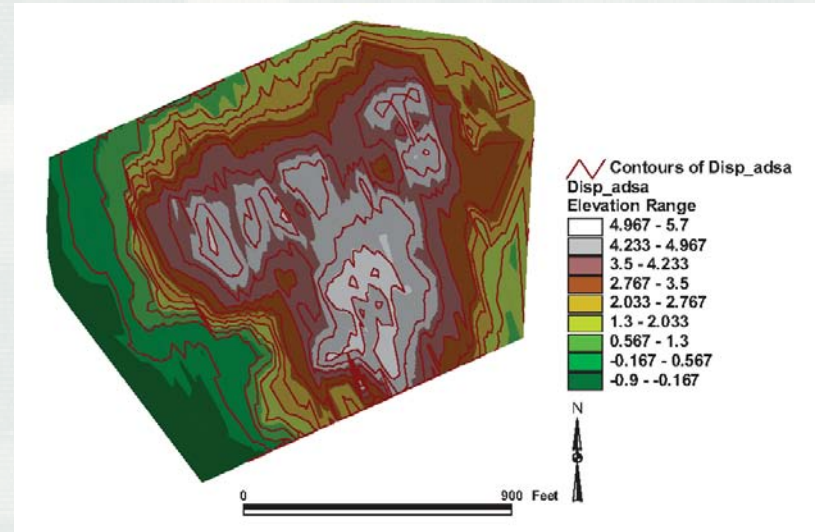
- Approach
  - Work with LaCPR and others to assess success and issues with ongoing projects
  - Use ongoing field studies in conjunction with DOER research to develop guidance and tools

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Open Lake and Bay Dredged Material Placement

- Problem
    - DM suitable for open water placement if often placed in CDFs or far offshore due to precedent
    - CDF capacity limited
    - Stakeholders (States) are concerned about providing permits for lakes/bays

- Objective
    - Develop and demonstrate methods to quantify impacts from all aspects of open lake/bay placement (sedimentation, turbidity, chemistry, habitat, toxicity)

- Approach
    - Work with State and other regulatory agencies to develop robust, defensible methods to address permitting issues

Bed and Fluid Mud Transport Model
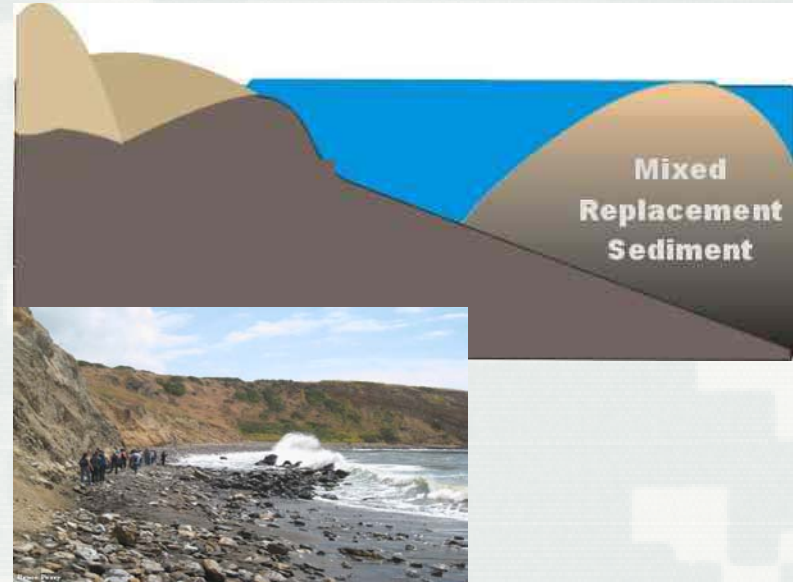
- Problem
  - Dredged material placement issues are becoming more complex
    - Nearshore placement
    - Beneficial use
  - Present methods cannot represent critical processes
 - Predictive capabilities are required

- Objective
  - To develop multi-grain sediment transport algorithms that replicate critical processes for dredged material fate, including fluid mud and bed load

Mixed Replacement Sediment

- Approach
  - Review existing models, new methods, and data (SDP)
  - Develop new set of comprehensive algorithms
  - Incorporate into LTFATE
  - Validate through appropriate application

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Re-Engineering of D2M2 Software
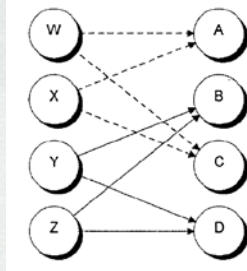
- Problem
  - D2M2 is a application that systematically evaluates numerous placement options and identifies those options that are best (either from a cost or environmental perspective), but this application is outdated.

- Objective
  - Reengineer D2M2 and add additional capabilities, including a decision-analytical model for integration of stakeholder values and GIS module for spatial optimization and data visualization

- Approach
  - Rewrite to conform to current software engineering principles
  - Incorporate decision and GIS module for spatial optimization and data visualization
  - User manual and documentation for training

Dredging Data Trends and Tools

- Problem
  - To conduct system-level analyses, an in-depth understanding of dredging is required from the channel reach level, to the project level, upward to the regional and national levels
  - Dredging Quality Management (DQM) collects these types of data, but system analysis capabilities limited.

- Objective
  - Provide users with applications to address specific, prioritized needs
  - Reduce time, complexity and margin for error involved in manual data analysis
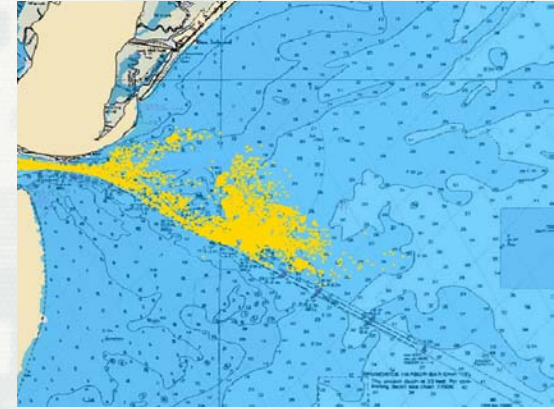
- Approach
  - Survey USACE to identify and prioritize trends analysis needs
  - Examples of needs include hopper dredge utilization tool, turtle take analysis application, and economic load analysis
  - Design, develop, field test, document, deploy, train

Agitation Dredging Decision Support Tool

- Problem
  - Agitation dredging, where practiced, relies on experienced Quality Assurance personnel to minimize dredged material re-entering the channel
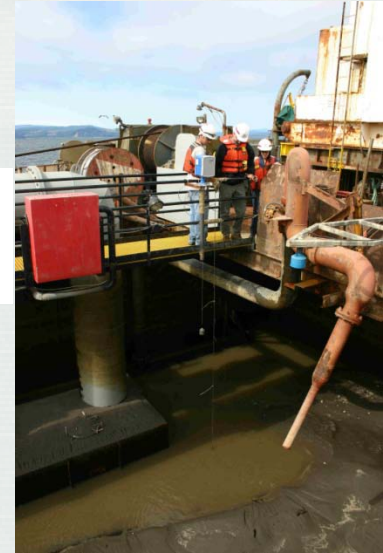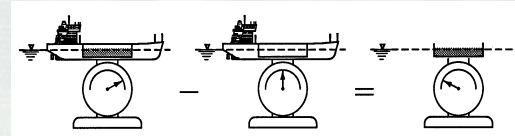
- Objective
  - Work with natural forces when possible
  - Improve accuracy of hopper dredge overflow predictions
  - Increase dredging efficiency to reduce costs

- Approach
  - Use DQM data and dredge process models to provide detailed input to the Particle Tracking Model (PTM).
  - Use PTM results to evaluate dredging scenarios – tune to site specific conditions as needed
  - Use NOAA operational forecast models and DQM data to provide near real-time guidance for dredge operations

Bin Measure for Dredging Contract Payment Purposes

- ## Problem
  - Rental hopper dredging contracts ($120M in FY10) don't provide contractor incentive to optimize production
  - Contract payment based on hopper (bin) loads require manual soundings

- ## Objective
  - Dredging Quality Management (old SI) automated dredge monitoring system installed on every hopper dredge in US
  - Use DQM to deliver automated hopper load measurement technology for equitable payment basis that incentivizes contractor to optimize production

- ## Approach
  - Develop dredge status and production module to base hopper load measurement upon
  - Develop improved hopper load measurement technology
  - Conduct technology field demos with districts and contractors to prove accuracy, precision, and equity

YOUR INPUT

- What other needs do you have in dredged material management?
  - ► DMAM – get em up and let us know!
  - ► Contact focus area or program manager
  - ► Timothy.L.Welp@usace.army.mil