

The Particle Tracking Model (PTM)

PI: Tahirih Lackey

Motivation: To predict the far-field fate of resuspended sediment

Environmental Concerns:

- ❑ Total Suspended Solids (TSS) concentration
 - ❑ light attenuation
 - ❑ fish and larval migrations
- ❑ Contaminants
- ❑ Sediment deposition
 - ❑ egg burial
 - ❑ coral reefs



The Particle Tracking Model (PTM)

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PTM is a Lagrangian particle tracker that models transport processes (advection, diffusion, deposition, etc) for representative parcels to determine constituent (sediment, contaminants, biologicals, etc) fate.

Input Requirements

- Grid/Bathymetry Data
- Hydrodynamic Data
- Released Sediment Characteristics
- Release Protocols
- Native Sediment Data

PTM

Time-dependent
Particle Positions
 $P(t,X,Y,Z)$

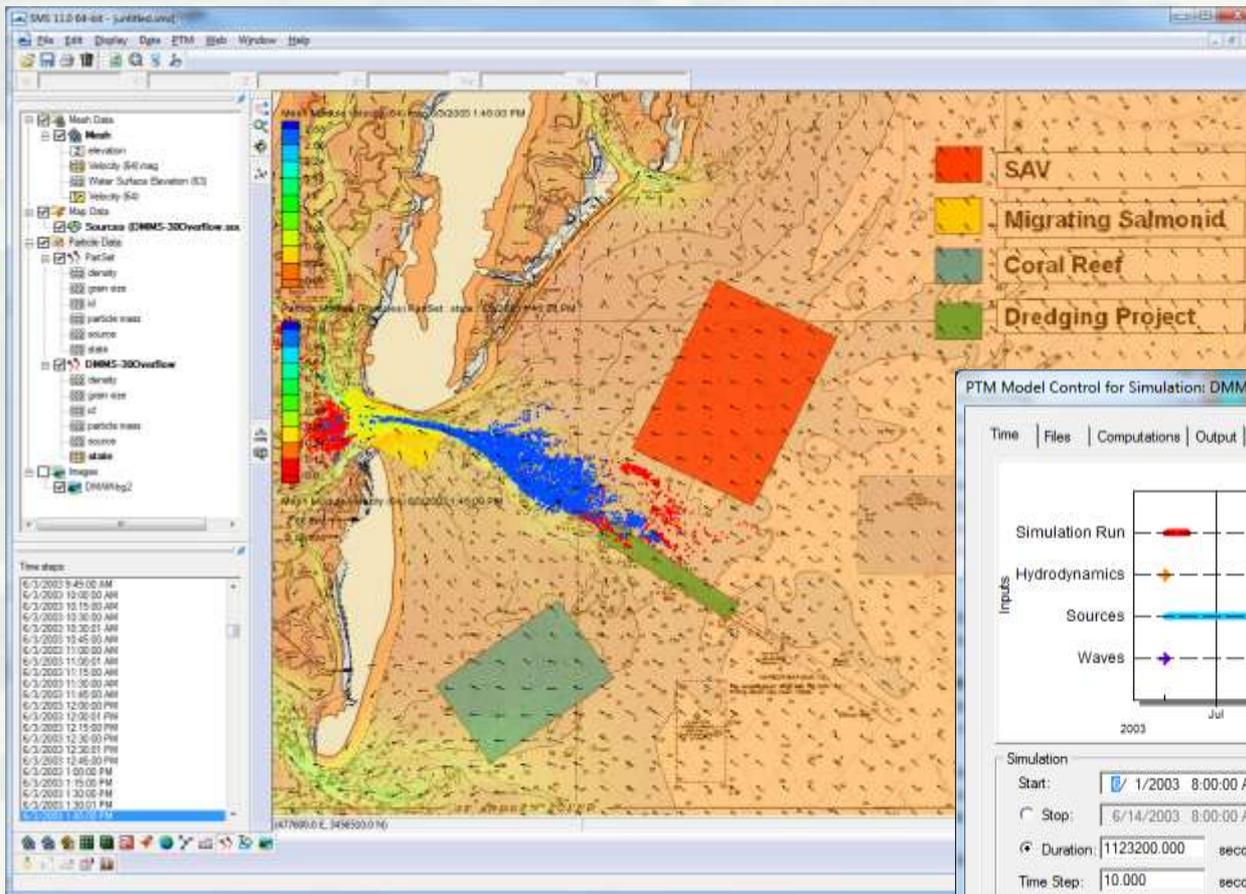
PTM/Surface-water Modeling System (SMS) Data Analysis Tools

- Deposition
- Concentration
- Exposure
- Accumulation
- Pathways

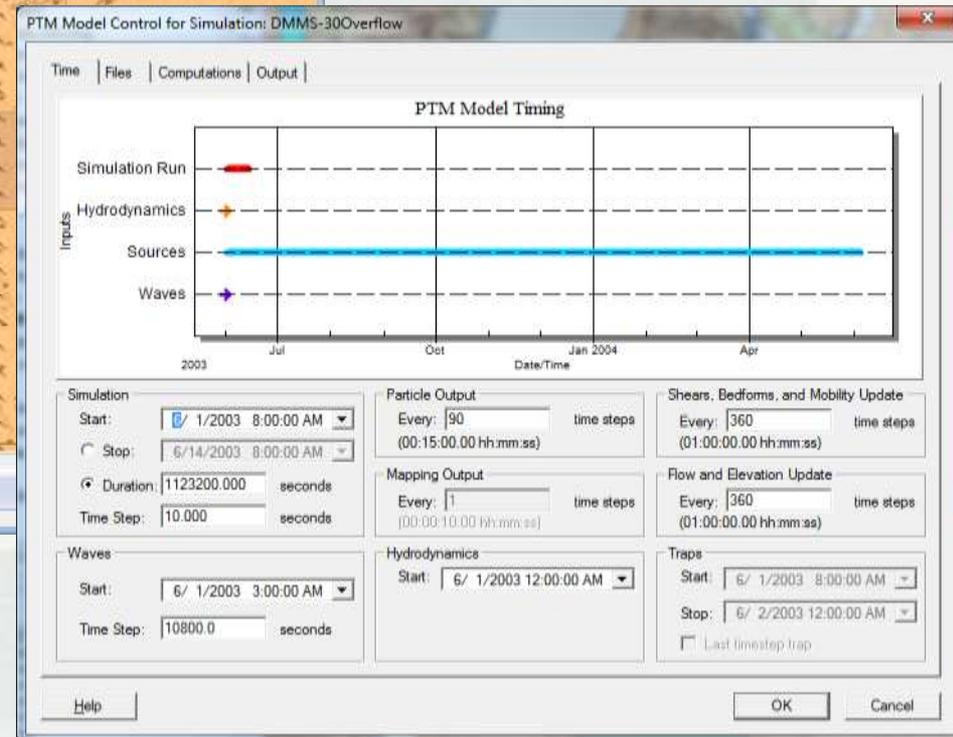


SMS: PTM I/O, Visualization, and Analysis Interface

PTM has a user friendly interface for model input and a powerful visualization for model output.



SMS/PTM interface

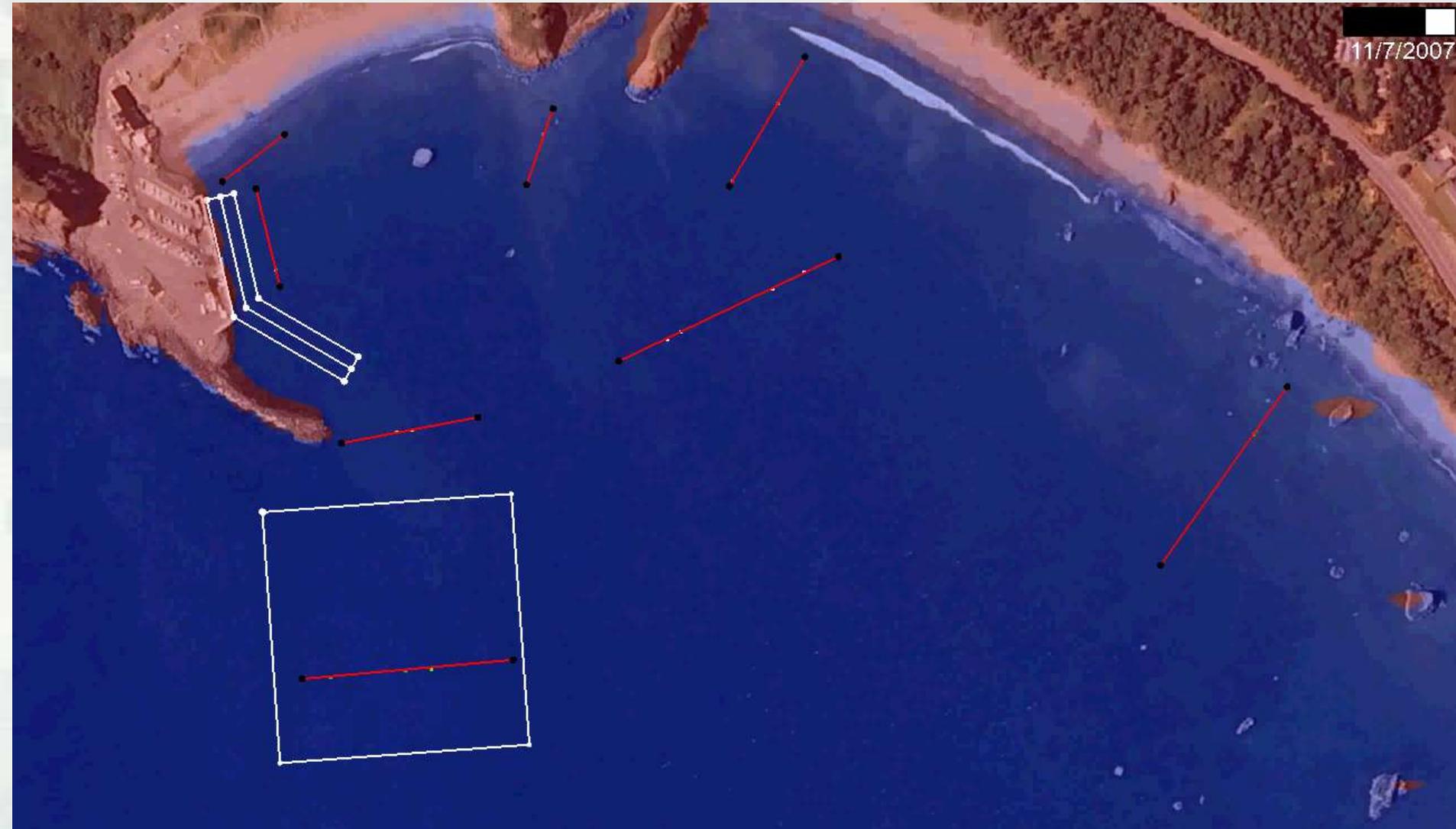


SMS/PTM Input interface

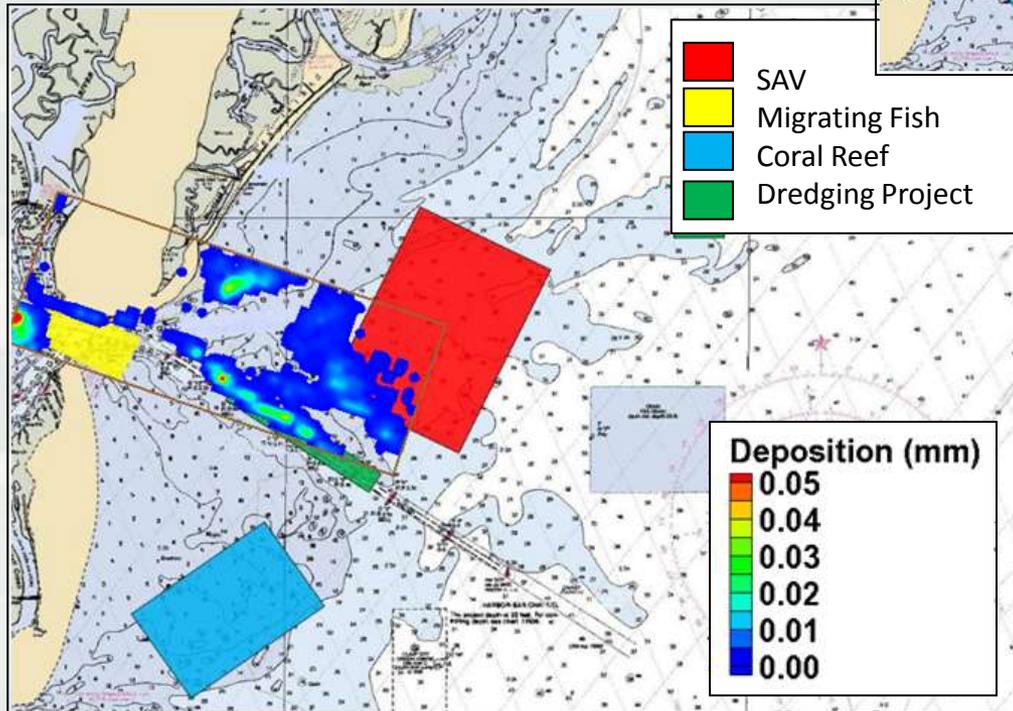
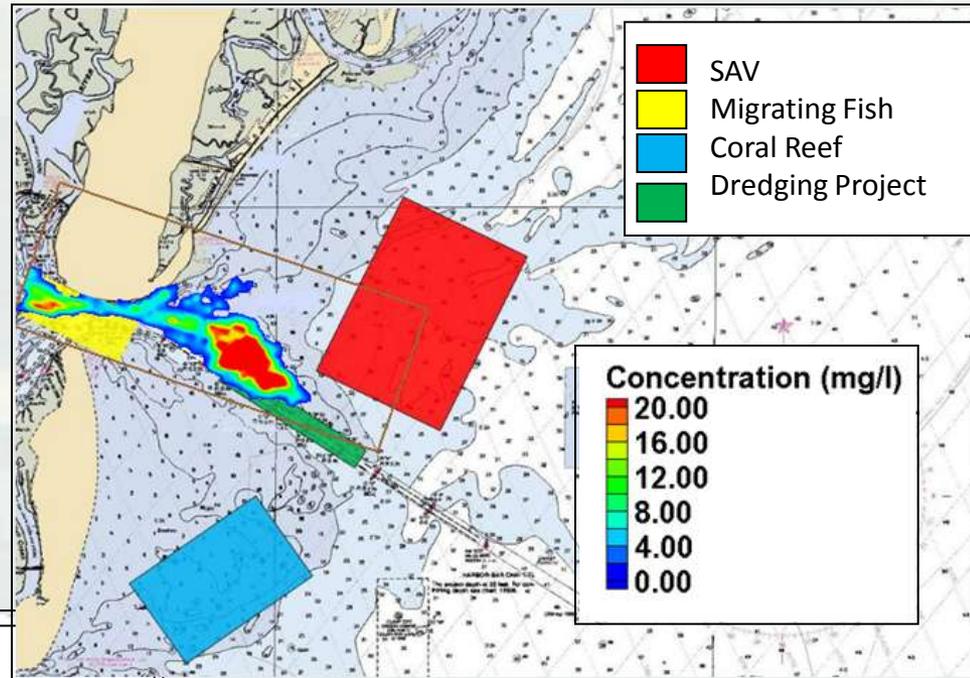
Port Orford, Oregon

Modified Breakwater, Erosional Transport

(particles are color coded based on initial position)



Suspended Sediment Concentration and Deposition Mapping

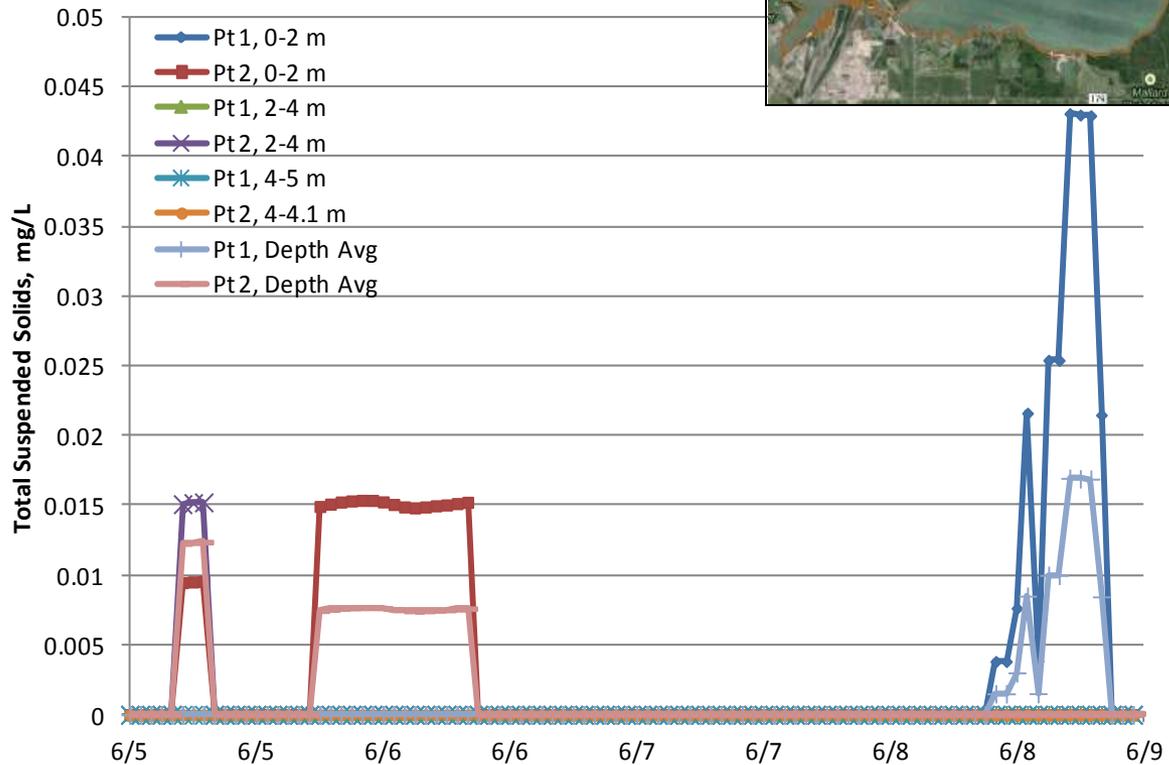
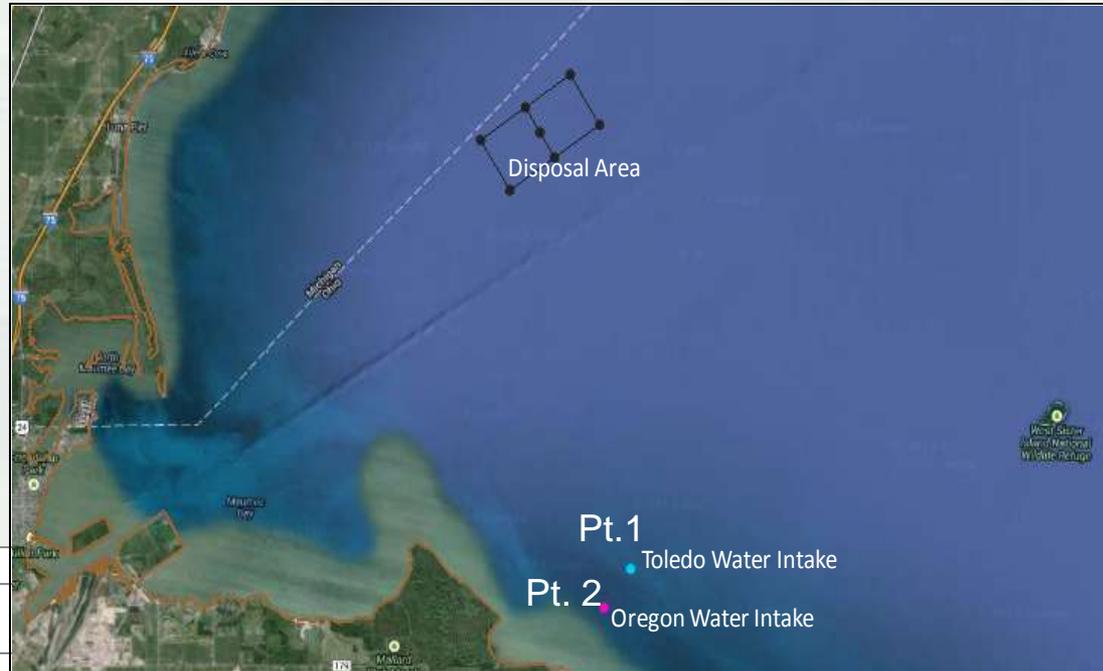


ERDC

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Toledo Harbor

Map of Open Water Placement sites near water intakes



Suspended Sediment Concentration at Water Intakes (vertically binned from bottom)

Benefits of a Lagrangian model

Numerical Efficiency and Accuracy

- Models only independently user specified sources
- Model is uncoupled from hydrodynamics, so extremely efficient for multiple scenarios and exploring unknown parameters
- Most projects can be run by the user on a PC

Analysis Capabilities

- Visualization is user friendly with SMS interface
- Sediment pathways are easy to identify
- Post processing items like concentration, deposition, etc.
- Time histories



Who is using PTM?

Numbers from the beginning of FY15...

- PTM/SMS Non-Government Users (domestic and international)
 - ▶ Commercial: 40 organizations, 63 licenses
 - ▶ Academic: 31 organizations, 35 licenses
- PTM/SMS Government Projects/Users
 - ▶ Districts: 13+ (*Districts counted are where PTM projects occurred. In some cases there are multiple projects within a District.*)
 - ▶ Other agencies: EPA, Navy



What are they doing with the model?

PTM is being used to model:

- ▶ CSO outflow sediment, constituents, and debris (multiple sites)
- ▶ Sediment transport from dredges (multiple sites)
- ▶ Contaminant transport from dredges (multiple sites)
- ▶ Propwash transport – sediment/contaminants (San Diego)
- ▶ Erosional transport (Port Orford)

- ▶ Larval fish transport (multiple sites)
- ▶ Egg transport in Newark Bay
- ▶ Water particulates on the Gulf Coast

References:

<http://el.erdc.usace.army.mil/dots/doer/ptm.html>



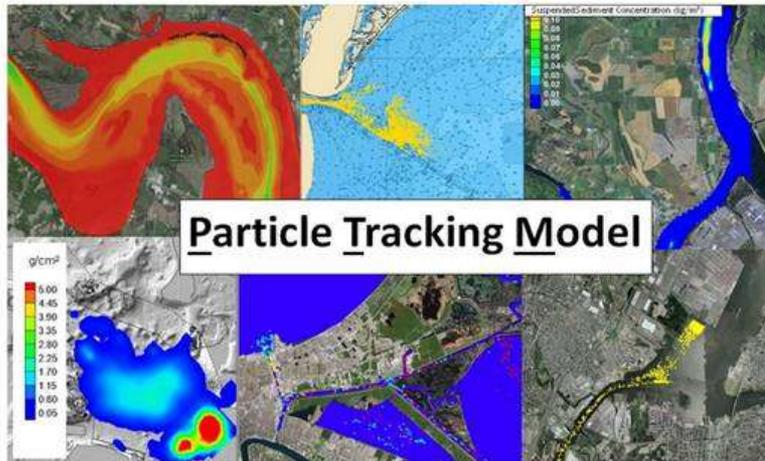
New PTM Website

(Dredging Model Data Integration Framework Web-interface)

PTM Sediment Transport

Contact ✉

Particle Tracking Model, a Lagrangian particle tracker numerical model to simulate particle transport processes.



Particle Tracking Model

Input Parameters

- + Hydrodynamics
- + Native/Bed Sediment Characterization
- + Simulation Temporal Details
 - Grid (Bathymetry)
 - Bed Porosity
 - Temperature
 - Salinity
 - Diffusion Parameters
 - Computational methods and numerical scheme choices

Output Parameters

- + Particle Output File (_particle.h5)
- + Mesh Data Output File (_mesh.h5)



Access

Documentation

Workshop Test cases

Case Studies

Includes:

- Technical Reports
- Technical Notes (including a series of TNs on model usage)
- Journal Papers
- Fact sheets

Includes: Basic test cases that guide new users in model usage including data analysis techniques

Will include a library of case study vignettes. (DOTS Activity FY16)

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Questions?

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