Overview of the SMS (v11.0)

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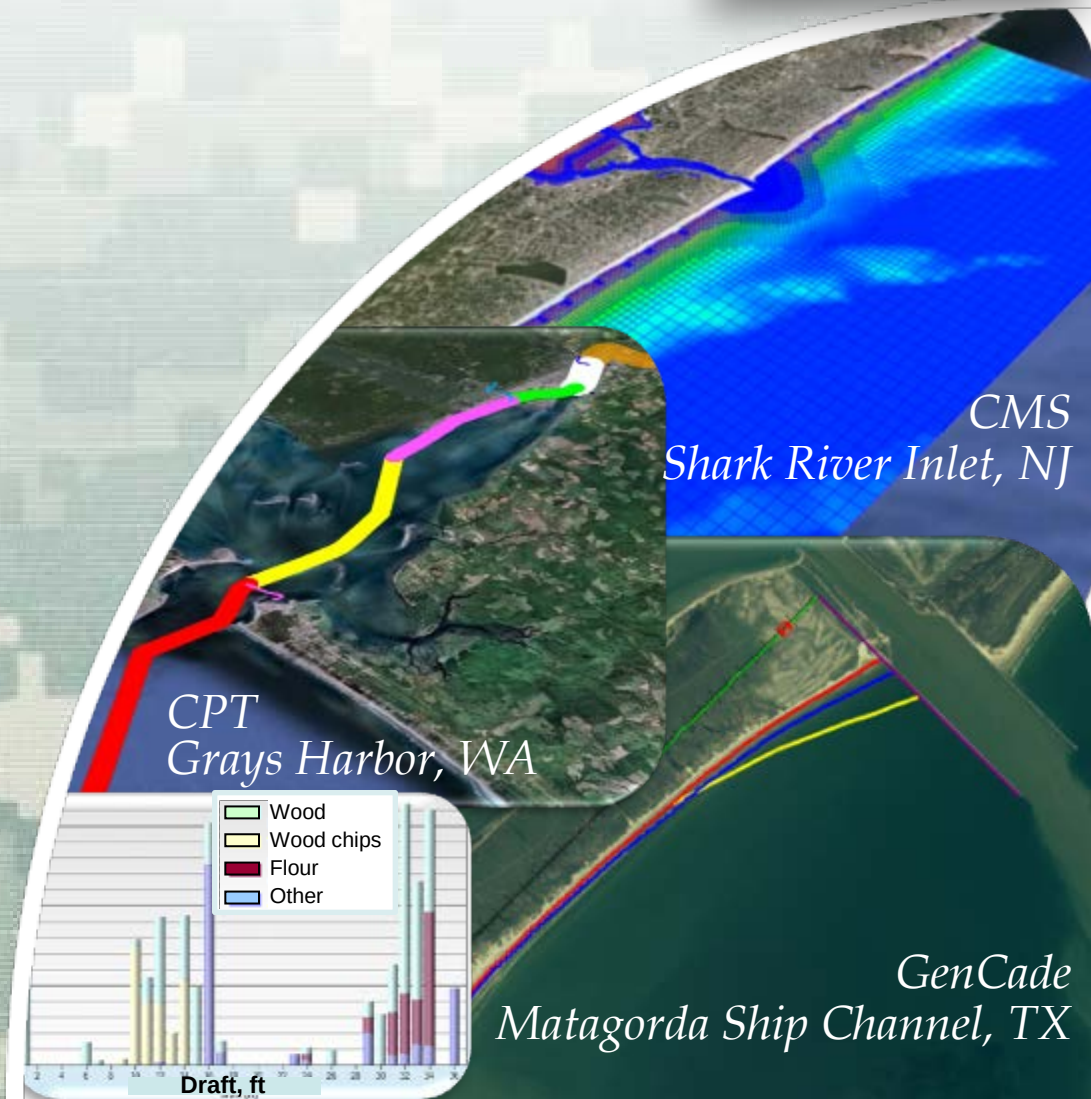

US Army Corps of Engineers
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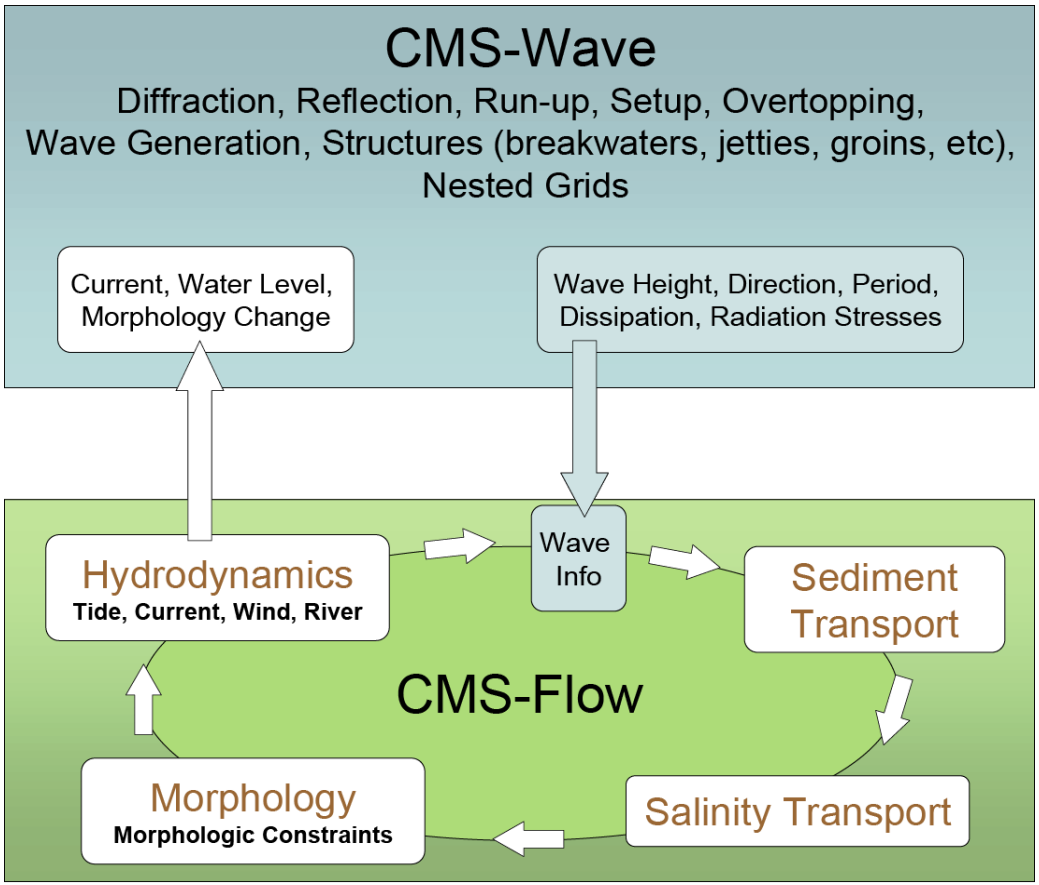
Overview of Presentation

Introduction to the Surface-water Modeling System (SMS v.11.0)

- What is it?
- Tools, Modules, Data Tree, Images, etc.
- CMS Models interface

CMS Overview



SMS

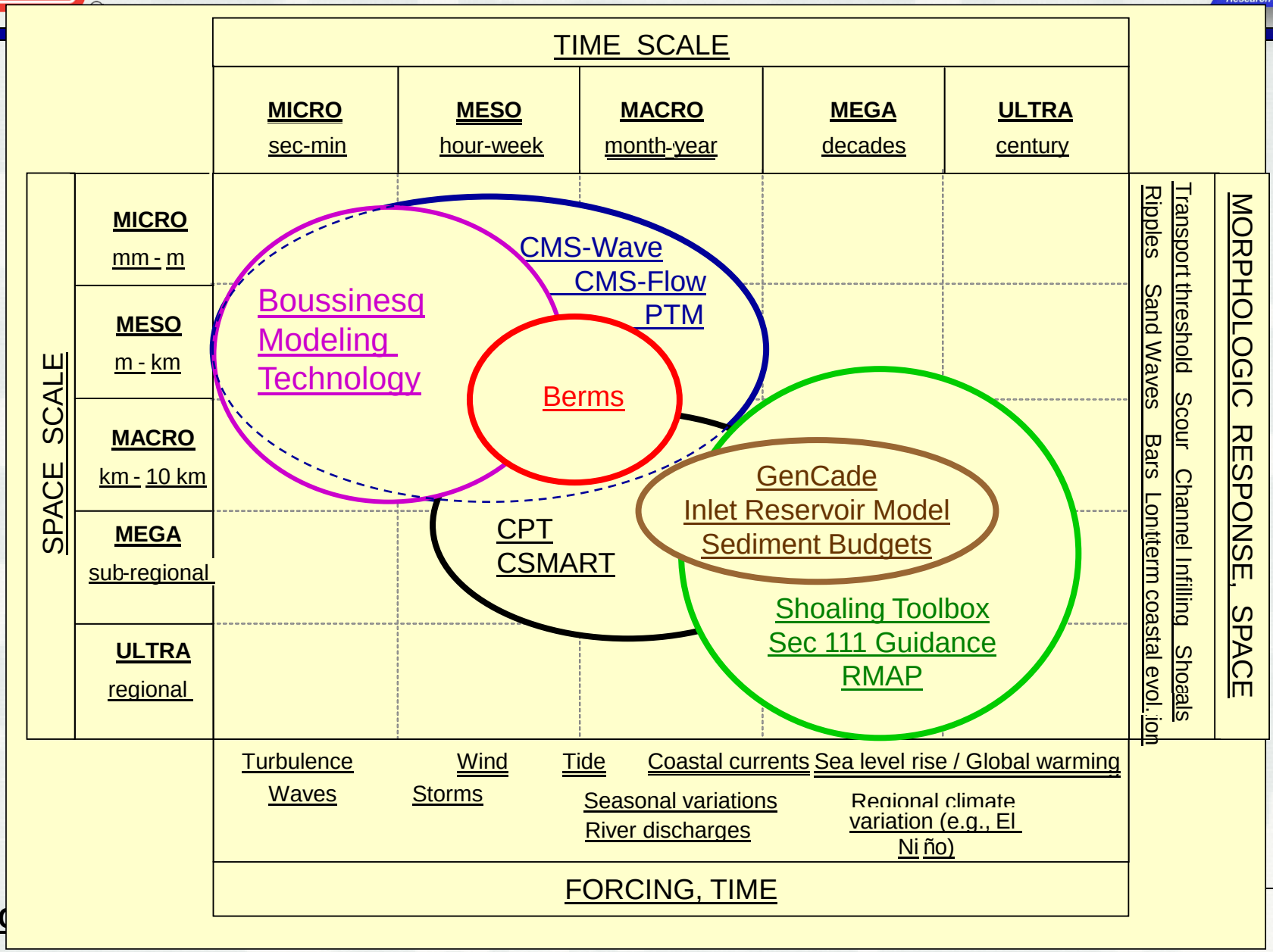
Since 1997…

- 38 workshops
- Districts can independently run the CMS!

Advantages…

- Robust
- Physics-based
- Integrated SYSTEM
- In SMS
- User-friendly

Scales of Coverage



What is the SMS?

- **A Pre-Processor**
  - Organize and create input files for Corps of Engineers' Numerical Models
- **A Post-Processor (visualize results)**
  - Create plots
  - Create film loops
  - Data calculator
  - Dataset creation
- **Connect with outside tools**
  - Import/export CAD data
  - Import/export GIS data
  - Import/export tabular ASCII data
  - Import/export image data

Overview of SMS interface

The SMS interface is modular. Separate modules pertain to each data type. As the user switches from one module to another, the menus and tools change. Inside the modules, the user associates a numerical model with a mesh or grid. When that grid is active, the tools and menus for the associated model are also enabled.

The SMS screen includes several toolbars, edit fields, and menus. Some of these change as the user switches modules or numerical models. The principal components include:

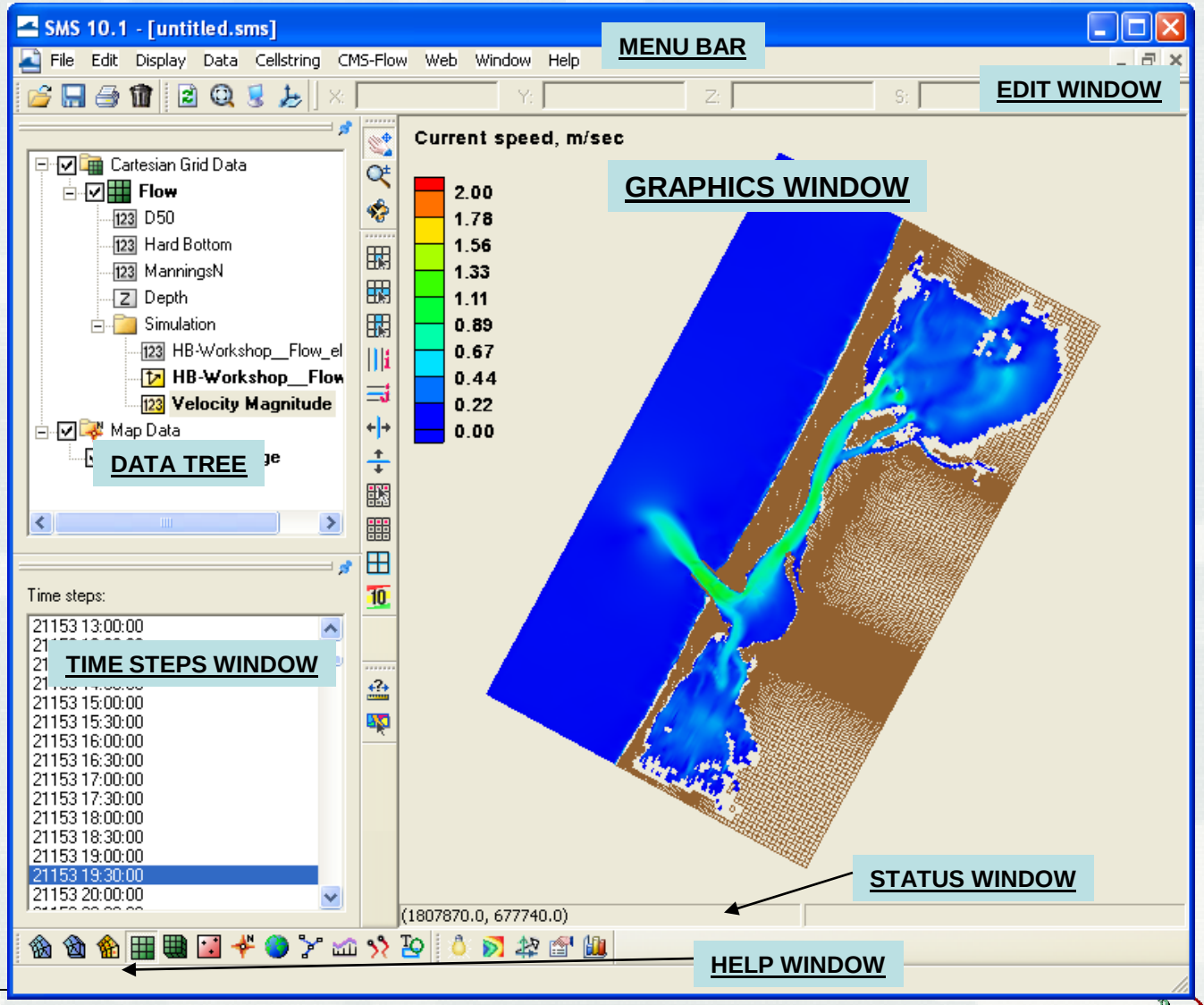
- Menu Bar - Menu to issue commands. These change as the module and model change.
- Edit Window - Fields directly below the menu bar showing the coordinates and function values for selected entities.
- Graphics Window - Display panel to show the data being manipulated.
- Project Explorer (Data Tree) - Tree representation of data currently referenced through SMS.
- Time Step Window – Appears if transient data are available.
- Toolbars - Several toolbars can be displayed. For more information on each toolbar, see the Toolbars article.
- Help or Status Window

The toolbars, project explorer, time steps window, and edit window are dockable windows. Dockable windows may be positioned by the user.

SMS Modeling Suite

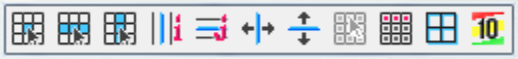
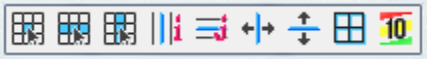
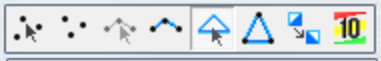
The Data Tree (also referred to as the “Project Explorer") is a dockable window that appears by default on the left side of the SMS screen.

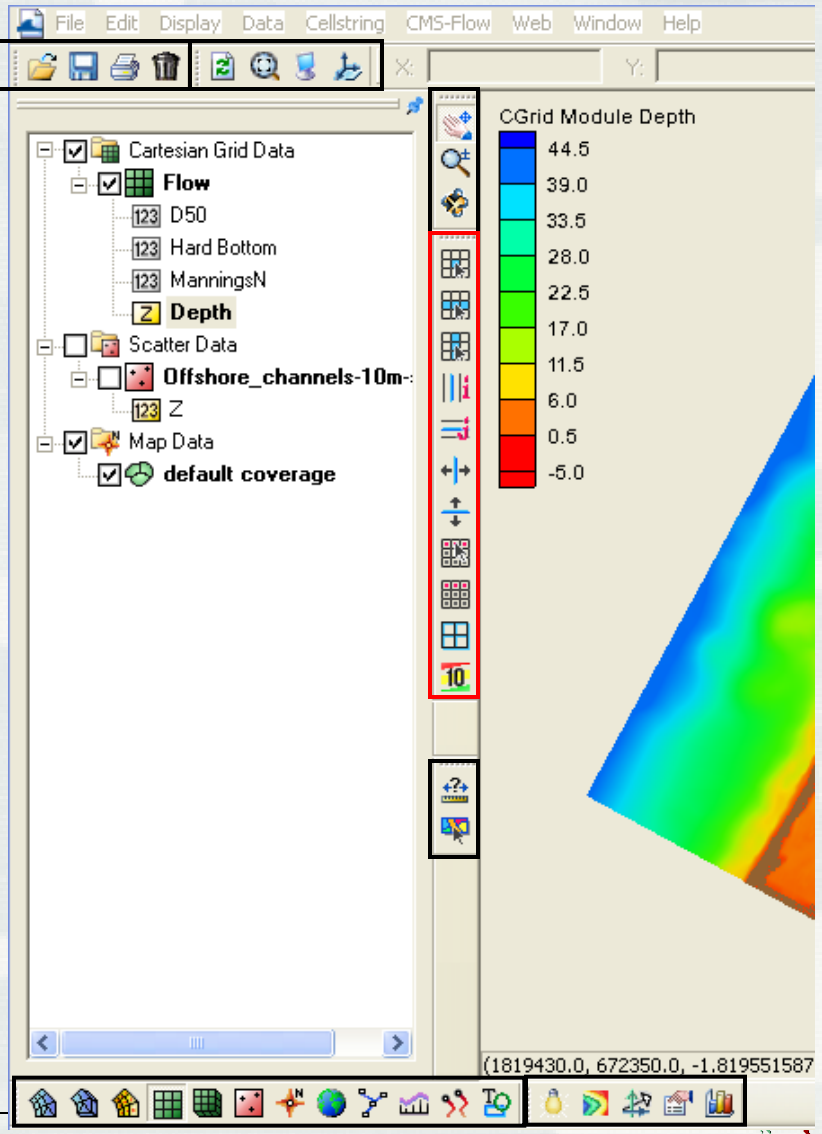
This window displays a hierarchical tree structure representing all data currently being managed in an SMS simulation.



Toolbars

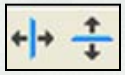
Toolbars

- Static Toolbar
- Dynamic Toolbar
  - Grid
    - CMS-Flow 
    - CMS-Wave 
  - Scatter 
  - Annotation
- Data Toolbar
- Optional Toolbars
  - Macro
  - File
  - Display
- Module Toolbar



Dynamic Toolbar

Cartesian Grid tools

- Select Cell, Row, and Column
- Split Column and Row
- Move Column and Row Edges 
- Select and Create Cellstrings
- Create Grid Frame
- Apply Contour Labels

Scatter Data tools

- Select and Create Point
- Select and Create Breakline
- Select and Create Triangle
- Flip Triangle Edge

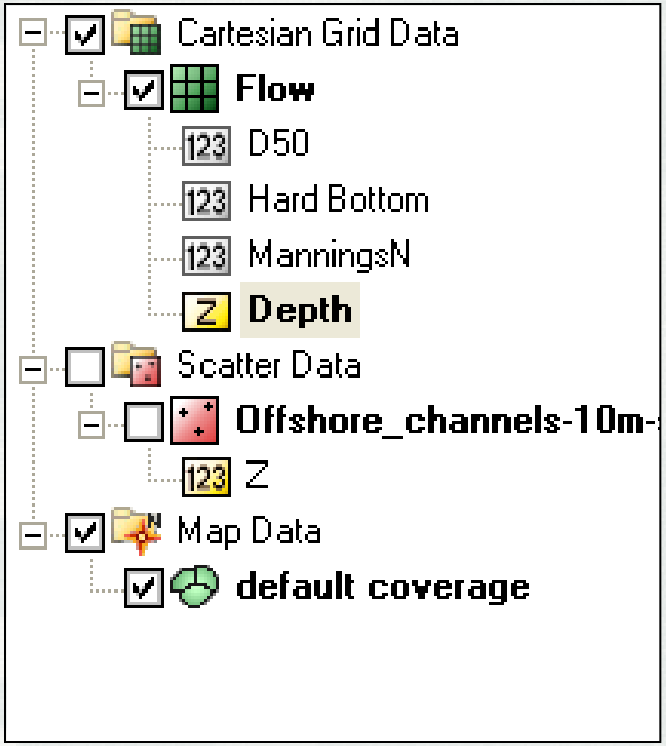
Map Data Tools

- Select Feature Node
- Create Feature Node
- Select Vertex
- Add Vertex
- Select Feature Arc
- Create Feature Arc
- Select Feature Polygon
- Create 2-d Grid Frame
- Select 2-d Grid Frame

Selection tools usually have an arrow that points to the specific type of element.

Creation tools are identical to selection tools, only they do not have the arrow.

Data Tree Components



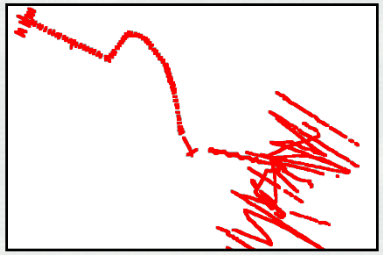
- The Data Tree makes selection of loaded datasets easy. Simply click on a dataset to make it active, and the graphics window updates accordingly.
- There are several “right-click” options available depending on the type of dataset activated, and within which module it is located. A few of these are:
  - Basic Dataset Information
  - Dataset-specific contour options
  - Export to file
  - Metadata Information
- The display of each asset in the Data Tree can be turned off by unchecking the display box next to the dataset name.

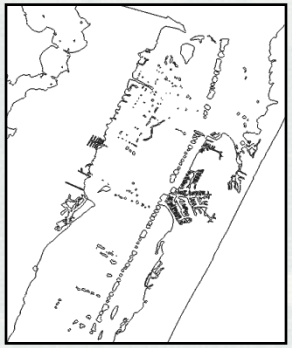
SMS – a complete modeling interface

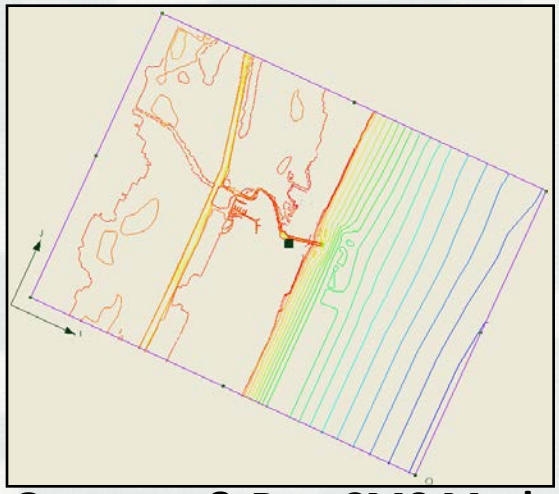
Build a CMS model from start to finish – all within SMS

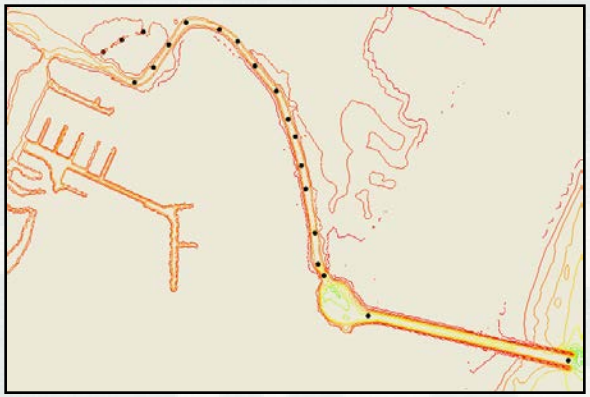
Import Background Data

- Topographic & bathymetric data – numerous formats supported
- Images – maps & aerial photos
- CAD, GIS & spreadsheet data



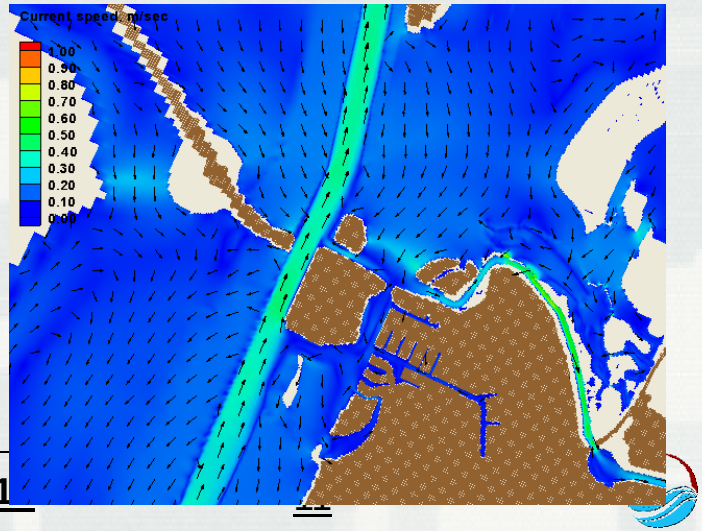






Create Conceptual Model

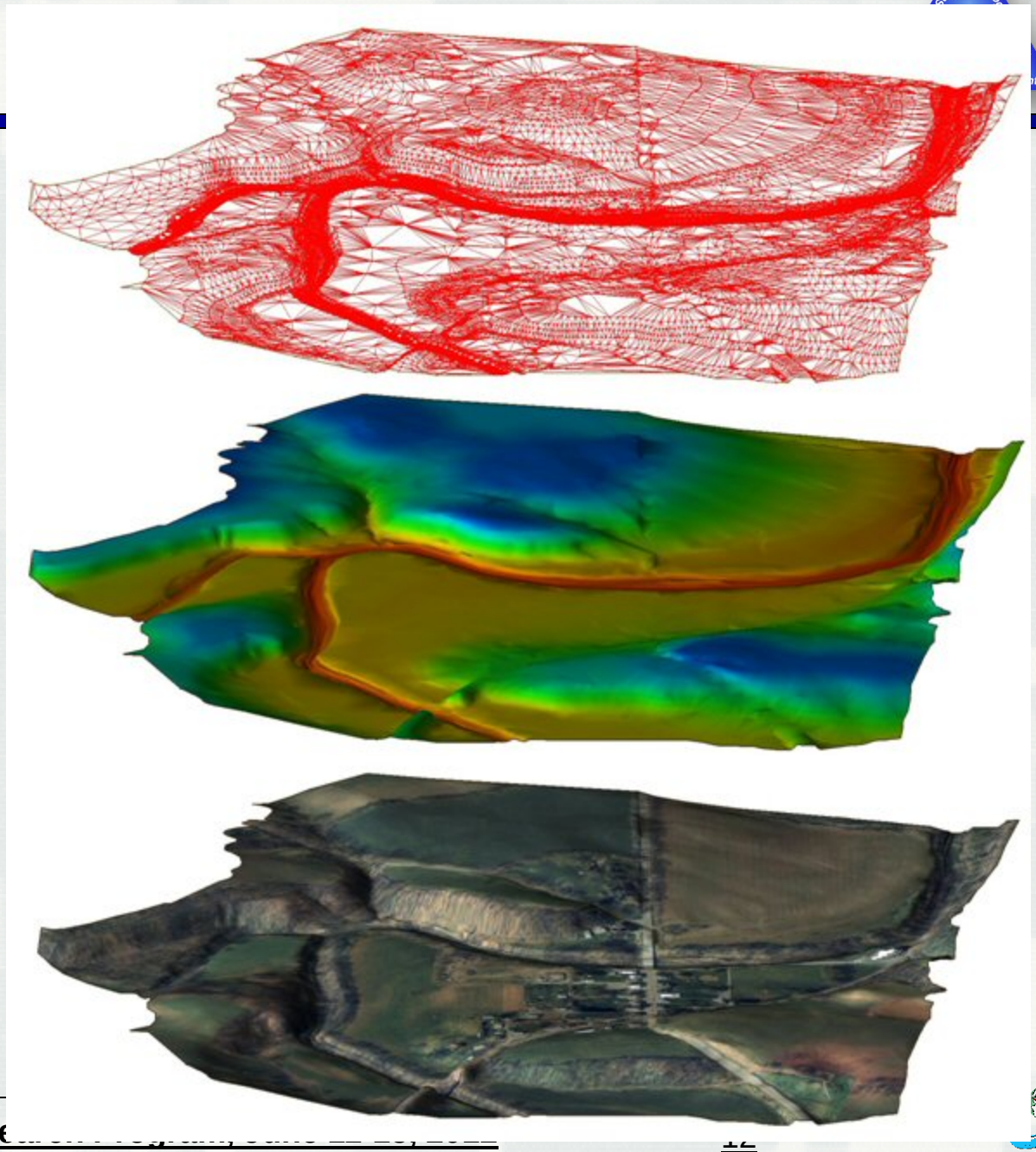
- Delineate CMS model domain
- Define areas of finer resolution



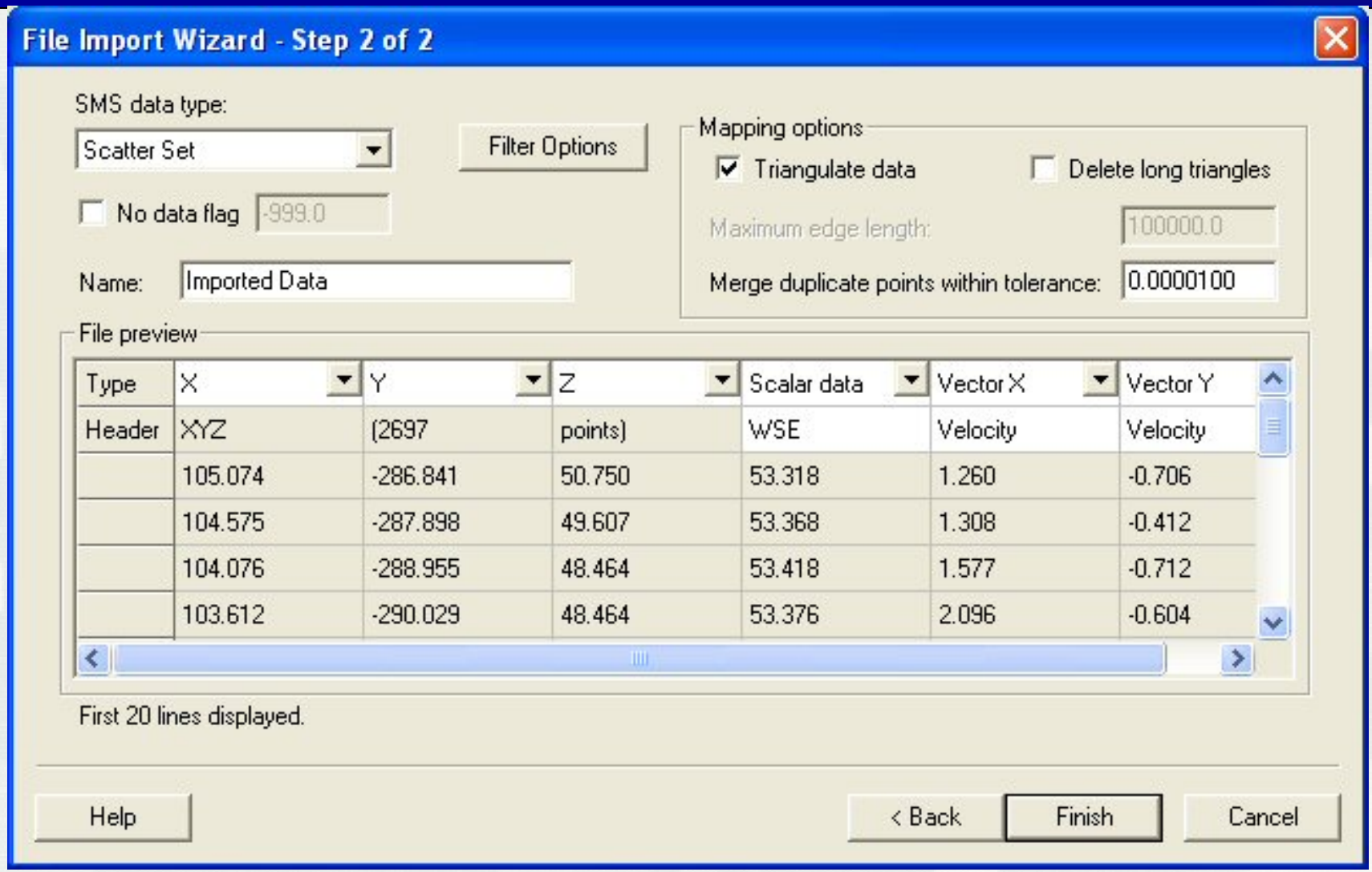
Generate & Run CMS Models

- Automatically generate grid
- Interpolate depths from background data
- Utilize built-in interfaces to define model-specific parameters and boundary conditions
- Run model and visualize results

SMS – Data Processing

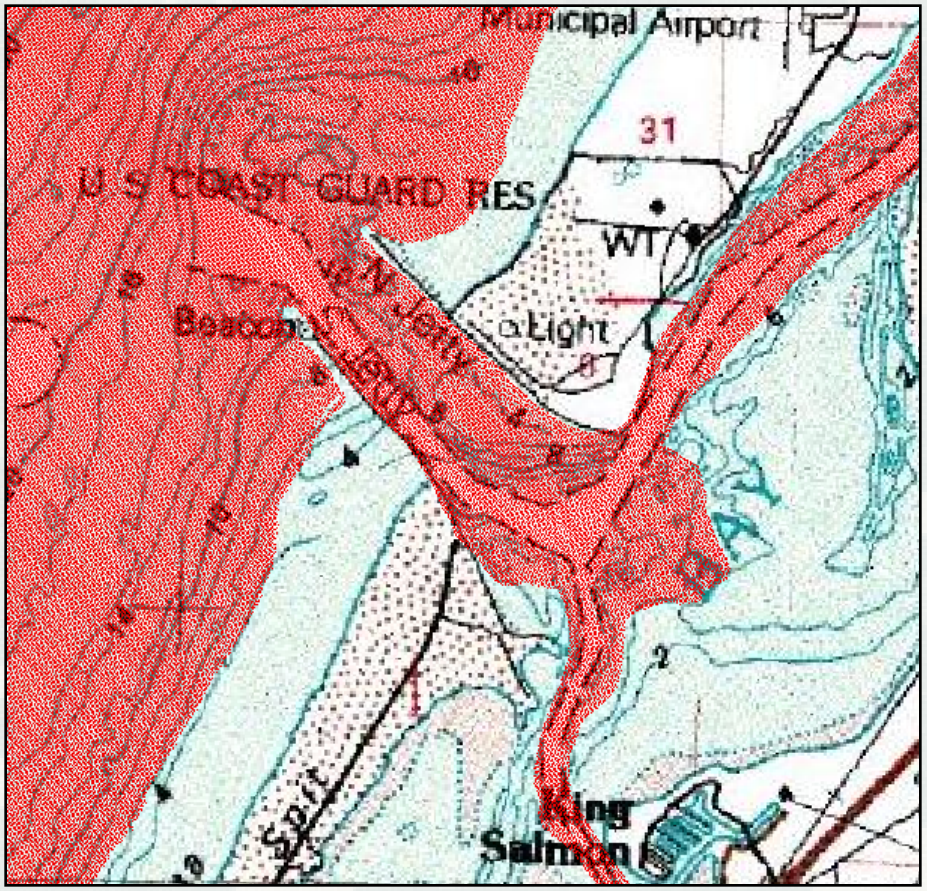


Import Wizard

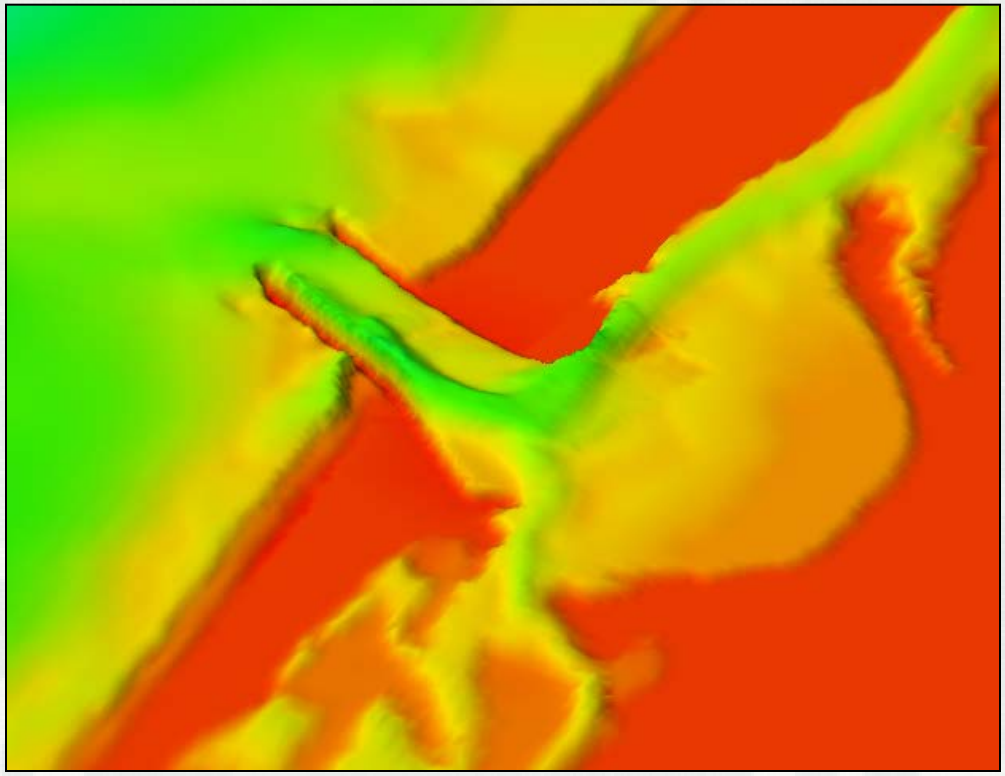


Scattered Data (TINs)

- **Stores spatially varied data**
  - Bathymetric data most common
  - Interpolates from one grid/mesh to another
  - Allows combination of data sources
  - Facilitates data thinning or filtering



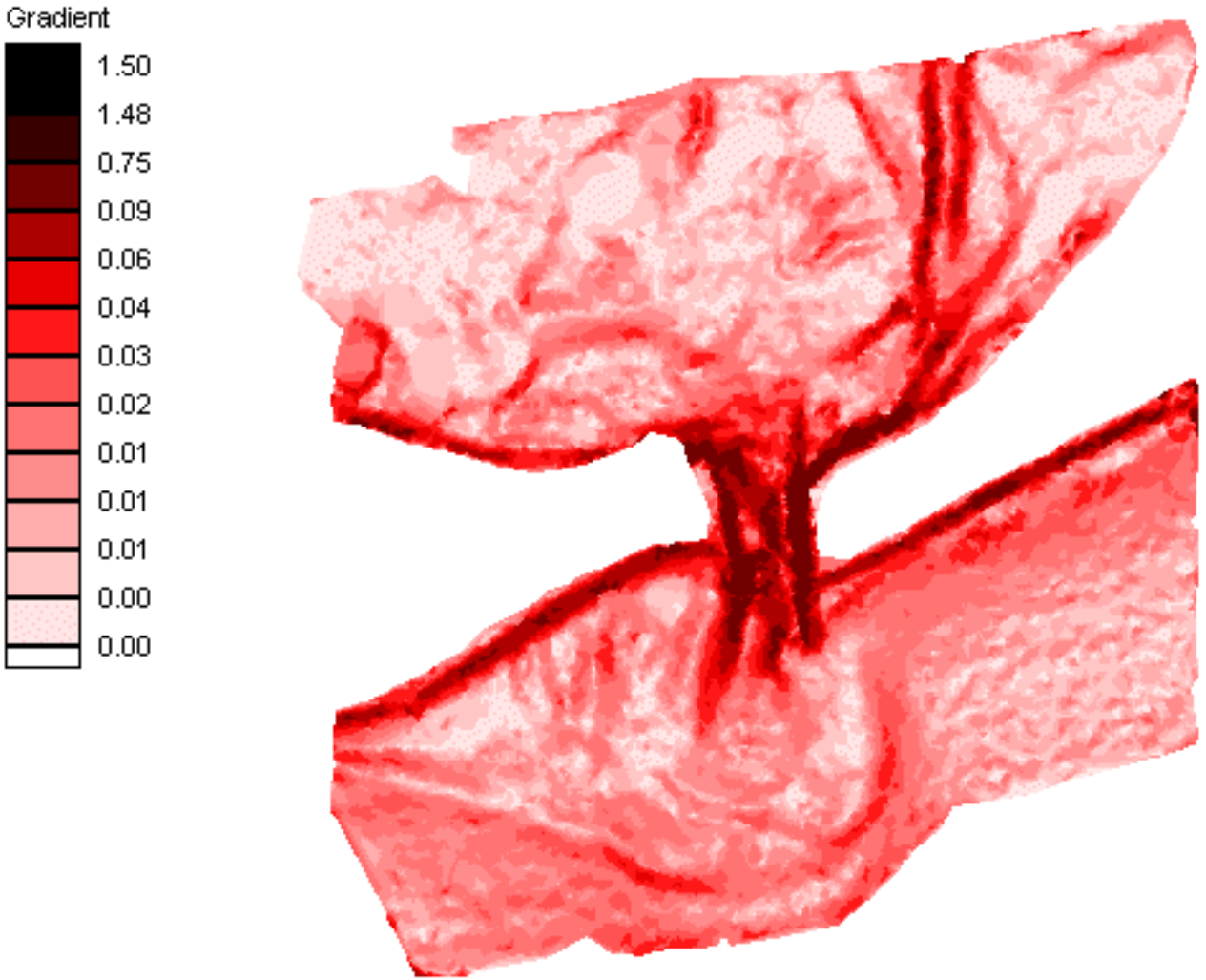
Visualization of Scattered Data



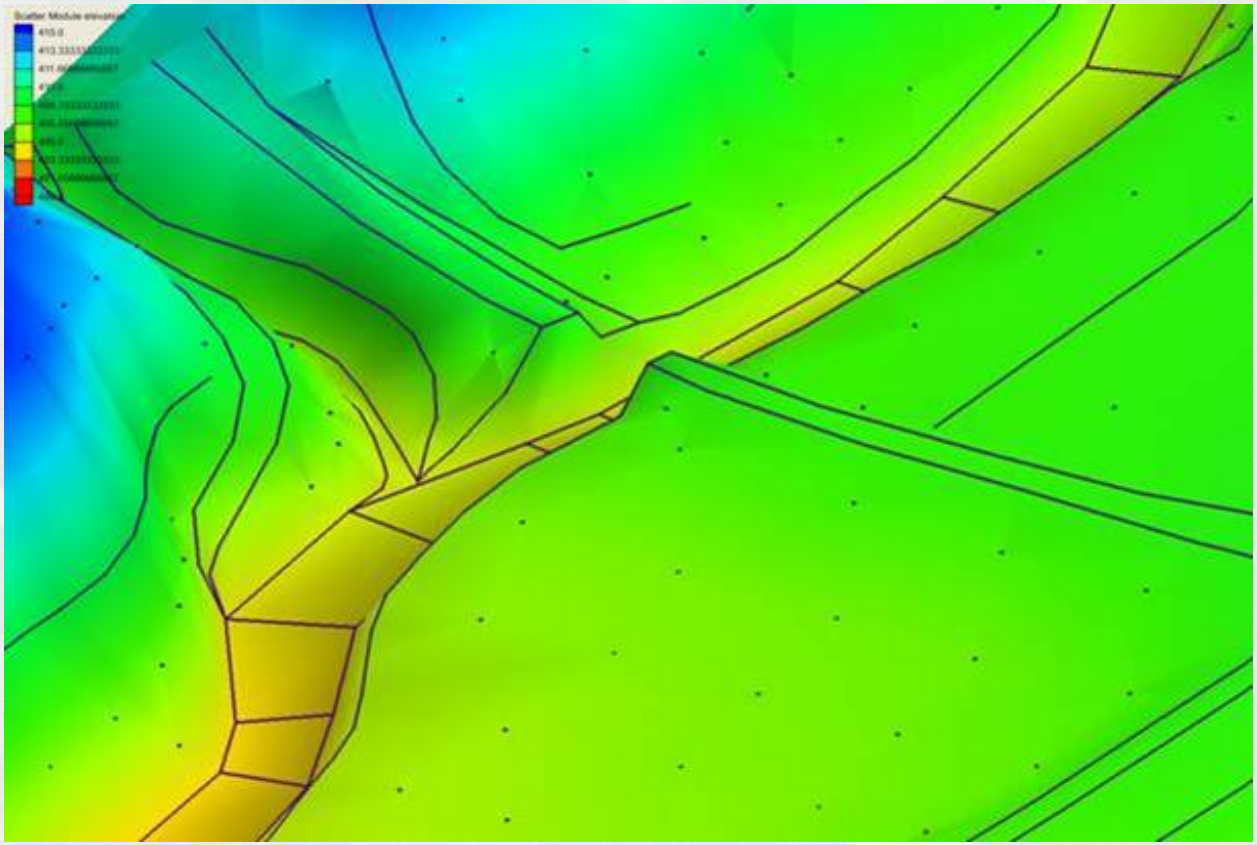
Humboldt Bay, CA
Oblique view
Z-magnification 5x

- **Options**
  - Magnify in Z direction
  - Oblique or plan views
  - Fill with contours options
  - Shading

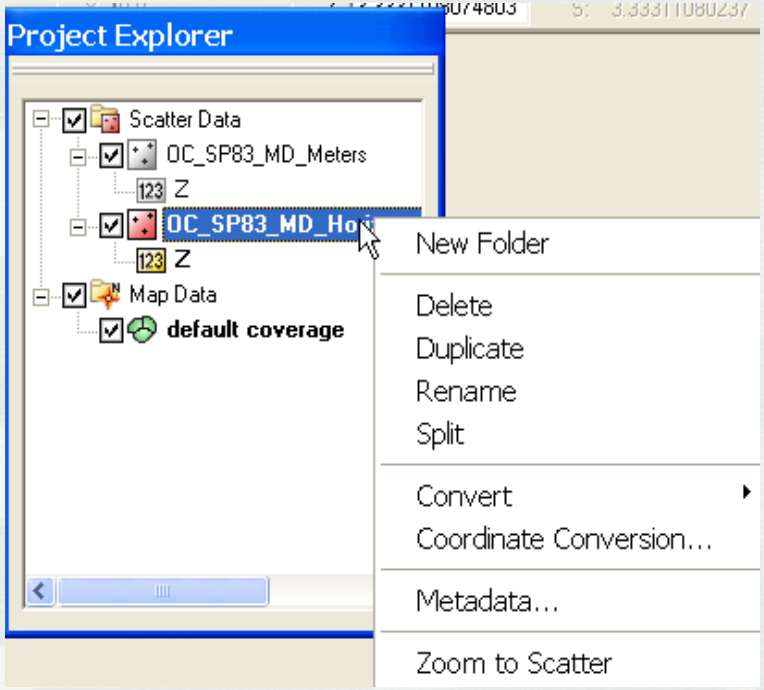
Lidar Survey



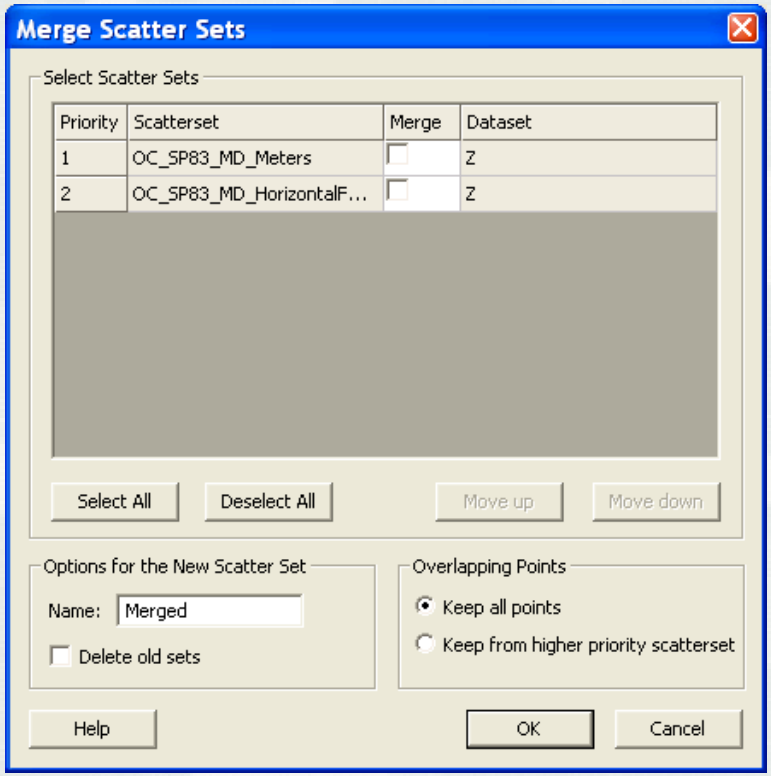
Breaklines



Operating With Scatter Sets

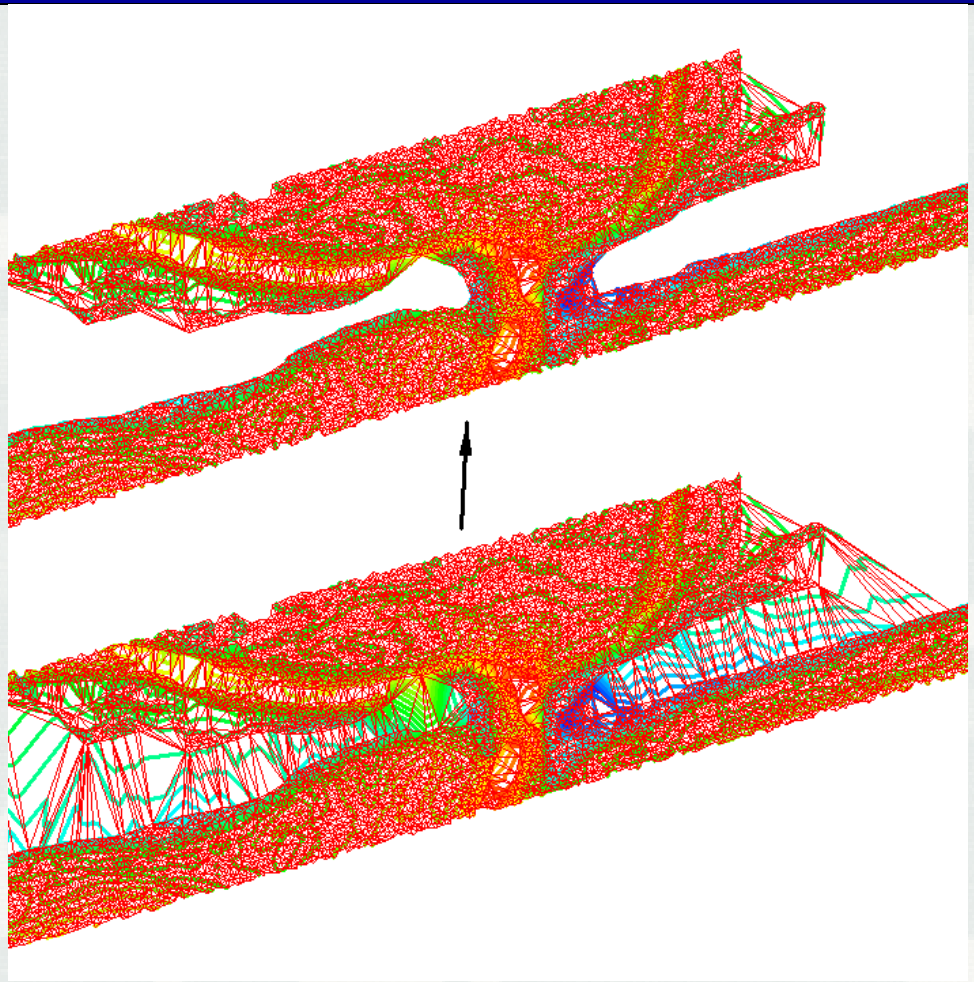


- **Merge**



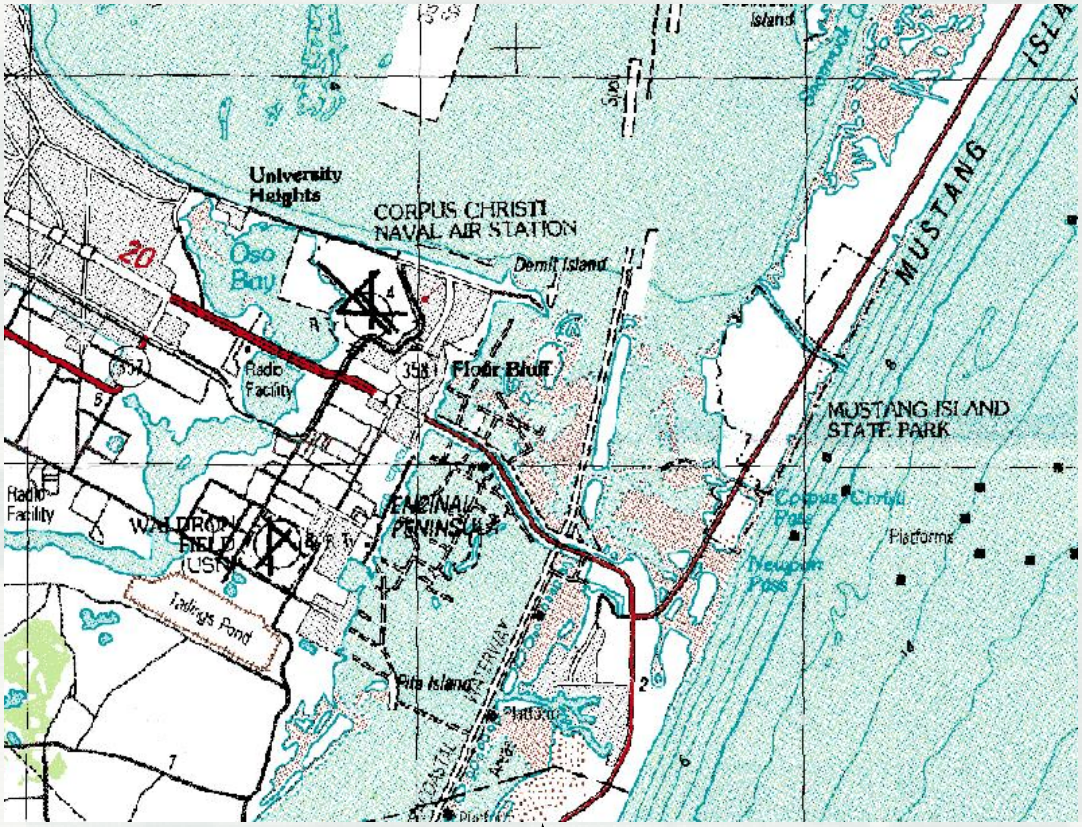
Points and Triangles

- **User can delete points or triangles to change extents of a set.**
- **User can swap edges to alter shape of surface**
  - **Used in linear interpolation**



Images

Topo Maps

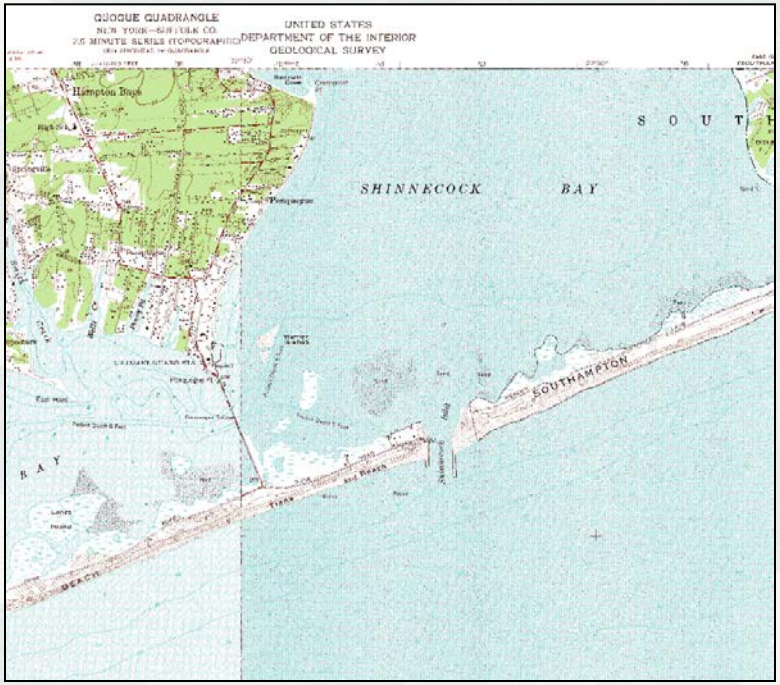


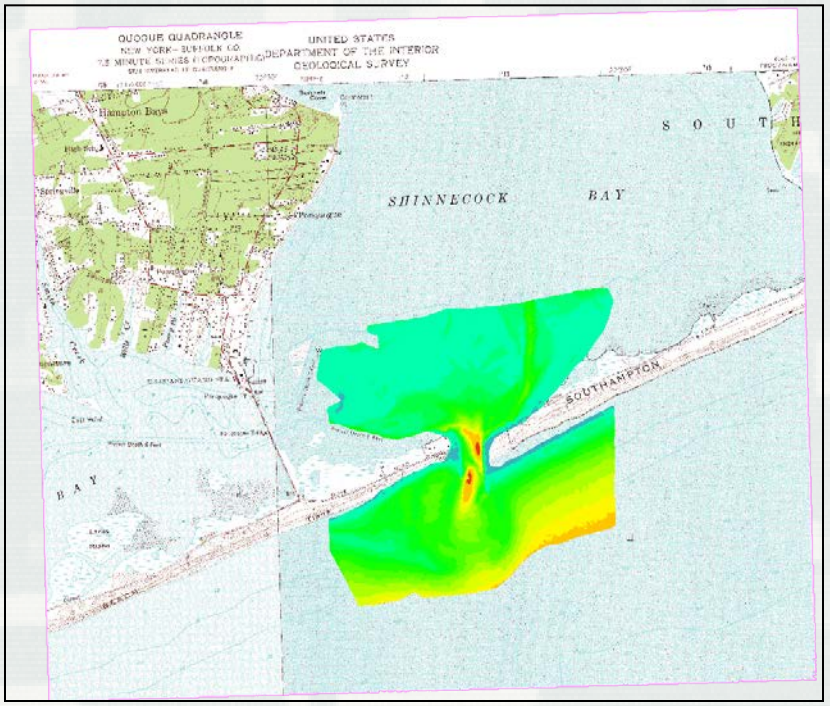
Aerial Photos

http://terraserver.microsoft.com

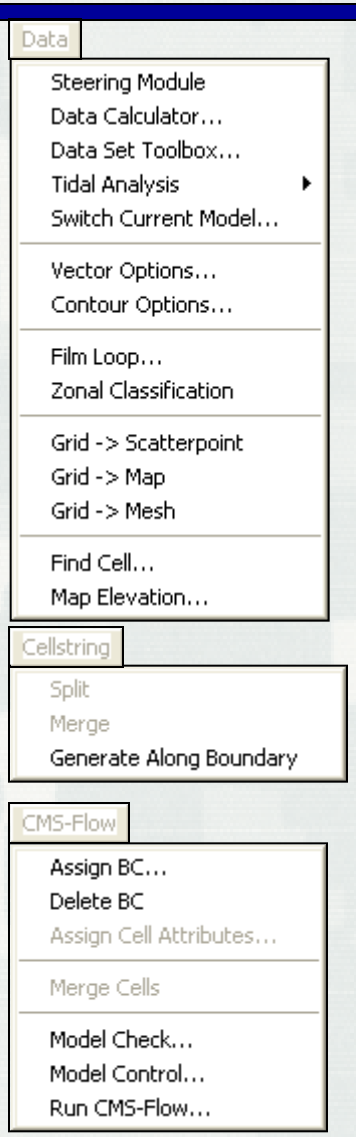
Image Data

Overlay data over images





CMS-Flow Interface: Pull-down Menus



The Data pull-down menu contains many items – here are a few:

- Steering Module – Starts/controls interaction between Flow and Wave
- Data Calculator – Dataset-based functions
- Dataset Toolbox – Dataset-based operations (includes Calculator)
- Vector/Contour Options – Change appearance of data within the Graphics Window
- Film Loop – Generate animations based on loaded data/solutions
- Grid -> Scatterpoint – Convert CMS-Flow grid to Scatterpoint dataset (TIN)

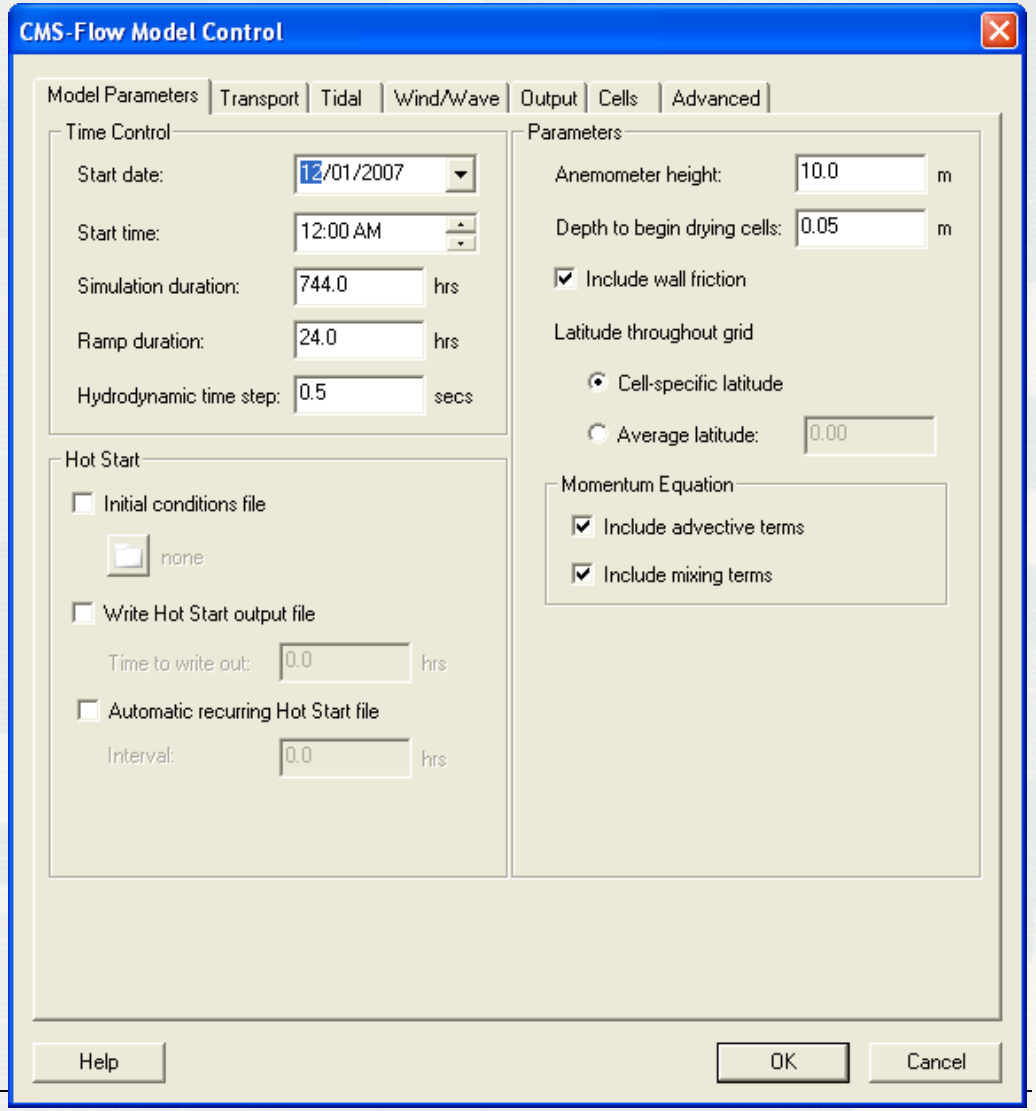
The Cellstring menu contains operations for boundary condition forcing strings.

The CMS-Flow menu contains commands to operate the model.

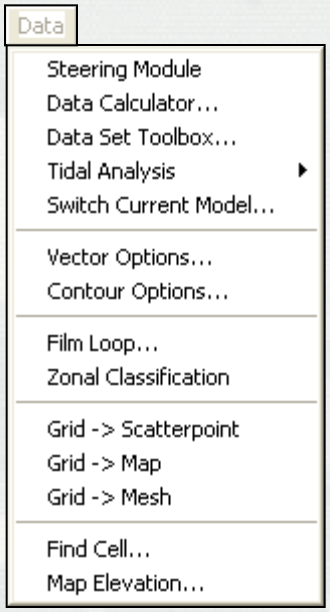
- Assign BC – Assigns boundary condition forcing information to cellstrings
- Delete BC – Delete the forcing informaiton from a cellstring
- Model Control – Set up the parameters and running options for the CMS-Flow simulation
- Run CMS-Flow – Start CMS-Flow based on Model Control options.

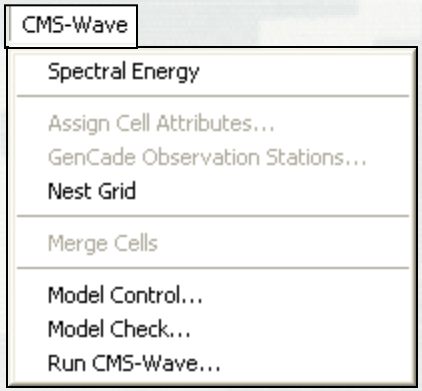
CMS-Flow Model Control
Parameter Specification and File I/O

- Time Control
- Auxiliary Files
- Parameters
  - Wet/Dry depth
  - Flags
- Calculations to Include
  - Sediment Transport
  - Wind
  - Waves
  - Salinity



CMS-Wave Interface: Pull-down Menus





The Data are the same for both CMS-Flow and CMS-Wave.

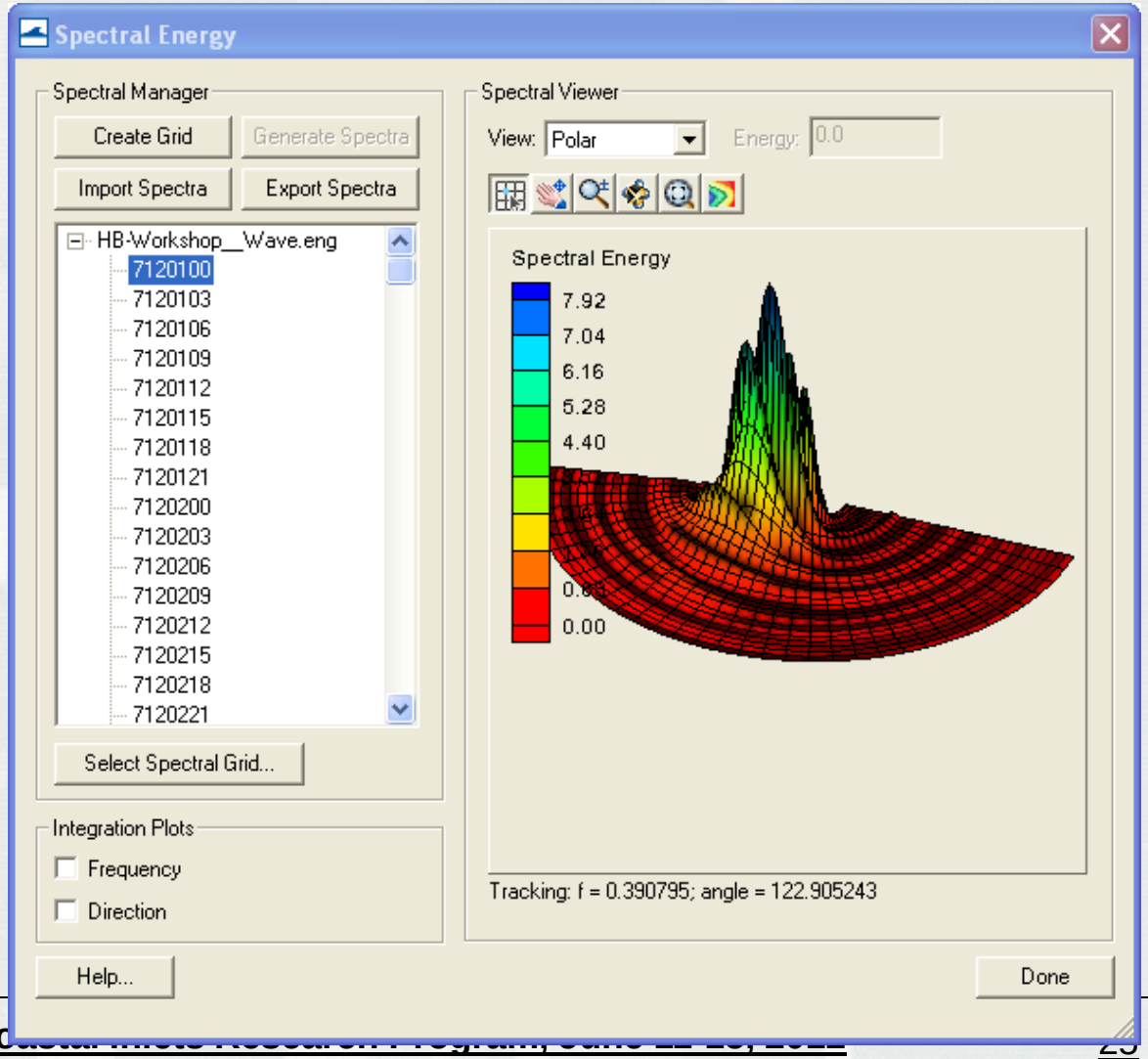
- Steering Module – Starts/controls interaction between Flow and Wave
- Data Calculator – Dataset-based functions
- Dataset Toolbox – Dataset-based operations (includes Calculator)
- Vector/Contour Options – Change appearance of data in Graphics Window
- Film Loop – Generate animations based on loaded data/solutions
- Grid -> Scatterpoint – Convert CMS-Flow grid to Scatterpoint dataset (TIN)

The CMS-Wave menu contains commands to operate the model.

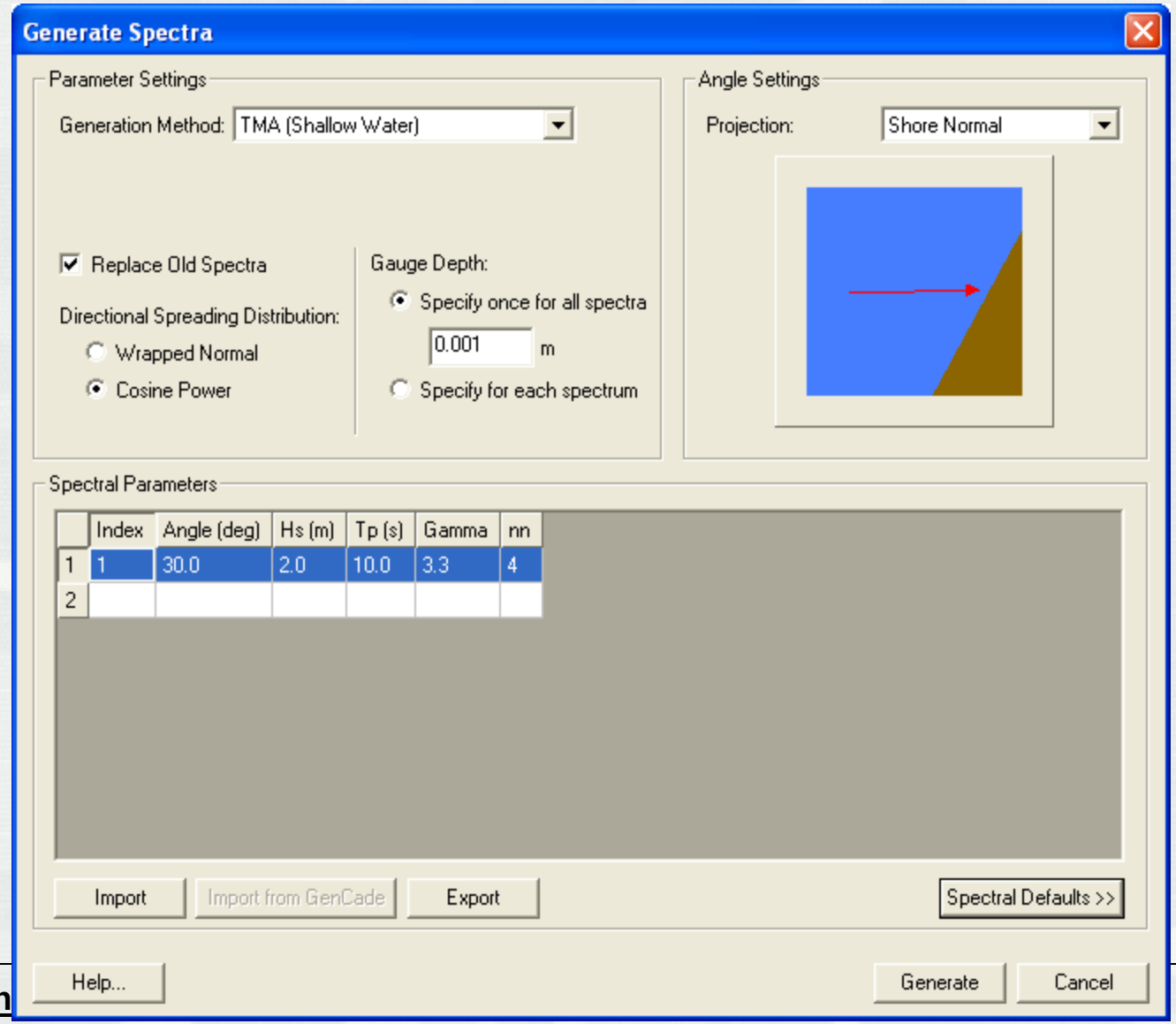
- Spectral Energy – Allows user to Create Spectral Energy forcing from wave characteristics or Import existing data from a wave gauge
- Nest Grid – Allows use of a nested (child) wave grid for better resolution in some areas
- Model Control – Set up the parameters and running options for a CMS-Wave simulation
- Model Check – Analyze present wave grid and modeling parameters for errors before run commences.
- Run CMS-Wave – Start CMS-Wave based on Model Control options.

Spectral Energy menu

Example of Imported Spectra from Wave Gauge

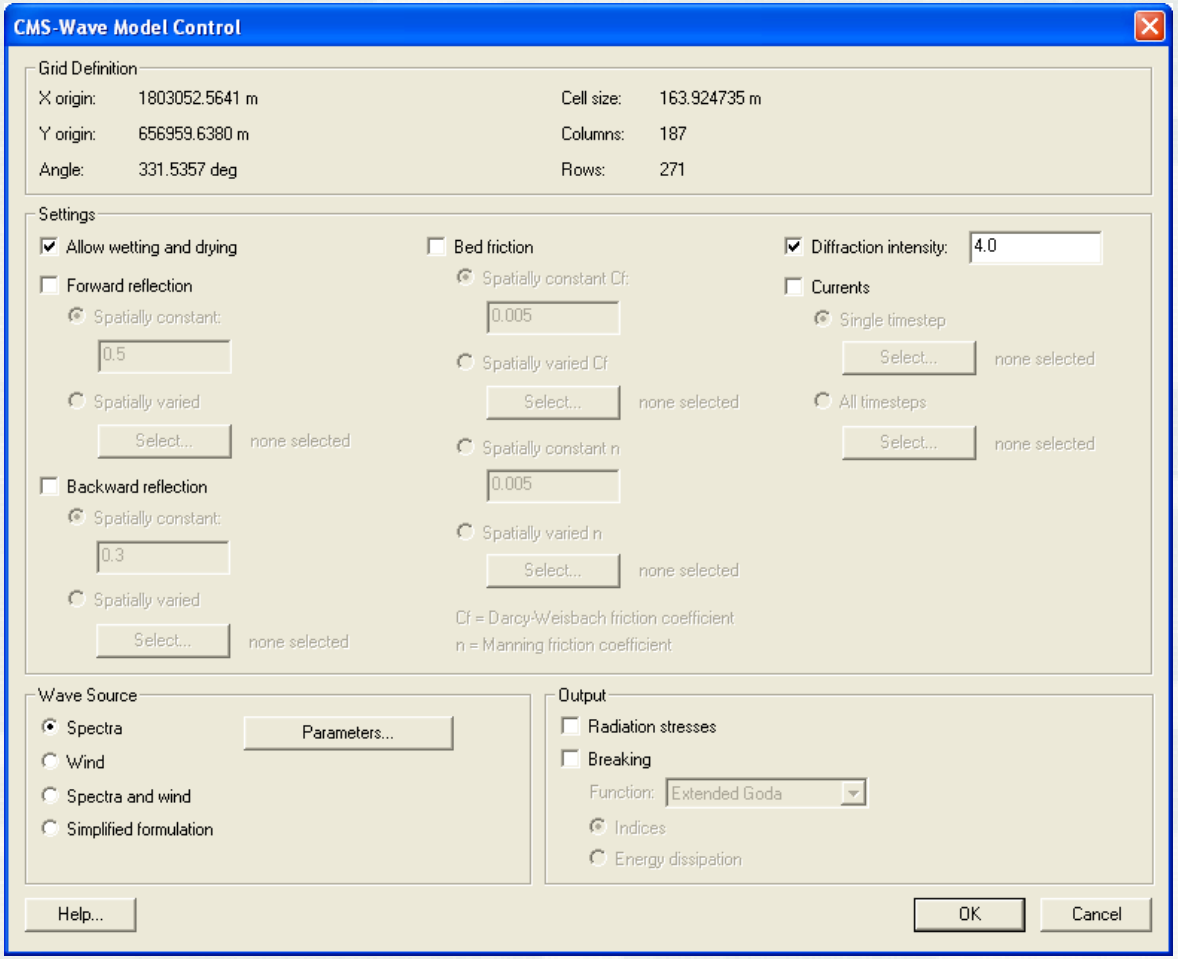


Generate Spectra from Bulk Criteria



Model Control

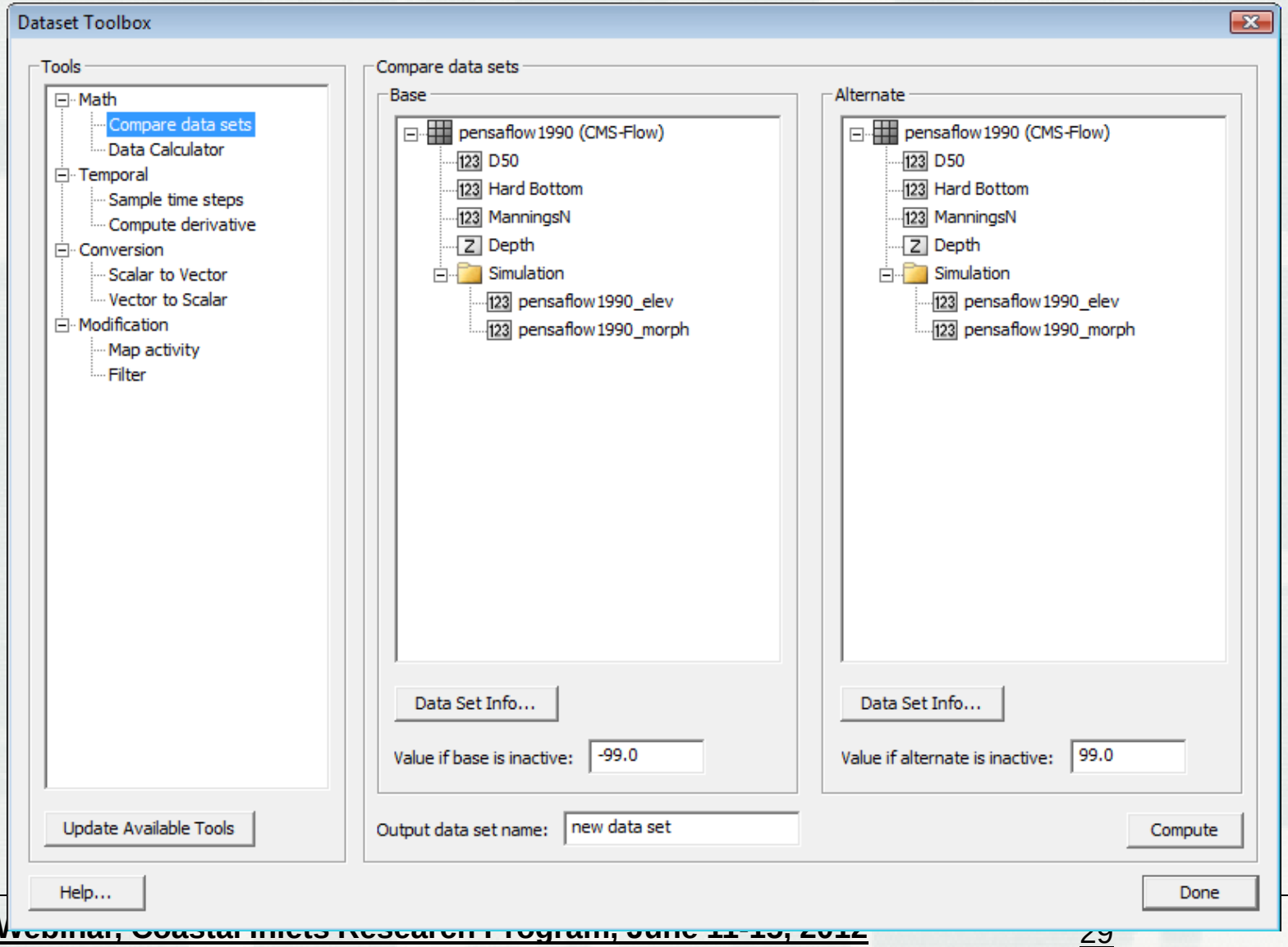
- Turn on Wetting & Drying of Cells
- Turn on Reflection (FWD, BWD)
- Choose Bed Friction type
- Set parameters
- Choose Output Datasets
- Choose Wave Source



Recent additions to the SMS

- Dataset Toolbox
- Grid duplication/rotation tools
- Web Menu
- Spatial Data Coverages
  - Data types
  - Plot types
  - Compass plots
- Coordinate Projections
  - More projections
  - Automatic re-projection of data with projection file

Dataset Toolbox



Dataset Toolbox

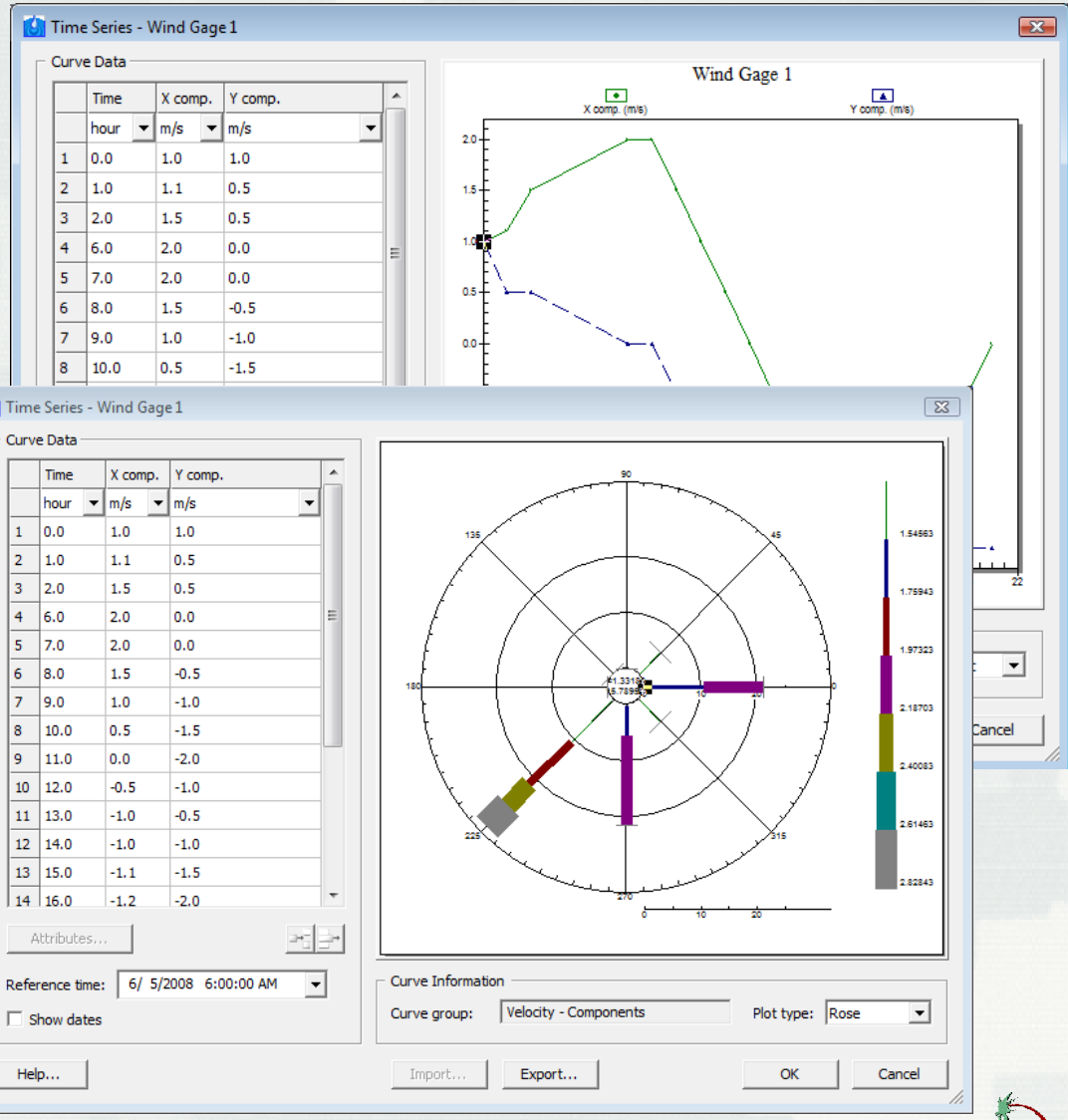
- Temporal Operations
  - Sample times
  - Temporal derivatives
- Mathematical Operations
  - Comparisons
  - Data Calculator
- Spatial Operations
  - Spacing
  - Gradients/Derivatives
  - Smoothing
- Conversions
  - Vector <-> Scalars
- Coastal Functions
  - Wavelength/Celerity
  - Courant number
- Activity Mapping
  - Map activity
  - Value filtering

Web Menu

- **Import data from web …**
  - Virtual Earth
  - Image data
  - Elevation data
- **Find Data**
  - Links to useful web sites
- **Tidal Data**
  - Links to coastal filtering tools

Spatial Data Coverages

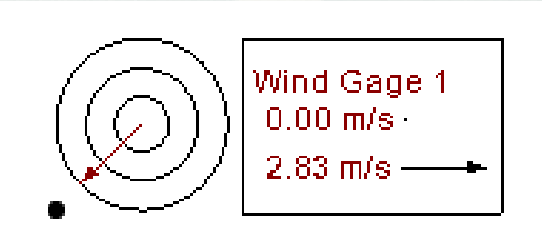
- Create nodes at locations of interest (gauges)
- Associate temporal data with location
  - Scalar data
  - X/Y vector data
  - Mag/dir vector data
- Plot types
  - Scientific
  - Multi-axis
  - Rose plots

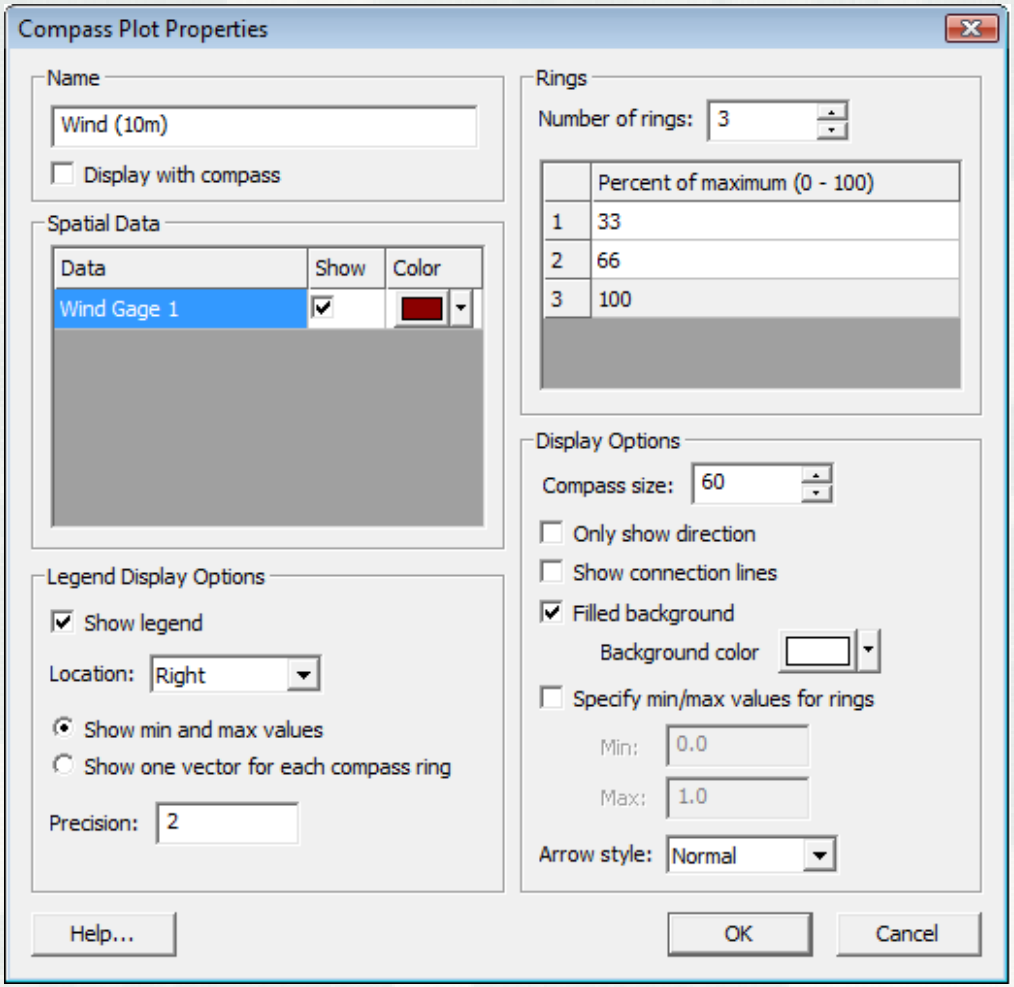


Spatial Data Coverages

Compass plot

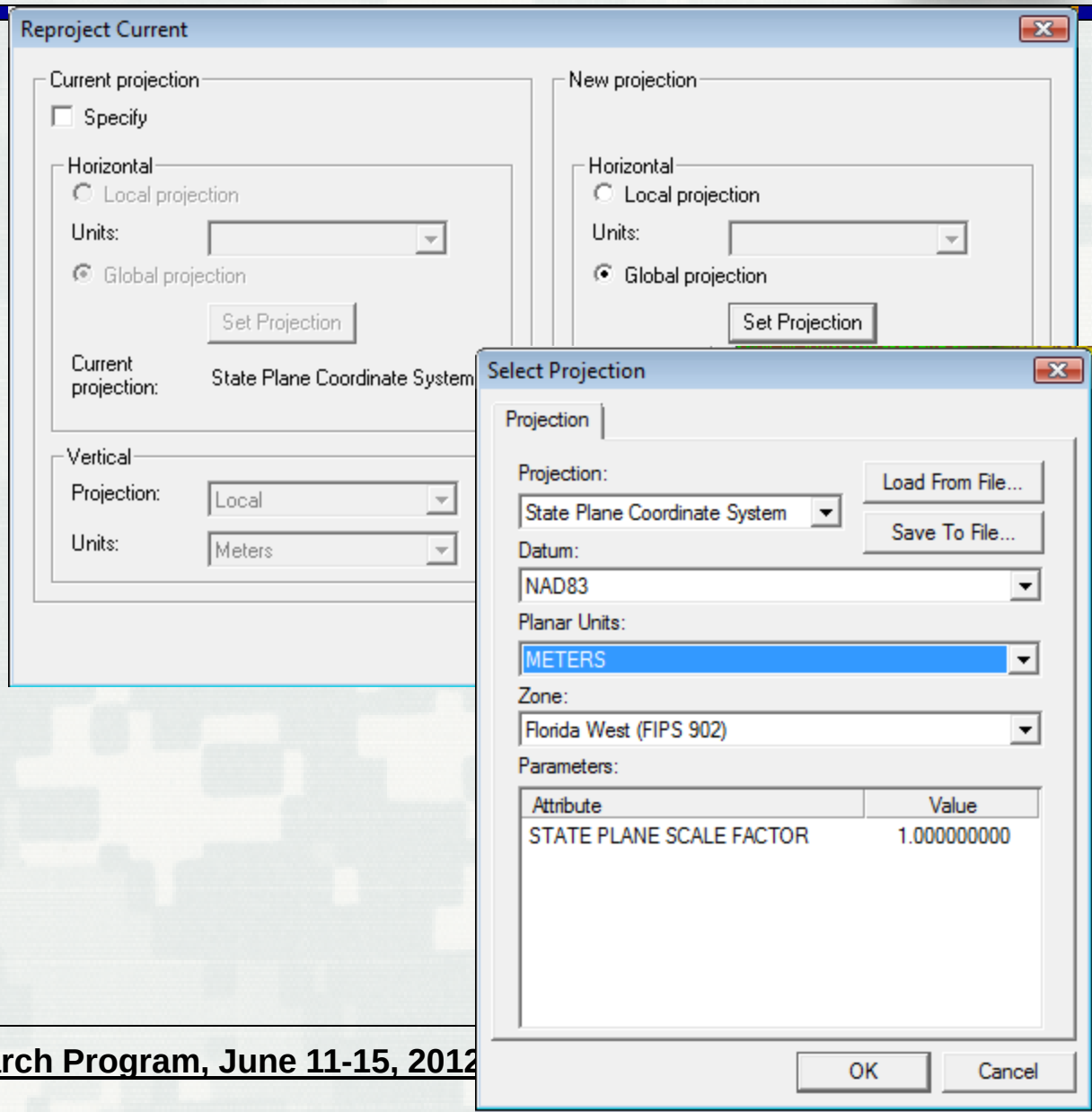
- Displayed on graphics window
- Updates with dates
- User managed





Coordinate Projections

- All major datums
- Project
  - Point
  - Object
  - Entire project
- Support for projection files
- Automatic detection of projections
  - Images
  - CAD
  - GIS

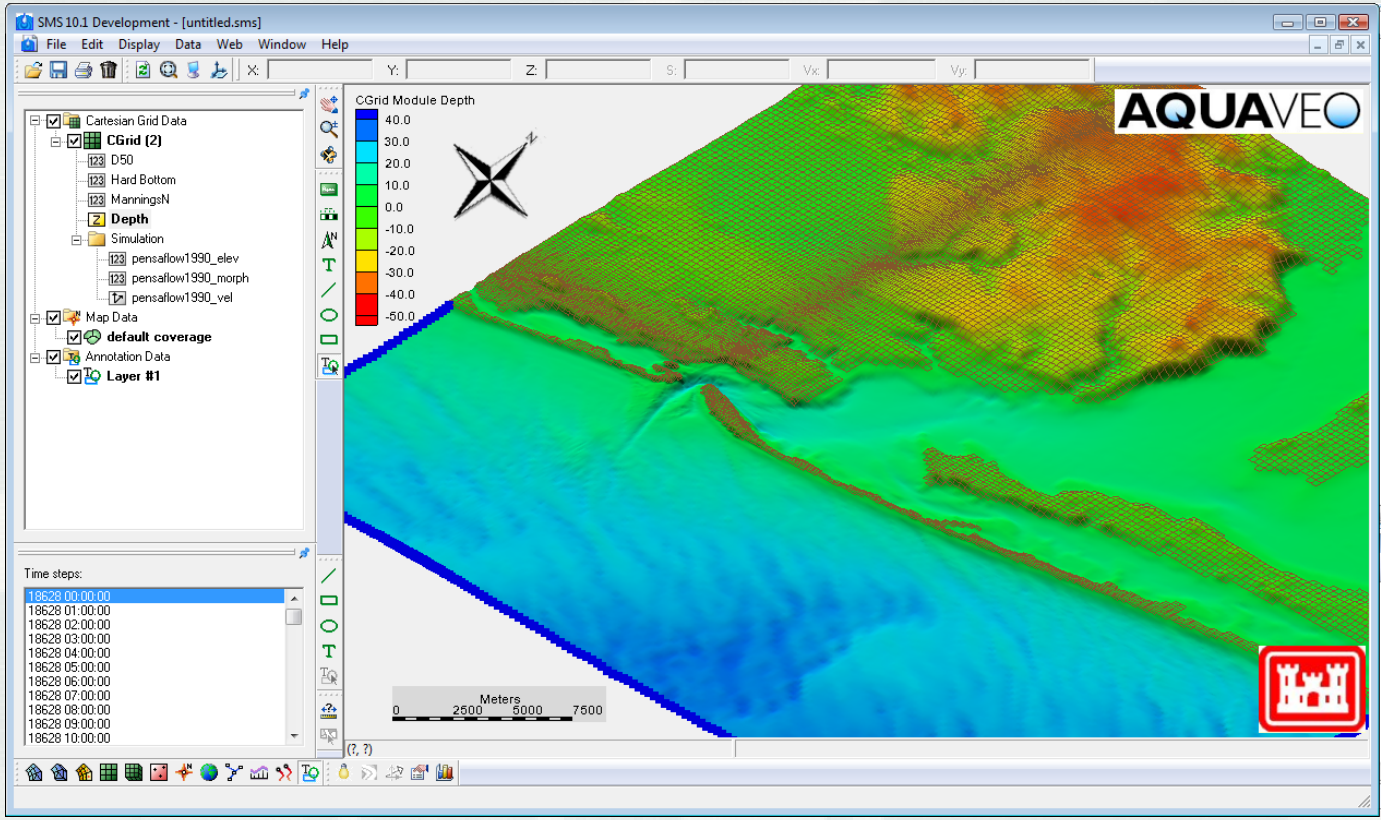


SMS – Post Processing

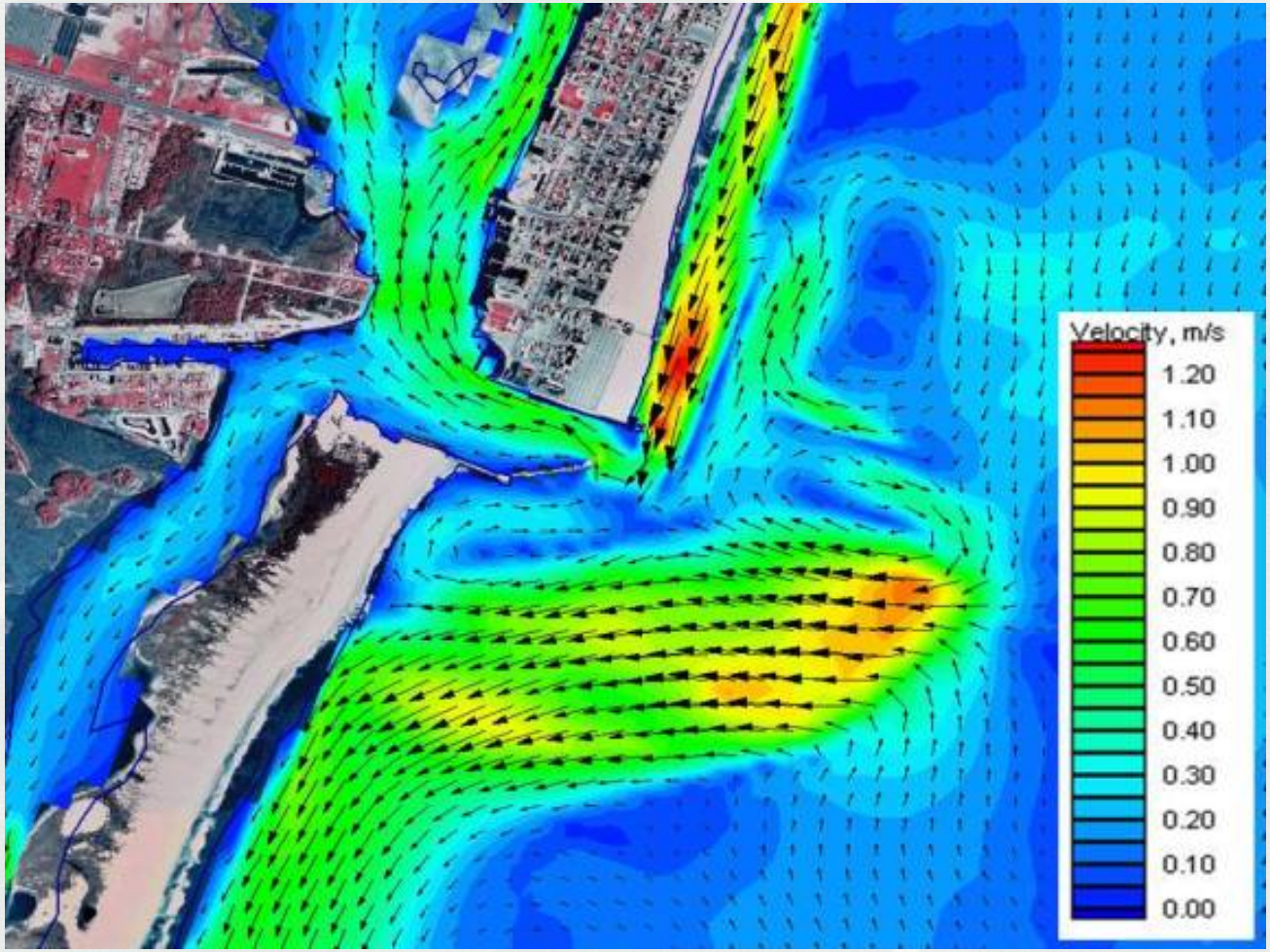
- Annotations
- Graphic images
- Animations
  - AVI filmloops
  - kmz – Google Earth Exports
- 2D Plots
  - Time series
  - Profiles and Cross sections – both steady state and transient

Annotation Layers

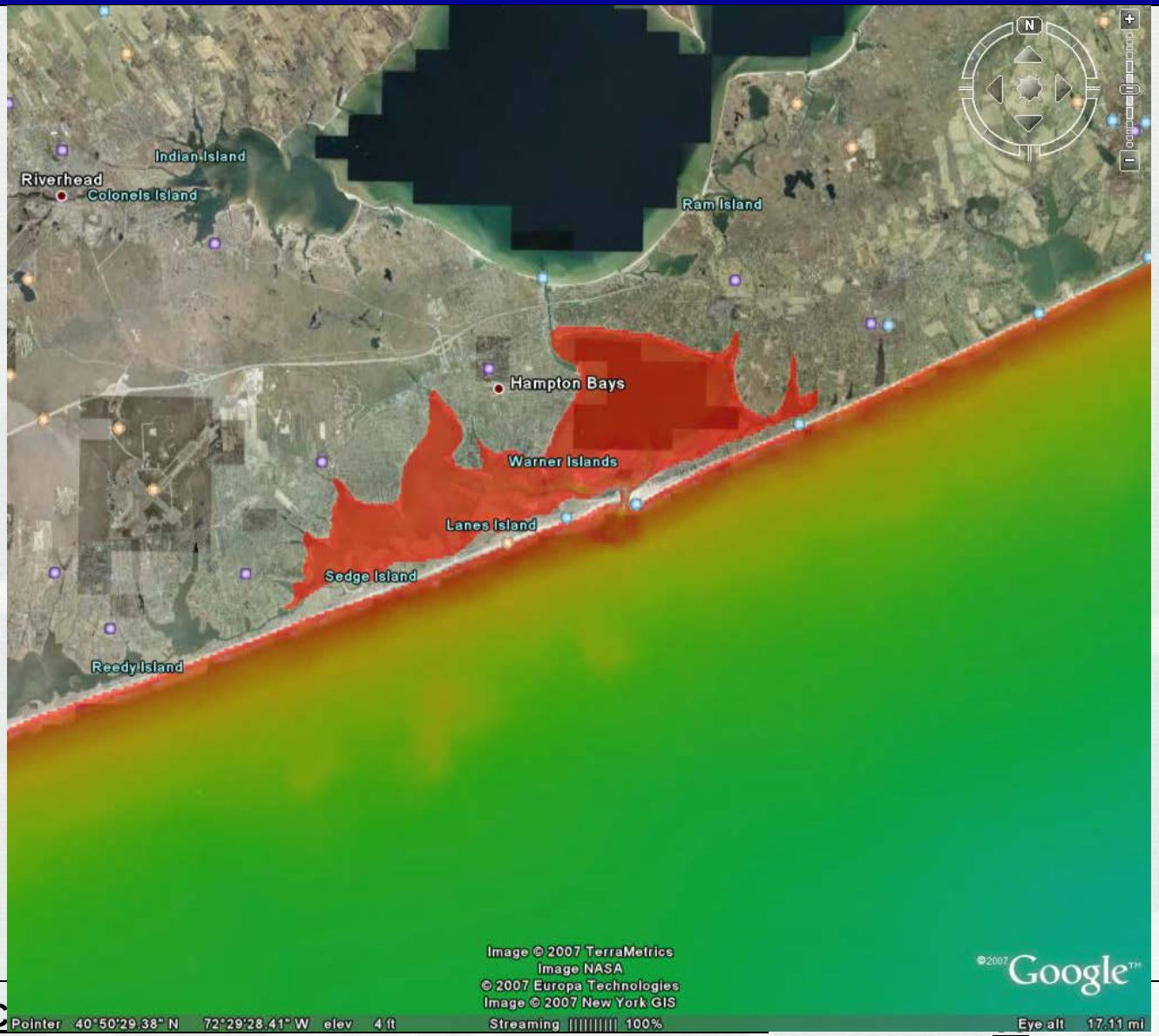
- Replaces Drawing Objects
- New Objects
  - Screen space images (logos)
  - Scale bars
  - North Arrows
- Organizes entities into layers
- Anchored in either world or screen



Contour/Vector Plots



Google Overlay (zoom)



Obtaining and Activating SMS

http://cirp.usace.army.mil/products/SMS.html

USACE –

Contact sms@erdc.usace.army.mil and request a password for SMS 11.0.

Others –

- Visit http://www.aquaveo.com/password_request for a temporary password.
- Contact Aquaveo sales at sales@aquaveo.com or call (801) 302-1400.
- Request evaluation version from within the SMS registration form.

Questions?

Mitch Brown
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