Overview of the Surface-water Modeling Software (SMS) GUI

Objective: This lecture will discuss the Surface-water Modeling Software GUI.
Outline

- Introduction to SMS
- Mesh Generation
- Interpolation
- Manning’s n Coefficient
- Boundary Conditions
Introduction to SMS

The Complete Surface-water Solution

SMS offers the complete solution for efficiently managing the entire surface-water modeling process including riverine and coastal applications.

http://www.Aquaveo.com/
Introduction to SMS

- SMS is a *model-independent* GIS for numerical modeling
- It uses a *Conceptual Approach*
- User-interface for Multiple 2D/3D models
  - ADCIRC
  - ADH
  - CMS FLOW/CMS Wave
  - FESWMS
  - HYDRO AS-2D
- RiverFlow2D uses SMS for model setup
  - Mesh generation and refinement
  - Interpolation of elevations
  - Assigning boundary conditions
- RiverFlow2D uses the Generic Mesh Module
  - Defining spatially variable roughness
  - Assigning components
  - Visualizing model results
Introduction to SMS

- SMS Features
  - 64-bit (handle large models)
  - Online web services
  - Optimized OpenGL graphics for improved hardware rendering and realistic renderings
  - Generate Animations and KMZ’s
  - Add Annotations, scale bars, north arrows
  - Horizontal Projection on the fly
  - GIS and CAD import
  - Data Calculator
  - Wiki/Forum/Tutorials/Videos
Introduction to SMS

- SMS is broken up 12 Modules
  - Mesh
  - Curvilinear Grid
  - Cartesian Grid
  - 3D Cartesian Grid
  - Scatter
  - Map
  - GIS
  - 1D Grid
  - Particle Module
  - Images
  - CAD
  - Annotation
Mesh Module

- Used to create, edit, and visualize mesh data
- Also referred to as unstructured or flexible meshes
- Meshes defined by nodes and elements/cells
- Add boundary conditions
Introduction to SMS

Scatter Module

- Used to create, edit, and visualize point data sets and triangulated irregular networks
- DEMs can be read in and converted to TINs
- Filter scatter sets to eliminate redundant data
- Datasets can be interpolated to other modules (meshes, grids, etc.)
Map Module/Conceptual Module

- Create and edit GIS like data
- Used to create conceptual models as well as data for other purposes
- Conceptual model is a geometry (mesh/grid) independent representation of the numeric model domain
- Conceptual models can be converted to model geometry and boundary conditions
- Conceptual model makes it easier to create, edit, and alter models
### Introduction to SMS

#### Map Module/Conceptual Module Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Tool Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Select Feature Point or Node" /></td>
<td>Select Feature Point or Node</td>
</tr>
<tr>
<td><img src="image" alt="Create Feature Point" /></td>
<td>Create Feature Point</td>
</tr>
<tr>
<td><img src="image" alt="Select Feature Vertex" /></td>
<td>Select Feature Vertex</td>
</tr>
<tr>
<td><img src="image" alt="Create Feature Vertex" /></td>
<td>Create Feature Vertex</td>
</tr>
</tbody>
</table>

[The Select Feature Point or Node tool](image) is used to select stand alone feature points or the ends of arcs. A single point is selected by left-clicking directly on it. Multiple points can be selected at once by dragging a box. To drag a selection box, left-click and hold the button while dragging the mouse to the appropriate dimensions; release the button to enclose and select the contents. Additional points can be appended to the selection list by holding the `SHIFT` key while selecting by any method. Selecting new points without holding the `SHIFT` key will first clear the selection list and then add the newly selected points. A selected point can be removed from the selection list by holding the `SHIFT` key as it is reselected. Pressing the `ESC` key will clear the entire selection list. Right-clicking will open a menu specific to this tool.

Feature points are locked so they are not accidentally dragged. When a single point is selected, its location is shown in the Edit Window. The coordinates can be changed by typing in the edit field.

The Graphics Window's status bar will display information on the selected items depending on the settings find through the `File | Info Options` command in the File Menu.

Selected points can be deleted by selecting the Edit | Delete menu command on the Edit Menu, by pressing the `DELETE` or `BACKSPACE` keys, or from the right-click menu. Arcs attached to the deleted points are deleted.

This tool is available when one or more feature points exist.

[The Create Feature Point tool](image) is used to place new feature point in the current coverage. A single point is created at a time by left-clicking at the coordinate desired. The newly created point is selected to allow Z Coordinate changes in the Edit Window.

This tool is always available, however, creating a feature point is only allowed while in plan view.

[The Select Feature Vertex tool](image) is used to select one or more vertices on an arc. These vertices define the shape of the arc. The vertex may have a "z" elevation specified, but no other attributes are associated with the feature vertices.

[The Create Feature Vertex tool](image) is used to create a new vertex on the interior of an arc. The vertex is created at the current arc location, but can be selected and moved to change the shape of the arc. The vertex may have a "z" elevation specified, but no other attributes are associated with the feature vertices.
### Select Feature Arc

The **Select Feature Arc** tool is used to select one or more existing feature arcs. This is typically done to assign attributes to an arc or delete the arc. A single arc is selected by left-clicking directly on it. Double-clicking on the arc will bring up the arc attributes dialog or that arc. Multiple arcs can be selected at once by dragging a box. Additional arcs can be appended to the selection list by holding the `SHIFT` key while selecting by any method. Selecting new arcs without holding the `SHIFT` key will first clear the selection list and then add the newly selected points. A selected arc can be removed from the selection list by holding the `SHIFT` key as it is reselected. Pressing the `ESC` key will clear the entire selection list. Right-clicking will open a menu specific to this tool.

Feature arcs may have elevations associated with the arc as an entity. This is independent of the node and vertex elevations. When a single arc is selected, its elevation is shown in the **Edit Window**. The coordinates can be changed by typing in the edit field.

Multiple feature arcs may also be selected to create a feature arc group to associate attributes with a string of arcs rather than a single arc. These arcs must connect end to end. The arc group is created from the **Feature Objects** menu command.

The Graphics Window’s status bar will display information on the selected items depending on the settings found through the **File | Info Options** command in the **File Menu**.

Selected arcs can be deleted by selecting the **Edit | Delete** menu command on the **Edit Menu**, by pressing the `DELETE` or `BACKSPACE` keys, or from the right-click menu. Nodes attached only to the deleted arcs are deleted.

This tool is available when one or more feature arcs exist.
Introduction to SMS

Module Summary

- Scatter Data
  - Elevation data
  - Compare Results
- Map Data
  - Model boundary
  - Mesh interpolation
  - Manning’s n value
  - Observation data
- Mesh
  - Property boundaries
  - Boundary conditions
  - Physical parameters
  - Initial conditions
  - Topographies
  - Model results
Optional Macros

Optional Macro Toolbar

- Lighting Options – See Lighting Options.
- Contour Options – See Contour Options.
- Vector Options – See Vector Options.
- Get Module Info – See Get Info.
- Plot Wizard – See Plot Wizard.

File Toolbar

- Open – See Open.
- Save Project – See Save Project.
- Print – See Print.
- Delete – Delete the selected items. If none are selected, delete all items.

Display Toolbar

- Refresh – See Refresh.
- Frame – See Frame.
- Display Options – See Display Options.
- Plan View – See Plan View.
Introduction to SMS

File Menu
Introduction to SMS

Edit Menu
Introduction to SMS

Mesh Display Menu
Introduction to SMS

Mesh Display Options

![Mesh Display Options](Image)
Mesh Display Options

Display Options

2D Mesh
General
Map
Scatter

Contour method
Color Fill
Use Color Ramp
Color Ramp...

Data range
Dataset: elevation
Min: -6.437989234324
Max: 128.6759924316
Specify a range
Min: 0.1
Max: 12.01
Fill above

Contour interval
Number of Contours
11

Populate Values...
Populate Colors...

Value
Color
1.0
1
2.0
2.91
3.0
4.82
4.0
5.73
5.0
6.64
6.0
7.55
7.0
8.46
8.0

Transparency: 53 %

Specify precision 1
Legend: Options...
Bold Options...
Label Options...

All On
All Off
OK
Cancel
Introduction to SMS

Mesh Display Options
Introduction to SMS

Mesh Display Options
Introduction to SMS

Mesh Display Projection
Introduction to SMS

Mesh Display Plot Wizard

Plot Wizard - Step 1 of 2

- Plot Type:
  - Computed vs. Observed Data
  - Residual vs. Observed Data
  - Error vs. Simulation
  - Error vs. Time Step
  - Error Summary
  - Time Series
  - Observation Profile
  - ARR Mesh Quality

No observation coverage exists. Shows how computed values change over time at an observation point.
Introduction to SMS

Mesh Data Menu
Introduction to SMS

Mesh Data Calculator

Dataset Toolbox

- Math
  - Compare datasets
  - Data Calculator
  - Angle convention
- Spatial
  - Geometry
  - Grid Spacing
- Temporal
  - Sample time steps
  - Compute derivative
- Conversion
  - Scalar to Vector
  - Vector to Scalar
- Coastal
  - Wave Length and Celerity
  - Gravity Waves
  - Adveective
- Modification
  - Map activity
  - Filter

Data Sets

- Mesh
  - d1. elevation
  - OUTPUT RESULTS
    - d2. Bed Elevation
    - d3. DELTA BED
    - d4. CRY-WET
    - d5. Depth
    - d6. Froude
    - d7. 0rg Bed Elevation
    - d8. Shear Stress TAU
    - d9. Velocity Mag
    - d10. Volum Sed Transport Mag
    - d11. WSE
    - d12. x location
    - d13. y location

Time Steps

- 1. 00:00:00

Calculator

Output dataset name: new dataset

Done
Introduction to SMS

Mesh Nodes Menu
Introduction to SMS

Mesh Elements Menu
Introduction to SMS

Mesh Web Menu
Introduction to SMS

Mesh Window Menu
Introduction to SMS

Mesh Help Menu
Introduction to SMS

Mesh RiverFlow2D Menu
Mesh RiverFlow2D Menu

- Each tab represents input data that is in the DIP
- Some of the newer features in the DIP will be added to SMS in the near future
Exporting RiverFlow2D Files

- RiverFlow2D will convert the *.2dm file and run
Introduction to SMS

**RiverFlow2D_Template.2dm**

- SMS requires the RiverFlow2D.2dm to be read into the program to add the RiverFlow2D menus
Generating a Mesh

- Read in elevation data into scatter module
Generating a Mesh

- Switch to Map Module
- Create a polygon for channel and outer boundary
- Redistribute vertices along polylines
- Define a material for each polygon
Add Boundary Conditions

- Add boundary conditions to upstream end along polyline
- Add boundary to upstream downstream end along polyline
Generating a Mesh

- Double click on polygon
- Set mesh type
- Set interpolation Type
- Set Material (Manning’s)
- Right click layer and specify to create mesh
Interpolation Method

- Multiple interpolation options
- Extrapolate if missing data
- Truncate values to limit interpolation
Multiple Data Sets

- When selecting interpolation method, select which data set to use for interpolation
- For overbank, select the elevation data set
- For channel, select Channel Data
Multiple Data Sets

- Multiple Scatter sets can be merged together
- Option to delete lower priority scatter data if they overlap