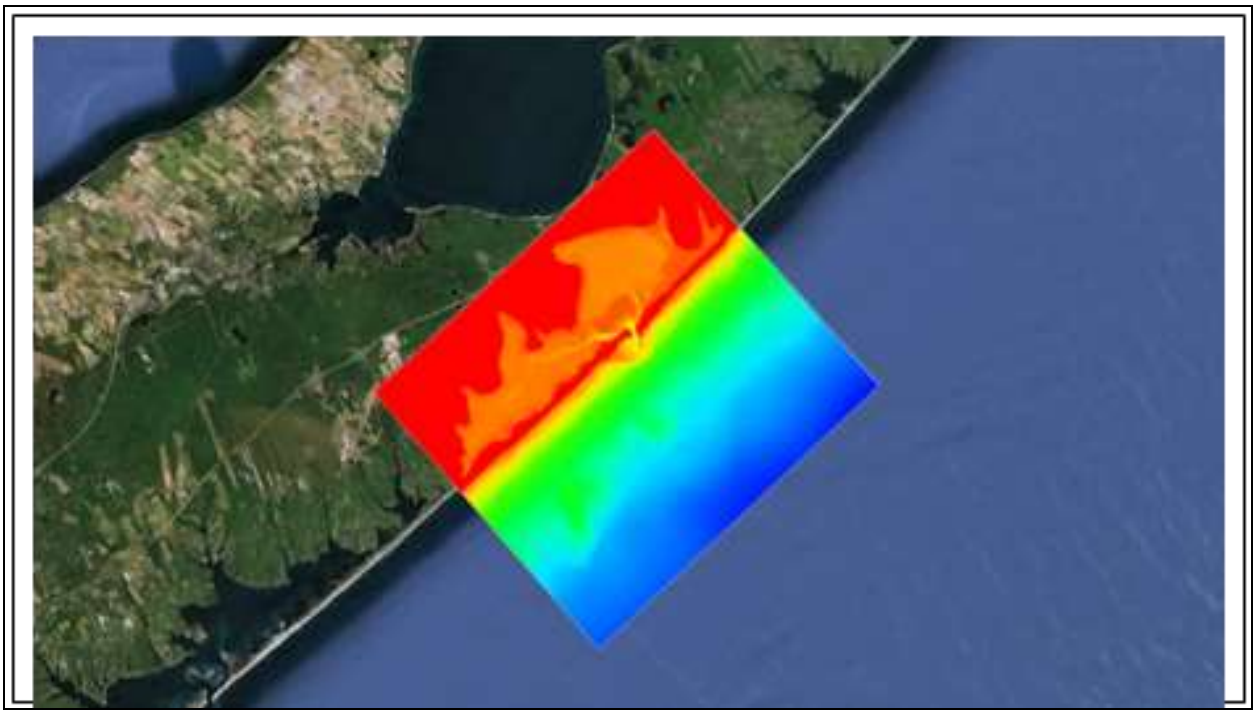
SMS

v. 13.1

SMS 13.1 Tutorial

Cartesian Grid Generation



Objectives

This tutorial gives a brief introduction to generating a Cartesian Grid in SMS.

Prerequisites

- Overview Tutorial
- Map Module Tutorial

Requirements

- Map Module
- Cartesian Grid Module
- Scatter Module

Time

- 5–10 minutes

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1 Introduction

This tutorial demonstrates how to create a Cartesian grid in SMS. Some of the models that use Cartesian grids include STWAVE, CMS-Wave, and TUFLOW. This tutorial uses data from Shinnecock Inlet, Long Island, New York, in the United States.

2 Getting Started

The initial project includes a digital elevation map (TIF file) as well as a bathymetric survey scatter dataset of the area around Shinnecock Inlet on the south shore of Long Island, New York.

To open the project, do the following:

1. Select *File* | **Open...** to bring up the *Open* dialog.
2. Browse to the *data files* folder for this tutorial and select "shinnecock.sms".
3. Click **Open** to import the project and exit the *Open* dialog.

The project should appear similar to Figure 1.

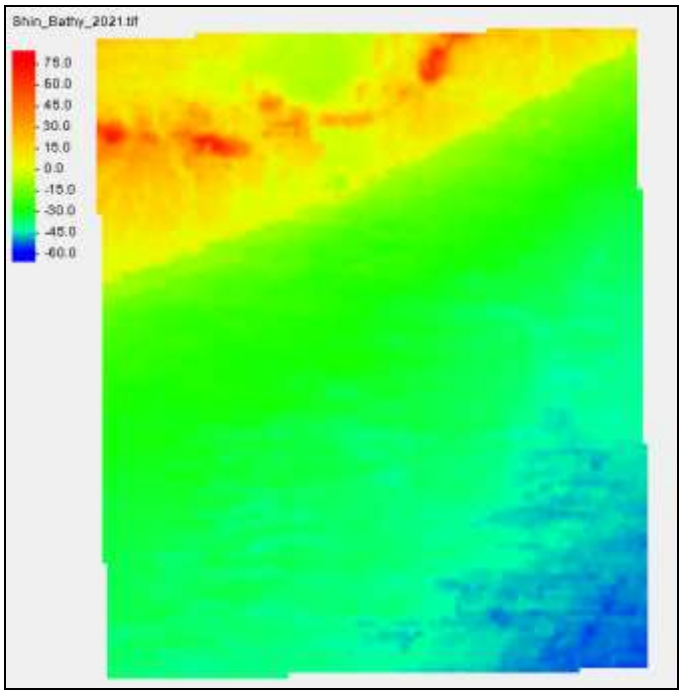

Figure 1 Initial project appearance

3 Creating the Cartesian Grid

The next step is to create a Cartesian grid. The grid frame is created in the **Map** module, which contains tools for creating GIS objects such as points, arcs, and polygons. It is also used for creating a frame which will be filled in by a Cartesian grid.

3.1 Creating the Cartesian Grid Frame

To create the grid frame:

1. In the Project Explorer, turn on "Shinnecock".
2. Switch to the **Map** module.
3. Right-click "Area Property" in the Project Explorer, select *Type* | *Generic*| **CGrid Generator**.
4. Right-click "Area Property" and select **Rename**.
5. Enter "Shinnecock" and press *Enter* to set the new name.
6. Using the **Create 2-D Grid Frame** tool, click out three corners of the grid in the order shown in Figure 2 to create the grid frame.

The first two points clicked define the *i*-direction, which is the direction of the incoming waves, and the last two points clicked are placed on the land.

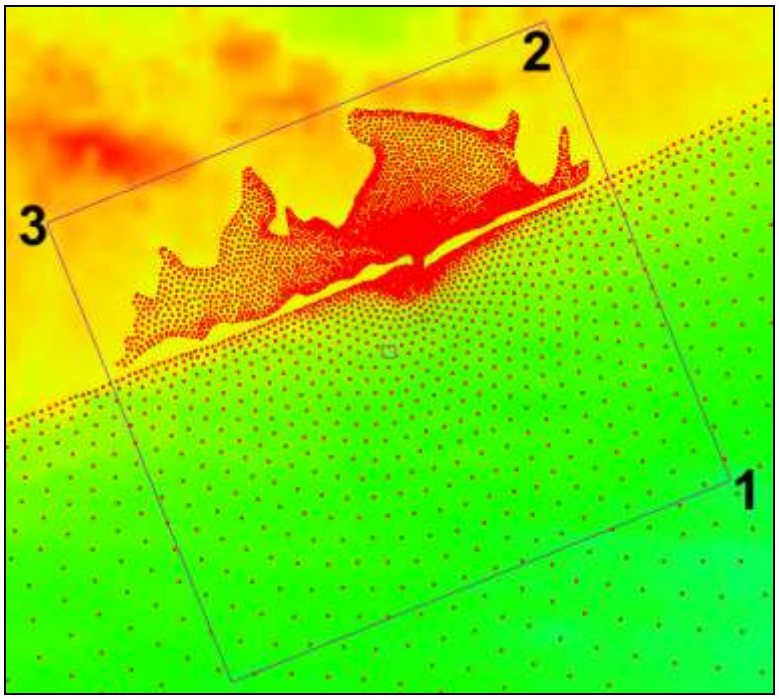

Figure 2 Creating the Cartesian grid frame

7. Using the **Select Grid Frame** tool, click on the selection box in the middle of the grid frame. The origin should be in the bottom right corner of the grid, as indicated by the arrows (Figure 3).

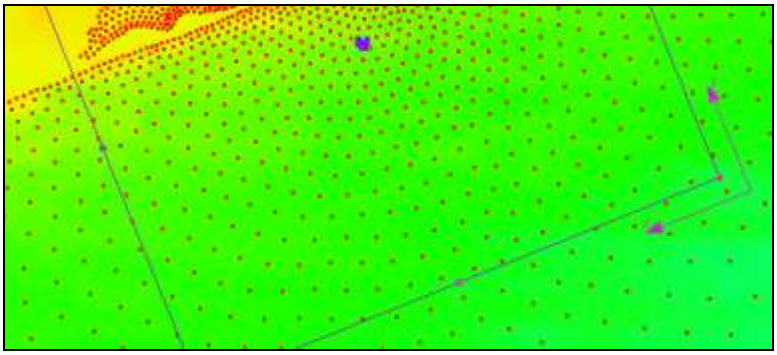

Figure 3 The origin is at the bottom right corner of the grid

8. Resize the grid frame by dragging the corners or edges until the grid frame fits over the desired area.

Dragging a corner or side resizes the frame. Dragging the middle point moves the entire frame. Rotate the frame around the origin by dragging the circle located at the top right corner just outside the grid.

9. Double-click on the grid frame to bring up the *Grid Frame Properties* dialog.

The origin and angle can be manually entered in this dialog. This allows for greater precision in placement of the grid.

10. In the *Origin, Orientation and Dimensions* section; enter "438,000.0" as the *Origin X*.
11. Enter "70,000.0" as the *Origin Y*.
12. Enter "112.0" as the *Angle*.
13. Enter "15,000.0" as the *I size* and "17,000.0" as the *J size*.

These values can also be edited when generating the 2D grid in section 3.2.

14. Click **OK** to close the *Grid Frame Properties* dialog.
15. Click outside the grid frame to unselect the grid.
16. **Frame** the project.

3.2 Mapping to the Grid

This section covers how to fill in the interior of the grid. While the grid is filling, the depth and current values will be interpolated from the scatter set and mapped to each cell.

To do this:

1. Right-click on "Shinnecock" and select *Convert* | **Map → 2D Grid** to bring up the *Map → 2D Grid* dialog.
2. Verify the values in the *Origin, Orientation and Dimensions* section match those given in steps 9–12 in section 3.1.
3. In both the *I Cell Options* and *J Cell Options* sections, select *Cell size* and enter "100.0" in the field to the right of each.
4. In the *Elevation Options* section, select "Raster" from the *Source* drop-down then click **Options…** to bring up the *Raster Sets* dialog.
5. Select "Shin_bathy_2021.tif" from the tree list.
6. Click **OK** to exit the *Raster Sets* dialog.

The elevation values will now be interpolated to the final Cartesian grid. Other options can be selected as needed.

7. Click **OK** to exit the *Map → 2D Grid* dialog and create the Cartesian grid.
8. In the Project Explorer, hide "Shinnecock".

The project should appear similar to Figure 4.

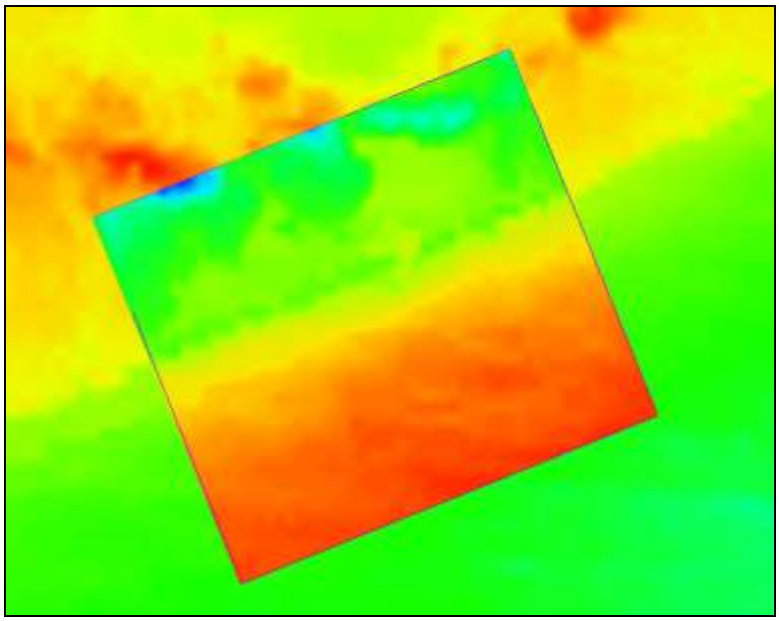

Figure 4 Cartesian grid

A Cartesian grid has been created from the grid frame.

4 Interpolating to a 2D Grid

It is easy to interpolate elevations when creating the 2D grid. However, updated elevation values to represent updated surveys or proposed conditions may be desired.. To do this:

1. Right-click on "  Shinnecock" and select **Interpolate to…** to bring up the *Interpolation Options* dialog.
2. In the *Interpolate from* section, select "  elevation" from the tree list.
3. Change the *New name* column from "elevation" to "new elevation". This will be the name of the new dataset on the grid.
4. Turn on the *Map Z* toggle box to indicate that this should be the elevation dataset (the z values) for the grid.
5. In the *Interpolate to* section, select "Shinnecock Grid"
6. Click the **Options** button next to Interpolation method at the bottom of the dialog to open the *Interpolate – Linear* dialog.
7. Change the *Value* in the *Extrapolation* section to "1.0" to represent dry land.
8. Click **OK** to close the *Interpolate – Linear* dialog.
9. Click **OK** to close the *Interpolation Options* dialog.

SMS brings up a warning that around 6153 cells were assigned values from the extrapolation value. This is because these cells do not lie inside the extents of the scatter set.

10. Click **OK** to close the warning.

The "elevation" dataset on the scatter set has now been interpolated to the Cartesian grid as "new elevation". It has also been assigned to be the "Z" dataset. The old dataset still exists on the grid as a regular scalar dataset.

5 Grid Display Options

To view only the grid:

1. **Frame** the project.
2. Right-click on the " Cartesian Grid Data" object in the Project Explorer and select **Display Options…** to bring up the *Display Options* dialog.
3. On the *Cartesian Grid* tab, click **All Off** and turn on *Contours*.
4. On the *Contours* tab, in the *Contour method* section, select "Color Fill" from the first drop-down.
5. Click on the **Color Ramp...** button. This brings up the *Color Options* dialog.
6. Select *User defined* as the *Palette Method* and select the "Atlas Shader" palette on the right side.
7. Click **OK** to close the *Color Options* dialog.
8. Turn on the *Specify a range* option
9. Enter "-40" for *Min* and "15" for *Max*.

This corresponds to 40 meters below sea level as dark blue and 15 meters above sea level as red.

10. Click **OK** to close the *Display Options* dialog.
11. Switch between the two datasets under the " Shinnecock Grid" to visualize the different elevations.

6 Conclusion

This concludes the "Cartesian Grid Generation" tutorial, which showed how to create a Cartesian grid using the Cartesian grid generator coverage. It also showed ways to interpret elevation to a Cartesian grid.