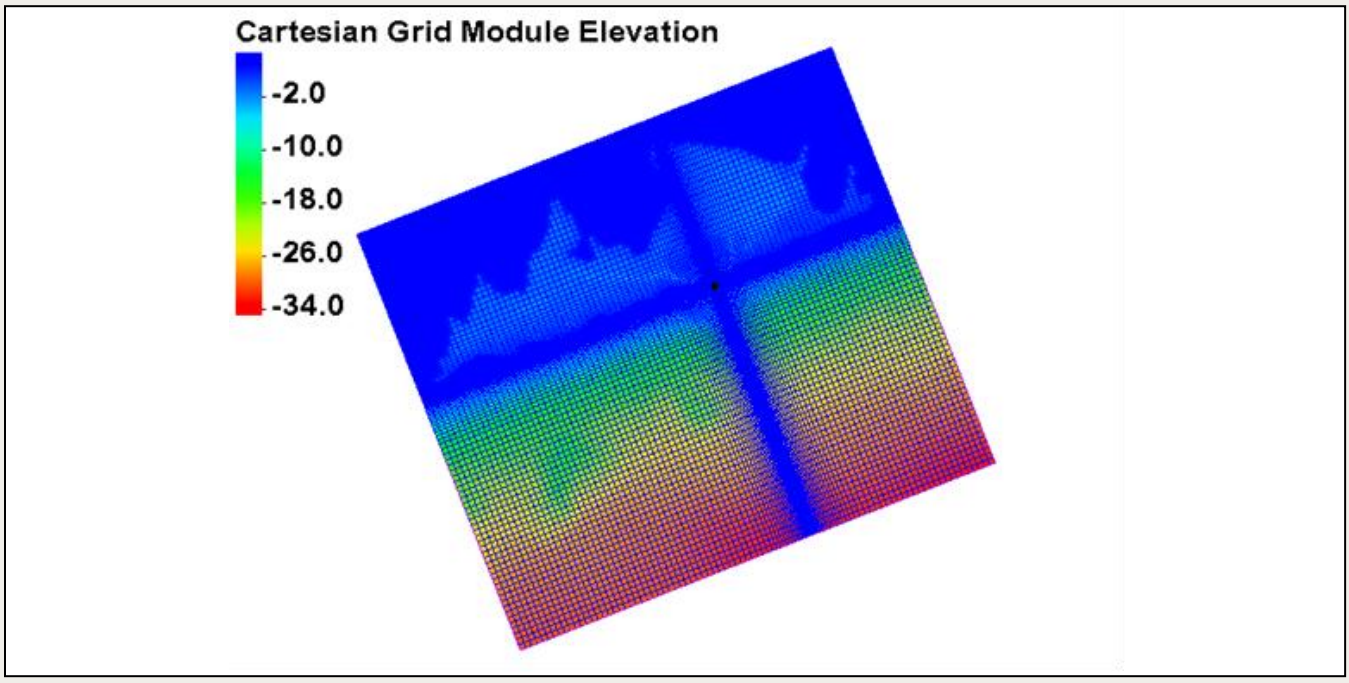
SMS 14.0 Tutorial

Variable Resolution Cell-Centered Grid

Creating a Variable Resolution Cell-Centered Grid



Objectives

Learn to create a variable resolution cell-centered grid using data from the area on the south shore of Shinnecock Inlet, Long Island, New York.

Prerequisite Tutorials

- Overview
- Creating a Cell-Centered Grid

Required Components

- SMS Core

Time

- 5–10 minutes

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1 Introduction

This tutorial demonstrates the creation of a cell-centered grid with variable cell resolution for use with the Coastal Modeling System (CMS) models. This type of grid is typically used with the CMS-Wave numerical model. It is recommended that quadtree grids be used for CMS-Flow.

The data used for this tutorial includes images, bathymetry data, and coastline data for the south shore of Long Island, New York, in the area of Shinnecock Bay.

2 Getting Started

To begin the tutorial, open the project file containing all of the data needed to complete this tutorial:

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.

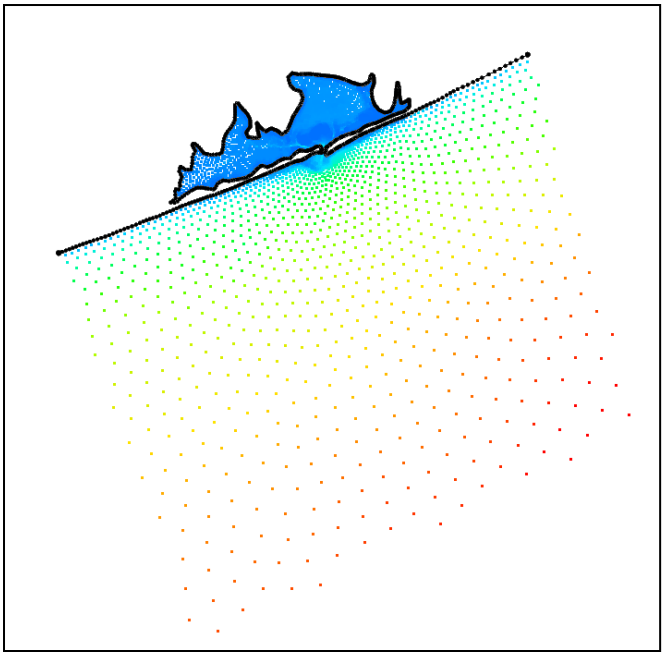

Figure 1 Scatter points with bathymetric data at Shinnecock Bay

The project contains a bathymetry scatter set and a coastline arc. The projected coordinates for all of the data have already been set to State Plane, Long Island, New York with units of meters. Annotation objects have been added for guidance in using the tutorial.

3 Creating the CGrid Generator Coverage and Gridframe

To create a Cartesian grid, a CGrid Generator coverage with a grid frame is used. The computational domain of a Cartesian grid can be defined with three mouse clicks. Many Cartesian grid based wave models assume that the I-direction of the grid is aligned with the principal wave direction. To define the grid in this fashion:

1. Right-click on the "Map Data" entry in the Project Explorer and select **New Coverage** to open the *New Coverage* dialog.
2. Under the Generic tab, Select "CGrid Generator" for the *Coverage Type* and enter "20-200 meter" for the *Coverage Name*.
3. Click **OK** to close the *New Coverage* dialog.
4. Turn on the "Grid Guidance" annotation layer.

This layer includes three labeled points.

5. Using the **Create 2-D Grid Frame** tool, click near the location of the point labeled "Point 1".
6. Move the mouse to the location of "Point 2" and click again.

A line will be drawn from the original click point to the cursor.

7. Move the mouse to the location of "Point 3" and click a third time.
8. Turn off the "Grid Guidance" annotation layer.

4 Creating a Refine Point

Refine points can be created to adjust the resolution of the Cartesian grid. In this case, we want smaller cells in the area of the inlet. To specify this:

1. **Zoom** into the inlet (Figure 2) to get a clear view of the two sides.

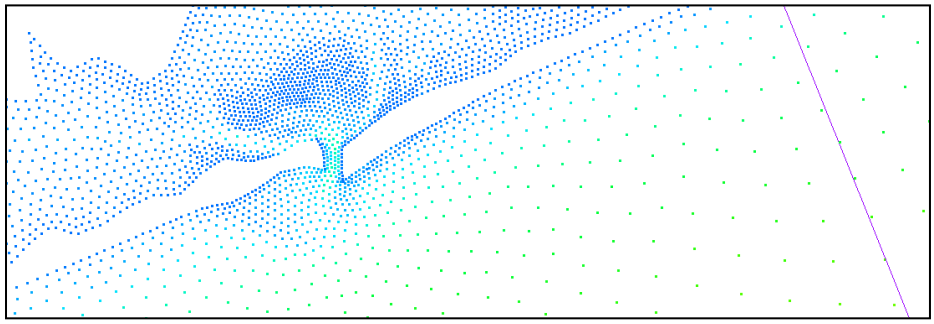

Figure 2 Zoom location show by the red rectangle

2. Using the **Create Feature Point** tool, click in the middle of the inlet.
3. Using the **Select Feature Point** tool, double-click on the node to bring up the *Refine Point* dialog.
4. Turn on both *Refine grid in the I direction* and *Refine grid in the J direction* to specify refinement in both directions.
5. Enter "20" (m) as the base cell size in both edit fields.
6. Click **OK** to exit the *Refine Point* dialog.

7. Right-click "20-200 meter" coverage and select *Convert* | **Map → 2D Grid** to bring up the *Map → 2D Grid* dialog.
8. Select the Use refine points option for both the I Cell Options and J Cell Options.
9. Enter "200" as the *Maximum cell size* for both directions.
10. Leave the *Maximum bias* value at 1.1.

This indicates that the cells will get 10% bigger at most in each row/column until they reach the maximum size.

11. In the *Elevation options* section, select "Scatter Set" from the *Source* drop-down.
12. Click **Select…** to bring up the *Interpolation* dialog.
13. Select the "elevation" function as the *Scatter Set To Interpolate From.*
14. In the *Interpolation Options* section, under *Extrapolation*, enter "2.0" as the *Single Value.*

This instructs SMS to assign any cell that is created outside of the scatter set a value of 2 meters above sea level (land).

15. Click **OK** to close the *Interpolation* dialog.

The *Map → 2D Grid* should appear similar to Figure 3.

This ensures that the land will be treated as land. This step would not be required if survey data included points on the shore with positive elevations.

16. Click **OK** to close the *Map → 2D Grid* dialog and create the grid.

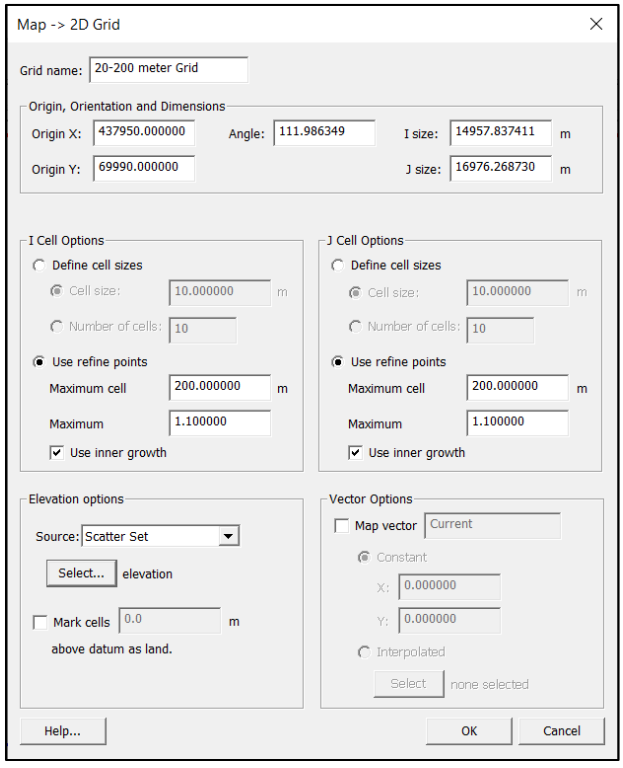

Figure 3 The Map to 2D Grid dialog with parameters

The resulting grid has cells by the refine point that are 20 meters square. As the cells get further from the inlet, they grow to 200 meters square. Individual rows/columns must maintain the same height/width so cells in line with the refine point will be rectangular.

The resulting grid should appear as shown in Figure 4.

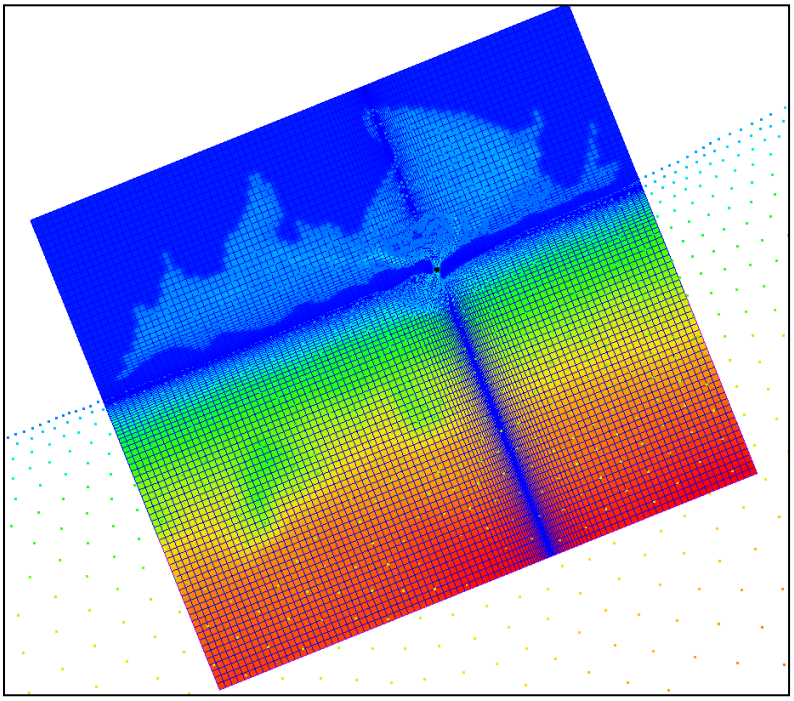

Figure 4 Resulting grid contours

5 Conclusion

This concludes the “Creating a Variable Resolution Cell-Centered Grid” tutorial. This has illustrated:

- The creation of a grid frame in a CGrid generator coverage.
- The creation and specification of parameters for a refine point.
- Creation of a Cartesian grid from the CGrid generator coverage.

If desired, experiment with:

- Specifying a varying resolution in only one direction.
- Working with multiple refine points and experimenting with the *Use inner growth* option to control the size of cells between refine points. With this option off, the size varies linearly between refine points. With it on, the cells grow towards the maximum size allowed.