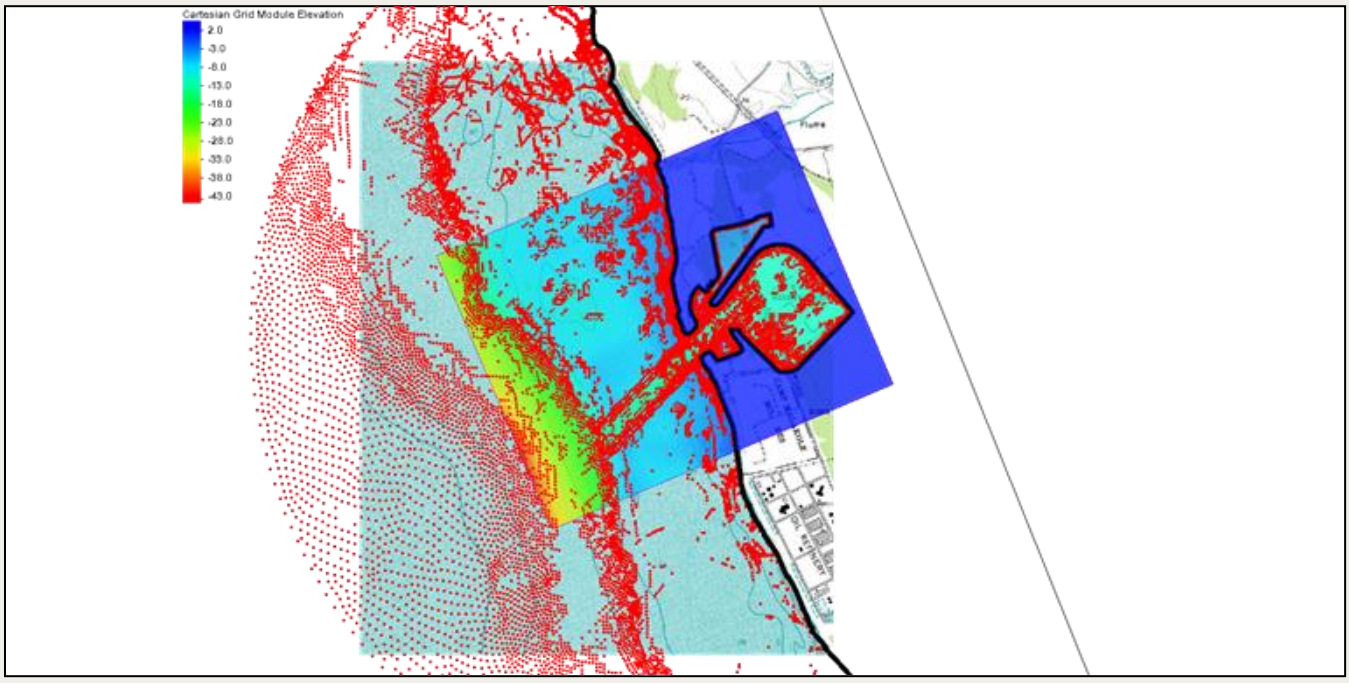
SMS 13.3 Tutorial

Creating a Cell-Centered Grid

Cell-Centered Grids in SMS



Objectives

Learn to create a cell-centered grid using data from the area around Kalaeloa Barbers Point Harbor in Hawaii.

Prerequisite Tutorials

- Overview

Required Components

- SMS Core
- BOUSS-2D Model & Interface

Time

- 5–15 minutes

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1 Introduction

This tutorial demonstrates the creation of a cell-centered grid for use with BOUSS-2D. However, these steps would be similar to those for any model that uses cell-centered grids.

The data used for this tutorial includes images, bathymetry data, and coastline data for the southwest corner of the island of Oahu, Hawaii.

2 Getting Started

To begin the tutorial, open a 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 "kalaeloa.sms".
3. Click **Open** to import the project and exit the *Open* dialog.

The project should appear similar to Figure 1.

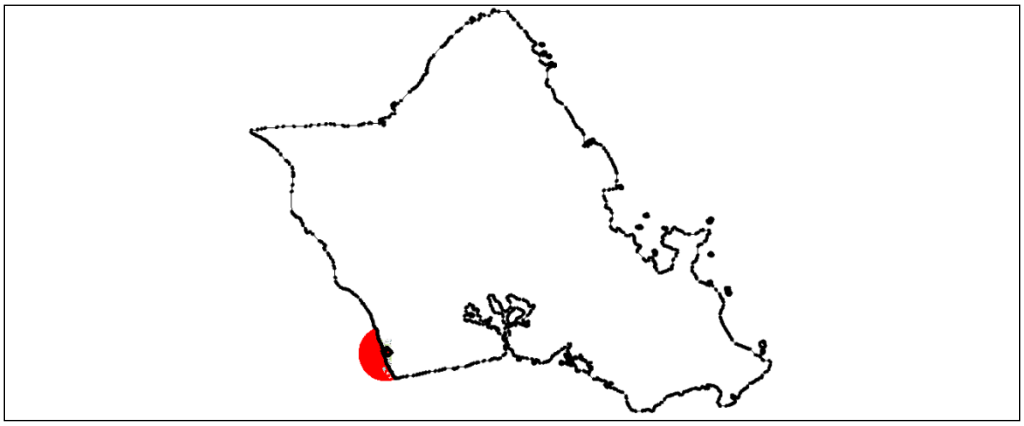

Figure 1 Coastline of Oahu with bathymetric data at Kalaeloa Barbers Point Harbor

The project contains two topographic maps, a bathymetry scatter set, and a coastline arc. The projected coordinates for all of the data has already been set.

The images came from TerraServer[1] and are therefore registered to the Transverse Mercator NAD 83 coordinate frame. The bathymetry has been transformed to be relative to this coordinate frame.

[1] See http://www.terraserver.com/ for more details.

3 Trimming the Coastline

There is currently more coastline here than is needed for this tutorial, including many other harbors, land features, and islands unrelated to Kalaeloa Barbers Point Harbor. Use the following steps to trim the coastline to the area involved.

1. **Zoom** into the area being modeled (where the maps and the scattered point data are located, as seen in Figure 2).

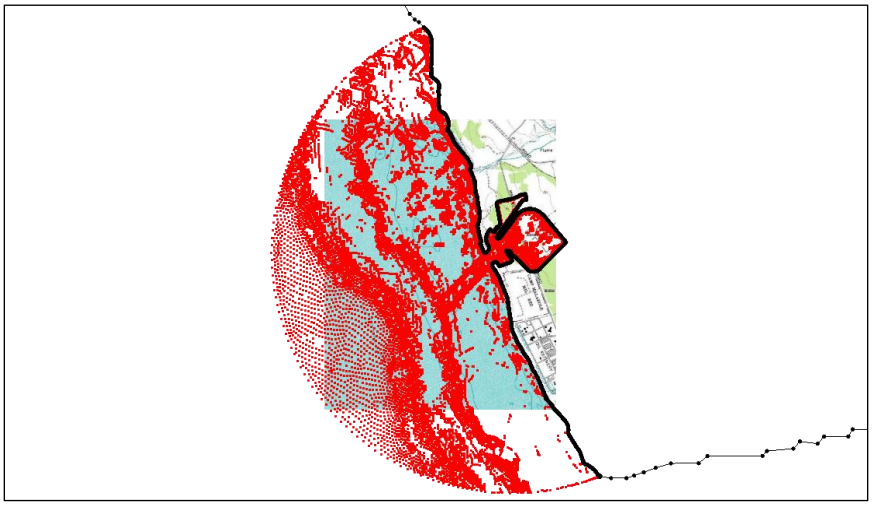

Figure 2 Area being modeled

2. Switch to the **Map Module**.
3. Right-click on "Area Property" and select *Type* | *Models* | *BOUSS-2D* | **BOUSS-2D**.
4. Using the **Create Feature Arc** tool, create an arc as shown in Figure 3, beginning with P1 and continuing through P3.
5. Using the **Select Feature Arc** tool, select the coastline away from the area of interest and hit the *Delete* key to eliminate this arc (the part to the right of P3 and above P1 in Figure 3).

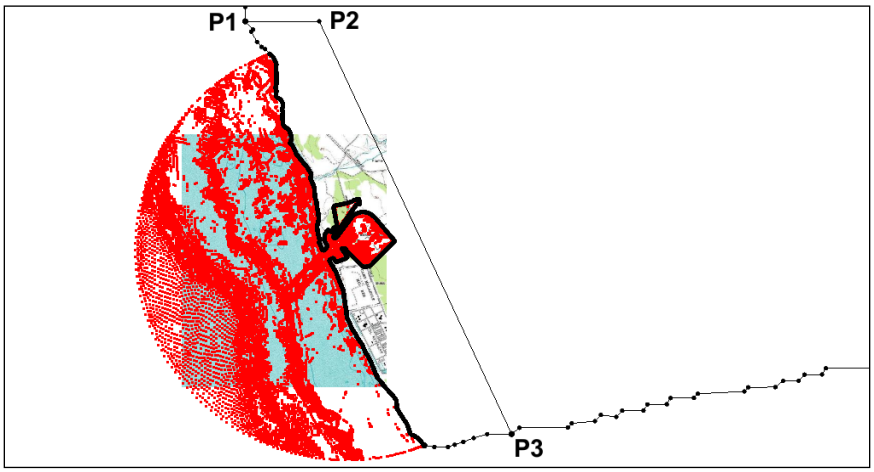

Figure 3 Arc bisecting area around simulation from island

6. Click **Yes** when asked to confirm the deletion.

7. **Frame** the project to show the various islands which did not get deleted with the main island shoreline arc.
8. Using the **Select Feature Arc** tool, drag a box around the various island arcs and *Delete* them. Repeat until all the island arcs are deleted.
9. **Frame** the project when done.

The project should appear similar to Figure 4.

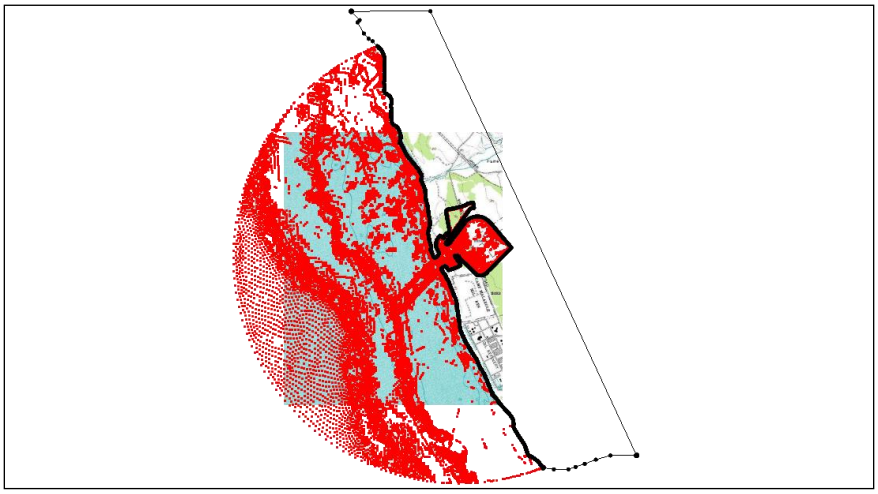

Figure 4 Area of interest after extra coastline arcs deleted

Now to build a polygon to represent the land around Kalaeloa Barbers Point Harbor:

1. Select *Feature Objects* | **Build Polygons**.
2. Using the **Select Polygon** tool, select the newly-created land polygon.
3. Select *Feature Objects* | **Select Intersecting Objects …** to bring up the *Select Intersecting Objects* dialog (Figure 5).
4. In the *Choose Data to Select* section, select *Scatter*.
5. Next to the *Scatter* option, change the drop-down menu to “Triangles”.
6. Turn on “ bp_bathy_filtered” under “ Scatter Data” in the dataset tree.
7. Click **OK** to close the *Select Intersecting Objects* dialog.

The surface now represents the seabed around the region of Kalaeloa Barbers Point Harbor. The next step is to create a computational grid for BOUSS-2D.

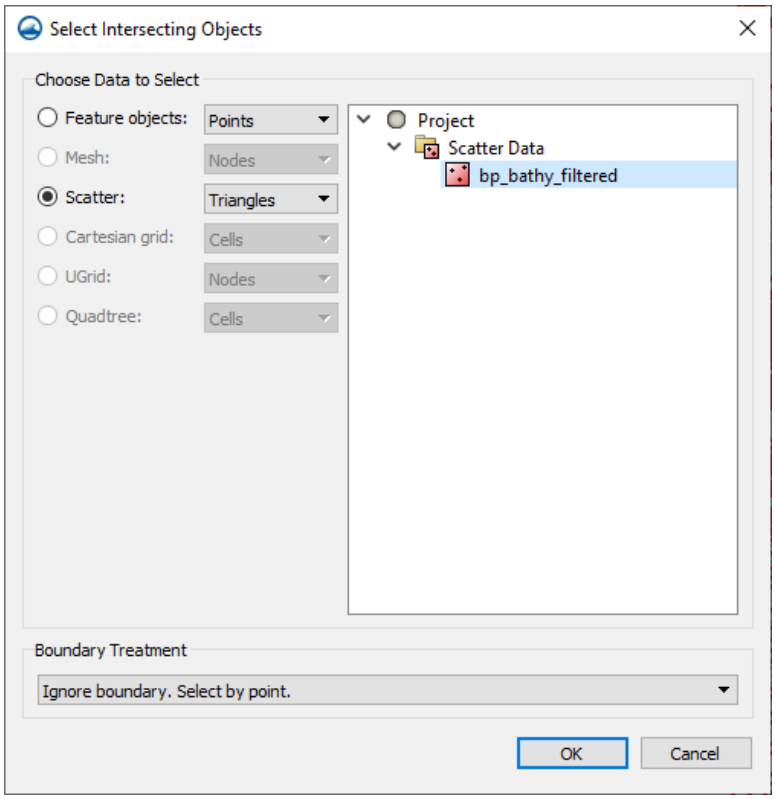

Figure 5 Select Intersecting Objects dialog

4 Creating the Grid

The computational domain of BOUSS-2D is a Cartesian grid that can be defined with three mouse clicks. To ensure consistency, create the grid by following these steps:

1. **Zoom** into the harbor area as shown in Figure 6.

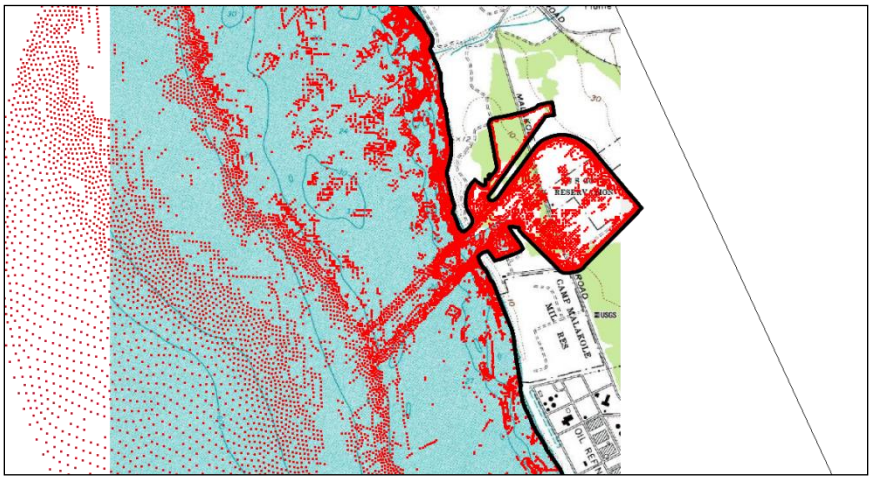

Figure 6 Zoomed view of harbor area

2. Select "Area Property" to make it active.

3. Using the **Create 2-D Grid Frame** tool, click a grid approximately as shown in Figure 7. The grid does not have to be exactly the same since it will be modified in the *Map → 2D Grid* dialog.

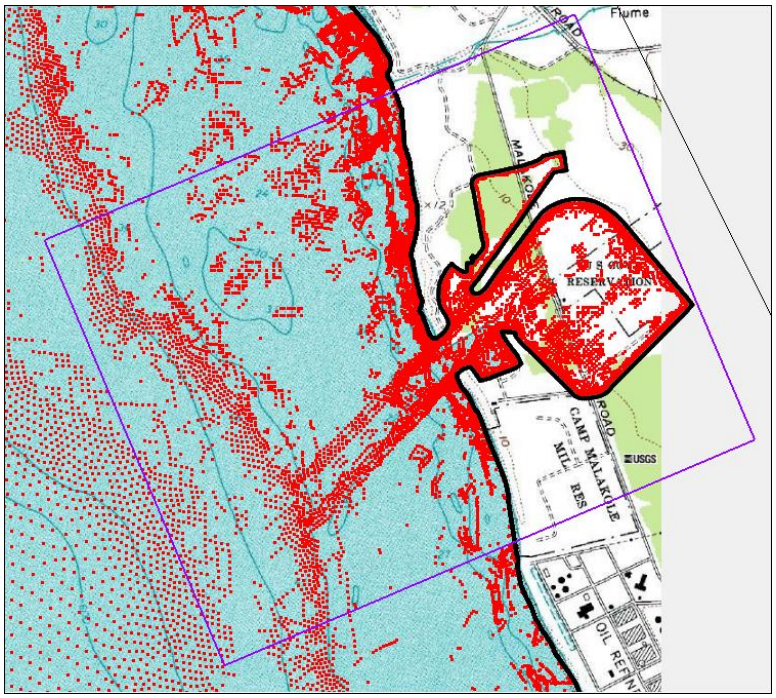

Figure 7 Grid frame

4. Right-click "Area Property" and select *Convert* | **Map → 2D Grid** to bring up the *Map → 2D Grid* dialog (Figure 8).

For consistency, the following values will be entered to define the grid. In other projects, these values can be left as defined by the grid frame if desired.

5. In the *Origin, Orientation and Dimensions* section, enter "590100.0" as the *Origin X*.
6. Enter "2356750.0" as the *Origin Y*.
7. Enter "23.0" as the *Angle*.
8. Enter "2500.0" as the *I Size*.
9. Enter "2000.0" as the *J Size*.

Next to enter the elevation source for the grid.

10. In the *Elevation options* section, select "Scatter Set" from the *Source* drop-down and click **Select…** to bring up the *Interpolation* dialog.
11. In the *Interpolation Options* section, enter "1.0" as the *Single Value*.

This assures 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.

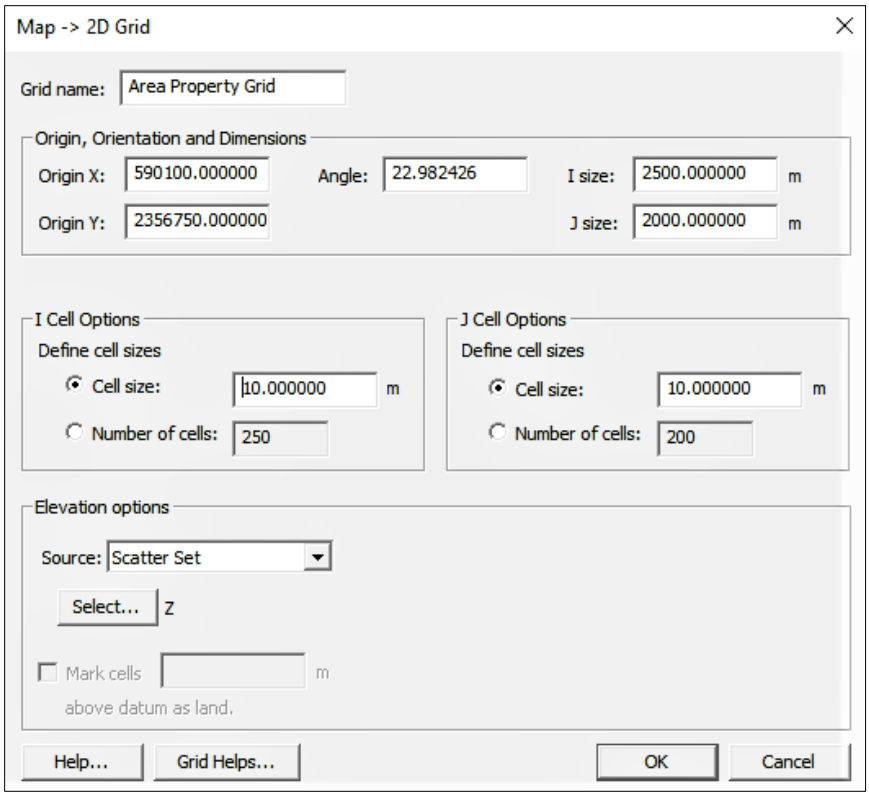

Figure 8 Parameters to create the grid

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

For the next part, keep in mind that an appropriate cell size depends on the wavelength of the waves being modeled.

13. Click **Grid Helps…** to open the *BOUSS-2D Map → 2D Grid Helps* dialog.
14. Turn on *T (wave period)* and enter "15.0".
15. Click **OK** to close the *BOUSS-2D Map → 2D Grid Helps* dialog.

Notice that the recommended cell size is about 11.7 meters. Smaller cells increase the definition of the model, but also increase computation time. For the purposes of this tutorial, a smaller cell size will be used.

16. Enter "10.0" as the *Cell size* in both the *I Cell Options* and *J Cell Options* sections.
17. Click **OK** to close the *Map → 2D Grid* dialog and create the grid.
18. Right-click on the newly created "Area Property Grid" and select **Rename**.
19. Enter "10m Grid" and press *Enter* to set the new name.

It is a good habit to change the name of grids once they are created so that basic information about them can be recognized through the name. It is now easy to see that the grid has a cell size of 10m in I and J directions.

5 Setting the Display Options

Now to adjust the display options to view how the elevation data was added to the grid:

1. Turn off "Scatter Data" and "Map Data" in the Project Explorer.
2. Select *Display* | **Display Options…** to open the *Display Options* dialog.
3. Select "Cartesian Grid" from the list on the left.
4. On the *Cartesian Grid* tab, turn off *Cells* and turn on *Contours*.
5. On the *Contours* tab, in the *Contour method* section, select "Color Fill" from the first drop-down.
6. Enter "25" as the *Transparency*.
7. Click **OK** to close the *Display Options* dialog.

The display should appear similar to Figure 9.

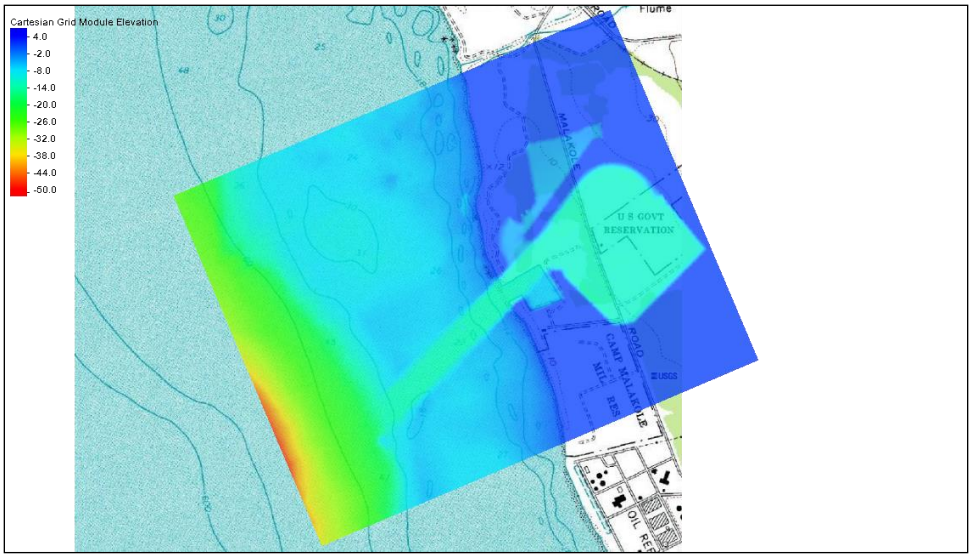

Figure 9 Resulting grid contours

6 Conclusion

This concludes the "Creating a Cell-Centered Grid" tutorial. Feel free to continue experimenting with the SMS interface, or exit the program.