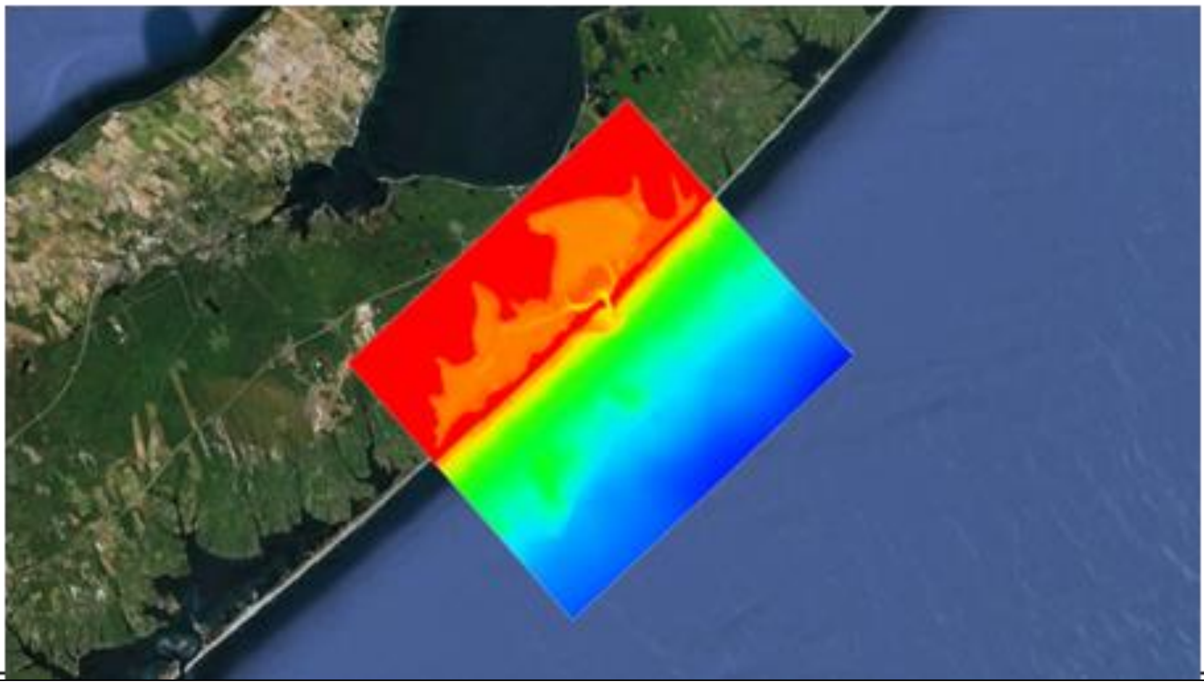
v. 13.1

SMS 13.1 Tutorial

CMS-Wave Analysis



Objectives

This tutorial gives a brief introduction to the CMS-Wave interface and model. A previously-created grid will be edited, CMS-WAVE will be run, and the results visualized.

Prerequisites

- Overview Tutorial
- Map Module Tutorial

Requirements

- CMS-Wave
- Map Module
- Cartesian Grid Module
- Scatter Module

Time

- 15–30 minutes

1 Introduction

This model is similar to STWAVE and the tutorials for the models are similar. As with the STWAVE tutorial, scatter set data from the south shore of Shinnecock Inlet, Long Island, New York, is used. The display and object projections have already been set.

2 Getting Started

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. The project contains a 2D grid set to the CMS-WAVE model type. See the "Grid Generation" tutorial for information on how this grid was generated.

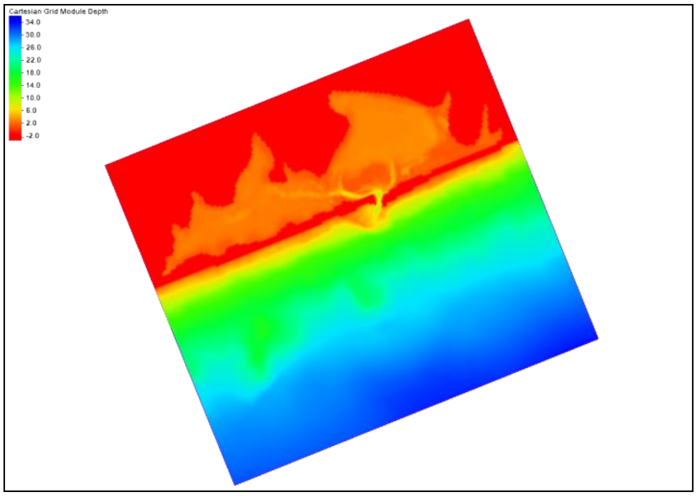


Figure 1 Initial project appearance

3 Editing the Grid and Running CMS-Wave

3.1 Generating Spectral Energy Distribution

Now to generate the spectral energy distribution by doing the following:

1. Right-click " Map Data" in the Project Explorer and select **New Coverage** to bring up the *New Coverage* dialog.
2. In the *Coverage Type* section, select *Generic* | **Spectral**.
3. Enter "Spectral" as the *Coverage Name*.
4. Click **OK** to close the *New Coverage* dialog.
5. Using the **Create Feature Point** tool, create a node near the middle of the bottom grid boundary (see arrow in Figure 2).
6. Using the **Select Feature Point** tool, double-click on the node to bring up the *Spectral Energy* dialog.
7. Click on the **Update Reference Time…** button. The *Time Settings* dialog appears. Enter "04/05/2018 12:00 AM" as the reference time.
8. Click **OK** to close the *Time Settings* dialog.
9. SMS will ask if you want to recalculate the reference times. Since no data is loaded it doesn't matter what you enter. Click **Yes**.
10. In the *Spectral Manager* section, click **Create Grid** to bring up the *Spectral Grid Attributes* dialog.
11. Enter "112.0" as the *Grid angle*.

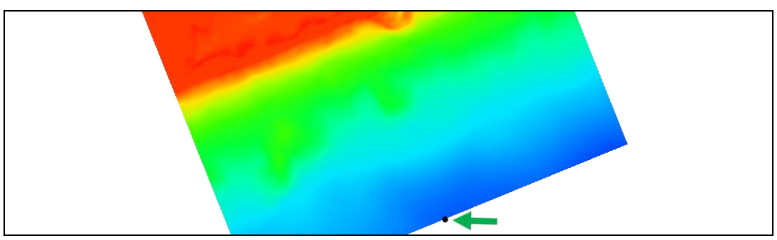


Figure 2 Node near the middle of the bottom grid boundary

This matches the angle of the CMS-Wave grid.

12. Select "Local" from the *Spectral energy grid plane type* drop-down.
13. Click **OK** to close the *Spectral Grid Attributes* dialog and open the *Create Spectral Energy Grid* dialog.
14. In the *Frequency Distribution* section, enter "40" as the *Number*.
15. Click **OK** to create a new spectral energy grid and close the *Create Spectral Energy Grid* dialog.

The new spectral energy grid will appear in the *Spectral Manager* section below the four buttons at the top. This section is the spectral energy tree.

16. Select "Spectral Grid" to see an example displayed in the *Spectral Viewer* section.
17. Click **Generate Spectra** to bring up the *Generate Spectra* dialog.
18. In the *Spectral Parameters* section, enter the following parameters into the spreadsheet:

Time Offset (hrs)/Index	Angle (deg)	Hs (m)	Tp (s)	Gamma	nn
1.0	25.0	1.0	20.0	8.0	30

19. In the *Parameter Settings* section, select *Specify once for all spectra* under *Seaward Boundary Depth* and enter "32.0" in the field below that.

This tutorial assumes that the wave gauge is approximately at the offshore edge of the grid. If the gauge was in deeper water, specify the actual depth of the gauge.

20. Click **Generate** to generate the spectrum and close the *Generate Spectra* dialog.

The new spectrum, labeled "1.00000", should appear below the grid in the spectral energy tree. The "1.00000" represents the time offset from the reference time in hours. The reference time is displayed below the tree control.

21. Select the spectrum "1.00000".

The contours show the energy distribution. Select cell corners to view/edit their energies.

22. Click **Done** to exit the *Spectral Energy* dialog.

3.2 Model Control

In the model control, CMS-Wave inputs can be set. To view the wind parameters:

1. Select " CMS-Wave Grid" in the Project Explorer to make it active.
2. Select *CMS-Wave* | **Model Control…** to bring up the *CMS-Wave Model Control* dialog.
3. In the *Spectra* subsection of the *Input Forcing* section, select "Half plane" from the *Plane type* drop-down.
4. Click **Spectral Grid...** to bring up the *Spectral Grid Properties* dialog.
5. In the *Frequency Distribution* section, enter "40" as the *Number*.
6. Click **OK** to close the *Spectral Grid Properties* dialog.
7. At the bottom of the *Input Forcing* section, click **Define Cases…** to bring up the *Spectral Events* dialog.
8. In the *Edge Boundary Type* section, click **(none selected)** to the right of *Side 1* to bring up the *Select spectral coverage* dialog.

9. Select "Spectral" from the list and click **OK** to close the *Select spectral coverage* dialog.

This assigns the spectral data contained in the coverage to the boundary.

10. In the *Events* section, click **Populate From Coverage**.

This creates an event for every time entry defined in the spectral coverage. In this case, there is one event created with a time of "1.000".

11. Click **OK** to exit the *Spectral Events* dialog.
12. Click **OK** to close the *CMS-Wave Model Control* dialog.

3.3 Selecting Monitoring Stations

The final step is to select cells to act as monitoring stations. When selecting a cell, the i and j location can be seen at the bottom of the screen in the status portion of the Edit Window. SMS can also select cells by selecting their i and j coordinates.

1. Select the **Select Grid Cell** tool.
2. Make sure no cells are selected and select *Data* | **Find Cell…** to bring up the *Find Cell* dialog.
3. Select *Find by (I,J)*, then enter "110" for *I* and "60" for *J*.
4. Click **OK** to close the *Find Cell* dialog.

A cell in the bay should now be selected (Figure 3). It is also possible to select cells by entering the nearest *x* and *y* values or entering the cell ID.

5. Select *CMS-Wave* | **Assign Cell Attributes…** to bring up the *Cell Attributes* dialog.
6. In the *Cell Type* section, select *Monitoring Station* and click **OK** to close the *Cell Attributes* dialog.
7. Repeat steps 2–6 to assign monitoring stations in the inlet and the ocean. The *i* and *j* coordinates for the inlet cell are 92 and 66, respectively, and the *i* and *j* coordinates for the ocean cell are 50 and 70, respectively.

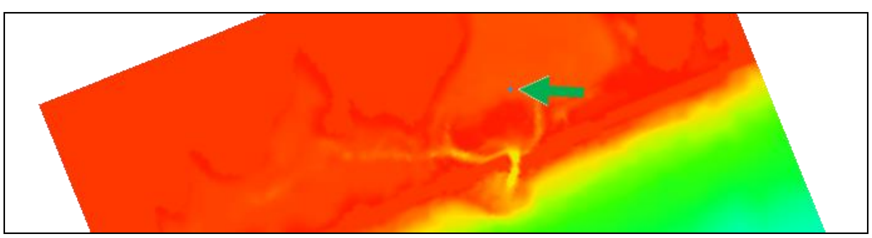


Figure 3 The first selected cell (indicated by arrow)

3.4 Saving the Simulation

Before running CMS-Wave, it is recommended to save the simulation:

1. Select *File* | **Save As…** to bring up the *Save As* dialog.
2. Select "Project Files (*.sms)" from the *Save as type* drop-down.
3. Enter "shinnecock1.sms" as the *File name*.
4. Click **Save** to save the project under the new name and close the *Save As* dialog.

3.5 Running CMS-Wave

To run CMS-Wave:

1. Select *CMS-Wave* | **Save project, Export and Launch CMS-Wave** to bring up the *CMS-WAVE* model wrapper dialog.
2. If a message such as "cmswave.exe – not found" is given, click the **File Browse** button to manually find the CMS-Wave executable.
3. When CMS-Wave has finished running, turn on *Load solution* and click **Exit** to close the *CMS-WAVE* model wrapper dialog.

4 Post Processing

SMS provides several tools for visualizing the results of model runs.

4.1 Visualizing the CMS-Wave Solution

To see the solution results:

1. Click **Display Options** to bring up the *Display Options* dialog.
2. Select "Cartesian Grid" from the list on the left.
3. On the *Cartesian Grid* tab, turn on *Contours* and *Vectors*.
4. On the *Contours* tab, in the *Contour method* section, select "Color Fill" from the first drop-down.
5. On the *Vectors* tab, in the *Arrow Options* section, select "Define min. and max. length" from the *Shaft length* drop-down.
6. Enter "25" as the *Minimum*.
7. Enter "50" as the *Maximum*.
8. In the *Vector Display Placement and Filter* section, select "on a grid" from the *Display* drop-down.
9. Click **OK** to exit the *Display Options* dialog.
10. Select " Depth" under " CMS-Wave Grid" in the Project Explorer to view their contours and vectors.

The project should appear similar to Figure 4.

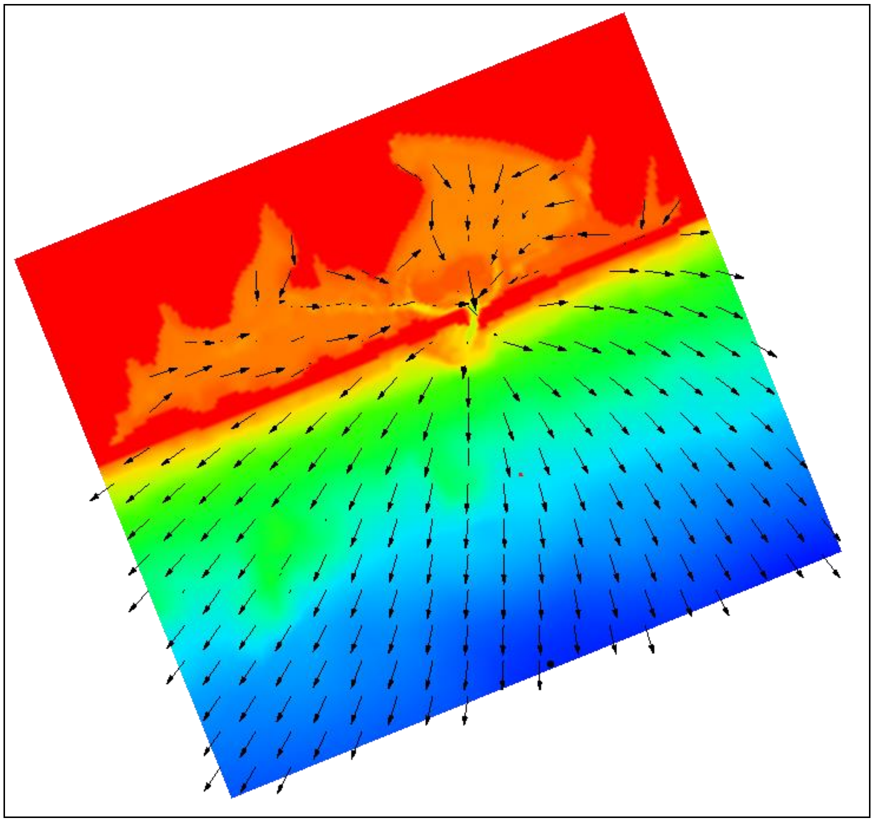


Figure 4 CMS-Wave results

4.2 Visualizing Current Effects

To see the effects when a current is added at the inlet from the receding tide, do this:

1. Select *CMS-Wave* | **Model Control…** to bring up the *CMS-Wave Model Control* again.
2. In the *Input Forcing* section, select "Spatially varying" from the *Currents* drop-down and click **Select…** to bring up the *Select Currents Dataset* dialog.
3. Select " Wave" from the list in the *Select* section and click **Select** to close the *Select Currents Dataset* dialog.
4. Click **OK** to exit the *Model Control* dialog.
5. Use *File* | **Save As…** to bring up the *Save As* dialog.
6. Enter "shinnecock1_curr.sms" as the *File name*.
7. Click **Save** to save the project under the new name and close the *Save As* dialog.
8. Rerun CMS-Wave by selecting *CMS-Wave* **| Save project, Export and Launch CMS-Wave** to bring up the *CMS-WAVE* model wrapper dialog.
9. When the model is finished running, turn on *Load solution* and click **Exit** to close the *CMS-WAVE* model wrapper dialog.

10. Select the different scalar and vector datasets of this simulation to view the contours and vectors.

Notice the difference that the current makes to the results.

4.3 Visualizing the Spectral Energy

The spectral energy is recorded at each monitoring station in the grid frame. To view the spectral energy:

1. Select *File* | **Open…** to bring up the *Open* dialog.
2. Select "shinnecock1_curr__CMS-Wave Grid.obs" and click **Open** to import the solution file and exit the *Open* dialog.

SMS will create a new coverage that can be used to visualize the spectral data contained in the observation file.

3. Select " shinnecock1_curr__CMS-Wave Grid" to make it active.

Three nodes should appear in this coverage located where the monitoring stations were specified. It may be necessary to turn off the display of the grid contours to see the nodes.

4. To view the data at each location, use the **Select Feature Point** tool and double-click on the desired node to bring up the *Spectral Energy* dialog.
5. Review the spectral energy at each monitoring station using the *Spectral Viewer* section.

The ocean station is not much different than the input spectral energy. The energy increases in the inlet and changes direction. The energy in the bay is very low compared to the inlet. Look at the spectral energies of the monitoring stations with a current. Notice that the current dampens the energy in the inlet but slightly increases the energy in the bay.

6. When done reviewing, click **Done** to exit the *Spectral Energy* dialog.

5 Conclusion

This concludes the "CMS-Wave Analysis" tutorial. The model contains many more features and capabilities that have not been explored in this document. Refer to the CMS-Wave User Manual and the SMS help file found in *Help* | **SMS Help…** for more information.

