

## 1. Introduction

This case focuses on the northeastern region of Onslow Bay, NC, and includes an initial shoreline, regional contour, wave gauges, inlets, dredging, and beach fills. Most of the features used in this grid come from the capabilities of Cascade (calculating across inlets). It is more complex than the simple example, but it is not as intensive as the Long Island example. This model was calibrated as part of a previous study; however, some features such as a groin and comprehensive dredging are not included in this example mode. Therefore, this example case has not been verified.

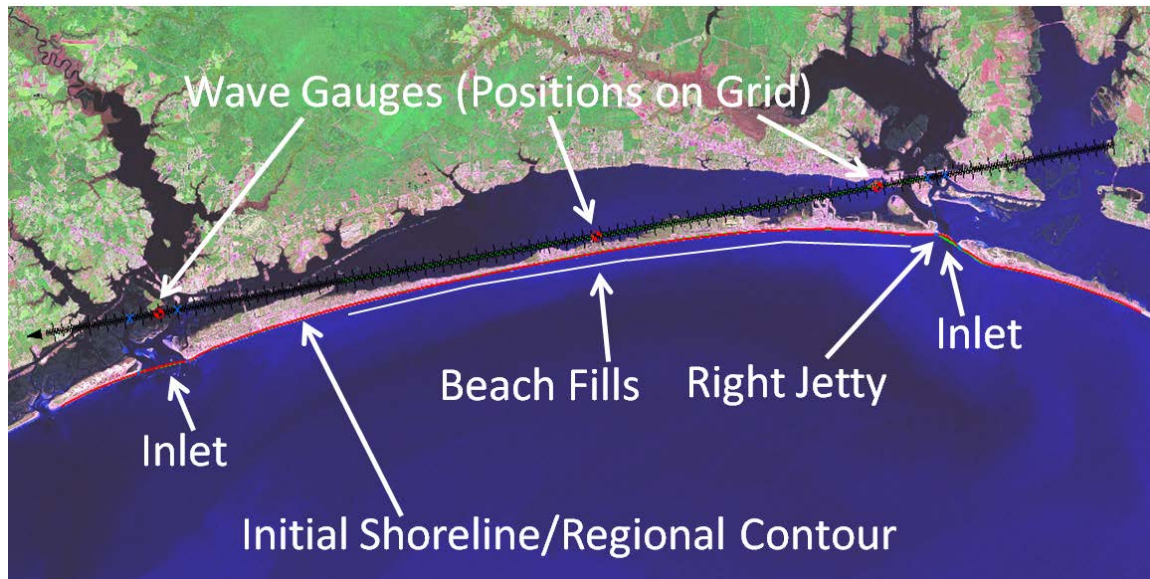


Figure 1 – Example feature overview.

## 2. Conceptual Model Setup

As much of the setup as possible is done in conceptual model space through the SMS map module. Creating the model in this manner, rather than making changing in the 1D grid module, enables modification without duplication of effort.

### 2.1 Set Up SMS 11.1

- Open SMS 11.1
- Identify location of GenCade executable.
  - *Edit->Preferences*. Select the *File Locations* tab and scroll down to *GenCade* under *Model Executables*.
  - Click the button under *Executable* located directly to the right of *GenCade*.
  - Browse to the latest model version, *GenCade\_v1r1.exe*, the newest provided executable.
- Change coverage type to GenCade.
  - Right click on the default coverage.
  - Select *Type-> Models->GenCade*.

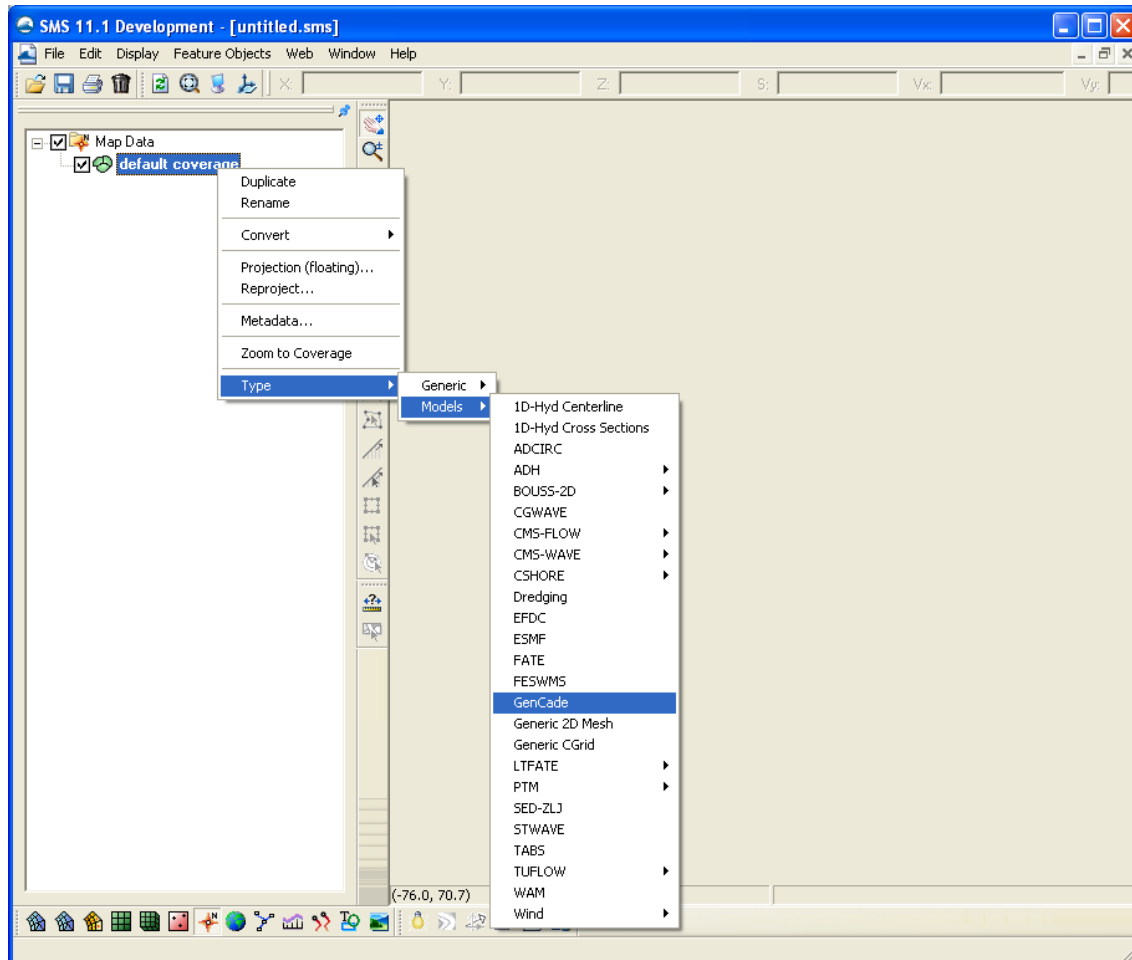


Figure 2. Set Model Type to GenCade.

- Set display projection.
  - Click *Edit->Projection* then select *Global projection*.
  - Set projection to *State Plane Coordinate System, North Carolina (FIPS 3200), NAD83, feet (U.S. Survey)*.
  - Set vertical projection to local with units in feet.
- **Note: The sign convention for the conceptual model grid is in degrees counterclockwise from the x axis. The sign convention will change after converting to the GenCade grid.**
- Set map data projection in SMS.
  - Right click on the Coverage name and select *Projection (floating)*.
  - Select *Global projection*.
  - Set projection to *State Plane Coordinate System, North Carolina (FIPS 3200), NAD83, feet (U.S. Survey)*.
  - Set vertical projection to *local* with units in feet.

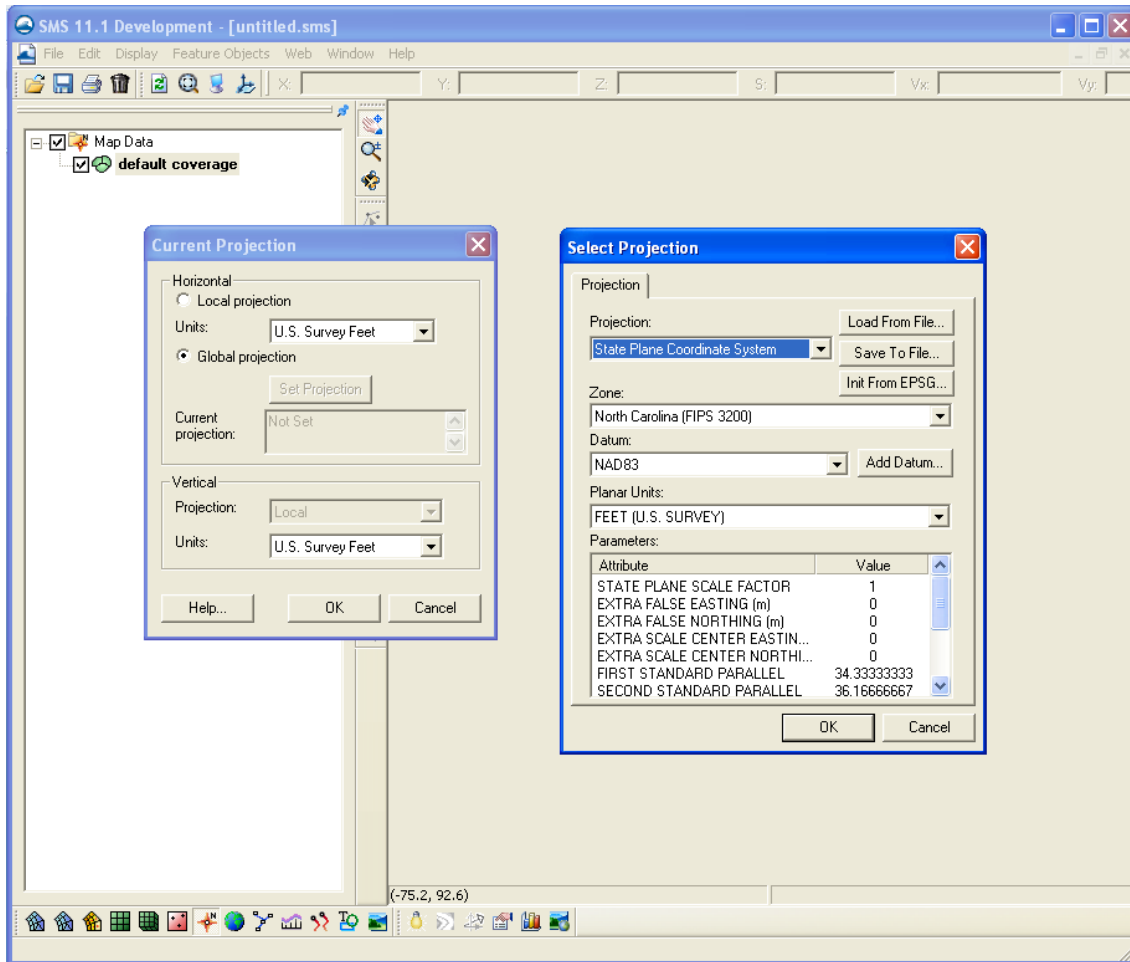


Figure 3. Set Model Projection.

## 2.2 Initial Shoreline and Regional Contour

The initial shoreline represents the initial condition from which model calculations begin. The regional contour represents the equilibrium shape of the shoreline in a regional context. A regional contour could be specified as an offshore contour, shoreline, or any other contour that accurately represents the regional shoreline trends.

- The initial shoreline in \*.cst format is located in \initial\1997initial.cst. The format of the \*.cst file was discussed in the simple example, so it will not be repeated here.
- Click the *Select Features Arc* button and click on the arc. The *GenCade Arc Attributes* window will open. Define the arc as *Initial Shoreline*.

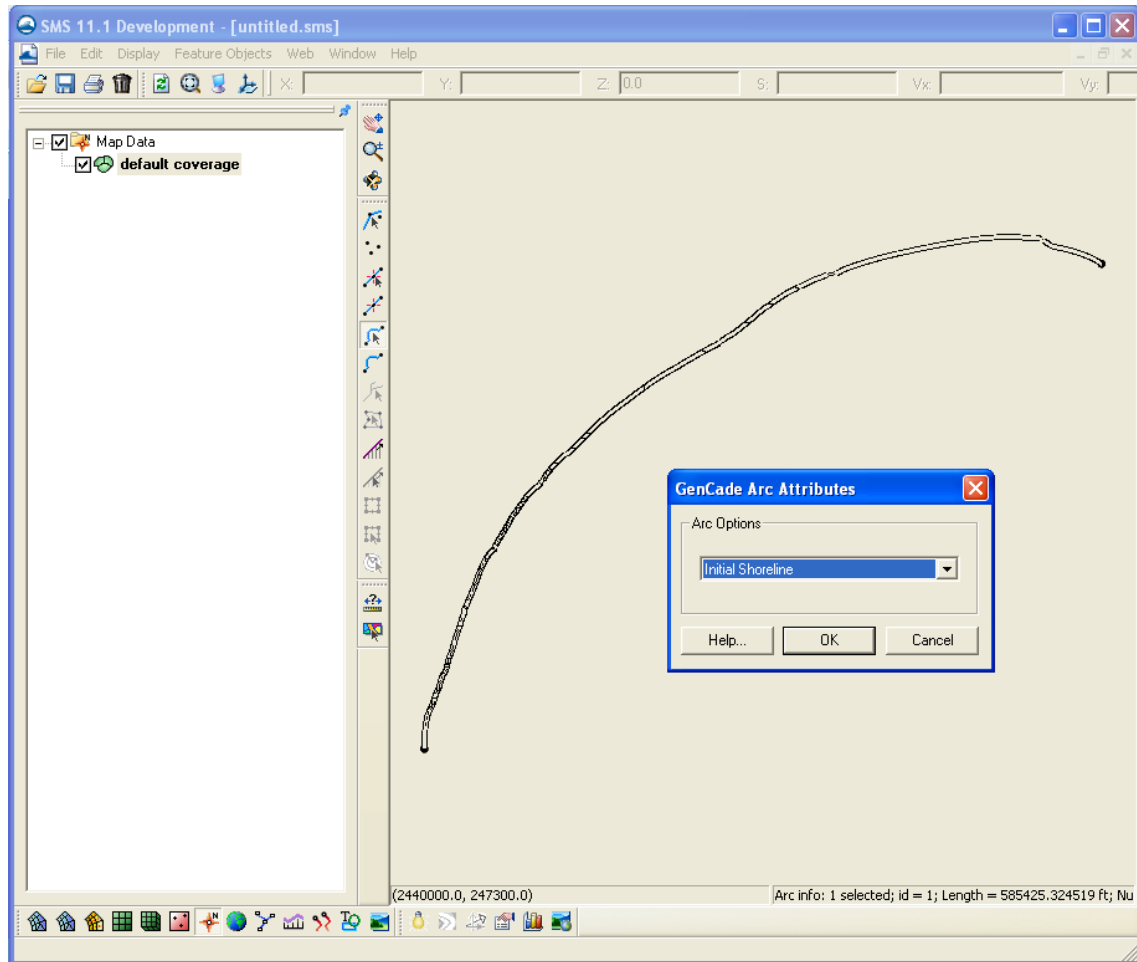


Figure 4. Set Initial Shoreline.

- Right click on *Map Data* and click on *New Coverage*. Name the new coverage *Regional\_contour*. Scroll down under *Coverage Type* to *GenCade*.
- Open *regional\_contour.cst* in the SMS (located in `\regional_contour`). Click on *Select Feature Arc* and select *Regional Contour* under *Arc Options* of the *GenCade Arc Attributes* window.
- Merge the regional contour and the initial shoreline in one coverage.
  - Select the initial shoreline and regional contour coverages; hold down CTRL to select multiple coverages.
  - Right click and select *Merge Coverages*.
    - A window will open providing the option to delete the source coverages. Select *No* to save the old coverages in case you need to merge again.
    - A new coverage is created named *Merge coverage*.
    - Delete the initial shoreline and regional contour coverages if no longer needed.

### 2.3 Import Aerial Photograph

Georeferenced aerials provide an easy way of identifying features to include in GenCade, forming the basis for much of the model setup. Take the following steps to import the aerial:

- Open \ aerial\N-18-30\_2000.sid.
- Right click on the aerial and go to *Projection*. Notice that the projection of the aerial is in *UTM, WGS84, Meters, Zone 18*. It is not necessary to convert to the same projection as the project. If the user converts the projection of the aerial in the SMS, the \*.prj will be permanently modified.

## 2.4 Inlets

Although the shorelines in the merged coverage extend from Cape Lookout to Cape Fear, this example only includes the northeastern section of Onslow Bay. This example includes the two northernmost inlets, Beaufort Inlet and Bogue Inlet. Beaufort Inlet is located at (2700203, 351058) while Bogue Inlet is at (2567933, 329182).

- Create a feature arc from east to west across Beaufort Inlet. The position of the inlet on the GenCade grid is controlled by the location of the two endpoints.
- Once Beaufort Inlet is drawn, select the arc and double-click on the line representing the inlet.
- Select *Inlet* from the drop down menu and select *Attributes*. Name the inlet *Beaufort*.
- Set the *Inlet Shoal Volumes* under the *Volume* button to match the table below.

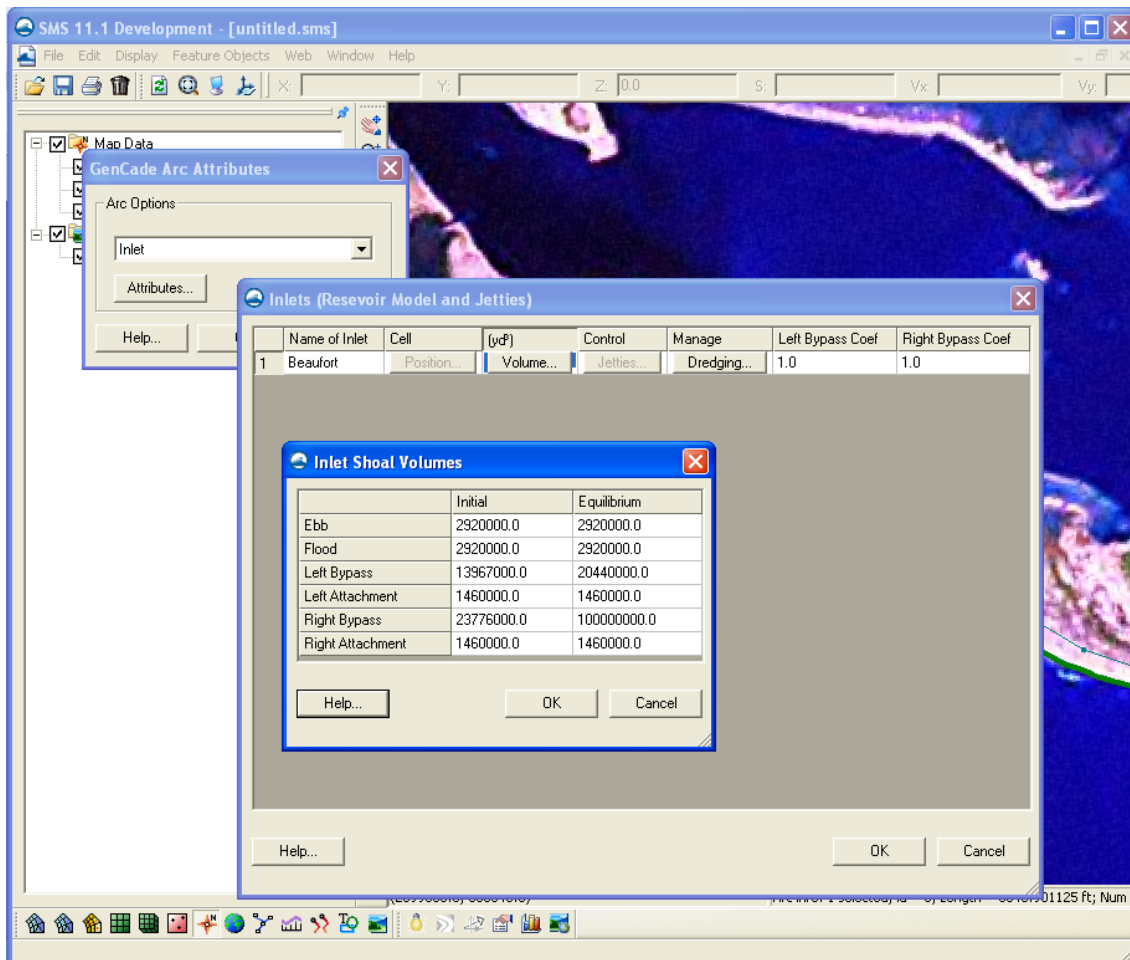


Figure 5. Assign Inlet Attributes.

Table 1. Beaufort Inlet Shoal Volumes

Beaufort Inlet	Initial, yd <sup>3</sup>	Equilibrium, yd <sup>3</sup>
Ebb	2,920,000	2,920,000
Flood	2,920,000	2,920,000
Left Bypass	13,967,000	20,440,000
Left Attachment	1,460,000	1,460,000
Right Bypass	23,776,000	100,000,000
Right Attachment	1,460,000	1,460,000

- Specify two dredging events by clicking on *Dredging*.
  - Begin Date: 01-Jul-1997; End Date: 01-Sep-1997; Shoal to be Mined: Right Bypass; Volume: 187,359
  - Begin Date: 01-Jul-1997; End Date: 01-Sep-1997; Shoal to be Mined: Left Bypass; Volume: 80,297

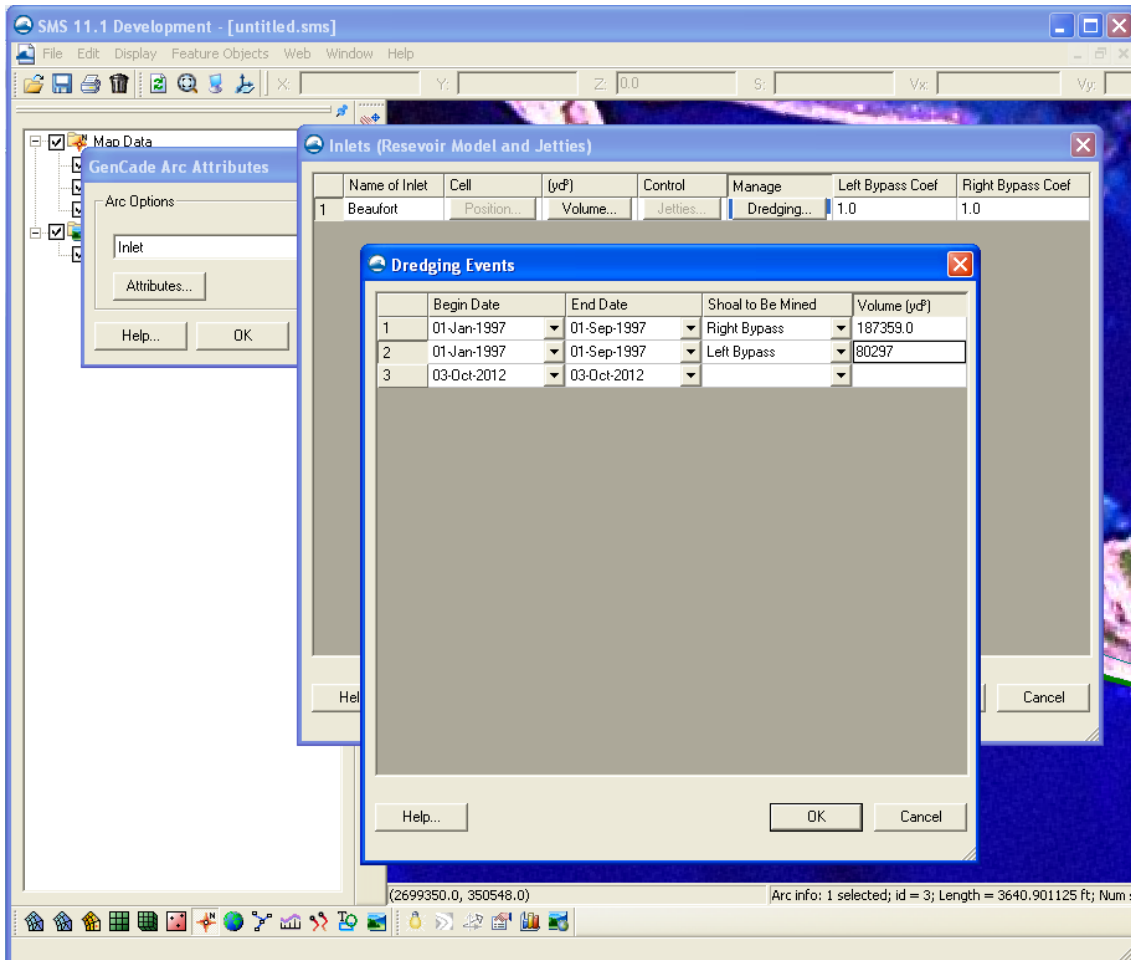


Figure 6. Assign Dredging Attributes.

- Change *Right Bypass Coef* to 3.

- Click *Ok* to exit *Attributes*. The feature arc will turn blue representing an inlet.
- Add a right jetty by creating a new feature arc. The coordinates of the ends of the jetty are (2698300, 352008) and (2698445, 351294).
- Click on the arc to open the *GenCade Arc Attributes* window. Define the arc as *Right Jetty on Inlet\** and go to *Attributes*. Change the *Permeability* to 0.5, check *Diffraction*, and define the *Seaward Depth* as 5 ft.

\* The jetty to the west is considered the “right” jetty based on GenCade configuration. Consider a person on a vessel in the middle of the inlet looking out into the ocean. The left jetty is always to the left of the person based on the direction the person is facing. For this case, the left jetty is the east jetty and the right jetty is the west jetty.

- Create a feature arc representing Bogue Inlet. Select the arc, and double-click on the line representing the inlet.
- Select *Inlet* from the drop down menu and select *Attributes*. Name the inlet *Bogue*.
- Set the *Inlet Shoal Volumes* under the *Volume* button to match the table below.

Table 2. Bogue Inlet Shoal Volumes.

Bogue Inlet		
	Initial, yd <sup>3</sup>	Equilibrium, yd <sup>3</sup>
Ebb	15,300,000	15,300,000
Flood	15,300,000	15,300,000
Left Bypass	425,000	425,000
Left Attachment	425,000	425,000
Right Bypass	425,000	425,000
Right Attachment	425,000	425,000

- Bogue Inlet does not have any dredging events or jetties, so no additional information is needed for GenCade.
- Click *OK* to exit *Attributes*. The feature arc will turn blue representing an inlet.

## 2.5 Beach Fills

There are seven beach fill events on Bogue Banks. Some of these events occur during the same time period, but since the quantity of sand is not the same at all locations, it is necessary to consider these as two separate beach fill events.

- Click on the *Create Feature Arc* button and draw arcs representing beach fills.
- Click on the *Select Feature Arc* button and double-click on the arc to open the *GenCade Arc Attributes* window.
- Define the arc as *Beach Fill Event* and click on *Attributes*.
- Specify the *Begin Date*, *End Date*, and *Added Berm Width* based on the information below.
- After all of the information is entered, the beach fill will turn green.
- The figure below shows the locations of all of the beach fills. These should be drawn as shown and then refined based on the X-Y locations of the nodes.

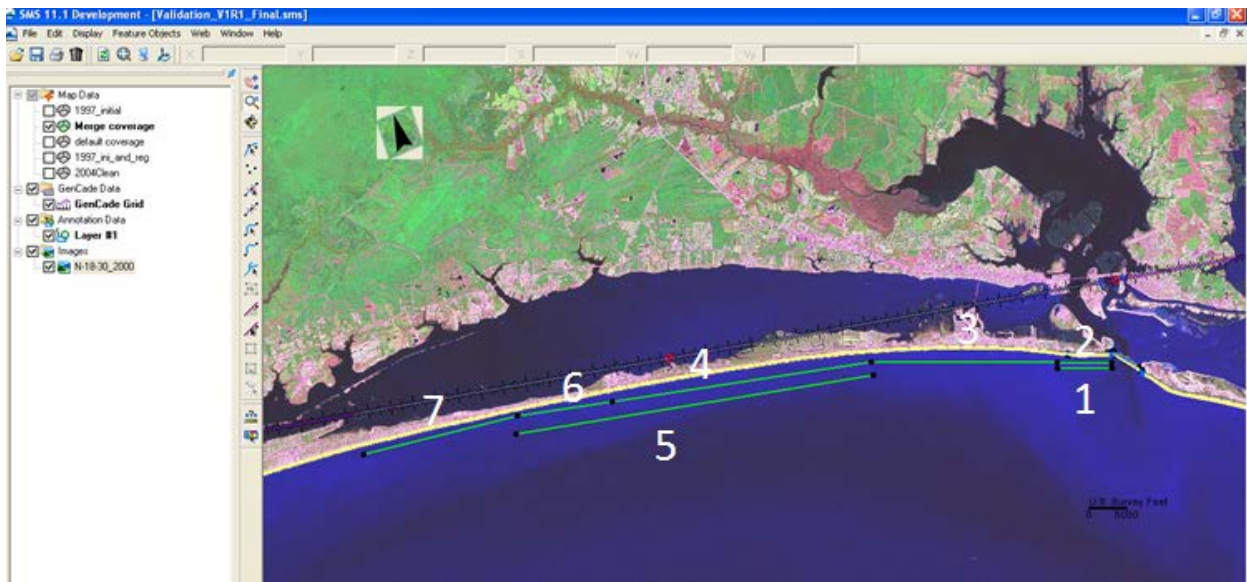


Figure 7. Locations of Beach Fills.

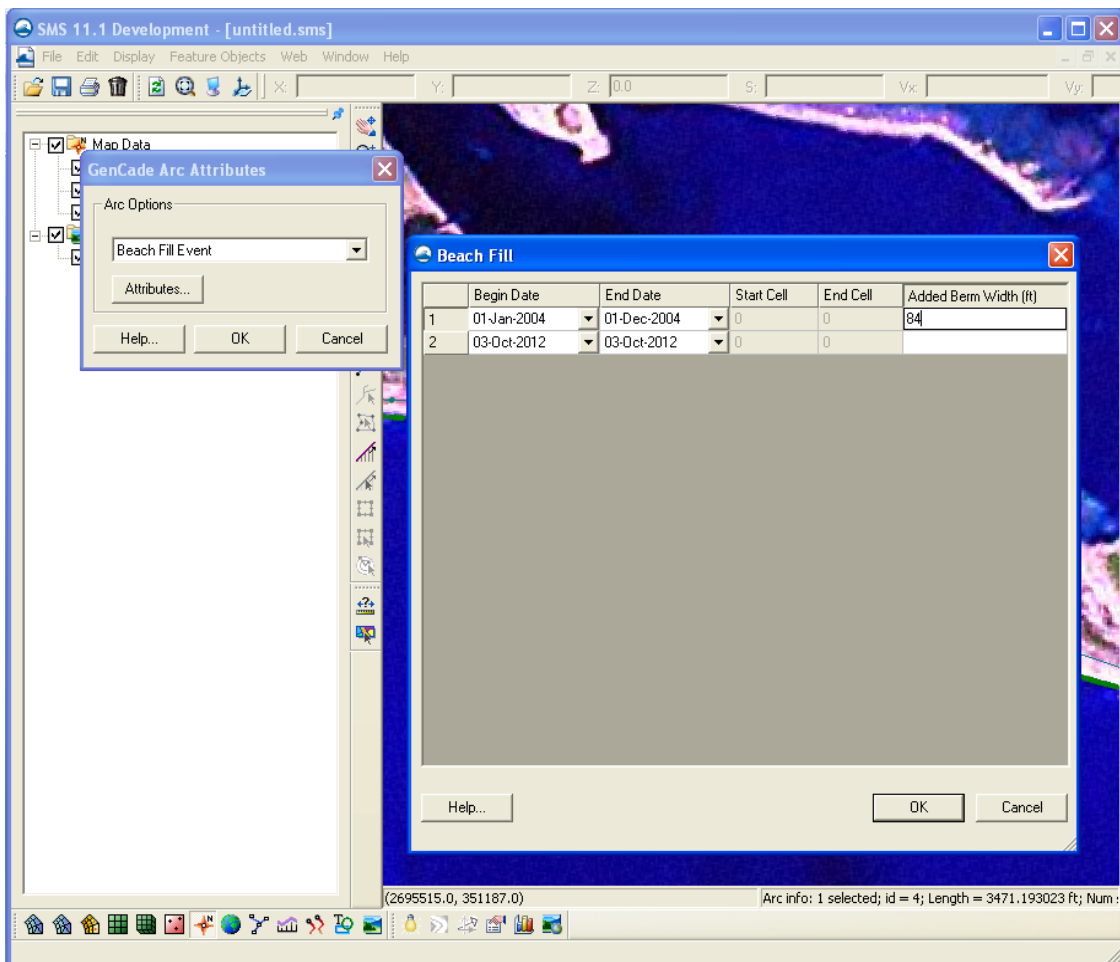


Figure 8. Assign Beach Fill Attributes.



Table 3. Beach Fill Attributes.

Number	X1	Y1	X2	Y2	Begin Date	End Date	Added Berm Width
1	2,698,160	349,730	2,691,000	349,660	1-Nov-04	1-Dec-04	84
2	2,698,130	350,420	2,690,975	350,451	1-Jul-02	1-Aug-02	37
3	2,690,975	350,451	2,666,592	350,501	1-Nov-04	1-Dec-04	84
4	2,666,592	350,501	2,632,650	345,300	1-Jul-02	1-Aug-02	40
5	2,666,870	348,780	2,620,040	341,070	8-Feb-04	23-Mar-04	39
6	2,632,650	345,300	2,620,210	343,456	1-Jul-02	1-Aug-02	57
7	2,620,210	343,456	2,600,070	338,410	1-Jul-03	1-Sep-03	51

## 2.6 Wave Gauges

This example has three WIS wave gauges.

- Click *Edit->Single Point Projection* to add a feature point at the coordinates of the wave gauge.
  - Under *Convert From* select *Global Projection* and *Set Projection* to Geographic with NAD83 as the horizontal datum and Arc Degrees as the *Planar Units*. Set the *Vertical Projection* to Local and the *Units* to feet.
  - Under *Convert To* select *Global Projection* and *Set Projection* to State Plane Coordinate System, North Carolina (FIPS 3200), with NAD83 as the horizontal datum and feet as the *Planar Units*. Set the *Vertical Projection* to Local and the *Units* to feet.
  - Longitude: -76.67
  - Latitude: 34.5
  - Check the *Create feature point* box.
  - Select *Close*.
- Double click on the feature point with the *Select Feature Point* tool and check the *Wave gage* box. Click on the *Options* button.
- Enter *Depth* of 62 ft and click the *Data* button.
- Change the *Convention* to Meteorologic under *Interpret Directions As*.
- Click *Import* and open the desired file for the waves.
- The five columns should be defined as *Date*, *Time*, *Height*, *Period*, and *Direction*.
- Click *Finish*.

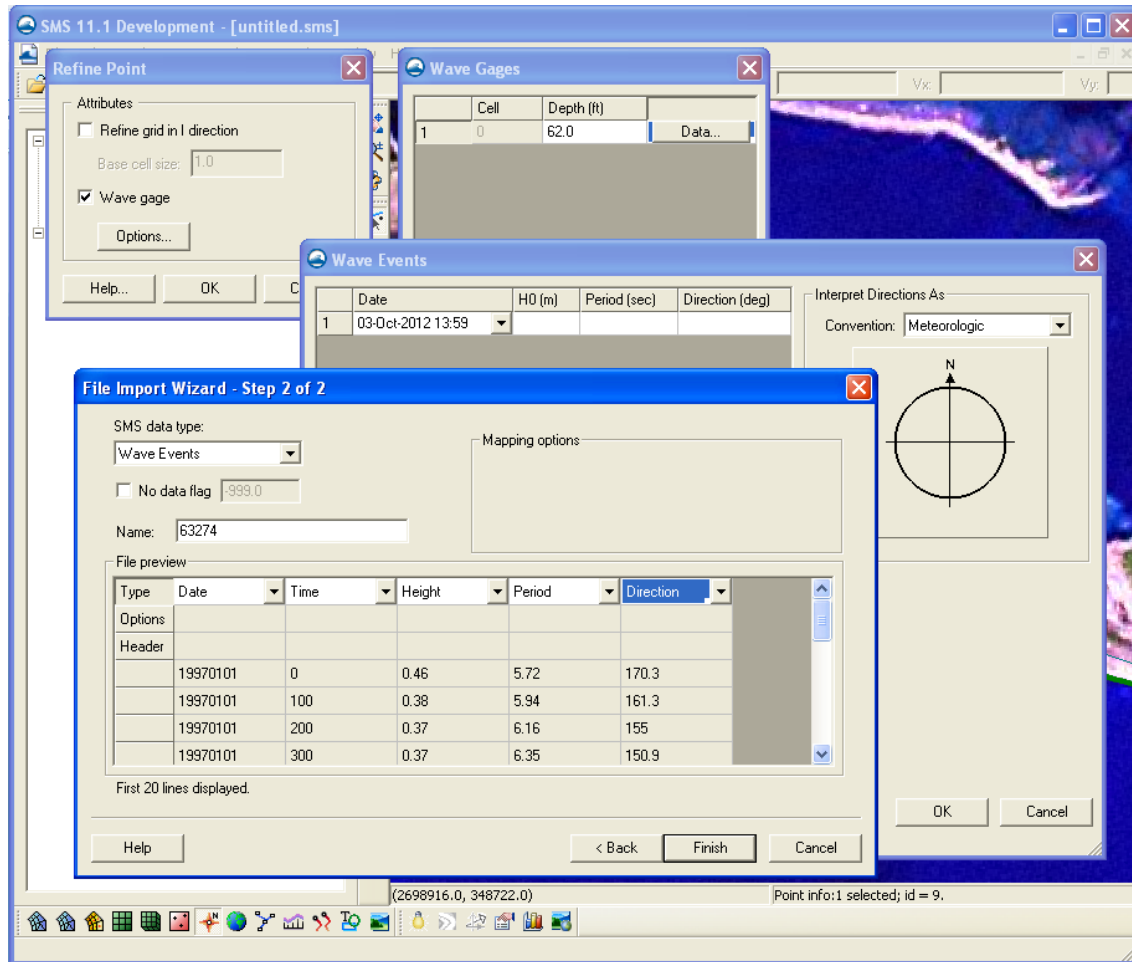


Figure 9. Assign Wave Gauge Attributes.

Repeat the same instructions for the other two wave gauges.

- Wave Gauge 2:
  - Longitude: -76.83
  - Latitude: 34.5
  - Depth: 69 ft
- Wave Gauge 3:
  - Longitude: -77.08
  - Latitude: 34.5
  - Depth: 56 ft

## 2.7 Grid Frame

- Click the *Create 1D Grid Frame* button. Click on the location you want the grid frame to start and then double-click at the ending location
  - If a person was walking down the grid to the arrow, the water would be to the left and the land would be to the right. For example, if the GenCade grid arrow was pointing south, the water would be to the east (left) and the land would be to the west (right).

- In this example, the grid frame should start to the northeast of the initial shoreline and end to the northwest. The initial shoreline will be located to the south of the grid frame.

It is necessary to convert to a 1D grid before attempting to import wave data in shore normal convention. If the wave data are in meteorological, oceanographic, or Cartesian, the wave information can be imported prior to setting up the grid frame and converting to the GenCade model. The data were in meteorological convention in this example, so all of the steps related to the wave gauges were completed before setting up the grid frame.

- Click on the *Select 1D Grid Frame* button and then click inside the rectangle that appears in the center of the grid frame.
  - The grid frame can be lengthened or shortened by dragging the end point and rotated by dragging the circle at the end of the frame.
- Right click and select *Properties*, or double-click the rectangle. The *Grid Frame Properties* window will open and the following can be defined:
  - *Origin X*: 2727719.0798
  - *Origin Y*: 366426.87964
  - *Angle*: 190
  - *I Size*: 181,200
  - Click on *Define cell sizes* and change the *Cell Size* to 300 ft. The *Number of Cells* should automatically change to 604.

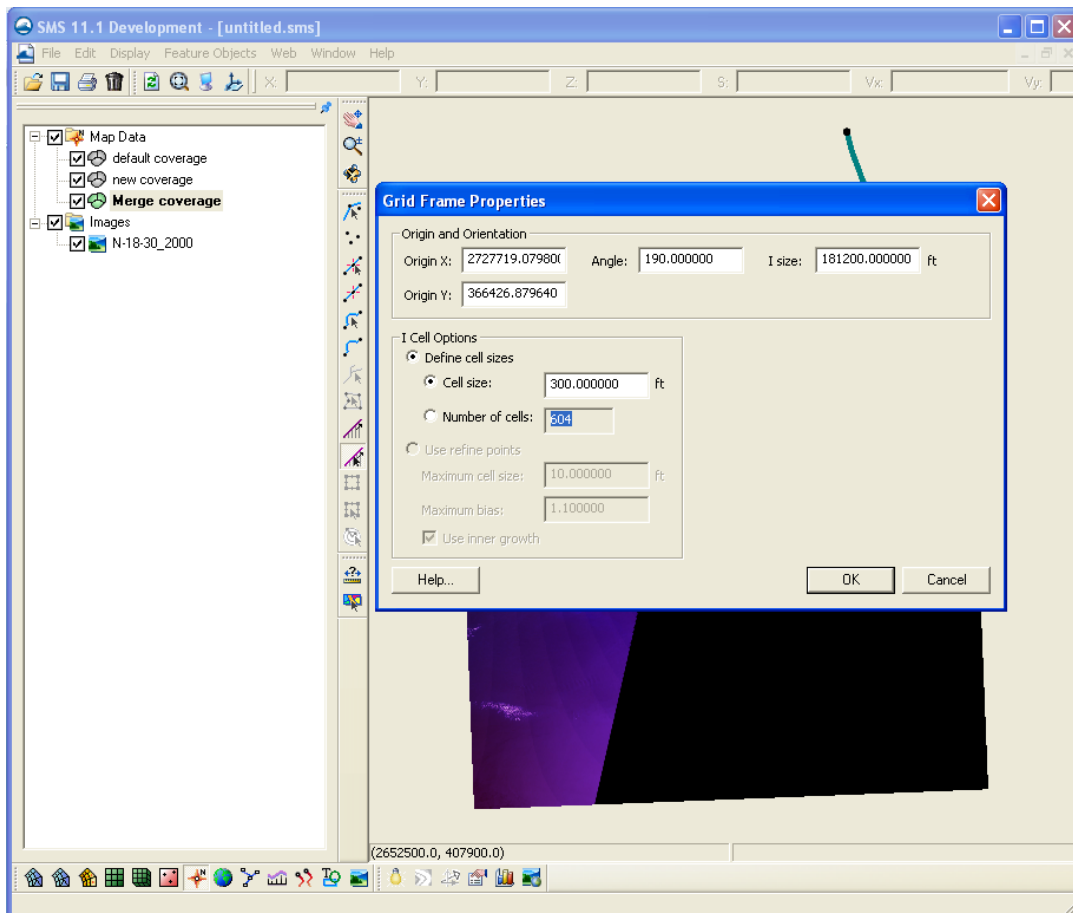


Figure 10. Set Up 1-D Grid Frame.

### 3. Convert to GenCade Model Grid

- Right click on the GenCade coverage and select *Convert->Map->1D Grid*.
- Verify the settings in the properties window haven't changed and select *OK*.
- In GenCade, the default setting for the attachment bars is directly adjacent to the inlet. For Beaufort Inlet, these locations need to be modified.
  - Select the GenCade grid in the Project Explorer. This will add the *GenCade* menu.
  - Go to *GenCade->Edit Inlets*. This opens the *Inlets(Reservoir Model and Jetties)* window.
  - Click the *Position* under *Cell* for Beaufort Inlet. This opens the *Inlet Position* window.
  - Change the parameters to the following:
    - Left Bypass Beg Cell: 94
    - Left Bypass End Cell: 95
    - Right Bypass Beg Cell: 106
    - Right Bypass End Cell: 107
- Verify that all information entered in the conceptual model is correct in the GenCade model.
  - Select the GenCade grid in the Project Explorer.
  - Under the *GenCade* menu, all of the inputs can be reviewed or modified.
  - Select *GenCade->Edit Grid* and notice that the *Azimuth* is not the same as the angle selected in the conceptual grid frame.
  - **Note: The sign convention for the GenCade model grid is in degrees clockwise from north. Wave data must be relative to the orientation of the GenCade model grid and not the conceptual model grid.**

### 4. Setup and Run the GenCade Model

- Select the GenCade grid in the Project Explorer
- Go to *GenCade->Model Control* to open the *GenCade Model Control* window.
- Under the *Model Setup* tab enter the following:
  - Start Date: 01-Jan-1997 12:00 AM
  - End Date: 27-Aug-2004 12:00 AM
  - Time Step: 1 hr
  - Recording Time Step: 168 hr
- Under the *Beach Setup* tab enter the following:
  - Effective Grain Size: 0.17 mm
  - Average Berm Height: 4.5 ft
  - Closure Depth: 26.5 ft
  - K1: 0.6
  - K2: 0.4
- Under the *Seaward BC* enter the following:
  - Number of Cells in the Offshore Contour Smoothing Window: 100
- Under *Lateral BC* enter the following:
  - Left Lateral BC and Right Lateral BC: Pinned

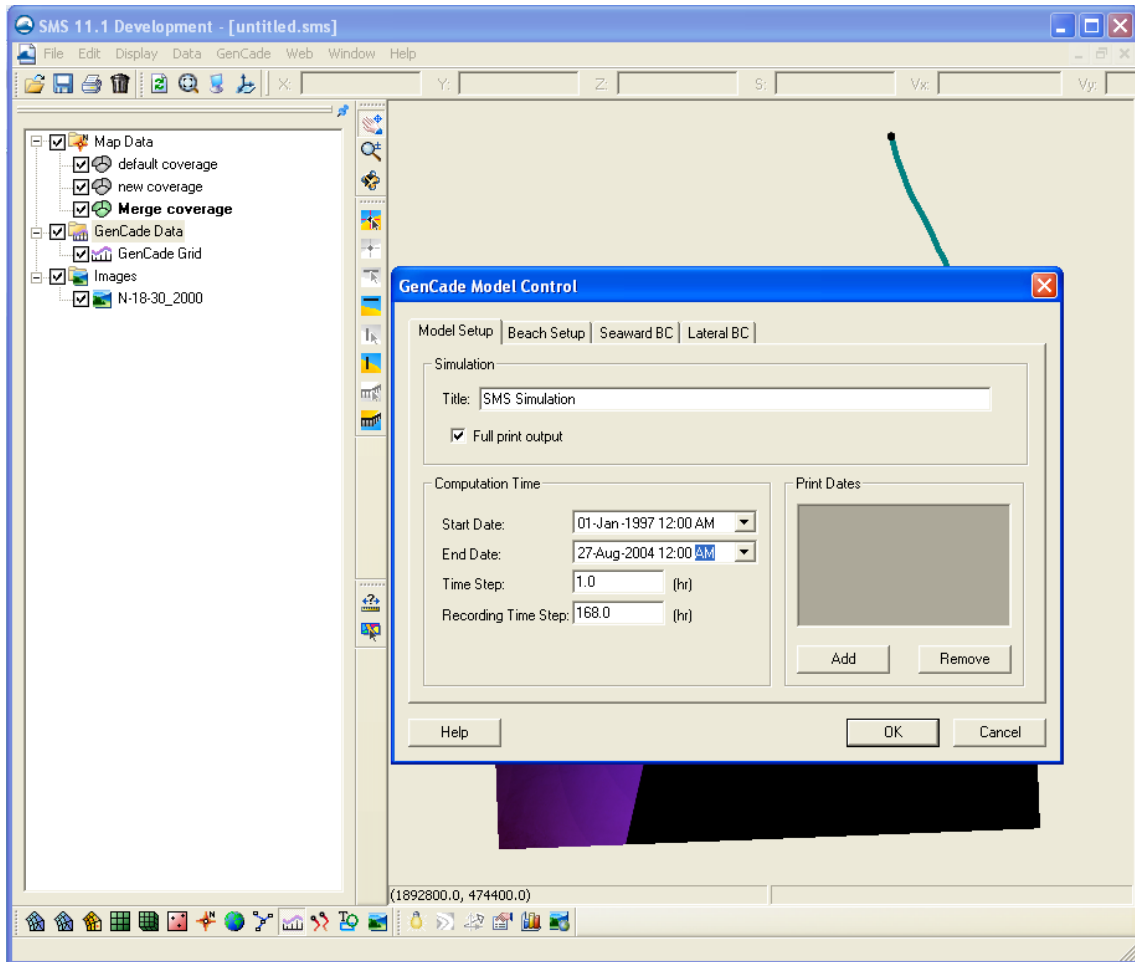


Figure 11. GenCade Model Control.

- Save GenCade by going to *File->Save As*.
- Go to *GenCade->Run GenCade* to run GenCade.

Information about viewing results in the SMS was already discussed in the simple example case, so it will not be included here.

## Supplemental Data for Model Setup

GenCade model setup parameters.	
Parameter	Value
Start Date	1/1/1997 0:00
End Date	8/27/2004 0:00
Time Step	1
Recording Time Step	168
Effective Grain Size, mm	0.17
Average Berm Height, ft	4.5
Depth of Closure, ft	26.5
K1	0.6
K2	0.4
Height Amplification Factor	1
Angle Amplification Factor	1
Angle Offset	0
Wave Components to Apply	Primary
Number of cells in offshore contour smoothing window	100
Left Lateral Boundary Condition	Pinned
Right Later Boundary Condition, ft per sim. period	Pinned

Conceptual grid frame parameters.	
Parameter	Value
Origin X, ft	2,727,719.0798
Origin Y, ft	366,426.87964
Angle, °	190
I size, ft	181,200
Cell Size, ft	300
Number of Cells	604
Use Refine Points	no

Wave Gauge Locations	
Cell Index	Depth, ft
99	62
297	69
547	56

Beaufort Inlet		
	Beginning Cell	Ending Cell
<b>Inlet</b>	96	105
<b>Left Bypass</b>	94	95

<b>Right Bypass</b>	106	107
Beaufort Inlet		
	<b>Initial</b>	<b>Equilibrium</b>
<b>Ebb</b>	2,920,000	2,920,000
<b>Flood</b>	2,920,000	2,920,000
<b>Left Bypass</b>	13,967,000	20,440,000
<b>Left Attachment</b>	1,460,000	1,460,000
<b>Right Bypass</b>	23,776,000	100,000,000
<b>Right Attachment</b>	1,460,000	1,460,000

Beaufort Inlet					
<b>Jetty</b>	<b>Exists</b>	<b>Length</b>	<b>Permeability</b>	<b>Diffracting</b>	<b>Seaward Depth, ft</b>
Left	No	-	-	-	-
Right	Yes	9819.59	0.5	Yes	5

Dredging Events			
<b>Begin Date</b>	<b>End Date</b>	<b>Shoal to be Mined</b>	<b>Volume, cu yd</b>
1-Jul-1997	1-Sep-1997	Right Bypass	187,359
1-Jul-1997	1-Sep-1997	Left Bypass	80,297

Beaufort Inlet	
<b>Left Bypass Coef</b>	<b>Right Bypass Coef</b>
no	3

Bogue Inlet		
	<b>Beginning Cell</b>	<b>Ending Cell</b>
<b>Inlet</b>	531	557
<b>Left Bypass</b>	530	530
<b>Right Bypass</b>	558	558

Bogue Inlet		
	<b>Initial</b>	<b>Equilibrium</b>
<b>Ebb</b>	15,300,000	15,300,000
<b>Flood</b>	15,300,000	15,300,000
<b>Left Bypass</b>	425,000	425,000
<b>Left Attachment</b>	425,000	425,000
<b>Right Bypass</b>	425,000	425,000
<b>Right Attachment</b>	425,000	425,000

Beach fill parameters.

<b>Begin Date</b>	<b>End Date</b>	<b>Start Cell</b>	<b>End Cell</b>	<b>Added Berm Width, ft</b>
1-Jul-2002	1-Aug-2002	107	130	37
1-Nov-2002	1-Dec-2004	107	131	84
1-Nov-2002	1-Dec-2004	130	210	84
1-Jul-2002	1-Aug-2002	210	325	40
8-Feb-2004	23-Mar-2004	210	369	39
1-Jul-2002	1-Aug-2002	325	367	57
1-Jul-2003	1-Sep-2003	367	436	51