Workshop 2

Background Data

2.1 Introduction

This tutorial describes the process of using background data such as *TIFF/JPG* images, bathymetric information, and coastline arcs. Although an image is not required to create a simulation, it can greatly assist with the network construction process. Bathymetric information, on the other hand, is required. The model must be given this bed elevation data to make accurate predictions. Similarly, coastline arcs are required for the specification of boundary conditions. You will need the following files:

- ec2000v2d.grd (East Coast Data Base file)
- shin-GEODAS.xyz (GEODAS Surveys)
- shin-SHOALS.pts (SHOALS Survey file)

All other files that will be created in this tutorial are included in the "output" directory.

2.2 Using a Background Image

A good way to visualize the model is to import a digital image of the site. The image used in this example is a USGS aerial photograph obtained from the website http://terraserver.homeadvisor.msn.com/default.asp. The file was saved in the JPG format, but the TIFF format is also acceptable. Note that TIFF images have various compression schemes, but SMS only supports the uncompressed format and the LZW compression. If an image is loaded, it will be displayed first so that all other data is drawn on top.

2.2.1 Downloading the Image

If you have access to the internet and want to get your own image file, follow these steps. Otherwise, skip to Section 2.2.2.

1. Go to the website http://terraserver.homeadvisor.msn.com/default.asp. You will see the following page.

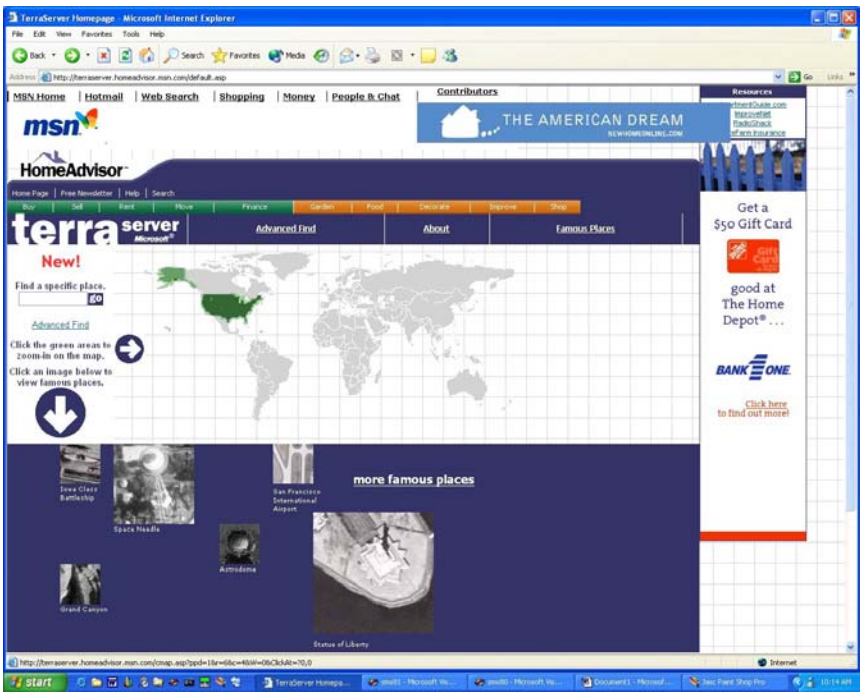

Figure 2-1 Downloading an image from the internet.

2. Zoom in on the area near Long Island, New York by clicking with the mouse. You will see an image like the following picture.

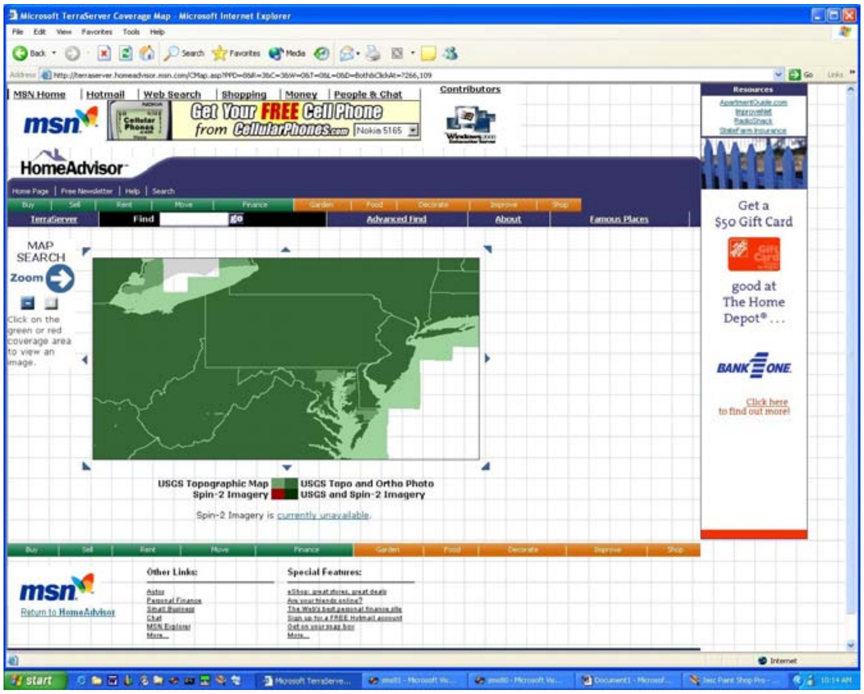

Figure 2-2 Zooming on area to download

3. In this case, we need to zoom more to get an adequate image of Shinnecock Bay on Long Island, New York. After zooming the image will appear as:

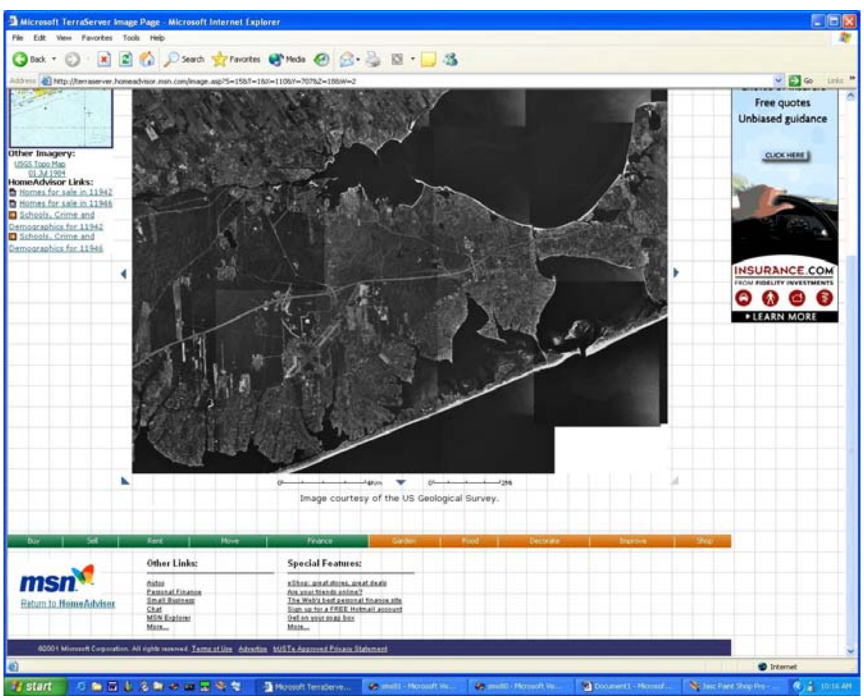

Figure 2-3 Final zoom

4. Once the aerial photographs appear, change the image size to "large." Zoom in further or use the arrows on the side and corners of the image to center the

desired area in the frame. When the desired image is centered, click the "Free Download" link on the left of the image.

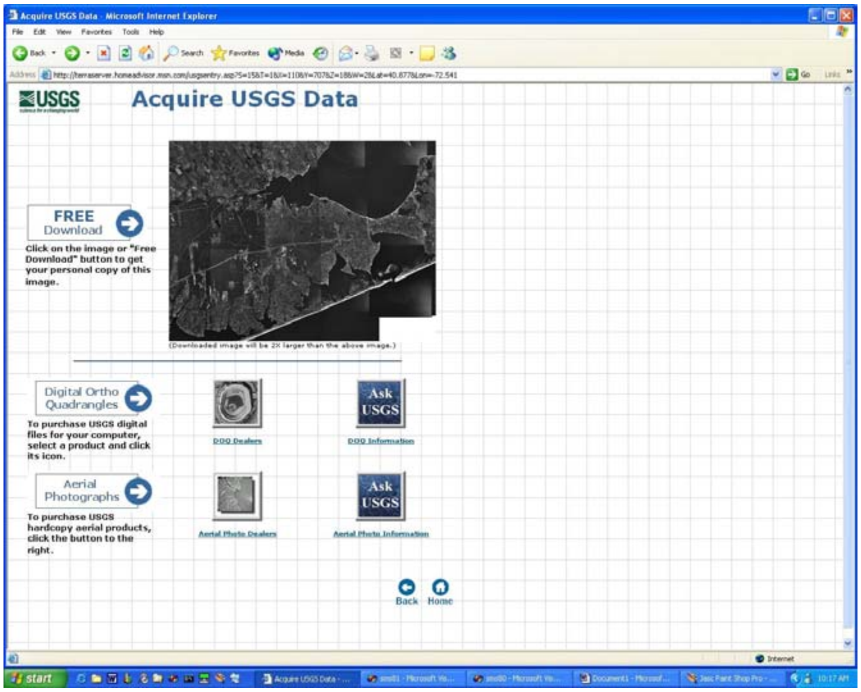

Figure 2-4 Ready for download.

5. Follow the instructions to save the image file and the World File. Name the image shin.jpg and the World File shin.jpgw and save them in the "output" directory. (These files are already saved there just in case you can not complete the process yourself.)

2.2.2 Importing the Image

To import the JPG image:

1. Select *File* | *Open*.

2. Open the file *shin.jpg* from the "output" directory. A preview image will be shown in the *Register Image* dialog. (Do not click the *OK* button yet.)

The image will look like Figure 2-5.

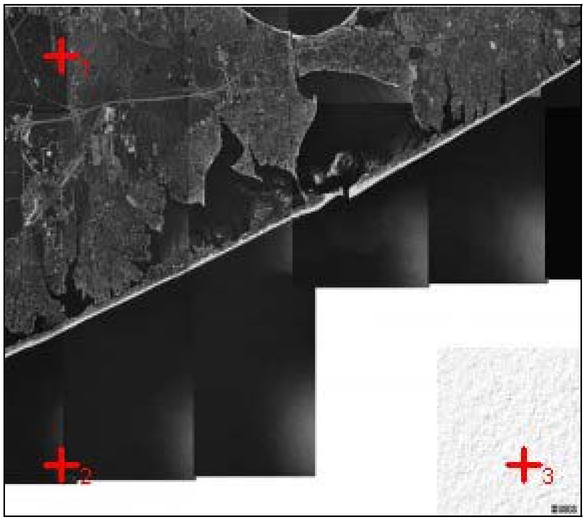

Figure 2-5 The shin.jpg image with registration point locations

2.2.3 Registering the Image

Most images must be registered to a real world coordinate system after being opened into SMS. The only exception is Geo-Referenced TIFF images, which contain a registration as part of the image itself. To register an image, three points on the image, called *registration points*, are given real world coordinates. When the image is drawn, it is skewed, rotated, and stretched according to the registration points.

For this example, the registration points are set by reading in the World File created previously. To read the file *shin.jgw* from the "output" directory:

1. Click the "Import World File" button and select *shin.jgw*.

2. Click *OK* to close the *Register Image* dialog and view the imported image.

The image will be sampled and displayed in the SMS window.

2.2.4 Image Resampling

To save processor time and computer memory, SMS only remembers that portion of the image that is inside the window when the image is sampled. SMS does not automatically resample, or re-read the image when you zoom in, zoom out, or pan the view. Because of this, if you change the view boundaries in one of these ways, the image becomes blurry. To illustrate this:

1. Choose the *Zoom*  tool from the *Toolbox*.

2. Click in the window to zoom the view. The image will look grainy.

3. Resample the image by clicking the *Resample* macro. The image will become more clear

Repeat this process a couple more times to see how it changes the image on the screen. The image will continue to become clearer as long as the resolution can still be increased. There comes a point, however, when the image quality no longer improves. The displayed quality can only be as good as the original image quality. For higher resolution images (that take up more disk space), image quality can be quite good, even when zoomed in a lot.

Before you can continue this workshop, you need to get the entire image back. If you click the *Frame* macro the image redraws but does not zoom out. Why? As was previously stated, SMS only remembers that part of the image that fit inside the window when the image was last sampled. To get the entire image back on the screen:

1. Be sure you are in the *Map* module.

2. Select *Images* | *Fit Entire*. SMS will automatically zoom out to the required point at which the entire image will fit on the screen. A box will outline the image's full size.

3. Resample once again to see the entire image.

2.2.5 Coordinate Conversion

Before continuing, the coordinates of the JPG image will be converted to a geographical coordinate system. From the website where the image was downloaded, we learn that all the images are in meters in the UTM NAD 83, Zone 18 coordinated system. To convert the current coordinates:

1. Select *Edit* | *Coordinate Conversions*….

2. Click the *Current Options*… button to set the current coordinate system.

3. Set the *Horizontal System* as "UTM NAD 83" and select "18" as the *UTM Zone*. Change the horizontal *Units* to "meters." Also change the vertical *Units* to "meters."

4. Click *OK* to close the *Coordinates* dialog.

5. In the *Coordinate Conversion* dialog set the *Horizontal System* as "Geographic NAD 83 (US)" and change the vertical *Units* to "meters."

6. Click *OK* to close the *Coordinate Conversion* dialog and complete the actual conversion.

Now that we are in a geographic coordinate system, we can read and edit the bathymetric data.

2.3 Using the East Coast Database for Bathymetry

This lesson will illustrate combining bathymetry data from multiple data sources. The first source, known as the East Coast Database, will be used for a fairly large area. This recently completed database includes an ADCIRC mesh and solution of the entire east coast of North America. In this case we are extracting bathymetry for a smaller study area.

2.3.1 Converting the East Coast Database to Scatter Points

In order to utilize the ECDB data, it must be converted into SMS scatter points. The scatter points are what SMS uses to extract bathymetric information for the model. To convert this data to scatter points:

1. Select *File* | *Open* and open the file "ec2000v2d.grd." This is a large mesh and may take a minute to read in. Figure 2-6 show what the ECDB looks like after it has been read in. The area that we want to extract is outlined with a read box.

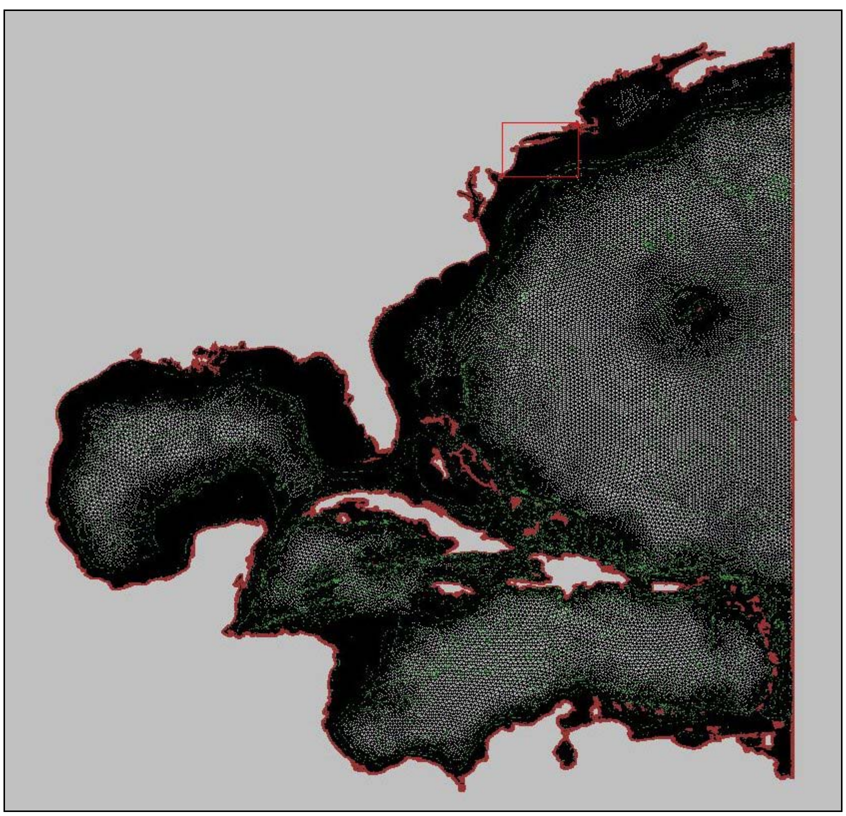

Figure 2-6 The East Coast Database with highlighted area of interest

2. Next, select *Data | Mesh -> Scatterpoint* to create a scatter set from the ECDB mesh. When asked, leave the name the new scatter set as "scatter."

3. Before continuing, turn off the display of the ECDB mesh since it will no longer be used. Do this by selecting *Display | Display Options…* or by clicking the *Display Options* macro. In the *Mesh* tab, click the *All Off* button to turn off all the mesh display options.

4. In the *Scatter Module*, use the *Select Scatter Point* tool create a box to select the scatter points that lie within the highlighted box as shown in Figure 2-6. The coordinates of the top left corner of the box are approximately (75, 42). The bottom right corner of the box should be at about the coordinates (69, 38).

5. After the scatter points have been selected, select *Scatter | Split Scatter Set*. This will create a new scatter set from the selected scatter points. When asked, name the new scatter set "ECDB." Now, select *Scatter | Delete Scatter Set* and deleted the scatter set named "scatter" by checking the check box next to the name and clicking the *Delete* button. Click *Done* to exit the dialog. Finally, *Frame* the data.

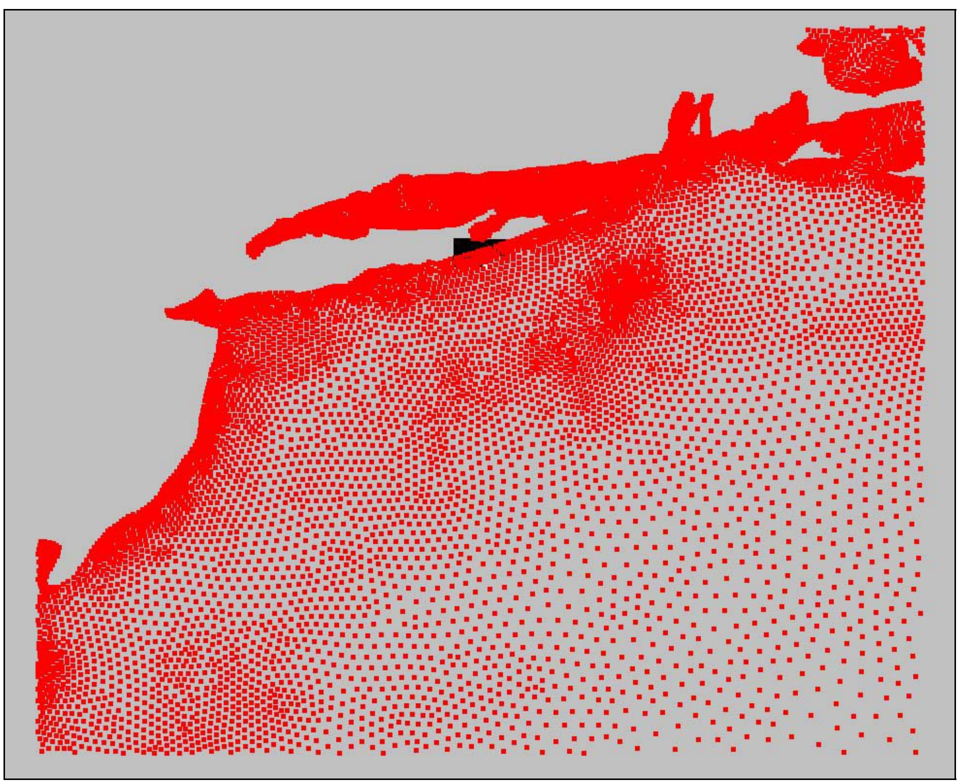

Figure 2-7 Scatter set data extracted from the East Coast Database

A large area around Shinnecock Bay has now been extracted from the ECDB and will appear similar to what is shown in Figure 2-7. However, this data contains the depth of the ocean (positive value) at each scatter point. That is the format that

ADCIRC uses, however, most data sources store the values as elevations (negative values). We need to convert the depths to elevation to combine this data with other data. To make this change:

1. Select *Data | Transform….*

2. Convert the data to elevations by selecting the *Depths -> Elevation* toggle. You can leave the water surface elevation (*WSE*) at 0.0 since that is the datum we want. If the depths were measured relative to another benchmark, the offset of that benchmark could be entered when converting the values from depths to elevations.

3. Click *OK* to finish the transformation.

Now the bathymetry from the ECDB has been completely extracted for our specific use. (In the "output" directory a file entitled "shin-ECDB.sup" has been saved with this extracted bathymetry. It can be read in if any problems were encountered during the extraction process.)

The scatter points from the ECDB are widely spread and alone would not create an accurate model of a coastal feature such as an inlet or bay. More refined data around the feature of interest will be combined with the ECDB data to create a more accurate model.

2.4 Using GEODAS Survey Data

GEODAS survey data can be obtained from a GEODAS database on CD-ROM. Since everyone does not have access to this data, the GEODAS data for this workshop has already been compiled and saved. To open this data:

- Open the file "shin-GEODAS.sup" from the "workshop" directory.

- Make sure you are bring the data in as a scatter set and click on *Next*.

- The next page of the importer allows you to map different columns of data. The default is that the three columns correspond to X, Y, and Z respectively. Leave this and click *Next*.

- The last page allows you to convert the data in this file from another coordinate system into the current system. The data in this file is already in Geographic NAD 83, so no conversion is required. Therefore, press *Finish*.

Figure 2-8 shows the GEODAS survey data (in red) on top of the ECDB data (in green). More refined data on the south of Shinnecock Inlet from the GEODAS survey data will help create a more accurate model near the inlet.

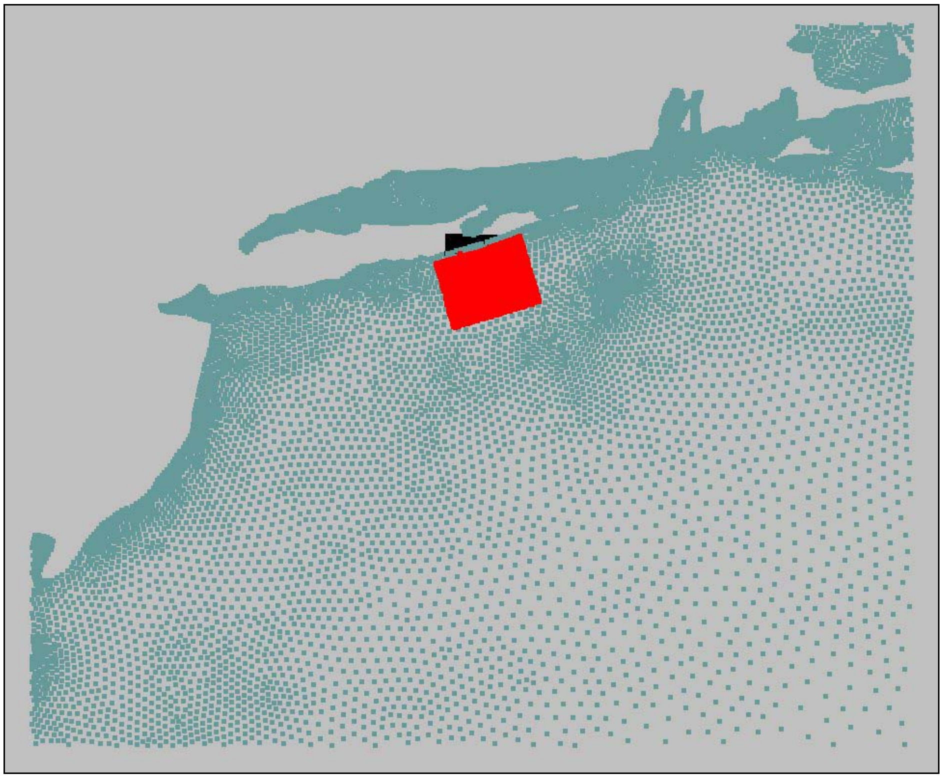

Figure 2-8 GEODAS survey data on top of ECDB data

Like the ECDB data, the GEODAS data has to be altered a little. By going to the website http://co-ops.nos.noaa.gov/bench.html and selecting the New York region and then selecting Shinnecock Inlet we can view bench mark data. The data we used was taken at Mean Low Water. The benchmark information at the NOAA site indicates that this is .16 m above Mean Lower Low Water. ADCIRC data is usually in Mean Tide Level, which for this site is 1.83 M above Mean Lower Low Water. To adjust this data:

1. Select *Data* | *Transform….*
2. Select *Translate* and the *Z* button to adjust the datum. Enter a value of 1.67 (1.83 - 0.16). Then click *OK* to finish the transformation.

2.5 Using SHOAL Survey Data

SHOALS Survey data includes very refined data. We have a SHOALS survey including about 20,000 scatter points in Shinnecock Inlet itself. This will help the model be accurate around the inlet.

- Open the file "shin-SHOALS.pts"
- Click on the Finish Button to accept all defaults.

Figure 2-9 shows the SHOALS data on top of both the GEODAS and ECDB data.

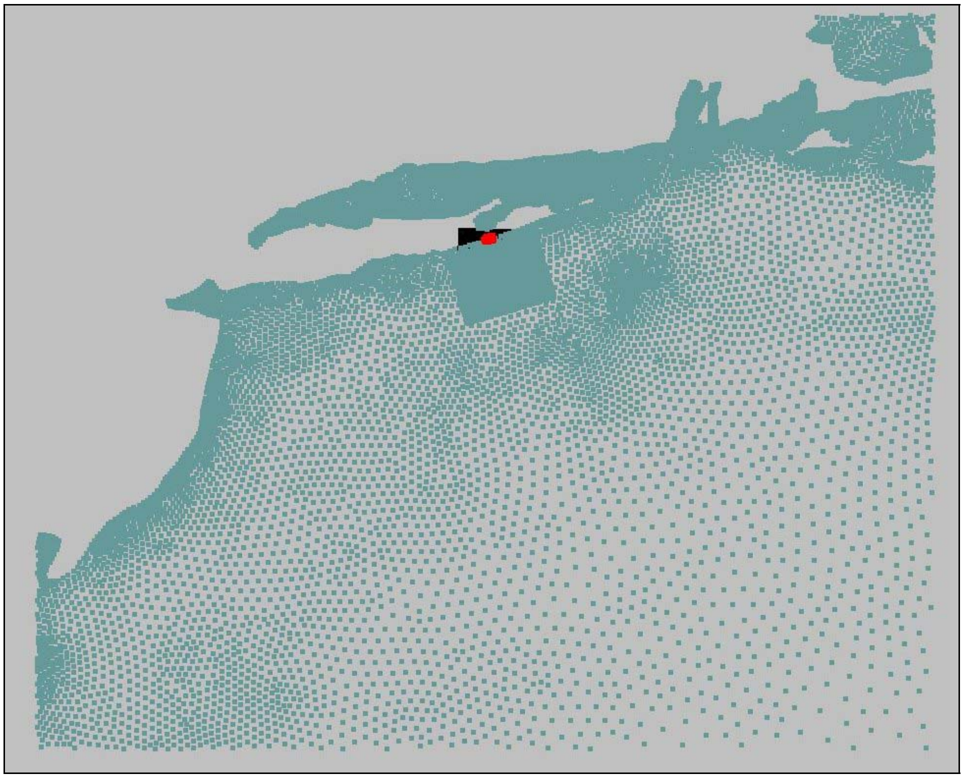

Figure 2-9 SHOALS data on top of GEODAS and ECDB data

2.6 Joining All Scatter Point Sets

You should now have three scattered data sets, one from the East Coast Database, one from the GEODAS Surveys, and one from a SHOALS Survey. These all need to be combined into a single scatter set to define the bathymetry of the model. To do this:

1. Switch back to the *Scatter*  module.

2. Choose *Scatter* | *Merge Sets* to open the *Merge Scatter Sets* dialog.

3. Click the *All->* button. This tells SMS to merge all three sets into one.

4. Use the *Delete overlapping regions* option to remove data points from lower quality surveys. Make sure that shin-SHOALS is on the top (first choice), followed by GEODAS (second choice) and the ECDB set will fill in all regions that are not covered by the other two.

5. You no longer need the three separate scattered data sets, so you should delete them by selecting the *Delete Old Sets* toggle box.

6. Set the *New Name* as “scatter_bathymetry”.

7. Click the *OK* button.

After a few seconds, the screen will refresh and you will see a single scattered data set that contains a combination of all three of the other sets.

You can now save a scatter point super file that contains only the bathymetry data for this model. To save this file:

1. Select *File* | *Save As*.

2. From the *Save as type* drop-down list, choose “Scatter Super Files (*.sup)”. Enter the name “shin_bathymetry” and click the *Save* button.

2.7 Extracting Coastlines

Coastlines can be extracted from the website http://rimmer.ngdc.noaa.gov/coast. We want to extract a coastline for about the same area that our bathymetry data covers. This is approximately from latitudes 38 to 42 and from longitudes -75 to -69. (These are the same coordinates as the area extracted from the ECDB.) If you do not know the latitude and longitudes of the area you want to extract the coastline from, a Java Map can be used to highlight the desired area. To extract a coastline:

1. Enter 42 as the upper latitude, 38 as the lower latitude, -75 as the westernmost longitude, and -69 as the easternmost longitude. Again, this general area can also be selected from the Java Map.

2. Leave the Coastline data base as the World Vector Shoreline (greater or lesser resolutions can be used if desired). Set ZIP as the Compression method for extracted ASCII data and Arc/Info Ungenerate as the Coastline Format.

3. Click the Submit button to extract the coastline.

4. Click on the ZIP file and save it in the “output” directory.

The coastline has now been extracted, but needs to be edited so SMS can read it in. To edit the file:

1. Unzip the file and open it in a word processing program such as Notepad.

2. On the first line of the file type “COAST.” On the second line type “ARCINFO.”

3. Go to the bottom of the file and find the number of the last arc. This number is right above the xy info for the last point. Go back to the top of the file and type the number of the last arc on the third line.

4. Save the changes and close the file.

The file can now be read into SMS by simply selecting File | Open and selecting the file. (The file has been saved in the “output” directory as *shin.dat* if you cannot finish the above process.)

Figure 2-10 shows how the background data will appear in SMS. The background data includes the JPG image, the merged bathymetric data, and the extracted coastline.

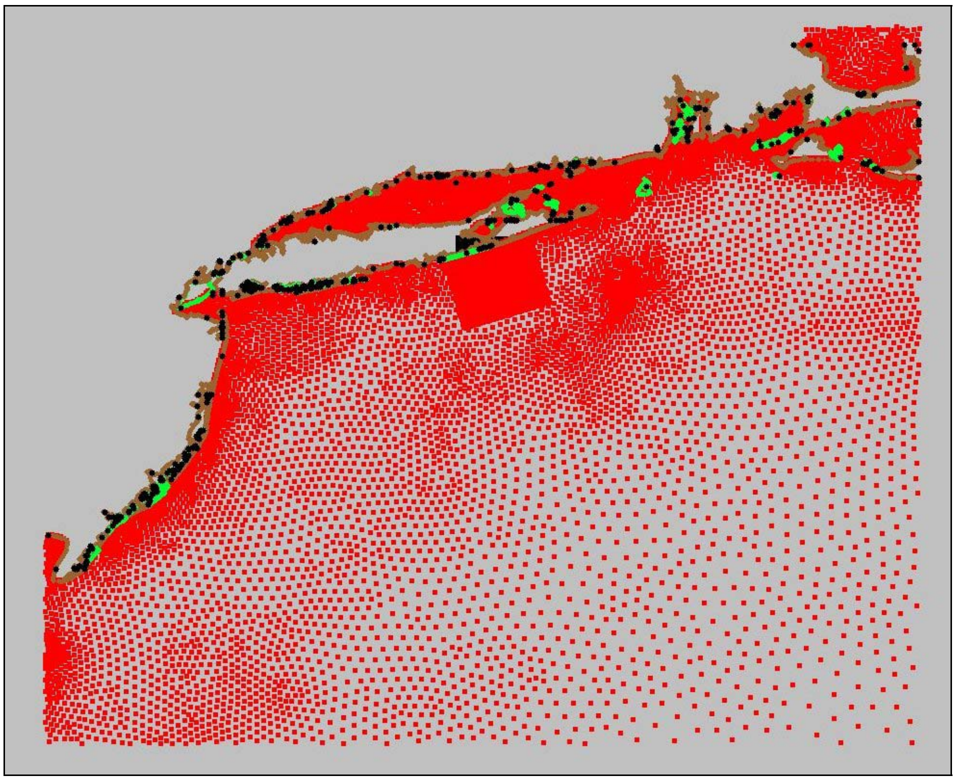

Figure 2-10 Final background data: image, bathymetry, and coastline

2.8 Conclusion

This concludes the Background Data workshop. It is important to note here that all the data in this workshop was previously mapped to a single coordinate system. Getting all your data in a single coordinate system can be a challenging problem. SMS has coordinate conversion tools that can be used, but you might also need other tools to accomplish this feat.

You may continue to experiment with the SMS interface or you may exit the program. If you wish to exit *SMS* at this point:

1. Choose *File | Exit*. If asked to confirm, click the *Yes* button.