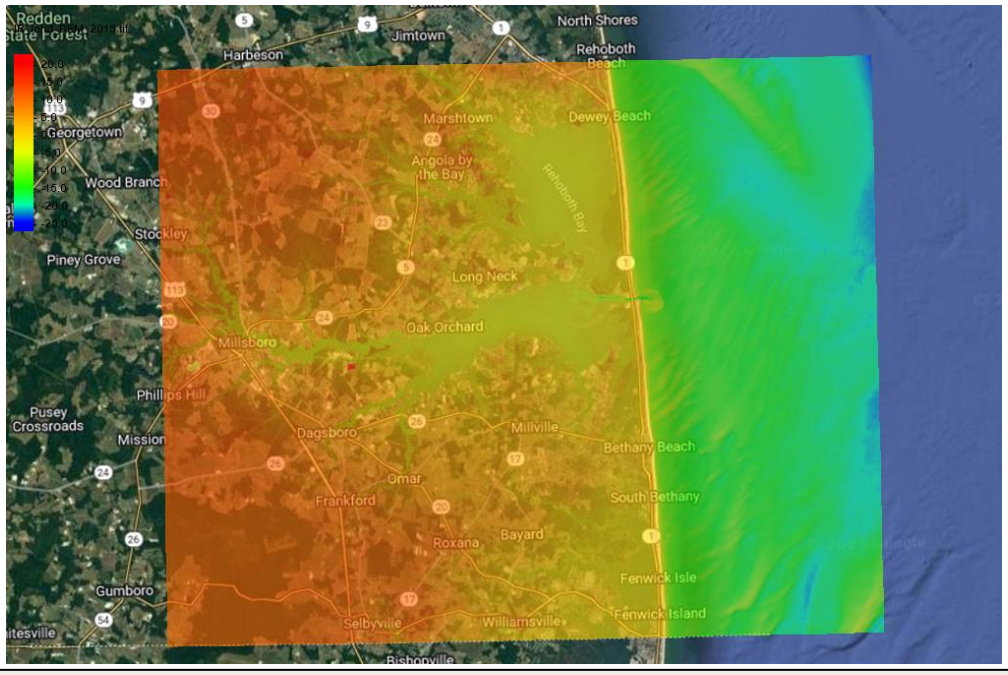
SMS 14.0 Tutorial

Background Data for Coastal Applications



Objectives

This tutorial demonstrates how to load, manage, and edit background data for a coastal application.

Prerequisite Tutorials

- Overview
- Map Module
- Raster

Required Components

- SMS Core

Time

- 10–15 minutes

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1 Introduction

This exercise describes how to load, manage, and utilize background data common to almost all numerical models. For this exercise the data consists of a digital elevation map (DEM) including both bathymetry and topography as well as imagery available online.

Although an image is not required to create a simulation, it can greatly assist with understanding/interpreting the simulation data. All simulations require data to compute mesh or grid to serve as the basis computations.

If an internet connection is available, you may generate images from a web source. If not, you can view the sample files provided.

This exercise utilizes data from the region around Indian River Inlet located on Delmarva Peninsula along the Maryland coast between Delaware Bay and Chesapeake Bay.

2 Setting the Coordinate Projection

A coordinate projection is a method for assigning values to each point in space. In modeling applications, the modeler chooses the projection to be used based on the numeric engine capabilities. Points in the modeling space then correspond to the (X, Y) or (Latitude, Longitude) of the area being modeled. It is often convenient to work with an accepted global projection that expresses locations on earth. For example, a geographic projection uses spherical coordinates aligned with the spin axis of Earth. Other common projections include the Universal Transverse Mercator (UTM) system and (for the U.S.A.) State Plane coordinates systems.

Available data for a site may be referenced to other projections. In these cases, the projection for the data must be specified so that it can be utilized in the desired projection. SMS employs methods to either project this data to the display projection as it is needed, or the data can be reprojected to the desired projection. In the former case, the original data is maintained. In the latter, the coordinate values for each point are computed relative to the new projection and saved.

For this example, we are building a model for the ADCIRC numerical engine. This engine is designed to run in geographic coordinates. However, the process used to generate the mesh often uses linear distances. In this type of situation, some reprojection of data during the process is standard. In order to work in linear distances, it makes sense to select a rectilinear space, containing the region we are modeling, in which to work.

To do this:

1. Launch the SMS application.
2. From the *Menu Bar,* select *Display* | **Display Projection…** from the top menu in SMS to open the *Display Projection* dialog.
3. In the *Horizontal* section, select the **Global projection** radio button. This opens the *Horizontal Projection* dialog.

4. For *Add projection from:* click the **Library…** button to bring up the *Select Projection* dialog. A warning dialog may appear, click the **OK** button to dismiss the warning.
5. For the *Projection,* select the “State Plane Coordinate System (NAD83)” drop-down menu item.
6. For the *Zone,* select the “Maryland/District of Columbia (FIPS 1900)” drop-down menu item.
7. For the *Datum,* select the “NAD83” drop-down menu item.
8. For the *Units,* select the “meters” drop-down menu item.
9. Click the **OK** button to close the *Select Projection* dialog.
10. Click the **OK** button to close the *Horizontal Projection* dialog.
11. In the *Display Projection* dialog, in the *Vertical* section, for the *Datum,* select the “Local” drop-down menu item.
12. For the *Units,* select the “Meters” drop-down menu item.
13. Click the **OK** button to close the *Display Projection* dialog.

The display projection is shown in the *Status Bar* in lower right corner of the SMS interface.

If your project includes multiple data sources, with more than one vertical datum, you will need to correct them to a single datum. SMS can convert between NAVD 88 and NGVD 29. Local sea level references must be taken into account manually when using the Translate Data or Datum Shift commands.

3 Bathy/Topo Data

A numerical model requires geometric data including bathymetry (underwater) and topography (overland) elevations anywhere the water will cover in the simulation. This section illustrates how to load a digital elevation map in the form of a GeoTIFF raster.

1. From the *Menu* bar, select *File* | **Open…** to bring up the *Open* dialog.
2. For *Files of type,* select the “TIFF Image Files (*.tif, *.tiff)” drop down menu item.
3. Navigate to the *Exercises/Indian River* folder.
4. Select the “IR_Inlet_DEM_2015.tif” file.
5. Click the **Open** button to close the dialog and load the data.

When SMS finishes reading the file, it updates the display to show the DEM.

Note that the image is not aligned to the X and Y axes of the display. This is because the image has its own projection, in this case it is geographic. It has been reprojected to display in the state plane system.

1. In the *Project Explorer,* right-click on the “  IR_Inlet_DEM_2015.tif” image and select the **Properties...** context menu item to open the *Properties* dialog.
2. Review the attributes of the DEM including the pixel size, elevation range and projection.
3. Click the **OK** button to close the *Properties* dialog.

4 Reviewing the Simulation Area

A good way to visualize the model is to import a digital image of the site. This image may be an aerial photo or a topographic chart. In this example, we will use the "Google Hybrid" web service. SMS provides a tool that retrieves online dynamic images that change resolution as you zoom in and out of your project. If you have internet access, you can obtain image data by following these steps:

1. From the *Macro* bar, select the **Add Online Maps** macro to open the *Get Online Maps* dialog. Alternatively, select *File* | *Add Online Maps* from the menu bar.
2. Select the *Google Hybrid* item.
3. Click the **OK** button to close the *Get Online Maps* dialog.

SMS will create links to the web services for this map and add them to the Images section of the *Project Explorer*. The image will actually cover the elevation raster because it is "above" the raster in the tree.

Note: depending on internet speed and the status of the web service, this may take a minute to set up. If internet connectivity is not available, load this image using the *File* | *Open* command and choosing the file "Google Hybrid_exported.tif".

1. In the *Project Explorer,* drag the "Google Hybrid" item to below the "IR_Inlet_DEM_2015.tif" item.
2. In the *Project Explorer,* right-click on the "IR_Inlet_DEM_2015.tif" image and select the **Transparency…** context menu item to open the *Layer Transparency* dialog.
3. In the *Transparency %* field, enter "40" to set the image to 40% transparent. (You can also drag or click in the scroll bar to edit the transparency.)
4. Click the **OK** button to save the transparency setting and close the *Layer Transparency* dialog.

The SMS interface should now appear similar to Figure 1.

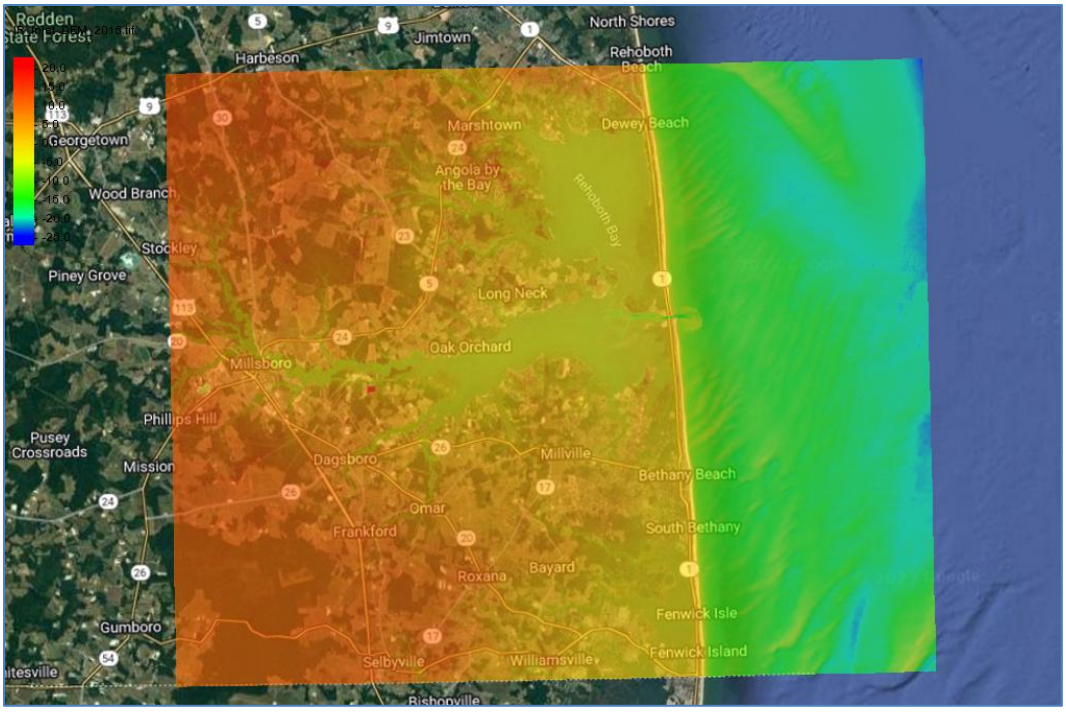

Figure 1: Elevation Data Over an Aerial Image

Any georeferenced image or aerial photo can be managed in a similar fashion. An image from “Google Maps” named “Google Map_exported.tif” is also included in the *Background Data* folder for use if desired.

5 Saving the Project

It is always a good idea to save your work often. Since SMS does not include a general "Undo" feature, if a command creates an unintended result, it cannot always be easily fixed. Similarly, if there are stability issues, a saved project makes renewing a session of SMS much easier. To save the project to this point:

5. From the Menu bar, select the *File* | **Save New Project...** menu item to open the *Save* dialog.
6. Navigate to the *Exercises/Indian River/work* folder.
7. For the *File name,* enter the "IR_background".
8. Click the **Save** button to save the file and close the *Save* dialog.

6 Conclusion

This concludes the “Background Data for Coastal Applications” exercise. Several features have been demonstrated including:

- Setting project projection.
- Loading objects with a different projection from the project projection.
- Loading digital elevation maps.
- Loading online or static images.

If time permits, you could try experimenting with other image sources.