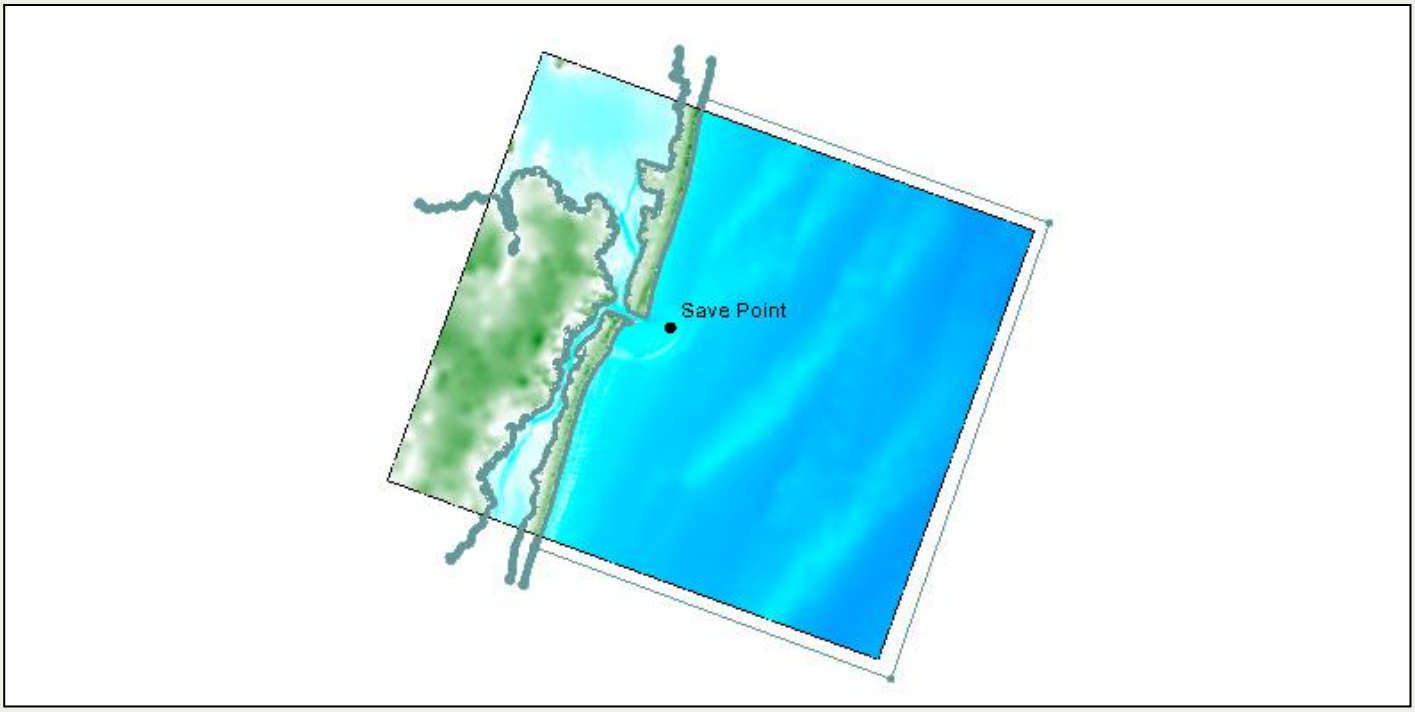
SMS 14.0 Tutorial

CMS-Flow Components

Creating the initial components for a CMS-Flow simulation.



Objectives

This tutorial demonstrates how to setup the components for a CMS-Flow simulation.

Prerequisite Tutorials

- Overview
- Quadtree Generation

Required Components

- SMS Core
- CMS-Flow Model & Interface

Time

- 10–20 minutes

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1 Introduction

This tutorial demonstrates creating the initial components for a basic CMS-Flow simulation in SMS. This includes:

- Creating a boundary condition coverage and defining the boundary conditions.
- Creating an activity coverage and defining activity zones.
- Creating a save points coverage and defining monitor locations.
- Creating a roughness dataset.

A quadtree constrained UGrid is provided in this tutorial. For more information on generating a quadtree constrained UGrid, see the “Quadtree Generation” tutorial.

The data used in this tutorial is from the Ocean City inlet and the surrounding coastline in the state of Maryland in the United States. The projection for the project has been preset.

The creation and running of this simulation are continued in another tutorial.

2 Getting Started

Start by importing a project file containing the data for this CMS-Flow simulation:

1. Launch or restart SMS.
2. Select *File* | **Open…** to bring up the *Open* dialog.
3. Select “Project Files (*.sms)” from the *Files of type* drop-down.
4. Browse to *data files* folder for this tutorial and select “ocean_city_quadtree.sms”.
5. Click **Open** to import the project and exit the *Open* dialog.

The project should appear similar to Figure 1. The initial project contains raster data, preset display themes, map coverages, and two quadtrees.

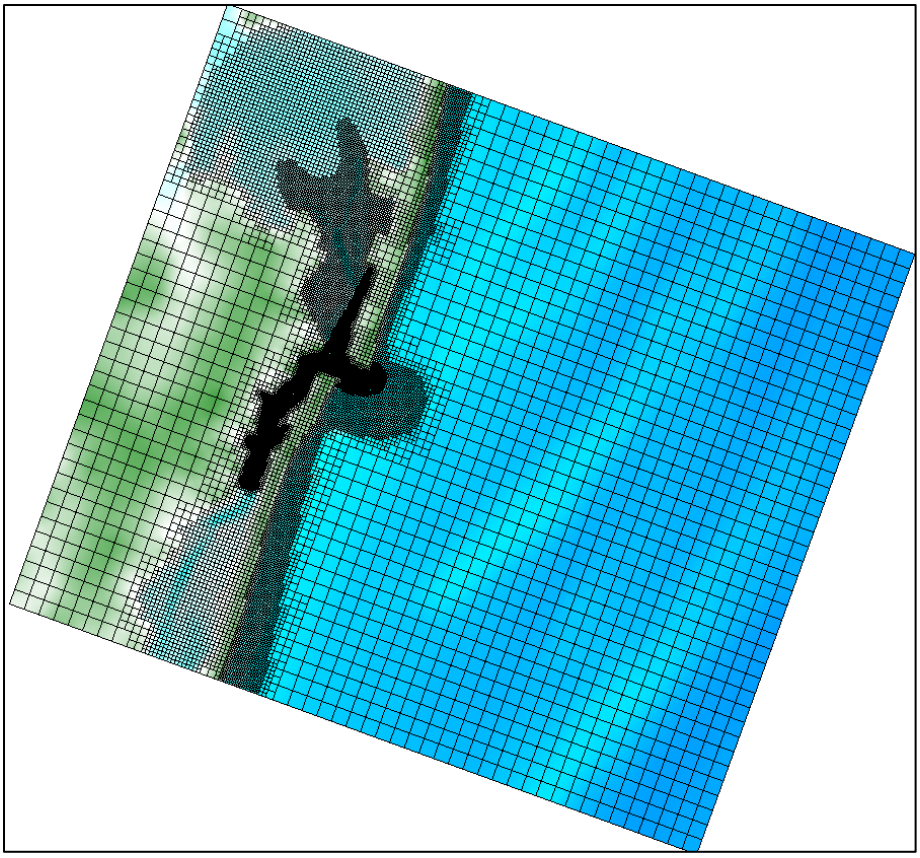

Figure 1 Ocean City inlet

3 Defining Boundary Conditions

Boundary conditions for a CMS-Flow simulation are defined using feature arcs in a CMS-Flow boundary conditions coverage.

3.1 Create the Boundary Conditions Coverage

Create the boundary condition by doing the following:

1. Right-click on "Map Data" and select **New Coverage** to bring up the *New Coverage* dialog.
2. In the *Coverage Type* section, under *Models* | *CMS-Flow*, select **Boundary Conditions**.
3. For the *Coverage Name,* enter "Tidal BC".
4. Click **OK** to close the *New Coverage* dialog and create the new "Tidal BC" coverage in the Project Explorer.
5. In the Project Explorer, right-click on "Map Data" and select **New Folder.**
6. Rename the new folder to "CMS-Flow".
7. Drag the "Tidal BC" coverage to be under the "CMS-Flow" folder.

Note: Grouping coverages by type can facilitate working with the Project Explorer as the project gets more complicated.

3.2 Defining Boundary Condition Arcs

Next, an arc is needed that defines the CMS-Flow boundary location.

1. Turn on the "Pruned Coastline" coverage.
2. Make sure the "Tidal BC" coverage" is still the active coverage (bold).
3. Using the **Create Feature Arc** tool, create a boundary arc enclosing the ocean side of the UGrid as shown in Figure 2. Start by clicking on the coastline then click two more times to surround the grid and close the arc by clicking on the coastline again.

Note: As shown, the arc does not need to be exact or even particularly close to the grid. By default, this new arc is specified as an "Unassigned" boundary condition.

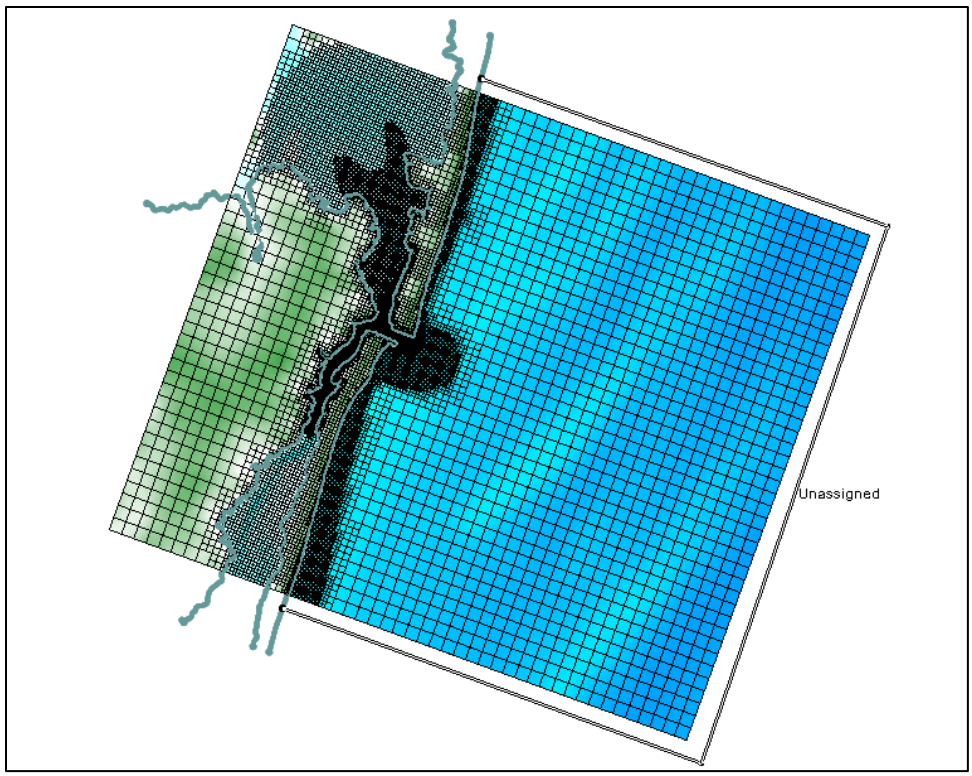

Figure 2 Ocean boundary condition arc

4. Using the **Select Feature Arc** tool, select the ocean boundary condition arc.
5. Right-click on the selected arc and select **Assign Boundary Conditions…** to bring up the *Arc Boundary Condition* dialog.
6. For the *Name*, enter "Ocean".
7. In the *Options* section, change the *Type* to "WSE-forcing".
8. Change *WSE source* to "Tidal constituent".
9. Above the *Constituents* table, click the **Add Row** button to add a second constituent row to the table.

10. Using the table below, enter the data defining a tidal signal with a maximum of 1.8 meters amplitude:

Constituent	Amplitude (m)	Phase (deg)
M2	1.3	0
O1	0.5	0

11. Enter “0.0” as the *Constant value for WSE offset (m)*.
12. Click **OK** to close the *Arc Boundary Condition* dialog.

This is the only assignment that needs to be made for this simple case. All other boundaries of the grid will be assumed to be closed for this case. CMS-Flow supports several other types of boundary conditions that will not be illustrated in this tutorial.

4 Defining Save Points

Save points can be used to specify data to gather during the model run.

4.1 Create the Save Points Coverage

Create a save points by doing the following:

1. Right-click on “ Map Data” and select **New Coverage** to bring up the *New Coverage* dialog.
2. In the *Coverage Type* section, under *Models* | *CMS-Flow,* select **Save Points**.
3. Click **OK** to close the *New Coverage* dialog and create the new “ Save Points” coverage in the Project Explorer.
4. In the Project Explorer, drag the new “ Save Points” coverage to be under the “ CMS-Flow” folder.
5. Right-click on “ Save Points” and select **Save Points Properties…** to bring up the *Save Points Properties* dialog.
6. For *Hydro*, enter “10.0” as the value and select “minutes” from the drop-down.
7. Click **OK** to close the *Save Points Properties* dialog.

4.2 Defining Save Points

Next, points are needed to define the locations in the domain where CMS-Flow should record data at a higher temporal resolution.

1. Using the **Create Feature Point** tool, create a feature point within the UGrid area as in Figure 3.

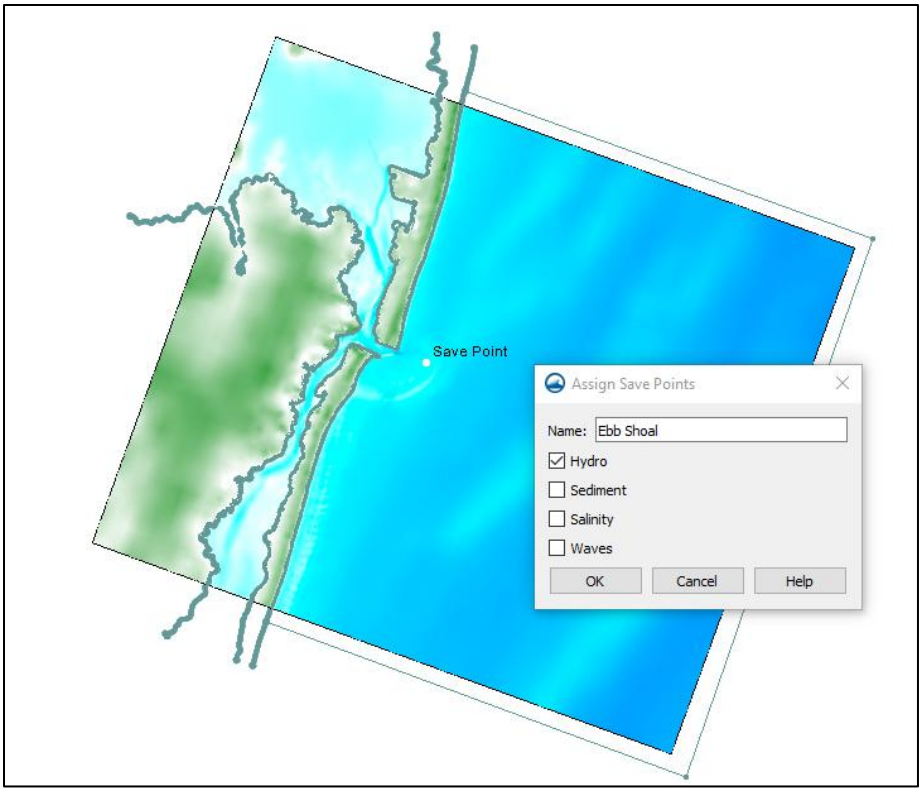

Figure 3 Save point

2. Using the **Select Feature Point** tool, select the newly created point.
3. Right-click in the Graphics Window and select **Assign Save Points…** to bring up the *Assign Save Points* dialog.
4. For the *Name*, enter “Ebb Shoal”.
5. Turn on the *Hydro* option.
6. Click **OK** to close the *Assign Save Points* dialog.

A save point has now been set, and it is ready to be added to a simulation.

5 Defining Activity

A CMS-Flow simulation can be made more efficient by assigning areas that will never get wet to be inactive. An activity coverage defines active and inactive regions. In this case, the elevation source included both bathymetry and topography, so land cells have valid elevations and could be used to simulate flooding as water levels rise with the tide. For illustration we will limit flooding to area below the 0.0 contour. Another contour value could be used.

5.1 Create the Activity Coverage

To flag the land areas as inactive, do the following:

1. Right-click on “ Pruned Coastline” and select **Duplicate** to create a new “ Pruned Coastline (2)” coverage.

2. Right-click on "Pruned Coastline (2)" and select **Rename**.
3. Enter "Activity" and press *Enter* to set the new name.
4. Right-click on "Activity" and select *Type* | *Generic* | **Activity Classification**
5. Drag the "Activity" coverage to be under the "CMS-Flow" folder.
6. Select "Activity" to make it active.
7. **Frame** the project.

5.2 Defining the Active Region

Now create a polygon in the activity coverage to enclose the wet area:

1. Using the **Create Feature Arc** tool, create three arcs connecting the end points of the coastline that enclosing the land (see Figure 4).

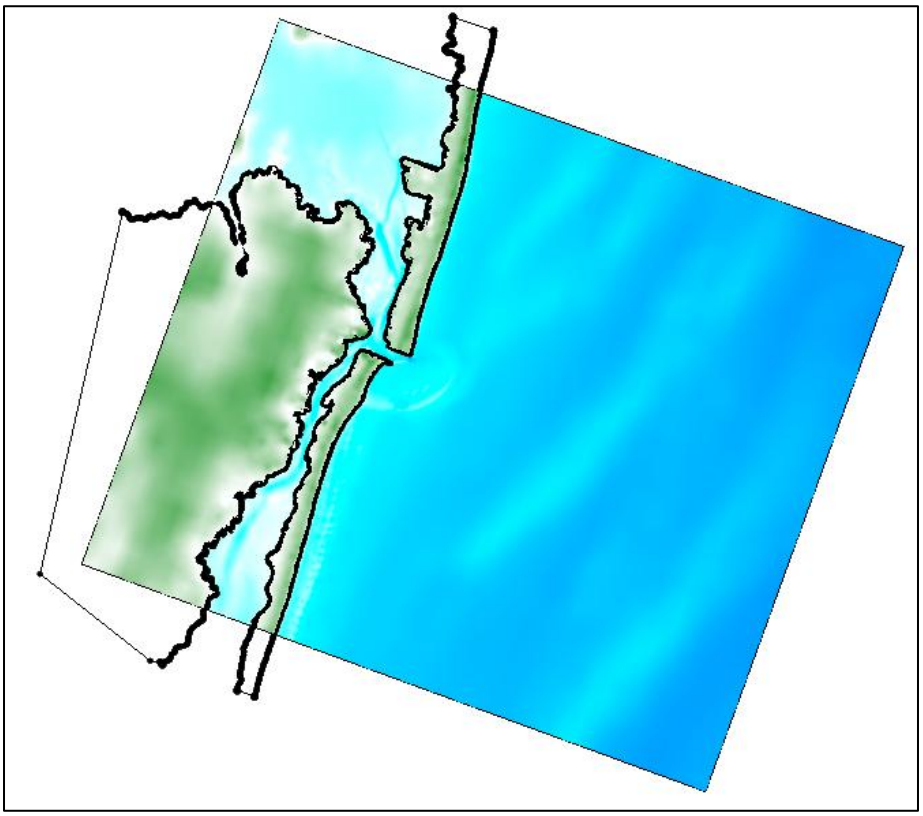

Figure 4 Arcs enclosing the land and water

2. Select *Feature Objects* | **Build Polygons** or click the **Build Polygons** macro in the toolbar.
3. If a warning appears about one or more feature arcs being cleaned, click **OK**.

By default, all polygons are classified as inactive regions. Areas outside of any polygon are defaulted to active. Therefore, these polygons make all the land area inactive.

6 Defining Bottom Roughness

CMS-Flow can make use of bottom roughness. This is typically defined as a dataset with the UGrid. To define the roughness dataset, do the following:

1. Select "Refinement Zones Grid" to make it active.
2. Right-click on the "Cell Z" dataset and select **Duplicate**.
3. Right-click on the newly created "Cell Z (2)" dataset and select Rename.
4. Change the dataset name to "n = 0.025".
5. Click on "n = 0.025" to make it active.
6. Using the **Select Cell** tool, drag a box around the entire UGrid to select all the cells.
7. In the *S* edit field just above the Graphics Window, enter "0.025".

Now to save the project by doing the following:

8. Select *File* | **Save Project** from the menu bar.

7 Conclusion

This concludes the "CMS-Flow Components" tutorial. The tutorial covered the following:

- How to create a CMS-Flow boundary condition coverage and assign a tidal boundary.
- How to create a save points coverage and define a save point.
- How to create an activity coverage and assign the active region.
- How to create a roughness dataset.

This tutorial demonstrated setting up the components for a CMS-Flow simulation. Defining the simulation parameters and running a CMS-Flow simulation are covered in the "CMS-Flow Simulation" tutorial.

Additional tutorials review additional boundary condition types, adjustments to elevation data based on MSL, and additional options for defining activity regions.