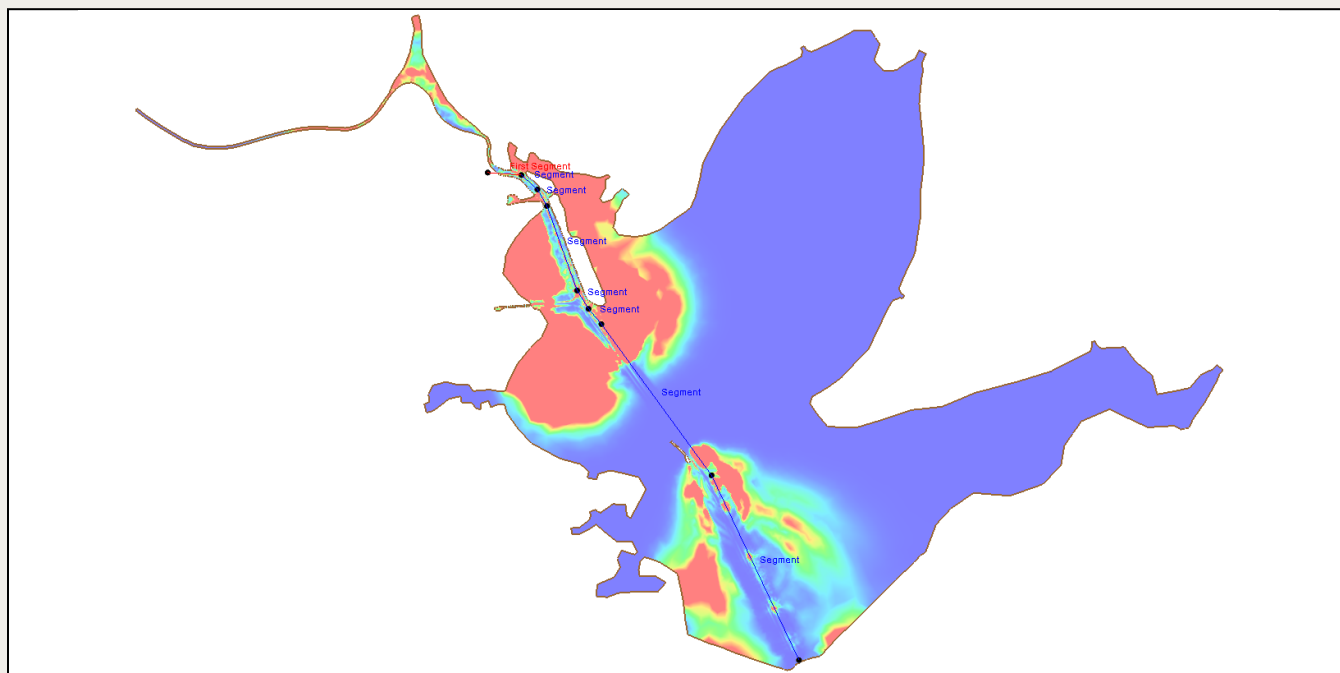




SMS 14.0 Tutorial

AdH Vessels

Using AdH to model vessel effects



Objectives

This tutorial demonstrates the ability of AdH to model the effect of vessels on the hydrodynamics of a simulation using a simple example of a small, shallow hexagon-shaped lake.

Prerequisite Tutorials

- Overview

Required Components

- SMS Core
- AdH Model & Interface

Time

- 20–30 minutes

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1 Introduction

One of the features of AdH is the ability to model the effect of vessels on the hydrodynamics of a simulation. The vessel's presence is incorporated into the model by applying a pressure field to the water column. The bed shear stresses due to the vessel can also be outputted.

2 Setting up a Vessel

For this tutorial, start with importing a pre-created AdH project. The project contains a grid with an initial depth (ioh) hot start dataset, and an AdH simulation containing materials and boundary conditions coverages.

2.1 Opening the Mesh Representing a Pond

To import the project files:

1. Launch SMS (or press *Ctrl-N* if already in SMS).
2. Select *File* | **Open...** to bring up the *Open* dialog.
3. Select the file "VesselTutorial.sms" in the *data files* folder for this tutorial.
4. Click **Open** to import the project and close the *Open* dialog.

The initial project should appear similar to figure 1.

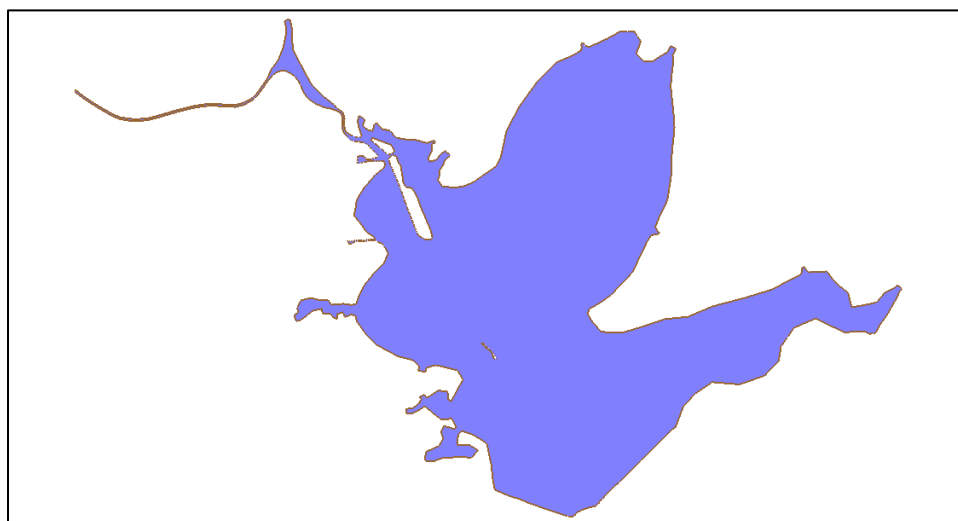


Figure 1 The initial project

2.2 Creating a Vessel

This lake is a simple ten meter deep pond in the shape of a hexagon. It is about 300–350 meters across. This does not exactly represent an actual lake but it is big enough to contain a moving boat for simulation purposes.

The vessel and path information will be stored as part of an SMS coverage. The vessel attributes will be stored as coverage attributes and the path as arcs within SMS.

The effect of the propeller for vessels can also be simulated. If vessels are turned on, AdH assumes two propellers equally spaced from the middle of the boat.

First, the vessel needs to be created and defined by doing the following:

1. Right-click on “ Map Data” in the Project Explorer and select **New Coverage** to bring up the *New Coverage* dialog.
2. Set the *Coverage Type* to “Vessel” under *AdH*.
3. For the *Coverage Name*, enter “boat”.
4. Click **OK**, to close the *New Coverage* dialog.

The new “ boat” coverage will appear in the Project Explorer.

5. Right-click on the “ boat” coverage and select the **Vessel Parameters** command to open the *Vessel Parameters* dialog.
6. In the list on the left side of the dialog, turn on the *Vessel* option
7. For the parameters on the right side of the dialog, enter the following:
 - *Vessel draft (DRFT)* to “5.0”.
 - *Vessel length (BLEN)* to “100.0”.
 - *Vessel width (BWID)* to “20.0”.
 - *Bow draft ratio (CBOW)* to “0.95”.
 - *Stern draft ration (CSTR)* to “0.95”.
 - Leave everything else at the default settings.
8. Click **OK** to close the *Vessel Parameters* dialog.

Now that the vessel attributes have been defined, the boat path within the domain should be defined. The paths are defined by feature arcs. Each feature arc has an attribute that defines the speed of the boat at that segment.

Set the arc properties by doing the following:

9. Select the “ boat” coverage to make it active.
10. Using the **Create Feature Arc**  tool, create eight arcs as shown in Figure 2.

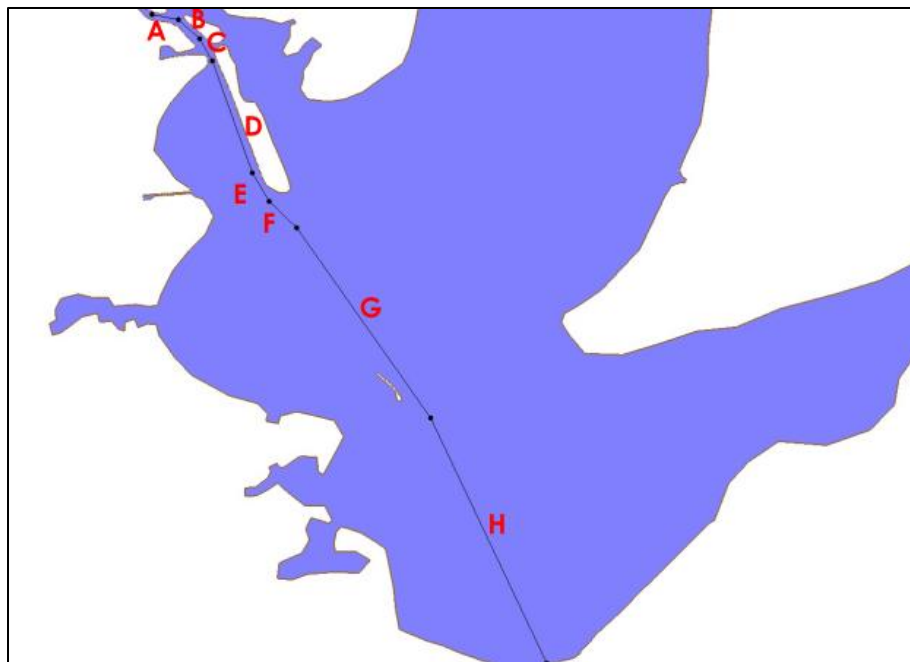


Figure 2 First boat path with labeled arcs

11. Right-click the bottommost arc (labeled H in Figure 2) and select **Assign arc attributes...** to open the *Arc Properties* dialog.
12. On the left side of the dialog, turn on the *First Segment* option.
13. Set the *Type of Segment* option to “Line”.
14. Set the *Vessel time of arrival* option to “1874.0”.
15. Click **OK** to close the *Arc Properties* dialog.
16. Right-click the second bottommost arc (labeled G in Figure 2) and select **Assign arc attributes...** to open the *Arc Properties* dialog.
17. On the left side of the dialog, turn on the *Segment* option.
18. Set the *Type of Segment* option to “Line”.
19. Set the *Vessel time of arrival* option to “3552.0”.
20. Click **OK** to close the *Arc Properties* dialog
21. Repeat steps 16–20 for each of the remaining arcs working from bottom to top change the *Vessel time of arrival* option as follows:
 - Arc F: 3739.0
 - Arc E: 3985.0
 - Arc D: 4826.0
 - Arc C: 4981.6
 - Arc B: 5225.0
 - Arc A: 5374.0
22. Right-click on the “ boat” coverage and select the *Apply to | AdH Simulations* → **Sim** context menu command.

2.3 Creating a Second Vessel

With one vessel defined, an additional vessel can be added to the simulation using a similar process. Add a second vessel by doing the following:

1. Right-click on “ Map Data” in the Project Explorer and select **New Coverage** to bring up the *New Coverage* dialog.
2. Set the *Coverage Type* to “Vessel” under *AdH*.
3. For the *Coverage Name*, enter “boat2”.
4. Click **OK**, to close the *New Coverage* dialog.

The new “ boat2” coverage will appear in the Project Explorer.

5. Right-click on the “ boat2” coverage and select the **Vessel Parameters** command to open the *Vessel Parameters* dialog.
6. In the list on the left side of the dialog, turn on the *Vessel* option
7. For the parameters on the right side of the dialog, enter the following:
 - *Vessel draft (DRFT)* to “7.0”.
 - *Vessel length (BLEN)* to “150.0”.
 - *Vessel width (BWID)* to “20.0”.
 - *Bow draft ratio (CBOW)* to “0.95”.
 - *Stern draft ration (CSTR)* to “0.95”.
 - Leave everything else at the default settings.
8. Click **OK** to close the *Vessel Parameters* dialog.

Set the vessel's arc properties by doing the following:

9. Select the “ boat2” coverage to make it active.
10. Using the **Create Feature Arc**  tool, create six arcs as shown in Figure 3.

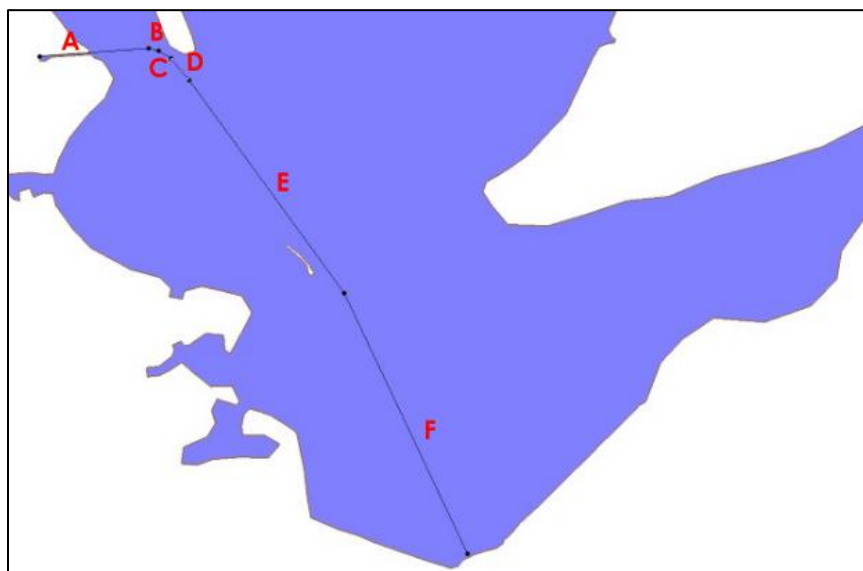


Figure 3 Second boat path with labeled arcs

11. Right-click the top leftmost arc (labeled A in Figure 3) and select **Assign arc attributes...** to open the *Arc Properties* dialog.
12. On the left side of the dialog, turn on the *First Segment* option.
13. Set the *Type of Segment* option to "Line".
14. Set the *Vessel time of arrival* option to "2405.0".
15. Click **OK** to close the *Arc Properties* dialog.
16. Right-click the second topmost arc (labeled B in Figure 2) and select **Assign arc attributes...** to open the *Arc Properties* dialog.
17. On the left side of the dialog, turn on the *Segment* option.
18. Set the *Type of Segment* option to "Line".
19. Set the *Vessel time of arrival* option to "2441.0".
20. Click **OK** to close the *Arc Properties* dialog.
21. Repeat steps 17–21 for each of the remaining arcs working from top to bottom change the *Vessel time of arrival* option as follows:
 - Arc C: 2480.0
 - Arc D: 2518.0
 - Arc E: 4022.6
 - Arc F: 5516.0
22. Right-click on the  boat2" coverage and select the *Apply to | AdH Simulations* → **Sim** context menu command.

2.4 Creating a Third Vessel

With two vessels defined, a third, larger, vessel can be added to the simulation. Add a third vessel by doing the following:

1. Right-click on  Map Data" in the Project Explorer and select **New Coverage** to bring up the *New Coverage* dialog.
2. Set the *Coverage Type* to "Vessel" under *AdH*.
3. For the *Coverage Name*, enter "boat3".
4. Click **OK**, to close the *New Coverage* dialog.

The new  boat3" coverage will appear in the Project Explorer.

5. Right-click on the  boat3" coverage and select the **Vessel Parameters** command to open the *Vessel Parameters* dialog.
6. In the list on the left side of the dialog, turn on the *Vessel* option
7. For the parameters on the right side of the dialog, enter the following:
 - *Vessel draft (DRFT)* to "8.0".
 - *Vessel length (BLEN)* to "200.0".
 - *Vessel width (BWID)* to "30.0".
 - *Bow draft ratio (CBOW)* to "0.95".

- Stern draft ration (CSTR) to “0.95”.
 - Leave everything else at the default settings.
8. Click **OK** to close the *Vessel Parameters* dialog.
- Set the vessel's arc properties by doing the following:
9. Select the “ boat3” coverage to make it active.
10. Using the **Create Feature Arc**  tool, create 8 arcs as shown in Figure 4.

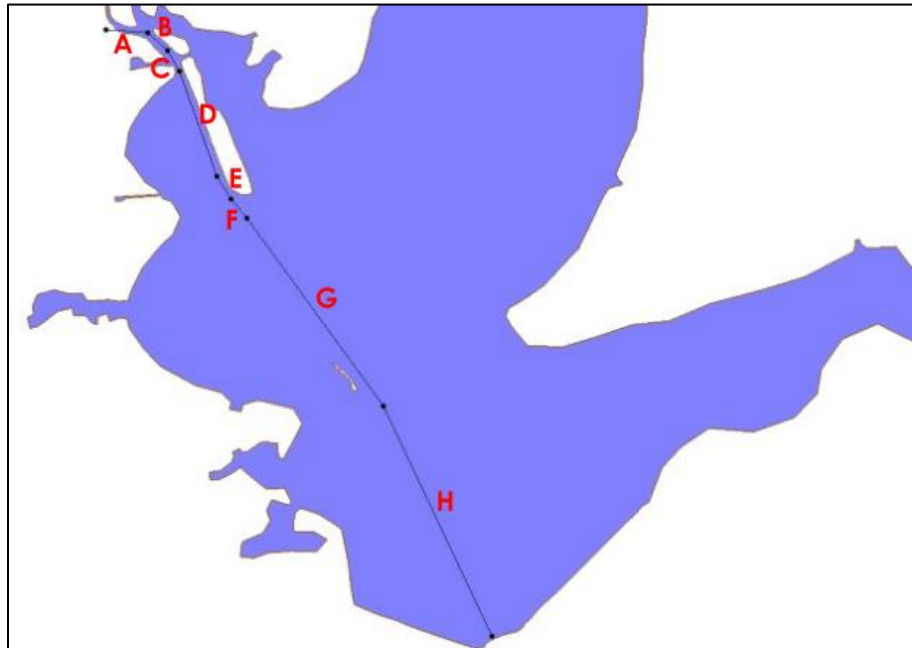


Figure 4 Third boat path with labeled arcs

- Right-click the top leftmost arc (labeled A in Figure 4) and select **Assign arc attributes...** to open the *Arc Properties* dialog.
- On the left side of the dialog, turn on the *First Segment* option.
- Set the *Type of Segment* option to “Line”.
- Set the *Vessel time of arrival* option to “321.0”.
- Click **OK** to close the *Arc Properties* dialog.
- Right-click the second topmost arc (labeled B in Figure 4) and select **Assign arc attributes...** to open the *Arc Properties* dialog.
- On the left side of the dialog, turn on the *Segment* option.
- Set the *Type of Segment* option to “Line”.
- Set the *Vessel time of arrival* option to “484.0”.
- Click **OK** to close the *Arc Properties* dialog.
- Repeat steps 17–21 for each of the remaining arcs working from top to bottom change the *Vessel time of arrival* option as follows:
 - Arc C: 587.0
 - Arc D: 1148.0

- Arc *E*: 1292.0
- Arc *F*: 1437.0
- Arc *G*: 2555.0
- Arc *H*: 3805.0

22. Right-click on the “ boat3” coverage and select the *Apply to | AdH Simulations* → **Sim** context menu command.

3 Setting the Model Parameters

The next step is to set up the model parameters to include vessels in the AdH simulation:

1. Right-click on the “ Tides” simulation and select the **Model Control...** context menu command to bring up the *Model Control* dialog.
2. Select the *Operation* tab.
3. Turn on the *Vessel* option.
4. Click the **Select Vessels...** button to open the *Select Vessel Coverages* dialog.
5. Select all of the boat coverages.
6. Click **OK** to close the *Select Vessel Coverages* dialog.
7. Click **OK** to close the *Model Control* dialog.

4 Saving the Project

Before running the simulation, it is recommended the project be saved by doing the following:

1. Select *File | Save New Project...* to bring up the *Save* dialog.
2. Enter “VesselFinal” as the *File name* and select “Project Files (*.sms)” for *Save as type*.
3. Click the **Save** button to save the file and close the *Save* dialog.

Additional projects for modeling tests may be saved by incrementing the number in the name of the file, or by entering a completely different name for the project file.

5 Simulation Run

This example has a long run time. For this reason, this section may be skipped and the solution files provided with this tutorial can be loaded to view the results.

To run the model check, do the following:

1. Right-click on the “ Sim” simulation and select the **Save Project, Simulation and Run...** context menu command to bring up the *Simulation Run Queue* dialog.

If any problems are found in the model quality check, the problems will appear in the text field at the bottom of the dialog. The steps needed to correct the problems will also be displayed.

The “Sims” simulation should be at the top of the list of simulations. There should be only one simulation in the list at this time. This simulation has a longer run time and may take around an hour to finish.

2. Click on the **Load Solution** button to load the solution datasets.

New solution datasets will appear below the “ Sim” simulation in the Project Explorer.

6 Reviewing the Results

With the solution files loaded, the effects of the vessels can be viewed. To view the solution data:

1. In the Project Explorer, select the “ ERROR SI” dataset and scroll through the time steps.
2. In the Project Explorer, select the “ HYDRO_ERROR SI” dataset and scroll through the time steps.

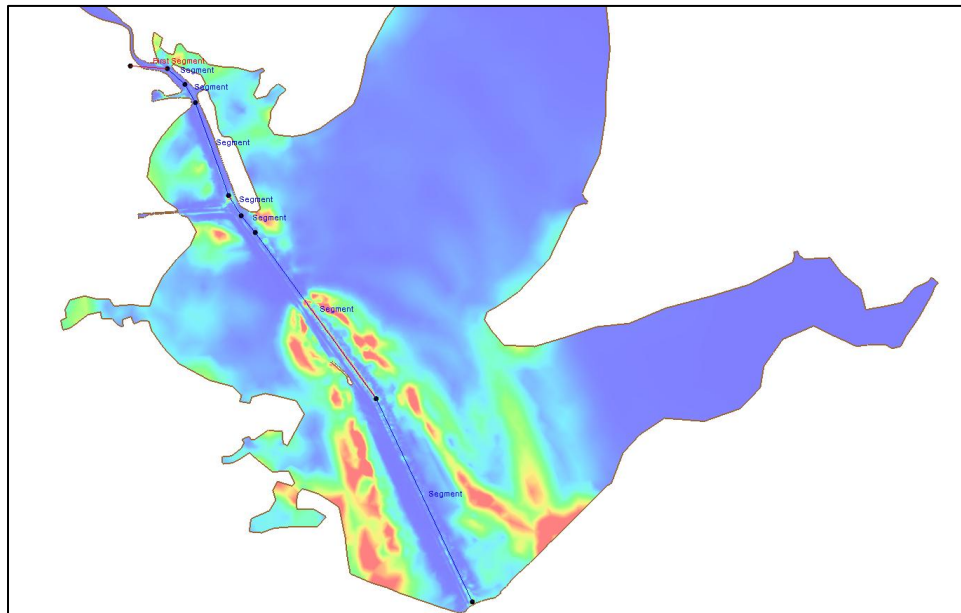


Figure 5 The ERROR SI dataset

7 Conclusion

This concludes the *AdH Vessel* tutorial. This tutorial covered:

- Creating an AdH vessel coverage
- Assigning vessel properties
- Creating a vessel path and path attributes
- Reviewing path results