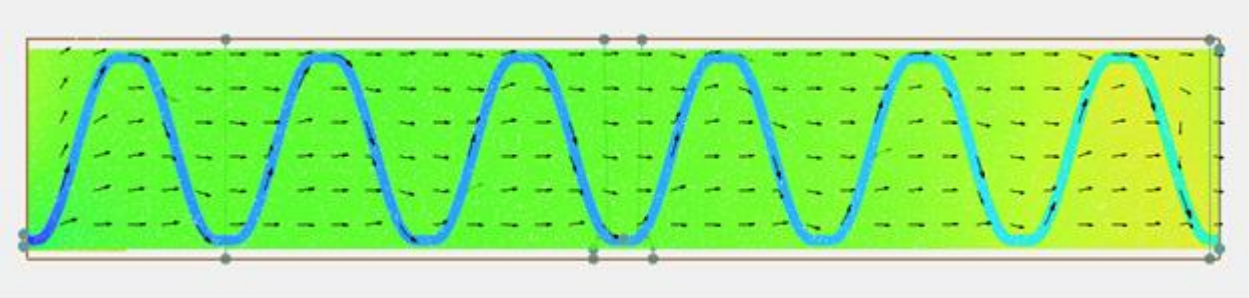
SMS 13.3 Tutorial

SRH-2D Advanced Simulations – Scenarios

Scenarios tool for SRH-2D



Objectives

This tutorial shows how to define parameter functionality in a Sedimentation and River Hydraulics – Two-Dimensional (SRH-2D) simulation.

Prerequisite Tutorials

- Overview
- SRH-2D

Required Components

- SMS Core
- SRH-2D Model & Interface

Time

- 20–30 minutes

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1 Introduction

The Sedimentation and River Hydraulics – Two-Dimensional model (SRH-2D) is a two-dimensional (2D) hydraulic, sediment, temperature, and vegetation model for river systems developed at the Unites States Bureau of Reclamation (USBR) and sponsored by the United States Federal Highway Administration (FHWA).

After setting up an SRH-2D simulation, SMS contains the option to perform additional simulations using a specified set of parameters. This allows for quickly creating variable simulation results.

This tutorial will demonstrate using the advanced simulations parameter functionality to create additional simulation scenarios. It will make use of a pre-generated model that uses an idealized river example. The advanced simulation options will then be accessed to set up alternate simulation runs that make use of varying inflow and material values.

2 Getting Started

A previously created project will be used for this tutorial. Start the tutorial by doing the following:

1. Launch the SMS application.
2. Select *File* | **Open…** to bring up the *Open* dialog.
3. Browse to the *data files* folder for this project.
4. Select "IdealRiverParameters.sms" and click **Open** to import the project and exit the *Open* dialog.

The project should appear similar to Figure 1. The project contains a simple mesh along with map coverages for the boundary conditions, materials, and monitoring data. An SRH-2D simulation has been created with defined parameters.

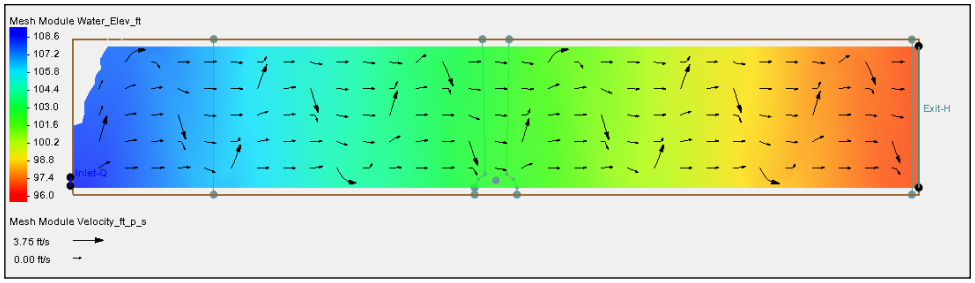

Figure 1 The initial project

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2.1 Review the Simulation

Before continuing, examine the inflow boundary conditions. To do this:

1. Select "2000 cfs" coverage to make it active.
2. Using the **Select Feature Arc** tool, double-click on the inflow arc on the left (upstream) side to open the *SRH2D Assign BC* dialog.
3. Notice under the *Discharge options*, the discharge has been sent to a constant of 2000 cfs.
4. Click **Cancel** to close the *SRH2D Assign BC* dialog.

Also, review the solution from the initial simulation run:

5. Select the "Water_Elev_ft" dataset to review the dataset values.
6. Repeat Step 5 with the other solution datasets.

3 Activating Simulation Parameters

Additional solution datasets can be generated using the advanced simulation parameters. This functionality allows running additional simulations that make changes to common simulation variables. Specifically, these include changes to boundary condition flow rates and water levels, material roughness values, initial conditions, and the number of time steps. Aspects of the simulation such as the output format, mesh structure, and monitor lines cannot be changed using this feature. In this case, a new simulation should be created with the desired changes.

To activate the simulation parameters functionality, do the following:

1. Right-click on the "Base" simulation and select *Tools* | **Advanced Simulation (Beta)…** to bring up the *Advanced Simulation* dialog.
2. Turn on the *Use parameters* option.

The *Advanced Simulation* dialog allows setting multiple simulation runs and designating variations for each simulation run. Two run types are allowed: scenarios and calibration. This tutorial demonstrates using scenarios.

Below the run type, a list shows the available parameters that can be altered with each model run. On the right side of the dialog, the number of model runs can be specified.

To see how this works, do the following:

3. Make sure the *Run type* is set to "Scenarios".
4. Under *Available parameters*, turn on *Inlet Q*.
5. Also under *Available parameters*, turn on *Manning's N* for the channel.
6. On the right side of the dialog, change the *Number of runs* to be "4".

The number of model runs has now been set. Next, the values for the inlet and Manning's n can be changed for each of the model runs.

3.1 Adding Inlet Flow Parameters

Start with changing the inlet flow for the model runs by doing the following:

1. For *Run 1*, set *Inlet Q Arc 1* to be "1000".

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2. For *Run 2*, set *Inlet Q Arc 1* to be “1500”.
3. For *Run 3*, set *Inlet Q Arc 1* to be “4500”.

For the last model, set an XY series. To do this:

4. Click the **XY Series…** button (next to the *Number of runs*) to open the *XY Series List* dialog.
5. On the left column, click the **Insert Row** button.
6. For the *Name*, enter “Inflow Hydrograph”.
7. In the middle column, change the *Number of rows* to be 3.
8. Enter the following XY values using the table below:

X Value	Y Value
0	1000
210	4500
270	3500

9. Click **OK** to close the *XY Series List* dialog.
10. For *Run 4*, set *Inlet Q Arc 1* to be “Inflow Hydrograph” using the drop-down menu.

Before continuing, change the name of run 4 to better identify the scenario.

11. Double-click on *Run 4* in the *Run* column.
12. Enter “Q_Hydrograph” and press *Enter* to change the name.

3.2 Adding Manning’s N Parameters

The roughness value for the channel will now be changed for the last scenario run. To do this:

1. For *Run 4*, set *Manning’s N channel* to be “0.035”.
2. Click **OK** to exit the *Advanced Simulation* dialog.
3. **Save** the project.

4 Running SRH-2D

The model runs are now ready to be executed. SMS will apply the advanced simulation parameters and multiple model runs will be started. To do this:

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

The necessary input files for all four of the model runs will be exported.

2. If advised of the monitor coverage being renumbered, click **Yes** to close the notice.
3. If a warning appears that the existing solution data will be removed from the project, click **OK**.

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Note that each of the scenario runs appear in the run queue under the "Base" simulation. When finished, you can check the *Command line* tab for each scenario or review the plots for each scenario.

4. Click **Load Solution** to import the solutions into SMS.
5. Click **Close** to exit the *Simulation Run Queue* dialog.

5 Viewing SRH-2D Output

As SRH-2D runs, it generates a XMDF file for each of the scenarios. The solution datasets for each scenario will be loaded into the project. Because all of the model runs were part of the same simulation, all of the solution datasets will be loaded under the same simulation folder. The solution for each scenario appears in a solution folder under the simulation ("Base (SRH-2D)") folder. Each scenario folder is named to match its scenario name.

1. Expand all four scenario solution folders.
2. Select the "Water_Elev_ft" dataset for "Run 1", then "Run 2", then "Run 3", and finally the "Q_Hydrograph" run.

Note the differences in water level for each simulation.

3. Repeat step 2 for the "Vel_Mag_ft_p_s" dataset or other datasets.

Note: if desired, set the contour options to a specific range so that the meaning of colors will not change from one scenario to another.

Use the visualization tools in SMS as described in the "Data Visualization" tutorial or other tutorials to evaluate the solution datasets created by the SRH-2D model.

6 Run Statistics

SMS allows running a statistical operation on the generated solution data.

1. Right-click on the "Base" simulation and select *Tools* | **Statistical Analysis (Beta)**.

This opens a status window as SMS computes statistical datasets for the minimum, maximum, and standard deviation of each of the solution datasets across all scenarios. If an error appears during the statistical analysis, the *SRH-2D Solution Statistics* dialog will remain open and show the error.

2. Select each "stddev_" dataset in turn and see how much the solutions vary throughout the domain for each solution dataset.

Note what portion of the domain has the highest sensitivity (greatest standard deviation) and make sure this makes sense.

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7 Conclusion

This concludes the “SRH-2D Advanced Simulation – Scenarios” tutorial for SMS. The tutorial demonstrated and discussed the following:

- Accessing the advanced simulation options
- Creating multiple simulation scenarios
- Creating scenarios with varying inflow and material inputs
- Running multiple simulation scenarios
- Running SRH-2D statistical analysis of the solution sets

Feel free to continue experimenting with the project, or exit the program.

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