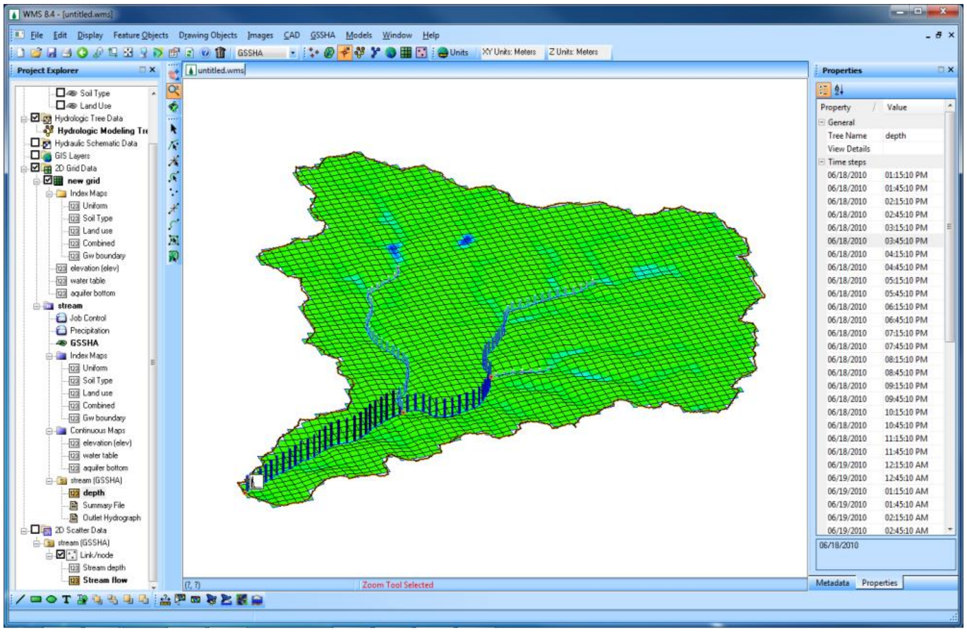
WMS

v. 11.0

WMS 11.0 Tutorial

Manual Calibration of GSSHA Models

Learn how to manually calibrate a GSSHA model



Objectives

This tutorial demonstrates how to calibrate a GSSHA model by running a sensitivity analysis on the input parameters. A sensitivity analysis helps with understanding how changes in input parameters impact the output of the model.

Prerequisite Tutorials

- Developing a GSSHA Model using the Hydrologic Modeling Wizard

Required Components

- Data
- Drainage
- Map
- Hydrology
- 2D Grid
- GSSHA

Time

- 20–40 minutes

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1 Introduction

Creating a working GSSHA model is a preliminary step in hydrologic modeling. Such models can be used in analyzing different hydrologic problems only if the model developer has enough confidence in the model. Generally, such models should be calibrated.

In this tutorial, a pre-existing GSSHA project for the Goodwin Creek watershed will be imported and a sensitivity analysis will be performed on the parameters in order to understand how parameters can be modified to calibrate the model. In this tutorial we will manually adjust parameters for a calibration, in the next tutorial we will use a series of batch or stochastic runs to calibrate the model and then finally we will use an automated shuffle, complex, evolution scheme to automate the calibration. In all cases a sensitivity analysis on the parameters is helpful in guiding the calibration.

2 Getting Started

It is necessary when calibrating to run GSSHA to get a base case, which will be used to calibrate the model afterwards. To create a base dataset:

1. Open WMS to get started. If WMS is already open, select *File* | **New** to reset to the default settings.
2. Select *File* | **Open** to bring up the *Open* dialog.
3. Navigate to *GSSHACalibration1\Calibration\Manual* and select "goodwin.prj".
4. Click **Open** to open the project and exit the *Open* dialog. The project should look similar to Figure 1 below.

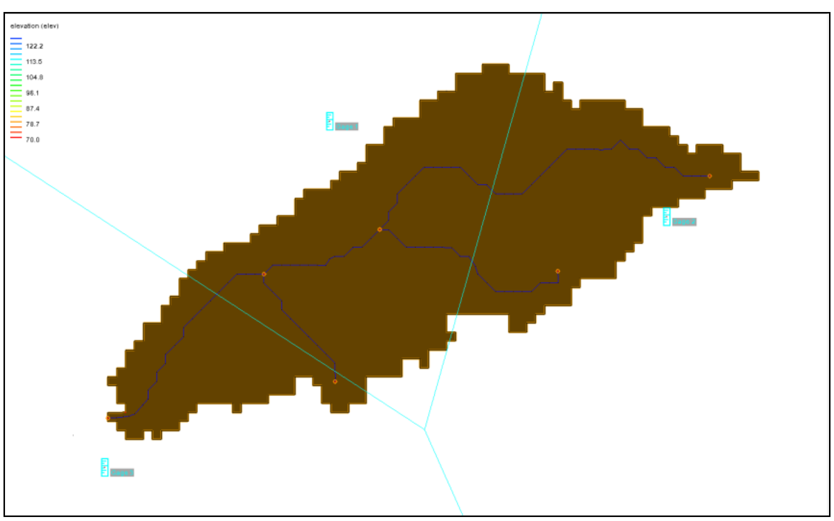

Figure 1 Beginning GSSHA model

5. Select the 2-D Grid Module to activate the GSSHA settings.
6. Select *GSSHA* | **Model Check** to bring up the *GSSHA Model Check* dialog.
7. Click **Done** to close the *GSSHA Model Check* dialog.
8. Select *GSSHA* | **Run GSSHA** to bring up the *GSSHA Run Options* dialog.
9. Click **OK** to close the *GSSHA Run Options* dialog and open the *Model Wrapper* dialog.
10. When the model finishes running, click **Close** to exit the *Model Wrapper* dialog and read in the solution.

3 Comparing to Observed Flow Values

Now that there is a base simulation associated with the model, it is now possible to compare the results to the observed flow to see where adjustments can be made to the parameters. This comparison can be done in a spreadsheet editing program. To compare the base case to the observed flows:

1. In a File Explorer, navigate to *GSSHACalibration1\Calibration* and open the spreadsheet titled “ManualCalib.xls” in a spreadsheet program.
2. Notice that the data from the base model has already been imported. Click on the sheet titled “All comparison” to view how the hydrographs compare.

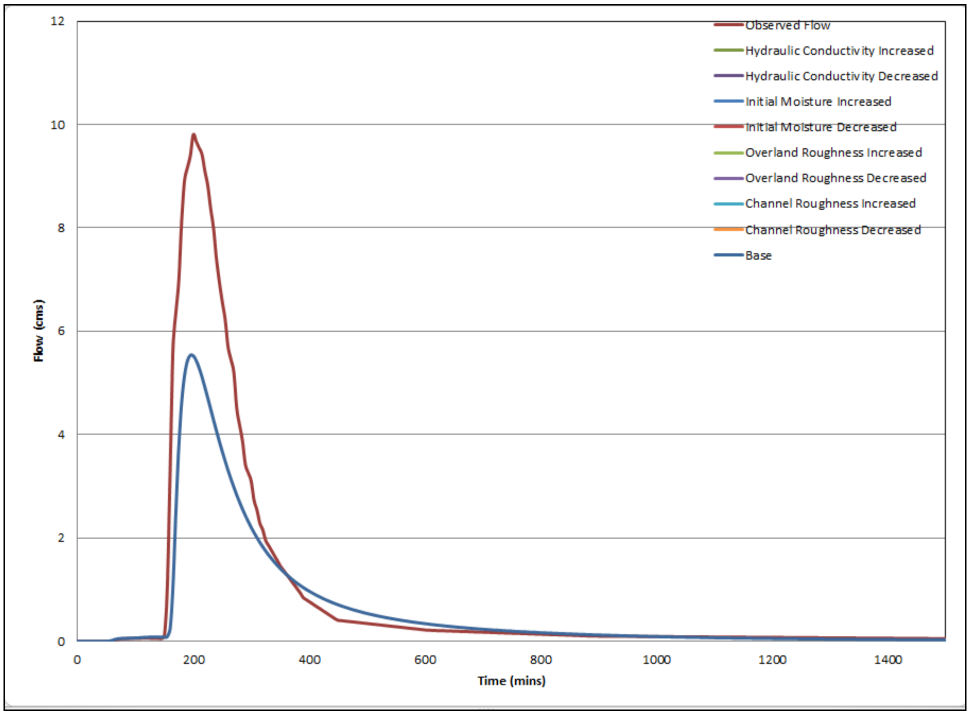

Figure 2 Hydrograph comparison between the base model simulation and the observed flows for the area.

It is clear when looking at the hydrograph that the base model is much lower (under-predicting) than the observed flow.

4 Testing Parameters

As seen above, there are differences between the simulation results and the observed flow. Notice whether the model is under- or over-predicting the flow (under-predicting in this case). This indicates what needs to be done next with the parameters so that the simulation results match up with the observed data.

Although there are several parameters that affect the outflow, there are a few which are more sensitive. The more sensitive parameters include:

- Hydraulic Conductivity
- Initial Moisture
- Overland Roughness
- Channel Roughness

The next portion of the tutorial will cover how to perform a sensitivity analysis on one parameter of the model. Use this information to perform a sensitivity analysis on the other three critical parameters afterward if desired.

The spreadsheet titled "ManualCalib" that was opened previously has a table of the original parameter values for convenience. The blue colored cells in the table indicate what the weights of the parameters should be. To obtain a 25% increase, enter 1.25 into the cell and for a 25% decrease, enter 0.75 into the cell. The spreadsheet has been organized with a row for an increase and a row for a decrease.

1. In the spreadsheet, "ManualCalib.xls" enter "1.25" in the blue cell to the right of *25% increased* in the first table titled *Hydraulic Conductivity*.
2. In the spreadsheet, "ManualCalib.xls" enter "0.75" in the blue cell to the right of *25% decreased* in the first table titled *Hydraulic Conductivity*.

Enter the weights in Blue colored cells (1.25 for 25% increase and 0.75 for 25% decrease)

		Hydraulic Conductivity										
		IDs	1	2	3	4	5	6	7	8	9	
		Description	gullied-land	gullied-land	water-.3%	pasture	cotton	pine	pine	cotton	pasture	
		Description	silt-loam-15%	sand-1%		clay-loam-3.5%	clay-loam-5%	clay-loam-10%	silt-loam-17%	silt-loam-9%	silt-loam-39%	
		Original Parameters	3.331339	1.41	0.003	0.019943	0.189387	0.292474	1.227514	2.693927	0.246209	
25% increased		**Updated Parameters**	0	0	0	0	0	0	0	0	0	25% increased
25% decreased			0	0	0	0	0	0	0	0	0	25% decreased

		Soil Moisture										
		IDs	1	2	3	4	5	6	7	8	9	
		Description	gullied-land	gullied-land	water-.3%	pasture	cotton	pine	pine	cotton	pasture	
		Description	silt-loam-15%	sand-1%		clay-loam-3.5%	clay-loam-5%	clay-loam-10%	silt-loam-17%	silt-loam-9%	silt-loam-39%	
		Original Parameters	0.33	0.15	0.15	0.15	0.318	0.318	0.33	0.33	0.33	
25% increased		**Updated Parameters**	0	0	0	0	0	0	0	0	0	25% increased
25% decreased			0	0	0	0	0	0	0	0	0	25% decreased

		Overland Roughness						
		IDs	1	2	300%	4	500.00%	
		Description 1	pine 27%	water 0.3%	cotton 14%	pasture 42%	gullied land 16%	
		Original Parameters	0.050541	0.358	0.461467	0.072003	0.97199	
25% increased		**Updated Parameters**	0	0	0	0	0	25% increased
25% decreased			0	0	0	0	0	25% decreased

		Channel Roughness		
		Original Parameters	0.03541	
25% increased		**Updated Parameters**	0	25% increased
25% decreased			0	25% decreased

Figure 3 Table of values for each of the critical input parameters.

3. Copy the values highlighted in yellow from the first row titled *25% increased*.
4. Return to WMS and click *GSSHA* | **Map Tables** to bring up the *GSSHA Map Table Editor* dialog.
5. Select the *Infiltration* tab to view the infiltration parameters.

6. Paste the values copied from the spreadsheet into the *Hydraulic conductivity (cm/hr)* row.
7. Click **Done** to exit the *GSSHA Map Table Editor* dialog.
8. Select *GSSHA* | **Run GSSHA** to bring up the *GSSHA Run Options* dialog.
9. Click **OK** to exit the *GSSHA Run Options* dialog and open the *Model Wrapper* dialog.
10. When the simulation has finished, click **Close** to exit the *Model Wrapper* dialog and read in the solution.
11. Using the **Select hydrographs**  tool, double-click on the hydrograph icon displayed near the outlet of the watershed. This will bring up the *Hydrograph* dialog.
12. Right-click on the hydrograph and select **View Values** to bring up the *View Values* dialog.
13. Copy the values in the *Flow (m^3/s)* column.
14. Return to the "ManualCalib" spreadsheet, and paste the values into the column titled *Increased* under *Hydraulic Conductivity*.
15. Repeat steps 3-14 to evaluate the values for a decreased hydraulic conductivity. For step 3, copy the values from the *25% decreased* row instead. For step 14, copy the values into the column titled *Decreased* under *Hydraulic Conductivity*.
16. Within the spreadsheet, select the "Hyd_Cond" sheet to view the comparison in the model and how it compares to the observed flow.

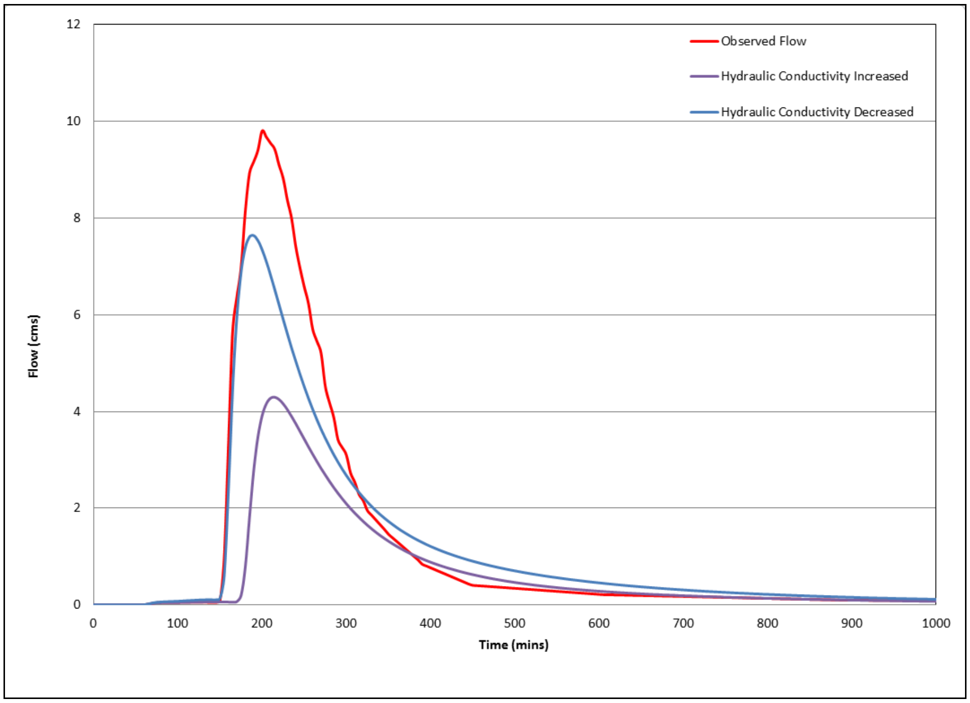

Figure 4 Hydraulic conductivity sensitivity analysis.

To run the sensitivity analysis on the other parameters, simply copy the original values for hydraulic conductivity back into the mapping table, and repeat the process with a new parameter.

5 Conclusion

This concludes the “Manual Calibration of GSSHA Models” tutorial. Further analysis may be performed by following the tutorial for varying parameters until all of the parameters produce a predicted flow similar to the observed flow. This tutorial covered how to perform a manual calibration of a GSSHA model.

