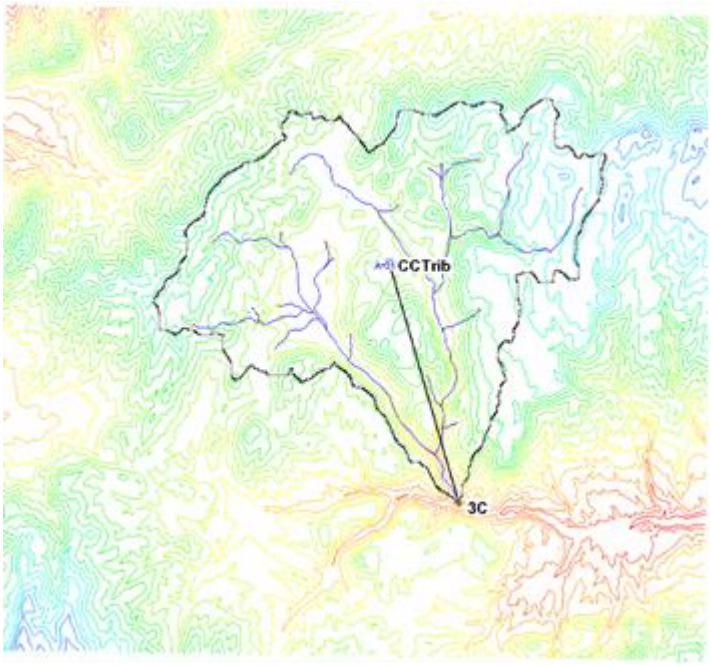
WMS 11.2 Tutorial

HEC-HMS Modeling

Learn how to set up a basic HEC-HMS model using WMS



Objectives

Build a basic HEC-HMS model using DEM, land use, and soil data. Compute the geometric and hydrologic parameters required to run the HEC-HMS model.

Prerequisite Tutorials

- DEM Delineation

Required Components

- WMS Core
- HEC-HMS Model

Time

- 15–30 minutes

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1 Introduction

WMS includes a graphical interface to HEC-HMS. This tutorial is similar to the "Watershed Modeling - HEC-1 Interface" tutorial. Geometric attributes such as areas, lengths, and slopes are computed automatically from the digital watershed. Parameters such as loss rates, base flow, unit hydrograph method, and routing data are entered through a series of interactive dialog boxes. Once the parameters needed to define an HMS model have been entered, an input file with the proper format for HMS can be created automatically.

Since only parts of the HMS input file are defined in this tutorial, feel free to explore the different available options of each dialog, being sure to select the given method and values before exiting the dialog. Unlike HEC-1, it is necessary to export the HMS files from WMS and then run the HMS graphical user interface to view the results. In order to do this, have the most recent version of HMS installed.[1]

The workflow for this tutorial will proceed as follows:

Open a file with a watershed delineated from a DEM. Then develop a simple, single basin model using the delineated watershed to derive many of the parameters. Land use and soil shapefiles (downloaded from the Internet) will be used to develop a SCS curve number (CN) value.

2 Getting Started

Starting WMS new at the beginning of each tutorial is recommended. This resets the data, display options, and other WMS settings to their defaults. To do this:

1. If necessary, launch WMS.
2. If WMS is already running, press *Ctrl-N* or select *File* | **New…** to ensure that the program settings are restored to their default state.
3. A dialog may appear asking to save changes. Click **Don't Save** to clear all data.

The Graphics Window of WMS should refresh to show an empty space.

[1] The most recent version of HEC-HMS is available on the U.S. Army Corps of Engineers Hydrologic Engineering Center website: http://www.hec.usace.army.mil/software/hec-hms/downloads.aspx.

3 Single Basin Analysis

When building a model, it is necessary to enter the global—or Job Control—parameters, as well as basin and meteorological data.

3.1 Setting up the Job Control

Most of the parameters required for a HEC-HMS model are defined for basins, outlets, and reaches. However, there are some "global" parameters that control the overall simulation and are not specific to any basin or reach in the model. These parameters are defined in the WMS interface using the Job Control dialog.

1. Select *File* **| Open…** to bring up the *Open* dialog.
2. Select "WMS XMDF Project File (*.wms)" from the *Files of type* drop-down.
3. Browse to the *hec-1\hec-1* directory and select "hec-1_SingleWatershed.wms".
4. Click **Open** to import the project file and close the *Open* dialog.

The project in the Main Graphics Window should appear similar to Figure 1.

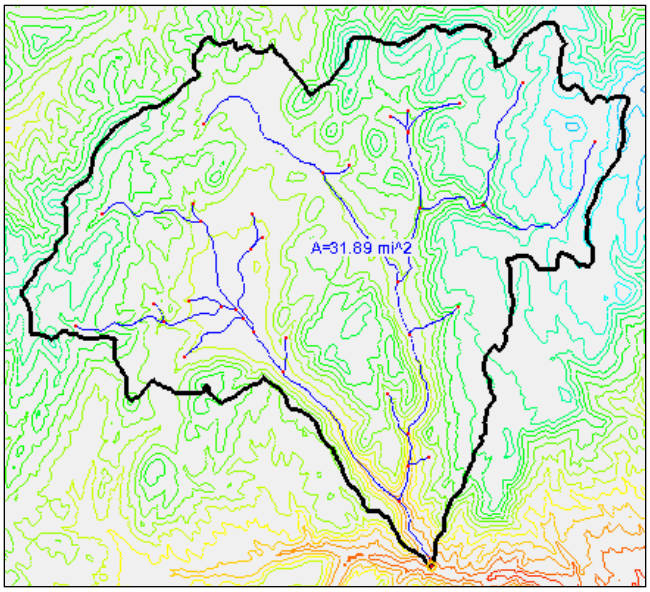

Figure 1 The drainage basin used in this tutorial

5. Turn off "GIS Data" in the Project Explorer.
6. Switch to the **Hydrologic Modeling** module.
7. Select "HEC-HMS" from the Model selection drop-down (Figure 2).

Figure 2 HEC-HMS selected in Model drop-down

8. Select *HEC-HMS* **| Job Control…** to bring up the *HMS Job Control* dialog.
9. In the *Control Options* tab, enter "Clear Creek Tributary" as the *Name*.
10. In the *Description* field, enter "job1".

By default the simulation is set to run for 24 hours starting from July 1, 2015 date at 15 minute intervals. For this simulation, the settings need to be changed to run it for 25 hours at five minute intervals.

11. Add one hour to the *Ending time* by clicking the small up arrow located just to the right of the field, or by manually changing the hours part of the field.
12. Select “2 Minutes” from the *Time interval* drop-down.
13. In the *Basin Options* tab, enter “Clear Creek Tributary” in the *Name* field.

The basin model units are also set on the *Basin Options* tab, but they will be left at default for this tutorial. Note that setting the computation units does not cause any unit conversion to take place. This tells HEC-HMS that input units will be provided in English units (sq. miles for area, inches for rain, feet/miles for length) and expect results of computation to be in English units (cfs). If specifying Metric, then ensure that input units are metric (sq. kilometers, mm for rain, meters/kilometers for length) and results will be in metric (cms).

14. In the *Meteorological Options* tab, enter “Clear Creek Tributary” in the *Name* field.
15. Click **OK** to close the *HMS Job Control* dialog.

Note that HEC-HMS includes advanced options for long term simulation and local inflows at junctions, but these will not be explored in this tutorial.

3.2 Setting up the Meteorological Data

In HEC-1, precipitation is handled as a Basin Data attribute. HEC-HMS instead defines precipitation separately in the Meteorological Parameters. This is because of the ability of HEC-HMS to model long term simulations that require additional information and often a lot more input.

1. Select *HEC-HMS* **| Meteorologic Parameters…** to bring up the *HMS Meteorological Model* dialog.
2. Select “SCS Hypothetical Storm” from the *Precipitation Method* drop-down.
3. In the *Precipitation Data* section, select “Type II” from the *Storm Selection* drop-down.
4. Enter “1.8” as the *Storm Depth*.
5. Click **OK** to close the *HMS Meteorological Model* dialog.

3.3 Setting up the Basin Data Parameters

1. Using the **Select basin** tool, double-click on the brown basin icon to bring up the *HMS Properties* dialog. The icon may be partially obscured by another label (Figure 3).

Double-clicking on a basin or outlet icon always brings up the parameter editor dialog for the current model (in this case, HEC-HMS). Notice that the area has been calculated—in this case, in square miles—because calculations are performed in English units.

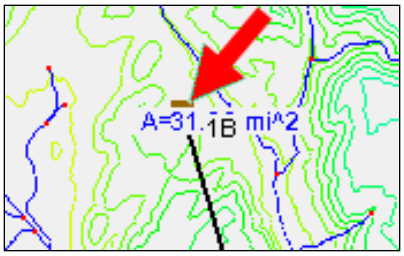

Figure 3 Basin icon 1B behind label, with top just visible

2. In the *Display options* section, turn on *Loss Rate Method* in the *Display* column. A new column will appear in the *Properties* section.
3. Turn on *SCS Curve Number* in the *Show* column. Several new columns will appear in the *Properties* section.
4. Scroll down and turn on *Transform* in the *Display* column. Several new columns will appear in the *Properties* section.
5. Turn on *SCS* in the *Show* column. Two new columns will appear in the *Properties* section.
6. In the *Properties* section, click the "1B" in the *Name* column to highlight it.
7. Enter "CCTrib" and press the *Tab* key twice to move to the *Description* field.
8. Enter "Main Branch" and press *Tab* four times to go to the *SCS Curve No.* column.
9. Enter "70.0" in the *SCS Curve No.* column.

For the SCS CN method, initial losses are estimated as 20% of the maximum storage value computed from the CN when the initial loss is zero. To override this computation, enter a value other than zero. For now, assume there is no impervious area.

10. Scroll to the right and click **Compute…** in the *Basin Data* column to bring up the *Basin Time Computation* dialog.
11. Select "Compute Lag Time" from the *Computation type* drop-down.
12. Select "SCS Method" from the *Method* drop-down.
13. Click **OK** to update the computed lag time and close the *Basin Time Computation* dialog.
14. Click **OK** to close the *HMS Properties* dialog.

The brown basin icon formerly named "1B" is now named "CCTrib". All of the parameters set to run a single basin analysis are now entered.

3.4 Running HEC-HMS

Whenever running an HEC-HMS simulation, the information created in WMS must be saved to HEC-HMS files and then loaded as a project in HEC-HMS. This tutorial is not a comprehensive review of HEC-HMS but should give an idea of how to open a project created by WMS, run an analysis and view some basic results.

1. Select *HEC-HMS* | **Save HMS File…** to bring up the *Save HMS File* dialog.
2. Select "HMS file (*.hms)" from the *Save as type* drop-down.
3. Enter "CCTribNew.hms" in the *File name* field.

Use only alphanumeric characters in the file name, and do not use any characters with diacritics (i.e., umlaut, accent, circumflex) or use spaces. HEC-HMS will not process the files correctly if special characters are in the file name.

4. Click **Save** to save the HMS file and close the *Save HMS File* dialog.

Now launch HEC-HMS on the computer.

5. Locate and launch "HEC-HMS.exe" on the computer being used.
6. Once in HEC-HMS, select *File* **| Open…** to bring up the *Open an Existing Project* dialog.
7. If needed, click **Browse** to bring up the *Select Project File* dialog.
8. Browse to where the HMS project from WMS was just saved (the default location is the *hec-1\hec-1* tutorial directory) and select "CCTribNew.hms".
9. Click **Select** to open the file and close the *Select Project File* dialog.
10. Click **Convert Project** if asked to convert from an older version of HEC-HMS to a new version.
11. The *Open File Format* dialog may appear. If so, in the *Open file as* section, select "HMS Basin Files" from the drop-down and click **OK** to close the *Open File Format* dialog.
12. In the HEC-HMS Project Explorer (called the Watershed Explorer in HEC-HMS), expand the "Basin Models", "Meteorologic Models", and "Control Specifications" folders.
13. Expand the "Clear Creek Tributary" basin model by selecting it.
14. Expand "CCTrib". The HEC-HMS Project Explorer should appear similar to Figure 4.

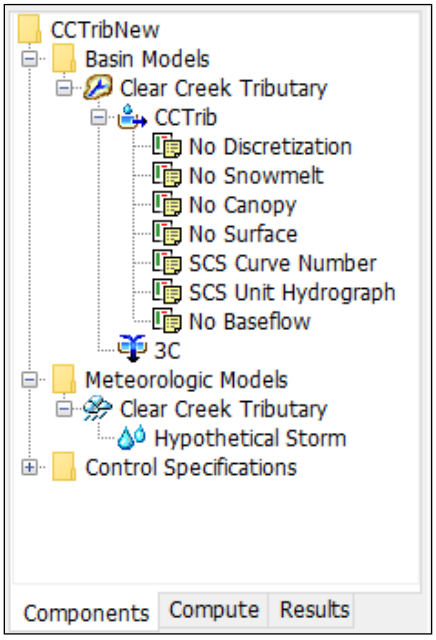

Figure 4 HEC-HMS Project Explorer

To run the simulation, do the following in HEC-HMS:

15. Switch to the *Compute* tab in the HEC-HMS Project Explorer.

16. Select "Run 1" under the " Simulation Runs" folder under " CCTribNew".
17. Select *Compute* **| Compute Run [Run 1]** to bring up a progress dialog.
18. If necessary, click **Close** when HEC-HMS finishes computing to close the progress dialog.
19. Click on the *Results* tab in the HEC-HMS Project Explorer.
20. Expand the " Simulation Runs" folder and select " Run 1" to expand the results.
21. Select " Global Summary" to bring up the *Global Summary Results for Run "Run 1"* dialog. This dialog displays the peak discharge flow.
22. Select " CCTrib" in the HEC-HMS Project Explorer to expand the basin results.
23. Select " Graph" to view the outflow hydrograph and rainfall plot.
24. Select " Summary Table" to review the computed results.
25. Select " Time-Series Table" to explore the computed time series data.
26. Review the remaining plots (" Outflow", " Precipitation", " Cumulative Precipitation", and so on) by selecting each in turn to make them appear in the *Preview* tab in the section below the HEC-HMS Project Explorer.

There is now a completed HEC-HMS simulation for a single basin. The resulting hydrograph for the CCTrib sub-basin element should look similar to Figure 5.

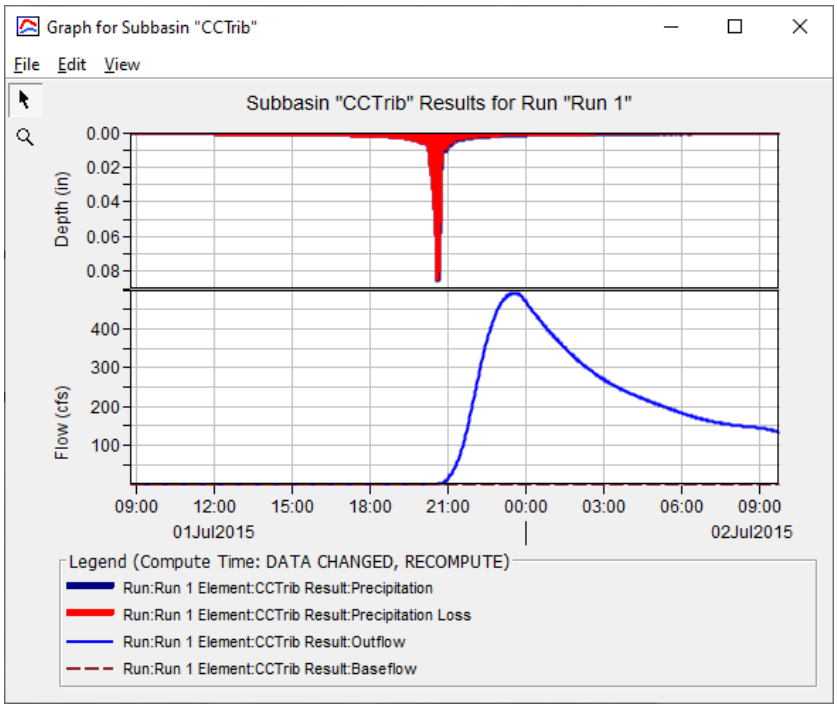

Figure 5 Solution hydrograph for HEC-HMS simulation

Feel free to explore the HEC-HMS input parameters passed from WMS, computed results, or any other options in HEC-HMS.

27. When finished, select *File* **| Exit** to close the project and exit HEC-HMS.

28. Click **Yes** if prompted to save the project.

4 Conclusion

This concludes the “HEC-HMS Modeling” tutorial. The key concepts discussed and demonstrated include:

- Entering job control parameters
- Defining basin parameters such as loss rates, precipitation, and hydrograph methodology
- Performing a watershed analysis
- Saving and running HEC-HMS simulations