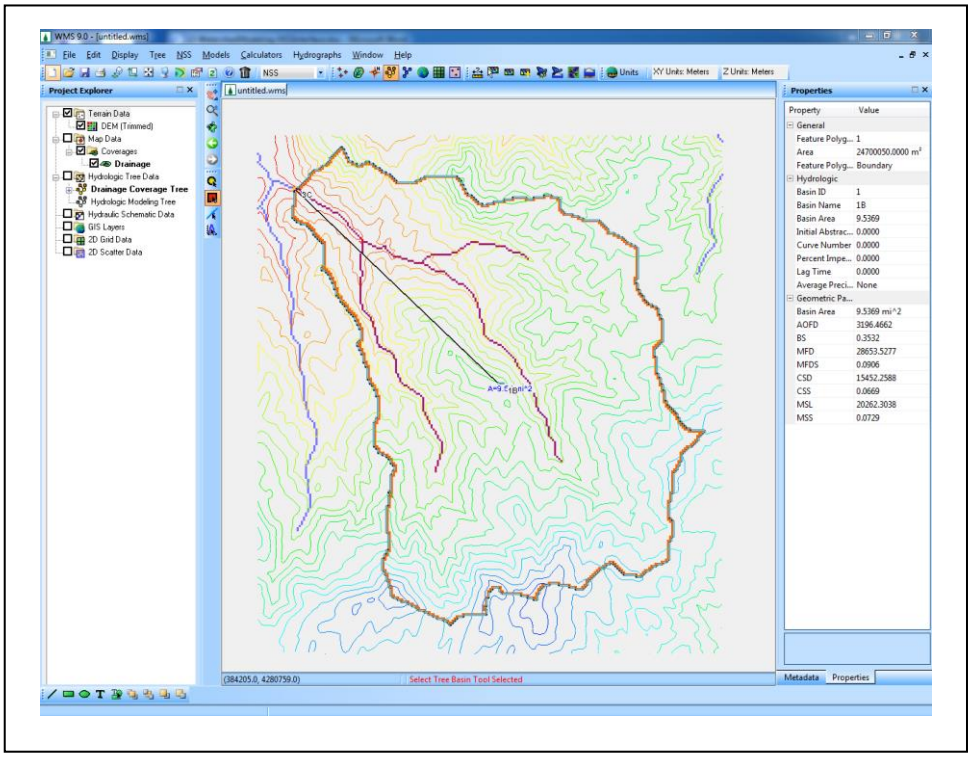
WMS

v. 10.1

WMS 10.1 Tutorial

Watershed Modeling – National Streamflow Statistics Program Interface

Use the NSS interface to estimate peak flows at different recurrence intervals



Objectives

Learn to delineate a basin for an area of interest, run NSS to estimate peak flows at different recurrence intervals, and use an NSS region coverage to automatically compute regions for an NSS model.

Prerequisite Tutorials

- Watershed Modeling – DEM Delineation

Required Components

- Data
- Drainage
- Map
- Hydrology

Time

- 15–45 minutes

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1 Introduction

The National Streamflow Statistics (NSS) program, developed by the USGS, provides a quick and easy way of estimating peak flows for ungaged watersheds. This data can be used in the design of culverts, flood-control structures, and flood-plain management. It utilizes regression equations that have been developed for each state. Most regression equations are functions of parameters such as area, slope, and runoff distance that are automatically computed by WMS when delineating a watershed.

This program was introduced in a previous tutorial when discussing overlay and time of travel computations. This tutorial demonstrates data collection and starting a project from scratch. NSS will then be run for the selected area to compute the peak flows for the different return periods. If the equation ends up needing variables not derived from the DEM alone, then a general overlay may need to be implemented in order to compute percentages of land use, soil, or rainfall for different regions.

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 **No** to clear all data.

The graphics window of WMS should refresh to show an empty space.

3 Utilizing an NSS Region Coverage

This tutorial demonstrates how to create an NSS region coverage that can be used to map equations for a given state— Florida, in this case.

The NSS Region coverage type allows WMS to automatically determine which regression equations to use for an NSS simulation. If a drainage basin overlaps multiple NSS regions, the NSS Region coverage automates the calculations for the percentage of the watershed in each region.

An NSS Region coverage will be used to automatically assign the region for an NSS simulation. This coverage was digitized from an image that displays the NSS regions of Florida. A similar map could be made by scanning or importing a map of the regions to

create an image file, registering the image to a recognized projection system, digitizing the polygons, and assigning the state and region. Most states have less than 10 regions so it generally takes only a few minutes to digitize.

Details on how to scan images and create polygons by digitizing are given in the tutorials on images and feature objects. The USGS website for NSS[1] has images available in the state by state documentation of the equations. These images can be saved and then registered in WMS. In this example, an image will be imported that has already been registered and had polygons digitized.

1. Switch to the **Map** module.
2. Select *File* | **Open** to bring up the *Open* dialog.
3. Select "JPEG Image File (*.jpg;*.jpeg)" from the *Files of type* drop-down.
4. Browse to the *nss\nss* folder and select "NSSMapFL.jpg".
5. Click **Open** to import the file and exit the *Open* dialog.
6. If asked to build image pyramids, click **Yes**.

The process of building image pyramids may take moments to several minutes to complete. Once complete, the Main Graphics Window should appear similar to Figure 1.

Figure 1 Imported map showing four regions in Florida

[1] See http://water.usgs.gov/osw/programs/nss/

3.1 Assigning Regions to Feature Polygons

Notice that Florida has four main regions as shown in Figure 1 (the fifth area at the bottom is not used in this tutorial). The polygons have already been digitized to save time, so the next step is to open the WMS MAP file containing polygons in an NSS Region coverage that represent each of these regions. The assignment of attributes will be completed during this tutorial. For more information on digitizing, please see the "3 Introduction – Basic Feature Objects" tutorial.

1. Click **Open** to bring up the *Open* dialog.
2. Select "Feature Object Files (*.map)" from the *Files of type* drop-down.
3. Select "NSSMapFL.map" and click **Open** to import the MAP file and exit the *Open* dialog.

This MAP file was digitized directly from the map image previously imported.

4. Using the **Select Feature Polygon** tool, double-click in the top left polygon ("1" in Figure 2) to bring up the *NSS Region Polygon Attributes* dialog.

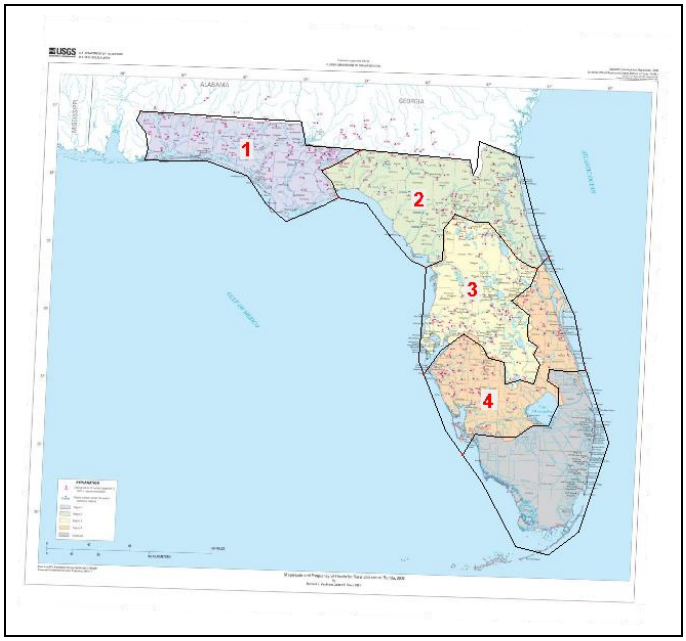

Figure 2 Map broken into regions, numbered clockwise from top left

5. In the *Select NSS Region* section, select "Florida" from the *State* drop-down.
6. Choose "Rural Region 1 2011 5034" from the *NSS Region* drop-down.
7. Click **OK** to close the *NSS Regional Polygon Attributes* dialog.
8. Repeat steps 4-7 for the regions labelled "2", "3", and "4", assigning them to "Rural Region 2 2011 5034", "Rural Region 3 2011 5034", "Rural Region 4 2011 5034" (respectively).

The polygon southernmost should be left undefined in this tutorial.

3.2 Opening the Watershed

1. Click **Open** to bring up the *Open* dialog.
2. Select "WMS XMDF Project File (*.wms)" from the *Files of type* drop-down.
3. In the *Open* dialog, locate and open "NSS_FL.wms".

The study area appears as a small polygon near the top of region "2" (Figure 3).

Figure 3 Study area (in rectangle)

To zoom in on the correct area quickly, do the following:

4. Right-click on " Drainage" in the Project Explorer and select **Zoom to Layer**.

This zooms in on the study area (Figure 4).

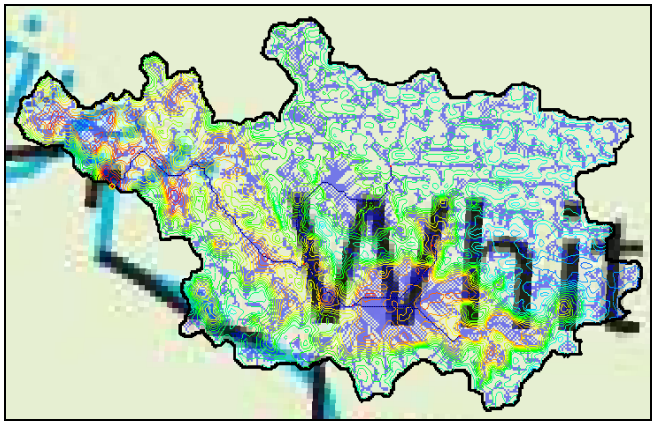

Figure 4 Study area

5. Right-click on " DEM" in the Project Explorer and select **Display Options…** to open the *Display Options* dialog.
6. Select "DEM Data" from the list on the left.
7. On the *DEM* tab, turn off *DEM Contours* and click **OK** to close the *Display Options* dialog.

The study area should appear similar to Figure 5.

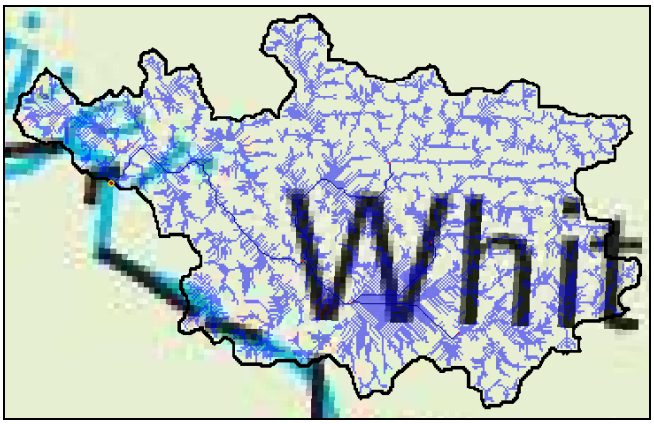

Figure 5 Study area with DEM contours turned off

8. Right-click on "Drainage" and select **Compute Basin Data…** to bring up the *Units* dialog.
9. In the *Model units* section, click **Current Projection…** to bring up the *Display Projection* dialog.
10. In the *Horizontal* section, select *Global Projection* and click **Set Projection…** to bring up the *Select Projection* dialog.
11. Select "Meters" from the *Planar Units* drop-down and click **OK** to close the *Select Projection* dialog.
12. In the *Vertical* section, select "Meters" from the *Units* drop-down and click **OK** to close the *Display Projection* dialog.
13. Click **OK** to close the *Units* dialog.

The view of the study area should update to appear similar to Figure 6.

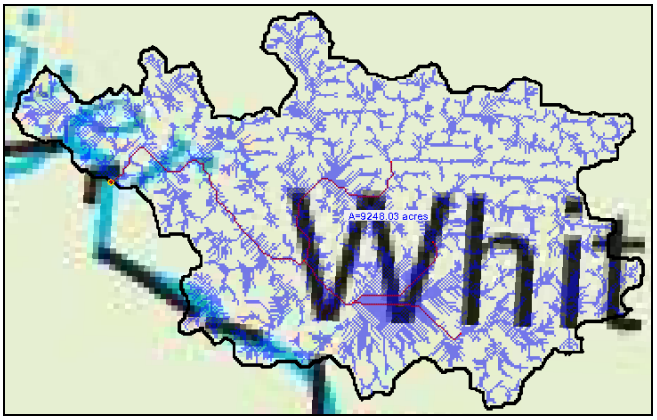

Figure 6 The study area after units and projection updated

3.3 Running NSS

1. Switch to the **Hydrologic Modeling** module.
2. Select "NSS" from the Model drop-down (Figure 7).

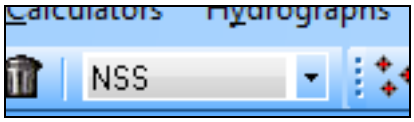

Figure 7 NSS selected

3. Using the **Select Basin** tool, double-click in basin 1B to bring up the *National Streamflow Statistics Method* dialog.
4. If prompted to use polygons, click **Yes**.

Notice that in the *Regional regression equations* section, "Rural Region 2 2011 5034" is automatically selected. If the basin had overlapped with another NSS region, the areas and percentages of overlap for each region would also have been calculated.

5. In the *Variable values* section, on the *Percent Storage from NLCD1992* row, enter "10.8" in the *Value* column.

For more information on how the *Percent Storage from NLCD1992* variable was calculated, see the "Watershed Modeling – Time of Concentration Calculations and Composite CN" tutorial.

6. In the *Results* section, click **Compute Results** to populate the spreadsheet below that.

In the *Results* table, the computed peak flow values will be displayed in the *Peak [cfs]* column for the different recurrence intervals in the *Recurrence [years]* column.

7. Click **Done** to close the *National Streamflow Statistics Method* dialog.

The "NSS Region" coverage allows WMS to automatically load the appropriate regression equation(s) when opening the NSS dialog. This might not save a great deal of time if running the simulation once for a single basin. If planning to study many different basins on a regular basis, however, creating an "NSS Region" coverage for the state is very efficient.

4 Conclusion

This concludes the "Watershed Modeling – National Streamflow Statistics Program Interface" tutorial. The following key concepts were discussed and demonstrated:

- How to calculate important parameters with the Compute Basin Data command
- How to use an NSS Region coverage to automatically determine which equations should be used and to compute any areas of NSS region overlap