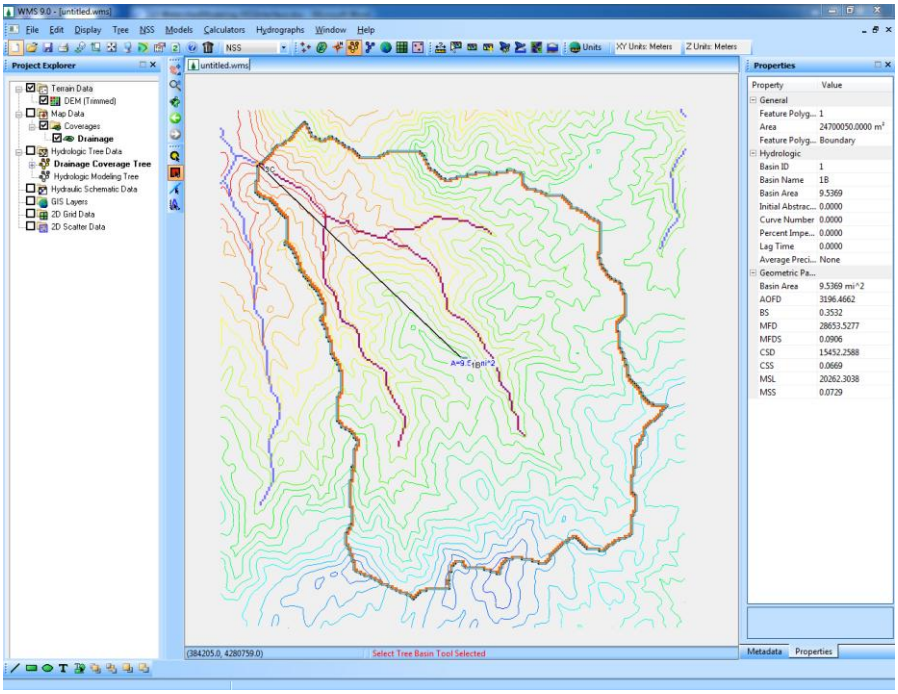
WMS

v. 9.1

WMS 9.1 Tutorial

Watershed Modeling – National Streamflow Statistics Program (NSS) Interface

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



Objectives

Delineate a basin for an area of interest and run NSS to estimate peak flows at different recurrence intervals. Also, learn how to 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 Contents

2 Introduction

The National Streamflow Statistics 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.

You were already introduced to this program in a previous chapter discussing overlay and time of travel computations (Volume 2, Chapter 3). In this exercise you will have the chance to review data collection and starting a project from scratch. You will then run the NSS program for your selected area to compute the peak flows for the different return periods. If your equation ends up needing variables not derived from the DEM alone, then you might consider doing the general overlay in order to compute percentages of land use, soil, or rainfall for different regions.

3 Data Collection

You will begin by downloading the necessary files. Remember that you can go to the geospatial data acquisition (GSDA) web page on the xmswiki at http://xmswiki.com/wiki/GSDA:GSDA as a starting point.

1. Download a DEM using the web services tools available in WMS or get it from the National Elevation Dataset web site, or another similar site. This should be an area that contains a watershed of personal interest to you.
2. Open the DEM in a new instance of WMS and set the proper projection. Reproject the data as necessary. See the chapter on DEM basics if you need help (*"4 EditingElevations-DEMBasics"*).
3. Download the topographic map from using *Get Online maps* tool in WMS. See the tutorials on images if you need help (*"2 Introduction-Images"*).

4 Basin Delineation

You will want to identify a watershed that is defined completely within your DEM. If your area does not contain a complete watershed, or the watershed you were trying to work on then you may need to repeat the delineation.

1. Switch to the *Drainage* module
2. Run TOPAZ, delineate your watershed, and compute your basin data. If possible, you can use the Delineate Basins Wizard command in the DEM menu to delineate your watershed.

5 Running NSS

Now you should be prepared to run a basin NSS simulation.

1. Switch to the *Hydrologic Modeling* module
2. Make sure Model combo box is set to *NSS*
3. Choose the *Select Basin* tool
4. Double-click on your basin
5. Select your state and region
6. Define any variables not computed. You may wish to get land use, soils, or rainfall data and use it to automatically calculate other variables where needed.
7. Compute the peak flows

At this point you have your results and should feel confident that you could repeat this process again and again. You may wish to adjust display settings and add annotations to prepare report documentation on this project.

When you are finished, do the following before moving on to the rest of the exercise.

8. Save the project if you wish
9. Select ***File | New***
10. Select *No* if asked if you want to save your changes

6 Utilizing an NSS Region Coverage

This portion of the exercise is optional. It will teach you how to create an NSS region coverage that can be used to map equations for a given state, using Florida as an example. If you do not have a need or interest for this you do not need to complete it.

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

You will now use an NSS Region coverage to automatically assign the region for an NSS simulation. This coverage was digitized from an image that displays the NSS regions of

Florida. This image was obtained from the NSS documentation and you could make a similar map by scanning (or capturing if electronic) a map of the regions to create an image file, registering the image to a recognized projection system, digitizing the polygons (most states have less than 10 regions so it would take only a few minutes to digitize), and assigning the state and region. Details on how to scan images and create polygons by digitizing are given in the chapters on images and feature objects (see Volume 1). The USGS website (http://water.usgs.gov/software/NSS/) for NSS 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 we will read in an image that has already been registered and polygons that were digitized from the image.

1. Switch to the *Map* module
2. Select ***File | Open***
3. Locate the ***General WMS\nss*** folder in your tutorial files. If you have used default installation settings in WMS, the tutorial files will be located in ***\My documents\WMS 9.1\Tutorials\.***
4. Open *"NSSmap_FL.jpg"*

6.1 Assigning Regions to Feature Polygons

We see from the image that Florida has three regions: A, B, and C. You will now open a WMS .map file that contains these three polygons in an NSS Region coverage. In the interest of time the polygons have already been digitized (see the tutorial on feature objects in *"3 Introduction-BasicFeatureObjects"* for more information about digitizing/building polygons), but the assignment of attributes (state/region) has been left for you to do.

1. Select ***File | Open***
2. Open *"NSSmap_FL.map"*

This file was digitized directly from the image. See *"3 Introduction-BasicFeatureObjects"* for information on how to digitize features from images.

3. Choose the *Select Feature Polygon* tool
4. Double-click in the polygon corresponding to the region labeled C, as shown in Figure 7-1
5. Choose *Florida* from the State list
6. Choose *Region C* from the NSS Region list
7. Select *OK*
8. Assign NSS Regions for the remaining two polygons in the same manner

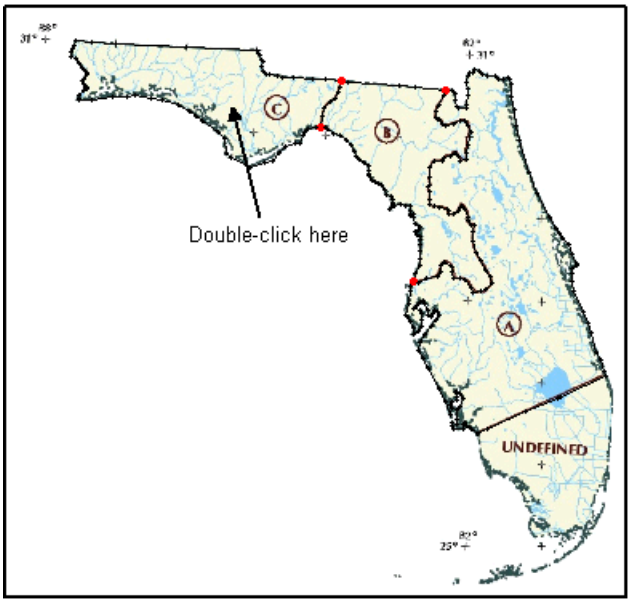

Figure 6-1: Image displaying NSS Regions for Florida

6.2 Opening the Watershed

1. Select ***File | Open***
2. Open *"NSS_FL.wms"*

At this point, the study area appears as a small polygon. You will zoom in to better distinguish the area.

3. Right-click on the *Drainage* coverage and select the ***Zoom to Layer*** menu item. This will zoom in on the region indicated in Figure 6-2

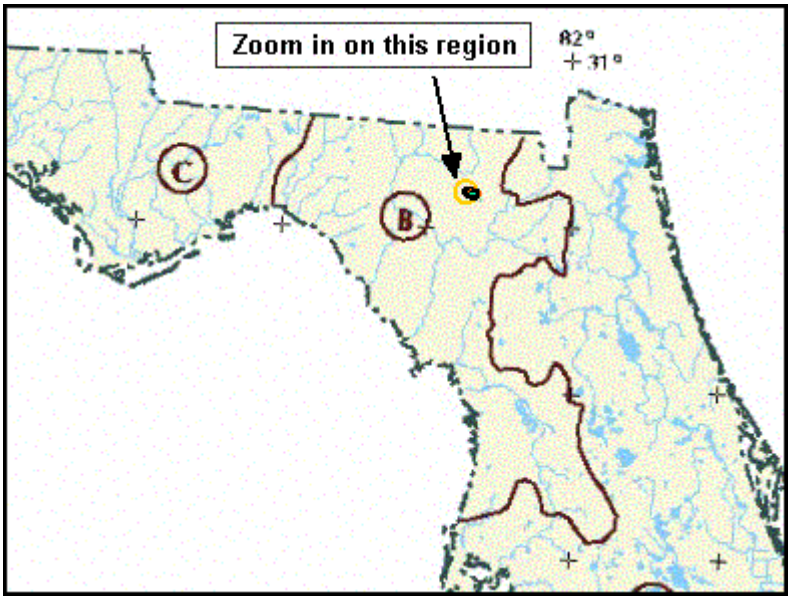

Figure 6-2: Zoom in on the watershed.

4. Right-click on *DEM* in the Project Explorer and select ***Display Options***
5. Choose the *DEM Data* option in the window on the left of the dialog if it is not already selected
6. Toggle off the check box for displaying *DEM Contours*
7. Select *OK*
8. Right-click on *Drainage* coverage and select ***Compute Basin Data***
9. Select the *Current Projection* button
10. Select *Global Projection*
11. Select *Set Projection*
12. Ensure *Meters* are selected in the Planar Units drop down box
13. Select OK
14. Ensure *Meters* are selected as the vertical units
15. Select *OK* twice

6.3 Running NSS

1. Switch to the *Hydrologic Modeling* module
2. Make sure Model combo box is set to *NSS*
3. Choose the *Select Basin* tool
4. Double-click on the icon for Basin 1B
5. Select *Yes*

Notice that the regression equation is automatically selected. Also, if our basin had overlapped with another NSS region, the areas and percentages of overlap for each region would also have been calculated.

6. Enter **10.8** for the Lake Area variable
7. Select the *Compute Results* button
8. Select *Done*

As you can see, the NSS Region coverage allows WMS to automatically load the appropriate regression equation(s) when we open the NSS dialog. This might not save you a great deal of time if you are only running the simulation once for a single basin. Nevertheless, if you plan to study many different basins on a regular basis, then creating an NSS Region coverage for your state would prove to be very efficient.

7 Conclusion

In this exercise, we have discussed the following concepts in conjunction with setting up an NSS simulation:

1. 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