

## Lecture 10

### GIS and Modeling Integration 2: Examples



April 27, 2009  
CEEN 4800/6965 - Special Topics  
*Geographic Information Systems and Hydrologic & Hydraulic Modeling*  
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## FINAL EXAM

- Date: 5/4/09
- Duration: 1 hour
- Content: All lectures and exercises covered since mid term exam starting Lecture 6: Creating and Editing Data and ending what's covered today.
- Type: Open book (you can use your book, handouts, notes, and computer)
- Format: 30 multiple choice and short answer questions
  - 2 minutes / question
  - Not enough time to search the answers; you should study and know where the answers are

# Presentation by Eli Zini

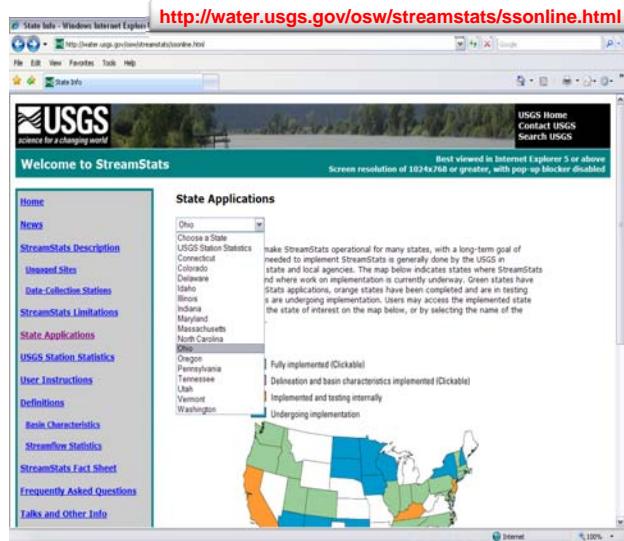
- Civil Associate II, Michael Baker Jr., Inc., Moon Township, PA
  - Department Civil Engineering
  - Supervisor: Larry Diday
- Work Experience
  - FEMA Floodplain Modification Review
  - Water Resources (Hydrology/Hydraulics)
    - Open Channel H&H – Bridge and Culvert Modeling
    - Conduit Modeling – Sanitary Systems
  - Site Development (Grading/Stormwater Management)
- Education
  - B.S., Civil and Environmental Engineering, University of Pittsburgh, 2005
  - Professional Certificates
    - Engineer in Training (EIT), 2005

# Outline

- Introduction
- GIS Applications in Hydrologic Modeling
- Exercise Using USGS Streamstats
- Additional Software
- Homework

# USGS Stream Stats Website

- StreamStats is a Web-based **GIS** application created by USGS, in cooperation with ESRI
- StreamStats functionality is based on ESRI's ArcHydro Data Model and Tools, described at <http://support.esri.com/index.cfm?fa=downloads.dataModel.filteredGateway&dmid=15>.
- StreamStats allows users to obtain:
  - Streamflow statistics
  - Basin characteristics, and
  - Descriptive information for USGS data-collection stations and user-selected ungaged sites.
- It also allows users to identify stream reaches that are upstream and downstream from user-selected sites.



## Toolbar Buttons

- Help button describes the toolbar on top.

The main page of the web tool displays the status map of each state. From this page you can search, edit, or move around, using the buttons on the toolbar (see below for details on the buttons). You can also customize the view by taking advantage of clicking the screen and/or the zoom buttons.

**Search** is used to search a point on the map. Select this tool, then click and drag a box on the map around the area that you wish to zoom in more detail. Clicking a point during a box, will zoom in with the center point where you click by a factor of approximately 2.

**Zoom In** does the same thing as zoom to box, the box draws with the tools used to calculate a zoom-in-factor. A smaller box will zoom out more than a larger one. Clicking without dragging, will zoom in with the center point where you click by a factor of approximately 2.

**Zoom Out** will zoom out to the starting/initial extent of the map.

**Pan** (hand icon) is used to drag the map in any direction and recenter the view. Simply click on the Pan Tool, then drag the map to a new location.

**GetInfo** is used to discover the attributes attached to spatial features in the map. Mostly watershed attributes for all layers under a point clicked on the map.

**LastExtent** will change the extent to the last extent (the last undo feature just for the zoom tool).

**DelinBound** is used to click on the StreamGrid and delineate a basin. This tool is only active when zoomed into 24000.

**EditBasin** is used to edit the delineation if it is incorrect. For further help on this tool [click here](#).

**FlowStats** allows the user to get the flow statistics after you have used the Polyk Delineation button to get your polygon and have thoroughly checked its accuracy.

**BasisChar** allows the user to get the basin characteristics after you have used the Polyk Delineation button to get your polygon and have thoroughly checked its accuracy.

**Download** will allow the user to download the delineated basin polygon. If the download is done after FlowStats and BasisChar, the watershed attributes table will contain values for the basin characteristics and streamflow estimates that are returned in the reports.

**GetReport** displays a report containing descriptive information, physical characteristics and streamflow statistics for gaging stations, along with citations for the sources of these data. To use, turn on the StreamReport layer under "Water" in the Map Layers. After selecting the GetReport tool, click on a gage shown on the map to open a new browser window containing the report.

**Print** will produce a map that shows the same area, and the same layers in a new browser window. This new window will have no frames, so it will not be interactive.

**Help** will display these user instructions.

**Return Map** returns the current view of the map, reapplying the data layers, and recentering images.

**Reset Layers** will return the layers to match the map. If you have made changes to the data layers and have not hit **REFRESH** and then change your mind use the **RESET** to return layer list to match the current display.

StreamStats in Ohio - Windows Internet Explorer  
<http://water.usgs.gov/oss/streamstats/ohio.html>

File Edit View Favorites Tools Help

StreamStats in Ohio

StreamStats

Screen resolution of 1024x768 or greater, with pop-up blocker disabled

**Ohio**

The reports below document the regression equations available in StreamStats for Ohio, the methods used to develop the equations and to measure the basin characteristics used in the equations, and the errors associated with the estimates obtained from the equations. Users should familiarize themselves with this report before using StreamStats to obtain estimates of streamflow statistics for ungauged sites.

- Koltun, G.F., Kula, S.P., and Puskas, B.M., 2006, A Streamflow Statistics (StreamStats) Web Application for Ohio: U.S. Geological Survey Scientific Investigations Report 2006-5312, 62 p.
- Koltun, G.F., 2003, Techniques for estimating flood-peak discharges of rural, unregulated streams in Ohio: U.S. Geological Survey Scientific Investigations Report 03-4164, 75 p.
- Koltun, G.F., and Whitehead, M.T., 2002, Techniques for estimating selected streamflow characteristics of rural, unregulated streams in Ohio: U.S. Geological Survey Scientific Investigations Report 02-4068, 50 p.

**Interactive Map**

StreamStats for Ohio was developed in cooperation with:  
 Ohio Department of Transportation,  
 U.S. Department of Transportation, Federal Highway Administration,  
 Federal Emergency Management Agency,  
 Ohio Environmental Protection Agency, and  
 Ohio Department of Natural Resources.

avscript:openMap('http://streamstats.usgs.gov/ohstreamstats/index.asp');

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USGS OH StreamStats - Windows Internet Explorer  
<http://streamstats.usgs.gov/ohstreamstats/index.asp>

Pop-up blocked. To see this pop-up or additional options click here...

**USGS**

**Ohio StreamStats**

**USGS GIS Based Map Interface**

ZoomIn ZoomOut Pan GetInfo FullExtent LastExtent Basin Definition EditBasin FlowStats BasinChar ClearBasin Download GageInfo Print Help

Scale

Zoom To: lat/long GO

Latitude: 40 0 0  
 Longitude: 83 0 0

Map Layers | Locator Map

- BASE LAYERS
- WATER
- POLITICAL

Refresh Map Reset Layers

USGS Scale 1:4034106

Accessibility FOIA Privacy Policies and Notices

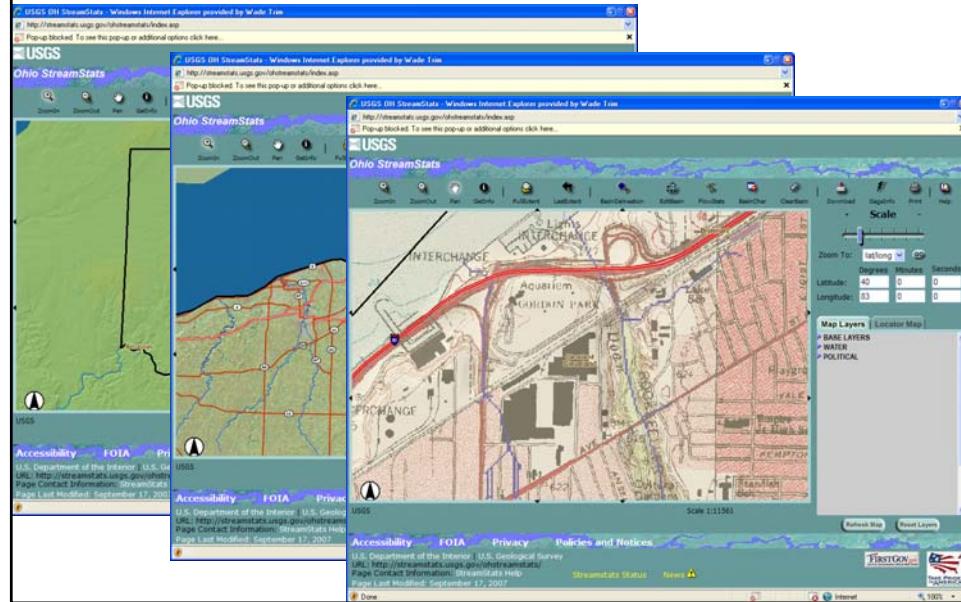
U.S. Department of the Interior | U.S. Geological Survey  
 URL: <http://streamstats.usgs.gov/ohstreamstats/>  
 Page Contact Information: StreamStats Help  
 Page Last Modified: September 17, 2007

Streamstats Status News

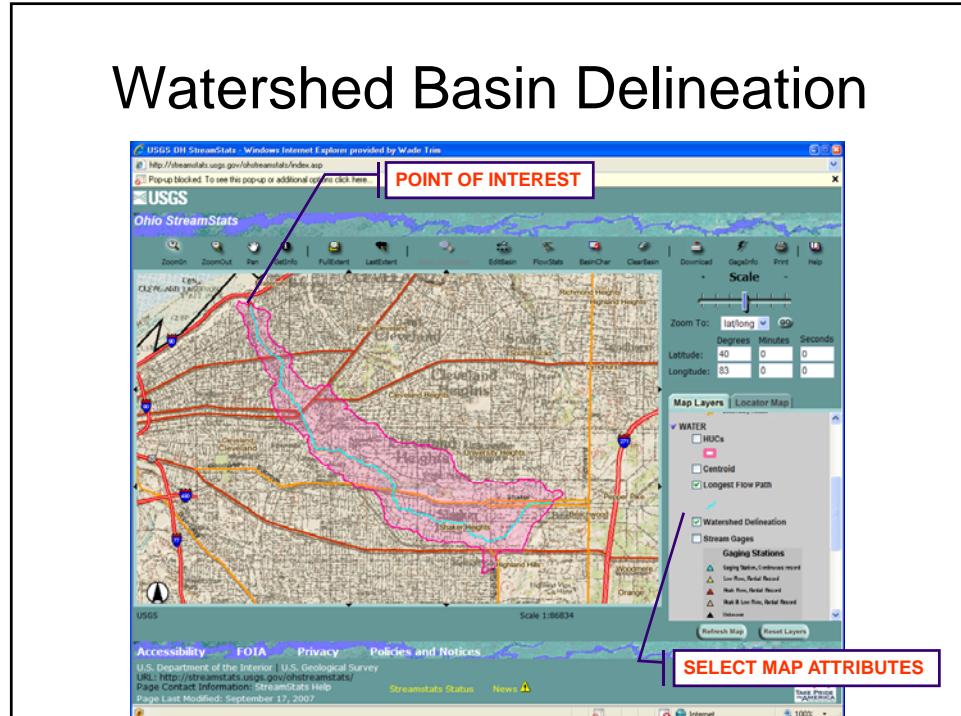
FIRSTGOV.gov The U.S. Government's Official Web Portal 

Internet 100%

## Zoom To Project Location



## Watershed Basin Delineation



## FlowStats

**Streamflow Statistics Report**

**Peak Flow Basin Characteristics**

Parameter	Value	Min	Max
Drainage Area (square miles)	8.81	0.01	7422
Ohio Region C Indicator 1 if in C else 0 (dimensionless)	1	0	1
Stream Slope 10 and 85 Longest Flow Path (feet per mi)	59.6	1.53	674
Percent Storage from NLCD (percent)	3.37	0	25.8

**Low Flow Basin Characteristics**

Parameter	Value	Min	Max
Drainage Area (square miles)	8.81	0.12	7422
Percent Forest (percent)	12.8	0	99.1
Percent Storage from NLCD (percent)	3.37	0	19
Mean Annual Precipitation (inches)	38	34	43.2
Streamflow Variability Index (dimensionless)	0.55	0.29	1.12
Latitude of Basin Centroid (decimal degrees)	41.4696	41.2	41.59
Longitude of Basin Centroid (decimal degrees)	81.5712	80.53	84.6

**Streamflow Statistics**

Statistic	Flow (ft <sup>3</sup> /s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	503	37	2.1	276	909
PK5	824	35	3.3	476	1460
PK10	1080	34	4.4	617	1880
PK25	1399	35	5.9	785	2460
PK50	1620	37	6.8	899	2928
PK100	1860	38	7.5	1010	3440
PK500	2429	42	8.6	1230	4750

## Basin Characteristics

**Select Basin Characteristics**

- Drainage Area, in square miles
- Region A indicator for Ohio Peak Flows
- Region C indicator for Ohio Peak Flows
- Percent of area covered by forest
- Percent of area covered by water or wetlands
- Mean annual precipitation at basin centroid, in inches
- Y coordinate (latitude) of the centroid, in decimal degrees
- X coordinate (longitude) of the centroid, in decimal degrees
- Stream Slope 10 and 85 Longest Flow Path, in feet per mile
- Streamflow variability index at the outlet

**Compute Characteristics**

**Basin Characteristics Report**

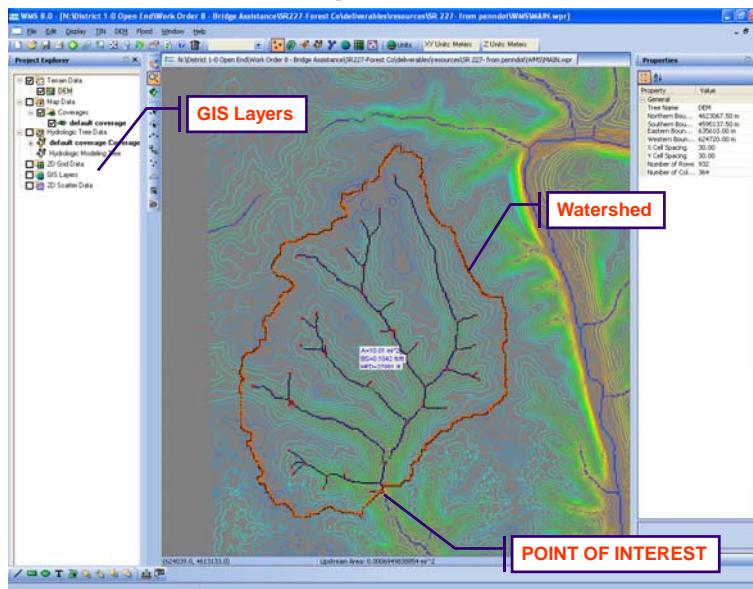
Parameter	Value
Region A indicator for Ohio Peak Flows	1
Region C indicator for Ohio Peak Flows	0
Area in square miles	8.81
Percent of area covered by forest	12.8
Percent of area covered by water or wetlands	3.37
Stream Slope 10 and 85 Longest Flow Path, in feet per mile	59.6
Mean annual precipitation at basin centroid, in inches	38
Streamflow variability index at the outlet	0.55

## Additional Software

- WMS, Watershed Modeling System, Aquaveo
  - <http://www.aquaveo.com/>
  - Free download of demo version
  - Compatible with ArcGIS
- HEC-GEORAS, Hydrologic Engineering Center Geographic River Analysis System, Army Corp. of Engineers
  - <http://www.hec.usace.army.mil/software/>
  - Free download of full version
  - Compatible with ArcGIS

NOTE: Both WMS and HEC-GEORAS require the user to import GIS based surface, ie: topographic contours in the form of a Digital Elevation Model (DEM) or Triangular Irregular Network (TIN) file. These files are available for some regions of the United States where data has been compiled. For Pennsylvania go to: <http://www.pasda.psu.edu/>

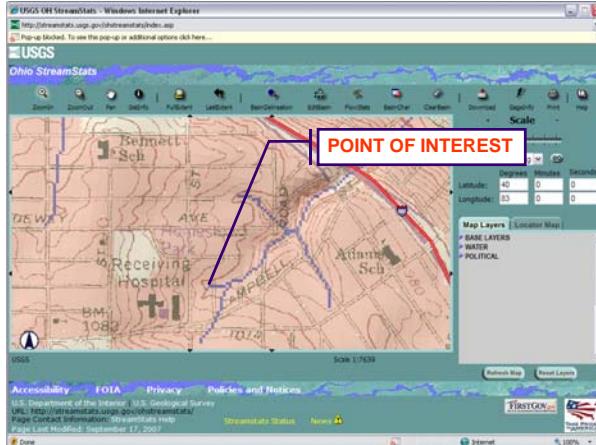
# WMS Interface



# Homework 7

Mandatory for Grad. Students Only  
Optional for Undergraduates

- Create a basin delineation using the USGS StreamStats GIS application. For the watershed outside of the Youngstown State University campus as shown below. Follow the instructions on the following page for details.



## Homework 7 Instructions

- Create a Watershed Basin with an outlet at the Point of Interest on the YSU campus as shown on the previous slide.
- Using the "Map Layers" display the longest flow path and Centroid of the basin.
- Create the Flow Stats Report and the Basin Characteristics Report. Select all parameters for the Basin Characteristics Report.
- In a brief (one page) summary tabulate the drainage area in acres, percent forest, latitude and longitude, and the 2, 25, and 100 year peak flow events. Describe how these parameters can be used to design future development on the YSU campus.
- Turn in watershed basin delineation from USGS Streamstats web site, Flow Stats, Basin Characteristics, and your one page summary and future development essay.

## **Questions?**

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**Baker**