

Hydrologic Engineering Applications of Geographic Information Systems

Objectives: The participant will acquire practical knowledge and skills in the application of GIS technologies for digital terrain modeling, watershed and stream network delineation, computation of watershed and stream characteristics, hydrologic parameter estimation and mapping of water depths, flood damage assessment, etc. Hands-on experience in applying ArcView to perform such analysis will be obtained. The participant will not gain broad-based skills in using ArcView or ArcInfo, but sufficient knowledge and skills will be acquired to enable application of supplied scripts and procedures to perform specific hydrologic engineering analyses. While prior training in ArcView or ArcInfo is desirable, it is not a prerequisite for this course.

HYDROLOGIC ENGINEERING APPLICATIONS OF GEOGRAPHIC INFORMATION SYSTEMS

Monday

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| 8:00-9:00am | Introduction
Welcome to HEC, class and staff introductions, and course overview. |
| 9:00-9:45am | Lecture 1.1 Hydrologic Engineering Applications of GIS
What is GIS? What does it offer to hydrologic analysis? |
| 9:45-10:00am | Break |
| 10:00-10:45am | Lecture 1.2 GIS Concepts: Features and Tables
Vector GIS and topology. GIS as a database. |
| 10:45-11:45am | Workshop 1.3 Viewing Data in ArcView
The ArcView user interface, projects and map layouts. |
| 11:45am-12:45pm | Lunch |
| 12:45-1:30pm | Lecture 1.4 Data Sources in ArcView
Sources of GIS data and how ArcView uses them. |
| 1:30-2:30pm | Workshop 1.5 Getting Data into ArcView
Making GIS data available for viewing and analysis in ArcView. |
| 2:30-2:45pm | Break |
| 2:45-3:30pm | Lecture 1.6 Introduction to Spatial Analysis
GIS functions for spatial analysis. Buffering, clipping, editing. |
| 3:30-4:45pm | Workshop 1.7 Spatial Operations in ArcView
Using ArcView for spatial analysis. |
| 4:45-5:00pm | Review |

Tuesday

- 8:00-8:45am Lecture 2.1 **Introduction to HEC-HMS and HEC-GeoHMS**
Hydrologic modeling capabilities of HMS; data and parameter organization. How GeoHMS supports model development for HMS.
- 8:45-9:30am Lecture 2.2 **Raster GIS and ArcView Spatial Analyst**
Grid data structure. Continuous and categorical data layers. Grid operations. Introduction to digital elevation models (DEMs)
- 9:30-9:45am **Break**
- 9:45-11:00am Workshop 2.3 **Using Spatial Analyst**
Using grid data in ArcView. Vector/Raster conversion. Grid calculations.
- 11:00-11:45am Lecture 2.4 **Arc Hydro Tools: Terrain Preprocessing and GIS Data Setup**
Processing terrain information for drainage paths and preliminary delineation of stream and subbasin will be discussed in context of the 8-point pour model.
- 11:45 am -1:00 pm **Class Photo and Lunch**
- 1:00-2:15pm Workshop 2.5 **Arc Hydro Tools: Terrain Preprocessing and GIS Data Setup**
Using Arc Hydro Tools to preprocess the DEM and prepare GIS data for detailed subbasin delineation of the watershed.
- 2:15-3:00pm Lecture 2.6 **GeoHMS: Building a Hydrologic Model with ArcView**
Approaches to subdividing basin according to project specifications and extraction of characteristics of stream and basin will be presented.
- 3:00-3:15pm **Break**
- 3:15-4:00pm Workshop 2.7 **GeoHMS: Develop Detailed Subbasin Delineation**
Using GeoHMS to subdivide the basin and extract stream and sub-basin characteristics.
- 4:00-5:00pm Lecture 2.8 **NEXRAD Radar Rainfall Analysis and Mod Clark**
Radar rainfall data acquisition—Stage I – Stage IV. Geographic referencing of the precipitation grid (HRAP and SHG). The modified Clark rainfall/runoff transformation.

Wednesday

- 8:00-8:45am Lecture 3.1 **GeoHMS and HMS: Assembling a Hydrologic Model**
Develop hydrologic inputs using GeoHMS that will be run in HMS. Estimate hydrologic parameters with the physical characteristics of stream and basin.
- 8:45-9:45am Workshop 3.2 **GeoHMS and HMS: Assembling a Hydrologic Model**
Generate hydrologic inputs using GeoHMS and import them into HMS. Input additional hydrologic parameters and make a simulation run.
- 9:45-10:00am **Break**
- 10:00-11:00am Lecture 3.3 **Acquiring and Processing DEM Data**
What you should expect from DEM data sets provided by the USGS. How you can make them useful in spite of all that.
- 11:00 - 11:45am Lecture 3.4 **Coordinate Systems and Metadata**
Common coordinate systems and Datums. How to pick a coordinate system.
- 11:45am-12:45pm **Lunch**
- 12:45 - 1:45pm Lecture 3.5 **Elevation Data Collection**
Photogrammetry, LIDAR, etc.
- 1:45-2:00pm **Break**
- 2:00-3:00pm Lecture 3.6: **Contracting for Survey Data**
What to ask surveyors for. Verifying survey results. Sample survey contract.
- 3:00-4:00pm Lecture 3.7: **Triangulated Irregular Networks (TINs)**
Representing surfaces with TINs. The ArcView 3D Analyst Extension.
- 4:00-5:00pm Workshop 3.8: **Hands-On 3D Analyst**
Creating a TIN. Adding Breaklines. Recognizing and fixing problems.

Thursday

- 8:00-8:30am Lecture 4.1 **Introduction to HEC-RAS**
An overview of the HEC-RAS program: data requirements, user interface, and capabilities.
- 8:30-9:30am Lecture 4.2 **Using GIS To Develop Geometric Data For HEC-RAS**
Using GIS to extract cross section data and other cross section properties from terrain models.
- 9:30-9:45am **Break**
- 9:45-11:15am Workshop 4.3 **Using GIS To Develop Geometric Data For HEC-RAS**
HEC-GeoRAS (ArcView version) will be used to extract cross section data, and then export the information to a GIS exchange file.
- 11:15-11:45am **Review**
- 11:45am-12:45pm **Lunch**
- 12:45-1:45pm Lecture 4.4 **Importing GIS Data into HEC-RAS and Exporting Results To GIS For Floodplain Mapping**
Importing cross section data from a GIS, completing the geometry data, performing the computations, and exporting the results to the GIS exchange file.
- 1:45-2:00pm **Break**
- 2:00–3:00pm Lecture 4.5 **Importing HEC-RAS Results And Developing Flood Inundation Maps In The GIS**
Importing HEC-RAS computed water surface profiles and bounding polygons. Developing flood inundation maps and depth grids for display in the GIS.
- 3:00-4:30pm Workshop 4.6 **Importing HEC-RAS Results to GIS**
The data will be imported into HEC-RAS, and water surface profiles will be computed. The HEC-RAS results will be exported to the GIS for floodplain mapping.
- 4:30-5:00pm **Review**

Friday

8:00-9:00am	Lecture 5.1 Advanced Features in GeoRAS New features and plans for GeoRAS. Levee alignments ineffective flow areas, clever GeoRAS user tricks.
9:00-10:00am	Lecture 5.2 EFM Applications of GIS Overview of Ecosystem Functions Model. Using GIS data for habitat monitoring.
10:00-10:15am	Break
10:15-11:00am	Lecture 5.3 New Tools: HEC-GeoDozer – The Digital Dozer for Terrain A new ArcMap tool bar for editing DEMs for drainage analysis.
11:00-11:45 am	Course Critique and Closure