GIS Applications In Flood Forecasting Using HEC-RAS

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OUTLINES

- Introduction
  - Flooding: Cause And Effect
  - Meaning And functions
- Methodology
- Case Study (1) In Greece.
- Case Study (2) In Zaremrood River, Iran.
- Results And Discussion.
- Conclusion & Recommendations
Introduction

What Is The Problem?

- Flood hazards.

Example Floodplain
Flooding: Cause And Effect

Why?

• To limit losses from water in its destructive capacity-flooding such as:
  - Population
  - Homes
  - Infrastructure
• Managing and evaluating all river, rainfall, and Runoff.
• Predicting of flood hazards
• Using a new technology
  - GIS (ArcGIS).
  - HEC-RAS.
Meanings And Functions

- **ArcGIS**: Geographic Information System, SW&HW
  - Visualizing, managing,
  - editing, querying
  - Creating mapping
  - And analyzing geographic data.
Meanings And Functions

- **HEC-RAS**: developed by the Hydrologic Engineering Center (HEC) for River Analysis System (RAS).
  - hydraulic analysis program
  - analysis stream channel
  - Determination floodplain
Methodology

• Study area.
• Datasets.
• Analysis.
• Hydraulic simulation.
• Results.
Procedure Of Applications (ArcView & HEC-RAS)

- Spatial Data
- Attributes Data
- Cross Sections & Channel Geography
  - Boundary Conditions
  - Flow Data
  - Plan Data

Data Storage & Pre-processing: ArcView GIS

Output Drainage Network: Catchments area, Streams, Flowlengths, Slopes

Hydraulic Model: HEC-RAS

Post-processing: ArcView GIS

Output Floodplain: Area & Elevation
Summary For Analysis

• Interface between ArcView and HEC-RAS
• What does it do?
  – PreRAS Menu - prepares Geometry Data necessary for HEC-RAS modeling
  – GeoRAS_Util Menu – creates a table of Manning’s n value from land use shapefile
  – PostRAS Menu – reads RAS import file, creates Velocity and Depth TINs
Summary For Analysis
Case Studies

GIS-Based Floodplain Mapping In Thessaly plain, Pineios river Greece – Case Study (1)

Flood Forecasting In Zaremrood River, Iran – Case Study (2).
Datasets

- Generation of HEC-RAS input file using ArcView pre-processor, The length of river is ~6.5 Km, width ~500m.
Hydraulic Simulation Using HEC-RAS

- Water surface extents for the 10-year return period.
Hydraulic Simulation Using HEC-RAS

- Water surface extents for the 50-year return period.
Water surface elevations for the 10-year return period.

Water surface elevations for the 50-year return period.
Cross section plots of 2 years flood level, using HEC-RAS Model

Cross section plots of 100 years flood level, using HEC-RAS Model
The Final Result

- 100-year water surface profile of Zaremrood River as a result of HEC-RAS simulation.
Conclusion

Using GIS with HEC-RAS in flood forecasting is the best way for evaluation:

- Rapid preparation of geometry data (point and click), via import/export files.
- Floodplain maps can be made faster
- Floodplain maps can include several flow scenarios.
- Makes data into visual event – easier for your brain to process!
Recommendations

- Establish local flood forecasting centers.
- Providing early warning by forecasting magnitude.
- Improve communication between the National Weather Service and emergency management personnel identifying where flooding is occurring.
- Establish The Flood Forecasting System.
The Flood Forecasting System

**Input Data**
- Weather
- Terrain
- Land use/cover
- Soils
- Flow

**Model Application**

**Preliminary Data Analysis**
- Analysis of historical flow

**Rainfall-Runoff Models**
- Generation of surface runoff

**Flow Hydrographs**
- Observed
- Simulated

**Flow Routing models**
- Routing of flow down the river channel

**Determination of flood extent**

**Information Dissemination**
- Bulletins
- Flooded area maps
- Radio broadcasts
- Cell phones
- Etc
References

- Tate E.C.,(1999). Floodplain mapping using HEC-RAS and ArcView GIS. University of Texas at Austin, Austin.
Thank You