Flood Hazard Module Unit 1: Introduction to Flooding and Hazard Analyses Student Exercise

Venkatesh Merwade (Purdue University) and Jim McNamara (Boise State University)

*Unit 1 introduces students to the basics of flooding, but emphasis is given more to the quantitative and societal aspects. Specifically, students learn how to use historical data to estimate frequency, and assess impacts of some historical floods on the society using maps and other online information. The goal of this exercise is to test students’ skills in performing the quantitative analysis and gather reflection on what they learned from their group activity.*

# Introduction

Identifying flood hazard requires the knowledge of historical climate, geophysical setting, and the overall land use changes that have occurred or will occur in the future. In this exercise, you are given historical streamflow information at two different locations in the United States to assess how the annual peak flow, which is used for flood hazard analyses, at these two locations has changed since the data has been collected.

# Exercises

# Part A: Quantitative Analysis (Individual Activity)

Understanding the climate, geography, and land use change in the region. While climate can be described using different variables, students should focus on precipitation. You are given data for two gauging stations as described in Table 1 below. The Excel File with the data

|  |  |  |
| --- | --- | --- |
| Station Number and Name | Drainage area | Location |
| USGS 05532500 DES PLAINES RIVER AT RIVERSIDE, IL | 630 square miles | Riverside, IL |
| USGS 03335000 WILDCAT CREEK NEAR LAFAYETTE, IN | 794 square miles | Lafayette, IN |

## Plotting of Annual Maximum Series

Use the Exercise streamflow data to create a neat plot of annual maximum series for the two locations.

## Computing Frequency and Return Period

Compute the average recurrence interval for 6000 cfs flow and 15000 cfs flow for the Des Plaines River and Wildcat Creek, respectively. What is the annual probability of occurrence for these flows at these two locations?

## Relating flood hazard to natural and anthropogenic drivers

Write a summary (100 words) about the annual maximum series and potential flood hazard at these two locations to include the following:

* How is the topography, geography, and climate different at these two locations?
* How is the annual maximum series different or similar at these two locations? What are the possible causes for these similarities or differences?
* Has the maximum flow magnitude increased or decreased over the entire or some part of the record? What may have caused this increase or decrease?

# Part B: Qualitative Analysis (Group Activity)

Your group has been assigned an area for performing flood risk assessment. For this area, perform the following (save your data, graphs, and maps, as you will use them in creating a PowerPoint presentation):

* Pick the specified gauging station (See Table 1 below) for the area, and get the flood stage/discharge for that site using the National Weather Service Advanced Hydrologic Prediction Service at: <https://water.weather.gov/ahps/forecasts.php>. You will have to zoom to the station on the AHPS website, and then click to see a graph for the station, which also shows the flood stage. This plot shows the flood/action stage on one axis and the corresponding discharge on the other axis. Use this discharge value as reference for the USGS annual maximum series in finding the number of times this gauge has been flooded.
* Obtain historical daily and annual maximum series for the USGS gauge to see how many times this gauge has been flooded since the data has been recorded. Instructions on getting the daily and annual peak time series from USGS gauges and viewing the data in Excel are in a provided tutorial.
* Pick the most recent major flood for this area and find its return period. This can either be done through quantitative analysis as described in Part A or can be obtained from news reports.
* Get the FEMA flood hazard map for this area and display it using either ArcMap or Google Earth. Instructions for getting the FEMA map and plotting it in ArcMap are also provided on black board under Flood Module/Unit 1 folder.
* Get any data or information on the damages from this recent flood. This can be done via online search or through published news reports.
* Do some online research on the area to see if any flood management strategy has been implemented or is being implemented. Use the four strategies as outlined in the FEMA document/presentation.
* Discuss any potential flood management plan for the community to minimize the damages from future floods.

# Part C: Presentation

Use your data and results from Part B to create a PowerPoint presentation of fewer than ten slides. Your PowerPoint must include the following slides:

* Title: title of your presentation “Flood hazard assessment for …” By Author 1, Author 2, etc.
* Introduction: A brief introduction about the area including the name of the city, county, demographics, etc. An image or map of the area should be included.
* Flood Stage: this slide will include the national weather service’s AHPS image of the gauge showing the action, minor and major flood stage
* Hydrologic analysis: One or more slides showing the daily and annual maximum discharge for the gauge, number of times this gauge has exceeded the action, minor or major flood stage as per the AHPS criteria
* 100-year flood hazard map: one slide shown the 100-year FEMA map for the area
* Most recent flooding information: one or more slides discussing one of the recent floods in the area including the return period for this flood, flow magnitude compared to the AHPS major flood, human and economic losses from this event. Some images to demonstrate the damage from this flood may be included.
* Flood management: one or more slides discussing the flood management strategies used by this community to minimize flood hazard. Future flood management strategies that could be used should also be included.
* Summary/conclusion: one slide to include summary, final thoughts or conclusions, including what surprised you most during the course of this analysis.