

ESM 235: Watershed Analysis

Scott Jasechko, Winter 2021

“Hydrologic and geomorphic basis of environmental management problems concerning land surfaces and channels in small drainage basins, particularly the effects of land use and engineered alteration to stream channels. Emphasis placed in the integrated application of both theory and field methods to analyze existing conditions, evaluate the potential effectiveness of alternative solutions, and understand the limitations imposed by intrinsic watershed conditions and other human constraints. Implications for in-stream biota and water quality are acknowledged but not emphasized in this course.”

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Office Hours: By appointment

Office: Bren Hall 4404

Class Hours: Monday, Wednesday, 8:00-9:15

Class Room: *online*

Course Text and Relevant Readings: Readings posted to Gauchospace

Grading:

Item	Percent of course grade
Lab 1	15
Lab 2	15
Lab 3	15
Lab 4	15
Midterm	20
Term project	20

Term project:

- Completing a (mini) watershed analysis
- Can be collaborative (can work in small teams of <4)
- I will provide some recommendations for an array of study watersheds (where I'm confident that sufficient data exists for your study), but I'll work with you to identify a watershed in a region that interests you if you'd like to go beyond this list of watersheds
- Full details will be released following the course midterm (see class schedule below)

Course Objectives:

1. Understand core qualitative and quantitative principles of watershed physiography and functions including:
 - a. Cumulative effects [Class #1]
 - b. Watershed boundaries [Class #1 and Lab #1]
 - c. Watershed physiography (e.g., bifurcation ratios, stream orders) [Class #1]
 - d. Watershed inventory [Classes #1-2 and #11]
 - e. Geospatial analyses and elevation data [Classes #1-2 and Lab #1]
 - f. Soil forming and weathering processes [Classes #2 and #11]
 - g. Catchment water balances [Classes #3-7]
 - h. Precipitation heterogeneity [Classes #3-7; Lab #2]
 - i. Runoff generation and hydrographs [Classes #5-7, #13; Lab #3]
 - j. Statistical analyses of streamflow data [Class #8; Lab #4]
 - k. Interactions between groundwaters and surface waters [Classes #9-10; Lab #3]
 - l. Mass wasting and catchment erosion [Class #11]
2. Review, synthesize and present results of a watershed analysis [Oral Presentations during Classes #17 and #18]

Course Overview and Connections to Course Objectives:

- Classes #1 through #11 introduce core principles of watershed analysis, including hydrologic and geomorphic processes [*Direct link to course objective 1 – objective 1 outcomes evaluated via Labs 1-4 and Midterm*]
- Term project presentations—where each group or individual presents results from their mini watershed analysis—will take place during classes #17 and #18 [*Direct link to course objective 2 – objective success evaluated via Oral presentation*]

Tentative schedule (subject to changes)

Date	Lectures (Monday or Wednesday)	Lab (Friday)
Monday, 04-Jan-21 (Class #1) Wednesday, 06-Jan-21 (Class #2)	Analyzing Watersheds; Delineating watersheds; Watershed functions Elevation data; Watershed physiography;	Lab 1 - Watershed Delineation
Monday, 11-Jan-21 (Class #3) Wednesday, 13-Jan-21 (Class #4)	Hydrological Processes; Conceptual hydrologic models; Water Balances Hydrological Processes; Conceptual hydrologic models; Water Balances	<i>no lab</i>
Monday, 18-Jan-21		
Wednesday, 20-Jan-21 (Class #5)	Precipitation Data Analysis, Rainfall Intensity, Runoff Generation	Lab 2 - Precipitation
Monday, 25-Jan-21 (Class #6) Wednesday, 27-Jan-21 (Class #7)	Rainfall-Runoff; Streamflow; Hydrographs Rainfall-Runoff; Streamflow; Hydrographs	Lab 3 – Streamflow
Monday, 01-Feb-21 (Class #8) Wednesday, 03-Feb-21 (Class #9)	Flood Frequency Groundwater/Surface-Water Connections	Lab 4 - Flood frequency (<i>*GP Reviews Part 1 on Friday</i>)
Monday, 08-Feb-21 (Class #10) Wednesday, 10-Feb-21 (Class #11)	Groundwater/Surface-Water Connections Mass wasting, catchment erosion	Lab 4 - Flood frequency* (<i>GP Reviews Part 2 on Friday</i>)
Monday, 15-Feb-21		
Wednesday, 17-Feb-21 (Class #12)	<i>Midterm (take home problem set)</i>	
Monday, 22-Feb-21 (Class #13) Wednesday, 24-Feb-21 (Class #14)	Components of watershed analysis (term project intro.); Snow hydrology Disturbances and impacts on watershed functions (e.g., fire, urbanization)	<i>Term project</i>
Monday, 01-Mar-21 (Class #15) Wednesday, 03-Mar-21 (Class #16)	<i>Term projects</i> <i>Term projects</i>	<i>Term project</i>
Monday, 08-Mar-21 (Class #17) Wednesday, 10-Mar-21 (Class #18)	Presentations day (part 1 of 2) Presentations day (part 2 of 2)	

* the same lab will be held in these two weeks and you can select whichever Friday works best for your schedule (with consideration that some of you will be completing your GP faculty reviews)