Geology 472/572: Surface Water Hydrology

Syllabus and Schedule - Fall 2007
Dr. Robert Mitchell

See also: Project 2 | GIS Exercise | Report Template

Text

Physical Hydrology 2rd Edition, S. Lawrence Dingman, 2002

Learning Objectives

(1) Understand the watershed characteristics that determine the magnitude and timing of water flow in a stream, and the techniques used to model (predict) these processes, (2) develop a framework for solving field and modeling problems (e.g., GIS), and (3) provide an overview of current issues in the field of surface water hydrology. This course offers 1-credit for writing proficiency.

Format

Lectures
One-hour lectures will be on Monday, Tuesday, and Thursday in room ES 223.

Computer Labs
A one-hour lab will be on Friday in the Spatial Analysis computer lab AH 016. There will be some Fridays that we will meet in the lecture room. I will keep you informed.

Assessment

Projects

There are 6 or so small projects during the quarter. The projects are Excel and writing intensive, and some involve GIS. The motivation for the projects is to allow you to couple classroom theory with a local watershed and learn how to gather, analyze, and interpret real data from the watershed, and write professional reports.

Projects will be due at the beginning of the class period of the due date. Projects will be deducted 10% for each day they are late. Projects will not be accepted after graded projects are returned.

Projects
Project 1 – GIS: Characterizing the Lake-Whatcom Watershed
Project 2 – GIS: Areal precipitation estimates in the Lake-Whatcom Watershed (Memo report)
Project 3 – Soil properties and predicting infiltration using the Green-and-Ampt model (Memo report)
Project 4 – Estimating free-water evaporation from Lake Whatcom using the Penman model
Project 5 – Estimating evapotranspiration using the Penman-Monteith model (Memo report)
Project 6 – Smith Creek Hydrograph Analysis (Memo report)

Un-graded Exercises

Exercise 1 – Frequency analysis of precipitation data
Exercise 2 – Predicting snow melt using an energy-budget approach
Exercise 3 – Measuring stream discharge using the USGS Midsection method (field groups)

This course offers 1-credit for writing proficiency. As such, I require that 4 projects be presented in a professional "memo" style format using a word processor (Word) and Excel for data analysis, graphs and tables. The memo portion is restricted to two pages to improve concise writing, and includes an introduction, results, and discussion section. I also require all figures and tables to be neat and accurate have a "stand alone" format. Equations and calculations are neatly summarized in an appendix.

Note: Graduate students will be responsible for an independent research project that will be worth 10% of the Geol 572 grade. I suggest a topic that relates to or contributes to your thesis research.

Exams

There is one midterm and a final exam. The final exam is comprehensive, but is weighted more on the second half of the course. The exams are typically short answer essay with an emphasis on

process description. At times I integrate problems that require calculations. You are not required to memorize equations, I provide them during exams.

You will be required to take all exams at the scheduled times. Make-up exams will be given only in the case of official prearranged absences or emergencies. An excused absence form from the office of Student Affairs is required.

Grading

The grading break down will be as follows:
Projects.....50% (40% for graduate students and 10% for the term project)
Midterm.....20%
Final Exam.....30% (The final is scheduled for Wed Dec 12 from 1:00 to 3:00 pm)

A grading scale will be as follows (a curve is possible but not certain):
100-93 = A, 92-90 = A-, 89-88 = B+, 87-83 = B, 82-80 = B-, 79-78 = C+, 77-73 = C, 72-70 = C-, 69-68 = D+, 67-63 = D, 62-60 = D-, 60 or below = F

Academic honesty is an important part of every course at WWU. Please refer to Appendix D (p. 389-390) of the 2007-2008 Course Catalog for details.

I reserve the right to change the syllabus as required throughout the term to better meet the instructional needs of the class.

SURFACE-WATER HYDROLOGY TOPICS
Introduction – Chapter 1 (pp. 1 – 12 and 24 -26)
1. Definition of hydrology, hydrologic cycle and water budgets
GIS – Handouts and pp. 373, 383-384
2. Elements if GIS
Watersheds – Chapter 5 (125 – 129)
3. Elements of a watershed
Streamflow Measurements – Handout
4. Measurement of stage, velocity, and discharge
5. Staqe-discharge relation and rating curves
Precipitation - Chapter 2
6. Properties of water: hydrogen bonds, heat capacity, latent heats, phase changes, vapor pressure, humidity
7. Physics of precipitation formation
8. Cooling mechanisms (fronts, convective processes, and the orographic effect)
9. Precipitation variability and point measurement
10. Areal averages (arithmetic, Thiessen polygon, and isohyetal methods)
11. Frequency analysis of precipitation data
Infiltration and Soil Water Processes– Chapter 3
12. Physical process of infiltration (surface tension and capillarity)
13. Soil-water content, pressure head (suction) and soil-water characteristic curves
14. Hydraulic conductivity (saturated and unsaturated)
15. The infiltration process and the Green-and-Ampt Model
16. Groundwater and baseflow
Evapotranspiration – Chapter 4
17. Evaporation and mass transfer
18. Evaporation and energy
19. Modeling evaporation (Penman method)
20. Transpiration basics (plant physiology)
21. Interception and leaf-area index
22. Canopy conductance and atmospheric conductance
23. Estimating potential evapotranspiration (Thornthwaite and Penman-Monteith methods)
Snowmelt – Chapter 10.7
24. Snow formation, distribution and measurement
25. Snow metmorphosis and snow-water equivalent
26. Snow-pack energy budgets and snow melt
27. Snow melt modeling
Runoff and Subsurface Drainage – Chapter 5
28. Contributions to stream flow
29. Hydrographs and hydrograph analysis
30. Effective rainfall