Fall 9-2015

GEO 460.01: Process Geomorphology

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Geosciences 460: Process Geomorphology Fall 2015

Course Information

- Instructor Name: Andrew Wilcox
- Office: CHCB 357
- Email: andrew.wilcox@umontana.edu
- Class meetings: TR 9:10-11, CHCB 348
- Office Hours: M 3-4pm, or by appointment
- Website: Moodle umonline.umt.edu

Overview

Process Geomorphology will provide an in-depth investigation of the processes that determine the form and evolution of landscapes, starting with rivers and then focusing on hillslopes, glaciers, and tectonic geomorphology. The course will combine lectures, discussions, field data collection, calculations, and other activities. Active learning and student participation will be an essential component.

Course Objectives

To provide students with:

- a strong understanding of the linkages between landscape form and process
- familiarity and experience applying fundamental concepts in physical systems
- experience collecting and analyzing field data
- opportunities for developing scientific writing skills
- opportunities to develop and apply skills in physics and mathematics
- experience in interpreting and analyzing literature from both secondary and primary sources
- practice in using models, data, and logical reasoning to critically evaluate and connect information about geomorphic processes
- experience communicating an understanding of the interrelationships among geomorphic concepts and theories to peers and others
- experience working as members of productive, collaborative teams

Assessment

30% In-class and lab exercises, other homework, class participation, quizzes
40% Field project reports
10% Midterm
20% Final exam

Course Information, Guidelines and Policies

Field Trips

The field trips are required. The data collected on these field trips will be the basis for much of your work in this class. See me right away if you have scheduling conflict. You will need a field book, so purchase one now if you don't have one.

- 9/19: Field trip 1
- 10/31: Field trip 2
- There may be a 3rd field trip

Prerequisites

One semester calculus and one semester physics are firm prerequisites. Calculus and physics will be used in the class. Computer literacy is also expected; assignments will be given involving computations, the use of spreadsheets and retrieval of data over the internet. The most important requirement is to be prepared to devote time and effort to this class (I will too).

Attendance

Much of the material covered in class will not be in the assigned reading. There will often be in-class activities that contribute to your grade. All exams are open note, so taking good and organized notes will be beneficial. If you miss class, it is your responsibility to find out what you missed, which should involve consulting the course website and your peers.

Readings

Required text:

Anderson, R.S. and Anderson, S.P., 2010. *Geomorphology: The Mechanics and Chemistry of Landscapes*. Cambridge University Press, Cambridge, UK, 637 pp.

It is challenging, very good, and essential to your learning in the course, so I encourage you to devote more time and attention to it than you normally might for textbooks.

Journal papers and supplemental readings will also be assigned; a partial / example list is as follows:

Dietrich, W.E., Bellugi, D.G., Sklar, L.S., Stock, J.D., Heimsath, A.M. and Roering, J.J., 2003. Geomorphic transport laws for predicting landscape form and dynamics. In: P.R. Wilcock and R.M. Iverson (Editors), *Prediction in Geomorphology*. American Geophysical Union, Washington D.C., pp. 103-132.

Dietrich, W.E. and Perron, J.T., 2006. The search for a topographic signature of life. *Nature* 439(7075): 411-418.

Egholm, D.L., Nielsen, S.B., Pedersen, V.K. and Lesemann, J.E., 2009. Glacial effects limiting mountain height. *Nature,* 460(7257): 884-887.

Gabet, E. J., and A. Bookter (2008), A morphometric analysis of gullies scoured by post-fire progressively bulked debris flows in southwest Montana, USA, *Geomorphology*, *96*(3-4), 298-309.

Kirchner, J.W. 2002. Subtleties of sand reveal how mountains crumble. *Science* 295: 256-258.

Montgomery, D.R. and J.M. Buffington. 1997. Channel reach morphology in mountain drainage basins. *GSA Bulletin* 109.

Montgomery, D.R. 2007. Is agriculture eroding civilization's foundation? *GSA Today* 17(10): 4-9.

Naylor, S. and Gabet, E.J.. 2007. Valley asymmetry and glacial vs. non-glacial erosion in the Bitterroot Range, Montana, USA. *Geology* 35(4): 375-378.

Pedersen, V.L. and D.K. Egholm. 2013 Glaciations in response to climate variations preconditioned by evolving topography. *Nature* 403: 206-210.

Perron, J.T., Kirchner, J.W. and Dietrich, W.E., 2009. Formation of evenly spaced ridges and valleys. *Nature*, 460(7254): 502-505.

Pinter, N. and M.T. Brandon. 1997. How erosion builds mountains. *Scientific American*. April: 74-79.

Trush, W.J., S. M. McBain, and L. B. Leopold. 2000. Attributes of an alluvial river and their relation to water policy and management. *Proceedings of the National Academy of Sciences* 97: 11858-11863.

Course website

Please check the course website (Moodle) regularly, especially before class, for announcements, notes, readings, assignments, and schedule updates. Some of the class lecture notes will be posted.

Email

Feel free to communicate with me by email, and note that: 1) I'm likely to read your email fairly soon after I receive it but I may not respond immediately; 2) if you have questions that others are also likely to have, please save them for class; 3) if you need to miss class for any reason, please let me know in advance by email; 4) assignments submitted electronically must be well organized, consolidated into at most 2 files, and contain your last name in the file name.

Late Policy

1 assignment can be handed in late without penalty, reason, or prior communication. Otherwise 2% of total points are deducted per day late. No credit allowed for assignments handed in > 1 week after due date or after answer key / grading rubric posted, whichever comes first.

Student Conduct Code

The Student Conduct Code at the University of Montana embodies and promotes honesty, integrity, accountability, rights, and responsibilities associated with constructive citizenship in our academic community. This Code describes expected standards of behavior for all students, including academic conduct and general conduct, and it outlines students' rights, responsibilities, and the campus processes for adjudicating alleged violations. Full student conduct code. http://www.umt.edu/vpsa/policies/student_conduct.php

Course Withdrawal

Students may use Cyberbear to drop courses through the first 15 instructional days of the semester. Beginning the 16th instructional day of the semester through the 45th instructional day, students use paper forms to drop, add and make changes of section, grading option or credit. GEO460 may not be taken as credit/no-credit.

Disability Modifications

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. https://www.umt.edu/dss/default.php If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or call 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.

Schedule (next page)

- Class meeting topics are subject to change
- Readings will be announced each week and must be completed before the following class.
- Updates to the syllabus will be announced in class and posted on Moodle

Week	Date	Class meeting topic	Textbook reading
1	1-Sep	Introduction	A&A 1
	3-Sep	Introduction continued; Lab 1: Landscape attributes and metrics	
2	8-Sep	Fluvial processes: alluvial rivers	A&A 12 (380-395)
	10-Sep	Lab 2 (surveying)	
3	15-Sep	Fluvial processes: flow and sediment transport	A&A 12 (395-414), 13 (optional)
	17-Sep	Fluvial processes: Hydraulic geometry, channel patterns, long profiles	
Saturday, September 19: Field trip (fluvial processes)			
4	22-Sep	Fluvial processes: floods, dominant Q, channel adjustments, classification	A&A 12 (395-414), 13 (optional)
	24-Sep	Fluvial processes wrap-up	
5	29-Sep	Water in the landscape; Channel networks and drainage basins, hillslope hydrology	A&A 7 (160-183, 200-202, 207-210)
	1-Oct	Weathering	
6	6-Oct	Sediment budgets	A&A 10 (304-313)
	8-Oct	AWRA	
7	13-Oct	Landslides & debris flows	A&A 10 (313-330)
	15-Oct	Landslide mechanics	
8	20-Oct	Slope stability (*Field project 1 reports due*)	A&A 10 (330-345)
	22-Oct	Hillslope processes wrap-up	
9	27-Oct	Midterm	A&A 3 (26-43; 55-56)
	29-Oct	Large-scale geomorphology	
Saturday, October 31: Field trip (hillslope processes)			
10	3-Nov	Tectonic geomorphology	A&A 4
	5-Nov	Tectonic geomorphology	
11	10-Nov	Glacial processes: intro, mass balance	A&A 8 (212-232)
	12-Nov	Glacial processes: mass balance, flow mechanics	
12	17-Nov	Glacial processes: erosion, landforms	A&A 8 (232-266)
	19-Nov	Glacial processes: glaciers & climate, jokulhlaups, glacial hydrology	
13	24-Nov	Megafloods, Glacial Lake Missoula, Dating methods *(Field project 2 reports due)*	A&A 17 (532-546; 554)
	26-Nov	no class, thanksgiving	
14	1-Dec	Climate change & geomorphology	A&A 5 (96-106, 113-117)
	3-Dec	Ecogeomorphology, restoration	
15	8-Dec	Human effects on geomorphic processes	
	10-Dec	Course wrap-up	
16	12/15	*Final exam* (10:10-12:10)	