EAS 4803/8803: Geomorphology (3 credits)

Class
Tuesday + Thursday 12:30 to 1:45 pm
Cherry Emerson 322

Office hours
Wednesday 3:00 to 5:00 pm
Ford ES&T L1110 (EAS computer lab)

Instructor
Dr. Karl A. Lang (he/him), Asst. Professor
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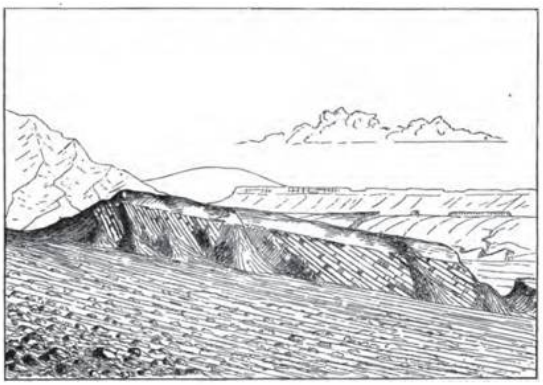
@iamskeptikarl



A hill of planation
Report on the Geology of the Henry Mountains
G.K. Gilbert, 1877

Outline
A quantitative study of the processes shaping planetary surfaces, with an introduction to landscape evolution models and current methods for measuring landscape change. Surface processes discussed span more than 8 orders of magnitude in spatial and temporal scales. Examples are drawn from tectonically active and inactive regions of Earth, Mars and other planetary bodies. The course is designed for graduate and advanced undergraduate students.

Goals
The goals for this course are to provide both an *intuitive* understanding of geomorphic processes as well as the *quantitative* background to predict and measure landscape change. Quantitative aspects of this course will also develop *practical* skills manipulating and interpreting Digital Elevation Models (DEMs) in Matlab. The course also includes an opportunity for *field experience* in geomorphic observation, interpretation and peer-instruction. For graduate students, this course also serves as an introduction to the geomorphology academic *literature*.

A note about credit offerings
Similar courses have been previously offered in 3 and 4 credit versions. This course is 3 credits and does not include formal laboratory sections. Future versions of this course may return to a 4 credit offering with labs, depending on student interests and curricular requirements.

Prerequisites
A familiarity with mechanics, calculus with differential equations, and basic geological principles will be helpful in this class. Possible prerequisites could include EAS 2600, PHYS 2211 or similar courses. Prior experience with Matlab is desirable, but not required. *Students seeking additional practice with Matlab should also join the non-credit Matlab course offered by Dr. Ito and Dr. Robel this semester.* Please reach out early if you have any questions about course material.

Readings
This course has a lot of required reading, particularly for graduate students. This is intended to provide an academic foundation from which to build your own understanding of current research. Our textbook is *Geomorphology: The Mechanics and Chemistry of Landscapes* (2010) by Robert S. Anderson and Suzanne P. Anderson, published by Cambridge University Press, 1st edition. All students should complete recommended readings from the textbook and (for graduate students) academic literature prior to their respective class. Each class will begin with a short reading quiz and brief discussion to check your understanding of the assigned readings.

Grading Rubric

Your final grade will be evaluate based on successful completion of Reading Quizzes, Problem Sets and Presentations during a field trip to Tallulah Falls. Graduate (and willing Undergraduate) students will also write AGU-style Plain Language Summaries as part of a friendly competition. Final grades will be calculated following the official Georgia Tech Grading System (https://registrar.gatech.edu/info/grading-system).

I will use the following grading scale to calculate a final grade average:
A = 100 B = 90, C = 80, D = 70, F = 60, 0 = 0. Extra credit is not offered.

Reading Quizzes (10%)

Most classes will begin with a 1 question (~5 minute) quiz drawn from the assigned readings for that class. Quizzes may or may not be different for Undergraduate and Graduate students, depending on the assigned readings. Reading Quizzes are designed to motivate readings and check your understanding of important topics.

Problem sets (70%)

There will be 5 problem sets primarily based in Matlab using TopoToolbox (https://topotoolbox.wordpress.com/), a collection of tools for DEM interpretation and manipulation. Problem Set assessment will follow:

A - Successful completion of the Problem Set (90-100% answers correct) *with* additional creative reanalysis of Problem Set data or your own research
B – Successful completion of the Problem Set (90-100% answers correct)
C – Unsuccessful completion of the Problem Set (50-90% answers correct)
D – Unsuccessful completion of the Problem Set (0-50% answers correct)
F – Unsuccessful completion of the Problem Set (0% answers correct)
0 – Nothing turned in

If you are struggling with a Problem Set, *please* come to office hours in the EAS Computer Lab (L1110). You may correct and resubmit any Problem Set scoring a C, D or F for a 1 letter grade improvement. Resubmissions are due by the subsequent Problem Set due date. Early submissions are welcome, late submissions are not accepted.

Field Trip Presentations (20%)

We will have one field trip to Tallulah Falls – tentatively scheduled for a single, full day on 11/6. I will assign small groups to present on pertinent topics during the field trip. Groups will have a short period for explanation and will be provided with a medium-sized dry-erase board and colored dry-erase markers for illustration. Grades will be partially determined through peer-assessment. I will provide a presentation rubric later in the semester.

Plain Language Summaries

Graduate students will also write AGU-style Plain Language Summaries (<200 words, see: https://www.agu.org/Publish-with-AGU/Publish/Author-Resources/Plain-Language-Summary) to be submitted with each of the first four Problem Sets. A Summary may summarize any one of the literature selections read since the previous Problem Set due date (4-5 papers). Summaries will be anonymously peer-reviewed, ranked and the best summary will receive a unique and priceless prize. Undergraduates may also participate in the competition, but are not required.

How many years can a mountain exist, before it is washed to the sea?
Bob Dylan, 1963

Policies

Course materials
Slides, additional rubrics, announcements, grades and other course materials will be available on the Canvas course website. Please check the site regularly for updates.

Academic integrity
Instructors and students should follow the Georgia Tech Academic Honor Code: https://policylibrary.gatech.edu/student-affairs/academic-honor-code. You are encouraged to work together on Problem Sets, but you must submit your own final version. Any violation of the honor code (e.g. plagiarism, cheating) will automatically earn a zero for the assignment.

Absences and Accommodations
I will accommodate approved absences (e.g. missing a Reading Quiz). Please provide documentation for the absence and obtain approval in advance. The Institute Absence policy is available here: www.catalog.gatech.edu/rules/4/. If you are a student with a documented short-term or permanent disability seeking accommodations in this course, please contact The Office of Disability Services: disabilityservices.gatech.edu (or by phone at 404-894-2563) for guidance and additional resources without disclosing your private information. Please provide as much advance notice as possible in requesting accommodations.

Mutual respect
It is my goal to foster an inclusive and collegial atmosphere that encourages intellectual discourse. To this end, I expect that you will behave in a professional, mature manner treating your peers with the same respect you would expect from them. This includes: addressing people with the name and pronoun of their choice, avoiding interruptions and overtalking, and apologizing when mistakes happen. Intentionally disrespectful behavior of any kind will not be tolerated. Please reach out to me, or another faculty member if you are uncomfortable with any part of the course. Remember that faculty are also considered mandatory reporters of any event that constitutes discrimination under the scope of Title IX (https://titleix.gatech.edu/). You may also report evidence for discrimination through the Ethics Reporting Hotline: 866-384-4277.

Special arrangements concerning COVID-19
I am planning to lecture in-person and indoors this semester. excepting a few planned remote lectures. While on campus, please follow the Georgia Tech Campus Guidelines based on CDC recommendations to limit the spread of COVID-19 (https://health.gatech.edu/tech-moving-forward). Currently these guidelines encourage everyone to get a COVID-19 vaccination and wear a mask in campus buildings. Free vaccinations and testing are available to everyone in the campus community, see: https://mytest.gatech.edu/ for more information. We may need to adapt the course as the situation changes, I thank you in advance for your understanding and flexibility.

Resources for students at Georgia Tech

Academic support

Center for Academic Success http://success.gatech.edu
1-to-1 tutoring http://success.gatech.edu/1-1-tutoring
Peer-Led Undergraduate Study (PLUS) http://success.gatech.edu/tutoring/plus
Academic coaching http://success.gatech.edu/coaching

Residence Life's Learning Assistance Program
https://housing.gatech.edu/learning-assistance-program
Drop-in tutoring for many 1000 level courses

OMED: Educational Services (http://omed.gatech.edu/programs/academic-support)
Group study sessions and tutoring programs

Communication Center (http://www.communicationcenter.gatech.edu)
Individualized help with writing and multimedia projects

- Academic advisors for your major: http://advising.gatech.edu/

Personal support

Georgia Tech Resources

The Office of the Dean of Students: http://studentlife.gatech.edu/content/services
OR 404-894-6367, Smithgall Student Services Building 2nd floor
You also may request assistance at https://gatech-advocate.symplicity.com/care_report/index.php/pid383662?

Counseling Center: http://counseling.gatech.edu
OR 404-894-2575; Smithgall Student Services Building 2nd floor
Services include short-term individual counseling, group counseling, couples counseling, testing and assessment, referral services, and crisis intervention. Their website also includes links to state and national resources.
Students in crisis may walk in during business hours (8am-5pm, Monday through Friday) or contact the counselor on call after hours at 404-894-2204.

Students' Temporary Assistance and Resources (STAR):
http://studentlife.gatech.edu/content/need-help
Can assist with interview clothing, food, and housing needs.

Stamps Health Services: https://health.gatech.edu; 404-894-1420
Primary care, pharmacy, women's health, psychiatry, immunization and allergy, health promotion, and nutrition

OMED: Educational Services: http://www.omed.gatech.edu
Women's Resource Center: http://www.womenscenter.gatech.edu; 404-385-0230
LGBTQIA Resource Center: http://lgbtqia.gatech.edu/; 404-385-2679
Veteran's Resource Center: http://veterans.gatech.edu/; 404-385-2067
Georgia Tech Police: https://police.gatech.edu/; 404-894-2500

Campus Maps

General campus map: https://map.gatech.edu/
Gender neutral bathrooms: https://lgbtqia.gatech.edu/content/gender-inclusive-restroom-map
COVID-19 testing sites: https://map.gatech.edu/?id=82#!ce/50361?ct/50361,50938,51169
Campus community crime map:
https://www.communitycrimemap.com/?address=Georgia%20Institute%20of%20Technology%20North%20Ave%20NW%20Atlanta,%20GA%2030332

DAY	DATE	TOPIC	UNDERGRADUATE	GRADUATE	DUE DATES
T	8/24	Introduction, Climate drivers	Chp. 1, Chp. 5 (108-119)		
R	8/26	Tectonic drivers I	Skim Chp. 2, Chp. 3 (36-59)	England and Molnar, 1990	
T	8/31	Tectonic drivers II	Chp. 4 (78-91)	Whipple, 2009	
R	9/2	Weathering	Skim Chp. 7 (160-200)	White and Brantley, 2003	
T	9/7	Soil Production	Chp. 7 (202-211), Humpries and Wilkinson, 2007	Heimsath et al., 1997	
R	9/9	Hillslope diffusion	Chp. 11 (363-370), Chp. 10 (304-328)	Roering et al., 2007	PS I, PLS: 8/24-9/9
T	9/14	How to digest an academic paper - Discussion led by Dr. Kelly Thomson			
R	9/16	Landslides *(remote lecture)*	Chp. 10 (330-340)	Hovius et al., 1997	
T	9/21	Debris Flows	Chp. 10 (340-347)	Whipple and Dunne, 1992	
R	9/23	Alluvial channels, Flow mechanics I	Chp. 12 (380-395)	Skim USGS T&M Book 3 Section A Chapter 8	
T	9/28	Flow mechanics II	Chp. 12 (399-405)	Montgomery and Buffington 1997	
R	9/30	Channel profiles	Chp. 12 (395-399, 405-410)	Sklar and Dietrich, 1998	
T	10/5	Sediment transport I	Chp. 14 (461-473)	Lamb et al., 2008	
R	10/7	Sediment transport I I	Chp. 14 (453-461)	Anderson and Hallet, 1986	PS II, PLS: 9/16-10/7
T	*10/12*		*No Class - Fall Break*		
R	10/14	Channel networks	Chp. 11 (348-351, 370-377)	Montgomery and Dietrich, 1988	
T	10/19	Bedrock channels I	Chp. 13 (428-435)	Hancock et al., 1998	
R	10/21	Bedrock channels II	Chp. 13 (435-449)	Whipple and Tucker, 1999	
T	10/26	Glaciers Guest: Dr. Alex Robel	Chp. 8 (213-245)	*TBA*	
R	10/28	Periglacial processes Guest: Dr. Frances Rivera Hernandez	Chp. 9 (280-296)	*TBA*	
T	11/2	Glacial geomorphology	Chp. 8 (245-266)	Egholm et al., 2009	
R	11/4	Floods	Chp. 17	Lamb and Fonstad, 2010	PS III, PLS: 10/14-11/4
S	*11/6*		*Fieldtrip to Tallulah Gorge, read Willett et al. (2014)*		
T	11/9	Landscape evolution models I	Tucker and Bras, 1998		
R	11/11	Landscape evolution models II	Kooi and Beaumont, 1996		
T	11/16	Landscape evolution models III	Willet et al., 1999; Koons et al., 2002		
R	11/18	Dates and Rates of landscape evolutic	Chp. 6		
T	11/23	Luminesence Dating	Rhodes et al., 2011		PS IV, PLS: 11/6-11/16
R	*11/25*		*No Class - Thanksgiving Holiday*		
T	11/30	Cosmogenic Radionuclides	Cerling and Craig, 1994		
R	12/2	Fission-track thermochronology	Tagami and O'Sullivan, 2005		
T	12/7	Noble gas thermochronology	Harrison and Zeitler, 2005		
T	12/14		*No Class - Finals Week*		PS V