Syllabus, GLG362 Geomorphology; Instructor: K. Whipple

1. Course Description

The Earth's near surface environment has been termed the "critical zone" as this is the zone that supports most life and because the Earth's surface is the dynamic interface where much of the geologic record is produced. We now know that we face rapid climate change and the consequences of changes in landuse, water resources, and ecosystems. But how will changes to the environment manifest themselves in the critical zone – in the form and function of the Earth's surface (landforms, water resources, soils, natural hazards, ecosystems) – and how will these changes impact us? Critical to planning a response to, or mitigation of, environmental change is an understanding how the Earth surface works – the interaction of physical, chemical and biotic processes in shaping the surface and determining fluid, solute and sediment fluxes.

This course offers a quantitative introduction to the form and function of the Earth's surface including the essentials of hydrology (runoff, groundwater), rivers, weathering, soil formation, erosion, slope stability, sediment transport, alluvial and coastal landforms, and ice sheet stability. This project-based course includes GIS analysis, interpretation of remotely sensed imagery, and field investigation (2 weekend trips) of geomorphic phenomena. Lessons learned are directly applicable to investigations of other planetary surfaces.

Prerequisites:
GLG 101 or SES 121 with C or better; MAT 266 or 271 with C or better; PHY121/122 or PHY150 with C or better, *or* permission of instructor

2. Learning Outcomes

Learning outcomes include both academic and practical job-skill goals. After taking this course students will be able to:

1. Approach earth science problems systematically through application of the principles of conservation of mass and momentum
2. Understand the fundamentals of surface hydrology and flood generation, including the influence of land use changes
3. Understand fundamental controls on erosion rates and on the pace and pattern of landscape evolution
4. Interpret the past history of climate and tectonic uplift from the record preserved in landforms and sediments
5. Appreciate the mechanisms and sensitivities of earth system response to environmental change (land use change, damming of rivers, climate change)
6. Use Excel and ArcGIS effectively in the analysis of earth science problems
7. Make geologic interpretations of aerial and satellite images

3. Assignments

This is a projects-based course. There are no exams. The course is built around five hands-on projects: (1) Hydrology and ArcGIS; (2) Cinder Cone Evolution; (3) Verde River Flow Hydraulics; (4) Alluvial Fan Evolution; and (5) Bedrock Channel Evolution. Three projects involve the preparation of technical scientific reports (Hydrology and ArcGIS, Cinder Cone Evolution, and Alluvial Fan Evolution). Guidelines for best practices in preparation of technical reports are provided. The remaining two projects (Verde River Flow Hydraulics and Bedrock Channel Evolution) involve calculations and data analysis and short-answer paragraph discussions of a set of posed questions. Two projects involve field trips including data collection efforts (Cinder Cone Evolution and Verde River Flow Hydraulics). Participation in both field exercises is strongly recommended, but are not required. All field data collected is shared with all students and the projects and reports are based on analysis of this data. Each project has interim benchmark due dates that are listed in the lab guides and posted on the course website. The interim due dates are imposed to (a) make sure all stay on track, and (b) provide feedback on the underlying analysis before students begin the preparation of their lab project reports.

In this course we will collect data in cooperative groups. Most lecture periods will also involve times when students are asked to discuss lecture topics in small groups and share their ideas with the class. Collaborative work in groups on data analysis is also encouraged as it can enhance the learning experience of all involved. All are, however, of course expected to turn in their own work. Preparation of final reports should be done independently (see statement on Academic Honesty below).

4. Grading Policy and Percentages

Each project is worth 50 points, for a total of 250 points. An additional 5% (12 points) is attributed to participation in class discussions. For projects with written reports, students will be graded both on the accuracy of the data analysis and calculations and on the quality of the written presentation. In depth feedback about report organization, clarity, and writing style will be provided. Grading of written reports follows this template (50 point total):

Presentation (15)

Clear statement of objectives, motivation and hypothesis(es)	(5)
Clarity (writing, illustrations, integration of text and figures)	(10)

Analysis (25)

Data / interpretations clearly separated - unit definitions / criteria - relative age criteria	(10)
Internal consistency of interpretation - cogent synthesis of data - pro and con evidence presented - appropriate mapping considering focus of report	(15)

- alternate models recognized and considered

Further Work (10)

Define problem areas (specific) and alternate hypotheses	(5)
Suggest future work and solutions (specific / feasible)	(5)

Important: I will grade based on internal consistency, logic, clarity of writing and figures. I will not grade based on whether you have come up with the "right" answer. There is in fact no known "right" or complete answer to the problems you will tackle in this class.

5. Required Readings

Textbook: Geomorphology: The Mechanics and Chemistry of Landscapes, Anderson and Anderson. Cambridge Univ. Press, 2010.

Weekly reading assignments from the text are detailed in the course schedule (in bold), typically one chapter per week.

Additional reading assignments of journal articles are associated with 3 of the 5 class projects. These are noted in the course schedule and will be posted to the course website.

6. Course Schedule (2016: MW 9-10:15, Labs W 12:55-2:55)

Week	Dates	Lecture Topics/Reading	Lab Exercises/Field Trips
1	Aug 18	No class: Reading only; **Chap 1, Essay**	No Lab week 1 (Projects Due every 3 weeks)
2	Aug 22 – Aug 24	Introduction; Runoff/Drainage Basins **Chap 11**	Lab 1: ArcGIS DEM Analysis and Hydrology I: **Due Aug 26**
3	Aug 29 – Aug 31	Runoff/Channel Initiation **Chap 11, Notes**	Lab 1: ArcGIS DEM Analysis and Hydrology II: **Due Sept 2**
4	Sept 7 **H: Sept 5**	Channel Initiation, Hillslope Processes **Ch10, papers**	Lab 1: ArcGIS DEM Analysis and Hydrology III: **Due Sept 9** **Trip: Sept 10-11 (camping)**
5	Sept 12-14	Soil Transport, Linear Diffusion, Hillslope Form **Ch10 304-328, 344**	Lab 2: Cinder Cone Evolution (prep)
6	Sept 19-21	Non-linear Diffusion, Slope Stability Hillslope Form – **Ch10 328-344**	Lab 2: Cinder Cone Evolution **Due Oct 4**
7	Sept 26-28	Fluvial Processes – Open Channel Flow **Notes, Ch12 380-396**	Lab 2: Cinder Cone Evolution **Due Oct 4** **Verde River Trip: Sept 30/Oct 1**
8	Oct 3-5	Fluvial Processes, Sediment Transport and Landforms **Ch12 396-405, 14 452-468**	Lab 3: Stream Flow, **Part I Due Oct 12**

9	Oct 12 **FB: 8-11**	River Profiles, Alluvial Fans **Ch12 405-411, Papers**	Lab 3: Flood Frequency, Field Data Analysis, **Part II Due Oct 21**
10	Oct 17-19	Alluvial Fans, Air Photo Interpretation, Mapping (project) **Papers**	Lab 3: Stream Flow **Part II Due Oct 21**
11	Oct 24-26	Alluvial Fans (project) **Papers**	Lab 4: Death Valley Alluvial Fans **Due Nov 11**
12	Oct 31 - Nov 2	Alluvial Fans (project) **Papers**	Lab 4: Death Valley Alluvial Fans **Due Nov 11**
13	Nov 7 **H: Nov 9**	Erosion Rates, Soil Production and Landscape Form **Ch7 202-208, 328-330, Ch6 131-146**	Lab 4: Death Valley Alluvial Fans **Due Nov 11**
14	Nov 14-16	River Incision Processes, Tectonic Geomorphology **Ch4 78-96, Ch13**	Lab 5: Bedrock Channel Evolution (Wednesday lab); **Due Dec 2**
15	Nov 21-23 **Thgiv: 24**	Bedrock Channel Processes and Evolution, Continued **Paper, Ch7 200-202, Ch8 212-232**	Lab 5: Bedrock Channel Evolution **Due Dec 2**
16	Nov 28 – Nov 30	Interaction of Climate and Tectonics **Paper, Ch7 200-202, Ch8 212-232**	Lab 5: Bedrock Channel Evolution **Due Dec 2**

7. Academic Honesty

Academic honesty is expected of all students in all examinations, papers, laboratory work, academic transactions and records. Academic misconduct and academic dishonesty will not be tolerated. Students engaging in misconduct or dishonest practices on exams, quizzes, or other assignments will be dealt with according to the guidelines established by the university (http://provost.asu.edu/academicintegrity). The possible sanctions include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of E), course failure due to academic dishonesty (indicated on the transcript as a grade of XE), loss of registration privileges, disqualification and dismissal.

8. Disability Policy

Students who feel they will need disability accommodations in this class but have not registered with the Disability Resource Center (DRC) should let me know and contact DRC immediately (www.asu.edu/studentaffairs/ed/drc). Information regarding disability is confidential.The DRC office is located on the first floor of the Matthews Center Building. DRC staff can also be reached at: 480-965-1234 (V), 480-965-9000 (TTY). Their hours are 8:00 AM to 5:00 PM, Monday through Friday.