

# GEOGRAPHY 347

## CLIMATIC GEOMORPHOLOGY

Dr. D. Scott Mackay, Instructor

### Course Objectives

The general aim of this course is to examine how landforms and the processes that produce them change as climate changes. We will do this by dividing the earth into four type of landscapes, namely humid, arid, periglacial, and glacial. We will discuss the geomorphic processes and landforms that characterize each landscape. Towards the end of the course we will discuss past climates (over the last 1-2 million years) and potential for future climates, and their role on geomorphic processes.

### Required Text

Ritter, D.F., R.C. Kochel, J.R. Miller. 2002. *Process Geomorphology*, 4<sup>th</sup> Edition, McGraw-Hill, New York.

### Additional References (not required reading)

Bloom, A.L. 1991. *Geomorphology : A Systematic Analysis of Late Cenozoic Landforms*, Prentice-Hall, Englewood Cliffs, NJ.

Chorley, R.J., S.A. Schumm, and D.E. Sugden. 1985. *Geomorphology*, Methuen, London.

Sugden, D.E. and B.S. John. 1976. *Glaciers and Landscape: A Geomorphological Approach*, Edward Arnold, London.

### Grading

Your final grade will be based exclusively on two tests (25% each), a term paper (30%), an annotated bibliography on the topic of your term paper (10%), and class participation (10%). Tests will be some combination of in-class multiple-choice, short answer, and/or take-home essay. In-class exams will be about 45 minutes in duration, non-cumulative, and will be based on lectures and readings. Make-up tests will only be given where a student contacts me either before or on the day of the scheduled test and offers an acceptable excuse. In the case of an illness or accident a medical certificate from either a doctor or Health Services will be required. Under no circumstances will a student be permitted to take more than one makeup test. The format for make-up tests may differ from that of the regularly scheduled test, and will most likely be essay format.

Term papers and annotated bibliographies must be printed using a high quality printer (e.g., laser printer), with a length of about 3000 words (12 pages), not including references cited. Pages must be double-spaced and font should be 11 or 12 pt. References must follow a format acceptable in the scientific literature, be consistently applied throughout the paper, and must not include references taken from the World-Wide Web (WWW) or other “grey” literature. Papers that cite the WWW will be returned without grading. Written work is due in-class on the scheduled due date. The instructor reserves the right to extend this time to end-of-business-day, but under no circumstances is obligated to do so. Late work will be subjected to a penalty of 5% per day. The instructor also reserves the right to allow or disallow written material to be revised and resubmitted for re-grading.

It is important to note that plagiarism is a serious offence and will be handled according to University guidelines. We will use a fairly broad definition here. Examples of plagiarism include whole or substantial copying of other work, failing to cite work used, using work from another student, colleague, etc, or substantial use of your own work from a paper in another course. If you are uncertain whether you are running the risk of plagiarizing other work it’s best to ask the instructor.

It is assumed that everyone will make every effort to attend classes. Class participation will be assessed periodically with non-graded in-class assignments, as well as active participation (e.g., asking questions). In-class assignments may take the form of brief discussion in small groups, panels, surveys, or similar activities. The intention here is to promote group discussion and learning of concepts.

The following table describes how numerical grades will be translated into letter grades:

A	(88% or higher)
A-	(84% to 87.9%)
B+	(80% to 83.9%)
B	(76% to 79.9%)
B-	(72% to 75.9%)
C+	(68% to 71.9%)
C	(64% to 67.9%)
C-	(60% to 63.9%)
D+	(56% to 59.9%)
D	(52% to 55.9%)

## **Office Hours**

Should you have any problem or question regarding the course, I will always be available in my office (113 Wilkeson Quad, Ellicott Complex) from 11:00 am to Noon on Mondays and Wednesdays. If you wish to make an appointment for some other time, my office number is 645-2722 ext. 64 and my email address is [dsmackay@buffalo.edu](mailto:dsmackay@buffalo.edu).

## **Course Outline and Readings**

### **Basics of Geomorphic Processes**

Equilibrium concepts; forces; thresholds and complex response; linkages  
Reference: text Ch. 1

### **Internal Forces**

Epeirogeny; orogeny; volcanism  
Reference: text Ch. 2 (p. 21-34)

### **Climate**

Processes and landforms; climate change; sea-level change;  
Reference: text Ch. 2 (p. 34-38)

### ***[Humid Landscapes]***

#### **Drainage Basins**

Infiltration; runoff; basin morphometry; basin evolution  
Reference: text Ch. 5 (p. 135-160)

#### **Hillslope Processes**

Chemical weathering; mass movements; hillslope forms; erosion and sediment loss  
Reference: text Ch. 3 (p. 42-48); Ch. 4 (p. 92-133), Ch. 5 (p. 173-188)

#### **Fluvial Processes**

Basic river mechanics; sediment transport; quasi-equilibrium condition; time  
Reference text Ch. 6

### ***[Arid Landscapes]***

#### **Weathering Processes**

Weathering; rock varnish; desert pavement  
Reference: text Ch. 8

#### **Hillslope and Stream Processes**

Hydraulic processes; hillslope forms; flow regimes; channel form and sediment transport;  
adjustment of alluvial landforms; alluvial fans  
Reference: text review Chs. 4-7

#### **Sand Deserts**

Transport of sand; hierarchy of forms  
Reference: text Ch. 8

### **FIRST TEST (March 5)**

### **ANNOTATED BIBIOLOGRAPHY DUE (March 10)**

*[Periglacial Landscapes]*

**Frozen Ground Processes and Forms**

Permafrost; periglacial processes; nivation; periglacial landforms

Reference: text Ch. 11 p. 358-396

**Engineering problems**

Construction; pipelines; implications of global warming

Reference: text Ch. 11 p. 397-405

*[Glacial Landscapes]*

**Glaciers and Glacial Mechanics**

Origins of glacial ice; mass balance ice movements; Ice structures

Reference: text Ch. 9

**Glacial Landforms**

Erosion processes and features; depositional processes and features;

Reference: text Ch. 10

**Glacial Climates**

Climate records; older climates; Causes of glaciations

Reference: TBA

**Future Climates**

Human versus natural factors; feedback mechanisms; current trends; implications

Reference: TBA

**TERM PAPERS DUE (April 19)**

**SECOND TEST (April 26)**