Principles of Glaciology

Syllabus

Course
Geology 540: Principles of Glaciology
3:00-4:20 T Th
C310 ESC

Instructor
Summer Rupper
S317 ESC
2-6946
summer_rupper@byu.edu
Office hours: 3-5 M

TA
Annika Quick
C171B ESC
annika.quick@gmail.com
Office hours: 10-11 M,W

Description
This course covers a broad range of geophysical problems involving ice in the environment, and its role in global change. The course stresses a physical and chemical understanding of the underlying processes.

Learning Objectives
On completion of this course, you will hopefully be able to

1. Describe the components of the cryosphere, their geographical extent, and their physical and chemical properties.
2. Evaluate the role of the cryospheric components in global environmental change.
3. Discuss the importance of cryospheric change on society.

All learning activities in this course are designed to help reinforce the above learning objectives, as well as give you ample opportunity to improve your skills in three key areas:

1. Improve critical thinking and problem solving skills.
2. Write and speak clearly and succinctly.
3. Identify the audience and appropriately modify writing/speaking for that audience.
Topics (approximately 1 week per topic)
1. Introduction to and geography of the cryosphere
2. Physical properties of ice
3. Ice in the atmosphere – cloud physics
4. Snow – deposition, wind transport, metamorphism
5. Avalanches
6. Glaciers – mass and energy budgets
7. Glaciers – dynamics
8. Glaciers – hydrology
9. Glacier variations – response to climate change, surging glaciers, and tidewater glaciers
10. Ice sheets, ice streams, and ice shelves
11. Geochemistry of ice sheets and glaciers
12. Glacial geomorphology – erosion
13. Glacial geomorphology – processes, rates, and landforms
14. Glacier and ice sheet reconstructions
15. Permafrost, icy soils and landscapes, patterned ground
16. Sea ice

Textbook
No required text for this course. My lecture notes come from several textbooks, journal articles, and course notes from classes I’ve taken. The primary sources used are

Books:
Glaciers and Glaciation, Benn and Evans
Physics of Glaciers, Paterson
Field Techniques in Glaciology and Glacial Geomorphology, Hubbard and Glasser
The Cryosphere and Global Environmental Change, Slaymaker and Kelly
The Avalanche Handbook, McClung and Schauer

Lecture Notes from UW Courses:
Formation of Snow and Ice Masses – Steve Warren
Glacial Geology – Steve Porter
Glacial Environments – Steve Porter
Glaciers and Climate – Ed Waddington
Physics of Ice – Charlie Raymond
Stable Isotope Geochemistry – Eric Steig
Grading
Details on the research project, problem sets and labs, and participation are included in the supplementary materials handed out and discussed at the start of the semester and as necessary throughout the course.

**Research Projects** 50%
- Project 1: 15% of grade
- Project 2: 35% of grade

**Problem Sets and Labs** 35%
- Problem sets, labs, field trip

**Participation** 15%
- Lecture Reviews, in-class discussions, surveys

**Grading System**
- 95-100 A
- 90-95 A-
- 87-90 B+
- 84-87 B-
- 80-84 B
- 77-80 C+
- 74-77 C
- 70-74 C-
- 67-70 D+
- 64-67 D
- 60-64 D-
- <60 E