

GLACIERS - GEOS/PHYS 617 (3 credits)

Prerequisites: Permission of instructor

Fall 2005, Meeting times: TBA, Rm 417, Elvey (Geophysical Institute)

Instructor: Martin Truffer, Geophysical Institute 401 D, *5359
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office hours: by appointment

LITERATURE

Text: *The physics of glaciers*, 1994, Paterson

Additional reading:

There are many books on glaciers. Post and LaChapelle (2000, smaller reprint of an earlier out-of-print edition) has spectacular pictures illustrating many glaciological features, focusing on Alaska. Hambrey and Alean (2004) is a similar book, written for the lay person, with a more global coverage.

Knight (1999) gives a good overview of the field. It is mostly an undergraduate book; not always free of errors. It has an excellent list of references. Hubbard and Glasser (2005) discuss glaciological field methods. More quantitative books include Hooke (1998) and Van der Veen (1999). For a detailed theoretical treatment of continuum mechanics applied to ice refer to Hutter (1983) and Lliboutry (1987). Malvern (1969) is an excellent reference for general continuum mechanics.

Petrenko and Whitworth (1999) and the (unfortunately) out-of-print Hobbs (1974) treat the topic of ice physics, the latter in great detail.

Hambrey, M. and J. Alean. 2004. *Glaciers*. Cambridge University Press. Second edition.

Hobbs, P.V. 1974. *Ice Physics*. Clarendon Press. Oxford.

Hooke., R.L. 1998. *Principles of Glacier Mechanics*. Prentice Hall, New Jersey, 248pp.

Hubbard, B. and N. Glasser. 2005. *Field Techniques in Glaciology and Glacial Geomorphology*. Wiley, 412 pp.

Hutter, K. 1983. *Theoretical glaciology; Material science of ice and the mechanics of glaciers and ice sheets*. D. Reidel Publishing Company/Tokyo, Terra Scientific Publishing Company.

Knight, P.G. 1999. *Glaciers*. Routledge, 261 pp.

Lliboutry, L.A. 1987. *Very slow flow of solids. Basics of modeling in geodynamics and glaciology*. Dordrecht, etc., Martinus Nijhoff Publishers.

Malvern, L.E. 1969. *Introduction to the mechanics of a continuum medium*. Prentice-Hall, Englewood Cliffs, NJ.

Paterson, W.S.B. 1994. *The physics of glaciers*. Pergamon, New York, etc., third edition.

Petrenko, V.F. and R.W. Whitworth.. 2002. *Physics of Ice*. Oxford University Press, 390 pp.

Post, A. and E. LaChapelle. 2000. *Glacier Ice*. University of Washington Press, Seattle, revised edition.

van der Veen, C.J. 1999. *Fundamentals of Glacier Dynamics*. A. Balkema, 462pp.

The *International Glaciological Society* (IGS) publishes two journals: *Journal of Glaciology* and *Annals of Glaciology*. *J. Glac.* is a regular quarterly journal containing articles about glaciers, sea ice, ice in general, and snow. The *Annals* appear twice annually and result from papers presented at an IGS meeting, so they are usually concentrated on a broad general topic. Various AGU journals also publish articles on glaciology; most prominently *Geophysical Research Letters* and *JGR - Earth Surface Processes*. An online AGU service (virtual journal: Cryosphere) makes all ice related articles of each AGU journal available to subscribers.

TOPICS

The course aims at familiarizing the student with the physics of glaciers. The student is expected to be able to critically read and review the current literature on glaciers. This will be achieved by teaching basic concepts with the help of text books, and also by reading and reviewing classic and current papers.

Instructional methods: lecture and student presentations

Tentative outline:

- Introduction
- Transformation of snow to ice
- Glacier mass balance: measurements and models
- Glacier – climate models (macroscopic glacier models)
- The flow of ice (full equations)
- The flow of ice (temperate, cold, polythermal)
- The flow of ice (Shallow Ice Approximation, ice shelves, valley glaciers, etc)
- Glacier hydrology
- Basal motion of glaciers
- Glacier surges
- Ice-Ocean interaction: Tidewater and outlet glaciers

Class attendance is mandatory and participation encouraged.

GRADING:	Problem sets:	50%
	Student presentations:	25%
	Final Exam:	20%
	Participation:	5%

Each student will present a topic by summarizing 2-3 papers. The topic should be approved by the instructor and chosen by mid-October.

The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. Please let the instructor know if you need special accommodation.