Earth and Space Sciences 533 – Atmospheric Sciences 512
Dynamics of Snow and Ice Masses
Spring 2021

Meeting times: Mon-Wed 9:30-10:50 - by Zoom
Class website: http://courses.washington.edu/ess533/

Instructors: Ed Waddington
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Office Hours: by Zoom, by arrangement

Learning Objectives

- You will develop an appreciation of ice as the most dynamic solid surface on planet Earth.
- You will understand processes controlling motion of snow, firn, and glaciers.
- You will be able to calculate or predict ice motions using a variety of simple approximations.
- You will develop an appreciation of the advances in snow and ice dynamics since c1950.

Subject outline:

- Introduction and perspective
- Mechanical behavior of glacier ice, snow, and firn
- Flow of sloped ice and snow slabs
- Valley glaciers and ice sheets
- Flow lines in glaciers and ice sheets - longitudinal gradients
- Three-dimensional flow and topography of ice-sheet surfaces
- Snow slope stability and avalanches
- Response of glaciers and ice sheets to climate change
- Instabilities in ice sheet response

We will have to be selective, because we will probably not have enough time to address all of these topics.

Sources of information
Books:

- Cuffey and Paterson. 2010. *The Physics of Glaciers.4th Ed.* Elsevier.
- Hooke. 2005. *Principles of Glacier Mechanics.2nd ed.* Prentice Hall.
- Colbeck (Ed.). 1980. *Dynamics of Snow and Ice Masses.* Academic Press.
- Hutter. 1983. *Theoretical Glaciology.* Reidel.
- Fowler. 2011. *Mathematical Geoscience*. Springer.
- van der Veen. 2001. *Fundamentals of Glacier Dynamics.*
- Salm and Gubler (Eds.). 1987. *Avalanche Formation, Movement and Effects.* IAHS Publication No. 162.
- McClung and Schaerer 2006. *The Avalanche Handbook.*

Principal Journals

- *Journal Glaciology*
- *Annals of Glaciology*
- *Journal of Geophysical Research*
- *Geophysical Research Letters*
- *Cold Regions Science and Technology*
- *The Cryosphere*

Class Organization

- Zoom Lectures with break-out discussions.
- Highlights of previous class in a 60-second presentation and ~150-word written abstract by a designated student (sign-up sheet is on Canvas Home page)
- Scheduled presentations or literature review by participants.
- Term Projects
  - By end of third week, each student tentatively chooses a "focus area".
  - By end of fifth week, each student chooses a focus area and tentative topic.
  - By end of seventh week: each student has chosen a definite topic.

Assigned Work

- Readings from selected book chapters and journal articles
- Presentations and discussion in class
- Homework problem sets
- Mid-term take-at-home exam
- 10-minute oral presentation of term topic, Wednesday June 9, 2021 (830-1020)
- Written paper is due Friday June 11. Targeted length 4 pages after formatting and typesetting, e.g. in Geophysical Research Letters style
- No final exam.

Example focus areas

Glaciers:

- Glacial erosion, transport and deposition
- Current changes in the ice sheets, and their causes
- Ice sheet dynamics in climate models
- Ice motion and problems of ice-core interpretation
- Response of glaciers to climate change
- Rheology of glacier ice

Seasonal snow:

- Snow creep and forces
- Prediction of avalanche hazard
- Avalanche run out and impact
- Processes in snow models

Firn:

- Processes in firn compaction
- Water in firn
- Mass and isotope transfer by water vapor

Assessment

- Homework 25%
- Mid-term 25%
- Project 25%
- Participation 25%

DSABILITY–RELATED NEEDS

To request academic accommodations due to a disability, please contact Disability Resources for Students (DRS) 011 Mary Gates Hall

uwdrs@uw.edu

206-543-8924 (Voice), 206-543-8925 (TTY), 206-616-8379 (FAX).

If you have a letter from DRS, please present the letter to the coordinating instructor so that he or she can discuss with you the accommodations that you might need in this class.

ACADEMIC INTEGRITY:

At the University level, passing off anyone else's scholarly work (which can include written material, exam answers, graphics or other images, and even ideas) as your own, without proper attribution, is considered to be academic misconduct. ***For example, cutting and pasting text from a web site and submitting it as your own work is plagiarism, and repeat offenses can lead to dismissal from the university.***

Plagiarism, cheating, and other misconduct are serious violations of the University of Washington **Student Conduct Code** (WAC 478-120).

http://www.washington.edu/cssc/for-students/student-code-of-conduct/

We expect that you will know and follow the university's policies on cheating and plagiarism. Any suspected cases of academic misconduct will be handled according to University of Washington regulations. For more information, see the University of Washington **Community Standards and Student Conduct** website.

http://www.washington.edu/cssc/

Please also review the College of the Environment **Academic Misconduct Policy**.

http://coenv.washington.edu/intranet/academics/academic-policies/academic-misconduct/

NOTICE

The University has a license agreement with SimCheck by Turnitin, an educational tool that helps prevent or identify plagiarism from Internet resources. Your instructor may use the service in this class by requiring that assignments be submitted electronically to be checked by SimCheck. The SimCheck Report will indicate the amount of original text in your work and whether all material that you quoted, paraphrased, summarized, or used from another source is appropriately referenced.

RELIGIOUS ACCOMMODATION

Washington state law (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/ SB 5166-2019-20) requires institutions of higher education to administer a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's Religious Accommodation Policy is available at

https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/

Accommodations must be requested within the first two weeks of any course using the Religious Accommodation Request Form

https://registrar.washington.edu/students/religious-accommodations-request/

SAFETY

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