

EARTH AND SPACE SCIENCES
431A PRINCIPLES OF GLACIOLOGY
505A THE CRYOSPHERE

Autumn 2019
4 Credits, SLN 14993
4 Credits, SLN 15015

M-W-F, 1:30 - 2:50 pm. **Room:** JHN 127
Mon.-Wed.: Lectures, Fri: Lab/Discussion

Class web page: <http://courses.washington.edu/ess431/>

Instructor:

Knut Christianson
218 ATG Building
knut@uw.edu

T.A.'s:

Andrew Hoffman
210 ATG Building
hoffmaao@uw.edu

Alexander Huth
210 ATG Building
ahuth@uw.edu

Additional Instructors: Conway, Hallet, Light, Roe, Steig, Waddington, Warren

Office Hours: Tu, Th 2-3 pm, Drop in / By Appointment (Knut)

Required Text: *The Cryosphere* by S.J. Marshall

Optional books:

Glacial Geologic Processes by D.J. Drewry
Physics of Glaciers by K. Cuffey and W.S.B. Paterson
Glaciers of North America by S. Ferguson
Avalanche Handbook by D. McClung & P. Schaerer

Grade Breakdown - ESS 431:

[25%] – Problem Sets (out of class)
[30%] – Midterm Exam
[30%] – Final Exam
[15%] – Participation (reading questions)

Grade Breakdown - ESS 505:

[25%] – Problem Sets (out of class)
[25%] – Midterm Exam
[25%] – Final Exam
[10%] – Term paper/project
[15%] – Participation (reading questions)

Late Work Policy:

Work for this class will typically be assigned with the following schedule:

- 1) Reading questions, due each day at the beginning of lecture
- 2) Lab assignments, completed in class each Friday
- 3) Problem sets, due one week after posting

Reading questions can be submitted either in person, via Canvas or by email (in the event that you cannot be in class), but will not be accepted late. Reading assignments and labs will be graded as C/NC and will be considered part of the participation portion of your grade.

Problem sets will be graded based on the accuracy of your responses. They are due at the beginning of class, one week after assigned. If you feel you will not be able to complete the assignment on time, contact Knut, Andrew, or Alex before the work is due and we will accommodate you. Otherwise, late homework turned in within one week of the due date will be penalized by 10%, with additional 10% penalty a week for further delay. You are encouraged to

work together on solving the problems, but you are expected to write and turn in your own answers.

Missing Exam Policy:

Exams can only be made up under extraordinary circumstances. The instructor must be notified as early as circumstances allow if you have missed or expect to miss an exam.

Course Content:

This course is taught by a group of UW faculty and senior grad students who all have active research interests in **Glaciology**, defined in a broad sense as ***ice in the environment***. The course covers the molecular structure of water and ice, ice in clouds, glaciers and polar ice sheets, glacial geology, frozen ground and permafrost, seasonal snow, sea ice, and ice ages. Instructors relate the various forms of ice to other processes such as polar oceanography, atmospheric circulation, and climate change. The course achieves the advanced standards expected of a 400-level course by challenging students to critically understand concepts such as conservation laws and how to deduce behaviors of macroscopic systems from knowledge of microscopic properties, rather than by introducing advanced mathematical or physical complexity.

Course Structure:*Principles of Glaciology:*

Unit 1 – Overview of the Cryosphere: what it is and how we observe it

Unit 2 – Ice formation and molecular structure/behavior

Unit 3 – Ice Dynamics

Unit 4 – Alpine and continental glacier systems

----- Midterm 1 ----- [Friday, November 8th 1:30-2:50 pm]

Special Topics in Glaciology:

Avalanches, Paleoclimate, Glacial Geology and Erosion, Sea Ice, Modern Change

----- Final Exam ----- [Monday, December 9th 2:30-4:20 pm]

The final exam is cumulative, but it will focus on material presented in the second half of the course.

Field Trip:

We plan a field trip to Easton Glacier on Mt. Baker on Saturday, October 26th. There will be a homework assignment associated with the field trip. If you are unable to go on the trip, it will be possible to do an alternative assignment; however, if you can possibly go on the field trip, this should be your preferred option.

Additional Comments:

This course is designed for undergraduate students with some math and science background, such as Physics 121/122. It should be well-suited for ESS Majors who have fulfilled their physics requirements, and for Atmospheric Sciences students pursuing the Climate track. Other

undergraduates can do well in the class if they are comfortable with basic physics ideas such as heat conduction, vapor pressure, and forces. Please talk with an instructor or T.A. if you do not have the PHYS 121/122 prerequisites.

Graduate students take ESS 505 because of an interest in ice in their research, or to fulfill the breadth requirement in the ESS graduate program. For all students, this course is a way to discover the range of UW faculty research interests in Glaciology.

Safety:

If you feel unsafe or at-risk in any way while taking any course, contact [SafeCampus](#), 206-685-7233 anytime—no matter where you work or study—to anonymously discuss safety and well-being concerns for yourself or others. SafeCampus can provide individualized support, discuss short- and long-term solutions, and connect you with additional resources when requested. For a broader range of resources and assistance see the [Husky Health & Well-Being](#) website.

Access and Accommodations:

Your experience in this class is important to me. If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course.

If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at:

011 Mary Gates Hall; Box 352808; Seattle, WA 98195-2808
uwdrs@uw.edu
206-543-8924 (Voice & Relay)
206-616-8379 (Fax)

DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

Religious Accommodation:

Washington state law requires that UW develop 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 policy, including more information about how to request an accommodation, is available at [Religious Accommodations Policy \(https://registrar.washington.edu/students/religious-accommodations-request/\)](https://registrar.washington.edu/students/religious-accommodations-request/). Accommodations must be requested within the first two weeks of this course using the [Religious Accommodations Request form \(https://registrar.washington.edu/students/religious-accommodations-request/\)](https://registrar.washington.edu/students/religious-accommodations-request/).

Academic Integrity:

The University of Washington Student Conduct Code ([WAC 478-121](#)) defines prohibited academic and behavioral conduct and describes how the University holds students accountable. We expect that you will know and follow university policies on cheating and plagiarism.

Acts of academic misconduct include:

- Cheating:
 - unauthorized assistance in person and/or online for assignments, quizzes, tests or exams
 - using another student's work without permission and instructor authorization
 - allowing anyone to take a course, assignment or exam for you without instructor authorization
- Falsification: intentional use of falsified data, information or records
- Plagiarism: representing the work of others as your own without giving appropriate credit to the original author(s)
- Unauthorized collaboration: working with each other on assignments without permission
- Engaging in behavior prohibited by an instructor
- Multiple submissions of the same work in different courses without instructor permission
- Deliberately damaging or destroying student work to gain advantage
- Unauthorized recording, and/or subsequent dissemination of instructional content

Any suspected cases of academic misconduct will be handled according to university regulations. For more information, see the College of the Environment's [Academic Misconduct Policy](#) and the [Community Standards and Student Conduct](#) website.

Other courses about ice and glaciers:

If you feel that you are not ready to take ESS 431, but you have an interest in glaciers and ice, you can also consider two other courses:

ESS 203, Glaciers and Global Change, Winter 2020

Instructor: Ed Waddington, Earth and Space Sciences.

This course is designed for students without a science background who are interested in glaciers, how glaciers flow, how they advance and retreat as climate changes, and how information about past climates is recorded within the layers of polar glaciers and ice sheets.

ESS 203 qualifies as a *Natural World* (NW) course, and as an *Individuals and Society* (I&S) course, with optional *Writing credit* (W).

ESS 302, Great Ice Age, not scheduled 2019-2020 academic year

Instructor: Terry Swanson, Earth and Space Sciences

This course is designed for students with at least one basic geology class in their background. It focuses on geological changes and the continental-scale ice sheets associated with the Pleistocene Ice Ages of the past two million years. ESS 302 is also a *Natural World* (NW) course.