

# ICE SHEETS AND GLACIERS WINTER 2023

## GEOG 420

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### CLASS SCHEDULE

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Section	Location	Time	Instructor(s)
<b>GEOG 420</b> 001 [LEC]	RCH 309	Tuesdays & Thursdays 11:30 a.m. - 12:50 p.m.	Wesley Van Wychen wesley.van.wychen@uwaterloo.ca
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### INSTRUCTOR / TA INFORMATION

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Instructor: Wesley Van Wychen

Office: EV1-230

Email: wvanwychen@uwaterloo.ca (please note that I will try to respond to messages within two business days of receipt).

Office hours: Tuesdays 10:00-11:30 am, or by appointment.

### COURSE DESCRIPTION

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#### *Calendar Description for GEOG 420*

This course will introduce the basics of glaciology, with a focus on climate change and physical processes. Key areas covered by the course include glacial mass change in a warming climate, ice dynamics, various spatial and temporal scales of glaciation, and geomorphological features caused by glaciation.

Prereq: GEOG 201/305 or GEOG 209; Level at least 3A. Antireq: GEOG 474 001 W17

The world's glaciers and ice sheets are changing as a result of human-driven climate change. We begin this course by learning what glaciers are, how they form and the controls on their global distribution. We then focus on the concepts of glacier mass balance, glacier hydrology and glacier motion. Finally, we will explore the wider implications of glacier mass loss.

## LEARNING OUTCOMES

### By the end of this course students should be able to:

Describe the core concepts of glacier mass balance
Identify and describe the components of glacier hydrology (surface hydrology, englacial hydrology, basal hydrology and pro-glacial hydrology)
Explain why glaciers flow and how this varies in time and space
Critically analyze the implications of regional glacier loss in a warming climate
Demonstrate critical thinking and knowledge synthesis through the preparation and presentation of a formal research project

## TENTATIVE COURSE SCHEDULE

The instructor reserves the right to modify the course schedule and lecture order as appropriate.

Week	Date	Topic	Assessment	Readings
1	Jan 10th	Course Introduction		Ch. 1
	Jan 12th	Global distribution of Glaciers		
2	Jan 17th	How to make a Glacier		Ch. 2
	Jan 19th	Glacier Mass Balance		Ch. 4
3	Jan 24th	Glacier Hydrology		Ch. 5
	Jan 26th	Research Paper Work Period		
4	Jan 31	Ice Flow Processes		
	Feb 2nd	Glacier Dynamics	<b>Proposal/Annotated Bibliography Due (15% of Final Grade)</b>	Ch. 6
5	Feb 7th	Class Seminar #1	<b>Class Seminar #1 (5% of final grade)</b>	
	Feb 9th	Glacier Dynamics (con't)		
6	Feb 14th	Glacial Geomorphology (erosion)		Ch. 10 (pp. 371-386; 436-440)
	Feb 16th	Mid-Term	<b>Mid-Term Quiz (10% of final grade)</b>	

READING WEEK	Feb 21st	NO CLASSES		
READING WEEK	Feb 23rd	NO CLASSES		
7	Feb 28th	Glacial Geomorphology (erosion)		Ch. 11 (pp. 442-492; 510-535)
	Mar 2nd	Class Seminar #2	<b>Class Seminar #2 (5% of final grade)</b>	
8	Mar 7th	Research Paper Work Period		
	Mar 9th	The Greenland Ice Sheet	<b>Term Paper - Draft 1 Due (10% of final grade)</b>	
9	Mar 14th	The Antarctic Ice Sheet		
	Mar 16th	Measuring Glaciers (Field methods)		
10	Mar 21st	Measuring Glaciers (Remote Sensing)		
	Mar 23rd	Research Paper Work Period		
11	Mar 28th	Final Project Presentation	<b>Term Paper Presentations (10% of final grade)</b>	
	Mar 30th	Final Project Presentation		
12	Apr 4th	Final Project Presentation		
	Apr 6th	Final Project Presentation/Research Paper work period		

## TEXTS / MATERIALS

Title / Name	Notes / Comments	Required
Benn, D. and Evans, D. 2010. Glaciers and Glaciation, 2nd Edition.	Copies of this textbook are available at the UW bookstore. The course text has been used in the past and used copies may be available. A copy has also been placed on reserve at the Dana Porter Library.	Yes

## STUDENT ASSESSMENT

Component	Value
Class Seminars (Completed Feb 7th and Mar 2nd)	(10% - 2 worth 5% each)
Term Paper Proposal and Annotated Bibliography (Due Feb 2nd)	(15%)
Mid-Term (Completed Feb 16th)	(10%)
Term Paper - Draft 1 (Due Mar 9th)	(10%)
Term Paper Presentation (Completed Mar 28th, Mar 30th, Apr 4th, Apr 6th))	(10%)
Final Paper - Final Draft (Due Apr 10th)	(25%)
Final Exam (Scheduled during the exam period)	(20%)

**All assessments are to be submitted via the 'dropbox' tool in the course LEARN page (except for the mid-term quiz and final exam).**

### Assessments:

#### *Class Seminars:*

Throughout the course there will be time set aside for class seminars (times and dates noted in the course outline). Readings will be assigned prior to the topic of that week (either in the preceding class or on LEARN). In total there are 2 class seminars, each of which is worth 5% of the final grade (collectively they comprise 10% of the total grade). Students are expected to hand in a ~one page summary of the paper that will be discussed prior to the class seminar in order to provide evidence that they have prepared for the class discussion and completed the assigned reading. Class discussions will be held during our regular in class time. This summary should be uploaded to the appropriate dropbox on the course LEARN page prior to the beginning of the class seminar.

#### *Major Research Project:*

Students will work on a major research assignment throughout this course, which is comprised of the following elements:

1. Research Proposal and Annotated Bibliography
2. Term Paper (First Draft)
3. Term Paper (Final Draft)
4. Presentation of Final Project

Students will choose a glaciated region of the world and will write a major research paper which outlines the ongoing changes to glaciers and their implications for that region. More details will be provided at the start of the course.

A late penalty of 10% per day (including weekends) will be applied to all elements of the major research assignment (1-4 above) without a valid reason for lateness (e.g. a doctor's note or bereavement or at the discretion of the instructor). This 10% late penalty is applied immediately after the assignment is due. Any assignments submitted 10 days beyond

the due date will not be accepted (unless at the discretion of the instructor). The instructor reserves the right to modify this late penalty in situations where it is deemed appropriate.

*Requests for Extensions: Requests of extension of the due dates for the submission of assignments is at the discretion of the instructor and will only be considered in situations that are deemed necessary. Any requests should be made to the instructor before the due date of an assignment.*

### *Mid-Term Quiz*

There will be one mid-term quiz which will cover materials learned up to the point that the mid-term is held. Mid-term content will cover course materials presented in lectures, in the text book and in the course seminars.

### *Final Exam*

There will be a final exam scheduled during the exam period. The final exam will cover all course content, including lectures and class seminars.

### **Self-declared absence**

As you are aware, you have one self-declared absence (SD) per term available via Quest to provide you with a 48 hour extension on any component in one of your courses. If you choose to use your self-declared absence this course, the following policies will apply:

SD absence declared for a period which includes a due date for a written component of the term paper-> extension for 48 hrs. on that component. If the due date is beyond the 48 hour SD absence, it is unaffected. For example, your paper is due Feb. 13th. If you invoke the SD absence on the 12th or 13th, the due date moves to the 15th for you. If you invoke it on the 9th or 10th, the original date of Feb. 13th does not change.

SD absence declared for the mid-term term (Feb 16th) -> weight of the test transfers to the final exam

SD absence declared for your term paper presentation -> you will provide a pre-recorded presentation of your work after the 48 hr period has elapsed.

## **ASSIGNMENT SCREENING**

No assignment screening will be used in this course.

## **ADMINISTRATIVE POLICY**

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**Territorial Acknowledgement:** The University of Waterloo acknowledges that much of our work takes place on the traditional territory of the Neutral, Anishinaabeg and Haudenosaunee peoples. Our main campus is situated on the Haldimand Tract, the land granted to the Six Nations that includes six miles on each side of the Grand River. Our active work toward reconciliation takes place across our campuses through research, learning, teaching, and community building, and is centralized within the [Office of Indigenous Relations](https://uwaterloo.ca/indigenous) (<https://uwaterloo.ca/indigenous>)

**Intellectual Property:** For further information on IP related to teaching, please see [https://uwaterloo.ca/legal-and-immigration-services/sites/ca.legal-and-immigration-services/files/uploads/files/volume\\_1\\_issue\\_3\\_winter\\_2018.pdf](https://uwaterloo.ca/legal-and-immigration-services/sites/ca.legal-and-immigration-services/files/uploads/files/volume_1_issue_3_winter_2018.pdf) ([https://uwaterloo.ca/legal-and-immigration-services/sites/ca.legal-and-immigration-services/files/uploads/files/volume\\_1\\_issue\\_3\\_winter\\_2018.pdf](https://uwaterloo.ca/legal-and-immigration-services/sites/ca.legal-and-immigration-services/files/uploads/files/volume_1_issue_3_winter_2018.pdf)) and the Guidelines for Faculty, Staff and Students Entering Relationships with External Organizations Offering Access to

Course Materials, <https://uwaterloo.ca/secretariat/faculty-staff-and-students-entering-relationships-external> (<https://uwaterloo.ca/secretariat/faculty-staff-and-students-entering-relationships-external>) . The following text is recommended:

Students should be aware that this course contains the intellectual property of their instructor, TA, and/or the University of Waterloo. Intellectual property includes items such as:

- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student's educational experience. However, sharing this intellectual property without the intellectual property owner's permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

Permission from an instructor, TA or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

**Research Ethics:** The University of Waterloo requires all research conducted by its students, staff, and faculty which involves humans as participants to undergo prior ethics review and clearance through the Director, Office of Human Research and Animal Care (Office). The ethics review and clearance processes are intended to ensure that projects comply with the Office's Guidelines for Research with Human Participants (Guidelines) as well as those of provincial and federal agencies, and that the safety, rights and welfare of participants are adequately protected. The Guidelines inform researchers about ethical issues and procedures which are of concern when conducting research with humans (e.g. confidentiality, risks and benefits, informed consent process, etc.). If the development of your research proposal consists of research that involves humans as participants, the please contact the course instructor for guidance and see: <https://uwaterloo.ca/research/office-research-ethics> (<https://uwaterloo.ca/research/office-research-ethics>)

**Anti-racism Statement:** The University of Waterloo does not tolerate racism or any other form of discrimination and expects campus community members to contribute to a culture where all members feel safe and valued. Any member of the campus community who has experienced racism or discrimination at the University is encouraged to seek guidance from the Office of Equity, Diversity, Inclusion & Anti-racism (EDI-R) via email at [equity@uwaterloo.ca](mailto:equity@uwaterloo.ca) (<mailto:equity@uwaterloo.ca>) or through their website: [uwaterloo.ca/human-rights-equity-inclusion/about/equity-office3](https://uwaterloo.ca/human-rights-equity-inclusion/about/equity-office3)

**Co-op interviews and class attendance:** Co-op students are encouraged to try and choose interview time slots that result in the least amount of disruption to class schedules. When this is challenging, or not possible, a student may miss a portion of a class meeting for an interview. Instructors are asked for leniency in these situations; but, a co-op interview does not relieve the student of any requirements associated with that class meeting.

When a co-op interview conflicts with an in-class evaluation mechanism (e.g., test, quiz, presentation, critique), class attendance takes precedence and the onus is on the student to reschedule the interview. CEE provides an interview

conflict procedure to manage these situations.

Students will be required to provide copies of their interview schedules (they may be printed from WaterlooWorks) should there be a need to verify class absence due to co-op interviews.

**Declaring an absence:** Regardless of the process used to declare an absence, instructors maintain agency over decisions regarding course component accommodations.

Self-declared absences (for flu-like illness, short-term 48 hour self declared absences) must be submitted through Quest.

Absences requiring documentation (e.g. Verification of Illness Form, bereavement, etc.) - send your documentation to env-vif@uwaterloo. Do not send documentation to your advisor, course instructor, teaching assistant, or lab coordinator. Submission to env-vif@uwaterloo.ca () will notify all of your instructors of your absence. Students taking courses in Arts that require accommodation, should reach out to those instructors independently.

**Mental Health:** The University of Waterloo, the Faculty of Environment and our Departments/Schools consider students' well-being to be extremely important. We recognize that throughout the term students may face health challenges - physical and / or emotional. **Please note that help is available.** Mental health is a serious issue for everyone and can affect your ability to do your best work. Counselling Services <https://uwaterloo.ca/campus-wellness/> (<https://uwaterloo.ca/campus-wellness/>) is an inclusive, non-judgmental, and confidential space for anyone to seek support. They offer confidential counselling for a variety of areas including anxiety, stress management, depression, grief, substance use, sexuality, relationship issues, and much more.

All students are encouraged to download the WatSAFE app which is available free through the google and iOS app stores. The WatSAFE app provides on- and off-campus contacts for students in distress, including international students, and other information related to campus safety and security.

**Religious Observances:** Students need to inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

**Communications with Instructor and Teaching Assistants:** All communication with students must be through either the student's University of Waterloo email account or via LEARN. If a student emails the instructor or TA from a personal account they will be requested to resend the email using their personal University of Waterloo email account.

**Recording lecture:** Use of recording devices during lectures is only allowed with explicit permission of the instructor of the course. If allowed, video recordings may only include images of the instructor and not fellow classmates. Posting of videos or links to the video to any website, including but not limited to social media sites such as: facebook, twitter, etc., is strictly prohibited.

## UNIVERSITY POLICY

**Academic integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check [the Office of Academic Integrity](https://uwaterloo.ca/academic-integrity/) (<https://uwaterloo.ca/academic-integrity/>) for more information.]

**Grievance:** A student who believes that a decision affecting some aspect of their university life has been unfair or unreasonable may have grounds for initiating a grievance. Read [Policy 70, Student Petitions and Grievances, Section 4](#)

(<https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-70>) . When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

**Discipline:** A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for their actions. [Check [the Office of Academic Integrity](https://uwaterloo.ca/academic-integrity/) (<https://uwaterloo.ca/academic-integrity/>) for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to [Policy 71, Student Discipline](https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-71) (<https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-71>) . For typical penalties, check [Guidelines for the Assessment of Penalties](https://uwaterloo.ca/secretariat/guidelines/guidelines-assessment-penalties) (<https://uwaterloo.ca/secretariat/guidelines/guidelines-assessment-penalties>) .

**Appeals:** A decision made or penalty imposed under [Policy 70, Student Petitions and Grievances](https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-70) (<https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-70>) (other than a petition) or [Policy 71, Student Discipline](https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-71) (<https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-71>) may be appealed if there is a ground. A student who believes they have a ground for an appeal should refer to [Policy 72, Student Appeals](https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-72) (<https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-72>) .

**Note for students with disabilities:** [AccessAbility Services](https://uwaterloo.ca/disability-services/) (<https://uwaterloo.ca/disability-services/>) , located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.

**Turnitin.com:** Text matching software (Turnitin®) may be used to screen assignments in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, therefore students must be given an alternative (e.g., scaffolded assignment or annotated bibliography), if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin in this course.

It is the responsibility of the student to notify the instructor if they, in the first week of term or at the time assignment details are provided, wish to submit alternate assignment.