

GEOG 209 – Hydroclimatology – Spring 2023

Contact Information

Instructor: Dr. Quinn Lewis

Office: EV1-233

Office Hours: M 1:00 PM – 2:00 PM EST and by appointment (in-person or online)

Email: quinn.lewis@uwaterloo.ca

TA: Rachel Sun, 178sun@uwaterloo.ca

Office Hours : T 10:30-11:30, EV1-356

TA : Jake Ferguson, j5ferguson@uwaterloo.ca

Office Hours : Th 3:00-5:00 EV1-244G



Course Description

This course provides students with a thorough background of the fundamental processes governing the climate and hydrological systems, and the links between them. The course first reviews fundamental atmospheric and hydrologic processes, and traces the flow of energy and water between the Earth's surface and the atmosphere.

Then the physical processes controlling the water cycle are examined, including evapotranspiration, precipitation, runoff and water storage in the natural reservoirs (including soil and groundwater, rivers, lakes, and wetlands). Finally, students will learn about the roles of water and climate in the Earth's main biomes.

Goals and Expected Learning Outcomes

Students will be given the opportunity to gain experience manipulating real hydrological and meteorological data. This course will serve as an introduction to near-surface hydroclimatic processes and their feedbacks, and climate change, forming essential background for upper level courses in geography and environmental sciences. The fundamental knowledge and skills developed in this course will provide students with the basis to appreciate and understand the natural hydrologic and climate systems.

Specific learning outcomes are as follows:

1. Describe the balances of energy and water in the Earth's climate system.
 - a. For example, calculate energy balances for the Earth and specific systems.
2. Understand the processes controlling the cycle of water between the surface and the atmosphere.
 - a. For example, be able to determine estimates of water residence time on and below Earth's surface.
3. Describe how and where water is stored in its three phases, and the effect of changes of state.
 - a. For example, know the percentages of fresh water stored in each state and in different systems.
4. Appreciate the different roles of the water cycle in climate change.
 - a. For example, determine why certain areas of the world might become wetter while other areas might be drier.
5. Apply this knowledge using actual datasets and real-world case studies.
 - a. For example, learn how large-scale damming of rivers in the Amazon might affect the region's hydroclimate.

Courses in the Context of COVID-19 – it's basically not a thing anymore!

- This is an in-person course. We will operate under the assumption that all meetings will take place in-person. **You are expected to come to class unless you have an excused reason to miss.** Let the instructor and your TA know **as soon as possible** if you are looking for an absence to be excused.
- In the event classes are cancelled in the short term: online adaptation of planned material. In the event classes are cancelled in the long term: full shift to online-specific teaching material.
- If a student must miss class due to self-isolation, an agreement between the student and instructor will be reached on how to proceed.
- The instructor reserves the right to alter the specifics of each activity for practical reasons or as a response to student feedback.

This course must fully comply with University-wide COVID guidelines found here:

<https://uwaterloo.ca/coronavirus/>. This includes rules on masking, distancing, and so on.

Class Schedule (Lectures 8:30-10:20, Arts Lecture 208)

Week	Topic	Reading Material*	Class Activity	Lab Activity**
1 Begins May 8	Introduction to hydroclimatology, importance of water	Post an interesting article related to hydroclimate	Class introduction, setting	Assigned: Lab 0 – Introduction to Hydroclimatology

			expectations, and Q and A	
2 May 15	Energy balance 1	Chapter 1 of textbook (see below for textbook information)		Assigned: Lab 1 – Gaining Real-world Hydroclimatology Skills Due: Lab 0
3 May 22	Energy balance 2	Chapter 2		Lab 1
4 May 29	Hydrological cycle and global water balance	Chapter 3		Assigned: Lab 2 – Hydrologic Cycle Due: Lab 1
5 June 5	Precipitation	Chapter 4	Midterm Exam Review	Lab 2
6 June 12	Evaporation	Chapter 5	Midterm Exam (covers material from weeks 1-5)	Assigned: No Lab (midterm week) Due: Lab 2
7 June 19	Water storage and flow	Chapter 6		Assigned: Lab 3 – Streamflow
8 June 26	Hydroclimate spatial variations	Chapter 7		Lab 3
9 July 3	Hydroclimate temporal variations	Chapter 8		Assigned: Lab 4 – Evapotranspiration Due: Lab 3
10 July 10	Hydroclimate extremes – flooding and drought	Chapter 9		Lab 4
11 July 17	Climate feedbacks	Chapter 10		Assigned: Lab 5 – Conclusion and Applications Due: Lab 4
12 July 24	Course review		Final Exam Review	Due: Lab 5

Final Examination Period begins August 4 and ends August 19. Final Examination schedule released June 2. Final and Midterm Exams will be online. Go [here](#) for important dates.

*any additional reading material will be posted on Learn.

**Labs are due Friday at 11:59 PM EST of the scheduled week, turned in to Learn. For example, Lab 0 is due Friday May 19, 11:59 PM EST.

Study Breaks:

Victoria Day: Monday, May 22 – *make up day Tuesday, May 23*

Canada Day: Monday, July 3, 2022 – *make up day Monday, July 31*

Civic Day: Monday, August 7

Assessment

Attendance (5%)

Midterm Exam (open book/"take home") – done online (15%)

Final Assessment (open book/"take home") – done online (25%)

Laboratory Assignments (55%)

Late work: Work between 0 and 2 days late will be assessed a 15% penalty. Work between 2 and 5 days late will be assessed a 30% penalty. Work over 5 days late will be assessed a 50% penalty. Late work will not be accepted after more than 3 weeks past due date.

Example – you submit a lab 3 days late, and your grade is 30/30 (100%). You have an adjusted grade of $100 \cdot (30/30) \cdot 0.7 = 70\%$. You submit a lab 18 hours late and your grade is 25/30 (83%). You have an adjusted grade of $100 \cdot (25/30) \cdot .85 = 70.8\%$.

Textbook/Readings

“Hydroclimatology: Perspectives and Applications”, M.L. Shelton, Cambridge, 2009. [freely available via UW library website. Hard copies available at UW Bookstore, online retailers and used from various sources.]

Any additional readings or resources will be provided by the instructor on Learn.

Attendance

I will randomly take attendance during 8 class periods by providing the answer to a LEARN quiz during class time. You will have until the end of the day of the lecture to answer the attendance question on Learn. For every correct answer, you will receive 1% of your total class grade, for a maximum of 5%. In other words, to get the full 5% of the attendance grade you need to answer 5 of the 8 quizzes correctly. Therefore, you don't have to come to every single lecture, but you should make as many as possible.

Midterm and Final Assessment

The course assessments will be “open book” examinations, hosted online, that will include multiple choice and short answer questions. Students will have at least 48 hours to complete the assessment and are allowed to use all class material and online resources. *The midterm and final assessments are to be done individually.*

Laboratory Assignments

We are finally able to spend time in the river, woods, and soil to get hands on experience with the data collection, analysis, and science communication that is key in hydroclimatology. Hydrology and climatology are visible and visceral topics that lend themselves to experiential work, but we will also use modern computing and online resources that scientists use on a daily basis. Laboratory assignments will leverage new and emerging online technology and datasets, and will use real data in the same ways real hydrologists and climatologists do.

Students will be assigned an introductory “Lab 0”, which will be based on completion and effort. “Lab 0” is designed to engage students and assess their experiences in the course. If completed, all students will receive 5% of the lab component grade (2.75% of the course grade). Labs 1-4 will each be worth 20% of the lab component grade (11% of the course grade), and Lab 5, which serves as a course conclusion, will be worth 15% of the lab component grade (8.25% of the course grade). That’s better than a lab final exam, right?

Lab 0: 5%

Labs 1-4: 80%

Lab 5: 15%

More information on each lab will be provided during the week the lab is assigned.

Expectations and Diversity Statement

I expect you:

- to engage in this course, enjoy it, and ask questions if you do not understand something
- to produce your own work - no cheating or plagiarism

I expect myself:

- to be prepared and organized
- to be available if you need assistance
- to give fair assignments and exams
- to treat all students with respect

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students’ learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, native language, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

Any student who may need extra assistance meeting the requirements of this course should email me as soon as possible so we can discuss accommodations to ensure your success in the course.

Turnitin.com: Text matching software 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 (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. The alternative to using this software is to prepare an annotated bibliography for each assignment. For advice on how to prepare an annotated bibliography, see: <https://guides.library.cornell.edu/annotatedbibliography>.

Additional Statements

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 <http://www.uwaterloo.ca/counselling-services> 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.

NEW: ChatGPT and AI: Our instructional team is intelligent and technological enough to understand when cheating with the help of AI is probable. We reserve the right to use tools to confirm the use of AI on assignments. AI can be a useful study tool, but we consider pasting anything from an AI tool directly into an assignment as cheating. Plus, you won't do well on the exams if you cheat your way through labs or expect AI to answer the exam questions.

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.

Unclaimed assignments: Unclaimed assignments will be retained until one month after term grades become official in quest. After that time, they will be destroyed in compliance with UW's [confidential shredding procedures](#).

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.