GEOG 3105-A – Climate and Atmospheric Change: Course Outline

Department of Geography and Environmental Studies, Carleton University

Course credit:	0.5
Course outline:	Winter 2026
Lectures:	Tuesdays from 6:35-8:25 PM
Labs:	Tuesdays from 12:35-2:25 PM Tuesdays from 2:35-4:25 PM
Instructor:	Adam Kirkwood, Ph.D.
Contact information:	adamkirkwood@cunet.carleton.ca
Office hours:	Tuesdays from 8:30-9:30 PM in SH 417, or by appointment.
Teaching Assistants:	Anna Brownlee, AnnaBrownlee@cmail.carleton.ca

Course description:

Although the Earth's climate has varied appreciably in the past due to natural forcing, human activities are increasingly contributing to climate warming. Since the Earth's climate system is interlinked with many biophysical processes on the planet, climate change has important repercussions. This course will examine climate and atmospheric change from a scientific perspective. We will look at proxy evidence of past climate change followed by historical and instrumental records, which reveal recent and current climate variability, and then models, which enable the projection of future climates under certain scenarios. Students will gain an understanding of the relative importance of climate forcing factors and feedbacks as well as an appreciation of the uncertainties and outstanding debates in climate science. The focus of this course is how and why our climate changes from an interdisciplinary scientific perspective. However, we will take some time to examine some implications and impacts of climate change as well as the interface between science, the media, the public and policy.

Course Objectives:

By the end of this course, students will have a strong understanding of the science behind climate change. Specifically, students will be able to:

1) Explain how anthropogenic climate change differs from natural variations in climate;
2) Understand the spatial and temporal patterns of climate change, and the physical mechanisms driving them;
3) Engage in discourse about the causes and potential solutions to climate change;
4) Communicate complex scientific topics through both written and verbal communications in a way that is scientifically accurate and understandable.

General communication and asking questions to the teaching team

All lecture and lab materials will be posted on Brightspace, and general announcements related to the course will be made in the accouchements section of Brightspace. Extension requests, accommodation requests, or otherwise private/personal correspondence should be sent to adamkirkwood@cunet.carleton.ca.

The teaching team is happy to answer any questions about course content or assessments for students. This will be done through the course Brightspace under the discussion forum titled "Ask the teaching team. Any questions related to content or assessment need to be asked on this forum, and not through email.

Course Schedule:

Note that labs do not occur every week, and only occur on the weeks listed below. Note that schedule is subject to change, and the most up-to-date syllabus will always be posted on Brightspace.

Week	Lecture Topic	Lab	Lab Submission Date
1: January 6	- Course introduction - Climate change		
2: January 13	- Energy balance and climate system	**Lab 1 –** Writing science/project proposal	
3: January 20	- Evidence for modern climate change		**Lab 1: Thursday, January 22**
4: January 27	- Evidence for past climate change	**Lab 2 –** Climate change and AI	
5: February 3	- Greenhouse gas and climate forcing		**Lab 2: Thursday, February 5**
6: February 10	- Feedbacks and the climate system	**Lab 3 –** Recent climate	
7: February 17	**READING WEEK – NO CLASS**		
8: February 24	- Climate models		**Lab 3: Thursday, February 26**
9: March 3	- Impacts and consequences of climate change	**Lab 4 –** Future climate	
10: March 10	- Extreme and attribution of climate change	**Lab 4 –** Future climate	**Lab 4: Sunday, March 15**
11: March 17	- Ozone layer - Internal climate variability		
12: March 24	- Climate science and society		
13: March 31	- Exam review		**Final group project: April 2**

Course Evaluation:

The course evaluation will consist of 4 labs, a group report, and a cumulative final examination. The weighting of evaluation is as follows:

Lab 1 – Science writing	10%
Lab 2 – Climate change and AI	10%
Lab 3 – Recent climate	10%

Lab 4 – Future climate	15%
Final group report	25%
Final Examination	30%

Lab Assignments

Students may work with classmates on assignments, but all submitted assignments must be **original and unique**. Any material from outside of course content must be acknowledged and cited properly. It is expected that assignments will be submitted with proper spelling and grammar and in the format requested in assignment guidelines. Specific instructions for assignments will be provided including the marks associated with each question of the assignment, and marks associated with structure/clarity.

SUBMISSION OF ASSIGNMENTS: Assignments should be submitted by **11:59 PM** on the date specified in the assignment instructions to the corresponding assignment submission on Brightspace.

LATE POLICY FOR ASSIGNMENTS: Late submission of assignments will be deducted 5% per day (including weekends) following the 11:59 PM deadline, up to a maximum of 5 days. Following 5 days, assignments will not be graded and assigned a value of 0, unless arrangements are made with the course instructor who agrees to mark the assignment. For assignment 5, late assignments will not be accepted, and deadline extensions will not be granted.

DEADLINE EXTENSIONS: Deadline extensions must be requested **at least 3 days in advance of the assignment due date**. Requests for extensions must be made with the course instructor, teaching assistants are not able to grant extensions, so please do not contact them for this purpose. Deadline extensions will not be considered for longer than 3 days unless for medical or bereavement purposes.

Final group assignment

The final assignment of this course will be completed in groups of 4-5 people that are assigned by the course instructor. The assignment is designed to combine both group and individual assessments. Each student will receive:

1) A group grade based on the quality of the final report;
2) An individual grade based on an independently submitted individual component, and;
3) An adjustment based on confidential peer evaluation of contributions to the groups work.

All students are expected to contribute equitably to the group work, communicate professionally and in a timely manner, and participate actively in scheduled group work during labs and in-class discussion periods. If students cannot resolve conflict internally within the group, they are encouraged and expected to bring concerns to the teaching team early so that facilitation and support can be provided. It is important that clear documentation is provided should there be any conflict among the group to allow the teaching team to make informed decisions regarding the path forward.

The instructor will use anonymous peer evaluation forms to adjust individual grades up or down relative to the group grade. Persistent non-participation or any serious breaches of

professional/academic conduct may result in penalties or removal from the group by discretion of the instructor.

Final exam

The final exam will be scheduled during the final exam period (April 11-23, 2026) be inclusive of all material covered in lecture. While there will not be specific questions related to content covered in lab, the material covered may be relevant and helpful for long-answer questions.

Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

Course readings

Required reading:

1. IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 3–32, doi:10.1017/9781009157896.001.

2. Arias, P.A., et al., 2021: Technical Summary. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 33–144. doi:10.1017/9781009157896.002.

3. IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, *In press*, doi:10.1017/9781009157896.

Note that all the component chapters of this report are available in draft here: https://www.ipcc.ch/report/ar6/wg1/ *and can be downloaded and cited on a per chapter basis. Students will be expected to consult the full AR6 WG1 report to learn about specific issues (especially for their term paper) or for further details related to the lecture (relevant sections will be recommended for you).* ***Unless you have a specific reason to do so, please avoid consulting out-of-date IPCC reports.***

Recommended supplemental reading:

1. Dessler, A.E. 2021: Introduction to Modern Climate Change. Cambridge University Press, Cambridge, United Kingdom. A second edition of this book is acceptable as well. [On reserve at the library]. Students may find this textbook more accessible than the IPCC reports.

2. Bush, E. and Lemmen, D.S., editors (2019): Canada's Changing Climate Report; Government of Canada, Ottawa, ON. 444 p. https://changingclimate.ca/CCCR2019/ This is the most recent comprehensive report on the impact of climate change in Canada (natural sciences perspective only).

Other materials (articles, etc.) that may be highlighted during the lectures will be available through Brightspace/ARES.

Key academic dates:

- **January 16, 2026:** Last day for registration and course changes for full winter course
- **January 31, 2026:** Last day to withdraw from full winter courses with a full fee adjustment
- **March 15, 2026:** Last day to request Formal Examination Accommodations with the Paul Mention Centre for Students with Disabilities. Last day for academic withdrawal from full winter course.
- **April 11-23, 2026:** Final examinations for full winter course.

Online tools:

- **Brightspace**: Brightspace will be the dominant teaching tool in this course, and all course information, lecture content, assignment content, assignment submissions, and grade tracking will be completed in Brightspace.
- **Mentimeter**: Mentimeter is an online platform that allows student engagement during lecture, including the generation of word clouds, polls, multiple choice questions, etc., and will often be incorporated into lectures.
- **Wooclap**: Wooclap is an online tool that may be used for reviewing class material. Practice questions completed on Wooclap ***are not graded***, but participation is strongly encouraged as it provides excellent review of lecture content.

Personal statement on EDI in the classroom/learning environment

I recognize that my positionality influences the way I see and engage with the world, and my perception on content that may be covered in this course. Being aware of this, I strive to present course material in a way that is sensitive to the lived experiences of students, course observers, and to the people who live and steward the ecosystems which we discuss from afar. I especially note that while we discuss the ecosystems of Canada from the unceded Anishinabe Algonquin traditional territory, we are discussing traditional territories of many other Indigenous Peoples across Canada who have been stewards of the lands for generations.

Through the duration of this course, I have zero tolerance for misconduct on the basis of personal identity or expression (see below for code of conduct). I recognize the different learning ability and strengths of students, and have structured this course in attempt to accommodate learners by incorporating multiple forms of evaluation, the use of text, diagrams, videos, and summaries. I wish for students of any personal identity or expression to feel comfortable and confident in my classroom, and strive to make room for all students to have equitable learning opportunities through the duration of this course.

Statement on academic code of conduct
Students are to complete and submit their own work, and complete module quizzes and the final exam without the assistance of others, and without reference to course material, online material, or any other source of information.

The Academic Integrity and Offences Code of Conduct outlined by Carleton University rules that discrimination or harassment based on race, sex, ancestry, place of origin, colour, ethnic origin, citizenship, creed, political affiliation or belief, sexual orientation, gender identity, marital status, family status, or disability/handicap will not be tolerated, and will result in repercussions at the University level. More about the code of conduct here.

Instructor statement on use of generative AI (e.g., ChatGPT). Generative AI is a powerful tool to help you understand complex topics, synthesize large amounts of information, and improve your writing. The use of generative AI tools in this course is not discouraged, but responsible and ethical use of AI must be followed. For example, using generative AI tools to assist with reviewing what you have already written is a responsible use of generative AI tools. Asking generative AI tools to *write* material for you is plagiarism, and may result in a 0% on the respective assignment. If AI is used, you ***must*** keep a record of the prompts you requested, and the answers that were provided and submit these as an appendix to your assignment.

Plagiarism
The following is the Carleton University statement on plagiarism:
The University Academic Integrity Policy defines plagiarism as "*presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own."* This includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source.

Examples of plagiarism include, but are not limited to:

- Any submission prepared in whole or in part, by someone else, including the unauthorized use of generative AI tools (e.g., ChatGPT);
- Using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment;
- Using another's data or research findings without appropriate acknowledgement;
- Submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own; and
- Failing to acknowledge sources through the use of proper citations when using another's work and/or failing to use quotations marks.

Plagiarism is a serious offence that cannot be resolved directly by the course's instructor. The Associate Dean of the Faculty conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of "F" for the course.

Academic Accommodations
Students requiring academic accommodations should note the following processes:

Pregnancy obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For accommodation regarding a formally-scheduled final exam, you must complete the Pregnancy Accommodation Form (click here).

Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details click here.

Academic Accommodations for Students with Disabilities: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, ***please request your accommodations for this course through the Ventus Student Portal at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable).*** Requests made within two weeks will be reviewed on a case-by-case basis. For final exams, the deadlines to request accommodations are published in the University Academic Calendars. After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

Survivors of Sexual Violence: As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: https://carleton.ca/equity/sexual-assault-support-services

Accommodation for Student Activities
Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation will be provided to students who compete or perform at the national or international level. Write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

Student mental health resources
As a University student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. If you need help, please speak to someone. There are numerous resources available both on- and off-campus to support you.
Emergency Resources (on and off campus): https://carleton.ca/health/emergencies-and-crisis/emergency-numbers/

Carleton Resources:

- Mental Health and Wellbeing: https://carleton.ca/wellness/

- Health & Counselling Services: https://carleton.ca/health/
- Paul Menton Centre: https://carleton.ca/pmc/
- Academic Advising Centre (AAC): https://carleton.ca/academicadvising/
- Centre for Student Academic Support (CSAS): https://carleton.ca/csas/
- Equity & Inclusivity Communities: https://carleton.ca/equity/

Off Campus Resources:

- Distress Centre of Ottawa and Region: (613) 238-3311 or TEXT: 343-306-5550, https://www.dcottawa.on.ca/
- Mental Health Crisis Service: (613) 722-6914, 1-866-996-0991, http://www.crisisline.ca/
- Empower Me: 1-844-741-6389, https://students.carleton.ca/services/empower-me-counselling-services/
- Good2Talk: 1-866-925-5454, https://good2talk.ca/
- The Walk-In Counselling Clinic: https://walkincounselling.com