

GEOGRAPHY AND ENVIRONMENTAL STUDIES
Carleton University

COURSE OUTLINE - Fall 2026

Course website: <https://brightspace.carleton.ca/d2l/home/450077>

COURSE:	Climate and Atmospheric Change - GEOG 3105A
INSTRUCTOR:	Derek Mueller Email: derek.mueller@carleton.ca Phone: 613-520-2600 x1984
OFFICE HOURS:	By chance or appointment
TEACHING ASSISTANT:	Visveshwar (Vish) Senthilkumaran Email: VisveshwarSenthilku3@cmail.carleton.ca
PREREQUISITES:	GEOG 2013
PRECLUSIONS:	None
COURSE FORMAT:	In person
COURSE STRUCTURE:	A one term course with lectures, labs, assignments, term paper and a final exam.
LECTURES:	Wednesdays 08:35 - 11:25
LABORATORY:	Thursdays 08:35 – 10:25 (A2) and 14:35 – 16:25 (A1)

COURSE DESCRIPTION:

The global climate system, with emphasis on global change variability over the historical and modern periods; the changing composition of the atmosphere and its impact on climate; analysis and interpretation of climatic and atmospheric data; modeling of climate systems (*from Carleton University, Undergraduate Calendar*).

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:

The aim of this course is to give students a solid grounding in the science of climate change. By the end of the course, students will be able to separate scientific facts from personal opinions and will be prepared to participate in solving one of the most pervasive environmental issues and great challenge of our time. Another very important aspect of this course will be improving academic/scientific written communication. Students will

improve their writing skills and learn to express the scientific knowledge they gain in a rigorous way.

COMMUNICATION:

This course uses Brightspace, Carleton's learning management system to collect assignments, disseminate materials and for discussion. To access your courses on Brightspace go to <https://brightspace.carleton.ca>. For help and support, go to <https://carleton.ca/students>. Any unresolved questions can be directed to Information Technology Services (ITS) by phone at 613-520-3700 or via email at its.service.desk@carleton.ca.

Private correspondence with the Instructor and Teaching Assistant should be through a Carleton email account (this is accessible in Brightspace). If you have questions of a general nature, please post it to the discussion board in Brightspace so that others can benefit from the answers. The Instructor will check email and Brightspace every 24 hours and do their best to respond to queries within 48 hours.

Information on Brightspace or sent via email will be considered to have been provided to all students within 24 hours of posting and students will be fully responsible for reading and responding appropriately to this information. This includes posts to Discussion forums, so *students are encouraged to subscribe* so they do not miss anything.

TEXTBOOK/READINGS:

Required reading:

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](https://doi.org/10.1017/9781009157896.001). (freely available online)

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](https://doi.org/10.1017/9781009157896.002). (freely available online)

IPCC, 2023: 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, 2204 pgs, [doi:10.1017/9781009157896](https://doi.org/10.1017/9781009157896). (freely available online)

Note that all the component chapters of this report are available 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 or for further details related to the lectures (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:

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. (available on Amazon.ca for ~\$52)

Environment and Climate Change Canada. (2026). Canada's Changing Climate Report 2026.

Government of Canada. (1448 pages).

<https://www.canada.ca/en/environment-climate-change/services/science-technology/changing-climate-report-2026.html> This is the most recent comprehensive report on the impact of climate change in Canada. (freely available online)

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

EVALUATION:	Assignments/exercises (x5)	45%
	In-class participation	10%
	Term paper	20%
	Final exam	<u>25%</u>
		100%

Note that Carleton uses an alphabetical grading system. 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.

ASSIGNMENTS/EXERCISES:

There will be 5 assignments/exercises to be submitted during the term:

- 1) You will be asked to read several articles and synthesize this material into a coherent text, you will select your own term paper topic (from a list of suggested topics) and search for relevant literature. (This will follow a session where you will learn how to search for literature).
- 2) You will explore recent climate change and interpret your findings using spreadsheet software and resources on the internet.
- 3) You will work on making a detailed outline of your term paper. As well you will begin writing a section of your paper and you will edit a peer's writing.
- 4) You will interpret outputs from various scenarios simulated with global climate model.
- 5) You will read several papers and come ready to discuss these in a seminar and write a brief report.

Assignments must be typed and handed-in on Brightspace. These assignments are time stamped by Brightspace upon receipt and the time they are late will be rounded up to the nearest hour. Each student can be late up to 48 hours *in total* without penalty for assignments 1 to 4. After this number of late hours is accumulated, any subsequent *late submission* for short assignments will receive zero. No lates will be accepted for assignment 5.

IN-CLASS PARTICIPATION:

Students are expected to come to class and participate by asking and answering questions. A point will be given to students who are present during the entire lecture period, with partial points assigned for coming late/leaving early. An additional point will be given to students who are engaged throughout the class (listening, attentive, answer questions put to them directly) and a further point will be given if they ask or answer questions unprompted. Total 3 points per class will be summed at the end of term and re-scaled such that top marks will be given to those who nearly always participate fully and those who only attend at every opportunity achieve a passing grade. Absences consistent with the accommodation policy will not count against students.

TERM PAPER:

Students will write a research paper on a topic related to the course material. Students are expected to research the topic thoroughly and follow standard guidelines for academic paper writing, including proper referencing. Detailed instructions will be provided at a later date. Final papers will be due on Brightspace by **23:59 on November 24**. They should be no more than 2500 words of text (excluding figures, tables, references, etc.). Term papers that are late will be accepted with a penalty. For each day that assignments are late (rounding up to

the nearest day), 1 mark will be deducted from your *final course grade*. Term papers later than 6 days will not be accepted. On the last day of class each student will discuss their paper with the course Instructor in a short interview.

Students who miss course deadlines for a valid medical reason or other extenuating circumstances will be accommodated. Students must contact the instructor(s) as soon as possible, and normally no later than 24 hours after the submission deadline for course deliverables. Please be prepared to complete the [Academic Consideration for Coursework Form](#).

EXAMINATION:

There will be a formal exam held during the exam period. It will be based on material from the entire term.

Cell phones, social media and other distractions:

Students must turn off their cell phones before each class. Interruption of classes by users of cell phones is disruptive and distracting for instructors and students alike. Consultation of social media during class is similarly inappropriate as is browsing on sites that are unrelated to the course content and/or working on assignments for other courses.

Course materials and copyright:

Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copy protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s).

Students registered in the course may take notes and make copies of course materials for their own educational use only. Under the University's [Copyright Policy](#), faculty own the copyright to instructional materials – including those resources created specifically for the purposes of instruction, such as lectures slides, lecture notes, and presentations. Students cannot copy, reproduce, display, or distribute these materials or otherwise circulate these materials without the instructor's written permission.

Unauthorized student recording of classroom or other academic activities (including advising sessions or office hours) is prohibited. Unauthorized recording is unethical and may also be a violation of University policy. Students requesting the use of assistive technology as an accommodation should contact the [Paul Menton Centre](#). Unauthorized use of classroom recordings – including distributing or posting them – is also prohibited. Students who engage in unauthorized recording, unauthorized use of a recording, or unauthorized distribution of instructional materials will be referred to the appropriate University office for follow-up.

Plagiarism:

The University Senate 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 sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to: books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, art works, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, material on the internet and/or conversations.

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 follows a rigorous [process for academic integrity allegations](#), including reviewing documents and interviewing the student, when an instructor suspects a violation has been committed. Penalties for violations may include a final grade of "F" for the course.

The university's full Academic Integrity Policy can be found [here](#).

In GEOG 3105, students considering submitting substantially the same piece of work previously submitted for credit in this or another course must seek approval from the course Instructor.

Generative Artificial Intelligence (AI) Policy:

In this course, the use of generative AI *is permitted but only under specific conditions*. Students are encouraged to avail themselves of these tools to help them learn course material or to help them review their writing (except in certain assignments). However, AI also has the potential to short-circuit learning by quickly generating written or other content that can be submitted for grading without any oversight, understanding or further student input. Students are *not permitted* to do this as it undermines the course learning objectives. Submitting material that is *written* by generative AI is plagiarism and contravenes Carleton's academic integrity policy.

Students are **fully responsible** for the content of the coursework that they submit. They should have an understanding of the material that they submit that is commensurate with the grade that they achieve, and should be able to explain decisions that they made in their submissions so it is clear that they did the work. This includes decisions related to citing academic sources. Their submissions should not contain fake references, hallucinations or other hallmarks of AI. If students use AI to assist in their assignments, they **must keep a record of the prompts and generated answers** and submit these as an appendix to the assignment. See also citing Generative AI on the [MacOdrum Library website](#).

If a student is suspected of violating this AI policy, they may be interviewed by the course instructor and may be subject to an allegation under Carleton's Academic Integrity Policy.

As our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

Statement on Student Mental Health

As a 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. For more information, please consult <https://wellness.carleton.ca/>. Here is a list that may be helpful:

Emergency Resources (on and off campus):

- <https://wellness.carleton.ca/get-help-now/>
- Crisis/Urgent Counselling Support: 613-520-6674 (Mon-Fri, 8:30-4:30)
- Suicide Crisis Helpline: call or text 9-8-8, 24 hours a day, 7 days a week.
- For immediate danger or urgent medical support: call 9-1-1

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>

Academic Accommodation:

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances, are outlined on the Academic Accommodations website (<https://students.carleton.ca/course-outline>).

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Academic consideration for medical or other extenuating circumstances: Students must contact the instructor(s) as soon as possible, and normally no later than 24 hours after the submission deadline for course deliverables. Please be prepared to complete the [Academic Consideration for Coursework Form](#).

Other Important Locations on Campus:

Writing Services <https://carleton.ca/csas/support/> (4th Floor, MacOdrum Library)

Centre for Student Academic Support <https://carleton.ca/csas/> (CSAS, 4th Floor, MacOdrum Library)

Other Important Locations on Campus:

Writing Services <https://carleton.ca/csas/writing-services/> (506 and 507 MacOdrum Library)

Centre for Student Academic Support <https://carleton.ca/csas/> (CSAS, 2nd Floor, MacOdrum Library)

CLASS SCHEDULE, TOPICS AND READING LIST (Subject to modification!!)

Month	Day	Topic
Sep	09	01 – Introduction to the course and climate change
	10	Lab 1 – Finding and synthesizing literature (A237)
	16	02 – Earth's energy balance
	23	03 – Evidence for warming
	24	Lab 2 – Recent climate (A237)
	30	04 – Greenhouse gases and other climate forcings
Oct	07	05 – Feedbacks in the climate system
	08	Lab 3 – Science writing and paper outline (A237)
	14	06 – Climate models
	21	07 – Past climate change
	22	Lab 4 – Future climate (A237)
	28	READING WEEK (no class)
Nov	04	08 – Major consequences
	11	09 – Extremes
	12	Lab 5a– Seminar (part 1) (A211)
	18	10 – Regional impacts and mitigation
	19	Lab 5b – Seminar (part 2) (A211)
	24	Term paper due @ 23:59
	25	11 – Guest lecture
Dec	02	12 – Climate science and society
	09	13 – Exam prep

Note that lab assignments will typically be due on Tuesdays at 23:59 (12 days after the lab session).

LECTURES:	Wednesdays	08:35 – 11:25
LABORATORY A2:	Thursdays	08:35 – 10:25
LABORATORY A1:	Thursdays	14:35 – 16:25