

ENVS*4050 - Predicting Impacts of Environmental Change

Winter 2026 Course Outline

Section: 01

Credits: 0.50

Land Acknowledgement: Guelph

The University of Guelph resides on the ancestral lands of the Attawandaron people and the treaty lands and territory of the Mississaugas of the Credit. We recognize the significance of the Dish with One Spoon Covenant to this land and offer respect to our Anishinaabe, Haudenosaunee and Métis neighbours. Today, this gathering place is home to many First Nations, Inuit, and Métis peoples and acknowledging them reminds us of our important connection to this land where we work and learn.

Calendar Description

This course is focused on the effects of urbanization and pollutant and greenhouse gas emissions on local, regional and global climates and the subsequent impacts on human life. Students will develop and apply simple numerical models of atmospheric processes toward solving practical problems, including applications related to land-atmosphere exchange of heat and water, air quality, and assessment of thermal comfort in urban environments. Students will learn tools for analysis of global climate model data, preparing them to work directly with the data underlying projected future climates.

Prerequisite(s): ENVS*3050

Department(s): School of Environmental Sciences

Lecture Schedule

Fri 8:30am-11:20am in ALEX*337 (1/5 to 4/21)

Instructor Information

Hang Yin

Email: hyin09@uoguelph.ca

Learning Resources

Required Resources

Oke, T. R., Mills, G., Christen, A., & Voogt, J. A. (2017). *Urban climates*. Cambridge University Press. (Required Textbook)
An ebook is available through the University of Guelph Library.

Course Technologies and Technical Support (Required Software)

CourseLink: The course website is available via CourseLink. CourseLink (powered by D2L's Brightspace) is the University of Guelph's online learning management system (LMS). Lectures, assignments, assignment submission (Dropbox) and grades are available through CourseLink. You are responsible for ensuring that your computer system meets the necessary CourseLink system requirements.

Course Resources

De Visscher, A. (2013). *Air dispersion modeling: foundations and applications*. John Wiley & Sons. (Recommended Textbook)
An ebook is available through the University of Guelph Library.

Bonan, G. (2015). *Ecological climatology: concepts and applications*. Cambridge University Press. (Recommended Textbook)
An ebook is available through the University of Guelph Library.

Lecture Notes and Library Access (Readings)

Partial lecture slide decks (i.e., handouts in PDF format) will be posted on CourseLink, typically ahead of class activities. Students will be expected to take personal notes, as needed, about additional materials not included in the handouts. The instructor will provide links to interesting instructional videos, tutorials, websites and/or phone applications when appropriate. Google can also be a useful resource for this course. As a student, you have

access to the University of Guelph's library collection, including both physical and electronic materials. For information on checking out library items, accessing electronic journals and returning items to the library, visit the library website. If you are studying off-campus and would like to access the library's electronic resources, use the Off-Campus Login option and log in, either by using your Single Sign-On credentials or by using your last name and library barcode. <https://www.lib.uoguelph.ca/> <https://www.lib.uoguelph.ca/campus-login>

Campus Resources

If you are concerned about any aspect of your academic program: Make an appointment with a Program Counsellor (<https://www.uoguelph.ca/uaic/programcounsellors>) in your degree program. If you are struggling to succeed academically. There are numerous academic resources offered by the Learning Commons (<https://www.lib.uoguelph.ca/using-library/spaces/learning-commons>) including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills.

Cost of Textbooks and Learning Resources

Textbook / Learning Resource	Required / Recommended	Cost
Urban Climates by Oke et al. (Cambridge)	Required	Ebook available at University of Guelph library at no charge

Course Learning Outcomes

1. Describe the basic mechanisms underlying mass and energy exchange between land and atmosphere and assess their modification in urban environments.
2. Describe basic physical and chemical processes associated with regional air quality and global climate change.
3. Implement several energy exchange mechanisms in a numerical model using discretization and related modelling principles.
4. Create simulations, perform sensitivity analyses, and correctly interpret simulation results.
5. Analyze multi-variable, multi-dimensional datasets.
6. Communicate results graphically, in writing, and orally, meeting appropriate scientific standards.

Teaching and Learning Activities

Weekly Activities

The schedule below may be adjusted through the term as needed.

Jan. 5: Intro to course; Historical impacts of humans on environments; Introduction to urban climate

Jan. 12: Urban climate concepts; Surface energy balance; Methods of investigation, incl. numerical modelling

Jan. 19: Urban airflow; Urban radiation

Jan. 26: Urban energy balance; Urban water balance

Feb. 2: Urban heat islands; Climate sensitive design

Feb. 9: Numerical model evaluation; Climates of humans

Feb. 16: No class (winter break)

Feb. 23: Midterm; Air quality introduction

Mar. 2: Air dispersion modelling

Mar. 9: Urban air quality; Climate change mechanisms and feedbacks

Mar. 16: General circulation modelling; Downscaling; Clouds and aerosols

Mar. 23: Climate change impacts; Urban development and climate change; Mitigation/adaptation

Mar. 30: Student project presentations

Assessment Breakdown

Description	Weighting (%)	Due Date
Assignment # 1	10%	Week 4 (1/30)
Assignment # 2	15%	Week 6 (2/13)
Assignment # 3	10%	Week 9 (3/6)
Assignment # 4	10%	Week 11 (3/20)
Assignment # 5 (report & presentation)	15%	Week 13 (4/3)
Midterm exam	15%	Week 8 (2/27)
Final exam	20%	(4/18)
Participation in class	5%	All weeks

Assessment Details

Assignment

Assignment #1 - Surface energy balance model development	10
Course Learning Outcomes Assessed: 1, 3, 4, 6	
Assignment #2 - Urban climate model development	15
Course Learning Outcomes Assessed: 1, 3, 4, 6	
Assignment #3 - Evaluation of a heat exposure model	10
Course Learning Outcomes Assessed: 1, 4, 6	
Assignment #4 - Air dispersion modelling	10
Course Learning Outcomes Assessed: 2, 4, 6	
Assignment #5 - Projecting future extreme heat (report + presentation)	15
Course Learning Outcomes Assessed: 2, 5, 6	

Exam

Midterm exam	15
Course Learning Outcomes Assessed: 1	
Final exam	20
Course Learning Outcomes Assessed: 1, 2	

Participation

Class participation	5
Course Learning Outcomes Assessed: 1, 2, 6	

Final Exam

Date: Apr 18

Time: Sa 8:30am-10:30am

Location: TBA *Please see Web Advisor closer to the date of scheduled final for location.*

To understand rules and regulations regarding Examinations students are encouraged to read Student's Responsibilities (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/examinations/>)

If the student is unable to meet the final exam requirements due to medical, psychological or compassionate circumstances they are encouraged to review Student's Responsibilities in the Academic Consideration, Appeals and Petitions (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/>) section of the Academic Calendar.

Last Day to Drop Course

The final day to drop Winter 2026 courses without academic penalty is the last day of classes: April 06

After this date, a mark will be recorded, whether course work is completed or not (a zero is assigned for missed tests/assignments). This mark will show on the student's transcript and will be calculated into their average.

Course Grading Policies

Submission of Assignments

All assignments should be submitted electronically via the online Dropbox tool available from CourseLink. When submitting your assignments using the Dropbox tool, do not leave the page until your work has successfully uploaded. To verify that your submission was complete, you can view the submission history immediately after the upload to see which files uploaded successfully. The system will also email you a receipt. Save this email receipt as proof of submission. Handwritten or typed submissions (or combinations of both) are acceptable and should be submitted at the start of class or slid under the instructor's office door (Alex 108). If, for some reason, you have a technical difficulty when submitting your work electronically, please contact an instructor or CourseLink Support. <http://spaces.uoguelph.ca/ed/contact-us/>

Late Assignment

Assignments that are due on class day are due prior to the start of class (i.e., at 2:30 pm Monday). Assignments that are not submitted by the due date and time without prior permission from the instructor (e.g., due to extenuating circumstances) will incur a 10% penalty per day late.

Course Standard Statements

Course Technology Requirements

A laptop with the ability run Python (www.python.org) and a data analysis program (e.g., Microsoft Excel, R) is required. Laptops with the Windows operating system will provide additional functionality for one assignment, but Mac and Linux laptops are acceptable as well.

Grades and feedback

The instructor will attempt to have assessment feedback posted online within 2 weeks of each submission deadline. The instructor will review your assignments and return, to you, an annotated version of the file that you originally submitted. Your grade will therefore be written directly on the annotated version of your submitted file. Please note that your grades for individual assessments may not be entered in the Grades tool of the course website. At the end of the term and after the final exam period has ended, as a University of Guelph student, you will be able to access your final course grade by logging into WebAdvisor (using your U of G central ID). <https://webadvisor.uoguelph.ca>

Standard Statements for Undergraduate Courses

Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-misconduct/>) is outlined in the Undergraduate Calendar.

Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability. Use of the SAS Exam Centre requires students to make a booking at least 10 days in advance, and no later than the first business day in November, March or July as appropriate for the semester. Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time. For students at the Guelph campus, information can be found on the SAS website. (<https://www.uoguelph.ca/sas>)

Accommodation of Religious Obligations

If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements.

See the Academic calendar for information on regulations and procedures for Academic Accommodations of Religious Obligations (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-accommodation-religious-obligations/>).

Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all undergraduate students except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in the Undergraduate Calendar - Dropping Courses (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/dropping-courses/>).

Email Communication

As per university regulations, all students are required to check their uoguelph.ca e-mail account regularly: e-mail is the official route of communication between the University and its students.

Health and Wellbeing

The University of Guelph provides a wide range of health and wellbeing services at the Vaccarino Centre for Student Wellness (<https://wellness.uoguelph.ca/>). If you are concerned about your mental health and not sure where to start, connect with a Student Wellness Navigator (<https://wellness.uoguelph.ca/navigators>) who can help develop a plan to manage and support your mental health or check out our mental wellbeing resources (<https://wellness.uoguelph.ca/shine-this-year>). The Student Wellness team are here to help and welcome the opportunity to connect with you.

Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

Recording of Materials

Presentations that are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The Academic Calendars (<http://www.uoguelph.ca/registrar/calendars/?index>) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the Undergraduate Calendar for information on regulations and procedures for Academic Consideration. (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/>)