

COURSE OUTLINE		
<b>TERM:</b> Fall 2022	<b>COURSE NO:</b> GEOG 414	
<b>INSTRUCTOR:</b>	<b>COURSE TITLE:</b> The Science of Climate Change	
<b>OFFICE:</b> LOCAL: <b>E-MAIL:</b> @capilanou.ca	<b>SECTION NO(S):</b>	<b>CREDITS:</b> 4.0
<b>OFFICE HOURS:</b>		
<b>COURSE WEBSITE:</b>		

Capilano University acknowledges with respect the Lilwat7úl (Lil'wat), xʷmə ꞓ ʔkʷəyəm (Musqueam), shíshálh (Sechelt), Skw̓xwú7mesh (Squamish), and Səlílwətaʔ/Selilwitulh (Tsleil-Waututh) people on whose territories our campuses are located.

### **COURSE FORMAT**

Three hours of class time, two lab hours per week, and an additional hour delivered through on-line or other activities for a 15-week semester, which includes two weeks for final exams.

### **COURSE PREREQUISITES**

GEOG 214

### **CALENDAR DESCRIPTION**

This course provides students with a scientific foundation of anthropogenic climate change and an introduction to climate models and frameworks in climate change vulnerability assessment. It focuses on fundamental physical processes that shape climate and on evidence for past and present climate change. During the course students study consequences of climate change, such as sea level change, variations in precipitation, vegetation, and storm systems, and the incidence of disease. The science behind mitigation and adaptation proposals is investigated.

### **COURSE NOTE**

GEOG 414 is an approved Science and Technology course for Cap Core requirements.

GEOG 414 is an approved Quantitative/Analytical course for baccalaureate degrees.

GEOG 414 is an approved Science course.

GEOG 414 is an approved Lab Science course.

### **REQUIRED TEXTS AND/OR RESOURCES**

Edmund A. Mathez and Jason E. Smerdon (2018), Climate Change, 2nd Edition, Columbia University Press.

*The Intergovernmental panel on climate change.* IPCC. (n.d.). <https://www.ipcc.ch/>.

## Required Technology

This course includes practical class activities to introduce students to “big climate data” analysis and the basics of climate models using Python. Python is freely available online at:

<https://www.python.org/downloads/>

## COURSE STUDENT LEARNING OUTCOMES

**On successful completion of this course, students will be able to do the following:**

1. Identify climate system components and the basic principles of regional and global climate modelling.
2. Explain the earth energy balance and develop a simple one layer energy balance model.
3. Evaluate the scale of anthropogenic carbon emissions within the context of the global carbon cycle.
4. Describe the natural and anthropogenic climate drivers responsible for controlling Earth's climate in the recent past and in the future.
5. Determine how the climate system responds to climate drivers via climate feedbacks.
6. Describe how global climate models (GCMs) work.
7. Access, read and analyse climate model output.
8. Identify emission scenarios, radiative forcing and projections of future climate.
9. Assess uncertainties associated with observational climate data and GCMs.
10. Evaluate approaches to adaptation, mitigation and vulnerability assessment.

**Students who complete this Science and Technology course will be able to do the following:**

- Apply numerical and computational strategies to solve problems.
- Assess the cultural, economic, and political effects of technology.
- Assess the impacts of human activity on natural systems and articulate ways in which environmental sustainability may be achieved.
- Evaluate scientific information (e.g., distinguish primary and secondary sources, assess credibility and validity of information).
- Demonstrate how a problem, concept, or process can be modelled numerically, graphically, or algorithmically.
- Explain how scientific inquiry is based on investigation of evidence and evolves based on new findings.

## COURSE CONTENT

### TOPICS

Week	Topic
1	Introduction climate change science
2	Climate modeling and climate change feedbacks: linking the atmosphere, oceans, biosphere, and cryosphere
3	Greenhouse gases and the concept of the radiation balance and global warming

4	Developing a simple one layer energy balance model
5	The carbon cycle, its Influences on climate, and carbon sequestration by natural landscapes.
6	Emission scenarios, radiative forcing, and projections of future climate
7	Future changes in weather and climate extremes – Canadian and global contexts
8	Introduction to GCM databases and raw model output.
9	Climate models data visualization and analysis - Part I
10	Climate models data visualization and analysis - Part II
11	GCM data downscaling
12	Evaluation of climate models and model uncertainty
13	Climate change Impacts, adaptation, and vulnerability
14 & 15	Final Exam Period

Lab	Topic
1	Review of the physics of the atmosphere, units, dimensions
2	Climate change databases
3	Scripting and spreadsheets in climate data
4	Greenhouse gas emissions and their relation to climate change
5	Introduction to Python and its uses in climate science
6	Python libraries for reading, analysing and visualizing climate data, Panda and Matplotlib
7	Python libraries for reading, analysing, and visualizing climate data, Panda and Matplotlib
8	Python libraries for reading, analysing and visualizing climate data, NumPy, SciPy
9	A very simple energy balance model development using Python
10	Downscaling GCM outputs
11	Evaluation of climate models accuracy
12	Future climate change and extreme events
13	Climate change Impact assessment methodology

### EVALUATION PROFILE

Quizzes	10 %
Project	10 %
Lab Assignments	25 %
Midterm	25 %
Final exam	30 %
<b>Total</b>	<b>100 %</b>

\*Note: A passing grade (50% or more) is required on the lab portion of the course for the student to obtain a passing grade for the entire course. The lab portion includes the lab assignments in addition to the term project. Students must also have a passing grade (50% or more) in the lecture portion in order to pass this course.

**GRADING PROFILE**

A+ = 90-100	B+ = 77-79	C+ = 67-69	D = 50-59
A = 85-89	B = 73-76	C = 63-66	F = 0-49
A- = 80-84	B- = 70-72	C- = 60-62	

**Incomplete Grades**

Grades of Incomplete "I" are assigned only in exceptional circumstances when a student requests extra time to complete their coursework. Such agreements are made only at the request of the student, who is responsible to determine from the instructor the outstanding requirements of the course.

**Late Assignments**

Unless otherwise instructed, assignments are due on the submission date listed. Late assignments will not be accepted except in the case of exceptional circumstances and at the instructor's discretion.

**Missed Exams/Quizzes/Labs etc.**

In general, any graded activity that is missed due to student absence cannot be made up. At the discretion of the instructor make-up exams, quizzes and/or tests may be given, and they are generally given only in medical emergencies or severe personal crises. Some missed assignments or other activities may not be able to be accommodated.

**Attendance**

Students are expected to attend all on campus classes, participate in all associated activities (online), and are responsible for all materials and activities during the class.

**English Usage**

Students are expected to proofread all written work for any grammatical, spelling and stylistic errors. Instructors may deduct marks for incorrect grammar and spelling in written assignments.

**Electronic Devices**

Students are encouraged to use electronic devices to take notes or look up information relative to the material being covered as long as the use of those devices does not distract others in the class. Students may not use electronic devices during quizzes or tests unless permitted by the instructor.

**On-Line Communication**

Outside of the classroom, instructors will (if necessary) communicate with students using either their official Capilano University email or eLearn (<https://elearn.capu.ca/my/>); please check both regularly. Official communication between Capilano University and students is delivered to students' Capilano University email addresses only.

## UNIVERSITY OPERATIONAL DETAILS

### Tools for Success

Many services are available to support student success for Capilano University students. A central navigation point for all services can be found at: <https://www.capilanou.ca/student-life/>

**Capilano University Security: download the [CapU Mobile Safety App](#)**

### Policy Statement (S2009-06)

Capilano University has policies on Academic Appeals (including appeal of final grade), Student Conduct, Academic Integrity, Academic Probation and other educational issues. These and other policies are available on the University website.

### Academic Integrity (S2017-05)

Any instance of academic dishonesty or breach of the standards of academic integrity is serious and students will be held accountable for their actions, whether acting alone or in a group. See policy and procedures S2017-05 Academic Integrity for more information: <https://www.capilanou.ca/about-capu/governance/policies/>

Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances, are prohibited and will be handled in accordance with the Student Academic Integrity Procedures.

**Academic dishonesty** is any act that breaches one or more of the principles of academic integrity. Acts of academic dishonesty may include but are not limited to the following types:

**Cheating:** Using or providing unauthorized aids, assistance or materials while preparing or completing assessments, or when completing practical work (in clinical, practicum, or lab settings), including but not limited to the following:

- Copying or attempting to copy the work of another during an assessment;
- Communicating work to another student during an examination;
- Using unauthorized aids, notes, or electronic devices or means during an examination;
- Unauthorized possession of an assessment or answer key; and/or,
- Submitting of a substantially similar assessment by two or more students, except in the case where such submission is specifically authorized by the instructor.

**Fraud:** Creation or use of falsified documents.

**Misuse or misrepresentation of sources:** Presenting source material in such a way as to distort its original purpose or implication(s); misattributing words, ideas, etc. to someone other than the original source; misrepresenting or manipulating research findings or data; and/or suppressing aspects of findings or data in order to present conclusions in a light other than the research, taken as a whole, would support.

**Plagiarism:** Presenting or submitting, as one's own work, the research, words, ideas, artistic imagery, arguments, calculations, illustrations, or diagrams of another person or persons without explicit or accurate citation or credit.

**Self-Plagiarism:** Submitting one's own work for credit in more than one course without the permission of the instructors, or re-submitting work, in whole or in part, for which credit has already been granted without permission of the instructors.

**Prohibited Conduct:** The following are examples of other conduct specifically prohibited:

- Taking unauthorized possession of the work of another student (for example, intercepting and removing such work from a photocopier or printer, or collecting the graded work of another student from a stack of papers);
- Falsifying one's own and/or other students' attendance in a course;
- Impersonating or allowing the impersonation of an individual;
- Modifying a graded assessment then submitting it for re-grading; or,
- Assisting or attempting to assist another person to commit any breach of academic integrity.
- Using text or online resources on evaluation components when explicitly instructed not to do so.
- Working on activities together when explicitly instructed not to do so.

### **Sexual Violence and Misconduct**

All Members of the University Community have the right to work, teach and study in an environment that is free from all forms of sexual violence and misconduct. Policy B401 defines sexual assault as follows:

Sexual assault is any form of sexual contact that occurs without ongoing and freely given consent, including the threat of sexual contact without consent. Sexual assault can be committed by a stranger, someone known to the survivor or an intimate partner.

Safety and security at the University are a priority and any form of sexual violence and misconduct will not be tolerated or condoned. The University expects all Students and Members of the University Community to abide by all laws and University policies, including B.401 Sexual Violence and Misconduct Policy and B.401.1 Sexual Violence and Misconduct Procedure (found on Policy page <https://www.capilanou.ca/about-capu/governance/policies/>)

**Emergencies:** Students are expected to familiarise themselves with the emergency policies where appropriate and the emergency procedures posted on the wall of the classroom.