GEOG 460 Climatology

School of Geography, University of Otago
Course Outline for 2025

1. General information

Instructor: Professor Nicolas Cullen
Office: 4.C.12a, Richardson Building
Phone: +64 21 279 1447
Email: nicolas.cullen@otago.ac.nz

Meeting: **Tuesday 1000-1300, Room R4N6 and R3N4**

Prescription: **Climatic forcing of seasonal snow, glaciers and avalanches; climate change**

2. Course objective and scope

The objective of this course is to give students an opportunity to advance their knowledge of field research methods in climatology and to establish a better understanding of the multi-scale atmospheric processes that control our atmosphere, weather and climate. Emphasis in this course is placed on the methods and techniques used to investigate atmospheric processes in mountainous terrain. In particular, students will develop an understanding of how to deploy atmospheric instruments, as well as being given the opportunity to develop their quantitative skills to analyse both observational and modelled climate data. These advanced quantitative methods will be used to better understand how climate change is impacting the variability of seasonal snow, glaciers and avalanches.

3. Course programme

The course is structured into three primary units.

- **To build a theoretical understanding of how climate forcing has impacted seasonal snow, glaciers and avalanches in different regions on Earth.** This will be obtained through a number of lectures and theoretical readings throughout the course.
- **To learn how to programme dataloggers and conduct field research**. To build practical skills associated with obtaining observational data, students will be introduced to data-logger programming that underpins efforts associated with designing automatic weather stations. This effort is aligned to a field exercise that gives students a broad understanding of the theory, processes and current knowledge associated with obtaining meteorological observations in an alpine setting.
- **To advance data analysis skills and project management**. To advance quantitative techniques and learn new approaches to post-process and analyse atmospheric data. Atmospheric and snow modelling may be used to better understand how multi-scale atmospheric processes can influence seasonal snow, glaciers and/or avalanches in alpine terrain.

On completion of this course students will have:

- an advanced understanding of the theory, processes and current knowledge of how changes in the climate system are impacting seasonal snow, glaciers and avalanches,
- the ability to set up and deploy instrumentation on automatic weather stations, including knowing how to programme data-loggers used to obtain and store meteorological data,
- developed new quantitative skills to analyse observational and model derived climatological data to assess the impacts of climate change on seasonal snow, glaciers and/or avalanches in alpine terrain, and
- developed new written, oral and time management skills to ensure a data intensive research project is completed.

4. Assessment

This paper has two major written assignments, a student-led presentation and one-page assignments that support the reading in the course (4 units of assessment). Please submit hardcopies (printed) and digital (email) copies of the primary assignments to the course coordinator (Nicolas Cullen). Digital copies should be emailed to nicolas.cullen@otago.ac.nz. **Failure to submit both a hard and digital copy will result in forfeiture of marks for the piece of assessment.**

Assessment Task	Unit	Value	Due Date
One-page assignments	1	10%	As requested
Student presentations	2	15%	25 March to 8 April 2025
Theoretical review	3	35%	1 May 2025
Snow modelling report	4	40%	6 June 2025
Total		100%	

Unit 1: One-page assignments

To build a theoretical background of the role climate forcing plays in controlling changes in seasonal snow, glaciers and avalanches, students will be assigned readings each week at the beginning of the course. From these readings and any others of interest, each member of the class is expected to write a one-page assignment that targets key aspects of the readings. The writing is expected to be similar to an opinion editorial (op-ed) that might be found in a newspaper column or in a journal that describes the key components of a publication. It should attempt to formulate a viewpoint based on an objective, balanced analysis of the topic at hand. Your writing style and ability to express clear viewpoints will be the key criteria for assessment. It is anticipated that 3-4 one-page assignments will be completed over the duration of the course.

Unit 2: Student presentation

Each student will be expected to give a 20-minute oral presentation that briefly introduces the theory, processes and/or current knowledge associated with a research area in alpine climatology, in particular over snow- and ice-covered surfaces. The presentation should aim to target recent and current literature and/or the identification of specific themes or lines of inquiry or debate in the subfield chosen, providing detail from several key papers from the recent international literature. The presentation should foster a discussion about the subfield and its main contentious issues (5-minutes of questions and discussion).

Unit 3: Theoretical review

The theoretical review provides an opportunity for students to consolidate knowledge gained from their oral presentation. It is expected that the written review will enable you to evaluate and provide a synthesis of the existing knowledge of your chosen subfield. There should be a logical connection between your chosen topic and the overarching theme of the course – how changes in the climate system are impacting different components of the cryosphere. Critically, it gives you an opportunity to expand and build more depth about the existing knowledge of the subfield you have identified. **The theoretical review should not exceed 2500 words**.

Unit 4: Snow modelling report

The snow modelling report should contain the key results from the field excursion (observational data) and snow modelling results. The interpretation of your findings and discussion of their significance will be critical in determining your final grade. The report should be structured in a form suitable for submission to an academic journal (e.g. *International Journal of Climatology*). The research should contain the following subheadings: Abstract - Introduction – Methods – Results – Discussion – Conclusions - References. **Each student will also be expected to contribute to a group discussion of the key findings of the snow modelling prior to the final report being submitted. The report should not exceed 3000 words**.

The workload expectations and allocation of time for each of the tasks in this course are provided in the following table.

Assessment	Task	Hours
One-page assignments	Reading and preparation	10
	Writing	10
		20
Student seminars	Preparation	20
	Attendance	10
		30
Theoretical review	Preparation	30
	Writing review	30
		60
Field work	Datalogger programming	10
	Field work	20
		30
Snow modelling workshops	Workshops	10
	Data analysis and modelling	25
	Report writing	25
		60
Total		**200**

5. Late submission of work

There will be a late penalty of 5% per day as stipulated in the Policy on student internal assessment. There is a Late Assignment Submission Penalty Calculator that is a simple tool to show how the late penalty system works. There are generally no exceptions to the above. No course work will be accepted after 5 p.m. on 18 June 2025. The grading system for all course work follows that used by the University of Otago.

6. Plagiarism/dishonest practice

All students should make sure that all submitted work is their own. Care should be taken to correctly cite the work of others, and the course coordinator will be happy to provide guidance on this. Dishonest practice is seeking to gain for yourself, or assisting another person to gain, an academic advantage by deception or other unfair means.

The most common form of dishonest practice is plagiarism. You plagiarise when you use knowledge that has been created elsewhere without indicating the source of that knowledge. Any student found responsible for plagiarism in any piece of work submitted for assessment shall be subject to the University's dishonest practice regulations, which will result in some form of penalty, ranging from forfeiture of marks for the piece of work submitted, a zero grade for the paper, or in extreme cases exclusion from the University. There are no exceptions to this policy. For further details about the University's position on plagiarism please carefully read the material here.

The University's approach to the use of generative-artificial intelligences and autonomous content generation in learning and teaching can be found here.

7. What do you do if you have concerns about the course?

If any student is concerned with any aspect of the course then he or she should not hesitate to approach the course coordinator and lecturer Nicolas Cullen. I will be happy to discuss any concerns that you may have. Alternatively, students can report their concerns to other staff if required. If, after making approaches via these channels, you do not feel that your concerns have been addressed appropriately, there are impartial university channels that can be explored to help find a resolution. For further advice and more information about these alternative pathways contact Geography's Head of School.

8. Scheduled activities

The below outline provides the scheduled activities. There may be some small changes to this schedule but only if there is consensus by the class to do so.

Week	Date	Topic and Session
9	25-Feb	Introduction – climate, cryosphere and data-loggers
10	4-Mar	Programming data-loggers and instruments
11	11-Mar	Programming data-loggers and exit test
12	18-Mar	Seasonal snow and modelling
13	25-Mar	Student presentations
14	1-Apr	Student presentations
15	8-Apr	Student presentations
16	15-Apr	Field trip to Lauder, NIWA and Pisa Range
17		**Mid Semester Break**
18	29-Apr	Snow modelling
19	6-May	Snow modelling
20	13-May	Snow modelling and report writing
21	20-May	Presentation of key results
22	27-May	Course reflections