University of Manitoba
Clayton H. Riddell Faculty of Environment, Earth, and Resources
Department of Environment and Geography

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Course Details

Course Title & Number:	GEOG 4560 Techniques in Climatology
Number of Credit Hours:	3
Class Times & Days of Week:	Tuesdays and Thursdays: 2 pm – 3:45 pm
Room:	St John's College room 202
Lecture Materials:	UM Learn
Pre-Requisites:	GEOG 3320 (Microclimates) or permission of instructor

Instructor Contact Information

Instructor(s) Name:	Dr. Tim Papakyriakou
Preferred Form of Address:	Tim
Office Location:	584 Wallace Building
Office Hour:	By appointment, and generally available after class:
Email:	Tim.Papakyriakou@Umanitoba.ca I try to reply to emails within 24 hours of them being received during weekdays, excluding holidays. It may be that emails received later in the day of Fridays or weekends won't be answered until the following Monday.
Contact:	Email is my preferred mode for contact. Also, I will often be available right after class to discuss course material in person.

Course Objectives

The objective of this course is to expose students to a variety of current measurement methods and analysis techniques used by researchers who undertake microclimatological and micrometeorological research. So equipped, the student will gain the ability to critique studies in these areas on the basis of their methods, and themselves design experiments and analyze data to undertake fundamental research into the nature and controls of fluxes that exchange heat, water, trace gases, momentum, and radiation over natural terrestrial, aquatic and marine ecosystems.

Course Description

This course builds on microclimatological concepts introduced in previous courses. In this course, the student will follow lines of study into various field and analysis techniques that form the basis of research in the areas of microclimatology/micrometeorology. Increasingly, the living system feeds back to affect microclimatological and micrometeorological processes, and hence elements of biophysics and biogeochemistry that drive the surface exchanges of heat, water and greenhouse gases form an important component of this course. Emphasis will be placed on the theoretical basis and application of sensors and techniques used to monitor processes (e.g. energy and mass flows) and resulting phenomena (e.g., temperature) that shape microclimates across a variety of space and time scales. The aim of the course is to prepare the student for independent research in applied climatology, including the affiliated fields of ecology, hydrology, oceanography, and various fields of atmospheric science.

Course Format

The course will combine formal lectures, student-led seminars based on journal manuscripts, and activities based on field data. Readings will be assigned. It is expected that students will have read and reflected on the materials specified for class meetings. With student seminars, the intention is to emphasize discussion and dialogue in order to enhance the students' reflective capacities. It is therefore expected that class members will participate in class discussions. The application of techniques for the analysis of data will allow the student practical application of theory and methods reviewed in lectures, readings and seminars.

These activities (for credit and not for credit) will be scheduled periodically over the term. This is a lecture only course (no laboratory section).

Textbook, Readings, Materials

Readings will be assigned over the course of the term for discussion and reference. There is no single required text. Material will be drawn from the references provided below, in addition to journal articles and reports that will be available for download from the UM Library system, or posted on UMLearn. A core list of texts in support of the course appear below.

1) Bonan, G., 2015: Ecological Climatology: Concepts and Application, Cambridge University Press, 675 pp

2) Burba, G., 2013. Eddy Covariance Method for Scientific, Industrial, Agricultural, and Regulatory Applications: A Field Book on Measuring Ecosystem Gas Exchange and Areal Emission Rates. LI-COR Biosciences, Lincoln, NE, USA, 331 pp. (download from: http://www.licor.com/env/products/eddy_covariance/ec_book.html)
3) Matson, P.A., and R.C. Harris (ed), 1995: Biogenic Trace Gases: Measuring Emissions from Soil and Water, Blackwell Science, 394 pp. (full text available on-line, UM Libraries)
4) Oke, T.R., 1987: Boundary Layer Climates, Routledge, 433 pp.
5) Strangeway, I., 2000: Measuring the Natural Environment, 2nd ed, Cambridge University Press, 534 pp. (full text available on-line, UM Libraries)
6) Trembley et al., 2005: Greenhouse Gas Emissions – Fluxes and Processes, Hydroelectric Reservoirs and Natural Environments, Springer, 732 pp.
7) Unwin, D. M., 1980: Microclimate Measurement for Ecologists, Academic Press, Toronto, 95 pp.

Class Content

Course material will be organized according to the following modules. Some modules require more than one lecture to cover. Modules may be substituted, removed or presented in a different order depending on the class dynamics. Text chapters associated with the module are given.

1 Course Background and Review of Micrometeorological Concepts
2 Measurement Basics and Error Characterization
3 Measurement of Surface Meteorological Elements
4 Characterization of the Surface Radiation Fields and Budgets
5 Characterization of Heat, Water and Momentum Fluxes
6 Gas Fluxes and Moderating Properties and Processes
- Terrestrial Systems
- Aquatic and Marine Systems

7 Eddy Covariance – measurement of turbulent fluxes
8 On the Horizon – Advancements in the Field

Course Evaluation Methods

Term assignments will consist of a combination of reports on short readings, and data assignments, and a major term paper will form the basis of a class seminar presented by the student.

The short reading assignments will involve a short concise review of publications of relevance to a course topic. The student can draw on material within textbooks to supplement the papers as necessary. The submitted assignment should be no more than 3 pages (1.5 line spacing) in length, not including citation list. Some readings will be assigned, while it is also expected that the student be able to locate relevant readings on their own. The student will be expected to

review the main points of their reading synthesis to the class in the form of a short (10-minute) presentation. Additional details will be provided in class.

Data assignments will involve manipulating a data set within a computer environment for micrometeorological analysis. The assignment should be submitted in report form, complete with introduction, methods, results, summary conclusions and reference list.

The major term paper will provide the student the opportunity to research at depth methodologies used in support of a research area. For example, a paper may examine and critique current methods for estimating carbon flux from water surfaces. The student's topic must be pre-approved by the instructor. The submitted paper should be no more than 15 pages (1.5 line spacing) in length, not including a citation list. The main features of the paper will form the basis of a 20-minute seminar presentation to the class. A copy of the presentation (digital) must be submitted to the instructor 3 days prior to scheduled presentation. The paper must be thoroughly researched and well written, free of grammatical and spelling mistakes. The seminar must be well-organized and effectively structured to relay salient features of the research paper to the student body.

Assessment Tool	**Value of Final Grade**
Short Reading Assignment 1	10%
Short Reading Assignment 2	10%
Data Assignment 1	15%
Data Assignment 2	25%
Major term paper	30%
Seminar	10%

Grading

Letter Grade	Percentage out of 100
A+	90-100
A	80-89
B+	75-79
B	70-74
C+	65-69
C	60-64
D	50-59
F	Less than 50

Referencing Style

Assignments should use the APA reference style as outlined here.

Course Technology

It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. While the lectures are preferably in-person, there is the possibility that one, or some lectures are on-line, using the software Zoom. Students require a computer with web connection with video and audio capability. Ideally the student's computer should also have basic software for spreadsheet and word processing. It will be difficult to complete the course assignments without software like MS Excel and MS Word, or their equivalents.

Course material will be provided through UM Learn, for information on access and navigation of this resource, see the Centre For The Advancement Of Teaching & Learning.

Class Communication

The University requires all students to activate an official University email account. For full details of the Electronic Communication with Students please visit: http://umanitoba.ca/admin/governance/media/Electronic_Communication_with_Students_Policy_-_2014_06_05.pdf

Please note that all communication between myself and you as a student must comply with the electronic communication with student policy (http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html). You are required to obtain and use your U of M email account for all communication between yourself and the university.

Expectations: I Expect You To

Please be courteous to your fellow students by showing up to class on time, and refrain from social talk once the class has begun. While in class cellular phones should be in silent mode, and under no circumstances should phones, or computers be used in class for reasons other than required by the course (e.g., note taking).

Class attendance is compulsory. Lecture discussions not on digital copies of lecture presentations can be on term tests. The expectation is that everyone participates in class discussions.

I will treat you with respect and would appreciate the same courtesy in return. See the University of Manitoba Respectful Work and Learning Environment Policy.

Academic Integrity:

Students should acquaint themselves with the University's policy on academic misconduct. (http://umanitoba.ca/student/studentdiscipline/academic_misconduct.html), and Academic supports (http://umanitoba.ca/student-supports/academic-supports/academic-integrity).

Below are some tips:

- Learn what is meant by plagiarism, cheating, impersonation and academic fraud
- Unless otherwise specified all work is to be completed independently.
- Keep track of references and sources of information used in written assignments (including web references with date)
- Attribute the source of ideas and material in your written submission
- If in doubt, consult your instructor.

Students Accessibility Services

If you are a student with a disability, please contact SAS for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Student Accessibility Services http://umanitoba.ca/student/saa/accessibility/
520 University Centre
204 474 7423
Student_accessibility@umanitoba.ca

Voluntarily Withdrawal from Course

The final date for voluntarily withdraw from this course is March 22, 2023. Students are encouraged to discuss with the instructor before a decision to withdraw is made.

Assignment Extension and Late Submission Policy

Assignment due dates will be explicitly stated on the instructions for assignments. Students will not be permitted to hand in assignments late, except for documented medical or compassionate reasons. Assignments will be penalized -10% for each day, or part therein, late.