University of Manitoba
Faculty of CHRFEER
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:	2:30 – 3:45 Tuesday and Thursday
Location for classes/labs/tutorials:	TBD
Pre-Requisites:	GEOG 3320 or permission of Dept. Head

Instructor Contact Information

Instructor(s) Name:	Tim Papakyriakou
Preferred Form of Address:	Tim
Office Location:	584 Wallace Bldg
Office Hours or Availability:	Available by appointment scheduled via email
Office Phone No.	204-474-8513
Email:	Tim.Papakyriakou@Umanitoba.ca
Contact:	I usually respond to email within 8-12 hours Monday to Friday. Email is my preferred mode for contact. Also, I will often be available after class to discuss course material in person.

Course Description

This course builds on microclimatological concepts introduced in previous courses. Here the student will further lines of study into various field and analysis techniques that form the basis of research in the areas of microclimatology/micrometeorology, as well as other branches of ecosystem science. 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 climate 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.

The course format will combine formal lectures with student-led seminars and activities. It is expected and required that the class 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.

General Course Information

Discussion will revolve around methods supporting microclimatology and micrometeorology research. 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 climate across a variety of space and time scales. Discussion will be an important component of instruction. The course format will combine formal lectures with student-led seminars and activities. It is expected and required that the class 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.

This is a lecture only course (no laboratory section). Activities (for credit and not for credit) will be scheduled periodically over the term to practice the application of theory and methods discussed in class.

Course Goals

The objective of this course is to expose students to a variety of current measurement methods and analysis techniques used by researchers who undertake microclimatology/micrometeorology research. So equipped, the student should gain the ability to critique studies in these areas on the basis of their methods, and themselves design experiments to undertake fundamental research into the nature and controls of fluxes that exchange heat, water, trace gases, momentum, and radiation over natural land and water systems.

Using Copyrighted Material

Please respect copyright. We will use copyrighted content in this course. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the *Copyright Act* applies or written permission has been confirmed. For more information, see the University's Copyright Office website at http://umanitoba.ca/copyright/ or contact um_copyright@umanitoba.ca.

Recording Class Lectures

The course instructor (Tim Papakyriakou) and the University of Manitoba hold copyright over the course materials, presentations and lectures which form part of this course. No audio or

video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission by the course instructor (Tim Papakyriakou). Course materials (both paper and digital) are for the participant's private study and research.

Textbook, Readings, Materials

Preliminary List of Assigned Readings

Readings will be assigned over the course of the term for discussion and reference.

Books/Chapters

1) Strangeway, I., 2000: Measuring the Natural Environment, 2nd ed, Cambridge University Press, 534 pp. (full text available on-line, UM Libraries)
2) Unwin, D. M., 1980: Microclimate Measurement for Ecologists, Academic Press, Toronto, 95 pp.
3) 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)
4) 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)
5) Oke, T.R., 1987: Boundary Layer Climates, Routledge, 433 pp.

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. The student can use all technology in classroom setting only for educational purposes approved by instructor and/or the University of Manitoba Disability Services. Student should not participate in personal direct electronic messaging / posting activities (e-mail, texting, video or voice chat, wikis, blogs, social networking (e.g. Facebook) online and offline "gaming" during scheduled class time. If student is on call (emergency) the student should switch his/her cell phone on vibrate mode and leave the classroom before using it.

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 on time, refrain from social talk.

Class attendance is compulsory. Students with excessive unexcused absences may be subject to debarment. The expectation is that everyone participate in the discussion.

I will treat you with respect and would appreciate the same courtesy in return. See 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). Below are some tips:

- Learn what is meant by plagiarism, cheating, impersonation and academic fraud
- 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.

Unless otherwise specified all work is to be completed independently.

Students Accessibility Services

Student 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

Class Schedule

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 Measurement Basics and Error Characterization (Jan. 4 & 9)
2 Electrical DC Circuits and Site Power Considerations (Jan. 9 & 11)
3 Characterizing Surface Meteorology
- Temperature, Humidity & Wind (Jan. 16)
- Barometric Pressure & Precipitation (Jan. 18)
- Soil Moisture (Jan. 30)
- *Applications of Remote Sensing (Feb. 1)*

4 Characterizing Surface Radiation Regimes
- Primer on Radiation (Feb. 6)
- Solar Radiation, Long-wave and All-wave Radiation (Feb. 6 & 8)
- *Applications of Remote Sensing or Process Model (Feb. 13)*

5 Estimation of Heat and Momentum Fluxes (micrometeorological)
- Profile approaches (Feb. 13)
- Eddy Covariance (Feb. 15)

6 Trace Gases
- Representation and Measurement of Gas Concentration (Feb. 27)
- Measurement of Gas Fluxes (aquatic/marine and terrestrial)
    - Non-micrometeorological (Mar. 1)
    - Micrometeorological (Mar. 8)

7 Carbon Cycle Studies
- Aquatic carbon system (March 13)

8 Student-led Research Methodology (March 15 to 29)
- *Geophysical, Biophysical or Biogeochemical system. Topics are to be determined. Sample topics could include:*
    - *NPP – terrestrial or aquatic systems*
    - *Novel approaches to surface-atm coupling*
    - *Rivers/Lakes*
    - *Sea Ice*
    - *Carbon Budget Studies*
    - *Heat Budgets*

Course Evaluation Methods

You are responsible for all material covered in class lectures, readings and assignments.

Term assignments will consist of two short reading assignments, one data assignment and a major paper. The major paper will form the basis of one class seminar presented by the student. The assignments will focus on the areas of surface meteorology, flux, and flux budgeting. The assignments will be assigned at the end of course modules.

The short reading assignments will involve the review of 2-3 research publications on a topic of relevance to the course using information from peer-reviewed journal papers. The student can draw on material within textbooks to supplement the papers. The submitted assignment should be no more than 4 pages (1.5 line spacing) in length, not including citation list. The student's topic must be pre-approved by the instructor. The student will be asked to submit a draft reference list no less than 2 weeks prior to the paper due date for approval.

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

The major paper will draw from material covered from textbooks and journal articles. The student's topic must be pre-approved by the instructor. The submitted paper should be no more than 10 pages (1.5 line spacing) in length, not including a citation list. The main features of the paper will form the basis of a 20-30 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. The student will be asked to submit a draft reference list no less than 4 weeks prior to the paper due date for approval.

Assessment Tool	Value of Final Grade
Reading Assignment 1	7.5%
Reading Assignment 2	7.5%
Data Assignment	30%
Major term paper	40%
Seminar	15%

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. See
http://libguides.lib.umanitoba.ca/c.php?g=298394&p=1988884

Assignment Grading Times

Usually assignments will be graded within 1 week of submission. The final **date for voluntarily withdraw** from this course is **March 16**. Students may have access to their marks prior to this date and are encouraged to talk with the instructor before a decision to withdraw is made.

Assignment Extension and Late Submission Policy

Unless otherwise stated, assignments are due during the class period of the due date and submitted as hard copies. Students will not be permitted to write make-up tests or hand in assignments late, except for documented medical or compassionate reasons. Assignments will be penalized -10% each day, or part therein, late.