

**University of Waterloo**  
**Department of Geography and Environmental Management**

**GEOGRAPHY 409**  
**ENERGY BALANCE CLIMATOLOGY**

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Winter 2020  
Lectures: F 8:30 – 11:20  
EV1 132  
Office Hours: Wednesday 12:30 – 2:20

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**INTRODUCTION**

This course provides an introduction to the study of micrometeorology and physical climatology, examining the processes that underlie the behaviour of the atmosphere close to the surface. In Geography 409 the focus is on the energy exchanges within the planetary boundary layer of the atmosphere and other interfaces, such as that for plants and animals, as interest dictates. This will lead to an explanation of the microclimate variations within small places. This is one step in an understanding of the linkages between the atmosphere and the other components of the planet system. The balance of the energy exchanges within the boundary layer dictate the energy available for all other global processes.

The topics to be covered are:

1. The concept of an "Active Surface" and the relationship between energy balance and the microclimate.
2. Convective and conductive energy exchange - the flux profile relationships and the Bowen Ratio.
3. The energy and radiation balance of selected surfaces. (student seminars)

**COURSE OBJECTIVES**

The objective of this course is to provide students with the background to further their interests in weather, climate and hydrology, and provide the theoretical foundations for further study in science and management courses.

The specific objectives are:

1. To identify the key boundary layer energy exchange processes that drive the hydroclimate system.
2. To gain experience with the tools and methodologies necessary to analyze hydrological, weather and climate information.
3. Understand the processes controlling the cycling of water between the surface and the atmosphere, and where it is stored in its three phases.
4. To identify and evaluate the characteristics of different land-use types and ecosystems that drive their hydroclimatic regimes.

### **COURSE REQUIREMENTS**

The student seminars covering the third topic are presentations by the students based upon a topic in the text. Past experience in this course shows that when students have prepared and taught a lecture, they have learned more and retained more than by studying the topic for a test, for example. With this seminar approach, the student will be teaching that topic to the rest of the class. I expect the presentations for each topic to be a minimum of 40 minutes, and using powerpoint slides. There will be a maximum of 12 lecture topics to be chosen by groups of 1-3 students.

*In addition*, at the end of each seminar, the student will present a critical review of one current journal article relevant to that topic that will provide an update on the text material. This would typically be a few slides summarizing the objectives, approach, key results and conclusions of the article and one slide on your critical evaluation of the results. This may include an assessment of what you think the next steps might be, or an evaluation of how this research contributes to the larger picture of the field of study, or what the investigator may have done differently had the opportunity be available.

The student will submit the slide deck used for *both* the seminar and journal review as the written component of the assignment (no other written submission is required for this section). **This submission will be due the day before the presentation.** The seminar will be graded out of 25% and the review will be graded out of an additional 5%. These assignments will be determined for each student during the third week of class (class time on **January 24**) by a signup on-line. Depending on class numbers it is possible that there may be more than one student per topic, each agreeing to address a specific sub-topic. The slide decks will be posted in the class section on 'Learn'.

The following addition to this assignment was suggested by your colleagues in the class in 2013 as a way of involving the class more in this component. After the class, the presenter will provide 6 question multiple choice questions to me, which will be put on LEARN as 5 question quizzes. These will test the rest of the class that will assess what has been presented in the literature review and journal review. Each correct answer is worth 1 mark and therefore each test is worth 5 marks. For each student, 30% of the final grade is allotted to

these tests. Each week that has 2 topics will have 1 quiz of 5 questions, which will be created by randomly selecting from the 10 questions supplied by the two groups in total. That represents answering tests for seven student-lead classes. 7 quizzes will be written and the best 6 will be used for your grade. All quizzes will be done on LEARN, with the weekly quizzes opening Fridays at noon and closing Monday at midnight. You will not receive your grade for the week's quiz until that quiz is closed on Monday night.

A research paper completed in pairs of students will be graded out of 30% of the final mark. It will be due electronically on LEARN by 4:30 on **March 27** (Friday of the last full week of classes). This paper may be a critical evaluation of a research project discussed in the literature. It may also be an analysis of a set of data collected by the student, or abstracted from the literature. It could focus on the development and testing of an instrument or field experiment. The topic should be cleared before you start to ensure that it is manageable within the time and space limitations. A one page summary with an additional proposed bibliography is to be submitted by each team in the fourth week (class time on **January 31**). The paper will be approximately 12 – 15 pages in length, typed, double spaced, exclusive of abstract, figures and bibliography. To repeat, the final submission date for the complete paper is **March 27** (Friday of the last full week of classes).

It is possible to present group research papers (i.e. more than a pair of students). In this case, I will need a signed statement from each individual, all on one page appended to the one-page summary submitted during class time on **January 31**, stipulating that the final mark will be assigned equally to all members of the group. I would expect the effort for x students in the group to be reflected in x times the page length.

Note that a **late penalty of 5%** of the course mark will be applied for every three working days the seminar overheads *or* the paper is submitted after the due date.

## **GRADES**

Student lecture:	20 Marks
Student literature review:	5 Marks
LEARN Quizzes on lecture and literature review by other students:	30 Marks
Research Paper:	30 Marks
Class participation:	5 Marks
Research Paper Presentation:	5 Marks

## **COURSE MATERIALS**

Text: BOUNDARY LAYER CLIMATES, T. R. Oke. Available in Bookstore, online and on reserve at Porter Library.

Supplementary materials will be provided on LEARN as needed.

## **CLASS SCHEDULE:**

Jan. 10: Introduction and Concept of Energy Balance of an 'Active Surface'  
Jan. 17: Active Surface  
Jan. 24: Flux Profile Relationships  
Jan. 31: Flux Profile Relationships  
Feb. 7: Microclimate of Desert & Snow and Ice Environments tutorials by students  
Feb. 14: Microclimate of Water Surfaces & Special Features of Vegetation tutorials by students  
Feb. 21: Reading week  
Feb. 28: Microclimate of Vegetation (Leaves & Plant Covers) tutorials by students  
March 6: Microclimate of Non-uniform Terrain (Patches & Topography) by students  
March 13: Microclimate of Animals & Air Pollution tutorials by students  
March 20: Intentionally Modified Climates tutorial by students / Research Paper Presentations  
March 27: Microclimate of Urban Environments by students / Research Paper Presentations  
April 3: Research Paper Presentations

Materials and announcement for the class will be found on the LEARN web site at:

<http://learn.uwaterloo.ca/>

(use your WatIAM/Quest username and password)

Documentation on this site is available at:

<https://uwaterloo.ca/learn-help/>

I will post the overheads for the lectures that I give on this site in advance, and will post those given by the students as they are submitted to me by the morning of the presentation, at the latest.

## **LEGAL STUFF**

**Late Submission:** Failure to submit your work on time will result in a grade of 5% per business day beyond the due date for that assignment. Late work will not be accepted under any circumstances without official documentation; for example, a University Illness verification form.

**Illness During Term:** Please refer to the University of Waterloo Policies regarding documentation and the management of requests for accommodation due to illness during the term. Illness verification forms are required for any student seeking accommodation for any course requirement missed due to an illness. Please refer to [http://www.registrar.uwaterloo.ca/students/accom\\_illness.html](http://www.registrar.uwaterloo.ca/students/accom_illness.html) for more information.

**Policy on Regrading Assignments:** If you notice an error in the assessment of your work please follow these steps:

1. Wait 48 hours after the assignment was returned before requesting a regrade

2. All regrade requests must be submitted in hard-copy to the instructor, describing the errors you believe were made. Verbal or emailed requests will not be accepted. Be as specific as possible and list all relevant details, e.g., “my marks were summed incorrectly for questions 1–5”.
3. If another student’s assignment is used as an example or reason for an error in grading, both assignments must be submitted for a regrade.
4. The entire assignment will be regraded, not just the errors indicated in the written request. The resulting grade may increase or decrease depending on the result of the regrading.

**Policy on Email Correspondence:** Students are encouraged to attend office hours to discuss any issues relating to the course. On the other hand, students should rarely need to send email to the instructor or TA because most information required is available elsewhere: e.g., in this course outline, on UW LEARN, on the Discussion boards, in the textbook, after class, or at office hours. However, if your question or concern cannot wait until the next lecture then please remember these policies when sending email:

- Always send emails from your University of Waterloo email account.
- All emails should have the following subject line: “GEOG209: <<insert your message here>>”
- If your email includes an attachment, describe the contents of the attachment in the email. Be polite, respectful and professional.
- Proofread your email and use correct grammar and punctuation.
- Always use an appropriate greeting, and sign your full name.
- Allow the instructor or TA at least two business days to respond before sending the request again. Mark all urgent matters “URGENT” in the subject line.
- The instructor or TA reserves the right to reply to you along with the entire class if the question is deemed to be relevant to other students on the course.

**Unclaimed assignments:** Assignments that are not picked up by students must be retained for one year after last use (i.e., after the end of the term in which the work was submitted or after the resolution of any grade revision request or appeal), unless students are notified that they will be retained for a shorter period of time. Instructors who do not wish to retain unclaimed assignments for one year may dispose of them sooner provided they include notification of this practice on the course outline.

Unclaimed assignments will be retained until one month after term grades become official in quest. After that time, they will be destroyed in compliance with UW’s confidential shredding procedures.

## UW POLICIES

**Academic Integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [www.uwaterloo.ca/academicintegrity/](http://www.uwaterloo.ca/academicintegrity/)

Students who are unsure what constitutes an academic offence are requested to visit the on-line tutorial at <http://www.lib.uwaterloo.ca/ait/>

**Research Ethics:** Please also note that the 'University of Waterloo requires all research conducted by its students, staff, and faculty which involves humans as participants to undergo prior ethics review and clearance through the Director, Office of Human Research and Animal Care (Office). The ethics review and clearance processes are intended to ensure that projects comply with the Office's Guidelines for Research with Human Participants (Guidelines) as well as those of provincial and federal agencies, and that the safety, rights and welfare of participants are adequately protected. The Guidelines inform researchers about ethical issues and procedures which are of concern when conducting research with humans (e.g. confidentiality, risks and benefits, informed consent process, etc.). If the development of your research proposal consists of research that involves humans as participants, the please contact the course instructor for guidance and see <http://iris.uwaterloo.ca/ethics/>

**Note for students with disabilities:** The AccessAbility Office located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AccessAbility Office at the beginning of each academic term.

**Religious Observances:** Student needs to inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

**Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, [www.adm.uwaterloo.ca/infosec/Policies/policy70.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm). When in doubt please contact your Undergraduate Advisor for details.

**Discipline (as noted above under 2a):** A student is expected to know what constitutes academic integrity, to avoid committing academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, [www.adm.uwaterloo.ca/infosec/Policies/policy71.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm). For typical penalties, check Guidelines for Assessment of Penalties, [www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm](http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm)

**Appeals:** A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 – (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals) [www.adm.uwaterloo.ca/infosec/Policies/policy72.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm)

**Academic Integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check [www.uwaterloo.ca/academicintegrity/](http://www.uwaterloo.ca/academicintegrity/) for more information.]

Note the following for essay substitutions:

Plagiarism detection software (Turnitin or similar) will be used to screen assignments in this course. This is being done to verify that use of all materials and sources in assignments is documented. Students will be given an option if they do not want to have their assignment screened by Turnitin. In the first week of the term, details will be provided about arrangements and alternatives for the use of Turnitin in this course. For further information on UW's Turnitin guidelines, see: <https://uwaterloo.ca/academic-integrity/integrity-waterloo-faculty/turnitin-waterloo>