

Geography 5922: Microclimatological Measurements – Fall 2021

Class times: M, W 3:55-5:15 pm

Classroom: Derby Hall, room 0070 (and 0140)

Instructor: Jim DeGrand

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Office hours: 2:30 – 3:30 pm, M & W, or by appointment

Course Description and expected learning outcomes: This course serves as an introduction to microclimatological instrumentation and fieldwork. We will learn about various environmental sensors: how they work, how they should be deployed, how to retrieve and process information from them, how to interpret the data they produce. A student successfully completing this course will:

1. Possess a working knowledge of an array of meteorological sensors. In this context, a working knowledge includes an understanding of the operating principles of a sensor, its calibration, its limitations in terms of uncertainty and the standards observed for its deployment
2. Be able to program a data acquisition device to interact with the above sensors. This interaction would include steps necessary to power the sensors and retrieve, process and store the data they produce.
3. Have gained experience in the selection of sites and the assembly of equipment required for the deployment of the above sensors in accordance with accepted observational standards.
4. Have gained experience in the analysis of meteorological and microclimatological data. Here we will emphasize the importance and influence of site characteristics on measured meteorological variables and derived microclimatological parameters.
5. Have gained skill in the written and oral communication of the results of campaigns of environmental measurement.

Course Activities:

While the course catalogue describes this as a lecture format course, I will not be presenting a lot of formal lectures. Instead, you will spend your time in class doing a wide range of things:

- working with sensors and loggers to gain understanding of sensor design and function and data logger programming
- working at field sites setting up our field experiments
- listening (attentively) to lecture material from me
- working on assignments

As with any course at this level, this course requires a substantial time commitment outside of the scheduled class meetings. Time outside of class will be spent on assigned reading from the texts, completing homework assignments, setting up experiments in the field, and homework assignments based on field experiments. I will also supplement classroom instruction with lessons selected from the library of material provided through the COMET program run by the National Center for Atmospheric Research. You will have to register for this program (see Carmen page for details), work through the assigned lessons and take the end-of-lesson quizzes. The results of the quizzes will be emailed to me and recorded in the gradebook.

Early in the semester we will meet in small groups on 2 different weekends to set up equipment in the field. Our primary field sites will be:

- the OSU Turfgrass Research Center on Waterman Farm.
- The OSU airport on W Case Rd.

Attendance at these 2 field experiences is mandatory. In addition, there will be an optional 3rd opportunity for field work setting up equipment at the Farm Science Review held annually at the Molly Caren Agricultural Research Center just northeast of London, OH.

Following these initial small group field experiences, we will spend much of the 2nd half of the semester setting up and analyzing data from 3 successive microclimate experiments at the Turfgrass site. Each of these will be replicated at the Airport site by small groups of students. These group setups will be done outside of class, without my assistance and will be graded.

Each microclimate field setup will be associated with one or more homework exercises in which you will use the data generated during the experiment to demonstrate various concepts in microclimatology and derive various microclimatologically significant parameters or values. Each exercise will also feature questions about the sensors used in the experiments.

At this point I do not plan to offer any exams in this course.

Participation: This is not the type of course in which you can just read the textbook, take the exams (there aren't any) and expect to do well. This semester, you have the opportunity to work with research grade meteorological instrumentation; to benefit from this opportunity you have to be present. To encourage you to come to class I will take attendance at each class meeting. To encourage you to come prepared, I have assigned modules and quizzes on Carmen that will be due before the related class meetings.

Evaluation: Your grade will be based on your scores in several assignment categories weighted as follows:

Weight	Assignment category
5%	Class participation (mostly a function of attendance)
4%	Carmen quizzes (2)
14%	Quizzes from COMET lessons (7)
21%	In-class worksheets (3)
6%	Participation in field experiences (2)
37%	Homework exercises (5)
10%	Field group setup
3%	Field book

At present I do not plan to offer written exams.

Textbooks:

Required:

Oke, Timothy R. *Boundary layer climates*. Routledge, 2002. (2002). This text should be available at the Bookstore. Typically, inexpensive used copies can be found on-line. You all have taken G5921 and this is the required text for that course so I assume you already have a copy. For our purposes, the appendices of this text are particularly useful. In these, the author discusses instrumental approaches to quantifying several important micro-climate variables, particularly those associated with the surface energy balance.

Brock, Fred V. and Richardson, Scott J.. (2001). *Meteorological Measurement Systems*. Oxford University Press. This text deals specifically with instrumentation and is organized by sensor type (thermometry, barometry, etc) It is available through the library in an on-line version so you should be able to access it at no cost.

In addition, I will assign numerous sensors manuals for your review.

Order of Topics Covered

Electricity and measurement basics
Dataloggers and datalogger programming
Sensors – static and dynamic characteristics
Sensors – calibration and uncertainty
Temperature sensors
Wind sensors
Humidity sensors
Radiation sensors
Precipitation sensors

Beginning in the 2nd half of the semester, we will combine our consideration of types of sensors with 3 microclimate field experiments:

- Profiles of atmospheric variables in the lower 6 meters of the surface layer
- Solar and terrestrial radiation; net radiation
- The ground heat flux

A tentative schedule is available on Carmen. This will undoubtedly change so check Carmen frequently for announcements of schedule updates.

Academic misconduct

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>.

Disability Services

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.