

Geography 5922: Microclimatological Measurements – Fall 2018

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

Classroom: Derby Hall, room 0070 (and 0140)

Instructor: Jim DeGrand

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Office: 0110 Derby Hall

Phone: (614) 514-5985

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

Course Description: 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 and how to store and retrieve information from them. It is my belief that learning about environmental sensors is aided by incorporating the sensors into a campaign of measurement to achieve a specific goal. For this reason we will use the evaluation of the surface energy balance as the motivation for our investigations of microclimatological instrumentation. Microclimatological concepts necessary for such an evaluation will be covered as we go along. At the end of the course, students will have gained some expertise in and understanding of:

- sensor selection, evaluation and deployment
- data acquisition systems
- data analysis and display
- processes in the atmospheric boundary layer

Course Expectations: This is very much a “hand-on” course. As such, class attendance and participation are central to success (see below). Much of the course will take place outside of the classroom – on those days come prepared to work outdoors. I expect students to develop an understanding of and facility with:

- Basic microclimatological concepts related to the surface energy balance
- Basic field techniques for evaluating the surface energy balance
- Meteorological sensors
- Dataloggers and datalogger programming
- Data analysis and display

I expect students to keep detailed notes in a field notebook (see below) to be turned in for evaluation at the end of the quarter.

Field Experiments: My hope is that we will complete 4 major field experiments:

- Profiling the lowest 6 meters of the boundary layer
- Evaluation of the surface radiation budget
- Evaluation of the ground heat flux
- Evaluation of the turbulent fluxes of sensible and latent heat via the aerodynamic profile method

The field experiments will be carried out at 2 sites: the OSU Airport and the OSU Turfgrass Research Center. This will give us 2 sites for intercomparison and will give you practice setting up equipment in the field. The setups at the airport will be done during class time under instructor supervision. The setups at the Turfgrass Center will be done by groups on their own time and will be evaluated as part of the class grade (see below).

Group Fieldwork Assignments: As indicated above, each field setup done in class will be replicated by a student group at the other field site. Groups will be chosen by the instructor and announced at the conclusion of the setup done by the entire class. Each group will have 1 week to complete the setup.

Written Assignments: There will be written assignments associated with each of the above mentioned field experiments. In these assignments students will analyze the relevant data, prepare graphs as directed and respond to questions regarding the experiment and the data obtained.

Datalogger/sensor programming demonstrations: Students, working in groups of 2 (your choice of partner) will demonstrate their ability to program a datalogger to read a sensor and store the output in accordance with my specifications. There will be 2 such demonstrations: one approximately halfway through the semester, the other at the end of the semester during finals week. The demonstrations will be done in room 0070 Derby Hall, outside of class time by appointment with me. For the first demonstration each group will be assigned a specific sensor. For the second demonstration two sensors will be picked randomly from the list of all the assigned sensors (but not the one done previously). I will pick the sensors for the second demonstration at the time of the demonstration. In addition to programming the datalogger and demonstrating that the sensor is functioning correctly, students will be asked basic questions about the sensor and the program.

Participation: This is not the type of course in which you can just read the textbook, take the exams and expect to do well. In this course you have the opportunity to work with research grade meteorological instrumentation; you will get very little out of the course if you fail to come to class. To encourage you to come to class I will take attendance at each class meeting. To encourage you to come prepared, I will, from time to time, administer a brief quiz on assigned reading material at the beginning of class.

Evaluation:

- 4% Class participation
- 4% Quizzes
- 4% Fieldbook
- 24% Datalogger/sensor programming demonstrations
- 14% Field experiment setups
- 50% Written assignments regarding the experiments listed above

At present I do not plan to offer written exams.

Textbook:

Required: Oke, T. R., Boundary Layer Climates, (1987). This text should be available at the Bookstore. Typically, inexpensive used copies can be found on-line.

Also useful is: Arya, Introduction to Micrometeorology, (2001)

A field notebook is required. I recommend “Right in the Rain” notebooks which should be available at the bookstore (certainly available on-line).

Order of Topics Covered

Boundary layer structure

Electricity and measurement basics

Dataloggers and datalogger programming

Sensors – static and dynamic characteristics

Earth’s radiation budget and the radiation budget of a simple surface

Determination of net radiation

The ground heat flux

Determination of the ground heat flux

Turbulent fluxes of sensible and latent heat

Determination of the turbulent fluxes of sensible and latent heat by various methods

Examination of the surface energy balance

Characteristics of other sensors not used in the class field experiments (as time allows)

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.

