Geography 5922 Microclimatological Measurements – Fall 2015

Class times: T, Th 2:20-3:40 pm
Classroom: Derby Hall, room 0070 (and 0140)

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Office hours: 9-11 am, T & Th, 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, hopefully, 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 – 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.

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 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 accord with my specifications. There will be 2 such demonstrations: one approximately halfway through the semester, the other at the end during finals week. The demonstrations will be done in room 0070 Derby Hall, outside of class time by appointment with me. Each group will be assigned a specific sensor for the first demonstration. 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.

Evaluation:

5% Class participation
5% Fieldbook
25% Datalogger/sensor programming demonstrations
15% 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).
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

Dataloggers and datalogger programming
Sensors – static and dynamic characteristics
Boundary layer structure

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