Geography 5922: Microclimatological Measurements – Fall 2017

Class times: T, Th 9:35-10:55 am
Classroom: Derby Hall, room 0070 (and 0140)

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Office hours: 11 am - noon, 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 retrieve and store information from them. It is my belief that learning about environmental sensors is enhanced by actually using them in a campaign of measurement to achieve a specific goal. For this reason, each student will participate in a project that seeks to achieve something meaningful in terms of microclimate measurement. 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). I expect students to develop an understanding of and facility with:

- Basic microclimatological concepts, especially those related to their individual projects
- Basic field techniques for conducting microclimate fieldwork
- 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 semester.

Student Evaluation: Students will be evaluated based on several different assignments as described below:

Assignment 1: Datalogger programming and sensor siting: In this assignment students will be interpreting CRBasic programs, writing a simple CRBasic program and commenting on siting of various sensors based on readings of manuals for those sensors

Assignment 2: Sensor intercomparison and characterization In this assignment students will work with data generated by sensors setup for the class. The sensors

will be set up at the same site and, to the extent possible, will have identical environmental exposure. This will allow us to compare sensors of similar types and identify any that exhibit unacceptable levels of error.

Midterm Exam: There will be one midterm exam covering concepts presented in lectures.

Datalogger/sensor programming demonstration: Each student, working in groups of 2, will demonstrate his/her ability to program a datalogger to read sensors and store their output in accordance with my specifications. The demonstrations will take place by appointment in Derby 0070 between the beginning of class on 11/16 and the end of class on 11/21. Each group will have 20 minutes for the demonstration. Some demonstrations will necessarily be scheduled outside of class time. I will randomly pick 2 sensors for the demonstration at the time of the demonstration. The list of sensors from which I will choose, along with the documentation necessary for programming and wiring them will be posted on Carmen. In addition to programming the datalogger and demonstrating that the sensors function correctly, students will be asked basic questions about the sensors and the program.

Group field project: Each student, working in a group of 2 or 3 will participate in a field project throughout the semester. Students will choose a project from a list of topics provided by me or may propose their own. Groups must be established and topics chosen by the end of class, 8/29. Project proposals not on the list must receive my approval before any work proceeds on them. During the semester groups will work independently with the instructor to put together the elements of a successful field campaign:

1. Formulating the question(s) addressed and the scope of the campaign
2. Determining equipment needed, finding appropriate field sites and determining a schedule for the campaign
3. Writing the datalogger program and setting up the equipment
4. Retrieving and analyzing the data
5. Formulating conclusions based on the analysis
6. Presenting results

Each group will prepare a poster summarizing its project and these will be presented to the class on 12/5 (final day of classes) and 12/8 (scheduled final exam date).

Course participation: I will keep track of attendance when the class meets as a whole and I will also make note of individual participation in group field project activities

Field book: Students will take detailed notes of field activities in a notebook. These will be collected at the end of the semester and evaluated based on how well the notes allow me to reconstruct what took place in the field.

Grading: Grades will be determined based on performance in the elements of the course as follows:

- 5% Class participation
- 3% Fieldbook
- 15% Datalogger/sensor programming demonstrations
- 10% Written assignment 1
- 10% Written assignment 2
- 15% Midterm exam
- 42% Field project

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

- Basics of measurement
- Sensors – static and dynamic characteristics
- DC circuits: measuring voltage and resistance
- Dataloggers and datalogger programming
- Measurement of specific meteorological elements:
  - Temperature
  - Humidity
  - Radiation
  - Wind
  - Precipitation
  - Time permitting:
    - Pressure
    - Heat flux
    - Turbulent fluxes