GEOG 5922 Microclimatology: Microclimatological Measurements

Autumn 2023

INSTRUCTOR & CLASS INFORMATION

Instructor: Jacklynn K. Beck,

Office: Derby Hall 1070

Office Hours: Fridays from 9:00-11:00 am, and by appointment

Email: beck.746@osu.edu

Class Meetings: Friday 1:00 – 4:00 pm, Derby Hall 140

COURSE MATERIALS

- Text: Meteorological Measurements and Instrumentation (Class Readings)
  - Author: F.V. Brock
  - ISBN: 9781118745809
- Text: Boundary Layer Climates (Reference for Assignments)
  - Author: Author: T. R. Oke
  - ISBN: 978-0415043199
- Anaconda Navigator with Jupyter Notebook Installed
- Access to Carmen Canvas

EVALUATION

The following table breaks down how grades will be weighted for each assignment throughout the semester.

Type of Assessment	Percent of Final Grade
Lab Exercises	20%
Midterm Practical	20%
Quizzes – Content/Field and Comet	15%
Course and Field Work Participation`	10%
Final Project 1. Project Proposal 2. Abstract 3. Project Deployment 4. Final Paper 5. Poster Presentation	Project Total = 35%

Late work policy: All assignments are due at the time listed on the carmen website. Failure to submit assignments by their deadline will result in a 10% deduction for the individual/team with late work. No assignments, labs, or quizzes will be accepted beyond December 7, 2023 (Reading Day) unless the due date is set for the final exam time.

Assignment Description

Labs - Lab reports will be completed to demonstrate knowledge gained in the course lab periods. Students will interpret data, identify error sources, and visualize their data using python and ArcGIS Pro.

Midterm Practical – Students will be expected to write and send a functioning program for a designated sensor. They will also be expected to identify errors in a deployed sensor setup and explain the impact these errors will have on the data and troubleshoot how to fix the error.

Quizzes – Throughout the semester there will be two types of quizzes given. There will be carmen quizzes, and COMET quizzes.

1. Carmen quizzes will be given online, and will contain questions from the lab material covered from class content, and field experiences.
2. Comet quizzes will be given at the end of each comet module. Each student will be given 3 attempts to complete the quiz. An email will be sent to the instructor with your quiz score.

Participation – Participation in all class activities is expected to earn full credit. This includes participating in class discussions, completing field exercises/labs, and doing your share of the final project.

Final Project

The final project for the course will be completed in 5 tasks as a team throughout the semester.

1. **Abstract** – Students will write an abstract to be submitted to the AMS Student Conference session on Instrumentation. The abstract must be less than 1000 words and in AMS format. Examples of previous abstracts will be provided.

2. **Project Proposal** – Students will design a research project for their semester project. For this assessment they will write a 2 page maximum report outlining their research question, what instruments they will be deploying, and describe the purpose of their research question basing it in the literature.
    a. Previous project examples:
        i. Evaluating the impact of turf on the surface radiation balance
        ii. Testing the accuracy of ClimaVUE 50 sensors
        iii. Quantifying the error of tipping bucket rain gauges in high rainfall rates

3. **Project Deployment** – Students will develop a list of all the materials and tools they need as if they were preparing to go on a field campaign. They will write an appropriate program for their project. Then they will use these materials to deploy their project and collect data for their final project.

4. **Final Paper** – Students will write a report of their findings from their research project. The paper should be written using an appropriate AMS journal style. Information about the final paper requirements will be provided closer to the deadline.

5. **Poster Presentation** – Students will create a poster to present during a department research poster session during the time of the final exam. For this presentation should be prepared with a 30 second elevator pitch of their project as well as a 3-5 minute poster talk as if they are at a conference poster session.

Grading Scale
A = 93 to 100%, A- = 90 to 92%, B+ = 87 to 89%, B = 83 to 86%, B- = 80 to 82%, C+ = 77 to 79%, C = 73 to 76%, C- = 70 to 72%, D+ = 67 to 69%, D = 60 to 66%, E = <59%

EXPECTATIONS

Students

- To attend all classes and be on time
- To complete all assignments by the deadline listed in Carmen
- To obtain any missed material from their peers
- To treat all members of the class with respect
- To attend office hours and seek assistance when needed

Instructor

- To teach the students all material to make them successful
- To ensure that all course material is accessible to students
- To hold a minimum of 2 office hours each week for students.
- To grade all assignments within 1 week post deadline

OBJECTIVES

Course Objectives

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. For each meteorological variable the lectures will provide an overview of:

- Importance of the measurements. How are the measurements used?
- Instruments and how they work. How are measurements made?
- Application of knowledge through hands-on data collection with both basic and advanced instruments (in-class exercise)

The in-class exercises will give students the opportunity to apply these principles by making measurements in the field. The research project will provide the students to design an experiment and to collect data to answer a research question that is of interest to them. We will cover the following meteorological variables this semester:

- Air temperature (sling psychrometer; thermometer, thermistor)
- Surface temperature (IR temperature)

- Humidity (sling psychrometer; hygrometer)
- Precipitation
- Solar radiation
- Soil moisture and soil temperature
- Various other meteorological sensors
- Dataloggers and datalogger programming

Learning Objectives

As a result of taking this course you should know certain things (knowledge objectives) and be able to do certain things (skill objectives). Knowledge objectives (Things you should know by the end of the course):

- Describe the processes that are responsible for energy, moisture and momentum exchange between the surface and the atmosphere
- Describe the spatial and temporal variations in each component of the near-surface atmosphere, surface energy and moisture budgets, and the physical processes that are responsible for these patterns
- Describe how each component of the surface energy and moisture budget are measured using sensors and the calibration, limitations, uncertainty/biases in the measurements and the standards observed for its deployment
- Evaluate how human activities influence moisture and energy fluxes in the boundary layer at local, regional and global scales
- Evaluate how human activities are influenced by moisture and energy fluxes in the boundary layer at local, regional and global scales
- Critically evaluate and identify sources of uncertainty in measurements of surface energy and water exchanges

Skill objectives

- Measure and interpret meteorological variables and the surface energy budget
- Deploy sensors in accordance with accepted observational standards and collect measurements using a datalogger
- Quantify the influence of site characteristics on energy, moisture and momentum fluxes
- Use Python to visualize data using maps and graphs
- Generate graphs and maps for your group project and oral presentation
- Write a scientific report that answers a research question based on an analysis of data. This paper will conform to the standard for publication in a peer-reviewed journal
- Deliver a clear and concise oral presentation on the research that you completed during the semester

STATEMENT ON ACADEMIC MISCONDUCT

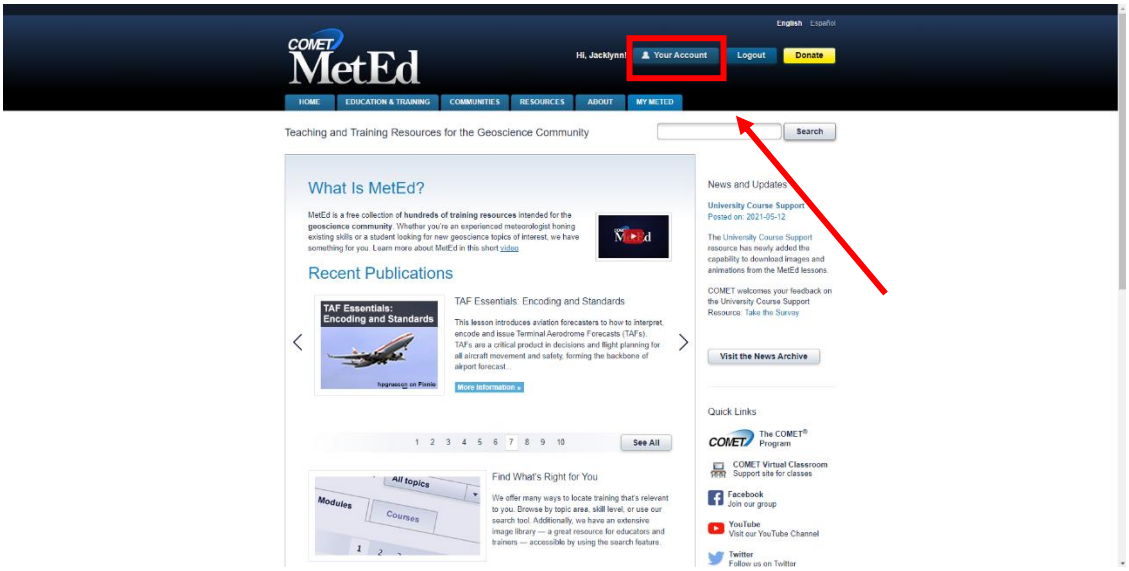
It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but 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 at http://studentlife.osu.edu/csc/.

DISABILITY SERVICES

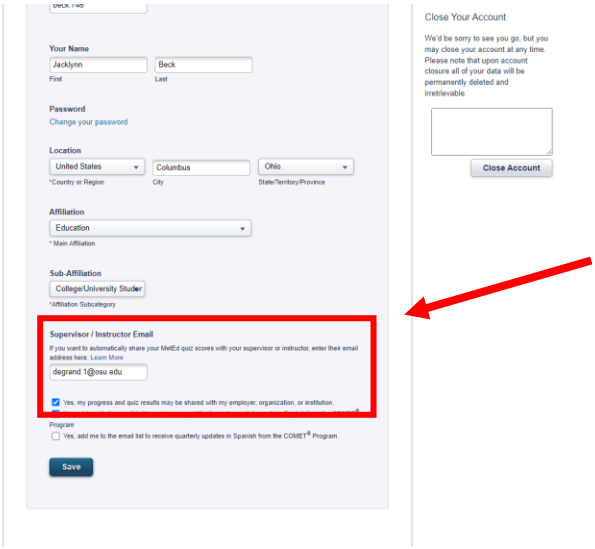
The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. You are also welcome to register with Student Life Disability Services to establish reasonable accommodations. 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.

COMET MetEd Setup

Go to meted.ucar.edu to set up you COMET MetEd Account. Your main affiliation is Education, and Sub Affiliation is College/University Student.



Once you are logged in to COMET, click Your Account as shown above.



Scroll to the bottom of the account page and enter beck.746@osu.edu into the Supervisor/ Instructor Email box. Also Click Yes, my progress and quiz results may be shared with my employer, organization or institution. This will email your quiz results to the instructor once you are finished.

TENTATIVE COURSE CALENDAR

The following is a tentative schedule of when we will cover material in this class. This is subject to change. All changes will be sent out through carmen announcement and discussed in class.

Week	Date	Topic	Location	Project	Assignments
Week 1	Aug 25	Course Intro, and Intro to sensors & Research Design	DB 140		Lab 1 Quiz 1
Week 2	Sept 1	Electricity, Circuits & Half Bridge, Building Tripods	DB 140 Courtyard	Abstract	Lab 2 & 3 Quiz 2
Week 3	Sept 8	Data Loggers Intro Radiometers & Net-Radiometers	DB 140 Courtyard		Quiz 3 Lab 4
Week 4	Sept 15	Temperature, Windspeed & Direction Profile	Waterman Farm	Proposal	Lab 5 Quiz 4
Week 5	Sept 22	Precipitation and Humidity Sensors Fieldwork Experience 3	Derby hall G2	Deploy G1	Lab 6 Quiz 5
Week 6	Sept 29	Intro to soil moisture Sensors Fieldwork Experience	Derby 140 Oval		Lab 7 Quiz 6
Week 7	Oct 6	Precipitation and Humidity Sensors Fieldwork Experience 3	Derby hall G2	Deploy G2	Lab 6 Quiz 5
Week 8	Oct 13	No Class - Fall Break			
Week 9	Oct 20	Midterm Practical Exam	Derby 140		Midterm
Week 10	Oct 27	Data Quality and Calibration Group Work	Derby 140		Quiz 6
Week 11	Nov 3	Exposure and Instrument siting Field improvisation exercise	Derby 140 Courtyard		Lab 7 Quiz 7
Week 12	Nov 10	No Class – Veterans Day			
Week 13	Nov 17	Other Measurement Systems Group Work	Derby 140		Quiz 8
Week 14	Nov 24	No Class – Thanksgiving Break			
Week 15	Dec 1	In-Class Workday	Derby 140	Final Paper	SEI
Week 16	Finals	Final project presentations		Presentation	

FIELDWORK SITE DIRECTIONS

Waterman Agricultural and Natural Resources Laboratory

From **Derby Hall**

Take Annie & John Glenn Ave past the RPAC to Lane Avenue. Turn Left onto Lane Avenue and continue straight. Turn Right onto Carmack Road into Waterman Farm (There are cows on your left 😊). Continue around the bend and turn left at the green houses. Follow the road around to the parking lots as shown on the map below.