



**METR 3613: Meteorological Measurement Systems**  
School of Meteorology, University of Oklahoma  
Fall 2018 Syllabus\*

**METR3613 Lectures**

**Time and Location:** MWF 12:00-12:50 pm, National Weather Center 1350

**Instructor:** **Dr. Scott Salesky** ([salesky@ou.edu](mailto:salesky@ou.edu))  
Office: NWC 5650  
Phone: 405-325-1738  
Office Hours: Mondays 1-2 pm or by appointment

Help sessions (focused on the homework assignments) will typically meet in NWC 5720 (Linux Lab). See course schedule for more details.

**METR 3613 Labs**

**METR 3613-011** T 12:30 – 2:30 pm, National Weather Center 5302  
TA: Brian Greene  
[brian.green@ou.edu](mailto:brian.green@ou.edu)

**METR 3613-012** R 2:30 – 4:30 pm, National Weather Center 5302  
TA: Joshua Gebauer  
[joshua.gebauer@ou.edu](mailto:joshua.gebauer@ou.edu)

The TAs will announce their office hours and locations at the first lab sessions.

**Textbooks:**

1. Brock, Fred V. and Richardson, Scott J., 2001: *Meteorological Measurement Systems*,

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\*The instructors reserve the right to alter any or all of stated policies and dates if they feel it is in the best interest of the students in the class. Any changes to the proposed syllabus will be announced in class.

Oxford University Press. (About \$150)

2. Emeis, Stefan, 2010: *Measurement Methods in Atmospheric Sciences – In Situ and Remote*, Borntraeger Science Publishers. (About \$85)

**Course Web Site:** The main course website can be found on Canvas: [canvas.ou.edu](https://canvas.ou.edu). All necessary course materials (lab descriptions, assignments, grades, etc.) and announcements will be posted on this site. Please become familiar with it and check it regularly. **You will have to submit all of your lab reports and homework solutions through Canvas.**

**Course Prerequisites:** Grade of C or better in METR 2023 and 2021, MATH 2433, 2443 or 2934, PHYS 1215 or 2524, and METR 1313 or CS 1313 or CS 1323.

**Purpose of this Course:** Regardless of which area of atmospheric science you are interested in, measurements of atmospheric variables will undoubtedly influence your work. In any area of science, it is observations of nature that lead to new theories and new understanding. In meteorology, we cannot hope to predict weather accurately unless we have sufficient knowledge of the current state of the atmosphere. This information is essential for accurate numerical forecasts of the weather. Thus, knowledge of the techniques used to obtain atmospheric measurements, the possible flaws in collected data, and the manipulations performed on the data before they are used are essential to any meteorologist, whether forecaster or researcher. The purpose of this course is to provide you with that knowledge.

**Objectives:** This course is designed for meteorology majors. The main objectives are to provide you with an understanding of the concepts in performing careful meteorological measurements and to provide an overview of state-of-the art instruments for these measurements. We will discuss the limitations of the instruments and identify major causes of errors in measurement output. Furthermore, we will focus on basic procedures of data analysis and interpretation.

**Methods:** To facilitate learning, this course will take place in a variety of settings. We will have a mix of **standard classroom lectures, hands-on labs, help sessions followed by homework assignments, and field trips**. Please review the schedule carefully as it provides details about the timing of various activities and related deadlines. It is good practice to bring hard copies of the lecture notes from Canvas to class. This will help you take notes during the lectures. **It is expected that you review the material covered in class and read the relevant chapters of the textbook even when no formal reading assignments are given in class.** Note that unannounced quizzes covering the material from the previous lectures can be expected.

**Labs:** You will work on lab assignments as part of a team of 3-5 students all semester. The teams will be formed at the beginning of the semester, and we expect them to remain unchanged until the end of the semester. It is in your best interest to cooperate with your team members and to work together effectively during the lab experiments and in the

analysis of your results.

In order to perform the laboratory experiments successfully and in a timely manner, **it is absolutely necessary that you read the lab description before coming to the lab sessions.** You will need to download the description from Canvas and bring a printed copy to the lab sessions. At the beginning of each lab, a quiz will be given to check how well you are prepared to perform the lab exercises. Each quiz will be graded as 10% of the grade for the lab exercise. If you fail to demonstrate that you are prepared, the instructor has the right to exclude you from the lab. Formal lab reports, **individually written by each student**, must be submitted 2 weeks after completion of the lab exercises (see attached schedule for details). An outline and instructions for lab reports will be handed out and discussed at the beginning of the course. It is very important that you follow the instructions closely. **You should come to the labs with a notebook to take notes, and ideally a laptop to record data in a spreadsheet and to take notes during labs.** This will save you a lot of time in the data analysis and preparation of your lab reports.

**Homework:** The homework assignments will provide you additional hands-on experience in working with meteorological data. In the design of the assignments, we focus on teaching, some basic data processing, statistical data analysis and data presentation skills. **In order to be consistent across the Meteorology curriculum, we will be using Python for programming and data analysis in this course.** We also emphasize demonstrating the sensitivity of meteorological data to instrument and exposure errors. Preceding each homework assignment, important information about the assignments will be given in a help session. Please check the attached schedule carefully for the specific dates of these help sessions and related deadlines for the assignments.

**Assignment instructions:** All lab and homework assignments are **individual** assignments. While some teamwork is allowed and encouraged in the data analysis parts of the assignments, **sharing of computer code or word documents is not allowed and will be treated as academic misconduct.** The only exceptions are that figures can be shared if a lab team is working together on the data analysis. Lab reports must be written by each student individually and the discussion of the figures should demonstrate that the student writing the report contributed to the data analysis and plotting of the results (i.e. the student knows what is plotted and what the results mean) and did not copy from someone else. **Any form of copying text from previous years' reports, laboratory descriptions posted online, or any other material publicly available without proper referencing will be treated as plagiarism, and will be dealt with according to the OU Academic Integrity Code, as discussed below.**

### Grading and Exams:

Lab Assignments (5)	25%
Graded Homework Assignments (3)	15%
Midterm Exams (2)	20% each
Final Exam	20%

## Important Dates:

1st midterm exam (in class)	<b>Wednesday, Oct. 10</b>
2nd midterm exam (in class)	<b>Wednesday, Nov. 7</b>
Final Exam	<b>Friday, Dec. 14, 1:30-3:30pm (NWC 1350)</b>

**For more information on other deadlines, see the detailed course schedule, which is posted on Canvas.**

**Attendance and Make-up Policy** In this course, participation will be strongly encouraged. Note that some material will be available only during class, and unannounced quizzes will be given. For both of these reasons, we expect you to attend all class periods. **Laboratory exercises, help sessions, and field trips require your attendance, and cannot be made up without PRIOR permission, which will be granted on a case-by-case basis, and under extraordinary circumstances.**

**IF YOU MISS A LAB, YOU MAY NOT USE SOMEONE ELSE'S DATA!** Any attempt to do so without permission of the instructors will be treated as academic misconduct, and actions will be taken according to the academic misconduct code described below.

Make-up exams will only be allowed under extraordinary circumstances if an exam is missed. **You MUST notify the instructor BEFORE then exam. Sickness will be accepted as an excuse only if accompanied by a note from a physician.**

## Other Important Policies

**Additional Support for Learning** The University of Oklahoma provides additional support to assist with your success in this course. The University College provides free tutoring through Action Tutoring ([ou.edu/univcoll/action\\_tutoring](http://ou.edu/univcoll/action_tutoring)). The Writing Center ([ou.edu/writingcenter](http://ou.edu/writingcenter)) provides assistance on writing and consultations to improve writing skills. The OU Meteorology Student Affairs Committee (SAC) also staffs a Help Desk for undergraduate students, which is located behind the OWL space on the first floor of the NWC. Currently the Help Desk is staffed from 5:00-7:00 pm on Mondays-Thursdays and 7:00-9:00 pm on Sundays.

**Academic Integrity:** All students are expected to conform to university-level standards of ethics, academic integrity, and academic honesty. Misconduct such as copying, plagiarism, fabrication, and fraud, as well as attempting to commit such acts or assisting others in doing so will not be tolerated. By enrolling in this course, you agree to be bound by the University of Oklahoma Academic Integrity Code ([integrity.ou.edu/students.html](http://integrity.ou.edu/students.html)). **I expect you to carefully review the Student's Guide to Academic Integrity, which is available at the above link. It provides detailed and clear information about what is considered cheating, the process for reporting misconduct, and possible sanctions.** Additionally, I would like to point out that sharing of computer code (e.g. Python scripts) for any METR 3613 homework or lab assignments is not allowed and will be treated as a form of academic misconduct.

**Tentative Schedule and List of Course Topics:** A tentative course schedule, which shows a calendar of course topics and assignment due dates is available on Canvas and is included below. All important course activities and deadlines are listed in this schedule. **Note that up-to-date deadlines for course assignments will be listed on Canvas.**

Week	Date	Event	Lecturer	Topic	Textbook Chapters / HW assignments	Comments / Deadlines
1	Sunday, August 19, 2018					
	Monday, August 20, 2018	Lecture 1	Scott Salesky	Introduction / Course Overview	HW 1: Summary of Mesonet paper (mandatory, but ungraded)	
	Tuesday, August 21, 2018	No formal lab session				
	Wednesday, August 22, 2018	Lecture 2	Scott Salesky	Measurement Basics / Surface Observation Networks	Emeis, Ch. 2; BR, Ch. 1	
	Thursday, August 23, 2018	No formal lab session				
	Friday, August 24, 2018	Lecture 3	Scott Salesky	Data Sampling, Errors, and QA	Emeis, Ch. 2; BR, Ch. 13	
Saturday, August 25, 2018						
2	Sunday, August 26, 2018					
	Monday, August 27, 2018	Lecture 4	Scott Salesky	Basic Electronics	BR, Appendix D	Deadline: Submit HW 1 (summary of Mesonet paper) to Dropbox on Canvas by midnight.
	Tuesday, August 28, 2018	Lab intro	Brian Greene	Organizational remarks, team selection, expectations for lab reports		Deadline: Bring a hard copy of Mesonet paper summary to lab
	Wednesday, August 29, 2018	Lecture 5	Scott Salesky	Thermometry	Emeis, Ch. 3.1; BR, Ch. 4	
	Thursday, August 30, 2018	Lab intro	Joshua Gebauer	Organizational remarks, team selection, expectations for lab reports		Deadline: Bring a hard copy of Mesonet paper summary to lab
	Friday, August 31, 2018	Help Session	Fred Carr, Petra Klein, Elinor Martin	Info session about METR Exchange programs		
Saturday, September 1, 2018						
3	Sunday, September 2, 2018					
	Monday, September 3, 2018	Labor Day				
	Tuesday, September 4, 2018	Lab 1, Group A	Brian Greene	Basic Electronics		
	Wednesday, September 5, 2018	Lecture 6	Scott Salesky	Thermometry	Emeis, Ch. 3.1; BR, Ch. 4	
	Thursday, September 6, 2018	Lab 1, Group B	Joshua Gebauer	Basic Electronics		
	Friday, September 7, 2018	Lecture 7	Scott Salesky	Static Performance Characteristics	BR, Ch. 3	
Saturday, September 8, 2018						
4	Sunday, September 9, 2018					
	Monday, September 10, 2018	Lecture 8	Scott Salesky	Static Performance Characteristics	BR, Ch. 3	
	Tuesday, September 11, 2018	Lab 1, Group C	Brian Greene	Basic Electronics		
	Wednesday, September 12, 2018	Lecture 9	Scott Salesky	Static Performance Characteristics	BR, Ch. 3	
	Thursday, September 13, 2018	Lab 1, Group D	Joshua Gebauer	Basic Electronics		
	Friday, September 14, 2018	Help Session (NWC 5720)	Scott Salesky and TAs	Overview of HW assignments, access to Mesonet data, and intro to simple data analysis in Python	HW 2: Download Mesonet data, perform basic data analysis, and prepare basic plots with Python	
Saturday, September 15, 2018						

Week	Date	Event	Lecturer	Topic	Textbook Chapters / HW assignments	Comments / Deadlines
5	Sunday, September 16, 2018					
	Monday, September 17, 2018	Help Session	Scott Salesky and TAs	Follow-up information about writing lab reports, reinforce citing literature, figures, captions, etc.		
	Tuesday, September 18, 2018	Lab 2, Group A	Brian Greene	Wind vane calibration		
	Wednesday, September 19, 2018	Help Session (NWC 5720)	Scott Salesky and TAs	Q&A Session about Homework 2		
	Thursday, September 20, 2018	Lab 2, Group B	Joshua Gebauer	Wind vane calibration		
	Friday, September 21, 2018	Lecture 10	Scott Salesky	Barometry	Emeis, Ch. 3.3, BR, Ch. 2	
	Saturday, September 22, 2018					
6	Sunday, September 23, 2018					
	Monday, September 24, 2018	Lecture 11	Scott Salesky	Humidity Measurements	Emeis, Ch. 3.2; BR, Ch. 5	Deadline, Lab Report 1, Group A
	Tuesday, September 25, 2018	Lab 2, Group C	Brian Greene	Wind vane calibration		
	Wednesday, September 26, 2018	Help Session (NWC 5720)	Scott Salesky and TAs	Python Session 2: Automated processing of multiple files		Deadline, Lab Report 1, Group B
	Thursday, September 27, 2018	Lab 2, Group D	Joshua Gebauer	Wind vane calibration		
	Friday, September 28, 2018	Lecture 12	Scott Salesky	Humidity Measurements	Emeis, Ch. 3.2; BR, Ch. 5	
	Saturday, September 29, 2018					
7	Sunday, September 30, 2018					
	Monday, October 1, 2018	Lecture 13	Scott Salesky	Humidity Measurements	Emeis, Ch. 3.2; BR, Ch. 5	Deadline, Lab Report 1, Group C
	Tuesday, October 2, 2018	Lab 3, Group A	Brian Greene	Thermistor calibration		Deadline, Lab Report 2, Group A
	Wednesday, October 3, 2018	Help Session (NWC 5720)	Scott Salesky and TAs	Simple analysis of Mesonet data with Python	HW 3: Download Mesonet data, perform data analysis and plots with Python	Deadline, Homework 2. Deadline, Lab Report 1, Group D
	Thursday, October 4, 2018	Lab 3, Group B	Joshua Gebauer	Thermistor calibration		Deadline, Lab Report 2, Group B
	Friday, October 5, 2018	Beat Texas!				
	Saturday, October 6, 2018					
8	Sunday, October 7, 2018					
	Monday, October 8, 2018	Lecture 14	Scott Salesky	Review session: discussion of old exam		
	Tuesday, October 9, 2018	Lab 3, Group C	Brian Greene	Thermistor calibration		Deadline, Lab Report 2, Group C
	Wednesday, October 10, 2018	Exam 1	Scott Salesky			
	Thursday, October 11, 2018	Lab 3, Group D	Joshua Gebauer	Thermistor calibration		Deadline, Lab Report 2, Group D
	Friday, October 12, 2018	Lecture 15	Scott Salesky	Dynamic Performance Characteristics	BR: Ch. 6	
	Saturday, October 13, 2018					

Week	Date	Event	Lecturer	Topic	Textbook Chapters / HW assignments	Comments / Deadlines	
9	Sunday, October 14, 2018						
	Monday, October 15, 2018	Lecture 16	Scott Salesky	Dynamic Performance Characteristics	BR: Ch. 6		
	Tuesday, October 16, 2018	Lab 4, Group A	Brian Greene	Time constant		Deadline, Lab Report 3, Group A	
	Wednesday, October 17, 2018	Lecture 17	Scott Salesky	Dynamic Performance Characteristics	BR: Ch. 6		
	Thursday, October 18, 2018	Lab 4, Group B	Joshua Gebauer	Time constant		Deadline, Lab Report 3, Group B	
	Friday, October 19, 2018	Lecture 18	Scott Salesky	Dynamic Performance Characteristics	BR: Ch. 6		
	Saturday, October 20, 2018						
10	Sunday, October 21, 2018						
	Monday, October 22, 2018	Lecture 19	Scott Salesky	Precipitation Measurements	Emeis Ch. 4.1; BR: Ch. 9		
	Tuesday, October 23, 2018	Lab 4, Group C	Brian Greene	Time constant		Deadline, Lab Report 3, Group C	
	Wednesday, October 24, 2018	Lecture 20	Scott Salesky	Anemometry	Emeis, Ch. 3.4; BR: Ch. 7	Deadline, Homework 3	
	Thursday, October 25, 2018	Lab 4, Group D	Joshua Gebauer	Time constant		Deadline, Lab Report 3, Group D	
	Friday, October 26, 2018	Lecture 21	Scott Salesky	Anemometry	Emeis, Ch. 3.4; BR: Ch. 7		
	Saturday, October 27, 2018						
11	Sunday, October 28, 2018						
	Monday, October 29, 2018	Lecture 22	Scott Salesky	Anemometry	Emeis, Ch. 3.4; BR: Ch. 7		
	Tuesday, October 30, 2018	Lab 5, Group A	Brian Greene	Rain Gauges		Deadline, Lab Report 4, Group A	
	Wednesday, October 31, 2018	Lecture 23	Scott Salesky	Radiosonde Measurements			
	Thursday, November 1, 2018	Lab 5, Group B	Joshua Gebauer	Rain Gauges		Deadline, Lab Report 4, Group B	
	Friday, November 2, 2018	Help Session (NWC 5720)	Scott Salesky and TAs	Introduction: Analysis of radiosonde data with Python (HW4)			
	Saturday, November 3, 2018						
12	Sunday, November 4, 2018						
	Monday, November 5, 2018	Lecture 24	Scott Salesky	Review Session			
	Tuesday, November 6, 2018	Lab 5, Group C	Brian Greene	Rain Gauges		Deadline, Lab Report 4, Group C	
	Wednesday, November 7, 2018	Exam 2	Scott Salesky				
	Thursday, November 8, 2018	Lab 5, Group D	Joshua Gebauer	Rain Gauges		Deadline, Lab Report 4, Group D	
	Friday, November 9, 2018	Help Session (NWC 5720)	Scott Salesky and TAs	QA Session about HW4	HW4: Download lidar / radiosonde data, prepare plots with Python, discuss results		
	Saturday, November 10, 2018						



Week	Date	Event	Lecturer	Topic	Textbook Chapters / HW assignments	Comments / Deadlines
13	Sunday, November 11, 2018					Deadline, Lab Report 5, Group A
	Monday, November 12, 2018	Lecture 25	Scott Salesky	Overview of remote sensing / lidar	Emeis Ch. 7	
	Tuesday, November 13, 2018	Lab 6, Group A+C	Matt Carney / Brian Greene	Release of Radiosonde		Deadline, Lab Report 5, Group B
	Wednesday, November 14, 2018	Lecture 26	Mike Biggerstaff	Radar measurements	Emeis Ch. 7.2.1; BR Ch. 9.2.2	
	Thursday, November 15, 2018	Lab 6, Group B+D	Matt Carney / Joshua Gebauer	Release of Radiosonde		
	Friday, November 16, 2018	Lecture 27	Mike Biggerstaff	Radar measurements	Emeis Ch. 7.2.1; BR Ch. 9.2.2	
	Saturday, November 17, 2018					
14	Sunday, November 18, 2018					Deadline, Lab Report 5, Group C
	Monday, November 19, 2018	Lecture 28	Petra Klein	Radiation balance / radiation sensors	Emeis Ch. 6; BR Ch. 10	
	Tuesday, November 20, 2018	no lab				Deadline, Lab Report 5, Group D
	Wednesday, November 21, 2018	Thanksgiving break				
	Thursday, November 22, 2018	Thanksgiving break				
	Friday, November 23, 2018	Thanksgiving break				
	Saturday, November 24, 2018					
15	Sunday, November 25, 2018					
	Monday, November 26, 2018	Lecture 29	Scott Salesky	Surface energy balance	Emeis Ch. 6; BR Ch. 10	
	Tuesday, November 27, 2018	no lab				
	Wednesday, November 28, 2018	Lecture 30	Brad Illston (OCS)	Mesonet data and QA/QC overview		Deadline, Homework 4
	Thursday, November 29, 2018	no lab				
	Friday, November 30, 2018	Mesonet tour	Brad Illston (OCS)	Tour of Oklahoma Mesonet		
	Saturday, December 1, 2018					
16	Sunday, December 2, 2018					
	Monday, December 3, 2018	Lecture 30	Scott Salesky	Special topics		
	Tuesday, December 4, 2018	no lab				
	Wednesday, December 5, 2018	Lecture 31	Scott Salesky	Special topics		
	Thursday, December 6, 2018	no lab				
	Friday, December 7, 2018	Lecture 32	Scott Salesky	Review Session		
	Saturday, December 8, 2018					
Finals	Sunday, December 9, 2018					
	Monday, December 10, 2018					
	Tuesday, December 11, 2018					
	Wednesday, December 12, 2018					
	Thursday, December 13, 2018					
	Friday, December 14, 2018	Final Exam	1:30-3:30 pm	NWC 1350		
Saturday, December 15, 2018						

Lab Topics	Group	Lab Date	Due date
0 Lab intro; writing lab reports	A + C	Tuesday, Aug. 28	
	B + D	Thursday, Aug. 30	
1 Basic electronics	A	Tuesday, Sept. 4	Monday, Sept. 24
	B	Thursday, Sept. 6	Wednesday, Sept. 26
	C	Tuesday, Sept. 11	Monday, Oct. 1
	D	Thursday, Sept. 13	Wednesday, Oct. 3
2 Wind vane calibration	A	Tuesday, Sept. 18	Tuesday, Oct. 2
	B	Thursday, Sept. 20	Thursday, Oct. 4
	C	Tuesday, Sept. 25	Tuesday, Oct. 9
	D	Thursday, Sept. 27	Thursday, Oct. 11
3 Thermistor calibration	A	Tuesday, Oct. 2	Tuesday, Oct. 16
	B	Thursday, Oct. 4	Thursday, Oct. 18
	C	Tuesday, Oct. 9	Tuesday, Oct. 23
	D	Thursday, Oct. 11	Thursday, Oct. 25
4 Time constant	A	Tuesday, Oct. 16	Tuesday, Oct. 30
	B	Thursday, Oct. 18	Thursday, Nov. 1
	C	Tuesday, Oct. 23	Tuesday, Nov. 6
	D	Thursday, Oct. 25	Thursday, Nov. 8
5 Rain gauges	A	Tuesday, Oct. 30	Sunday, Nov. 11
	B	Thursday, Nov. 1	Tuesday, Nov. 13
	C	Tuesday, Nov. 6	Sunday, Nov. 18
	D	Thursday, Nov. 8	Tuesday, Nov. 20
6 Radiosonde launch	A + C	Tuesday, Nov. 13	Wednesday, Nov. 28 (HW#4)
	B + D	Thursday, Nov. 15	Wednesday, Nov. 28 (HW#4)