

# METR 3613: Meteorological Measurements



## FALL 2012: SYLLABUS\*

### METR 3613 Lectures:

**Time and Location:** M, W, F 1:00 - 1:50 PM, NWC 1350  
Help Sessions may be scheduled during the F class time.  
See attached schedule for details.

**Instructor:** **Dr. Petra Klein** ([pkklein@ou.edu](mailto:pkklein@ou.edu))  
NWC 5339, Phone 325-1631  
Office hours: M/F 2:15 – 3:00pm or by appointment

**TA:** **Larissa Reames** ([lreames@ou.edu](mailto:lreames@ou.edu))  
NWC 5104  
Office hours: M 2:30-3:30 or by appointment.

### METR 3613 Labs:

**METR 3613\_011:** T 9:30 - 11:30 AM, NWC 5302  
**TA: Greg Blumberg** ([wblumberg@ou.edu](mailto:wblumberg@ou.edu))  
NWC 5335  
Office hours: T 11:30am-12:30pm or by appointment

**METR 3613\_012:** W 2:00 - 4:00 PM, NWC 5302  
**TA: Elizabeth Davidson** ([erockwell@ou.edu](mailto:erockwell@ou.edu))  
NWC 3910-A  
Office hours: W 4-5pm in NWC 5302 or by appointment

### Required Textbooks:

- I. Emeis Stefan, 2010: Measurement Methods in Atmospheric Sciences – *In-situ and Remote*, Borntraeger Science Publishers.
- II. Brock, Fred V. and Richardson, Scott J., 2001: *Meteorological Measurement Systems*, Oxford University Press.

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## **Web Sites**

You can find the main web site for this class on the Desire2Learn (D2L) system: <https://learn.ou.edu/index.asp>. All necessary course materials (lab descriptions, assignments, grades, etc.) and important announcements (e.g., directions to the field-trip sites) will be posted on this site. Please become familiar with this site and check it frequently. **You have to submit all your lab reports and homework solutions to drop boxes on D2L.**

## **Purpose of this Course:**

No matter what area of meteorology is of special interest to you, measurements of the atmospheric parameters will undoubtedly influence your work. In any area of science, it is our observations of nature that lead to new theories and new understanding. In meteorology, we cannot hope to make a successful weather prediction unless we have sufficient knowledge of the current state of the atmosphere. The maps we use give us a representation of this state. The models we use ingest this initial state and compute a predicted state for the future. Thus, knowledge of the techniques used to obtain these measurements, the possible flaws in the data collected, and the manipulations performed on the data before they are used are essential to any meteorologist, whether a forecaster or a researcher. This course is designed to provide you with this knowledge.

## **Objective**

The course is designed for meteorology majors. The main objective is to provide you with an understanding of the concepts used in performing careful meteorological measurements and to provide an overview of state-of-the art instruments used for these measurements. We will discuss the limitations of the instruments and identify major causes of errors in measurement output. Furthermore, we will teach to you basic procedures of data analysis and interpretation, and you will learn to work effectively in a team.

## **Methods**

To facilitate the learning process, this course will use 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 attached schedule carefully as it provides details about the timing of various activities and related deadlines. It is a good practice to bring hard copies of the b/w lecture notes that are posted on D2L to class. This will allow you to easily 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 (unannounced quizzes covering the material from the previous lectures can be expected).**

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 classes. You need to download the description from Desire2Learn and bring a printed copy to the lab classes. 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 corresponding to each lab exercise. If you fail to demonstrate that you are prepared, the lab instructor**

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**has the right to exclude you from the labs.** Formal lab reports must be submitted 2 weeks after completion of the experiments (see attached schedule for deadlines). An outline and instructions for the lab reports will be handed out and discussed at the beginning of the course and it is very important that you closely follow the instructions. **You are also required to purchase lab books for taking notes during the labs.**

The homework assignments will provide you additional hands-on experience in working with meteorological data. In the design of these assignments, we focus on teaching, some basic data processing, statistical data analysis and data presentation skills using state-of-the-art software. We also put emphasis on demonstrating to you the sensitivity of meteorological data towards instrument and exposure errors. Preceding each homework assignment, important information about the assignments will be given in a help session. Please carefully check the attached schedule for the specific dates of these help sessions and related deadlines for the assignments.

### **Lab Reports:**

All semester long, you will work on your lab assignments in a team of 3-5 students. 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 own best interest that you cooperate well with your team members and effectively work together during the lab experiments, and in the analysis and discussion of your results. We also strongly encourage teamwork during the homework assignments. **However, we expect that each student prepares an independent write-up and submits his/her own lab report and homework solution.** Any form of copying text from reports of other students, the laboratory descriptions posted on the web, or any other material publicly available without making references will be treated as plagiarism, and actions will be taken according to the academic misconduct code further described below. See also <http://www.ou.edu/provost/integrity/#3> for examples of plagiarism.

### **Grading and Exams:**

5 Lab Assignments, in total:	25%
4 Graded Homework Assignments, in total:	20%
Two In-Class Exams (September, November, each 20%):	40%
Final Comprehensive Exam (December):	15%

### **Important Dates**

1st Hourly In-Class Exam:	<b>Wednesday, September 26, 2012</b>
2nd Hourly In-Class Exam:	<b>Friday, November 02, 2012</b>
Final Exam:	<b>Thursday, December 13, 2012</b>

**For more information on other deadlines see also the attached detailed schedule.**

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## **Attendance and Make-up Policy**

In this class, 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 100% attendance to be the norm. **Laboratory exercises, help sessions, and fieldtrips absolutely 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 by the instructors will be treated as academic misconduct, and actions will be taken according to the academic misconduct code described further below.**

Only under extraordinary circumstances make-ups will be given if an exam is missed. **You MUST notify the instructor BEFORE the exams. Sickness will be accepted as an excuse only if accompanied by a note from a physician.**

## **Other Important Policies**

**Reasonable Accommodation:** The University of Oklahoma is committed to providing reasonable accommodation for all students with disabilities. Students with disabilities who require accommodations in this course are requested to speak with the professor as early in the semester as possible. **Students with disabilities must be registered with the Disability Resource Center prior to receiving accommodations in this course.** The Disability Resource Center is located in Goddard Health Center, Suite 166, phone 405/325-3852 or TDD only 405/325-4173.

**Academic Misconduct:** All provisions of the Norman Campus Academic Misconduct Code shall apply in cases of academic dishonesty. Academic misconduct is defined as “any act that improperly affects the evaluation of a student’s academic performance or achievement.” All faculty at the University of Oklahoma expect academic integrity from each student. Misconduct such as plagiarism, fabrication, and fraud, as well as attempting to commit such acts or assisting others in so doing, will not be tolerated. Students are responsible for knowing the academic misconduct code, which is included in the student code ([http://judicial.ou.edu/images/stories/student\\_codebook.pdf](http://judicial.ou.edu/images/stories/student_codebook.pdf)). All instances of alleged academic misconduct will be thoroughly investigated and action will be taken according to the rights and responsibilities under the academic misconduct code described at <http://www.ou.edu/provost/integrity-rights/>.

## **Tentative Schedule and list of course topics:**

See tables on the next 5 pages.

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Date	Event	Lecturer	Topic	Textbook Chapters/HW Assignments	Comments/Deadlines
Wednesday, August 1, 12					
Thursday, August 2, 12					
Friday, August 3, 12					
Saturday, August 4, 12					
Sunday, August 5, 12					
Monday, August 6, 12					
Tuesday, August 7, 12					
Wednesday, August 8, 12					
Thursday, August 9, 12					
Friday, August 10, 12					
Saturday, August 11, 12					
Sunday, August 12, 12					
Monday, August 13, 12					
Tuesday, August 14, 12					
Wednesday, August 15, 12					
Thursday, August 16, 12					
Friday, August 17, 12					
Saturday, August 18, 12					
Sunday, August 19, 12					
Monday, August 20, 12	Lecture 1	Petra Klein	Introduction - Course Overview		
Tuesday, August 21, 12	No lab session				
Wednesday, August 22, 12	Lecture 2 No lab session	Petra Klein	Measurement Basics	Emeis: Ch. 2; BR: Ch. 1	
Thursday, August 23, 12					
Friday, August 24, 12	Lecture 3	Petra Klein	Measurement Basics	Emeis: Ch. 2; BR: Ch. 1	
Saturday, August 25, 12					
Sunday, August 26, 12					
Monday, August 27, 12	Lecture 4	Petra Klein	Basic Electronics	BR: Appendix D	
Tuesday, August 28, 12	Lab Intro	Greg Blumberg	Organizational remarks, team selection, etc.		
Wednesday, August 29, 12	Lecture 5 Lab Intro	Petra Klein Elizabeth Davidson	Thermometry Organizational remarks, team selection etc.	Emeis: Ch. 3.1; BR: Ch. 4	
Thursday, August 30, 12					
Friday, August 31, 12	Help Session 1	Petra Klein	Overview of the HW assignments and information about writing of lab reports	HW 1: Summary of Mesonet Paper (mandatory but ungraded!)	Hand Out Papers to Read

Date	Event	Lecturer	Topic	Textbook Chapters/HW Assignments	Comments/Deadlines
Saturday, September 1, 12					
Sunday, September 2, 12					
Monday, September 3, 12	Labor day				
Tuesday, September 4, 12	Lab 1-Group A	Greg Blumberg	Basic electronics		
Wednesday, September 5, 12	Lecture 6 Lab 1-Group C	Petra Klein Elizabeth Davidson	Thermometry Basic electronics	Emeis: Ch. 3.1; BR: Ch. 4	
Thursday, September 6, 12					
Friday, September 7, 12	Help Session 2	Petra Klein	Info session about METR Exchange programs		
Saturday, September 8, 12					
Sunday, September 9, 12					
Monday, September 10, 12	Lecture 7	Petra Klein	Static Performance Characteristics	BR: Ch. 3	
Tuesday, September 11, 12	Lab 1-Group B	Greg Blumberg	Basic electronics		
Wednesday, September 12, 12	Lecture 8 Lab 1-Group D	Petra Klein Elizabeth Davidson	Static Performance Characteristics Basic electronics	BR: Ch. 3	
Thursday, September 13, 12					Deadline: Submit HW 1 (written summary of the assigned paper) to dropbox on D2L by 8pm
Friday, September 14, 12	Help Session 3	Petra Klein	Discussion of the Mesonet paper, access to Mesonet data and simple data analysis in Excel	HW 2: Download Mesonet data files, perform basic data analysis and prepare basic plots with Excel	Deadline: Bring a written summary of the assigned paper to class
Saturday, September 15, 12					
Sunday, September 16, 12					
Monday, September 17, 12	Lecture 9	Petra Klein	Static Performance Characteristics	BR: Ch. 3	Deadline Lab Report 1 - Group A, 8pm
Tuesday, September 18, 12	Lab 2-Group A	Greg Blumberg	Wind vane calibration		Deadline Lab Report 1 - Group C, 8pm
Wednesday, September 19, 12	Lecture 10 Lab 2-Group C	Petra Klein Elizabeth Davidson	Barometry Wind vane calibration	Emeis: Ch. 3.3; BR: Ch. 2	
Thursday, September 20, 12					
Friday, September 21, 12	Possible Field Trip to the Arm Site	Petra Klein, TAs and Matt Carney			
Saturday, September 22, 12					
Sunday, September 23, 12					
Monday, September 24, 12	Lecture 11	Petra Klein	Review session		Deadline Lab Report 1 - Group B, 8pm
Tuesday, September 25, 12	Lab 2-Group B	Greg Blumberg	Wind vane calibration		Deadline Lab Report 1 - Group D, 8pm
Wednesday, September 26, 12	Exam 1 Lab 2-Group D	Petra Klein Elizabeth Davidson			
Thursday, September 27, 12					
Friday, September 28, 12	Lecture 12		Exam 1 discussion/Humidity Measurements	Emeis: Ch. 3.2; BR: Ch. 5	Deadline: Submit HW 2 to dropbox on D2L by 9am
Saturday, September 29, 12					
Sunday, September 30, 12					

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Date	Event	Lecturer	Topic	Textbook Chapters/HW Assignments	Comments/Deadlines
Monday, October 1, 12	Lecture 13		Humidity Measurements	Emeis: Ch. 3.2; BR: Ch. 5	Deadline Lab Report 2 - Group A, 8pm
Tuesday, October 2, 12	Lab 3-Group A	Greg Blumberg	Thermistor calibration		Deadline Lab Report 2 - Group C, 8pm
Wednesday, October 3, 12	Lecture 14		Humidity Measurements	Emeis: Ch. 3.2; BR: Ch. 5	
Thursday, October 4, 12	Lab 3-Group C	Elizabeth Davidson	Thermistor calibration		
Friday, October 5, 12	Help Session 4	Petra Klein	Simple analysis of Mesonet data with Matlab	HW 3: Download Mesonet data files, perform basic data analysis and prepare basic plots with Matlab	stress conversion of humidity variables
Saturday, October 6, 12					
Sunday, October 7, 12					
Monday, October 8, 12	Lecture 15		Dynamic Performance Characteristics		Deadline Lab Report 2 - Group B, 8pm
Tuesday, October 9, 12	Lab 3-Group B	Greg Blumberg	Thermistor calibration		Deadline Lab Report 2 - Group D, 8pm
Wednesday, October 10, 12	Lecture 16	Petra Klein	Dynamic Performance Characteristics	BR: Ch. 6	
Thursday, October 11, 12	Lab 3-Group D	Elizabeth Davidson	Thermistor calibration		
Friday, October 12, 12	Texas Game Day				
Saturday, October 13, 12					
Sunday, October 14, 12					
Monday, October 15, 12	Lecture 17	Petra Klein	Dynamic Performance Characteristics	BR: Ch. 6	Deadline Lab Report 3 - Group A, 8pm
Tuesday, October 16, 12	Lab 4-Group A	Greg Blumberg	Time constant		Deadline Lab Report 3 - Group C, 8pm
Wednesday, October 17, 12	Lecture 18	Petra Klein	Anemometry	Emeis Ch. 3.4; BR: Ch. 7	
Thursday, October 18, 12	Lab 4-Group C	Elizabeth Davidson	Time constant		
Friday, October 19, 12	Fieldtrip	OCS	Tour of the Mesonet Facilities		Deadline: Submit HW 3 to dropbox on D2L by 9am
Saturday, October 20, 12					
Sunday, October 21, 12					
Monday, October 22, 12	Lecture 19	Petra Klein	Anemometry	Emeis Ch. 3.4; BR: Ch. 7	Deadline Lab Report 3 - Group B, 8pm
Tuesday, October 23, 12	Lab 4-Group B	Greg Blumberg	Time constant		Deadline Lab Report 3 - Group D, 8pm
Wednesday, October 24, 12	Lecture 20	Petra Klein	Radiosondes	BR: Ch. 12	
Thursday, October 25, 12	Lab 4-Group D	Elizabeth Davidson	Time constant		
Friday, October 26, 12	Help Session 5	Petra Klein	Analysis of Radiosonde data with Matlab	HW 4: Download Radiosonde data files, and prepare basic plots with Matlab	
Saturday, October 27, 12					
Sunday, October 28, 12					
Monday, October 29, 12	Lecture 21	P. Klein	Precipitation measurements	Emeis Ch. 4.1; BR: Ch. 9	Deadline Lab Report 4 - Group A, 8pm
Tuesday, October 30, 12	Lab 5-Group A	Greg Blumberg	Rain Gauges		Deadline Lab Report 4 - Group C, 8pm
Wednesday, October 31, 12	Lecture 22	P. Klein	Review Session		
Thursday, October 31, 12	Lab 5-Group C	Greg Blumberg	Rain Gauges		

Date	Event	Lecturer	Topic	Textbook Chapters/HW Assignments	Comments/Deadlines
Thursday, November 1, 12					
Friday, November 2, 12	Exam 2				
Saturday, November 3, 12					
Sunday, November 4, 12					
Monday, November 5, 12	Lecture 23	P. Klein	Review Exam 2 and Radiation Measurements	Emeis: Ch.6.1; BR: Ch. 10	Deadline Lab Report 4 - Group B, 8pm
Tuesday, November 6, 12	Lab 5-Group B	Greg Blumberg	Rain Gauges		Deadline Lab Report 4 - Group D, 8pm
Wednesday, November 7, 12	Lecture 24	P. Klein	Radiation and Surface-Energy Balance	Emeis: Ch.6; BR: Ch. 10	
Thursday, November 8, 12	Lab 5-Group D	Elizabeth Davidson	Rain Gauges		
Friday, November 9, 12	Lecture 25	P. Klein	Radiation and Surface-Energy Balance	Emeis: Ch.6; BR: Ch. 10	Deadline: Submit HW 4 to dropbox on D2L by 9am
Saturday, November 10, 12					
Sunday, November 11, 12					
Monday, November 12, 12	Lecture 26	Petra Klein	Basics of Remote Sensing and Scintillometer Measurements	Emeis: Ch. 7.1 and 7.3.1	Deadline Lab Report 5 - Group A, 8pm
Tuesday, November 13, 12	Lab 6-Group A+B	Petra Klein + Greg Blumberg	Tour of the NWC Roof Observatory		Deadline Lab Report 5 - Group C, 8pm
Wednesday, November 14, 12	Lecture 27	Petra Klein	Sodar Measurements	Emeis: Ch. 7.2.3	
Thursday, November 15, 12	Lab 6-Group C+D	Petra Klein + Elizabeth Davidson	Tour of the NWC Roof Observatory		
Friday, November 16, 12	Help Session 6	Petra Klein	Analysis of radiation and surface energy balance data with Matlab	HW 5: Analyze roof data files, and prepare basic plots with Matlab	
Saturday, November 17, 12					
Sunday, November 18, 12					
Monday, November 19, 12	Lecture 27	Petra Klein	Lidar Measurements	Emeis: Ch. 7.2.5	Deadline Lab Report 5 - Group B, 8pm
Tuesday, November 20, 12	Thanksgiving				Deadline Lab Report 5 - Group D, 8pm
Wednesday, November 21, 12	Thanksgiving				
Thursday, November 22, 12	Thanksgiving				
Friday, November 23, 12	Thanksgiving				
Saturday, November 24, 12	Thanksgiving				
Sunday, November 25, 12	Thanksgiving				
Monday, November 26, 12	Lecture 26	TBA	Radar, Guest Lectures		
Tuesday, November 27, 12	TBD				
Wednesday, November 28, 12	Lecture 27	TBA	Radar, Guest Lectures		
Thursday, November 29, 12	TBD				
Friday, November 30, 12	Lecture 28	TBA	Remote sensing of thermodynamic profiles	Emeis: Ch. 8	Deadline: Submit HW 5 to dropbox on D2L by 9am

Date	Event	Lecturer	Topic	Textbook Chapters/HW Assignments	Comments/Deadlines
Saturday, December 1, 12					
Sunday, December 2, 12					
Monday, December 3, 12	Lecture 29	TBA	Remote sensing of thermodynamic profiles	Emeis: Ch. 8	
Tuesday, December 4, 12	no lab				
Wednesday, December 5, 12	Lecture 30	P. Klein	Visibility and Cloud Height,	BR: Ch. 11	
Thursday, December 6, 12	no lab				
Friday, December 7, 12	Lecture 31	P. Klein	Last lecture - review session		
Saturday, December 8, 12					
Sunday, December 9, 12					
Monday, December 10, 12					
Tuesday, December 11, 12					
Wednesday, December 12, 12					
Thursday, December 13, 12	Final Exam		8.00-10.00am		
Friday, December 14, 12					
Saturday, December 15, 12					

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