METR 5004: Fundamentals of Atmospheric Science (Fall 2014)

Instructor: Prof. Steven Cavallo
Class meetings: MTWR 10:00-10:50 in NWC 1313
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Office hours: MTW 11am-12pm
Course web page: http://arctic.som.ou.edu/scavallo/classes/metr_5004/f2014/
Grader: Chris Riedel (NWC 5340)

Prerequisites: Graduate standing in a meteorology, physical science, or engineering program, or permission by instructor. Incoming graduate students are expected to have a working knowledge of calculus through ordinary differential equations (MATH 3113 or MATH 3413).

Course description:

Present a rigorous survey of the fundamental concepts in atmospheric science to provide the foundation for future graduate course work in meteorology and in related disciplines. The benefit to students in the graduate meteorology program who have undergraduate degrees outside of meteorology will be to provide sufficient background knowledge so that the students are prepared to successfully undertake graduate course work in meteorology. The benefit to graduate students with undergraduate degrees in meteorology is to present a breadth of subject areas that are not typically covered in most undergraduate programs and to cover these areas at the level of rigor expected in graduate studies. Graduate students in related fields, such as hydrology and radar engineering, will benefit from a survey of the important concepts in the atmospheric sciences. The course will be taught at a rapid pace due to the large amount of material covered.

Required text:

(1) "Atmospheric Science: An introductory survey" by John M. Wallace and Peter V. Hobbs.

Non-required but potentially helpful text books:

(1) "Atmospheric Chemistry and Global Change" by Guy P. Brasseur, John J. Orlando, and Geoffrey S. Tyndall
(2) "Introduction to Atmospheric Chemistry" by Daniel J. Jacob (available for free in its entirety at http://acmg.seas.harvard.edu/people/faculty/djj/book/)
(3) "Basic Physical Chemistry for the Atmospheric Sciences" by Peter V. Hobbs
(4) "Introduction to Atmospheric Chemistry" by Peter V. Hobbs
(5) "Doppler Radar and Weather Observations: Second Edition" by Richard Doviak and Dusan Zrnic

Notices:

It is the policy of the University to excuse absences of students that result from religious observances and to provide without penalty for the rescheduling of examinations and additional required class work that may fall on religious holidays.

Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact me personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your education opportunities.

Grading:

Grade percentages will be determined as shown below. Note that there will almost certainly be a grading curve, with *final grades based on a relative grade distribution of the class.* Course grade weights:

Component	**Tentative date**	**Relative weight**
Homeworks/Quizzes	In-class quizzes usually on Thursday	10%
Chemistry Midterm Exam	Thursday September 18	15%
Exam 1	Thursday October 23	20%
Exam 2	Thursday November 20	25%
Final Exam	Thursday December 8 8-10am	30%

Homeworks/Quizzes:

Homeworks will occasionally be assigned for you to turn in for a grade. There will be also be in-class quizzes over the reading material from the Wallace and Hobbs (denoted as "W&H" on the schedule) textbook. In-class quizzes will be announced ahead of time so that you can prepare. A good way to prepare for quizzes is to do the practice problems at the end of the corresponding chapters before the quiz (refer to the list of practice problems provided in this syllabus). Quizzes will be closed notes and closed books. Although quizzes will focus on the reading material of that particular week, there may also be questions from earlier material. There may be additional quizzes or homeworks from material covered by guest lecturers that may not be from W&H.

Quizzes are meant to help (1) keep you up-to-date with the fast-paced structure of this course and (2) prepare you for the types of questions that may appear on exams. Since quizzes cover concepts that are usually being covered the same week of class, they will have the lowest weight on your overall course grade in order to minimize the penalty on your grade. Furthermore, **one quiz grade will be dropped to take into account travel, an unavoidable absence, or a bad day**. No make up quizzes will be allowed.

Chemistry midterm exam:

There will be an exam covering basic physical chemistry *before* your atmospheric chemistry unit in order to help you brush up on your chemistry background before jumping into atmospheric chemistry. To best prepare, **read chapters 1,2,3,4,and 7 of "Basic Physical Chemistry for the Atmospheric Sciences" by Peter V. Hobbs** before taking this exam. We will provide you with these readings, so it is not necessary to buy this book. Exam questions will be similar to the problems found at the end of the corresponding chapters. We will also provide you with a handout containing hints and solutions to selected exercises from these textbook problems. The exam is closed notes and closed books.

Exams:

There will be 2 regular exams, tentatively planned for the dates listed on the schedule. Note that while the second exam will focus on the material covered after the first exam, there may be questions or concepts from earlier material. Exams will be closed notes and closed books.

Final exam:

The final exam is scheduled for Thursday Dec. 8 8-10am. It will be cumulative, closed notes, and closed books.

Suggested practice problems:

The problems listed below are good practice problems from the W&H textbook. They will not be graded, but doing these problems will help you to learn the concepts covered in this course. Solutions to most of the problems below will be provided on the course web page or on D2L.

Chapter 1:	1.6, 1.8, 1.9, 1.11, 1.12, 1.13, 1.16, 1.17, 1.19, 1.20, 1.21
Chapter 2:	2.7, 2.8, 2.9, 2.10, 2.14, 2.15, 2.16, 2.18, 2.20, 2.21
Chapter 3:	3.18, 3.19, 3.20, 3.25, 3.26, 3.27, 3.28, 3.29, 3.32, 3.33, 3.35, 3.37, 3.38, 3.39, 3.41, 3.42, 3.43, 3.45, 3.46, 3.47, 3.48, 3.49, 3.50, 3.53, 3.54, 3.58, 3.59, 3.60, 3.61, 3.62, 3.64, 3.65
Chapter 4:	4.11, 4.12, 4.14, 4.15, 4.16, 4.17, 4.20, 4.31, 4.39, 4.40, 4.41, 4.43, 4.45, 4.46, 4.47, 4.48, 4.54, 4.55, 4.56
Chapter 5:	5.12, 5.13, 5.14, 5.15, 5.16, 5.17, 5.18, 5.19, 5.20, 5.23, 5.24, 5.25, 5.26, 5.27, 5.28, 5.29, 5.30, 5.31
Chapter 6:	6.8, 6.10, 6.11, 6.13, 6.14, 6.15, 6.16, 6.17, 6.18, 6.20, 6.21, 6.22, 6.23, 6.24, 6.25, 6.26, 6.27, 6.28, 6.29, 6.30, 6.31, 6.32, 6.33, 6.34, 6.35, 6.36, 6.38, 6.39, 6.40
Chapter 7:	7.5, 7.7, 7.8, 7.12, 7.16, 7.19, 7.20, 7.22, 7.23, 7.26, 7.27, 7.33, 7.34, 7.35, 7.37, 7.39, 7.44, 7.45
Chapter 8 (through 8.3):	8.8(a-l), 8.12, 8.13, 8.14, 8.15
Chapter 8 (8.4 only):	8.8(m-v), 8.16, 8.17, 8.18, 8.19, 8.20, 8.21
Chapter 9:	9.7, 9.8, 9.9, 9.10, 9.11, 9.16, 9.17, 9.19, 9.24, 9.25, 9.26, 9.27, 9.29
Chapter 10:	10.5, 10.6, 10.7, 10.8, 10.10, 10.12, 10.13, 10.14, 10.16, 10.18, 10.19

Tentative schedule

Wk	Date	Topic(s)	Reading
1	Aug. 18	Introduction;	Ch. 1
		The Earth System	Ch. 2
		Class will meet in NWC 5720 Wednesday Aug. 20	
		No class Tuesday and Thursday Aug. 19 and 21	
2	Aug. 25	Atmospheric dynamics	Ch. 7
		Homework: W&H Ch.1,2,7	
		No class Monday, Tuesday, Wednesday Aug. 25, 26, 27	
3	Sept. 1	Atmospheric thermodynamics	Ch. 3
		No class Monday Sept. 1	
4	Sept. 8	Atmospheric thermodynamics (cont'd)	Ch. 3
		Midlatitude meteorology	Ch. 8 (through 8.3)
		Quiz: W&H Ch.3	
5	Sept. 15	Midlatitude meteorology (cont'd)	Ch. 8
Thursday September 18: Chemistry Midterm Exam			
6	Sept. 22	Atmospheric chemistry	Ch. 5
		Guest lecturer: Dr. John Orlando (NCAR)	
7	Sept. 29	Cloud microphysics	Ch. 6
		Guest lecturer: Dr. Corey Potvin (CIMMS)	
		Homework: W&H Ch. 6	
8	Oct. 6	Radiative transfer	Ch. 4
		Quiz: W&H Ch. 4	
9	Oct. 13	Numerical weather prediction (NWP)	TBD
		Guest lecturer: Dr. Lou Wicker (NSSL)	
		Homework: NWP	
10	Oct. 20	The atmospheric boundary layer	Ch. 9
Thursday October 23: Exam 1			
11	Oct. 27	Tropical meteorology	TBD
		Guest lecturer: Prof. Lance Leslie (SoM)	
		Quiz: W&H Ch. 9 (Monday Oct. 27)	
		Homework: Tropical meteorology	
12	Nov. 3	Radar meteorology	TBD
		Guest lecturer: Dr. Dick Doviak (NSSL)	
		Homework: Radar meteorology	
13	Nov. 10	Radar meteorology (cont'd)	Handouts
		Guest lecturer: Dr. Dick Doviak (NSSL)	
			TBD
14	Nov. 17	Data assimilation (DA)	TBD
		Guest lecturer: Dr. Lou Wicker (NSSL)	
		Homework: DA	
Thursday November 20: Exam 2			
15	Nov. 24	Climate Dynamics	Ch. 10
		No class Wednesday and Thursday Nov. 26, 27	
16	Dec. 1	Climate Dynamics	Ch. 10
		Polar meteorology	TBD
		Quiz: W&H Ch. 10 and polar meteorology	
Thursday Dec. 8: Final Exam 8-10am			