ATMOS 5000
Introduction to Atmospheric Sciences
Fall Semester 2019 (Hybrid/IVC/Online)

MWF 10:45-11:35 (Lecture)
1250 WEB

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Office Hours: MWF 1:00-2:00
or by appointment

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1. Course Description:

This class provides a survey of the atmosphere for physical science and engineering majors. Topics include the structure of the atmosphere, atmospheric thermodynamics, cloud physics, radiative transfer, and atmospheric dynamics. It is a rigorous three-credit, one-semester course designed to bring you over to the quantitative side of the science. In fact, you should realize from the start that if you can't quantify it, you are probably not doing science.

In this course, we will use the basic mathematics, physics, and chemistry that you have studied to this point to describe the atmosphere and many atmospheric processes in a quantitative fashion. This course is the first of a series of theoretical and practical courses that you will take to qualify yourself as an atmospheric scientist. The material that you see here will be repeated and expanded upon as you move on to higher-level courses. An added benefit of this course is the improvement of your knowledge of physics, mathematics, and chemistry as you apply those general concepts to the more specific problems related to the atmosphere and its behavior.

2. Course Objectives:

- Apply the chemical equations of state to predict atmospheric behavior of dry and moist air parcels in the atmosphere.
- Apply the first law of thermodynamics to atmospheric processes.
- Develop equations to describe the saturation vapor pressure over curved, solution droplets.
- Develop continuous and stochastic cloud droplet growth models.
- Apply the Blackbody radiation laws to formulate simple radiative equilibrium models for the Earth.
- Apply the Blackbody radiation laws to quantitatively describe the scattering and absorption of radiation in the Earth's atmosphere.
- Apply Newton's laws to develop sets of equations which can be used to predict atmospheric motions on local, regional, and global scales.

3. Prerequisites:

- MATH 1050 & CHEM 1210

4. Required Textbook:

- Stull, Roland, Practical Meteorology: An Algebra-based Survey of Atmospheric Science (Version 1.02b), The University of British Columbia Press, ISBN-13: 978-0-88865-283-6, 2017. **Available for free at:** https://www.eoas.ubc.ca/books/Practical_Meteorology/prmet102/Practical_Meteorology-v1.02b-WholeBookColor.pdf

5. Class Delivery Format

The class format is designed for maximum flexibility. The base format is a hybrid (i.e., flipped) classroom in which all lectures are available on video for review prior to class. In-person classroom sessions will involve active learning exercises, practice problems, and interactive question and answer periods. In-person classroom sessions will continue as long as it is deemed safe by the University and as long as students are interested in this delivery format. Students who do not wish to participate in-person (for any reason) will be accommodated. All in-class sessions will be livestreamed via Zoom for synchronous learning or alternatively recorded for asynchronous participation.

The University has decided that all classes on the following dates shall only be offered in an online format:

9/28, 9/30, 10/2, 10/5, 10/7, 10/9, 11/30, 12/2

I also plan to make the day before the Thanksgiving holiday (i.e., 11/25) an online-only class as well. There will be no in-person class meetings on these days. However, I will be holding a livestreamed class session via Zoom which will also be recorded for asynchronous participation. If the University deems it unsafe to hold in-class meetings, then the course will move completely online. This change may occur at any time during the semester.

6. Evaluation Methods and Criteria:

Grades will be based upon your performance on the homework, quizzes, and exams. The weighted contribution of each of these items to your final grade is given below:

	Weight
Homework	30%
Quizzes (Drop 5 lowest scores)	30%
Exam 1: Thermodynamics	10%
Exam 2: Cloud Physics	10%
Exam 3: Radiative Transfer	10%
Exam 4: Atmospheric Dynamics	10%
	100%

Homework applies and extends what is discussed in class. Much of the most important learning takes place when you do homework. As you work on the problems, you learn both the subject matter and *how* to solve complex problems. You may work on homework with other students, but do not copy from anyone. Late homework is not accepted, so

turn in as much as you get done even if that is not everything. The main purpose for doing homework is to help *YOU* learn the material. Keep in mind that I am available during office hours or by appointment to assist you, if necessary.

All exams will be open book and open note. You will, however, be expected to complete the questions individually without assistance from other students. All exams will be made available on a Monday and will be due on Friday of the same week. The dates of each take-home exam, as well as the topics covered, are shown in the following table:

	Available	**Due**	**Chapters**
Exam#1 Thermodynamics	09/28	10/02	Chapter 1: Atmospheric Basics Chapter 3: Thermodynamics Chapter 4: Water Vapor
Exam #2 Cloud Physics	11/02	11/06	Chapter 5: Atmospheric Stability Chapter 6: Clouds Chapter 7: Precipitation Processes Chapter 14: Thunderstorm Fundamentals Chapter 15: Thunderstorm Hazards
Exam #3 Radiative Transfer	11/16	11/20	Chapter 2: Solar & Infrared Radiation Chapter 8: Satellites & Radar
Exam #4 Atmospheric Dynamics	12/4	12/11	Chapter 9: Weather Reports & Map Analysis Chapter 10: Atmospheric Forces & Wind Chapter 12: Fronts & Air Masses

Final grades are based on the following scale:

Score	**Grade**
> 92.5%	A
90% - 92.5%	A-
87.5% - 90%	B+
82.5% - 87.5%	B
80% - 82.5%	B-
77.5% - 80%	C+
72.5% - 77.5%	C
70% - 72.5%	C-
67.5% - 70%	D+
62.5% - 67.5%	D
60% - 62.5%	D-
< 60%	E

Sometimes cutoff points are lowered to produce more natural break-points and a reasonable distribution of grades, but please don't count on it.

7. Detailed Course Outline:

Class #	Date	Topics	Reading Assignments	Quizzes/ Homework
1	8/24	Chapter 1: Atmospheric Basics	1.1, 1.2, 1.3	
2	8/26	Chapter 1: Atmospheric Basics	1.4, 1.5	Quiz#1
3	8/28	Chapter 1: Atmospheric Basics	1.6	Quiz#2
4	8/31	Chapter 1: Atmospheric Basics	1.7, 1.8	Quiz#3
5	9/2	Chapter 3: Thermodynamics	3.1	Quiz#4
6	9/4	Chapter 3: Thermodynamics	3.2, 3.3	Quiz#5/HW#1
	9/7	****** University Holiday – No Class ******		
7	9/9	Chapter 3: Thermodynamics	3.4	Quiz#6
8	9/11	Chapter 3: Thermodynamics	3.5	Quiz#7
9	9/14	Chapter 3: Thermodynamics	3.6, 3.7	Quiz#8
10	9/16	Chapter 4: Water Vapor	4.1, 4.2	Quiz#9
11	9/18	Chapter 4: Water Vapor	4.3, 4.4	Quiz#10/HW#2
12	9/21	Chapter 4: Water Vapor	4.5	Quiz#11
13	9/23	Chapter 5: Atmospheric Stability	5.1, 5.2	Quiz#12
14	9/25	Chapter 5: Atmospheric Stability	5.3, 5.4, 5.5	Quiz#13/HW#3
15	9/28	Chapter 5: Atmospheric Stability	5.6, 5.7, 5.8	Quiz#14
16	9/30	Chapter 6: Clouds	6.1, 6.2, 6.3	Quiz#15
17	10/2	Chapter 6: Clouds	6.4, 6.5, 6.6, 6.8	Quiz#16/HW#4
18	10/5	Chapter 7: Precipitation Processes	7.1, 7.2	Quiz#17
19	10/7	Chapter 7: Precipitation Processes	7.4	Quiz#18
20	10/9	Chapter 7: Precipitation Processes	7.3, 7.5	Quiz#19
23	10/12	Chapter 7: Precipitation Processes	7.6, 7.7	Quiz#20
24	10/14	Chapter 14: Thunderstorm Fundamentals	14.1, 14.2	Quiz#21
25	10/16	Chapter 14: Thunderstorm Fundamentals	14.3, 14.4, 14.5	Quiz#22/HW#5
26	10/19	Chapter 14: Thunderstorm Fundamentals	14.6, 14.7	Quiz#23
27	10/21	Chapter 15: Thunderstorm Hazards	15.1, 15.2	Quiz#24
28	10/23	Chapter 15: Thunderstorm Hazards	15.3	Quiz#25
29	10/26	Chapter 2: Solar & Infrared Radiation	2.1, 2.2	Quiz#26
30	10/28	Chapter 2: Solar & Infrared Radiation	2.3	Quiz#27/HW#6
31	10/30	Chapter 2: Solar & Infrared Radiation	2.4	Quiz#28
32	11/2	Chapter 8: Satellites & Radar	8.1	Quiz#29
33	11/4	Chapter 8: Satellites & Radar	8.2	Quiz#30/HW#7
34	11/6	Chapter 8: Satellites & Radar	8.3	Quiz#31
35	11/9	Chapter 10: Atmospheric Forces & Wind	10.1, 10.2, 10.3	Quiz#32
36	11/11	Chapter 10: Atmospheric Forces & Wind	10.4, 10.5	Quiz#33/HW#8
37	11/13	Chapter 10: Atmospheric Forces & Wind	10.6, 10.7	Quiz#34
38	11/16	Chapter 10: Atmospheric Forces & Wind	10.8, 10.9	Quiz#35
39	11/18	Chapter 9: Weather Reports & Map Analysis	9.1, 9.2	Quiz#36
40	11/20	Chapter 9: Weather Reports & Map Analysis	9.3	Quiz#37/HW#9
41	11/23	Chapter 12: Fronts & Airmasses	12.1, 12.2	Quiz#38
42	11/25	Chapter 12: Fronts & Airmasses	12.3	Quiz#39

	11/27	****** University Holiday – No Class ******		
43	11/30	Chapter 12: Fronts & Airmasses	12.4, 12.5	Quiz#40
44	12/2	Chapter 12: Fronts & Airmasses	12.6, 12.7, 12.8, 12.9	Quiz#41
	12/4			Quiz#42/HW#10

Note: Shaded class days are designated as online only and will not meet in person

8. Use of Canvas:

This course depends on students using Canvas to access class content, submit assignments, participate in online discussions, etc. Students not familiar with Canvas are expected to complete the online tutorials, contact support at classhelp@utah.edu, or call 581-6112 immediately.

9. The Americans with Disabilities Act:

The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 801-581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability Services.

10. Addressing Sexual Misconduct:

Title IX makes it clear that violence and harassment based on sex and gender (which Includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

11. Student Names and Personal Pronouns Statement:

Class rosters are provided to the instructor with the student's legal name as well as "Preferred first name" (if previously entered by you in the Student Profile section of your CIS account). While CIS refers to this as merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you in class, on papers, exams, group projects, etc. Please advise me of any name or pronoun changes (and update CIS) so I can help create a learning environment in which you, your name, and your pronoun will be respected. If you need assistance getting your preferred name on your UIDcard, please visit the LGBT Resource Center Room 409 in the Olpin Union Building, or email

bpeacock@sa.utah.edu to schedule a time to drop by. The LGBT Resource Center hours are M-F 8am-5pm, and 8am-6pm on Tuesdays.

12. Campus Safety

The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.

13. Other Class Policies:

Students must take every exam with exceptions governed by University Policy. Plagiarizing, copying, cheating or otherwise misrepresenting ones' work will not be tolerated and will be dealt with as harshly as permitted under University Policy.

Do not break the scientific code of honor.

I will take attendance for the in-person class sessions for contact tracing purposes only.