Cloud Physics, Atmospheric Electricity, & Atmospheric Optics

Syllabus

IMPORTANT NOTICE

Any student in this course who has a disability that may prevent her or him from fully demonstrating her or his capabilities should contact me personally as soon as possible to discuss accommodation necessary to ensure full participation and to facilitate educational opportunity.

Meets: MWF 0900-0950, NWC 5600

Instructor: William H. Beasley, Professor
Office: NWC Room 5650
Telephone 325-3440
email: whb@ou.edu

Office Hours: By Appointment
Almost Any Time

Text: Wallace and Hobbs (2nd edition)

Possibly Useful Other Texts: Rogers and Yau, Second Edition, Fleagle and Businger, Serway, Tipler, Halliday, Resnick & Walker, Sears & Zemansky, Griffiths

Principal Course Topics

1. Physics of Clouds and Precipitation
   - Warm-Cloud processes
   - Ice processes
   - Precipitation Formation
   - Electrification

2. Introduction to Electromagnetic Fields and Waves
   - Maxwell Equations
   - Electromagnetic Waves
   - More on Thunderstorm Electrification, Lightning
   - Wave Propagation, Index of Refraction, Antennas*
   - Remote Sensing
     - Passive (Lightning Location Systems)
     - Active (Radar)
   - Earth in Space*

N.B.: By the time you finish this course I hope there is one thing you will never forget: ***Without electricity, there would be no T in +TS.***

3. Atmospheric Optical Phenomena
   - Scattering, Refraction, Diffraction, Spectra
   - Optical Phenomena (Rainbows, Haloes, Glories, Red Sunsets, Green TSTMS, etc.)
   - Colors in Nature, Human Vision*
   - Remote Sensing again*

Topics marked with * may be treated briefly or skipped if time runs short.

Course Objectives

The **objectives** of the course are to improve your ability to think critically about and to solve problems in atmospheric physics and to provide you with an opportunity to learn a number of concepts that may be important in your career as a meteorologist. This will require that you integrate your knowledge of physics and your skills in mathematics.

Course Grade

Generalities

My philosophy of grades is that a course grade is an integral rather than a differential quantity. As you learned in integral Calculus, a finite number of singularities makes no contribution to the integral! How does this apply to grades? This means that I try to design it so that any one bad day does not end up costing a letter grade. It also means that neither sheer brilliance, without application and diligence, nor hard work, without thought and attention to detail, will guarantee an "A" in the course. I have devised a grading system that I hope will make the best of your concern about grades by exploiting it as a means to the end of learning.

I make the following assumptions:

1. People learn in many different ways and at different rates.
2. People tend to procrastinate.
3. Problem-solving skills are best developed in small increments and cannot be crammed in the night before a big exam.
4. If the easiest path to follow is also contrived to be the best one, even students will follow it.

My intention is that the grade scheme fade into the background and the desire to learn occupy the foreground.

Particulars

	weight
Homework Problem Sets (H) (7)	20%
Short Exams (30 to 50 minutes) (E) (7, drop lowest, count 6)	60%
Final Exam (F)	20%

Components of Course Numerical Grade

Homework Problem Sets

There will be 7 problem sets, one due every other week, starting January 25. See advice on homework further on in the syllabus.

Short Exams

There will be 7 short exams, one every other week, starting February 1. These exams will be directly related to the homework problem sets due the previous week and lectures for the two-week period leading up to the exam day. The exams will be open book, open notes, open homework problem sets, etc. I will drop the lowest grade, so that the best 6 grades will count. This will allow for unavoidable absences, etc. There will be no makeup exams.

Final Exam

There will be an open-book, comprehensive, cumulative final examination. It will be on Tuesday May 7 8AM to 10 AM. It will be mandatory.

Correspondence Between Numerical Scores and Letter Grades

Scores on exams during the semester may run low. Don't let it worry you excessively. You would be wise not to assume that 90 to 100 is an A, 80 to 89 is a B, 70 to 79 is a C, etc. My experience is that it is not always easy to make things come out that way. My preference is to push the limits by making exams sufficiently challenging that there are few grades of 100%. If I am successful, and if for example the highest average in the class is 85, or whatever, then so be it. That does not necessarily mean there would be no grades of "A". In such a case, I would most likely normalize (or "curve") the grades. Furthermore, I try to assign grades in such a way that one or two percentage points out of 100 do not make a letter-grade difference. I have been reasonably successful at this in the past.

Homework Rules

You may take the heading of this section two ways. You may view the word "Homework" as an adjective and "Rules" as a noun. Or you may view the word "Homework" as a noun and Rules" as a verb. Both are true. If you believe, as I do, that

> **"Education is a wonderful thing, but it is well to remember from time to time that nothing worth learning can be taught."** (Oscar Wilde)

then you would be well advised to take advantage of homework problem sets as the means of learning. I can only try to help by pointing out the pitfalls that I know of (and I don't know them all, even at my ripe old age) and making suggestions for things to try. I can try to de-emphasize the general obsession with getting the "right" answer, in favor of understanding what you are doing. To paraphrase Prof. Kingsfield in the movie "The Paper Chase" (highly recommended by me!) "You teach yourselves atmospheric physics, I teach you how to think like an atmospheric physicsist!" Another quote is in order:

> **"The aim of education should be to teach us rather how to think, than what to think - rather to improve our minds, so as to enable us to think for ourselves, than to load the memory with thoughts of other men.** (Bill Beattie) (I don't know who that is either!)

and another:

> **"Nothing makes me sadder than the peer pressure that enforces conformity and erases wonder. ...Countless others had the light of intellectual wonder extinguished because a thoughtless and swaggering fellow student called them nerds on the playground.... We must rage against the dying of the light - and although Dylan Thomas spoke of bodily death in his famous line, we may also apply his words to the extinction of wonder in the mind, by pressures of conformity in an anti-intellectual culture." -** Stephen Jay Gould, Bully for Brontosaurus: Reflections in Natural History. 1991

How does all this relate to the problem sets? Just this: Each person should try to do the problems on his or her own as soon as possible after they are assigned. Then, after giving it

your best honest, not-fooling-yourself effort, get together with others and share ideas. Finally, when all done, write out your solutions on your own, not just cloning those of others. You will not have that option on the exams, so practice for exams by working homework problems under conditions that at least partially simulate exam conditions. In other words, I encourage you to work together on problem sets towards understanding, then to go back to your room or wherever and work out the details and presentation on your own. To encourage you towards this end, the grader will be on the lookout for evidence of cloning! One of the hardest things we as humans have to do in our lives is to learn how not to fool ourselves (see Feynman's writings). Please take advantage of this experience to make a good start in that direction.

Finally, the burden of turning around 40 problem sets over the weekend in a meaningful way is a heavy one for your grader. Therefore I have authorized him to be merciless if necessary about legibility, organization, neatness, boxes around answers, etc., in order to make it a doable task. I will apply similar stringent requirements on exams, so you might as well practice on the problem sets.

Some simple expectations for homework and exams:

1. Name on every page
2. No pages torn out of spiral notebooks
3. Boxes around answers
4. Proper units with numerical answers. If the answer is 12 meters, the answer 12, without "meters", gets no credit
5. Pages stapled together. If you cannot afford a stapler, see me!
6. Legible writing or printing.

Any Questions?

Pledge

The OU Honor Pledge is required on all work, including homework. In the case of homework, the key word in the pledge is "inappropriate". It is easy to sign the pledge on an exam when you cannot even see paper of the next person over or in front of you. On homework, you are on your honor with regard to the interpretation of "inappropriate". To me, on homework, it means what I said above: you can and should work together with others as you wish, or find stuff in other books as you wish, in order to achieve the necessary understanding of the problems, but the paper you turn in is your unique presentation of the results of your solution of the problems, not just cloned or copied from someone else without understanding or care just to get it done. By signing the pledge on homework problem sets, you are affirming to yourself, me, your peers, and the university that you have satisfied these criteria.

This is what you write on every piece of work that is turned in for a grade:

On my honor, I affirm that I have neither given nor received inappropriate aid in the completion of this exercise.

Name: _____

Date: _____

METR 3223 **Physical Meteorology II** Spring, 2013 01/20/13

Tentative schedule as of 01/20/13

Jan	14	Intro/Get Acquainted
	16	Survey/DQ
	18	hw1 assigned
	21	MLK day
	23	Lecture
	25	Lecture, ps1 due (at beginning of class), hw2 assigned
	28	Lecture, ps1 returned
	30	Lecture,
Feb	01	Short Exam 1
	04	Lecture
	06	Lecture
	08	Lecture, ps2 due (at beginning of class), hw3 assigned
	11	Lecture, ps2 returned
	13	Lecture
	15	Lecture, Short Exam 2
	18	Lecture
	20	Lecture
	22	Lecture, ps3 due (at beginning of class), hw4 assigned
	25	Lecture, ps3 returned
	27	Lecture
Mar	01	Lecture, Short Exam 3
	04	Lecture
	06	Lecture
	08	Lecture, ps4 due (at beginning of class), hw5 assigned
	11	Lecture, ps4 returned
	13	Lecture
	15	Lecture, Short Exam 4
	25	Lecture
	27	Lecture
	29	Lecture, ps5 due (at beginning of class), hw6 assigned
Apr	01	Lecture, ps5 returned
	03	Lecture
	05	Lecture, Short Exam 5

08 Lecture
10 Lecture
12 Lecture, ps6 due (at beginning of class), hw7 assigned

15 Lecture, ps6 returned
17 Lecture
19 Lecture, Short Exam 6

22 Lecture
24 Lecture
26 Lecture, ps7 due (at beginning of class)

29 Lecture, ps7 returned
May 01 Lecture, review for final exam
03 Short Exam 7, review for final exam

07 Final Exam 0800 -1000 CDT