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Course Syllabus
ATM 445/645 Atmospheric Dynamics I (3 Credits)
Department of Atmospheric Sciences, CNSM
University of Alaska Fairbanks
Fall 2014 (Sept-Dec 2014)

Instructor: U. Bhatt (474-2662, usbhatt@alaska.edu), IARC 307
When: M-W-F 10:30-11:30AM, Murie Room 102
Office Hours: M, W—11:30 AM-12:30 PM and by appointment (send email)
Course Web page:
http://www.gi.alaska.edu/~bhatt/Teaching/ATM645.fall2014/atm645.fall14.html
Registration information: ATM445 CRN: **75636** or ATM645 CRN: **75641**
Course Pre-/co-requisites: ATM 401/601 or permission of the instructor.

Course Description:

This course covers the basics of atmospheric dynamics including conservation laws, development of the equations of motion, thermal wind, circulation and vorticity, geostrophy, quasi-geostrophic motions, waves, and instabilities. We will cover the topics from Chapters 1-7 of the Holton and Hakim textbook (see below). A detailed schedule of topics is available on the course web page under 'Course Calendar' and will likely evolve during the course of the semester.

Materials Needed:

Required Text: Required Text: James R. Holton and Gregory J. Hakim, 2013: An Introduction to Dynamic Meteorology, 5th Edition. Academic Press. 532pp.
Text web site that provides book graphics and access to Matlab scripts:
http://booksite.elsevier.com/9780123848666/index.php
Textbook errata: http://holton-hakim.blogspot.com/2013/02/errata.html

Additional Useful Texts:

See list below.

Other Tools:

- Access to Matlab to run scripts in Holton book (UAF has site license)
- Your favorite math books.
- Books on reference in Mather Library (see below)

Course Goals:

Students will gain a fundamental knowledge of Atmospheric Dynamics and be prepared to take additional more advanced Atmospheric Dynamics courses.

Student Learning Outcomes:

Students who take this class, participate, do the homework, and attend regularly are expected to have the following skills:

- Understand and apply scale analysis to atmospheric motion equations

- Understand basic concepts in atmospheric dynamics such as: consequences of non-inertial reference frames, thermal wind, circulation, vorticity, quasi-geostrophic motions, waves, and baroclinic instability.
- Follow the derivation and be able to provide a physical interpretation of terms in the equations of motion
- Apply concepts from this class to their research
- Pass the Atmospheric Dynamics Comprehensive Exam (if applicable).

Instructional methods: This course is based on lectures, which will cover the major topics, emphasizing and discussing the important points. They are not sessions to regurgitate material already written in the text (though they sometimes may be!). The main text book is an update of the classic atmospheric dynamics book. Your personal participation is important, and it is will help you learn more efficiently to read the assigned material to reinforce the lectures. Matlab scripts may be used to reinforce the material, depending on the availability of the university site license and student expertise in Matlab.

Course Policies:

Homework: There will be approximately one homework assignment each 1-2 weeks. The problems list will be handed out in class. You are highly encouraged to work with others on the homework, but please make sure that you understand the problems that you hand in. I will randomly ask students to present the homework on the board and the board presentation of the problems will be the major part of your homework grade. You will hand in your homework papers after the problems have been discussed in class on the due date. Due to time constraints, we will not discuss all the homework problems in class, but solutions will be available in a folder box outside my office. **Late problem sets will have grade lowered by 10% per day late.**

Exams: There will be 3 in-class exams, with the first part closed book and the second part open book. **Exam 1 is on 3 Oct 2014, Exam 2 is on 5 Nov 2014, and Exam 3 is on 12 Dec 2014.** Missed exams will be given a 0 grade and make up exams will be given only under extenuating circumstances.

Class Project: The class project will entail reading/understanding a mutually agreed upon dynamics paper (probably a classic type) and giving a 15-minute presentation to the class which summarizes the key points of the paper and presents some critiques. Details, including suggested papers, will be provided separately. Final presentations will be Friday **5 Dec 2014**.

Complaints and Concerns: You are always welcome to talk to me to express complaints and concerns about the class. I will listen, though I do not guarantee that I will change the way I am doing things.

Plagiarism etc: Plagiarism and cheating are matters of serious concern for students and academic institutions. This is true in this class as well. The UAF Honor Code (or Student Code of Conduct) defines academic standards expected at the University of Alaska Fairbanks, which will be followed in this class. (Taken from the UAF plagiarism web site, which has many links with good information about this topic).

Evaluation: The course grade will consist of the following components. Final letter grades will be based on a standard scale: A=90 to 100%, B=80% to 89%, C=70% to 79%, D=50% to 69%, and F≤50%. As of Fall 2006, UAF has instituted a +/- scale to the grades, so the bottom and top 3 percentage points will fall within the '-' and '+' ranges, respectively. For example: 90-92% will be an A-, 93-96% will be an A, and above 97% will be an A+. Note that tests will be graded on a curve, so the above scale may be modified.

	ATM645	ATM445
Class Project	10%	5%
Homework	10%	15%
Quizzes	10%	10%
Class Participation (paper & homework discussion)	10%	10%
Exam1	20%	20%
Exam 2	20%	20%
Exam 3	20%	20%

Additional References: To see the same topics explained differently, try the following:

Basic Atmospheric Dynamics Texts (Overviews)

Riegel, C.A. and A.F.C., Bridger, 1992: Fundamentals of Atmospheric Dynamics and Thermodynamics, World Scientific, xx pp.
Lynch, A. and J. Cassano, 2006: Applied Atmospheric Dynamics, John Wiley, 290 pp., (will be available in September 2006).
Cushman-Roisin, B., 1994: Introduction to Geophysical Fluid Dynamics, Prentice-Hall, 320 pp.
Haltiner, G. J., and F. L. Martin, 1957: Dynamic and Physical Meteorology, McGraw-Hill, 470 pp.
Zdunkowski, W. and A. Bott, 2003: Dynamics of the Atmosphere : A Course in Theoretical Meteorology, Cambridge, 738pp.

Advanced Dynamics Texts (& Special Topics)

Andrews, D. G., J. R. Holton, and C. B. Leovy, 1987: Middle Atmosphere Dynamics, Academic Press, 489 pp.
Dutton, J. A., 2002: The Ceaseless Wind, McGraw-Hill, 640 pp.
Gill A. E., 1982: Atmosphere-Ocean Dynamics, Academic Press, 662 pp.
Green, J. & others, 2004: Atmospheric Dynamics, Cambridge University Press, 223 pp.
Lindzen, R. S., 1990: Dynamics in Atmospheric Physics, Cambridge University Press, 310 pp.
Pedlosky, J., 1998: Geophysical Fluid Dynamics, Second edition, Springer-Verlag, 710 pp.
Pedlosky, J., 2003: Waves in the Ocean and Atmosphere, Springer-Verlag, 260 pp.

Mathematics References

Boas, Mary L., 1983: Mathematical Methods in the Physical Sciences, 2nd Edition, Wiley, 816 pp.
Schey, H. M., 1996: Div, Grad, Curl, and All That: An Informal Text on Vector Calculus, Third Edition, W. W. Norton and Co, 176 pp.

Books on Reserve in Mather Library

Boas, Mary L., 1983: Mathematical Methods in the Physical Sciences, 2nd Edition, Wiley, 816 pp.
Cushman-Roisin, B., 1994: Introduction to Geophysical Fluid Dynamics, Prentice-Hall, 320 pp.
Dutton, J. A., 2002: The Ceaseless Wind, McGraw-Hill, 640 pp.
Holton, J., 2004: An Introduction to Dynamic Meteorology (The International Geophysics Series, Vol 88) , Academic Press, 535 pp.
Riegel, C.A. and A.F.C., Bridger, 1992: Fundamentals of Atmospheric Dynamics and Thermodynamics, World Scientific, xx pp.
Schey, H. M., 1996: Div, Grad, Curl, and All That: An Informal Text on Vector Calculus, Third Edition, W. W. Norton and Co, 176 pp.
Zdunkowski, W. and A. Bott, 2003: Dynamics of the Atmosphere : A Course in Theoretical Meteorology, Cambridge, 738pp.

General Advice: Atmospheric Dynamics is not something you read and memorize, rather it is something you learn how to do. Try the following study procedure:

1. Read the material either prior or just after the lecture, so that you will know what it's about.
2. Listen carefully to the lecture and take notes, ask questions and participate. This is 5% of your grade and could mean the difference between a letter grade in the end. Also, this is a good opportunity for you to practice how science is done.
3. There is a two step process in learning this material well. First you must solve the math and then second, think about the physical interpretation of the results. I will at times leave out steps in the derivations (but describe how to get from point a to b). I recommend that you work out the missing steps to help your understanding of the where the equations come from.
4. This is crucial: *Do not go back and read and re-read* the chapter until you "understand it." Rather, start working the problems and then go back through the chapter to clarify points as they come up. Sometimes it is helpful to read relevant sections in other texts to see alternate ways of presenting the material. Atmospheric science is a relatively young subject so there are not always standard explanations for phenomena, as in more mature scientific disciplines.

Disabilities Services:

The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. We will work with the Office of Disabilities Services (203 WHIT, 474-7043) to provide reasonable accommodation to students with disabilities.