ATMS-505: WEATHER SYSTEMS

Instructor: Prof. Jeff Frame
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Office Hours: M, W 11:00-12:00; T, Th 10:00-11:00 or by appointment

Meeting Times: Tu, Th; 3:30-4:50; 109 Atmospheric Sciences

Credits: 4 hours

Prerequisites: Graduate standing or permission of instructor.

Required Text: *Midlatitude Synoptic Meteorology* by Gary Lackmann.
ISBN: 978-1-878220-10-3

Optional Texts: *Mesoscale Meteorology in Midlatitudes*, by Paul Markowski and Yvette Richardson. ISBN 978-0-4707-4213-6.

Severe and Hazardous Weather, by Robert Rauber, John Walsh, and Donna Charlevoix. ISBN 978-0-7575-9772-5. (For students unfamiliar with introductory meteorology.)

Course Description: This course will provide students with both a theoretical and observational survey of midlatitude weather systems. The first half of this course focuses on synoptic-scale cyclones. Topics covered include weather map analysis, thermal wind, quasi-geostrophic theory, ageostrophic circulations, frontogenesis, baroclinic instability, and cyclogenesis. In the second half of this course, we will apply what we have learned in the first half of the course to weather forecasting, including winter storms, temperature and precipitation forecasting, ensemble forecasting, severe weather forecasting, and weather communication. The last two weeks of the course will include a rigorous examination of deep moist convection. Many topics will be introduced through class lecture and discussion and students will be expected to develop an understanding of these topics via analysis of the weather outside of class (including participating in the WxChallenge forecasting contest), class assignments, and exam preparation.

Course Websites: A wealth of forecasting links, some of which will be discussed in class, are available on the course website, http://compass2g.illinois.edu. Use these links or your favorite weather sites as a starting point for your weather forecasts. Other materials, including lecture notes, homework assignments, and handouts will be uploaded to this site throughout the semester. Note that downloading lecture notes from Compass is **not** an adequate substitute for attending class; these notes are intended to provide you with some of the imagery shown during the lectures. Many key details will be missing from these summaries and will be given in class.

COURSE WORK

Homework Assignments: Homework assignments will be assigned regularly throughout the semester. These assignments may consist of weather analyses, qualitative reasoning questions, and quantitative or theoretical exercises designed to help you learn the material and to develop your scientific problem solving skills. Assignments will be posted on the course web page and handed out in class. Students may work together on these assignments; however, each student must submit the solutions in his or her own words and include all details of any work which led to the solution. *Verbatim copying of answers on homework assignments will not be tolerated under any circumstances*. Late homework assignments will be penalized by 20% for each day that they are late. If you have a valid excuse for not being able to complete an assignment on time, please let me know before it is due.

Exams: There will be one in-class midterm exam during the semester and a cumulative final exam held during the final exam period. **You are required to take exams during the scheduled time. Exams cannot be made up except in extremely unusual circumstances and absolutely must be cleared with me in advance.**

Tentative Exam Dates: Tuesday, March 17 IN CLASS
Wednesday, May 14, 1:30-4:30pm (Finals Week)

Grading: Your grade will be calculated as follows:

20% Mid-Term Exam	30% Homework Assignments
20% Final Exam	5% WxChallenge Participation
15% Class Project	10% Weather Briefing(s)

Students who finish above the class mean can expect a grade of A or A-. Students who finish below the class mean can expect a grade of B+ or B. I reserve the right to assign lower grades to students who finish well below the class mean and display a significant lack of understanding of fundamental concepts or principles covered in this class.

WxChallenge: Participation in the WxChallenge national forecasting contest is required for this class. For every city for which you fail to forecast on at least 6 of the 8 possible dates, your score will be lowered by one point out of the six possible for this portion of your grade. For more information on the WxChallenge, please visit http://www.wxchallenge.com. Please contact me for more information, including on how to sign up for the contest. The contest resumes on Monday, January 26, and the registration deadline is Friday, January 23. You must register by the deadline in order to participate in the WxChallenge.
All forecasts are due at 0000 UTC (6:00 pm CST/7:00 pm CDT).

Class Project: All students will be required to complete an original research project (i.e., case study) on a weather event relevant to the material covered in this course. Possible

topics include midlatitude cyclones, blizzards, severe weather outbreaks, or other topics of a student's interest. Topics must be approved by the instructor in advance and two students may not write a paper on the same topic (e.g., the same tornado outbreak). Students will be expected to apply the concepts covered in class to the event in question. More information on this project will be distributed later in the semester.

Weather Briefings: After the first few weeks of class, responsibility for the daily weather briefings at the beginning of class will pass from the instructor to the students. The purpose of these student-led briefings is to allow students to explain the processes responsible for the current weather conditions both in the local area and in other regions of interest around the United States, to offer a well-reasoned short-term forecast for the local area, and to hone their public speaking skills. Half of your grades will be based on my evaluation of your briefings, and the other half of your grades will come from the evaluation of your briefings by your fellow students. A schedule will be distributed a few weeks into the semester detailing the date(s) for which you will be responsible for the weather briefing. Student-led weather briefings should be 10-15 minutes in length.

Class Participation: In the best learning environments, students participate actively in the class discussions via asking questions and contributing knowledge. Active participation in weather briefings and lectures is crucial to the development of your forecasting skills. If you have a good reason for missing class (i.e., illness, conference travel, etc), please email me before class and you will be excused from class that day. It will be your responsibility to get any class notes from another student.

COURSE POLICIES

Email: I will strive to answer all student emails in a timely matter. Email should be reserved for quick questions, especially after hours. If you have a more significant question or other problem, do not hesitate to stop by my or your TA's office during office hours or to make an appointment. Please include "ATMS-505" in the subject line when emailing me.

Respect: You will treat other students and the instructor with respect and will ensure that the classroom is a good learning environment free from disruptions such as extraneous conversation and *the ringing of cell phones*. The use of classroom computers, personal laptops, or mobile devices for non-class related activities, **including Facebook and text messaging**, is not permitted during class time. Please come to class on time. If you must come to class late or leave early, please do so without disrupting the class. Each class will start and end on time.

Academic Integrity: Students are permitted work together on homework assignments, but the final product must be your own; students turning in assignments that are blatantly copied will receive no credit. You are expected to complete your exams independently. Failure to do so will result in strict disciplinary action. Please see http://www.uiuc.edu/admin_manual/code/rule_33.html for more information.

Special Needs: To insure that disability-related concerns are properly addressed from the beginning of the course, students with disabilities who require reasonable accommodations to participate in this class are asked to see the instructor as soon as possible in accordance with university policy. For more information, please visit
http://www.uiuc.edu/admin_manual/code/rule_4.html

Tentative Course Schedule:

Date		Topic	Reading
Tu	01-20	Introduction; Surface Weather Observations	1.1
Th	01-22	Surface Weather Analysis	6.1, 6.4, Ch 12
Tu	01-27	Thermodynamic Diagrams	
Th	01-29	Review of Dynamics/Thermodynamics	1.2-1.3, 1.6
Tu	02-03	Hypsometric and Thermal Wind Equations	1.4
Th	02-05	Vorticity	1.5
Tu	02-10	Quasi-Geostrophic Omega	2.1-2.3
Th	02-12	Q-Vectors	2.3 (part)
Tu	02-17	Q-G Height Tendency/Isallobaric Wind	2.4-2.5
Th	02-19	Isentropic Analysis	Ch 3
Tu	02-24	Potential Vorticity	Ch 4
Th	02-26	Kinematic Frontogenesis	6.2
Tu	03-03	Dynamic Frontogenesis	6.3
Th	03-05	Baroclinic Instability	Ch 7
Tu	03-10	Midlatitude Cyclones I	Ch 5
Th	03-12	Midlatitude Cyclones II	Ch 5
Tu	03-17	**MID TERM EXAM**	
Th	03-19	Winter Storms	Ch 9
Tu	03-24	***SPRING BREAK - NO CLASSES***	
Th	03-26		
Tu	03-31	Numerical Weather Prediction I	10.1-10.3
Th	04-02	Numerical Weather Prediction II	10.4-10.5
Tu	04-07	Ensemble Forecasting	10.6
Th	04-09	Operational Models/Model Output Statistcs	10.7
Tu	04-14	Weather Forecasting and Communication	Ch 11
Th	04-16	The Convective Boundary Layer	
Tu	04-21	Convective Organization/Single-Cell Convection	
Th	04-23	Multicellular Convection/Mesoscale Convective Systems	
Tu	04-28	Supercellular Convection	
Th	04-30	Convective Hazards	
Tu	05-05	Catch up/Review	
Th	05-14	**FINAL EXAM, 8:00-11:00am**	