ATMS 314: MESOSCALE DYNAMICS

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Meeting Time: M W F, 1:00 - 2:00, 109 Atmospheric Sciences

Credits: 3 hours

Prerequisites: ATMS 301 (Atmospheric Thermodynamics), ATMS 302 (Atmospheric Dynamics I), ATMS 303 (Synoptic-Dynamic Weather Analysis)

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

Course Description: This course provides an in-depth examination of atmospheric processes that occur on the mesoscale (roughly between 1-100 km in scale). Our study of these phenomena will be both qualitative (e.g., through map analyses and case studies) and quantitative (e.g., through mathematical calculations and derivations) in order to demonstrate the linkage between observed mesoscale processes and their theoretical and dynamical foundations. We will begin by formally defining the mesoscale (it does not only include thunderstorms and severe weather!) and by reviewing essential concepts from thermodynamics and dynamics as well as sounding and radar analysis techniques. Mesoscale processes and phenomena covered in this course include mesoscale instabilities, boundary layer processes, lake-effect convection, the nocturnal low-level jet, mesoscale boundaries, mountain and gravity waves, and deep moist convection (convection initiation, ordinary convection, multicellular convection, mesoscale convective systems, supercellular convection) and its associated hazards (tornadoes, damaging winds, hail, flash floods).

Course Websites: Important course information, including lecture summaries, in-class animations, homework assignments, course announcements, and other materials will be made available online via Compass on a regular basis. Downloading this material is **not** an adequate substitute for attending class; it is 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 Website: http://compass2g.illinois.edu

COURSE WORK:

Homework Assignments: Homework sets will be assigned approximately weekly throughout the semester. These assignments will consist of mesoscale weather analyses, qualitative reasoning questions, and quantitative problems designed to help you learn the material and to develop your scientific problem solving skills. Assignments will be posted on the course web page. 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 Chris or me know before it is due.

Exams: There will be three exams during the semester. The first two exams will be held in the evening and the third exam will be held during the allotted final exam period. The exams will not be designed to be cumulative; however, it is the nature of meteorology courses that many concepts covered early in a course are often necessary for a complete understanding of the materials covered later in a course. The focus of any exam will be on the material covered since the previous exam. **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. The exam days are (tentative):

Monday, February 16, 6:30-8:30pm
Monday, April 6, 6:30-8:30pm
Wednesday, May 13, 7:00-10:00 pm

Quizzes: Brief quizzes will be given in class throughout the semester. These quizzes will always be announced at least one class period in advance and will be designed to test your understanding of a particular topic (e.g., thermodynamic diagrams). If you will be absent on a quiz date, you must let me know *in advance* to be permitted to make up that particular quiz. Failure to do so will result in a grade of zero for that quiz, except in unusual circumstances.

Class Participation: The best learning environments are when students participate actively in the class discussions via asking questions and contributing personal weather experiences and knowledge. Asking questions in class is always encouraged.

Grading: Your grade will be calculated as follows:

15% Exam I	A+	> 97%	C	72 - 77%
15% Exam II	A	92 - 97%	C-	70 - 71%
20% Final Exam	A-	90 - 91%	D+	68 - 69%
10% Quizzes	B+	88 - 89%	D	62 - 67%
35% Homework Assignments	B	82 - 87%	D-	60 - 61%
5% Class Attendance and Participation	B-	80 - 81%	F	< 60%
	C+	78 - 79%		

TENTATIVE READING LIST

Below is a list of topics to be covered in this course, along with the relevant pages to be read from the textbook. When we are nearing the conclusion of a certain topic in class, please begin reading about the following topic in your textbook.

What is the Mesoscale?	Ch. 1
Review of Continuity and Vorticity Equations	2.2-2.4
Review of Thermodynamics and Skew-T Diagrams	2.1, 2.6
Hodographs	2.7
Radar	Appendix A
Buoyancy and Static Instability	2.3.3, 3.1
Mesoscale Instabilities	3.2-3.5
The Boundary Layer	skim 4.1; 4.2-4.4
Lake-Effect Convection	4.5
Urban Heat Island	4.6
The Low-Level Jet	4.7
Mesoscale Boundaries	skim 5.1; 5.2-5.4
SPRING BREAK	*March 23-27*
Mesoscale Gravity Waves	skim Ch. 6
Orographic Mesoscale Phenomena	skim Ch. 11-12, 13.3-13.4
Cold Air Damming	13.1-13.2
Convection Initiation	Ch. 7
Convective Organization and Single-Cell Convection	8.1-8.2
Multicellular Convection and Mesoscale Convective Systems	8.3, Ch. 9
Supercellular Convection	8.4, skim 2.5
Tornadoes	10.1
Convective Hazards	10.2-10.4

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-314" in the subject line when emailing me or Chris.

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