ATS 641: Mesoscale Meteorology
Spring 2017
TR, 1:00-2:15 PM, ATS Room 101 (2 credits)

Course Description and Prerequisites

This course will cover the theory and application of mesoscale meteorology, and how mesoscale phenomena relate to features and processes on larger and smaller scales. The course is scheduled for four hours per week, which will nominally include one hour of lecture and one hour of lab each day of class, although this will vary throughout the semester.

Prerequisite: ATS640 or previous undergraduate coursework in meteorology, or consent of the instructor

Learning Outcomes

Upon completion of this course, students will be able to:

- Describe the basic theories describing mesoscale weather phenomena
- Understand the techniques used in mesoanalysis and mesoscale numerical modeling
- Apply the theories to observed mesoscale phenomena through analysis of recent and historical weather events

Instructor Information

Name	Dr. Russ S. Schumacher
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Course websites	http://schumacher.atmos.colostate.edu/teaching/ats641/ http://canvas.colostate.edu

Teaching assistant

Name	Nathan Kelly
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Office hours	TBD (will be determined first week of class)
Office location	ATS Room 412

Textbook

Required textbook: Paul M. Markowski and Yvette P. Richardson, *Mesoscale Meteorology in Midlatitudes,* Wiley-Blackwell, 2010. [Note: an online version is available from the CSU library.]

Other useful texts (not required):
Mesoscale Meteorology and Forecasting, AMS Monograph, 1986.
Severe Convective Storms, AMS Monograph, 2001.
Robert J. Trapp, *Mesoscale-Convective Processes in the Atmosphere*, Cambridge University Press, 2013.

I will also be making use of notes written by Dr. Richard Johnson, which I will make available as the semester goes along. He has been kind enough to give permission to use them, and I would appreciate it if you do not redistribute them without permission (see also copyright policy below). Additionally, copies of Powerpoint slides used in class and other supplemental material will be made available either on Canvas or via e-mail.

Grading Policies

Course grading will be based on a combination of lab exercises, a midterm exam, and a final exam. The lab assignments will be worth 40%, the midterm exam will be worth 25%, and the final exam will be worth 35% of your final grade. Plus/minus grading will be used.

Lab exercises

There will be 4-6 lab exercises over the course of the semester. These will involve applying the concepts discussed in class, and will often involve analyzing interesting recent mesoscale weather events. One or more will also involve running and processing output from a numerical model (more on this will be provided in class).

Class forecast contest

A class forecast contest will be conduced, with two separate "tournaments" separated by Spring Break. Your forecasting performance will not affect your grade, but participation is expected. Forecasts will be made each day of class. More details will be provided in class.

Weather discussions

The last 15-20 minutes of each class period will be devoted to a class discussion of current or recent mesoscale weather. During most weeks, the discussion on Tuesday will be led either by the instructor or the TA, and the discussion on Thursday will be led by one of the students in the class. Each student will be responsible for preparing and leading the discussion in class twice over the course of the semester. Furthermore, the student leading the discussion in class is also responsible for posting a brief written discussion online. Weather discussions should be focused on understanding of physical/dynamical processes. All students are also expected to participate in the discussions by asking questions or suggesting items of interest.

Expectations

At least 2 hours of effort are expected to complete readings and lab assignments outside of class for each hour of class time.

Special needs

If you have special learning needs that should be accommodated in this class, please see the instructor during the first two weeks of the semester, and refer to http://rds.colostate.edu/accommodation-process for more information.

Copyright policy

All materials used in this class are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless permission is expressly granted.

Academic Integrity and Plagiarism

Academic integrity is a crucial part of the vibrant learning community at Colorado State University and in the Department of Atmospheric Science. We expect all students to conduct their academic work with integrity, and particularly to avoid plagiarism. As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Plagiarism is a violation of the University rules on academic integrity. If you plagiarize in your work you could lose credit for the plagiarized work, fail the assignment, or fail the course. Plagiarism could result in expulsion from the university. Each instance of plagiarism, classroom cheating, and other types of academic dishonesty will be addressed according to the principles published in the CSU General Catalog (see, http://catalog.colostate.edu/general-

catalog/policies/students-responsibilities/#academic-integrity)
In this course, students are generally allowed (and encouraged!) to discuss the lab assignments with each other, but each student is expected to do his or her own work and turn in his or her own assignment.

Tentative* Schedule for ATS641 (TR 1:00-2:15pm)

Dates	Topic	Reading
17, 19 January	Syllabus; Introduction; Definitions of mesoscale; review/introduction of pertinent equations, Mesoanalysis techniques; Fort Collins climatology	Chapter 1 of MMM, Chapters 1-2, 9 of Johnson notes
24, 26 January	**AMS ANNUAL MEETING, NO CLASS (will schedule makeup classes)**	
31 January, 2 February	Review of synoptic meteorology; Potential vorticity	Chapter 2 MMM, Chapters 3-4 of Johnson notes
(rescheduled classes)	Fronts and frontogenesis; Low-level jets	Chapters 4.7 and 5 of MMM
7, 9 February	Instabilities	Chapter 4.7 of MMM
14, 16 February	Orographic flows (mountain waves, downslope windstorms, flow blocking, Front Range snowstorms)	Chapters 11-13 of MMM, Chapters 7,8,10 of Johnson notes
21, 23 February	Orographic flows, continued	
28 February, 2 March	Convective processes (introduction)	Chapter 7 of MMM, Chapter 11 of Johnson notes
7, 9 March	**Midterm exam (specific date TBD)**	
14, 16 March	**SPRING BREAK: NO CLASS**	
21, 23 March	Convective processes (continued)	Chapters 8, 10 of MMM
28, 30 March	Convective processes (continued)	
4, 6 April	Mesoscale convective systems	Chapter 9 of MMM, Chapter 12 of Johnson notes
11, 13 April	Mesoscale convective systems (continued)	
18, 20 April	Mesoscale convective systems (continued)	
25, 27 April	Flash floods; microbursts; derechoes	Chapter 10 of MMM; Chapters 13-14 of Johnson notes
2, 4 May	Other unfinished topics and miscellaneous mesoscale phenomena	
Tuesday, 9 May	**FINAL EXAM, 2-4 pm**	

*Other topics may also be inserted into the schedule as time and student interest allow. It is also possible that topics will be rearranged if a particularly interesting weather event occurs that relates to one of the topics. If major changes are to be made during the semester, an updated version of the schedule will be provided.