ATS 641: Mesoscale Meteorology
Spring 2016
TR, 1:00-2:50 PM, ATS Room 101

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
E-mail russ.schumacher@colostate.edu
Phone 970.491.8084
Office hours By appointment; please send e-mail to set up time
Office location ATS Room 413
Course websites http://schumacher.atmos.colostate.edu/teaching/ats641/
http://canvas.colostate.edu

Teaching assistant
Name Greg Herman
E-mail gherman@rams.colostate.edu
Phone 970.491.8393
Office hours TBD (will be determined first week of class)
Office location ATS Room 411

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.

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 6-8 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 conducted, 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. 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 in the online forum on Canvas. Weather discussions should be focused on understanding of physical/dynamical processes. All students are also expected to participate in the daily 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 1:00-2:50pm)**

<table>
<thead>
<tr>
<th>Dates</th>
<th>Topic</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>19, 21 January</td>
<td>Syllabus; Introduction; Definitions of mesoscale; review/introduction of pertinent equations, Mesoanalysis techniques; Fort Collins climatology</td>
<td>Chapter 1 of MMM, Chapters 1-2, 9 of Johnson notes</td>
</tr>
<tr>
<td>26, 28 January</td>
<td>Approximated equations for mesoscale flows (QG, SG, etc.); vertical motion; Q-vectors; potential vorticity</td>
<td>Chapter 2 MMM, Chapters 3-4 of Johnson notes</td>
</tr>
<tr>
<td>2, 4 February</td>
<td>Fronts and frontogenesis; Other boundaries: drylines; sea-breeze fronts; density currents</td>
<td>Chapter 5 of MMM</td>
</tr>
<tr>
<td>9, 11 February</td>
<td>Jets; jet streaks; low-level jets</td>
<td>Chapter 4.7 of MMM</td>
</tr>
<tr>
<td>16, 18 February</td>
<td>Instabilities</td>
<td>Chapter 3 of MMM</td>
</tr>
<tr>
<td>23, 25 February</td>
<td>Orographic flows (mountain waves, downslope windstorms, flow blocking, Front Range snowstorms)</td>
<td>Chapters 11-13 of MMM, Chapters 7,8,10 of Johnson notes</td>
</tr>
<tr>
<td>1, 3 March</td>
<td>Orographic flows, continued</td>
<td></td>
</tr>
<tr>
<td>8, 10 March</td>
<td>Midterm exam <em>(specific date TBD)</em></td>
<td>Mesoscale and storm-scale numerical modeling</td>
</tr>
<tr>
<td>15, 17 March</td>
<td><strong>SPRING BREAK: NO CLASS</strong></td>
<td></td>
</tr>
<tr>
<td>22, 24 March</td>
<td>Convective processes</td>
<td>Chapter 7 of MMM, Chapter 11 of Johnson notes</td>
</tr>
<tr>
<td>29, 31 March</td>
<td>Convective processes (continued)</td>
<td>Chapters 8, 10 of MMM</td>
</tr>
<tr>
<td>5, 7 April</td>
<td>Convective processes (continued)</td>
<td></td>
</tr>
<tr>
<td>12, 14 April</td>
<td>Mesoscale convective systems</td>
<td>Chapter 9 of MMM, Chapter 12 of Johnson notes</td>
</tr>
<tr>
<td>19, 21 April</td>
<td>Mesoscale convective systems (continued)</td>
<td></td>
</tr>
<tr>
<td>26, 28 April</td>
<td>Flash floods; microbursts</td>
<td>Chapter 10 of MMM, Chapters 13-14 of Johnson notes</td>
</tr>
<tr>
<td>3, 5 May</td>
<td>Other unfinished topics and miscellaneous mesoscale phenomena</td>
<td></td>
</tr>
<tr>
<td>Weds., 11 May</td>
<td><strong>FINAL EXAM, 9:40-11:40 am</strong></td>
<td></td>
</tr>
</tbody>
</table>

*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.*