ATM678, Mesoscale Dynamics
Spring 2012

Class time: TR 11:30am to 1pm

Classroom: IARC 407

Instructor: Nicole Mölders

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Office: IARC 309

Office hours: Tuesday 1-2 pm, Thursday 1-2 pm

Course Description: The class provides a comprehensive explanation of mesoscale air motions – their phenology, basic physics and mechanisms, why they build and how mesoscale motions interact with the micro and large scale. Classical and non-classical mesoscale circulations, supercell, single and multiple cell thunderstorm dynamics and tornado formation will be discussed. Impact of mesoscale circulations on air quality will be discussed if the majority of the class indicates an interest in this subject.

Course objective: By the end of the semester, you should be able to understand and explore the mesoscale dynamical processes, and put them into equations. You should be able to solve fundamental problems related to the basics of mesoscale dynamics how they typically occur in mesoscale applications (e.g. forecasts of fire weather, land-sea breezes, hazards, air quality). You should be able to analyze and interpret observational data, satellite images, and mesoscale model data in terms of typical mesoscale dynamics. Fundamental goals are that you develop skills to analyze meoscale meteorological data and identify mesoscale dynamical processes. This includes application of learned material to totally different problems or putting learned material together in a new context to solve a problem. Moreover, you are to gain presentation and writing experiences and learn about the scientific publication process.

Student Learning Outcomes:

- Understand mesoscale dynamics and interaction of mesoscale processes with micro- and large scale
- Learn to discuss science in an effective manner
- Develop skills to read papers critically
- Improve the quality of your presentations
- Understand the scientific review process
- Know how to write a research paper

Suggested readings/textbook:

Lin, Y.-L., 2007. Mesoscale Dynamics, Cambridge University Press, pp. 630.

I recommend that you have a look at other books frequently. You should also read other printed material, as assigned.

Other course resources: I will put some relevant material on **Blackboard**. I expect you to download and read the material. It is your responsibility to apply for an UAF gmail account because Blackboard access is only available with that account. You will be hooked up automatically for access to Blackboard when you register for this class. However, if problems occur with this automatic procedure and you cannot log in, send me an email so that I can verify the email address, enroll you into Blackboard manually, and set up your Blackboard account for this class.

Attendance: You should attend class regularly and use the recommended book and a book of your choice related to mesoscale dynamics. Class attendance and participation in the in-class exercises/discussions are required and will be a part of your grade. Missing 50% of the classes will result in an F. Unexcused absence leads to deduction of the attendance points and lessens your chances to accumulate points for presentation of your homework that would have been discussed the day of your absence. Excused absences are approved in advance or absences due to a documented emergency. Such documentation must be made immediately upon the student's return to class. Please understand that this is a college course - you are expected to be on time for class and have all the required material unpacked.

Homework: is typically a reading assignment and due at the start of class except for the reviews that are in writing and due in the third week after spring break. Each student is expected to be able to present the homework in front of the class. The contributions should be thorough and complete, reflecting the thought that you have put into your tasks. You are expected to present your homework at the board when you are called to do so. This presentation will be graded for completeness, correctness, understanding, and the way of presentation. You will be randomly picked several times per semester for presenting the homework. If you cannot present or do not have the homework, when you are chosen to be the presenter, you will get an F. If homework is assigned as a group task, every group member must be able to answer questions related to the presentation or do the presentation. The group homework will be graded for completeness, correctness, understanding, presentation, discussion (50%) and how the group worked as a team (50%). This grading on group work is to learn efficient teamwork, because future research questions will more and more often require teamwork.

Since the homework is typically reading, no late homework will be accepted (except in excused absences). Late homework should be submitted in readable style. "Readable style" means typed, double-spaced, using at least a 12-point font, one-inch margins, and in hard copy format. It is simply too tricky to edit and make comments in single-spaced type. If you have not met these stipulations, I will return it to you ungraded. Late homework will not be accepted via e-mail or fax unless you make prior arrangements with me.

It is your responsibility to prepare homework on time. I strongly suggest that you plan and schedule your work. I recommend having backup systems in place so you can have all work completed on schedule. Getting work done on time is a key to early success in your future business, consultant or scientific career. A major complaint of employers is that faculty do not instill a sense of responsibility in students.

It is part of your homework - even when not said explicitly - to read parts of books on the subject of the class, the readings and the material provided. This means that at the beginning of the class I will ask questions and you can offer to answer them, but I also reserve the right to randomly ask students who do not volunteer. The answers are also part of your homework grade. There may be "popup quizzes" to examine your knowledge. Note that if you have an unexcused absence when a popup quiz occurs, you will lose points both on attendance and the quiz.

Project: In the first two weeks of the semesters, you will have to sign up for a mesoscale dynamics project of your interest. You will do some literature research on the subject and prepare a research review paper on the project. I will explain how to write a research paper. We will use AGU style for formatting, layout and citations. After spring break, you will provide a first draft in threefold hardcopies and an electronic version. I will not grade the draft. Instead, two students and I will review these hardcopies anonymously. I will explain how to write a review and what

Other important information: It is essential that you (1) keep up with the assigned readings, (2) budget your time wisely to complete all of your assignments, and (3) seek clarification on any material, which you do not understand, during business or class hours. If I am not covering subjects adequately, or the in-class exercises are confusing or difficult, or if you do not understand the questions/tasks/expectations, please let me know. I want you to understand the material.

Grading Policy:

on the responses and reactions to the reviewers (10% of the grade) and your revised final project paper (30% of the grade). Furthermore, the grade will be 10% attendance (unexcused attendance leads to an F on attendance for that day), 10% quizzes, and 10% homework presentations and in-class participation. In class-participation refers to answering questions that I ask, summarizing last weeks class, contributing to discussions let by me, and volunteering to present homework reading assignments. There will be frequent quizzes to test your homework reading assignments. To get a "C" grade, 50% of the points in each category have to be earned. This means, for instance, that you must pass all categories with at least 50% of the points. The grade distribution is as follows: A percentage of 90% or better will guarantee the student an A grade; a percentage of 70% or better will guarantee the student a B grade; a percentage of 50% or better will guarantee the student a C grade; a percentage of 30% will guarantee the student a D grade; any percentage less than 30% will lead to an F grade. Grades of "incomplete" will be given only in cases where an extraordinary, exceptional reason, submitted in writing by the student and judged valid by me. See UAF policies for details. I will use +/- grade with the following UAF rules A 4.0, A- 3.7, B+ 3.3, B 3.0, B- 2.7, C+ 2.3, C 2.0, C- 1.7, D+ 1.3, D 1.0, D- 0.7, and F 0.0, respectively. Thus, 85-89% is A-, 77-84% is B+, 70-76% is B, 64-69% is B-, 57-63% is C+, 50-56% is C, 44-49% is C-, 40-43% is D+, 35-39% is D, 30-34% is D-, and <30 is F. Note that this is a graduate class. This means that if you want to take this class as a choice in your comps you will have to pass it at least with a B. Lower grades may jeopardize your graduate standing.

Learning is an interactive process and each class is individual. Although I have put a lot of thought into the sequence of topics, this schedule is tentative by purpose and subject to change as necessary due to availability of support materials, adaptation to specific needs of the class, etc. The schedule for this class will remain an on-going construction in light of what is accomplished in each class meeting. To get a better understanding for mesoscale dynamics it will be required to pick up subjects that are caused by actual mesoscale events. Departures from the schedule, such as additional readings, assignments, deadline changes, and activities, may be announced in class. These changes will take priority over the printed schedule. It is your responsibility to be in class and to keep up-to-date on whatever changes I make, or the class negotiates.

Tentative Spring 2012 Schedule:

week 1: Introduction to mesoscale dynamics
week 2-3: Basic concepts, statistical analysis of data
week 3-6: Classical mesoscale circulations (land-sea breeze, mountain-valley circulation, monsoon); how to write a research paper
week 7-8: Non-classical mesoscale circulations (vegetation breeze, fire scar breezes); how to write a review of a research paper
week 9-10: Cloud dynamics, squall-lines (interaction microphysical dynamics including impacts of aerosols on dynamics, updraft and downdraft formation)
end of week 10: draft project paper due in 3 copies for peer-review
week 11-12: Super-cells, single thunderstorms, multi-cell thunderstorms and tornados

end of week 11: reviews due