ATS712
Dynamics of Clouds
Fall Semester 2012

Meeting Times:
T/Th: 9-10:15am
Room: ATS 101

Instructor:
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Office Hours: T/Th 1-2pm

Course Description:
This class focuses on the general dynamics of cloud systems. Models of fog, stratocumuli, cumuli, cumulonimbi, mesoscale convective systems and orographic systems will be presented.

Classes will be held for 75 minutes twice a week, and will include presentations by the instructor and students. Material covered in class will be supplemented by several homework assignments throughout the semester. The class will conclude with student presentations on a chosen topic. These will be held during finals week.

Students should expect to spend at least 2 hours of effort for each hour spent in class each week in order to complete the class project, class presentation and homework assignments.

Grading:
No exams will be held for this class. A final term paper (50%), the presentation of this paper (20%), and three homework assignments (30%) will constitute your final grade in this class.

Required Reading and other Tools / Skills
Cotton, W.R., G.H. Bryan, and S.C. van den Heever, 2010: *Storm and Cloud Dynamics*, 2nd Edition. Academic Press.
Basic coding abilitities.

Class Webpage
The webpage for this class may be found at:
http://reef.atmos.colostate.edu/~sue/vdhpage/login712.php
Class notes, homework sets and general announcements can be found at this site.

Science Questions
As this is a 700 level class that is geared more towards providing a background for research, class discussions will be held at the end of each topic or main subsection to discuss science questions arising from the material just presented. Each student is expected to have thought about such questions independently and be able to present these in class if called on.

Potential Topics
Possible topics and the class time spent on them are shown in the next table. Please note that our 700 level classes are intended to be somewhat flexible. We may thus decide to cover one specific topic in more detail than shown in the table or introduce a topic that is not shown here, both of which would lead to changes in the table.

Potential Course Topics

Topics	Subtopics	SCD Chapter	Approx Classes
Clouds – Introduction	• Classification of clouds • Cloud time scales, vertical velocities, and liquid water contents	1	1
Fogs and Stratocumulus Clouds	• Types of fog and formation mechanisms • Radiation fog and physics and dynamics • Valley fog • Marine fog • Stratocumulus clouds	6	5
Cumulus Clouds	• Boundary layer cumuli – an ensemble view • Theories of entrainment, detrainment, and downdraft initiation in cumuli • The role of precipitation • Cloud merger and larger scale convergence	7	6
Cumulonimbus Clouds and Severe Convective Storms	• Descriptive storm models and storm types • Updrafts and turbulence in cumulonimbi • Updraft magnitudes and profiles • Turbulence • Downdrafts: origin and intensity • Low-level outflows and gust fronts • Theories of storm movement and propagation • Mesocyclones and tornadoes • Hailstorms	8	6

	• Models of hailstorms and hail formation processes • Rainfall from cumulonimbus clouds • Aerosol impacts on convective precipitation		
MCSs	• Definition of mesoscale convective systems • Conceptual models of MCSs • Climatology of MCSs • MCVs and Tropical Cyclone Genesis • Impacts of MCSs	9	6
Orographic Systems	• Theory of flow over hills and mountains • Effects of clouds on orographic flow • Orogenic precipitation • Turbulence eddies and embedded convection in orographic clouds • Blocking impacts on orographic precipitation • Distribution of supercooled liquid-water in orographic clouds • Efficiency of orographic precipitation and diurnal variability • Aerosol influences on orographic precipitation	11	4
Clouds, Storms and Climate	• Clouds and the global radiation budget • Hot towers and tropical circulations • Clouds and global hydrological cycle • Cloud Venting • Aerosol pollution impacts on global climate • Representing clouds in GCMs	12	2
TOTAL CLASSES			30

Academic Integrity Policy

This course will adhere to the CSU Academic Integrity Policy as found in the General Catalog (http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf) and the Student Conduct Code (http://www.conflictresolution.colostate.edu/conduct-code). At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.