

ATM OCN 453
Synoptic Laboratory II:
Mesoscale Meteorology
Spring 2009

Instructor:

Professor Gregory Tripoli
AOS 1431
262-3700
Office Hours: MWF 2:00-3:20pm

TA:

Daniel Henz
AOS 1439 (lab), 1449 (office)
Office Hours: TBD

Web page:

<http://www.aos.wisc.edu/~aos453>

Grading:

Formal Laboratory (30%)

Lab Assignments	25%
1. Misc	
2. MOAXS	
3. <i>DSWS</i>	
4. <i>SS</i>	
Weather Discussions	5%

Case Studies (40%)

Major Case Study 1	15%
Major Case Study 2	20%
Major Case Study 2 Presentation	5%

Exams (30%)

Quizzes 7.5% each
(5 quizzes total, 1 dropped)

Assignments will be turned in at the **beginning** of lab on the assigned due date. Assignments turned in after the start of lab will be considered late! Late assignments can still be turned in for partial credit. Each day the assignment is late will result in a (20%) penalty NO EXCEPTIONS! i.e. if the assignment is turned in 2 days late, the starting grade will be 60%.

Suggested Reading:

1. *Severe and Hazardous Weather*, Rauber et al., Kendall/Hunt (2006)
2. *Mesoscale Meteorology and Forecasting (MMF)*, Edited by P. S. Ray (1986)
3. *Cloud Dynamics*, Robert A. Houze Jr., AP, 1993
4. *Atmospheric Convection*, K. A. Emanuel, OUP, 1994
5. *Storm and Cloud Dynamics*, Cotton and Anthes, AP 1982A
6. *Review of Static Stability Indices and Related Thermodynamic Parameters*, Randy A. Peppler, 1988
7. *Synoptic-Dynamic Meteorology in Middle Latitudes Volume II: Observations and Theory of weather Systems*, Bluestein

8. *Mid-Latitude Weather Systems*, T.N. Carlson, 1991, HarperCollins Academic
9. *Mountain Meteorology Fundamentals and Applications*, 2000, Oxford University Press
10. *Sea Breeze and Local Winds*, John. E. Simpson, 1994, Cambridge University Press

Lecture Syllabus

- I. Introduction to Mesoscale Meteorology (2 lectures)**
 - i. Mesoscale Classifications (Ch 2 MMF)**
 1. Rossby Radius of Deformation
 2. Relative to Rossby Radius
 3. Orlanski Classification
- II. Atmospheric Convective Instabilities (9 lectures)**
 - i. Synoptic Destabilization (1 lecture)**
 1. Upper Level Mixed Layers
 2. Synoptic Lifting
 3. Dynamic Destabilization
 4. Differential Advection
 - ii. Dry-Convection instabilities**
 - iii. Cumulus Cloud Dynamics (1 lecture)**
 1. Concept of Buoyancy
 2. Concept of Entrainment
 - iv. Basic Moist Convective Instabilities (Ch11 MMF) (2 lectures)**
 1. Conditional Instability of the First Kind
 2. Conditional Instability of the Second Kind
 3. Conditional Symmetric Instability
 - v. Deep convection organization (5 lectures)**
 1. Ordinary Cumulonimbi
 2. Multi-cell thunderstorms
 3. Supercell thunderstorms
 4. Tornadoes
- III. Orographic Mechanically Driven Mesoscale Circulations (3 lectures)**
 - i.** Upslope Precipitation (Ch 19 MMF) (1 lectures)
 - ii.** Orographically enhanced Convection (Ch 19 MMF) (1 lecture)
 - iii.** Downslope Wind Storms (Ch 12, Ch 20 MMF) (1 lectures)

Spring Break

- IV. Mesoscale Boundary Layer Circulation Systems and Clouds (4 lectures)**
 - i. Fog**
 - ii. Boundary Layer Convection**
 - iii. Strato-Cumulus**
 - iv. Arctic Stratus**

v. Lake Effect Storms

V. Mesoscale Circulation Systems and Storms (14 lectures)

i. Thermally Driven Mesoscale Circulation Systems in the Planetary Boundary Layer (PBL) (4 lectures)

1. Sea and Lake Breeze Systems (1)
2. Vegetation and Land-use Induced Circulations
3. Orographic Thermally Driven Mesoscale Circulations (1 lectures)
4. Dry Line (inland sea breeze) circulations (Ch 23 MMF) (1 lecture)
5. Nocturnal Southerly Jet (1 lecture) (march 1)

ii. Meso-Beta-scale Convective Systems (B, 3.4, Ch 15 MMF) (6 lectures)

1. Middle Latitude Squall Lines
2. Super Cellular Squall Lines
3. Derecho Convective Systems and Bow Echos
4. Australian Squall Lines
5. Tropical Squall Lines (Ch 16 MMF)
6. Overview of Severe Weather
 - a. Tornadoes and Tornado genesis (Ch 18 MMF)
 - b. Downbursts, Microbursts (CA Ch 9)
 - c. Hail (CA Ch 9)
 - d. Flash Floods (CA Ch9, CH13 MMF)

iii. Meso-Alpha-scale Convective Systems (B, 3.4, Ch 15 MMF) (4 lectures)

1. Orogenic Convective Systems
2. Prefrontal Squall Lines
3. Mesoscale Convective Complexes and Tropical Cloud Clusters (Ch 17)
4. Air-Sea Interaction Cyclones (2 lectures)
5. Tropical Cyclone
6. Polar Low