ATM OCN 453
Synoptic Laboratory II:
Mesoscale Meteorology
Spring 2007

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

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Grading:
Formal Laboratory (30%)
Lab Assignments 25%
   1. Misc
   2. MOAXS
   3. DSWS
   4. SS
   5. TC
Weather Discussions 5%

Case Studies (40%)
   Minor Case Study 1 7.5%
   Major Case Study 1 12.5%
   Major Case Study 2 15%
   Major Case Study 2 Presentation 5%

Exams (30%)
Quizzes 7.5% each
(5 quizzes total, 1 dropped)

Suggested Reading:
5. Storm and Cloud Dynamics, Cotton and Anthes, AP 1982
7. Synoptic-Dynamic Meteorology in Middle Latitudes Volume II: Observations and Theory of weather Systems, Bluestein
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. Destabilization (1 lecture)
      1. Upper Level Mixed Layers
      2. Synoptic Lifting
      3. Dynamic Destabilization
      4. Differential Advection

II. Boundary Layer Circulation Systems and Clouds (3 lectures)
   i. Fog
   ii. Strato-Cumulus
   iii. Dry-Convection instabilities
   iv. Boundary layer Convection
   v. Lake Effect Storms

III. Mesoscale Circulation Systems (8 lectures)
   i. Orographic Mechanically Driven Mesoscale Circulations (3 lectures)
      1. Upslope Precipitation (Ch 19 MMF) (1 lectures)
      2. Orographically enhanced Convection (Ch 19 MMF) (1 lecture)
      3. Downslope Wind Storms (Ch 12, Ch 20 MMF) (1 lectures)
   ii. 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)

IV. Deep Moist Convective Systems (13 lectures)
   i. Cumulus Cloud Dynamics (1 lecture)
      1. Concept of Buoyancy
      2. Concept of Entrainment
   ii. 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
   iii. Meso-Beta-scale Convective Systems (B, 3.4, Ch 15 MMF) (6 lectures)
      1. Ordinary Cumulonimbi (Ch15 MMF)
      2. Multicellular Convective Systems (Ch 15 MMF)
      3. Super Cell Convective Systems (Ch 15 MMF)
      4. Middle Latitude Squall Lines
      5. Super Cellular Squall Lines
      6. Derecho Convective Systems and Bow Echos
7. Australian Squall Lines
8. Tropical Squall Lines (Ch 16 MMF)
9. 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)

iv. 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