

Mesoscale Analysis and Forecasting

Review sheet for Final Exam: 20 April 2009, 1–4 PM

This exam will count for 12.5% of your final grade. Unit 4 includes the topics that we covered from MCSs through the low level jet. The exam will be conceptual, and will not require you to do derivations.

Comprehensive aspect:

- There will be one or two questions related to the most frequently missed items from each of the previous three exams. Old questions could re-appear either verbatim, or with slight modifications/improvements; and, I may design new questions that cover the same concepts.

Some things to have down:

- Know your way around skew- T ln- p diagrams and hodographs
- Be able to draw phenomena: plan views and cross-sections... reflectivity, flow fields, cloud outlines, etc.

Unit 4 questions/topics for thought and review:

- What is a mesoscale convective system (MCS)? Why are they important? What are the impacts of their large size and long lifetimes? Why do many MCSs develop trailing stratiform precipitation? What does the flow field in a mature MCS with trailing stratiform precipitation look like? What does the reflectivity field look like? Why does the rear inflow jet develop? What is its importance? Why can MCSs be so long-lived? What is a line-end vortex? What processes lead to such vortices? What is a bow echo? A line echo wave pattern? What are the roles of bowing lines and mesovortices in producing severe winds? In producing tornadoes? What is a mesoscale convective complex (MCC)? What is the climatology of MCCs like? How does the Coriolis acceleration factor into the structures and behavior of MCSs? What is a mesoscale convective vortex (MCV)? What processes lead to MCVs? What are the impacts of MCVs?
- What are derechos? Why are they a forecast concern? What are typical derecho ingredients and patterns?
- What is the basic physical process for growth of a hailstone? What are the environmental ingredients for severe hail? Why is each ingredient important? What kinds of storms produce the largest hail? Why?
- What is the "first law of QPF"? What are the necessary ingredients for flash flooding? Why are MCSs often implicated? What kinds of scenarios favor slow ground-relative storm motions?
- What are the primary features of the U.S. thunderstorm and severe weather climatologies?
- What is the dryline? Why does it develop? How does it move? What accounts for the wind fields in its vicinity? How might the dryline relate to convective initiation?
- What are the basic properties of the nocturnal low-level jet? Why is it important? Can you explain the key physical mechanisms that have been hypothesized to cause the low-level jet? How does each hypothesis fit with the climatology of the low-level jet?