Mesoscale Analysis and Forecasting
Review sheet for 3rd Midterm Exam: 2 April 2009

This exam will count for 12.5% of your final grade.

Unit 3 includes the topics that we covered beginning with supercells and extending through tornadoes. MCSs will be on the Unit 4 exam (not this exam). The relevant sections of the text are 7.5 and 9.2. The exam will be conceptual, and will not require you to do derivations. However, we spent some time using and working out some important equations. You should have enough familiarity to recognize these equations, and to apply them. Examples include:

• Vertical vorticity equation and its application to supercells and tornadoes

Other things to have down:

• Know your way around skew-T ln-p diagrams and hodographs
• Be able to draw phenomena: supercells of all types (splitting, right and left movers, LP/classic/HPs), tornadoes, etc... plan views and cross–sections... reflectivity, flow fields, cloud outlines, etc.

Unit 3 questions/topics for thought and review:
• Why do supercells rotate? What are the key terms in the vorticity equation? What is the difference between crosswise and streamwise vorticity? Why does this matter? What enables a supercell to be long–lived? Why do storms split? What storm–scale processes account for wall clouds? Shelf clouds? The bounded weak echo region (BWER)? The hook echo? The rear flank downdraft (RFD) and forward flank downdraft (FFD)? The flanking line? What selects between mirror–image splitting supercells and predominant left or right–movers? What is storm–relative helicity? How is it determined from a hodograph? Why is it important? How is it that supercells can persist in environments with low CAPE? What are the differences between classic, LP and HP supercells?
• Know the keys on the "basic, ingredients-based approach to the convective forecasting process" handout. What are the key environmental parameters that select between ordinary cells, multicells, and supercells? Why is each parameter physically relevant for each mode?
• What are the ingredients in the supercell composite parameter? Why is each ingredient important? Which is more important: for one ingredient to be very large, or for all ingredients to be sufficient? Why?
• Revisit the COMET module lab exercise... What is the impact of high versus low CAPE? A dry sounding versus a moist sounding? Deep shear versus shallow shear? Curved versus straight hodographs? Quarter–turn versus half–turn hodographs?
• How are advection, propagation, and motion different? How are discrete and continuous propagation different? Can you explain the motion of multicells and supercells?
• What are the generally observed environmental ingredients that accompany supercellular tornadoes? What are the generally observed storm–scale processes that accompany tornadogenesis in a supercell? What are some sources from which large vertical vorticity at the ground can arise? What is needed in order for this large vertical vorticity to be stretched into a tornado? Why are most tornadoes produced by supercells? Why do such a small fraction of supercells actually produce tornadoes?
• What are the ingredients in the significant tornado parameter? Why is each ingredient important?
• What are common large scale patterns that accompany tornado outbreaks? Why are these patterns favorable (think in terms of ingredients)? What are the likely failure modes for each pattern? What should you key on to identify each pattern in observational data (make sure you can do this)?