Mesoscale Meteorology (METR 4433)
Spring 2002

Study Guide for Final Comprehensive Exam

In addition to the topics summarized in the study guide for exam 1 and 2, we cover the following major topics: Supercell storm dynamics, tornadoes and tornado dynamics. For each of these phenomena, we discussed their general behaviors and characteristics, the dynamics of their formation and development, and the types of weather and damages they produces, etc. Specific topics include:

- Supercell storm, definition, typical weather, supercell climatology
- Supercell characteristics, typical internal flow structure, main branches of flow, roles and behaviors of updraft and downdraft
- Typical echo patterns of supercell storm in both horizontal and vertical plane views and the causes of such patterns
- Wall clouds and processes by which they form
- Conceptual model of tornadic supercells
- Effects of environment on storm types, CAPE and vertical environmental shear – the key environmental parameters
- The vorticity equation and the individual source terms in the equation
- Processes by which vertical vorticity can be changed – advection, stretching and tilting. Following an air parcel, only the latter two.
- Use of the vorticity equation to explain the origin and intensification of updraft rotation
- Generation of horizontal vorticity and its role in storm dynamics
- Diagnostic pressure equation and the forcing terms
- Use of the pressure equation to explain the enhancement of updraft by rotation and the storm splitting
- Use of the equation to explain the favoring of one of the split members of storm and the effect of the hodograph curvature
- The concept and definition of streamwise vorticity, storm-relative helicity, and relative helicity
- The dependency of storm behavior on low-level storm-relative helicity and physical explanation of the behaviors
- The determination of environmental shear, vorticity from hodographs, and the effect of the curvature of hodograph and the relative position of storm-motion vector on storm-relative helicity and storm behavior
- Bulk Richardson number as a predictor of storm types
- Pros and cons of BRN and helicity as predictors, what they are best for?
- Helicity contours on hodograph

Note that the above list serves as a review aid only. The exam questions are by no means limited to these topics only. You should study all topics covered in this course. The rough weight of the new materials in the exam is 60%.