2007 METR 4433 EXAM 2 Study Guide

PBL and related phenomena

- Understand the theories and be able to explain the formation of low-level jet in the nocturnal boundary layer that is associated with sloping terrain, and the role of vertical momentum transport/mixing in the process

Convective Dynamics

- Know the basic classification of convective storms in the atmosphere
- Know the atmospheric conditions conducive to the development of the different types of convective storms
- Understand the physical characteristics of and be able to explain the life cycle of a single-cell thunderstorm
- Understand the physical meaning of the terms in the perturbation vertical momentum equation, and be able to apply this equation to simple problems in convection (i.e. understand the response, via the perturbation pressure gradient force, to a buoyant thermal "bubble" rising through its environment)
- Understand the various contributions to the buoyancy force, including temperature and water vapor perturbations, and liquid/and or ice loading.
- Know the basics of Parcel Theory and how CAPE is derived from it.
- Be able to describe the basic physical characteristics and life cycle of a multi-cell storm.
- Understand the role varying levels of mid-level storm relative inflow have on the regeneration period for individual cells in a multi-cell storm
- Be able to distinguish between the two major contributing modes of multicell storm propagation: discrete vs. continuous
- Understand the role the gust front has in the life cycle of multicell storms
- Understand factors that can affect the propagation speed of density currents
- Know the location and basic causes of high and low pressure perturbations associated with a cold pool and associated gust front, particularly in how they may affect the lifting of low-level air over the gust front head.

Squall line and its dynamics

- Know the typical life cycle of a squall line and be able to discuss the physical characteristics of a squall line in both a plan view sense and in vertical cross sections perpendicular to the line, at each stage of its life cycle.
- General characteristics of squall lines
- Conceptual models of squall lines
- Flow pattern in mature squall lines
- Weather associated with mature squall lines
- Different ways squall line forms
- Effect of vertical shear on long-lasting squall lines

- Behaviors and evolutions, including stages, of squall lines forming in environmental shear of different strengths
- Perturbation pressure patterns associated with squall lines and their cause and effect
- Rear inflow jet in mature squall line systems and the relation of their strength with environmental conditions
- Effect of vorticity sources on the evolution of squall lines
- RKW theory and optimal condition for long-lasting squall lines

Bright Bands.

- The phenomena and reason that they exist.

Bow Echoes

- The phenomena and weather.
- The conceptual model, typical life cycle of bow echoes, and the stages that typical bow echoes evolves through.
- Bookend vortices, their origin and their impact on low-level circulation and surface winds
- Rear inflow notch and its association with rear inflow jet.
- Favorable environment for severe bow echoes