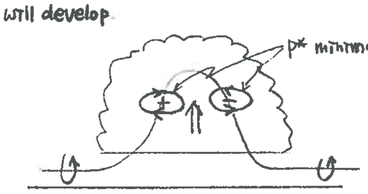
✓ 11. One part of the dynamic perturbation pressure eq. (p^*) deals with rotation.

a. Explain this term in a way that you mother understand.

b. What kind of vertical distribution of p^* and resulting p^* force result from this process in a supercell? (You should describe certain aspects of storm structure here.) How does this distribution of p^* affect the evolution of the supercell?

Sol)
(a) The perturbation pressure, p^*, is proportional to the negative of the vert. vort. squared $p^* \propto -\zeta^2$. Therefore, no matter the orientation of the spin (cyclonic or anticyclonic), the p^* will always be negative. A low p^* will develop.

(b)



due to shear horiz. vort. ⇒ tilted ⇒ vert. vort. ⇒ p^* minima
⇒ upward directed p^* force ⇒ favored areas for updraft development in time.

✓ 12. There is a second term in the dynamic perturbation pressure eq. that is very important in supercells. It is given by

$$\nabla^2 p_0^* = -2\rho_0 \vec{S} \cdot \nabla w$$

a. Describe this term in your own words

b. Assume you are downshear of a strong updraft. What will be the vertical distribution of p^* and the resulting p^* force in this area? How does this affect the evolution of the updraft?

Sol) Skip.

✓ 13. Describe the sequence of events that leads to the formation of the rear flank downdraft just prior to tornadogenesis. This explanation should be based on vorticity concepts.

Sol)
We have horiz. vort. due to env. shear at first. In addition to this, after the forward flank downdraft has formed, we get additional horiz. vort. due to gradients of buoyancy. We get baroclinically-generated horiz. vort. which is often greater than the horiz. vort. due to the environment shear. Then this vort. gets advected. It is then tilted and streched. We get a downward directed perturbation pressure force usually to the rear of the main updraft. This then leads to the formation of the RFD.

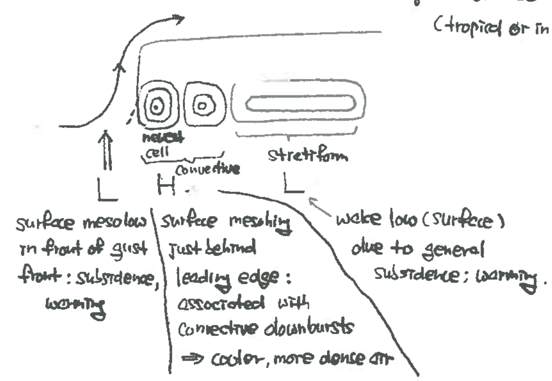
✓ 14. Describe the life cycle of a tornado in words, i.e., the visual aspects of it.

Sol)
First, there is an organizing stage. A funnel cloud may form from an organized wall cloud. Debris may soon be seen at the ground before the condensation funnel extends all the way down. The next stage is the mature stage. The tornado strengthens and reaches its maximum width and strength. Then, we reach the shrinking stage. The wall clouds begins to dissipate, while the tornado gets taller. The tornado may tilt due to the interaction with the RFD and FFD. Finally, we reach the decaying stage where there is little or no wall cloud and the tornado may be rope-like

✓ 15. Sketch a cross section through a convective line with a trailing stratiform precipitation area. Indicate the precipitation areas (new/old convective areas and stratiform), the important flow regimes, and the location of meso highs and mesolows at the surface.

Sol)

Squall line/MCS moving westward
(tropical or in mid-lats too)



16. Microbursts have been found to be caused mostly by the buoyancy term in the vertical eq. of motion. Modeling studies have determined the combinations of lapse rate and rainwater that are conducive to burst formation.

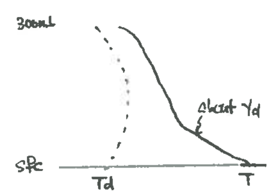
a. Describe these findings for wet microbursts and for dry microbursts.

b. Sketch a temperature/dew point sounding for a typical dry microburst case.

Sol)
(a) dry microbursts:
very steep lapse rate needed (close to γ_d)
rainwater < 0.25 mm

wet microbursts
not as steep of a lapse rate is needed (6~9°C/km)
rainwater > 0.25 mm
θe found to decrease with height more rapidly than normal

(b)



onion-type sounding:
Any parcel cooler than environment will rapidly descend.