MR3252: Tropical Meteorology
Homework 2

Name:_____

1. Given the following assumptions/facts:
   a. Flow in a tropical cyclone above the boundary layer is approximately in gradient wind, thermal wind, and hydrostatic balance.
   b. Mesoscale subsidence occurs in the eye of a mature tropical cyclone.
   c. Angular momentum is conserved during ascent in an eyewall.

   Reason that eyewall must be sloped such that the radius of maximum wind in a TC is farther from the center of rotation in the upper troposphere than it is at the top of the boundary layer. You should expect to explain your reasoning using a combination of words and mathematics. State any additional valid assumptions you must make.

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2. The following are real observations from In-Salah, Algeria, and Abidjan, Cote d'Ivoire for a summer afternoon in the past:

Site	925 mb T	850 mb T	700 mb T	500 mb T
In-Salah (27.2°N, 2.5°E)	35.0°C	28.0°C	13.8°C	-6.5°C
Abidjan (5.4°N, 4.0°W)	18.8°C	15.2°C	9.2°C	-5.5°C

   a. Based on the information above, make an argument for a strong easterly wind at 700 mb at Ouagadougou, Burkina Faso (12.4°N, 1.5°W). The distance between In-Salah and Abidjan is about 2500 km.

   b. What impact would warming the equatorial Atlantic Ocean (and not warming anything else) have on the magnitude of this wind?

   c. In the space below, or on another page, sketch a reasonable estimate of the thermally direct meridional circulation associated with the easterly jet as a north-to-south cross-section. Assume that the temperature at In-Salah is also cooler than at Abidjan above 500 mb all the way up to the tropopause (presumed to be around 150 mb). Let the south end of your cross section be near 5°N and the north end of the cross section be near 25°N. Indicate the position of the easterly jet on your drawing.

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3. Prove that an African easterly wave to the south of an easterly jet can only amplify via barotropic conversion of energy in the mean flow to eddy energy when the trough axis of the wave is tilted from southwest to northeast. You can start with the expression given in class that describes this conversion: $-\overline{u'v'}\frac{\partial \bar{u}}{\partial y}$