

ATM 651 - Intro to Atmospheric Dynamics
Comps question 2021 (Mapes)

1. What two force balances comprise Thermal Wind Balance (TWB)? What accelerations are neglected in assuming these balances? Discuss the conditions for TWB validity conceptually, grounded in the concepts underpinning the equations of motion.
2. Consider a localized cyclonic potential vorticity (PV) anomaly concentrated at the surface. Sketch contours of pressure in the x-z plane slicing through the PV anomaly, and indicate winds into/out of the page. You may exaggerate the vertical excursions of the p contours for clarity. Based on the thickness of layers between these contours, label warmer vs. cooler areas in the middle troposphere. Is this a warm core or cool core cyclone? Sketch potential temperature contours in the same x-z plane.
3. Repeat 2. for a positive PV anomaly confined near the tropopause, extending your sketches up into the stratosphere. Is this cyclone cool or warm core in the troposphere? Is it cool or warm core in the stratosphere?
3. The prognostic equation for PV has the vertical heating gradient as its only source term. Discuss how PV anomalies near the surface and near the tropopause, both of which are familiar common weather systems affecting Florida, get created.