ATSC 5160 Homework 4 due Mon 11 April 11 at 11 am

1. (30%) Problem 8.5 in Martin (2006).

2. (40%) In class we developed the theory of symmetric instability in the north-south direction. Explore SI in the east-west direction. Assume symmetry in the y-direction and define $M_g=v_g+fx$ (note: please keep your answers short)

a. Draw an E-W schematic cross section with M_g and θ_e lines, containing a region of potential symmetric instability (PSI). Show the location of the jet (in or out of the page?) Also highlight the region of PSI.
b. Explain the relationship between the slope of the M_g lines and the jet.
c. In this case, the change in ambient kinetic energy resulting from the exchange of parcels (tubes) 1 and 2 is $\Delta KE = mf\Delta x(M_{g1} - M_{g2})$. You do not need to derive this, but please explain in words why $\Delta KE < 0$ implies instability.
d. Show that this instability condition is equivalent to the condition that the θ_e lines are steeper than the M_g lines.

3. (30%) Section 6 in the COMET module "an operational approach to slantwise convection " (http://meted.ucar.edu/norlat/slant/navmenu0.htm) has a checklist of 7 items to evaluate the potential of slantwise convection (PSI). Briefly comment on the last 6 of them (the first one is rather specific to the area of interest of this forecaster, Kent Johnson, in BC).