Atmospheric Sciences 101, Autumn 2004
Homework #4: Due at the **beginning** of lecture Thursday, 4 November 2004

Answer questions 1 and 2 using the 500 mb and surface maps below, and EoM pages 224—227.
1. Label the trough and ridge on the 500 mb map. [1]

b) On the surface map, draw arrows around the High pressure and Low pressure indicating the direction of winds at the surface (*hint*: these winds will be either counterclockwise/clockwise and also either converging in or diverging out away from the H and L) [2]

c) Now consider the 500 mb map, fill in the correct answer (either convergence or divergence): [1]
   At the location labeled A, there is _________ of the upper-level wind.
   At the location labeled B, there is _________ of the upper-level wind.

d) On the 500 mb map, indicate with a plus (+) where positive relative vorticity is found and a minus (-) where negative relative vorticity is found. [1]

2. a) Draw a vertical cross-section that indicates convergence/divergence of the winds at the 500 mb level and draw arrows indicating winds at the surface near the location of the surface Low pressure center. In your drawing, indicate convergence or divergence at the upper-levels, rising or sinking air between the surface and upper levels, and arrows indicating surface winds. A *partially* complete illustration of a surface high pressure center is included as a guide.[2]

   ![Diagram](image)

   b) On the surface map, draw the location of the cold front and the warm front. (Remember how we find fronts just by looking at the pressure contours)[2]

c) Now look at the black dots on the surface map located in western Virginia and western Kentucky. Based on their locations relative to the fronts you drew on the surface map, answer the following (circle the correct answer):

   The location in western Virginia will be (warmer/colder) than the location in western Kentucky.[.5]

   The winds at the Virginia location will be out of the (south/north). [.5]
3. Measures of humidity. Define the following, using a single sentence, making sure to refer to how they quantify the amount of moisture in the air. Also, state what happens to the values of each when the temperature is increased.
   a) Vapor Pressure
   b) Dew Point
   c) Relative Humidity
   d) Wet bulb temperature
   e) Saturation Vapor Pressure

4. For parts (a) – (c), consider the following three rooms:
   - A living room at 20 deg C and a dewpoint of 10 deg C.
   - An uninsulated garage at 10 deg C and a dewpoint of 10 deg C.
   - A sauna at 70 deg C and a dewpoint of 20 deg C.
   a) Which room's air has the highest vapor pressure?
   b) Which room has the highest relative humidity?
   c) If a container full of air from the sauna was brought into the living room and allowed to cool to the temperature of the room, what would the dewpoint of the container of air be?
   d) On a clear, calm night with evening temperatures of 14 deg C and a dew point of 10 deg C, what two moisture-related phenomena can we expect to form? Think about what will happen to the temperature as the night progresses.
5. For the following, use either the figures in lecture, or those in EoM pp 194—196.
   a) Are the Pacific Northwest and Alaska warmer or cooler than normal during an El Nino event?[1]

   b) During La Nina, would it be drier or wetter in Indonesia? [1]

   c) During El Nino, does there tend to be a ridge, a trough, or neither in the jet stream over the Pacific Northwest? [1]

   d) During El Nino, ocean temperatures along the Peruvian and northern Chilean coast are much warmer than normal. Would this be due to enhanced or reduced coastal oceanic upwelling? What would have to happen to the winds to induce this change in the upwelling? [1]

   e) List two characteristics (choose from warmer, cooler, wetter, drier, windier, less windy) that winters in the Pacific Northwest would tend to have during the positive PDO phase. Does the mountain snowpack at the end of winter tend to be larger or smaller than normal during the positive PDO phase? [1]