ATM 317 Homework # 6
Due Wednesday 3 May, 5:00 PM

Answer the following questions on a separate sheet of paper. **SHOW ALL WORK!**

1. Figure 1 shows the 500 hPa geopotential height (black contours, units: m) and temperature (red dashed contours, units: K) for a specific time.

a) Draw thermal wind vectors throughout the diagram.

b) Indicate regions characterized by positive and negative geostrophic relative vorticity.

c) Using the Sutcliff-Trenberth form of the QG omega equation, indicate the locations of upward and downward vertical motion.

2. Assume the following conditions in the atmosphere: (i) a 300 hPa jet streak at 50°N where the zonal wind increases uniformly from 20 m sec^{-1} to 70 m sec^{-1} over 1000 km, (ii) the meridional geostrophic wind is reflective about the jet axis and increases linearly, such that the amplitude is 10 m sec^{-1} 500 km from the jet axis, and (iii) a meridional temperature gradient of -3 K (1000 km)$^{-1}$ (the temperature decreases as you move to the north). Estimate the ageostrophic wind shear that would be required to maintain the magnitude of the vertical wind shear. Hint: Sketch a figure of this situation before you try to solve the problem.

3. Use the Q-vector form of the QG omega equation to explain the vertical motions you would expect in the environment represented in Figure 2. Show your work, including the geostrophic wind and wind shear vectors.
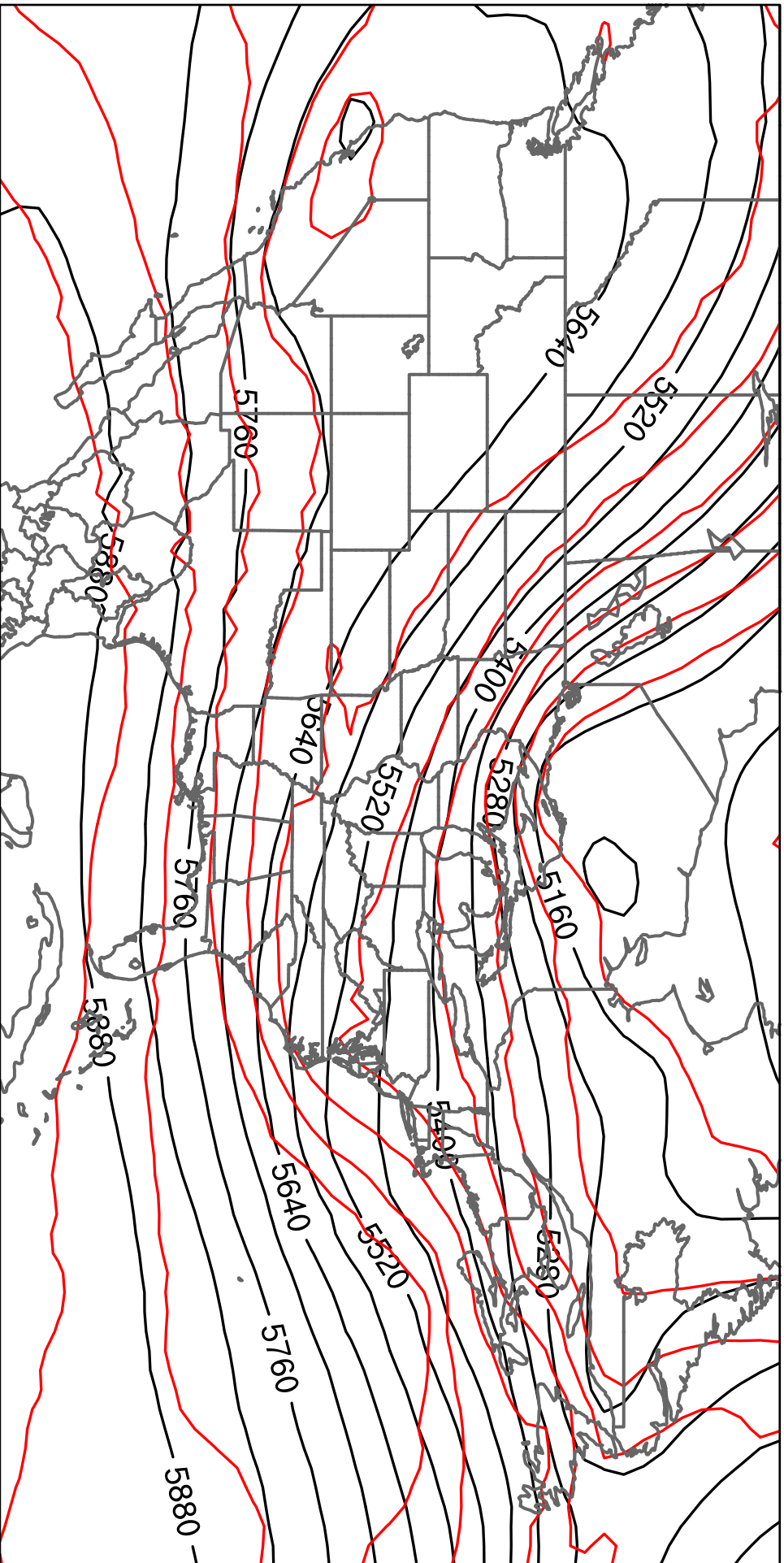
Figure 1

Figure 2