ATM 317 End of Semester Mini-Project

Using the appropriate Figures and your knowledge of the course material presented in ATM 317, you should be able to:

1. Use the Sutcliffe-Trenberth version of the QG-omega equation to identify regions of upward and downward vertical motion in Fig. 1.

2. Draw several Q-vectors in Fig. 2 to identify regions of upward and downward vertical motion.

3. Apply *your favorite* version of the QG-omega equation (because you probably should have a favorite by now) to identify the vertical circulations in the jet entrance & exit regions in Fig. 3.

4. Using your analysis of the jet exit region circulation in Fig. 3, label regions of expected upward and downward vertical motion in the cross section in Fig. 4 and determine the type of the thermal circulation. How would this circulation change the horizontal temperature gradient?

5. In Fig. 3, identify regions of positive and negative shear and curvature vorticity.

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6. Describe the contribution of geostrophic temperature advection and geostrophic momentum advection, in both the jet entrance and exit regions, to the time tendency of the geostrophic vertical shear.

7. Draw a conceptual diagram based on the cross section that determines the sign of the tilting term in the vorticity equation at the point labeled C.

8. If the surface cyclone is located in the region of strongest column average upward vertical motion, based on your analysis where would you expect the surface low?

9. Explain, by applying and referencing your analysis from questions 1-8, whether you expect this surface cyclone to strengthen or weaken?

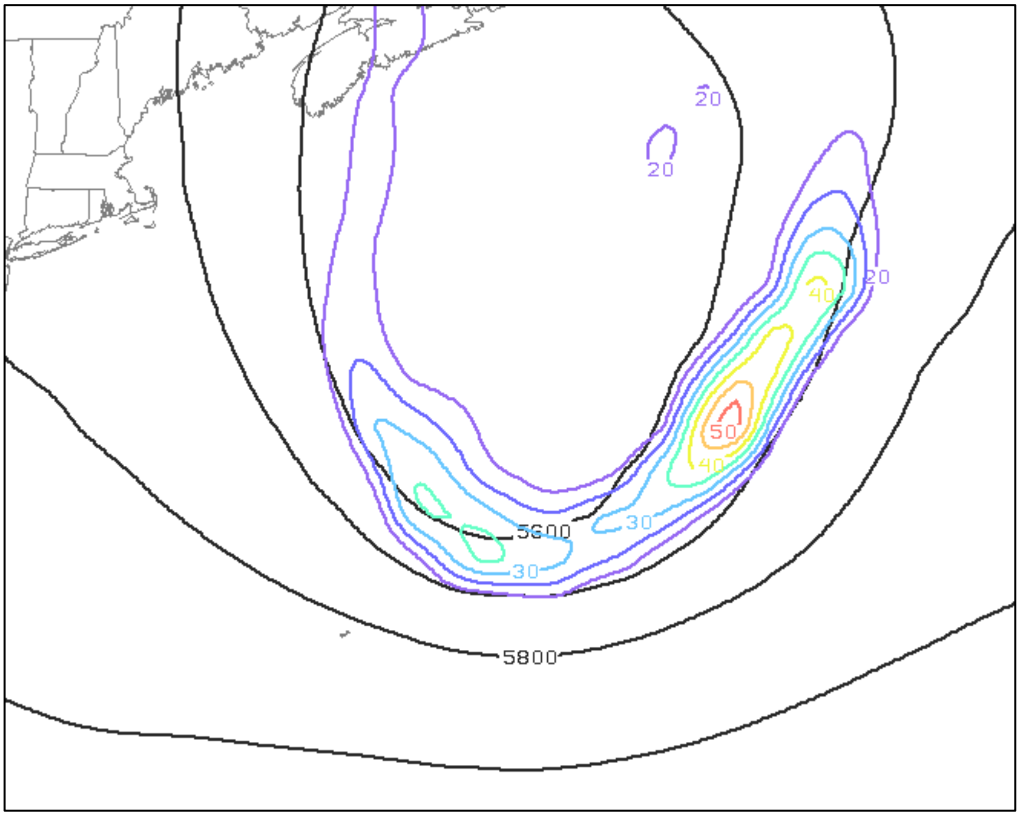

Figure 1: The 850 to 400 hPa thickness (m, black) and 850 to 400 hPa average absolute geostrophic vorticity (x10^{-5} s^{-1}, colors).

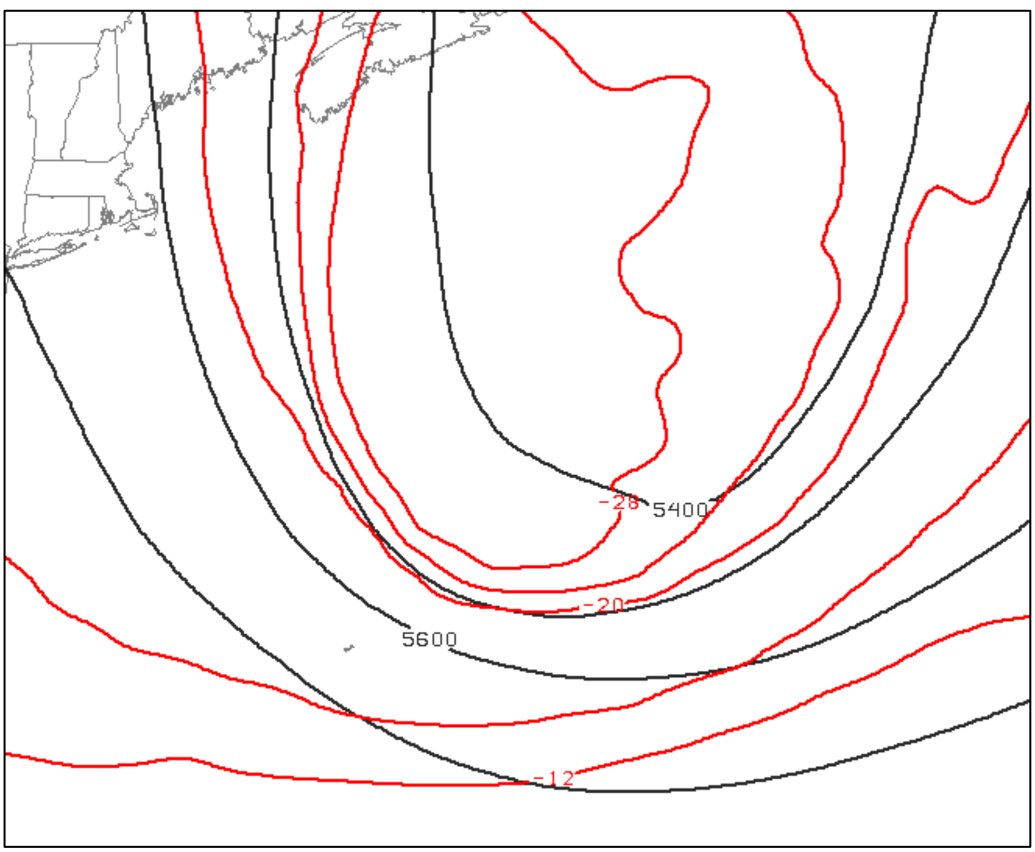

Figure 2: The 500 hPa geopotential height (m, black) and temperature (˚C, red).

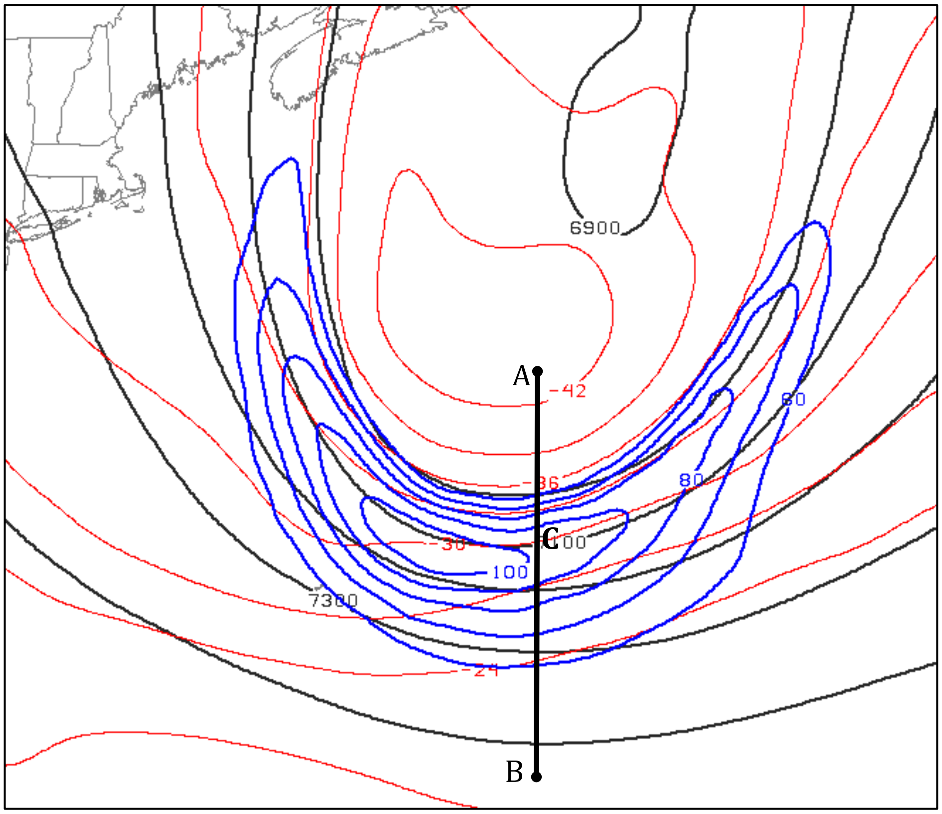

Figure 3: 400 hPa geopotential height (m, black), temperature (˚C, red) and geostrophic wind speed (m s^{-1}, blue). A cross section along the line A-B is shown in Fig. 4.

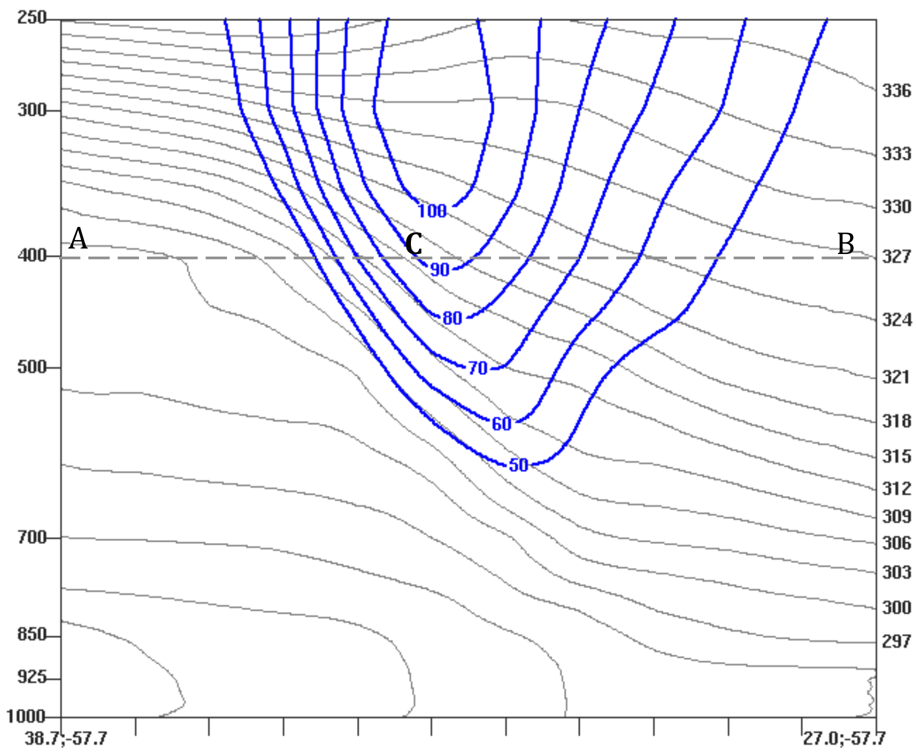

Figure 4: A cross section along the line A-B in Fig. 3, showing potential temperature (K, gray) and geostrophic wind speed (m s^{-1}, blue). The dashed line represents the exact location of the line in Fig. 3.