

Laboratory 7

Quasigeostrophic Forcing Functions

300 points.

You are provided with the following for 12 UTC 12/4/12

- (a) WRF-NAM initialization of SLP and 1000-500 mb thickness;
- (b) WRF-NAM initialization of 500 mb heights and absolute vorticity;
- (c) Location map. Note A, B and C.
- (d) Visible and infrared satellite images for 1901 UTC 12/4/12
- (e) Charts I produced from mod_grib: (i) 850 mb temperature advection; (ii) 500 mb absolute vorticity advection; and (iii) 700 mb vertical velocity.

You will be **QUALITATIVELY** evaluating the contributions to upward or downward motion at these locations on the basis of the descriptive form of the quasigeostrophic omega equation, as discussed in class.

Upward Vertical Motion at Given Level (say, in the mid-troposphere, 500 mb)	Prop To	Cyclonic (Positive) Vorticity Advection_*	and/or	Warm Temperature Advection at that Level	and/or	Sensible Temperature Rises at that Level	and/or	Friction*
		*Really, differential cyclonig vorticity advection centered at the level)		(The sign of the temperatre advection can be estimated by the geostrophic temperature advection)		*Really, differential friction centered at the level)		
		Term A		Term B		Term C		Term D

Part A. Evaluations (100 pts)

1. Your first estimate for the sign of these two terms will come from an evaluation of their qualitative nature using (a) and (b) above, assuming that the temperature advection from nam_thick is proportional to the 850 mb temperature advection. (50 points)

	A	B	C
850 mb Temperature Advection			
500 mb Absolute Vorticity Advection			
Net Effect			

Table 1: Forcing for upward or downward synoptic scale motion determined from nam_thick and nam_vort. (Insert “Up” or “Down” in each box for the forcing terms and either “Up”, “Down” or “Indeterminate” in the row labeled Net Effect.)

2. Your second estimate for the sign of these terms will come from looking at their values at the three locations on the actual values on the mod_grib charts (50 points)

	A	B	C
850 mb Temperature Advection			
500 mb Absolute Vorticity Advection			
Net Effect			

Table 2: Forcing for upward or downward synoptic scale motion determined from mod_grib plots. (Insert “Up” or “Down” in each box for the forcing terms and either “Up”, “Down” or “Indeterminate” in the row labeled Net Effect.)

Part B. Comparison with Actual Vertical Motion Fields (30 points)

Complete Table 3, which is simply the qualitative nature of the vertical motion at 700 mb, and Table 4, which is simply the nature of the 300 mb convergence field. (15 points)

	A	B	C
700 mb Vertical Velocity			

Table 3: Insert the actual 700 mb vertical velocity for each location (in microbars per second) (15 points)

	A	B	C
300 mb DIV/CONV			

Table 4: Insert the actual 300 mb divergence or convergence for each location (in units of 10^{-5} s^{-1})

Part C. Synthesis (40 points each for 160 points)

1. Perform a careful frontal analysis on (a).
2. Each student should compare their results in Tables 1 and 2 with the actual values of vertical velocity and upper tropospheric divergence. Write a few paragraphs in discussion. Were your results consistent or not? Discuss carefully.
3. Each student should compare their frontal analysis with the two satellite mages. Were your results consistent or not? Discuss carefully.

4. Each student should compare Tables 3 and 4 and should determine whether Dines' Compensation was illustrated by this case.