EAS372 Assignment 5 Due: 5 April, 2013

Format: Please submit a tidy, organized report *in hard copy*, covering the exercise below. Report should be single-sided, double spaced with font size 12 pt. The page limit is **five**, not counting figures and tables.

Option A: Analysis of a storm from perspective of the quasi-geostrophic model

Document a midlatitude storm of your choosing, highlighting the ways in which its intensity (and possibly, development) reflects the factors that the QG model would suggest are most significant: (differential) vorticity advection, and temperature advection. Document your storm over a period long enough to track its motion and evolution (say 2-4 days), but there is no need to document its entire life cycle. Give a multi-level description taking the meteorologists perspective (rather than the viewpoint of a member of the public or media). The many types of evidence you might use include analyses, zero-hour progs and forecasts as displayed on surface and isobaric charts (as we have noted in class, a useful variety of fields may be displayed), satellite images, soundings and cross-sections, and (possibly) radar.

Your storm may occur or have occurred in any part of the world, at any time; however in making your selection please do bear in mind that you will want to be able to access many types of charts, which suggests you should favour "real time" storms in North America.

Option B: Calculation of turbulence statistics

The accompanying data file 'utah.dat' (6.75 MB) contains a time series of wind and temperature registered at 20 Hz and covering one hour, from two sonic anemometers (1,2) at heights $z_1 = 3$ m and $z_2 = 25.69$ m standing on an isolated tower on a salt flat in Utah (24 May, 2005; the data span local midday). The data are arranged in columns in the order $u_1, v_1, w_1, T_1, u_2, v_2, w_2, T_2$, where u is the northerly component, v the easterly component and w is the vertical velocity (units for the wind velocities, $\mathrm{m\,s^{-1}}$). The number of entries (N) in each column should be 20×3600 (but may differ slightly, so either N should be computed from the number of lines of data read, or set slightly smaller than 72,000).

Write a program to read the data file, compute, and write to a file the following statistics for each of the two levels:

- mean velocity components U, V, W and mean wind direction $\beta = \arctan(V/U)$ (note: this wind direction is relative to the frame of the instrument, and possible values $-180 \leq \beta \leq 180^{o}$)
- velocity variances ($\sigma_u^2 \equiv \overline{u'u'}$, σ_v^2, σ_w^2) and covariances ($\overline{u'v'}$, $\overline{u'w'}$, $\overline{v'w'}$
- vertical heat flux density $Q_H = \rho\, c_p\, \overline{w'T'}$ (to compute the density, assume the local pressure was $p = 820$ mb).