EAS372 Assignment 2 (15%) Due: Fri. 14 Mar. 2014

Format: Please submit a tidy, organized report *in electronic format* (PDF), covering the exercises below. Text should be double spaced with font size 12 pt. No page limit.

Create histogram and empirical PDF (6%)

Column-organized file YEG_Feb_81_2010.csv lists daily max, min and mean temperatures for YEG (Edmonton Int'l Airport) for every February day in the interval 1981-2010 inclusive ($N = 843$ days; a few days are missing). Compute the mean $\overline{T}$ and standard deviation σ_T of the series of daily mean temperatures. Create a histogram of the daily mean temperatures, using a bin-width of 2°C. For each bin (label "j", j=1...) compute the relative frequency n_j (total count of days falling in that bin, divided by N). Plot this histogram. Then divide each n_j by the bin width (2°C) to obtain an empirical probability density function f_j. Plot f_j, and compare with a Normal distribution

$$f(T) = \frac{1}{\sqrt{2\pi}\,\sigma_T} \, \exp\left(-\frac{T - \overline{T}}{2\,\sigma_T^2}\right)$$

plotting using your computed mean $\overline{T}$ and standard deviation σ_T.

Compute eddy fluxes (6%)

Compute the 30-min average vertical flux densities of sensible heat Q_H, of latent heat Q_E, of water vapour E $(= Q_E/L_v)$ and of carbon dioxide F_c from the raw data given in file "Timeseries13_20110816_tab.dat" (columns tab separated). The signals, recorded at 10Hz, span 13:30-14:00 MDT on 16 Aug. 2011, and were recorded over a wheat crop at St. Albert by a sonic anemometer at a height of 2.5 m. Column 1: vertical velocity $w\,[\mathrm{m\,s^{-1}}]$. Column 2: $T - 25\,[\mathrm{°C}]$. Column 3: scaled carbon dioxide concentration "C" which can be converted to true concentration of CO2 $[\mathrm{g\,m^{-3}}]$ by the calculation $\rho_{CO2} = 0.001(C + 600)$. Column 4: absolute humidity $[\mathrm{g\,m^{-3}}]$. Assume the pressure $P = 91$ kPa, in order to compute a mean air density ρ. Compute the fluxes as (e.g.)

$$Q_H = \rho\,c_p\,\overline{w'T'}$$

where a prime designates the *deviation from the mean value*.

Plot daily surface energy budget (3%)

Plot the daily cycle in hourly-averaged energy balance components (file "flanagan.txt") over grassland in Alberta, 1 July 2003. File gives net radiation (labelled Q^*), sensible and latent heat flux densities (Q_H, Q_E) and the "ground" heat flux (Q_G). All fluxes are in $[\mathrm{W\,m^{-2}}]$; data courtesy of Dr. L. Flanagan (U. Lethbridge).