SIO 217B Atmospheric and Climate Sciences II

Exercise #3

1. a) At large scales, the atmosphere is in hydrostatic balance. This means the upward pressure gradient (resulting from the decrease of atmospheric pressure with height) balances the downward gradient of weight of the atmosphere. Write down an equation for calculating the average upward vertical pressure gradient ($-\partial p/\partial z$) within the layer between 1000 hPa and 850 hPa (units are N m^{-2} m^{-1}).

   b) Download the files containing the geopotential heights of the 1000-hPa pressure surface (Z_{1000}) and the 850-hPa pressure surface (Z_{850}) for 1993 March 14 00Z. Carry out the above calculation, and plot the results in the domain 20-55°N, 230-310°E.

2. Download the file containing temperature on the 925-hPa surface (T_{925}), which is halfway between 1000 hPa and 850 hPa, for 1993 March 14 00Z. Calculate density on the 925-hPa surface, and then multiply it by the acceleration of gravity ($\rho_{925}g$). Plot this over your calculated $-\partial p/\partial z$ using a different color or line pattern. We cannot expect perfect agreement since the average pressure gradient within the 1000-850 hPa layer is not necessarily the same as the pressure gradient at 925 hPa.