Homework assignment number 4 Due Thursday May 7, 2002
Oceanography 423

The data set for this homework assignment can be found on the Ocean 423 web site. Download the file circ.mat. In it, you will find the following variables
H The depth of the wind-driven layer (m)
N The buoyancy frequency (1/s)
R_earth Radius of the earth (m)
omega rotation rate of the earth
rho_o the mean density of the fluid
latnp Latitude vector in degrees
stressnp zonal wind-stress N/m2

Using this data set, make the following calculations and plot each quantity. Make sure you look at the units and orders of magnitude of each quantiaty.

a) Compute and plot Coriolis parameter as a function of latitude and plot it (remember that latitude is in degrees, not radians). This has units of 1/s.
b) Computre and plot beta as a function of latitude. This has units of $s^{-1} m^{-1}$.
c) Computer and plot the meridional Ekman volume transport per unit length as a function of latitude and plot it (with units of $m^2 s^{-1}$).
d) Compute and plot the Ekman pumping as a function of latitude (units of m/s). At what latitudes does the sign of the Ekman pumping change?
e) Compute and plot the total (Ekman plus geostrophic) meridional volume transport per unit length of longitude from the Sverdrup balance and plot it (units of $m^2 s^{-1}$).
f) Compute and plot the total meridional volume transport assuming that the ocean basin is 70 degrees of longitude wide. Give this in units of Sverdrups, $10^6 m^3 s^{-1}$. At what latitude is the maximum northward western boundary current transport as predicted by Sverdrups theory?
g) Compute and plot the baroclinic Rossby radius of deformation as a function of latitude.
h) Compute and plot how long (in years) it would take a 1st mode baroclinic Rossby wave to carry the signal of this change to the western boundary from the eastern boundary, as a function of latitude.

Tips to using matlab
1. Use the subplot command to divide the page up into many plots
2. Remember to save your script so you can redo if you make a mistake.
3. If you want to take the derivative of a vector b of length 20

```
gradb=b(2:20)-b(1:19)
```

Note that the gradient is one shorter than the original vector.