Homework 5, Due November 9

1) Assume elevated topography is in isostatic equilibrium with normal continental crust at zero elevation. Derive the following expression relating outward force of the highland lithosphere to the first moment of the anomalous density

$$F_s = g\int_0^L \Delta\rho(z)z\,dz$$

where $\Delta\rho(z)$ is the density difference between the elevated crust and the normal crust and L is the depth of compensation.

2) Apply this model to the Tibet plateau which is elevated by about 5000 m above the Indian subcontinent; assume Airy compensation (ρ_c=2700 ρ_m=3200). Calculate the outward force of the plateau.

What is the average stress in the 62-km thick crust of the Tibetan plateau (i.e. outward force from problem 2) divided by crustal thickness)? The average stress drop during a major earthquake is only 5 MPa. What does this imply about the geodynamic importance of earthquakes?

3) For a thin elastic plate, develop a relationship between bending moment and plate curvature.

4) Do problem 3-19 in T&S

5) The differential equation for the deflection of a thin elastic plate *w(x)* in response to a line load $V_o\delta(x)$ is:

$$D\frac{d^4w}{dx^4} + (\rho_m - \rho_w)gw(x) = V_0\delta(x)$$

See T&S section 3-16 for definitions of terms. Take the fourier transform of this differential equation and solve for *W(k)*. Generate this function in Matlab and take the inverse fourier transform. Can you get the numerical calculation to match equation the analytic solution given in equation 3-130 of T&S? (Make sure the length of the model is about 10 times the flexural wavelength to avoid edge effects.)