SIO 182 Assignment 2.

Given 21 January, due 28 January

1) In anticipation of a manned mission to Mars, derive the magnitude of the free-air correction on the surface of that planet.

2) The height of the cliff between the beach and the car park at IGPP is about 40 m. Assuming an average density of 2200 kg/m^3 for the cliff rocks, estimate the difference in observed gravity between the beach and the car park. Show your working and make sure the sign of the difference is clear. (Neglect any terrain corrections or edge effects.)

3) Carry out the Nettleton's method part of the gravity analysis to derive a Bouguer density for La Jolla. The Nettleton data, with calibration, drift, and latitude corrected, is in `Nettleton.txt`, a data file that can be `'load'`ed into Matlab (Matlab will ignore all the lines starting with '%'). The data file has 12 columns:

1. Entry number: this allows you to work out how to index the data to isolate each survey.
2. Station ID. For benchmarks these are the city's numbers, for other sites a negative number.
3. Latitude.
4. Longitude.
5. Height, in feet, from the city data base, except for negative ID, which are other estimates in feet.
6. Northing, in units of 100 feet, from the city database.
7. Easting, ditto.
8. Measurement time, whole hours.
9. Measurement time, closest minute.
10. Meter reading, gravimeter units.
11. Raw gravity, mgals.
12. Latitude corrected gravity, mgals.

These data are taken from the 2002 and 2003 surveys for a Nettleton's method profile over the La Jolla Scenic Drive ridge. I have corrected the data for latitude, but later you will have to do this yourself for the rest of the data set. You only need the longitude, height, and latitude corrected gravity data for this assignment.

a) Compute free-air gravity by making an elevation correction. Note that elevation is in feet, not meters, and so needs converting. Make Bouguer corrections to free-air gravity for various sensible densities (between 1.5 and 4.0 g/cc, for example).

b) Plot your results (elevation, free-air gravity, and various Bouguer gravities) against the E-W position. Choose your favorite density. Does it make sense?

c) Now plot the Nettleton data as free-air gravity against elevation. Use Matlab's PolyFit to fit a line to the data (a degree 1 polynomial). Compute the Bouguer density from the slope of the line. Is this a better estimate than the graphical Nettleton's method?