# Geophysics 210 Fall 2008   Assignment 1 – Gravity

Question 1

- A number of countries use geothermal heat sources to generate electricity. Gravity data is sometimes used to investigate subsurface structure in such regions.

- The data shown below were collected on the island of Leyte in the southern Philippines. Consider the profile shown below that crossed an inactive andesite volcano.

- Note that the measured gravity data mirror the topography of the volcano.

- The numerical data are listed in the Excel spreadsheet that is also on the class webpage.
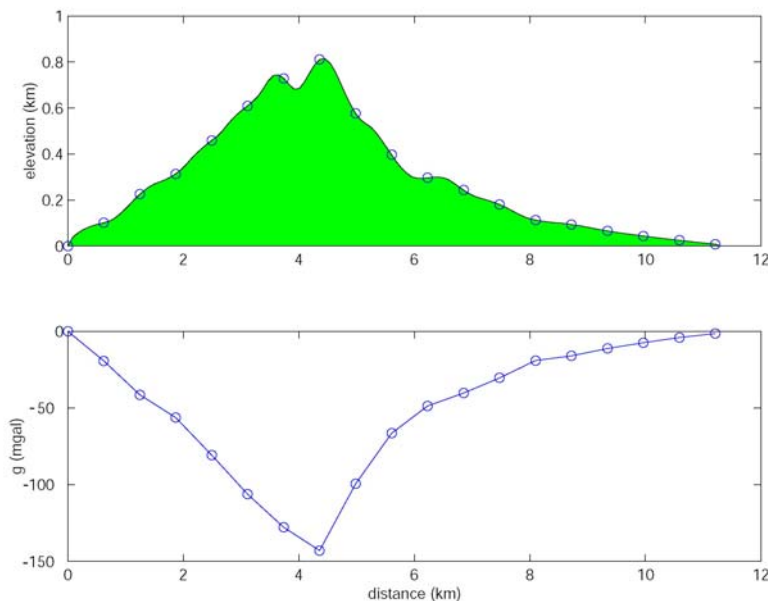
In (a)-(d), do the calculation by hand for the point on top of the volcano.

Show your working for the other points use the spreadsheet.

- (a) Compute the Free Air correction using the formula in your notes.
- (b) Compute the Free Air gravity anomaly.
- (c) Compute the Bouguer correction using the formula in your notes.
- (d) Compute the Bouguer anomaly.

- (e) **Plot** the measured gravity, Free Air anomaly and Bouguer anomaly.
- (f) What is the **maximum value** of the Bouguer gravity anomaly?
- (g) Compute the **half width** of the anomaly on east and west sides.
- (h) Compute the **average** half width.
- (i) Estimate the **depth** of the body that causes the Bouguer anomaly
- (j) Given the location, what could **cause** this density change?

Question 2

A 5 km high plateau is located in a region where the crust is 30 km thick.
The crustal and mantle densities are 2800 kg m^{-3} and 3100 kg m^{-3} respectively and
the plateau is in isostatic equilibrium.

Answer the following assuming that Airy's hypothesis applies.

(a) What is the thickness of the crustal root needed to support the plateau?

(b) Erosion removes 1 km from the surface of the plateau, but the crustal root does
not immediately change. Is the plateau now under or over compensated?

(c) Isostatic equilibrium is regained. How high will the mountain range be now?

Question 3

In Eastern Turkey a collision between the Arabian and Eurasian plates has formed the 2
km high Anatolian plateau. Over much of this plateau the Bouguer anomaly is -150
mgal (blue colours).
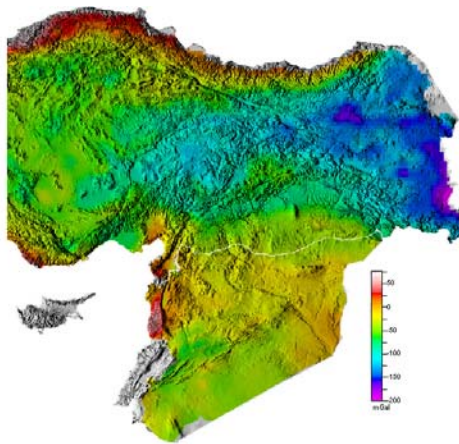
(a) Is the Anatolian Plateau in isostatic equilibrium, under compensated or over
compensated?

(b) What other forces could maintain equilibrium in this case?

Assume that crustal and mantle density of 2800 kg m^{-3} and 3100 kg m^{-3} respectively

Reading
Chapter 5 from the text book.

This assignment will be due in class **Thursday September 25 2008**
Please contact me, or the teaching assistant if you have questions.