Assignment 3

GEO5230/6230 - Potential Fields 1

October 23, 2009

1 Introduction

In this exercise, you are asked to compute some gravity anomalies of a profile across a Basin & Range basin, namely the southern Salt Lake Valley. At the end of the document you will find a table of station locations, elevations, and observed gravity values for the profile. Please turn in the plots and answers to your questions, showing all work. You are encouraged to use Matlab (or Octave) for this exercise, but it is not strictly required.

2 Instructions

- Compute the free-air and complete Bouguer gravity anomalies for each station, and plot vs easting. On a separate panel (with identical X values), show the station elevations.
  - Convert the station locations from latitude and longitude to UTM northing and easting; assume the WGS84 datum. There is a Matlab script (`wgs2utm.m`) provided on the class web page if you need it.
  - Collapse the stations into a single east-west profile. Some stations are displaced from the central profile line, so make sure to project them onto the east-west profile line.
  - The terrain correction for each station has been supplied in the last column of the data listing; this correction was computed at a reduction density of 2670 kg/m^3.
  - The appropriate reduction density depends on local geology. Given how we want to use the Bouguer anomaly, decide how to choose an appropriate reduction density, and defend your choice. Hint:

you will probably want to try multiple densities before making a final choice.

- Assuming a constant density for the basin fill and basement, what's the basin shape?
- Using the formula for the gravity effect of a disc above the central point, what's the basin depth?

3 Gravity Stations

These stations were extracted from the 1999 edition of the National Geodetic Survey gravity database. These data are available on the class web page (`http://thermal.gg.utah.edu/teaching`) as a text file.

Latitude	**Longitude**	**Elevation (m)**	**Gravity (mGal)**	**T.C.(mGal)**
40.699800	-111.876083	1298.80	979777.688	1.59
40.699900	-111.852883	1338.40	979773.312	2.02
40.699800	-111.833283	1381.00	979768.875	2.60
40.699583	-111.794100	1505.70	979746.312	5.74
40.703900	-111.938083	1294.20	979779.375	0.80
40.725800	-111.937883	1292.00	979782.125	0.78
40.714100	-111.925300	1289.30	979779.688	0.90
40.725583	-111.922600	1289.30	979780.875	0.92
40.733383	-111.910400	1288.70	979781.000	1.12
40.722300	-111.897900	1292.40	979779.312	1.24
40.722300	-111.878800	1303.30	979779.000	1.51
40.733383	-111.852883	1347.20	979776.375	2.05
40.741383	-111.852883	1363.40	979776.312	2.14
40.718300	-111.852800	1345.70	979774.125	1.97
40.725300	-111.833583	1373.40	979770.812	2.73
40.712600	-111.833283	1380.70	979770.625	2.54
40.737800	-111.829883	1413.40	979768.500	2.76
40.725083	-111.823783	1407.60	979768.375	3.11
40.742900	-111.820383	1465.80	979760.688	3.10
40.728883	-111.814600	1472.20	979758.812	3.83
40.714100	-111.805300	1485.30	979754.125	4.57
40.709400	-111.797600	1438.40	979760.625	8.14
40.713300	-111.786600	1497.80	979743.688	9.71