GEOL 384.3 and GEOL 334.3

Lab #3: Depth estimates for gravity and magnetic anomalies

In this lab, you will work with several figures representing magnetics profiles and a gravity contour map from a variety of situations, using the graphical methods described in the "Source estimation" lecture. Your goal will be to estimate the depth to source in each case using the suggested technique.

The data plots shown below are also provided in Word worksheet file which you may modify and use for your report.

Assignments

1) **In each of the three copies of Fig. 1 provided in file** lab3_worksheet.docx **, estimate the depth to the source** on the three magnetic profiles using Peters slope, the Linear Slope Distance, and Sokolov's methods.

   Assume a shape factor of 1 in all cases, but remember that this could be as small as 0.3 and as large as 2 depending on the shape of the source. Therefore, there could be considerable error in the depth estimates due to uncertainty in the shape factor.

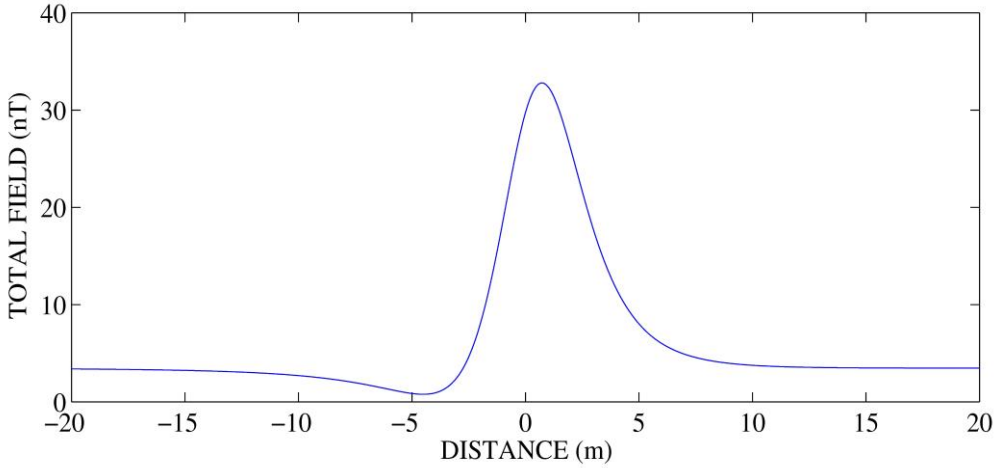

Fig. 1. Magnetic profile to estimate the depth of the source by Peters slope, Linear Slope, and Sokolov's methods

2) Fig. 2 shows another profile across a dike-like target (steeply dipping planar structure). This time, instead of a continuous line, we have discrete measurements at half-meter intervals, which makes work a little harder. In three copies of this figure, **find the approximate position of the target along the profile using the E-line, Werner's, and Logachev's methods**.

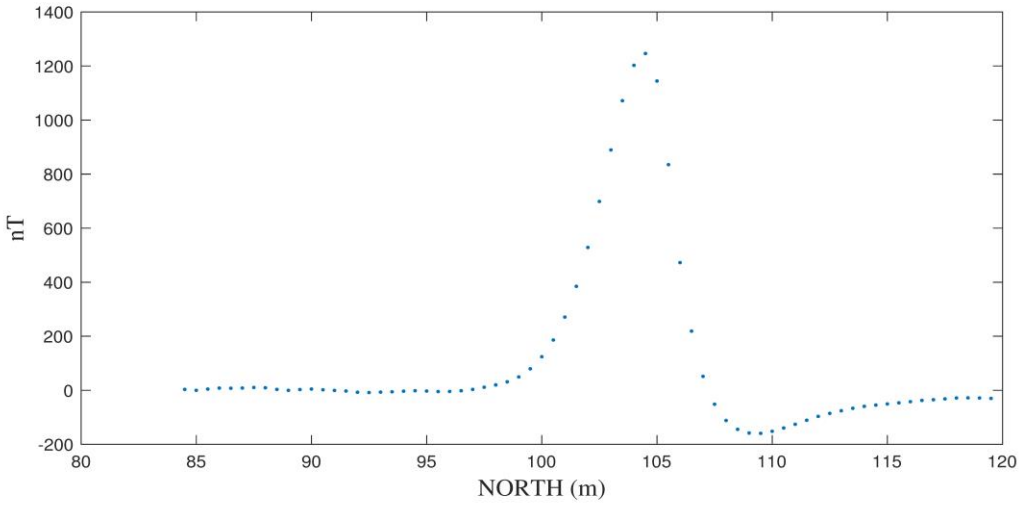

Fig. 2. Magnetic profile to estimate the position of the source by E-line, Werner's, and Logachev's methods

3) In Fig. 3, there is another profile 2.5 m to the east of the previous one. Use the E-line method only and compare the interpreted location of the top of the dike to the previous one. What can you say about the strike of the dike?

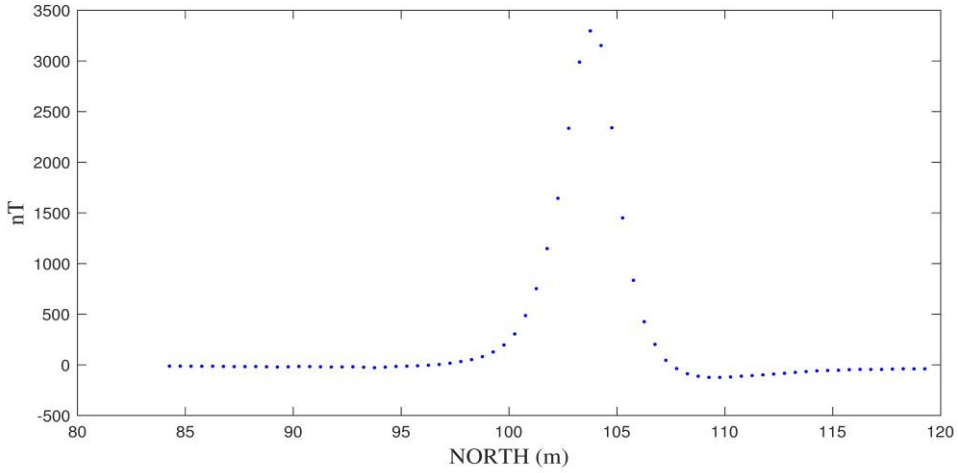

Fig. 3. Magnetic profile located 2.5 m east of the one in Fig. 2.

4) Fig. 4 shows a contour map of gravity over the Woodlawn sulphide deposit in Australia. The contour interval is 0.05 mGal and the peak anomaly is 0.8 mGal. **Estimate the depth to the source**. Which way do you think the strike, dip, rake, and plunge of the ore body go?

The ore body likely looks like an elongated linear structure (like a rod, cigar, palm of your hand, etc.) within a dipping plane. The strike is the horizontal direction within this plane, and the dip is the angle of this plane relative to the vertical direction. The plunge is the downward dip of the linear ore body. The rake direction is the horizontal projection of the elongated body.

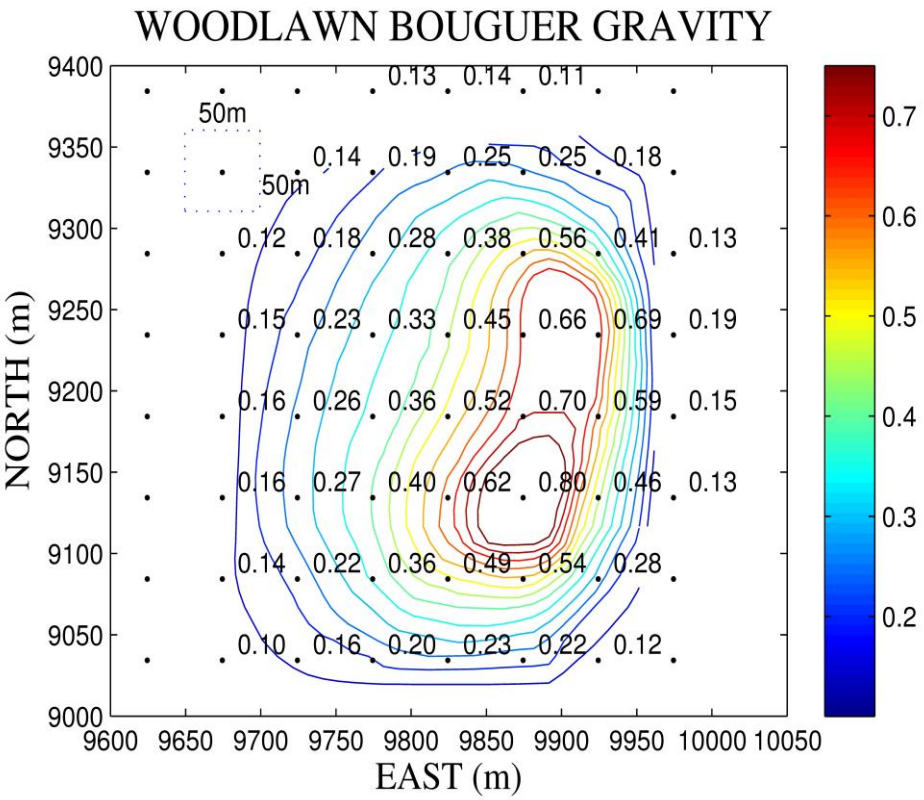

Fig. 4. Gridded values (dots with numbers) and contours (color) of Bouguer gravity anomaly

5) **GEOL334 (but recommended for all):** From Fig. 4, **make a rough estimate of the excess mass** of the deposit. The gravity stations (black dots) are 50 m apart, and so estimate the excess mass by integration (sum all gravity values shown in the plot, multiply by the area of the 50×50 m grid box around each station, and divide by $2\pi G$).

Hand in:

Brief answers to the questions highlighted in **bold** above with figures embedded in a Word or PowerPoint document by email.