MAGNETIC COMPUTER LAB

Part 2

In Part 1 of this lab exercise, we undertook an analysis of the gravity anomalies detected over the area of interest. The model developed from the gravity anomalies provides us with the bedrock profile. This step was necessary as a precursor to the interpretation of the magnetic data because the bedrock is itself magnetic and formed in a basalt layer with susceptibility of 0.006 cgs units. Since our objective is to find buried metallic containers at the site, being able to discriminate or separate out the contribution of the bedrock topography to the magnetic anomalies observed in the area is critical to accurately pinpointing the location of the buried containers of radioactive debris.

We have determined the contribution of bedrock to the measured magnetic anomaly and are now able to relate residual anomalies unrelated to bedrock to the buried metallic debris at the site.

Today’s exercise goes quickly, so make screen captures and begin preparation of your lab report.

Procedures
- Copy the MaglabP2 folder from the common drive to your G or C:\Drive
- Get into GM-SYS and Open the file MaglabP2.sur. Your start-up window should look like that below.
• For starters check individual layer parameters. Do not alter the bedrock configuration. Zoom in on the object labeled drums. We will use one object to represent the cluster of drums.
• Assign a susceptibility of 0.55 to the drum body and check off the 2 and 3/4D check box as shown below. We’ll assume that the drums are 5 feet long, and that they are stacked on their side. We’ll also assume that our profile goes directly over the buried drums (the peak of the anomaly observed on the survey map). Thus the strike length - into and out of - the cross section will be 2.5 feet.

![Image of Block - Drums window]

• Open the Y+ folder and define the strike-length of the drums into the section as 2.5 feet (below). Set susceptibility to 0, the susceptibility of the surrounding alluvial deposits.

![Image of Block - Drums window]
• In the Y- folder define the length as –2.5 feet (that is 2.5 feet out of the plane of the section). Set the susceptibility to 0. This represents the susceptibility of the materials beyond the ends of the drum, i.e., the susceptibility of the alluvium.

• Click OK

• The location of the body shown in the starting model is the result of a rough guess. I placed an object beneath the peak of the anomaly and made some minor adjustments to its location. Your startup window should look something like that shown below.

Try and fine-tune the location and size of the buried cluster of drums by running an inversion. Click on the inversion option in the action toolbar and set up the inversion parameters.

Inversion parameters –
  Free both X and Z coordinates.
  Set dX to 5 and dZ to 5.
  Zoom in on the drum cluster and free only the three points that outline the cluster for inversion.
  The inversion process may actually weaken the match, but click next step a few times and note where the coordinates start to drift.
  Exit the inversion window and then begin to manually adjust the locations of the cluster boundary.
  You’ll probably want to zoom out a bit before making manual adjustments. Zoom in or out to suit your interests.
  The resulting adjustments – after some tinkering – may look like that on the following page.
• Beware of the perfect match associated with various configurations of very flat drums.

• Now that you have a fairly good idea where the drums are located, we can make a rough estimate of how many drums are buried at the site. This estimate assumes that we know something about the size of the drums. To make things easy we'll assume the drums have a cross sectional area of 4 ft$^2$.

• In our approach thus far, we have assumed that the drums producing the anomaly are clustered together in one area. To estimate the number of drums we simply calculate the cross sectional area of the derived triangle and divide it by the cross sectional area of a single drum (4 ft$^2$). To calculate the area of this triangle you'll want to examine the x and z coordinate locations using the eyeball. Write down these coordinates and plot them on a sheet of graph paper at one-to-one scale so you can measure the base and height of your triangle.

• Show your triangle plot. Remember that the area of a triangle is 1/2 the base times the height. Discuss your results.

• Discuss possible limitations of the result you obtained. In your discussion, also consider the relative influence of depth of burial. Remember that a buried drum has a magnetic field that is roughly equivalent to a simple dipole field. The magnetic anomaly produced by the drum will diminish with increased depth of burial ($r$) as $1/r^3$. Drums buried deeper at the site may not be resolvable. Compare the relative magnitude of an anomaly associated with a drum buried 7 feet beneath the surface to one buried 20 feet beneath the surface. Could there be more drums there than you suspect?

• Illustrate your model by choosing fill patterns for the objects in your model. Also check the plan view to make sure your model has been correctly defined (see example figure below).
Model display: Configuration of the bedrock surface separating basalt from alluvia was defined through modeling of the residual gravity data across the site. The cluster of buried drums is modeled as a triangular shaped object with 5 foot strike length. Magnetic calculations and observations are shown in the center pane.
Geol 454: Environmental and Exploration Geophysics 1
Magnetics lab – 2016 Reporting format and some questions to guide your summary

Things to do
1) Explain the problem. What are you looking for and why was the gravity survey necessary?
2) Provide a figure(s) showing the results of modeling. This could include the gravity and magnetic panes from a GMSYS screenshot.
3) Provide graph showing area in which drums are enclosed along with computation of the number of drums
4) Summarize the general findings with reference to figures/illustrations you provide.

The grade will be based on
1) Organization
2) Demonstration of your understanding of the problem and its solution;
3) Effectiveness of your presentation (clear explanation that demonstrates understanding of geophysical principles, correct use of terminology, effective figure(s) with useful labels and explanatory caption, reference to figure(s) in your discussion).

In general this is intended to be a relatively short summary. There are no recommendations for number of pages or figures.

Due date to be announced