GOPH 547 – Gravity and Magnetics (W2016)
Lab Assignment #4

In this lab assignment, you will develop Matlab code to perform typical processing on vertical component magnetic survey data including residual removal, upward continuation and downward continuation. Based on your results, you will write a brief scientific report (see report format and rubric under Lab Information on D2L) discussing your results. The raw data for the lab is contained in the file **"goph_547_w2016_lab4_data.mat"** on D2L. You will submit the assignment to the Dropbox on D2L on as a compressed (**.zip**) file entitled **"GOPH_547_Lab_4_St_00123456.zip"** containing a copy of your report in **.pdf** format and a copy of all Matlab code used to generate your report results. In the file name, replace **00123456** with your 8-digit UCID number.

Instructions

1. Create a 2-D contour plot of the raw F_z data as well as plots of the raw F_z data against x and y coordinates only. You will use the latter two plots to examine the regional variation of the F_z data and remove it so that you can examine only the residual. Discuss any initial observations that you have about the regional variation in F_z.
2. Fit a first order polynomial to the F_z vs. y data of the form,

$$F_z(y) = a_0 + a_1 y \tag{1}$$

   and add a line to the plot of F_z vs. y data from Step 1.
3. Remove the linear component of the regional variation in the y direction from the data (i.e. $F_z = F_z - a_1 y$). Create a new set of plots as in Step 1 and discuss your observations about the regional variations in F_z that remain.
4. Repeat Steps 2-3 for the regional variation in the x direction.
5. Remove the constant component of the regional by subtracting the minimum value of F_z after completing Step 4.
6. Upward continue the F_z data by h = 30 m by performing the following integration,

$$F_z(x', y', -h) = \frac{h}{2\pi}\int_y\int_x\left[\frac{F_z(x,y,0)}{R^3}\right]dxdy = \frac{h}{2\pi}\int_y\int_x\left[\frac{F_z(x,y,0)}{\left\{(x-x')^2+(y-y')^2+h^2\right\}^{\frac{3}{2}}}\right]dxdy \tag{2}$$

7. Downward continue the F_z data by h = 30 m by applying the following finite difference approximation,

$$\begin{aligned} F_z(x', y', +h) \approx\ & 6F_z(x', y', +h) - \cdots \\ & \cdots - \left\{F_z(x'-h, y', 0) + F_z(x'+h, y', 0) + \cdots\right. \\ & \cdots + F_z(x', y'-h, 0) + F_z(x', y'+h, 0) + \cdots \\ & \left.\cdots + F_z(x', y', -h)\right\} \end{aligned} \tag{3}$$

8. Compare your results from Steps 6-7 with the F_z data after removing all components of the regional. Discuss the effect of upward and downward continuation on the data.

Closure and Deliverables

Create a report following the Lab Report Instructions on D2L. Make sure to address all questions above in your Results and Discussion section. Follow the instructions at the beginning of this assignment page for naming the report and the compressed folder containing your report and code. You may modularize your code as you see fit, but make sure that the overall driver script is called `GOPH_547_Lab_4_St_00123456.m` so that we know which script to run to regenerate all plots in your report. Submit the compressed folder containing your report and code to the Dropbox on D2L.