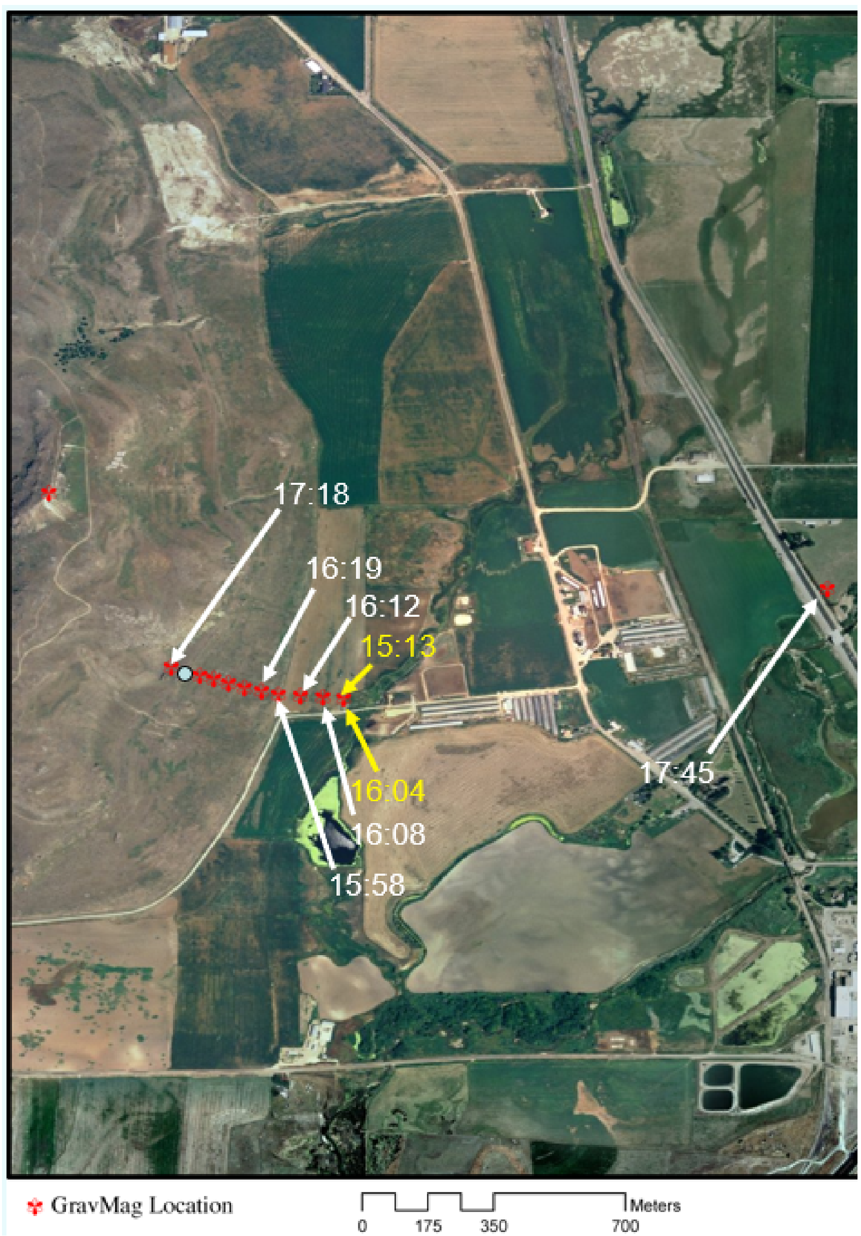
Saturday, April4th, 2020

Applied Geophysics – GEO 5660/6660
Lab Exercise # 5: Gravity Modeling: Little Mountain, Idaho

Due: Monday, April 12th, 5 PM

(Email lab write-ups to rgmcdermott@aggiemail.usu.edu)

Introduction: Your assignment for this lab is to use gravity data collected by a previous GEO 5660 class from Little Mountain, Idaho, (right) to infer local crustal structure and test various hypotheses about why this topographic anomaly exists. The raw data, times that each data were collected, and elevation of each data point are hosted in an excel spreadsheet on the course website.



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1. Acquire and reduce the gravity data. Treat **site 1** as your reference site (zero anomaly). ***These data have already been corrected for tidal effects and dial reading.*** You will need to do the rest.

a) Calculate drift (in mGal/hour). From repeated measurements at a site and do a drift correction.

b) Calculate GRS67 reference gravity (i.e., g_n, see lecture/text) and do a latitude correction.

c) Calculate the free air correction and the free air anomaly

d) Calculate the Bouguer slab correction and simple Bouguer anomaly.

e) A terrain correction has already been calculated (using ***GravMag*** and elevation data) and provided to you in the excel sheet. Use these values to calculate the complete Bouguer anomaly.

Your final reports should include plots for each step that demonstrate how the data changes with each successive correction. (In other words, each plot should include the corrected data and the raw data so you can evaluate how each correction influences the final data you use in your modeling.

2. A critical component of working with geophysical data is evaluating possible errors in the data collection. While collecting the above data, there ws some uncertainty concerning whether the dial readings at site 1 are correct. This would call into question the validity of your drift correction! Further, the position of site 10 was not precisely measured, but approximated.

a) Plot your data at the following steps, *with and without the drift correction*: Free air anomaly, simple Bouguer anomaly, and complete Bouguer anomaly. Are the values at site 1 consistent with the other measurements? Does the profile of the data seem cleaner with or without the drift correction? Does this help us determine whether the dial reading edits were reasonable?

b) Do you see any evidence the estimate of site 10's position might be off? If so, by about how much?

3. Use your final, corrected data, from Question 1 to evaluate three possible models for the origin of Little Mountain suggested below. Create a ***GravMag*** prismatic model for each end member and vary the density contrasts/prism endpoints as needed to optimize the fit for that model type. ***Compare the RMS residuals*** for each model to evaluate how well each fits the observed data.

a) A horst associated with active normal faulting

b) An allochthonous remnant from Laramide thrusting

c) A Paleotopographic surface that was never buried by Cache Valley normal faulting and sedimentation.

Discuss your results. Can any of the endmember models be ruled out based solely on the gravity data? Why or why not?

REPORTS:

Your reports should include any relevant plots, numerical data and short blurbs (nothing formal) for where you are asked to comment. Submit your assignment as a single document (Word, PDF, etc). ***Include your name in the filename.***