LAB 2: The Density of St. Louis Heights Ridge

Due Tue, Feb 9

The purpose of this lab is to learn how to do a gravity survey, reduce the data, and to do a simple interpretation for the density of the subsurface. Your objective is to determine the density of the St. Louis Heights Ridge.

1. Gravity survey

We will measure gravity at 3-4 sites. One sight will be at the base of St. Louis Heights and will serve as our base station. This station will be the site of our first and last measurement. It will be critical to measure both the time and coordinate of each measurement. See the attached maps to design your survey.

2. Gravity reduction

2.1 First correct for the temporal variation in our instrument much like we did in Lab 1

2.3 Then determine the elevation of each of our measurements using the digital elevation map I provide (we will do this in the lab).

2.4 Plot measured gravity and elevation versus distance (in km) from our base station.

2.5 Compute and plot free-air gravity anomaly (FAA) versus distance from our base station. With your base station as your reference point, you should subtract the value at the base-station from each measurement. Doing so will make the FAA be zero at the base station and all other points will vary relative to zero.

2.6 By using the infinite slab approximation you can compute the attraction of the crustal mass between each measurement and the level of our base station (see diagram below).

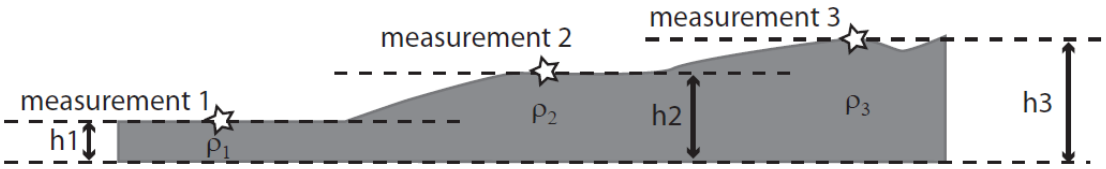
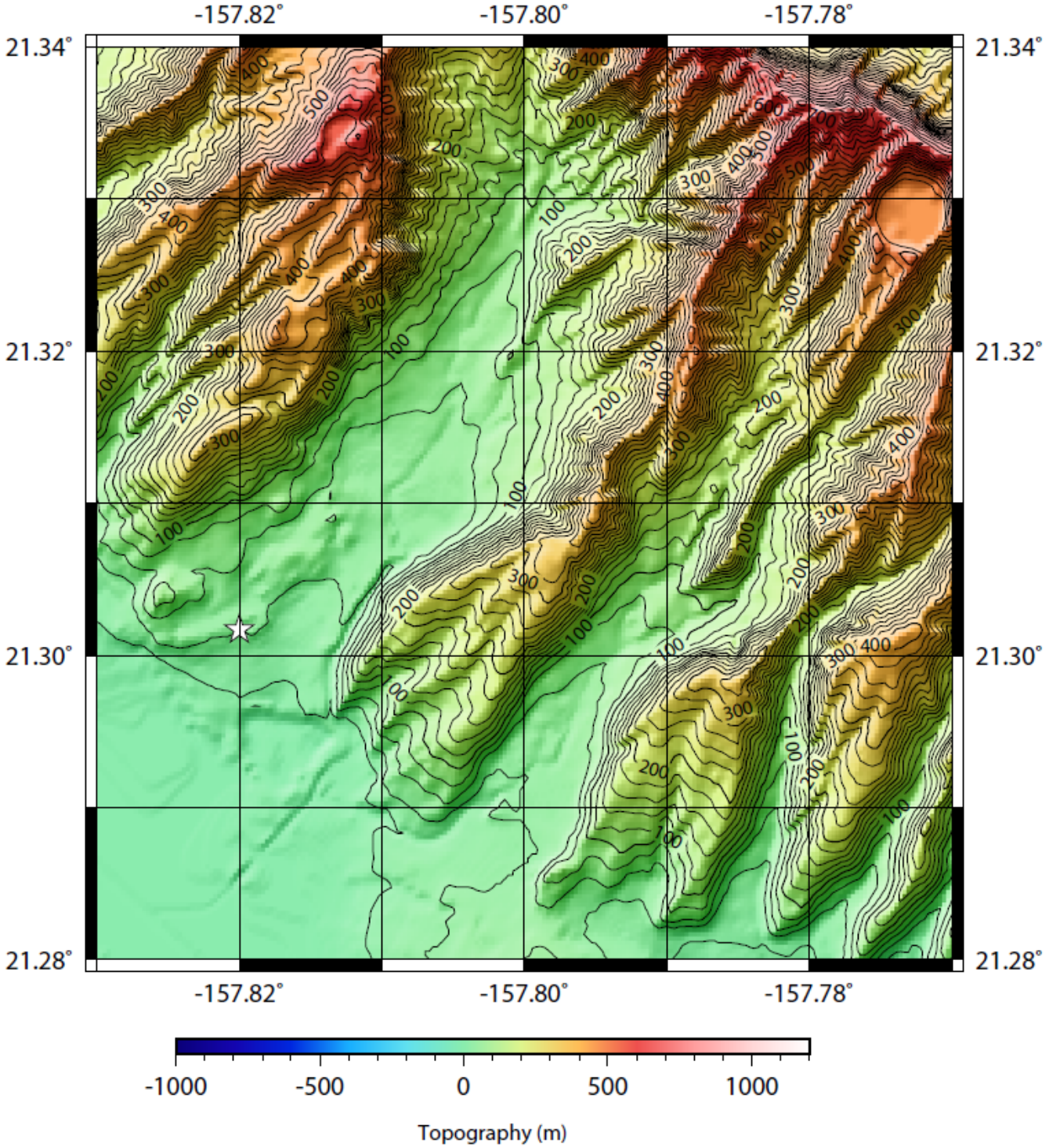


Diagram: Cartoon showing 3 measurements taken along a hill slope. The attraction of the crust below each measurement can be approximated as the attraction of 3 slabs of uniform thickness (h) and density (ρ) beneath each point extending infinitely north, south, east, and west (dashed lines).

For each station, estimate the range of densities ρ that can explain the free-air gravity at each location. By "range" I means determine a lower-bound, upper-bound, and optimal density that fall within say 10% of the observed FAA at each location. Plot the FAA predictions for your lower-bound, upper-bound and optimal densities with your plot of observed FAA vs distance.

3. Interpretation of results

Clearly discuss the main trend that you see in your estimated densities. If they vary, discuss the possible artificial causes. One major artificial effect is your approximation of each point being on top of an infinite slab, but infact St. Louis Heights is a ridge of limited extent. Also, while considering this approximating discuss whether your densities are likely to be slightly too high or slightly too low compared to reality. Discuss whether the densities (and their variation) are or are not consistent with what you know about the geology.


-157.82°
-157.80°
-157.78°
21.34°
21.32°
21.30°
21.28°
-1000
-500
0
500
1000
Topography (m)


Puu Ualakea State Wayside
Manoa Valley District Park
Manoa Rd
Oahu Ave
Waahila Ridge State Recreation Area
Paloio Ave
Pukele Stream
Hala Terrace
Manoa Stream
Paloio Valley Field
University Ave
Malle Way
The Mall St
Campus Rd
Metcalf St
Moiliili Quarry
Dole St
Tennis Courts
E West Rd
Lunalilo Fwy
Cook Field
Kanewai Park
S King St
S Beretania St
Waialae Ave
Chaminade University of Honolulu
Kapiolani Blvd
Honolulu Stadium State Park
Diamond Head - Kapahulu - St Louis
Mauumae Nature Park
10th Ave
5th Ave
6th Ave
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