440 Geophysics: Fieldtrip guide for Death Valley, April 2005
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Objective

We will be performing a gravity and several seismic surveys from Friday until Sunday noon with the goal of inferring information about the subsurface structure. The study area is Mormon point in Death Valley. For the gravity survey, we will try to invert for the depth of basement underneath a several km thick sediment cover over normal fault structures. For the refraction seismic work, we will be studying several fault scarps and contact structures at ~10 m depth.

Setting

Death Valley is in eastern California, about 240 mi from LA (~4 hours driving). Our study (and Kurt Frankel's thesis) region is south of Furnace Creek, around Mormon point. See, e.g., Keener et al. (Geology, 21, 327, 2003), as sent out in PDF, for some geology. Death Valley is part of the Eastern California Shear Zone, which takes up 20-40% of the plate boundary deformation between the Pacific and the North American plate at the present time. The structures we are looking for are normal faults, active ~10 Ma years ago.

Techniques and reading

Geology

Kurt Frankel of USC will be giving an introduction to the geological setting in the field and supervise the gravity survey together with Peter Powers.

Gravity

We will be using a Worden gravimeter, and a more advanced LaCoste Romberg instrument to measure gravity anomalies. Those will be corrected, first, for the elevation and latitude of observation (Free air correction), and then for terrain (Bouguer correction). Read Fowler p. 205-214, Musset & Khan chap. 8, and my gravity handout for more details. We will be choosing a base location, against which all gravity will be referred. During the day, we will return to this station several times in loops, to be able to correct for the drift of the instrument. Gravity will be measured by two groups, one using
the Warden, the other the LaCoste Romberg under supervision of a CU Fullerton grad student.

**GPS**

We will be using kinematic, differential GPS measurements to get the relative location with respect to a base station. For this, each gravity group will carry a GPS receiver, antenna, and tripod. The tripod will have to be leveled by line of sight with the gravity meter. Since the free air and Bouguer corrections per meter height change are \( \sim 3 \times 10^{-6} \, \text{m/s}^2 = 0.3 \, \text{mGal} \), and both instruments have precisions (far) better than 0.1 mGal, we will have to get good vertical relative locations, at least down to 30 cm. This is why we will have to record GPS data for \( \sim 15 \) min at each gravity point.

**Seismics**

We will do a refraction survey with a 24 channel Bison machine. Reading: Fowler p. 140-148, Musset & Khan, chap. 6 and your lecture notes.

**Logistics**

**Meeting time and place**

We will meet Friday, 04/29, at 6:30 am behind the Earth Science building on USC campus. Transportation will be provided in two vans (one departmental, one rental). We will leave Death Valley Sunday at 1 pm to make it back to LA hopefully around 6pm.

**Accommodation**

We will be camping in Furnace Creek campground (see map). Furnace creek has bathrooms and running water, and also fire pits. However, the park service is not taking reservations for the campground so it is a first come, first served situation. If for some reason we don't get a camp ground, we are going to be camping on “wilderness land” \( \sim 30 \) miles to the south of the field area (this would pose a number of problems regarding charging our equipment etc). That being said, it is important for us to leave very early on Friday morning, so we get to Furnace creek around noon and can claim some camp grounds.
Food

We should have the food taken care of prior to leaving for the field. We are going to break into teams for preparing the meals on Tuesday, we recommend three groups: one group in-charge of the lunches and breakfasts, and each of the other groups in-charge of one dinner. There will be 2 dinners, 2 breakfasts, and 2 lunches for 11 people. Everybody should bring a lunch for Friday, we may be stopping at a store on the way up so we can pick up some fire wood.

Weather

For those of you who have never camped in Death Valley, here is a bit of advice. It should be hot - typically for the end of April and beginning of May, the temperature is in the mid 80's to mid 90's. Remember it is the desert, so there is no shade, and you need to remember to protect yourself from the Sun. The nights are fairly warm in the mid sixties or so, so a light sleeping bag should be sufficient. These temperatures are estimates, of course, always be prepared. Right now (04/27), the weather forecast is a 20% chance of rain, and highs in the mid 80s.

Things to bring

You will be responsible to bring the following items yourself
- refillable water bottle (we will be spending the day in the middle of nowhere, but will have several 5 gallon jugs of water with us)
- a hat that will protect your face and neck
- sun glasses (you are gonna want to protect your eyes - it gets bright out there)
- shorts/pants
- short sleeve shirt(s)
- long sleeve shirt (one for evening and/or one for working in the sun (if you desire))
- rain jacket on the (right now 20%) chance that it actually rains
- socks
- hiking or running shoes (you will be walking around on an alluvial fan all day
- comfortable shoes for after you work
- sleeping bag
- pillow
- tent (you can share with others, but make sure you arrange it ahead of time)
- flash light/head lamp
- toiletries
- camera
- notebook for recording data
- pencils, eraser, ruler, graphing paper (or paper with squares printed on it)
- pocket calculator
- day pack
- alternative beverages

Optional items include:

- bandana (keep you cool and the sun off)
- chair for relaxing after a day of work
- bug repellent (you will likely not need it)
- frisbee or other recreational sports stuff
Overview map with major roads