GE 167: Homework 1 Due: Tuesday, April 5, 2011

The primary goal of this homework is to make sure everybody is able to handle a basic plotting tool (GMT or equivalent) that we will use in class. If you need help, please see Francisco or me ASAP. From the class web site, you can download a template GMT file `<location.gmt>` that you can modify/augment for your homework. This file should work on any of the division linux machines that are on the communal network. Note, this file already reads part of the data file you will use – so you just have to modify the <gawk> command to access different columns. Additional GMT routines that may be useful are indicated below.

From the class website you are given the Southern California Earthquake Center crustal motion model CMM4, here called `<socal_vfield_4p0_3D.dat>` and a file that describes the format (essentially a bunch of columns with geographic coordinates of each measurement site, horizontal velocities, errors, and a site name).

1. You will first want to construct a good basemap. For the geographic range of the data file, plot topography in shaded relief - color for elevation, shading for slope (`grdgradient and grdimage`). Add coastline information, as well as state and national boundaries (`pscoast`). Then add faults and any other relevant information. Make sure that you have scale bars, useful tick marks, etc. `<location.gmt>` actually does all this for you. Now add the velocity vectors from CMM4 (`psvelo`) along with the error ellipses. Add a velocity scale bar somewhere.
2. Now construct profiles of the velocity field across the San Andreas Fault. (You can make the actual plots in GMT, Matlab, or anything else). However, GMT has tools that will at least make it easier for you to extract the relevant subsets of data. You should make plots for 3 profiles: (a) north of the intersection with the Garlock Fault, (b) from LA, across the San Gabriel Mountains to the Mojave dessert, and (c) to the south across the San Andreas, San Jacinto, and Elsinore faults. The profiles should all be locally perpendicular to the San Andreas Fault. Begin by selecting sites within a specified rectangle or distance from the profile (`gmtselect`). Calculate the fault parallel and fault perpendicular components of the velocity field (you will need to rotate the velocity components into a local coordinate system. You may also want to rotate the errors into that coordinate system (optional at this point). Plot the 2 components separately as a function of distance along the profile. For these purposes, feel free to remove the mean velocity from each profile. (Why is this OK?). Show the location of the profiles (and perhaps indicate the relevant sites) on your map.
3. How different are the 3 profiles you generate? Can you suggest reasons for any of these differences?