

GE161 Plate Tectonics. Fall 2007. PS 5 – seismicity. Instructions for the computer programs.

Seismotectonics Programs Instructions for Ge161 PS 5, Fall 2007

A. Make plots of the distribution of the epicenters.

search the USGS/NEIC (PDE) catalog 1973-Present:

<http://neic.usgs.gov/neis/epic/epic.html>

- you can choose to get a map as output (choose Output file type 4, Generate Map).

- You can also output data to plot using GMT, but only if you feel like it. It is fine to use the maps you get from the browser window. However, in this case, do one version of the search where you keep a list of the earthquakes so you can see their depths, magnitudes etc (option 1 for example).

Use the "rectangular area" search parameters that correspond to your study area.

Remember you need to make 3 seismicity plots, showing the events in different depth ranges. Please make 3 separate plots (not just one with all the depths together). You can choose different depth ranges using the "optional parameters" list at the bottom of the web page.

B. Search the catalog for the Centroid Moment Tensor solutions.

<http://www.globalCMT.org/CMTsearch.html>

For the data output, choose the fourth option, "GMT psmecha input" format for plotting in GMT.

(The reason you choose this format is because the script

you will be using to make the maps expects this format when it reads

the focal mechanisms.) Save the

list of earthquakes (without any header lines)

as a plain text (ascii) file with the extension ".save" (e.g., myname.save) in your UNIX or Linux directory.

You should also run the search and look at the results in "Full Format" because

you can see all kinds of interesting details (for instance, you can

see the eigenvectors and eigenvalues and figure out how close each event

is to being a purely double-couple event).

C. Download the GMT plotting script "cmt\_plot\_new.gmt" to your home directory, using the link on the class web site.

Make sure to change the permission on the file so you can execute it. It should run on either Unix or Linux.

D. Plot the focal mechanisms. NOTE that if you have not used GMT before you may need to set the GMTHOME environment variable with the

command:

```
setenv GMTHOME /opt/GMT
```

(You will need to do this in the window you are working in, before you run the plotting programs. You will need to do it each time you work in a different window, including new sessions.)

To plot the CMT Focal Mechanisms:

```
computer% cmt_plot_new.gmt
```

Usage: cmt\_plot.gmt file\_name minlon maxlon minlat maxlat title mag\_scale  
title must be one word or multiple words connected by underscores

\*\*\*\*\*NOTE\*\*\*\*\*

- 1) file\_name is the \*.save file. You may want to use plot boundaries slightly larger (~5 degrees) than the boundaries you gave for your CMT search.
- 2) Depending on your map area, the size of your plot may need to be changed. This can be done by changing the scaling parameter -Jm# to slightly larger or smaller scales. This number is the ratio of inch:degree on the map. (ex. change -Jm0.12 to -Jm0.18 gives a larger map)
- 3) Depending on your GMT defaults, you may need to change the size of the beach balls to be larger or smaller. You do this by changing the number after -Sd in the call to the cmt\_plot\_new.gmt script; make it smaller if your beach balls are too large, or make it larger if your beach balls are too small.
- 4) If you change the -Sd to -Sm the program will plot the complete moment tensor, including any non-double-couple components, instead of the double couple moment tensor. You can use whichever one you prefer for this homework assignment. Double-couple versions are easier to interpret.
- 5) If you don't like where the bottom left corner of the map sits on the page, you can change this by changing the coordinates of this origin in the "origin" variable in the cmt\_plot\_new.gmt script in your directory.

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For example, if my CMT focal mechanism information is in the file nz.save, my longitude range is 155 to 190, and my latitude range is -60 to -25, I would run the command like this:

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```
computer% cmt_plot_new.gmt nz.save 155 190 -60 -25 New_Zealand_CMT -Sd0.5
pscoast: Working on block # 522
pscoast: Adding Rivers...
pscoast: Adding Borders...
psxy: Working on file /home/datalib/Plate_Boundaries/nuvel1_boundaries
psmecha: Working on file temp
psmecha: Number of records read: 42
[1] 27226
Plotting ...
```

And then it will display the map on the screen, using the "xv" software, with the focal mechanisms plotted. If you don't like using xv you can change "xv" to "display" in the script.

Note that if my data area crosses 180 degrees I have to search the CMT catalog twice: for example, for the New Zealand region, I would search it once from 155 to 180 and once from -180 to -170 in order to get the data from either side of the date line.

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Other useful info:

The web site <http://atlas.geo.cornell.edu> has an interactive mapping tool that you can use to make plots of different geological and geophysical features anywhere on earth, including seismicity, CMT focal mechanisms, etc. You can play around with this, and it might come in handy for some things. However, for example, if you are plotting the CMT solutions, it won't tell you what depth the different events occurred at.

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Last edited Oct. 26, 2007 by J. Stock.