GEOPHYSICS (GEOL 4433) - Fall 2008

LABORATORY 1 - MANIPULATING DIGITAL GEOPHYSICAL DATA BASES

Due 15 September 2008

For this lab, we will investigate several digital databases of geophysical data and manipulate these data using Microcsoft Excel in order to gain some familiarity with the data and nuances of ingesting those data into spreadsheet software for visual display.

For our first exercise, we will investigate the geomorphology of the world's ocean basins in a most traditional manner - indeed, in the same manner that geologists historically learned about the seafloor - through examination of the bathymetry (depth) of the oceans. However, our method for examining ocean basin bathymetry will rely on a decidedly late 20th Century innovation - the Internet and World-Wide Web. Using the Internet to obtain some information regarding the geographic features of the ocean basins list below. :

FEATURE	approx. LAT	approx. LON	approx. LAT	approx. LON
Mendocino Fracture Zone	45ºN	140ºW	35ºN	140ºW
Hatteras Abyssal Plain	32ºN	75ºW	32ºN	65ºW
Atlantic Ocean Basin	36ºN	80ºW	36ºN	0ºW
Reykjanes Ridge	60ºN	35ºW	60ºN	15ºW
East Pacific Rise	40ºS	90ºW	40ºS	140ºW
Marianas Trench & Island Arc	12ºN	140ºE	12ºN	160ºE
Himalaya & Tibetan Plateau	20ºN	78ºE	35ºN	78ºE

Mid-Pacific Mountains	18ºN	165ºE	18ºN	165ºW

Once you have located these sites, go to the World-Wide Web and visit the National Geophysical Data Center (NGDC), Marine Geology & Geophysics Division (MG & G). At the bottom of their home page:

1. click on the "Bathymetry & Global Relief" link;
2. locate and click on " ETOPO1 1-minute relief database"
3. locate and click on "Grid Translator"

The "Grid Translator" link transports you to the GEODAS Grid Translator page, which is linked to a large database of marine geophysical data (note the link icons at the bottom of the page - if you want to know more, you can explore the GEODAS Home site). In order to acquire the data you will need to complete this lab exercise, you will need to fill in the form on the Grid Translator page. First, you must enter a name in the "Your Grid ID" box. This name will be the file name for the data you request and will be the file you download once your query is completed. Its a good idea to enter your initials then a brief term that will help you ID the file later (For example, I might enter 'SKBMendo' for the data pertaining to the Mendocino Fracture Zone above). For the Grid Database choose "ETOPO1-1-minute global relief-beta". Enter the latitude and longitude values above for one of your sites Note: For your query to work, you must enter a N latitude value higher than the S latitude value. What this means is that you must enter a south latitude that is at least 1 minute less than the North latitude. In some instances, this will give you more data than we want to plot, so you will need to delete these extra data points from your file once you import it into Excel. For the "Grid Format" you want to click the radio button for "x,y, z (lon,lat,depth), "no header", and "tab" delimited file. Once you have entered all information, click on the "Submit" buttton. When your file is ready, click on the button labeled "Compress and Retrieve Your Grid". Click on the "Retrieve" button and download the file to your computer or thumb drive or other device. Note that the file you retrieve is compressed (.ZIP) to save space and make the file transfer faster. Once you have downloaded this file to your local computer, you must uncompress it before you can ingest the data to Excel.

After you have uncompressed your file you can start Microsoft Excel. When Excel has finished loading, choose "File Open" from the Excel menu bar. Your file is an ASCII text file (i.e. it has a .xyz extension, but this can be changed to .txt so it can be opened using Excel). You will need to choose the file type(. txt) from the "File Types" block on the "File Open" dialogue box to see it on your disk or folder. Choose your file and it should load into Excel. Your data should paste directly into the spreadsheet. In most cases, your data will load into Excel as text and you will need to parse the data into columns in the spreadsheet. To do this, select column A in the spreadsheet. Then choose "Data" from the Excel menu bar at the top of the screen, and then choose "Text to Columns" option. When the dialogue begins, click on the "Delimited" button and click on "Next". When the next dialogue box appears, click on the "Tab"

box for the delimiter, then click on the "Next" button. Finally, choose the "Finish" button and your file should take all items from column A and place them in columns A, B, C labeled Lat, Lon, Depth. Next select either the latitude or longitude column along with the depth data and create a scatter plot with a line connecting points of the data. This is effectively a topographic profile across each feature so you can see its form in the same manner we would create topographic profiles in General Geology labs.

Repeat this process for each of the seafloor features listed in the table on your lab assignment. When you make your graphs, give some consideration to both the vertical and horizontal scales. Try to create graphs which have the same vertical and horizontal scales so you can compare features directly. For example, plot the Himalaya/Tibetan plateau profile at the same scale as the Marianas Trench/Arc profile. You will be amazed!

Be prepared to turn in your hardcopy prints of your profiles next week.

PART II

By the mid-1960's, advances in the field of seismology (including establishment of global seismograph networks, ability to telemeter data from remote locations to central data clearinghouses, improved sensitivity of seismometers) made it possible for geoscientists to begin compiling large data sets revealing the pattern of global seismic activity. These data were crucial to development of the "plate" concept in plate tectonics, and this week we will compile some data from a global seismic catalog maintained and made available via the Internet by the Advanced National Seismic System (**ANSS**), the University of California (**Berkeley Seismological Laboratory**), and the Northern California Earthquake Data Center (**NCEDC**). Data downloaded from the Internet will be imported to Excel, and we will generate maps showing the distribution of earthquakes along a E-W profiles across the western margin of South America and the eastern margin of Japan.

Enter the beginning year and date in the format specified in the box labeled "**Start date,time:**". Enter the ending year and date in the box labeled "**End date,time:**". Moving to the next item on the form, enter a minimum magnitude of 3.0 in the appropriate box. Enter the latitude and longitude values given in the table below for both the South American margin and Japan. Acquire data from 1960-2007.

NAME	BEGIN	END
Peru-Chile Margin	30.29ºS 76.03ºW	33.20ºS 65.67ºW
Japan Margin	41.04ºN 137.75ºE	37.44ºN 146.52ºW

Leave the remaining boxes blank and scroll down to "**Output Control**". Make sure the button for "**Send**

output to my browser" is highlighted, and set the "**Line limit on output:**" to 100000 (this will ensure that you will get the entire year's data). Finally, click on the "**Submit request**" button and wait for your data to appear on the screen. BE PATIENT - these files are rather large and could take a few minutes to complete downloading if the network is slow. When you see your data on the screen and are certain it is done downloading, use your cursor to select the header line and all other data. Once you have selected all the data, hit 'ctrl+C' to copy the data to your computer clipboard. Open MS-Excel, and "Paste special" the data as "text". All your data should load onto the spreadsheet in seperate columns. Using the charting options of MS-Excel, create a scatter plot of your earthquake data by plotting longitude vs. depth. Once you have plotted all the earthquake foci, go back to the ETOPO1 database and download topographic data for the two areas above so you can create a topographic profile for each location. Proceed as previously to acquire the profile data. Once you obtain the profile data, plot a topographic profile on the same chart as your earthquake data. Use the topo profile to interpret your earthquake data. Print hardcopies of both your plots and submit with the other topographic profiles next week.

Be aware that this exercise will take some time. Each database has its own nuances that you must understand, and you must manipulate the data somewhat in order to achieve the desired results. Understanding databases and the format in which data are entered into geophysical databases is a key component of making use of these tools. If you just download data and plot it without any thought, you will generate plots just fine, but these plots will be meaningless geophysically and geologically. This exercise contains a number of 'booby traps' in the databases we are using. I'm not going to tell you where or what they are. As graduate students and soon-to-be professionals, I expect you to take the time and diligence to police your own work to ensure that the results you present are accurate.