GEOPHYS 624   Homework 1

Due: Sep 26, Thursday (in class)
Computer usage: Note, you could do the following in the classroom L1-207 (open during the day), or you could potentially use computers in L1-150 (though not thoroughly tested).
Note: you could log in from home computer to university account by
> ssh **your_username@gpu.srv.ualberta.ca**

However, if you hope to use computer programs specially designed for this course, you need to be in the lab room since that is the only place they may be accessible.

Problem 1 (35 pt).   See attached seismograms below. The earthquake occurs at the depth of 300 km. Assume the rays directly go up more or less vertically to the receiver. The time scale does not start from 0.

Figure 2.4-8: Seismograms at two Japanese stations above an earthquake.
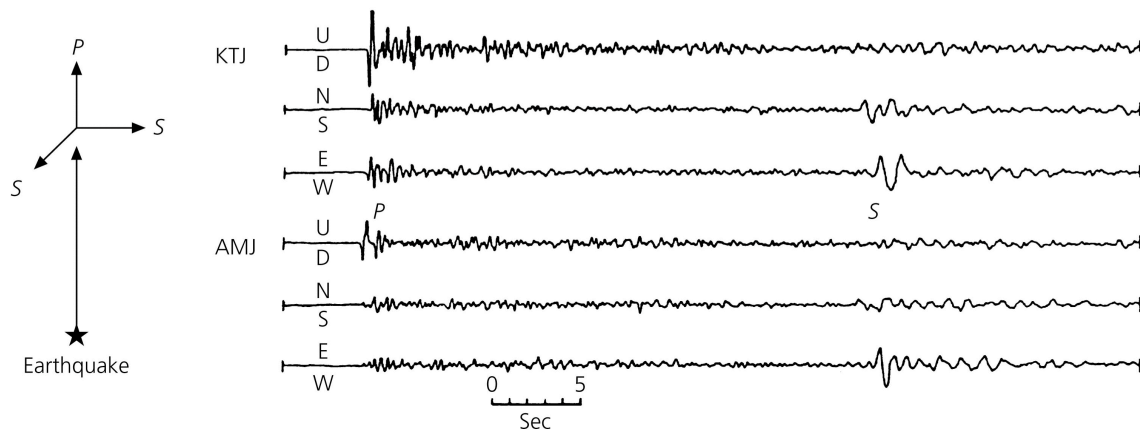
(1) Measure the travel time difference between P and S waves.
(2) Estimate the P and S wave velocities by assuming the earth is a Poisson solid
(3) Suppose the S phase on the radial component differs with S phase on the transverse component by 1 sec, **a**. What do we call this phenomenon, and **b**. What is the cause of this effect?
(4) Suppose the effect in part (3) is caused by a localized anomalous segment of the rays that is 20 km long. Suppose the S phase recorded by Radial component goes through this segment with a speed of 5 km/s, assume it is faster than the transverse wave, what is the speed of the S phase recorded on the transverse component going through this region?

Problem 2 (25 points, getting data, have fun!)
This exercise gets you started with requesting data from the IRIS (Incorporated Research in Seismology), the largest data center in the world.   You are asked to submit a map of the stations in the permanent seismic network with network code of US. Then you need

to find an earthquake (with given information below) and generate a request file for data retrieval (the so called "BREQ_FAST" file.

(1) got to webpage http://www.iris.edu/ and click on "software" button and highlight the "DMS software". Choose "Web Utilities". You will be prompted a list of options on the left portion of the webpage. Click on "SeismiQuery" and then on the new page, find and press the "stations" button in the lower set of options. Then you should come to the "view station inventories" page, enter "US" as network. Do "view result". Click "Make station map". Then "Make Map" and wait a while. Print the map in black and white. These are broadband seismic stations in network "US" (there are more in other networks in this region).

(2) Go back to the "Seismic Query" page. This time choose "events". You will be prompted for many options for an earthquake search in the database. I like you to set "magnitude" to >= 9.0 and time between January 1, 2000 and Jan 1, 2005. Click on "view result". Print out the result of your search.

(3) Go back to the "Seismic Query" page. This time I like you to click on "breq_fast". Enter network (not Virtual Network) as US and station as BOZ. Then, based on your search result from part (2), enter "data start time *" 5 minutes earlier than the listed earthquake time. And then enter in "data end time *" exactly 1 hour after your start time (meaning, you will be requesting 1 hour of continuous of data. Click "start query".

(4) Tell me which city the station is in.

(5) View the BREQ_FAST File. Print the output. Then send a copy to your own email address.

Request data from the IRIS data center by using the BREQ_FAST request email. You may have to wait for an hour or so (typically a few minutes would suffice) before they email you and tell you what to do. Report here the name of your file. If you don't get an email about the 'request has been received' in a very short time, it is a sign of trouble and most likely suggests problems with your request. To send correctly, you email address cannot have this option of automatically adding information such as "Yu Jeffrey Gu, Dept. of Physics", etc.

Problem 3 (40 pt): Complete the lab assignment 1. Instructions on some of the programs and explanation are given in lab_instructions_2012.pdf (check the course website under Programming & Labs Section for link)