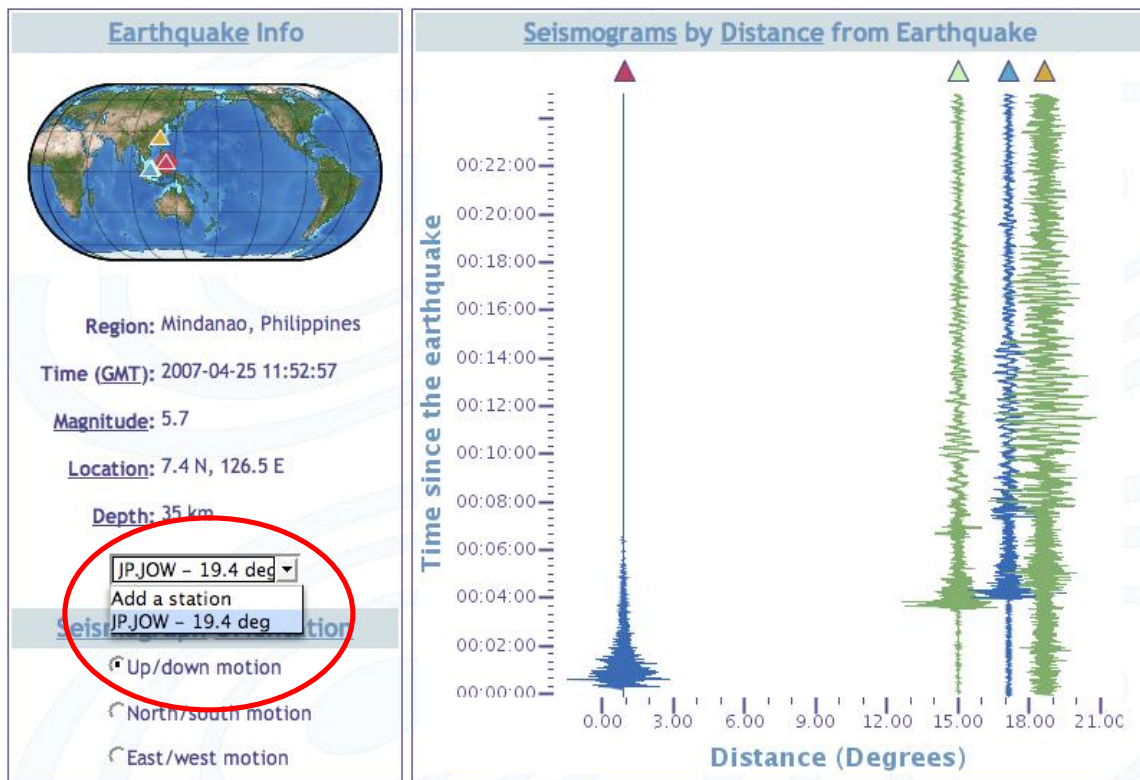


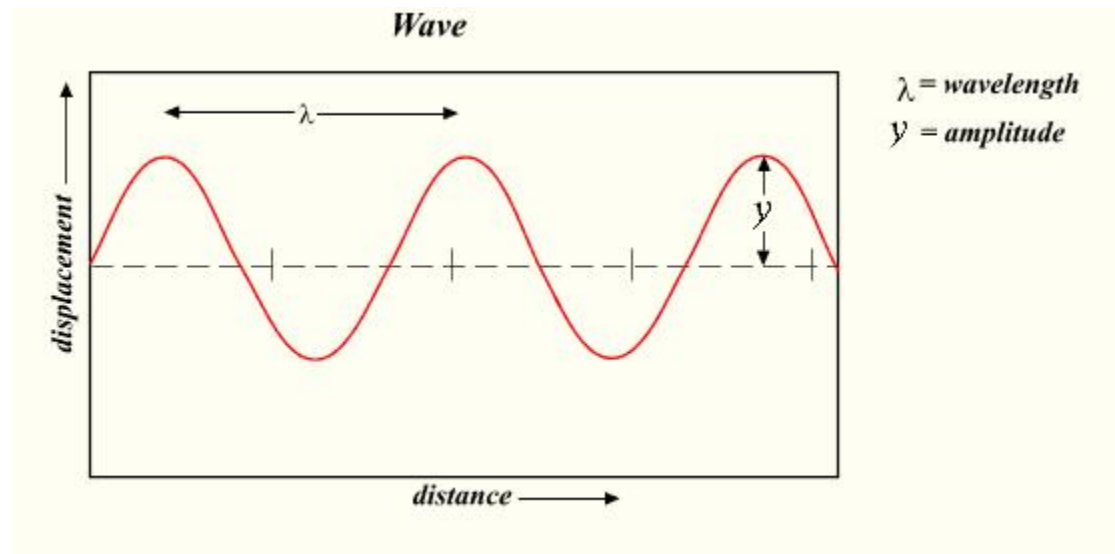
COMPARING GROUND MOTION FROM EARTHQUAKES

1. You will access data on earthquakes in the Rapid Earthquake Viewer and complete the data table included in this worksheet.
2. Go to the Rapid Earthquake Viewer (<http://rev.seis.sc.edu>) and click on "Earthquake View."
3. The drop-down menu at the bottom lists the earthquakes by date and name. You will be gathering data on these five earthquakes:
 - a. 2007-04-25 11:52 GMT, Mindanao, Philippines, 5.5
 - b. 2007-04-25 13:34 GMT, Vanuatu Islands, 6.3
 - c. 2007-03-25 00:40 GMT, Vanuatu Islands, 7.1
 - d. 1989-10-18 00:04 GMT, South of Java, Indonesia, 7.7
 - e. 2007-01-13 04:23 GMT, East of Kuril Islands, 8.2
4. Select the first earthquake in Mindanao, Philippines and click "Go". You will see a map of the Earth with the location of the earthquake marked with a circle. The triangles represent seismograph stations.
5. A list of stations is provided at the bottom of the page. For the Mindanao, Philippines earthquake, look for station name JP.JOW. If this station is not in the list at the bottom of the page, use the drop-down menu on the left side of the page to add the station. (See image below.) After adding the station, scroll down to the list of stations at the bottom of the page and click on the station code (JP.JOW) to access more detailed information for this station. On occasion the seismogram won't appear; click on the Save seismogram as PDF to view it.



6. Record the following information about this earthquake at this station in the data table below: earthquake depth, the distance between the earthquake and this station, and the amplitude of the seismic wave at its maximum for the vertical (up/down) component of motion, and the time since earthquake at which this maximum occurred.

The **amplitude** of the seismic wave is measured from the center of the seismogram to the crest of the wave. Note the unit of measure on the y axis (microns/sec, mm/sec or nm/sec).



7. In the seismogram below, the maximum amplitude of ground motion is 9.5 microns/sec. Use the maximum amplitude on the seismogram labeled Vertical.



8. Return to "Earthquake View" and repeat the steps for all the earthquakes. Note that the data table indicates the station for which to record data for each

earthquake. If the station is not available from the drop down list, choose another station at approximately 20 degrees from the earthquake.

10. When you have gathered the information for all five earthquakes, verify that the amplitude data are recorded in microns/sec. If not, you will need to convert all the amplitudes to microns/sec.

Hint:

- 1000 nanometers/sec = 1 micron/sec
- 0.1 millimeters/sec = 100 microns/sec
- 1000 microns/sec = 1 millimeter/sec

For example, if the amplitude is 700 nanometers/sec, you must convert it to microns/sec:

$$700nm/sec \times \frac{1micron/sec}{1000nm/sec} = 0.7microns/sec$$

11. Once the table is complete, you are ready to create a graph.

DIRECTIONS FOR GRAPHING USING MICROSOFT EXCEL

1. Open Microsoft Excel.

Create a data table with magnitude in column A and Amplitude in column B. In the first row, type Magnitude in column A and Amplitude (microns/sec) in column B. Enter the data from your worksheet, one row per earthquake. Do not add the units (see Figure 1.)

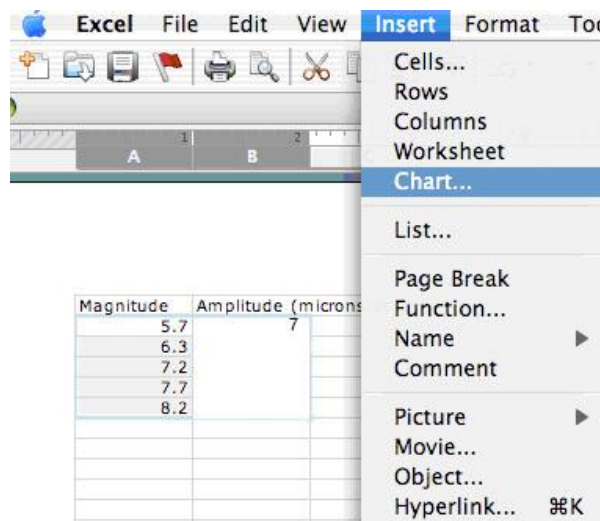


Figure 1

2. Highlight the data and click on Insert from the menu at the top of the application. Select Chart.
3. Select X-Y Scatter, then select the first chart sub-type. (see Figure 2) Click Next.

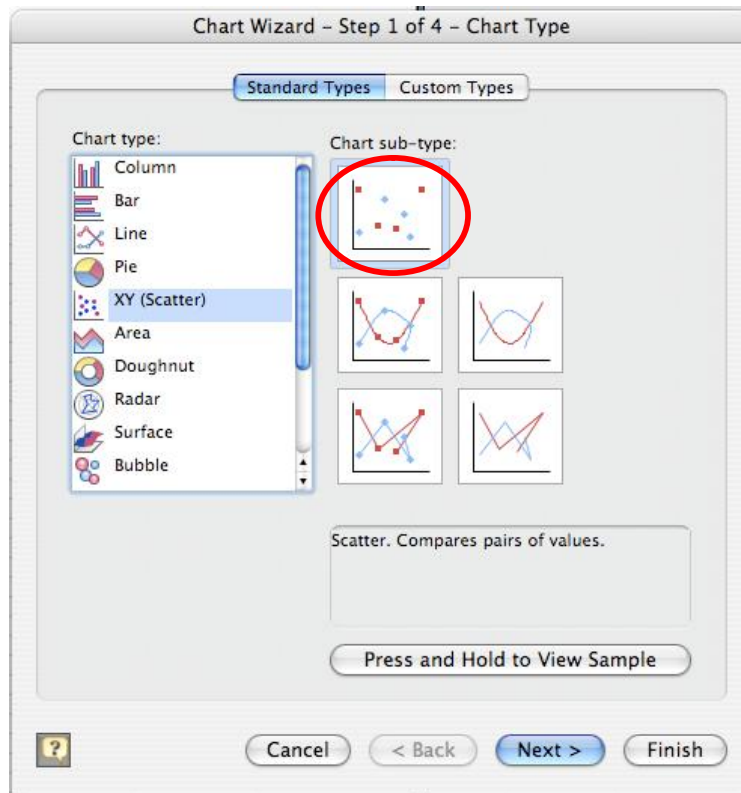
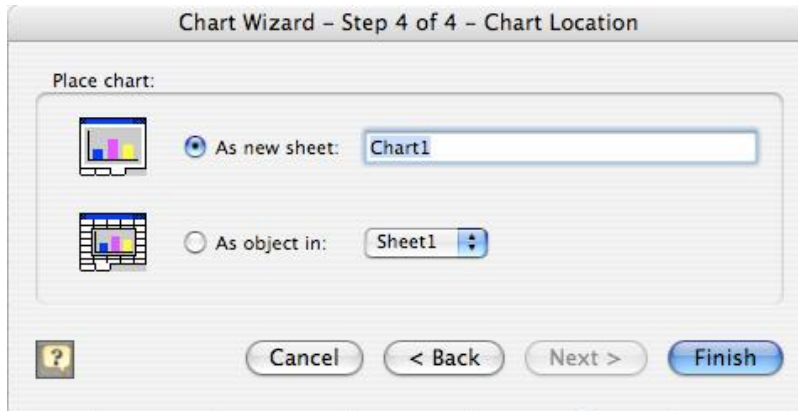


Figure 2

4. The Data range is already entered. Select Columns from 'Series in:' radio buttons. Click Next.
5. The screen should be on the "Titles" tab; if it is not, choose "Titles" from the tabs at the top. Give your graph a title. Name the X and Y axes appropriately.
6. Choose "Axes" from the tabs at the top. Select both "Value X-Axis" and "Value Y-Axis".
7. Choose "Legend" from the tabs at the top. Click on "Show Legend" to remove the check in the box. Click "Next".
8. Select "As new Sheet". Click "Finish".

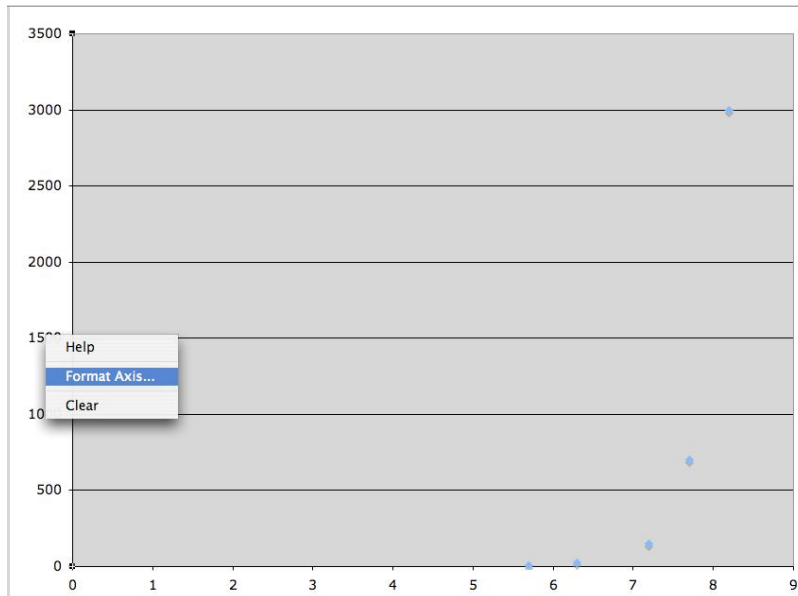
Note: These directions work on both Mac and PC applications.



9. Your graph will appear on the screen.

Changing Axes to Logarithmic in Excel:

1. Right click on the Y-Axis line. (If you are using a Mac hold down Ctrl and click.) Select "Format Axis".



2. Select "Scale" from the tabs at the top of the box.
3. Check the box for "Logarithmic Scale". Click "OK" and a new plot will be generated. Save your work.

Format Axis

Colors and Lines Scale Font Number Alignment

Value (Y) axis scale
Auto

Minimum: 0

Maximum: 3500

Major unit: 500

Minor unit: 100

Value (X) axis
Crosses at: 0

Display units: None Show display units label on chart

Logarithmic scale

Values in reverse order

Value (X) axis crosses at maximum value

Cancel OK

Name _____ Date _____

Earthquake Location and date	Earthquake magnitude	Earthquake depth (km)	Station code	Distance (deg and km)	Amplitude and units	Amplitude (microns/sec, convert if necessary)	Time since earthquake (show units)
Mindanao, Philippines 2007-04-25 11:52 GMT	5.5		JP.JOW				
Vanuatu Islands 2007-04-25 13:34 GMT	6.3		IU.CTAO				
Vanuatu Islands 2007-03-25 00:40 GMT	7.1		IU.CTAO				
South of Java, Indonesia 2006-07-17 08:19:25 GMT	7.7		MY.LDM				
East of Kuril Islands 2007-01-13 04:23 GMT	8.2		AK.ATKA				

Questions:

1. What variable was held almost constant in collecting the data for each earthquake? Why was this important?
2. Examine the log and the non-log plot comparing the values at each plotted point. Are they the same? How does using a logarithmic scale change the visualization of this relationship?
3. Why do you think a logarithmic scale is used to measure magnitude?
4. Using your graph to estimate, what would you expect the amplitude of ground motion to be 20° away from a magnitude 6.0 earthquake? For a 4.7 earthquake? Include units in your answer.
5. Using your graph to estimate, what would you expect the amplitude of ground motion to be 20° away from a magnitude 8.7 earthquake?
6. What other factors might control how much the ground shakes from an earthquake?