Rapid Earthquake Viewer (REV) Tutorial Worksheet

Name:

Directions:
Go to http://rev.seis.sc.edu/index.html

Work through this tutorial to learn about the capabilities of REV and complete the following questions.

On the home page of the REV website are a list of the most recent earthquakes, a highlighted "Earthquake in the News" and links to the Earthquake View, the Station View, and a glossary.

1. List the five most recent earthquakes. Include location, date, and magnitude.

A glossary provides definitions and supporting information about the earthquake information provided by REV. Click on any bold and underlined word to access the glossary.

*2. Using the glossary, find and define **seismogram**.*

Navigate to Earthquake View.
On the Earthquake View page you see a map of the world centered over the Pacific Ocean. Also on this page are separate links to different views of the world, and the REV Help system. Below the map is a drop-down box with recent, notable earthquakes listed.

3. What happens when you click on the Help button? Describe the areas outlined in the Help section.

When done, click on Help Off to return to the Earthquake View.

4. The map in Earthquake View has circles in three different colors. What does each of these colors represent?

- *Red*
- *Orange*
- *Yellow*

5. What does the dot inside the circle represent?

6. What do the sizes of the circles represent?

7. Using the drop-down box below the map, identify a large earthquake of 7.0 or greater and note its location, date, and magnitude below.

Select this earthquake and click on the GO button to view more information about the earthquake. Click on the Help button and orient yourself to the areas of this page.

8. What are the three areas of the page identified in the Help section?

When you are finished, click on Help Off.

9. On the Earthquake Information page, what does the circle on the map (upper left) mean? What do the triangles indicate?

10. Notice that the colored triangles on the map also appear at the top of the seismogram box (right). Describe the relationship between a triangle and the squiggly line below it. Utilize Help and linked glossary terms if you need assistance with this.

The stations are ordered with increasing distance from the earthquake. Note that the distance to the earthquake is provided in two different units, degrees and kilometers.

*11. a. Find **distance** in the REV Glossary and summarize the relationship between these two units.*

***b. Now, see if you can determine how many kilometers are in <u>one</u> degree. (Hint: distance to earthquakes in kilometers ÷ distance to earthquake in degrees) Calculate for several stations and average results to verify accuracy.*

12. Each station is ordered by increasing distance from the earthquake location. The y-axis shows time since the earthquake in hours, minutes, and seconds (HH:MM:SS). How long after the earthquake occurred did the nearest station detect the ground motion? The farthest station? One station near the middle? Describe the trend you notice.

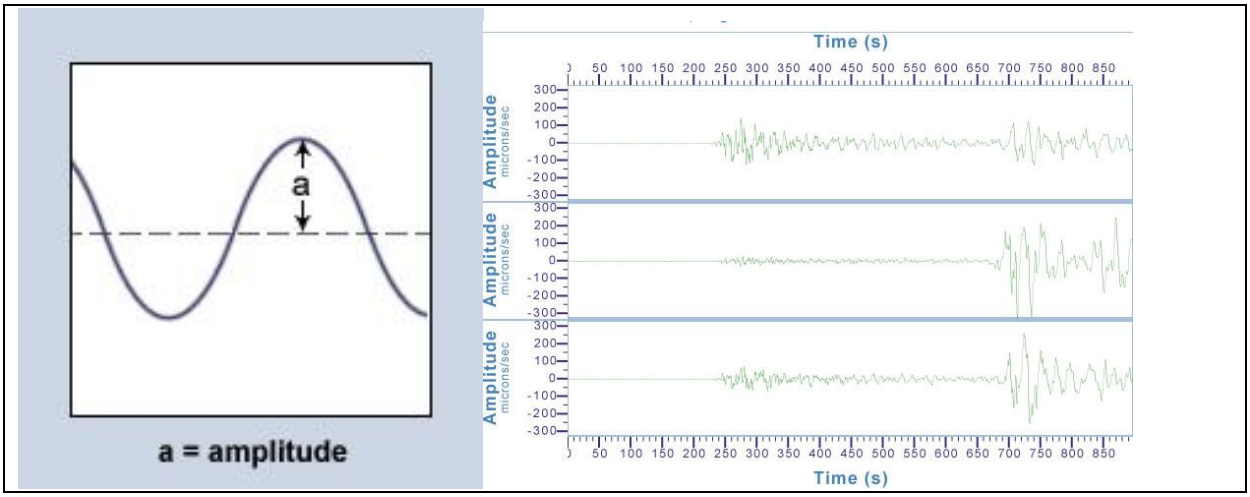
Each station has a unique 3 to 6 letter code that identifies it. Station names can often be long and this is a way for seismologists to quickly refer to or identify stations. The two letters and/or numbers you will see at the start of the station code in REV indicate the station's network code. For example, the code "US.NHSC" refers to a station in New Hope, South Carolina in the United States National Seismic Network.

13. Choose a station which is less than 100 degrees in distance from the earthquake and click on the station code from the listing of stations at the bottom of the page to viewed detailed information for this station.
Record-
Station Code:

Station Name:

Distance to Earthquake (degrees and km):

Seismograms provide a visual and quantifiable representation of ground shaking that occurs at a particular station. The **amplitude** of the seismic wave indicates the amount of ground shaking that was recorded at that station over time. The amplitude is measured from the center of the seismogram to the crest of the wave.



14. What is the maximum amplitude recorded for this earthquake?

Be careful to read the plots properly. The y-axes for each of the three components are often different from each other. This is done so that you can easily see the shape of the waves. To pick the maximum amplitude, you need to read the largest amplitude off each plot (taking into account the y-axis scale) and then select the largest value of those three. Don't forget to check to see if the peak amplitude is on the negative side of the axis – negative numbers just mean that the movement is in the opposite direction of the positive numbers. It usually doesn't matter which is the maximum direction of the shaking– only the amplitude of the movement.

15. Why do you think the amplitude of the seismograms vary over time?

Select the "Overlay estimated P/S-wave arrival times" checkbox. ***Note:*** These flags are estimated by a computer model; the model does not take into account slight variations within the structure of the Earth and the difference in the materials through which the waves are traveling. Hint: Click on the radio buttons under Select Zoom to magnify the areas around the P or S wave.

16 a. What appears on each seismogram?

b. How long after the earthquake begins at the epicenter does the P wave arrive? Remember time is recorded in HH:MM:SS on the seismogram graph.

***c. Estimate the speed of P waves in kilometers per second. (Hint: speed = distance ÷ time. For the time, you'll need to convert from minutes into seconds). 1 km/second = 2237 miles per hour. How fast is this in miles per hour?*

c. When does the S-wave arrive?

You can zoom in on the time period when the P and S waves arrived by selecting **Around P wave** or **Around S wave** in the Select Zoom box. Try this and see if your estimates of P and S wave arrival times change at all.

REV shows three seismograms for each station. They are labeled Vertical, North-South, and East-West on the far right side of each seismogram. These record the amount of motion in each direction separately. In an earthquake, the ground can shake all over the place and in every direction. The seismogram labeled "vertical" describes how much the station shook up and down. Where the line is above 0, the station moved upwards. Negative values mean it dropped down. Similarly, the seismograms for East-West and North-South indicate movement in those directions. To visualize this, click here http://www.teachingboxes.org/earthquakes/resources/3components.mov
In this animation, the first sequence shows just the North-South component of shaking. Notice how the house only moves back in forth in a single direction. The second shows only the East-West component. Again, it moves only in a single direction along a straight line. The third part shows a more realistic scenario with all three components of shaking at once. The purple square in this third sequence stays stationary at the original location of the house. It's there to help you recognize that the house is moving all over the place in every direction. The seismometers in the three different directions record this motion, and you need all three of them to reconstruct the motion completely.

17. a. Look at the three seismograms. Are they the same? Pay attention to both the axes and the shape of the wiggles. Describe any differences.

***b. Which component records the highest amplitude during the time around the P wave arrival? Which component records the highest amplitude around the S wave arrival? Are they the same? If not, why do you think the amplitude would be different in different directions for P waves and S waves? (Think about the direction of a fault slipping and how the house moved in the animation.)*

c. Do you think it is important to record the amount of shaking in all different directions? Why or why not?

Return to the record section view. You can add more stations and seismograms to the Seismograms by Distance from Earthquake box. Go Back (using your browser back button or clicking on "More about this earthquake in the earthquake Info box) to this page and study the locations of the seismograms. Identify where there is a gap between them. Using the **Add a station** drop-down box (left), select a station located in one of the gaps between stations/seismograms.

18. *a. What station did you add?*

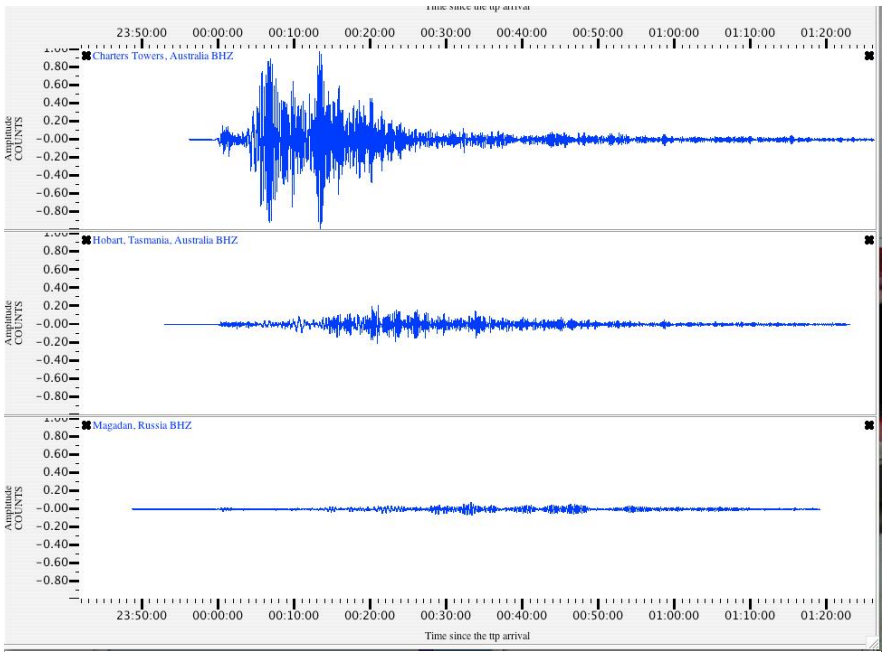
b. *What is its distance in degrees and km from the earthquake?*

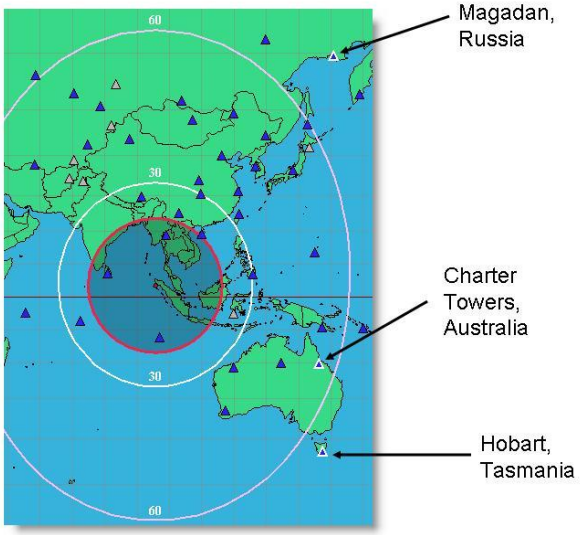
c. What is the maximum amplitude?

d. What is the unit of measure for amplitude (y axis):

e. Are these units the same or different from the previous station?

The figure below shows seismograms from three stations for the same earthquake shown on the associated map. The amplitude scale for each of these is the same. The top seismogram is from a station located approximately 55 degrees away (Charter Towers, Australia), the middle one is 65 degrees away (Hobart, Tasmania), and the bottom one is 70 degrees away (Magadan, Russia) from the earthquake epicenter. Note: This figure shows the seismograms using the same unit of measure for all three, while the seismograms shown in the REV tool are magnified so that more details are visible.





19. What do you notice about these seismograms? What happens as the distance from the station to the epicenter increases?

Type your zip code into the "Change Station" box at the bottom left and click on the GO button.

20. Where is the station closest to you that detected this earthquake? At what time since the earthquake did the P wave arrive?

Click on Station View at the top of the page to explore another path through REV; the world centered over the Pacific Ocean. Also on this page are separate links to different views of the world, and REV's Help system. Below the map is a text entry box for entering a zip code to find the station nearest to that geographic area.

21. Click on the Contiguous US map tab at the top of the page. Describe the pattern of stations you see in the US. Why do you think this pattern exists?

Find and select the station closest to where you live by clicking a blue station icon or enter your zip code in the text box near the bottom and click Go. On the left you can see the location plotted on a map accompanied by place name and latitude and longitude.

22. Record-

Station name:

Code:

Location:

Today's seismic record is displayed. Use the Previous Day and Next Day buttons to look at the record over the last few days. Have any earthquakes been recorded? Check the box beside Show Earthquakes (if any) to see if you are correct. If so, a box will appear on the seismogram. Hover over it to identify any earthquakes and their point of origin.

23. Record any earthquakes that were detected at the station nearest you. Did you feel this ground motion? If not, why?

24. Did you see any seismic activity that was not related to an earthquake? What might have caused it?

25. You have now explored the main features of the Rapid Earthquake Viewer on-line data access tool. How might you use this tool the next time an earthquake occurs?