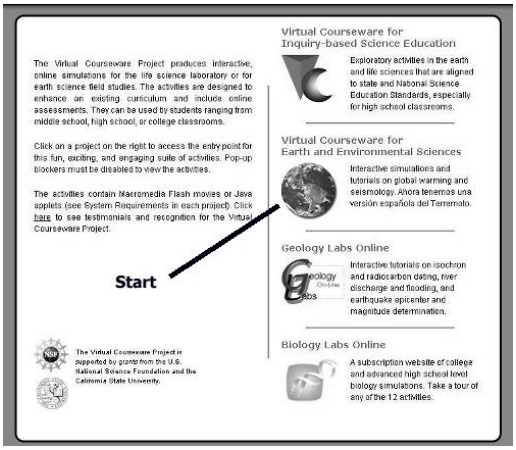
Earthquakes – Measuring the Location of the Epicenter

In this exercise you will learn how to measure the epicenter and the magnitude of an earthquake using a virtual lab simulator from the California State University, Los Angeles. Since this is an Internet based exercise you will be able to access it from anywhere you have an Internet connection. During this exercise you will be making a number of measurements that will be used to determine the location and magnitude of an earthquake. To use this exercise you can use Internet Explorer or Netscape Navigator on a PC. Your Web browser will need to be able to run ActiveX controls in order to run this activity. The virtual exercise is located at www.sciencecourseware.com. At the end of the activity there will be a short quiz that will be recorded on the California State University Web site as well as print out you certificate of completion to be turned in.

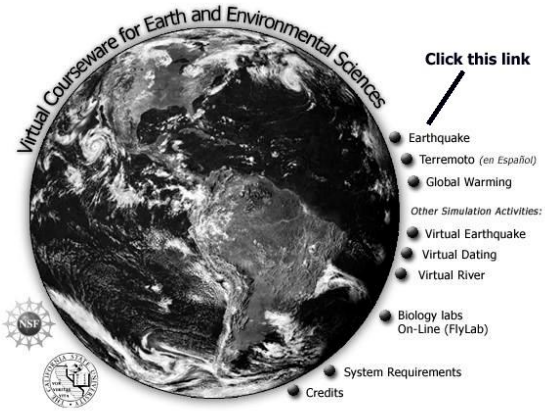
Your Class Code for Earthquake is 566931.

Procedure: Travel Times and Distances

1. Log into the campus network or if at home connect to the Internet. Open Internet Explorer and browse to www.sciencecourseware.com. From the home page of Virtual Courseware click on the "Earthquake" link (first link from the top right hand side).



Link on the Home page

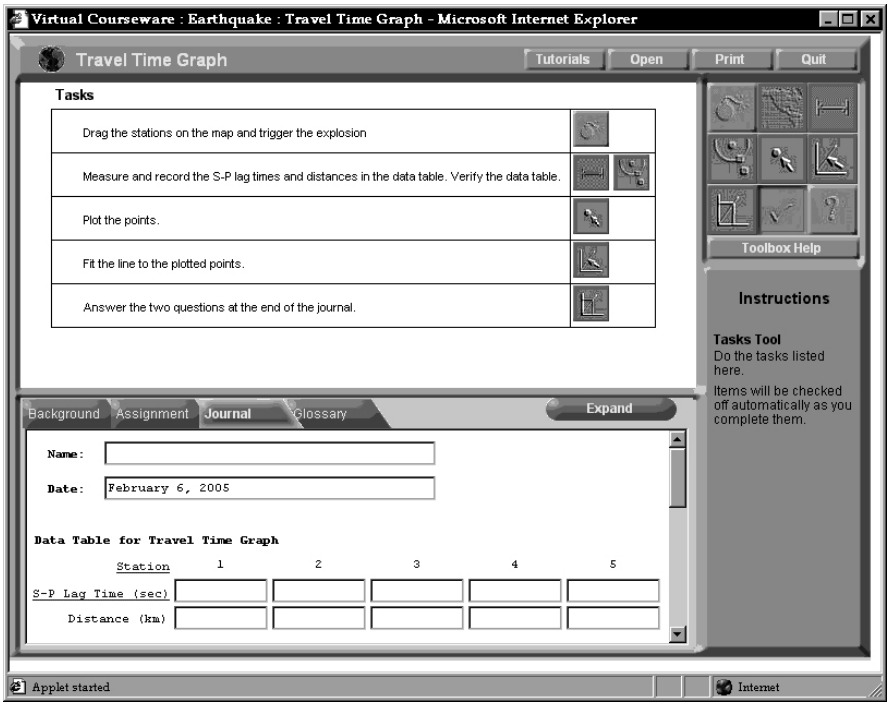


Earth and Environmental Sciences Applications

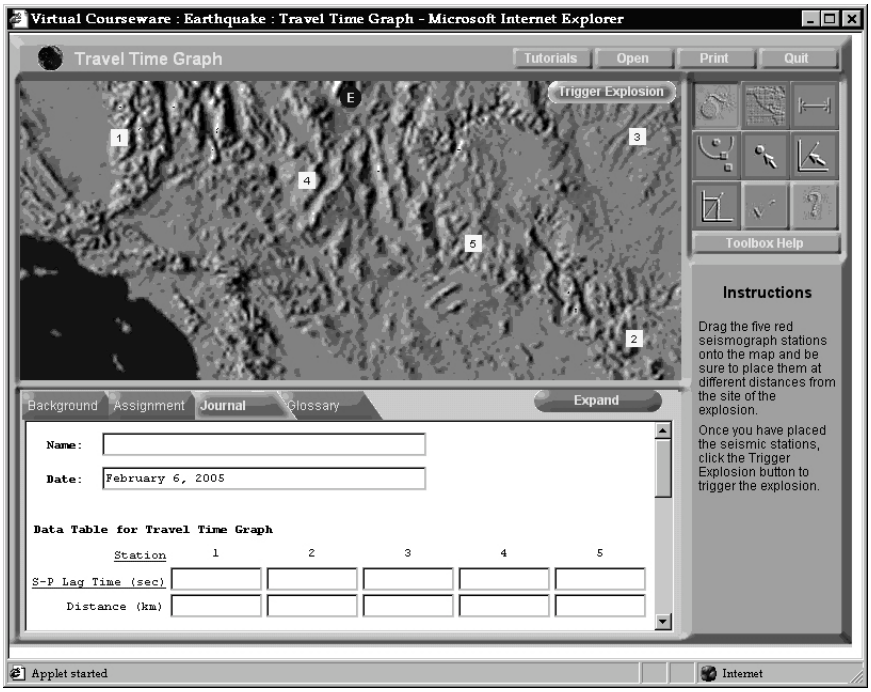
2. Click on the "Demonstration" button. Follow through the demonstration since it shows you how the application works. Each of the tools used in this exercise is explained here.

3. Click on the "Tutorials" button to view the tutorials on S-P Interval, Latitude and Longitude. **Use the "Close Window" button to close the window.**

4. Click on the “Travel Time” button. A new window will load. Please carefully read the instructions in the “Background” tab. When you have read the instruction from the “Background” tab click the “Assignment” tab and read the instructions here. The “Journal” tab is where you will record your data. The “Glossary” tab is a glossary of terms used in the exercise. Your tasks are listed in the top pane of the application. To get started you will need to the first enabled task button (the bomb) in the “Toolbox” in the upper right hand corner. **Be sure to enter your name in the journal.**



5. Drag the records around the screen at different distances from the epicenter (indicated by the “E”)and click the “Trigger Explosion” button.



6. The next task is to measure the S-P lag times and distances. Click the “S-P” button. If you are not sure which button it is hover your mouse cursor over the buttons to see a tool tip describing the button. Record the lag times in your Journal for the five stations. You can switch between stations using the drop-down in the upper left corner. You may need to adjust the scale using the drop-down in the upper right corner. To properly measure the lag times you want to measure from where the S and P waves just begin leaving the center line. Next, use the “Distances: button and your lag times to determine the distances from the epicenter for each station. The “Distance: tool allows you to drag the mouse to your stations. **You want to measure to the center of the stations.** When you are done click the “Verify Data Table” button. If any values are off you will be given a chance to correct them.

7. Now you are ready to plot the data using the “Point Plotter” tool from the tool box. Click the “Point Plotter” button. Drag your points to the correct locations on the graph. As you drag the points you will see the coordinates changing next to the point. Click the “Verify Points” button when you are done positioning the points.

8. Use the “Fit Line” graphing tool to fit a line to the points so that you get the smallest error sum and use the Verify button to validate your slope. To answer the two questions at the end of the journal you will need to view your graph again by clicking the “Time-Travel” button. You can drag the graph to answer the questions. When you are done answering the questions click the “Verify Answers” button.

9. **Use only the QUIT button in order to close the Time Travel window and proceed to the next activity.** If you choose to save your work you will need to save to your folder on the network drive**. You also need print your work before you leave this part of the activity. You will hand in your journal along with your certificate**.

Procedure: Epicenter and Magnitude

10. Enter your name in the journal. And use the location selector to choose a location or you can let it select a random location (default). Click the “Select Earthquake” tool and click the “Trigger Earthquake button on the map.

11. Measure the S-P lag times for three of the stations using the "S-P" tool. Record the station numbers and lag times in the journal. If the amplitudes appear too small or too large you can change the magnification using the "Seismogram Scale" drop-down in the upper right corner. . **Be sure to enter the data into the correct boxes in your journal.**

12. Use the "Distance" graph tool to find the distances from the S-P lag times of the three stations.

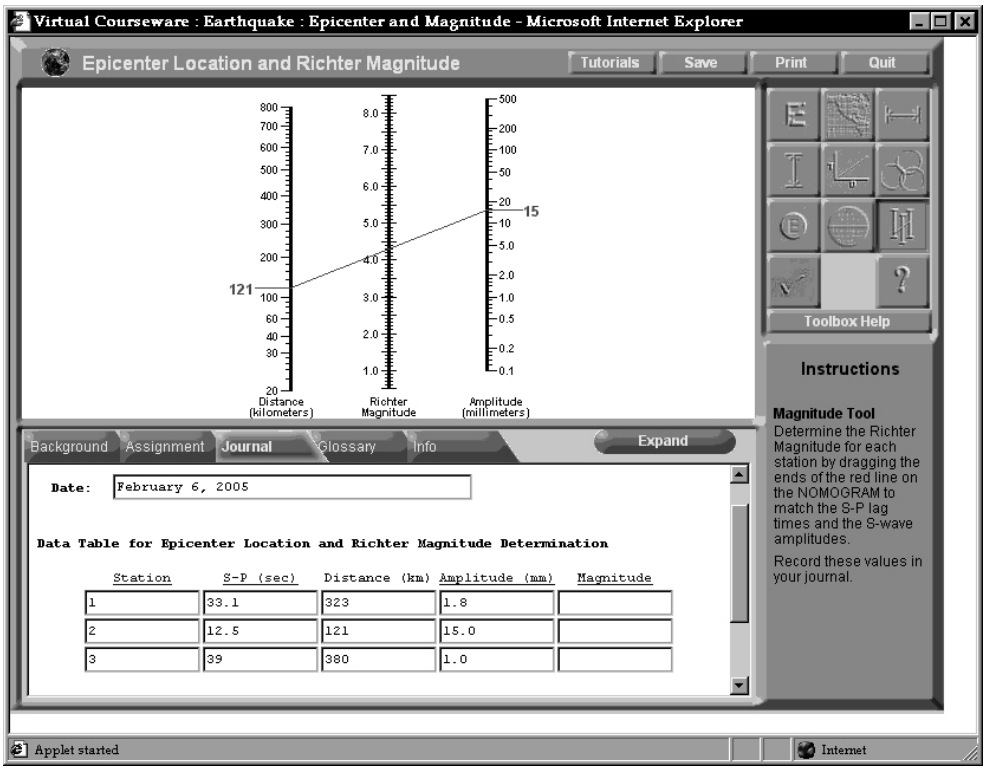
13. Use the "Magnitude" button to measure the amplitude in millimeters.

14. Use the "Triangulation" tool to draw circles with radii matching your measurements for the three stations. Where the three circles meet is the epicenter.

15. Click the "Epicenter" tool and move the epicenter icon to the location of your epicenter. Make sure the icon is centered on the location.

16. Click the "Map" tool to read the latitude and longitude in degrees and minutes and record them in your journal. Each division in latitude is ¼ degree or 15 minutes. Each division in longitude is also ¼ degree or 15 minutes. Be sure to indicate N, S, E, W.

17. Click the 'Magnitude" button to read the magnitude by moving the sliders on the tool so that the distances and amplitudes match for each station. The magnitude is read off the center scale.



18. When the journal is filled out click the "Verify Answers". If all of your answers are correct you will be taken to the assessment quiz. **Before starting the assessment quiz you need to print the journal. The journal is to be handed in.**

19. Complete the assessment quiz. You will first need to enter your name, Institution (**Kansas City Kansas Community College**), location (**Kansas City, KS**), and class code (**566931**). Read the questions carefully. You will not be able to go back to a prior question.

20.**When you have finished the assessment print the certificate and turn the certificate in with your journals.**