

## Natural Hazards Practical Exercise 2.

### Locating Earthquake Epicentres

The aim of this exercise is to use scientific knowledge about the arrival times of earthquakes to locate the earthquake's epicenter on a map.

*Need: pen, paper, compass (or piece of string).*

Background:

Earthquakes produce “longitudinal primary waves (P waves)” and “transverse secondary waves (S waves)”. Large earthquakes also produce surface waves which are the most damaging to life and property.

P waves and S waves travel through the Earth at different speeds and the different arrival times of the waves can help us to locate where the epicentre of an earthquake was.

A P wave will arrive first and an S wave will arrive second. The time difference between the two is directly related to the distance the earthquake was from the seismic recording station.

Exercise:

Figure 1 (below) shows the arrival times of the P and S waves from an earthquake at three different seismic recording stations.

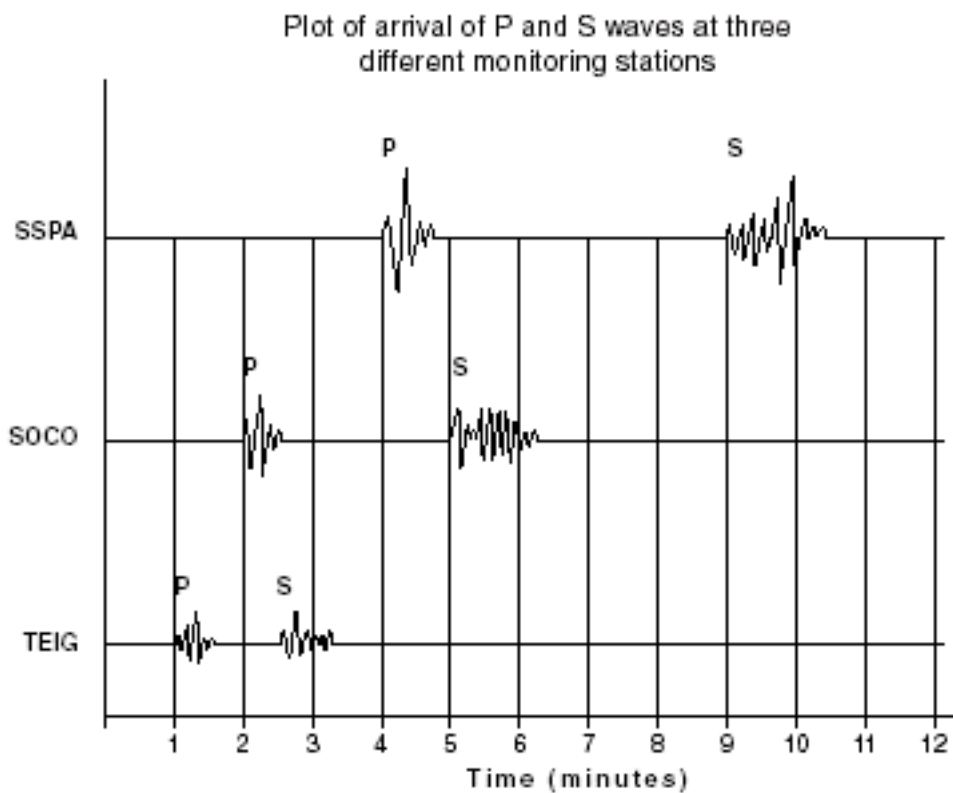
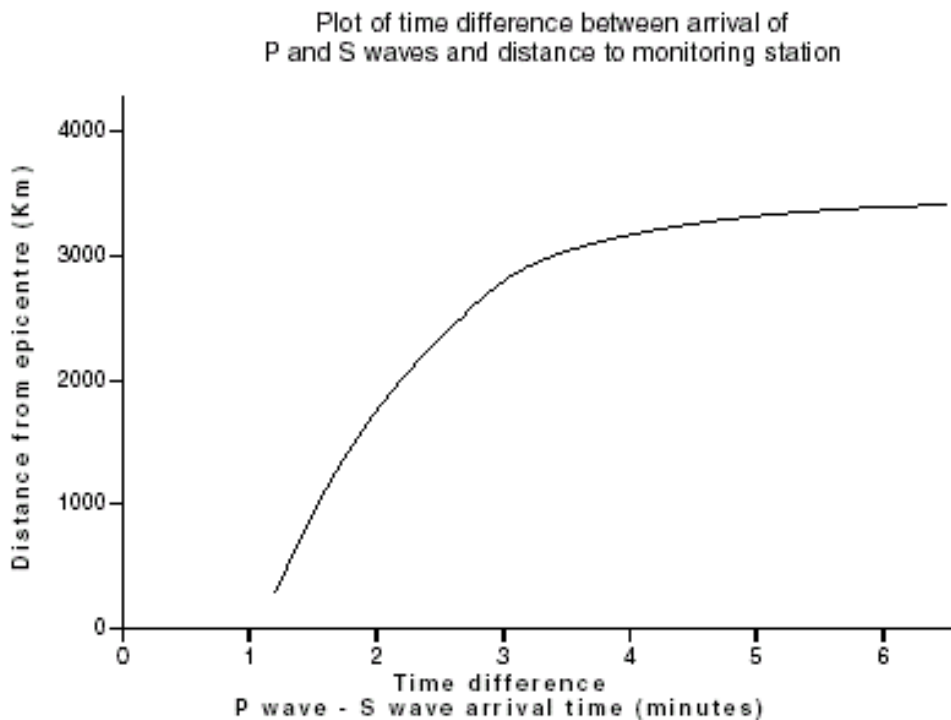
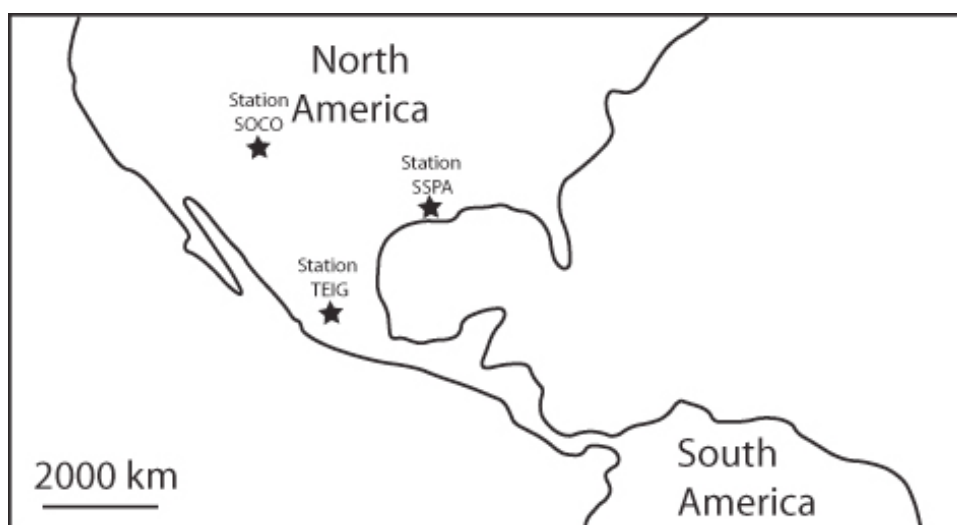


Figure 2 (below) shows a graph plotting the relationship between the difference in P and S wave arrival times and the distance from the earthquake epicentre.



Question 1: Use the information provided to determine the distance each seismic station is from the epicentre of the earthquake.

Question 2: Plot these distances on the map below to work out where the earthquake epicentre was.



Question 3: We have used the data from 3 seismic stations to locate this earthquake epicentre. What is the minimum number of seismic stations needed to locate an earthquake? Explain your answer.

Solutions:

Question 1 Answer:

Station 1 (SSPA):

Difference between P and S wave arrival: 5 minutes

Distance from seismic station: ~3300 km

Station 2 (SOCO):

Difference between P and S wave arrival: 3 minutes

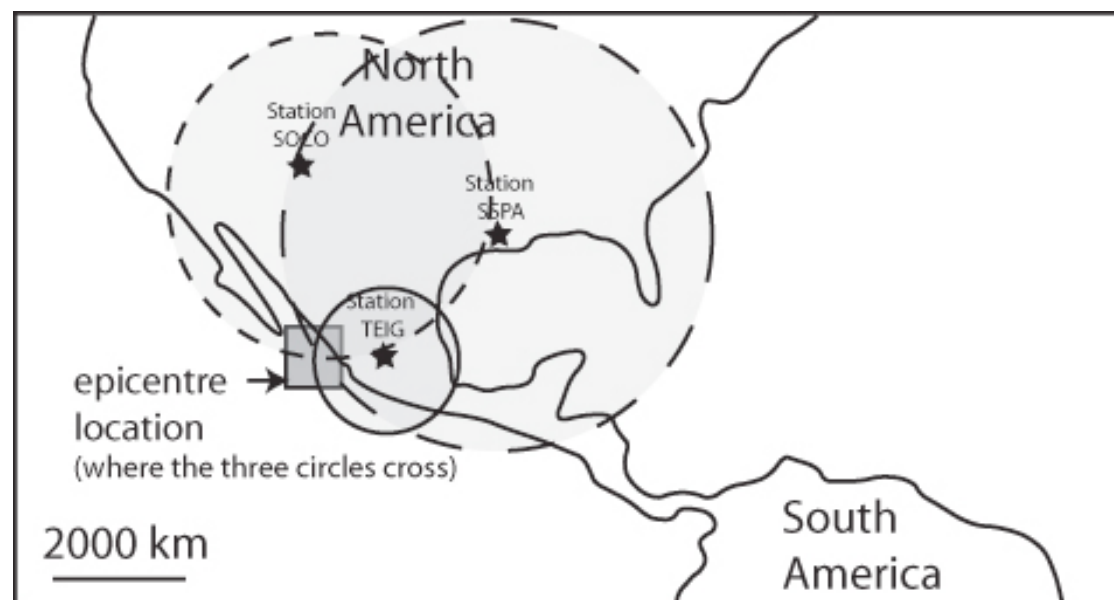
Distance from seismic station: ~2900 km

Station 3 (TEIG):

Difference between P and S wave arrival: 1.5 minutes

Distance from seismic station: ~1000 km

Question 2 Answer:



Question 3 Answer:

The minimum number of seismic stations is 3 (more could be used but not less). If you only have two seismic stations the arcs defining the distance from the station the earthquakes occurred at would cross twice, providing two possible locations. The third station is needed to define which of the two options is correct.