The Epicentre of an Earthquake

The epicentre of an earthquake is the location on the Earth's surface directly above the origin or focus of the earthquake (as this is usually deep underground).

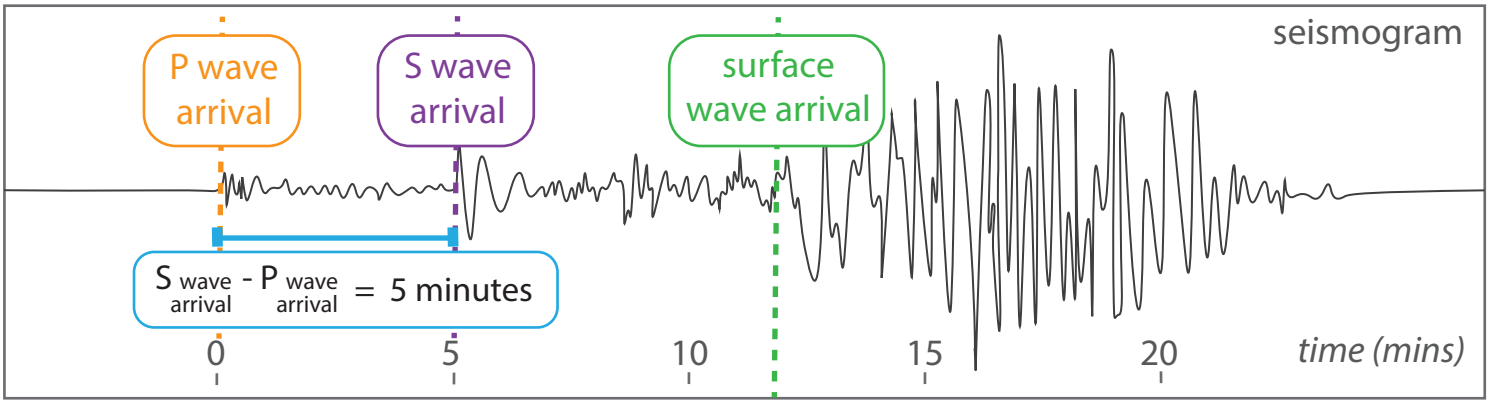
To locate the epicentre of the earthquake we need to know how far away it is and in what direction.

Earthquakes produce seismic waves called P and S waves. P waves and S waves travel through the Earth at different speeds and and will arrive at different times.

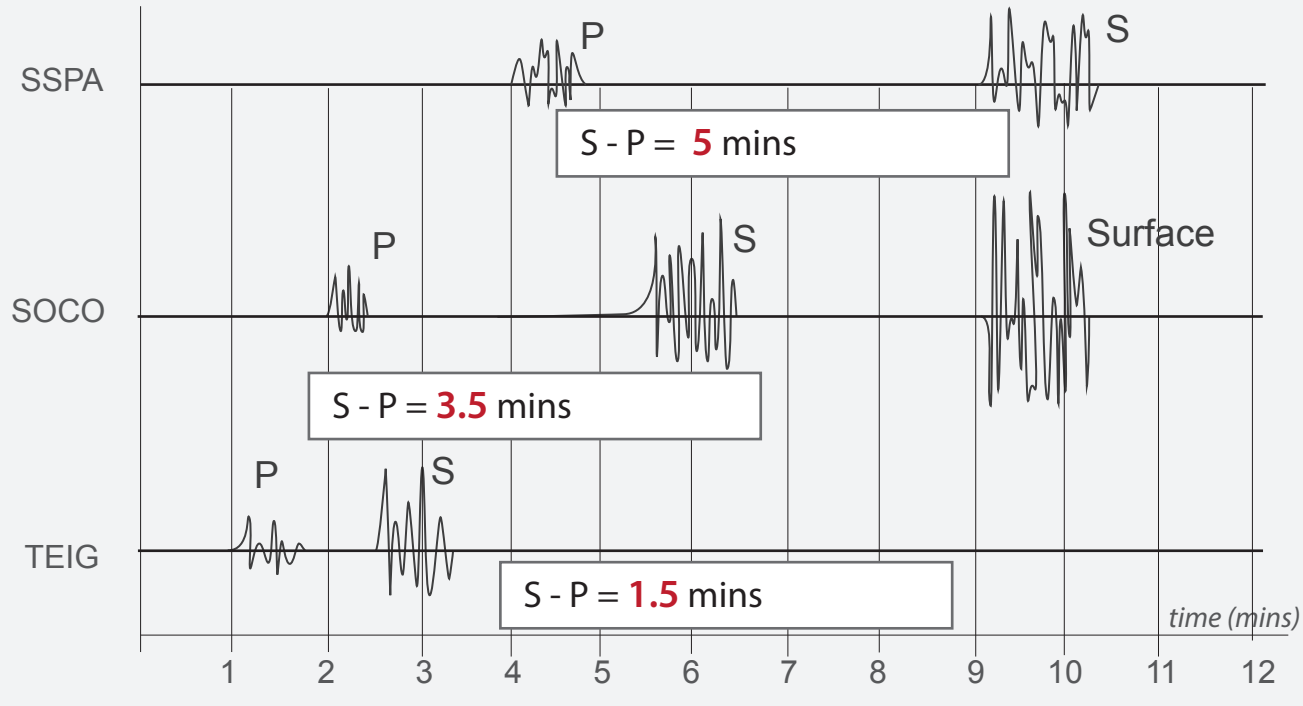
A P wave will arrive first and an S wave will arrive second.

Part 1: Find the time

The time difference between the arrival of the P wave and S wave can be used to calculate the distance of the earthquake epicentre from the seismometer (and hence seismic recording station itself).

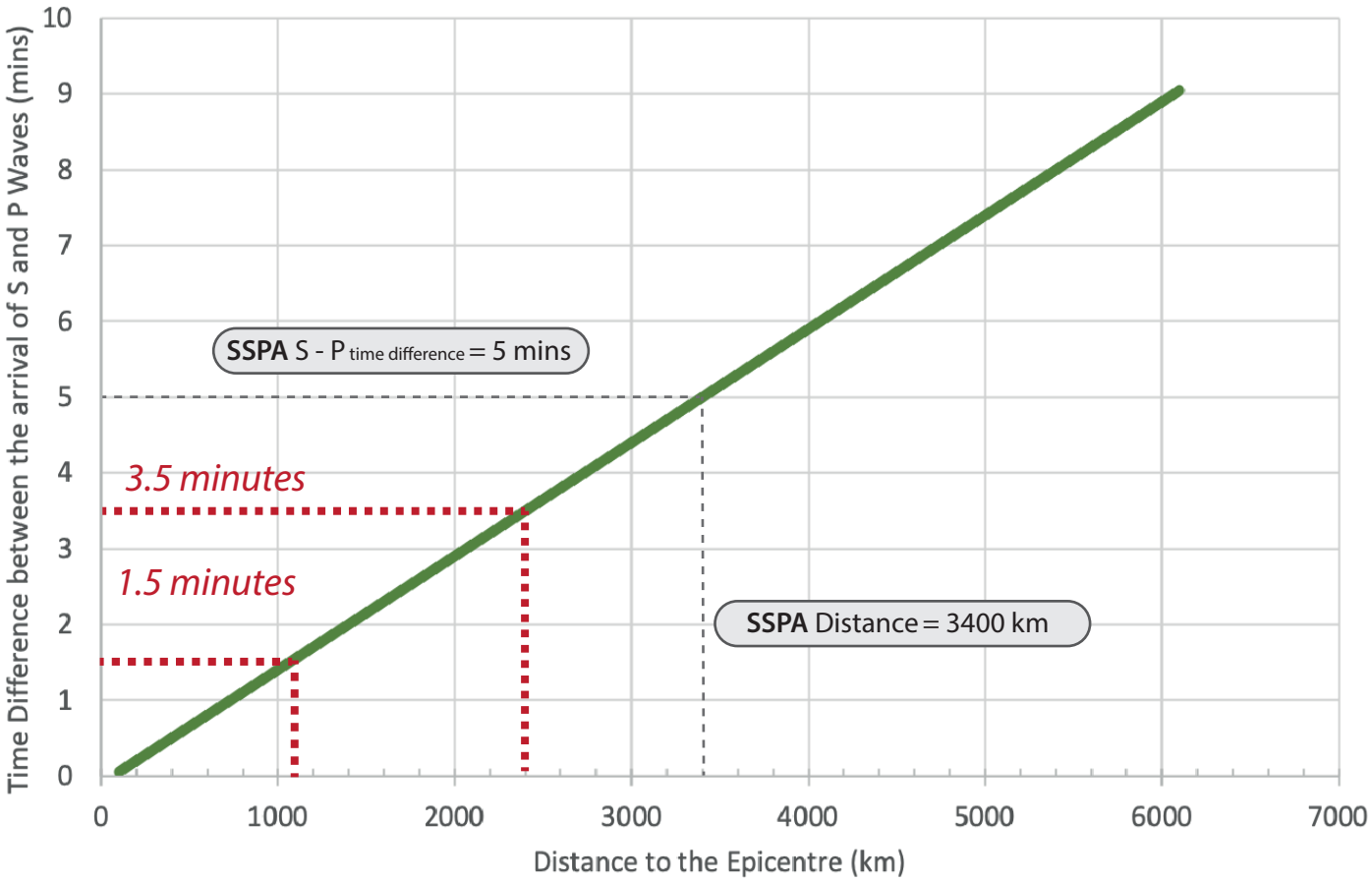


Use the example above to help you measure and record the time difference between the arrivals of the P and S wave at the three seismic recording stations (SSPA, SOCO and TEIG) on the seismogram below.



Part 2: Find the distance

The graph given below shows a general plot of S – P time difference against distance to the earthquake epicentre. Use this graph and your S – P time differences to work out the distance of each seismometer from the epicentre. The SSPA seismic station has been done for you.



Seismic Station	Time Difference (mins)	Distance (km)
SSPA	5	3400
SOCO	3.5	2400
TEIG	1.5	1100

Part 3: Set up the map

Step 1: For this activity you will need to use the map on page four. You have three seismic stations on your map, SSPA, SOCO and TEIG. Find each one and put a small blob of blu tac on each location (on top of the star).

Step 2: Look at the scale in the bottom left corner of the map. Use it to work out how many centimetres would represent 1000 km of the map. NB: This scale factor is correct for A4 paper, other paper sizes might change this a bit.

Equipment:

Pen or Pencil
Paper
Scissors
String (or twine, shoe lace)
Blu-tac
Sticky Tape

Use the scale factor on the map to calculate how many kilometres are represented by 1 cm on your map.

1 cm = 600 km

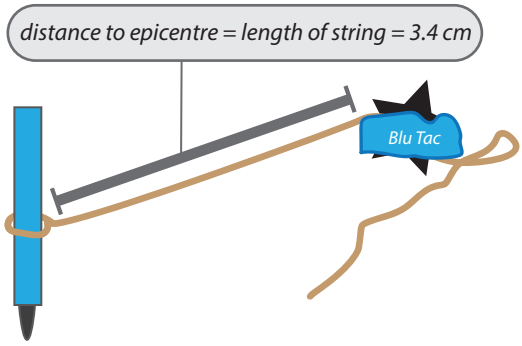
Part 4: Find the epicentre

Step 1: Using the scale on the map (e.g. 1 cm = 1000 km), work out the length of string needed to represent the distance of each seismic station to the epicentre (e.g. for SSPA, 3400 km would be scaled to 3.4 cm of string).

Step 2: Now is time to create a compass. If you have a compass already - you can of course use that instead!

Take your pen and a long length of string. Tie a loop in the end of the string so that your pen fits inside the loop (stick to the pen using sticky tape if needed).

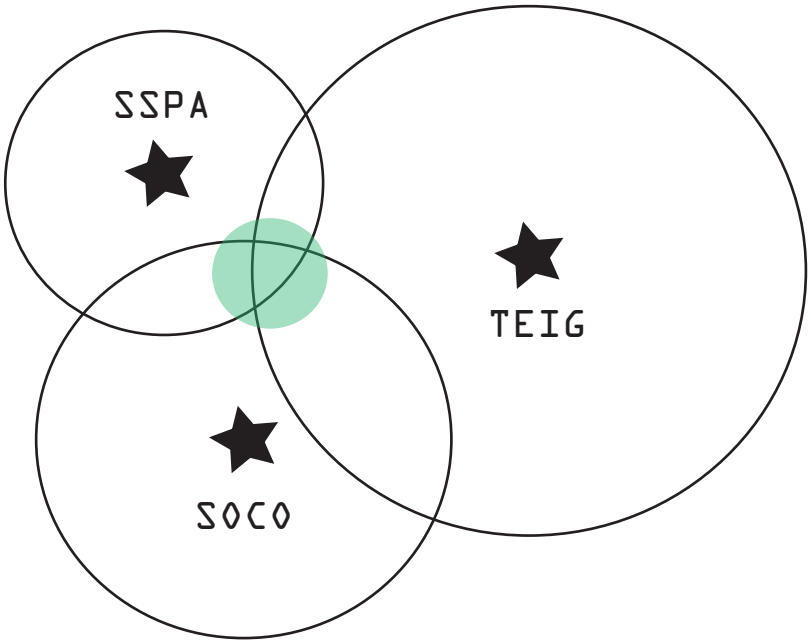
Measure the correct length for one of the three seismic stations (SSPA, TEIG or SOCO) and stick the opposite end of the string to the blu tac on the matching seismic station.



You might be asking why you need to create a compass to calculate the epicentre. This is because although you have calculated the distance from the seismometer to the epicentre, you don't know which direction it is in. By drawing a circle at the scaled distance around the seismic station, you know that the epicentre will be somewhere on the edge of the circle.

Step 3: Use your compass to draw a circle round the station. Repeat this for each seismic station, remeasuring the string so that it is the correct length for each seismic station.

Where all three circles overlap is the epicentre of the earthquake! (green circle)



notes:

1.5 cm = 900 km (scale from map, this scale may vary depending on paper size and print options. Be careful when printing out and determining scale.)

900/1.5 = 600 so, 1 cm = 600 km

SSPA: 3400 / 600 = 5.7, so the radius of the circle = 5.7 cm
SOCO: 2400/600 = 4, so radius of circle = 4 cm
TEIG: 1100/600 = 1.8 cm, so radius of circle = 1.8 cm

A Map of North and South America.

Use this to triangulate and locate the epicentre of an earthquake.