



South Australia

EarthResources

Information Sheet



Earthquake recording in South Australia

What is seismology?

The Earth's crust can be likened to a round ball with a soft centre and an outside shell cracked into many segments. These segments are continuously moving as they float on this soft centre.

Sometimes the edges of the segments rub against each other releasing a large amount of energy — this is felt as an earthquake.

Seismology is the science of recording these movements.

How are earthquakes recorded?

A sensor called a seismometer, which is rather like a very sensitive microphone, is buried in the ground. The seismometer will detect any minor movements of the earth and produce a corresponding signal.

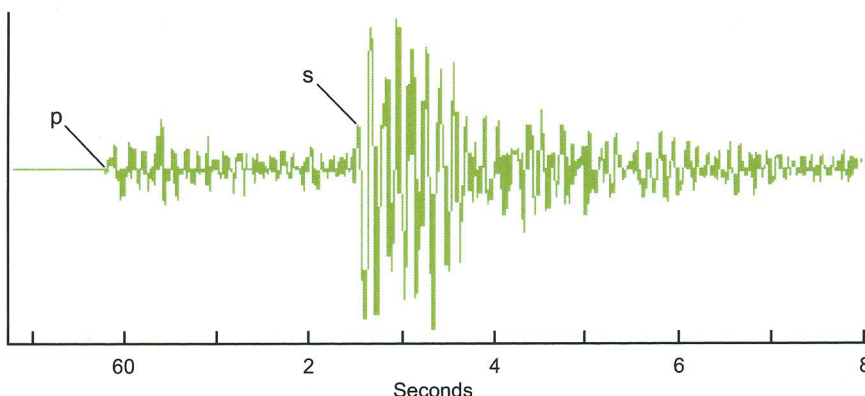
This signal is amplified many times and processed by electronic equipment. The signal may then be recorded by a pen-on-paper drum recorder or may be stored electronically (similar to a computer file).

The recording equipment is known as a seismograph.

This very sensitive equipment not only records earthquakes but also detects a number of other occurrences such as large animals moving about near the seismometer, heavy traffic on nearby roads or quarry and mining blasts. The resulting signal from each of these has a distinctive shape.

What does an earthquake signal look like?

This is a typical earthquake signal:



These signals are recorded with a very accurate time scale. Note the points labelled 'P' and 'S' on the signal. By measuring the time difference between these two points, and performing some calculations, it is possible to determine the distance from the sensor to the earthquake epicentre.

The vertical size of the signal can be used to determine the magnitude of the earthquake.

How does the magnitude scale work?

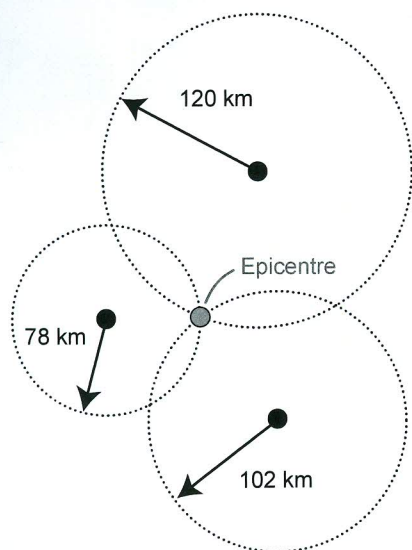
The magnitude scale commonly used is the 'Richter Scale'. This is a logarithmic-based scale, i.e. the difference between each step is a factor of ten times (e.g. Mag. 4.0 is ten times greater than Mag. 3.0). To give an idea of the range of the scale, magnitudes below about 2.5 are not normally felt by humans but are recorded by seismographs. Magnitudes between 3 and 5 may frighten people but do not cause much damage. Over 6, the damage is normally major to devastating.

How are earthquakes located?

The location of an earthquake can be determined by using a network of recording stations. A method similar to triangulation can then be used to determine the location of the earthquake.

Put simply, a circle is drawn around each station; the size of the radius of the circle represents the distance from the station to the earthquake. When three or more stations are available, the place where the circles intersect each other is the location or 'epicentre' of the earthquake.





Earthquakes actually occur at varying depths in the Earth's crust. In Australia, this is normally down to around 20 km deep, whilst overseas earthquakes can be over 300 km deep. The actual location below the Earth's surface at which the earthquake occurs is called the 'hypocentre'; the 'epicentre' is the point on the earth's surface directly above the hypocentre.

Where are these recording stations?

There are 44 stations (in 2013) located throughout South Australia, mainly around the Adelaide and mid-north regions. These stations are mainly digital automatic recorders, but there are a few remaining pen-on-paper drum recorders.

The drum recorders require someone to visit them daily to change paper, and records are sent to Adelaide once per week for processing.

The digital recorders require little help from local people, except where there is a breakdown of the instrument or communications. Communications are by satellite, mobile phone, radio, landline broadband or dial-up. This is often via the internet, but sometimes via a private network. Data is usually sent continuously, in very close to real-time, to a processing centre. The digital recorders have much more accurate timing than drum recorders (0.01 seconds compared to 0.3) and usually at least 1000 times more dynamic range. They often have three directions of motion (east-west, north-south, up-down) compared to only up-down on most drum recorders.

Processing the information

A central computer monitors incoming data to detect larger earthquakes and provide rapid notification. Automatic notification by computer of an epicenter and magnitude is not reliable. They are reviewed by trained personnel, who also review the daily data for lots of smaller earthquakes. Paper records are viewed later, and relevant data added.

What is this information used for?

The information is used to determine the earthquake risk for a particular area of the state. The results are used by construction engineers when designing buildings, by insurance companies when determining insurance risks, and by disaster planning and emergency service organisations etc.

How often do earthquakes occur?

Earthquakes occur far more often in South Australia than most people realise. It is common for there to be 10–20 earthquakes per month with magnitudes between 1 and 2. These mostly go unreported because they are too small to be felt, however the sensitive instruments can detect them.

On average, there is one magnitude 4 earthquake each year, with a magnitude 6 earthquake about every 50 years.

Can earthquakes be predicted?

Although earthquake prediction would be very useful, unfortunately at this stage there is no proven reliable method. Work is always continuing in this area.

Largest earthquakes in South Australia

Some of the largest earthquakes that have occurred in South Australia are:

- 1897, Beachport 6.5
- 1902, Warooka 6.0
- 1948, Robe 5.6
- 1954, Adelaide 5.5
- 1986, Marryat Creek 6.0
- 1997, Burra 5.1
- 2012, Ernabella 5.7

What to do when an earthquake occurs?

- DROP to the floor, seek COVER under a table, and HOLD onto a leg.
- Do not run outside.
- If outside, stay in the open away from buildings, power lines or structures that may fall.
- Avoid using your mobile phone except in an emergency.
- Go to www.sa.gov.au, Emergency, safety and infrastructure, Earthquakes for more information.

Can overseas earthquakes be detected?

Overseas earthquakes and even large nuclear blasts can be detected by sensitive Australian seismographs, depending on size and distance. Sensitive sites record magnitude 5 earthquakes in active areas to the north and northeast of Australia almost every day.

Glossary of terms

Seismometer: the sensor that picks up the earth's movement.

Seismograph: the recording equipment that stores the signal of the earth's movement.

P wave: primary or compressional wave from an earthquake.

S wave: secondary or shear wave from an earthquake.

Epicentre: the location on the surface of the Earth directly above the hypocentre.

Hypocentre: the location beneath the Earth's surface where the earthquake actually occurred.

Magnitude: a scale that indicates the energy release of the earthquake.

Intensity: the force of the earthquake as determined from the physical effects of the earthquake at a particular place.

Further information

For further information please contact:

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www.dmitre.sa.gov.au/earthquakes

