Tsunami in Australia

The Australian coastline has experienced tsunami through recorded history but most have been small and have presented little threat of land inundation to our coastal communities. Despite this, unusual tides or currents caused by even relatively small tsunami can be dangerous to marine users and boats. The risk of a tsunami impact to Australia varies from 'relatively low', for most of our coastline, to 'moderate' on the north-west coast of Western Australia (WA) due to its proximity to Indonesia and other countries in that region prone to large undersea earthquakes and volcanic activity.

Since European settlement several large tsunami have reached Australia's northwest coast. On 17 July 2006 a magnitude 7.7 undersea earthquake south of Java generated a tsunami that affected parts of the WA coast, particularly Steep Point. Waves of up to two metres were recorded with evidence of inundation up to 200 metres inland. This tsunami caused widespread erosion, extensive vegetation damage and destroyed several campsites.

In 1977, a six metre 'run-up' was observed at Cape Leveque, WA, ie the tsunami travelled inland to a point six metres above sea level. Further south in the Onslow-Exmouth region in June 1994, tsunami waves with over a four metre run-up appeared out of a calm sea and inundated 300 metres inland. Both of these WA tsunami were generated by earthquakes off Indonesia.

In May 1960, a large earthquake along the tectonic plate boundaries off the coastline of Chile resulted in the largest recorded tsunami along the east coast of Australia. This event generated tsunami waves of just under one metre in height in Sydney Harbour. Slight to moderate damage (mainly to boats) was recorded in harbours at Lord Howe Island, Evans Head, Newcastle, Sydney and Eden.

The Joint Australian Tsunami Warning Centre (JATWC), jointly operated by the Bureau of Meteorology and Geoscience Australia, detects and verifies any tsunami threat to the coastline of Australia and its offshore territories.

Tsunami warnings in Australia

Marine and immediate foreshore threat

Depending on the level of threat determined by the JATWC, the Bureau of Meteorology may issue a tsunami warning (via the radio, television, 1300 TSUNAMI, or the Bureau's website www.bom.gov.au/tsunami) restricted to the marine environment and immediate foreshore area for parts of the Australian coastline. You will be advised to:

- Get out of the water and move away from the immediate water's edge of harbours, coastal estuaries, rock platforms and beaches.
- Return any boats in harbours, estuaries and in shallow coastal water to shore, then secure your boat and move away from the waterfront.
- Move any vessels already at sea to deep water well offshore and remain there until further advised.
- Not go to the coast or headlands to watch the tsunami.
- Listen to the media for further information and follow the advice from emergency services.
- Check that your neighbours have received this advice.

The Bureau of Meteorology — Geoscience Australia

The Joint Australian Tsunami Warning Centre operates 24 hours a day, seven days a week.

Land inundation threat

If there is a possibility of more serious inundation of coastal land, the JATWC may extend the tsunami warning for the marine environment and immediate foreshore to a tsunami warning for more extensive land inundation. Advice on the appropriate response is determined in consultation with the relevant State or Territory emergency authority who may order the evacuation of low lying coastal areas. You will be advised to:

- Take only essential items that you can carry including important papers, family photographs and medical needs.
- Go to higher ground or inland. Move away from all beaches and the water's edge of harbours and coastal estuaries.
- Walk to safety if possible to avoid traffic jams.
- Take shelter in the upper storey of a sturdy brick or concrete multi-storey building if you cannot leave the area.

Cancellation of a tsunami warning

Tsunami warnings will be cancelled by the JATWC when the main threat is deemed to have passed. The relevant State or Territory emergency authority will inform the public when it is safe to return to the affected area. Caution should still be exercised however, as unusually strong waves, currents and abnormal sea levels may still affect some beaches, harbours and coastal waterways for hours, or even days after, depending on the location.

Information within warnings

It is important that you follow the advice contained in these warnings. By reading this guide and responding to advice included in warnings, you can minimise the risk to your safety. Evacuation or exclusion orders are legally enforceable under State/Territory legislation.

Where can I find more information on tsunami?

Bureau of Meteorology

www.bom.gov.au/tsunami

Geoscience Australia

www.ga.gov.au/hazards/tsunami

Emergency Management Australia

www.ema.gov.au/tsunami

Australian State and Territory emergency services

www.ses.nsw.gov.au
www.ses.vic.gov.au
www.emergency.qld.gov.au/ses
www.fesa.wa.gov.au
www.ses.sa.gov.au
www.ses.tas.gov.au
www.ses.act.gov.au
www.emergency.nt.gov.au

For latest tsunami warnings call 1300 TSUNAMI (1300 878 6264) or visit the Bureau's website www.bom.gov.au/tsunami

For tsunami assistance call SES on 132 500 (or if in Tas or NT police assistance on 131 444).

For life threatening emergencies call 000.

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Front cover image courtesy of Anders Ginnvin 2004

Australian Government

Tsunami Awareness

Produced in conjunction with Australian State and Territory governments.

Tsunami *is a Japanese word:* ***tsu*** *meaning 'harbour' and* ***nami*** *meaning 'wave'.*

Image courtesy of Anders Grawin 2004.

Tsunami explained

A tsunami is a series of waves travelling across the ocean due to a sudden displacement of a large body of water. This displacement can be caused by events such as undersea earthquakes, landslides, volcanic eruptions or even asteroid impacts. Tsunami are different from wind swell waves on the ocean. Normal ocean and wind swell waves may cause motion in the water to depths of 150 metres. In contrast, the passage of tsunami involve the movement of water all the way to the seafloor.

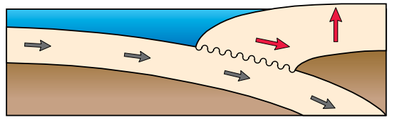
Tsunami waves move outwards away from their source and may go unnoticed by ships, boats or from the air. As tsunami cross the deep ocean, wave heights may be much less than one metre but speeds can reach up to 950km/hr. Tsunami have extremely long wavelengths – up to hundreds of kilometres between wave crests in the deep ocean.

Depending on how tsunami approach the coastline, they may look like rapidly rising or falling tides or a series of breaking waves. Tsunami will also look and behave differently depending on the shape of the seafloor and coastline. There may be a relatively long time between waves arriving at the coastline and the first wave is not necessarily the largest. The second or third wave is generally larger. As tsunami approach the shore, speed reduces and wave height can grow significantly – up to several metres. It is not so much this movement of water, but the energy moving through it that makes tsunami so dangerous.

In Australia, tsunami can vary in size and severity. A relatively small tsunami may still result in strong rips and currents that can be dangerous to swimmers and other marine users. Sea levels and waves that are higher than normal can endanger coastal users (such as beachgoers, fishers and marine industries) and cause damage to moored boats. In the event of a large tsunami travelling in the direction of Australia, there could be extensive inundation of coastal land (ie water that overflows onto normally dry land areas), serious threat to lives and damage to property.

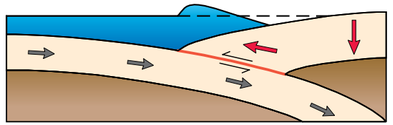
Earthquake-generated tsunami

Tsunami are typically generated by undersea earthquakes that occur along the earth's subduction zones. A subduction zone is an area where two tectonic plates meet with one sliding underneath the other, creating a build up in pressure.



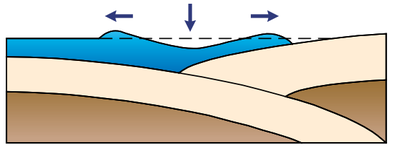
Prior to undersea earthquake

This is a picture of the lower tectonic plate dragging against the upper plate, causing stress.



At time of undersea earthquake

Stress on the tectonic plates causes the upper plate to rebound to its initial position, causing tsunami.



After undersea earthquake

The tsunami moves outwards across the ocean.

Illustrations courtesy of Geoscience Australia.

Tsunami are sometimes called 'tidal waves' but this is misleading. Although tsunami impact on a coastline can be affected by tide level, tsunami are unrelated to tides.

Indian Ocean Tsunami:

26 December 2004

A magnitude 9.3 undersea earthquake occurred off the west coast of Sumatra where the Indo-Australian Plate is sliding under the Eurasian Plate. The part of the fault that ruptured and caused the Indian Ocean Tsunami was 1200km long. When the rupture occurred, parts of Indonesia moved westwards by 5–10 metres.

The displacement of the ocean floor caused a tsunami, devastating communities in Indonesia, Sri Lanka and Thailand and affecting many other countries along the Indian Ocean rim. Close to 300 000 people lost their lives.

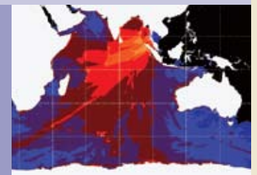


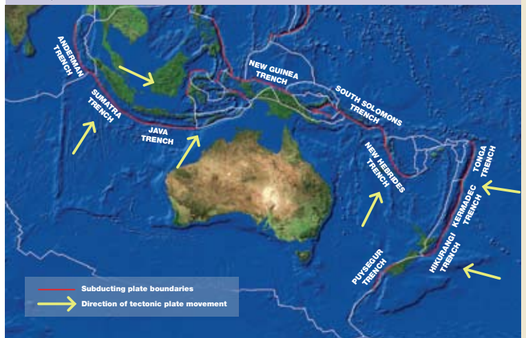
Image courtesy of Bureau of Meteorology.

Computer modelled wave heights of the tsunami generated 26 December 2004 (yellow/red highest waves).

In this instance the impact on Australia during the December 2004 Indian Ocean Tsunami was relatively minor. Although the more destructive waves did not travel towards Australia during this event, a half metre tsunami wave passed the Cocos Islands and dangerous rips and currents were experienced on the western and southern coasts of Australia. At least 30 people were rescued after being swept out to sea, some relatively minor land inundation occurred and boats were damaged in marinas. Fortunately no lives were lost.

Australia is surrounded by active tectonic plate boundaries.

Image courtesy of Geoscience Australia.



Australian Tsunami Warning System

Since the Indian Ocean Tsunami in December 2004, a number of countries around the world, including Australia, have increased efforts to monitor, plan and warn for tsunami. The Australian Government, through the Bureau of Meteorology, Geoscience Australia, and Emergency Management Australia, has been working with State and Territory governments and other agencies to develop the Australia Tsunami Warning System (ATWS).

This initiative is providing a comprehensive tsunami warning system for Australia, supporting international efforts in the establishment of the Indian Ocean Tsunami Warning System and contributing to the facilitation of tsunami warnings for the South West Pacific.

It is providing an around-the-clock tsunami monitoring and analysis capacity for Australia, integrated into our well-established emergency management arrangements. The existing sea-level and seismic networks have been upgraded and expanded to ensure accurate and timely tsunami warnings. This initiative also includes: enhancement of Australia's tsunami modelling capabilities; deployment of deep-ocean tsunami detection buoys; operation of the Joint Australian Tsunami Warning Centre; and implementation of national tsunami education and training programs for the community and industry.

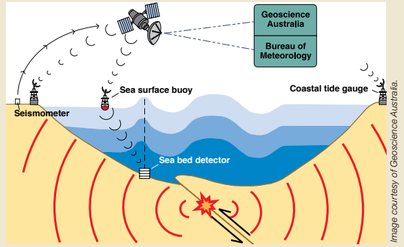


Image courtesy of Geoscience Australia.

An undersea earthquake causes displacement of both the sea floor and the sea surface, and the spreading out of seismic waves (in red). The disturbance in the sea surface radiates outward as a tsunami, which travels much slower than the seismic waves. Once the seismic waves are detected by distant (usually land-based) seismometers, sea-level data from coastal tide gauges or deep sea buoys are analysed to determine whether a tsunami has actually been generated.

What are the natural warning signs of tsunami?

The following are natural signs of tsunami that you may, but not always, experience when you are near the coast in Australia or overseas. If you notice any of these warning signs take appropriate action as outlined in this guide.

You may...

Feel the earth shake

A large undersea earthquake may be felt prior to tsunami by an ongoing shaking of the ground in coastal regions. However, you may not feel an earthquake if the source is far away.

See the ocean drop

As tsunami approach the shoreline, the sea level may, but not always recede/drop dramatically before returning as a fast-moving wall of water.

Hear an unusual roaring sound

A roaring sound from the ocean may precede the arrival of tsunami.

In the unlikely event of tsunami being generated directly offshore from our coast, little or no warning may be available for communities initially impacted apart from possible natural warning signs.

Deployment of an Australian tsunami detection buoy.

Image courtesy of Bureau of Meteorology.