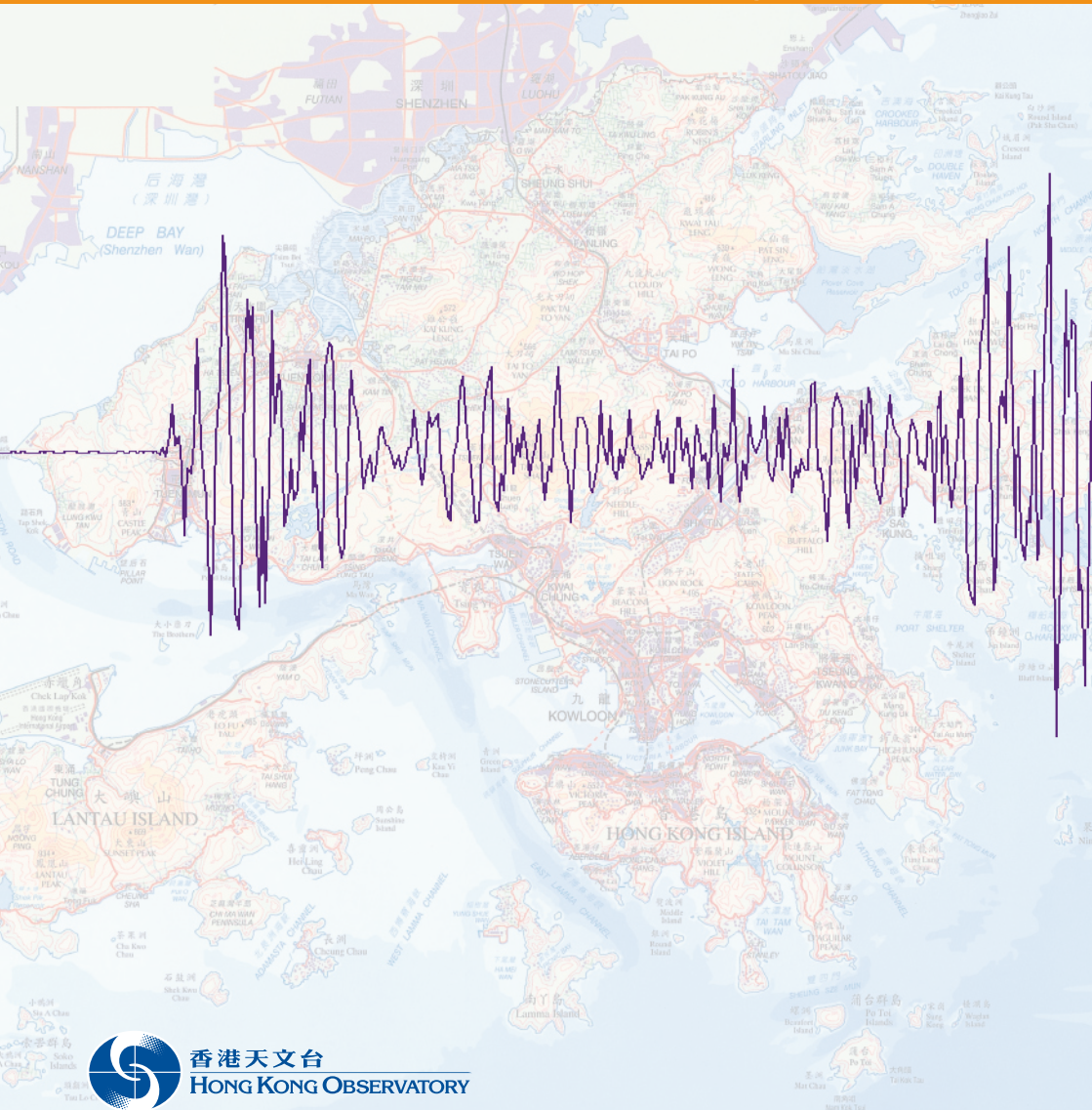


地震和香港

Earthquake and Hong Kong

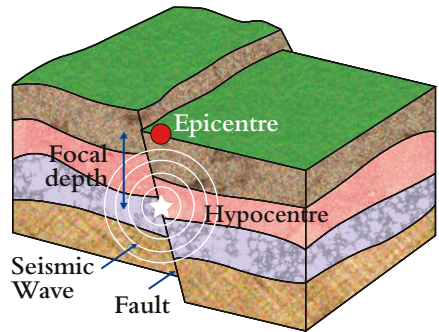


香港天文台
HONG KONG OBSERVATORY

Earthquake Occurrence and Measurement

Tectonic plates move relative to one another. At the boundary between two plates, frictional force acts against relative movement and energy builds up. An earthquake usually occurs when the rock deep underground ruptures, releasing the energy accumulated over time. The seismic waves generated by the rupture propagate in all directions, shaking the ground and houses when they reach the surface of the earth. Earthquakes of this type are called tectonic earthquakes, and account for 90 per cent of all earthquakes. They, in particular the severe ones, occur at the boundaries between major tectonic plates. Some tectonic earthquakes do occur on faults within a tectonic plate, but the frequency of occurrence and the intensities are lower than those at the edges of tectonic plates.

The location where seismic waves are generated is called the hypocentre. Its vertical projection onto the earth's surface is called



Generation of seismic waves

the epicentre. The distance of the epicentre from the hypocentre is called focal depth. Earthquakes with focal depths less than 70 kilometres are called shallow earthquakes. Destructive earthquakes are in general shallow earthquakes. For example, the focal depth of the Tangshan earthquake that occurred in 1976 was around 12 kilometres.

Using the arrival time of seismic waves recorded by seismographs in various parts of the world, the epicentre and focal depth of an earthquake can be calculated. The peak amplitudes of seismic waves near the epicentre can be used to determine the magnitude of the earthquake on the Richter Scale

which is an indication of the severity of the earthquake in terms of the total energy released. An increase of one step in magnitude corresponds to a 10-fold increase in the amplitude of seismic waves and a 32-fold increase in energy.

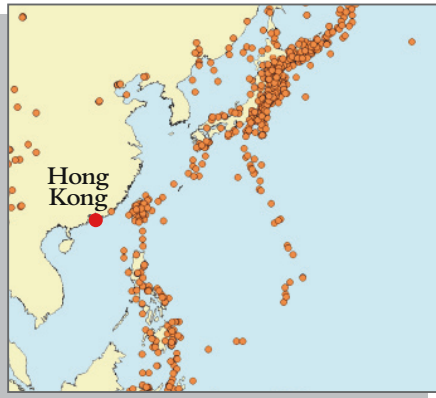
For large earthquakes, a more accurate measure of the total energy released is given by the so called “moment magnitude scale”, which is based on the area of fault rupture and the size of the fault dislocation of the earthquake. However, the complexity of measurement and computation is much higher than that for determining the magnitude on the Richter Scale.

For the same earthquake, locations at different distances from the epicentre will have different degrees of ground shaking, which is expressed by the intensity on the Modified Mercalli Scale. The intensity is determined based on reported effects of the earth tremor on people, furniture, buildings, geological structure,

etc. Generally speaking, a place further away from the epicentre will have lower intensity but it also depends on other factors such as soil conditions of the region. More information on the Modified Mercalli Scale is given on the Observatory's website at: http://www.weather.gov.hk/gts/quake/mms_e.htm

Earth Tremors in Hong Kong

Hong Kong is situated on the southern coast of mainland China, on the eastern side of the Pearl River Estuary and facing the South China Sea. The location is within the Eurasian plate and not on the edge of a tectonic plate. The well-known circum-Pacific seismic belt where major tectonic plates meet runs through Japan, Taiwan and the Philippines. Hong Kong is far away from this seismic belt, over 600 kilometres from the nearest point. Hence, the chance of strong earthquakes occurring in Hong Kong is very low.



Distribution of earthquake epicentres of magnitude 7 or above in 1901-2005. Most of these earthquakes occurred on the circum-Pacific seismic belt.

Historically, there has never been any destructive earth tremor in Hong Kong. Since 1905 when the Hong Kong Observatory began making records of locally felt earth tremors and up to 2008, a total of 163 earth tremors of various intensities were felt in Hong Kong, all without casualty. Most of these earth tremors were of intensity 5 or below on the Modified Mercalli Scale. The strongest tremor was intensity 6 to 7 which occurred in 1918 and was caused by an earthquake near

Shantou about 300 kilometres from Hong Kong. That tremor caused minor damages to a few buildings, and was the only earthquake that had caused damage in Hong Kong since 1905.

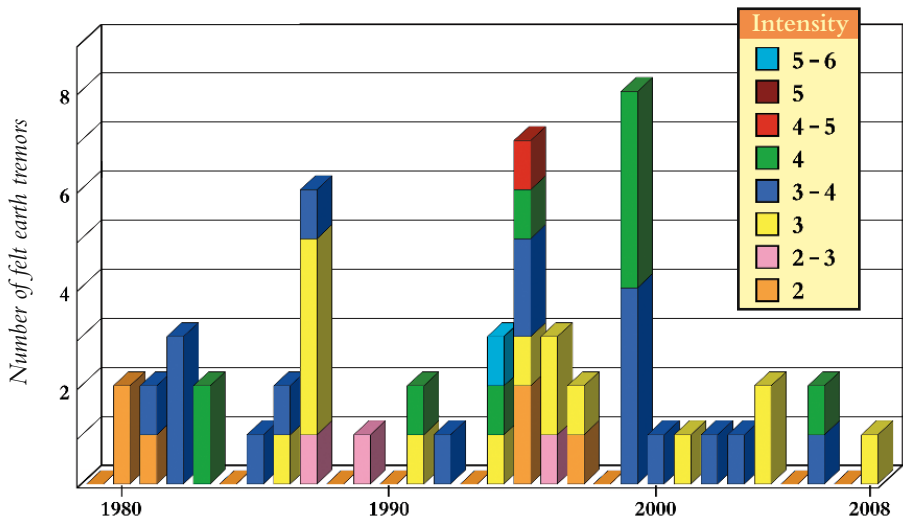
From 1979 to 2008, there were altogether six locally felt earth tremors with epicentres located within Hong Kong. One was at Mai Po in 1983, and two were in 1982 and three in 1995 over the sea east of Lantau Island. All these tremors were minor with intensities below 5.

According to seismo-tectonic analysis, the faults in Hong Kong and nearby waters are not active. The geological settings are not favourable for generating strong earthquakes. Earthquakes that occur in Hong Kong and its vicinity can shake the ground to the extent felt by people, but the chance of causing serious damage is very low. Hong Kong can also be affected by remote earthquakes, occurring in areas near Taiwan,

the northern part of the South China Sea, Heyuan and Yangjiang of Guangdong, the border between Guangdong and Fujian, Beibu Wan, etc. These earthquakes are also unlikely to bring about damage in Hong Kong. Various studies have shown that the return period for a locally felt earth tremor of intensity 5 or above in Hong Kong is 15 to 20 years and that for a tremor of intensity 7 or above is 350 to 400 years.

Safety Precautions

With the current technology, there is no reliable method to predict the occurrence of earthquakes. So any notification, including press releases, can only be issued after an earthquake has occurred. As the damage of an earthquake is inflicted within a few minutes of its occurrence, members of the public who feel an intense earth tremor should take safety measures without waiting for information from the authorities.



Number and intensity of locally felt earth tremors in 1979-2008

In the majority of cases, earth tremors felt in Hong Kong are of intensity 5 or below on the Modified Mercalli Scale which are unlikely to cause any damage. It is therefore unnecessary to take any safety measures against these minor tremors. As a matter of fact, all safety measures carry some inherent risks. This is particularly the case in crowded areas where people rushing to escape may cause greater harm.

During the earthquake:

1. Do not panic, keep calm.
2. Douse all fires.
3. If the earthquake catches you indoors, stay indoors. Take cover under a sturdy piece of furniture. Stay away from glass, or loose hanging objects.
4. If you are outside, move away from buildings, steep slopes and utility wires.
5. If you are in a crowded place, do not rush for cover or to doorways.

6. If you are in a moving vehicle, stop as quickly as safety permits, but stay in the vehicle until the shaking stops.
7. If you are in a lift, get out of the lift as quickly as possible.
8. If you are in a tunnel, move out of the tunnel to the open as quickly as safety permits.

After the earthquake:

1. Check for casualties and seek assistance if needed.
2. If you suspect a gas leak, open windows and shut off the main valve. Leave the building and report the gas leaks. Do not light a fire or use the telephone at the site.
3. Turn off the main valve if water supply is damaged.
4. Do not use the telephone except to report an emergency or to obtain assistance.
5. Stay out of severely damaged buildings as aftershocks may cause them to collapse. Report any building damage to the authorities.

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