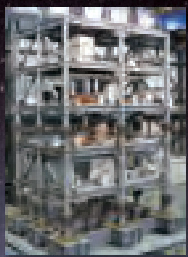
Earthquake Awareness



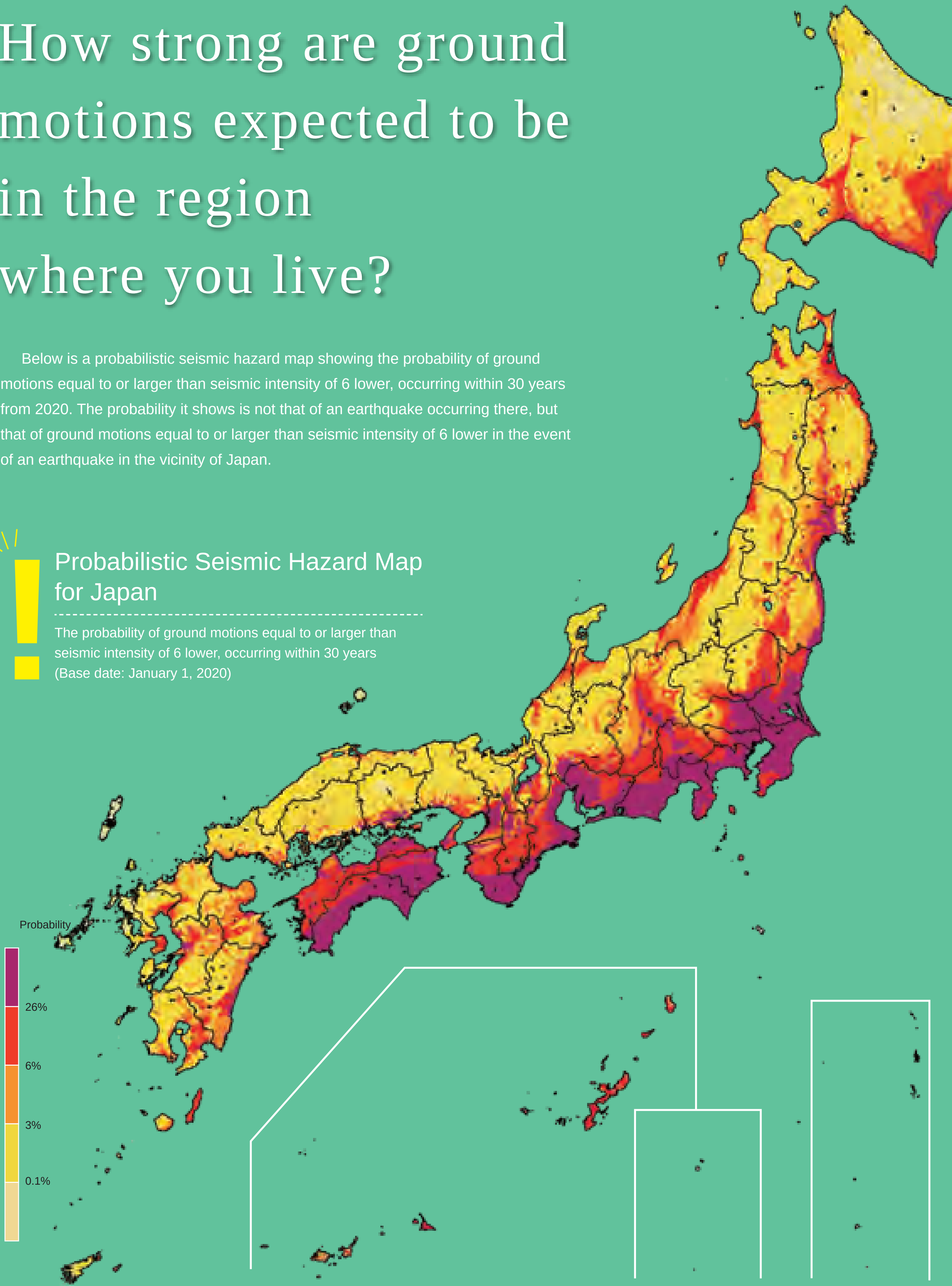
The Headquarters for Earthquake Research Promotion

How strong are ground motions expected to be in the region where you live?

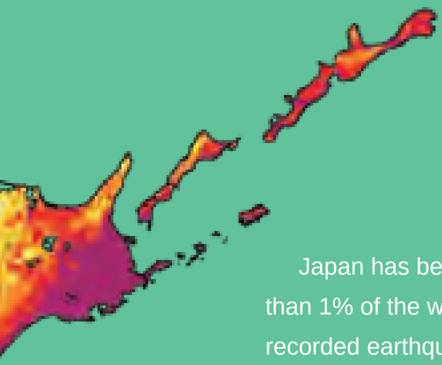
Below is a probabilistic seismic hazard map showing the probability of ground motions equal to or larger than seismic intensity of 6 lower, occurring within 30 years from 2020. The probability it shows is not that of an earthquake occurring there, but that of ground motions equal to or larger than seismic intensity of 6 lower in the event of an earthquake in the vicinity of Japan.

Probabilistic Seismic Hazard Map for Japan

The probability of ground motions equal to or larger than seismic intensity of 6 lower, occurring within 30 years (Base date: January 1, 2020)



Probabilistic seismic hazard maps are based on the latest surveys and research but the available data are limited and there are uncertainties in the results.
The seismic intensity describes the scale of ground motion at a particular location. It is classified into 10 categories; namely 0 to 4, and 5 lower, 5 upper, 6 lower, 6 upper and 7.
For more detailed information, please see the website for probabilistic seismic hazard maps for Japan listed on P18.



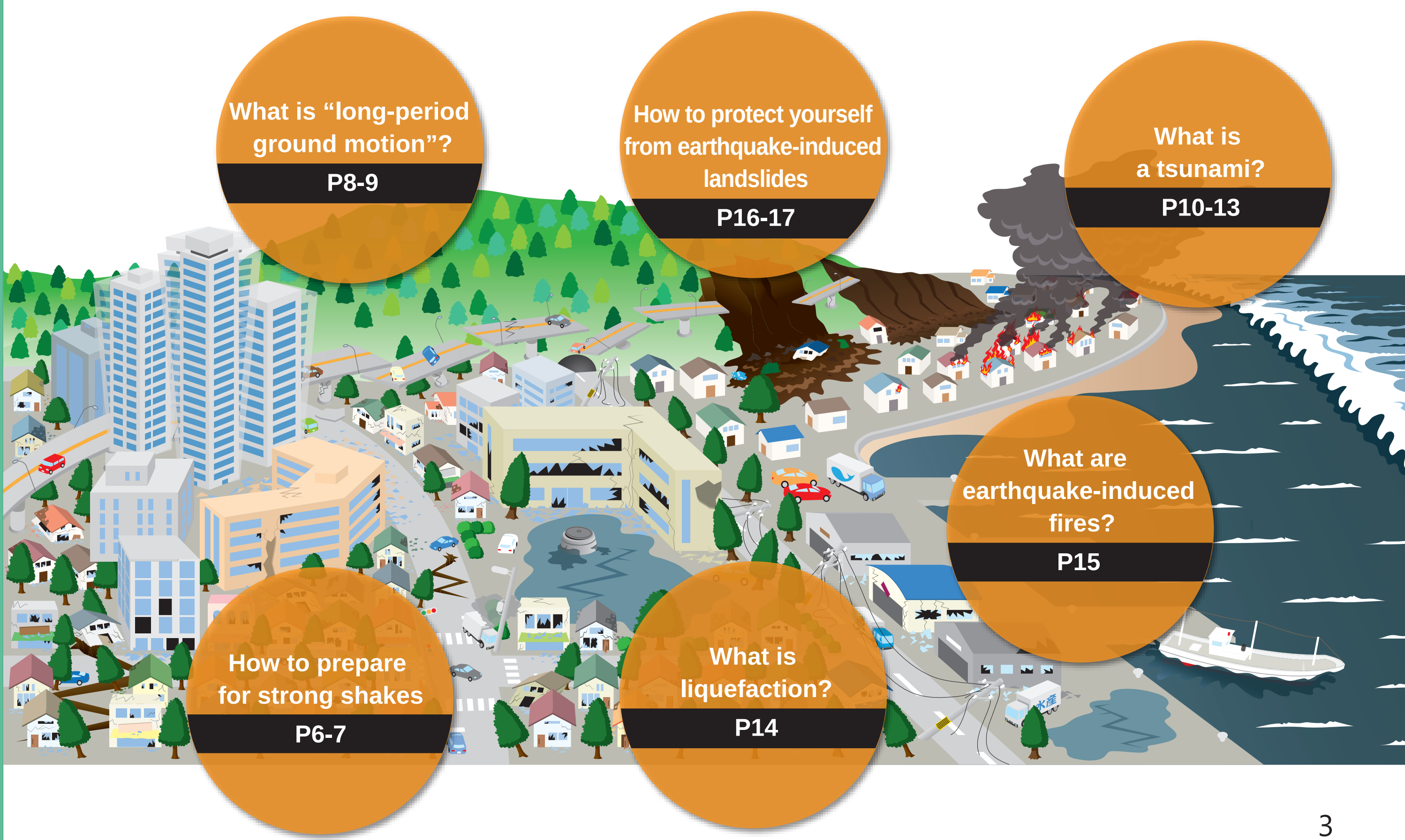
Japan has been struck by approximately 10% of the world's earthquakes. This is despite its small area, being less than 1% of the world's total land area. The 2011 off the Pacific Coast of Tohoku Earthquake was Japan's biggest ever recorded earthquake. Living as we do in Japan, one of the world's most earthquake-prone countries, we need to consider what can be done to protect our lives and property.

It will help us to deepen our understanding of earthquakes and reduce the damage they cause if we can gain sufficient data and knowledge from surveys and research with regard to where earthquakes have occurred in the past, what type they were, and the degree of ground motion and damage likely to be caused if an earthquake occurs in your area.

More about damage and other phenomena caused by earthquakes and seismic waves!

What kinds of damage and other effects are caused by earthquakes and seismic waves?

In this pamphlet you will find the explanations about damage and other phenomena caused by earthquakes and their seismic waves, and how to prepare against them.

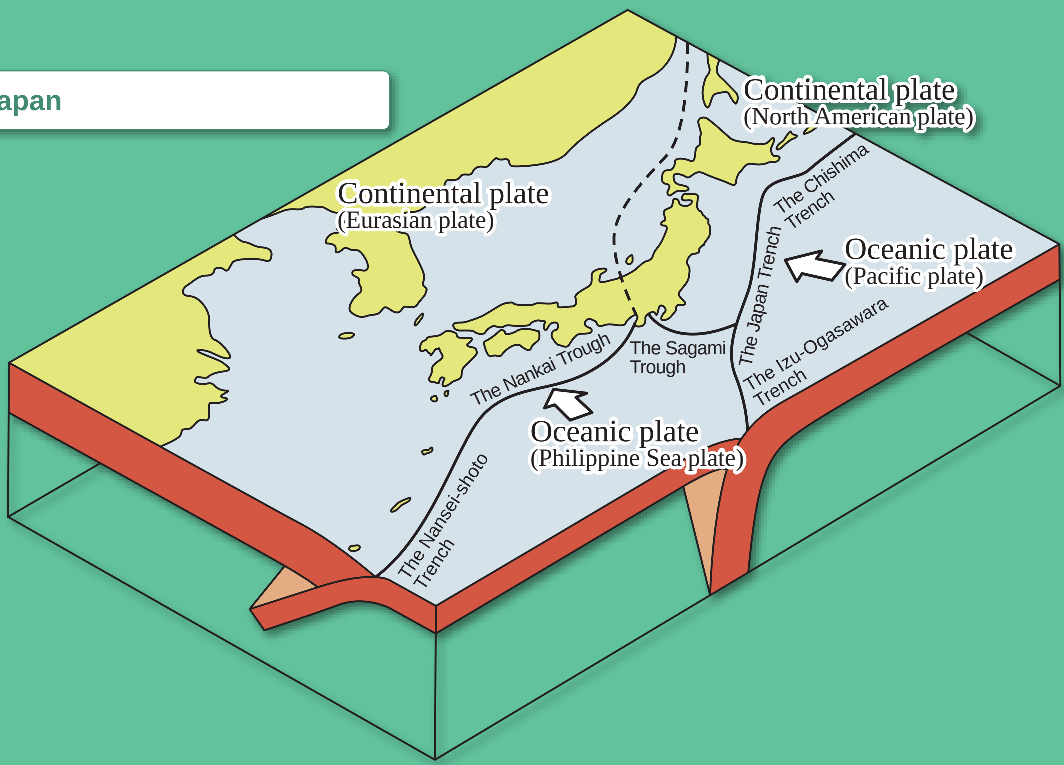


? Why are there so many earthquakes in Japan?

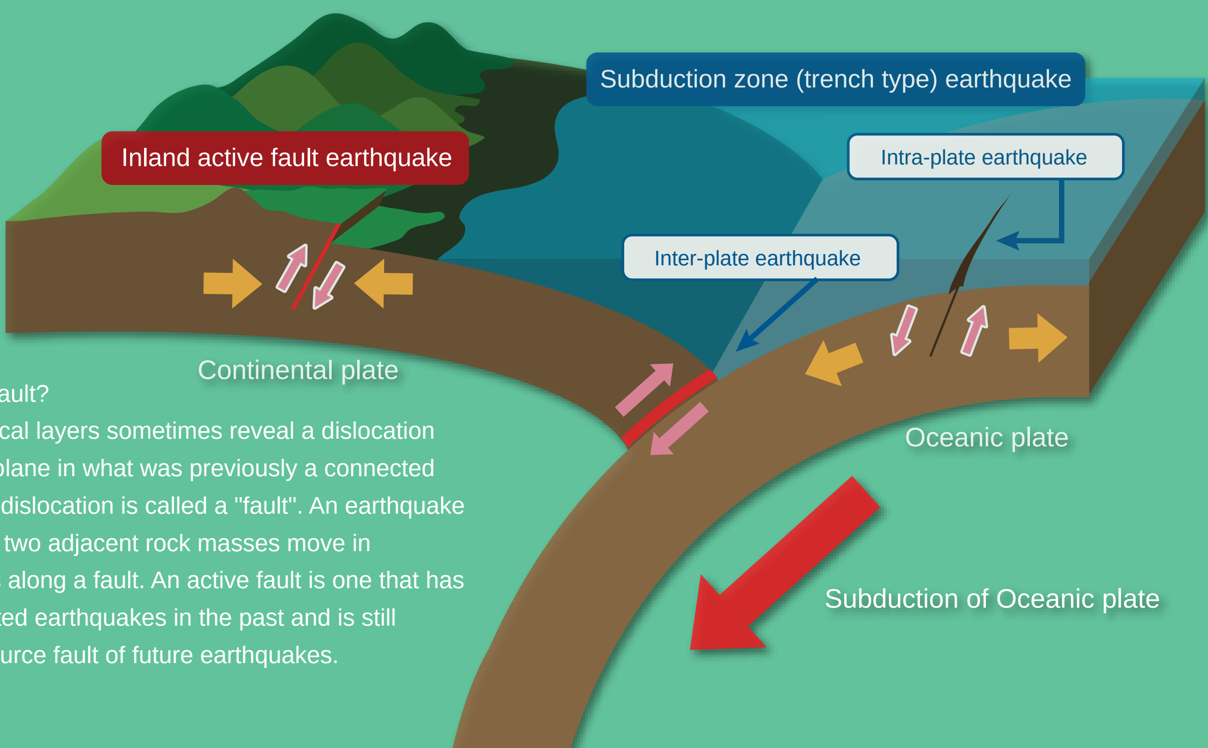
The surface of the earth is covered with more than a dozen huge plates (plate-like masses of rock) which move in different directions at a speed of several centimeters per year (plate motion). Tremendous forces are applied by plate motion to the underground rock masses near the plate boundaries. A vast amount of energy (strain) builds up inside the rock masses and stress is accumulated. If a rock mass fractures, an earthquake occurs.

Four plates collide in the vicinity of Japan, and the large strain energy accumulated causes many earthquakes.

The plates surrounding Japan



Types of earthquakes that occur in and around Japan



* What is an active fault?
Surveys of geological layers sometimes reveal a dislocation along a particular plane in what was previously a connected layer. This kind of dislocation is called a "fault". An earthquake is generated when two adjacent rock masses move in opposite directions along a fault. An active fault is one that has repeatedly generated earthquakes in the past and is still deemed to be a source fault of future earthquakes.

Past major earthquakes that caused great damage

Subduction zone earthquakes can generate tsunamis resulting in loss of lives and damage to buildings. Meanwhile, inland active fault earthquakes not only damage buildings but can also generate landslides when strong seismic waves strike hilly terrain. The above are just a few examples of earthquake damage. Both subduction zone earthquakes and inland active fault earthquakes actually inflict various forms of damage.

Japan has suffered huge damage in such events as the Kanto Earthquake in 1923, Hyogo-Ken-nanbu Earthquake in 1995 and the Off the Pacific Coast of Tohoku Earthquake in 2011.

Looking at all the earthquakes in Japan that inflicted major damage over the past 200 years, the average recurrence interval is 20 years for subduction zone earthquakes and 10 years for inland active fault earthquakes.

Photo provided by Kyodo News Service

The Kanto Earthquake

The Great Kanto Earthquake (subduction zone earthquake)
September 1, 1923. Magnitude 7.9

Killed or missing
Over 105,000

This massive earthquake struck the modernized capital and many people lost their lives in the fires that followed the earthquake. In remembrance, September 1st has been designated Disaster Preparedness Day and disaster drills are carried out throughout Japan.

Photo provided by Kobe City, Hyogo Pref.

Hyogo-Ken-nanbu Earthquake

The Great Hanshin-Awaji Earthquake Disaster (active fault earthquake)
January 17, 1995. Magnitude 7.3

Killed or missing
6,437

This earthquake struck a densely populated major city. Many people lost their lives when buildings collapsed due to the shaking, and infrastructure such as roads and railways was also badly damaged. It underlined the importance of municipal disaster prevention and mitigation strategies, as well as "self-help" and "cooperation".

Photo provided by Miyako City, Iwate Pref.

The Off the Pacific Coast of Tohoku Earthquake

The Great East Japan Earthquake (subduction zone earthquake)
March 11, 2011. Magnitude 9.0

Killed or missing
22,010
As of March 2016

This was the Japan's biggest ever recorded earthquake. Many lives were lost, particularly in the tsunami. It reminded us of the importance of preparations for tsunamis and for extensive, serious damage. Measures are currently being advanced.

* "Magnitude" indicates the size of the earthquake itself.
* The Japan Meteorological Agency names the phenomenon that caused a disaster. Different names are used according to whether the earthquake (phenomenon) or the disaster is being specified. For example, the disaster caused by what the Japan Meteorological Agency named Hyogo-Ken-nanbu Earthquake, 1995 is designated by the government as the Great Hanshin-Awaji Earthquake Disaster, and the disaster caused by the 2011 off the Pacific Coast of Tohoku Earthquake as the Great East Japan Earthquake.
This pamphlet uses the names given by the Japan Meteorological Agency.

How to prepare for strong shakes

Earthquake damage to buildings

Collapsed wooden house
(The Mid Niigata prefecture Earthquake in 2004)
(Photo provided by Niigata Pref.)

Damage inside a store
(The Noto Hanto Earthquake in 2007)
(Photo provided by the Hokkoku Shimbun)

Damaged Uto city hall
(The 2016 Kumamoto Earthquake)
(Photo provided by the Japan Meteorological Agency)

Strong shaking occurs when an earthquake strikes.
Surveys of recent major earthquakes show that strong shaking caused extensive damage, including collapsed wooden houses, damaged city hall, overturned furniture and scattered broken glass.

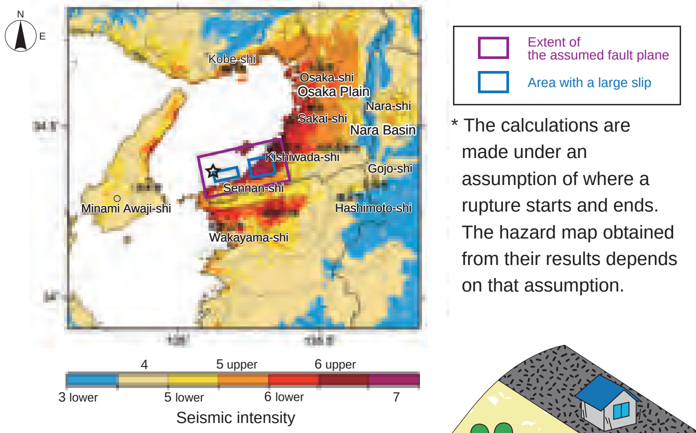
Which places are likely to shake?

The figure on the right shows the estimated level of shaking in surrounding areas if an earthquake occurred on a fault in South Osaka.

When an earthquake occurs, the slip on the fault plane is not uniform; even within the same fault, some parts slip greatly and some not very much. The area within the large rectangle is the hypothesized extent of the fault, and the two small rectangles enclose the parts of the fault that would slip greatly. You will see from the diagram that the vicinity of the inner rectangles (areas with big slip) would experience particularly strong shaking in comparison with the surrounding areas.

The calculations also show that if the fault started to slip in the starred location, the slip would spread eastward, intensifying the shaking on the east side of the fault.

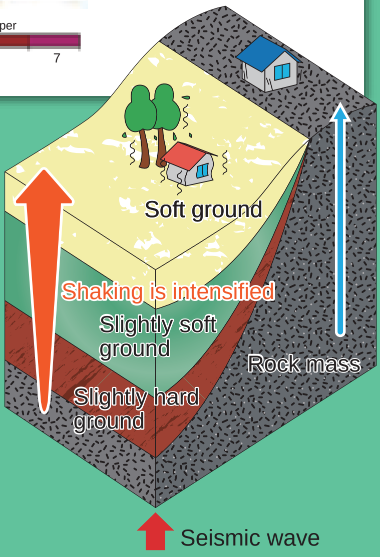
Probablistic seismic hazard map for a hypothetical earthquake source fault *



* The calculations are made under an assumption of where a rupture starts and ends. The hazard map obtained from their results depends on that assumption.

There would be strong shaking on the Osaka Plain, with its thick layer of soft ground, and around the Nara Basin. The low-lying riverside area around Wakayama is also more prone to shaking than surrounding areas.

The ground has a big influence on the intensity of the shaking in an earthquake. For example, it is known to become more intense when seismic waves are transmitted from a hard rock mass to a soft soil, as in the figure on the right.



The intensity of the shaking can be hugely magnified depending on the quality of the ground, making damage to buildings more likely. Remember that old wooden houses have low earthquake resistance and tend to be in greater danger of collapse.

What is an “earthquake early warning”?

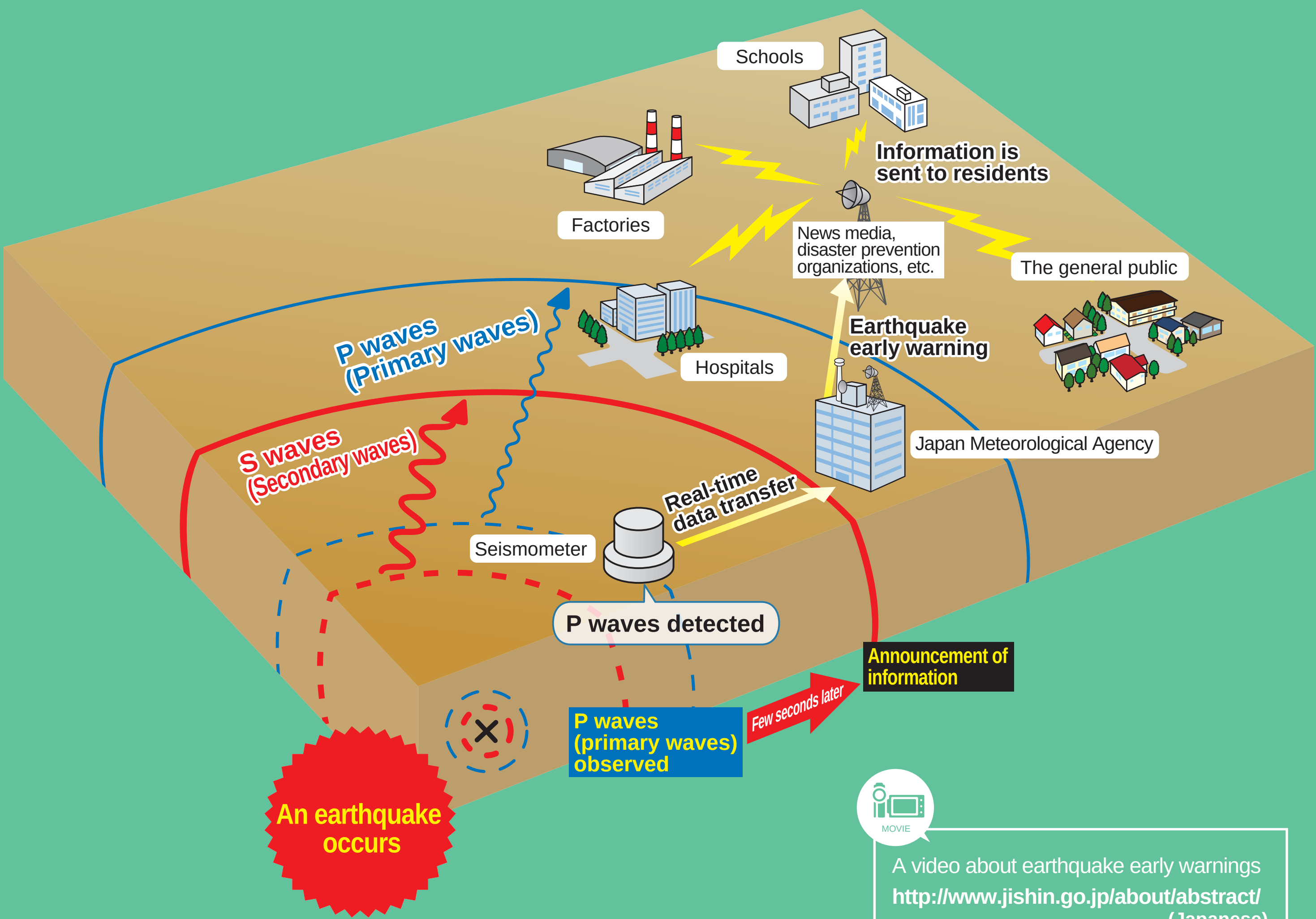
Seismic waves are detected in the ground by seismometers and a warning issued before the strong shaking starts.

You have probably seen earthquake early warnings on your TV or mobile phone.

They notify us as swiftly as possible of the estimated seismic intensity before the strong shaking of the earthquake arrives.

When an earthquake occurs, the shaking is transmitted as waves (seismic waves). Seismic waves have P waves (primary waves) and S waves (secondary waves), and damage due to earthquake shaking is mainly caused by the S waves. P waves are transmitted more quickly than S waves.

Earthquake early warnings exploit this characteristic. The P waves are swiftly detected by the nearby seismometers to the hypocenter and warn us of the imminent danger of strong shaking before the S waves arrive.

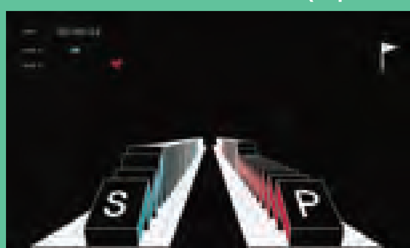


Earthquake early warnings enable us to take measures to protect ourselves in the short space of time before the seismic waves arrive, for example by stopping elevators at the nearest floor, slowing down trains, ensuring the safety of hospital patients and activating machine control in places such as factories.

Technological developments by the Railway Technical Research Institute, the Japan Meteorological Agency and the National Research Institute for Earth Science and Disaster Resilience make earthquake early warnings possible.

MOVIE

A video about earthquake early warnings
http://www.jishin.go.jp/about/abstract/
(Japanese)



Video: The Headquarters for Earthquake Research Promotion

What is "long-period ground motion"?

It is ground motion with a period of between several seconds and more than a dozen seconds. ("Period" means the duration of one shake back and forth.) It can travel to places very distant from the hypocenter.

Each building has a period at which it is particularly susceptible to shake. "Resonance" occurs when this period and the ground motion period match, and the building shakes wildly. Wooden houses tend to be susceptible to shake if the period is 1 second or less, and skyscrapers of 60-70 stories if the period is 6-7seconds.

**A building has its own natural period when it is particularly susceptible to shake.
If seismic waves occur near that period, the building shakes wildly. This phenomenon is called "resonance".**

Damage to skyscrapers and oil tanks from long-period ground motion

The Off the Pacific Coast of Tohoku Earthquake led to prolonged wild shaking of skyscrapers in Tokyo and Osaka that made it hard for the people in them to remain on their feet.

Elevators stopped and some ceiling boards fell down in skyscrapers in Osaka, hundreds of kilometers away from the hypocenter. It was long-period ground motion that shook those buildings.

In the Tokachi-oki Earthquake in 2003, long-period ground motion made the floating roofs of oil tanks in Tomakomai shake wildly and sink, leading to static electricity-induced fires two days after the earthquake. Long-period ground motion thus presents a new disaster prevention challenge.

Oil tank fire in Tomakomai
(Photo provided by the Fire and Disaster Management Agency)

Earthquake Disaster Mitigation

Research

Experiments Using E-Defense

Verification of the Impacts of Earthquake Shaking on Buildings

National Research Institute for Earth Science and Disaster Resilience (NIED) has a 3-D full-scale earthquake testing facility called "E-Defense" in Miki City, Hyogo Prefecture.

At E-Defense, a full-scale building is placed on the world's largest 3-D shaking table of 20m x 15m and subjected to a shaking of large earthquake (seismic intensity 7 class), like the one which caused the Great Hanshin-Awaji Earthquake, etc. From this shaking test, the process of damage to the building itself, its interior and facilities can be observed in detail.

For example, two wooden houses, one with seismic reinforcement and one without, were shaken simultaneously, and the effect of seismic reinforcement was verified from the collapse condition of the house without seismic reinforcement.

An experiment on the shaking-induced destruction of wooden houses with and without reinforcement

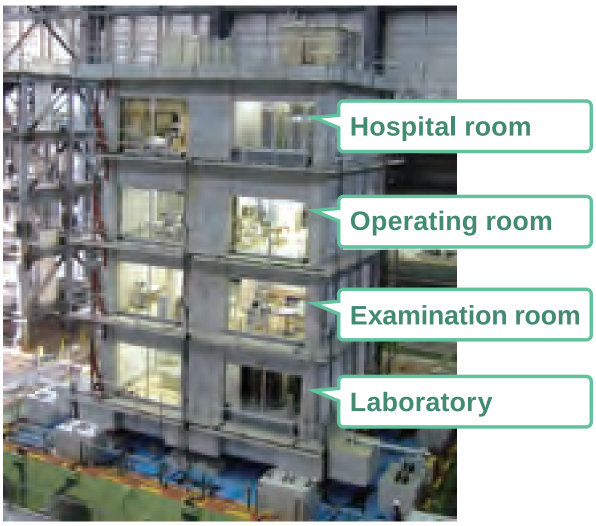
Experiment on the destruction of wooden houses with and without seismic strengthening

http://www.bosai.go.jp/hyogo/research/movie/movie-detail.html#2 (Japanese)

Video: E-Defense, the National Research Institute for Earth Science and Disaster Resilience

From the viewpoint of protecting not only the strength of building itself but also our lives and livelihoods and socio-economic activities within it, we conduct shaking tests at E-Defense to evaluate the functional retention capacity of buildings that serve as headquarters for disaster countermeasures and should be protected in the event of an earthquake. For example, to verify the ability of a hospital to maintain its functional retention capacity in the event of large earthquake, we conducted a shaking test of a seismic-isolated structure building that faithfully reproduces the functions of a hospital by setting up rooms equipped with real facilities and equipment, such as patient rooms, operating rooms, and staff stations, inside the hospital building. Although the seismic-isolated structure of the hospital significantly reduced seismic forces, it became clear that seismic countermeasures for indoor facilities and equipment indispensable for medical activities are also important for the continuation of hospital functions during a large earthquake.

Test structure



Inside the hospital with seismic isolation (Castor free beds moved significantly)

Experiment to preserve the function of important facility (hospital)

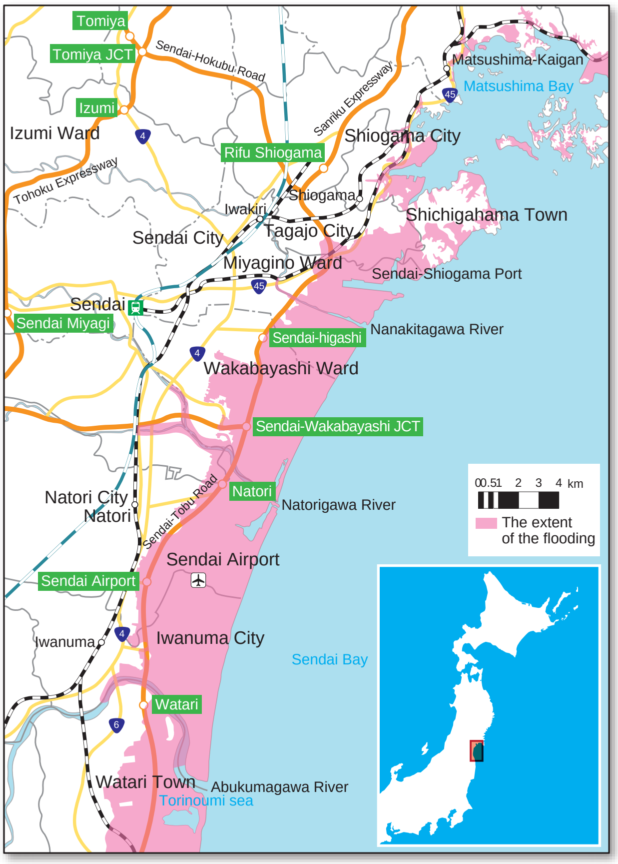
https://www.bosai.go.jp/hyogo/research/movie/movie-detail.html#20 (Japanese)

Video: E-Defense, the National Research Institute for Earth Science and Disaster Resilience

What is a tsunami?

A tsunami hit the Pacific coast of East Japan

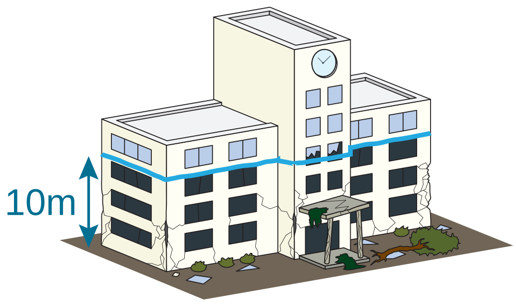
A tsunami was recorded on the Pacific coast of the Tohoku region and other coastlines throughout Japan due to the 2011 off the Pacific Coast of Tohoku Earthquake. It flooded huge swathes of land as far as several kilometers inland all along the Pacific coast of East Japan and caused immense damage.



The extent of the flooding in part of Miyagi Pref.
The Geospatial Information Authority of Japan 1: 100,000 scale flooding map

Photo provided by Miyako City, Iwate Pref.

Photo provided by the Iwate General Construction Association



Traces still remain of the more than 10-meter high tsunami (higher than the third floor of a school) which hit a 530 km stretch of the Tohoku region's Pacific coastline in the Off the Pacific Coast of Tohoku Earthquake.

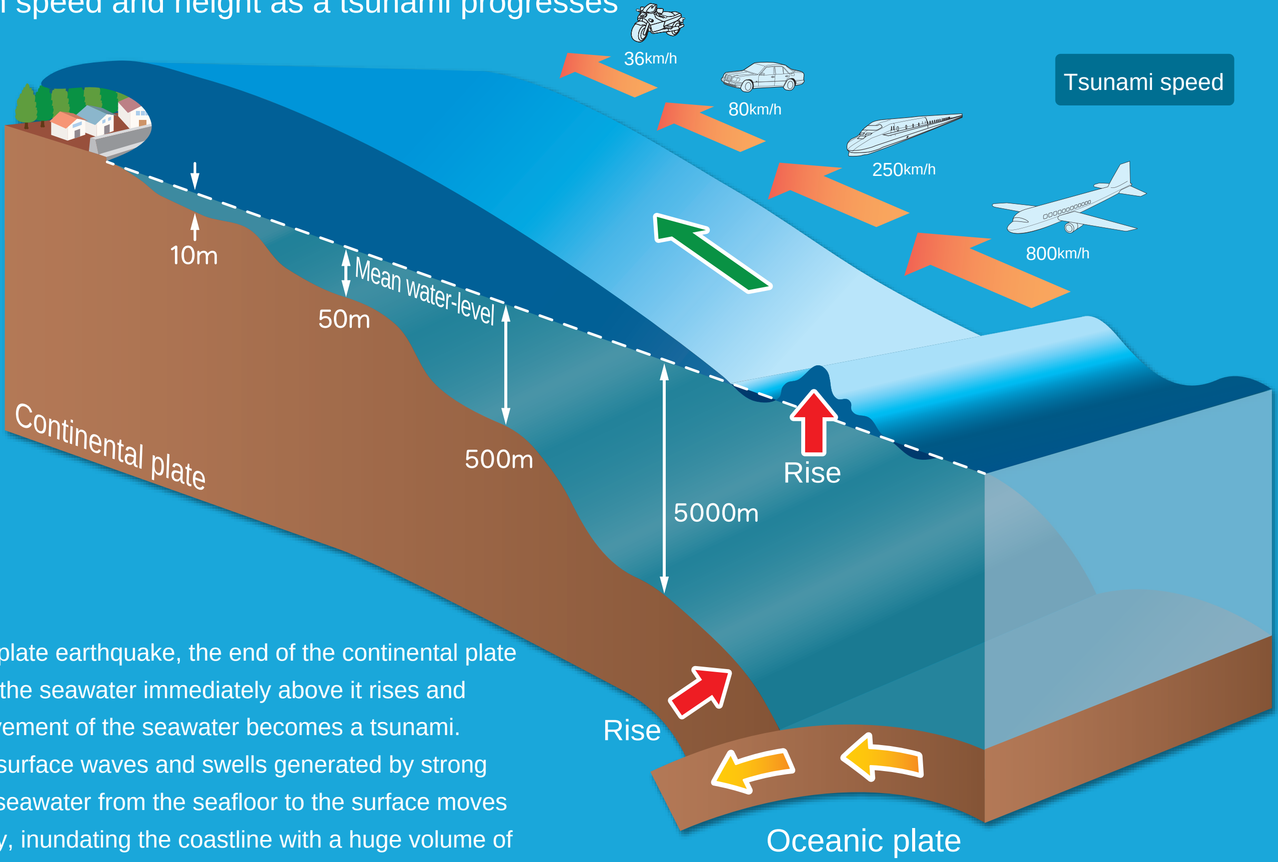
That is not the only earthquake to cause tsunami damage in Japan.

The 1993 Southwest off Hokkaido Earthquake devastated Okushiri Island. The tsunami struck 2 to 3 minutes after the earthquake.

The Japan Sea coast and Pacific coast of West Japan have also experienced great damage from tsunamis. Also, in 1960 a tsunami generated by an earthquake in Chile hit Japan roughly one day later and caused great damage. (See P. 12)

Coastlines throughout Japan are thus in danger of tsunamis, which in some cases can strike within minutes.

Changes in speed and height as a tsunami progresses



In an inter-plate earthquake, the end of the continental plate jumps up and the seawater immediately above it rises and falls. This movement of the seawater becomes a tsunami.

Unlike the surface waves and swells generated by strong winds, all the seawater from the seafloor to the surface moves simultaneously, inundating the coastline with a huge volume of water and causing great damage.

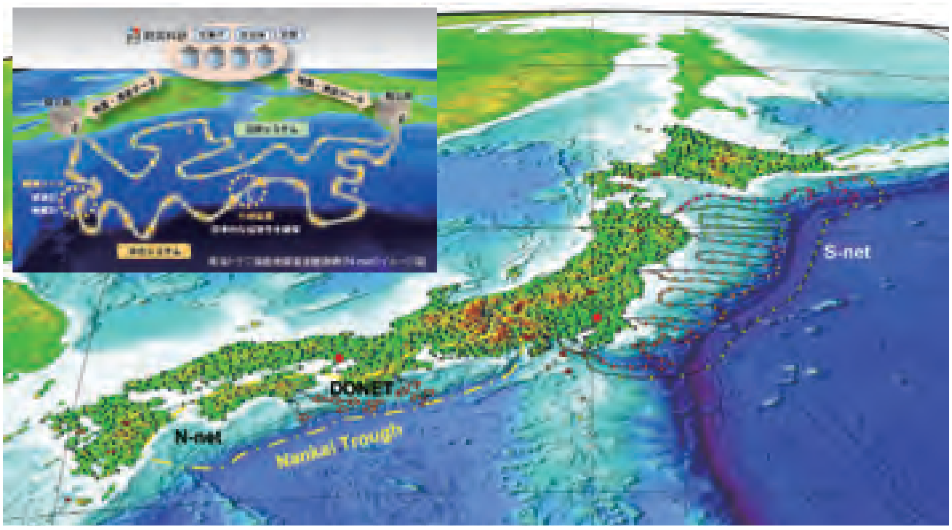
Research Introduction

Aiming for the Early Detection and Information Transmission of Earthquakes and Tsunamis

Large-scale earthquakes often occur in the ocean around the Japanese archipelago, and the seismic waves from an earthquake can last from a few seconds to several tens of seconds, while a tsunami can reach the shore a few minutes. Therefore, it is important to quickly and accurately detect the occurrence of earthquakes and tsunamis, and to promptly convey this information to disaster response agencies and other organizations. National Research Institute for Earth Science and Disaster Resilience (NIED) is operating the Seafloor observation network for earthquakes and tsunamis along the Japan Trench (S-net), which consists of 150 seismographs and water pressure gauges (for tsunami observation) for real-time observation using ocean bottom cables in the sea area from off the coast of Hokkaido to Boso Peninsula in Chiba Prefecture, mainly where the 2011 off the Pacific Coast of Tohoku Earthquake occurred.

In addition, in order to prepare for the Nankai Trough earthquake, which is considered to be highly likely to cause a mega-earthquake, NIED is operating the "DONET (Dense Oceanfloor Network system for Earthquakes and Tsunamis)" off the Kii Peninsula, etc. In addition, since 2019, NIED is also developing and maintaining the "Nankai Trough Seafloor Observation Network for Earthquakes and Tsunamis (N-net)" in the Hyuga-nada, from off Kochi Prefecture to off Miyazaki Prefecture, which is west of the expected seismic source region of the Nankai Trough Earthquake.

Data obtained at these seafloor observation stations are also sent in real time to the Japan Meteorological Agency (JMA) for use in issuing earth-quake early warning and tsunami information.



What are the characteristics of a tsunami?

They rush ashore with the speed of an Olympic sprinter

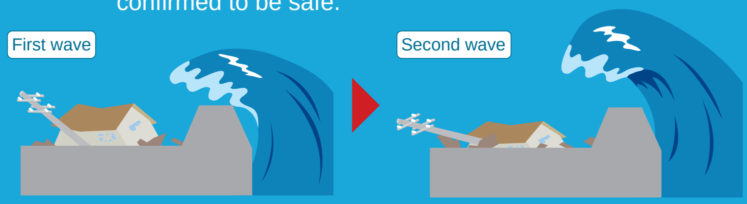
When a tsunami hits the shoreline, it maintains its height and destructive power as it moves inland. It also races upstream in rivers.

Offshore, tsunamis move at the speed of a jet plane. Their speed decreases as they near the shoreline but they rush ashore with the speed of an Olympic sprinter so the average person cannot outrun them.

You must start to evacuate before you see the tsunami heading towards the shore.

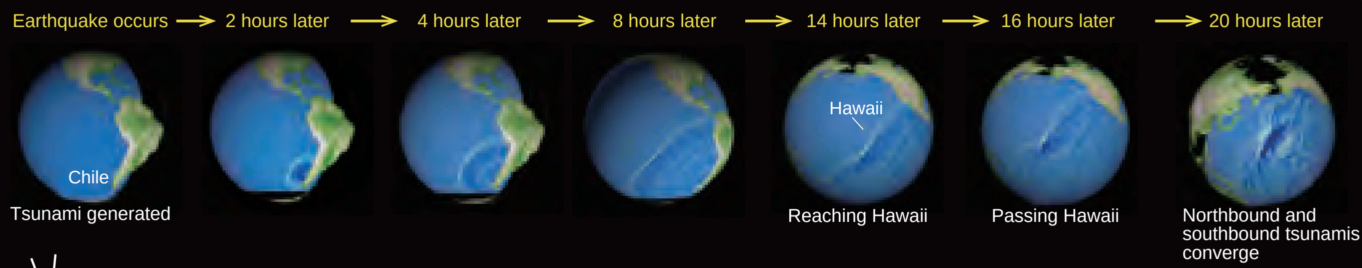
A tsunami is a series of waves

A tsunami strikes in a series of waves. Sometimes the second or succeeding waves are the biggest, not the first one to strike. Vigilance is needed until the tsunami warning has been lifted and the area is confirmed to be safe.



Seawaters do not always recede before a tsunami

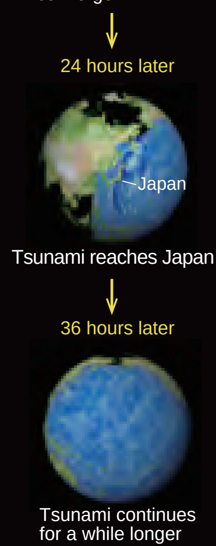
Depending on how the earthquake occurred, sometimes a huge wave strikes suddenly. Seawaters did not recede before a huge wave struck in the case of the tsunami after the Tokachi-oki Earthquake in 2003, and the tsunami generated by the 2004 earthquake off Sumatra Island, Indonesia that struck the coastlines of Sri Lanka and India.



Tsunamis can cross the Pacific?

At just after 04:00 (JST) on May 23, 1960 a Magnitude 9.5 earthquake, the biggest ever recorded, occurred in Southern Chile.

The huge tsunami this generated crossed the Pacific at an average speed of 750 km/h and arrived at the opposite Japanese shoreline 22.5 hours later at around 03:00 on May 24. It reached as 8 m in places along the Sanriku coast and caused immense damage, nationwide leaving 142 people dead or missing, around 1,500 homes destroyed and around 2,000 homes badly damaged. Damage was caused in almost every area along the Pacific coast, from Hokkaido to Okinawa.

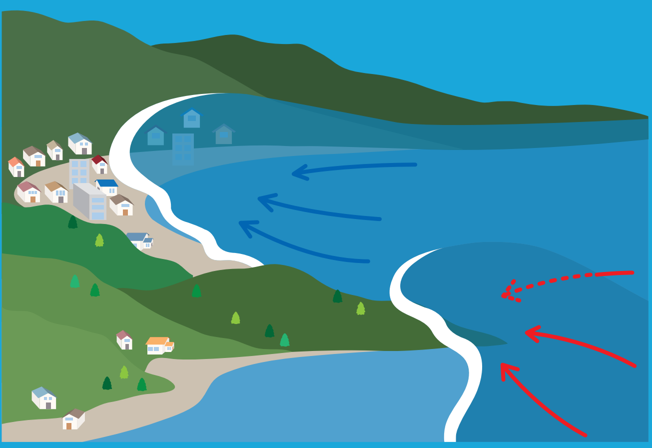


Source: "Report of the Committee for Technical Investigation on Countermeasures for Earthquakes and Tsunamis Based on the Lessons Learned from the Past Disasters - Tsunami of Chilean Earthquake, 1960" (The Cabinet Office)

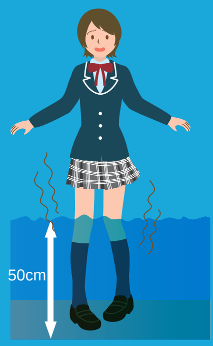
Waves converge at places such as cape tips and inside V-shaped bays

Tsunami height is greatly influenced by coastal terrain.

Particular caution is required at places where waves converge, such as cape tips and inside V-shaped bays.



Even a 50-cm tsunami is dangerous

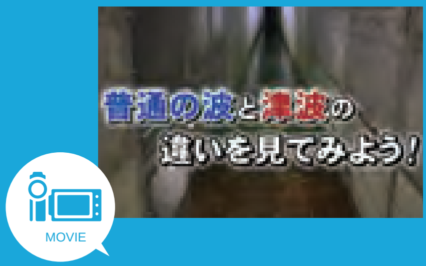


A tsunami surges with tremendous force and adults are sometimes washed away by a 30-cm one. It is impossible to stay on your feet in a 50-cm tsunami.

Even if there is no strong shaking, seek a safe place from tsunamis if you feel a jolt that is long in duration

There have been cases where very big tsunamis have come ashore even though no particularly strong shaking was felt. Such earthquakes are known as "tsunami earthquakes".

A famous example of a Japanese tsunami earthquake is the Meiji Sanriku Earthquake in 1896, which claimed 21,959 victims. Although the shaking on the Pacific coastline is estimated to have been around Intensity 4, the Sanriku coast was hit by the second biggest tsunami in modern times, surpassed only by the one in the Off the Pacific Coast of Tohoku Earthquake.



Video of a tsunami experiment (Approx. 1 min.)

This experiment shows an artificially generated tsunami. It demonstrates the difference between waves and tsunamis, and also the force of a tsunami.

http://www.jma.go.jp/jma/kishou/books/tsunami_dvd/index.html (Japanese)

Video : The National Institute of Maritime, Port and Aviation Technology Port and Airport Research Institute

What to do if a tsunami occurs!

1. If you feel a strong ground motion, or a jolt that is not that strong but is long in duration, immediately leave the shoreline and hurry to high ground.
2. If a tsunami warning is issued, leave the shoreline and evacuate to a safe place even if you did not feel an earthquake.
3. Get accurate information from sources such as radio, TV, loudspeaker announcements, mobile phones and smartphones*
4. During a tsunami advisory, refrain from sea bathing or seashore fishing.
5. A tsunami strikes in a series of waves. The first wave is not always the biggest and may be followed by bigger ones, so remain vigilant while a tsunami warning or advisory is in place.

*You can get reliable information on a mobile or smartphone from the Japan Meteorological Agency website.
http://www.jma.go.jp/jma/indexe.html

What is liquefaction?

Building collapse due to liquefaction
(Niigata Earthquake, 1964)
(Photo provided by Toda Corporation)

Manhole pushed up by liquefaction
(Hyogo-Ken-nanbu Earthquake, 1995)
(Photo provided by Takashi Tanikawa, Saitama University)

Gushed sand
(The 2011 off the Pacific Coast of Tohoku Earthquake)
(Photo provided by Tomioka Estate Home Management Association, Urayasu City, Chiba Pref.)

Liquefaction is a phenomenon where, due to the shaking of an earthquake, weak ground such as reclaimed land becomes like liquid. Liquefaction causes water-logged soil and water to erupt to the surface, sometimes damaging essential utilities or tilting buildings.

Liquefaction became widely-known after causing such damage as the collapse of a 4-storey reinforced concrete building at the time of Niigata Earthquake, 1964.

In recent years, large-scale liquefaction has occurred in areas such as reclaimed land, damaging buildings and roads, in the cases of both the 1995 Hyogoken-nanbu Earthquake and the 2011 Off the Pacific Coast of Tohoku Earthquake.

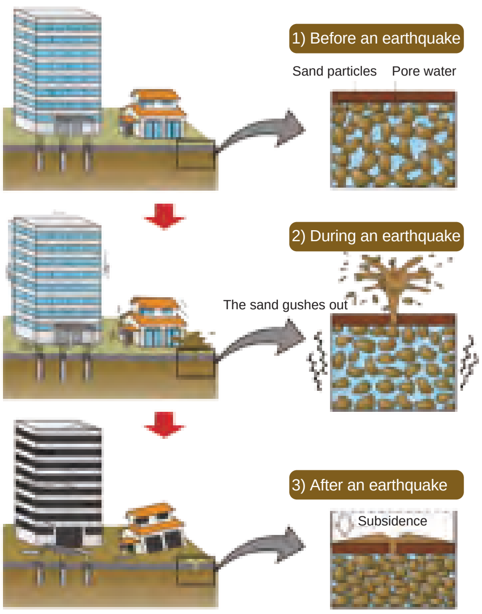
Why is ground such as reclaimed land vulnerable to liquefaction?

Soil on low land or reclaimed land contains a lot of water (pore water). In soil such as this, sand particles are holding each other together. With their water-filled pores, they stay stable.

When a strong shake is applied by an earthquake, this system is destroyed. When this happens, the water pressure between the sand particles increases. This turns the ground into a muddy, water-like state. The muddy water tries to support the load from above. However, if there are fissures or weak parts in the ground surface, the water becomes unable to support the load. This causes muddy water to erupt to the surface.

Liquefaction can cause various types of damage. In addition to ground subsidence, it can cause underground tanks or manholes to float, and buildings and other structures to lean or collapse.

The liquefaction process



Check which areas are vulnerable to liquefaction!

In the Off the Pacific Coast of Tohoku Earthquake, buildings were damaged by liquefaction not only on coastal reclaimed land but also inland on riverside land reclaimed from ponds and rice fields. A grasp of a plot of land's history is essential to know about any potential for liquefaction. That is shown in topographic and land condition maps drawn up by the Geospatial Information Authority of Japan, so please check the conditions of the area you live in.

You can check which municipalities have liquefaction hazard maps on the Ministry of Land, Infrastructure and Transport and Tourism's hazard map portal site*.

* http://disaportal.gsi.go.jp/ (Japanese)

What are earthquake-induced fires?

Earthquake-induced fires break out simultaneously in many locations. They then tend to spread due to a combination of factors such as fire engines being unable to use roads that have been damaged or blocked by fallen buildings, and fire hydrants and water pipes being broken.

Most of the fires are caused by the shaking, and start simultaneously within a short time of the earthquake. The more collapsed buildings there are, the further the fires spread. In the case of the Kanto Earthquake in 1923, the earthquake occurred while people were using open flames to prepare lunch, so there was extensive fire damage.

Fires can also be caused by devices such as electric stoves, aquarium heaters and incandescent light bulbs, or by sparks from severed or damaged electrical cords, when the power is restored.

Fires were started by the shaking in the Off the Pacific Coast of Tohoku Earthquake, just as they had been in the Hyogo-Ken-nanbu Earthquake. There were also tsunami-generated fires which were then spread by the drifting of burning objects.

Conflagration caused by Hyogo-Ken-nanbu Earthquake, 1995
(Photo provided by Hito-Machi-Nagata Earthquake Library, Kobe City)

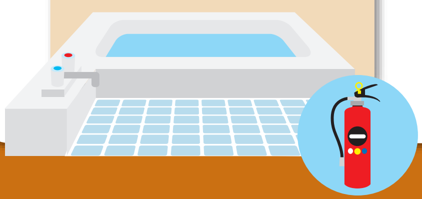
Conflagration caused by the 2011 Off the Pacific Coast of Tohoku Earthquake
(Photo provided by Yamada Town, Iwate Pref.)

Prepare against fire!

Prepare to fight a fire

Keep a fire extinguisher within easy reach and the bathtub filled. (Never leave a child unattended in the bathroom.)

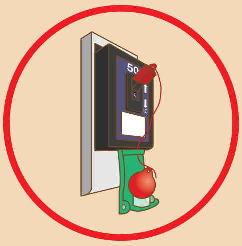
If an earthquake occurs while you are using open flames, move away from the flames and then calmly extinguish them when the shaking stops. If a fire starts, stay calm and put it out.



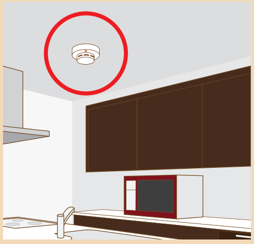
Precautions against fire

1. Unplug electrical devices that are not in use.

2. Install circuit breakers or outlets with a seismic shut-off function to prevent gas or electric fires.



3. Install fire alarms in your home to detect fires quickly.



How to protect yourself from earthquake-induced

Sediment disasters can isolate communities and create landslide dams

Landslides can occur when strong ground motion generated by a large-scale earthquake strikes hilly terrain. Earthquake-induced landslides are characterized by their large scale.

Caution is required since unstable slopes may crumble when aftershocks occur.

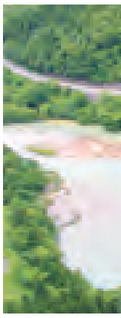
In addition, there may be more extensive damage when slopes weakened by earthquakes later collapse due to rainwater or snowmelt.

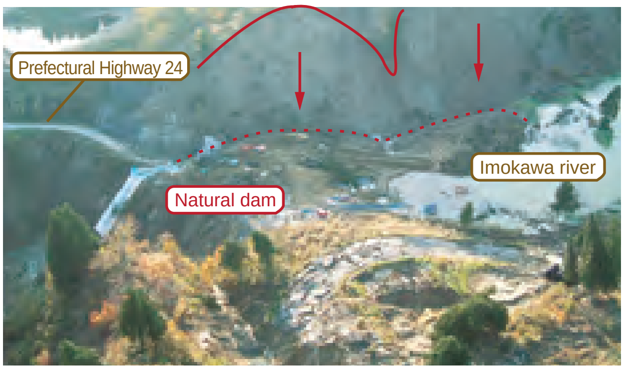
The 2004 Niigata Prefecture Chuetsu Earthquake led to many communities being isolated when roads to the outside world were cut off by the frequent landslides.

The collapsed soil also blocked rivers and streams, creating many natural (landslide) dams. Some communities were flooded, while those downstream were at an increased risk of a debris flow disaster if the dam burst.

Even in cities there are many places where there is a danger of landslides, so caution is required.

Landslide caused by Nagano-Ken-Seibu Earthquake, 1984
(Photo provided by Kajima Corporation)





The Mid Niigata prefecture Earthquake in 2004
Terano District (formerly Yamakoshi Village), Nagaoka City
Natural dam on the Imokawa river right bank
(Photo provided by Ministry of Land, Infrastructure, Transport and Tourism Hokuriku Regional Development Bureau)

How to protect yourself from earthquake-induced landslides:

Earthquakes weaken the soil deep into the ground, so there is a danger of landslides from aftershocks or even a little rain,

POINT 1 Check whether you live in a "sediment-related disaster hazard area".

Areas where there is a risk of landslides are called "sediment-related disaster hazard area". Check on the Ministry of Land, Infrastructure, Transport and Tourism Erosion and Sediment Control Department's website* whether your home is located in such a zone. Please contact your local municipality for further details.

Earthquakes in mountainous areas can lead to communities being cut off by damaged roads, causing problems with evacuation, rescue work and daily life after the disaster.

You need to consider the likelihood of being cut off and the safety of local roads.

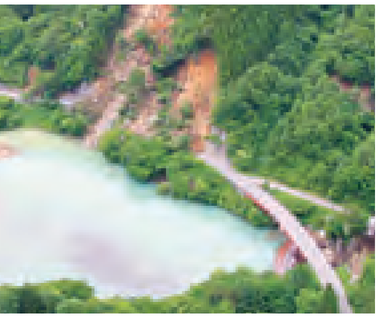
* http://www.mlit.go.jp/river/sabo/link_dosya_kiken.html (Japanese)

POINT 2 Evacuate swiftly if you notice that precede a landslide

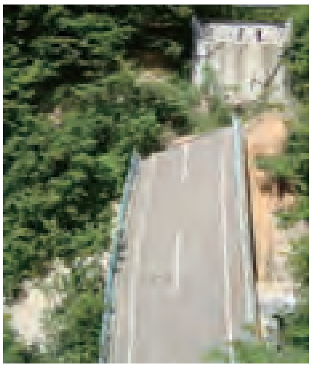
If you notice phenomena such as fissured ground, falling stones or rumbling in the ground, inform any other people nearby and swiftly evacuate to a place of safety.

Many landslides occur with no such preceding phenomena, so their absence does not mean that there is no danger.

landslides



Landslide caused by the Iwate-Miyagi Nairiku Earthquake in 2008 (Photo provided by South Wide-area Development Bureaus, Iwate Pref.)



Collapsed Matsurube Ohashi Bridge due to large-scale slope failure caused by the Iwate-Miyagi Nairiku Earthquake (Photo provided by South Wide-area Development Bureaus, Iwate Pref.)

Research Introduction

Storm, Flood, and Landslide

Experiments Using Large-scale Rainfall Simulator

Mitigation Measures of Landslide Disasters

When rain falls on slopes destabilized by earthquakes, the risk of landslides (slope failure) increases. At the Large-scale Rainfall Simulator of National Research Institute for Earth Science and Disaster Resilience, located in Tsukuba City, Ibaraki Prefecture, experiments and research are being conducted to mitigate landslide disasters during rainfall.

The Large-scale Rainfall Simulator has the world's largest rainfall area and rainfall capacity, which can reproduce rainfall from drizzle to torrential rains. Experiments using model slopes with the same conditions as the real thing are conducted in collaboration with universities, research institutes, and companies.

Specifically, slope collapse experiment is conducted using the same type of soil as decomposed granite soil “Masado” (which is susceptible to erosion by typhoons and heavy rain) widely distributed in western Japan to elucidate the collapse mechanism and conduct collapse prediction research using IoT sensors. In collaboration with a company, a disaster mitigation technology is developed to assess the surrounding risks by installing real-size utility poles with vibration-capturing sensors inside the experimental facility and identifying the vibrations that cause sediment to flow down the slope from among all the vibrations that occur during rainfall.

3 main points

POINT 1 POINT 2 POINT 3

not just on days with heavy rainfall.

phenomena

POINT 3 Be alert when it rains after an earthquake

Slopes may have been destabilized by an earthquake, so be particularly vigilant when it rains.

If a sediment disaster alert* has been issued for your area, go to an evacuation center or other safe place as quickly as possible.

People in an area at high risk of landslides should evacuate at an early stage, even if an alert is not issued.

If you cannot go to an evacuation center, take refuge in a safer room in your house, such as one upstairs or on the opposite side to the slope.

* http://www.jma.go.jp/jp/dosha/ (Japanese)

What you can do to prepare against earthquakes

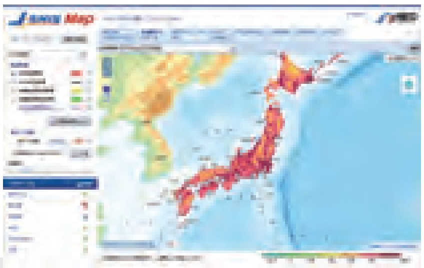
Check on your smartphone

The probabilistic seismic hazard maps mentioned on P2 can also be seen on the J-SHIS Map website. The smartphone app enables you to set the map display to your current location with GPS and see data such as the “probability of ground motions equal to or larger than seismic intensity of 6 lower, occurring within 30 years”.

Go to the J-SHIS Map website and enter your address in the "Place name" box. The map will show the probability of ground motions equal to or larger than seismic intensity of 6 lower, occurring within 30 years where you live.

The iPhone app "Moshi Yure" does a simulation of possible damage if a major earthquake hits your current location.

So, how was it?



Probabilistic Seismic Hazard Map for Japan on the J-SHIS Map website

Check for earthquake and subsoil info

The National Research Institute for Earth Science and Disaster Resilience

- For the J-SHIS Map website
  http://www.j-shis.bosai.go.jp/en/
- For the official J-SHIS smartphone app
  http://www.j-shis.bosai.go.jp/app-jshis (Japanese)

“Moshi Yure” simulation screenshots

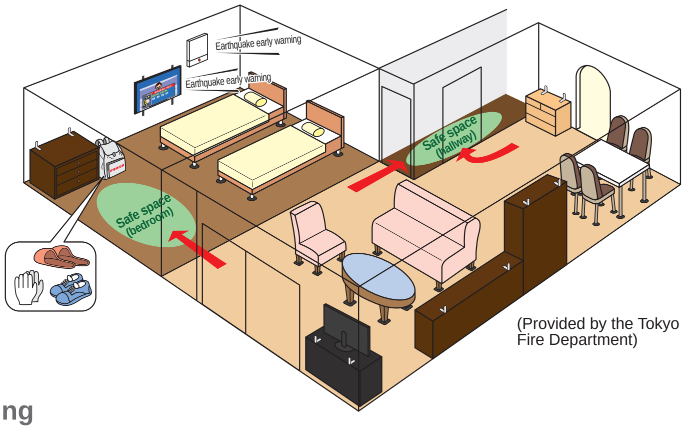
A simulation of seismic damage in your current location

The National Research Institute for Earth Science and Disaster Resilience

- For “Moshi Yure”
  http://www.j-shis.bosai.go.jp/app-ifearthquake (Japanese)

How to ensure your safety at home

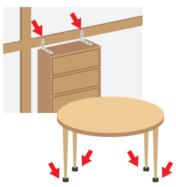
According to a survey by the Tokyo Fire Department, roughly 30-50% of injuries in recent earthquakes have been due to falling or shifting furniture. The danger is not just of being directly hit by furniture. People have been injured by tripping over fallen furniture or treading on broken glass or crockery, and it can also block their escape route.



(Provided by the Tokyo Fire Department)

How to keep furniture from falling or moving

Tips



- Secure furniture in place.
- Take measures to keep cupboard and window glass from shattering and scattering.
- Store heavy articles lower down in bookshelves and cabinets.
- Do not place dangerous articles high up on shelves or cupboards.
- Take measures so that glass objects (bottles etc.) do not fall over or roll out of store cupboards.

Create safe spaces at home

- Create uncluttered safe spaces in your home
- If you see or hear an earthquake early warning, take refuge in your safe space and crouch down low.

  Visit the Japan Meteorological Agency website for explanations on what to do in the event of an earthquake early warning.
  http://www.jma.go.jp/jma/en/Activities/eew.html

Examples of safe spaces

- Bedroom, home hallway, communal hallway, elevator lobby etc.

The nerve center of Japan's earthquake research

The five missions of the Headquarters for Earthquake Research Promotion!

The Headquarters for Earthquake Research Promotion was established by the government after the 1995 Great Hanshin-Awaji Earthquake Disaster to promote research of earthquakes in order to strengthen earthquake disaster prevention measures and reduce earthquake damage.
These are its five missions.

Mission 1

To determine policies for earthquake research initiatives nationwide

As an earthquake-prone country, Japan has installed many observation networks, accumulated a wealth of expertise in seismic activities and made great progress in earthquake surveys and research.

However, earthquakes are complex phenomena and many questions remain unanswered.

The Headquarters for Earthquake Research Promotion indicates research policy and promotes measures to reduce earthquake damage.

Mission 2

To coordinate the national budget for earthquake research

It compiles and coordinates the national budget for earthquake research.

The Headquarters for Earthquake Research Promotion ensures that all earthquake-related surveys and research at government organizations and universities accord with its policies, and that the various initiatives do not overlap.

Mission 3

To produce roadmaps for earthquake-related survey and observation

It plans how to proceed with the surveys and observations needed for helpful disaster prevention research.

Based on its plans, government organizations and universities collaborate in setting up facilities to observe earthquakes nationwide and carrying out various surveys.

Mission 4

To get a clear picture of seismic activity based on research and observation results, and study outcomes

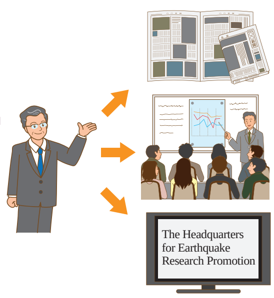
The “Earthquake Research Committee” holds monthly meetings where it classifies and analyzes research and observation results, to evaluate seismic activities in a comprehensive manner and publish its evaluations.

Ad hoc meetings are held in response to destructive earthquakes or marked crustal activity to assess the seismic activities.

Based on survey, observation and research results, it studies and assesses the magnitude and probability of future earthquakes, and their predicted shaking and tsunamis, and publishes the results in forms such as probabilistic seismic hazard maps.

Mission 5

To convey earthquake research results clearly to the general public



In addition to conveying research results to the general public in a clear and understandable form to boost disaster prevention awareness and encourage people to take definite action, earthquake research results are being publicized to encourage detailed disaster planning by disaster prevention organizations at the state and local government levels.

The Headquarters for Earthquake Research Promotion

The Earthquake and Disaster-Reduction Research Division, Research and Development Bureau, Ministry of Education, Culture, Sports, Science and Technology

(Secretariat Division of the Headquarters for Earthquake Research Promotion)

100-8959 3-2-2 Kasumigaseki, Chiyoda-ku, Tokyo
Tel: 03-5253-4111 (switchboard)
URL: https://www.jishin.go.jp/main/index-e.html

Word to search: headquarters for earthquake

headquarters for earthquake 検 索

March ,2022