Earthquakes – introductory module

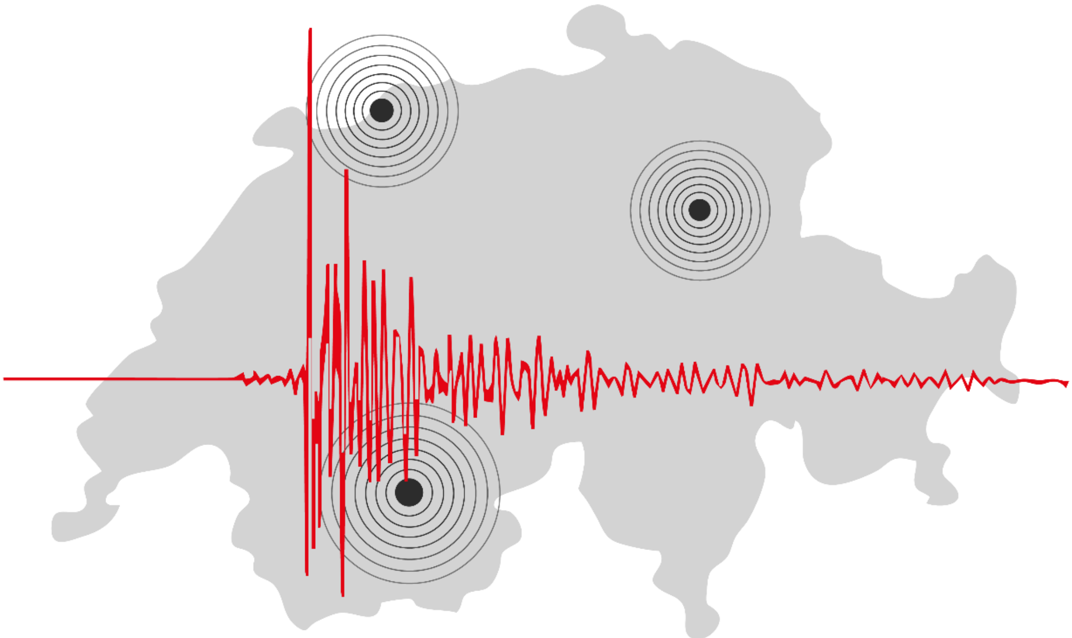
Basics and the most important concepts

Version June 2025

Teaching material developed by the Swiss Seismological Service at ETH Zurich in collaboration with the University of Lausanne and the Earthquake Prevention Learning Centre (CPPS) in Sion.

Access
Public

Further information
Further information on this teaching unit and other modules can be found on the website of the Swiss Seismological Service (SED) at ETH Zurich at www.seismo.ethz.ch/en/news-and-services/for-schools/teaching-resources.



Overview

Duration

– 2 x 45 min. (double lesson)

Prior knowledge

– None, this is an introduction to the topic of earthquakes
– Structure of the Earth advantageous (lithosphere etc.)

Learning objectives

1. Students know important terms relating to earthquakes, can describe them in their own words and apply them correctly (e.g. hypocentre, epicentre, magnitude, intensity, plate tectonics).
2. Students are aware of the frequency and effects of earthquakes in Switzerland and worldwide.
3. Students know the different types of seismic waves.
4. Students can tell how earthquakes occur and recognise the different types of faults.
5. Students understand the difference between magnitude and intensity and can thus explain the effects of an earthquake at different locations in a comprehensible way.
6. Students can assess which secondary processes can be triggered by earthquakes for different locations.
7. Students know the behavioural recommendations before, during and after a strong earthquake.

Material required

– Laptop
– Internet
– Slinky
– Sponge for plate boundary exercise

Further information

– Geography: Knowing and understanding – A handbook for upper secondary level; Hans-Rudolf Egli, Martin Hasler, Matthias Probst [in German]
– Swiss Seismological Service: www.seismo.ethz.ch
– Reports on internationally relevant earthquakes: www.earthscope.org/news/geophysical-events/?geophysical_event_category=earthquake (16-12-2024)
   – By clicking on an earthquake, you can download slides on this event for teaching purposes under "Teachable Moments".
– Fault models using foam blocks – classroom activity: www.bgs.ac.uk/download/earthquake-classroom-activities-fault-models-using-foam-blocks/ (16-12-2024)

Structure and content of the module

Introductory question: How strong were the largest earthquakes ever recorded in Switzerland and worldwide?

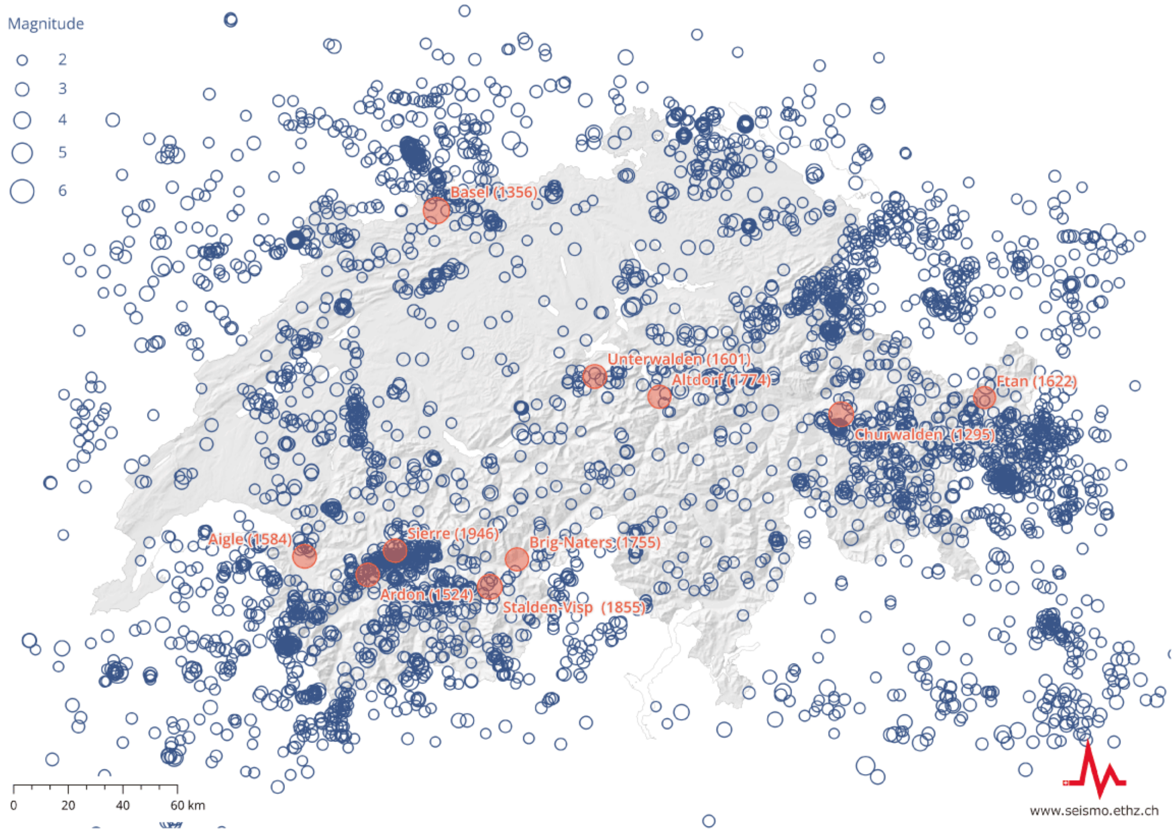


Figure 1 Overview of earthquakes with a magnitude of 2 or larger between 1975 and 2024 (blue dots), as well as the ten strongest documented earthquakes in Switzerland to date (red dots).

More information
Reports on internationally relevant earthquakes:
www.earthscope.org/news/geophysical-events/?geophysical_event_category=earthquake

Causes of earthquakes

Plates tectonics

The Earth's crust consists of seven large **lithospheric plates** and many smaller ones. These plates slowly "float" on the Earth's (viscous) **semi-liquid mantle**, moving toward, away from, or past each other (**plate tectonics**). Frictional forces at the edges of the plates prevent them from moving continuously. This causes **a steady build-up of pressure** within the rock strata on either side of the fault. If the stress becomes greater than the frictional forces, the plates suddenly separate, causing an earthquake. The energy released in this process spreads through the Earth and along its surface in the form of **seismic waves.** These waves cause vibrations that we perceive and that can cause damage.

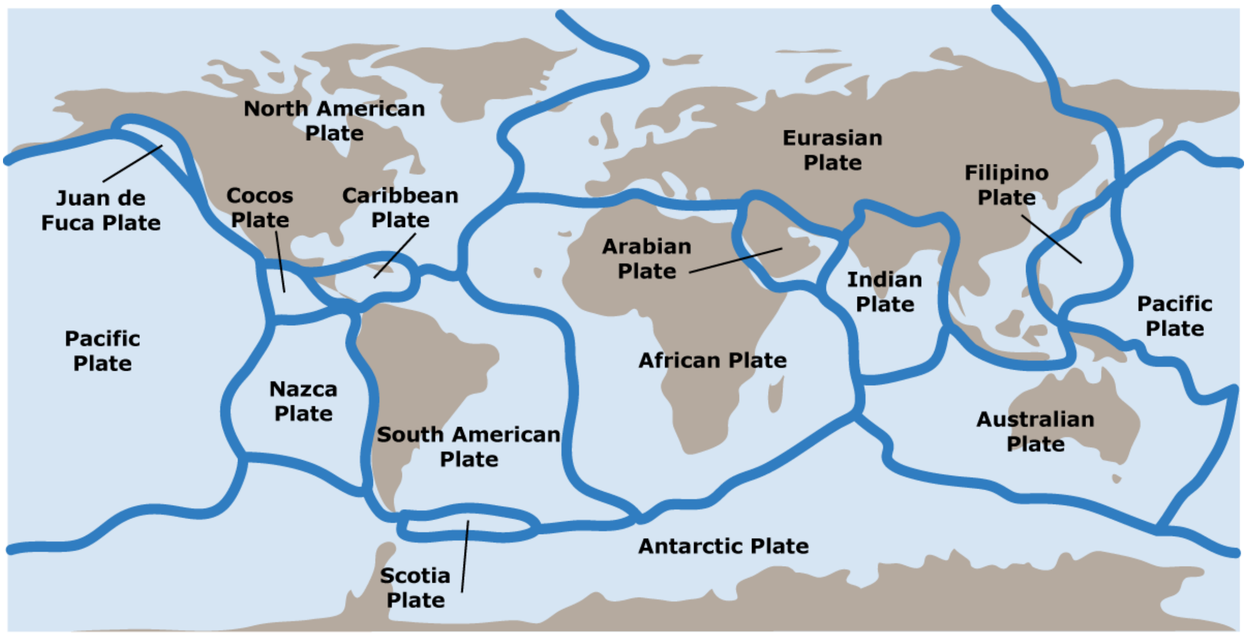
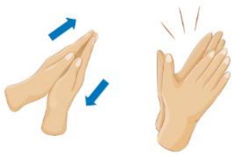


Figure 2 Tectonic plates.

Task 1: How do earthquakes occur?

Imagine your hands as two tectonic plates that collide. Press the palms of your hands firmly against each other and then try to push one hand along the other. Keep doing this until one hand breaks free.

What did you notice? How did the hand break loose?



Fault types

Depending on how the lithospheric plates move, we distinguish between three main types of plate boundaries: **Convergent boundaries** occur when plates move toward each other, and **divergent boundaries** occur when plates move away from each other. **Transform boundaries** (or strike-slip faults) occur when plates slide horizontally past one another.

These three types of faults, however, rarely occur in their pure form. In most cases, the movement between plates involves a combination of convergent and divergent motions, or a mix of divergent and transform movements.

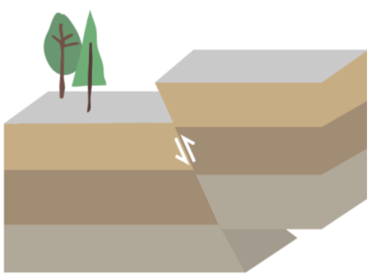
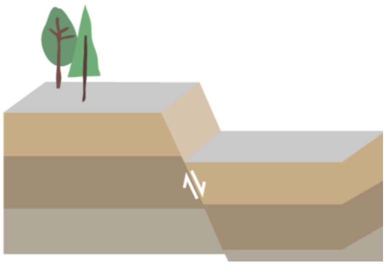
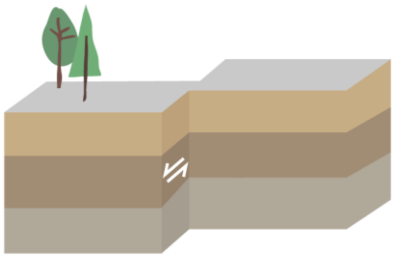
	Thrust fault (convergent)	**Normal fault (divergent)**	**Strike-slip fault (transform)**
Plate boundary			
Movement and effects	Toward each other: **Mountain building**	Away from each other: **Rift valley formation**	Past each other: **Crustal deformation**
Examples	Mountain belts, e.g. Alps (Europe), Himalayas (Asia) Papatea Fault (New Zealand) 	North Atlantic Ridge in Iceland, Great African Rift Valley 	San Andreas Fault (USA) 

Figure 3 Papatea Fault in New Zealand, activated by the Kaikōura earthquake (magnitude 7.8). Photo: Kate Pedley / University of Canterbury

Figure 4 North Atlantic Ridge in Iceland. Photo: Sansculotte /GNU free Documentation Licence

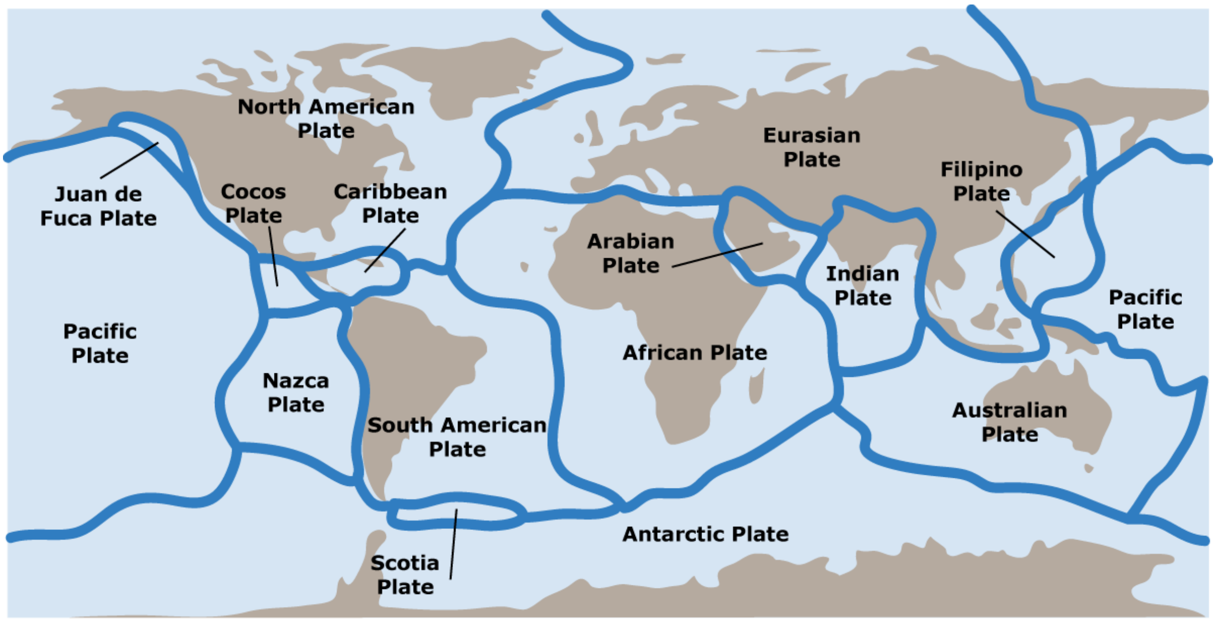
Figure 5 Rupture after the magnitude 7.1 earthquake in the Searles Valley (San Andreas Fault) in California. Photo: G.K. Gilbert

More information
Fault types sponge experiment: www.bgs.ac.uk/download/earthquake-classroom-activities-fault-models-using-foam-blocks/

Task 2: Earthquakes worldwide

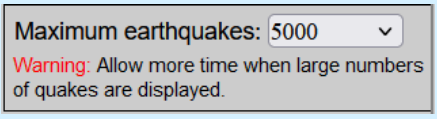
Using the interactive earthquake browser, answer the following questions:

1. How many earthquakes of magnitude over 5 and 7 occurred worldwide in 2023?
2. On the map below, mark the regions that experienced the most earthquakes with magnitude over 5.
3. Where in the world did the deepest earthquakes of magnitude over 5 occur?

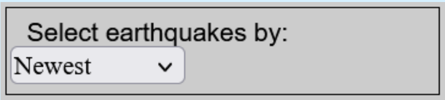


Go to the following website: **https://ds.iris.edu/ieb** and work with the menu on the right-hand side:

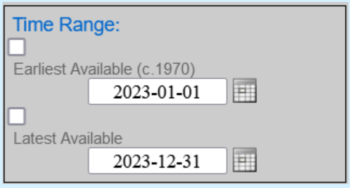
1. Set the maximum number of earthquakes to 5,000:



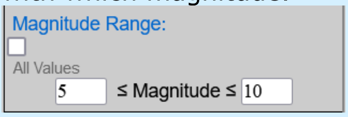
2. Leave the setting under "Select earthquakes by:" at "Newest".



3. First remove the two tick marks under "Time Range" to define the period for the year 2023:

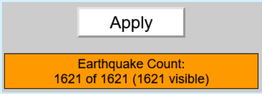


4. Under "Magnitude Range", you can narrow down which earthquakes should be displayed with which magnitude.



5. Show the plate boundaries on the map by selecting "on" from the drop-down menu under "Show plate boundaries".

6. Then click on **Apply**. Note: Do not zoom into the map, otherwise only the visible earthquakes will be counted.



With this tool you can explore much more, e.g. by selecting other time periods, magnitudes or regions. You can also view your earthquake selection as an animation.

Earthquakes and where they occur

Over 90% of all earthquakes, especially the largest ones, occur along plate boundaries, primarily around the Pacific Ocean between Asia and America, also known as the "**Ring of Fire**".

Earthquakes also occur along mountain belts such as the Alps, Himalayas and Andes. The remaining earthquakes happen along smaller tectonic faults, often within the plates. These are associated with the stresses caused by plate tectonics but can occur far from plate boundaries.

In addition to tectonic causes, **natural phenomena** like **rising magma** (volcanic earthquakes), **isostatic uplift**[1], or **collapsing underground cavities** (collapse earthquakes) can trigger seismic activity. There are also so-called **induced earthquakes,** caused by human activities, such as in connection with geothermal energy activity, filling large reservoirs, or natural gas extraction.

Videos on plate tectonics and the formation of earthquakes

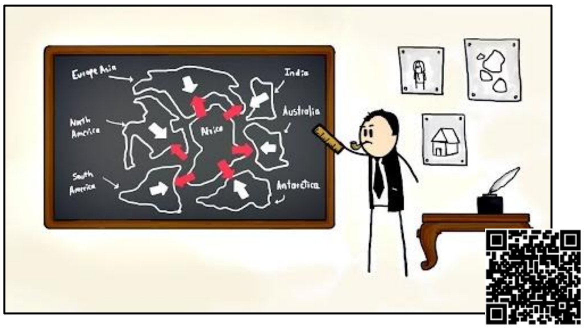


Figure 6 "Plate tectonics explained", source: MinuteEarth (Link: https://www.youtube.com/watch?v=kwfNGatxUJI) (03-07-2025)

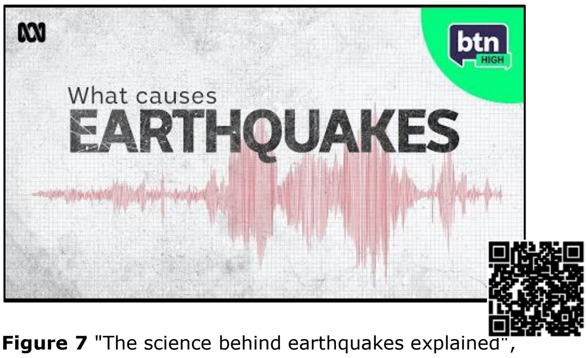


Figure 7 "The science behind earthquakes explained", source: ABC News (Link: https://www.youtube.com/watch?v=nyJLACdAwEo) (03-07-2025)

[1]Isostatic uplifts are geological processes in which the Earth's crust slowly rises due to changes in the load caused by glaciers, sediments or other mass movements (e.g. when large ice masses melt). These uplifts occur when the earth's crust and the underlying mantle attempt to restore isostatic equilibrium. This is similar to a floating object rising in the water when a load is removed.

Seismic waves

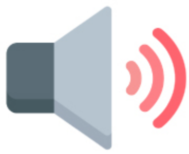
Earthquakes release energy in the form of **seismic waves**. These elastic waves travel in all directions from the earthquake's source (**hypocentre**) within the Earth's interior until they reach the surface. Upon reaching the surface, some of the waves are reflected and continue to propagate through the Earth.

Task 3: Which one is the fastest? Match each wave with its correct speed.

20,000 km/h (approx. 6 km/s)	**1,200 km/h** (approx. 330 m/s)	**1 billion km/h** (approx. 300.000 km/s)	**3,000 km/h** (approx. 830 m/s)

Seismic waves

Jet aircraft



Sound wave in the air

Electromagnetic waves

What are the hypocentre and epicentre?

Seismic waves radiate in all directions from the hypocentre, the point within the Earth where an earthquake originates. When the waves reach the Earth's surface, seismometers can record the vibrations. Depending on the earthquake's strength, distance, and local conditions (site effects), the shaking may be perceived by people as stronger or weaker. The hypocentre is described by the earthquake’s depth and its geographical coordinates (latitude and longitude).

The **epicentre** of an earthquake lies vertically above the hypocentre on the Earth's surface. It is described by its latitude and longitude. Generally, shaking is strongest at the epicentre and decreases with distance. In moderate earthquakes, damage is often confined to the epicentre. However, in stronger earthquakes, the affected area is much larger, sometimes extending for hundreds of kilometres along the ruptured fault.

Task 4: Fill in the correct terms in the empty boxes!

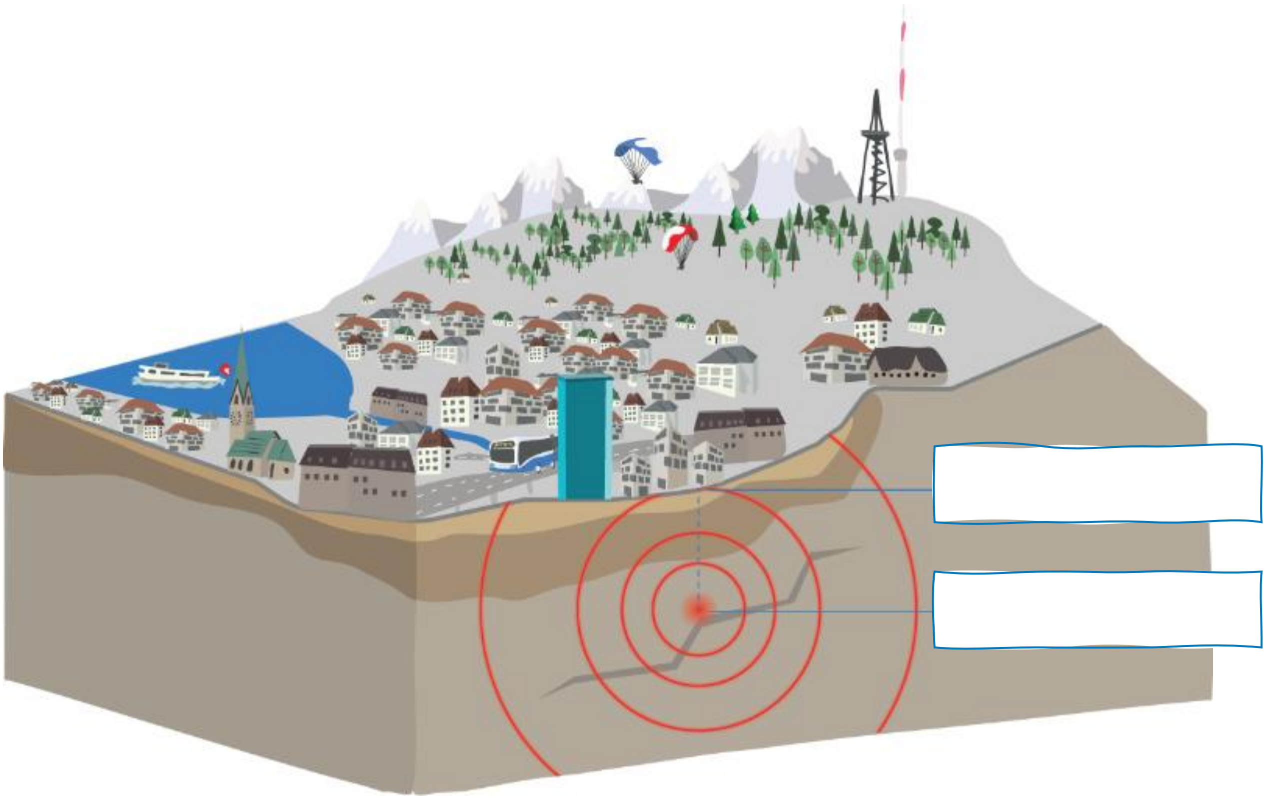


Figure 8 The hypocenter (also called the earthquake focus) is the point beneath the Earth's surface where the earthquake originates, while the epicenter is the point directly above it on the Earth's surface.

Properties of the different types of waves

Seismologists distinguish between **body waves** (P and S waves) and **surface waves** (Love and Rayleigh waves). Body waves travel through the Earth's interior, while surface waves move along the Earth's surface. These waves have different properties (type of propagation, speed). As they travel at different speeds, seismic stations detect and record them at different times on a **seismogram**.

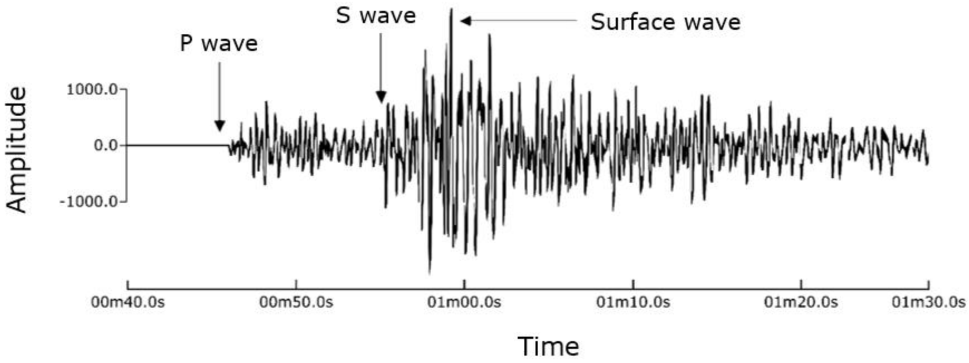
	Body waves		**Surface waves**	
	P waves (compression wave)	S waves (shear wave)	Love waves	Rayleigh waves
Propagation speed	5-8 km/s *in the Earth's crust and upper mantle*	3-5 km/s *in the Earth's crust and upper mantle*	2-4.5 km/s	2-4.0 km/s
Propagation	through the Earth's interior		along the Earth's surface	
Seismogram				

Figure 9 Seismogram of an earthquake with the different wave types.

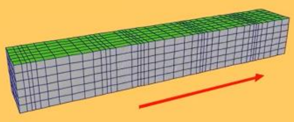
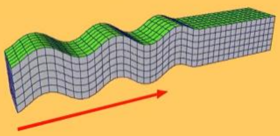
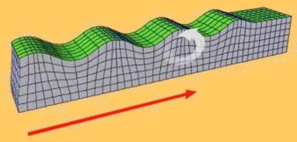
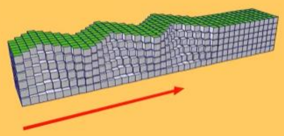
P waves	**S waves**	**Rayleigh waves**	**Love waves**
			
Watch animation	Watch animation	Watch animation	Watch animation

Figure 10 Illustration of the movement of body and surface waves. Individual links listed below[2] (Source: britannica.com, 07-08-2024)

Body waves include primary waves (P waves) and secondary waves (S waves), which spread out spherically from the hypocentre. **P waves** propagate by compressing and expanding the ground in the direction of travel, similar to the movement of an earthworm.

S waves cause particles to vibrate perpendicular to the direction of wave propagation, either horizontally (back and forth) or vertically (up and down), resembling the motion of a snake. Surface waves are generated when P and S waves reach the Earth's surface. **Rayleigh** waves[3] are excited by P-waves, **Love waves**[4] by S-waves. Love waves make the ground move side to

[2] P waves: www.britannica.com/video/20707/P-wave, S waves: www.britannica.com/video/20706/S-wave, Rayleigh waves: www.britannica.com/video/20704/Rayleigh-wave, Love wave:www.britannica.com/video/20705/Love-wave (16-12-2024)
[3] Named after the English mathematician John William Strutt Lord Rayleigh (1842-1919)
[4] Named after the English mathematician Augustus Edward Hough Love (1863-1940)

side, parallel to the Earth's surface. Rayleigh waves move in an elliptical, rolling motion vertically. Rayleigh waves often have significantly larger **amplitudes** and tend to cause the strongest shaking and most damage during earthquakes.

The following animation shows how body and surface waves propagate from an earthquake and how they are recorded in the form of a seismogram.

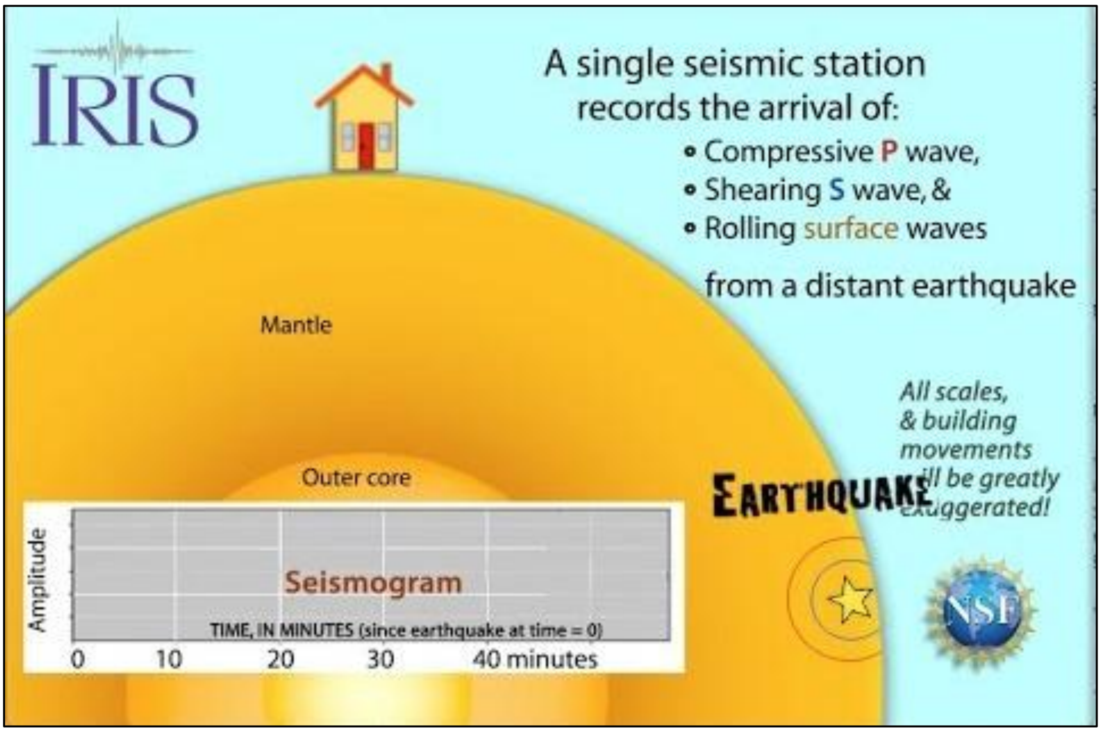
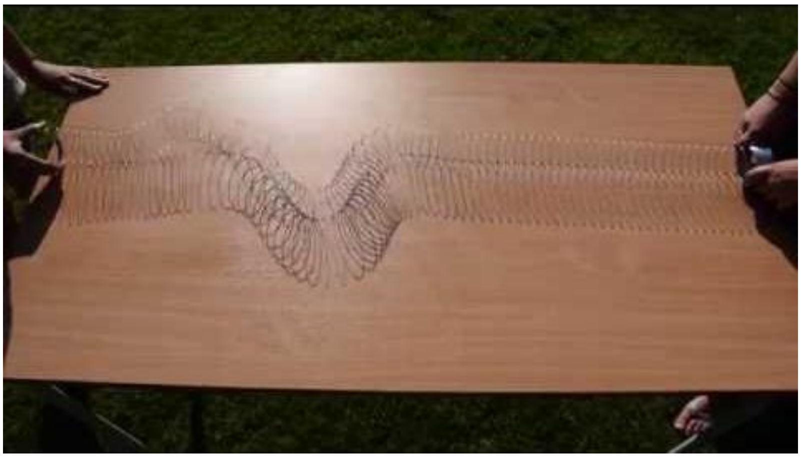


Figure 11 Animation showing the propagation of body and surface waves. (Source: IRIS Earthquake Science www.youtu.be/TLdXyFyQwbg, 29-05-2024)

Task 5: Slinky

Demonstration in class: Have two students each hold one end of a slinky, standing a short distance apart so that the slinky is taut. First, demonstrate **P waves** by sending a compression pulse along the slinky – pushing and pulling it back and forth in the direction between the students. Next, imitate **S waves** by moving the slinky side to side or up and down, creating waves that move perpendicular to the slinky's length.



Link to the video: www.youtube.com/watch?v=BxtiKodKq_E; 03-06-2024.

Task 6: Human waves

Demonstration in class: 5 voluntary students form a chain and demonstrate the propagation of P and S waves.

P waves

S waves

Video with explanations: www.youtube.com/watch?v=gjRGIpP-Qfw

Earthquake early warning

The goal of an earthquake early warning system is to alert people or machines about impending shaking before it is felt at a specific location. Unlike weather warnings, this is not a forecast because the earthquake has already started. Since P waves travel faster than S waves and data can be transmitted at the speed of light, areas at risk can receive warnings seconds before the more damaging shaking arrives. Typically, the warning time is only a few seconds.

Click on Figure 12 to watch the explanatory video about earthquake early warning.

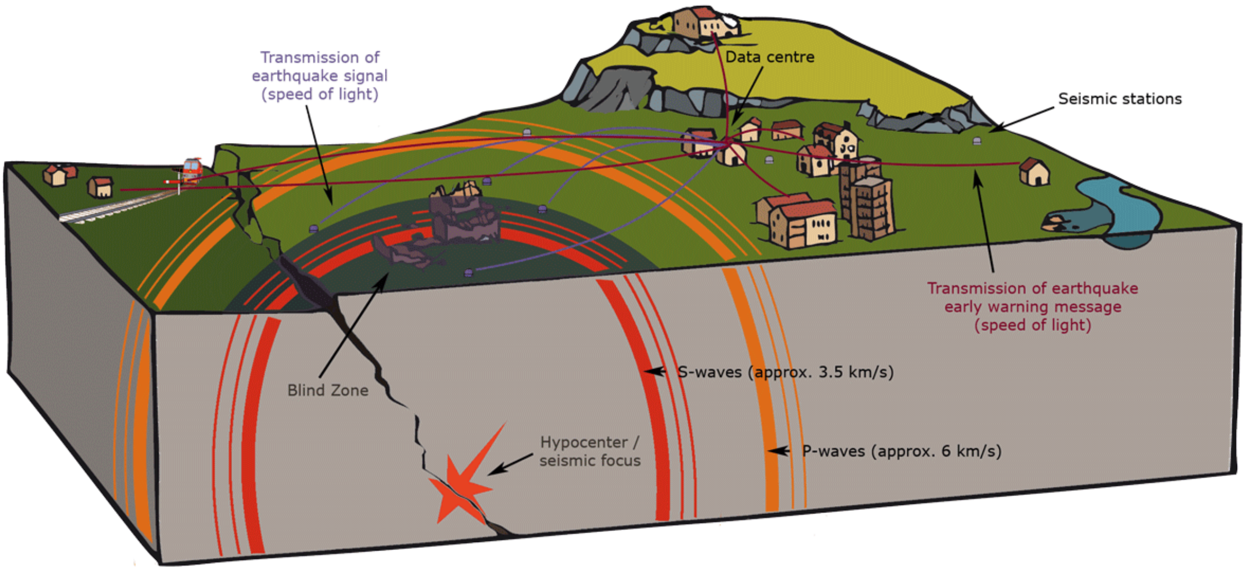


Figure 12 How earthquake early warning works.
Explanatory video at: http://seismo.ethz.ch/static/sedvideos/alert/alert_EN.html, (12-06-2025).

Magnitude and intensity

The strength of an earthquake is typically measured on two scales:
- The **magnitude** measures the energy released by the earthquake. It is a single value for each earthquake and does not depend on location.
- The **intensity** describes the level of destruction (to buildings, landscape) and how strongly people feel the shaking. Intensity varies by location, typically being greatest near the epicentre and lessening with distance

	Magnitude	**Intensity**
What is measured?	Released energy (strength of the earthquake)	Local effects of the tremors on the Earth's surface
How many values are there per earthquake?	One value per earthquake (independent of the distance)	Many values per earthquake (values decrease with increasing distance)
Dependent on location?	Independent of location	Dependent on location
Scale	No limitation; earthquakes generally noticeable from a magnitude of 2.5; Largest earthquake measured to date with a magnitude of 9.5 in Chile	I-XII, EMS-98 (European Macroseismic Scale of 1998)

Task 7: Comparison of magnitude and intensity

Form groups of two and look at the picture below. Imagine that the **lamp** represents the **hypocentre** of an earthquake.

Using the definitions of **magnitude** and **intensity** above, try to explain how these two terms can be applied to the picture.

Figure 13 Explaining magnitude and intensity using a light bulb analogy.
(Source: www.iris.edu/hq/inclass/activities/magnitude_and_intensity; 15-05-2024)

Magnitude

At the beginning of the 20th century, seismometers began providing increasingly precise records of ground movements, allowing scientists to calculate the earthquake's strength for the first time. The magnitude quantifies the energy released at the earthquake's source (hypocentre). In 1935, physicist and seismologist Charles Richter introduced the first magnitude scale. However, the Richter scale works best only for earthquakes within certain size and distance limits. For very large or distant earthquakes, it does not accurately measure the energy released. For this reason, other magnitude scales have been developed.

Magnitude is typically calculated using

- the maximum ground motion recorded (maximum amplitude),
- the distance between seismic stations and the earthquake source.

Both these values can be determined from a seismogram.

The magnitude scale is theoretically **unlimited** in both directions. However, from a scientific point of view, earthquakes with a magnitude greater than 10 are highly unlikely, as this would imply a rupture length of about 14,000 kilometres – roughly one-third of the Earth's circumference. The strongest earthquake recorded to date occurred in Chile in 1960. It had a magnitude of 9.5 and a rupture length of around 1,000 kilometres.

Magnitude is a **logarithmic value**. An increase of one magnitude unit corresponds to about 32 times more energy being released. For example, a magnitude 6 earthquake releases 32 times more energy than a magnitude 5, and nearly 1,000 times (approx. 32 x 32) more energy than a magnitude 4 earthquake (Figure 14).

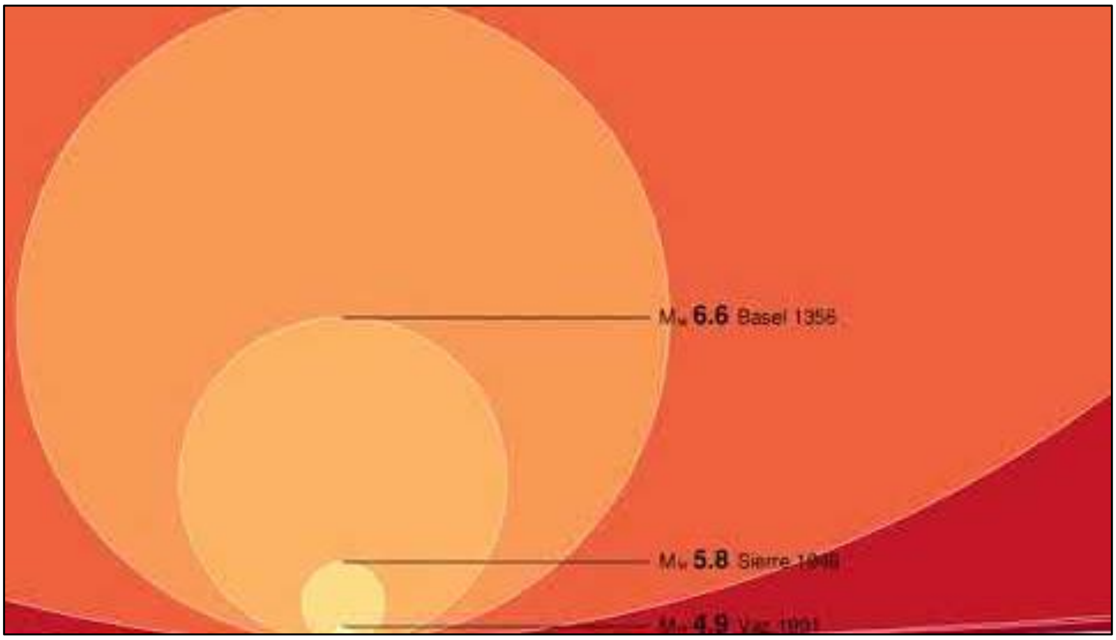


Figure 14 Animation illustrates how energy release increases with earthquake magnitude. The area of each circle is proportional to the amount of energy released by the respective earthquake. Link: https://www.youtube.com/embed/PwhDyKLVWuI?feature=oembed (22-08-2025)

To better understand the logarithmic scale of earthquakes, imagine that a magnitude 5 earthquake is like the energy needed to break one piece of spaghetti. But a magnitude 6 earthquake isn't just a little stronger, it's like breaking 32 pieces of spaghetti at once. A magnitude 7? That's about 1,000 pieces. And a magnitude 8? Nearly 33,000 spaghetti strands. As you can imagine, even trying to snap 1,000 spaghetti at once is nearly impossible. This analogy shows how quickly earthquake strength increases – each step up on the magnitude scale means much more energy released.

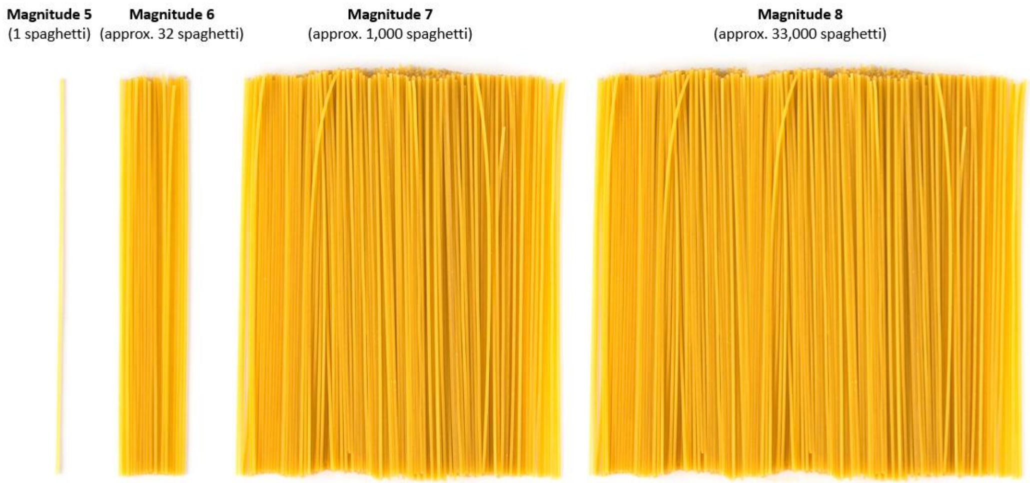


Figure 15 Logarithmic increase in energy with each unit increase in magnitude
Explanatory video available at: www.youtube.com/watch?v= g2HhVZqBFnY (29-05-2024).

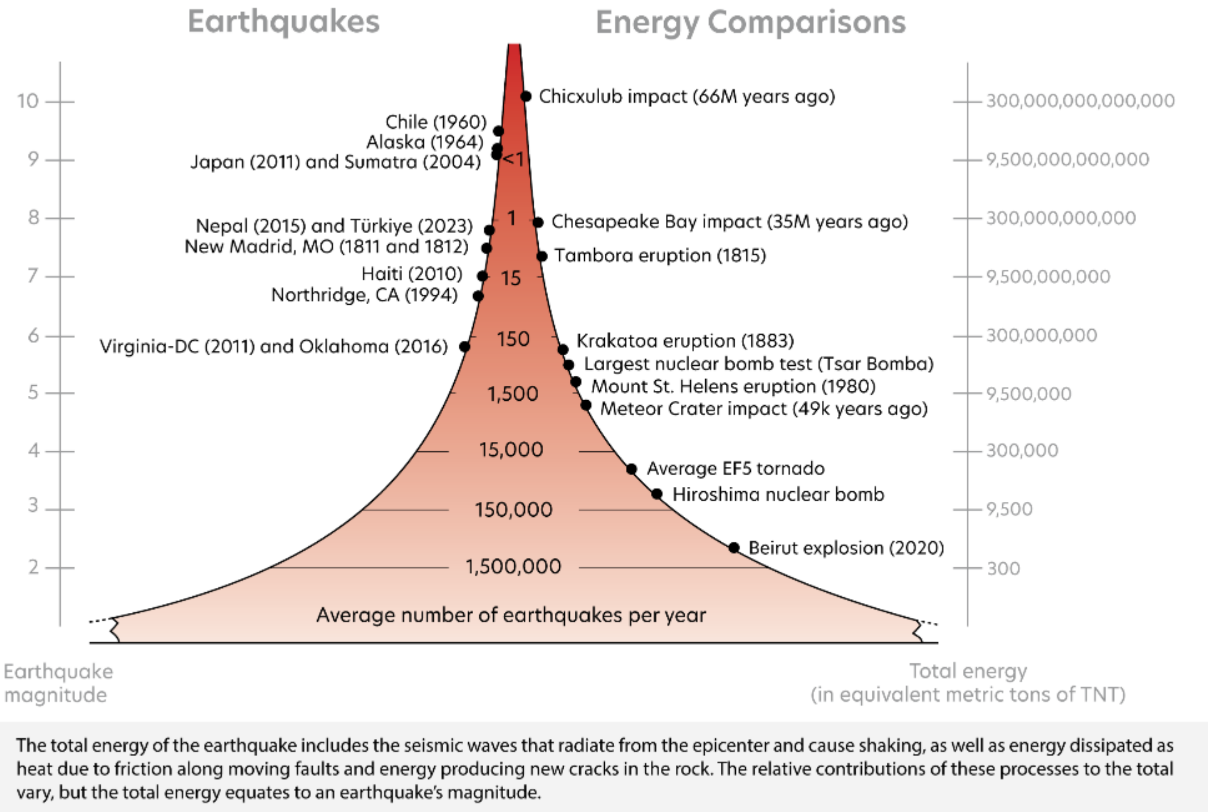


Figure 16 ©EarthScope, www.iris.edu/hq/inclass/fact-sheet/how_often_do_earthquakes_occur (02-07-2025)

Intensity

Ground movements are the **direct effect** of earthquakes. Intensity describes the extent of these local effects, based on the level of destruction to buildings and landscape, and the subjective perception of the shaking by observers.

Over 200 years ago, a damage scale was developed to describe the strength of shaking in earthquakes. In 1902, the Italian seismologist and volcanologist Giuseppe Mercalli (1850-1914) introduced the 12-stage Mercalli intensity scale. This scale has been revisited several times since. In Europe, the **intensity scale EMS-98** (European Macroseismic Scale 1998) has been officially valid since 1998 (Figure 17).

EMS-98 Intensity	Felt	Impact	Magnitude (Approxi-mated Value)	Building Damage (Masonry)
I	Not felt	Not felt		
II-III	Weak	Felt indoors by a few people. People at rest feel a swaying or light trembling.	2 / 3	
IV	Light	Felt indoors by many people, outdoors by very few. A few people are awakened. Windows, doors and dishes rattle.		
V	Moderat	Felt indoors by most, outdoors by few. Many sleeping people awake. A few are frightened. Buildings tremble throughout. Hanging objects swing considerably. Small objects are shifted. Doors and windows swing open or shut.	4	
VI	Strong	Many people are frightened and run outdoors. Some objects fall. Many houses suffer slight non-structural damage like hair-line cracks and fall of small pieces of plaster.		
VII	Very strong	Most people are frightened and run outdoors. Furniture is shifted and objects fall from shelves in large numbers. Many well built ordinary buildings suffer moderate damage: small cracks in walls, fall of plaster, parts of chimneys fall down; older buildings may show large cracks in walls and failure of fill-in walls.	5	
VIII	Severe	Many people find it difficult to stand. Many houses have large cracks in walls. A few well built ordinary buildings show serious failure of walls, while weak older structures may collapse.		
IX	Violent	General panic. Many weak constructions collapse. Even well built ordinary buildings show very heavy damage: serious failure of walls and partial structural failure.	6	
X+	Extreme	Most ordinary well built buildings collapse, even some with good earthquake resistant design are destroyed.	7	

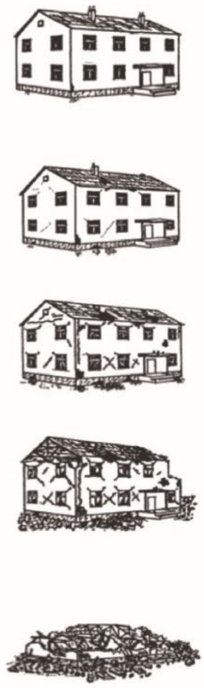


Figure 17 European Macroseismic Scale 1998 (EMS-98). In classical use, the Roman numerals between I (earthquake not felt) and XII (destruction) on the EMS-98 are determined subjectively.

Today, intensity can also be measured **instrumentally** using the maximum **ground accelerations and velocities** recorded by seismic stations, providing an objective measurement. This method offers a quick overview of the potential effects of an earthquake without relying on surveys or damage reports. To differentiate between the two, intensity based on human observations is called **macroseismic intensity**, while intensity measured by instruments is known as **instrumental intensity**.

The spatial distribution of intensities during an earthquake is often shown in **ShakeMaps** (Figure 18). These maps enable quick assessment of ground motion and the associated effects of the earthquake.

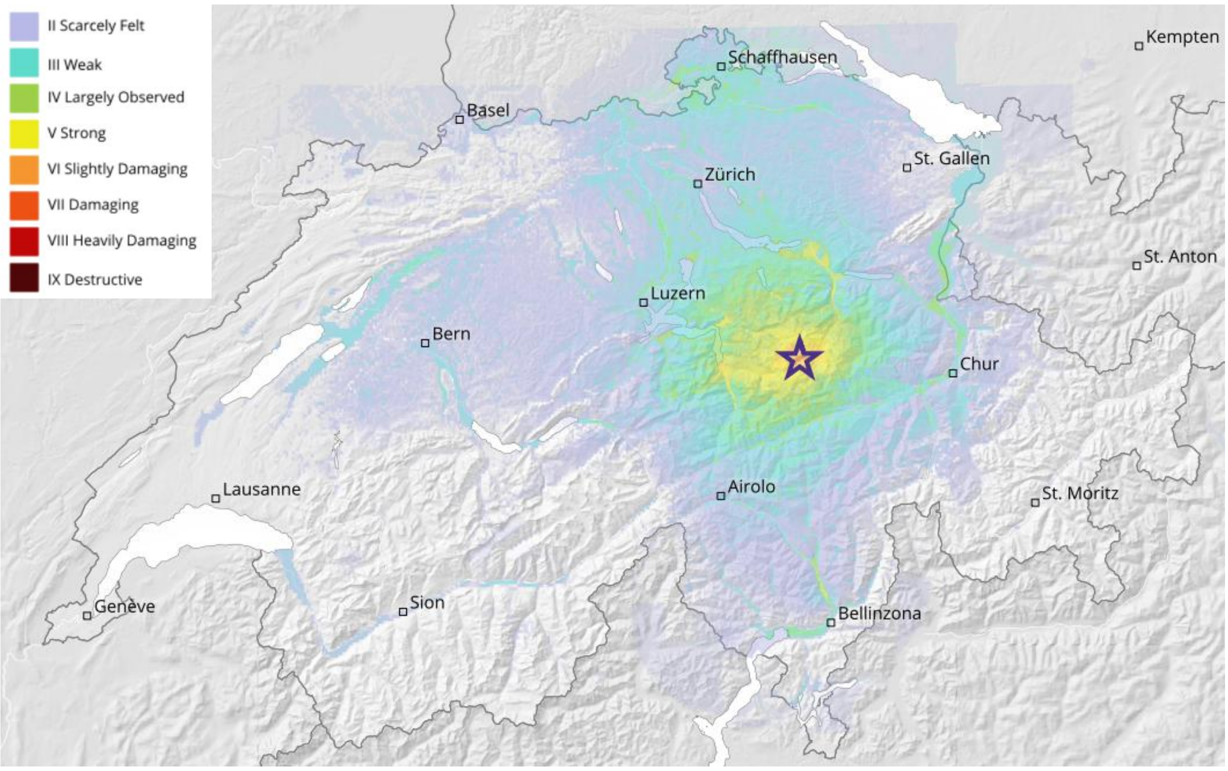


Figure 18 ShakeMap of the earthquake near Linthal (canton of Glarus) on 6 March 2017 with a magnitude of 4.6.

Learn more
More information about ShakeMaps in this brochure:
www.seismo.ethz.ch/export/sites/sedsite/knowledge/.galleries/pdf_brochures/Flyer_Shakemap_ENG.pdf_2063069299.pdf

Task 8: Intensities at different locations

Take a closer look at the ShakeMap of the earthquake near Linthal (canton of Glarus) on 6 March 2017 (Figure 18). You can also use the interactive map viewer.

Answer the following question:

Why was the earthquake felt weakly in some distant areas, but strongly in others?

a) This is an error on the map, it can't be.

b) In addition to the magnitude and distance from the epicentre, the geology (nature of the ground) influences how strong the shaking is.

c) There are many people in these regions, so it is more likely that someone felt the earthquake.

The following animation illustrates the propagation of the seismic waves from the earthquake near Linthal (canton of Glarus). Depending on local ground conditions, shaking can sometimes be stronger at more distant locations, especially where the subsoil is soft.

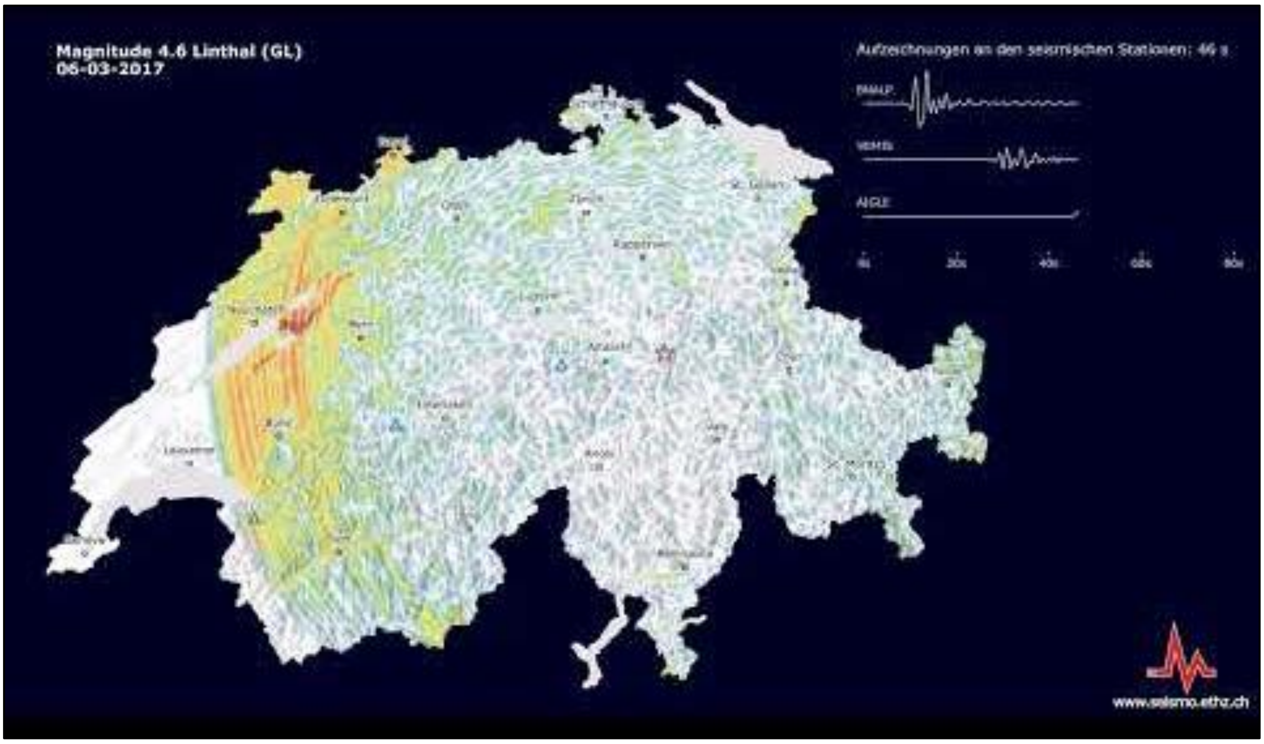


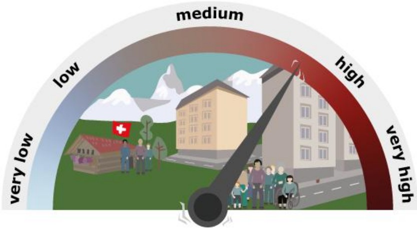
Figure 19 Animation of the earthquake in Linthal (GL) on 6 March 2017 showing the propagation of earthquake waves. The colours show the amplitude of the oscillation (= strength or deflection of the oscillation), measured in speed (mm/s). (Link: www.youtube.com/watch?v UBG1ztt4NCQ&feature== youtu.be, 16-10-2024)

Earthquake risk and the consequences of earthquakes

Task 9: What damage can earthquakes cause?

Choose one or more of the following three scenarios and think about the potential damage and other consequences a strong earthquake could cause in that region.

This can also be done as a partner activity, followed by a group discussion.



Scenario 1:

A strong earthquake in a large, densely populated city (e.g. Zurich)

Scenario 2:

A strong earthquake in the Swiss Alps (e.g. near Zermatt)

Scenario 3:

A strong earthquake at a location near the seacoast (e.g. in Costa Rica)

Earthquake risk

Earthquake risk quantifies the possible consequences of earthquake shaking, such as the number of damaged and destroyed buildings, injured or homeless people, and fatalities. Several factors are combined to assess earthquake risk in detail:

- Earthquake hazard: Where, how strong, and how often earthquakes occur.
- Local subsoil effects: Softer ground can amplify shaking, increasing damage potential.
- Building vulnerability: How much damage buildings sustain at different shaking intensities.
- Exposure: Earthquakes only cause damage where people and assets are present.

Figure 20 Components used to determine earthquake risk.

Humanitarian consequences

Injuries and fatalities
Earthquakes can directly cause injuries and fatalities from collapsing buildings, falling debris, and other hazards.

Psychological effects
Earthquakes can cause psychological effects such as fear, trauma and stress to those affected, especially if they have suffered severe loss or injury.

Economic and financial consequences

Building damage
Earthquakes can damage buildings, which in the worst cases can lead to building collapses.

Infrastructure damage
Roads, bridges, railways, and other infrastructure can be damaged, which can hinder rescue efforts.

Economic losses
The destruction of property and infrastructure can lead to significant economic losses, including the loss of livelihoods and jobs.

Depending on location and magnitude, earthquakes can trigger secondary effects:

Mass movements: Earthquakes can further destabilise slopes and trigger landslides, rockfalls, or avalanches.

Tsunamis: Underwater earthquakes can trigger tsunamis (i.e. large tidal waves) in the sea and lakes, which can heavily damage coastal areas.

Floods: Earthquakes can damage dams or block rivers, which can lead to flooding, especially in flat or coastal regions.

Soil liquefaction: In certain soils, shaking can cause the ground to temporarily lose its strength and behave like a liquid, which can lead to building damage.

Ground faulting: Earthquakes can cause visible cracks and shifts in the Earth's surface, altering the landscape.

Aftershocks: Aftershocks are to be expected after a major earthquake, potentially causing more damage and complicating rescue efforts.

Fires: Shaking can rupture gas pipes or cause electrical faults, leading to fires.


Bilder: Adobe Stock

Icons: Flaticon.com

Protection against earthquakes

Earthquakes can neither be precisely predicted nor prevented. However, their potential effects and damage can be reduced by taking simple precautions at home and while traveling.

Earthquake-resistant construction

The most effective protection against earthquake damage is building earthquake-resistant structures and securing objects that might fall or topple. The goal of earthquake-resistant construction is to prevent buildings from collapsing, thereby reducing injuries and fatalities. It also helps maintain the functionality of critical buildings during strong earthquakes and limits secondary damage, such as from fires.

In Switzerland, cantonal legislation regulates construction. Some building laws explicitly require adherence to the standards set by the Swiss Society of Engineers and Architects (SIA). In addition, an increasing number of cantons are imposing earthquake-specific requirements within the building permit process. However, the responsibility for implementing earthquake-resistant construction lies with the property owners and their appointed specialist planners.

Earthquake insurance

Earthquake insurance is a common way to protect against financial losses caused by earthquakes. Even buildings designed to withstand earthquakes can sustain significant damage, making insurance an important safety net.

Recommendation for action

Task 10: Make a note of how you would behave in various situations if the Earth suddenly began to shake.

1. Out on the street

This is how I would behave:

2. At home in the living room

This is how I would behave:

3. On holiday at the beach

This is how I would behave:

Before a strong earthquake

For new buildings, conversions and renovations

- Earthquake-resistant construction offers the best protection. The aim is to prevent the collapse of a building and thus fatalities and injuries.
- Consider whether taking out earthquake insurance is a sensible way to reduce your personal financial risk.

Sources of danger inside the building

- Secure objects that could fall or topple over due to shaking, and thereby cause injuries, e.g. ceiling panelling, shelves and their contents, televisions and stereos or light fittings.

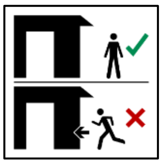
Be prepared (for earthquakes and other emergencies)

- Think about what to do during an earthquake.
- Put together a first aid kit and have emergency supplies ready.
- Make copies of important documents such as your passport or driving license and have them within reach in case of an incident.
- Have a torch, battery-operated radio and cash ready to bridge power cuts (it may not be possible to withdraw money from ATMs).
- Know where the main shut-off valves and switches for gas, water and electricity are located and how to use them.

During a strong earthquake

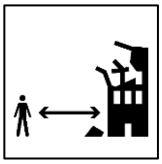
In a building

- Take cover (e.g. under a stable table).
- Beware of falling or toppling objects (e.g. shelves, heavy furniture, televisions, stereos and light fittings) and avoid proximity to windows and glass walls that could break.
- Only leave the building if the surrounding area is safe (e.g. if no other objects such as bricks are falling).



Outside

- Stay outside, do not flee into a building.



- Avoid proximity to buildings, bridges, electricity pylons, large trees and other objects that could collapse or fall.

- Leave the shore area of bodies of water.

In a vehicle

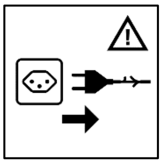
- Stop the vehicle and do not leave it during the earthquake.
- If possible, do not stop on bridges, in tunnels or subways.
- Avoid proximity to roadside buildings (risk of collapse).

After a strong earthquake

In the damaged area

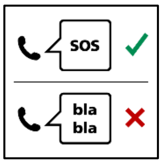
– Be prepared for aftershocks.
– Provide assistance without endangering yourself.
– Check buildings for damage. If there is major damage, leave the building carefully.

– Take care when leaving the building. Parts of masonry, roof beams, tiles, etc. could fall.
– Search the building and surroundings for sources of fire. If possible, extinguish small fires and/or alert the fire service.



– Check gas, water and electricity pipes for damage and switch off if suspected.

– Keep yourself informed via the radio, television or internet.
– Follow the instructions of the emergency services.



– Only make phone calls in emergencies. Keep the network free for real emergencies.
– No private car journeys. Keep roads clear for emergency services.
– Be prepared for power cuts.

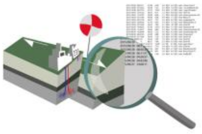
The information brochure "Help, the Earth is shaking! What to do in case of an incident?" can be downloaded here: www.seismo.ethz.ch/en/news-and-services/brochures/

Further teaching material

Want to learn more about earthquakes? Explore additional information here:

Earthquake risk and hazard in Switzerland
Download

Misinformation and media literacy
Download



Induced seismicity
Download

Earthquake monitoring and Raspberry Shake
Download

Further information on earthquakes can be found on the website of the Swiss Seismological Service at ETH Zurich at www.seismo.ethz.ch.

We welcome your questions and suggestions regarding the teaching modules, or any other topics related to earthquake education in schools.

E-mail us: seismo_at_school@sed.ethz.ch