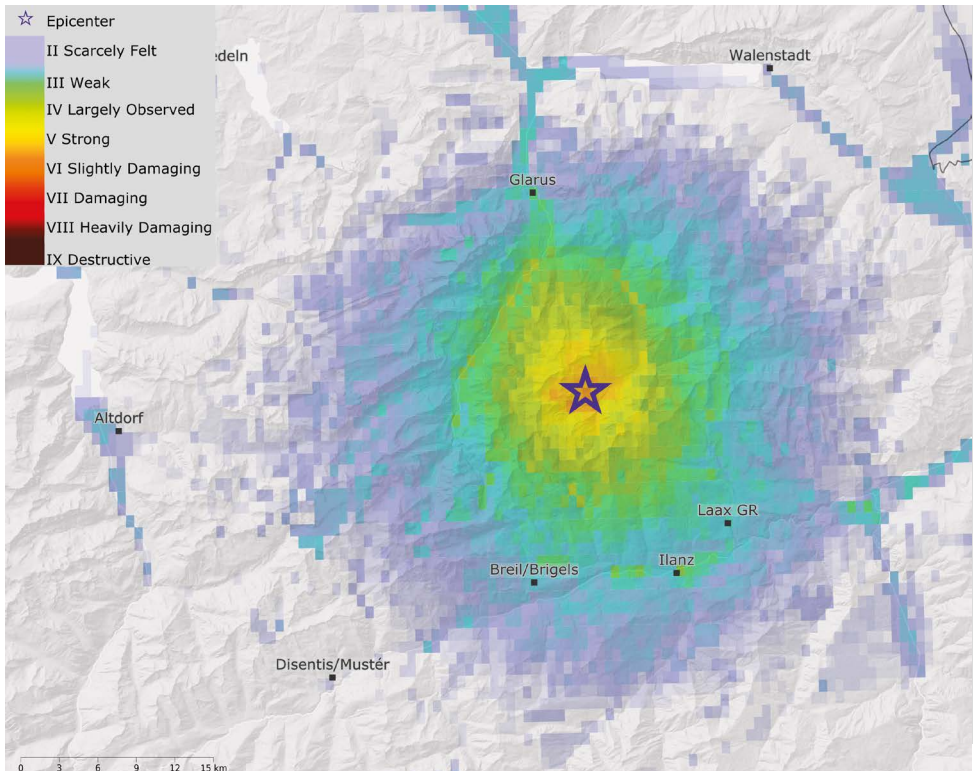




What Happened?

ShakeMaps and maps of ground shaking provide a rapid overview about the impacts of an earthquake



ShakeMap of an earthquake near Elm on November 10, 2020 with magnitude 3.9. The hypocentre was located at a depth of about 1.7 kilometers.

Immediately Informed About Earthquakes

The ground vibrates, glasses clink, and ceiling lamps swing. Following the initial surprise, one wonders what has just happened. You can find out whether an earthquake was the cause of the shaking within minutes from our website www.seismo.ethz.ch.







For every earthquake with a magnitude of 2.5 or greater, the Swiss Seismological Service (SED) publishes both a map of ground shaking and a ShakeMap. These provide an overview of the ground motion and associated impacts that can be expected from the earthquake. ShakeMaps provide considerably more information than standard earthquake maps, which typically show only the epicenter and the magnitude. The additional details are useful both to those affected by the ground shaking and to rescue workers who can use the maps as basis for further action.

Objectives and Components of a ShakeMap

Strong earthquakes cause a great deal of human suffering and enormous damage to buildings and other infrastructure. Immediately following a large earthquake, it is difficult to gain an overview of the situation in order to facilitate initiation of the appropriate measures. ShakeMaps support crisis management during this phase by indicating which areas are especially hard hit. They thereby help authorities and rescue workers target deployment of their resources and serve as a useful source of information. They show where and how intensely the earthquake was felt, as well as whether damage is to be expected. ShakeMaps originated in Southern California and are now used routinely in many earthquake-prone countries.

The creation of a ShakeMap involves several processing steps: First, the epicenter and magnitude of the earthquake are determined from the real-time data recorded by Switzerland's broadband seismic stations. This information is then combined with the observed maximum ground accelerations at the stations of the strong motion network and with values of the ground shaking based on historical measurements. Before the data is processed to determine macroseismic intensity (EMS-98), it is necessary to filter out local amplification effects. The models that are necessary for calculating ShakeMaps were calibrated especially for Switzerland.

The legend of the ShakeMap, derived from the European Macroseismic Scale (EMS-98).

EMS-98 Intensity	Felt	Impact	Magnitude (Approximated 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	Moderate	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	

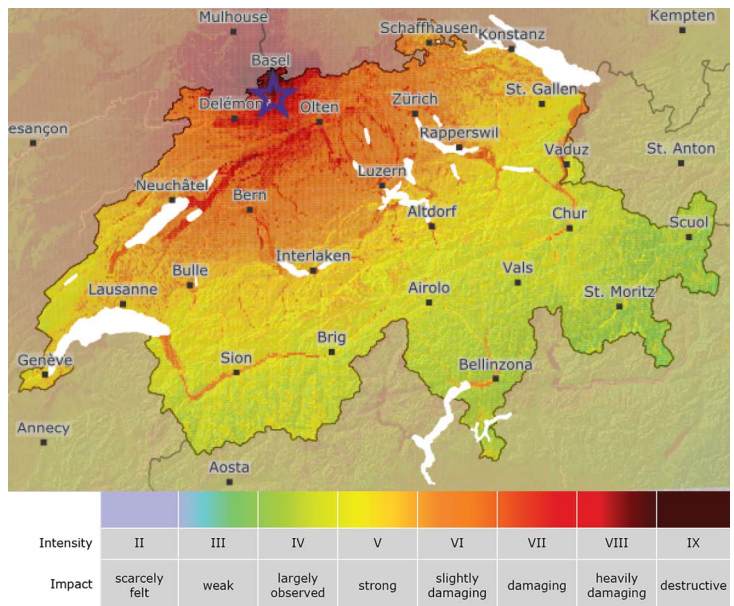
How to Read ShakeMaps

A ShakeMap shows the ground shaking that can be expected by an earthquake at every point in Switzerland. The data recorded by real-time seismometers is transmitted to the Swiss Seismological Service in Zurich. There, the data is analyzed and following an earthquake, a ShakeMap is created within approximately five minutes.

The ShakeMap for the scenario earthquake near Basel with a magnitude of 6.6 is shown below. A similar earthquake occurred at the same location on October 18, 1356, resulting in enormous damage. On average, a comparable earthquake can be expected in the Basel region every 1,500 to 2,500 years. The star denotes the epicenter of the earthquake. The colors indicate how strong the ground shaking would be at certain locations and what possible damage would result.

The colors used in the ShakeMap are derived from the European Macroseismic Scale (EMS-98), which is used as a measure for comparing the impact of earthquakes across Europe. This scenario earthquake would reach an intensity of IX near the epicenter and cause destructive damage as well as panic among the local population.

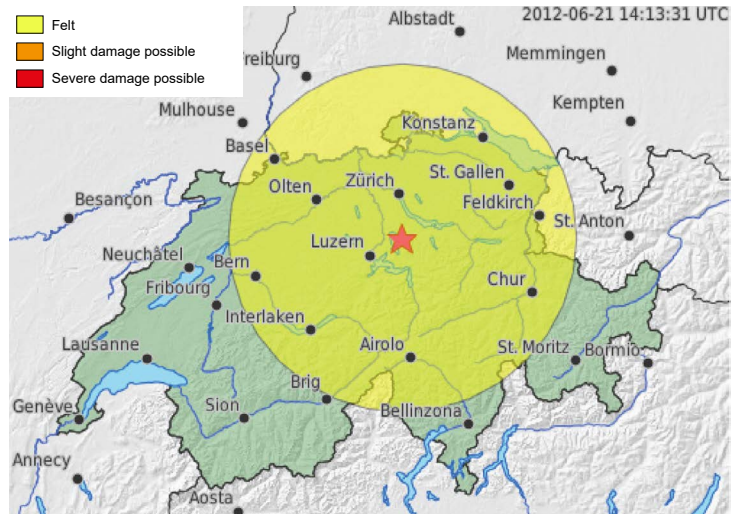
ShakeMap for the scenario of an earthquake near Basel with magnitude 6.6.



How to Read Maps of Ground Shaking

A map of ground shaking is created prior to the creation of the ShakeMap for every earthquake with a magnitude of 2.5 or greater. The colored circle on the map of ground shaking shown below from the 2012 Zug earthquake indicates the regions in which the earthquake was likely felt (yellow). The map of ground shaking is a simplified form of a ShakeMap and it may be produced faster than ShakeMaps. It indicates the area around the epicenter in which the earthquake is presumed to have been felt and suggests an initial damage estimate. Unlike the ShakeMap, the map of ground shaking takes neither the effects of the local subsurface nor the ground shaking actually measured by seismometers into account. It is based solely on the automatic earthquake location and the magnitude. The expected ground shaking is based on observations from past earthquakes in Switzerland.

Map of ground shaking of the earthquake in Zug on February 11, 2012 at 23:45 with a magnitude of 4.2.



Did You Feel It?

Seismologists need information about the felt or observed effects in order to determine the intensity of an earthquake across Switzerland. For this purpose, the Swiss Seismological Service first sends macroseismic questionnaires via the mail to the regions affected by an earthquake, and second encourages the public to enter event-related observations in the "Did you feel it?" area of the SED website. The online system simplifies and accelerates the data collection and subsequent evaluation.

The intensity determined through the use of observations reported by the general public is a key information to help scientists understand the effects of the current earthquake, and it also provides a way to compare the impacts of current earthquakes with those of the past. For the time preceding instrumental seismology (before 1970) the observations of the general public recorded in chronicles are often the only points of reference for determining the scope of damage caused by an earthquake.

How precisely an earthquake is perceived depends on where a person is located during the quake. The intensity a person experiences is dependent on the geological subsoil of a location (for example, vibrations on rocky subsoil are felt less strongly), the type of building one is in as well as the distance to the hypocenter (the earthquake waves lose energy as they travel). Thus, it is possible for an earthquake to be felt more strongly in a house located 20 km away from the epicenter and built on soft subsoil than in one which is 10 km away but built on rock.

Did You Feel an Earthquake?

Use the following link to report your observations to us:
www.seismo.ethz.ch/earthquakes/did-you-feel-an-earthquake/

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