Schweizerischer Erdbebendienst
Service Sismologique Suisse
Servizio Sismico Svizzero
Swiss Seismological Service

ETH zürich

Seismic Hazard Switzerland

When, where, and how often does certain shaking occur in Switzerland?

Seismic hazard model 2015

In Switzerland, earthquakes are the natural hazard with the greatest potential for causing damage. They cannot currently be prevented or reliably predicted. But, thanks to extensive research, much is now known about how often and how intensely the earth could shake at a given location in the future.

Switzerland's seismic hazard model is a comprehensive representation of this knowledge. It makes a forecast of potential earthquakes and the resulting ground motions over the next fifty years. The model is based on knowledge of tectonics and geology, information about the history of earthquakes, damage reports, and wave propagation models. Experts and authorities use it as a starting point for making decisions regarding earthquake mitigation and risk management. The Swiss seismic building codes are also based on this model.

Switzerland's seismic hazard model 2015 replaces the previous model from 2004. A periodic update reflecting the latest technological and scientific findings forms the basis for adequate protection measures. The seismic hazard model 2015 features new data, revised estimates of historical sources, a homoge-neous reference rock, and improved predictive models. The uncertainty regarding estimates of likely ground motions has been significantly reduced relative to the 2004 model, meaning the 2015 model provides a more solid estimate of seismic hazard and a good basis for a nationwide risk model.

The estimate of the regional distribution of Switzerland's seismic hazard has not changed substantially in the last ten years: Valais remains the region with the highest hazard, followed by Basel, Graubünden, the St. Gallen Rhine Valley, Central Switzerland, and the rest of Switzerland. But, compared to 2004, Graubünden now shows a slightly higher hazard, and expected ground motions are also slightly stronger than previously expected across Switzerland in several frequency ranges.

The maps shown illustrate in various ways how likely certain shaking is in Switzerland.

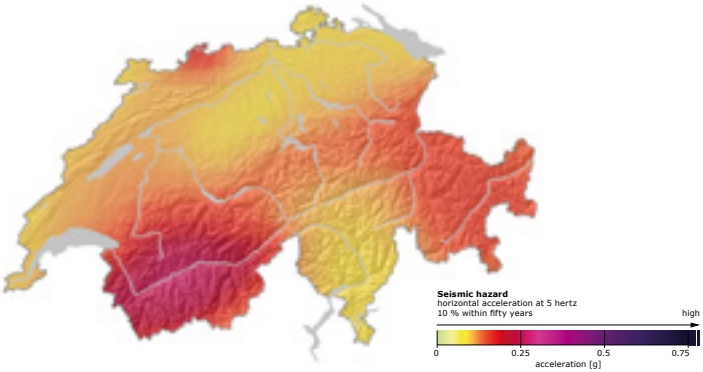
Hazard

The hazard map shows where and how often certain incidents of horizontal acceleration are likely.

Seismic hazard maps show the expected horizontal acceleration caused by earthquakes within a certain period at a specific location. The maps show expected acceleration values for a homogeneous reference rock. In order to carry out a localized hazard analysis, the local subsoil must be taken into consideration.

The rate at which a building vibrates as a result of an earthquake depends on its construction and the corresponding natural frequency. An earthquake with a ground acceleration of the same frequency as the natural frequency of any given building can cause the building to vibrate particularly strongly (resonance), which normally causes major damage. The average building in Switzerland with two to five floors generally has a natural frequency of 5 hertz.

Earthquake-resistant residential or office buildings in Switzerland are designed to withstand shaking that is expected to occur where the building is situated once every 500 years on average. The lifetime of a building is approximately fifty years. Within this lifetime, the probability of a residential or office building experiencing the design shaking is ten percent. Important infrastructures such as hospitals, stations, or dams require special protection and must therefore be able to withstand stronger shaking. For example, large dams should be able to withstand shaking expected to occur at their location once every 10,000 years.



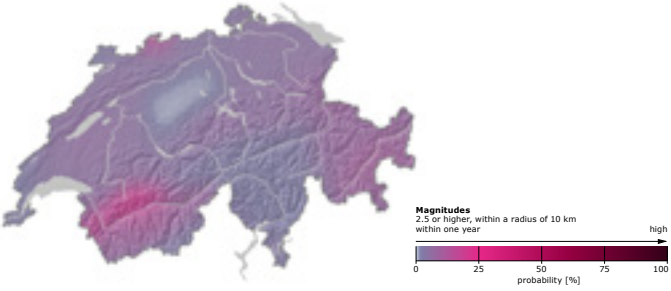
Horizontal acceleration at 5 hertz; the probability of a building constructed on rocky subsoil (reference rock) experiencing this is 10 % within fifty years.

Magnitudes

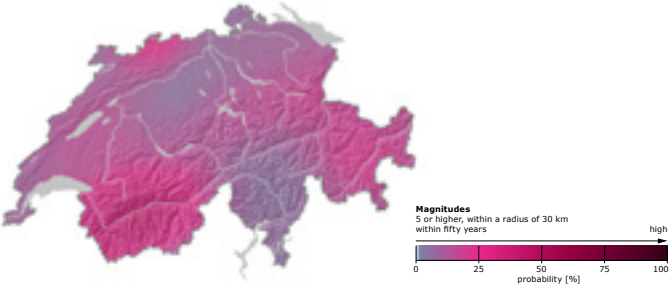
The magnitudes map shows how often an earthquake of, or above, a certain strength occurs.

The magnitudes maps show how often an earthquake of, or above, a certain size is expected to occur within a specific ra-dius and period.

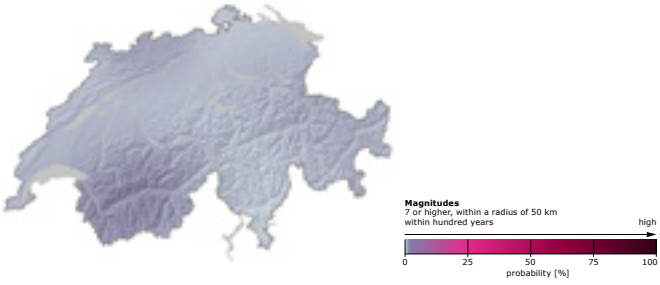
The probability of an earthquake of, or above, a certain magnitude is considered. There is no direct link to the possible effects of an earthquake, since these do not only depend on the magnitude, but also on the distance to the hypocenter, its depth, and the local subsoil. For example, an earthquake with a magnitude of 4.5 in the immediate vicinity will cause similar damage as an earthquake with a magnitude of 6 and its epicenter 75 km away.



Probability of feeling an earthquake within one year.



Probability of a potentially damaging earthquake within fifty years.



Probability of a destructive earthquake within hundred years.

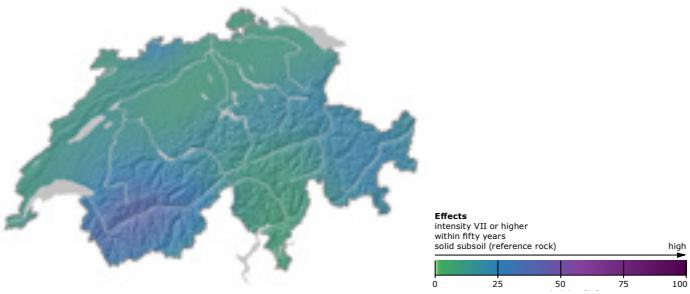
Effects

The effects map focuses on the likely consequences of an earthquake.

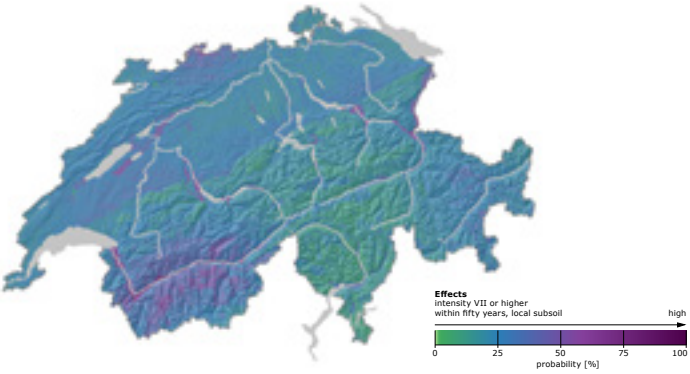
The effects of an earthquake are measured by intensity according to the European Macroseismic Scale (EMS-98). The maps show the probability of a particular intensity and the associated effects within a certain period.

Minor damage to buildings is likely from intensity VI upward, while intensity VII and above can result in major damage, including building collapse. Intensities below V do not generally cause any damage, although they can still be felt in some cases.

The effects of similarly-sized earthquakes vary primarily due to the distance from the hypocenter, its depth, and the local subsoil. In terms of the subsoil, the softer the ground, the more likely it is that damage will occur, as softer subsoil amplifies earthquake waves. Concerning depth and distance: the deeper in the earth's interior and the further away an earthquake occurs, the less damage is caused.



Probability of experiencing shaking on solid subsoil (reference rock) with an intensity VII or higher within fifty years.



Probability of experiencing shaking on local subsoil with an intensity VII or higher within fifty years.

Seismic hazard online

Maps

Discover the earthquake hazard map and other maps interactively on our website:
www.seismo.ethz.ch/knowledge/earthquake-hazard-and-risk/maps/

Background information

You can find further information and an extensive scientific report about the seismic hazard model on this site:
www.seismo.ethz.ch/knowledge/earthquake-hazard-and-risk/earthquake-hazard-switzerland/for-professionals/

For professionals

Professionals can find additional information, specific data, and parameters on this site:
www.seismo.ethz.ch/knowledge/earthquake-hazard-and-risk/for-professionals/

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