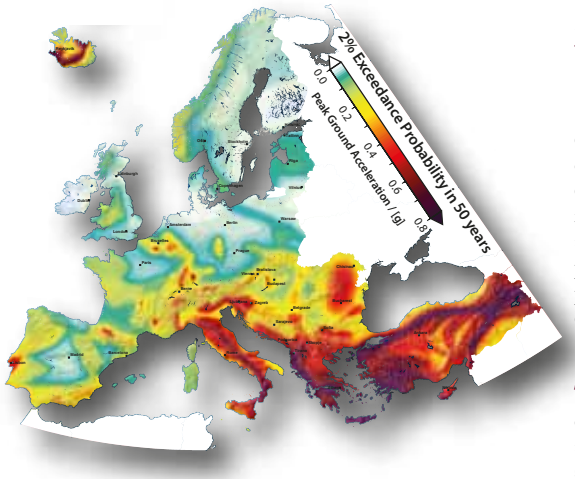

Figure 4: This European Seismic Hazard Map displays the ground motion (the Peak Ground Acceleration) expected to be reached or exceeded with a 2% probability in 50 years, i.e. these values return on average every 2475 years. Note the different color scale up to 0.8g.

From Hazard To Risk Assessment

Seismic hazard tells you about the likelihood of ground shaking in an area and is essential input to understand seismic risk, the likelihood of damage and loss for an area of interest.

The analysis of seismic risk in an area combines information on seismic hazard, the natural phenomena, with information on the elements exposed - buildings, infrastructure, or people - and the vulnerability of these elements to ground shaking. The difference between hazard and risk is an important one and the SHARE project focused entirely on seismic hazard.

Referencing

D. Giardini, J. Woessner, L. Danciu, F. Cotton, H. Crowley, G. Grünthal, R. Pinho, G. Valensise, S. Akkar, R. Arvidsson, R. Basili, T. Cameelbeck, A. Campos-Costa, J. Douglas, M. B. Demircioglu, M. Erdik, J. Fonseca, B. Glavatovic, C. Lindholm, K. Makropoulos, C. Meletti, R. Musson, K. Pitilakis, A. Rovida, K. Sesetyan, D. Stromeyer, M. Stucchi, **Seismic Hazard Harmonization in Europe (SHARE): Online Data Resource**, doi:10.12686/SED-00000001-SHARE, 2013.

Engineering Requirements and Uncertainties

Seismic design provisions, however, require hazard estimates for different exceedance probabilities when constructing a private home or critical infrastructure. For example, many European countries require earthquake resistant design of important infrastructure buildings such as hospitals using hazard values based on a 2% exceedance probability in 50 years hazard map (Figure 4), while private homes need to be designed for values of the 10% exceedance probability map (Figure 1).

The differences of these hazard values express to some degree the uncertainties of a probabilistic seismic hazard assessment. Assessment for the more distant future, like seismic hazard estimates that return on average every 2475 years (Figure 4), are more uncertain than those that return on average every 475 years (Figure 1). It is however important to quantify these uncertainties as they need to be considered in particular when designing critical infrastructures.

Online Access and Print Material

SHARE products, input data and results, are available and documented through the project website and the web portal of the European Facility for Earthquake Hazard and Risk (EFEHR).

An A0 poster and additional printable material is available for the on the web at the following sites:

Project Information: www.share-eu.org

Data Access: www.efehr.org

Contact Information

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SHARE

European Seismic Hazard Maps

Understanding seismic hazard is essential for earthquake resistant design of buildings. The collaborative EU-FP7 project Seismic Hazard Harmonization in Europe (SHARE) brought together scientists and engineers from around Europe to update the understanding of earthquake activity and the the related ground motions.

The main result is the European-wide reference model to harmonize seismic hazard assessment across national boundaries for engineering applications and to facilitate policy making for hazard and risk mitigation.

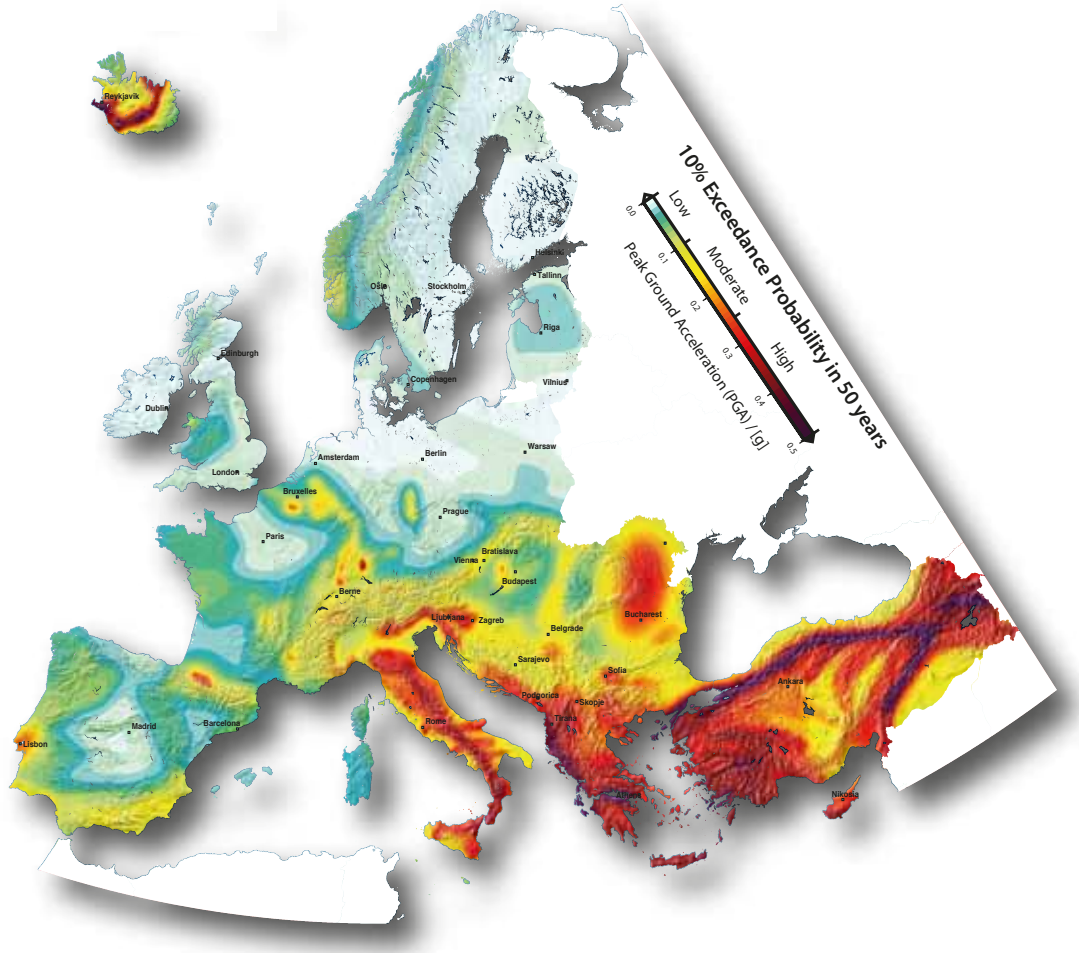

Figure 1: This European Seismic Hazard Map (ESHM) displays the ground motion (i.e. the Peak Ground Acceleration PGA) expected to be reached or exceeded with a 10% probability in 50 years, i.e. these values return on average every 475 years. Cold colours indicate comparatively low hazard areas (PGA≤0.1g), yellow to orange colours indicate moderate hazard areas (0.1<PGA≤0.25g) and red colours indicate high hazard areas (PGA>0.25g).

SHARE

Seismic Hazard Harmonization in Europe

Scope

Supported by the EU 7th Framework Program, the project "Seismic Hazard hARmonization in Europe" (SHARE) brought together leading scientists from 18 research institutions and 12 countries. The project aimed to homogeneously assess data and to harmonize methodologies to estimate seismic hazard throughout Europe, including Turkey. Over fifty researchers - seismologists, geologists, geodesists, historians, earthquake engineers, computer scientists, statisticians, and outreach specialists - formed the core team of the four year project, with more than 250 additional European experts providing their expertise and data.

Achievements

The project generated a complete set of harmonized seismic hazard results and maps, characterizing the hazard and its uncertainty, to serve as input for risk assessment and earthquake resistant design for different applications - ranging from private homes to multi-storey buildings and critical infrastructures such as bridges or dams. Through the coordination at the European Union level, these hazard results will help to harmonize the next generation of national seismic hazard assessments. In addition, the products will facilitate the update of the European seismic building code (EuroCode8).

The SHARE results form the basis for risk assessment and for the formulation of policies for its mitigation. The project results, however, do not replace the existing national design regulations and seismic provisions, which should be obeyed for today's design and construction of buildings.

The SHARE data collection and hazard results will accelerate the generation of new scientific and technical knowledge and data to further improve seismic hazard assessment in Europe.

Hazard Assessment Approach

The European Seismic Hazard Maps are based on a time-independent, probabilistic approach. Three different earthquake rate models have been assembled from data reflecting the state-of-the art knowledge on

- Past moderate to large earthquakes (Figure 2), as documented by their damaging effects through history and since 1980 with modern instrumental seismic networks. 30377 earthquakes in the period 1000-2007 were combined in a single SHARE European Earthquake Catalogue (SHEEC) with $M_W \geq 3.5$,

- 1128 active fault with a total length of 64,000km and three subduction zone models (Figure 3) are included in the European Database of Seismogenic Faults (EDSF),

- the rate of deformation of the earth's crust as observed by Global Positioning Systems (Figure 3).

The rate models are then combined with Ground Motion Prediction Equations, selected through an expert elicitation process and calibrated for the SHARE strong ground motion databank. Ground motion prediction equations model the amplitude decrease of the seismic waves propagating away from the earthquake hypocenter.

Maps of various ground motion parameters (spanning spectral ordinates from PGA to 10 seconds) and exceedance probabilities (ranging from 10^{-1} to 10^{-4} annual probabilities) have been calculated. The hazard values are referenced to a rock velocity of Vs_{30}=800m/s and were computed using the OpenQuake hazard engine developed within the Global Earthquake Model (GEM) initiative.

Hazard curves, uniform hazard spectra and disaggregation results are computed for more than 120,000 sites on-land within Europe and Turkey, spaced at about 10km from each other.

Earthquakes in Europe

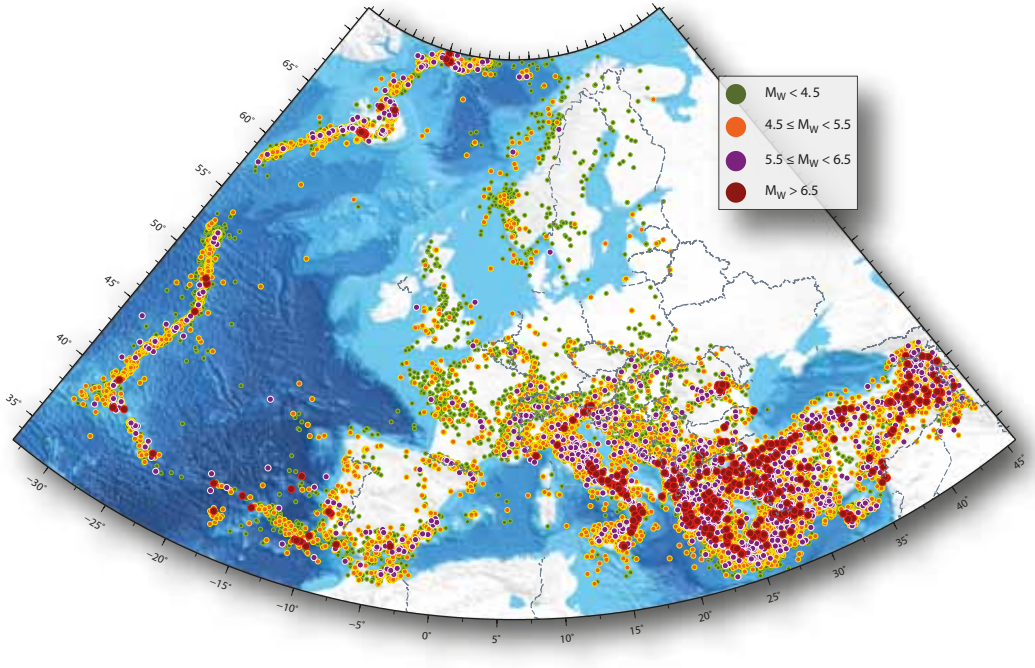

Figure 2: Earthquakes in Europe compiled in for the SHARE European Earthquake Catalog (SHEEC) covering the period 1000 - 2007 with moment magnitudes $M_W \geq 3.5$.

Active Faults in the Euro-Mediterranean Region

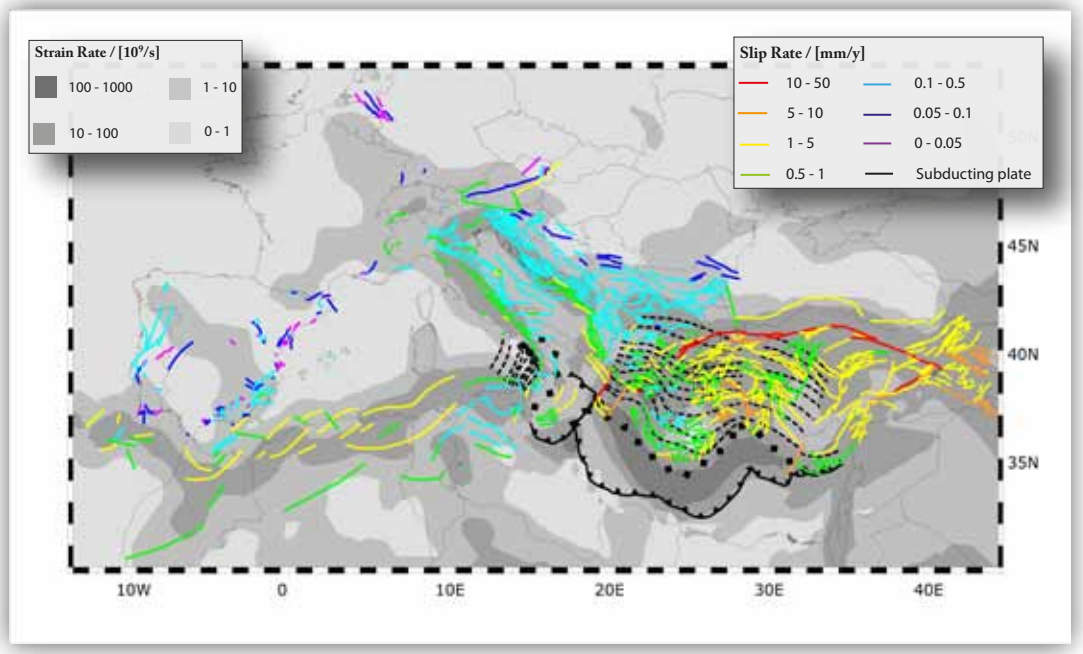

Figure 3: Active faults and subduction zones compiled in the SHARE Euro-Mediterranean Database of Seismigenic Faults (EDSF). Faults are coloured by slip rate (mm/y) depicting the rate of deformation of the crust. Subduction zones are indicated by black lines. The grey background illustrates strain rates in the earth's crust inferred from geologic and geodetic data.