From the models to actions

How to communicate seismic hazard and risk assessments?

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Only when we know what could happen, we can act.

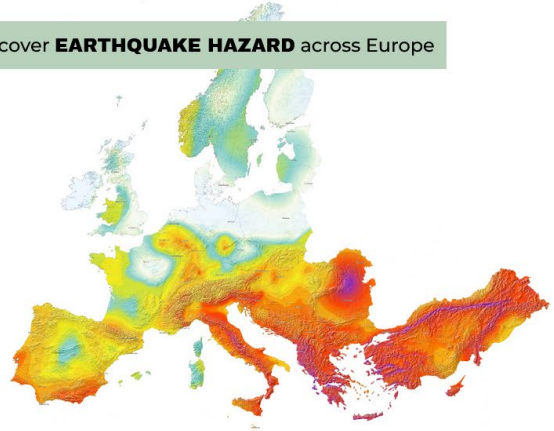
- Knowing seismic hazard and risk is at the beginning of any mitigation action.
  - Where do we have to expect damaging earthquakes?
  - How often do such earthquakes occur?
  - How well will the built environment withstand?
- Reducing the potential consequences of earthquakes in Europe is not only a technicality in the hands of trained professionals.
- Bringing the models to the people is a necessity AND a challenge!

How to launch a seismic hazard and risk models?

EARTHQUAKE HAZARD across Europe

Earthquake hazard describes the potential ground shaking due to future earthquakes in Europe.

Discover **EARTHQUAKE HAZARD** across Europe



EARTHQUAKE RISK across Europe

Earthquake risk estimates the impact that can be expected from future earthquakes in Europe.

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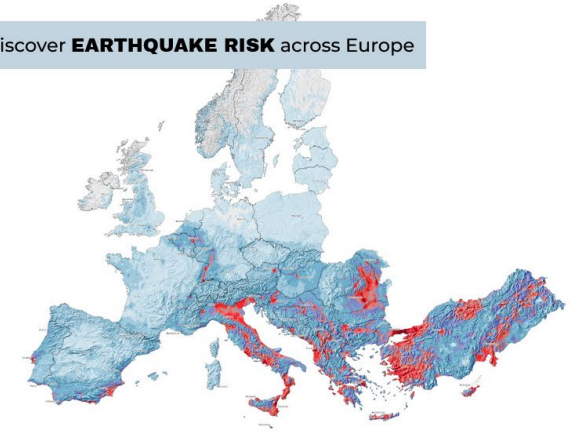
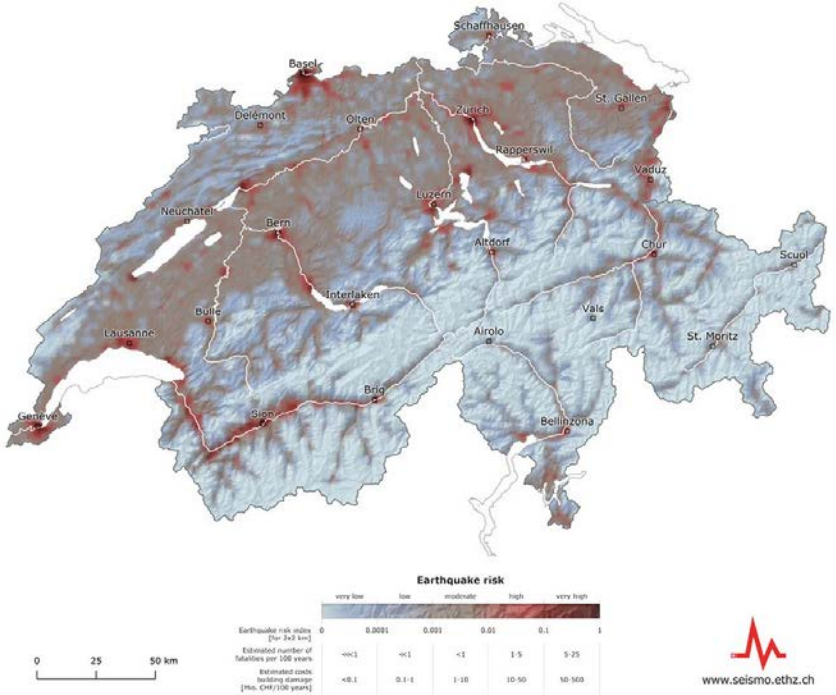
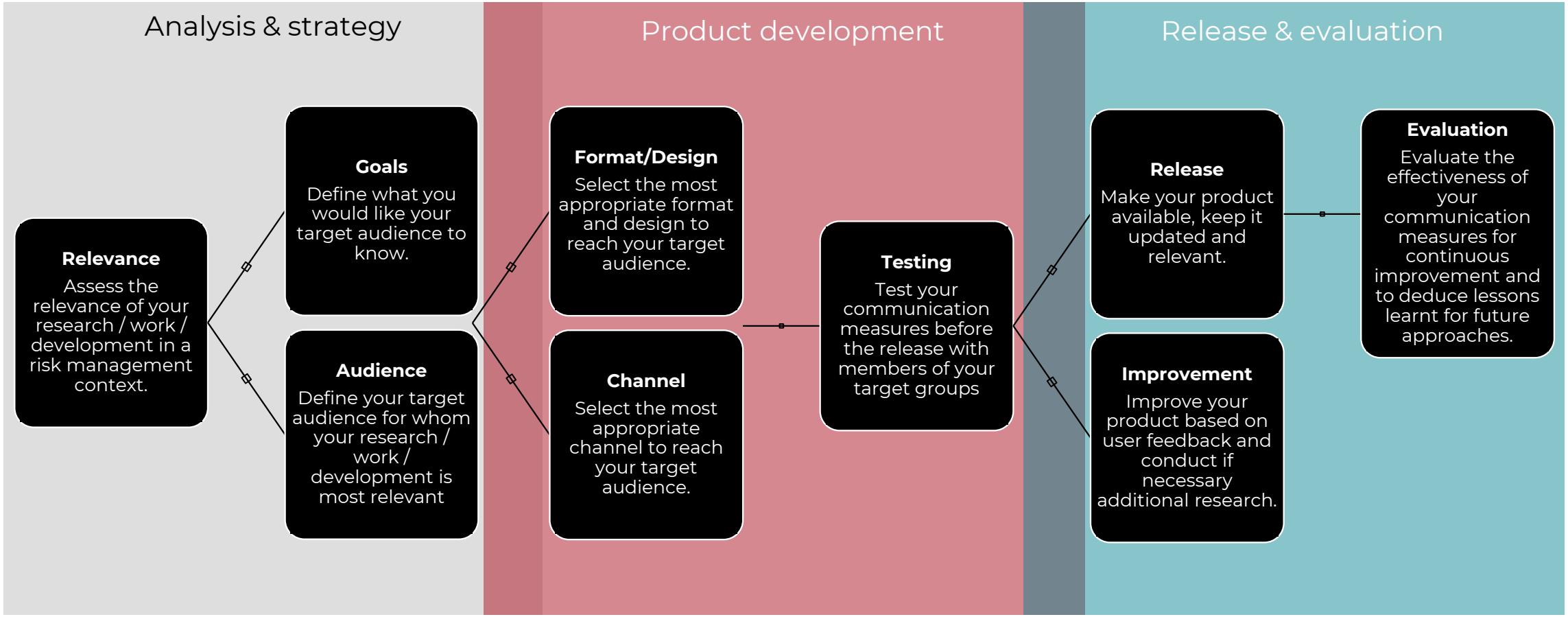




Process



Marti et al. (2020). Anecdotal Evidence Is An Insufficient Basis for Designing Earthquake Preparedness Campaigns. Seismological Research Letters (2020) 91 (4).

Process

- Iterative design process
- Interdisciplinary product development
- Transdisciplinary testing
  - Student survey
  - Workshop with national stakeholders
  - Two representative online surveys in Switzerland

Publications

Marti, M., Dallo, I., Roth, P., Papadopoulos, A. N., & Zaugg, S. (2023). Illustrating the impact of earthquakes: Evidence-based and user-centered recommendations on how to design earthquake scenarios and rapid impact assessments. *International Journal of Disaster Risk Reduction*, *90*, 103674. https://doi.org/10.1016/J.IJDRR.2023.103674

Dallo, I., Marti, M., Valenzuela, N., Crowley, H., Dabbeek, J., Danciu, L., Zaugg, S., Cotton, F., Giardini, D., Pinho, R., Schneider, J. F., Beauval, C., Correia, A. A., Ktenidou, O.-J., Mäntyniemi, P., Pagani, M., Silva, V., Weatherill, G., & Wiemer, S. (2024). The communication strategy for the release of the first European Seismic Risk Model and the updated European Seismic Hazard Model. *Natural Hazards and Earth System Sciences*, *24*(1), 291–307. https://doi.org/10.5194/nhess-24-291-2024

Dallo, I., Schnegg, L. N., Marti, M., Fulda, D., Papadopoulos, A. N., Roth, P., Danciu, L., Valenzuela, N., Wenk, S. R., Bergamo, P., Haslinger, F., Fäh, D., Kästli, P., & Wiemer, S. (2024). Designing understandable, action-oriented, and well-perceived earthquake risk maps – The Swiss case study. *Frontiers in Communication*, *8*, 1306104. https://doi.org/10.3389/FCOMM.2023.1306104

Launching the European earthquake hazard and risk models

EARTHQUAKE HAZARD across Europe

Earthquake hazard describes the potential ground shaking due to future earthquakes in Europe.

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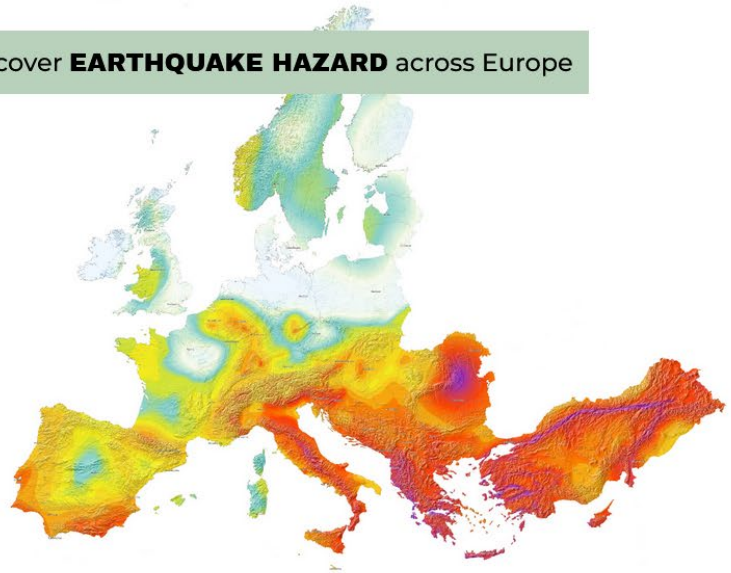

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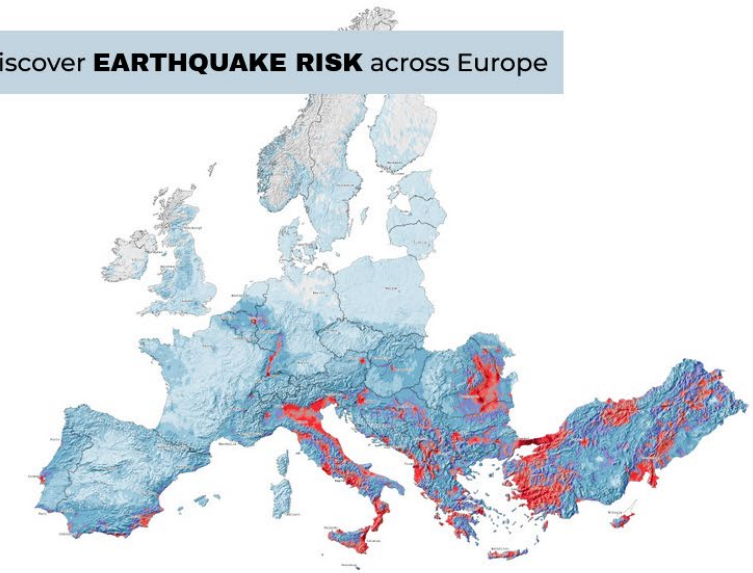
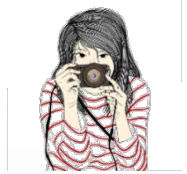


Target audiences

- We identified more then 20 target audiences
- To reduce complexity, we introduced four personas each representing a subset of our target audiences
- “How much would Persona A like that we add another layer of information?”

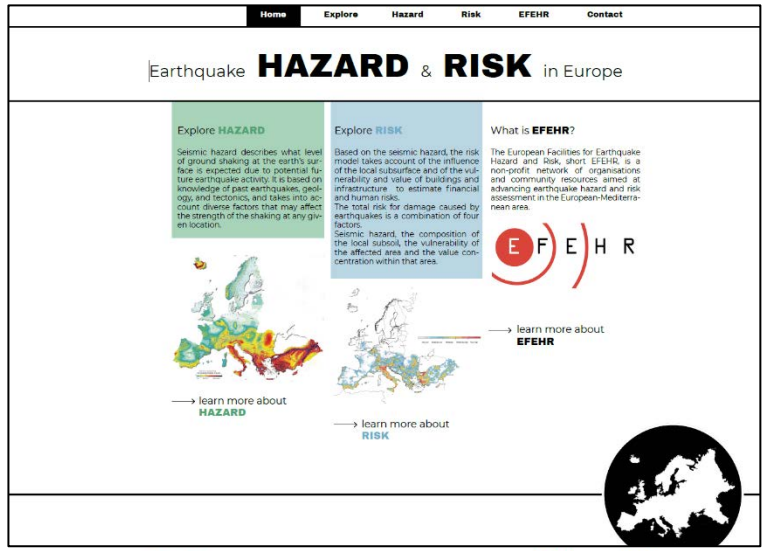
Target audience	**Modelers & Researchers**	**Professional users**	**Scientific community**	**Interested Public and Media**
				
Name	Leon	Joséphine	Dimitris	Kristina
Job Organisation Country	– CAT Modeler – SwissRe – Switzerland	– Disaster risk manager – French Civil Protection – France	– Geologist – U. of Patras – Greece	– Journalist – Jutarnji list – Croatia
Summary	*Leon will integrate the openly available input data of the European seismic hazard and risk models for their own analysis and commercial platform.*	*Joséphine wants to translate up-to-date information into concrete recommendations for action to reduce personal injury and property damage.*	*Dimitris needs openly available geological data to integrate them into his own research.*	*Kristina aims at transforming information related to Croatia into relevant and interesting stories for her readers.*

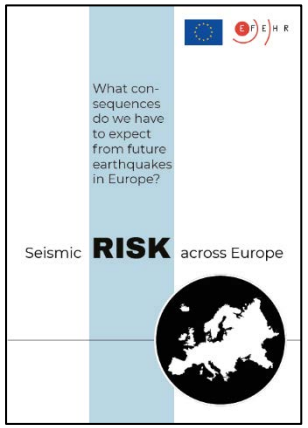
Level of experience with seismic hazard and risk models

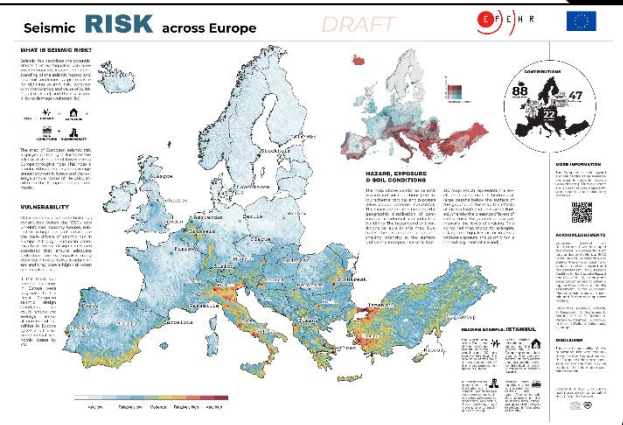
high

Products

- Redesign of the main entry point to explore the models www.efehr.org
- Posters
- Flyers
- Factsheets
- Technical report
- Press release
- Social media materials
- Explainer video
- Questions & answers
- Interactive map viewer

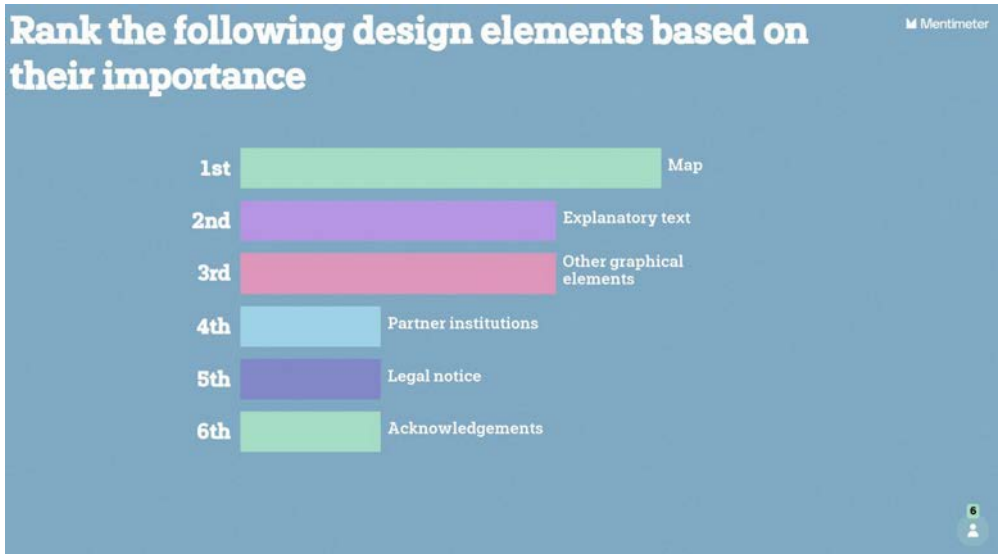






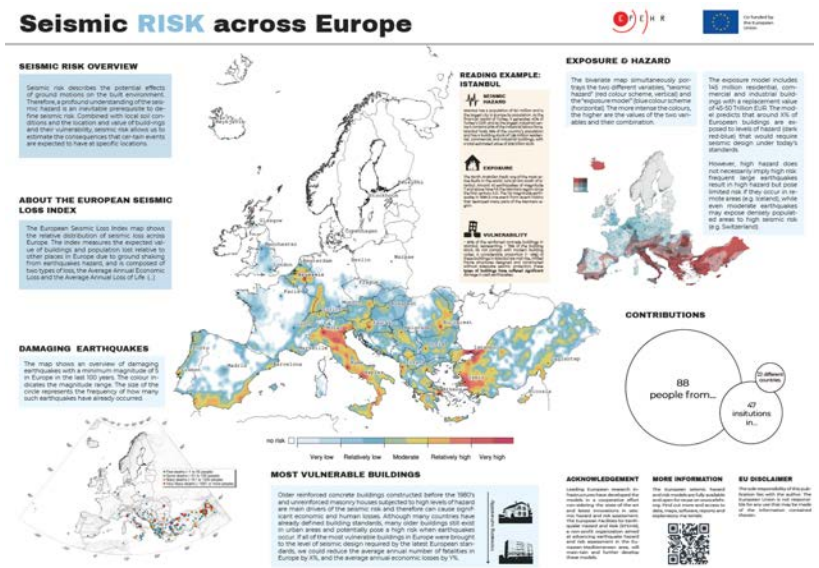
Product development – the example of the European seismic risk poster

- Target audiences: experts and semi-experts
- Important content elements
  - Title
  - Seismic loss index map (human & economic loss) (main map)
  - Explaining seismic risk
  - Combined hazard (site amplified hazard), exposure map and significant earthquakes map
  - Most vulnerable buildings
  - Reading example
  - QR code to access additional information
  - Authors
  - Copyright
  - Acknowledgement

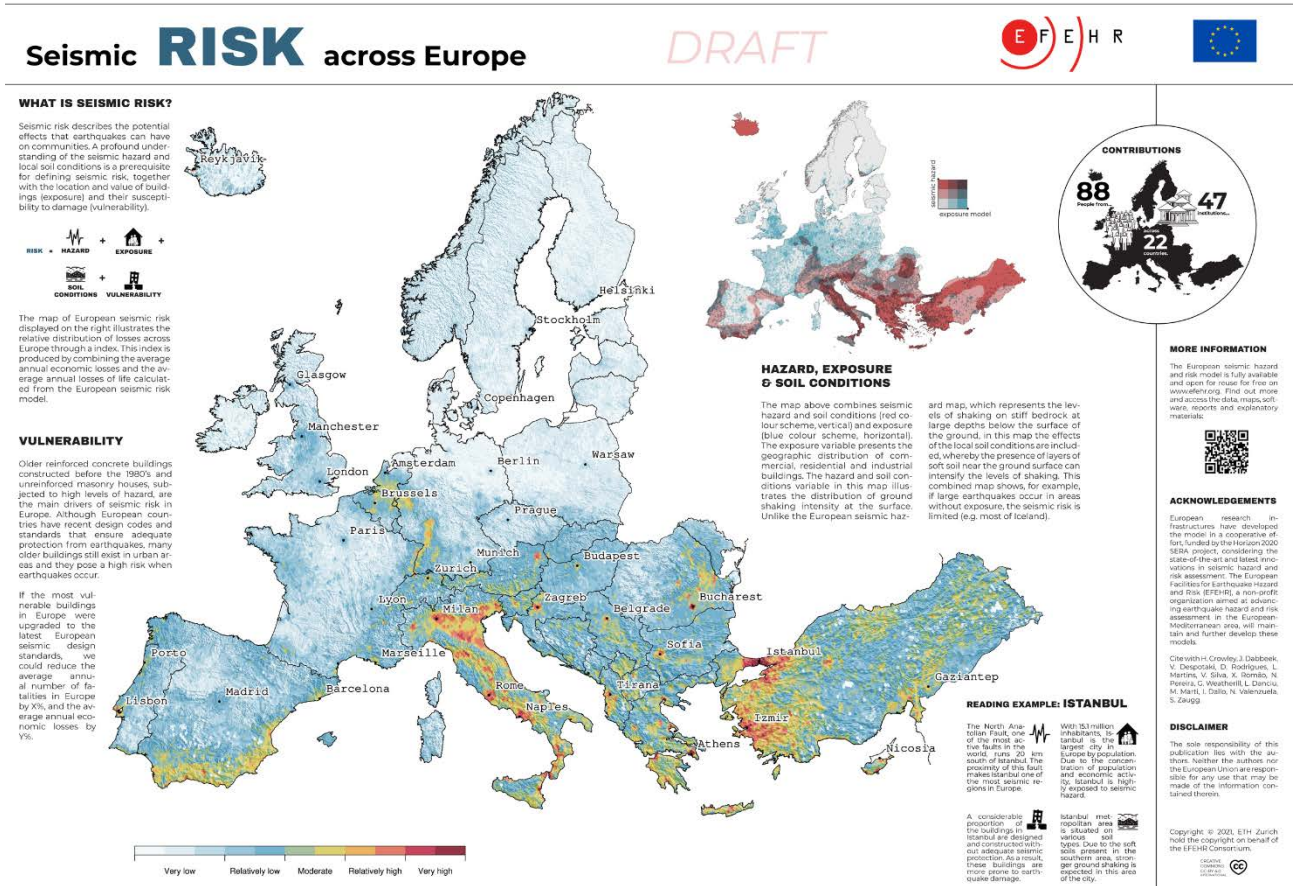


Product development – the example of the European seismic risk poster

First draft



Testing version



Final version of the European seismic risk poster

The EARTHQUAKE RISK map of Europe

WHAT IS EARTHQUAKE RISK?

Earthquake risk describes the potential effects that earthquakes can have on communities. A profound understanding of the earthquake hazard and local soil conditions, which tells us about the expected levels of future ground shaking, is a prerequisite for defining earthquake risk, together with the location and value of buildings (exposure) and their susceptibility to damage (vulnerability).

Hazard | Local soil conditions | Exposure | Vulnerability

HOW TO READ THE EARTHQUAKE RISK MAP OF EUROPE

The earthquake risk map of Europe illustrates the relative distribution of risk due to earthquakes across Europe through an index. This index combines quantities of average annual economic loss and average annual loss of life, calculated from the 2020 European Seismic Risk Model, normalised by the GDP per capita to account for the varying levels of resilience across Europe.

Low risk areas are coloured from white to light blue, moderate risk areas from blue to red and high risk areas appear in dark red.

The "very high" risk index areas could have an average annual economic loss of up to 65 M EUR and could reach over 30 fatalities a year, whereas the losses in a "moderate" risk index area could instead be up to 25 M EUR, with up to 2 fatalities per year.

READING EXAMPLE: ISTANBUL

The North Anatolian Fault, one of the most active faults in the world, runs 20 km south of Istanbul. The proximity of this fault makes Istanbul one of the most seismic regions in Europe.

Istanbul metropolitan area is situated on various soil types. Due to the soft soils present in the southern area, stronger ground shaking is expected in this area of the city.

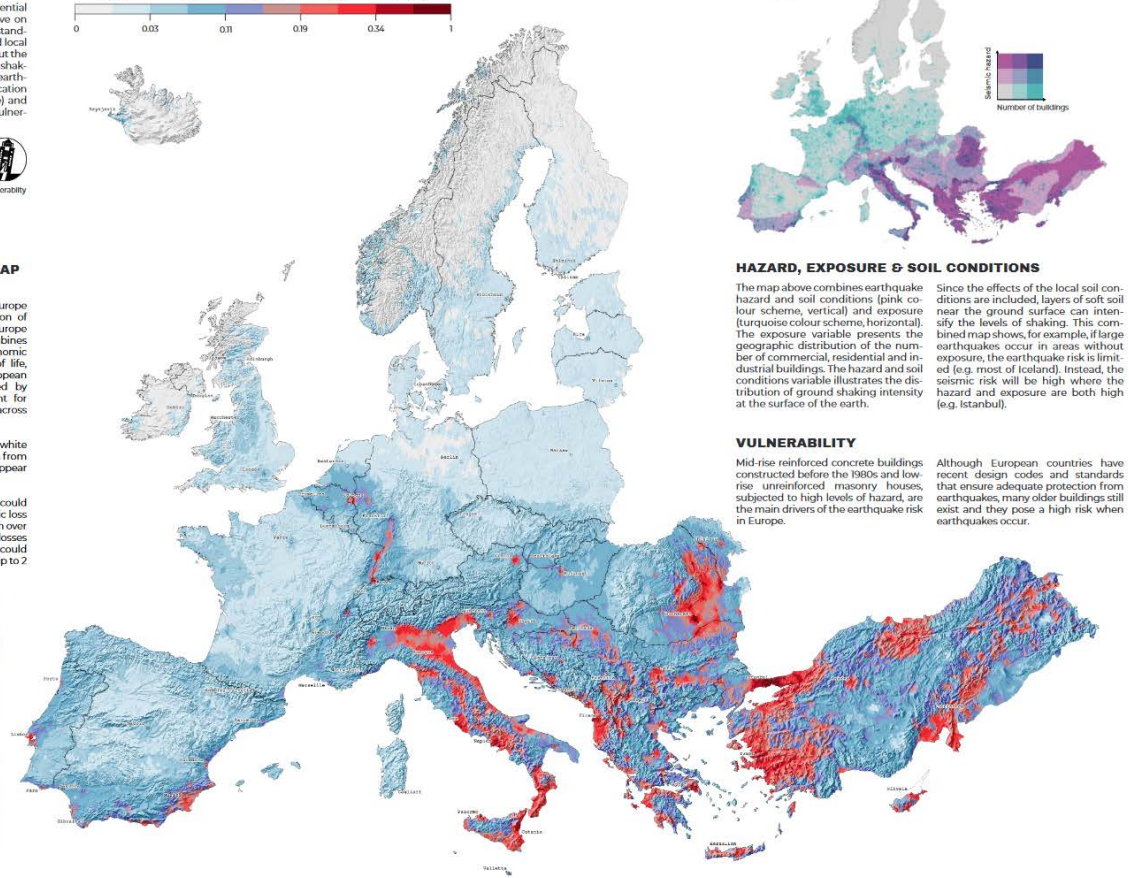
With 15.1 million inhabitants, Istanbul is the largest city in Europe by population. Due to the concentration of population and economic activity near active faults, Istanbul is highly exposed to seismic hazard.

A considerable proportion of the buildings in Istanbul are designed and constructed without adequate seismic protection. As a result, these buildings are more prone to earthquake damage.

THE EARTHQUAKE RISK INDEX MAP

Very low | Low | Moderate | High | Very high

0 | 0.03 | 0.11 | 0.19 | 0.34 | 1



HAZARD, EXPOSURE & SOIL CONDITIONS

The map above combines earthquake hazard and soil conditions (pink colour scheme, vertical) and exposure (turquoise colour scheme, horizontal). The exposure variable presents the geographic distribution of the number of commercial, residential and industrial buildings. The hazard and soil conditions variable illustrates the distribution of ground shaking intensity at the surface of the earth.

Since the effects of the local soil conditions are included, layers of soft soil near the ground surface can intensify the levels of shaking. This combined map shows, for example, if large earthquakes occur in areas without exposure, the earthquake risk is limited (e.g. most of Iceland). Instead, the seismic risk will be high where the hazard and exposure are both high (e.g. Istanbul).

VULNERABILITY

Mid-rise reinforced concrete buildings constructed before the 1980s and low-rise unreinforced masonry houses, subjected to high levels of hazard, are the main drivers of the earthquake risk in Europe.

Although European countries have recent design codes and standards that ensure adequate protection from earthquakes, many older buildings still exist and they pose a high risk when earthquakes occur.

MORE INFORMATION

Discover more about earthquake hazard and risk across Europe at www.efehr.org.

ACKNOWLEDGEMENTS

A core team of researchers from different institutions across Europe worked collaboratively in the framework of various projects to develop the 2020 European Seismic Risk Model (ESRM20).

Many more have contributed to the development of ESRM20 by different means including data compilation and curation, knowledge exchange or by providing feedback at meetings and webinars. This has all been undertaken in close collaboration with the GEM Foundation and the European Plate Observing System (EPOS). Here you can find the list with all names and institutions:

The development of the 2020 European Seismic Risk Model (ESRM20) has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements 730900, 676564 and 821115 of the projects SERA, EPOS-IP and RISE.

Funded by the European Union

CITATION

Crowley, H.[1], Dabbeek, J.[1], Despotaki, V.[2*], Rodrigues, D.[3*], Martins, L.[3*], Silva, V.[2], Romão, X.[4], Pereira, N.[4], Weatherill, G.[5], Danciu, L.[5] (2021): European Seismic Risk Model (ESRM20), EFEHR Technical Report 002, V1.0.0, 84 pp. https://doi.org/10.7414/EUC-EFEHR-TR002-ESRM20

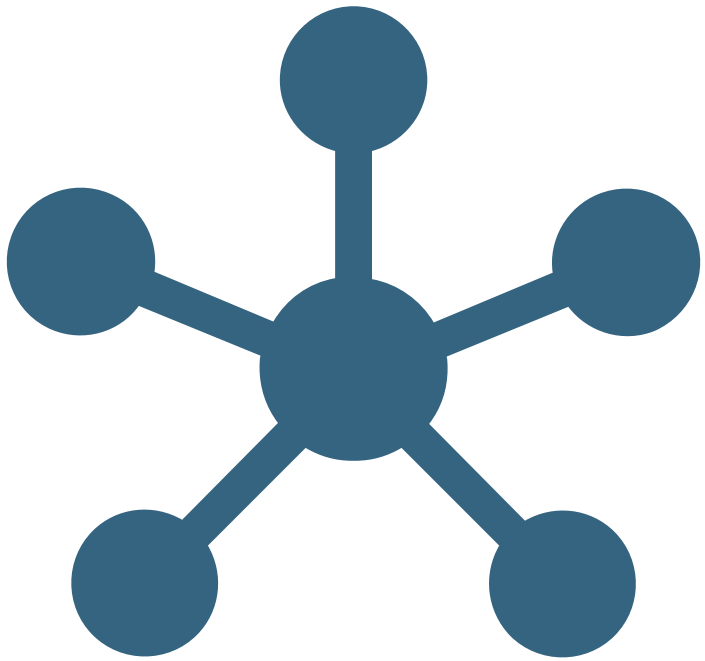
1. EUCENTRE, Foundation, Pavia, Italy
2. GEM Foundation, Pavia, Italy
3. University of Porto, Porto, Portugal
4. GFZ Potsdam, Germany
5. ETH Zurich, Switzerland
* Former affiliation

LICENSE

DISCLAIMER

Distribution channels

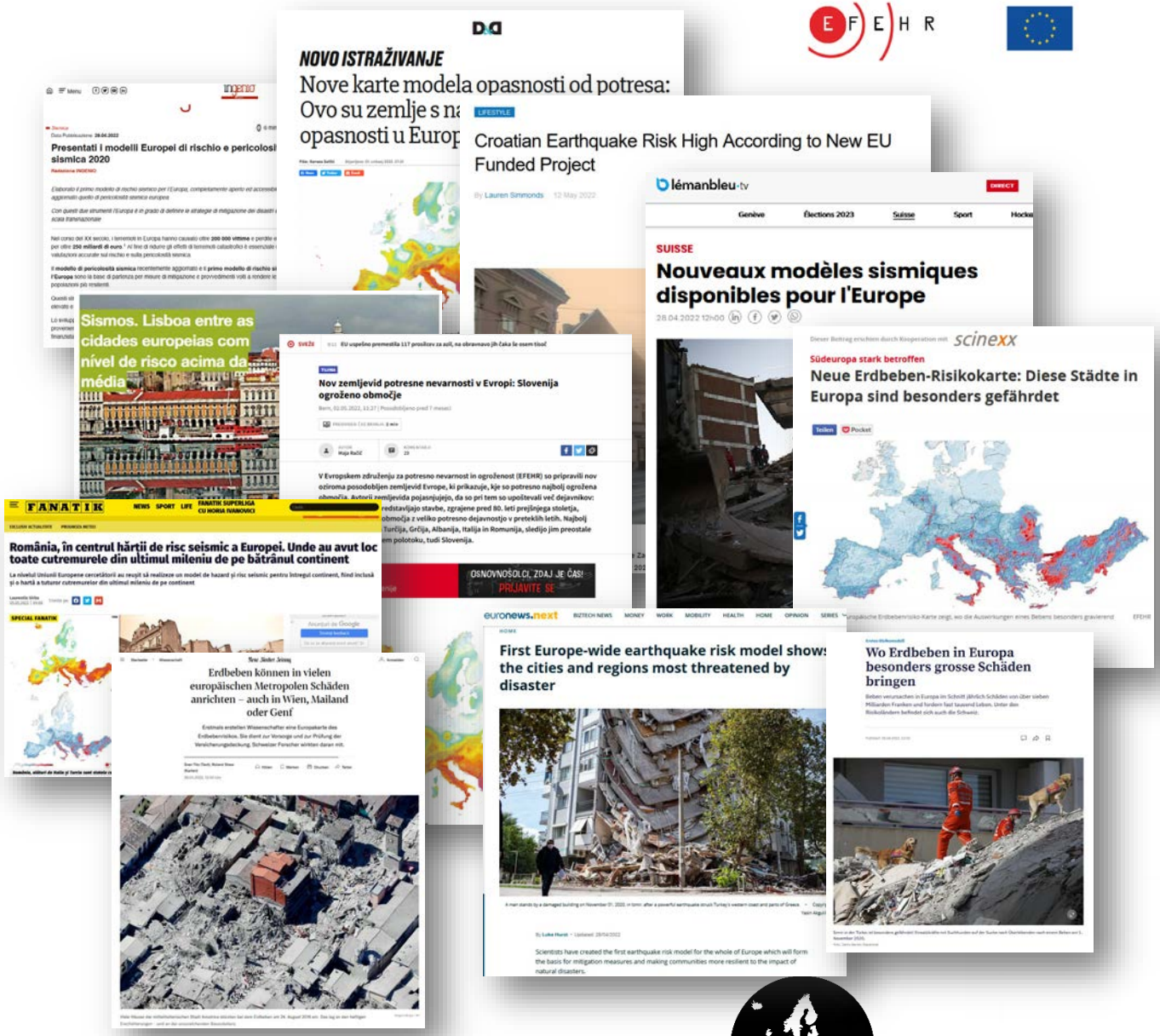
- Using established communication channels of the EFEHR consortium
- www.efehr.org website as the primary information hub to access the models.
- Close collaboration with EFEHR partner organizations and other institutions interested in sharing the knowledge about seismic hazard and risk in Europe



Media coverage

- 14 articles on websites, newsletters
- 37 articles in newspapers, online magazines
  - National press from various countries
  - Switzerland, Germany, UK, Greece, Portugal, Slovenia, Italy, Ireland, Romania, France, Croatia
  - International media and websites: EuroNews, Newswise, Swissinfo, Science X
- 40 post on social media channels
- 1 report in the radio

→ Often, text was adapted from the official EFEHR press release



Conclusions

- **Start early**
  The models do not need to be final to allow for product development and testing.

- **Listen to each other**
  Transdisciplinary collaboration requires interest and respect for other perspectives as well as room for discussions.

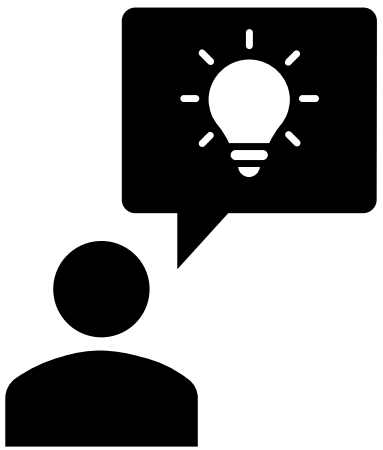
- **Take it step by step**
  Not only the models need time to develop, but also the communication materials. Usually, the first draft is not the final draft, do not start the process with this expectation.

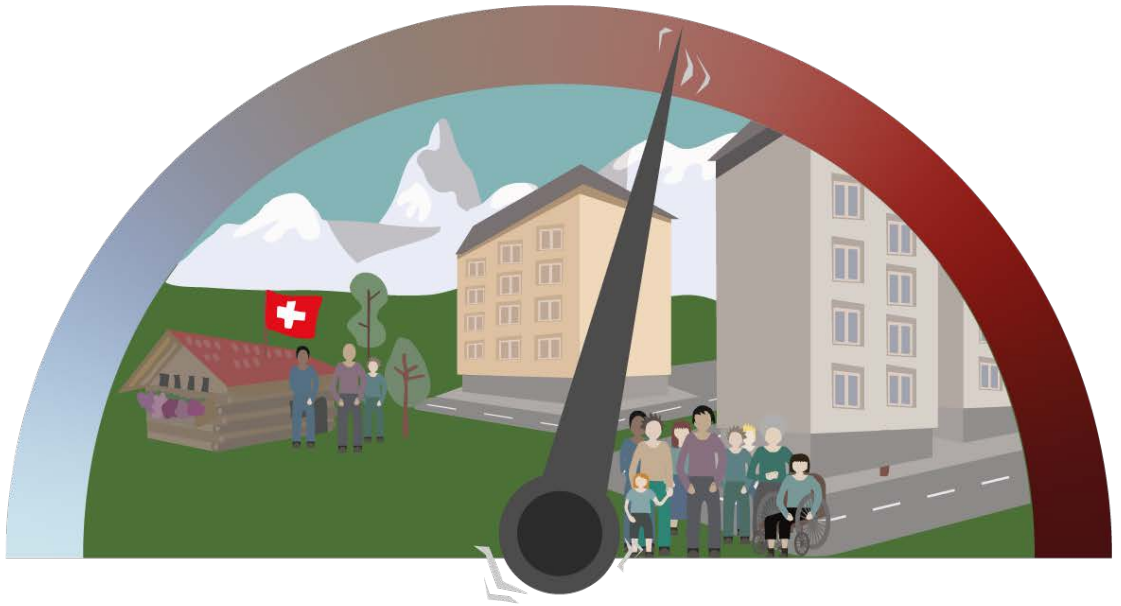
- **Evaluate**
  Even carefully designed communication materials may fail and be misunderstood. Therefore, test the communication materials in advance and evaluate if they really portray the message you intended.

- **Stay tuned**
  The job is not completed after the release. Be prepared to make changes, respond to requests, and continue sharing your knowledge.

Launching the Swiss earthquake model

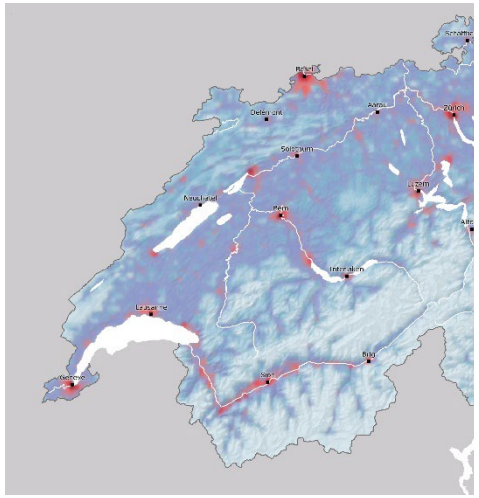
- Aim
  Provide information that allow the public, the authorities and the economy to make informed decisions and support event management.

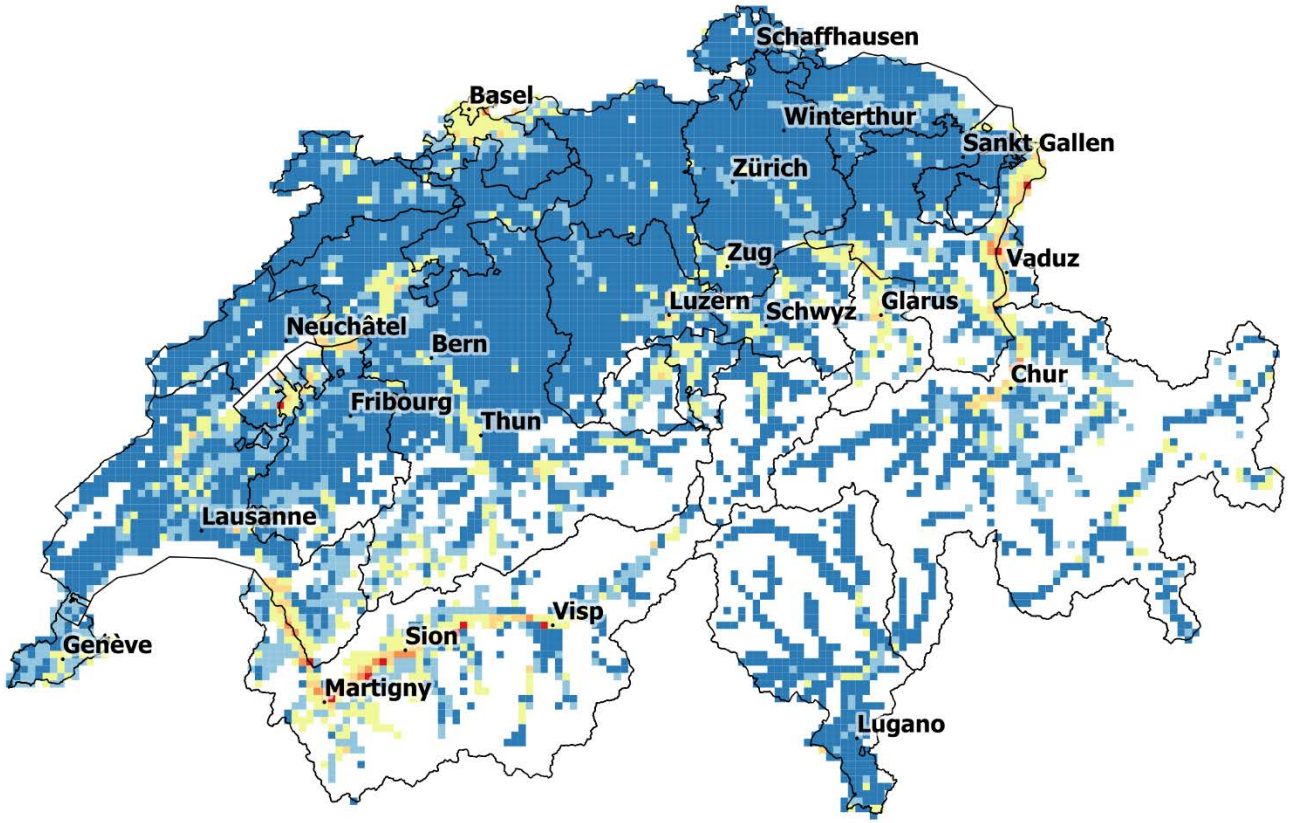


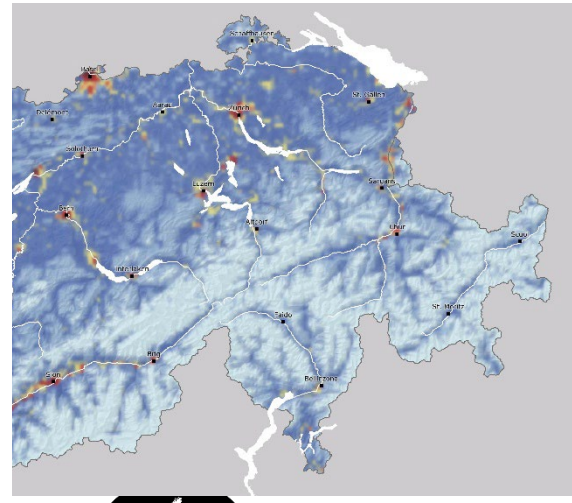


Which map shall it be?

- Earthquake risk map as the main communication product to inform the Swiss public.
- How do you design a map like this, including a legend, so that it adequately reflects the earthquake risk and supports its assessment?

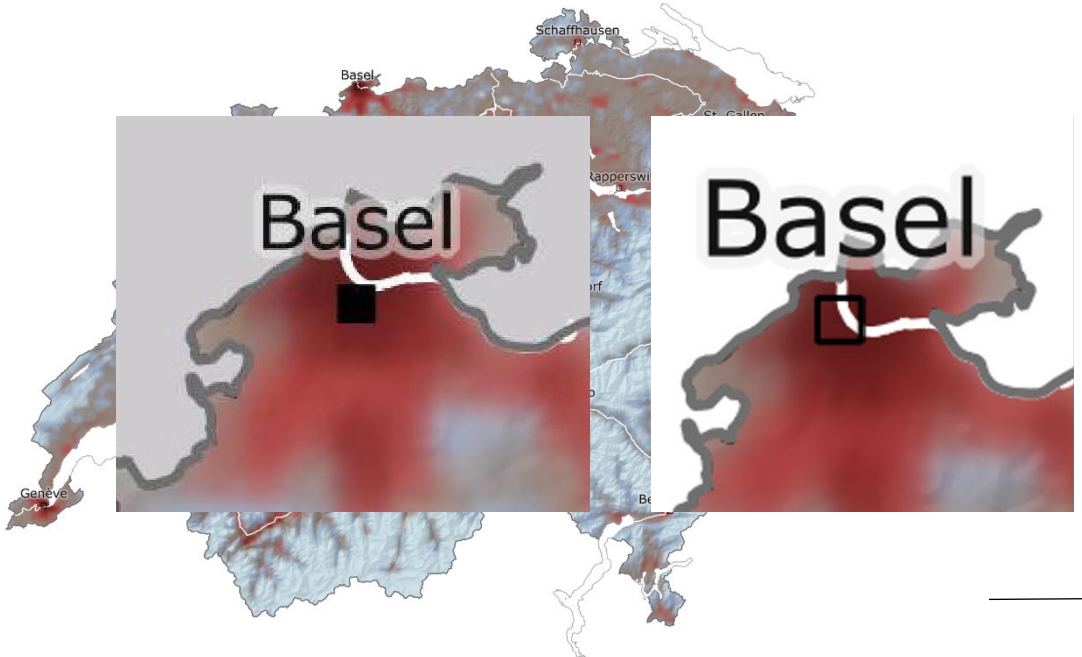






Which map shall it be?

- Most popular version
- Highest intention to take actions.
- Better understanding that all of the Swiss plateau has an elevated earthquake risk.
- Better understanding that most places in Switzerland are potentially at risk.

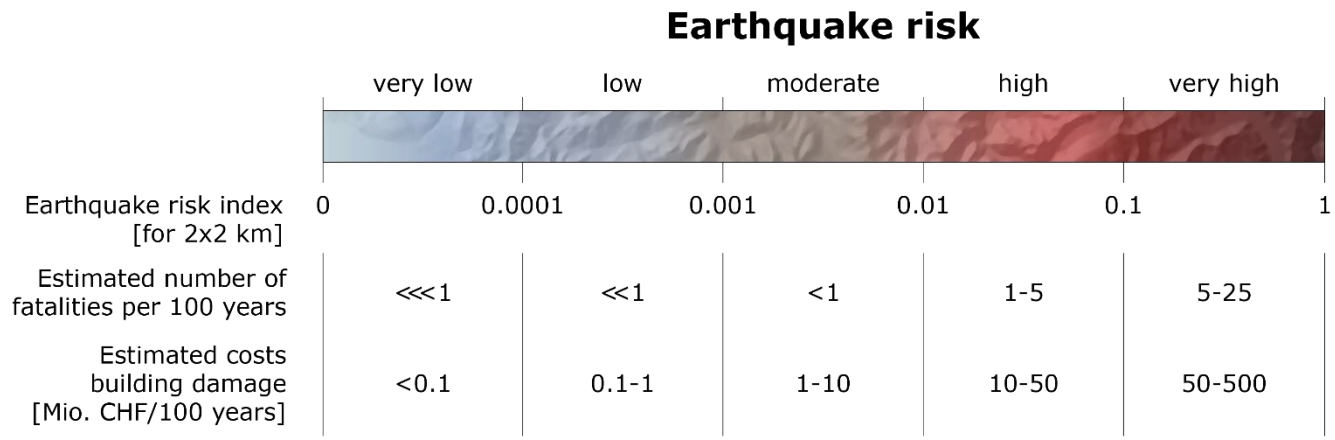


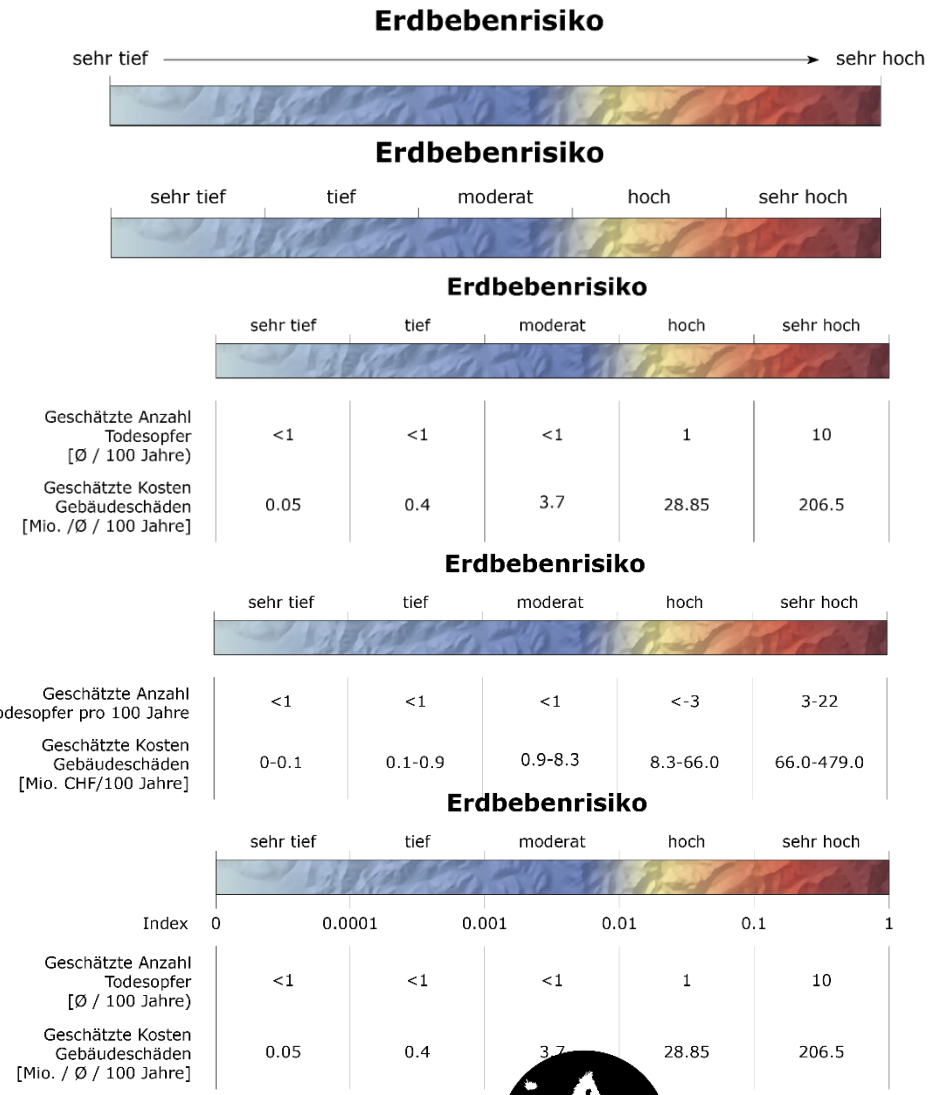
The Swiss plateau (the region between Lake Geneva and Lake Constance) and the Valais are at greater risk of earthquakes than the rest of Switzerland.

The risk of earthquakes is greatest in urban areas (cities).

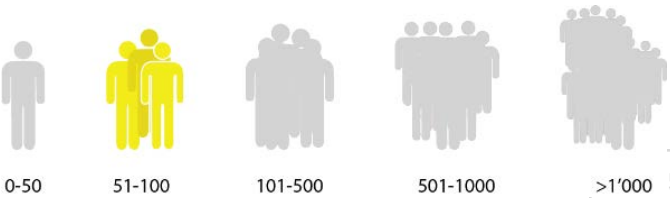
Which legend shall it be?

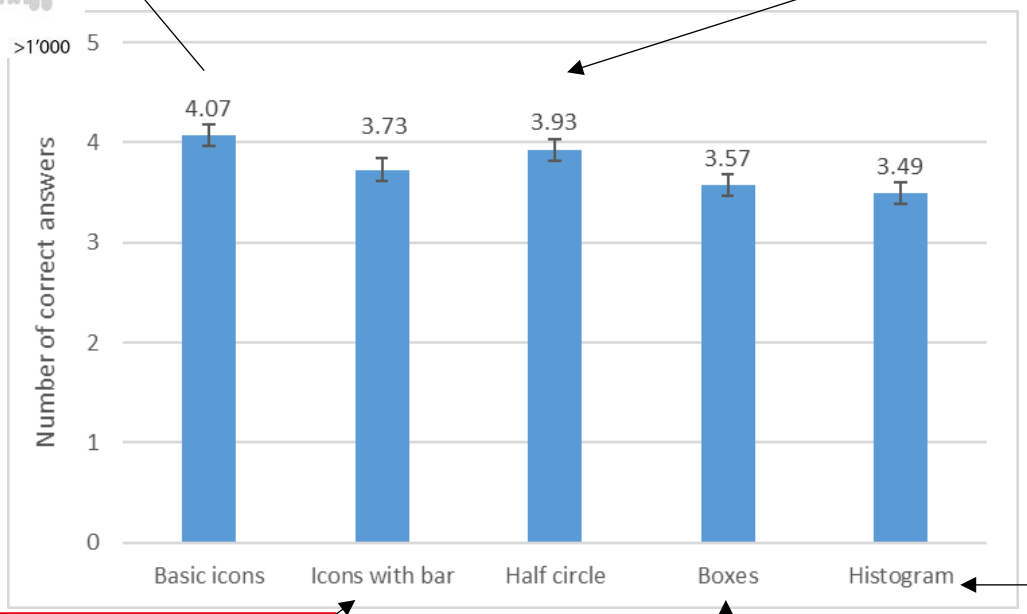
- Testing of six different versions
- Most complex version was among the favoured legends and led to the most adequate interpretation.

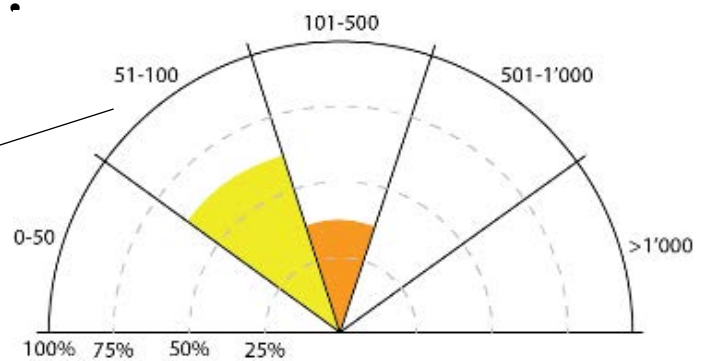


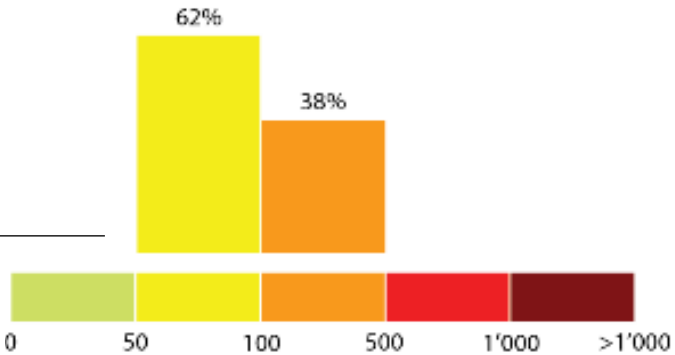


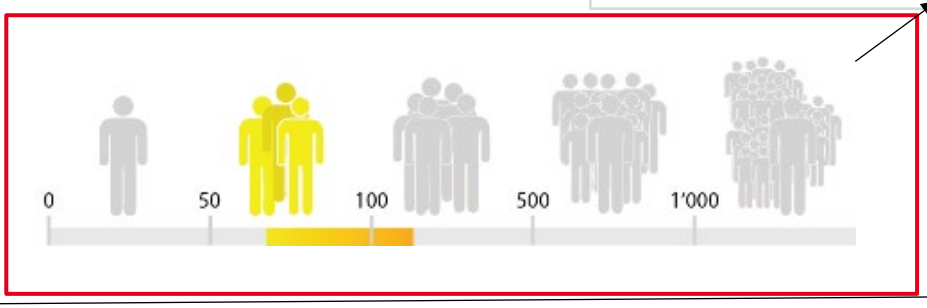
Which design shall it be to depict rapid impact information?

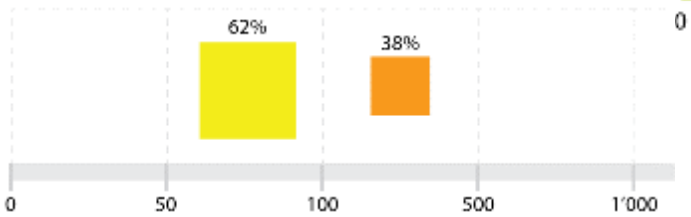












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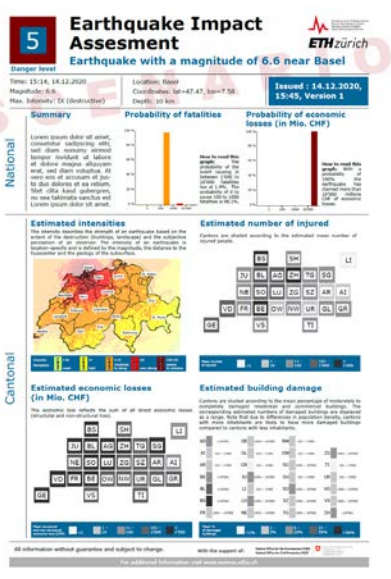

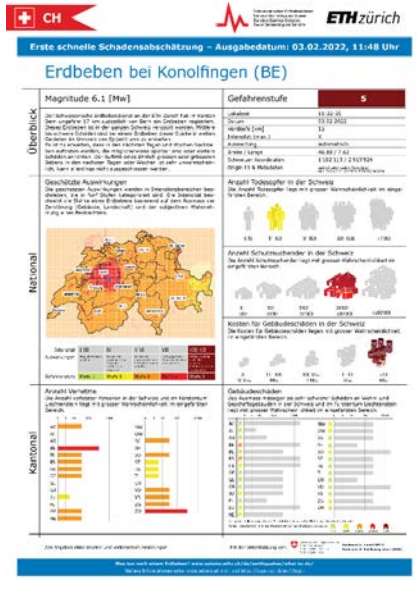

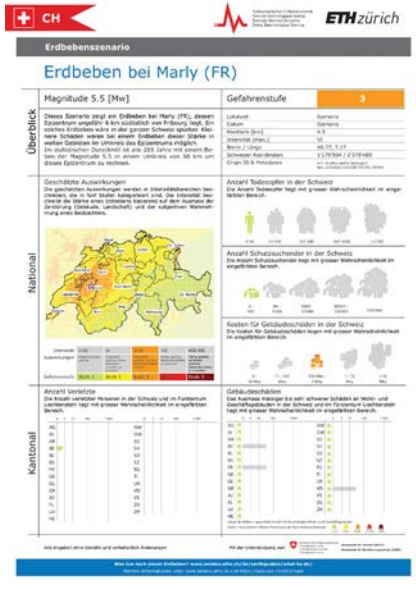

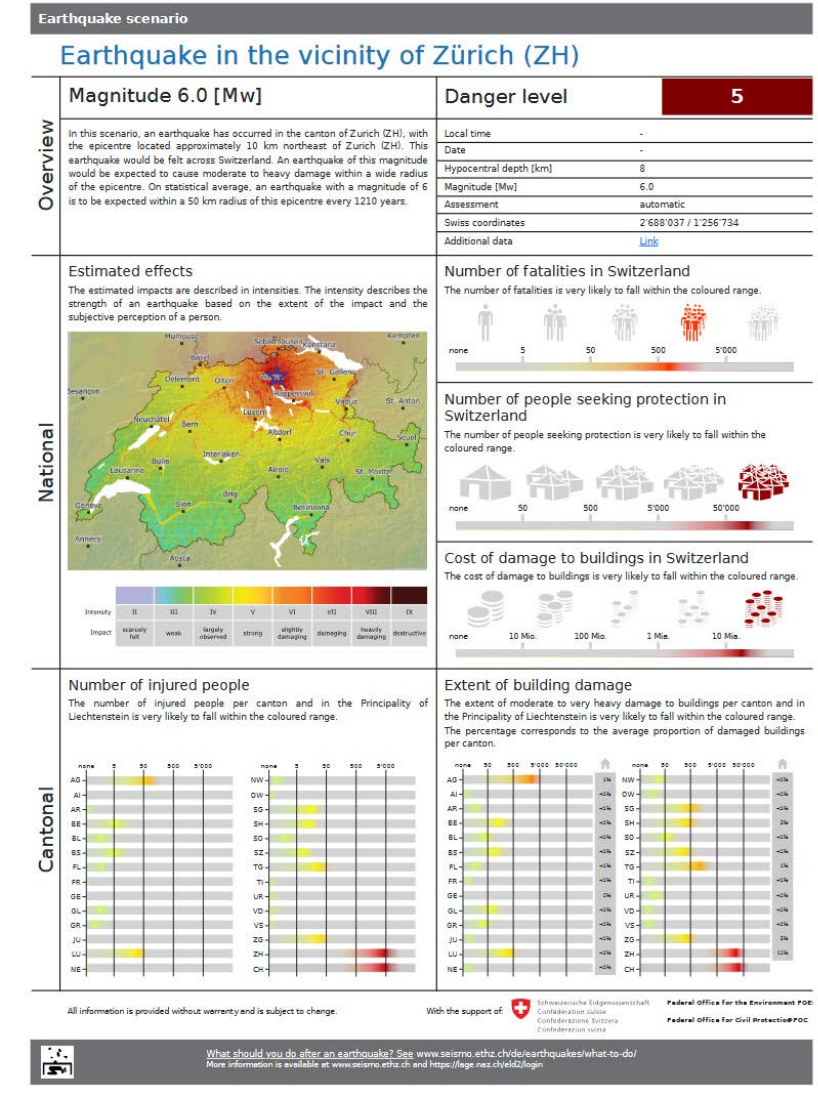

What did we learn?

- Informed decisions require comprehensible and accessible information.
- We as experts do not always intuitively choose the best version. Your perspective is important, but your stakeholders and users know better!
- Products are needed and will also be essential for future discussions.
- Make a plan.
  - Sometimes, your goals seem obvious, but it is worth while thinking about them in more detail.
  - Your models have the most impact if their results become accessible to a wide group people.
- Do not be afraid of an iterative process. Allocating «useless» products is more costly than investing in the design process.