Deliverable

D8.11 External newsletter released

Deliverable information	
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Summary

RISE sends an external newsletter via the email marketing service MailChimp to its members and to the interested public. Experiences of other projects proofed the effectiveness and relevance of this communications means in terms of enhancing project visibility and stakeholder engagement. The relatively high opening-rates of the first two external newsletters have demonstrated that they attract the interest of the audience.

The external newsletters are sent out once a year and inform about the latest achievements reached within the RISE project, new publications with RISE acknowledgement and provide further information on the topic of dynamic risk. The next external newsletter is planned for September 2021.

All published external newsletters are accessible to all on the RISE website. The newsletter is also shared on Twitter to reach a broader audience of the scientific community external to RISE.

The external newsletters usually follow a similar structure and are ordered in different sections:

External Newsletter
Greeting / overview / news in brief
A closer look Insights into different workpackages
RISE terminology Explanation of one important term of RISE project, for example “Dynamic Risk”
Miscellaneous Events, links, papers, conferences – all open to the public
Calendar Events, links, papers, conferences – all open to the public
Icons for website, email and Twitter
Logos and disclaimer

1. Detailed content of the released external newsletters

In the following a brief overview over the three external newsletters with regard to their content, opening rate and number of recipients. For the third external newsletter, which will be released in September 2021, its content is not entirely defined yet.

1.1 External newsletters overview

1st external newsletter

- Released on 3 March 2020
- Opening rate 55.9%, 129 recipients
- Content of the newsletter:
  - Introduction of the RISE project
  - Welcoming message from the RISE project manager
  - "A closer look"
    - Towards optical sensing of ground motion for improved seismic hazard assessment (WP2)
    - What is Operational Earthquake Forecasting? (WP3)
  - "RISE terminology"
    - The concept of "Dynamic Risks"
  - RISE and TURNkey at the European Seismological Commission (ESC2020), call for abstracts
  - Calendar

2nd external newsletter

- Released on 15 October 2020
- Opening rate 66.2%, 150 recipients
- Content of the newsletter:
  - Introduction / News in brief / Overview
  - Summary of each WP about their progress in the first project year
- "A closer look"
    - Structural Health Monitoring: Opportunities for Integrating Sensing Data into Rapid Loss Assessment (WP4)
    - Looking into the future of forecasts (WP5)
  - "RISE terminology"
    - The concept of "Earthquake Early Warning"
  - All RISE publications at one glance
  - Calendar

3rd external newsletter

- To be released in September 2021
- Intended content:
  - Introduction / News in brief / Overview
  - Summary of each WP about their progress by the midterm of the project
  - "A closer look"
    - Testing forecasts (WP7)
    - Earthquake Network (WP5)
  - "RISE terminology"
    - The concept of "Long-term earthquake forecasting (LEF)"
  - Insights into latest RISE publications
  - Calendar

2. Appendix

2.1 First external newsletter

Did you know that more than 170 million people in Europe are exposed to significant earthquake hazard? Advances in scientific understanding and emerging technologies offer enticing opportunities to consider earthquake risk as a time-dependent process. Developing such innovative approaches and measures in order to reduce future earthquake losses is the mission of RISE. It stands for **R**eal-time earthquake r**I**sk reduction for a re**S**ilient **E**urope and is a three-year project financed by the Horizon 2020 programme of the European Commission.

The RISE Project kick off was in September 2019 and all activities are now gaining momentum. This external newsletter, published three times a year, will update everyone interested in RISE progress, share results, events, open positions and more. In addition, in each external newsletter two work packages will Elaborate on a selected task in an approachable way. In this newsletter, two reports of Prof. Andreas Fichtner and Dr. Marcus Herrmann provide further insights in their research projects.

Another way to stay informed about the project is to follow RISE on Twitter or to discover more on its website.

Do you know someone who could be interested in RISE progress and findings?
You are welcome to forward this newsletter to your contacts!

A welcoming message from RISE project manager Dr. Banu Mena Cabrera

"RISE brings together seismologists, engineers, social scientists, economists, practitioners within and outside academia under one project and one goal; to advance real-time earthquake risk reduction capabilities for a resilient Europe. To maximise the impact of the project, RISE adopts an interdisciplinary and multi-hazard users' perspective and translates all RISE outputs and deliverables into tangible products and services, useful for and used by a wide range of stakeholders. It contains a comprehensive set of communication, dissemination, exploitation, and decision-support activities. In RISE, we are ambitious to achieve our goals and make an impact on societies of Europe and beyond.

As Project Manager, I am very excited about being part of this effort and helping to manage and sustain this collaboration towards achieving RISE objectives. We hope you enjoy getting the most up to date project information through our various channels."

A closer look

"Towards optical sensing of ground motion for improved seismic hazard assessment"

Prof. Andreas Fichtner, ETH Zurich

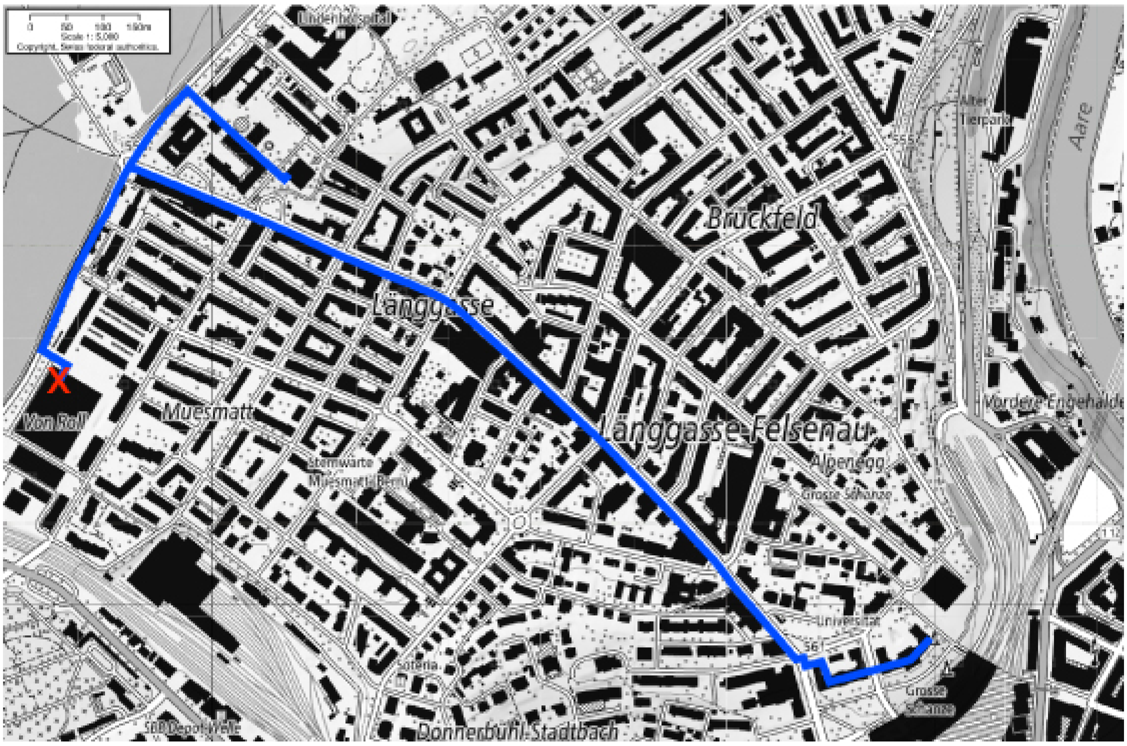
Optical fibres are the backbone of our modern communication network. Short pulses of laser light transmit enormous amounts of data, but on their journey from sender to receiver they also gather information about the optical fibre itself. In fact, microscopic displacements of the fibre slightly distort the laser pulses – an effect that has recently become detectable with highly sensitive interferometers.

This emerging technology, known as Distributed Acoustic Sensing (DAS), allows us to measure ground motion excited by a large variety of sources, such as earthquakes or landslides. Harnessing existing networks of telecommunication fibres, DAS therefore offers the opportunity to assess and potentially mitigate natural hazards in densely populated urban areas.

To explore this opportunity, RISE researchers at ETH Zurich are conducting a pilot experiment in the Swiss capital Bern, closely collaborating with the telecommunication company SWITCH. Several connected telecommunication fibres traversing the city in different directions along a 6 km long path measure ground motion every two metres, in real-time, nearly 1000 times per second (Fig. 1). Most of the observed ground motion is caused by traffic, industrial installations, and construction sites (Fig. 2).

Though the amplitude of these signals is, fortunately, much lower than the ground motion caused by destructive earthquakes, this wealth of data can be utilized to infer rock properties of the upper tens to hundreds of metres of the subsurface. Knowing these properties is essential to predict the ground motion caused by potential future earthquakes.

Research on DAS in urban environments is in its infancy, within the RISE project and worldwide. Initial results are very promising, especially in terms of the quality and unprecedented spatial resolution of the data. Yet, substantial research and development are still needed in order to process the enormous amounts of DAS data efficiently.



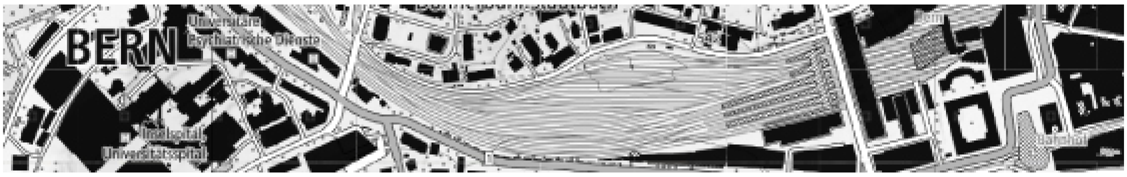


Fig. 1: Map of the north-western neighbourhoods of the Swiss capital city Bern. The position of fibre-optic telecommunication cables used in the DAS experiment are marked in blue. The red cross indicates the location of the interferometer in a building of the University of Bern.

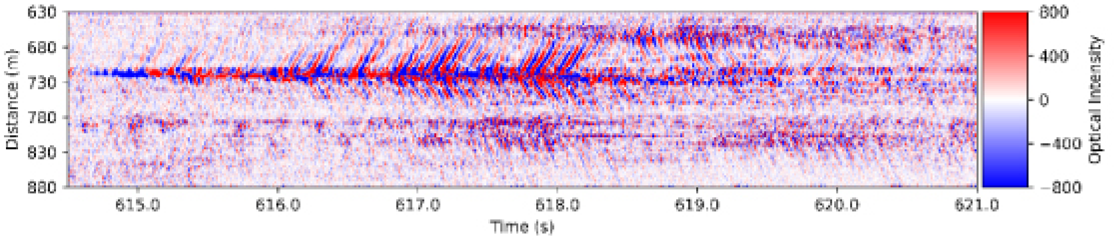


Fig. 2: Snapshot of an urban DAS recording in Bern for receivers located at distances between 630 m and 880 m from the interferometer. The record is 6.5 s long. Colours indicate strain rate in the direction of the fibre. The prominent signal corresponds to slow traffic at a speed of around 20 km/h (5.5 m/s). The more steeply dipping waves emanating from the traffic signal have a propagation speed of nearly 400 m/s, which corresponds to the shear wave velocity of the upper few tens of metres of the subsurface.

"What is Operational Earthquake Forecasting?"

Dr. Marcus Herrmann, University of Naples

To advance earthquake predictability research such as Operational Earthquake Forecasting (OEF) is one important focus of RISE. This research can benefit from the constantly evolving observational capabilities of seismic monitoring efforts, which, for instance, result in an ever-increasing amount of recorded earthquakes, especially toward smaller magnitudes. Such capabilities need to be exploited to gain more insight into the earthquake occurrence processes and, therefore, to improve earthquake forecasting.

In our first step we explore existing high-resolution earthquake catalogs that contain events with magnitudes down to M_L0 or below. We started to develop an interactive tool that will facilitate and aid us in a more intuitive analysis of seismicity in five dimensions (see Figure 1).

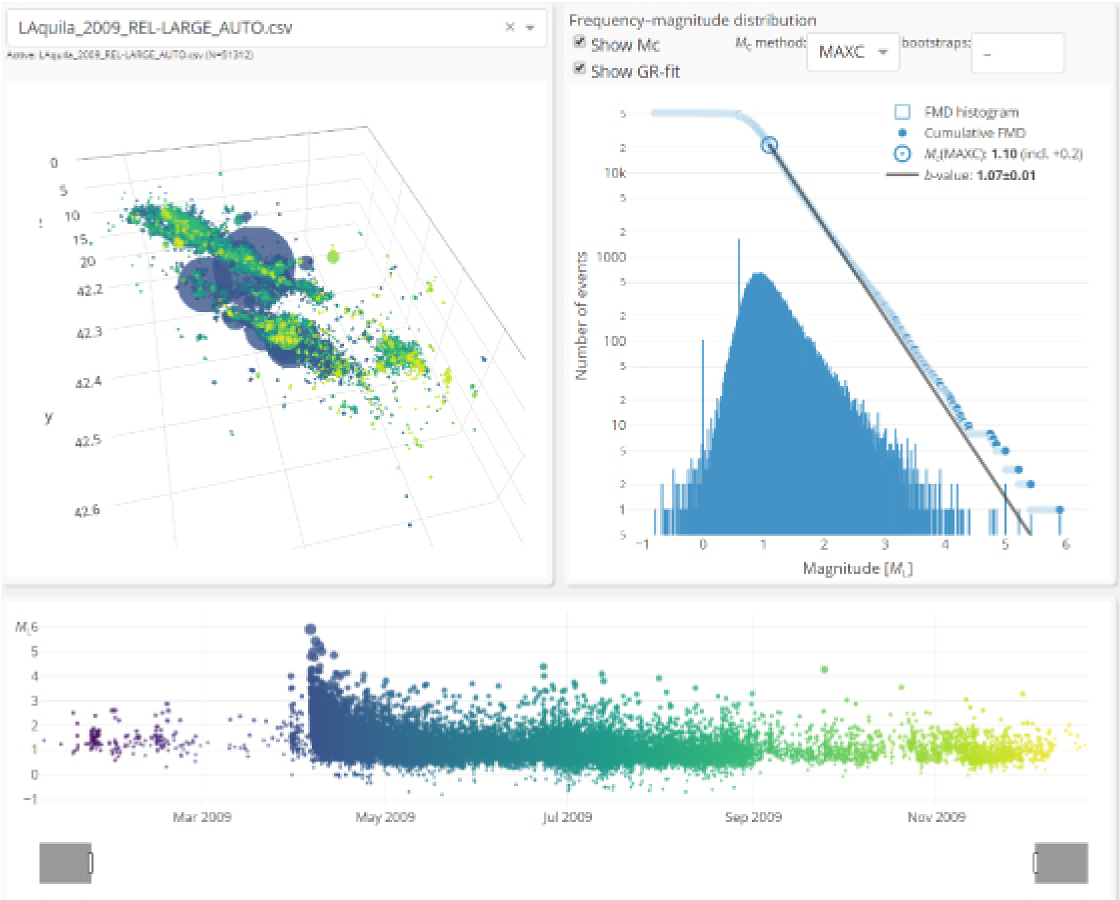


Figure 1: Screenshot of our interactive tool to explore seismic catalogs in five dimensions: spatially (rotatable 3D, top left), temporally (bottom), and magnitude-wise (Frequency-magnitude distribution, FMD, top right). Notice that the spikes in the FMD indicate magnitude errors in the example catalog of the L'Aquila sequence [Valoroso et al. 2013]. The interface runs in a web browser and can be made accessible for other researchers or the public. More analytic components and their interactions are currently being developed.

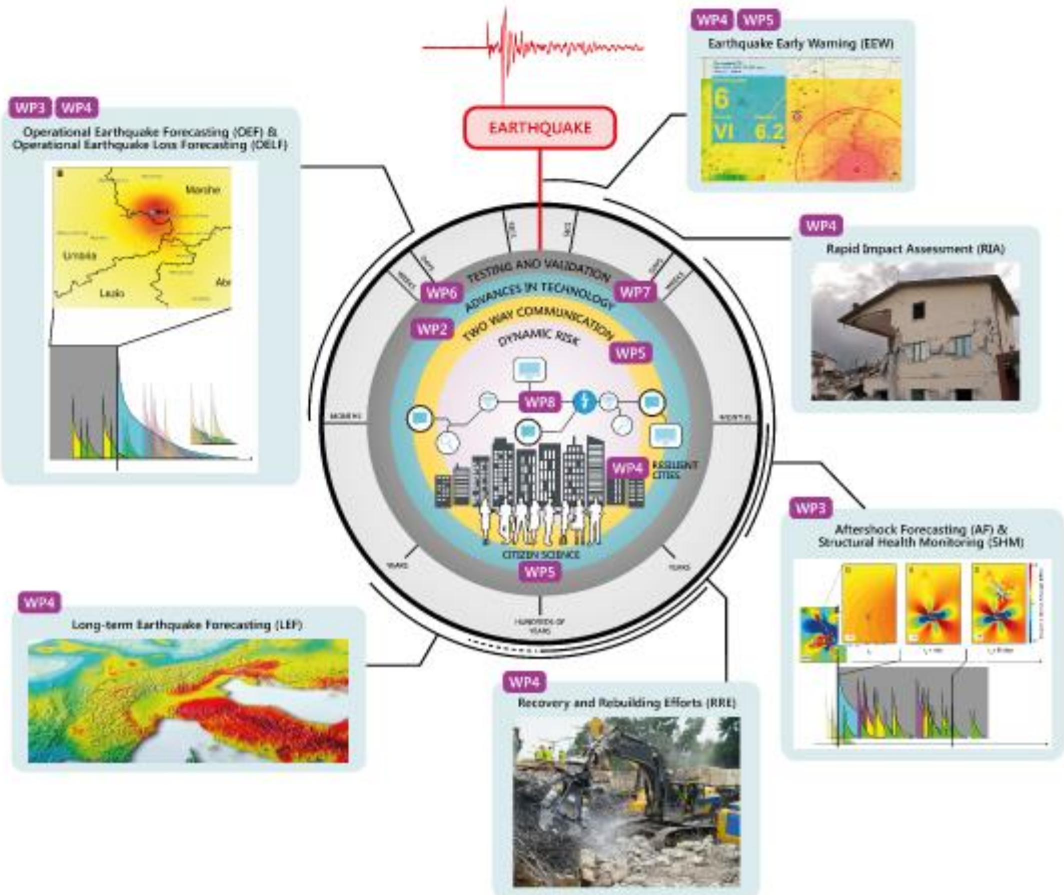
In particular, we will focus on these aspects:

1. Spatio-temporal variability in the frequency-magnitude distribution: e.g., statistical analyses of event sizes could tell us more about the state of a fault system.
2. Earthquake clustering properties: e.g., well-located hypocenters could reveal how earthquake sequences progress and how earthquakes are triggered.
3. Foreshock analysis: e.g., earthquakes prior to a larger earthquake might share a common spatial-temporal pattern. In addition, high-resolution catalogs could potentially reveal many more sequences that have foreshocks than is currently believed.
4. Limits of the current quality of earthquakes catalogs, e.g., what information are we missing?

We will adopt state-of-the-art methods (e.g., from the machine learning domain) to augment these analyses, for instance to employ a parameter selection and search for signals and patterns that are indicative of the earthquake occurrence process.

Our findings will have an impact for improving our understanding of the earthquake occurrence process. Our gained knowledge could allow us to develop innovative earthquake forecasting models, which can be stochastic, physics-based and/or of a hybrid type. Ultimately, our advances will contribute to a better mitigation of the seismic risk which will be analysed within another work package of RISE.

RISE terminology



The concept of "Dynamic Risks"

The RISE key concept and vision is to promote a shift in how earthquake risk is assessed and managed. We believe that by profiting from advances in scientific understanding and the dramatically changing technological capabilities, earthquake hazard and risk can soon be appreciated not as a constant in time, but as an evolving, integrated and dynamic risk. The dynamic risk that a structure is exposed depends on its structural type, location, occupancy, soil conditions, and topography, while people's risk is also affected by their exact location within a structure. However, dynamic risk also includes changes with time; gradually through urbanization, building stock changes and rapidly following a recent moderate or large earthquake, when the risk increases for the next days and weeks dramatically.

People's perception of — and behaviour relating to — risk is very personal and depends on far more than simply the probabilities for potential effects. Thus, good risk assessment and good risk communication must go hand in hand, with different forms of communication suitable for different timeframes and different regional contexts.

Discover here more about the main concepts of RISE to handle dynamic risks!

Miscellaneous

EU-funded projects at the European Seismological Commission

Together with a related EU-funded project TURNkey, RISE will host a session a at the 37th General Assembly of the European Seismological Commission ESC2020 in Corfu. The session is entitled "Towards operational forecasting of earthquakes and early warning capacity for more resilient societies". The session description reads as follows:

To help mitigate the risks related to earthquakes, citizens need additional protection that goes beyond building codes and retrofitting actions. These include Earthquake Early Warning (EEW) approaches and operational earthquake forecasting (OEF), but also Rapid Response to Earthquake (RRE) systems. Besides scientific and technological advances, a focus must be on improved preparedness due to more effective two-way communication of forecasts, early warning and uncertainties for users and the public.

In 2019, two new seismology and earthquake engineering related projects were awarded by the European Commission, RISE and TURNkey. In these two projects, more than 40 European institutions are collaborating on numerous aspects of improving real time seismology and its communication, and seismic risk reduction capacity. This session will give the opportunity to present and discuss first project results with the wider community. In addition, we welcome contributions on all aspects of improving earthquake resilience, including the scientific background, actual implementation scenarios and problems in communicating OEF, EEW and RRE results to stakeholders and public.

Become a part of it!

This is an excellent opportunity to learn more about the work conducted in the framework of these two European projects. We are looking forward to your contributions and encourage you to hand in your abstracts to join this session.

The abstract deadline is on 12 April 2020!

More information

Calendar

RISE related activities

6 - 11 September 2020, Corfu (Greek)
37th Assembly of the European Seismological Commission
More information

RISE related conferences

3 - 8 May 2020, Vienna (Austria)
EGU General Assembly 2020
More information

The next external newsletter will be released in September 2020. If you have anything you would like to share, please send your input to the communications team (nadja.hermann@sed.ethz.ch or michele.marti@sed.ethz.ch).

Liability claim

The European Commission is not responsible for any use that may be made of the information contained in this document. Also, responsibility for the information and views expressed in this document lies entirely with the author(s).

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Add us to your address book

Want to change how you receive these emails?
You can update your preferences or unsubscribe from this list.

mailchimp

2.2 Second external newsletter

Happy birthday, RISE - we celebrated the project's first year! It has been more than 12 months since the RISE community met for the first time in Switzerland and received an insight into the numerous work packages. In the meantime, we had to reorganize many meetings and interacted virtually instead of face-to-face. Nevertheless, RISE is progressing very well across all work packages.

After one year, first results are becoming apparent such as the deployment of a prototype array or the development of static and time-invariant exposure models for many countries. In this newsletter, let's have a closer look at the project's latest progress focusing on "Structural Health Monitoring" and related opportunities for integrating sensing data into rapid loss assessment. In addition, we are looking into the future of forecasts and its origin in 1854.

We hope you enjoy reading it!

WP Progress

WP1 | Management
...organized a new series of scientific focus meetings called "ZOOMing into RISE", where every two weeks a work package presents part of the work carried out recently. In addition, WP1 worked on the RISE Data Management Plan and opened a RISE Community Space to share open access data and publications. It updated the Project Management Plan, reflecting all achievements of the first year and planning the RISE activities for the year ahead.

WP2 | Innovation
...has successfully deployed a prototype array as a demonstrator in Bern (Switzerland) and designed an impulse generator which is currently being tested in multi-storey buildings. In the next 12 months, the existing mobile seismic shaker (a vibroseis truck) will be upgraded to perform soil-structure interaction tests.

WP3 | Advance
...focused on developing new and extending existing approaches to model seismicity. Some models have already demonstrated to improve forecasting performance and therefore, WP3 has made notable progress in the fields of earthquake forecasting. It also focused on physics-based modelling of seismicity, which is an evolving field and could attract significant interest outside of the RISE community.

WP4 | Effects
...developed static and time-invariant exposure models for 45 countries and time-invariant vulnerability models representing over 500 buildings. Furthermore, it evaluated the seismic risk reduction measures and tools developed in RISE in terms of their costs and benefits.

W5 | Society
...tested different start page designs and hazard announcements representing the diversity of elements used in multi-hazard platforms. Based on the results of the first study, it conducted seven "user-driven prototyping" workshops to understand which features of multi-hazard warning apps non-experts prefer.

WP6 | Demonstration
...could deploy low-cost medium-quality sensors based on MEMS accelerometers in several buildings by QuakeSaver and has developed frameworks for testing OELF at the national scale and RLA at the regional scale.

WP7 | Testing
...developed the modularized CSEP tool-kit which is currently in beta stage. Furthermore, a database for ground-motion model testing has been compiled and a new test metric for a designated b-value experiment is in the design phase.

WP8 | Impact
...has significantly increased the traffic on the RISE website within the first 12 months and therefore, could enhance the project's visibility. On twitter, WP8 is continuously sharing interesting content with the RISE community. In total, WP8 has published or shared 113 tweets, 2 external newsletters and 3 internal newsletters.

A closer look

Looking into the future of forecasts

Dr. Alexandra Freeman and Dr. Sarah Dryhust, University of Cambridge

In the United Kingdom's House of Commons in 1854, a Member of Parliament stood up and made the suggestion that recent scientific advances might allow the weather in the city to be known 'twenty-four hours in advance'. The House broke into uproar and laughter - the idea was considered utterly preposterous. But with thousands of lives being lost in the country every year as a result of storms, by 1861 storm warnings were being wired to ports using the new telegraph system. So popular were they, that these 'weather forecasts' quickly became a staple part of newspaper content across the country.

Now, 160 years later, operational earthquake forecasting is in a similar position. With a proliferation of sensors that would have been considered infeasible perhaps 50 years ago alongside growing computer modelling power and expertise, geoscientists increasingly have information about potential seismic activity that could be of use in emergency and public planning. But how best to communicate that?

Over a century of experience in communicating the risk of life-threatening storms has put meteorology in a strong position to help us tackle this problem, but they are not the only ones: those used to communicating flooding, epidemics of disease and even financial market fluctuations all have lessons we can learn from.

As well as talking to communications professionals in all these fields, we are also listening to people 'on the ground' in three key RISE countries: Italy, Switzerland and Iceland. By interviewing members of the public, emergency responders and long-term planners and testing our messages and visualisations on them we will hopefully soon be able to advise on how best to get useful 'earthquake forecasts' into the hands of those who can act on them.

Hopefully as well as learning from the successes of weather forecasting, we can be prepared by its failures. Tragically the father of the weather forecast, Robert Fitzroy, beset with scepticism from scientific colleagues about his methods, funding problems from government, and complaints from those who lost business as a result of false alarms in the warnings, killed himself before he saw them become the ubiquitous and lifesaving service that they are today. With the backing of RISE and alert to these potential barriers, we hope to overcome them.

THE WEATHER.

METEOROLOGICAL REPORTS.

Wednesday, July 31, 8 to 9 a.m.	B.	E.	M.	D.	F.	C.	I.	S.
Nairn..	29·54	57	56	W.S.W.	6	9	o.	3
Aberdeen	29·60	59	54	S.S.W.	5	1	b.	3
Leith	29·70	61	55	W.	3	5	c.	2
Berwick	29·69	59	55	W.S.W.	4	4	c.	2
Ardrossan . ..	29·73	57	55	W.	5	4	c.	5
Portrush	29·73	57	54	S.W.	2	2	b.	2
Shields	29·80	59	54	W.S.W.	4	5	o.	3
Galway	29·83	65	62	W.	5	4	c.	4
Scarborough ..	29·85	59	56	W.	3	6	c.	2
Liverpool.. ..	29·91	61	56	S.W.	2	8	c.	2
Valentia	29·87	62	60	S.W.	2	5	o.	3
Queenstown ..	29·83	61	59	W.	3	5	c.	2
Yarmouth.. ..	30·05	61	59	W.	5	2	c.	3
London	30·02	62	58	S.W.	3	2	b.	—
Dover..	30·04	70	61	S.W.	3	7	o.	2
Portsmouth ..	30·01	61	59	W.	3	6	o.	2
Portland	30·03	63	59	S.W.	3	2	c.	3
Plymouth.. ..	30·00	62	59	W.	5	1	b.	4
Penzance	30·04	61	60	S.W.	2	6	c.	3
Copenhagen ..	29·94	64	—	W.S.W.	2	6	c.	3
Helder	29·99	63	—	W.S.W.	6	5	c.	3
Brest	30·09	60	—	S.W.	2	6	c.	5
Bayonne	30·13	68	—	—	—	9	m.	5
Lisbon	30·18	70	—	N.N.W.	4	3	b.	2

General weather probable during next two days in the—
North—Moderate westerly wind; fine.
West—Moderate south-westerly; fine.
South—Fresh westerly; fine.

Explanation.

B. Barometer, corrected and reduced to 32° at mean sea level; each 10 feet of vertical rise causing about one-hundredth of an inch diminution, and each 10° above 32° causing nearly three-hundredths increase. E. Exposed thermometer in shade. M. Moistened bulb (for evaporation and dew-point). D. Direction of wind (true—two points *left* of magnetic). F. Force (1 to 12—estimated). C. Cloud (1 to 9). I. Initials:—b., blue sky; c., clouds (detached); f., fog; h., hail; l., lightning; m., misty (hazy); o., overcast (dull); r., rain; s., snow; t., thunder. S. Sea disturbance (1 to 9).

Figure: One of the early weather forecasts from the UK's Met Office – before they had worked on how to communicate such information in a clear and easily-understood way to different audiences.

Structural Health Monitoring: Opportunities for Integrating Sensing Data into Rapid Loss Assessment

Yves Reuland, ETH Zurich

The extreme loads imposed by earthquakes threaten the integrity of the built environment. As not all buildings react in the same way to earthquakes, a rapid understanding of the extent of damage to buildings and its consequences on providing safe shelter for the population is a crucial contribution to an earthquake-resilient Europe. Therefore, in a similar way to doctors who examine vital functions to diagnose the health of their patients, structural health monitoring allows engineers to diagnose the integrity of buildings.

In the absence of means for direct measurements of building damage, one objective of the RISE project consists in finding indirect indicators of damage. Data-driven structural health monitoring uses damage-sensitive indicators, which are derived from the building's earthquake response providing a real-time performance indication. To this end, signal processing, statistical analysis and machine learning are used to derive performance indicators from the time-and-frequency domain representation of the response. The increasing availability of sensing hardware at low cost, combined with the ever-growing possibilities for local data processing offered by the Internet-of-Things capabilities, provide exciting opportunities towards smart structures, which support engineers and decision-makers in the immediate aftermath of earthquakes. Hence, the early response to earthquake events can be improved by comparison to the current practice of time-consuming and potentially subjective visual inspections.

Well-designed damage-sensitive indicators help to more precisely diagnose damage by providing higher-level information regarding the location and the severity of building damages. The RISE project, through the breadth of its network, offers a rare opportunity to combine building-specific values from structural health monitoring with regionally applicable building behaviour models. With the engineering knowledge of building taxonomies and damage accumulation, the automation provided by data-driven structural-health monitoring can enable rapid assessment of regional consequences to the built environment, induced by earthquake events, and further provide guidance for rapid recovery.

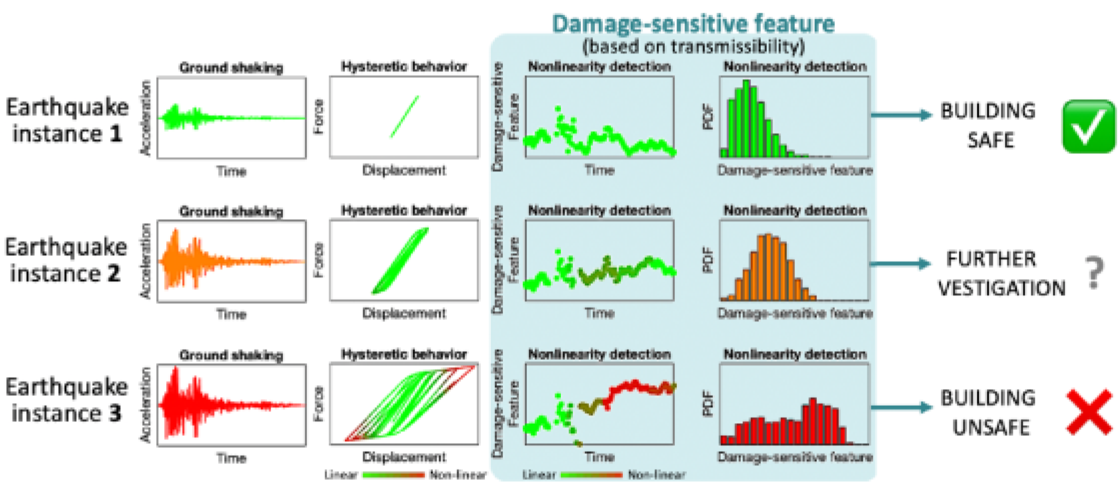
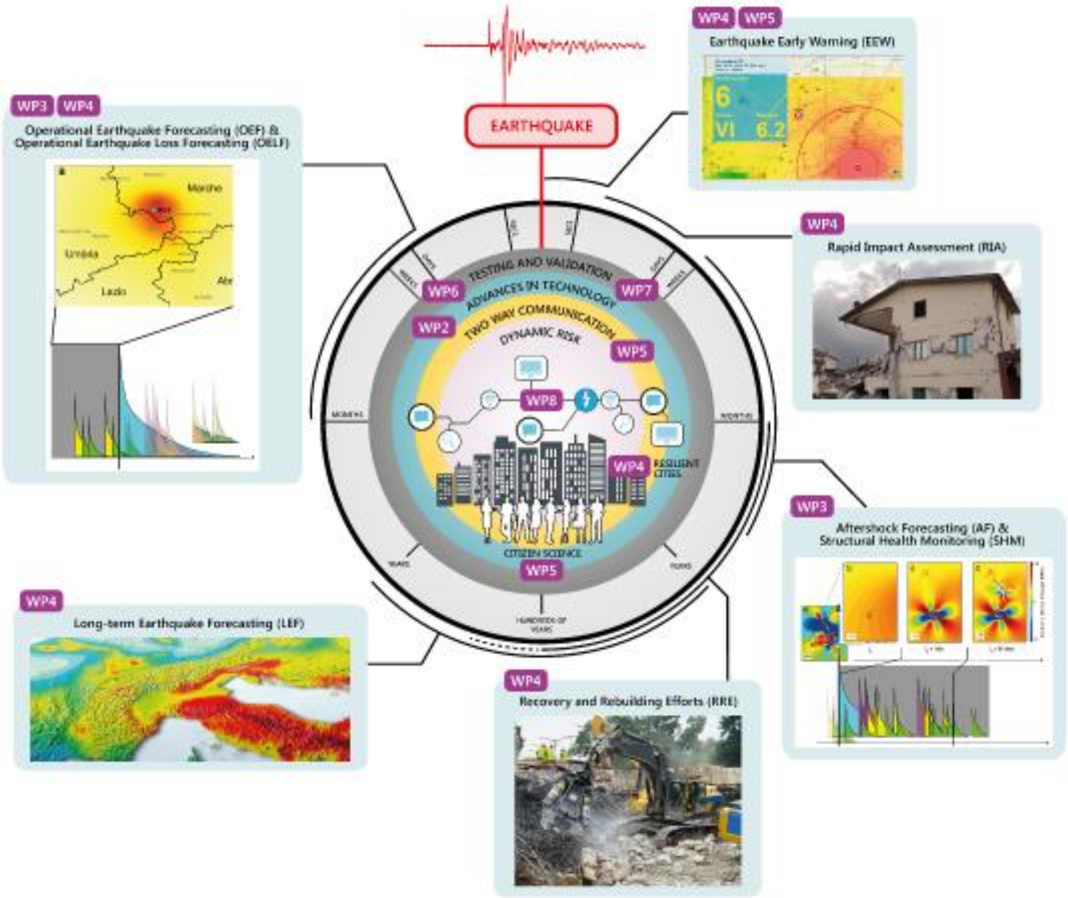


Figure: Damage-sensitive features (here transmissibility between base accelerations and rooftop accelerations) allow detecting nonlinear behaviour. Based on the distribution of the damage-sensitive feature and pre-established thresholds, the building can be tagged as safe or unsafe. Hysteretic behaviour, a direct indicator of nonlinearity, cannot be measured directly.

RISE terminology



The concept of "Earthquake Early Warning"

Earthquake Early Warning (EEW) aims to provide a warning that the shaking of an earthquake is expected before it actually arrives. The warning is issued immediately after the earthquake has occurred or while it is still ongoing. Therefore, EEW does not predict an earthquake.

EEW is possible because electromagnetic waves travel much faster than seismic waves. Therefore, alerts based on the signals captured by seismic sensors close to the epicentre arrive at distant sites before the damaging seismic waves.

EEW can save lives if the public reacts appropriately to the warning and it can protect infrastructure by triggering automated shutdown procedures. However, EEW usually can only provide some seconds warning time before the earthquake strikes. It is possible to rapidly forecast the time of arrival of seismic waves at a remote site, but the assessment of the magnitude and the strength of the earthquake is less certain. This results in the possibility that EEW issues false alerts and that it over- or underestimates the actual earthquake.

Discover here more about EEW and RISE's holistic concept of dynamic risk assessment!

Miscellaneous

All RISE publications at one glance

RISE has released 14 research articles, so far. For example, Irina Dallo dealt with the question "What defines the success of maps and additional information on a multi-hazard platform?" or Laure Fallou analysed the earthquake series in Mayotte Island with regards to citizen seismology. A Again another topic is covered by Ariana Astorga and Philippe Guéguen, who focus in their study on the analysis of long-term recovery and recovery of buildings during aftershocks, in order to detect permanent damage. Those are just three of many other publications released within the framework of RISE. In addition, a handful of other papers are shortly before release!

Would you like to know more about RISE publications? RISE has an open access research repository. We are also continuously updating our website and providing you with the latest RISE news!

Calendar

15 & 16 October 2020, digital
ICEG 2020: 14. International Conference on Earthquake Geology
More information

22 & 23 October 2020, digital
ICESE 2020: 14. International Conference on Earthquake Analysis and Structural Engineering
More information

The next external newsletter will be released in 2021. If you have anything you would like to share, please send your input to the communications team (nadja.valenzuela@sed.ethz.ch or michele.marti@sed.ethz.ch).

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2.3 Draft third external newsletter

Further news will be included in the newsletter, and editorial corrections will be made as soon as the final draft of the newsletter is ready.

Did you know that smartphones can detect earthquakes? Everyone from all places around the world can join this "Earthquake Network", a citizen science research project aiming to send out real-time alerts when the smartphone network detects earthquakes. Are you curious how this works exactly? Read in this newsletter more about the **Earthquake Network app**!

RISE has recently passed its half-time and can already look back to many highlights achieved during the first project phase. In this newsletter, we summarised only some of the most significant achievements and provide an overview of all **RISE publications** which have been released so far in 2021.

Earthquake forecasting is a key aspect of the RISE project. In a news article, we tell you how RISE is testing earthquake forecasts and explain the concept of "**Long-Term Earthquake Forecasting**" (LEF).

Stay tuned for more RISE news and publication and visit our website or follow us on Twitter!

Twitter Website

WP Progress

Work package 1: Management

- organised a series of project internal scientific focus meetings, "ZOOMing into RISE". WP 1 also planned the RISE (online) mid-term conference in May 2021, which allowed them to share research results and brainstorm how to extract the project's challenges and convert them to the project's highlights.
- ensures a close collaboration within the project and knowledge exchange with international experts by conducting regular meetings with the management board, WP leaders and the scientific advisory board.

Work package 2: Innovation

- established strategies for and demonstration of inclusion and processing of massive datasets in European seismic data archives and infrastructures.
- is developing a dynamic building exposure model that integrates the European exposure model developed in the previous Horizon 2020 project SERA with data on individual buildings that is continuously retrieved and updated from OpenStreetMap in near-real-time. This al-lows to incorporate to the model not only new information on existing buildings but also add/eliminate buildings when they are built/demolished.
- achieved that Distributed Acoustic Sensing (DAS) technology has been proven to be at EU Technology Readiness Level (TRL) 6: Technology demonstrated in relevant environment. DAS produces excellent data quality and increases the number of detected local events significantly. It also functions in extreme environments where the deployment of large seismometer arrays may be very challenging.

Work package 3: Advance

- improved the understanding of the earthquake generation process by investigating the space-time independence of the Gutenberg-Richter (GR) law and of more generic magnitude-frequency distributions (MFDs).
- implemented numerical codes, which translate these advancements in knowledge into improved Operational Earthquake Forecasting (OEF) models. All modelers have worked in developing the mathematical background for their models and published or have submitted several publications in international scientific journals.

Work package 4: Effects

- is improving the European database of building exposure and vulnerability models.
- is developing a methodology for Operational Earthquake Loss Forecasting (OELF) accounting for evolutionary exposure and vulnerability at national scale.
- enabled harmonised European ShakeMaps using state-of-the-art methods and models. The European ShakeMap system prototype is running at *http://shakemapeu.ingv.it/*.
- is evaluating alternative risk mitigation measures that are being developed and improved within RISE in terms of their costs vs benefits. RISE is proposing a systematic procedure for evaluating decisions based on cost-benefit analysis (CBA), assessing whether perceived benefits exceed the costs or not. The suggested CBA framework can complement the RISE products and highlight and support decision making.

Work package 5: Society

- is carrying out interviews and focus groups with different stakeholders in Italy, Switzerland and Iceland to review the current communication pathways for dynamic risk communication, operational earthquake forecasting and rapid impact assessments.
- has conducted several expert interviews with seismologists, social scientists and practitioners working on Early Earthquake Warning (EEW) systems to explore the public's expectations and needs.
- published two studies focusing on improving earthquake information in a multi-hazard context. Members of WP5 tested different start page and hazard announcement designs to assess the public's preferences and better understand which hazards, information, and features people prefer to have on a multi-hazard app.

Work package 6: Demonstration

- is demonstrating how an operational Rapid Loss Assessment (RIA) system could serve civil protection departments at national and European scales.
- is connecting Structural Health Monitoring (SHM) data with Rapid Loss Assessment (RLA) and Operational Earthquake Loss Forecasting (OELF). WP6 is also connecting SHM data with building exposure modelling.
- developed a preliminary application of OELF accounting for damage on building classes.

Work package 7: Testing

- designed a new community-based pyCSEP software toolkit for earthquake forecast developers in collaboration with project partner SCEC. It is a Python package to help earthquake forecast developers embed model evaluation into the model development process.

- conducted a series of virtual workshops between February and June 2021 to familiarise the RISE community of earthquake forecast modellers and testers with the hands-on use of pyCSEP.
- significantly improved in building ensemble modeling for OEF by testing new physics-based, stochastic and hybrid OEF models. Their results are published or have been submitted in several publications in international journals.

Work package 8 Impact

- has again increased the number of website visitors and twitter followers which helps to make the project more visible. In total, WP 8 has published or shared more than 170 tweets, 6 internal newsletters and 3 external newsletters.
- technically integrated the operational risk platform development and the CSEP testing center development.

A closer look

The Earthquake Network Project: An App Detecting Earthquakes in Real Time

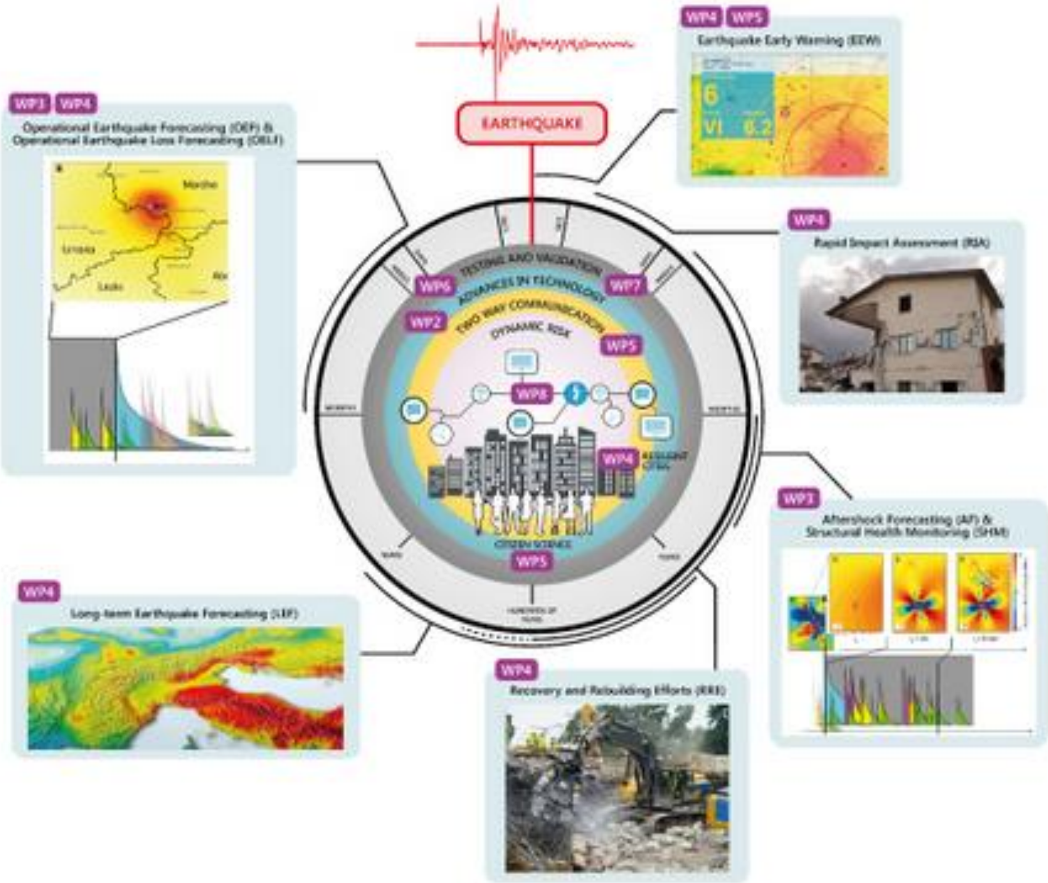
Dr. Francesco Finazzi, University of Bergamo (Italy)

Earthquake Network is a citizen science research project implementing an earthquake early warning system based on smartphone crowdsourcing. People join the project by installing a smartphone application and they receive real time alerts when earthquakes are detected by the smartphone network. Started at the end of 2012, the project has involved more than 5.5 million people and the application currently has around 500,000 active users. This makes Earthquake Network one of the largest citizen science project and an earthquake early warning system operational at the global scale.

Finazzi F. (2020) The Earthquake Network Project: A Platform for Earthquake Early Warning, Rapid Impact Assessment, and Search and Rescue. Front. Earth Sci. 8:243. doi: 10.3389/feart.2020.00243

Felt reports sent by users of the Earthquake Network app after a 3.6 magnitude earthquake in Puerto Rico on 26 January 2020, 01:59:26 UTC (EMSC catalog ID 823242) within 60 s from origin time. Blue star is the earthquake epicenter. Green (mild) and yellow (strong) stars are felt reports localized using smartphone spatial coordinates.

RISE terminology



The concept of "Long-term Earthquake Forecasting" (LEF)

Earthquake hazard describes how strong the Earth shakes at a specific location within a certain period on average. Such **long-term forecasting** is needed to develop design codes and strengthen other means of disaster preparedness. Furthermore, earthquake hazard information is one of the prerequisites to defining earthquake risk, which describes the potential effects of ground motions on the built environment and consequential effects such as fatalities. RISE aims to develop tools and measures to reduce future human and economic losses caused by earthquakes. To this end, the project adopts an integrative, holistic view of risk reduction targeting the different stages of risk management. Therefore, RISE will integrate the data of the latest European Seismic Hazard Model (ESHM20) to strengthen various aspects of risk management.

RISE is supporting the development of the European hazard and risk models, among others. The updated version of the European Seismic Hazard Model will be soon available. Together with its release, a fully open access seismic risk model for Europe will also be available at **www.efehr.org**.

Discover here more about LEF and RISE's holistic concept of dynamic risk assessment!

Miscellaneous

All RISE publications at one glance

So far, RISE has released nearly 30 **research articles**, and another handful are currently under review. In the following, you can find the overview of this years' released publications.

Seismological Research Letters

- Chioccarelli, E. and Iervolino, I. (2021) **Comparing Short-Term Seismic and COVID-19 Fatality Risks in Italy**
- Gulia, L., Gasperini, P. (2021) **Contamination of Frequency–Magnitude Slope (b-Value) by Quarry Blasts: An Example for Italy**
- Mancini, S. Werner, M., Segou, M. & Baptie, B. (2021) **Probabilistic Forecasting of Hydraulic Fracturing-Induced Seismicity Using an Injection-Rate Driven ETAS Model**
- Mizrahi, L., Nandan, S., Wiemer, S. (2021) **The Effect of Declustering on the Size Distribution of Mainshocks**
- Taroni, M., Zhuang, J., Marzocchi, W. (2021) **High-Definition Mapping of the Gutenberg–Richter. Value and Its Relevance: A Case Study in Italy**
- Vannucci, G., Lolli, B., Gasperini, P. (2021) **Inhomogeneity of Macroseismic Intensities in Italy and Consequences for Macroseismic Magnitude Estimation**

Bulletin of Earthquake Engineering

- Crowley, H., Despotaki, V., Silva, V. et al. (2021) **Model of seismic design lateral force levels for the existing reinforced concrete European building stock**
- Dabbeek, J., Crowley, H., Silva, V. et al. (2021) **Impact of exposure spatial resolution on seismic loss estimates in regional portfolios**

Bulletin of the Seismological Society of America

- Spassiani, I., Marzocchi, W. (2021) **An Energy-Dependent Earthquake Moment–Frequency Distribution**

International Journal of Disaster Risk Reduction

- Dallo, I., Marti, M. (2021) **Why should I use a multi-hazard app? Assessing the public's information needs and app feature preferences in a participatory process**

Would you like to know more about RISE publications? RISE has an **open access research repository**. We are also continuously updating our **website** and providing you with the latest RISE news!

Calendar

5 & 6 October 2021, Germany/hybrid
Second International Conference on Natural Hazards and Risks in a Changing World 2021
More information

27 September - 2 October 2021, Japan/hybrid
17WCEE: 17. World Conference on Earthquake Engineering
More information

The next external newsletter will be released in 2022. If you have anything you would like to share, please send your input to the communications team (nadja.valenzuela@sed.ethz.ch or michele.marti@sed.ethz.ch).

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