Communication of Seismic Risk in the Kyrgyz Republic

As part of the World Bank-funded "Measuring Seismic Risk in the Kyrgyz Republic" project

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[3]GFZ, Potsdam, Germany

No Risk Mitigation without Effective Risk Communication!

Who?

Consultants / Academics

To Whom?

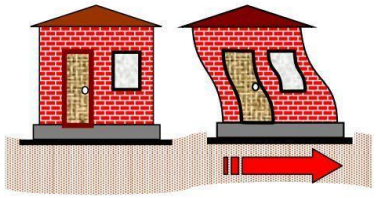
Government

The Public

Scientists / Engineers

What?

Hazard



Exposure and Vulnerability

Seismic losses / Casualties

Risk reduction measures

How?

Workshops

Technical Reports

Non-technical Brochures

Why?

Save lives

Save money

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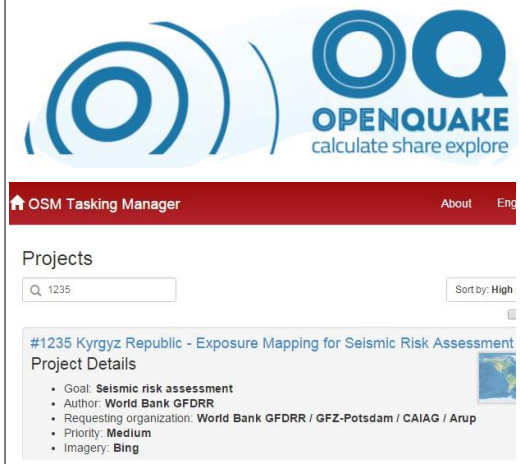
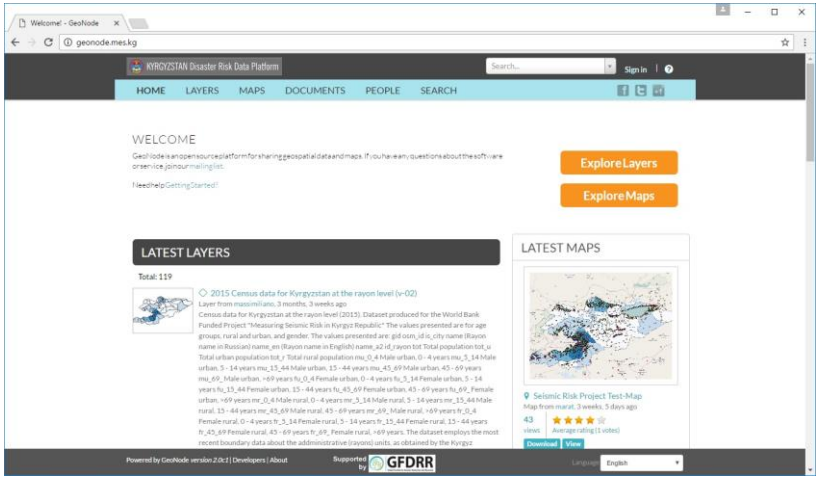
Communication of Risk and its Various Components

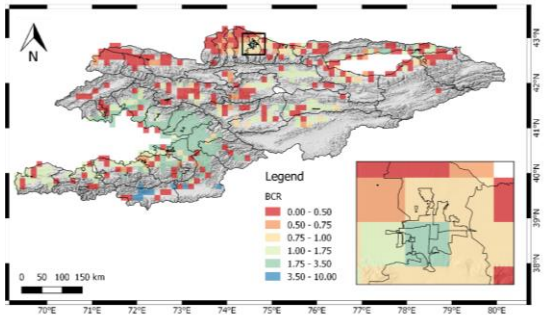
Technical communication of risk assessment practice



Technical communication of risk information



Technical communication of risk mitigation practice



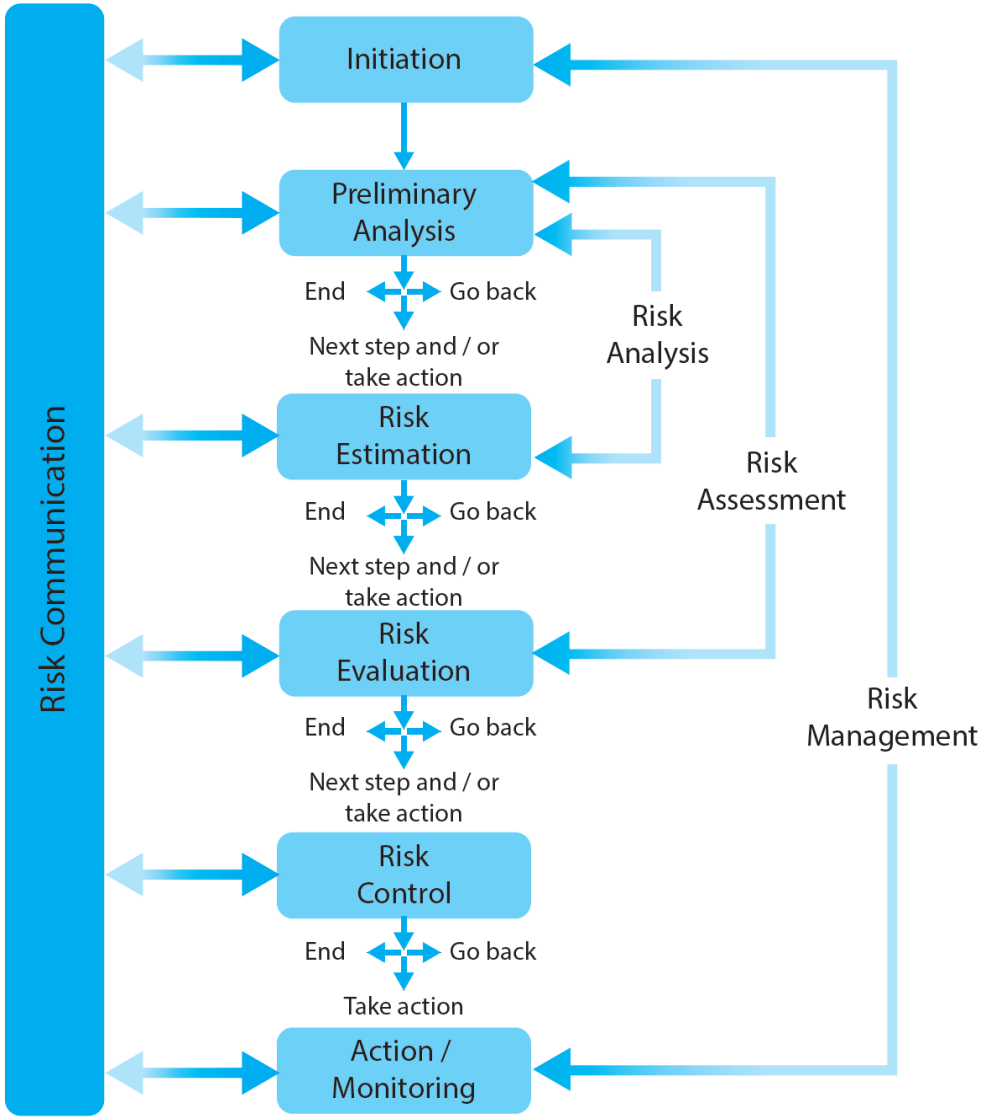
Non-technical communication of risk mitigation practice

CAIAG

GFZ Helmholtz Centre POTSDAM

ARUP

Communication of Risk and its Components (Hazard, Exposure, Vulnerability) are Undertaken at each Stage of the Project



Communication of risk has formed an integral part of the World Bank-funded "Measuring Seismic Risk in the Kyrgyz Republic" project (2015-2017)

Risk communication is undertaken at progress meetings and training workshops attended by Kyrgyz government employees, technical experts, scientists and engineers

The workshop participants provided feedback on the project team's risk analysis, assessment and proposed mitigation measures.

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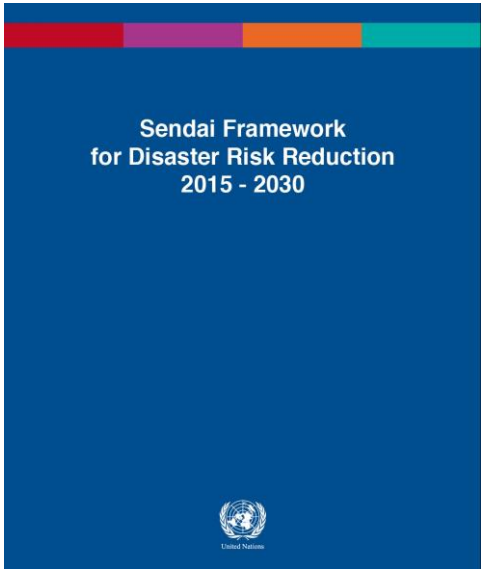
Risk Communication is one of the Goals of the Sendai Framework for Disaster Risk Reduction Strategy (2015 -2030)

The Sendai Framework has been adopted by the United Nations with the aim to guide the management of the risk associated with natural and man-made disasters



GOALS

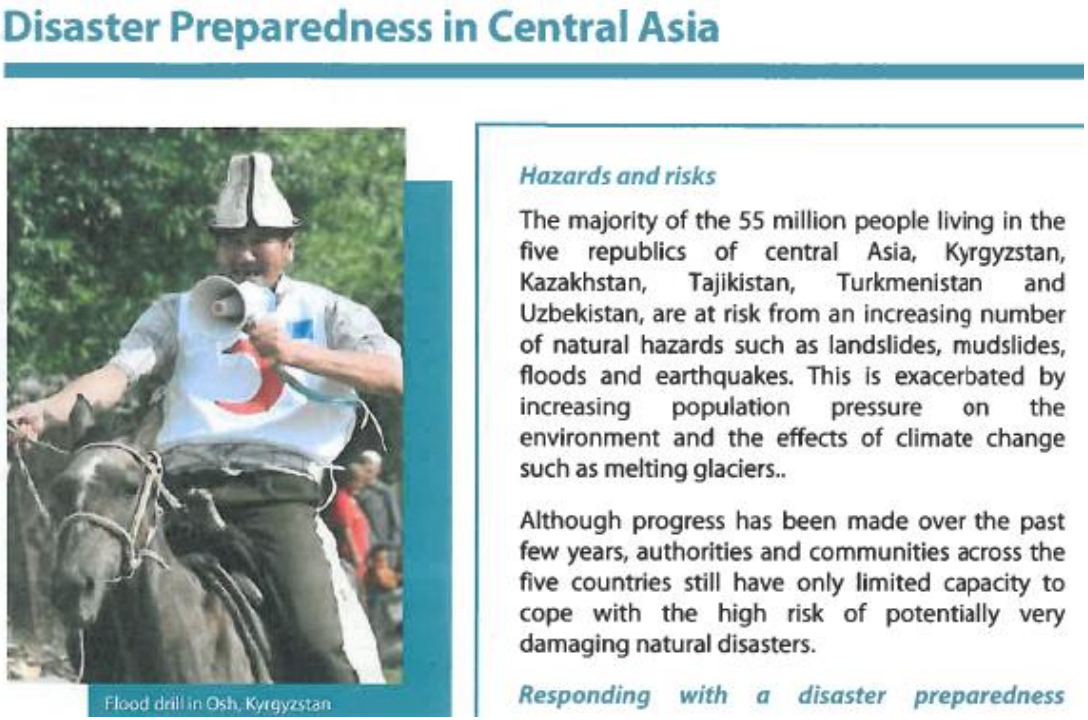
- Reduce loss of life
- Reduce the number of affected people
- Increased resilience to reduce the damage & disruption
- Improve regional and international cooperation
- Communication of risk

PRIORITIES

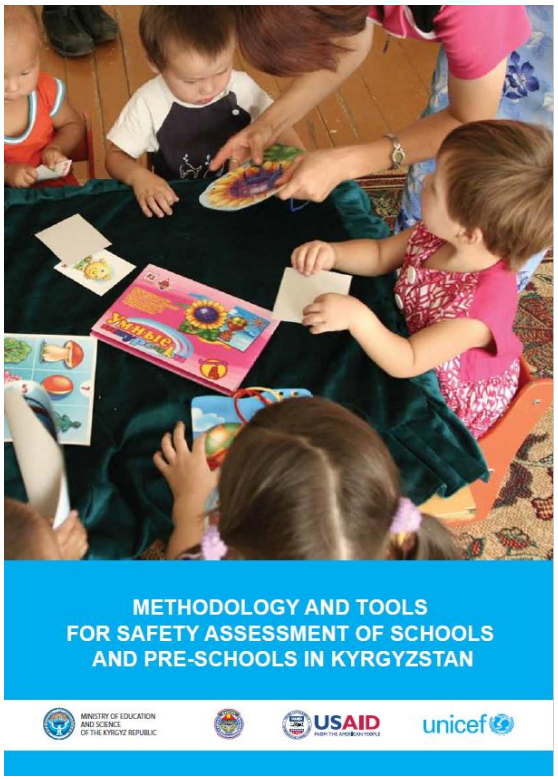
- Understanding risk
- Strengthening disaster risk governance
- Investing in risk reduction measures for improved resilience
- Enhancing disaster risk preparedness

Past DRM Activities in the Kyrgyz Republic

UNICEF disaster preparedness training for communities



Comprehensive risk assessment for schools in the Kyrgyz Republic in partnership with UNICEF



UNDP project “Integration of Disaster Risk Management in Decentralization Process in Kyrgyzstan”

Steering Committee for the Reduction of Seismic Risk in the Kyrgyz Republic: A Valuable Partner for Risk Communication

Client:
The Government of the Kyrgyz Republic
The World Bank
Global Facility for Disaster Reduction and Recovery

Steering Committee for the Reduction of Seismic Risk in the Kyrgyz Republic

Project Team: CAIAG, GEM Global Earthquake Model, GFZ Helmholtz Centre Potsdam, ARUP

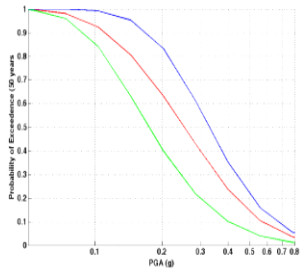
Purpose of the Steering Committee:

- Provide strategic direction and guidance to the Project Team undertaking the "Measuring Seismic Risk in the Kyrgyz Republic" project
- Facilitate the communication of the outcomes of project to relevant Government agencies of the Government
- Adopt and have ownership of the Seismic Risk Assessment, its results and recommendations

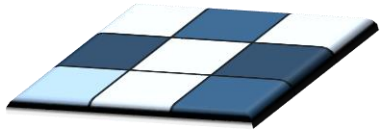
Membership of the Steering Committee:
Government agencies responsible for disaster risk reduction, the structural performance of buildings and infrastructure, and emergency response, such as:

- Ministry of Emergency Situations
- Institute of Seismology
- State Construction Agency
- State Insurance Company

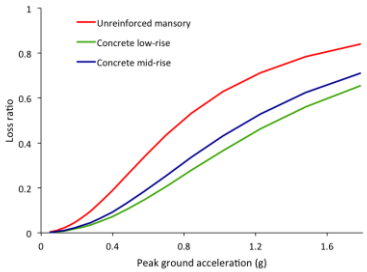
Technical communication of good risk management practice



Sets of hazard curves

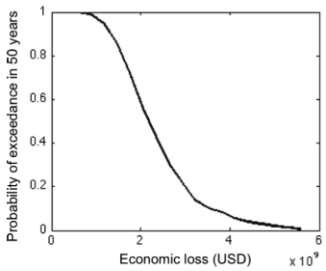


Exposure model

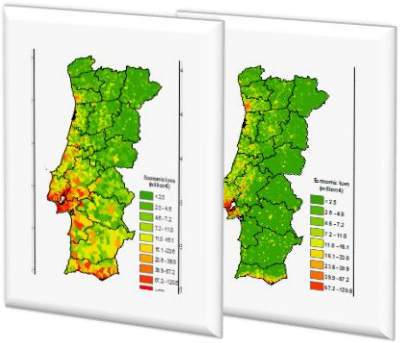


Vulnerability functions

OPENQUAKE
calculate share explore



Loss curves



Loss maps

Use of open-source tools like OpenQuake for seismic hazard and risk assessment

Seismic Hazard and Risk Training Workshops (November 2015, March 2017) held in Bishkek, Kyrgyz Republic

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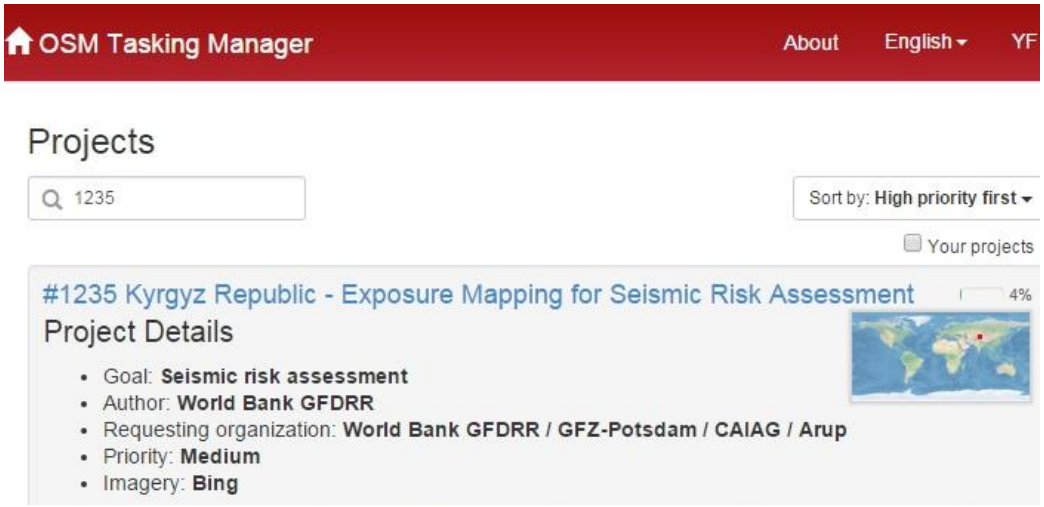
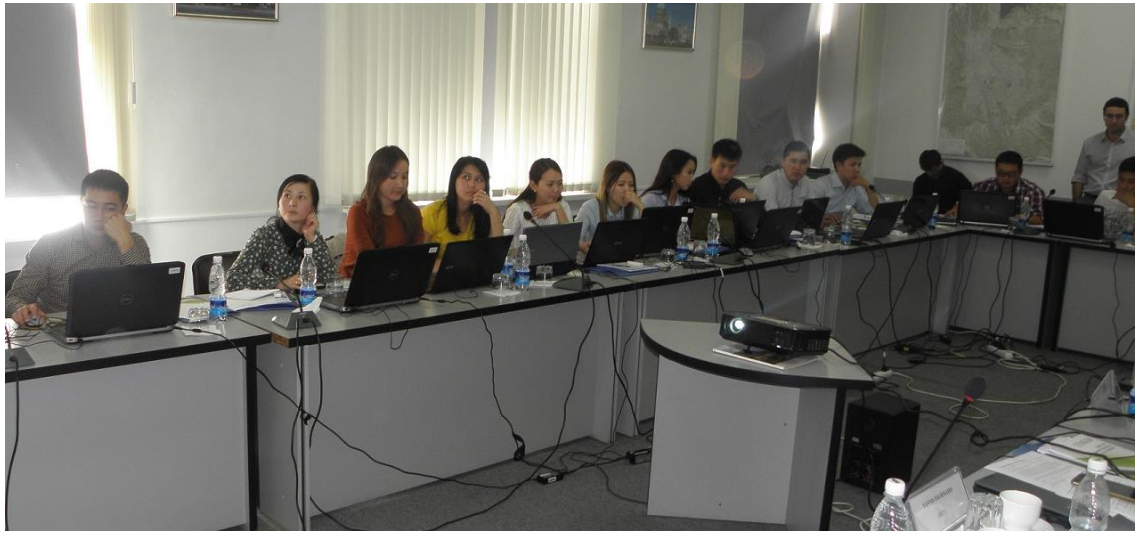
Technical communication of good risk management practice

Seismic risk assessments should involve the younger generation of scientists and engineers.

With the assistance of experts from the World Bank, a “task” was created on OpenStreetMap to allow the global community of volunteer mappers to locate assets (buildings and roads) at risk in the Kyrgyz Republic.



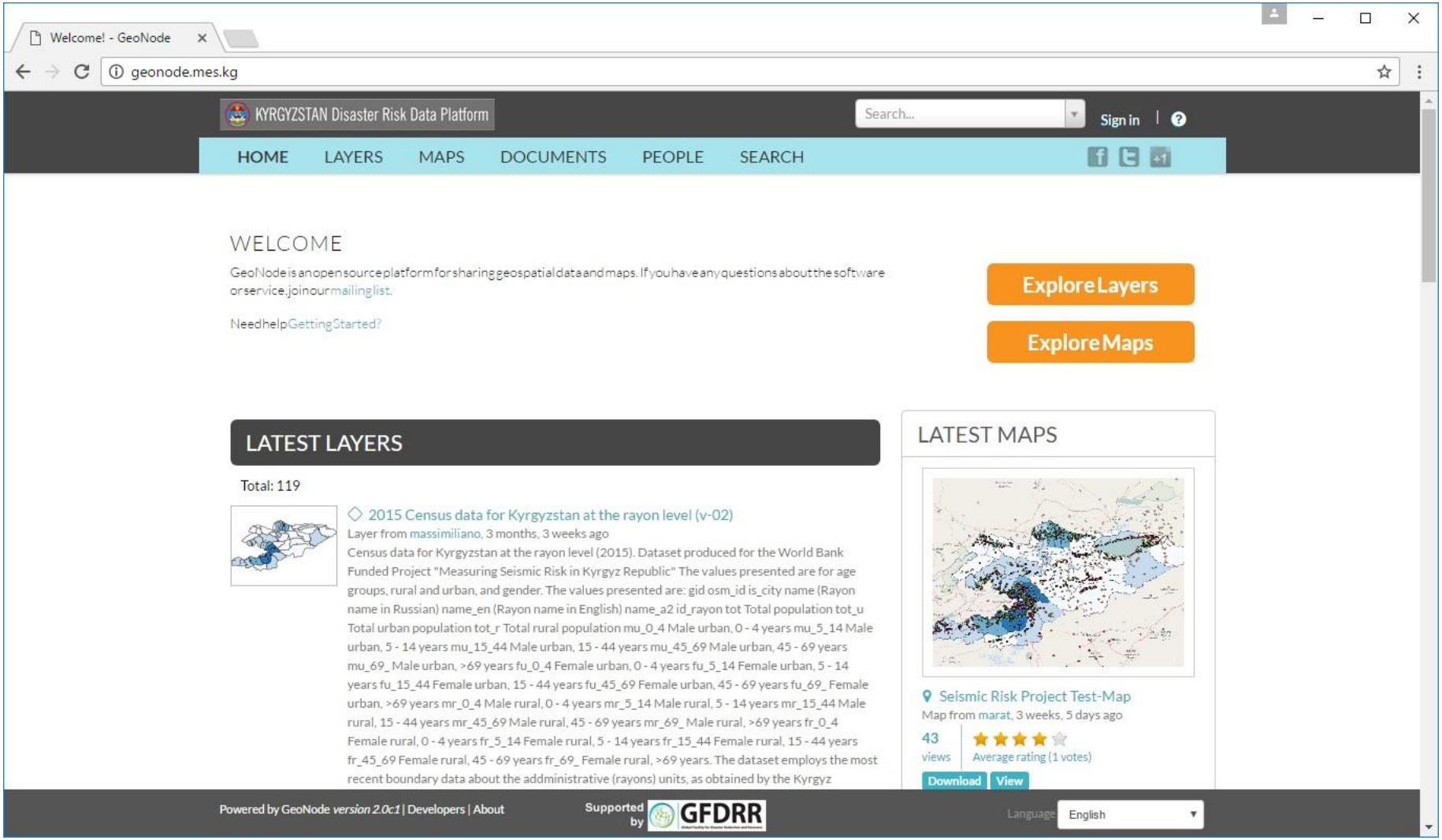


Community mapping workshop in Bishkek (October 2015) with engineering students from local universities.

Community mapping workshops being undertaken in Arup in 2016 and 2017 to update OpenStreetMap in Kyrgyz Republic

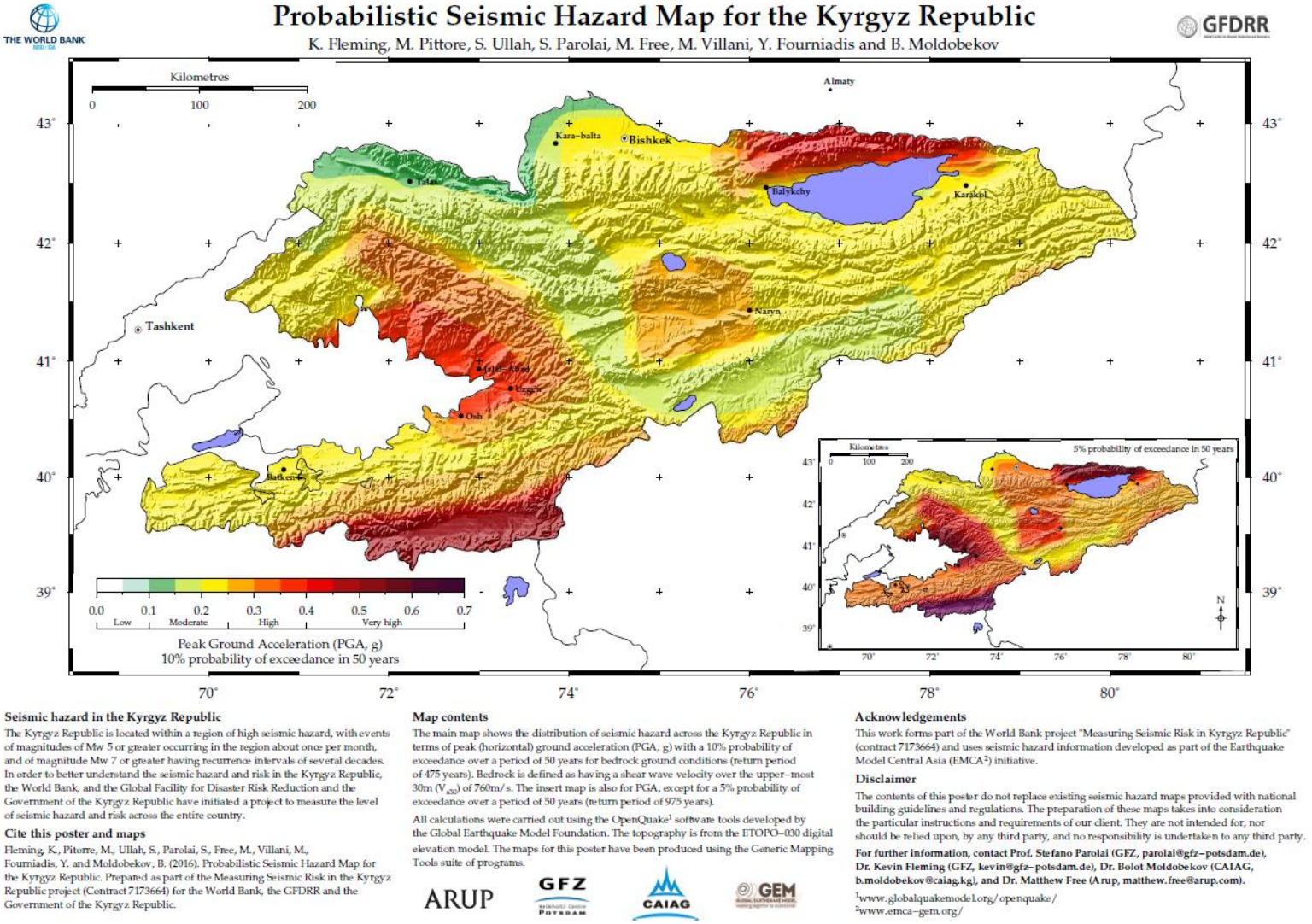
Technical communication of risk information

Geonode is a open-source platform for sharing geospatial data and maps, hosted by CAIAG and MES (http://geonode.caiag.kg/)



Technical communication of risk information

Capacity building of local institutions (Institute of Seismology) on good international practice, such as adopting peak ground acceleration as a measure of seismic hazard, instead of macroseismic intensity



Seismic hazard in the Kyrgyz Republic

The Kyrgyz Republic is located within a region of high seismic hazard, with events of magnitudes of Mw 5 or greater occurring in the region about once per month, and of magnitude Mw 7 or greater having recurrence intervals of several decades. In order to better understand the seismic hazard and risk in the Kyrgyz Republic, the World Bank, and the Global Facility for Disaster Risk Reduction and the Government of the Kyrgyz Republic have initiated a project to measure the level of seismic hazard and risk across the entire country.

Cite this poster and maps

Fleming, K., Pittore, M., Ullah, S., Parolai, S., Free, M., Villani, M., Fourniadis, Y. and Moldobekov, B. (2016). Probabilistic Seismic Hazard Map for the Kyrgyz Republic. Prepared as part of the Measuring Seismic Risk in the Kyrgyz Republic project (Contract 7173664) for the World Bank, the GFDRR and the Government of the Kyrgyz Republic.

Map contents

The main map shows the distribution of seismic hazard across the Kyrgyz Republic in terms of peak (horizontal) ground acceleration (PGA, g) with a 10% probability of exceedance over a period of 50 years for bedrock ground conditions (return period of 475 years). Bedrock is defined as having a shear wave velocity over the upper-most 30m (V_{s30}) of 760m/s. The insert map is also for PGA, except for a 5% probability of exceedance over a period of 50 years (return period of 975 years).

All calculations were carried out using the OpenQuake[1] software tools developed by the Global Earthquake Model Foundation. The topography is from the ETOPO-030 digital elevation model. The maps for this poster have been produced using the Generic Mapping Tools suite of programs.

ARUP GFZ Helmholtz Centre Potsdam CAIAG GEM

Acknowledgements

This work forms part of the World Bank project "Measuring Seismic Risk in Kyrgyz Republic" (contract 7173664) and uses seismic hazard information developed as part of the Earthquake Model Central Asia (EMCA[2]) initiative.

Disclaimer

The contents of this poster do not replace existing seismic hazard maps provided with national building guidelines and regulations. The preparation of these maps takes into consideration the particular instructions and requirements of our client. They are not intended for, nor should be relied upon, by any third party, and no responsibility is undertaken to any third party.

For further information, contact Prof. Stefano Parolai (GFZ, parolai@gfz-potsdam.de), Dr. Kevin Fleming (GFZ, kevin@gfz-potsdam.de), Dr. Bolot Moldobekov (CAIAG, b.moldobekov@caiag.kg), and Dr. Matthew Free (Arup, matthew.free@arup.com).

[1] www.globalquakemodel.org/openquake/
[2] www.emca-gem.org/

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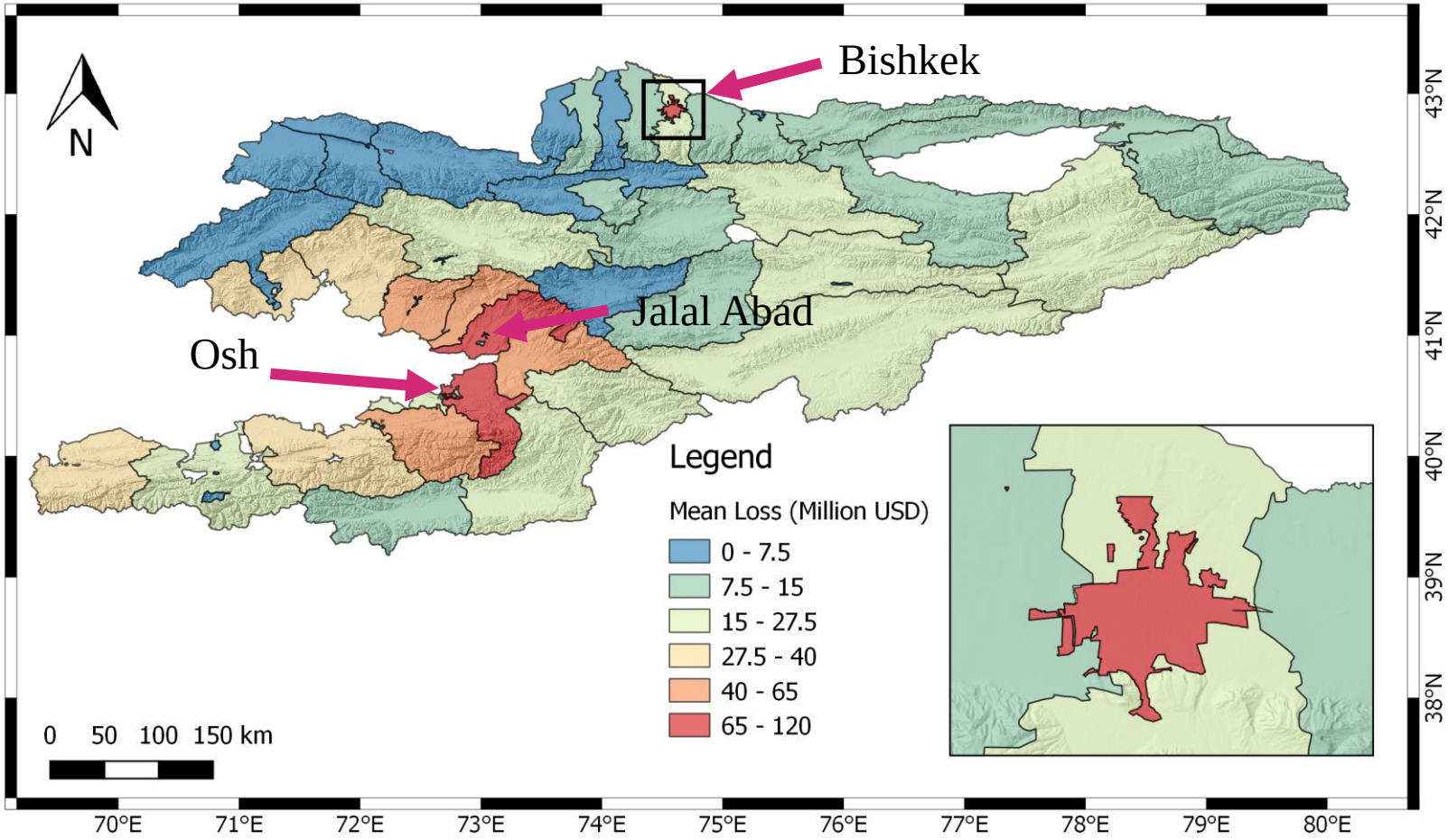
Technical communication of risk information

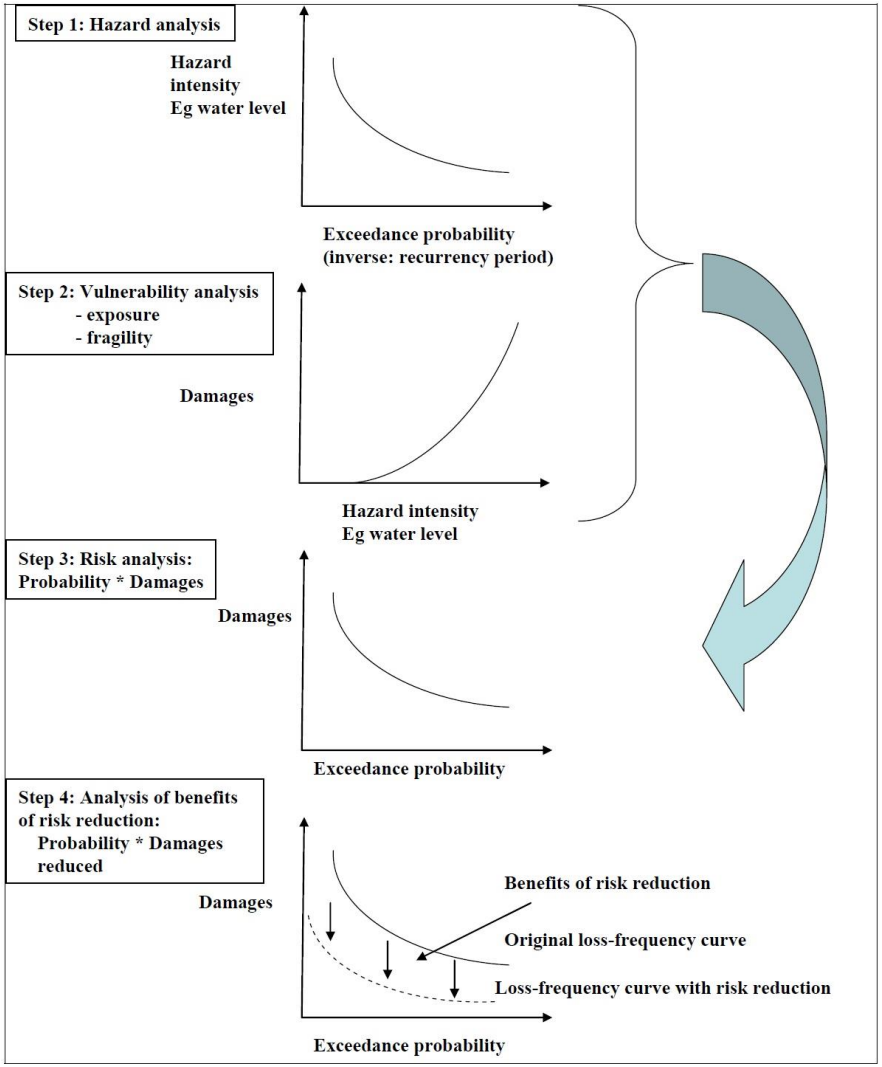
Communication of probabilistic risk results for schools to the Ministry of Education and Ministry of Finance

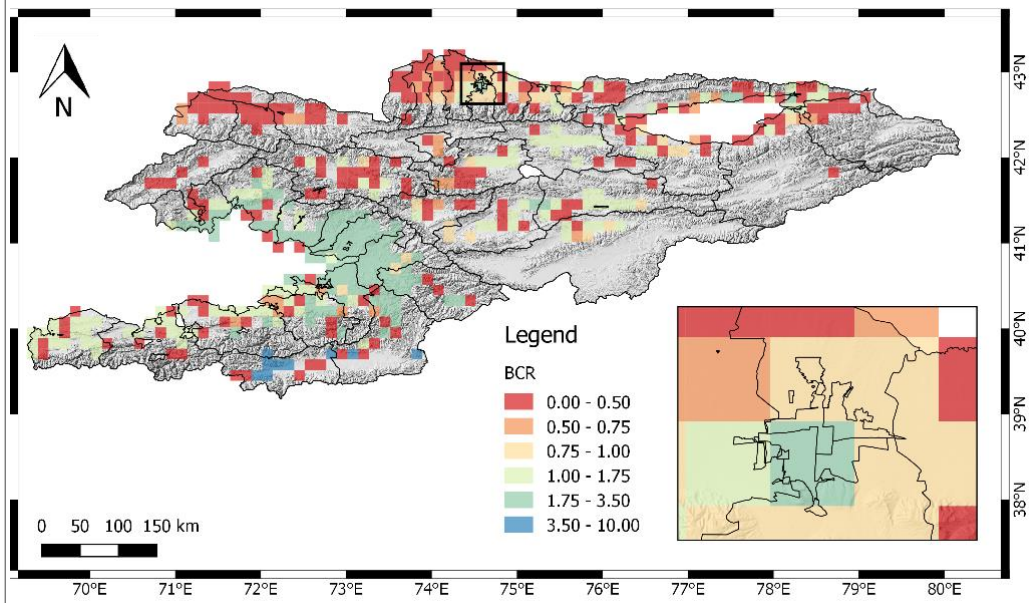


Expected economic losses to schools in USD with an exceedance probability of 10% in 50 years (approximate recurrence time of 500 years) aggregated at the county (rayon) scale.

Technical communication of risk information

Cost-benefit analysis: engagement with local engineers, State Construction Agency, ministries (e.g. Ministry of Finance)





Spatial distribution of the benefit-cost ratio (BCR) for the structural retrofitting of adobe, masonry and reinforced concrete school buildings (**NB**: A BCR greater than 1 suggests that the benefits of the retrofit outweigh the costs, and hence the investment is considered worthwhile).

Technical communication of risk information

Technical reports (in both English and Russian) have been widely disseminated to ministries, government agencies, and scientific institutes

Seismic hazard datasets

Fragility functions for buildings and transport infrastructure

Construction costs for buildings and transport infrastructure

Non-technical communication of risk information

Brochures in non-technical language for the communication of seismic risk information to a broad range of stakeholders, including the government agencies and the general public

Measuring Seismic Risk in the Kyrgyz Republic

Project Briefing Note – May 2016

About the Project

The Kyrgyz Republic is located within a region of high seismic hazard with earthquakes of magnitude Mw≥5 occurring about once per month, of Mw≥6 occurring about once per year and large earthquakes of Mw≥7 occurring about once every ten years. The Government of the Kyrgyz Republic is acutely aware of this issue and has been making significant progress to understand this hazard and other natural hazards that affect the country. The Ministry of Emergency Situations collects data on all natural hazards across the country and publishes annual reports summarising the locations, characteristics and losses associated with these events.

In order to better understand the hazard and the risk from earthquakes, the Government of the Kyrgyz Republic, with support from the World Bank and the Global Facility for Disaster Risk Reduction, is funding the project "Measuring Seismic Risk in the Kyrgyz Republic".

The project is being undertaken by a consortium comprising the Central Asian Institute of Applied Geosciences (CAIAG) working closely with Arup, who are a large global engineering company, and GFZ, the German scientific research organisation. The team are using the seismic hazard and risk calculation software developed by GEM (Global Earthquake Model), the specialist organisation in seismic risk assessment. This consortium of organisations brings together some of the best practical seismic risk expertise in the world. It is important that this local and international expertise is guided by local best practice in the Kyrgyz Republic, and a Steering Committee has been formed to ensure the project delivers the information that the Government of the Kyrgyz Republic needs.

Figure 1 Earthquake damage to buildings following the Nura earthquake of 2008 which resulted in the death of 74 people

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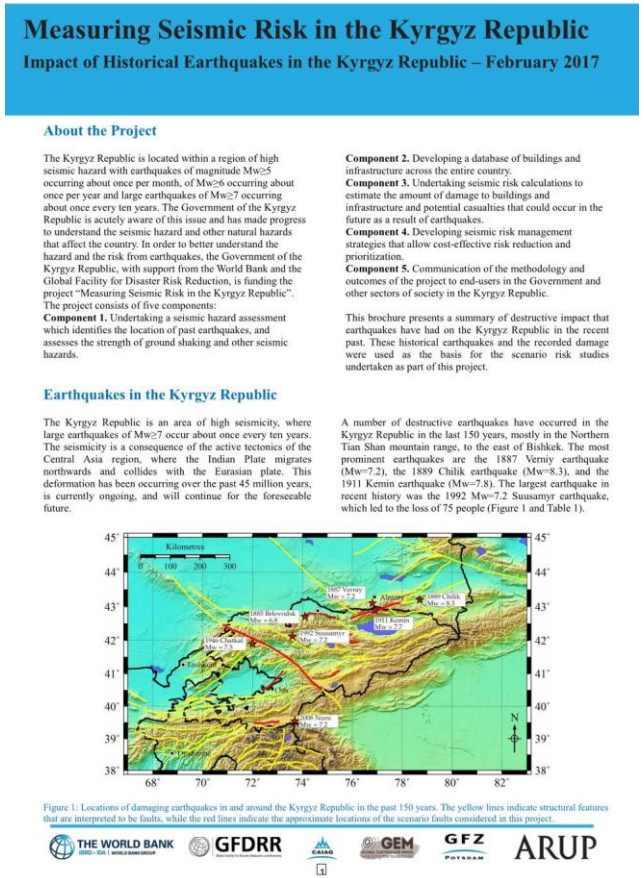
Project briefing note



Measuring Seismic Risk in the Kyrgyz Republic

Impact of Historical Earthquakes in the Kyrgyz Republic – February 2017

About the Project

The Kyrgyz Republic is located within a region of high seismic hazard with earthquakes of magnitude Mw≥5 occurring about once per month, of Mw≥6 occurring about once per year and large earthquakes of Mw≥7 occurring about once every ten years. The Government of the Kyrgyz Republic is acutely aware of this issue and has made progress to understand the seismic hazard and other natural hazards that affect the country. In order to better understand the hazard and the risk from earthquakes, the Government of the Kyrgyz Republic, with support from the World Bank and the Global Facility for Disaster Risk Reduction, is funding the project "Measuring Seismic Risk in the Kyrgyz Republic". The project consists of five components:

Component 1. Undertaking a seismic hazard assessment which identifies the location of past earthquakes, and assesses the strength of ground shaking and other seismic hazards.

Component 2. Developing a database of buildings and infrastructure across the entire country.

Component 3. Undertaking seismic risk calculations to estimate the amount of damage to buildings and infrastructure and potential casualties that could occur in the future as a result of earthquakes.

Component 4. Developing seismic risk management strategies that allow cost-effective risk reduction and prioritization.

Component 5. Communication of the methodology and outcomes of the project to end-users in the Government and other sectors of society in the Kyrgyz Republic.

This brochure presents a summary of destructive impact that earthquakes have had on the Kyrgyz Republic in the recent past. These historical earthquakes and the recorded damage were used as the basis for the scenario risk studies undertaken as part of this project.

Earthquakes in the Kyrgyz Republic

The Kyrgyz Republic is an area of high seismicity, where large earthquakes of Mw≥7 occur about once every ten years. The seismicity is a consequence of the active tectonics of the Central Asia region, where the Indian Plate migrates northwards and collides with the Eurasian plate. This deformation has been occurring over the past 45 million years, is currently ongoing, and will continue for the foreseeable future.

A number of destructive earthquakes have occurred in the Kyrgyz Republic in the last 150 years, mostly in the Northern Tian Shan mountain range, to the east of Bishkek. The most prominent earthquakes are the 1887 Verniy earthquake (Mw=7.2), the 1889 Chilik earthquake (Mw=8.3), and the 1911 Kemin earthquake (Mw=7.8). The largest earthquake in recent history was the 1992 Mw=7.2 Suusamyr earthquake, which led to the loss of 75 people (Figure 1 and Table 1).

Figure 1: Locations of damaging earthquakes in and around the Kyrgyz Republic in the past 150 years. The yellow lines indicate structural features that are interpreted to be faults, while the red lines indicate the approximate locations of the scenario faults considered in this project.

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Impact of historical earthquakes

Measuring Seismic Risk in the Kyrgyz Republic

Developing the Seismic Exposure Model – February 2017

Introduction

The Kyrgyz Republic is located within a region of high seismic hazard with earthquakes of magnitude Mw≥5 occurring about once per month, of Mw≥6 occurring about once per year and large earthquakes of Mw≥7 occurring about once every ten years. The Government of the Kyrgyz Republic is aware of this issue and has been making progress to understand the seismic hazard that affects the country. In order to better understand the hazard and the risk from earthquakes, the Government of the Kyrgyz Republic, with support from the World Bank and the Global Facility for Disaster Risk Reduction, is funding the project "Measuring Seismic Risk in the Kyrgyz Republic". The project consists of five components:

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Component 4. Developing seismic risk management strategies that allow cost-effective risk reduction and prioritization.

Component 5. Communication of the methodology and outcomes of the project to end-users in the Government and other sectors of society in the Kyrgyz Republic.

This brochure presents a summary of the development of a seismic exposure model comprising buildings and infrastructure across the entire Kyrgyz Republic.

What is at risk? The *exposure* model

Earthquake risk is a function of three interacting components: hazard, exposure and vulnerability. **Hazard** describes the likelihood of exceeding a certain level of seismic shaking at a specific location over a period of time, **exposure** refers to those elements (population, buildings, infrastructure) which are exposed to earthquakes and are subject to losses, while **vulnerability** defines the susceptibility of a population or structure to damage from earthquakes. All three components have to be assessed in order to understand seismic risk.

The Kyrgyz Republic is characterized by significant seismic hazard. In order to understand the extent to which this hazard translates into economic losses and casualties, it is necessary to provide a reliable and comprehensive exposure model. Within the project "Measuring Risk in the Kyrgyz Republic", the seismic exposure model has been developed on the basis of the following components: population, residential buildings (Figure 1), schools, critical structures (hospitals and fire stations), and transport lifelines (roads and bridges). With the support of local authorities, available data were collected and harmonized using standard formats. These data were integrated with information directly collected in the field or derived from different sources, including satellite imagery and collaborative (crowd-sourced) platforms.

The resulting exposure models were aggregated over different geographic boundaries, such as district (*rayon*) and region (*oblast*), were then used to estimate the impact of specific earthquake scenarios (based on historical records), and to evaluate the long-term seismic risk for the Kyrgyz Republic using probabilistic methodologies.

Figure 1 Pre-cast panel apartment buildings in Balytkchy, Kyrgyz Republic.

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Development of the seismic exposure model

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Thank you!