

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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No Risk Mitigation without Effective Risk Communication!

<p>Who?</p>  <p>Consultants / Academics</p>	<p>To Whom?</p> <div><p>Government</p></div> <div><p>The Public</p></div> <div><p>Scientists / Engineers</p></div>		
<p>What?</p>  <p>Hazard</p>	 <p>Exposure and Vulnerability</p>	 <p>Seismic losses / Casualties</p>	 <p>Risk reduction measures</p>
<p>How?</p>  <p>Workshops</p>	 <p>Technical Reports</p>	 <p>Non-technical Brochures</p>	
<p>Why?</p>  <p>Save lives</p>	 <p>Save money</p>		

Communication of Risk and its Various Components

Technical communication of risk assessment practice



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Projects

Q 1235

Sort by: High

#1235 Kyrgyz Republic - Exposure Mapping for Seismic Risk Assessment

Project Details

- Goal: **Seismic risk assessment**
- Author: **World Bank GFDRR**
- Requesting organization: **World Bank GFDRR / GFZ-Potsdam / CAIAG / Arup**
- Priority: **Medium**
- Imagery: **Bing**



Technical communication of risk information

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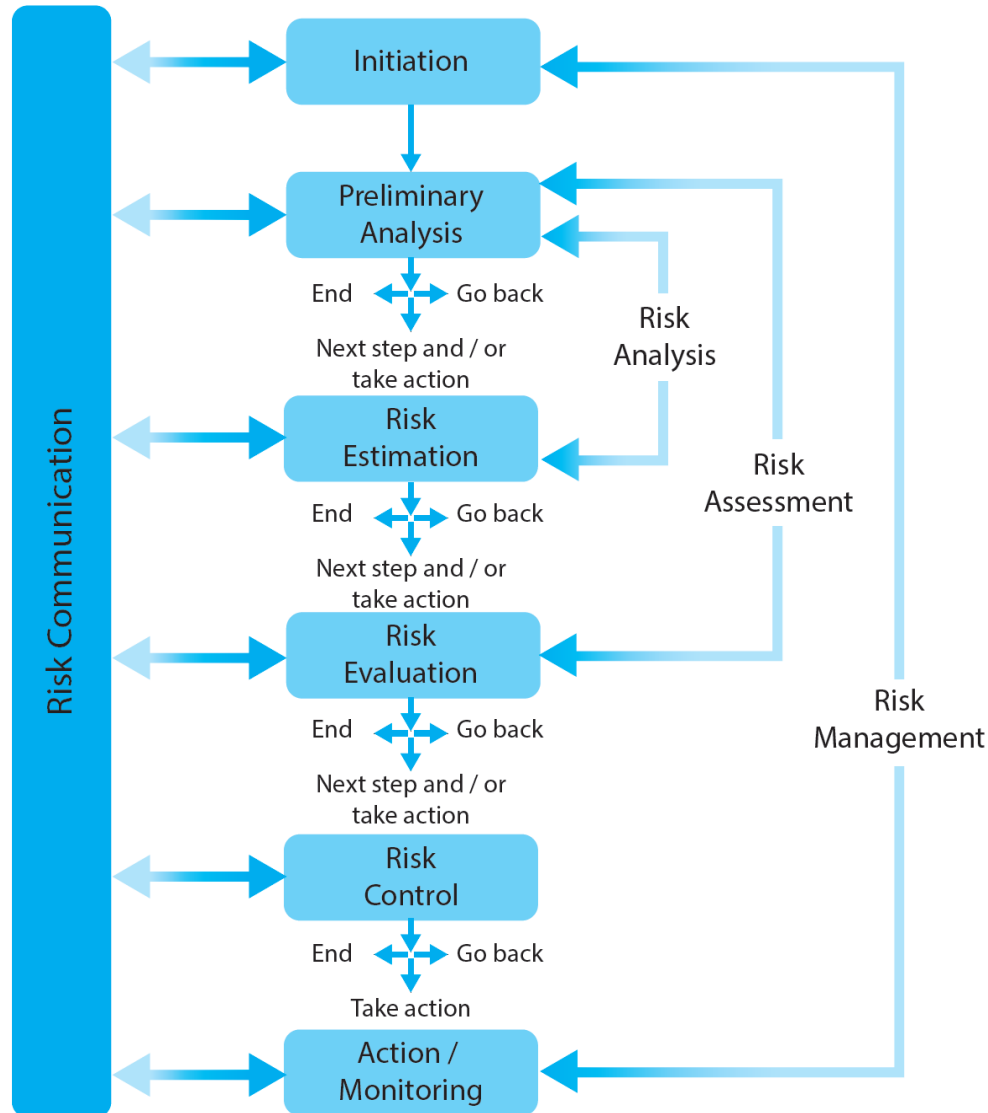


2015 Census data for Kyrgyzstan at the rayon level (v=02)

Layer from maxisat, 3 months, 3 weeks ago

Census data for Kyrgyzstan at the rayon level (2015). Dataset produced for the World Bank funded project "Measuring seismic risk in the Kyrgyz Republic". The values presented are for age groups, total and urban, and gender. The values presented are: g01=0, g02=0, g03=0, g04=0, g05=0, g06=0, g07=0, g08=0, g09=0, g10=0, g11=0, g12=0, g13=0, g14=0, g15=0, g16=0, g17=0, g18=0, g19=0, g20=0, g21=0, g22=0, g23=0, g24=0, g25=0, g26=0, g27=0, g28=0, g29=0, g30=0, g31=0, g32=0, g33=0, g34=0, g35=0, g36=0, g37=0, g38=0, g39=0, g40=0, g41=0, g42=0, g43=0, g44=0, g45=0, g46=0, g47=0, g48=0, g49=0, g50=0, g51=0, g52=0, g53=0, g54=0, g55=0, g56=0, g57=0, g58=0, g59=0, g60=0, g61=0, g62=0, g63=0, g64=0, g65=0, g66=0, g67=0, g68=0, g69=0, g70=0, g71=0, g72=0, g73=0, g74=0, g75=0, g76=0, g77=0, g78=0, g79=0, g80=0, g81=0, g82=0, g83=0, g84=0, g85=0, g86=0, g87=0, g88=0, g89=0, g90=0, g91=0, g92=0, g93=0, g94=0, g95=0, g96=0, g97=0, g98=0, g99=0, g100=0, g101=0, g102=0, g103=0, g104=0, g105=0, g106=0, g107=0, g108=0, g109=0, g110=0, g111=0, g112=0, g113=0, g114=0, g115=0, g116=0, g117=0, g118=0, g119=0, g120=0, g121=0, g122=0, g123=0, g124=0, g125=0, g126=0, g127=0, g128=0, g129=0, g130=0, g131=0, g132=0, g133=0, g134=0, 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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.

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

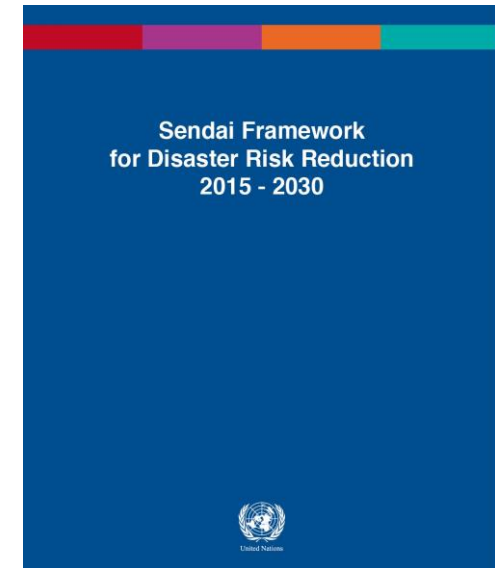
The Sendai Framework has been adopted by the United Nations with the aim to guide the management of the risk associated with natural and man-made disasters

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



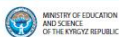
Past DRM Activities in the Kyrgyz Republic

UNICEF disaster preparedness training for communities

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



METHODOLOGY AND TOOLS
FOR SAFETY ASSESSMENT OF SCHOOLS
AND PRE-SCHOOLS IN KYRGYZSTAN



Disaster Preparedness in Central Asia



Flood drill in Osh, Kyrgyzstan

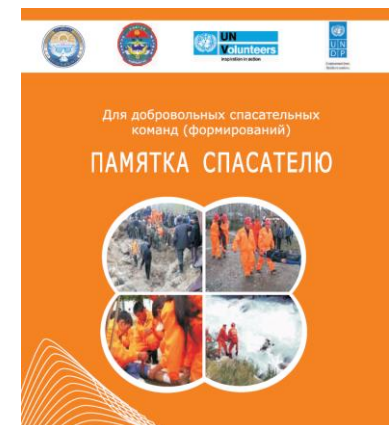
Hazards and risks

The majority of the 55 million people living in the five republics of central Asia, Kyrgyzstan, Kazakhstan, Tajikistan, Turkmenistan and Uzbekistan, are at risk from an increasing number of natural hazards such as landslides, mudslides, floods and earthquakes. This is exacerbated by increasing population pressure on the environment and the effects of climate change such as melting glaciers..

Although progress has been made over the past few years, authorities and communities across the five countries still have only limited capacity to cope with the high risk of potentially very damaging natural disasters.

Responding with a disaster preparedness

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:



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

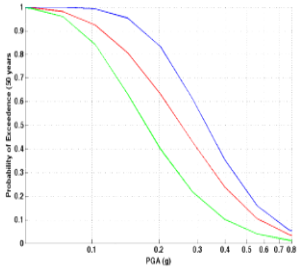
Membership of the Steering Committee:

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

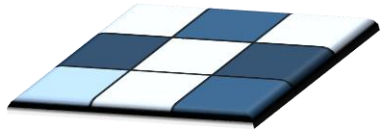
- Ministry of Emergency Situations
- Institute of Seismology
- State Construction Agency
- State Insurance Company



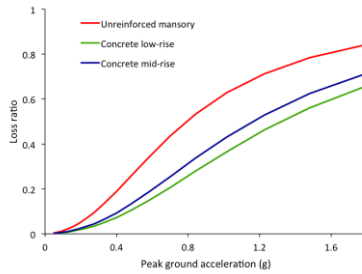
Technical communication of good risk management practice



Sets of hazard curves



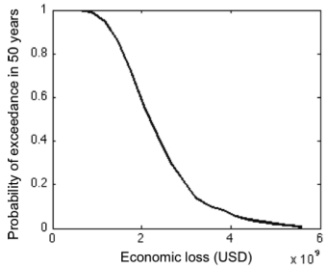
Exposure model



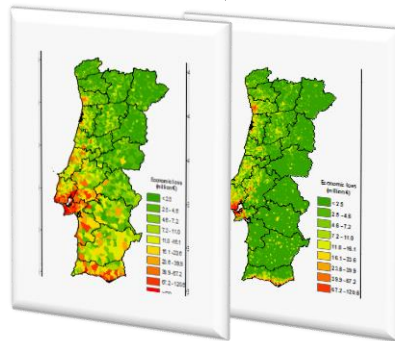
Vulnerability functions

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



Loss curves



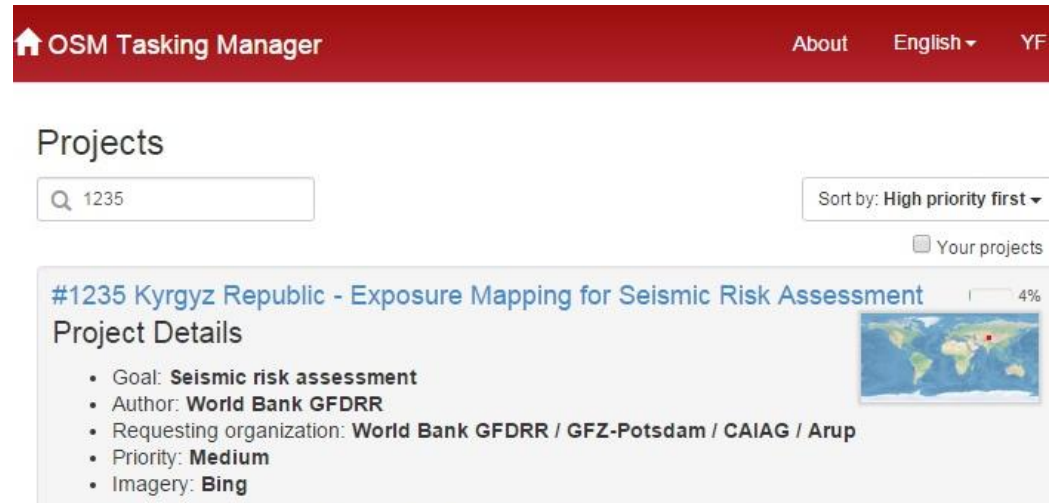
Loss maps



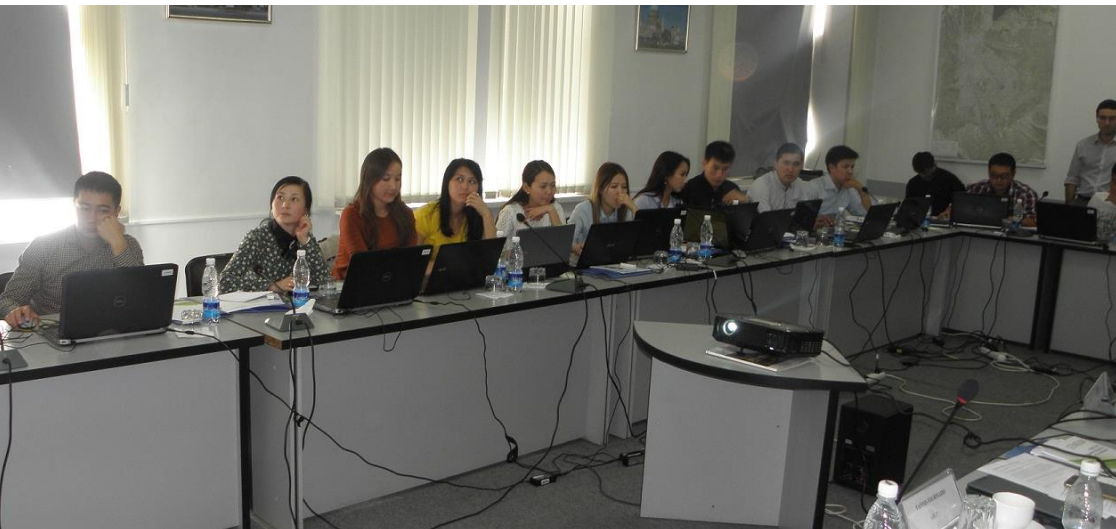
Technical communication of good risk management practice

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.



The screenshot shows the OSM Tasking Manager interface. At the top is a red header with the text "OSM Tasking Manager" and navigation links "About", "English", and "YF". Below the header, the "Projects" section is visible. A search bar contains the text "1235". To the right, a dropdown menu shows "Sort by: High priority first" and a checkbox for "Your projects". The main content area displays the project details for "#1235 Kyrgyz Republic - Exposure Mapping for Seismic Risk Assessment". The project details include a list of information: Goal: Seismic risk assessment, Author: World Bank GFDRR, Requesting organization: World Bank GFDRR / GFZ-Potsdam / CAIAG / Arup, Priority: Medium, and Imagery: Bing. A small world map is shown to the right of the project details.



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/>)

The screenshot displays the Geonode website interface. At the top, there is a browser window with the address bar showing 'geonode.mes.kg'. The website header includes a search bar, a 'Sign in' link, and a navigation menu with links for HOME, LAYERS, MAPS, DOCUMENTS, PEOPLE, and SEARCH. Below the header, a 'WELCOME' section provides an overview of the platform and includes buttons for 'Explore Layers' and 'Explore Maps'. The 'LATEST LAYERS' section features a map thumbnail and a detailed description of the '2015 Census data for Kyrgyzstan at the rayon level (v-02)'. The 'LATEST MAPS' section displays a map titled 'Seismic Risk Project Test-Map' with a rating of 4.3 stars and options to download or view. The footer contains information about the platform's version, developers, and sponsors, including CAIAG, GFDRR, GFZ, and ARUP.

WELCOME

GeoNode is an open source platform for sharing geospatial data and maps. If you have any questions about the software or service, join our mailing list.

Need help Getting Started?

Explore Layers

Explore Maps

LATEST LAYERS

Total: 119

2015 Census data for Kyrgyzstan at the rayon level (v-02)

Layer from massimiliano, 3 months, 3 weeks ago

Census data for Kyrgyzstan at the rayon level (2015). Dataset produced for the World Bank Funded Project "Measuring Seismic Risk in Kyrgyz Republic" The values presented are for age groups, rural and urban, and gender. The values presented are: gid osm_id is_city name (Rayon name in Russian) name_en (Rayon name in English) name_a2 id_rayon tot Total population tot_u Total urban population tot_r Total rural population mu_0_4 Male urban, 0 - 4 years mu_5_14 Male urban, 5 - 14 years mu_15_44 Male urban, 15 - 44 years mu_45_69 Male urban, 45 - 69 years mu_69_ Male urban, >69 years fu_0_4 Female urban, 0 - 4 years fu_5_14 Female urban, 5 - 14 years fu_15_44 Female urban, 15 - 44 years fu_45_69 Female urban, 45 - 69 years fu_69_ Female urban, >69 years mr_0_4 Male rural, 0 - 4 years mr_5_14 Male rural, 5 - 14 years mr_15_44 Male rural, 15 - 44 years mr_45_69 Male rural, 45 - 69 years mr_69_ Male rural, >69 years fr_0_4 Female rural, 0 - 4 years fr_5_14 Female rural, 5 - 14 years fr_15_44 Female rural, 15 - 44 years fr_45_69 Female rural, 45 - 69 years fr_69_ Female rural, >69 years. The dataset employs the most recent boundary data about the administrative (rayons) units, as obtained by the Kyrgyz

LATEST MAPS

Seismic Risk Project Test-Map

Map from marat, 3 weeks, 5 days ago

43 views

Average rating (1 votes)

Download View

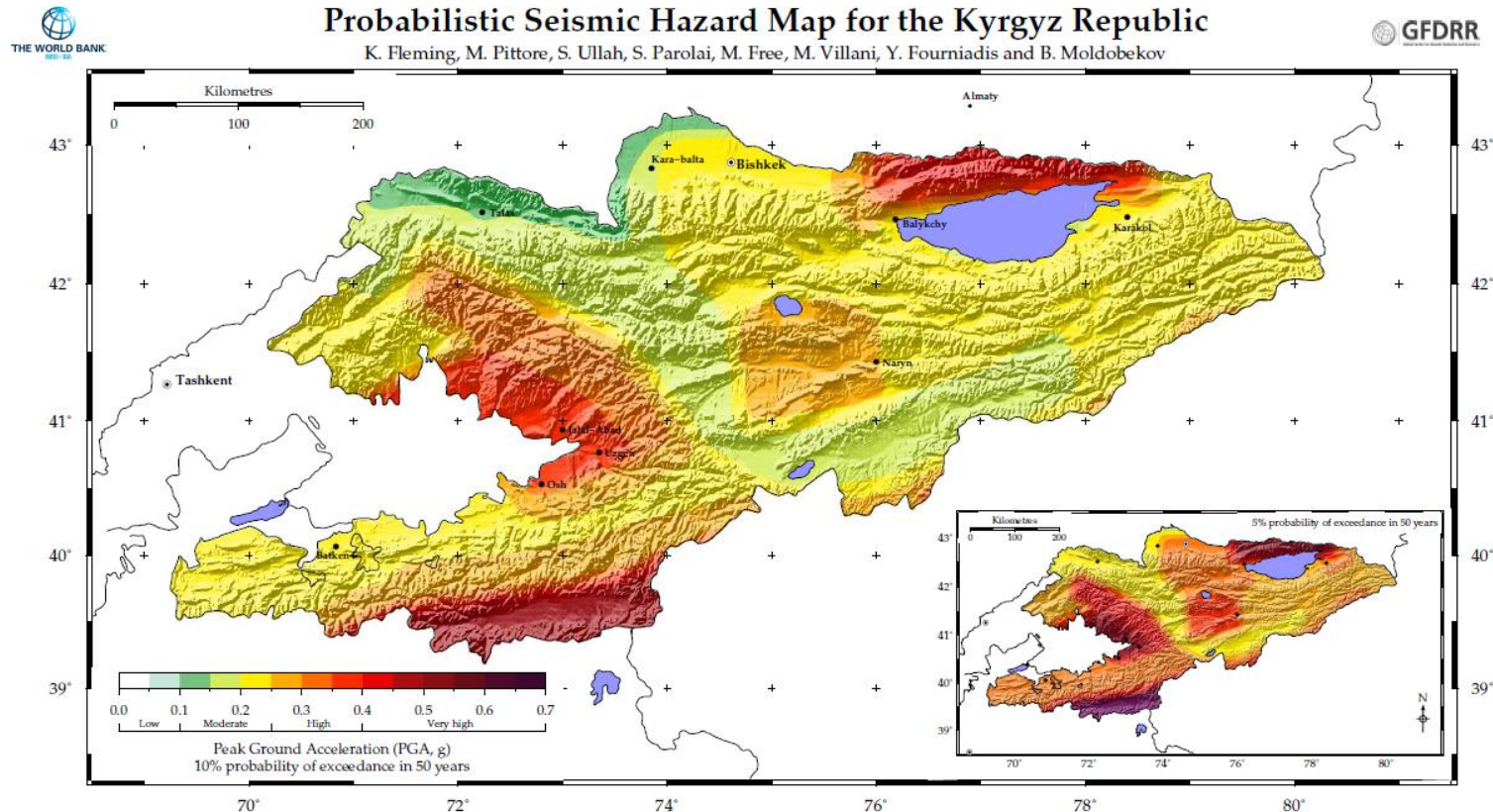
Powered by GeoNode version 2.0c1 | Developers | About

Supported by GFDRR

Language English

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_{ss}) of 760m/s. The inset 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 OpenQuake¹ 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
Central Asia
Initiative for
Assessment and
Improvement

GEM
Global Earthquake
Model Foundation

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 (EMCA²) 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.

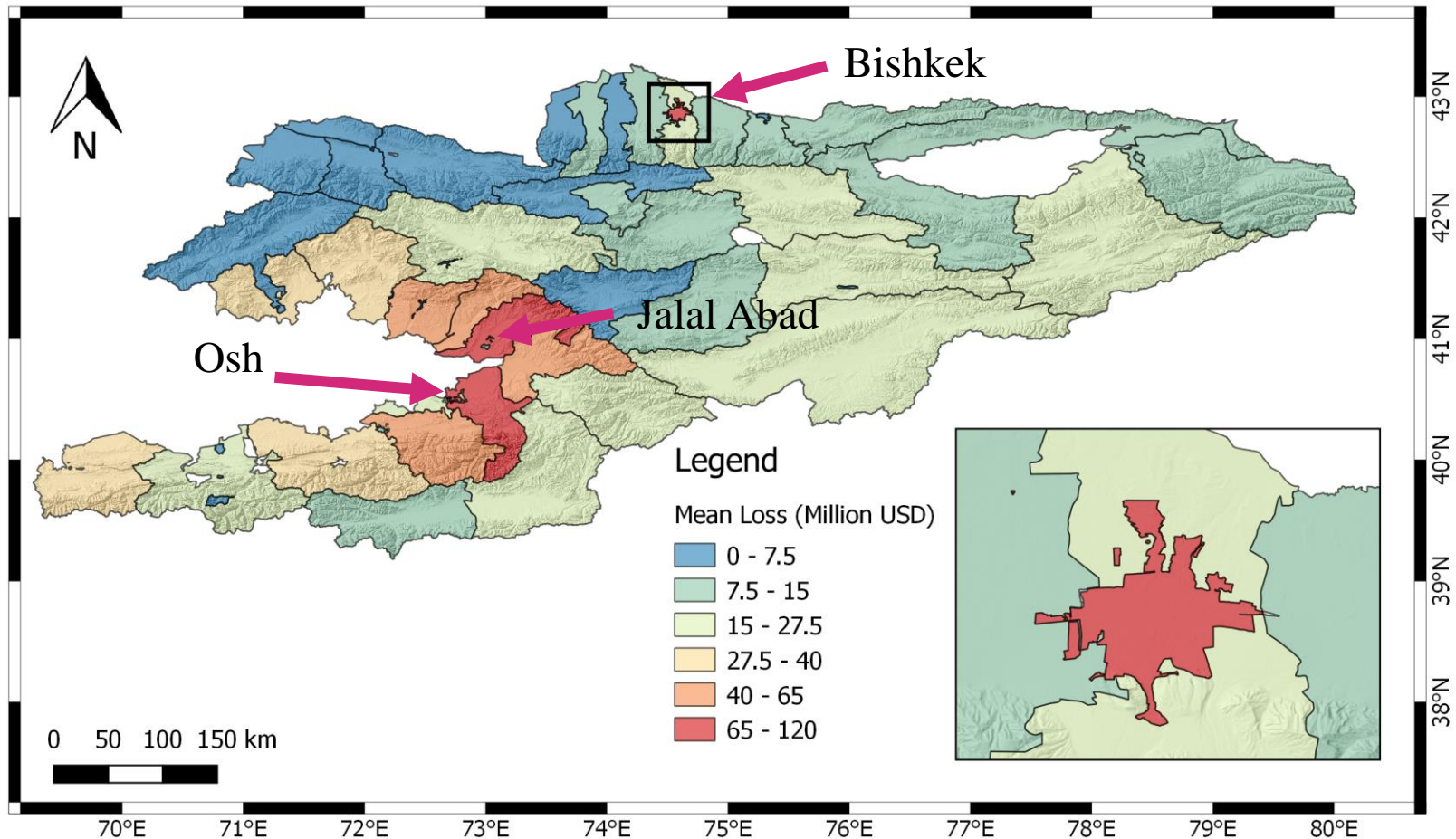
For further information, contact Prof. Stefano Parolai (GFZ, parolai@gfz-potsdam.de), Dr. Kevin Fleming (GFZ, kevin@gfz-potsdam.de), Dr. Bolot Moldobekov (CAIAG, b.moldobekov@caiag.kg), and Dr. Matthew Free (Arup, matthew.free@arup.com).

¹www.globalquakemodel.org/openquake/

²www.emca-gem.org/

Technical communication of risk information

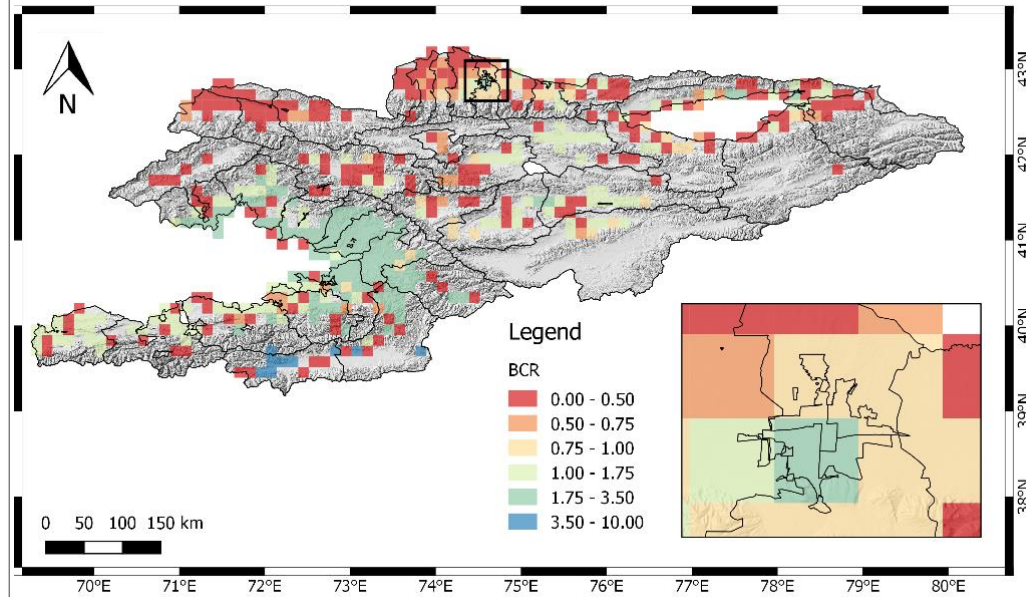
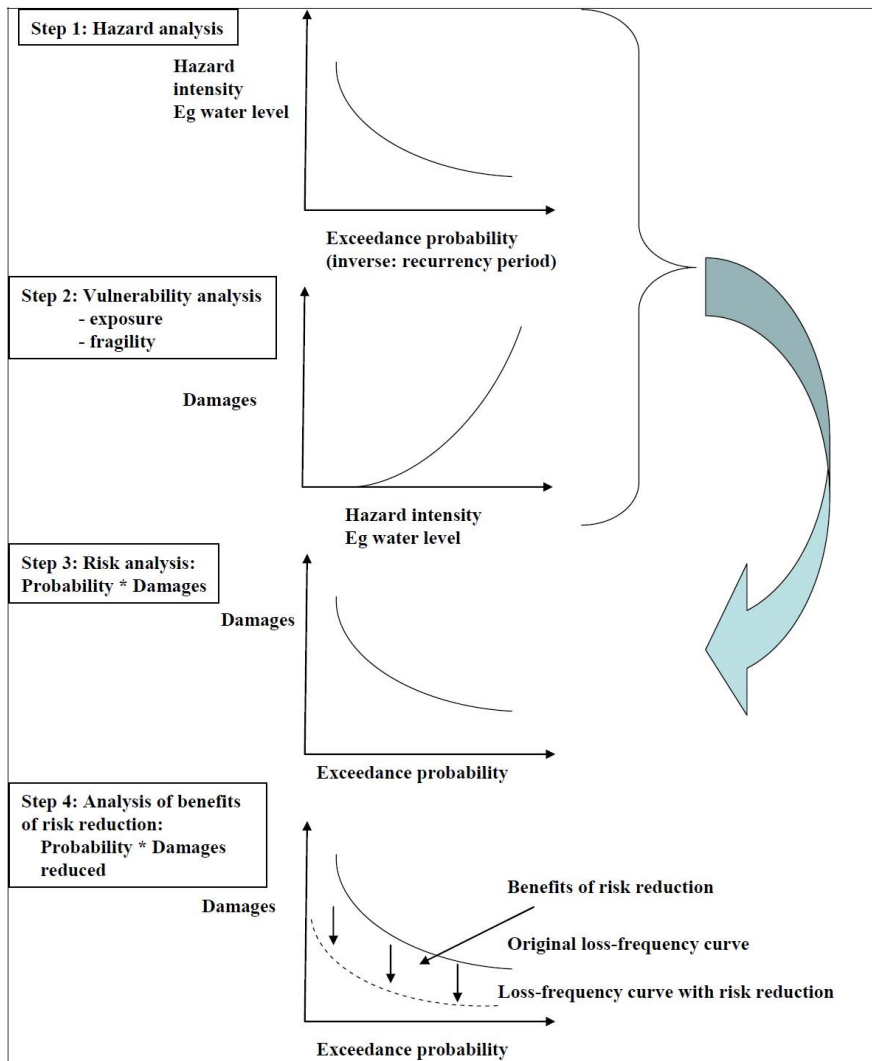
Communication of probabilistic risk results for schools to the Ministry of Education and Ministry of Finance



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 Shymkent earthquake of 2003 which resulted in the death of 74 people



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.

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 ongoing over the past 45 million years, is currently ongoing, and will continue for the foreseeable future.

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.



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 scenarios considered in this project.



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.

Component 1. Undertaking a seismic hazard assessment which identifies where earthquakes occur and how strong is the ground shaking and other hazards.

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",

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 the development of a seismic exposure model comprising buildings and infrastructure across the entire 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-war panel apartment buildings in Balykchy, Kyrgyz Republic.



Development of the seismic exposure model



Thank you!

