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Opportunities for international cooperation in the field of Disaster Risk and Resilience Research

Report from a Field Trip to Kyrgyzstan and Kazakhstan, 2-11.6.2024

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1. Field Trip Goals

INCREASE is a research project funded by the German Federal Ministry of Education and Research (BMBF), running from January 2021 until January 2025. The project partners consist of research institutions and universities, a national authority and a disaster risk reduction platform. The topical area is natural hazards, disaster risk management, urban planning, and social aspects. The project contributes to strengthening and internationalizing German research on civil security and to promote international and transdisciplinary partnerships as a basis for knowledge exchange and innovation.

The idea of INCREASE is to develop an Integrated Disaster Risk Management Concept that unites all actors of disaster risk management (e.g., government, civil protection organizations, city planning, population) on all levels (e.g., local, national, international). It also strives to integrate all phases of disaster risk management, from preparation to coping strategies during an event to recovery and build back better. Within this concept, the linkage of spatio-temporal scales, and dimensions of coincident or secondary hazards is also addressed. INCREASE aims to generate practical methods and tools according to the Integrated Disaster Risk Management (IDRM) approach and framework and to discuss their feasibility and transferability with respective stakeholders (e.g., a multi-hazard risk analysis, a risk and resilience toolbox, and a dashboard for decision makers).

The field trip has several objectives:

- Identifying topics of natural hazards and risks in Central Asia - in this case, Kazakhstan and Kyrgyzstan. Finding partners and options for knowledge exchange about disaster risk and urban planning, and future collaboration.
- Presenting the preliminary work of the INCREASE project to international experts, and obtaining feedback about their usability, further needs, and similar approaches existing in Kazakhstan and Kyrgyzstan. This includes testing the feasibility and transferability of the INCREASE approach, methods, and tools.

Overall, the main ambition is mutual learning across disciplines and countries to improve knowledge and action in the face of natural hazards and disaster risks.

2. Intention and ambition

This field trip served multiple purposes. The first and **major goal** was to test the transferability of the project. The INCREASE-project, funded by BMBF, 2021-2025, includes one work package (WP9) that aims at disseminating but at the same time testing the products of the project on transferability to other cities, regions, and countries. This was the purpose from the beginning of the project, but challenges occurred during the project run-time with continuing the collaboration with the country of Iran due to changing political circumstances. These challenges additionally spurred the need to find out if and how the project results can be transferred to other regions and countries as well.

Testing a transferability means that different conceptual, but also local and situational **contexts** have to be considered. That means that local conditions of natural hazards, urban architecture, local culture, political leadership, characteristics and capacities of institutions, and social cohesion are some of the factors which need to be observed when trying to transfer a scientific product with an application purpose to another site. How to identify, document, and deal with such context dimensions varies in different scientific disciplines.

It is a hallmark of the project INCREASE that it consists of a truly inter- and transdisciplinary consortium. On the other hand, this interdisciplinary set-up also poses several challenges that have hardly been addressed empirically in scientific research so far. The field trip was therefore at the same time a type of experiment. It is not just a question of science communication of interdisciplinarity, for example, by presenting the project products to an interdisciplinary audience and set of experts. It is also an open scientific question, about what makes an interdisciplinary set-up in a project different from a single discipline in achieving impact and transferability. The field trip already revealed many important lessons learned and insights in the long planning phase. Typical for a scientific project it took several joint meetings between the project partners on the German side to identify the goals, joint actions, and ambitions for that field trip. There were many challenges, uncertainties, and novelties of that field trip. The field trip target countries were novel to the project team, almost no one had been to those countries before, and they had not been on the agenda at the start of the project. Almost no one in the project team had skills in the local language or of Russian, which is also spoken there.

But the most important learning aspect is how different people with different disciplinary backgrounds bring in needs and ideas for such a field trip and the implementation and transferability of the products. This starts with the general conception of what a field trip actually is, how its purpose is defined and what can be derived from it. For some scientists and disciplines going on a field trip is common and they are familiar with such travels and visits. Scientific methods, such as fieldwork, field observation, excursions for deductive and scientific purposes, and other forms such as workshops are known to them. Still, there is a significant difference already between subdisciplines. For example, physical geographers would tend to observe soils, landscapes, and natural environments and areas. Whereas human geographers would focus on urban or rural settlements or land use and especially on humans and their interactions or infrastructure. Other disciplines attending the field trip included sociologists, who put their focus more on meeting people and finding out social and cultural

patterns as well as differences of such contexts. Other disciplines involved during the field trip were urban planners who were interested in observing living conditions, architecture and development options. Of course, the persons attending the field trip as scientists were not only bringing in their disciplinary view but also their personal interests and therefore contributed additional viewpoints of other disciplines and fields. Naturally one of the main questions was, how to integrate this scientifically into the field trip, and how to include it into the project tasks of identifying needs and options for transferability and implementation of the products.

The products that were mainly brought to the field trip and presented to local experts, included communication tools, scientific information systems, and support tools to identify gaps in disaster risk management as well as dashboards and Geo Information Systems. A dedicated communication tool, a social media app and a website were presented, besides other scientific communication forms such as knowledge exchange workshops, a disaster wiki, and an integrated disaster risk framework.
The field trip had many other additional objectives that fall outside of the description of traditional scientific mobility. For example, many scientists who are not geographers or anthropologists, use travel and mobility mainly to meet persons at conferences, workshops, or other official meetings. While this was a major part of the field trip, it was also important that all participants got an insight into a different culture and region. To avoid typical scientific mistakes of forgetting local, social, political and cultural context, it was important, not only to talk to people during the workshops and the breaks in between, but also to actually observe urban, rural and natural environments. This enables the participants to identify differences in natural hazard context, but also settlement and livelihoods from first-hand perspective. For example, a river flood affects a flat area with single detached houses quite differently than multistory apartments or rural settlements located in a ravine. A second example are wealthy and poor areas, which have different typologies of social, human, economic, and other capital.

It was a valuable experience to find out how each participant of the field trip could contribute to capturing all those differences of contexts. Some participants were familiar with expressing and documenting observations. Other participants lacked not only familiarity or methods for doing this but also didn't have exact ideas in the planning phase about what to do during that field trip. Therefore, a scientific plan was developed in which all participants contributed scientific ideas of what they aimed to analyze during the field trip. This already helped them to suggest topics for discussion and workshops to be conducted during the field trip but also to prepare follow-up documentation and potential joint publications or other future actions such as diving into new research fields.
The field trip had additional objectives such as exposing all the project participants to a foreign environment where they could directly see and identify differences that they could not conceptualize back home from their desks. The participants were also exposed to all the impressions and communication with external experts and local citizens. They were exposed to different observations and activities of the other participants during the field trip, before and after. This helped to generate reflections as an important part of testing hypotheses and assumptions and the products of the project that they developed.

In addition, a major effect from such joint travels is that it creates social cohesion among the group. This was not only very important to generate better ideas, how to integrate all the different products of the project and thereby take care of future sustainability and dissemination of the project over the end of the project for later output, outcome, and impact. It was also very important for that specific project as it had a very complex interdisciplinary ambition right from its beginning. Multi-hazard and multi-risk research still is rather young and underdeveloped in the area of natural hazards and risks. While it is a major trend in science, it lacks empirical research as well as testing and validation. Furthermore, this field lacks research in many disciplinary and interdisciplinary collaborations, as we could prove by conducting a literature review on the country Iran, which could not be published due to political reasons. Instead, we published the findings in a literature review on 20 countries in western Asia, including Iran, and 20 other countries in another literature review on East Africa for comparison.

The field trip was also very important to generate social cohesion and a joint understanding of interdisciplinarity between the participants. Any strands of research and processes were getting stuck, and could not be carried out as planned because of the difficult situation with the country of Iran that developed during the project runtime. This not only created a lot of additional stress but also frustration amongst the highly motivated participants on the German as well as on the Iranian side. These tensions already had existed from the project beginning due to the unclear situation of co-financing of the Iranian partners. Contrary to the communicated idea, the Iranian partners were not able to receive funding from their bodies as had been envisioned. This created different expectations from both sides and hampered the process from the beginning on. In addition, there were competitions on the Iranian side of partners, who would be the official spokesperson for the project. This was compensated by the research design on the German side that was informed by previous projects. The project design, therefore from the beginning, had a contingency plan that foresaw that all work could also be carried out without the Iranian partners if cooperation would prove to become difficult. For example, all scientific analyses using geo information were planned and designed to work with open access data as an alternative source as well. Of course, therefore the outcomes not only of the information systems, but also other planned products like a social media app, which was planned to be jointly developed with an Iranian disaster management authority, and to be implemented directly in Tehran, became impossible, and had to be carried out with an alternative plan. For similar international projects, such contingency planning can only be recommended. The political events in Iran in 2022 and in the following years with public protests and following reactions from the political side in Iran meant that ethical and security concerns predominated the work in the project to a great extent for at least a year. During that time, an additional contingency plan had to be developed. As part of that, it was decided to stop official cooperation with the partners in Iran, and halt that until different political framework conditions would be generated. Since it was not clear whether this would happen during the remaining runtime of the project, another alternative plan was developed. It was to broaden the project perspective to other countries and was prepared as a possible contingency option from the beginning of the project. This worked very well also for the original intentions of many of the project partners who aimed at international collaboration to generate new insights into their own knowledge base on disaster risk management by learning from other countries. But also, to get

in touch with other countries to prepare for future collaboration for either emergency management operations, scientific research, or mutual aid and relief work during and after a potential disaster. Conflict and communication problems could be avoided if there was risk-informed planning. Therefore, the project tasks, such as a planning and information system were already developed also in context and in collaboration with other countries by some of the project partners in Germany, Jordan, India, and during the field trip with Kyrgyzstan and Kazakhstan. But communication can also be improved not only by information systems and planning instruments such as urban planning, which integrates interdisciplinary perspectives. Better knowing the partners in different countries and understanding their planning systems, emergency coordination structures and governance, but also social and cultural differences can immensely help to avoid conflicts before, during and after a disaster. Since disasters are highly sensitive topics it is especially important to generate knowledge exchange and transfer of ideas as well as products and reflections in the so-called peacetime before a disaster happens.

Another major objective of the field trip was to prepare better planning and understanding of conflict management related to disaster risk in general. Of course, a topic such as disaster management is a very good leverage for any country to cooperate with other countries in the disaster response. This can help to overcome political or other differences that would persist, during an everyday exchange about economic or other activities. Therefore, the rare topic of emergency and disaster management is an important scientific, but also unique diplomatic option for better international cooperation.

The project participants needed to have such an exposure to a different country and context to be able to observe such processes rather than to just hypothesize about it. The social cohesion amongst the participants was also very important to generate not only internal and external knowledge exchange, but also to strengthen the team spirit since all the complexity and contingencies during the project runtime created stress and uncertainty. The field trip in this sense included the following objectives and successes.

The field trip provided the concrete implementation of the project by testing the transferability in a real and different context. It allowed for international cooperation and exchange, and mutual understanding between the participants in the project, but also with external partners. It created social cohesion that was important due to the complexity and stress during the project and the special ambition of the interdisciplinary and multi hazard topic. The field trip was a learning experiment similar to an excursion in geography. At the same time, it was a scientific delegation to showcase inter- and transdisciplinary perspectives and experiences in dealing with major disasters like the lessons learned from the floods in Germany in 2021.

The field trip is also thematically in line with a joint declaration of the heads of states of Central Asian countries and the German Chancellor to strengthen the joint cooperation in the thematic areas of climate change adaptation, environmental risk, resilience and direct dialogue between citizens (Z5+1 declaration: Gemeinsame Erklärung der Staatschefs Zentralasiens und des Bundeskanzlers der Bundesrepublik Deutschland, Link).

Scientific Interests of the German INCREASE partners:

- Standard Operating Procedures (THW)
- Operational DRM capacities (THW)
- Transferability and improvements of IDRM concept (DRU)
- Droughts, water scarcity: rural or urban, periurban (DRU)
- Landslide sediments entering river beds, overflowing the city (UW)
- Urban classification (IOER)
- Urban growth into natural hazard zones (THK)
- Critical infrastructure spatial risk assessment (THK)
- Urban-rural transects (THK)
- Testing of INCREASE interactive platform to identify and visualize hazard, vulnerability and integrated risk for urban areas (Risklayer)
- Identification of potential indicators for measuring urban resilience performance (KIT)
- Merging bottom-up and top-down risk management (Risklayer)
- Exchange of best practices and lessons learned (DKKV)
- Enhancing capacity of the National Platform for Disaster Risk Reduction through collaboration and coordination with Multi-Stakeholder (DKKV)

3. Bishkek, Kyrgyzstan

3.1 City of Bishkek

The German delegation was led through the city center of Bishkek by Ulan Abdybachaev, Deputy head of Department 1 "Geodynamics and Georisks" on Monday 3.6.2024. Not all of the German group of 13 persons could join since four persons were still delayed with their connecting flights in Istanbul.

First the exchange about most pressing natural hazard topics in Bishkek revealed that in the city center, floods are not yet a prominent problem. This changes in the southern outskirts where glacial lake outburst flows (GLOF) bring sediment and floods into the city.

Figure 1: Near-surface loose river gravel and pebble determine the building ground in the city (Photo: Büdel)

The city's underground is made up of coarse-grained fluvial sediments, with well-rounded gravels with boulders of 20-30 cm diameter. Those loose sediments can easily be eroded when protective measures are lacking and serve as groundwater reservoirs. There is a general high earthquake risk and many buildings are prepared up to a maximum of magnitude seven earthquake risk. Another major upcoming problem are heat waves, Mr. Abdybachaev stated.

Figure 2: Ulan Abdybachaev from CAIAG and Clara Athenstaedt discussing and translating about hospital characteristics (Photo: Fekete)

A hospital from the 1950s, or 60s is a center for cardiac emergencies, with a stroke unit. The city center consists of a mix of different architectural types. There are very modern buildings and high-rises from the past 10 years. At some construction sites, the typical construction style of concrete frame and filling with bricks could be observed. Overhead wires are common.

Figure 3 Overhead wires and construction type (Photo: Fekete)

The road layout in the city is dominated by very wide alleys for car traffic and pedestrian walkways. In between are sometimes lawns or tree alleys, but quite prevalent are open surface drainage canals that are kept very tidy at the moment and seem to be quite new. Rooftop drainage often ends above ground without further measures to protect against heavy rain. Some of the classical residential blocks from the Soviet era have modified additional tin roofs protecting balconies.

Figure 4: Rainwater pipes and drainage in the streets of Bishkek (Photo: Fekete)

Figure 5: Tin roofs added over balconies (Photo: Fekete)

Regarding heat waves, many buildings are visibly equipped with air-conditioning. The wide lanes and green in the city can help to circulate air and create some cooling. However, Mr. Abdybachaev stated that risk assessments and urban plans are still lacking implementation of heat waves and could be an interesting joint future research area. Medical and climatic studies are needed to assess the impact of "heat wave" on the urban community.

Trees in the city often have white color of lime at the base to protect against vermin. However, this does not seem to be used to reduce sun exposure as a climate change adaptation measure yet. Trees are in conflict with traffic and parking lots, as in many other cities worldwide.

Figure 6:Tree space and air conditioning (Photo: Fekete)

Many of the government buildings in the city center are currently renovated, and the overall city layout in the center is filled with wide open spaces. Few buildings have cellars, for example, the building of the standardization organization. In case of heavy rain or urban flooding, such basement entry points, or cellars would need to be protected.

Figure 7: Basement covered by roofs (Photo: Fekete)

Summary of possible topics for future research

- Earthquakes, building construction, overhead wires
- Heat and Cold Waves
- Storm water drainage
- GLOF risk

3.2 Knowledge Transfer Workshop: INCREASE IDRM Transferability to Kyrgyzstan - Central Asia

The exploratory workshop on INCREASE integrated disaster risk management transferability to Central Asia aimed to trigger discussions on concrete challenges and potentials for the development and implementation of an integrated disaster risk management (IDRM) in Kyrgyzstan, Kazakhstan, and Germany. Therefore, in the first part CAIAG, their invited partners and the INCREASE project partners came together to exchange. Presentations on the current state of the art in Kyrgyzstan were given by CAIAG on behalf of Ulan Abdybachaev, Dr. Ryskul Usabaliev, Dr. Sergei Erokhin and Dr. Alexander Zubovich. In the second part the INCREASE project was presented by Alexander Fekete (THK). Then a portfolio of different topics was offered based on the interest and needs of the participants. This portfolio started with a presentation on IDRM by Verena Flörchinger (DRU) followed by a demonstration of needs and feasibility looking into the INCREASE dashboard, toolbox, and social media app development by TH Köln/Risklayer presented by Alexander Fekete (THK) and a presentation by Luisa Knoche and Nils Krippner (THW) on Developing Standard Operating Procedures for Disaster Response Entities. The presentations and their followed discussions with the participants facilitated exchange and mutual learning from each other's contexts and to gain insights.

The knowledge transfer workshop in Kyrgyzstan was realized from DKKV together with CAIAG on the 04th of June in Bishkek, Kyrgyzstan with an overall of 40 participants.

As a summary, the workshop with CAIAG was very positive. There was a visible interest and engagement from CAIAG and its invited partners on scientific work and implementation, but also the organization and provision of staff, technology, and venue was excellent. The feasibility of the INCREASE products could be presented and have received very positive feedback. In addition, future cooperation activities and interest have been generated.

Figure 8: Workshop group at CAIAG (Photo: Siefker)

Dr. Uzakbaev of CAIAG opened the meeting and welcomed the 40 participants.

The first presentation was given by Ulan Abdybachaev of CAIAG. He talked about natural hazards in Kyrgyzstan, seismic microzonation and damage estimations for Bishkek. Kyrgyzstan has nationwide seismic hazard maps as well as seismic microzoning of some areas. A seismic impact scenario is also available for Bishkek, including potential impacts on critical infrastructure and fatality rates. He explained that, in general, scientific research in Kyrgyzstan focuses on seismic hazards, which are investigated using sensors and technology, as in several German-Kyrgyz projects jointly funded by the BMBF, such as CaTeNa.

Another research interest for CAIAG are the hazards landslides and mudflows which are captured in an inventory consisting of a map and a catalog and dating back to 1991. Mr. Abdybachaev also pointed out that a tool for assessing damage in mountainous regions is being developed and technologically complex campaigns such as resonance frequency measurements of slope stability and large-scale refraction seismic measurements of sediments had been launched. The occurrence and activation of landslides are primarily related to the engineering-geological conditions of landslide-prone slopes in combination with atmospheric precipitation during the period from November to February. Exceeding the average annual precipitation norms is defined as a period of high-water levels, and it is during this period that landslides are most frequently recorded.

The presentation sparked great interest not only from the German side but also from Kyrgyz participants. Prof. Stauch asked if there has been an increase in landslides in recent decades. Mr. Abdybachaev explained that CAIAG has noted an increase in frequency but not in intensity and magnitude due to missing research on these two factors. Further seismic risk assessment activities in Bishkek were already being discussed, also in connection to the Turkish/Syrian Earthquake Mw 7.8 at 6 February 2023. Future potential areas of research are targeting areas of concern in Bishkek and include updates and improvements of normative documents on human losses. Additionally, there is a need for expertise, interdisciplinarity and standardized approaches especially in the area of impact and loss assessment. Past approaches and standards from Soviet times need to be updated.

A Kyrgyz participant, Mr. Erkinbek Koichumanov of the NGO Camp Alatoo, asked how the findings are shared and who the beneficiaries are. Mr. Abdybachaev answers that it is shared with the ministry and official institutions. There is also an annual compendium published.

A person from a university in Kyrgyzstan asked about collaborations with institutions such as universities. CAIAG replied that collaborations can be implemented if they receive official requests. At CAIAG, a colleague from seismology who was in charge of such collaborations has just left for such institutions, and the position is now vacant.

Figure 9: Speakers the CAIAG Workshop (Photo: Siefker)

The next speaker, Dr. Ryskul Usubaliev presented the glacier distribution in Kyrgyzstan, with high densities of rivers, and distribution of lakes in this high alpine country. Glacier area reduction is measured using multi-temporal remote sensing data (Landsat, Sentinel, Planet, Worldview 2), with one glacier losing 25m/year, and glaciers generally melting faster than in the past, resulting in an increasingly negative mass balance. In the valleys they typically lose 10m/year, while melting in the valleys should be faster. In Soviet times they had a catalog of glaciers, now updated digitally. A 16% of loss in glaciers in general is documented.

Glacial lake outburst flood (GLOF) is another hazard type. As glaciers are disappearing, water availability is increased in the summer month and every year more glacial lakes emerge. Therefore, there is an increasing risk of GLOF outbursts and debris flows. GLOF density is high on the southern foothill areas, including Bishkek, but also at lake Issykul. At lake Akpay they monitored and could predict a GLOF in 2021, avoiding human harm. Prof. Georg Stauch asks if they have automatic satellite image mapping or visual image interpretation. They map manually.

A Kyrgyz colleague asks about glaciers, whether irrigation is dependent on glacier melt and about the creation of artificial glaciers for irrigation. There are 20 areas in Kyrgyzstan used for such so-called artificial glaciers. It is a regular issue, not really a glacier. They work pretty well in this transition period. Problems were discussed for the summer period where water is needed. Water stress is a topic for farmers and pastures.

Questions about glaciers as water towers and comparison to European alps were asked. Which population groups are exposed to risk? How is public awareness? Farmers and agriculture are mainly affected due to irrigation needs. But also, urban areas are affected by periodical drinking water shortages (e.g. in Bishkek). Particularly between the end of May and beginning of June is a period of water shortage. Also connected to rising temperatures and climate change. In some years they have less precipitation in the valleys, and if the glaciers have not yet started to melt this can lead to a water shortage until mid-June. Measures are water

reservoirs to accumulate water (replies from and Almabaek Aidakeev from the Ministry of Emergency Situations).

For the August 2021 GLOF, how was information provided and translated for the successful evacuation? How receptive are people to such warnings of GLOFs? They informed the people on-site. The warning was made 10 days before the event. No casualties were reported since the accumulation of water could be observed for quite some time in advance.

The work of the ministry was the evacuation of all houses and nomadic yurts. Some houses were destroyed that could not be removed, but they were abandoned at that time. Also, special signs and notices were put up to warn the population. Aug 31st 2021 the GLOF happened. The Ministry of Emergency Situations is responsible for the response part.

Which measures are taken besides monitoring (Dr. Thiebes)? An assessment and a map are provided, which can be used for an evacuation. There is also an automated early warning system (EWS) in one valley since it is highly populated.

How do people react to the warnings? In Germany, the warnings are sometimes ignored. That also happens in Kyrgyzstan. In the valley, people are used to mudflows and take the warning seriously, but it is less so in areas where they have not seen or experienced mudflows. For the Ala-Archa area, it is possible to communicate 15-20 minutes before an event since an automatic warning system exists.

Prof. Usupaev states that in many countries there is no uniform system, in Kyrgyzstan they created a unified system to collect natural hazard information. They published a compilation of forecasts. This is distributed to all ministries and all districts.

Limitations of the monitoring lie in technical details such as water, temperature, but they have more problems with geology, GLOF structures such as underground channels are more difficult to predict. Underground surface is another factor.

The Ministry of Emergency Situation of Kyrgyz Republic is a research and forecasting institute, having the mandate, resources and staff.

The third presentation was given by Dr. Sergei Erokhin from the Institute of Water Problems and Hydropower - Lab of hydrology based hazards, who worked a long time in the Geological Service on landslides, floods, and GLOFs. He talked about moraine and glacial lake outburst flows. He presented a 1966 outburst that triggered awareness and activities to deal with such GLOFs. He and his team developed a lake and GLOF classification that categorizes the glacial lakes by their morphogenesis. Main types are thermocarstic lakes and slope lakes developed in lateral moraines. The most hazardous moraine lakes are those still bordering glaciers but different types of lakes have different hazard characteristics.

2012 people in Bishkek were panicking when a GLOF was announced. Also 2024 a GLOF is expected. The Ala-Archa glacier is a fast-melting glacier and has several lakes that fall in the GLOF hazard category.

There exists a map for GLOF mudflow risk zonation for Bishkek and other valleys. Based on this protection measures or evacuations can be based. There are stations for measurements that are accessed by hiking, with equipment carried on horsebacks. There is a GLOF once or twice a year. Moraines mainly stem from the ice ages, but recent processes still occur, the last significant phase in the 19-20th century. There is an overlap of a 10.000-year process and a more rapid cyclic process.

Losing glaciers and ground ice will lead to more frequent hazards as it stabilizes the moraine sediments. Therefore, hazard susceptibility of lakes is easily underestimated, when underground melting and tunneling processes within a moraine weaken its stability without any surficial signs. It is asked, by one Kyrgyz scientist, if the recorded warming could not be tied to the natural warming and cooling cycles of the planet. So, it appears that climate change long term effects are differently seen between German and Kyrgyz scientists and that this is an interesting topic to jointly discuss.

Tourists from Bishkek and local people - how can they be informed and warned? Bridges and other infrastructure could be destroyed. Every council in the provinces and village council has the information, which is a book, so they can take charge of such measures. The Ministry also hosted meetings with local villagers who asked many questions. A common sense is that it is important that the population knows how to behave during an event, and that more information about DRM and trainings/drills are necessary.

The next presentation was by Dr. Alexander Zubovich about the system of data and monitoring by CAIAG. There are multiple monitoring stations, a sensor data storage system (sdss.caiag.kg/sdss) that is open and in public domain. With GFZ they host a database of 250 water surface level measurements by satellite altimetry over Central Asia but including Africa as well. They also run an earthquake EWS. Close to the Pamir is the most active seismic zone, but also at the lake Issykul. They also create information systems such as wildlife in Kyrgyzstan, or forest management. The forest info system is for internal usage of certain institutions. Users of such platforms are worldwide, as far as IPs are captured.

After a group photo and lunch, the workshop continued with presentations from the INCREASE team.

First the INCREASE project was presented by Prof. Dr. Alexander Fekete (THK) by giving an insight into multi-risk analysis and risk governance capabilities developed during the project, presenting the project partners and their activities as well as the goals of the field trip.

This was followed by a presentation of Verena Flörchinger (DRU) on IDRM which is at the heart of the INCREASE project. This included the study and the history of IDRM, it's dimensions and their indicators. The presentation went along with an invitation to an IDRM survey for Kyrgyzstan to identify gaps and potential improvements of DRM. With the feedback from workshop participants the language of the survey will be improved, facilitated, and then shared in the Kyrgyz community.

Another important topic of the workshop was a demonstration of needs and feasibility looking into the INCREASE dashboard, toolbox, and social media app development by TH Köln/Risklayer presented by Alexander Fekete (THK). Main outcomes of the part on needs and feasibility are a great interest in exchanging the Sendai framework from the Secretariat of the Ministry of Emergency Situation of the Kyrgyz Republic at CAIAG. Topics of interest are loss and damage assessment methods, and usage of EU databases such as Copernicus. A concrete suggestion for future cooperation is to join a National Adaptation Plan development for the City of Bishkek. The Ministry of Emergency Situation of the Kyrgyz Republic is furthermore reporting that social vulnerability assessment is important but too complex to do in Bishkek. They conducted this at administrative levels of 12 municipalities. For better analyses, historic data would be needed. A 112 emergency mobile app was also developed, where people can fill it with their own information, which can be used for research. Such apps have a high potential for emergency institutions. All INCREASE products presented are

highly important to Almabek Aidakeev, from the Ministry of Emergency Situations of the Kyrgyz Republic, who expresses that the improvement of coordination is also a need for Kyrgyz emergency institutions. DRR as a western concept has been adopted now for 20 years. They were impressed by the flood preparedness in Cologne, they had visited (Prof. Usupaev) and agreed that such an interdisciplinary approach is needed. He mentioned that sea level rise is a great problem as well, but was not talked about today, therefore we would also need to observe global risk management.

The last presentation was done by Luisa Knoche and Nils Krippner (THW) on Developing Standard Operating Procedures for Disaster Response Entities (SOP). For emergency relief it would be interesting for the German partners to see what the structure of actors in similar organizations and volunteer organizations is in Kyrgyzstan, as Mr. Aidakeev mentions. They have experience with SOP due to the 2023 Türkiye earthquake, where they were called by AFAD in Türkiye to help. They also have SOPs for disaster response in Kyrgyzstan. Red Cross/Crescent is located in Bishkek, but the structure of volunteers is different to Germany. Kyrgyzstan is proud of grassroot organizations, but they are very interested to learn how it is done in Germany.

In the following discussion different topics of interest mentioned by the Kyrgyz participants:

- Sendai Framework
- IDRM Dimensions
- Piedmont city
- Smog
- EWS, different EWS but integration and combining it with alerting
- Joint research on mudflows, GLOF, landslides etc.
- Heat waves
- 8/9 Oct 2024 is anniversary of CAIAG, and a conference
- CO_2 emission reduction also in Civil Protection and by forest fires

Regarding future cooperation ideas, there is a great interest to work with DKKV on National Platforms as they already had in the past, but also together with THW especially on the development of SOP. They are implementers of the NAP (Almabek Aidakeev, Ministry of Emergency Situations of Kyrgyzstan).

Challenges that can be addressed in the future encompass:

- Bishkek's city area has expanded by 40% by integrating surrounding outskirts and communities leading to new risks
- Community involvement: Only one NGO is present today, and unfortunately it is problematic to invite NGOs due to the new law on foreign agents.
- lessons from projects are forgotten and not continued or often land as a report on a shelf. That is why they created the previously mentioned database. Any pursued project should aim for a tangible outcome like a tool or platform, so that institutions and people can use it.
- Digitalization also is a problem since people lose knowledge of how to react (Abdybachaev).
- Risks outside of Bishkek could be higher since there is less preparedness.

Ideas for future activities themes that came up in addition by the German partners:

- Automatic mapping of glaciers
- Join a National Adaptation Plan (NAP) development for the city of Bishkek
- Sendai Reporting, structuring by the DRU survey
- Social Vulnerability Mapping

- Exchange on usability of information systems for stakeholders such as emergency management or the public

The meeting concluded with very positive statements from all department heads of CAIAG, the Ministry representative and the German delegation. For dinner, Mr Constantin Zelenty from the German embassy joined and reported on politics and economy in Kyrgyzstan. He also showed great interest in the activities of today.

3.3 Field visit with CAIAG

On Wed 5.6.2024, the group of 13 German participants was led by CAIAG, Ulan Abdybachaev to areas of interest around Bishkek. The head of the Department for the Prevention and Elimination of Consequences of Emergency Situations under the Ministry of Emergency Situations of the Kyrgyz Republic, Zhanysh Kalbanov joined, as well as Nazgul Alybaeva, Nazgul Usupbekova and another person from CAIAG.

Using a minibus, the participants could listen to the explanations from Ulan Abdybachaev while traveling south into the Ala-Acha valley. The road led through the southern parts of the city of Bishkek, crossing an elevation from around 900 m in the city center up to 2200 m.

Figure 10: Fig. Trip to Ala-Archa valley (Photo: Fekete)

At the southern rim of the city, larger residential buildings and government buildings were passed by. A first stop was overseeing part of the valley where mudflows could potentially enter into residential or administrative areas. A second stop was at a supermarket. The third stop was at a water dam, filled up with sediments. The fourth stop was at the national park.

Figure 11: Houses along the road and protection dam (Photo: Fekete)

Zhanysh Kalbanov and Ulan Abdybachaev explained measures taken for flood and mudflow protection during the stops. Some measures are protection various such as gabions. At the same time, many active and historic landslides, as well as indicators for surface and groundwater dependent gullying and mudflow occurrence could be seen along the valley. Traces of glaciers and moraine material could also be seen that could be easily mobilized by mudflows.

Figure 12: Gabion protection (Photo: Fekete), Slope destabilized by lateral erosion in loose sediments of a glacial lateral moraine above the Aksu alluvial fan (Photo: Büdel)

Along the way, and especially when walking up jointly and observing the sides there was plenty of room for exchange about the disaster management structure, international relief, coordination, local, regional, and national cooperation, and integration of expertise, and technical equipment, but also questions about integration of volunteers. Natural hazard assessment and modeling aspects were discussed mainly for mudflows, glacial lake outburst flows, and landslides. On the way back into the city several stops were made to observe rural and urban settlement patterns and building types.

Figure 13: Rural and urban settlement (Photo: Fekete)

Overall, this was a highly important field trip that not only allowed to see natural hazard features, but also protection measures, and allowed for expert exchange on risk assessment, risk management, communication and integration needs amongst any other topics. It also served to discuss the first ideas that CAIAG presented to the German participants about concrete future research corporation interests. The joint trip helped also to better create mutual understanding and to gain trust.

Figure 14: Lunch break (Photo: Fekete)

Figure 15: Day-trip group (Photo: Siefker)

3.4 Advisory Board Reflection

The German group then left Bishkek to Almaty and in the evening, the two advisory board members, Ulf Siefker and Christian Webersik, provided a first feedback and reflection on the first part of the field trip in Bishkek. Christian Webersik summarized the main topics and themes discussed during the workshop and also highlighted main ideas already stressed out by the CAIAG stakeholders for future cooperation.

CAIAG workshop input to INCREASE (Webersik):

Hazards and risks defined:

- Kyrgyzstan has large Alpine environments. Presentations related to geo-hazards, focused largely on glazier lake outbursts. Melting of glaciers threatens freshwater reservoirs (as well in the European context). Affected population is largely rural. However, also urban areas such as Bishkek can be affected by mud flows. Observations and warning of general public are main tools of safety management.
- Earthquakes also pose a hazard in Kyrgyzstan, early warning measures are in place

CAIAG's reflections on INCREASE

- In summary, material presented in the workshop is relevant for Kyrgyzstan's national adaptation plan
- The city Bishkek has grown a lot, with challenges in terms of smog, housing, and health infrastructure
- There is interest in early warning and early alerting systems
- Landslides, mudslides and flooding are threats to the population in cities and rural areas

- Apart from the capital, also urban areas in the periphery need to be taken into account
- Agricultural losses and biodiversity loss could be an interesting topic
- Drought is also becoming an issue
- Loss and damage are another topic of interest in urban areas and cities
- Towards the end of any project, there should be a tool, or scenario training, or lasting platforms
- Digitalization is also an important area of intervention, as more and more data is digitalized, but how is the disaster management system responding to this change

Reflections on the field trip and way forward

- Concrete funding opportunities are appreciated and need follow-up
- The comparative aspects of Central Asia have great potential
- CAIAG showed genuine interest in collaboration but the matching research and complementary interests could be challenging
- The integrating aspect of INCREASE is in its infancy in Kyrgyzstan and its institutions
- Top down, government driven interventions and disaster management is dominant
- Preparedness, hazard maps, social index vulnerability mapping, or practical tools, such as dashboards could be of great interest for Kyrgyzstan
- Potential overlap in discussing standard operations procedures
- In sum, the contextual and personal aspects of the field trip is an added value to INCREASE

Ulf Siefker added observations about cultural communication styles, but also underlying management structures and conflicts and problems. He received the information by individual conversations with persons from CAIAG especially during the field excursion day. Major findings are that in Kyrgyzstan an open communication seems possible, where even guests from Kyrgyzstan were allowed to question CAIAG and the ministry and it was partly a rather confrontative exchange, but in a very professional manner. During the communication with international guests, it seems that it is possible to ask very direct questions. There also appears to be a genuine interest in cooperation already in the preparation phase of our visit. This was underlined by the engagement in the following day and the four persons from CAIAG joining the group and expressing interest for future cooperation.

Concrete topics for future research were expressed as

- Earthquake risk assessment for critical water infrastructure in the city of Bishkek
- Landslide hazard monitoring in southern Kyrgyzstan

4. Astana, Ministry for Emergency Situations of the Republic of Kazakhstan

On June 6, a very successful meeting was held in Astana between representatives of various ministries and authorities in Kazakhstan (Emergency Situations, Natural Resources, Water) and the German delegation. The focus of the discussion was on lessons learned from flood disasters in Germany and Kazakhstan. Common themes were the warning and response of the population, the need for information systems and tools to enable decision making, and the need for international cooperation in the face of multiple and increasing hazard trends worldwide.

Figure 16: Group photo of the meeting in Astana (Photo: Ulf Siefker)

The meeting was convened and chaired by Mr. Rustambek Amrin, the head of the Emergency Situations Prevention Department of the Ministry of Emergency Situations of the Republic of Kazakhstan. He began by highlighting the goal of the meeting from his perspective: exchanging experiences and identifying future tools for emergency management. This, he noted, will contribute to avoiding future fatalities. He then went on to explain the flood risk in Kazakhstan and the measures being taken to address it. The flood in northern Kazakhstan, near the Russian border, in March and April 2024, was the most significant in recent years, causing damage to 12,000 houses. He emphasized that the growing number of transboundary hazards necessitates international cooperation. To this end, they are looking at Germany and its approach to handling floods as a model. Field visits have been made to Germany to learn about concepts, regulations and equipment used here to mitigate flood risk and its impacts. Kazakhstan is taking several measures to manage flood risk and is keen on comparing these systems to improve its own strategies. The Ministry of Emergency Situations and other ministries in Kazakhstan cooperate closely, a fact evident in the meeting where representatives from several institutions were present.

Alexander Fekete from the German delegation stressed that the shared experiences of Kazakhstan and Germany with floods provide a strong foundation for exchanging experiences and lessons learned. Extreme

events are increasingly occurring in several countries, including Germany and Kazakhstan. These events can lead to loss of life and economic damage, and also cause political and social stress. While scientists can provide crucial information, it is up to governments and administrations to make the necessary decisions. Floods not only kill people and damage infrastructure, but they also trigger additional secondary effects or cascading impacts. For instance, floods can disrupt essential services such as electricity, IT, and food supply. Another secondary impact is contamination, which in Germany led to houses being demolished even after the floods and rebuilding, due to health concerns. These secondary impacts create additional stress for those affected and for those involved in the emergency response.

The INCREASE project is a project that tries to integrate different types of stakeholders in a science policy-dialogue. Projects such as this help to save lives, and reduce economic costs, but also help to ameliorate political and societal conflicts. There is a lot of respect for how Kazakhstan is dealing with the flood. The German Federal Ministry for Education and Research is very much interested in such an exchange and lessons learned.

Figure 17: Appointment at the Center of Crisis Management, Astana (Photo: Priesmeier)

The Kazakh side (Alexey Sovetov, Deputy Chairman of the Committee on Civil Defense and Military Units) expressed especially interest in software for water modeling and flood forecasting. There is no joint or compatible software in Germany to combine all types of flood modeling of rivers and flash floods or to combine them with risk assessments, social vulnerability, or critical infrastructure amongst other important aspects. The project INCREASE is developing such tools and tries to find out the needs of stakeholders.

The Kazakh side expressed great interest in that work and it was agreed that slides and information would be sent.

The Kazakh side is using different types of information to use tools such as software satellite, imagery, and others. A major problem are long distances which can exceed 1000 km between villages along the river Ural for example. This is a problem for modeling and finding tools and data that are cost-efficient.

It was suggested to look at software used in the Netherlands since they have similarly flat land surfaces and a lot of experience with software development of flood modeling. The Kazakh side has already contacted the Netherlands as well. On the Kazakh side, they were impressed by the integrated approach along the River Rhine, where five countries are working together in a transboundary commission (IKSR.org). Another interest was whether Germany has experience with snowmelt and how such models and software can be integrated with river flood forecasting. Climate change is adding to it and snow is not the major problem in Germany these days. Still, there is a need for cooperation.

The joint discussion was very productive and very open, and there was great interest visible from both sides.

Then the German side gave presentations. First the slides from DKKV were presented by Dr. Benni Thiebes. The questions after the slides were that Kazakhstan has similar problems of warnings and ignoring warnings and they need to know exactly how many warnings and which type of warnings they need to issue in order to avoid over-warning. As an example, they said that for earthquakes they were holding exercises. Interviews were conducted in the city of Almaty and showed very little awareness about earthquake risk and measures to be taken by people. Almaty is a big city with big flows of migration. In February 2024 they had an earthquake of 5.5 magnitude and a series of other earthquakes. They then formed a task force at the emergency services for all regions. They were training to evacuate people to buildings with two floors or higher. More training and education for the population on behavior during earthquakes is nevertheless still needed. They stated that the measures taken and the conducted exercises were helpful because a second earthquake occurred with magnitude 5.3 and few people were injured. The Sirens worked, and only one person died as it jumped out of a window, probably because of fear.

Luisa Knoche from THW presented slides about the floods in 2021 in Germany.

In the discussion after, it was stated from Mr. Amrin that these are global challenges and that we need to learn from other countries. For example, floods also significantly occurred in China or even in Arab states such as UAE. Japan has an approach to combine both quake training and warning. However, even more important and grave than earthquake risks are tsunamis which cause cascading events in Japan. All types of disasters and measures need to be taken seriously. At the end, the plenum expressed that they were very grateful to the Germans for being open and also sharing their challenges. They are happy to continue working together in the future.

Afterwards, the company Risklayer gave a live presentation of their newly established software to display disasters and resilience for cities. The Kazakh side was very much interested to get contact information and receive information about it directly by email. The Kazakh officials are looking forward to a future meeting online and stated that this was indeed a very productive meeting. Some of them are responsible for projects such as risk mapping and have similar systems themselves. Still, they could still fine tune the tools in the future and within a joint corporation and efforts to mutual learning would be relevant. Also taking into account the specific danger of cascading effects, that considerably increase duration and dimensions of mitigation measures and missions is of high interest.

Alerting the population is also important, but it is necessary to combine it with the reaction of people and the question of which types of action they should be doing. They are looking for tools that can easily be used by normal people, but also stressed that these tools need the trust of the population. The INCREASE partners have

a wide range of experience having worked in other countries on exactly this combination of information, warning, usability by people and gaining trust. For example, INCREASE has developed a social media app demonstrator and analyzes how it can be used. As a wrap up, the Ministry of Emergencies stressed its interest in further cooperation and hopes that such friendly exchange will continue in the future.

Attendees from the Kazakh side:

Mr. Rustanbek Amrin, Head of the Emergency Prevention Department, Ministry of Emergency Situations of Kazakhstan

Mr. Alexey Sovetov, Deputy Chairman of the Committee on Civil Defense and Military Units

Mrs. Aray Seitbayeva, Deputy Director of the Department of International Cooperation

Mr. Edil Abraimev, Head of the Innovation Division, Ministry of Water Resources

Mr. Yuri Buchrin, Deputy head of the Department of Information, Digitalization and Communication

Mr. Natalia Dauletyarova, Department of Environmental Policy, Ministry of Natural Resources

Mr. Adel Akhmetov, Director of the Hydrological Department

Mr. Nurgatym Serikbai, Head of the Department Hydrology

5. Almaty, Kazakhstan

5.1 Knowledge Transfer Workshop: INCREASE IDRM Transferability to Kazakhstan - Central Asia

The exploratory workshop on INCREASE integrated disaster risk management transferability to Central Asia aimed to trigger discussions on concrete challenges and potentials for the development and implementation of an integrated disaster risk management (IDRM) in Kyrgyzstan, Kazakhstan, and Germany. Therefore, in the second part the National Academy of Sciences (NAS), their invited partners and the INCREASE project partners came together to exchange. Presentations on the current state of the art in Kazakhstan were given by 13 local partners. In the second part the INCREASE project was presented by Alexander Fekete (THK). Then a portfolio of different topics was offered based on the interest and needs of the participants. The presentations and their followed discussions with the participants facilitated exchange and mutual learning from each other's contexts and to gain insights. The knowledge transfer workshop in Kazakhstan was realized from DKKV together with NAS on the 07th of June in Almaty, Kazakhstan with an overall of 44 participants.

As a summary, the workshop with the NAS in Almaty was very positive. There was a visible interest and engagement from NAS and its invited partners on scientific work and implementation, but also the organization and provision of staff, technology, and venue was excellent. The feasibility of the INCREASE products could be presented and has received very positive feedback. In addition, future cooperation activities and interest has been generated.

Figure 18: Group photo of the workshop at the National Academy of Sciences (Photo: Siefker)

The workshop was opened by a welcoming speech of the president of the National Academy of Sciences (NAS) Prof. Dr. Akhylbek Kurishbayev. He stressed out the importance of the meeting, dealing with natural hazards and mentioned that this is also in line with general cooperation between both countries and it also fits to the general activities of a new German Kazak science center.

The German delegation (Prof. Dr. Fekete and Verena Flörchinger) expressed gratitude and the importance of closer cooperation in the fields of climate change and natural hazards, but also especially dealing with interdisciplinary and integrated approaches.

The head of the German Kazakh University, Wolrad Rommel, spoke about the importance of integrated water resources management. Water is a major topic not only for supply but also in relation to hydrogen production of energy in the future. In Kazakhstan, he also sees a lot of potential for a circular economy and waste management and addressing sustainable development through better integration of technical and organizational aspects of sustainability.

The vice president of the NAS, Mr. Abay Serikkanov, stressed the importance of research on climate change, especially emission reduction to better treat pollution. He showed that Kazakhstan by comparison with other countries has still a lot of room for development in this area. He gave an example of Karaganda that exceeds WHO thresholds for air borne particulates by 23 times. In addition, he referenced noise and light pollution as issues in Kazakhstan. He also stressed that at the global level, there is a lot of awareness about global risks as well, such as underlined by the World Economic Forum.

Peter Liebelt from the Central Asian Sustainable Innovation Bureau (CASIB) spoke about the floods in Kazakhstan and earthquakes this year showing that natural hazards indeed play a major role in the country. He mentioned that it is great to see that the German delegation met high-level partners in Astana already underlying the need for cooperation and joint action between the two countries on such topics. The CASIB office offers knowledge and technology transfer. He also introduced the client II funding line which includes research and applications for natural hazards.

Mrs. Elisaveta Yessenzhigitova, Deputy Director of the Institute of Seismology, introduced the variety of seismological events and hazards in Kazakhstan. Seismic monitoring is conducted throughout Kazachstan, with 70 monitoring stations total. An interesting aspect is the research about man-made earthquakes in the country. These are triggered by mining activities for example. Earthquakes are a major topic also in general in Kazakhstan, since 30% of the country is earthquake exposed, which a study by JAICA showed. Modeling is done as well as assessment of seismic hazards and forecast of seismic activities. Seismic microzonation maps are developed for the city of Almaty. They do mid-term and short-term projections with short-term protection projections ranging a span of 10 years or shorter. Also, secondary hazards such as mudslides are based on earthquakes. Man-made earthquakes are important because they cause a lot of industrial infrastructure and economic damage. For the city of Almaty, they also produced an inventory of buildings. They are interested in fostering man-made earthquake forecasting by analyzing activities, underground, mining, or oil production. Concluding the importance of international corporations was stressed mentioning examples from Japan and China.

Figure 19: Speakers at the National Academy of Sciences Workshop (Photos: Fekete, Siefker)

Farabi Yermekov, Kazakh National Agrarian Research University, introduced different types of remote sensing data used in Kazakhstan. They analyze vegetation growth and cover as examples. Also drone technologies are used to measure air quality or to control powerlines. It is also applied for search and rescue with thermal cameras to detect people and monitor wildfires. Farabi discussed the agricultural impacts of disasters, which include changes in agricultural yield, seasonality and the emergence of pests and diseases.

Aiman Nysanbayeva, head of the department and Senior Lecturer at Al-Farabi Kazakh National University, spoke about climate change, and how it is related to human health. The conception of the topic must be global, which has been shown by temperature and other increases worldwide. A specific topic is social vulnerability in urban areas, especially 'thermal islands' (heat island effect) in cities that increase heat-related stress and respective adaptation measures are needed. Heat islands also impact the economy financially due to increased health costs. Climate change interacting with glaciers leads to deficits of water for Almaty. There are also water conflicts with downstream countries which makes the case of water diplomacy and integrated water resources management an important topic. As a university, it does provide information, informs laws and policies and a global view that is needed.

Birzhan Serikbay, engineer of the Emergency Situations Department of the Almaty City, showed that Almaty has all kinds of hazards. 28 warning stations and 31 debris flow monitoring stations are installed. Hazards analyzed are, for example, glacial lake outbursts, debris flows, earthquakes, and avalanches. They provide training, awareness-raising programs and more. Two types of action plans exist for Almaty, one for natural hazards and one for man-made hazards. The City Plan considers the provision of critical services (17 identified), addressing individuals with mobility issues (80,000 estimate), provision of shelter (384 shelter locations) and various ways to enhance emergency communication. For people with hearing disabilities, sign language is used also in public communication. They provide programs for TV channels, for example, 30-second short interviews with subtitles in two languages. They have many resources, both human and technological.

Janna Bolegenobva, project manager at the Project Management Office of the Kazakh-British Technical University, talked about the sustainable development goals, and how risk management is an integrated approach that covers a large area of fields in economy as well as science such as industry and business where they also have a network of partners. The main topical area is environment, social and governance (ESG), and they develop products using artificial intelligence, such as social media apps informing also on natural disaster topics such as fires or safety. The university itself has sustainable energy including solar, wind and geothermal, and promotes gender balance through its program.

The presentation by Dr. Asan Aidarkhanov, Branch Director of the National Nuclear Center, was online talking about how climate change interacts with radiation risk. One example is polluted test sites of nuclear tests. Another interesting example are so-called ice quakes, or cryoseism, which is a seismic event caused by sudden glacial movements or ice contraction due to temperature changes. The melting of glaciers can be measured by seismic data and infrasound data. Another area is CO_2 soil emissions, and measuring isotope stability in lakes.

Dr. Natalya Mikhailova, Director of the Data Center of the National Nuclear Center, presented nuclear tests and seismology. Permanent control of nuclear treaties is an important issue. Especially interesting are the so-called aseismic territories of Kazakhstan where modeling evidence is missing, and therefore maps look empty like there would be no earthquake hazards. However, historic earthquakes prove that earthquake risk also exists outside of fault lines. Earthquakes can also occur near nuclear sites, or where there are solid mineral deposits. The research has led to a new seismic zoning map in 2023 that included the seismic events in areas not previously identified to be at risk in the 1998 and 2006 maps. Mining explosions are one reason for man-made seismic events. In the interrelation of climate change with glaciers and earthquakes, cryoseismology emerges as a topic. Glaciers can induce earthquakes by icebreaking and other phenomena, so-called ice quakes, with 20 years of data to justify this research.

Yerlan Saltykov, Ex-director of the science research institute «Almatygenplan», was presenting how startups can contribute to concepts of smart cities and therefore to urban development master plans. The referenced platform brings together architects, community, scientific and international organizations to raise funds. They are using artificial intelligence and are fostering international cooperation.

Sania Beisenbayeva, Head of the Monitoring and Warning Duty Service Department at the Kazakhstan Agency for Protection against Mudflows (Kazselezaschita) presented on mud flows and glacial lake outbursts. The interaction of hazard-triggering factors such as meltdowns destroying moraines leading to glacier lake outbursts or flows was presented. Mudflows are a general threat in the country. As stated, 2-10 million cubic meters of debris flow can travel up to 70 km / hour. There are several methods to control the discharge of lakes, such as blasting, bulldozers or drainage pipelines. It is shown that this is much more cost-effective as compared to measures provided to stop the debris flow after it has left the lake. Methods and experiments state back to the 1960s. Their works includes the forecasting of areas impacted by debris flows.

The last presentation from Aisulu Tursunova, Head of the Water Resources Laboratory and Elmira Talipova, Senior Researcher at the Institute of Geography and Water Security was on floods. From 26 March until 14 April 2024, flooding occurred in western Kazakhstan. They have been mapping water levels using satellite imagery, and local water level measurements. They conduct image processing before and after the floods using aerial

imagery and satellite imagery. They have created a task force to coordinate the efforts in flood mitigation. Charts of occurrences have been compiled also for decision-makers. Their recommendations were immediately implemented such as discharge in velocity solutions. They work together with German colleagues in Potsdam from the PIK. They are also very active in public media such as in television interviews.

Figure 20: Workshop venue at the Al-Farabi University Library (Photo: Siefker)

In the afternoon session of the knowledge transfer workshop, the INCREASE project was presented. First by Verena Flörchinger (DRU) Berlin, showing the integrated disaster risk management approach of INCREASE. Interests and questions after the presentation were raised on which practices are used in Germany regarding earthquakes and which type of long-term strategies are in place. The German partners showed that information systems exist as well as building codes, but that there is a general lack of awareness and information in Germany since there are hardly any significant earthquake events and experience with it. Trevor Girard´s (KIT) presentation provided more detailed insights into earthquake research.

After a presentation of INCREASE products by Prof. Dr. Alexander Fekete (THK) such as toolboxes, information systems, and social media applications, questions came from partners on which data types are used and how data is stored in the information systems. The German partners use a mix of open-source data as well as generating data in the project by empirical research such as interviews or by generating secondary data from statistics and geoinformation. The project is generally thought to be applicable worldwide, so it is independent of disclosure or problems of access from official sources. Another question from the audience was whether the German delegation could inform them about how earthquake-resistant buildings in Almaty are. The German delegation expressed that it has little experience with Kazakhstan yet, but indicated certain building and construction types that would be interesting for further research. For example, analyzing the different risks for the type of semi-detached housing, which has seen a lot of attachments and built-up of adjacent buildings in past decades. Comparing this with the residential blocks from the Soviet era, the Chrushkowka, and then also considering the building boom of high rises after the 1990s, especially in the northern areas where building codes would need to be checked.

The presentation of the German Federal Agency for Technical Relief (THW) held by Luisa Knoche and Nils Krippner on Standard Operating Procedures, provoked interest in education and questions whether there would be an interest in new master programs on disaster reduction, summer schools or similar. Additionally, the development of SOP could be a useful tool within a research cooperation to elaborate DRM capacities and define areas for knowledge exchange and future cooperation, i.e. in the field of Capacity Development.

The final presentation was by Dr. Benni Thiebes (DKKV) on the lessons to learn of the German floods in 2021. As the final part of the workshop, future funding options from a recent call from the BMBF and also topics of interest for future corporations were shared.

The vice president of NAS, Abay Serikkanov, who joined the delegation the whole day underlined in his wrap-up and concluding remarks that this was a highly successful workshop and that there is great interest to engage in acquiring future funding and continuing German-Kazakh cooperation.

And especially the coffee breaks, lunch, the evening dinner and time for transfer in-between on the bus enabled exchange for concrete cooperation ideas.

Some future research ideas identified and inspired throughout the presentations include:

Translating knowledge about hazard and risk types from Kazakh examples to German audiences and vice versa, for example:

- GLOFs, and cascading effects of mudflows and floods
- Ice quakes, cryo-seismology, salt dome quakes
- Man-made earthquakes
- “Aseismic” areas
- Nuclear test site pollution

Joint experiences

- Integrating social vulnerability into risk mapping, especially for thermal island in cities, and identifying adaptation measures
- Using remote and near sensing for wildfires, thermal identification of persons, search and rescue
- Integrated approaches exist such as integrated water resources management (IWRM), or integrated flood risk management (IFRM), but what about other hazard types and how to bridge this into IDRM; what are the differences that would get lost when integrating?

5.2 Medeo dam and city excursion Almaty

The day trip to the Medeo dam was led by Mrs. Botagoz Shakerbayeva from the National Academy of Sciences. It led from the city center of Almaty into the valley up to the ice-skating stadium Medeu and dam. On the way different building types in the south eastern part of the city could be observed. These included mainly residential buildings often of younger age and higher price ranges. Especially noteworthy are over ground gas pipelines running along the street close to the lanes or through the city and up to the valley. In a car accident or earthquake these could easily be disrupted.

From the ice stadium, the group walked up the stairs to the dam. A scientist, Mrs. Zhanar Raimbekova guided us to a local station of the Agency for Protection Against Mudflows and introduced us to an engineer who works shifts there to monitor the dam, weather stations and who is in charge to issue warnings in case of a

glacial lake outburst or mud flow. He reported that the last mudflows by heavy rains occurred two years ago but did not even reach the dam, on which the weather station now sits.

Figure 21: Weather station on Medeo dam, equipment (Photo: Fekete)

The last glacial lake outburst was 30 years ago. A flow barrier was constructed in the 1950s that the group also had passed on the bus. The dam was built in different periods since the 1960s and the station of the engineer was established in 1973 when the dam was extended in height. The dam is quite deep and wide and has been almost completely filled by a glacial lake outburst 30 years ago. However, there is an estimated capacity of sediment from glacial lake outbursts that would be 1000 times the water volume of the dam. In case of an event of a mudflow or glacial lake outburst, this should be reported by two people who are walking and taking a car to monitor the conditions. By radio, they would warn the engineer in the station who then would radio the warning to the civil protection unit in the city. The engineer estimated that it would take 30 minutes to get the warning to the people in the valley. Because the valley is highly populated with tourists going to the ice-skating stadium and to go hiking, there are police stations nearby and they would also be informed and could help to warn the people.

The station as well as other houses are supplied by yellow pipes for natural gas and gray pipes that carry water. The engineer works at the station for 12 years and has never experienced an interruption of supply.

One of his tasks is to record daily temperatures of air and water, and he has not experienced an increase in temperatures. He is doing 24-hour shifts and they are also sensors installed upstream. At the station there is no emergency food or equipment when they would be cut off as well as at the other stations, they also don't have power generators. Every year there's an emergency drill that also includes a competition.

Overall, the German delegation was impressed by this protection measure of a large dam that is still maintained and staffed with workers, although it was not necessary to use it for 30 years.

Figure 22: Medeo dam and rockfall protection (Photo: Fekete)

All around the area traces of landslides could be seen as well as rockfalls and warning signs of mud floors and avalanches. The engineer also had several maps showing typical avalanche lanes in the valleys around.

In the afternoon, the central eastern part of the city was visited by walking through the neighborhoods. Along the major north south alleys, especially in the northern part modern high-rises from the 2000s are established.

Figure 23: Business centers, hotels and modern apartment blocks on Dostyk Ave. near Armyanskaya (Photo: Fekete)

Hotel or business centers are located in those buildings and right behind it in the second line are old one to two story houses with large trees and garden areas. Although those houses are in the direct vicinity of the city center, and in the southern and higher part of the city with better air quality and in direct neighborhoods of expensive looking hotels, and business centers, those neighborhoods of the single houses are less maintained and cheaper building material is used. The houses display a variety of architectural styles and designs. Some houses have exterior walls clad in corrugated metal designed to look like bricks, while others have gates that

feature a stone or wood texture. Some very individual measures of crossbeam welding could be observed in one building that could be helpful in an earthquake.

Figure 24: Individual housing right behind Dostyk Ave, individual construction (Photo: Fekete)

But in nearby streets underneath the cable car to Kök Tebe, many individual and maybe private building activities could be observed and housing structures that looked less reliable in an earthquake. The river running south to north through the city has gabions protecting the embankments. The trained river bed is a rather narrow concrete channel. A cascade running quickly through the city with only about 1 m heights of canal walls that can easily be overflown.

Figure 25: Trained river and residential area beneath Kök Tebe Cable Car way (Photos: Fekete/ Flörchinger)

Figure 26: Individual construction, electricity tower (Photo: Fekete/ Flörchinger)

Walking down the main avenues further down south and a little bit more in the center of the city, Soviet house residential apartment blocks could be seen. They are either the five story older type with not all walls having windows or the younger nine story types which quite often have individual extension of living space around the balconies. Those buildings often look rundown from the outside.

Figure 27: Earthquake-resistant hotel from around 1979 and Soviet style 5-storey apartment block (Photo: Fekete)

In the downtown area east of Nayarbayev Avenue, there are residential neighborhoods inhabited by former officials and the upper class. Until the year 2000, certain streets were restricted for cars, and even today, due to urban structure, they remain traffic-calmed. Median strips with firs and pines, occasionally featuring water fountains, provide pedestrians and residents with a tranquil and cool atmosphere during the summer.

Figure 28: 5-storey (Chrushkowka) and 9-storey apartment blocks (Breshnewka) (Photo: Fekete)

More information about building structure, and relations to segments of society were provided by Mrs. Alina Beissenova, who had already joined the workshop. She informed that houses were not permitted to be built along the river until the 2000s, also since those rivers often run along earthquake lines. There were tiny houses before. The plots were given to people in the Stalin era who were sent there from Russia and often expelled there. This process of resettlement is referred to as 'kompot', which means 'mixed' oder 'diverse'. In the area of Almaty where resettlement occurred, old Russian houses from the time when entire villages were relocated can still be found today. During that period, artists and poets, deemed unreliable in Russia, were also sent there. As the city has evolved, they now live in the midst of urban development, in an area increasingly favored by the middle-upper class, offering better air quality close to the mountains. More to the south was a Russian

fortress and around it, lower economic income groups. Around the old train station there used to be more criminal activity. The people who are expelled from Russia and settle in the area tried to keep their properties and not sell it, despite the rich neighborhoods. In comparison to Soviet style that often did not have sewage or water they have that here.

For rural people, it is most common to move to the city and to find low-income jobs such as workers, taxi drivers. The Uber and Yandex app helped with taxi jobs. Unemployed people get less than $100 for a few months only. If they get low wage jobs such as street sweeper, they get $60 per month. It was reported that there is homelessness in the city. However, this was not apparent to us during our our field trip.
It is typical for those formerly rural people to buy multi general generational houses. In former times people from rural areas could not easily move to the city due to a permission needed to move to a city.
The first train station in the north saw people marginalized from former Russia to dwell there. There is also a former social housing where former municipal people get an apartment or orphans. In the 1970s, there was one Soviet shopping center, which led to a development of higher price living areas. A Turkish Walmart that was the first new shopping mall and became a very expensive living area.
Central heating is run by hot water pipes, which cannot be turned off. There are practices that if one person does not pay electricity then in the whole apartment block the electricity is cut off for everybody. Since the 2000s, with the rise in oil prices, it has been difficult for some people to settle bills. Another problem in the city center is that west east traffic is often hindered by roads ending at buildings. The north-south connections are more established.
In the 1980s and 1990s the pollution came from industry and was located in certain areas in the city, now it is more prevalent with more and more cars on the streets. Plants and people in the outskirts often burn coal, adding to the air pollution. A problem in the slope areas are water pipes that are leaking and can trigger landslides. This year a fatal landslide occurred killing several people. Ocean sediments are prevalent in the south east, adding to the landslide risk. Floods are a constant issue and the area around the airport often gets flooded. The current master plan is a general plan which did not pass the mayor's agreement yet.

5.3 Big Almaty River and Cosmo Station

On Sunday, 9.6.2024, the National Academy of Sciences led the German delegation on a day trip to the big Almaty Lake and to the Cosmo station. The trip started through the central parts of the city up to the south and inclining to higher elevation. In the southern part, large spacious university campuses, wide green areas such as the botanical garden, and high rises predominate.

Figure 29: High rises in the southern part of Almaty (Photo: Fekete)

Leading into the valley a large number of restaurants are located that can cater up to 500 people. This is an important cultural tradition in the south of Kazakhstan to invite relatives of a family for celebrations such as weddings, anniversaries or similar.

While in the southern part before the entry into the valley no overhead gas lines were to be seen, they appeared in the valley and led up to settlements. Many warning signs could be seen, especially on forest fires, also how forest fires endanger wildlife, avalanches and landslides.

Figure 30: Wild fire warning signs and weekend tourism (Photo: Fekete)

As in Medeo, a large mudflow barrier was passed.

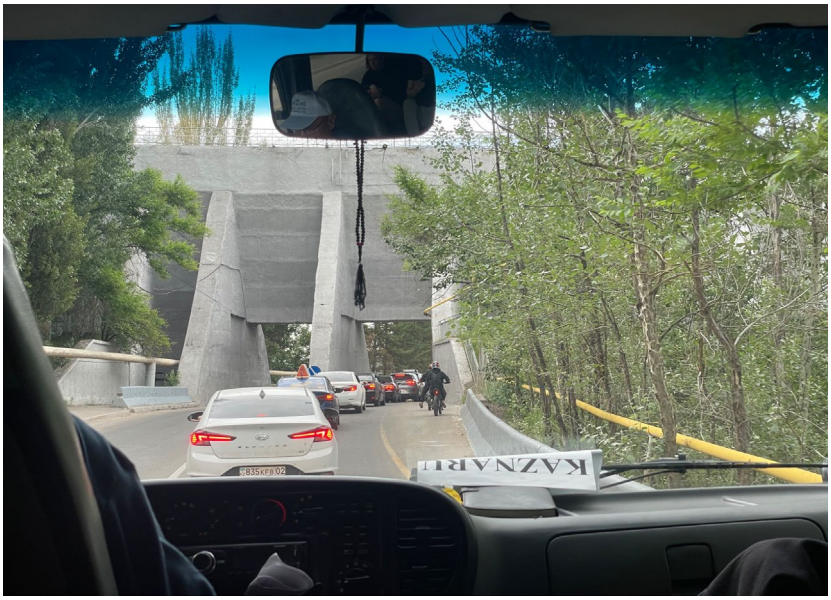

Figure 31: Mudflow barrier (Photo: Fekete)

Three military posts had to be passed and several special permissions were prepared by the National Academy of Sciences by Anar Mukhtarova so the group could enter a restricted area called Cosmo station, passing the Big Almaty lake, a dam.

Figure 32: Dam and Big Almaty Lake (Photo: Fekete)

The space station is on a territory already past the Kazakh border, where all passport details had to be recorded manually.

Figure 33: Kazakh border to Kyrgyzstan. Rock avalanche and mudflow traces (Photo: Fekete)

The group undertook a three hours hike starting from the border post at 2800 m elevation up to 3300 m of elevation, crossing a moraine and solifluction lobes.

Figure 34: Moraine valley with multiple overlays of mudflows and erosion. Avalanche paths (Photo: Fekete)

The group reached a small scientific settlement for scientists, existing since 1959. Several water tanks (holding 1000 m3), housing, facilities, and many buildings holding space telescopes, or measuring stations could be seen. Many of the houses were built on stilts so as to withstand permafrost thawing. However, at least one building could also be seen that was tilted as it had no stilts and other buildings had major cracks. The surrounding area is a high mountain area with many forms of mass movements from avalanches, glaciers, landslides, rockfalls, mudslides, and many more that are visibly active due to fresh traces. At the Cosmo station a scientist working there since 1968, showed the technical equipment and explained the details of measuring different types of energy particles. This serves astrophysics as well as the development of nuclear facilities and devices. They are studying unknown particles, galaxies, and the results are important to gauging radionuclide dating methods used in Geosciences for example, to determine the age of rocks or soil, thereby helping to understand dynamics of past and recent hazard processes as well.

The whole day trip was highly impressive, given the multitude of settlement patterns, natural hazards, and natural environments, passing through different height levels, and finally the astounding space station. Three people from the National Academy of Sciences international Office and another scientist, Zhanar Raimbekova,

and another professor of linguistics joined the German group on that day. It was an excellent occasion for time for individual talks and building up trust and joint experiences as well as knowledge exchange.

In the evening, some of the group were shown around the city center and some of the buildings such as Soviet era housing, more recent buildings, and aspects of urban planning and layout, community services, governmental building, a building protected against earthquakes and many more aspects by Alina Beissenova who had joined the workshop and the group yesterday already.

Figure 35: Privileged urban residential blocks in the city center of Almaty, house of former secretary of state, Kunaev (Photo: Fekete)

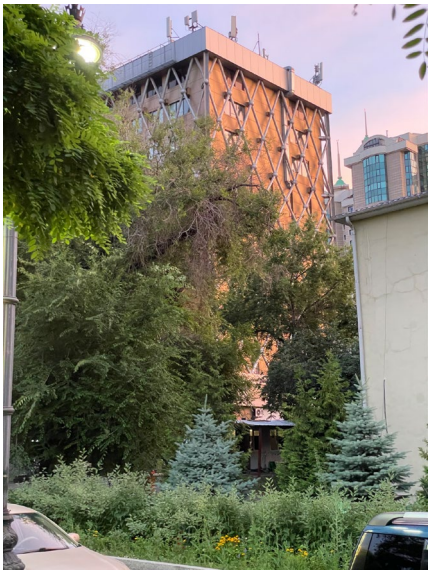

Figure 36: Earthquake-resistant building of the telecommunication company (Photo: Fekete)

5.4 Earthquake station

The day trip to Talgar was organized and led by the National Academy of Sciences. Mrs Anar Mukhtar guided the German delegation by bus to the east and outside of the city of Almaty, so that a transect into rural areas could again be achieved. Roads outside of the city were again populated by restaurants for larger celebrations, and later on villages were crossed. The village Besagash stems from 1953 and now becomes part of the city.

Single detached homes predominated and non-rectangular settlement layouts. Horses and traces of traditional yurt types seem to remain even within newly built houses.

Figure 37: Traditional Jurt next to a modern house (Photo: Fekete)

Entering the Talgar valley again, a large dam for flood and mudflow protection was crossed. Landslides from three years ago and many other landslides could be seen.

Figure 38: Talgar dam lake and landslide on the road (Photo: Fekete)

At the seismic station first, the traces of a flood from 2014 were visited. One house used for accommodation of the seismic scientist staff was flooded by 2.5 m in the June 2014 flood and abandoned thereafter. The same happened to a garage where a car was also affected. At the same level, a new earthquake warning station was built in 2023.

Figure 39: Accommodation house of seismic station flooded in 2014 and new seismic warning station from 2023 (Photo: Fekete)

This station is part of the early warning system for the city of Almaty. It measures differences between P waves and S waves and this allows for a lead time for early warning for Almaty for about 20 seconds. The system is connected automatically to switch off underground trains, electricity stations, or nuclear plants. It is part of a project that started in 2018 and ends this year. Since its implementation in 2023 no major earthquake has happened. However, there are continuous smaller earthquakes in the area every day or every week. They have currently 28 stations installed but would need 60. Also, sirens are automatically sounding.

In addition, the seismic station which again is a restricted area and needed a special permission, houses several other measurement instruments. They are partly installed in a tunnel specifically created in Soviet time in 1979.

Figure 40: Seismic measurement instruments in a tunnel to avoid outdoor noise (Photo: Fekete)

The instruments are sensitive and built inside the tunnel to avoid outdoor influences such as noise. Japanese and Chinese colleagues are interested in these tunnels as well. There are four such tunnels in Kazakhstan, another one is in Medeu (Medeo) valley. The data generated is analyzed on-site by scientists staying there on 15-day shifts. They are sitting in another house from 1980 that also got flooded to the ground floor. However, the computer equipment is stored on the first floor and was therefore not damaged in the 2014 flood event. The seismic measurements help to measure earth crust movement, which is about 0.5 to 0.6 mm per year. The seismic instruments can also be used to monitor the moon's distance from the Earth.

Figure 41: Monitoring of seismic activity (Photo: Fekete)

Asked about why the warning station is built into the floodplain, they didn't know. While they seem to be prepared very well for earthquakes, the German delegation was wondering why they would build a novel warning station into the floodplain. There are also no extra flood marks on the buildings to remember the height of the floods in 2014. The operator on site would also be able to communicate to the emergency services in Almaty to issue a warning or inform about earthquakes. The Talgar fault line runs through the valley. The children in school in Almaty receive training on what are protective walls and where they have to stand in case of an earthquake.

5.5 Reflection round

The feedback of the German participants about the field trip was very positive. It was a great opportunity to experience science policy cooperation from the beginning. The workshops at the institutions were very positive and successful since there was visible interest in contacts, receiving the slides and information, the preparation of the participants and attendance of different types of stakeholders.

Recommendations for improvement were to have more time for reflections and free time in between to digest information and explore the area and society individually, allowing participants to delve deeper into their own interests. The meeting in Astana also developed quite spontaneously and not all German participants could play a role. However, this was given the circumstances and overall was received as a very positive meeting since the objectives were achieved and there was also visible interest from the Kazakh side. Another request was to have a follow-up meeting between the German participants. While overall this trip is to be positively evaluated, it is worth discussing alternatives to several highly CO_2-emitting flights for future travel. This is particularly relevant since scientists, like the participants, research climate change, adaptation, and resilience and should serve as role models.

Reflecting on the cooperation opportunities the participants mentioned that both hosting institutions seem to be rather natural science or technology-driven. Institutions addressing societal perspectives were primarily

represented in the form of NGOs, but they were significantly underrepresented, and there was a lack of representation from social or cultural research institutions, probably since the topic of natural hazards is rather natural science in those countries.
Translation is a challenge and, in such contexts, where English is not a common language professional translators need to be taken into consideration for the future.

Apart from the direct feedback round, the following additional insights can be shared about organizational matters. The international office structures were very helpful indeed since they helped to very well organize all the meetings, and they speak English. Language is a major barrier for cooperation since few Germans speak Russian or the local languages. Only a few of the locals speak English, especially since most scientists are trained only in Russian. Regarding the flights and transfer, first of all, the travel route by plane was avoiding the war zone over Ukraine. A major problem was getting connection flights in Istanbul or Ankara which caused a delay of an additional one day for four people of the group and causing delays for most of the others as well.

5.6. Input from the embassy

In Almaty, Wolfgang Faust provided valuable insights. In Bishkek, Mr. Constantin Zelenty provided insights into culture, society and living conditions in Kyrgyzstan, which can be read in the respective section above.
Mr. Faust works for the embassy, had already attended the workshop, and joined the German group at the last dinner. He reported about the last earthquake in January 24 that people went out of their homes in panic and did not use collection points, but went to the car and tried to get out of the city which created traffic jams. After the earthquake new sign posts for emergency points, siren exercises, and emergency plans are established. There are continuous siren announcements now to practice and evacuation, but they are not understandable for foreigners like him. The epicenter of the earthquake was in China with a 7.5 magnitude and it occurred in Almaty with a 5.5 magnitude. The first earthquake happened in the middle of the night at 0:03 and the second during daytime. There were no damages, but the people were scared.
He also observed a mobile phone dependency of people relying on map and navigation services for example. In case of an emergency people might observe messaging on the phone and be dependent on it.
He also offered interesting insights into the culture of communication, which is important for products created in the INCREASE project. For example, people do not trust official websites too much. This could be important when developing a social media app or website application for an emergency authority. Another point is that the planning mentality is not the same as Germany. For example, the agenda and participants for the workshops were prepared two weeks before and this seems to be a typical planning phase other than in Germany, where things are often planned months beforehand. In official cooperations, paperwork with many signatures and stamps are highly recognized as well as personal contacts.
Smog occurs regularly between November to April and during daytime moves on into the mountains. In comparison to Germany, the motivation for saving energy and adaptation is missing since energy such as gas, electricity or water is much cheaper. They are used to supply interruptions and as an example in summer time regularly four weeks of hot water hot water is failing. A landslide had cut off the main water supply in the south of the city for over two weeks. But people have been used to supply interruptions since Soviet times.

He also stated that already 40 or 80 km outside of the city, the living conditions are significantly different than in the few big cities in Kazakhstan. Kazakhstan is a vast territory with only a handful of major cities, and is sparsely populated in-between. People in rural areas are living in conditions we would regard as extreme poverty in Germany. As an example, they do not have water, or electricity supply, and have to live from rainwater collection.

5.7 Transformational challenges for urban development in Almaty and Bishkek

The experiences of the field trip and a comparative perspective of the urban development of German cities allows an assessment of the transformational challenges in urban development in Almaty and Bishkek.

Both cities are facing major transformational and, above all, growth-related challenges, each with different starting conditions. Even after almost 35 years, the legacy of Soviet urban planning continues to play a dominant role in the urban structures of both cities. This legacy on the one hand and the market-driven development of the post-Soviet phase with a departure from the previously existing planning guidelines, has led to different developments in the two cities.

Comparable in both cities are the longer-term tasks in dealing with climate protection requirements (decarbonization and energy efficiency, particularly in the housing and mobility sectors), the shorter-term tasks of climate adaptation (growing risks from heavy rainfall and heat), the acute tasks of health development (including air pollutants) and the acute resilience requirements (including prevention against risks and disasters, particularly at the foot of the Tien Shan with high seismic risks, flooding, mudslides and debris avalanches etc.).

5.7.1 The view on Almaty

As a result of the post-Soviet wave of migration from Kazakhstan to other countries, Almaty also went through a phase of declining population growth and demand for housing. In particular, migration to Russia led to a sharp decline in the population across the country. In addition to the privatization of housing, this resulted in vacant flats in the central residential areas of the city. One consequence of this weakness in demand and purchasing power was that there was little or no investment in existing buildings during this phase. New residential construction also remained low during this phase as, despite the new market organization, there were only limited investment prospects due to the foreseeable weak growth in demand at the time.

With the development of the raw material fields after the turn of the millennium and the oil exports, there was a strong economic boom in the 2000s of this century. This also generated an enormous growth in urban development in terms of inhabitants and an investment boom in property, which is still continuing. The growth of the service sector has forced the construction of highly prestigious office buildings, initially adjacent to the city center. In addition, residential investments of various types have been made in many parts of the urban area. Almaty has grown both in the south into the previously unsettled or weekend home areas at the foot of the Tien Shan. And Almaty has grown extensively into the northern lowlands. As a result, the risks and burdens in new settlement areas have also increased and enforced the challenges for the city.

Despite the boom phase, the city is still characterized by many residential buildings from the various eras of Soviet housing construction with apparently a low level of modernization. In view of the medium and long-

term global urban transformation tasks of climate protection and climate adaptation as well as the resulting energy-related tasks, these specific housing stocks in Almaty face major challenges.

The Soviet legacy with a district heating system in the central city areas (which has been reported to be comparatively inefficient from today's perspective) offers great potential, at least with regard to future energy sources. This involves future state decisions to switch the energy supply from coal power to new energy sources (possibly natural gas as a bridging technology). These decisions are to be taken centrally and are therefore probably outside the investment processes to be organized at the city and individual building levels.

In the numerous suburban settlement areas, both the dense multi-story residential buildings and the more recent detached houses built to a simple standard (possibly also using provisional techniques), there are major transformation tasks in terms of building energy and building safety. Modernization requirements with regard to energy standards (cold winters and potential savings), earthquake safety (high seismic risks), flood protection (exposure) and the fundamental need for modernization are key challenges. The ownership structure is predominantly small-scale, i.e. individual private owners, either as owner-occupiers or small-scale landlords. This involves the difficult balance of initiating investments on the one hand and avoiding financial overburdening of low-income households on the other.

This will probably not be achievable through regulatory requirements alone but will require further mechanisms and dosed incentives in relation to technical organizational issues (cost-saving solutions, personal contributions) and financial incentives. Based on experience in Germany, area-based approaches are suitable for realizing such comparatively complex mechanisms. In addition, understanding the transformation tasks in an integrated neighborhood context also offers starting points for organizing preventive measures and response options in crisis situations. The transformational task of urban development can be concretized and operationalized in specific area-based approaches.

Almaty developed a master plan with visions for dealing with the future challenges of urban development over the next two decades. The master plan also addresses the nationwide goals of decarbonization. The master plan offers therefore a good opportunity to follow up on the outlined issues in the future and to take a specific, supplementary look at in-depth implementation issues.

5.7.2 The view on Bishkek

One of the fundamental differences between Bishkek and Almaty is the level of purchasing power, which is reflected in GDP per capita, for example. The economic output per inhabitant in Kazakhstan is at least five to ten times higher than in Kyrgyzstan. In addition, the population of Kyrgyzstan is only around a third of that of Kazakhstan. This fundamental starting situation has to be reflected in the framework conditions for urban development.

In the first post-Soviet phase, Bishkek experienced a decline in population and a significantly weakened demand for housing, which changed again in the following years to a population growth that continues to this day and thus also growth in housing and settlement areas. The purchasing power for this growth comes partly from the foreign income of temporary labor migrants from Bishkek, who also use it to finance their own properties.

In Bishkek, there was not an export surplus-driven development boom comparable to Almaty, meaning that the investment pressure remained significantly lower. The Soviet urban and building structure characterizes

the cityscape of Bishkek even more than in Almaty. Bishkek, like Almaty, benefits from the green structure of the main magistrals and complementary urban green areas as well as the open irrigation ditches (in concrete) in a south-north orientation following the gradient. On the one hand, the legacy of the building stock from the various phases of Soviet urban planning requires an over the time increasing investments. On the other hand, the urban growth in the following years has mainly taken place in two areas. Within the areas close to the city center or along transport axes (on brownfield sites or through the demolition of small former buildings) new multi-storey housing has been built, often in a simple standard. Local reports that the projects financed by individual owners and realized by project developers are financed to a large extent by the foreign income of household members.

In the second place, Bishkek is growing in the peripheral areas, both in higher locations in the direction of the Tien Shan (higher-quality locations due to the avoidance of smog pollution) and in the surrounding plains. This growth is predominantly in single-family house construction, often to a very simple standard and frequently with a lot of work done by the households themselves. The residential areas with small gardens or inner courtyards are usually fenced off with simple high fences and the neighborhoods evidently have low-quality public spaces. Due to the expansion of the settlement areas, the city of Bishkek is incorporating the neighborhoods.

One of the transformational challenges in Bishkek, probably even more acute than in Almaty, is the reduction of air pollution caused by fine dust. Particularly in the winter months, the amount of smog causes a considerable burden on the inhabitants, especially as the winter population of Bishkek is estimated to increase by several hundred thousand compared to the summer months. Family members who spend the summer in rural areas come to the city to join their families and relatives. A major factor is the energy used to heat homes in the simple detached houses, which mainly burn coal or wood for cost reasons. Even if there are gas pipes in the access roads, the connection costs and the investment in the gas boiler are often an economic obstacle for the households. As a medium-term bridging technology, the expansion of gas utilization (including higher CO_2 efficiency compared to coal and wood) would be an important transformational building block, which can also be expected to achieve greater local acceptance due to its direct impact on smog.

In summary, the challenges in Bishkek are, on the one hand, the modernization of the older Soviet housing stock with long-term solutions for energy transformation (decarbonization) and the question of how such processes can be organized in large communities of owners. On the other hand, there are considerable challenges in the simple single-family housing stock with an acute need for action with regard to air pollutants in the conversion from coal and wood firing to gas or possibly alternative energy sources. Here, the main focus is on incentives that enable households to find solutions in view of their low purchasing power, such as microcredits, interest relief, professional qualification/instruction for self-help or neighborly organization of self-help.

At the same time, both types are also concerned with the transformation to resilient neighborhoods and to combine earthquake safety, flood protection and heat resilience with organizational preventive neighborhood management in the face of crises. Area-based approaches should also be discussed in Bishkek as a concrete level of action and implementation. As no master plan process comparable to Almaty is known in Bishkek, the

questions and topics outlined here could be discussed as a building block for a possible future urban development process.

6. Summary and Conclusion

The goals of the field trip have been achieved. Natural hazard types that are similar to Germany could be seen on-site such as flood hazards, landslides, or heat in cities. Other natural hazard types that Germany is not familiar with such as earthquakes, glacial lake outbursts, man-made earthquakes, and more are important to learn about, and Central Asian countries offer a long range of expertise in interdisciplinary fields and are very open to share knowledge. Nevertheless, it seems that the field of disaster research is predominantly represented by natural and technical sciences. To what extent there are institutes that research hazards and disasters from a social science perspective could not be sufficiently identified during the field-trip. The second goal of the field trip to identify stakeholders for current and future cooperation has also been achieved. Based on pre-existing contacts made available through the DLR PT and through long-term funding lines of BMBF investing in centers such as CAIAG or CASIB in Kyrgyzstan or Kazakhstan and the long range of joint University activities at German and Kazakh universities further enabled to successfully interacting with a wide range of disciplines. But also through contacts of the German embassy and through the role of a national authority such as THW and by invitation to events, such as the German Kazakh Science Days in October 2023, and an invitation after the floods in Kazakhstan, by the Kazakh Embassy in Berlin, contacts could be established at the official lines to be invited to ministries. In both countries, not only scientists but also representatives from ministries with direct connection to disaster interacted on risk and emergency management topics and offered not only their expertise but also interest in future cooperation. Other types of stakeholders such as NGOs were also present and could provide important additional information about society, institutional and cultural settings. But especially being on-site in the countries again proved to be irreplaceable by online meetings. The formal workshops helped very much to establish knowledge exchange and to set the scene to get to know and contact each other as well as to demonstrate the existing stock of expertise. But especially the informal meetings and time to stay in the country for a longer period, enabled the participants to start gathering contacts and gaining trust for further cooperation.

Specific general topics of interest for the partners in both Kyrgyzstan and Kazakhstan were:

- Governance
- Multi-hazard and risk assessment
- Resilience
- Tools
- Warning

Mutual benefits for all were:

a) Local scientific institutions had an occasion for (interdisciplinary) interaction, e.g., to access people at the national research center directly for questions about data or cooperation.

b) Transdisciplinary interaction was also facilitated by the workshops, so that academics could interact with public administration and authorities, but also NGOs.

c) international exchange was fostered through the knowledge exchange through the workshops and day trips.

The third goal of the future has also been achieved, in that the products of the project INCREASE could be demonstrated and feedback could be collected. The products shown such as the integrated IDRM framework approach, the overall idea of integrating multiple hazards and dimensions of potential losses and damages was very well received and mutual interests were identified in both countries. The tools from INCREASE that were shown, such as information systems that enable better integration of different scientific methods and approaches, but at the same time provides the information in understandable formats and visualization also to decision-makers, was a very shared experience and enabled to directly match different scientific fields, but also enabled for scientists to directly find a language on which topics to work together. It was also a shared experience that it is increasingly important to integrate people into risk communication and especially the difficulties of how to inform people before and during a disaster. Also, generating awareness about risks is something that needs a broad approach of communication lines. Social media apps are increasingly gaining importance, especially among the younger population groups, but also other forms of communication were exchanged. Understanding culture and how people think, and act is key in understanding disaster risk as well as daily livelihoods.

This is important not only to better integrate people into a holistic disaster risk management approach but also to better match understanding between organizations and all types of stakeholders. This is important to generate an intercultural exchange between international partners, well in advance of a future disaster so that in a disaster situation, the cooperation and mutual understanding of procedures, structures and also cultural challenges is already known. Since in a disaster such as an earthquake or major floods, it is key that coordination and management are working and do not fail in the eyes of the public to save lives and avoid major economic damages.

It was highly important to learn about cultural as well as institutional aspects, in addition to scientific methods and tools. Therefore, also the last goal of the field trip was achieved when the German partners in a multidisciplinary and multi-risk complex project finally got to work together on sites on the ground and in an unfamiliar international setting. Being in a different international environment helps very much to better identify what needs to be observed when trying to transfer products developed. It also helped to generate mutual understanding of different methodological scientific approaches between the German partners. At the same time, international cooperation and learning could be conducted. And finally, concrete ideas, on how to advance the ideas and findings of the project INCREASE and to sustain it over the lifetime of the project funding could be collected and documented in this report. Overall, this shows that disaster risk topics are universal and are key not only to solving major humanitarian challenges such as lives at risk but also are an excellent topic for generating knowledge and scientific exchange on topics that are crossing not only national but also political and cultural borders. The visibility of expertise and stakeholders existing in Germany to contact for topics such as natural hazards, and disaster risk preparedness, but also in a concrete disaster situation has been improved through this field trip. Through the funding and scientific work, long term outcomes have been achieved such as institutional cooperation, scientific knowledge that is transferable and concrete tools that can be applied in different settings. Long-term impacts, such as cultural and institutional understanding have also been fostered through this field trip and project.

Annex

Workshop at CAIAG, Bishkek, June 4, 2024

Full name	***Organization/position***
Almabek Aidakeev	Ministry of Emergency Situations, Secretariat of the National Platform of the Kyrgyz Republic for Disaster Risk Reduction, Head of the Secretariat
Meder Dzhumabaev	Earthquake Resistant Construction Institute
Albina Abdyldaeva	Earthquake Resistant Construction Institute
Sergei Erokhin	Institute of Water Problems and Hydropower
Dmitry Perepelitsin	Institute of Water Problems and Hydropower
Volkov Roman	Institute of Water Problems and Hydropower
Atyrgul Dzhumabaeva	Institute of Seismology NAS KR
Valentina Grebennikova	Institute of Seismology NAS KR
Akzholtoy Mambetsadykova	Institute of Seismology NAS KR
Gulnura Mambetova	Institute of Seismology NAS KR
Ulugbek Begaliev	Rector of the International University of Innovative Technologies, President of the International Association of Earthquake Resistant Construction Experts
Elmira Sardarbekova	Kyrgyz Civil Engineering Institute named after N. Isanov, Department of Ecology and Protection in Emergency Situations
Gulmira Shabikova	Kyrgyz Civil Engineering Institute named after N. Isanov, Department of Ecology and Protection in Emergency Situations
Erkinbek Koichumanov	Camp Ala-Too
Murat Zhumashev	Director, Camp Ala-Too
Karabek Uzakbaev	CAIAG
Alexander Zubovich	CAIAG
Ryskul Usubaliev	CAIAG
Sheishenaly Usupaev	CAIAG
Ulan Abdybachaev	CAIAG
Sheishenaly Usupaev	CAIAG

Nazgul Alybaeva	CAIAG
Nazgul Usupbekova	CAIAG
Azamat Sharshebaev	CAIAG
Oleg Podrezov	CAIAG
Olga Kalashnikova	CAIAG
Azamat Osmonov	CAIAG

Workshop at the National Academy of Sciences, Almaty, 7.6.2024

Full name	**Organization, position**
Akhylbek Kurishbayev	Professor, Doctor, Chairman of the Board of the National Academy of Sciences of the Republic of Kazakhstan under the President of the Republic of Kazakhstan (NAS RK)
Abay Serikkanov	Candidate of physical and mathematical sciences, Vice-President, NAS RK
Kuantar Alikhanov	Director of the Interdisciplinary Center of Science NAS RK
Anar Mukhtarova	Head of the Department of Scientific and Technical Cooperation NAS RK
Altynai Kaliyeva	Chief Academic Officer of the Department of Scientific and Technical Cooperation NAS RK
Botagoz Shakerbaeva	Chief Academic Officer of the Department of Scientific and Technical Cooperation NAS RK
Bektemirov Alisher	Chief Academic Officer at the Center for Earth, Space and Communications Sciences NAS RK
Janna Bolegenova	Project manager. Project Management Office. Kazakh-British Technical University (KBTU)
Aigerim Mussabalinova	Senior Lecturer, School of Law KIMEP University, Consultant (expert) UNICEF in Kazakhstan
Prof. Dr. Wolrad Rommel	President of the Deutsch-Kasachische Universität (DKU)
Dr. Peter Liebelt	Head of the Central Asian Sustainable Innovation Bureau (CASIB)
Birzhan Serikbay	Engineer of the Emergency Management Department for the city of Almaty
Farabi Ermekov	Executive Director of the Scientific and Educational Technology Platform. Kazakh National Agrarian Research University (KazNARU)
Aiman Nysanbaeva	Candidate of Geographical Sciences, Head of Department, Senior Lecturer Faculty: Meteorology and Hydrology. Al-Farabi Kazakh National University (KazNU)
Dr. Asan Aidarkhanov	Director of the zoom branch, PhD, candidate of biological sciences, associate professor. National Nuclear Center. Radioecology
Dr. Natalya Mikhailova	Doctor of Physical and Mathematical Sciences , Director of the Center data from IGI NNC RK . National Nuclear Center. Seismology
Elizaveta Yesenzhigitova	Candidate of Geological and Mineralogical Sciences, Deputy Director. Institute of Seismology
Erlan Saltykov	Ex-director of science. Scientific Research LLP Scientific Institute "Almatygenplan"

Saniya Beisenbaeva	Head of the monitoring and warning duty service department. Kazakhstan agency for protection against mudflows (Kazselezaschita)
Tursunova Aisulu Alashevna	Candidate of Geographical Sciences, Head of the Water Resources Laboratory. Institute of Geography and Water Security
Talipova Elmira Kairatkyzy	Candidate of Medical Sciences, senior researcher. Institute of Geography and Water Security
Kuanysh Tastambek	Head of the institute. LLP "Research Institute of Ecological Problems" KazNU
Eldar Bolatbek	Engineer at the Environmental Engineering Laboratory of the Integrated Environmental Research Center. Research Institute "Institute of Nuclear Physics"
Aliya Uzbekova	Leading specialist of the department of civil defense and emergency situations. Research Institute "Institute of Nuclear Physics"
Evgeniy Klimov	Senior Researcher, Department of Rural Development and Organic Agriculture. LLP "Kazakh Research Institute of Agricultural Economics and Rural Development"
Mukhabat Sirazhitdinova	Junior specialist Institution "Institute of Hydrobiology and Ecology"
Asem Kashkereeva	Department of Emergency Situations of Almaty City
Duisebek Bakytbek	Head of the Department of Water Resources and Land Reclamation, Kazakh National Agrarian Research University
Gaukhar Mutasheva	Al-Farabi Kazakh National University (KazNU)
Bagdaulet Taranov	Al-Farabi Kazakh National University (KazNU)
Gulzhan Kusainova	Al-Farabi Kazakh National University (KazNU)
Mukhit Bekbauov	Al-Farabi Kazakh National University (KazNU)
Karima Myrzabek	Al-Farabi Kazakh National University (KazNU)
Mukambaev A.S.	Deputy Director of the Data Center, National Nuclear Center. Seismology
Abylay Uzbekov	PhD, SNS Data Center. National Nuclear Center. Seismology
Zhaina Otegen	PhD, LLP Research Institute "Almatygenplan"
Alina Beysenova	Dip. Arch (AA), RIBA Research Institute "Almatygenplan" LLP
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Makpal Zhunisova	Doctoral student, researcher Institute of Geography and Water Security
Ghani Babayev	Branch of the Committee for Industrial Safety in Almaty, Ministry of Emergency Situations of the Republic of Kazakhstan
Farit Wolfgang	GK ALMATY

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A. Otegen	Al-Farabi Kazakh National University (KazNU) – Chemistry Faculty
T. Esenkyzy	Al-Farabi Kazakh National University (KazNU) – Chemistry Faculty
Aynur Samen	Al-Farabi Kazakh National University (KazNU) – Chemistry Faculty
Alinura Bolat	Al-Farabi Kazakh National University (KazNU) – Chemistry Faculty
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Aruzhan Bakhytzhanova	Al-Farabi Kazakh National University (KazNU) – Chemistry Faculty
Araylym Rustam	Al-Farabi Kazakh National University (KazNU) – Chemistry Faculty
Zaure Allazova	Al-Farabi Kazakh National University (KazNU) – Chemistry Faculty
A. Kaldybaeva	Al-Farabi Kazakh National University (KazNU) – Chemistry Faculty
M. Zhunisova	Institute of Geography and Water Security
A.S. Aben	Kazakhstan Institute for Strategic Studies under the President of the Republic of Kazakhstan
Zh.T. Raiymbekova	Al-Farabi Kazakh National University (KazNU)