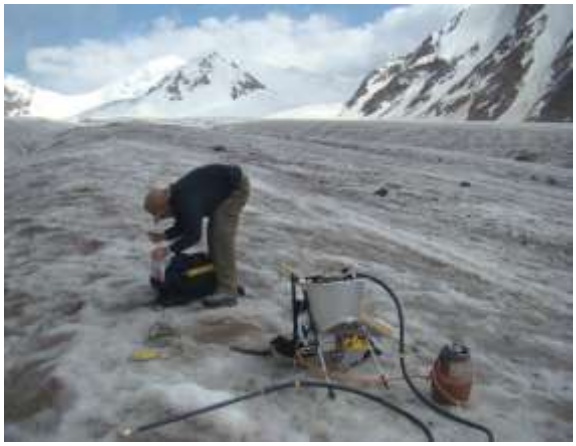
CENTRAL-ASIAN INSTITUTE FOR APPLIED GEOSCIENCES

Research & Development Programme

2014-2016



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Preface

In 2008 CAIAG has started the implementation of scientific projects in accordance with the main directions of the Institute when the scientific and technical capacity had been created. At the present, we give a careful consideration to the projects for the second research stage pursuant to the “Development strategy of CAIAG for the years 2012-2022" adopted in 2012.

It is supposed that this stage will accomplish those independent research activities that have been started in 2008. The 5-year studies (2008-2013) will be summarized, which are considered to be the basis for the future scientific activities and studies of the Institute.

Mr. Prof. Ch. Reigber is at the origins of the establishment of our Institute and development of scientific programmes. At the present stage of life of our Institute a significant contribution to the planning and running scientific studies and research activities is made by Mr. Dr. S. Parolai. Their sincere interest in the development of the Institute and a big personal engagement and contribution to the achievement of this goal encourage a deep appreciation. We express our sincere gratitude to Mr. Ch. Reigber and Mr. S. Parolai.

In the forthcoming session of the Scientific Advisory Board it is expected to discuss details of the the scientific programmes of CAIAG. We will be thankful to the members of the Advisory committee for useful criticism and will consider all the comments and proposals to improve the presented programme for the period 2014-2016. It will contribute to the final version of the programme to be submitted for approval by the Supervisory Board.

Contents

Introduction and Overview

Central Asia is the region that covers such countries as Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan and has a rugged topography and considered to be a perfect nature laboratory for studying intra-continental geo-processes. Being particular for its active water cycle, the region has a significant influence on the atmospheric heating processes, weather, climate and water cycle over the territory of Asia and at global scale. Active geodynamic processes connected with a continuous orogenesis induce a high seismicity in the region.

Such a high dynamics of the regional geologic and atmospheric regime resuls in a frequent occurrence of such natural disasters in Central Asia as earthquakes, floods, landslides, glacial lake outburst, mudflows, avalanches and droughts, which are partly connected both with the global change phenomena, and the anthropogenic and engineering activities as well. These natural and anthropogenic processes often result in human, economic losses, environmental problems, and have a strong negative impact on sustainable development and society welfare in Central Asia.

The assessment of risk related to any natural and anthropogenic changes that are possible to occur in Central Asia, and the development of adaptive measures are of strategic importance due to the impact of such processes on the population, interrelationship between different countries, and political stability of the region. Moreover, very often natural processes and disasters trigger cascade events. Therefore, a simple single-hazard risk assessment, not considering the interrelation between the hazards, is not sufficient to develop and provide realistic scenarios to end-users and stakeholders. That is why the concept of multirisk analysis encourages the realization of research programme and activities of the institute.

Research and Development Programme

Research and Development Programme of CAIAG for the period 2014-2016 (R&D PROG 14/16) is focused on four priority directions, which are important for Central Asian region:

1. Geodynamics and Georisks;
2. Climate, Water and Glaciers;
3. Monitoring systems and Data management;
4. Capacity building and Scientific cooperation.

The Institute has pointed out the tasks to be solved in a long-term perspective providing an advanced scientific monitoring infrastructure created in frames of international cooperation:

- Study of global and regional change processes and their effect on the environment;
- Monitoring and assessment of natural hazards, multi-risk assessment, disaster risk reduction including the development of early warning technologies;
- Applied multi-disciplinary research in the field of geodynamics and geohazards; water and land resources, including research of glaciers, rivers, reservoirs, underground water;
- Capacity building, training courses, education and public relations.

An important role of the research is played by a long-term work and scientific services provided to scientific and public communities.

- Operation and long-term maintenance of the network monitoring Earth's surface processes, which consist of seismic, geodesic, hydrometeorological stations all over the Central Asia, and the integration of these networks into global systems.
- Application of remote sensing techniques for research activities – acquisition of high-resolution space images, radar and interferometric data that extend the area covered by the monitoring of environment and geological processes.
- Creation and update of the geodata platform and information system based on the open access to needed data, maps and decision-making information.
- Consulting services for decion-makers and public communities.

The monitoring activities are focused on the extention and operation of the data collection system in a real—time mode with the purpose to establish a rapid response and early warning system for any type of disasters (earthquakes, landslides, hydro-meteorological disasters, or man-made disasters). An important step in these activities will be the preparation of proposals on disaster risk reduction measures and the development of preparedness measures together with the governmental authorities and organizations in Central Asia. This will involve the capacity building group from CAIAG.

For the first time the research programme the components "Study of limnological, potamological, hydrogeological, climate processes in the Issyk-Kul lake basin" and "Social economical analysis of the vulnerability of communities in areas prone to landslide activities".

The proposed projects will be carried out in next 3 years, which are initially aimed at the acquisition of basic observational data and the performance of scientific research activities on three key regions of Kyrgyzstan:

- The region of the Sary-Dshaz river basin including the Enylchek glacier, is one of the largest fresh water source and potential source for hydroenergetics in the area;

- The area of the Issyk-Kul and Chui depressions, where Bishkek city and resort-tourist zones are located, requires a particular approach in the development of measures for seismic risk and human-made impact reduction considering climate changes.
- The territory of mountain framing of the Ferghana basin and Inner Tien-Shan, which is one of the most populated zones in Central Asia and is prone to various risks of natural disasters (earthquakes, landslides, floods etc.)

All three areas are of critical importance for the estimation of probability of occurrence of natural and anthropogenic disasters, for the purpose of sustainable water supply in Kyrgyzstan and in adjacent regions in Uzbekistan, Kazakhstan and the Xinjiang province, development of large scale technical projects in the region, like hydroelectric power station cascades, high voltage power lines, water storage reservoirs and railway and road systems, and other projectspopulation.

The R&D Programme for the years 14/16 is supplemented by a range of the projects implemented under the initiative Global Change Observatory in Central Asia and “Earthquake Model in Central Asia” initiated by GEM.

Having a stable infrastructure and workforce resources created in the previous years, CAIAG tend to improve them and to relize the planned scientific programmes according to the Strategies of CAIAG adopted in 2012. Proposed programme is developed pursuant to the National Strategies of Sustainable Development of the Kyrgyz Republic 2013-2017 and to National Platform for disaster risk reduction.

THEME 1: GEODYNAMICS AND GEORISKS

Head of the development team: Sh.E.Usupaev

PROJECT 1.1. INTEGRATED GEOLOGICAL-GEOPHYSICAL RESEARCH OF THE SARY-DJAZ RIVER BASIN AS AN AREA FOR THE FUTURE CONSTRUCTION OF THE HYDROELECTRIC POWER PLANTS (CONTINUATION OF THE PROJECT)

Responsible executors: Usupaev Sh., Moldobekov B.D., Ormukov Ch.
Coexecutors: Kalmetieva Z.A., Zubovich A.V., Abdybachaev U., Orunbaev S., Mambetaliyev E., Konokov T., Serenkov A., Shakirov A.

1.1.1 Project short title

Integrated research of georisks and geodynamics of the Sary-Djaz river basin

1.1.2 Project summary

The Sary-Djaz river basin is located at the north-eastern part of Kyrgyzstan, at the highest place of the Tien Shan. The main tributaries are the Enilchek and Ak-Suu rivers. The main water resources of the Sary-Djaz river are concentrated in the largest Tien Shan glaciers called the Southern and Northern Enilchek (with a distance of over 60km and an average thickness of 200-300m), in the Ak-Shiyrak glacier and in one of the largest glacial lakes - Merzbacher lake.

High altitude location, rugged topography, isolation and remoteness, and severe climate as well resulted in the fact that the investigated area is not being exploited and populated developed, and there are no people who are permanently resident here. The transboundary Sary-Djaz river is not of much use in Kyrgyzstan and water resources mainly go to the western China (Xinjiang Uigur autonomous district) which uses 75% of its flow.

Construction of 4-5 hydro power stations with an expected capacity to be about 1,5 million kW/h and water reservoirs about 500 mill.cubes in the Sary-Djaz is expected and would be an impulse for economic development in Kyrgyzstan and Western China.

Moreover, the Sary-Djaz river basin represents an extensive basis for development of nonferrous and polymetallic metallurgy. Big deposits of tin, tungsten, copper, lead, molybdenum, polymetals, and tantalum represent a significant industrial value.

Due to exploration of mineral deposits, it is of necessity to assess natural risks related to the impact of environmental changes and climate change as well.

For sustainable industrial development of the this region it is necessary to continue the research, initiated by CAIAG in 2008-2009, and continued in 2010-2013 aimed at the study of neotectonical-geomorphological engineering geological and hydrological conditions, development of natural hazards and phenomena both over all the Sary-Djaz basin and in possible areas of expected location of hydropower station dams and reservoirs.

1.1.3 Project objectives and methods

Long-term objectives:

On the basis of integrated research of the area, scientifically justified recommendations will be made for using when planning and constructing hydro power stations and mining facilities.

The outputs of the research and monitoring network will make a basis of the database for implementing detailed geological, engineering-geological and hydrological studies aimed at construction of hydro power and mining facilities.

Short-term objectives:

Short-term aims include the study of geomorphological, engineering geological, hydrological conditions, in region, mapping of site-effects and georisks threatening to the future hydro-technical facilities and their infrastructure.

Methods:

- Geomorphological, engineering-geological and cryopedological methods (disaster location mapping);
- Complex geophysical research methods (engineering seismology, magnetic and electric exploration);
- Remote sensing methods (radar, multispectral and GNSS station positioning).

1.1.4 Current status and special requirements

The first stage of the research activities have been started in 2008-2009, that includes the describtion of geodynamics and seismicity of the region done on the basis of analysis of literature data and some field works; satellite images with active faults for updating the map of the newest tectonics.

At the second stage of the project (2010-2013) some geological and geophysical field surveys of large faults have been conducted; the measurements of the glacier thinckness in the area of Merzbacher Lake and hydroelectric measurements between upper and lower lakes have been conducted (NRS “GeoPribor” NAS KR). Experimental seismic noise measurements have been carried out on the glacier Southern Enilchek in the region of Mertzbacher Lake. Spatio-temporal distribution of earthquake epicentres and focal mechanisms has been analised. The analysis and interpretation of data on the Earth’s surface deformations being recorded by GNSS stations have been done.

1.1.5 Internal and external cooperation

The project will be implemented by CAIAG staff of the departments 1, 2, 3 together with GFZ. It is expected to keep a close cooperation with the Institute of Seismology of the National Academy of the Kyrgyz Republic, National Nuclear Center in Kazakhstan, and Xingjian – Uigur Institute of Ecology and Geography (China).

Coordination with Central Asian Global Change Observatory.

The proposed project has a close link with *Central Asian Global Change Observatory project*.

1.1.6 Work plan and required resources

Project duration: 2014-2016

2014

- Continuation of geomorphological, engineering-geological and geocryologic field and hydrological studies
- Investigation of natural hazards and phenomena
- Continuation of study of time series of GNSS stations' positioning to identify the changes of horizontal and vertical movements through basement structures;

2015

- Creation of active faults map on the topographic basis 1:10 000
- Investigation of geodynamic conditions in the future hydropower dam and reservoir location site;
- Investigation of the areas of hazardous slope process, erosion and georisk development;
- Additional geodetic, GPS and geophysical research in selected hydropower dam and reservoir sites

2016

- Creation of georisk maps (inclusive explaination notes and recommendations) in selected sites for future hydroulic facilities.

Required surveys/data and equipment:

- Optical and radar satellite images of the future hydropower dam and reservoir area and software to process these materials;
- Seismic noises and earthquake events measurements for the future creation of seismic microzonation maps for selected dam sites;

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PROJECT 1.2. SEISMOLOGIC RESEARCH

Responsible executors: Kalmetieva Z.A, Orunbaev S., Usupaev Sh., Ormukov Ch.
Coexecutors: Moldobekov B.D., Mambetaliyev E., Jusupova K., Serenkov A., Japarkulova A.

The project covers the main trends of surveys conducted by the CAIAG on applied scientific area - seismic microzonation. This trend was actualized in the first days of the CAIAG existence. The whole range of seismologic surveys in Bishkek and Karakol were completed. Instrumental studies of Dushanbe and Khorog were completed by the specilaists of the Dep.1 of CAIAG. The same works in Naryn town are in the process of completion.

The second trend was dedicated to detailed study of interrelation between seismic and landslide activity in the Tien Shan area. Preliminary data obtained on a potential principal impact of the stress field in the activation of landslides requires a more detail study of the stress field though seismological methods.

Since 2010 the CAIAG can work on compilation of the earthquake catalog (i.e. M≥4.5.) for whole Central Asia region.

The third trend is dedicated to process the data on earthquakes and develop the catalog of earthquakes of the Kyrgyzstan and Central Asia on the basis of CAREMON seismic monitoring network.

Subject to the foregoing, the **Project 1.2** consists of the following sections:

1.2. A. Seismic microzonation of the territories of major cities of Central Asia states (Bishkek, Karakol, Naryn in KR and Dushanbe, Khorog in RT).

1.2. B. Study of the earth crust stress field for Fergana depression and its mountain framing with the objective of investigating the relations between seismic and landslide processes.

1.2. C. Supplementation of the earthquake catalog (M≥4.5) for Central Asia territory

PROJECT 1.2. A: SEISMIC MICROZONATION IN THE TERRITORY OF MAJOR CITIES IN CENTRAL ASIAN STATES (BISHKEK, KARAKUL, NARYN IN KR AND DUSHANBE, KHOROG IN RT)

Responsible executors: Usupaev Sh., Orunbaev S.
Coexecutors: Moldobekov B.D., Mambetaliyev E., Serenkov A.

1.2.1 Project short title

Towards creating seismic micro-zonation map for the towns

1.2.2 Project summary

Central Asia is one of the most earthquake-prone regions. The evidence of that are the earthquakes with 9-10 intensity have occurred over the last 100-200 years, as Belovodskoe (1885), Vernenskoe (1887), Chilikskoe (1889), Keminskoe (1911), Ashgabadskoe (1948), Khaitskoe (1949), Suusamyrskoe (1992) which brought to many thousands of human losses and huge destructions. High level of seismic activity in the territory of big cities and settlements poses a continuous threat to safety of human life and affects social and economical development of the country.

Therefore, precise and detailed maps of seismic microzonation of the territories of major cities and industrial facitilies are of high economic and social importance, since they are generally used for a rational placement and distribution of industrial and urban buildings. Scientifically based quantitative data about the nature of strong earthquake ground shakings enable to take anti-seismic measures, which guarantee the stability of buildings and, constructions - that means contributing to seismic risk reduction and to public safety.

There are seismic microzonation maps of the major cities in CA states existing since the Soviet period, but they are already old. According to the new general plan of urban development these maps are considered to be out of date and need to be updated, since they do not meet modern normative requirements.

The first project aimed at updating the map for Bishkek using new methodologies have been initiated in 2008 by the group of seismologists from GFZ (Prof. Zshau and Prof. Parolai S.) under the project InWent (CASCADE) that laid the foundation for the future projects CAREMON and EMCA.

The field works were carried out together with the partners from GFZ, Institute of Seismology of Kyrgyzstan and Tajikistan in parallel with seismic measurements and obtained seismic noise records processing, as well as with a creation of seismic microzonation maps, which were completed in 2013 for the cities Karakol (Kyrgyzstan), Dushanbe and Khorog (Tajikistan), and from 2013 to 2014 these activities have being carried out in Naryn city (Kyrgyzstan), since 2014 in Almaty (Kazakhstan), where specialists of the Dep.1 “Geodynamics and Georisks” installed along with rented stations 5 own seismic stations of CAIAG.

Uniqueness of the project is that for the first time instrumental methods including the methods of seismic impedance and amplitude-frequency characteristic measurements have been introduced.

The final result of the works undertaken is creation of maps of seismic microzonation of major cities using new methodologies that are expected to be provided and shared with the State agency of architecture and construction and used for updating normative documents and building codes, for modeling destructive seismic events and designing seismic resistant constructions. These maps are also expected to be used by the Ministry for Emergency Situations to assess the risk and to create system for timely warning and response to emergencies.

I. Bishkek city

1.2.3 Project objectives and methods

Primary project aim – completion of seismic microzonation map for the city Bishkek.

Short-term objectives:

- Completion of seismic microzonation map and continuation of creation of the seismic vulnerability map and seismic risk map.

Long-term objectives:

- Creation of the early warning system for the city Bishkek under the project EMCA.

1.2.4 Current status and special requirements

According to the results of seismic noise measurements the horizontal to vertical spectral ratio have been estimated and the map of distribution of frequency (resonance) characteristics has been created. (Fig.1)

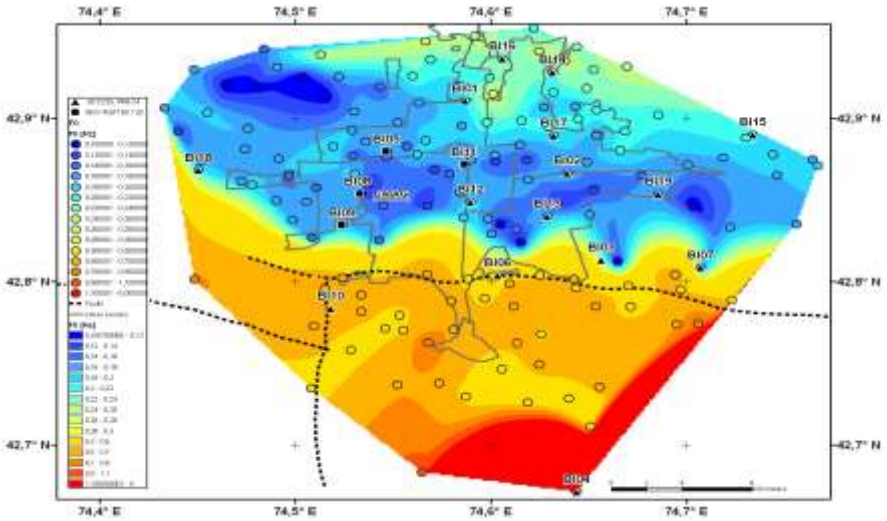

Fig.1. The scheme-map of frequency (resonance) charasterisitcs distribution, created on the basis of seismic noise measurements in the territory of Bishkek

Accroding to the results of spectral processing of all recorded earthquake data occurred at a distance of not more than 150 km from Bishkek the map of distribution of frequency characteristics have been created (Fig.2).

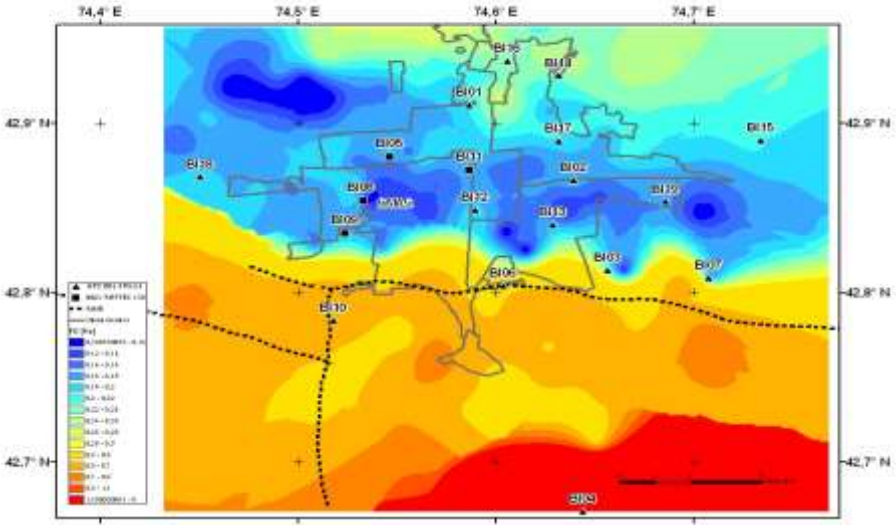

Fig.2 The scheme-map of frequency (resonance) charasterisitcs, estimated on the basis of earthquake events data recorded in the territory of Bishkek

The study of the Issyk-Ata active faults and its affected zone in the southern part of Bishkek has been conducted. The results of analysis obtained from instrumental data show that the width of the fault varies from from several tens to over 400 meters.

Obtained research results were reviewed by the Science-and-Technology Council of the Ministry of Emergency Situations and the Expert Council of the State Agency for Architecture and Construction in the Kyrgyz Republic. It was recommended to create a working group under the State agency to develop strategies and plan to introduce created maps into normative documents.

Under the project EMCA in cooperation with GFZ, activities to create accelometer network in Bishkek for monitoring and building vulnerability assessment have been started since 2012. These activities will be continued in 2014-1015.

1.2.5 Internal and external cooperation

The project will be implemented by CAIAG"s specialists in close cooperation with GFZ specialists and State Agency for Architecture and Construction.

1.2.6 Work plan and required resources

Duration of the project – 2014-2015

2014

- Creation of a monitoring network for early warning system of population of Bishkek.
- Additional engineering-geological, hydrogeological studies of recently built up territories in Bishkek city.

2015

- Preparation of the final report;

- Publication of integrated research results.

II. Karakol city

Project objectives and methods

A primary objective of the project is a completion of seismic microzonation map of the city Karakol.

- Completion of the seismic microzonation map and continuation of creation of the maps: “Seismic vulnerability” “Seismic risk”.

Methods

- Engineering geological method, based on qualitative, empirical dependence of seismic amplification on engineering geological ground properties.
- Geological methods (neotectonics, paleo-seismicity, fission track analysis);

Current status and special requirements

There are three types of seismic microzonation surveys undertaken: aerial survey, point measurements of the noise and earthquake recordings, using seismic stations Mark C34L+ EDL (20 sets provided by GFZ and 4 sets by CAIAG), Geophone 4,5 Hz + SOSEWIN (20 sets provided by GFZ), and one seismic station by CAIAG - Guralp CMG3D + EDL.. Earthquake data have been recorded by 22 seismic stations, 17 of them were installed within the city, 5 stations around the city. According to the results of seismic surveys in the territory of the city, the ground thickness has been estimated that is represented by different velocity of S-waves propagation. Velocity parameters can be classified into: upper thickness layer - 4-7 m with S-waves propagation velocity 220-300 m/sec., and bottom layer – 40 m and more, with S-waves propagation velocity 440-900 m/sec.

As a result, it is concluded that ground conditions of the territory of the city are heterogeneous and change with depth. In order to make the map, a detailed engineering and geological research is required.

Internal and external cooperation

The project will be implemented together with researchers from CAIAG and GFZ, Institute of Seismology NAS KR, State Agency for Architecture and Construction.

Work plan and required resources

Project duration - 3 years until 2014

In 2013 on the basis of conducted seismic measurements a site-effect map was developed for Karakol city with an assessment of quialitative parameters of the seismic effect.

2014

- Creation of maps “Seismic vulnerability” and ”Seismic risk”;

- Final report on Karakol city, creation of digital seismic microzonation maps with georisk assessment.
- Publication of research results

III. Naryn city

Project objectives and methods

A primary objective of the project is a completion of seismic microzonation map of the city Naryn.

- Seismic data processing and analysis;
- Study of frequency characteristics of the ground using noice and earthquake recordings;
- Creation of maps-schemes of distribution of frequency (resonance) soil characteristics

Methods

Methods of areal, permanent and mobile earthquake point measurements and site-effect assessment.

Current status and special requirements

Three types of seismometric observations: areal survey, noice point measurements and earthquake registration were carried out. The observations were carried out using seismic stations Mark C34L+ EDL (20 sets were provided by GFZ and 4 sets – by CAIAG), Geophone 4,5 Hz + SOSEWIN (20 sets – by GFZ), as well as one seismic station of CAIAG Guralp CMG3D + EDL. The earthquakes were recorded by 16 seismic stations, installed within the city. According to the results of areal seismic survey of the city, the ground layers with different cross-waves distribution rates were revealed.

Internal and external cooperation

The project will be implemented together with researchers from CAIAG and GFZ (Germany).

Work plan and required resources

Project duration – 2013-2014 years

2013

- Conduct of field seismometric investigations

2014

- Preparation of the final report, creation of digital seismic microzonation maps.
- Publication of integrated research results.

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PROJECT 1.2. B. STUDY OF THE EARTH CRUST STRESS FIELD FOR FERGANA DEPRESSION AND ITS MOUNTAIN FRAMING FOR THE PURPOSE OF INVESTIGATING THE RELATIONS BETWEEN SEISMIC AND LANDSLIDE PROCESSES

Responsible executors: B.D. Moldobekov, Z.A. Kalymetyeva.
Coexecutors: Ormukov Ch., Jusupova K., Japarkulova A., Abdybachaev U.

1.2.1 Project short title

Study of the earth crust stress field for Fergana depression

1.2.2 Project summary

Need for learning landslide processes in Kyrgyzstan is obvious – one third of annual material damage and human victims comes from landslides. It is considered that the main causes of landslide are engineering geological conditions, physical-mechanical properties of soil covering the slope, precipitations and earthquake impact (here, we do not talk of man-caused factors). Landslides activated during serious earthquakes are known and described by researchers (Keefer, 2002; Niyazov 2009 et al.). The investigation of the precipitation impact on landslides in Kyrgyzstan and in the whole world demonstrates a 50-60% association, what suggests a significant impact of the factor. It addition, it also suggests that, apart from precipitations, there should be another yet unaccounted factor. There is little knowledge of the background seismicity effect. Our researchers (Kalymetyeva and et al. 2010; Kalymetyeva and Moldobekov, 2012) show that such effect is not obvious. However, the fact demonstrating that in some cases, a simultaneous occurrence of very weak earthquakes and landslide shifting was registered which allows admitting that both events were triggered by one factor. Based on the comparative analysis of instrumental data on landslide shifting and time behavior of the direction of compression axis from the data of the earthquake origin areas, one can conclude that such factor may be a temporarily changing stress field.

In the framework of the project, it is planned to carry out a more detailed research on this association using contemporary devices and advanced methods for the analysis of the earthquake time-history.

1.2.3 Project objectives and methods

It is evident that in order to complete the proposed study, one should have information on landslides and the stress field.

Stress field information in the framework of the project will be retrieved from processing Fergana network observation data. The Fergana network was established under the Agreement between the GFZ Potsdam, CAIAG and the Kyrgyz Republic Ministry of Emergency Situations, funded by the GFZ and with equipment provided by the GIPP Potsdam. B. Schurr from the GFZ delivered digital records of the Fergana network and preliminary catalog to us. So far, we have only used the data on earthquake focus

mechanisms retrieved from analogue station records. The Fergana digital network allows completing a fuller analysis. Our tasks include: preparation of earthquake catalog and bulletins, definition of dynamics parameters of earthquake focuses and carrying out of cataclastic analysis through U.L. Rebetsky's method. To define the dynamics parameters, one should first define site-effects in the network station points through a spectral analysis. This work will be conducted through an agreement with S. Parolai. Early in 2013, S. Parolai gave a first training on site-effect definition.

The second task is to prepare a landslide catalog for the period of the Fergana network functioning. Regretfully, landslide information is not complete and not accurate. The fact of a landslide occurrence is registered in the Ministry of Emergency Situations. Therefore, the list of landslides includes mainly events which caused physical damage and human losses. In the Ministry of Emergency Situations' lists, there are no geographical coordinates of the landslides, time of their occurrence – the events are often given with several day accuracy. One should also mind that the time given in the lists often relates to the end of the landslide not to its start. Instrumental logging of the landslide shifts is carried out only in some points.

In addition, in the framework of the project, it is planned to complete a spectral analysis of the records of some Hindu Kush earthquakes in order to identify the frequency signature and duration of the quakes from the data of seismic stations located close to landslides and studied in detail by R.A. Niyazov (Uzbekistan Academy of Sciences).

1.2.4 Current status and special requirements

In 2012, we launched the first stage of the project – preparation of the earthquake catalog and bulletins. To do it, we first structured hourly files of wave patterns. We collected primary hourly files stored in separate stations in record-time hourly files. The software for this task was developed by a KRSU student who passed his internship in the CAIAG. We used the SeiSan software to process the records needed for the catalog and bulletin preparation. In 2012 the recordings of september-december of 2009 were processed. By 2014, it is planned to complete the earthquake (registered through the Fergana network) catalog and bulletins.

1.2.5 Internal and external cooperation

The project will be implemented by the specialists of the Dep.1. In addition, consultations in the GFZ with Bern Schurr (to have the earthquake records processed) and with Stefano Parolai (on spectral analysis and site-effects) will be required. At concluding stages, consultations with Yury Leonidovich Rebetsky in the Institute of Physics of the Earth of the Russian Academy of Sciences on interpretation of the results obtained will be required.

1.2.6 Work plan and required resources

2014

- Earthquake catalog and bulletin completion;
- Spectral analysis of Fergana network earthquake records;

- Spectral analysis of Hindu Kush earthquake records;
- Preparation of the landslide catalog.

2015

- Determination of site-effects and dynamic parameters;
- Performing cataclastic analysis.

2016

- Comparative analysis with landslide data;
- Generalization of results;
- Report preparation.

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PROJECT 1.2. C: DEVELOPMENT OF THE EARTHQUAKE CATALOGUE WITH M≥4.5 OF THE TERRITORY OF CENTRAL ASIA

Responsible executors: Kalmetieva Z.A., Jusupova K.
Coexecutors: Japarkulova A.

1.2.1 Project short title

The earthquake catalogue of Central Asia

1.2.2 Project summary

One of the main tasks of CAIAG from the first days of existence was a creation of permanent observation network and seismic stations. Those periods the organizations, which carried out seismic observations in post Soviet countries in Central Asia, faced significant difficulties (besides Kazakhstan). Due to this fact CAIAG identified one if its tasks, which was a step-by-step creation of digital seismic monitoring network in Kyrgyzstan with a further development of this network in Central Asia. The first step in solving this program was an installation of three digital seismic stations along the border of Kyrgyzstan with China in 2008-2009 with transmission of the data through satellite channels.

Then, this situation changed. In 2008 NORSAR within the Comprehensive Nuclear-Test-Ban Treaty assisted to the Institute of Seismology in creation of own digital station network, which is now registered in FDSN as KRNET. In 2009 within InWent and CASCADE projects GFZ and CAIAG together with national seismological institutes initiated a creation of CAREMON network. As a result, technical facilities were established for seismic monitoring of the whole Central Asian territory.

Currently, through SeisComP the data income into CAIAG from seismic stations of CAIAG, CAREMON network stations, KRNET network of the Institute of Seismology NAS KR, as well as from seismic stations of the international networks (Fig.3). A stable operation of this network is of great importance for CAIAG, as for organization, conducting and supporting research in the field of geosciences in Central Asia.

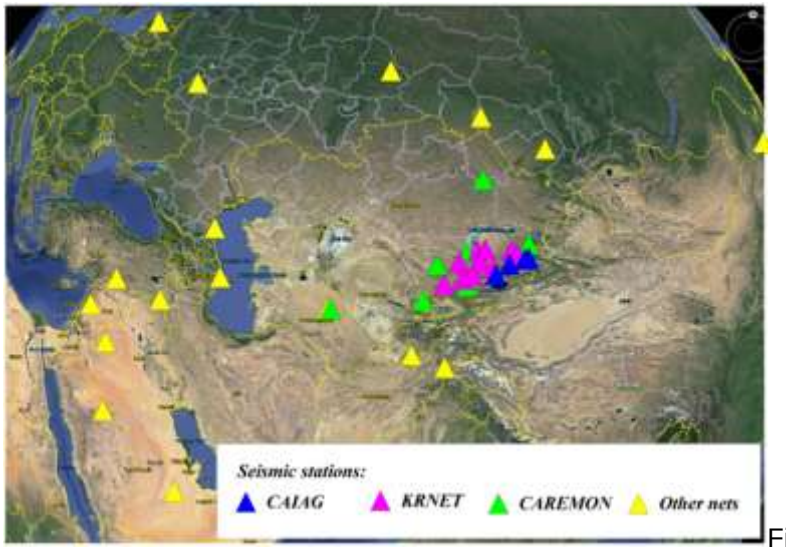

Fig.3.

1.2.3 Project objectives and methods

Since November 2010 CAIAG has created its own catalogue of earthquakes in Central Asia. Using the software SeisComP it is possible to automatically localize the seismic events in real-time, create bulletins of processed results, and create a wave form archive. Every day the operator analyses events from the automatic catalogue within coordinates 26-57° NL and 46-87 EL. For events with epicenters, identified with various values RMS more than 2 sec., the operator manually pricks the phases out and identifies the epicenters again. In case of strong earthquakes within Kyrgyzstan, the operator draws an information list up, where additionally a potential intensity in the epicenter on MSK-64 scale is indicated; and information on this event, which is on the sites of different international processing centres. The information list is provided to CAIAG.

1.2.4 Current status and special requirements

In 2012 an agreement on distribution of functional responsibilies, which stipulates that CAIAG focuses its activity on strong motions, was concluded between the Institute of Seismology NAS KR and CAIAG. A seismic observation infrastructure of CAIAG enables to create a catalogue of seismic events with M≥5 for Central Asian territory. The Fig.4 shows a map of epicenters of these representative events over the whole observation period of CAIAG, i.e. for 2010-2013. In fact, this map is a map of strong motions, because an earthquake with M=5 occurs on the ground surface with Io=5-6 on MSK64 scale. It means that such earthquake can cause cracks in adobe houses and even in plaster of the brick buildings. The earthquake with M≥6 already causes more serious destructions.

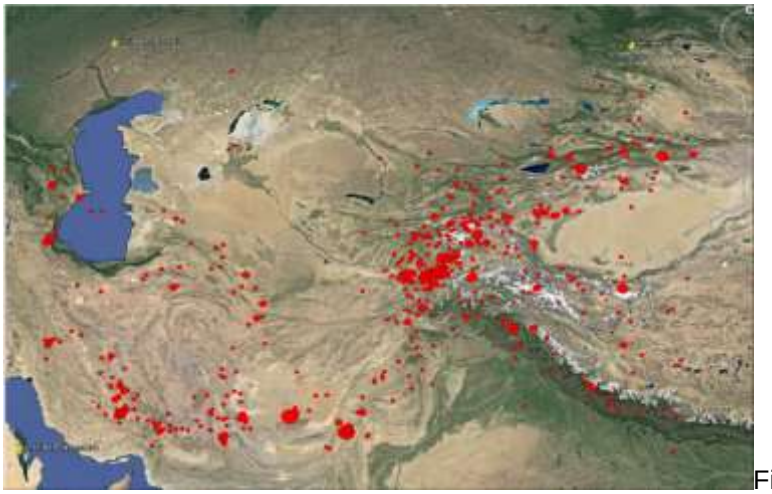
Fig.4

According to the data of the catalogue, a spatial-temporary distribution of registered earthquake epicenters is analyzed when comparing to existing published results.

1.2.5 Work plan and required resources

Project duration – 2014-2016 years

It is planned to generalize the observation materials annually when comparing to previous results.

PROJECT 1.3. STUDY OF LANDSLIDES (KYRGYZSTAN)

Responsible executors:

1.3.1 Project short title

Study of landslides using earth-observation and remote sensing methods in Kyrgyzstan

1.3.2 Project summary

Study of landslides numbering over 6,000 in the Kyrgyz Tien Shan (around 5,000 of those located in the southern part of the country) is a vital topic.

The CAIAG's Department 2 team carried out monitoring of landslides in representative areas, such as: a) Tuiuk Suu landslide in the area of Minkush which threatens to block the Tuiuk-Suu River and form a dammed lake able to wash out the radioactive waste tailings located upstream; b) Gulcha landslide where. after resettlement of the population from the affected area, a risk of new shifts with a potential to damage Gulcha village infrastructure still exists; c) Tektonic and Koi-Tash landslides in the area of the Mailuu-Suu town – they bear potential of forming a dammed lake and washing out radioactive tailings and waste rock dumps; in 2012-2013, study of the Tatyr landslide located in the Chon-Kurak canyon, upstream of the left tributary of the Alamedin River, was launched. It is the latter landslide located 25km away from Bishkek which should be comprehensively studied, including instrumental surveying, as a testing ground. In the future it is planned to create a dynamic model of the Tatyr landslide.

1.3.3 Project objectives and methods

Objective of the project is the study of landslide dynamics for development of forecast and risk reduction measures.

The key methods of the study are field engineering – geological, geophysical, and seismologic measurements. Remote sensing data processing and analysis.

1.3.4 Current status and special requirements

During the previous initial research stage, the Tatyr landslide was only reconnoitered. Preliminary characteristics of the landslide body were estimated. Instrumental measurements of seismic noises and first GPS readings were taken.

The means requested are equipments (seismic stations) GPS Topcon, needed for surveying and seismic sounding of the Tatyr landslide body.

1.3.5 Work plan and required resources

Project duration is 2014-2015 years.

2014

- Complex geophysical studies in landslide body and active faults.
- Seismo-metric observations to assess dynamic parameters of the landslide (areal survey, point noise measurements, earthquake recordings).

2015

- Quantitative assessment of seismic effects and preparation of a Tatyr landslide digitized map.
- Final report, creation of digital georisk assessment maps;
- Publication of the results obtained

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THEME 2: CLIMATE, WATER, GLACIERS

Head of the development team: Zh. Karamoldoev.

RESEARCH SUBJECT: GLACIOLOGY, POTAMOLOGY (RIVER HYDROLOGY), CLIMATOLOGY

PROJECT 2.1. STUDY OF BENCKMARK GLACIERS OF KYRGYZSTAN: ABRAMOV, GOLUBIN, SUYEK, PETROV, KARABATKAK, ENILCHEK WITH THE PURPOSE OF DEFINING THEIR BALANCE, MORPHOLOGICAL AND DYNAMIC CHARACTERISTICS, GLACIER RUNOFF AND CLIMATE CONDITIONS

Responsible executoros: R. Usubaliev, A. Osmonov, E. Azisov, A. Dudashvili, A. Mandychev, O. Kalashnikova, U. Podrezova.

2.1.1 Project short title

Study of benchmark glaciers of Kyrgyzstan

2.1.2 Project summary

Glaciers are one of the important water sources. In Central Asia, most of them are located in Kyrgyzstan. Therefore, study of their changes in correlation with the global climatic processes is an important scientific and practical task.

All the glaciers proposed for the research: Abramov, Golubin, Suyek, Petrov, Karabatkak, Enilchek (Fig.5), were previously, in 2008-2013, surveyed by the CAIAG's team in the framework of the CAWa and GCO CA projects. Three of those (Abramov, Golubin, and Karabatak) were considered benchmarks yet in the soviet period – historical data is available on them. Thus, the project follows the course of the historic research allowing supplementing and specifying our knowledge of the glaciers. Considerable size of the glacier territory stipulates a staged and time-spaced research based on availability of required funds and data.

Fig.5. Glaciers: 1-Abramov, 2-Golubin, 3-Karabatkak, 4-Petrov, Suyek, 5-Enilchek

Primary research methods for the glaciers will be GPS logging of their boundaries, absolute heights of the ice cover, measuring of ablation magnitude though ablation gauges, defining of snow line boundaries and snow density. Space imaging deciphering will be administered for the specification of the glacier boundaries and detection of their structural changes.

Parallel to the glaciological research, it is planned to take climatic and hydrometric monitoring immediately associated with specific glaciers with the purpose to identify the interrelation and reciprocal influence of the main factors of glacier formation and degradation.

Apart from the field measurement results, automatic meteorology stations' (such as Abramov, Merzbacher 1, 2, Golubin stations) data will be used. The data will provide information on temperature, precipitation, humidity, atmospheric pressure, wind and total solar radiation.

From the scientific factor and the practice of predicting water outbursts, Merzbacher glacial lake dammed by the Enilchek glacier is of interest (Fig.6). It is marked by significant (up to 1,000m3/s) and annually occurring outburst flooding.

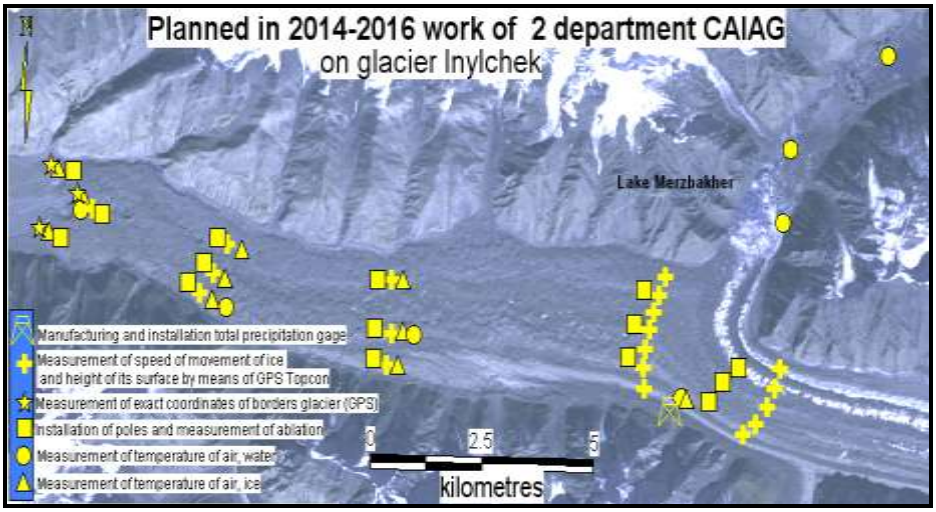

Fig.6. Area of study of the Enilchek glacier and Merzbacher Lake, current and planned scientific measurements

Study of the Enilchek glacier is supposed to be carried out on the basis of the Merzbacher station (Fig.7) set in cooperation between CAIAG and GFZ in August 2009.

Fig.7. High-elevation scientific station named after Gottfried Merzbacher

It is supposed to specify the summer glacier runoff for Southern and Northern Enilchek using automatic hydrometric stations, tracers in the form of paint or salt and Acoustic Digital Current Meter (Ott ADC). Sampling of melted glacier water, seasonal snow cover, dust and organic formations from the glacier surface will be completed to be later subjected to chemical, mineralogical and granulometric analyses.

Fluctuations of water levels in the Merzbacher Lake and ice cover of the lake will be surveyed with a water pressure meter, through visual observations with a HD camera, what will ensure monitoring of the continuous changes in water levels.

It is also planned to survey the Merzbacher Lake and its bottom sediments with sonar Raymarine A50D. Ice dam outburst mechanism will be also investigated. Structure of the glacier, its thickness, physical and mechanical properties of ice will be identified through a finely focused wide-bank seismic sounding or through an electromagnetic penetrating geo-radar. Acoustic noses of the glacier are also proposed for measurement.

The results received for glacier changing will become an important contribution to planning, using and predicting of water resource variability in the Central Asian region.

2.1.3 Project objective and methods

Long-term objectives:

The objective of the project follows the CAIAG's strategy for "Climate, Water and Glaciers" which envisages studying and forecasting of climatic change and water resource change tendencies in Kyrgyzstan and Central Asia.

The primary objective of the project is a retrieval of key glaciological parameters for Abramov, Golubin, Suyek, Petrov, Karabatkak, Enilchek glaciers, the Enilchek River and Lake Merzbacher. To implement the objective, it is planned to start monitoring long-term and short-term dynamics of the glacier systems with installation and employment of combined sensor system of remote sensing and instruments in the study area, and on the base of the Merzbacher integrated station. Parameters of the time series for the systems and the data retrieved from their analysis will become an integral part of the Central Asia geo-data base.

In the long-term perspective, it is supposed to study and understand changes in the dynamics of the glaciers in connection with the global climatic changes and their impact on

the water balance in Central Asia. Specific attention will be paid to identification of factors and processes which cause breakthrough of the ice dam of the Merzbacher and to the development of integrated system of remote sensing for monitoring natural disasters such as ice dam outburst flooding.

Short-term objectives:

The most important short-term objective is measurement of a number of parameters required for explanation, modeling and forecasting of glacial, water and atmospheric subsystems in the aspect of emergence of potential risks of geo-disasters and changes in water resources. The process includes a systematic collection of available and recent data, for example, ice ablation data, ice flow speed, hydrometric, and meteorological data retrieved both from field readings and from constant-duty ground registering and transmitting sensor stations.

Thus, in a short-term perspective, proceeding with installation of automatic meteorological, hydrometric geodesic sensor stations and special sensors equipped with a sattelite communication system will be of primary importance.

The final objective will be an assessment of the ice-water balance of the glaciers on the basis of the analysis of received data and multifactor modeling of interaction of the main natural factors determining the existence and evolution of the Kyrgyzstan glacier system.

An important task will be to process and transmit the data to outer users.

Methods:

- Decoding of remote sensing data (optical multispectral, hyperspectral and radar data).
- Geodesic readings and monitoring (GNSS, GPS – high-precision spot measurements, high-precision topographic measurements though an electronic tachymeter).
- Field taking of glaciological, meteorological, hydrometric parameters (hydro meteorological and hydrometric stations, flow rate and ablation measurements, thermal resistor installation).
- Monitoring of the lake water level using a pressure and temperature sensor - OTT Orpheus MiniGround Water Level Sensor. Merzbacher Lake bottom sounding through Raymarine A50D sonar.
- Monitoring of displacement of ablation gauges through GPS and electronic tachymeter.
- Definition of the glacier structure, its thickness, physical and mechanical parameters of ice through a mobile digital fine-focused wide-band seismic station or an electromagnetic penetrating geo-radar. Measuring of acoustic noise of the glacier.
- Chemical, mineralogical and granulometric analysis of samples of melted glacier water, seasonal snow cover, dust and organic formations taken from the surface of the glacier.
- Time and space modeling on the basis of GIS.

2.1.4 Current status and special requirements

As for the Abramov, Golubin, Suyek, Petrov, Karabatkak and Enilchek glaciers, glaciological, climatic and hydrometric data is currently available. In 2008-2013, CAIAG's team in cooperation with the GFZ Potsdam colleagues carried out a field survey of the glaciers and analyzed space imaging. As a result, ablation, ice movement speed, glacier area size change data was obtained.

The proposed project will include a range of activities related to the defined objectives. Success in the project realization will depend on the availability of scientific equipment.

The required additional data for the project realization includes optical and radar HD space images for the Abramov, Golubin, Suyek, Petrov, Karabatkak and Enilchek glaciers. In particular, in 2014, HD space imaging of World View 1, 2, Terra(Aster) satellites should be acquired for the Abramov, Karabatkak and Enilchek glaciers costing around 1300 EUR, and in 2016, - for the Golubin, Petrov and Suyek glacier for around 1400 EUR.

As for the equipment, the following is needed: electromagnetic penetration radar and portable seismic stations to survey the glacier structure, its heterogeneity and to define ice thickness and density, a geophone to read glacier acoustic noises, temperature sensors with loggers to study ice and water temperature regime.

To monitor microclimatic settings of the glacier, a mobile automatic meteorological station like VAISALA is needed. A mobile hydrometric station is needed to survey flow rates of liquid surface and solid runoffs. Preparation and installation of snow survey stakes observed by video cameras MRZ 1, MRZ 2 is also required.

To run analyses in a specialized laboratory to identify a chemical composition of water related to glaciers, a mineralogical and granulometric composition of dust and solid runoff, it is required to envisage funds provision in the amount of around 2,000 EUR a year.

To get to the glacier, it is required at least 5 hours of a helicopter flying.

2.1.5 Internal and external cooperation

The project is planned to be realized by researchers of the Departments 2, 3 and 4 (CAIAG) in close cooperation with scientists from GFZ. Specialists from the Hydromet agency under the MES KR, Kyrgyz-Slavic University, Institute of Water Problems, and Institute of Geology NAS KR and from other Central-Asian research centers will be involved into the project.

It is expected to involve foreign partners in the project:

- German Aerospace Centre, DLR, Oberpfaffenhofen;
- Commission on Glaciology of the Bavarian Academy of Sciences, Munich;
- Alfred Wegener Institute for Polar and Marine Research, Bremerhaven;
- Idaho University, the College of Mineral and Earth Resources, USA;
- Universities of Nagoya and Kyoto, Japan;
- Lomonosov Moscow state University, Institute of Geography of the Russian Academy of Sciences;
- Engineering-research Institute of the Chinese Academy of Sciences, Lanzhou, China, laboratory of cryosphere and environment of cold and arid regions.

2.1.6 Work plan and required resources

Project duration – 2014 – 2016

2014

- Analysis of remote sensing data, data on glaciological, climatic and potamologic settings and parameters in the area of the Abramov, Golubin, Suyek, Petrov, Karabatkak and Enilchek glaciers.
- Field work on glaciers. Taking hydrometric, ablation and topo-geodesic measurements, completing water and dust sampling and geophysical sensing of the glacier.

2015

- Proceeding with remote sensing, glaciological, hydrometric data and GPS parameter collection and analysis.
- Field glaciological, hydrometric and geophysical surveying.
- Analysis of the received data and development of multifactor interaction model for climatic, hydrometric and glaciological elements of the glacier system.

2016

- Development of GIS models for the glaciers, determination of mass balance and constituting water balance.
- Preparation of substantiation for the Merzbacher Lake outburst early warning system.

Required surveys/data and equipment:

- Decoding of remote sensing optical and radar data (space images of various types and precision levels with various time of shooting).
- Geodesic and topographic measurements on the basis of GPS/GLONASS units and electronic tachymeter (available), and geodesic GPS Topcon GB-1000 units (available).
- Glaciological (ablation), solid runoff hydrometric measurements by means of an acoustic digital current meter (Ott ADC) (available). Sounding of the Merzbacher Lake bottom through Raymarine A50D sonar (available).
- Geophysical sensing of the glacier to monitor its thickness, structure, density by means of a geo-radar system or a seismic station. A geophone for acoustic measurements. Measurements of ice and water temperature. The following is required: a georadar, portable mobile seismic stations, thermal sensors with a logger.
- Sampling to define a chemical composition of fluvial and glacial waters, mineralogical and granulometric composition of dust and solid runoff. Funding is required to carry out analyses in specialized laboratories.
- Near-surface meteorology: an automatic mobile meteorological station to monitor temperature, precipitation and humidity during a field season.

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PROJECT 2.2. STUDY OF LIMNOLOGICAL, POTAMOLOGICAL, HYDROGEOLOGICAL, AND CLIMATE PROCESSES IN THE BASIN OF ISSYK-KUL LAKE

Responsible executors: A.Shabunin, A.Mandychev, Dayrov M., Kalashnikova O., Podrezova J.

2.2.1 Project short title

Study of the Issyk-Kul lake basin

2.2.2 Project summary

The Issyk-Kul basin (Fig.8) and lake of the same name is one of the most important areas in Kyrgyzstan from economic, recreational and environmental point of view. Limnological, hydrometrical, hydrological, hydrogeological, and climate studies within this area enable to develop recommendations on sustainable use of natural resources of the basin and to solve ecological problems related to anthropogenic activities and climate warming. In particular, in the period from 1960 to 2005 the air temperature has risen by 1-1,5^{0}C in the near-shore zone of the Issyk-Kul basin. The tendency of climate warming in the Issyk-Kul region observed since 60-s in the XX century has a direct effect on water temperature in the lake. Thus, according to V.V.Romanovsky and A.G.Shabunin the temperature of deep water in the lake has risen by 0,5^{0}C in the period from 1981 to 2005. Further research works are expected to include the air and water temperature analysis using modern available data, and the filed studies of the water temperature on the surface and standard verticals of the lake.

Fig 8. Issyk-Kul basin

Warming has led to a partial degradation of the glaciation. According to estimates presented in publications, the area of glaciation (including the Issyk-Kul basin) reduces by 0,5-1% per year. In the future such a tendency can have a negative impact on the glacier-derived river discharge, and the contribution of river water to Issyk-Kul lake, what has a direct connection to the change of water level in the lake. Al lthese factors lead to disturbance of the ecological situation in the region.

Along with climate change impact, the lake is affected by recreational pressure every year. Anthropogenic activity in the Issyk-Kul lake basin (growth of water use, population, motor transport, construction of numerous recreation facilities in the near-shore zones) results in increased pressure upon the water resources of othe basin and closed lake as well.

Within this project it is planned to collect and analyze observation data and factual material of the recent years on climatic, hydrological, hydrogeological, limnological and other parameters of the studied area. Moreover, due to the fact that a number of existing meteorological stations and hydrological posts in the Issyk-Kul basin are not sufficient for a qualitative analysis of the parameters, it is expected to use broad band satellite data (optical images, radiometric and radar data). In particular, it is planned to decode the elements of natural environment, as well as to analyze the spatial distribution of principal climatic characteristics.

Obtained data will be used for analyzing the ecological state in the Issyk-Kul lake basin, forecasting the impact of the climate change and growth of anthropogenic pressure on morphometrical, hydrodynamical, thermical characteristics of the lake, as well as on water, glacial and other natural resources of the basin. The acquired results of the project will enable to develop recommendations on rational use of water resources of the Issyk-Kul basin, which contribute to economic development with no environmental losses.

2.2.3 Project objectives and methods

Long-term objectives:

The objective of the project is consistent with the strategy of CAIAG «Climate, Water and Glaciers» that envisages the forecast of climate and water resources change tendencies in Kyrgyzstan and Central Asia.

The main long-term objective of the present project is to study the impact of climate change and anthropogenic pressure on the ecology of ecosystem in the Issyk-Kul basin. The impact is to be assessed on the basis of analysis of changes of principal climatic and hydrological indicators.

Short-term objectives:

In short term perspectives it is planned to carry out climatic, hydrometrical, hydrogeological, limnological studies in the Issyk-Kul basin on the basis of existing factual data, remote sensing data, and data of field measurements of separate characteristics, and to develop climate and natural indicators monitoring network.

It is also expected to develop and update the database with hydrological and hydrodynamic parameters of the lake, as well as climatic, hydrogeological, limnological parameters of its basin.

Methods:

- Remote sensing data analysis using multispectral and radar space images, Terra, Aqua (MODIS), NOAA, Envisat, Jason, Topex Poseidon, IceSat data (altimetry, temberature, precipitations).
- Analysis of time series of precipitation parameters, air temperature, river and groundwater flow, lake-level.

- Field topographic, echo-sounding, limnological, hydrometrical, meteorological measurements. Measurement of water temperature in the lake, water stream and speed direction in the lake using water velocity meter device «Acoustic Digital Current Meter» (Ott ADC) (if any), depth of the lake and thickness of sedimentation using «Raymarine A50D» (if any).
- Analysis of spatial distribution and alteration of time parameters based on GIS, modeling of water balance of the lake and its basin.

2.2.4 Current status and special requirements

The studies of Issyk-Kul Lake and its basin have a long history and many scientific publications are devoted to them. A number of climatic, hydrological, glaciological, limnological, potamological and other studies were conducted in this region at different times.

Specialists of the Department «Climate, Water and Geoecology» of CAIAG have experience in conducting research activities in this region. They were involved in implementation of the R&D Programme and many international projects on studying the lake and its basin. In particular, A.G.Shabunin was involved in many international expeditions, instrumental observations of the temperature regime of Issyk-Kul Lake, its dynamics, physical-chemical properties (color, transparency, oxygen content, etc.). He took part in core sampling from the basin bottom. At a later stage he defended the PhD thesis: «Hydrodynamic processes in Issyk-Kul Lake and their effect on ecological situation in the lake basin» that was based on the results of conducted flied and analytical works.

A.N.Mandychev devoted research to groundwater of the Issyk-Kul basin; as a result for the first time the value of deep level groundwater resources has been estimated, and renewable resources and ecological state of quaternary groundwater aquifers, that are the main drinking water supply source, have been recalculated.

Currently, the available database on hydrological, climatic, limnological and other characteristics of the Issyk-Kul lake basin is sufficient, and includes both archive information obtained from meteorological and hydrological stations, and modern information obtained from satellite data (lake level, surface temperature etc). In the meantime there is an apparent lack of data from field works and monitoring stations.

Specific requirements for the project are:

- Satellite images of different types of different shooting periods, are needed for analyzing spatially distributed parameters and mapping of the region to assess anthropogenic pressure (among them are images of the satellite “Terra(Aster)”, life duration 3 years, around 2000 euro).
- Financial sources to analyze chemical composition, contamination and other water characteristics in certified laboratories. In particular, identification the content of nitrates, nitrites-ions as indicators of organic contamination in lake, river and groundwater. The chemical analysis will cost roughly 3000 euros per year.
- Tools to identify precise coordinates and terrain elevation in order to map the point sources of contamination and other parameters (geodesic and handheld GPS), a new geodesic GPS «Topcon GB-500, RTK» and a single GPS “Garmine e Trex” The cost is around 9500 euro.

- Georadar to estimate groundwater depth level. The cost is about 40000 euro.
- Digital thermo-sensors to create and install thermistor chains (multizone digital temperature sensors). The cost is around 2000 euro.

2.2.5 Internal and external cooperation

The project is planned to be implemented by the Departments 2 in cooperation with 3 (CAIAG), in cooperation with the Institute of water problems and hydropower NAS KR, Institute of Hydrogeologic expedition, Institute of Irrigation, and the main hydrometeorology department under the MES KR, and together with scientists from other Central-Asian countries.

2.2.6 Work plan and required resources

Project duration 2014-2016

2014

- Collection and analysis of remote sensing data, factual materials on hydrogeologic, climatic, hydrometric, limnological parameters of Issyk-Kul Lake and its basin;
- Supporting to create section for the geodatabase on meteorological, hydrological, limnological parameters;
- Analysis of acquired data using different data processing methods, analysis of climate change and related hydrogeologic, limnological, potamological changes in the region; estimation of anthropogenic pressure on the lake and its basin.
- Field surveys in the northern near-shore zone; measurements of water temperature, water stream velocity in the near-shore zones and lake water area using rented ships.

2015

- Continuation of collection of factual data on the Issyk-Kul basin;
- Field works to measure new hydrological, ecological, and GPS parameters, creation of termistor chains in the water area;
- Acquisition of new factual data through satellite image decoding and comparing the results of decoding for different time series;

2016

- Study of the climate change impact and the growth of anthropogenic lpressure on ecological situation in the basin;
- Development of unified GIS model of climatic, hydrologeological, potamological, and limnological systems interaction in the Issyk-Kul basin.

Required surveys/data and equipment:

- Optical and radar remote sensing data (space images of different types and different shooting time).
- Meteorological parameters: temperature and precipitations from weather station network. Long-term historical data on groundwater level regime.

- Hydrological observation data: river discharge rates according to hydro-post network and measured by velocity rate meter - Acoustic Digital Current Meter (Ott ADC) (is available).Water stream velocity in the lake;
- Measurements of the lake water level, bottom sediments using echo-sounder Raymarine A50D in the water area (is available).
- Geodesic ground mapping: geodesic measurements by GPS Topcon GB-1000 (is available) and electronic tacheometer (is available).

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THEME 3: MONITORING SYSTEMS AND DATA MANAGEMENT

Head of the development team: A. Zubovich

PROJECT 3.1. DEVELOPMENT OF DISASTERS MONITORING SYSTEM IN QUAZI-REAL TIME MODE

Responsible executors: A.Shakirov, Barkalov S.

3.1.1 Project short title

Natural disaster monitoring system

3.1.2 Project summary

Central Asia is a region that has a sharp continental climate, high mountains and numerous rivers and arid deserts. High tectonic activity results in destructive earthquakes that lead to devastating consequences. Landslides, avalanches, mudflows, flood and droughts are typical natural disasters for this region. These disasters affect infrastructure and human life activity. Therefore, creation of monitoring networks to track these dangerous phenomena is of high importance and essential for the countries located in this region. The project is focused on developing the monitoring systems founded in previous years. The system includes:

- Monitoring stations network
- Data transmission subsystem
- Data collection and processing subsystem

Monitoring network consists of stations of different purposes and configuration. What is common is that they are equipped with autonomous power supply system, control system for stations and devices to transmmit data. Sets of sensors can be changed depending on conditions of installation.

Data transmission subsystem is organized depending on the conditions of the place of its location. That is either the VSAT system, if any station is located in remote mountain areas, or the GSM communication, if it is located within the area of mobile communication coverage or Internet access, or if station is located in Internet-equipped settlement.

CAIAG's data collection and processing subsystem is equipped with modern hardware, including the set of servers, storage devices, and software packages which provide equipment control, data acquisition, processing and storage.

3.1.3 Project objectives and methods

The objective of this project is to develop the monitoring system of CAIAG, as a basis for early warning system.The project will include:

- Upgrading existing stations;
- Extension of monitoring system connecting new stations installed under other projects;

- Development and upgrade of hardware, software, and organization component of data collection and processing center.
- Maintanence of stations (planned and casual).

Experience in development of monitoring systems shows that the existing stations need to be upgraded.

Implementation of different projects aimed at creating stations and monitoring networks enables to exend and build the monitoring network. The problem that is apperantly to arise is the one connected with inconsistency of new formats and interfaces with existing system.

The given project component is amied at creation of the conditions that allow integrating new stations into monitoring system of CAIAG, including development of software tools, providing required equipment, conducting different activities.

3.1.4 Current status and special requirements

Currently, the monitoring system of CAIAG includes:

8 stations:

- 1 GNSS station with a receiver "**Allan Osborne BENCHMARK ACT**" (BIS2)
- 1 meteostation "**Vaisala PTU 200**" (BIS2)
- (4 GNSS stations with Topcon GB-1000 receivers and GSM communication.
- (KRGT, KRBK, TKUM, ARSL)
- 1 smart-station, which consists of a meteostation Vaisala WXT520, GNSS Topcon GB-100 receiver and satellite terminal VSAT (ENEL)
- 1 smart-station, which consists of a broad-band seismic station STS-2, and equipment for stations under CAWa project (ASAI)
- 7 stations from the CAWa project, one of them has been installed on the base of a former smart station in CAIAG (TARA, BAYT, KEKI, ABRA, DUPU, AYVA, MADK)
- Permanent and 1 temporal stations in the Inylchek glacier area, installed under the Global Change Observation programme (MRZ1, MRZ2, ICEDAM), 1 seismic station from the CAREMON network under InWent project. (SUFI)

The stations have different sets of sensors, but arranged according to a unified scheme: the control, power supply and communication systems. Locations of monitoring stations are shown in the Fig.9.

Fig.9. CAIAG's monitoring stations

3.1.5 Internal and external cooperation

The project is carried out by researchers from the Department 3. In some cases there are specialists from the Departments 1 and 2, 4 involved. Cooperation with GFZ is considered to be a principal and high-priority. Cooperation with Kyrgyz and Central Asian institutions, as well as with experts from Europe, Asia and North America will be continued.

3.1.6 Work plan and required resources

- Upgrading existing stations – 18 man/month;
- Extending monitoring system with new stations from other projects – 12 man/month;
- Development of hard-, software, managerial component of data collection and processing center – 18 man/month.

Fig.10. Smart station in Aksai (AKSA) upgraded under CAWa project, smart-station Maidanak (Uzbekistan)

PROJECT 3.2. DEVELOPMENT OF COMPUTERIZED INFORMATIONAL SYSTEM "DATA PLATFORM"

Responsible executors: M.M. Jantaev and D.A. Mandychev.

3.2.1 Project short title

Data platform

3.2.2 Project summary

The project is "Central Asia Geodata Base" as well as projects from 3 sources, such as "Sustainable Development of Issykkul. Geographical Informational Systems and Inventory Taking of Assets", "Mass Digitizing and Renewal of Urban and Rural Cadastral Maps", "Reduction of Vulnerability of Children to Adversities in Kyrgyzstan", "Development of Data Platform of Natural Disaster Risks in Kyrgyz Republic" allowed acquiring profound experience in the development of the geodata bases, in the organization and provision of access and access rights and in the interface development. Past experience and modern trends of the information technology development both place new demands:

The data should be controlled by those associated with their development and modification. This does not mean that the data should be stored in place of its origin. Due to modern communication technologies, they can be located anyplace. The only important thing is that the means of entering data, its storage and control should be **simple** and **accessible**, and easily managed by the owners of the data.

The data should be accessible in commonly recognizable formats. It means that if an access right to the data is granted, the data should be managed right on place without additional transformations.

There should be possibility of live combination of data from various sources. For example - preparation of various thematic maps from layers made by different owners and stored in any point on the globe.

The system of restricting and granting access rights to the data should be simple, reliable, flexible and illustrative, so to be able at any moment to easily restrict the access to some data and allow it to the other.

The system of new language adding with its vocabulary and managing existing vocabularies should be simple, intuitive and flexible.

3.2.3 Project objectives and methods

The project provides for the development of the computerized informational system **Data Platform** satisfying the above-listed requirements and being free of the named shortcomings.

Need in the system is significant. Its lack hinders data transferring between organizations, scientific community and people, holds back the development of

informational technologies in the countries. Various formats and standards, and, in many cases, their absence, do not allow quick exchanging of information. But even if the data is of one standard, but there are no means for its prompt integration – this also complicates its management.

Computerized informational system **Data Platform** should:

- Be easily installed on devices and with no excessive requirements for them.
- Be easily adjusted through a web-interface.
- Provide facilities for prompt addition of a new language and its vocabulary.
- Have simple and flexible decentralized system of access granting to the data. Data owner is accountable for it and he grants access rights to other users.
- Provide facilities to a common user for easy and intuitive data entry and its editing. The data should come with metainformation.
- Provide facilities for combining data from various sources, for creation, for example, of various thematic maps.
- Provide facilities for easy connection of new devices for analysis, processing and display of the data.

3.2.4 Current status and special requirements

The analysis of the software which meets the above-stated requirements revealed that such software does exist but it is either to be paid for, or has deficiencies preventing its prompt introduction. For example, this may be absence of Russian or other national languages. Or it may have limited facilities to grant and manage access rights. This may also be difficulties with the software upgrading, even if it is open coded.

3.2.5 Work plan and required resources

- Data Platform concept development – 6 men/months.
- Development of the Platform database structure and user interface – 24 man/months
- Data Platform task programming – 24 men/hours
- Software adjustment - 6 men/hours

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THEME 4: CAPACITY BUILDING AND SCIENTIFIC COOPERATION

PROJECT 4.1. CAPACITY BUILDING AS A KEY FACTOR IN THE DEVELOPMENT OF LOCAL COMMUNITIES (ISSYK-KUL OBLAST, KR)

Head of the development team: Proff.Dr.Bobushev T.S.

4.1.1 *Project short title*

Socio-economic analysis of sustainability of local communities

4.1.2 Project summary

Capacity building is a strenthening of knowledge, skills and relations of people to be able for them to create and support the development of their communities and districts. The people create and adapt local institutes. These people create and form a policy and measures, which support the development of their district. The capacity building is important for everybody, who is involved in creating and supporting the development of communities, particularly, in rural areas. A previous experience of the people in local communities within a planned economic system in the Former Soviet Union is related to management and realization of activities by “up-bottom” principle and sector-oriented initiatives in the development. Currently, it is essential to organize re-education for successful realization of partnership “bottom-up” approach. Usual capacity building programs were related particularly to professional training of developers of the projects and specialists of development agencies. But knowledge, skills and relations, required for realization of activities by “bottom-up” principle within the model of local development, significantly differ for being under service management by territoriality. As is known, Kyrgyzstan was the first country in post Soviet period, which realized a creation of local elections. Such breakthrough in regional development of the country was achieved thanks to the legislation on local bodies, which gained a political independency. However, despite specific achievements of the local bodies in improvement of the living standards of people, they still face a lot of problems in developing local communities without having own budget. Due to this fact, the proposed pilot project on investigation of the Issyk-Kul oblast should identify a potential for capacity building of local communities.

4.1.3 Project objectives and methods

A particular attention within the project will be paid to study of a potential for development of local communities in the investigated area in order to assess an availability of resources and actual state of the areas and which can promote the better life quality of people in local communities and facilitate their participation in forming the socio-economic development of their community. Educational institutions in local communities should be responsible in front of local people for a possibility to develop their skills, required for creating and developing a potential and being rewarded for community development.

In terms of above stated facts, capacity building of local communities will be realized through:

- Examine issues and identify priorities in development of communities and provision of an access to local people to resources and services, coordination of achievable actions,
- Involvement of members of the communities in development of social plans, plans of economic development, sport and recreation, as well as plans of environmental protection,
- Identification of the role of local communities as a partner in regional economic development.

4.1.4 Current status and special requirements

There are 5 districts in the Issyk-Kul oblast – Ak-Suu, Jeti-Oguz, Ton, Issyk-Kul and Tup with 61 local rural districts and 191 communities. The total population of 5 districts of the Issyk-Kul oblast is 448 000 people, with an average density 11.

4.1.5 Internal and external cooperation

Capacity building of local communities, particularly, rural communities in Kyrgyzstan stipulates an implementation of research activities, starting from analysis and assessment of geophysical processes, which can endanger local communities, to development of measures on adaptation of communities to changeable conditions:

- Examine the state of environment under the global climate change,
- Examine the living standards,
- Qualitative research of the living style of specific social groups,
- Social assessment of the consequences of economic reforms,
- Examine the quality of social services, subjects of economic and business activity etc.

The project will be implemented together with Dep.2

4.1.6 Work plan and required resources

Project duration: 1st phase - 2014-2015, 2nd phase – 2016-2017

Here there is a draft plan to be detailed after an expert review and recruitment of specialists.

1st phase - 2014-2015 project tasks are the following:

- Analysis of the capacity building of local communities to assess available resources and services and actual state of the territory, promote a participation of local people in forming the socio-economic development of their community,
- Research of socio-economic features of local communities in 12 rural districts and 30 villages of the Issyk-Kul and 13 ayil-districts, 51 districts, 51 ayil of the Jeti-Oguz oblasts,
- Generalization of statistical materials,

- Expeditional research of local communities through organizing a sociological survey of families on different criteria, and collectiing and analyzing the information on actual socio-economic and ecological state of local communities.

2nd phase - 2016-2017 project tasks are the following:

- Development of educational programs on improving skills of rural population for joint planning and producing ecologically pure products, combination of training and capacity building of local communities in the mountain regions,
- Development of a program for developing skills and providing an access for capacity building of 45 rural communities,
- Analysis of local economy, economical potential and problems; realization of programs on development of communities for guiding local enterpreneurs and organizations, and on joint utilization of equipment and offices for small business.

4.1.7 References

1. Specific Terms of Reference Provision of Technical Assistance to support the identification of a Rural Development Programme within the frame of the Multi-annual Indicative Programme (2014-2020) . FWC COM 2011 - LOT 1: Studies and technical assistance in all sectors DCI-ASIE/2014/337-078/1.
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4. КОНЦЕПЦИЯ устойчивого развития сельских территорий Российской Федерации на период до 2020 года. Москва, 2010.