

Application Form for World Centre of Excellence on Landslide Risk Reduction

2020-2023

1. **Name of Organization:** JSC "Hydroproject Institute"

2. **Name of Leader:** Alexander Strom

Affiliation: Alternative representative of JSC "Hydroproject Institute" in ICL

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Core members of the activities (Names/Affiliations):

Kanatbek Abdrakhmatov, Director of Kyrgyz Institute of Seismology (KIS)

Sergei Machekhin, Director of of the Geodynamics Research Center – branch of JSC "Hydroproject Institute" (GRC)

Andrey Gorbatikov, Consultant of the GRC, representative of JSC "Hydroproject Institute" in ICL

3. **Date of Submission of Application:** October 11, 2019

4. **Activity scale and targeted region:** Regional, with some outcomes of global interest

5. **Short Title:** Central Asia Rockslide Inventory. Compilation, Analysis and Training

6. **Objectives for the initial 3 years:**

Large-scale rockslide inventory of the Central Asian – one of the landslide "hotspots" – have been compiled. Large proportion of cases were quantified and included in the database (Strom A, Abdrakhmatov K, 2018 Rockslides and rock avalanches of Central Asia: distribution, morphology, and internal structure. Elsevier). Compilation of the inventory will be continued; the database will be extended by adding new cases and additional quantitative and qualitative parameters of rockslides and rockslide dams; its further analysis will be performed. WCoE will continue running the annual ICL Summer School on Rockslides and Related Phenomena in Kyrgyzstan.

7. **Background Justification:**

The inventory of large-scale rockslides of the Central Asian region that includes more than 1000 features exceeding ca. 1×10^6 m³ in volume has been compiled during the previous WCoE term. Qualitative and quantitative parameters of ca. 600 of them were included in the database. We plan to continue compilation of the database, describing and quantifying new features and adding additional parameters, those characterizing rockslide dams in particular. The aim is to compile the complete inventory and database that will allow more representative statistical analysis. Besides these regional studies, WCoE will continue running the Kokomeren Summer School in Kyrgyzstan – the two weeks long field training course in the area with the unique variability of rockslides and rock avalanches. For organizing this annual field training course since 2006 that was attended by young landslide researchers from 24 countries JSC "Hydroproject Institute" (together with KIS) was awarded as the WCoE in 2011-2014, 2014-2017 and 2017-2020.

8. Resources available for WCoE activities:

Personnel: Team leader Dr. Alexander Strom and Dr. Abdrakhmatov from KIS have been working in this region for decades. Other core members will help in organizing the Kokomeren Summer School in 2020-2023 and will support research activities of Hydroproject in the study region. Besides, some participants of the past Summer Schools expressed their interest to study rockslides in the Central Asia region.

Facilities: Identification, mapping and quantification of rockslides included in the inventory and database will be performed using free of charge resources of space images such as Google Earth and SAS Planet and global DEMs (SRTM, ASTER, etc.) as well as the commercial space images and aerial photographs available for some parts of the Central Asia. All cooking and transportation facilities necessary for Summer School are available. Participant stay in personal tents and sleeping bags. Several tents and sleeping bags can be provided by organizers if necessary. Regularly updated full-color Guidebook will be printed and provided to the attendees.

Budgets: Funds necessary to run the Kokomeren Summer School are covered by registration fees. We keep it relatively low (Euro 500 that covers all costs, except air fare – food, local transport, hotel/hostel in Bishkek for the last night before the departure, full-color detailed Guidebook). During last three years the Summer School was also supported by the UNESCO Almaty cluster office that covers all expenses of one participant from each Central Asian country per year and we expect they will support us in future.

Affiliation and Contribution to ICL/IPL-GPC: Annual participation of researchers from different countries in the ICL field training course promotes ICL/IPL popularization. Role of ICL and IPL in compilation of the Central Asia rockslides inventory was highlighted in the introduction of the book “Rockslides and rock avalanches of Central Asia: distribution, morphology, and internal structure”, Elsevier, 2018.

9. Description of past activities related to risk reduction of landslides and other earth system disasters

During 13 years of the Kokomeren Summer School about 150 students and young researchers from Argentina, Austria, Belgium, China (including Hong Kong), Czech Republic, France, Germany, Great Britain, Italy, Japan, Kazakhstan, Korea, Kyrgyzstan, New Zealand, Poland, Russia, Slovakia, Slovenia, Switzerland, Spain, Taiwan, Tajikistan, USA and Uzbekistan were acquainted with characteristic geomorphic, lithological and structural features typical of large-scale rockslides, including those producing long-runout rock avalanches and natural dams. Some of them became interested in more detailed research of these phenomena in the Central Asia region. Almost every year several previously unknown features were discovered during daily field trips and these findings strengthen the comprehensive model aimed to explain conversion of the initial rock slope failure into highly mobile flow-like rock avalanche motion affecting areas far away from the headscarp foot.

Besides variable rock slope failures, the Summer School participants have been also acquainted with impressive manifestation of neotectonics and active faulting that form the prerequisites of large-scale rockslides formation and can be interpreted, along with rockslides, as indicators of large prehistoric earthquakes.

Results of our study of the distribution of large-scale rockslides over the entire central Asia region, i.e. the Djungaria, Tien Shan and Pamir Mountain systems, have been summarized in the monograph “Rockslides and rock avalanches of Central Asia: distribution, morphology, and internal structure”, (Strom A., Abdrakhmatov K., 2018) published by Elsevier. ISBN: 978-0-12-803204-6. The database is available as Excel spreadsheet at the Elsevier website as the supplementary material. Database includes ca. 1000 case studies, all with coordinates, for about 600 of which parameters of their headscarps, deposits and of the dammed lakes are provided.

10. Planned future activities /Expected Results:

First we plan to fulfill more detailed Central Asian rockslide database where each case study included in the inventory will be characterized by both qualitative (rock type, rock avalanche type, presence and present-day state of the dammed lake) and quantitative parameters, characterizing the headscarp, the deposits, as well as the rockslide dam and the dammed lake. Every feature will be digitized on the georeferenced satellite images and DEMs and quantified with a help of the Global Mapper software. The database compiled in the form of the MS Excel spreadsheet will be extended, allowing classification, attribute sampling and more representative statistical analysis.

Besides office work we plan to visit several parts of the Central Asia region (Southern Kazakhstan, Northern Uzbekistan) to study rockslides identified in these areas and to date them. These studies are planned to be performed within the frames of the International Research Projects in cooperation both with local and foreign researchers.

Along with the rockslides database compilation and analysis we plan to continue running the annual field training courses in the Kokomeran River basin. The Guidebook will be reworked and updated, adding the descriptions of all daily routes in such form that in future they could be guided by somebody except the WCoE Leader. We also hope that data collected during Central Asian rockslides database compilation could be used to organize field training courses in other parts of the study region where numerous rockslides of variable types have been identified within the limited and easily attainable areas.

11. Beneficiaries of WCoE:

Landslide researchers working both in the Central Asia region and all over the World; emergency experts working on landslide and outburst flood hazard assessment; researchers and practitioners in the fields of paleoseismology and seismic hazard assessment; hydraulic engineers working on dam projects.

12. References:

- Reznichenko, N.V., Andrews, G.R., Geater, R.E., Strom A. (2017). Multiple origins of large hummock deposits in Alai Valley, Northern Pamir: Implications for palaeoclimate reconstructions. *Geomorphology* 285, 347–362.
- Zerkal, O., Frolova, Y., Strom. A. (2017). The conceptual modeling of the style of rock massif destruction and of its influence on rockslides and rock avalanche formation. In: Progressive rock failure conference, Monte Verità, 5–9 June 2017, Extended Abstracts, 113-114.
- Strom, A. (2018) Large-scale rockslide inventory of the Central Asia region: data and analysis. In: Shakoor A and Cato K (eds) IAEG/AEG annual meeting proceedings, San Francisco, California, 2018, 1 pp 145–153. https://doi.org/10.1007/978-3-319-93124-1_18.
- Strom, A., Abdrakhmatov, K. (2018) Rockslides and rock avalanches of Central Asia: distribution, morphology, and internal structure. Elsevier. 459 pp. ISBN: 978-0-12-803204-6.
- Strom, A., Li, L., Lan, H. (2019) Rock avalanche mobility: optimal characterization and the effects of confinement. *Landslides* (2019) 16, 1437–1452. DOI 10.1007/s10346-019-01181-z.

13. Articles reporting activities of WCoE, IPL project and ICL network

- Strom, A., Abdrakhmatov, K. (2017). Large-Scale Rockslide Inventories: From the Kokomeren River Basin to the Entire Central Asia Region (WCoE 2014–2017, IPL-106-2). In: K. Sassa et al. (eds.), *Advancing Culture of Living with Landslides*, DOI 10.1007/978-3-319-59469-9_28
- Strom, A., Abdrakhmatov, K. (2018). 2018 International Summer School on rockslides and related phenomena in the Kokomeren River valley (Kyrgyzstan). *Landslides* 15, 181–182. DOI: 10.1007/s10346-017-0930-8
- Strom, A., Abdrakhmatov, K. (2019). 2019 International Summer School on Rockslides and Related Phenomena in the Kokomeren River valley (Kyrgyzstan): ICL Kokomeren Summer School. *Landslides* 16, 1055–1057. DOI: 10.1007/s10346-019-01173-z

14. List of published or planned reports of WCOE 2017-2020 in journal “Landslides” or “WLF5 books” for ongoing WCOE organization.

- 1) We will publish the Announcement of the 2020 Kokomeren Summer School in *Landslides*. It will be submitted, likely, at the end of this year.
- 2) Report on the WCoE activities will be presented at the WLF-5. (Theme 1. WCoE: Central Asia Rockslide Inventory. Compilation and Analysis; Theme 5. Kokomeren Summer School on Rockslides and Related Phenomena).