Revised version

Application Form for World Centre of Excellence on Landslide Risk Reduction

2023-2026

1. Name of Organization

Laboratory of Engineering Geodynamics, Department of Engineering and Ecological Geology, Faculty of Geology, Moscow State University

2. Name of Leader

Viktor T. TROFIMOV

Head of Department of Engineering Geology and Ecological Geology

Oleg V. ZERKAL

Head of Laboratory of Engineering Geodynamics

Contact:

Faculty of Geology, MSU, Leninsky Gory St., 1, Moscow, Russia, 119991, +7(495)939-25-68, zerkalov@geol.msu.ru, igzov@mail.ru

3. Date of Submission of Application

2023/09/13

4. Activity scale and targeted region.

3) Continental

5. Short Title characterizing past and planned activities

Laboratory of Engineering Geodynamics, Faculty of Geology, MSU

6. Objectives for 3 years:

- comprehensive and complex research of landslide activity in Russia
- generalization and analysis of data on landslide activity in Russia
- education of students of Faculty of Geology, Moscow State University (level – BSc, MSc, PhD)

7. Background Justification:

Every year, 800 to 1100 different scale landslides are active on the territory of Russia, and in some years – up to 1300 landslides. Every year on the territory of Russia 40-70 landslides are formed, and in peak years - up to 300 new landslides. In recent years, several large scale landslides have been formed in Russia (Bureya Landslide (Far East of Russia), 2018, up to 25 million m^3, Buzulgan landslide (Caucasus, Russia), 2020, up to 7 million m^3). In this regard landslide hazard assessment is an important direction of scientific research and

practical work in Russia. It is also important to prepare students who will be involved in future studies of landslide activity in Russia.

8. Resources available for WCoE activities

Facilities and Budgets of the Department of Engineering and Ecological Geology (Faculty of Geology, Moscow State University)

The main activity of our team is carried out within the framework of the subproject "Regularities of formation, development and activity of landslides on the territory of Russia" (topic 4 as part of the project "Study of the diversity of engineering and geological conditions of the territory of Russia", 2020-2025), carried out by the Department of Engineering and Environmental Geology of the Geological Faculty of Moscow University. We receive additional opportunities for research within the framework of grants for the study of landslides. In 2023 Field work was carried out in the valley of the Mzymta River (Caucasus) and additional observations in the Crimea, field work is planned in the Russian part of Altai (mountain system in Asia).

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

In the International Program on Landslide, the following were performed:

2010-2012 IPL-169 “Landslide hazard and risk assessment in Geyser Valley (Kamchatka)”

2017-2019 IPL-215 “The Influence of Geological History in Modern Landslide Activity on the Site “VorobyovyGory“ (Moscow)”

In 2020-2022, specialists from the Laboratory of Engineering Geodynamics of Geological Faculty MSU studied several largescale landslides (Bureya Landslide (Far East of Russia), Buzulgan landslide and Krasnogorsk Landslide (Caucasus, Russia), rock avalanches in Mzymta valley (Western Caucasus, Russia) and others). The research of modern landslide activity on the site “Vorobyovy Gory" (Moscow, Russia) also continued. On the site “Vorobyovy Gory“ 29 wells (2285.5 m) were drilled, which were equipped with inclinometers for monitoring. This allowed to clarify the structure of the landslide massif. The properties of Cretaceous and Jurassic age soils were studied in the laboratory. Numerical simulation was carried out.

In 2020-2022, as technical projects, specialists from the Laboratory of Engineering Geodynamics of Geological Faculty MSU conducted a research of relict cryogenic slope deformations at the site "Sheregesh" (Kuznetsky Alatau Mountains, Russia), performed a study of modern landslides on Sakhalin Island, the Western Caucasus and the foothills of the Ural Mountains.

Together with the specialists of Ordzhonikidze Russian State Geological Prospecting University (I.K. Fomenko) and Geodynamics Research Center (A.L. Strom), the role of the seismic factor in the formation of rock slide in Dagestan (Caucasus, Russia) was analyzed.

10. Planned future activities /Expected Results:

Planned future activities on the territory of Russia in areas of large landslide activity, including the territory of Moscow, the Black Sea coast, the Caucasus, Ural and Altai Mountains, the volcanic region of Kamchatka, the mountainous regions of the Russian Far East (Bureinsky region, Sakhalin Island, the Pacific coast).

Investigating landslide activity in large areas, we actively use remote sensing analysis, which we supplement with field observation data. Then we perform spatial analysis in ArcGIS. When studying individual landslides, a standard set of works is carried out, including drilling, testing, laboratory study of rocks and soils, assessment of the safety factor, instrumental monitoring of activity (inclinometry). Landslides of different types will be investigated.

To assess landslide activity on the area of Russia (>17 mln km^2), it is planned to collect information from annual Reports on the state of the natural environment, which are published in each of the regions that are part of Russia. In case of receiving information about the high activity of landslides (for example, during abnormal precipitation), it is assumed to use remote sensing analysis. When receiving grants, it is planned to perform field observations. The collected information is accumulated in a database, the structure of which will be comparable to the structure of the Global Landslide Catalog. We propose to clarify the boundaries of territories with a wide spread of landslides on the territory of Russia, to assess landslide activity in modern climatic conditions.

Students and PhD students of the Geological Faculty of Moscow State University will take part in the study of landslide activity. The estimated number of prepared dissertations is 4-6 MSc dissertations per year, 2 PhD dissertations within 3 years.

The obtained results are planned to be presented at World Landslide Forums, Conferences organized by of ICL, IAEG, and published in scientific journals, including the journal “Landslides". In 2024-2026, we additionally expect to complete the preparation of manuscripts for publication (P-LRT book or “Landslides”) on topics (working titles):

1. Landslide Activity on the Site “Vorobyovy Gory“ (Moscow, Russia)
2. Rock avalanches of the Mzymta River valley (Caucasus, Russia)
3. Rock avalanches of the Crimean Mountains
4. Landslides of the coastal zone of the Ussury Bay of the Sea of Japan (Russia)

The presentation of the manuscripts will be carried out upon completion of the analysis of the received materials.

11. Beneficiaries of WCoE:

Specialists of the State Geological monitoring of Geological Survey of Russia, Emercom of Russia, students of Faculty of Geology of Moscow State University and MSU Branch in Dushanbe (Tadjikistan).

12. References:

List of publication on the ongoing WCOE 2020-2023 in ICL:

Barykina O., Zerkal O., Averin I., Samarin E. (2021) New Data on Geological Conditions of Landslide Activity on Vorobyovy Gory (Moscow, Russia)//Understanding and Reducing Landslide Disaster Risk/Guzzetti F., Mihalic Arbanas S., Reichenbach P., Sassa K., Bobrowsky P.T., Takara K., eds/Proc. WLF 2020. Springer, v. 2, pp. 143-148

Fomenko I.K., Zerkal O.V., Strom A., Shubina D., Musaeva L. (2021) The Krasnogorsk Landslide (Northern Caucasus): Its Evolution and Modern Activity//Understanding and Reducing Landslide Disaster Risk/Vilimek V., Wang F., Strom A., Sassa K., Bobrowsky P.T., Takara K., eds/Proc. WLF 2020. Springer, 2021, v. 5, pp. 49-56

Zerkal O.V., Makhinov A.N., Strom A., Kim V.I., Kharitonov M.E., Fomenko I.K. (2021) Formation of the 2018 Bureya Landslide, Far East of Russia//Understanding and Reducing Landslide Disaster Risk/Vilimek V., Wang F., Strom A., Sassa K., Bobrowsky P.T., Takara K., eds/Proc. WLF 2020. Springer, v. 5, pp. 111-116

Ponomarev A.A., Kang K., Zerkal O.V. (2021) Rock Avalanches in the Upper Reaches of the Mzymta River, Russia//Understanding and Reducing Landslide Disaster Risk/Vilimek V., Wang F., Strom A., Sassa K., Bobrowsky P.T., Takara K., eds/Proc. WLF 2020. Springer, v. 5, pp. 153-158

Zerkal O.V., Strom A.L. (2021) Classification of Cryogenic Landslides and Related Phenomena (by Example of the Territory of Russia)//Understanding and Reducing Landslide Disaster Risk/Arbanas Z., Bobrowsky P.T., Konagai K., Sassa K., Takara K., eds/Proc. WLF 2020. Springer, v. 6, pp. 377-383

Zerkal O.V., Barykina O.S. (2023) Suffosion Landslides as a Specific Type of Slope Deformations in the European Part of Russia//Progress in Landslide Research and Technology/I. Alcántara-Ayala et al. (eds.). Springer, vol. 1, Is. 2. pp. 99-108 (https://doi.org/10.1007/978-3-031-18471-0_8)

Other publications (2020-2023) (except articles in Russian)

Fomenko I., Strom A., Zerkal O. (2021) Possibility of landslide damming in the Vakhsh River catchment and its effect on the hydraulic schemes and population//Proceedings of the 13th International Symposium on Landslides. - International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE). paper 164

Zerkal O., Fomenko I., Shubina D., Gorobtsov D. (2021) The influence of fracture model on rock slopes stability assessment//Proceedings of the 13th International Symposium on Landslides. - International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE). paper 137

Kang K., Zerkal O.V., Ponomarev A.A., Fomenko I.K. (2021) Probabilistic Slope Stability Assessment Under Seismic Conditions Based on the Generalized Hoek-Brown Criterion//Soil Mechanics and Foundation Engineering, 58(3). pp. 223-229

Strom A., Fomenko I., Tarabukin V., Zerkal O. (2021) Prehistoric rock slides in Dagestan (Caucasus, Russia): Justification of their seismic triggering by slopes' stability back analysis//Leading to Innovative Engineering Geology Practices: Extended Abstracts Proc. 3rd European Regional conf. of the International Association for Engineering Geology & the Environment (EuroEnGeo Athens'2020, 6-10.10.2021). Athens. pp. 141-142

Strom A., Zerkal O. (2022) Role of flysch in rock avalanches formation in the eastern sector of the Alpine-Mediterranean belt//Italian Geotechnical Journal - Rivista Italiana Di Geotecnica. 1236(2). – pp. 24-33 dx.doi.org/10.19199/2022.2.0557-1405.024

Binh Van Duong, Fomenko I.K., Kien Trung Nguyen, Dang Hong Vu, Zerkal O.V., Ha Ngoc Thi Pham (2022) Earthquake-induced landslide hazard assessment in Trung Chai commune, Sapa, Vietnam using a deterministic method//Proc. of the Earth Science and Natural Resources for Sustainable Development (ERSD'2022, Hà Nội, 11.11.2022). Hà Nội. pp. 107-112

Zerkal O.V., Averin I.V., Ponomarev A.A., Samarin E.N., Fomenko I.K., Rodkina I.A. (2023) Study and Instrumental Monitoring of Landslides at the "Russkie Gorki" Site in the Mzymta River Valley, Sochi Region, Russia//Landslides: Detection, Prediction and Monitoring/P. Thambidurai and T. N. Singh, Eds. Springer. pp. 245-261 https://doi.org/10.1007/978-3-031-23859-8_12

Also published a book (in Russian)

Trofimov V.T., Zerkal O.V., eds (2022) Sklonovie Geologicheskie Protsessy [Slope geological processes]. Moscow, Pero Publ. 724 p.