

Application Form for World Centre of Excellence on Landslide Risk Reduction
2020-2023

1. Name of Organization: CERI - Centro di Ricerca Previsione, Prevenzione e Controllo dei Rischi Geologici (Research Centre on Geological risks) – Sapienza Università di Roma
2. Name of Leader: Francesca Bozzano
Affiliation: Director of CERI
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Core members of the activities
Names/Affiliations: (4 individuals maximum)
Carlo Esposito, Department of Earth Sciences and CERI – Sapienza Università di Roma
Gabriele Scarascia Mugnozza, Department of Earth Sciences and CERI – Sapienza Università di Roma
Salvatore Martino, Department of Earth Sciences and CERI – Sapienza Università di Roma
Paolo Mazzanti, Department of Earth Sciences and CERI – Sapienza Università di Roma
3. Date of Submission of Application: August 15 2019
4. Activity scale and targeted region.
1) Global, 2) Intercontinental, **3) Continental, 4) Regional, 5) National**
5. Short Title (10 words maximum) characterizing past and planned activities:
Development of multidisciplinary and integrated methodologies for mitigating geological risks
6. Objectives for the initial 3 years: (5 lines maximum; what you expect to accomplish?)
Tuning and refinement of advanced and integrated methodologies of landslide identification and monitoring for inventorying and early warning purposes, also based on experiences from site laboratories. Refinement of methodologies for the large scale forecasting of earthquake-triggered landslide scenarios. Support for training of researchers from developing countries. Support to the implementation of the Sendai Partnership for Disaster Risk Reduction 2015-2025.
7. Background Justification: (10 lines maximum)
The CERI research centre was created with the specific objective of bringing together the knowledge of researchers from different cultural backgrounds with the aim of facilitating interdisciplinary research lines aimed at a better knowledge of geological processes to favor risk reduction practices and policies. In fact, Italy is a nation marked by a high level of risk due to natural processes, with particular reference to geological ones. The geo-hydraulic risk is of particular impact and is therefore one of the central topic of

CERI's activities over the years, as also testified by its selection as one of WCoE under the title of “Research and development of advanced technologies for landslide hazard analysis in Italy” in the period 2008–2011. Another relevant activity of CERI is represented by teaching and training addressed to post-graduate students and technicians (mainly geologist and engineers) from public bodies and private companies.

8. Resources available for WCoE activities

Personnel: 2 Full Professors; 2 Associate Professors; 1 Assistant Professor; 3 Post-doc fellows; 3 PhD students; 3 High-qualification Technicians,

Facilities:

a. Laboratories: Soil mechanics laboratory; GIS and thematic mapping laboratory; Remote sensing laboratory; Quantitative hydrogeology laboratory; Chemistry of fluids laboratory.

b. Equipment: GBInSAR systems (2); Total Robotic Station; Terrestrial Laser Scanner; GPS; Geophysical equipment: 5 Seismic dataloggers; 8 triaxial geophones; 2 triaxial accelerometers; Weather station (pluviometer, thermometer, anemometer, hygrometer); Infrared thermal camera; UAVs: 2 multicopters, 1 fixed-wing; Inclinator probe; Conventional devices for field investigations on rock masses (sclerometers, point load, Barton profilometer); Phreatimeters and multi-parametric probes for on-site groundwater characterization; Instrumented flume for simulation of shallow landslides induced by rainfall; High performance workstations; High-capacity cluster server; Advanced software for: slope stability analyses, hydrogeological modeling, management and processing of remotely sensed data, geological modeling.

c. Budgets: in the last 3 and half years (01/01/2016 – 05/31/2019) the research centre CERI had a budget of about 2.3 M€ from EU funded projects and research collaboration agreements (about 1.4 M€) and other consulting activities for private and public companies (about 0.9 M€)

d. Affiliation and Contribution to ICL/IPL-GPC: CERI is full member of ICL since 2018 and participates to the Italian Network of ICL, established in November 2018.

9. Description of past activities related to risk reduction of landslides and other related earth system disasters (30 lines maximum).

With specific reference to landslide-related issues, CERI performs basic research oriented to geohydrological hazard evaluation and consulting for both public bodies and private companies facing problems – among other – of slope stability and ground settlements. In this frame CERI has supported civil protection authorities (national, regional and municipal) as well as companies managing strategic assets (such as motorways, railways and pipelines). For sake of synthesis it is possible to summarize our

activities in two main categories, namely large scale and site/slope scale.

Large scale: landslide hazard/susceptibility evaluations to support public bodies in charge of land planning (e.g., research agreement with the Metropolitan city of Rome; research agreement with the Italian Geological Survey to perform a preliminary landslide susceptibility assessment at the national level); use of satellite imagery for landslide detection (one of the first attempts to use Sentinel 1 imagery for landslide detection has been performed by researchers from CERI in collaboration with researchers from Spain); development of advanced algorithms for satellite InSAR processing and integration with geological modeling for the identification of subsidence and sink-hole prone areas (a national research program on this topic has been funded and a research collaboration with the company managing pipelines in the metropolitan area of Rome is ongoing); implementation and update of a national database of earthquake-induced ground deformations (CEDIT catalogue); development of a probabilistic approach to provide scenarios of earthquake induced landslides.

Site/slope scale: understanding the role of mass rock creep processes in predisposing/triggering massive rock slope failures; assessment of the potential of satellite-based technologies (i.e., advanced InSAR) to forecast massive rock slope failures; numerical and physical modeling of rainfall-triggered shallow landslides; development of integrated monitoring systems for rock mass characterization and detection of failure precursor.

10. Planned future activities /Expected Results: (20 lines maximum; work phases and milestones)

Activities of CERI will be addressed to:

- the development and testing of effective methodologies and procedures to support risk reduction and emergency management policies in the framework of a regional and national interconnected system between the scientific community and stakeholders, end-users, administration personnel and land use planners.
- the promotion of the protection of cultural heritage sites affected by geological hazards in the framework of mitigation and conservation strategies;
- the promotion of international master's Degree and/or Joint PhD Programs, with particular focus on the involvement of young scientists coming from developing countries;
- the development of research projects on innovative themes;
- the management of equipped experimental sites, such as those funded by the Italian Ministry of University and Research and managed by the Department of Earth Sciences, for performing experimental activities on: i) the characterization of equivalent rheology of rock masses, for the refinement of numerical modeling and, thus, failure forecasting, by means of a "multi-physics"

monitoring system including thermal, strain and micro-vibrational sensors, ii) the refinement of multi-parametric monitoring of rock cliffs for early warning purposes, by means of an ensemble of innovative and traditional monitoring devices and techniques, especially based on remote sensing.

11. Beneficiaries of WCoE: (5 lines maximum; who directly benefits from the work?)

Research activities performed and promoted by CERI are strongly addressed to process knowledge and monitoring for risk mitigation purposes. Thus, expected beneficiaries are mainly public authorities in charge of land planning, civil protection and conservation of cultural heritage. Also public/private companies managing relevant structures and infrastructures are potential beneficiaries. Finally, young scientists are expected beneficiaries of the proposed teaching/training activities.

12. References: 10 lines maximum, i.e. relevant publications, international/regional/national recognition supporting items 9-10.

Schilirò, L.; Poueme Djueyep, G.; Esposito, C.; Scarascia Mugnozza, G. (2019). The Role of Initial Soil Conditions in Shallow Landslide Triggering: Insights from Physically Based Approaches. GEOFLUIDS

S. Martino, S. Battaglia, F. D'Alessandro, M. Della Seta, C. Esposito, G. Martini, F. Pallone, F. Troiani (2019). Earthquake-induced landslide scenarios for seismic microzonation: application to the Accumoli area (Rieti, Italy). BULLETIN OF EARTHQUAKE ENGINEERING

Trigila, A.; Iadanza, C.; Esposito, C.; Scarascia Mugnozza, G. (2015). Comparison of Logistic Regression and Random Forests techniques for shallow landslide susceptibility assessment in Giampileri (NE Sicily, Italy). GEOMORPHOLOGY

S. Martino, F. Bozzano, P. Caporossi, D. D'Angiò, M. Della Seta, C. Esposito, A. Fantini, M. Fiorucci, L. M. Giannini, R. Iannucci, G. M. Marmoni, P. Mazzanti, C. Missori, S. Moretto, D. Piacentini, S. Rivellino, R. W. Romeo, P. Sarandrea, L. Schilirò, F. Troiani, C. Varone (2019). Impact of landslides on transportation routes during the 2016–2017 Central Italy seismic sequence. LANDSLIDES

Bozzano, F.; Esposito, C.; Mazzanti, P.; Patti, M.; Scancella, S. (2018). Imaging multi-age construction settlement behaviour by advanced SAR interferometry. REMOTE SENSING

Moretto, S.; Bozzano, F.; Esposito, C.; Mazzanti, P.; Rocca, A. (2017). Assessment of landslide pre-failure monitoring and forecasting using satellite SAR interferometry. GEOSCIENCES

Fiorucci M., Iannucci R., Lenti L., Martino S., Paciello A., Prestininzi A., Rivellino S. (2017). Nanoseismic monitoring of gravity-induced slope instabilities for the risk management of an aqueduct infrastructure in Central Apennines (Italy). NATURAL HAZARDS

Bozzano F., Esposito C., Fantini A., Fiorucci M., Martino S., Mazzanti P., Prestininzi A., Rivellino S., Rocca A. and Scarascia Mugnozza G., (2017). Multisensor Landslide Monitoring as a Challenge for Early

Warning: from Process Based to Statistic Based Approaches.. Proc. 4th World Landslide Forum, Slovenia, Ljubljana, Chapter 13, 33-39

13. If your organization is an ongoing WCoE 2014-2017, please attach the articles reporting activities of WCoE, IPL project and ICL network published/contributed to either in *Landslides: Journal of International Consortium on Landslides* or/and the Fourth World Landslide Forum 2017.

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

(Those organizations with no activity report/no achievement in WCOE 2017-2020 will not be accepted as the candidate of WCOE 2020-2023 to be submitted to the Independent Panel of Experts for WCOEs.)

Note: Please fill and submit this form **by 15 August 2019** to ICL secretariat <secretariat@iclhq.org>