<D25-2> Revised version

Application Form for World Centre of Excellence on Landslide Risk Reduction 2023-2026

1. **Name of Organization**

   CAMILaB - Laboratory of Environmental Cartography and Hydrogeological Modelling.
   (University of Calabria)

2. **Name of Leader**: Giovanna Capparelli

   Affiliation: position Associate Professor, University of Calabria (Unical) - Department of Computer Engineering, Modeling, Electronics and Systems Engineering (DIMES Dept.)

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   email: lab.camilab@gmail.com giovanna.capparelli@unical.it

   Core members of the activities:

   Pasquale Versace (Professor Emeritus – Unical Dimes)

   Daniela Biondi (Assistant Professor - Unical Dimes)

   Davide L. De Luca (Assistant Professor - Unical Dimes)

   Francesco Liguori (PhD – Joung Researcher - Unical Dimes)

3. **Date of Submission of Application**: March 30 , 2023

4. **Activity scale and targeted region** : Regional, National

5. **Short Title characterizing past and planned activities**

   Risk assessment and modelling for mitigation strategies and for early warning systems

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

   The goal is to promote research and industrial development activities in order to better understand and deepen the aspects relating to the vulnerability of elements at risk exposed to natural events and to support development actions for risk mitigation to improve sustainability and environmental resilience.
   A better understanding of the dynamic nature of risk is essential for accelerating risk-informed action towards the 2030 Agenda by all actors. The group is committed to the actions promoted by Kyoto 2020 for the global promotion of understanding and reduction of the risk of landslide disasters (KLC2020),

7. **Background Justification: (10 lines maximum)**

   CAMILab is a laboratory of the University of Calabria (UNICAL). Since January 2005, it is also a Centre of Competence of the National Department of Civil Protection, for which it promotes research aimed at risk prediction and prevention, and develops general guidelines for training activities in the field of civil

protection. Through various activities, CAMILab integrates research, teaching and service actions, focusing essentially on the analysis, forecasting and prevention of hydrogeological risk. All activities are carried out in cooperation with other national and international research groups, and they are developed on several themes, from landslides to floods to rain forecasts and recently also to the effects due to seismic events. A common thread of the study of natural events to define risk mitigation strategies links each activity. Among the main ones: implementation of analytical models for the analysis and prediction of landslides and floods, experimental laboratory activity studying the triggering mechanisms of the landslides, drafting of plans of structural and non-structural strategies for risk mitigation, realization and management of the networks for hydrogeological monitoring, creation of e-learning objects.

It has also actively participated in various IPL projects as well as various activities implemented by the ICL group, such as participation in internal meetings, various editions of the WLF, contributions in Springer book volumes and in Landslides journal.

8. **Resources available for WCoE activities**

   CAMIlab (https://www.camilab.unical.it) is located at the building 41/b, fifth and seventh floors. The staff is made up of professors, PhD students, laboratory technicians and some professional collaborators (engineers and geologists). To support its hydrogeological risk mitigation studies, Camilab manages six on site monitoring network and a significant landslide simulator. The laboratory is also equipped with technologies hardware, software, and handheld probes for landslide monitoring and hydrometric stations that are able to measure continual hydraulic tail water levels in order to appreciate the phase displacement of the flood wave peaks.

   Through agreements and public financing the Lab manages to guarantee an average between 500,000 e 700,000 € each year, which allow research grants to do investigations on landslides and grants for students to undertake postgraduate studies on landslides and in general on issues related to hydrogeological risk. We also organize workshops and conferences, occasional field trips and dissemination days of results to both the scientific and public community.

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

   Camilab has pursued, within an integrated framework, the development of research, teaching and consulting activities, in the fields of competence hereafter listed.

   Development of mathematical models for landslide prediction, for flood forecasting and rainfall nowcasting.

   Design and realization of integrated early warning systems for landslide events along motorways.

   Set up and management of systems and networks for hydrogeological monitoring of the territory also in emergency conditions.

Thanks to the physical scale model located, it has provides specific simulation studies of the triggering and propagation of landslides induced by precipitation.

Production of thematic maps, databases, environmental information systems, Web GIS.

Drawing up of intervention plans to mitigate hydrogeological risk and of emergency plans at municipal, provincial and regional level.

Drawing up of plans for large areas related to the identification of vulnerable areas and the risk assessment (hazard map, vulnerability map, risk map).

Promoting landslide research among students at bachelor and postgraduate levels.

Supporting activities and collaborating with the National Department of Civil Protection.

Activities to support local authorities in emergency management and in the assessment of damage and residual risk following hydrogeological events.

10. **Planned future activities /Expected Results:**

We will continue to work on landslide impact assessment in order to identify useful procedures for defining risk scenarios and event scenarios. Particular attention to the procedures for assessing the vulnerability of people and infrastructure exposed to landslide risk.

The activities will include fieldwork, through the experimental sites already available in the laboratory, risk perception analysis, landslide modeling also by using the landslide simulator.

In particular, we oriented our activities in 2024 on studying of new landslide cases to test the performance of efficiency and reliability of the models.

A "serious games" will be proposed, capable of providing a virtual simulation with which to develop skills and competences to be applied in the real world through exercise in a simulated and protected environment (in 2025).

A pilot case study will be identified on which to develop an integrated landslide risk analysis, through the joint use of the mathematical simulation model, laboratory experimentation and in situ monitoring through dedicated sensors (2026).

The results will be the subject of publication of articles, book chapters and books related to landslide disaster risk, including those for the open access book series 'Progress in Landslide Research and Technology' organized by ICL

Alongside research activities, many actions will be developed for the dissemination and dissemination of risk culture through advanced training courses and subnational and national multi-sectoral meetings in complicity with the National and Regional Civil Protection Department.

Participate and collaborate for the success of WLF6 and subsequent editions.

Offer new opportunities dedicated to young researchers, for landslide research activities and build alliances with other houses, as academia, policy makers and professionals

11. Beneficiaries of WCoE:

The lab promotes the transfer of its research products and results to young researchers, Public Authorities, both regional and national, policymakers and practitioners operating in the field of civil protection and soil conservation, such as the Civil Protection and the Scientific Community.

12. **References**: 10 lines maximum, i.e. relevant publications, international/regional/national recognition

- Biondi, D., Scarcella, G.E., Versace, P. (2023) CERCA (Cascading Effects in Risk Consequences Assessment): An operational tool for geo-hydrological scenario risk assessment and cascading effects evaluation Hydrology Research, 2023, 54(2), pp. 189–207

- De Luca, D.L., Capparelli, G (2022) "Rainfall nowcasting model for early warning systems applied to a case over Central Italy".Nat Hazards. doi.org/10.1007/s11069-021-05191-w

- Brighenti, R., Spaggiari, L., Segalini, A., R. Savi, Capparelli, G..(2021) "Debris flow impact on a flexible barrier: laboratory flume experiments and force-based mechanical model validation". Nat Hazards 106,735–756 doi.org/10.1007/s11069-020-04489-5

- Capparelli G, Damiano E., Greco R., Olivares L., Spolverino G. (2020) Physical modeling investigation of rainfall infiltration in steep layered volcanoclastic slopes. Journal of Hydrology 580 124199, DOI 10.1016/j.jhydrol.2019.124199

- Formetta G., Capparelli G (2019). Quantifying the three-dimensional effects of anisotropic soil horizons on hillslope hydrology and stability. Journal of Hydrology, vol. 570, p. 329-342, ISSN: 0022-1694, doi:10.1016/j.jhydrol.2018.12.064

- Formetta G, Capparelli G, Versace P. (2016). Evaluating performance of simplified physically based models for shallow landslide susceptibility. Hydrology And Earth System Sciences, p. 4585-4603, ISSN: 1607-7938, doi: 10.5194/hess-20-4585-2016 8 2016

- Capparelli G, Versace P. (2014). Analysis of landslide triggering conditions in the Sarno area using a physically based model. Hydrology And Earth System Sciences, vol. 18, p. 3225-3237, ISSN: 1027-5606

- Greco R, Giorgio M, Capparelli G, Versace P. (2013). Early warning of rainfall-induced landslides based on empirical mobility function predictor. Engineering Geology, vol. 153, p. 68-79, ISSN: 0013-7952, doi: 10.1016/j.enggeo.2012.11.009

- Capparelli G, Versace P (2011). FLaIR and SUSHI: two mathematical models for early warning of landslides induced by rainfall. Landslides, vol. 8, p. 67-79, ISSN: 1612-510X, doi:10.1007/s10346-010-0228-6

- Capparelli G, Tiranti D. (2010). Application of the MoniFLaIR early warning system for rainfall-induced landslides in Piedmont region (Italy). Landslides, vol. 7 (4), p. 401-410, ISSN: 1612-510X, doi: 10.1007/s10346-009-0189-9

13. If your organization is an ongoing WCoE 2020-2023, please attach the articles as pdf files reporting activities of WCoE, IPL project and ICL network published/contributed or a list of planned reports of WCOE 2020-2023 to either journal "Landslides" or/and "P-LRT books."

(Those organizations with no activity report/no achievement in WCOE 2020-2023 will not be accepted as the candidate of WCOE 2023-2026 to be submitted to the Independent Panel of Experts for WCOEs.)

Note: Please fill and submit this form by 30 March 2023 to **KLC2020 secretariat** <klc2020@iclhq.org>

For further reference, Please find attached
- the papers published in the Landslides Journal, and the book chapters we have written for the books published by ICL (Published papers)
- brochure with some example of the products and services provided by Camilab group (the brochure is dated 2018) (Brochure Camilab_update 2018)
- the volume with the description of the landslide simulator prototype (Landslide Simulator Volume)