Date of Submission	14 December, 2021

IPL Project Proposal Form 2022

(MAXIMUM: 3 PAGES IN LENGTH)

1. Project Title

   Initiation mechanism and criteria for hydrodynamic pressure-driven landslides

2. Main Project Fields

Select the suitable topics. If no suitable one, you may add new field.

(1) Technology Development

A. Monitoring and Early Warning, B. Hazard Mapping, Vulnerability and Risk Assessment

(2) Targeted Landslides: Mechanisms and Impacts

A. Catastrophic Landslides, B. Landslides Threatening Heritage Sites

(3) Capacity Building

A. Enhancing Human and Institutional Capacities

B. Collating and Disseminating Information/ Knowledge

(4) Mitigation, Preparedness and Recovery

A. Preparedness, B. Mitigation, C. Recovery

3. Name of Project leader: Changdong Li

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Core members of the Project:

Names/Affiliations: Changdong Li/ China University of Geosciences; Yong Liu/ China University of Geosciences; Jingjing Long /China University of Geosciences.

4. Objectives:

   The project aims to provide the disaster pregnant mechanism of landslide induced by dynamic water, and the mechanical mechanism of landslide induced by dynamic water and its criterion of sliding initiation. The results and findings are expected to support the development of major landslide prediction theory with related technical system, and serve the major strategic needs of national disaster prevention and reduction.

5. Background Justification:

   Under the hydrodynamic conditions of rainfall and reservoir water fluctuation, landslides have unique law of geological structure evolution and mechanical strength degradation, which would eventually cause catastrophic instability damage. The landslide prediction and forecasting under the above hydrodynamic conditions is one of the international frontier problems in the field of engineering geology, which needs to be broken through urgently.

6. Study Area: Three Gorges Reservoir Region, China

7. Project Duration: 2022.1-2025.12
8. Resources necessary for the Project and their mobilization

   Personnel, Facilities, and Budgets:

   Faculty of Engineering of China University of Geosciences is the main organization conducting main research of the proposal. Landslide geohazard research bases in the Three Gorges Reservoir region of China including the Badong field test site and the Majiagou landslide field test site have various in-situ experiments and monitoring projects, such as large-scale geotechnical tests, underground hydrological tests, surface and subsurface monitoring equipment for the research. The overall budget of the proposal is ￥1 million.
9. Project Description:

   Focusing on the key scientific problems of the sliding initiation mechanism and initiation criteria of hydrodynamic pressure-driven landslide, this project studies the physical and mechanical mechanism of landslide initiation from two aspects of strength degradation and seepage drive. Firstly, the time-space evolution law of seepage characteristic parameters of landslide under complex hydrodynamic conditions is revealed by carrying out the well-designed test of landslide seepage field. Subsequently, the macro- and meso- mechanical experiments including the shear-flow coupling test were conducted to clarify the multi-scale strength degradation mechanism of sliding zone under the complex hydrodynamic actions. The pore pressure-driven ring shear test and large-scale physical model test are then adopted to reveal the dynamic water response law and initiation mechanical mechanism of landslide. Based on the initiation mechanics and identification model of critical unstable state of the landslide, the threshold system of landslide instability and landslide initiation criterion are constructed.
10. Work Plan/Expected Results:

    (1) The representative hydrodynamic pressure-driven landslides in study area are chosen as the examples, combined with the field investigation and data collection, the landslide geological model which is sensitive to dynamic pressure is constructed. The temporal-spatial evolution law of landslide seepage key characteristic parameters is revealed under the hydrodynamic conditions, such as different precipitation intensity, duration and reservoir water level variation.

    (2) The microstructural evolution process of hydrodynamic sliding zone of accumulated landslides and bedding rock landslides is studied. The dynamic expansion mechanism of macroscopic structure of hydrodynamic sliding zone is proved. The strength deterioration law of hydrodynamic sliding zone is clarified, and the strength deterioration model of hydrodynamic sliding zone is established considering hydrodynamic and structural characteristic parameters.

    (3) The geo-mechanical model of landslide considering the controlling structure, dynamic seepage and strength deterioration is constructed to study the dynamic response law of stress field and strain field of landslide with multiple effects of hydrodynamic conditions.

    (4) The landslide strain field response model is constructed under the framework of multi-parameter linkage evolution rules. The critical instability state identification model of landslide is proposed, the critical instability threshold system of landslide is established, and the landslide starting

criterion based on the threshold system of landslide is constructed.

11. Deliverables/Time Frame:

(1) 2022.1-2022.12: Publish 2 SCI Papers, cultivate 2 post-graduate students.

(2) 2023.1-2023.12: Publish 2 SCI Papers, cultivate 2 post-graduate students.

(3) 2024.1-2024.12: Publish 2 SCI Papers, cultivate 3 post-graduate students, apply for a national invention patent.

(4) 2025.1-2025.12: Publish 3 SCI Papers, cultivate 2 post-graduate students, carry out a technical training and popular science activity for landslide geological disaster prevention, and publish a related monograph.

12. Project Beneficiaries:

The project focus on the key scientific problems about the initiation mechanism and criteria of hydrodynamic pressure-driven landslides in China Three Gorges Reservoir area, which is the fundamental work to construct a reliable and effective landslide early warning system and serve the major strategic needs of national disaster prevention and mitigation.

13. References (Optional):

[1] Li C, Long J, Liu Y. et al. (2021) Mechanism analysis and partition characteristics of a recent highway landslide in Southwest China based on a 3D multi-point deformation monitoring system. Landslides. https://doi.org/10.1007/s10346-021-01698-2

[2] Long J, Li C, Liu Y. et al. (2021) A multi-feature fusion transfer learning method for displacement prediction of rainfall reservoir-induced landslide with step-like deformation characteristics, Engineering Geology, 106494. https://doi.org/10.1016/j.enggeo.2021.106494.

Note: Please fill and submit this form by 15 December 2021 to ICL Network <icl-network@iclhq.org> and ICL secretariat <secretariat@iclhq.org>