Date of Submission	April 6th, 2019

IPL Project Proposal Form 2018

(MAXIMUM: 3 PAGES IN LENGTH)

1. Project Title: (2 lines maximum)

Evolution mechanism and control of landslides induced by sudden rainstorm.

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: Huiming Tang

Affiliation: (office and position)

Vice President, China University of Geosciences (Wuhan), China.

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Core members of the Project

Names/Affiliations: (4 individuals maximum)

Prof. Changdong Li/ Faculty of Engineering, China University of Geosciences (Wuhan), China.

Dr. Yunfeng Ge/ Faculty of Engineering, China University of Geosciences (Wuhan), China.

Dr. Jiaqing Zhou/ Faculty of Engineering, China University of Geosciences (Wuhan), China.

Mr. Wenqiang Chen/ Faculty of Engineering, China University of Geosciences (Wuhan), China.

4. Objectives: (5 lines maximum; what you expect to accomplish?)

(1)Establish geological and meteorological coupled model for the analysis of sudden rainstorm-induced landslide.

(2) Investigate the threshold level of rainfall for sudden rainstorm-induced landslide.

(3) Reveal the formation and evolution mechanisms of sudden rainstorm-induced landslide.

5. Background Justification: (10 lines maximum)

A large number of examples show that rainstorm is the main cause of landslides. The sudden rainstorm has the features of short term and high intensity, which tends to cause extensive and serious geological hazards. Critical rainfall threshold plays an important role in predicting landslide hazards. From the current literatures, few researches combine 3S technology with integrated environmental geological conditions to

investigate the early warning model for the rainstorm disaster, which requires more in-depth studies. Moreover, systematic researches on the multi-field information during the evolution process of landslides and the formation and evolution mechanisms of sudden rainstorm-induced landslides under complex geological structure conditions are also a very meaningful topic. The research results have important scientific and theoretical significance and extensive engineering application value for the monitoring, early warning and control of landslides in the Three Gorges Reservoir areas of China.

6. Study Area: (2 lines maximum; where will the project be conducted/applied?)

Baijiabao landslide, one of the most representative sudden rainstorm-induced landslides in the Three Gorges Reservoir area, China.

7. Project Duration: (1 line maximum)

Start and finish time: 2019.4 - 2022.4 Project duration: 36 months

8. Resources necessary for the Project and their mobilization

1) Personnel:

10 members (including: 4 Ph.D candidates and 6 postgraduates)

2) Facilities:

Intelligent data acquisition equipment and high-speed camera monitoring system, model test system for landslide physical model test, three-dimensional laser scanner, unmanned aerial vehicle etc.

3) Budgets:

30,000 US dollars in total (including lab facility cost (12,000 USD), field survey cost (15,000 USD), service and print charges (3,000 USD)). Amongst of them, we can obtain the contribution of 20,000 USD from the National Key R&D Program of China; consequently, the total expected through funding from a grant is 10,000 USD.

9. Project Description: (30 lines maximum)

(1) Establish geological and meteorological coupled model of sudden rainstorm-induced landslide

Research the deformation characteristics and failure mode of Baijiabao landslide via field investigation. By utilizing the comprehensive means of aerospace image, UAV photography, engineering geological subsurface drilling and field survey, automatic monitoring, etc., establish the fine geomechanics model of Baijiabao landslide. Based upon multi-channel satellite and integrated surface meteorological and hydrological monitoring system, investigate the characteristics of surface runoff and slope unsaturated seepage of sudden rainstorm and further to establish the geological and meteorological coupled analysis model of sudden rainstorm-induced landslide.

(2) Determine critical rainfall threshold of sudden rainstorm-induced landslide

Based on the landslide distribution data and meteorological data in the study area, develop the rainfall isoline model and identify the sensitive region of the study area. Using data mining algorithms such as Apriori and FP-tree, the correlation analysis between landslide and sudden rainstorm events in the study area as well as simulation experiments will be carried out to research the critical rainfall thresholds at different time scales for Baijiabao landslide under sudden rainstorm conditions.

(3) Reveal the formation and evolution mechanisms of sudden rainstorm-induced landslide

Apply the monitoring data of meteorology, surface and subsurface displacement, stress and seepage etc.

to analyze the multi-field response characteristics of Baijiabao landslide under sudden rainstorm condition. Perform laboratory and field tests to obtain the physical and mechanical parameters, deformation and structural characteristics of the rock and soil of Baijiabao landslide. By means of the physical model experiment and numerical simulation methods, explore the evolution law of multi-field parameters in the evolution process of landslide under sudden rainstorm condition and further reveal the formation and evolution mechanisms of sudden rainstorm-induced landslide.

10. Work Plan/Expected Results: (20 lines maximum; work phases and milestones)

(1) Establish fine geomechanical model and coupled geological-meteorological analysis model of Baijiabao landslide under sudden rainstorm condition through field investigation and sudden rainstorm process characteristics monitoring work.

(2) Collect landslide distribution data and meteorological data to establish rainfall isoline model of the study area. Determine the critical threshold level of rainfall at different time scales based on the correlation analysis between landslide and sudden rainstorm events in the study area.

(3) Obtain the multi-field response characteristics of Baijiabao landslide under sudden rainstorm condition, and reveal the formation and evolution mechanisms of the Baijiabao landslide induced by sudden rainstorm.

11. Deliverables/Time Frame: (10 lines maximum; what and when will you produce?)

(1) Illustration of the deformation and failure characteristics of Baijiabao landslide under sudden rainstorm conditions and the rainfall characteristics by field investigation and rainfall monitoring work, and establishment of the coupled geological-meteorological analysis model for sudden rainstorm-induced landslide; 2019.4-2019.11.

(2) Illustration of the procedure and results of the correlation analysis between landslide and sudden rainstorm, and determination of the threshold level of rainfall at different time scales in the study area; 2019.12-2021.7.

(3) Development of a multi-field characteristic monitoring system and physical model experimental device and method for sudden rainstorm-induced landslide; Report the relevant research results on its formation and evolution mechanism; 2020.8-2022.4.

12. Project Beneficiaries: (5 lines maximum; who directly benefits from the work?)

Local residents who are threaten by landslide hazards in the Three Gorges Reservoir Area. Government staffs who are responsible for the policy making of landslide management and the formulation of standards for landslide prediction and early warning and professional technical companies who work on the prevention and control of landslide hazards in reservoir areas. Researchers who are engaged in researches related to rainstorm-induced landslides.

13. References (Optional): (6 lines maximum; i.e. relevant publications)

(1) Tang, H., Li, C., Hu, X., Su, A., Wang, L., & Wu, Y., et al. (2015). Evolution characteristics of the huangtupo landslide based on in situ tunneling and monitoring. Landslides, 12(3), 511-521.

(2) Li, C., Wu, J., Tang, H., Hu, X., Liu, X., & Wang, C., et al. (2016). Model testing of the response of stabilizing piles in landslides with upper hard and lower weak bedrock. Engineering Geology, 204, 65-76.