

Progress Report of NEA - ICL Networks
1st January 2016 to 31st December 2017

1. Project Title of Network: North East Asia ICL Network (NEA-ICL)

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3. List of member organizations

- 1) China Geological Survey
- 2) Institute of Cold Regions Science and Engineering, Northeast Forestry University
- 3) Institute of Mountain Hazards and Environment, Chinese Academy of Sciences
- 4) Tongji University
- 5) Kyoto University, DPRI,
- 6) Forestry and Forest Product Research Institute
- 7) Japan Landslide Society
- 8) Korea Institute of Geoscience and Mineral Resources (KIGAM)
- 9) Korean Society of Forest Engineering
- 10) National Institute of Forest Science
- 11) Korea Infrastructure Safety & Technology Corporation
- 12) Korea Institute of Civil Engineering and Building Technology

4. Progress report of activities up to December 2017

4.1. Progress Report of Institute of Mountain Hazards and Environment Progress Report for 2016 and 2017

4.1.1. For year 2016

1. Annually, the amount of various program undertaken by the key laboratory in IMHE is 73, with the total funding of 57.47-million RMB, including 30 national or CAS program and 12 program supported by National Science Foundation of China. In the aspect of academic achievements, there are 94 papers published taking the laboratory as the first author affiliation and 24 patents approved.
2. The Shenzhen landslide which occurred in December 20th, 2015 is a typical ultra-long-distance landslide. The traditional quantitative assessing methods and the Mohr-Coulomb Model are neither available to conduct analysis for this landslide. Using Massflow code that developed by our institute, a new method was produced to conduct quantitative risk assessment for the damaging ranges of similar landslides and the research achievement was published in Landslides.

3. Based on previous research achievements and concluding the avalanche occurred after Wenchuan Earthquake, Nepal Earthquake and Ludian Earthquake, a specific analysis was conducted and the water eroded two-layer flow model of landslide was proposed
4. From May 22nd to 29th, 2016, The Training Course on Evaluation, Prediction and Warning for Earthquake Induced Mountain Hazards was hosted by the CAS key laboratory of mountain hazards and earth surface process at IMHE and attracted over 20 candidates from Nepal, Pakistan, India and Bhutan. It would be beneficial for deepening regional disaster reduction cooperation and improving disaster reduction capacity of developing countries.
5. The 1st International Workshop on Natural Hazards Risk Reduction for the Silk Road Economic Belt and the 21st Century Maritime Silk Road was held in Beijing on November 8th and 9th, 2016. The representatives from German, Russia, India, Nepal and etc. participated the workshop, including a huge amount of experts in disaster reduction area.
6. Institute of Mountain Hazards and Environment established a simulation platform in worldwide which considered the debris flow dynamic analysis in forming, running, accumulating, and regulating. Also, a debris flow prevention theory and technology system about forming-process material regulation and energy dissipation was produced to provide systemic solutions for future major debris flow.

4.1.2. For year 2017

1. The CAS Key Laboratory of Mountain Hazards and Earth Surface Process at IMHE undertook 84 programs or projects in total with 58.99 million RMB funding, including 22 national programs or projects. As for academic achievements, there are 106 paper published taking the laboratory as the first author affiliation.
2. IMHE sent several teams to provide scientific and technical support for disaster risk reduction after the major landslide occurred in Maoxian, Sichuan Province on June 24th, 2017 and the earthquake occurred in Jiuzhaigou Village on August 8th, 2017.
3. From July 17th to 18th, Institute of Mountain Hazards organized the 2017 CPEC Natural Disaster and Integrated Disaster Mitigation Conference & The 2nd Belt and Road Natural Disaster and Integrated Disaster Mitigation Conference, which was co-hosted by Chinese Academy of Sciences and Pakistan Academy of Sciences, and comprehensively deepened the cooperation between China and Pakistan in disaster prevention and reduction.
4. From September 2nd to 9th, Institute of Mountain Hazards organized the Developing Countries & Countries along Belt and Road Program Science and Technology Training Program and over 110 experts and government officers from 7 countries, including China, Pakistan, Nepal etc., participated in this program. It contributed to improving the disaster prevention theory and technology of these developing countries and established solid foundations for potential scientific cooperation.
5. An invention patent, which is called A Multi-Stage Monitoring and Early Warning System on Landslide Disasters, was produced and could provide a more accurate monitoring and early warning for disaster prevention.
6. Institute of Mountain Hazards and Environment organized and undertook the geological disaster

assessing works on Zhangmu Border (border between China and Nepal) after the earthquake occurred there on April 25th. A new understanding about multistage and multilayer of the landslides there was proposed and applied into practical assessment

4.2. Progress Report of Japan Landslide Society (JLS)

- 1. In 2017, totally 41 persons died or went missing in northern Kyushu in Japan due to the disaster of localized torrential downpours over a period of several hours, triggered by rainbands, or a group of cumulonimbus clouds running dozens of kilometers. Immediately after the disaster, JLS dispatched the emergency investigation team into the suffered areas to give technical advice to the related organs. According to the results obtained from the survey, essential facts relevant to the slope failure mechanisms were made clarified. Based on this activity, more effective countermeasures and risk assessment procedures for similar types of slope disasters can be developed in the future.*
- 2. Mechanism of rainfall-induced shallow landslides on tephra-covered slopes and susceptibility mapping have been studied in collaboration with National Institute for Land and Infrastructure Management, MLIT, Japan in April 2014-March, 2017. Based on field survey, experiment of model slopes, and FEM analysis on slope stability, contrast in permeability and soil hardness in stratified tephra layers makes slopes unstable during heavy rain. From the shallow landslide cases in Mt.Aso and Izu-Oshima Island, A landslide susceptibility mapping method has been proposed using GIS analysis on slope and relief factors, estimation of tephra thickness on slopes, and infinite slope stability analysis.*

4.3. Progress Report of Korea Institute of Geosciences and Mineral Resources (KIGAM)

Development of ICT-based landslide early warning system using predicted rainfall information

The ICT-based landslide early warning system is mainly composed of three technologies: the landslide prediction model, the debris flow mobility model, and the forecast rainfall interlocking technology. The landslide prediction model includes spatial and temporal dynamics of surface and subsurface water flow and unsaturated slope stability analysis considering suction stress. The numerical simulation of debris flow mobility is based on shallow water equations with Voellmy model. Rainfall-induced landslide thresholds and potential landslide hazards are based on the weather forecast information provided by Korea Meteorological Agency. The forecast rainfall is updated every 3 hours.

The landslide monitoring system are constructed at 11 locations in the national park areas, and the landslide detection system (S/W) was set up to manage the monitoring system and store the measured data from the monitoring sites. The landslide detection system (S/W) is constructed on the cloud server (G-Cloud, KT) to save and provide the monitoring data stably; and also landslide prediction map and landslide inventory sheet are loaded in the system.

4.4. Activities of National Institute of Forest Science (NIFoS), Republic of Korea, as a member of the ICL-NEA network in 2016-2017

1. To construct and operate long-term monitoring systems for four landslide sites, namely two shallow landslide-prone sites and two slow-moving landslide sites, around urban areas
2. To identify recent 35 slow-moving landslide sites in the whole country
3. To develop the procedure and method of our own field investigation for sites damaged by slow-moving landslides
4. To develop a method of evaluating susceptibility of earthquake-induced landslide considering the characteristics of earthquakes occurred in Republic of Korea (on-going)