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Rainfall-induced Landslide Monitoring Using Self-potential Approach

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Landslides are one of the most severe natural disasters in the world and there are two types; rainfall induced landslides and landslides triggered by an earthquake triggering. In China, Korea, and Japan, landslides frequently happen with heavy rainfall and make many losses of lives, houses, roads, railways, and lifelines such as power, gas, water, etc. In this proposal, basic study on early warning system for landslides will be investigated to understand landslide process through hydrological and electromagnetic changes. The final goal of the project is to develop a simple methodology for landslide monitoring/forecasting using self potential method in the frame work of joint research among China, Korea, and Japan.

The proposed project is developing a new scientific and technical methodology for prevention of natural soil disasters. The outline of the project is as follows; (1) basic understanding on the relationship between resistivity distribution and moisture in soil and their visualization of their dynamical changes in space and time using tomography technique, (2) laboratory experiments of rainfall induced landslides and sandbox for practical use of the basic understanding, (3) in-situ experiments in China, Korea, and Japan for evaluation. In consideration above, integration of geological, hydrological, geotechnical characteristics with electromagnetic one are essential. Furthermore, systematic procedure will be taken such as differences in soil and mean radii of soils. For the laboratory experiments of rainfall induced landslide, we use the equipment at Forest and Forestry Product Research Institute, Tsukuba, Japan.

Conventional methods to monitor landslides are based on geotechnical and hydrological approaches to measure pore pressures and displacement on the surface. In these methods, boreholes are required in general and may disturb the subsurface water system. Making boreholes causes a higher cost for monitoring and it is not so practical for field applications. On the other hand, self potential measurement to measure the surface potential difference using two electrodes is easy to set up and measure continuously. If the distribution of resistivity under the ground or soil moisture changes can be detected and can be visualized in space and time, we can have the remote sensing technique for monitoring the soil moisture or water content in the ground. The main purpose of this proposal is to establish a simple system for landslide monitoring/forecasting (early warning system) using electromagnetic approach through basic understanding on electromagnetic property based on hydrological, geotechnical, and geological changes.