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Investigation on Hydro-Electric Coupling by Sandbox and Indoor-Flume Experiments

Hiroshi Otsubo[1)], Katsumi Hattori[1)], Hiroaki Ochiai[2)], Kohei Okada[2)], Tomomi Terashima[3)], Eichiro Miyahira[3)], Bun-Gong Chae[4)], Qinghua Huang[5)]

1) *Graduate School of Science, Chiba University, JAPAN*

2) *Forestry and Forest Products Research Institute, JAPAN*

3) *DPRI, Kyoto University, JAPAN*

4) *KIGAM, KOREA*

5) *Peking University, CHINA*

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. In this research, basic study on early warning system for landslides will be performed to understand rainfall-induced landslide process by hydrological, geotechnical and electromagnetic changes. The final goal of the research is to develop a simple methodology for landslide monitoring/forecasting using self-potential method. Conventional methods for monitoring landslides are based on geotechnical and hydrological approaches measuring pore pressures and displacements on the surface. In these methods, boreholes are required in general which may disturb the subsurface water system. Making boreholes is costly and it is not so practical for field applications. On the other hand, self potential measurement using two electrodes is easy to set up and run continuously.

To understand the relation between self-potential changes, water flow and landslide, we conduct two different laboratory experiments. One is the sandbox experiment that we can conduct repeatedly and the other is the indoor rainfall-induced landslide experiment. In sandbox experiment, experiments have been performed with various water conditions and the relation between the water flow and self potential has been investigated. In several of indoor rainfall-induced landslide experiments show the result that the transient changes of self potential variation appear a few ten minutes before the main collapse.

Through indoor experiments, the coupling of hydraulic gradient and self-potential can be understood. It is found that the coupling, that is called electro-kinetic coupling, determines general tendency of self-potential and the transient changes could be related to the soil displacement. The details will be given in our presentation.

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