Geophysical Research Abstracts
Vol. 13, EGU2011-13321-1, 2011
EGU General Assembly 2011

Potential indicator for future landslide behavior: duration between time of soil saturation and time of failure

Sandy Budi Wibowo
Institut de Géographie, UFR de Géographie, Université Paris 1 Panthéon - Sorbonne, Paris, France (sandy_budi_wibowo@yahoo.co.id)

The landslide researches have been done since more than 150 years. However, innovative researches are still expected, especially on the triggering processes and its duration to better understand its natural processes. Therefore, as a new parameter, the duration between time of soil saturation and time of failure is proposed in this research by carrying out “homemade” landslide simulations and measuring the time needed for each sample. The aim of this study was to analyze this new parameter in order to describe the landslide behavior in the Brantas watershed in Java Island, Indonesia.

The investigation was conducted in four landslide locations, two of which were dominated by clay soils and the others by silty soils. This research was begun by the first soil sampling and laboratory analysis (soil texture, saturated hydraulic conductivity, soil porosity and bulk density) in order to determine the surface of rupture. The location of the slip surface in soil profile was determined at soil horizon boundary where the most contrasting soil properties between two horizons (upper and lower) existed. The second soil sampling was performed using landslide simulation tubes that were created by respecting the calibration of area ratio. In this undisturbed soil sampling, we took an upper horizon, a slip surface and a lower horizon in one tube. The slip surfaces were located in the middle of the tubes and represented soil dips of 40° and 70°. We repeated this soil sampling 10 times for every soil dip in every location. Thus, the total of soil sampling for landslide simulation was 80 samples. Moreover, every tube was soaked during 24 hours to reach the saturation point as the initial condition of soil sample in the simulation. The landslide simulation was applied with a rainfall simulator designed only for this tube. It produced a rainfall intensity of 50 mm/hour. During the landslide simulation, we calculated the time span between the soil saturated point and soil failure. We determined also the displaced and undisplaced material based on the simple formulas that were adapted from the calculation of bulk density.

The results showed that the duration between time of soil saturation and time of failure for clay soils was generally longer than for the silty soils. The duration for soil dip of 40° was also longer than that of 70°. The material within the landslide simulation tube consisted of displaced soil, displaced water, undisplaced soil, and undisplaced water. The volume of displaced and undisplaced clay soils was larger than the one of silty soils. However, the displaced soil occurred in soil dip of 70°, whereas the undisplaced soil often happened in soil dip of 40°. The displaced and undisplaced water quantity in silty soils was larger than in clay soils. The displaced water occurred in 70°, while the undisplaced water happened in soil dip of 40°.

The duration between time of soil saturation and time of failure was able to describe the landslide behavior and the duration of the landslide triggering process in Brantas watershed. In spite of the great fluctuation of this potential parameter, the 10 repetitions could help to assume the landslide behavior in different textures and soil dips. The calculated materials indicated that the slip surface didn’t exactly follow the shape of soil horizon boundary, especially in the case of clay soil landslides. This homemade physical landslide simulation was cheap but still capable of calculating the displaced material and allowed the measurement of the proposed parameter. It would be useful to predict the future landslide mechanism.