

Application of self potential prospecting to groundwater survey on a landslide slope

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An efficient and simple survey method of actual flow mechanism of groundwater is requested for slope conservation and underground material transportation. Underground temperature survey and tracer test are commonly conducted for this purpose. Self potential (SP) prospecting was applied to survey of groundwater flow system and confirmation of drainage works. Streaming potential closely related to seepage causes higher potential at the lower part of a slope than the upper part under the condition of negative zeta potential.

SP prospecting was conducted in a landslide area in Miyagi Prefecture where slope failure was caused by an earthquake in 2003. The slope was reclaimed about 30 years ago on a hill of pyroclastic flow deposit. Ground surface SP was measured in December 2003, seven month had passed since the slope failure and in June 2004, after construction of a drainage well and collecting borings as landslide mitigation. Survey area was about 150 x 100 m at the upper part of the collapse. SP was measured as potential difference between the measurement point and the fixed reference point using lead-chloride type non-polarized gypsum electrodes and a high input impedance DC voltmeter. The position of measurement points was determined by DGPS. SP distribution map was generated by kriging method and compared between two observations with GIS software.

It was estimated a plain area in the northwest of the collapse where low SP was observed was the recharge zone and groundwater concentrated in the northern area close to the collapse where higher SP was observed. After the construction of drainage works, SP decreased almost all the area, especially within the area of collection boring catchment. Averaged SP change was -8.5 mV. Increase in SP was found in a borehole at the depth of 10 meters where collection borings were installed. These phenomena indicated drainage works collected groundwater and lowered shallow groundwater potential. Actually, lowering of groundwater potential by 1m or more has been measured at the observation station since construction of drainage works.