Preliminary application of electrical resistivity tomography to estimate subsurface structure of unchanneled valley: A case at granitic hillslope near Mt. Tsukuba, Japan

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Subsurface structure, for example, depth of soil-bedrock interface, is one of the important factors for shallow landslide. Estimating spatially continuous subsurface structure requires an enormous amount of work and time, and more efficient survey method improves our understanding as well as the work time. Electrical resistivity tomography (ERT), which has conventionally been used for groundwater survey, is potentially useful for visualization of shallow subsurface structure. Therefore, we conducted ERT, cone penetration test and some soil tests at an unchanneled valley underlain by weathered granite near Mt. Tsukuba, Japan, and discussed the applicability of ERT imaging for estimation of shallow subsurface structure.
Little antecedent precipitation was observed before the ERT survey. Distribution of resistivity obtained from ERT with 0.5-m electrode spacing visualized the depth of loose soil (N_c = 3) as a band of a specific resistivity range (4000–10000 Ωm). However, the depth of soil-bedrock boundary (N_c = 30) did not correspond to any specific resistivity range. The resistivity distribution and the result of some soil tests indicate that surface layer was dry at the survey, and the deeper layer was wet because of bedrock groundwater. Thus, we presumed that surface electrical conductivity of the slope materials affected the resistivity value in the shallower layer, and that liquid electrical conductivity affected the resistivity value in the deeper layer that contain bedrock groundwater.

Keywords: Shallow landslide, Unchanneled valley, Granite, Electrical resistivity tomography, Subsurface structure

