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Visualization of Groundwater Motion Using Self-Potential Tomography for Indoor Rainfall-Induced Landslide Experiment
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As it increases in the frequency of the local heavy rain in recent years, the occurrence number of the landslide also increases. It's an important problem to elucidate the process of the landslide caused by rainfall and monitor the slope and forecast the occurrence time to reduce damages. To achieve this, we need to monitor groundwater movement. In this study, we try to develop the early warning system with SP method to predict/monitor rainfall-induced landslide.

The relationship between the SP fluctuation, the movement of water, and the displacement of soil is confirmed by the former interior flume experiments. We adopt the PRESS-aided Philips-Tikhonov regularization to develop the SP tomography and sand-box experiments to apply the tomography successfully show the water levels and flows. To expand the SP tomography approach to the flume tests, we perform the numerical simulation to visualize the underground water condition. The size of the slope is depth 9.0 m, height 4.8 m and width 1.0 m. And the height of the soil stratum is 0.7 m. We assume a rectangular reconstruction area and we divide the area into a 0.2 m x 0.1 m pixel, and compute the value of electric charge every pixel. In addition we assume the electric charge outside of the slope area is 0 and the permittivity in the analyzed area is uniform. Checkerboard-like positive and negative electric charges are generated and the number of electrodes was changed with 16-85. An error of 10% of the observation value has been added to data observed at electrodes.

We found the following results; (1) it's possible to reconstruct the structure of charge distribution with scale of 1.2 times greater than the inter-electrode distance. (2) the objective selectivity of the optimal reconstructed image with minimum PRESS criterion fails in the case of sparse electrodes.

Keywords: Self-Potential Tomography, PRESS-aided Philips-Tikhonov regularization, visualize underground water condition