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Commentary

Landslide Detection with Electrical Resistivity Tomography (ERT) Method

Michael E. Brown*

Department of Geosciences, Mississippi State University, Mississippi, USA

DESCRIPTION

The topmost layer of the earth's surface that is created on-site or transferred and deposited in its current location is called soil. It is referred to as residual soil and is created *in-situ* as a result of the basement rock beneath deteriorating. The production of residual soil is heavily influenced by the local climate, terrain, rock type, age, and drainage. The parent rock type has a significant impact on the characteristics and kind of this soil. For instance, acidic rock with high silica quartz content, known as felsic rock, weathered into a light-colored porous sand soil with quartz grains and clay. Additionally, basic rock with a low silica concentration weathered into soil with a high percentage of clay and a dark color. Particularly in the humid tropics of the world, residual soils are frequently found in unsaturated conditions above the groundwater table. In humid tropics all over the world, prolonged excessive rainfall has been a prominent element that is causing an increase in slope instabilities in the residual soil within slope areas. The slope instabilities developed as shallow landslides, which are common in slopes of residual soil, during long periods of extreme rainfall. The unsaturated zone (vadose zone) of the soil frequently experiences destructive shallow landslides, with the corresponding slip surfaces occurring above the groundwater table. They significantly alter the landscape and landform on the surface of the earth. In order to recognize and predict the occurrence of small landslides and lessen the impact of their devastation, it is essential to have knowledge of the elements that regulate the movement or displacement of shallow landslides during heavy and prolonged rainfall. Understanding the spatial patterns of landslides can be greatly improved by quantifying the stress that has been created within the residual soil as a result of its mechanical properties. The body, orientation, and depth of the landslide can all be determined *via* subsurface imaging of the soil water distribution. However, because it is quick, rapid, and non-invasive, the use of the geophysical technique known as Electrical Resistivity Tomography (ERT) to characterize unsaturated residual soil with significant soil spatial variability is particularly suited.

The ERT method is a technique for electrical testing in which two current electrodes induce current in the ground. Next, two more electrodes are used to measure the electrical potential drop. There are numerous designs of electrode arrays that can be employed, but they are all intended to collect data that can be used to estimate lateral and vertical variations in ground resistivity values. Geologic differences such as soil lithology (such as the difference between clay and gravel), the presence of ground water, fracture zones, variations in soil saturation, areas of elevated salinity, or, in some situations, ground water contamination can all be mapped using ERT. Although in the majority of geologic situations Multi-Channel Analysis of Surface Waves (MASW) or Seismic Refraction Tomography (SRT) are better suited for mapping top-of-bedrock, ERT can be utilized to map bedrock depths and shape. For mapping cavities like caves, karst, and/or evaporite dissolution sinkholes, ERT is frequently the best option. Similar to seismic, electrical imaging can be produced in 1D (vertical electrical sounding), 2D (profile), or 3D (volume). Electric current can flow through fluid in the voids and pores of rocks and soil when using ERT. When the presence of clay minerals or different porosities is the reason for differences in resistivity, ERT is capable of differentiating distinct lithologies with contrasting resistivity. The working principle of ERT method is linked with Ohm's law ($\Delta V=IR$). Through the controlled injection of an electrical current into the subsurface and measurements of the potential difference between pairs of electrodes at the surface, general ERT prospecting is frequently used to look into electrical resistivity structures. Using pairs of current electrodes to inject current (I) into the ground and potential electrodes to detect the potential difference (ΔV) between two randomly chosen places within a predetermined distance.

Correspondence to: Michael E. Brown, Department of Geosciences, Mississippi State University, Mississippi, USA, E-mail: ebrown.mich@gmail.com

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