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Resistivity profile of mountain slopes after deep catastrophic landslides caused by earthquake in Japan

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An airborne electromagnetic (AEM) survey can be used to estimate the resistivity structure underground by measuring the electromagnetic induction. An AEM survey can quickly obtain the resistivity in the depth direction for a wide area. The resistivity varies with the type of rock, water saturation, porosity, and clay mineral content. This study targeted the deep catastrophic landslide (DCL) triggered by the Iwate-Miyagi Inland Earthquake in 2008 on the slopes of Mt. Kurikoma, which is an active volcano in northeastern Japan. Fluidized material slid down the slope and struck a small spa, resulting in the loss of human life. When considering mitigation measures, it is important to predict those slopes where DCLs might occur. This study estimated the scale of the slopes at risk of DCLs.

First, we conducted a field survey and confirmed the distribution of geological conditions and collapse. Soft altered tuff breccia was spread over the entire slope, while andesite covered a head cliff on the upper slope. It was thought that the DCL occurred at the andesite cap rock, at the slip plane boundary of the andesite and altered tuff breccia.

Next, we conducted an AEM survey over a wide area, including the landslide. While the specific resistance of the uncollapsed zone was $\geq$ 400 Ω-m, that of the collapsed zone was $\leq$ 100–200 Ω-m.

Finally, comparing the results of the field and AEM surveys, the spatial distribution of the specific resistivity roughly corresponded to the underground geological setting, such as andesite cap rock. Based on the distribution of the high-resistivity zone, the slopes at risk of deep-seated landslides and the collapsed soil layer thickness could be estimated.

In conclusion, in order to evaluate the risk of a DCL, it is necessary consider underground information. An AEM survey is a practical method for evaluating the risk of a DCL.