Assessing Potential Landslide Areas Due to Earthquake Using Three-Dimensional Resistivity Datasets from Across a Wide Area

*Yusuke Sakai[1], Taro Uchida[1], YASUMASA FUJIWARA[2]

1. National Institute for Land and Infrastructure Management , 2. Eight-Japan Engineering Consultants

In recent years, sediment disasters due to earthquake have often occurred, including in the 2011 Great East Japan Earthquake, the 2016 Kumamoto Earthquake, the 2018 Hokkaido Eastern Iburi Earthquake. Measures for preventing and reducing the damage of sediment disaster due to earthquake are an urgent issue, because Nankai Trough Earthquakes are expected in the future. A variety of methods for assessing seismic landslide susceptibility have been proposed and their accuracy verified. In those methods, topographic parameters such as inclination of slope, curvature of slope, and relief are commonly used as controlling factors.

It has also been reported that underground structure has a large impact on seismic landslide occurrence, as in the case of the landslide that occurred around the Aso Volcanological Laboratory of Kyoto University in the 2016 Kumamoto Earthquake. Therefore, underground structure can be considered critical information for improving the predictability of potential landslide areas. However, geological maps only plot spatial patterns of the underground condition, and boring is required to obtain point information of underground structure in the depth direction. This lack of three-dimensional information of underground structures is one of key obstacles to evaluating potential landslide areas due to earthquake across a wide area.

Therefore, we used resistivity spatial patterns measured by airborne electromagnetic survey (AES). Airborne electromagnetic survey Based on electromagnetic induction, AES is an exploration technique for obtaining three-dimensional resistivity across a wide area by measuring the response to an induced electromagnetic field with an electromagnetic sensor from a helicopter.

The purpose of this study was to test the applicability of three-dimensional resistivity data to assessing seismic landslide susceptibility. We used three-dimensional resistivity data from the central cone of Aso Volcano measured before the 2016 Kumamoto Earthquake and landslide distribution maps made from airborne laser scanner datasets and orthoimages from before and after the earthquake. We identified the three-dimensional resistivity patterns in seismic landslide areas before landslide occurrence. Based on our findings, we argue the applicability of three-dimensional data for assessing seismic landslide susceptibility.

Keywords: resistivity, airborne electromagnetic survey, landslide, earthguake

