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The role of bedrock geology, rock uplift rate and topography on large catastrophic landslide occurrence

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For shallow landslide, many methods have been proposed to evaluate the landslide susceptibility. However, no comparable methods for large catastrophic bedrock landslide potential is avalible at present. Here we examined the role of bedrock geology, rock uplift rate and topography on large catastrophic landslide occurrence using new large catastrophic landslide datasets.

We compiled an inventory of large catastrophic landslide (V$>10^6$ m^3) in Japan. Our dataset includes about 120 landslides. Our dataset includes only the landslide occurred in the last 120 years, because these data are relatively reliable. Using GIS techniques, the relationship between landslide density and rock uplift rate and bedrock geology were calculated. We found that the landslide density increased with increase of rock uplift rate, but type of bedrock was not correlated with the landslide density.

We also analyzed the large catastrophic landslide data in Waniduka Mountains in south Japan. In Waniduka Mountains, about 10 large catastrophic landslides were triggered by a typhoon in 2005. We examined the relationship landslide percentage and variables, including morphology (e.g., slope angle, drainage area), micro-topography (e.g., flat crest slope, small cliff facing hillslope, old landslide) and geological structures (e.g., active fault, cap rock). We showed that both slope angle and drainage area were correlated with the landslide percentage and several variables of micro-topography were related to landslide occurrence, but geological structures were poorly correlated with the landslide occurrence. Based on the results of both analysis, new hazard mapping method for large catastrophic landslide are proposed.