

Geomorphological characteristics of landslide mass and scarp - Altitudinal change and comparison among multiple mountains -

Kentaro Maki[1]; Takashi Oguchi[2]; Yuichi S. Hayakawa[3]

[1] Earth & Planetary, Univ. of Tokyo; [2] CSIS, Univ. Tokyo; [3] Geoenvironmental Sci., Univ. Tsukuba

Most previous landslide studies focused on the geomorphological characteristics of the whole landslide topography or only landslide masses, and they seldom dealt with landslide scarps and geomorphological relationships between the landslide scarp and the landslide mass. This study examines the slope, dimensions, sliding types and the planer shape of landslide topography including both scarps and masses, using Geographic Information Systems. The altitudinal change of the landslide properties was analyzed and comparisons among four mountain ranges in Japan were conducted. The four ranges, Shirakami Mountains, Asahi Mountains, Akaishi Mountains, and Higashikubiki Hills, have many landslides, and are characterized by different altitudes, relief energies and ages.

It was found that slope angles of not only landslide masses but also scarps tend to be gentler than those of usual mountain slopes. This is attributed to frequent occurrence of earth-flow type landslides on relatively gentle slopes near ridges, while shallow slope failure and gullying are dominant on steeper slopes. The angle of landslide scarps can also decrease due to dissection processes after the formation of the scarps, leading to similar slope angle for both landslide scarps and masses on steep slopes.

With the increase of relief energies or altitudes, the area of landslide scarps increases more rapidly than that of landslide masses. The use of the area ratio of the landslide scarp to the mass along with the equivalent friction coefficient (height/length) can provide useful information about the sliding type of a landslide mass both at its upper and lower ends. In high-relief mountain ranges or higher altitudes within a range, the amount of sliding of the upper mass is relatively large but that of the lower mass is relatively small, because landslide masses tend to be compressed and heavily deformed by the pressure from the above. Upward extension of landslide topography due to the dissection process of landslide scarps as well as the increased slope length of V-shaped valleys in high-relief ranges or higher altitude zones are thought to increase the mean length of landslides.

The tortuosity factor of the landslide scarp crown was adopted to represent planer shape of a landslide scarp. The tortuosity factor is closely correlated with the sliding amount of the upper landslide mass. A previously indicated relationship between the tortuosity and the ratio of landslide length to width was found to have only a limited applicability. Comparisons of the length/width ratio among the four mountain ranges indicate that, while the ratios in the three steeper ranges are related to the scarp tortuosity and landslide length, the ratios for the gentlest Higashikubiki Hills is mainly determined by the extension of landslide masses associated with sliding processes.