

## Relief, bell-shape and distortion indexes as critical topography of creep deformation due to mountain gravity

YAGI, Hiroshi<sup>1\*</sup> ; HAYASHI, Kazunari<sup>2</sup> ; IMAIZUMI, Fumitoshi<sup>3</sup> ; SATO, Go<sup>4</sup> ; HIGAKI, Daisuke<sup>5</sup>

<sup>1</sup>Fac. Art, Science & Education, Yamagata University, <sup>2</sup>Okuyama Boring Co.,Ltd., <sup>3</sup>Fac. Agriculture, Shizuoka University, <sup>4</sup>Teikyo-Heisei University, <sup>5</sup>Fac. Agriculture & Life Sciences, Hirosaki University

### 1.Introduction

Double ridges or up-hill facing scarplets distributed on mountain ridge in high relief are known as indicators that mountain bodies are undergoing gravitational creep deformation and as signs of landslide in large scale. However, such micro topographies on ridges in Japan Alps has developed since 30 ka before. That is presumably attributed to one of the para-glacial phenomena. Trench study in Southern Japan Alps clarified that they have intermittently developed in a time scale of 10000 year and the last event, but a slight deformation occurred about 500-600 years ago. It is quite gradual movement. Consequently dense distribution of the up-hill facing scarplets is not always a pre-causious sign of sudden collapse of the mountain body in near future, though the earthquake occurs near the mountains. Other causative factors are required to induce landslide for hazard susceptibility mapping. We analyzed topographic features of mountain around Mt Shichmenzan and Ooyakuzure, which locate along the marginal mountains in Shizuoka Pref, and where huge co-seismic landslides occurred in 17th and 18th century, using DEM of 10m grid scale and more precise scale.

### 2.Topographic feature of mountain collapsed by earthquakes

Mountain ridges around Mt. Shichimenzan and Ooyakuzure show gentle and round and are fringed by distinct break of slopes. Mountain profiles of high contrast between steep lower slope and gentle ridge tops are similar to a bell-shaped mountains of high relief. In another word, the bell-shaped profile is one kind of the concavity in ridge profiles.

### 3.Critical topography of creep deformation

Dense distribution of uphill facing scarplets are observed along the main ridges of the study area by aerial photograph interpretation. However, co-seismic landslides occurred only at Mt. Shichimenzan and Ooyakuzure. We analyzed relief of ridges, considering those of the surrounding slopes and ridge scale over the study area. We call it the relief index. Also we analyzed degree of bell-shape, weighting the area of convex part of the profile. These two indexes are highly scored around Mt. Shichimenzan and Ooyakuzure, but not so high along the main ridge from Mt. Yambushi-toge to Mt Dainichi-toge where the uphill facing scarplets are densely distributed. These are considered as very convenient indexes to know the high susceptibility of landslide induced by earthquake. And distortion index that is calculated ratio of total length of up-hill facing scarplets to a original slope length is also introduced as critical topography of creep deformation due to mountain gravity.

Keywords: gravitational creep, critical topography, relief index, bell-shape index, distortion index, large scale landslide