Estimation of ground movement caused by the Iwate-Miyagi Nairiku Earthquake 2008, from the Geomorphic Image Analysis of LiDAR DEMs

Sakae Mukoyama[1]; Tomohiro Nishimura[2]; Norichika Asada[3]

[1] KOKUSAI KOGYO CO., LTD.; [2] Sabo-D,Kokusai Kogyo.; [3] KKC

http://www.kkc.co.jp/

About the generating mechanism of the remarkable ground ruptures observed in the northern area of the Aratozawa dam reservior at the Iwate-Miyagi Nairiku Earthquake in 2008, it is thought that there is a possibility of being a surface part of earthquake fault, or a possibility of being boundaries of landslides. It is expected that it becomes easy to understand the generating situation of ruptures by grasping the ground movement including the wide-area circumference. In this study we examined the technique of calculating the amount of ground surface movement from the DEMs of before and after the earthquake, and considered the tendency of a wide-area ground movement, and the factor of ruptures generating. Analysis was carried out by the following two methods.

1. Calculation and visualization of elevation difference value

From 2 periods DEMs, planar distribution of elevation difference value estimated easily. As a cause which elevation difference produces, vertical ground deformation and horizontal movement of the slope can be considered. In the research field, the area with comparatively large horizontal difference is clearly distinguished from the area which is almost stable from the relation between the pattern of change of elevation and original geographical feature.

2. Extraction of vector of movement by Geomorphic Image Matching analysis

We developed a method (Differential LiDAR Image Velocimetry) for estimating the vector of the displacement of detailed geomorphologic features by applying the technique of image matching analysis. And we extracted the moving tendency from the image of geographical features using DEM images. As a result, the direction of ground shortening was generally E-W or WNW-ESE. Additionally, there was a tendency of downward move in the horizontal displacement of the surface of several blocks.

From the results, it is thought that the gravitational mass movement restricted strongly the generating position, scale, and surface morphology of ground deformation of ruptures.

Moreover, the results of polynomial trend analysis for the surface movement indicate that there was southeastward movement in the area of the large-scale landslide which slided into the dam reservior.

This direction is coincident to the move direction of the landslide body, and there is a possibility that the movement of the ground generated just at the earthquake became a trigger of landslide’s first break.