Geomorophic change of Noto peninsula earthquake by LiDAR before and after earthquake

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1. Introduction

Comprehensive geographic and geological investigations around Noto peninsula have continuously conducted by Hokuriku Electric Power Company (HEOC) (Katagawa et.al., 2005).

Airborne LiDAR survey had conducted during October 2006 to November

which area extended over 1,000km^2. This LiDAR survey aimed to collect geographical information of active fault around this area as a part of the investigation (survey 1).

Airborne LiDAR survey is one of the pplication of laser range finder on an aircraft platform. The basic mechanism of Airborne LiDAR system is combination of laser range finder and GPS and IMU (Inertial Measurement Unit). Laser range finder measures distance between aircraft and surface. GPS determines location, speed and direction of the aircraft (1Hz). IMU detect altitude (rolling, pitching and heading) of the aircraft and interpolate GPS data within short time scale (200Hz). Elaborate 3d ground surface information is finally etrieved by post-processing which combines ground based reference GPS station data and above LiDAR data. In addition to the LiDAR, also color digital camera (4,000 x 4,000 pixels) is integrated in our system.

The main advantage of airborne LiDAR survey are 1) it can cover the wide area within short period compared with conventional ground based survey. 2) it can get precise topographic data (ground elevation) even in the forest area. Ordinal aerial photogrammetry also treats such area but results deeply depend on an individual operator and influence of tree and other obstacle is also unavoidable.

Our airborne LiDAR survey provides a geo-referenced point cloud (2 points per square meters). After classification of ground points, digital elevation model (1meter DEM) was calculated.

We use not only ordinary contour map and ortho-photo but also red relief image map to visualize LiDAR topographic data. Currently we perform topographic feature nterpretation with above data set.

2. Noto peninsula earthquake in 2007

Noto peninsula earthquake occurred on 25 March 2007, three month later just after finish of our LiDAR survey. The focus of this earthquake was at the offing of Noto peninsula. Aftershock (Reverberation) of this earthquake covered over Noto peninsula. The coverage of our LiDAR survey (survey 1) almost include entire part of this stricken area. Then LiDAR survey conducted again on 26 March and 6 April (survey 2) aiming for terrain change detection. The area of this LiDAR survey was 400km^2. Besides LiDAR survey, aerial photogrammetry with DMC (Digital Matrix Camera) also conducted. The area of DMC photogrammetry was 1,000km^2 which covers entire area of our second LiDAR survey. DMC consists of high resolution panchromatic optics and relatively low resolution multi-spectrum optics. DMC can provides high quality color image (100 million pixel) by integrating such two different type of images. The Photogrammetric scale of this DMC survey was 1/2,000 and ground resolution was 25cm.

3.conclusion

We had conducted two LiDAR survey just before and after the Noto peninsular earthquake. During this measurement period, several phenomena which accompany with this earthquake are also reported, movement of GPS reference points (GSI, 2007), earthquake fault (Kanazawa University, 2007; ERI, 2007), vertical fluctuation measured by seawater quasi-trace (AIST,2007).

By comparing these two DEMs (before and after the earthquake), not only the vertical displacement but also the horizontal displacement are expected bo be detectable. We will introduce the result of them and DMC image analysis in our presentation.