Landslide Monitoring and Potential Assessment from Differential Interferometric Radar Analysis and Ground Instrumentations

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INTRODUCTION

Landslide is a common issue in Taiwan with more than 70% area of this island is mountainous land. Typhoons and earthquakes attack Taiwan every year even by month. Landslide hazard mitigation is very important in hazard prevention chain. Two deep-seated landslides selected for monitoring in this research. Synthetic aperture radar images acquired by JAXA (Japan) are used in this research to monitor landslide displacement in large area. The electromagnetic waves from temporal images can use to derive differential between time period. Thus the displacement can be coverted from phase differences.

METHODOLODY

The study is trying to propose a method to produce landslide potential map from differential interferometric synthetic aperture radar (DInSAR). Potential landslide zones are mapped after fringes and displacements are generated from ALOS/ALOS2 radar image processing. Meanwhile, a deep-seated landslide site has been selected for instrumentation. Monitoring data from MEMS has been collected and analyzed to find relationship between landslide displacement, rainfall, and groundwater. DInSAR method is fine to observe landslide scar at two images with close dates. However, the displacement data shows too much noise to identify accuracy and comparison with benchmark data. Thus another approach small baseline subset (SBAS) is adopted for higher accuracy. This method searches points with the same radar signal strength through observing years and keep tracking locations in each scene. **Fig. 1** shows the result of SBAS method with larger zone of study area. The RMS error directly from radar shows 10mm with 95% confidence. **Fig. 1** shows the result from 2006 to 2016 combining ALOS and ALOS2 data.

CONCLUSIONS

In this work, we present a low-cost slope-monitoring device. The device is constructed using components purchased online at reasonable costs. The device is capable of recording triaxial accelerations at 200Hz onto standard SD (secure digital) memory cards. In addition, the sensed triaxial accelerations can be converted to tilt, which can then be sent via onboard GPRS module to a cloud server. Thus, the constructed device can be used for both static measurements of the slope surface and dynamic measurements of ground-surface acceleration. This information can assist assess slope condition regularly and dynamic force experienced by the slope after earthquake. The recorded data has been transferred into tilt as shown in **Fig. 2**. However, locale tilt or acceleration cannot reflect overall deformation. In order to verify SBAS results and to check the activity in this area, a single/dual frequency GPS system is installed in study area. **Fig. 3** shows the result of one monitoring landslide during a heavy rainfall event in June, 2017. The results also proved that SBAS method derived displacement map in **Fig. 1**.

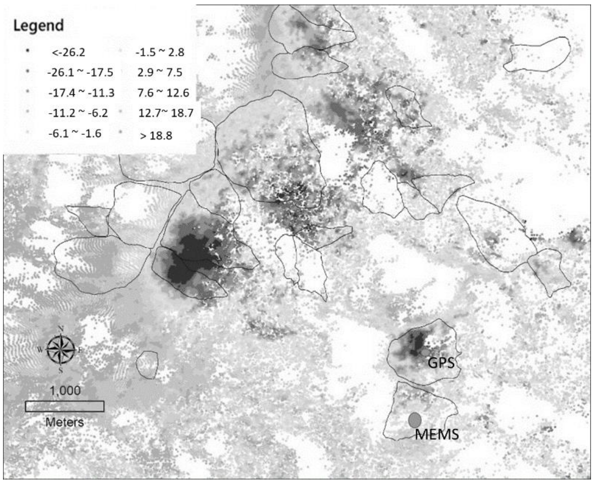

Fig. 1 Persistent scattering method derived vertical deformation from 2006 to 2016 (unit: mm/year)

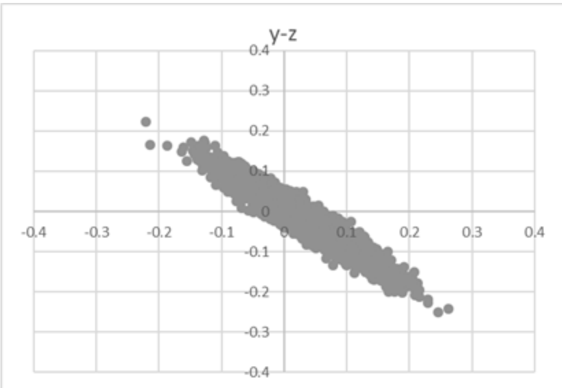

Fig. 2 Tilt derived from MEMS accelerometer of Y-Z plane

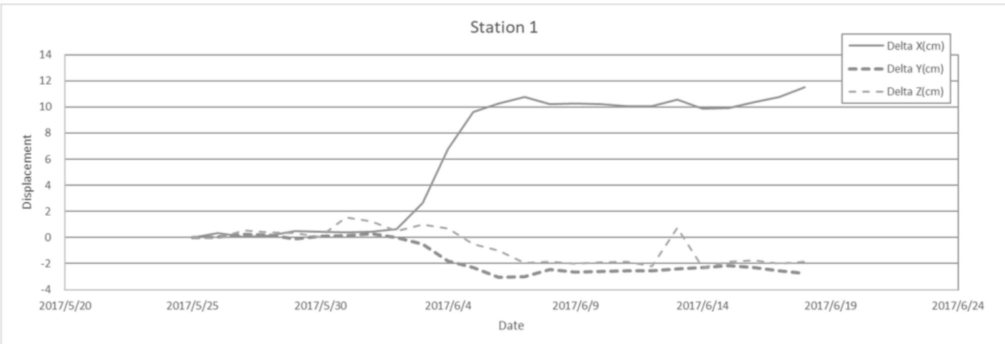

Fig. 3 GPS monitored result based on rainfall event in June, 2017

Keywords: Landslide, SAR, MEMS