Application of Radar Interferometry for Monitoring the Landslide Creeping of Jiufen Area, Northern Taiwan

Yu-Heng Tai[1], Chung-Pai Chang[1, 2]

[1]Institute of Geophysics, National Central University, Jhongli,32001 Taoyuan

[2]Center for Space and Remote Sensing Research, National Central University, Jhongli,32001 Taoyuan

Abstract

Taiwan is located between southeastern of Eurasian plate and the Philippine Sea plate. The convergence of these two plates causes quickly uplift and earthquakes. Besides, typhoons bring high and violent rainfalls while monsoon bring continuous and abundant precipitations. With such extreme tectonic and weather condition, Taiwan becomes one of the most active landslide areas in the world. Landslide is a type of material motion triggered by gravity. It destroys manmade structures and kills human being, causing a lot of hazard and economical loss in the recent years. Therefore, detection and monitoring of landslide and creeping thus play an important role in risk management and help us decrease the damage from such mass movement. Jiufen, which is one of the famous tourist place in northern Taiwan, has been determined as a creeping area in previous studies. In this study, we apply Interferometric Synthetic Aperture Radar (InSAR) techniques at Jiufen to monitor the creeping of slope. InSAR observations are obtained from ENVISAT, which were launched by European Space Agency (ESA), spaning from 2004 to 2008. Persistent Scatterer InSAR (PSInSAR) method is also applied to reduce the phase contributed from atmosphere and topography and helps us get more precise measurement. As the result, creeping velocity, about 5 mm/yr, along Line of Sight (LOS) direction has been measured. We compare the result with previous studies carried out by fieldwork to confirm the possibility of InSAR techniques applying on landslide monitoring. Moreover, the time-series analysis helps us to understand the motion of the creeping along with time. With InSAR result and fieldwork survey, we would have more useful information for geological interpretation of this area.

Reference

A. Hooper, H. Zebker, P. Segall, and B. Kampes, 2004. A new method for measuring deformation on volcanoes and other natural terrains using InSAR persistent scatterers. Geophys. Res. vol. 31, L23611.

A. Hooper, 2008. A multi-temporal InSAR method incorporating both persistent scatterer and small base- line approaches, Geophys. Res. Lett., 35, L16,302.

A. Ferretti, C. Prati, F. Rocca, 2001. Permanent Scatterers in SAR interferometry. IEEE Trans. Geosci. Remote Sens. 39 (1), pp. 8 – 20.

G. Herrera, F. Gutiérrez, J.C. García-Davalillo, J. Guerrero, D. Notti, J.P. Galve, J.A. Fernández-Merodo, G. Cooksley, 2013. Multi-sensor advanced DInSAR monitoring of very slow landslides: The Tena Valley case study (Central Spanish Pyrenees), Remote Sensing of Environment, 128, 31–43.

V. Tofani, F. Raspini, F. Catani, N. Casagli,2013. Persistent Scatterer Interferometry (PSI) Technique for Landslide Characterization and Monitoring. Remote Sens., 5, 1045-1065.

J.T. Liao, 2005. 九份地層滑動監測與評析期末報告書. 臺北縣政府委託計畫成果報告.

青山工程顧問有限公司, 2010. 臺北縣瑞芳鎮九份地區地滑層滑動監測與評估第五期計畫期末報告書. 臺北縣政府委託研究報告.