Investigation of active movement prior to artificial slope landslides from multi-temporal InSAR: a case study of Northern Taiwan

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Detection of slope instability using Interferometric Synthetic Aperture Radar (InSAR) can aid the understanding of landslide kinematics and prevent the related geological hazards. However, conventional InSAR techniques often fail in the retrieval of deformation measurements in mountainous areas with dense vegetation and complex terrain, thus resulting in diminished information of slope movement. In this study, we propose a new multi-temporal InSAR method to improve the spatial coverage of measurement points by jointly exploiting persistent scatterers (PS) and distributed scatterers (DS). Particularly, topographic errors and tropospheric delays are well-considered according to their spatial and temporal characteristics. We applied this method to retrieve the historic displacements prior to the collapse of an artificial slope in Northern Taiwan using 15 ALOS/PALSAR images. The derived results suggest a pre-landslide movement with a rate of approximately -30 mm/year in the radar line-of-sight (LOS) direction. Meanwhile, the time series displacements reveal that the temporal behaviors of downslope movement are correlated with local rainfall and seismic activities. The study helps to analyze the slope instability in Northern Taiwan.