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Using Artificial Point Targets for Monitoring Landslides with Interferometric Processing

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Abstract. Over the last 5 years, different methods of monitoring point targets with interferometry have been developed and proven introducing a new degree of accuracy and flexibility for interferometric applications. Given stable point targets, differential interferometric techniques can be applied in nearly any environmental and land-cover conditions. Monitoring slow-moving landslides with differential interferometric techniques has been limited to arid regions or areas with sufficient existing point targets (buildings, exposed rocks, infrastructure etc). In April 2005, a RADARSAT Fine-1 Beam mode data set was collected over one study area in southern Washington State and another southwest of Rio de Janeiro. Both study areas featured slow-moving landslides with approximately 10cm movement/year but both were not suitable for traditional differential InSAR (DInSAR) techniques. Heavy vegetation in both study areas eliminated any possibility of obtaining sufficient coherence to apply DInSAR techniques. Ground movement in these areas had a strong correlation with precipitation and significant rainfall had been known to trigger sudden movement events. While both the study areas had suitable stable point targets throughout the surrounding areas, neither specific landslide zones had sufficient targets for accurate movement measurements.

Palavras-chave: radar, RADARSAT, remote sensing.

1. Introduction

Interferometric Point Target Analysis (IPTA) was applied to both areas and artificial corner reflectors were installed to monitor areas without existing targets. The artificial corner reflectors were installed with the guidance of geo-technical engineers to have the greatest opportunity of capturing ground movement. Corner reflector locations also considered the proximity of the existing in-situ monitoring equipment for validation and calibration purposes. For each study area, the geo-technical team determined a stable area where a reference corner reflector could be installed and used as a reference point during the interferometric processing. Movement measurements were collected from both existing targets and corner reflector targets every 24 days to accurately monitor the landslide motion. In-situ measurements were collected by geo-technical engineers in parallel with the RADARSAT-1 acquisitions. InSAR measurements were then compared to readings from in-situ instrumentation and site visits (inclinometers) to demonstrate the accuracy and effectiveness of introducing corner reflectors in areas without existing monitoring. InSAR measurements were converted from line of sight measurements to ground movement for accurate comparisons with the in-situ measurements and observations.

IPTA techniques in combination with the deployment of artificial corner reflectors permits the monitoring of ground movement with high accuracy measurements in previously unsuitable areas. Installation of artificial point targets is not practical or suitable for all geo-hazard locations due to orientation, ground/weather conditions and theft/vandalism among other reasons but they can be deployed in many areas to expand the use of remote sensing technology, specifically InSAR for monitoring ground movement. This paper will demonstrate the effectiveness of using corner reflectors to increase the value of monitoring ground movement with InSAR.