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Potential of Sentinel 1 InSAR and Offset Tracking in Monitoring Post-cyclonic Landslides Activities in Reunion Island.

Marcello de Michele¹, Daniel Raucoules¹, Rault Claire², Bertrand Aunay², Michael Foumelis³

Organisation(s): 1: BRGM, Geophysical Imagery and Remote Sensing Unit, Orleans, 45000, France; 2: BRGM, Direction de Actions Territoriales, Saint Denis, La Réunion, 97400, France; 3: Aristotle University of Thessaloniki, Department of Physical and Environmental Geography, 541 24 Thessaloniki, Greece.

Submitted by: Dr Marcello de Michele, Phd, Hab
(BRGM French Geological Survey, FR)
ID: 1196

Thematic areas:: Landslides, sinkholes & related hazards InSAR data used: Sentinel-1

Please describe/list briefly what is the innovation/novelty in your research:

Within the InSAR and OT detection limits and the period of SAR measurements (October 2017–November 2018) this study displayed the ground motion and internal kinematics on several landslides on CdS. Moreover, we point out an unexpected pattern of ground motion, consistent with the geomorphology of the area but situated in a non-instrumented, uninhabited area on the ground. We suggest that it might correspond to an area that was considered stabilized or dormant, called Crete de Salaze. Motion in this area might have been reactivated as a consequence of heavy rainfall and thus represents a post cyclonic burst of ground motion.

Abstract

Landslide and erosion processes are causes of major concern to population and infrastructures on Reunion Island. These processes are led by the tropical climate of the island. The hydrological regime of the rivers is distinct owing to the coexistence of several major parameters that predispose it to extreme vulnerability. Holding almost all the world records for rainfall between 12 h (1170 mm) and 15 days (6083 mm), the island has a marked relief with a peak at 3,069 m, with exceptional cliffs that reach 1500 m in height. Cirque de Salazie (CdS) is the rainiest of the large erosional depressions on Reunion Island with an average annual cumulative rainfall of approximately 3,100 mm since 1963; a minimum of 698 mm was recorded in 1990, and a maximum of 5,893 mm was recorded in 1980. This depression is surrounded by steep rock cliffs and filled with epiclastic material. Intense river erosion incises deep valleys and has produced several isolated plateaus across the cirque.

This study examined the results of an interferometric Synthetic Aperture Radar (InSAR) and SAR Offset Tracking (OT) study on Cirque de Salazie, Reunion Island, France, within the context of the RENOVRIK project, a multidisciplinary programme to study the cyclonic risks in the South-West Indian Ocean. Despite numerous landslides on this territory, CdS is one of the denser populated areas in Reunion Island. One of the aims of the project was to assess whether Sentinel 1 SAR methods could be used to measure landslide motion and/or accelerations due to post cyclonic activity on CdS. We concentrated on the post 2017 cyclonic activity. We used the Copernicus Sentinel 1 data, acquired between 30/10/2017 and 06/11 2018. Sentinel 1 is a C-band SAR, and its signal can be severely affected by the presence of changing vegetation between two SAR acquisitions, particularly in CdS, where the vegetation canopy is well developed. This is why C-band radars such as the ones onboard Radarsat or Envisat, characterized by low acquisition frequency (24 and 36 days, respectively), could not be

routinely used on CdS to measure landslide motion with InSAR in the past. In this study, we used InSAR and OT techniques applied to Sentinel 1 SAR. We find that C-band SAR onboard Sentinel 1 can be used to monitor landslide motion in densely vegetated areas, thanks to its high acquisition frequency (12 days). OT stacking reveals a useful complement to InSAR, especially in mapping fast moving areas. In particular, we can highlight ground motion in the Hell-Bourg, Ile à Vidot, Grand Ilet, Camp Pierrot, and Belier landslides.

