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Detection of rock failures in the Dolomieu crater on La Réunion using multitemporal LiDAR and photogrammetric data

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The Dolomieu crater on the Piton de la Fournaise is a very active area in terms of volcanic activity and seismicity. As a consequence of the seismicity, the topographic conditions and the high amounts of rainfall, a lot of geomorphic processes are involved in reworking the vol-canic rocks and sediments, showing high magnitudes and short frequencies. As the crater is not accessible at all, the detection and the quantification of those processes is very challenging and can only be done by using different remote sensing technologies. Thus within the project “slidequakes” the whole inner Dolomieu crater was surveyed in cooperation with the vulca-nologic observatory of the IPGP on La Réunion using Ground based LiDAR and terrestrial manual and automatic (fixed webcams) digital photogrammetry. LiDAR and manual terres-trial photogrammetry acquisition was done during two missions in autumn 2014 and spring 2015.
During both, the LiDAR (2014) and the photogrammetric (2015) mission, the data were re-corded by hiking to the top of the Piton de la Fournaise and walking around the Dolomieur crater, which shows a diameter of 1.2 km. All in all, the crater was scanned in 2014 from 12 different scanposition, collecting 460 Mio points (unfiltered raw data). Every single scanposi-tion was registered by using the IPGP GNSS network around the Piton. This LiDAR data act as a base line data set for detecting surface changes by both, rainfall induced and seismic in-duced geomorphic processes. Beside this, the LiDAR data in combination with the fixed GNSS network were used to create an external orientation for the photogrammetric data.
After the global registration of the various data, surface changes for the single epochs were detectable. The analysis of those data showed a high activity of gravitational processes, in-cluding several smaller and one big event. But it could also be detected, that parts of the crater showed movements (mainly subsidences) of the surface as a consequence of seismic and tec-tonic activity following eruptions on the south western crater rim, which can be validated by the fixed GNSS stations. The result of this multitemporal analysis were brought together with the records of the very dense and high resolution network of seismic station of the slidequake project around the crater in order to combine the seismic signal on the one side and location, duration and magnitude of rockfalls on the other hand.