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Monitoring volcano deformation from space with Sentinel-1 data

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Monitoring crustal deformation in active volcanic areas could not be an easy task. In this sense, remote sensing can make the difference with respect to in-situ techniques, due to its capability to provide dense measurements at large spatial scale and at relatively low cost. In particular, the Differential Synthetic Aperture Radar Interferometry (DInSAR) is becoming one of the usual techniques to measure ground deformation in any atmospheric conditions and with a high accuracy level.
The increasing diffusion of the use of DInSAR is also due to the recent large availability of huge and easily accessible SAR data archives. Indeed, since late 2014, the Copernicus Sentinel-1 constellation is globally providing SAR data with a repeat-pass frequency that, in the best cases, is of 6 days. Just to understand the impact of such Earth Observation program, it is worth noting that nowadays the Sentinel-1 system acquires about 12 TB of SAR data per day all over the Earth.
It is therefore clear that with such a huge, global, constant and reliable availability of data it is possible to use the DInSAR technique for monitoring purposes, such as those related to the measurements of the ground motion in volcanic areas.
In this work we present the implementation of an operative service for monitoring the crustal deformation in active volcanoes through the use of DInSAR technique and Sentinel-1 data. The designed system is fully automatic and the process is triggered by the availability, for every monitored volcano site, of a new SAR data in the Sentinel-1 catalogues acquired from both ascending and descending passes. The data, per each orbit, are then ingested and processed through the well-known Parallel Small BAseline Subset (P-SBAS) DInSAR technique in order to generate the displacement time series. The so-retrieved Line of Sight (LOS) measurements are then combined to compute the Vertical and East-West component of the deformation, which are directly understandable by the end user.
The system is currently operative for the main active Italian volcanoes, such as the Campi Flegrei caldera, Mt. Vesuvius, Ischia, Mt. Etna and Stromboli, but it can be easily extended to include other volcanic areas on Earth. Indeed, although the service is intended to serve the Italian Department of Civil Protection, it is based on widely used IT standards so that it can be easily ported to several computing environments, such as those made available by the Copernicus DIAS. Moreover, it is planned to make available the generated DInSAR results to the Solid Earth community through the EPOS Research Infrastructure.
Retrieved deformation results and their implication in the volcano behavior understanding will be discussed at the conference.

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