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InSAR imaging of the December 2018 Etna Eruption

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On December 24th, 2018 Etna volcano began a very intense eruption, characterized by lava flows, considerable ash and gas emissions, and a seismic swarm, still ongoing at the time of writing, with more than a thousand of earthquakes, caused by the intrusion of the magma in the volcano. Two days later an earthquake, most likely triggered by the magma intrusion, with magnitude Mw 4.9 and hypocentre at a depth of $\sim$1 km, hits some villages located on the volcano southeast flank, close to the Catania city, causing damage and several ground fractures.
Thanks to SAR interferometry (InSAR), we have the capability to investigate the produced ground deformations. In particular, we estimated the horizontal and vertical components of the surface movement by exploiting the SAR images collected by Sentinel1-A/B sensors, operated by the European Space Agency, and acquired along both the ascending and descending track.
As result, we detected and measured the displacement of three main phenomena. The most important one, regarding the absolute displacement values, is the movement of the Etna summit area due to the opening of a dyke and the related magma ascent. The deformation involved a vast portion of the volcano flanks, reaching more than 40 cm and 65 cm along west and east directions, respectively.
Another deformation pattern is related to the concurrent Mw 4.9 earthquake. This event was generated by the slip of the Fiandaca-Pennisi Fault, and resulted in a mainly horizontal movement of $\sim$15 cm toward east and 20 cm toward west directions. The interferograms also allow the detection of a small-scale landslide that took place on the southwestern flank of the volcano, at $\sim$23 km away from the Etna eruption vent.
Using as input the interferometric results, the estimation of the volcanic dyke parameters and the seismic source were also performed.