Geophysical Research Abstracts
Vol. 21, EGU2019-9245-1, 2019
EGU General Assembly 2019

Integration of SAR and Seismic Interferometry techniques to investigate the 2011-2013 Campi Flegrei Caldera volcanic unrest episode

Susi Pepe (1), Luca De Siena (1,2,3), Andrea Barone (1,4), Raffaele Castaldo (1), Luca D'auria (5), Mariarosaria Manzo (1), Francesco Casu (1), Maurizio Fedi (4), Riccardo Lanari (1), Francesca Bianco (6), and Pietro Tizzani (1)

(1) National Research Council - IREA, Naples, Italy. Istituto per il Rilevamento Elettromagnetico dell'Ambiente (IREA), via Diocleziano 328, 80124 Napoli, Italy, (2) Dept. of Geology and Petroleum Geology, School of Geosciences, University of Aberdeen, Meston Building,, (3) Now at Institute of Geosciences, Johannes Gutenberg University, J.-J.-Becher-Weg 21, D-55128 Mainz, Germany, (4) Department of Earth, Environmental and Resources Science, University of Naples "Federico II". Monte Sant'Angelo (L building), Via Cinthia 21, 80126 Napoli, Italy, (5) Istituto Volcanòlogico de Canarias, 38320 San Cristóbal de La Laguna, S/C de Tenerife, Spain , (6) Istituto Nazionale di Geofisica e Vulcanologia, Sezione "Osservatorio Vesuviano, Via Diocleziano 328, 80124 Napoli, Italy

In this study, we combine two interferometric techniques Synthetic Aperture Radar (SAR) and Ambient Noise Tomography (ANT) to investigate the 2011-13 unrest phenomenon at Campi Flegrei Caldera (Southern Italy). In particular, the SAR Interferometry (InSAR) images both the spatial and the temporal features of the occurred ground deformation, while the ANT provides independent structural seismic constraints necessary to interpret deformation dynamics. For the first time we apply the Total Horizontal Derivative (THD) analysis to the ground deformation field detected via SAR Interferometry and COSMO-SkyMed data to better identify the complexity of the caldera structure.

We superimpose the THD maps and the epicenters of the earthquakes, recorded between January 2011 and December 2013, on the ANT images obtained using seismic interferometry, with the aim of linking these different, independent, observations. The comparison of the THD and ANT results shows that the caldera rim and the residuals of previous eruptions limit the horizontal propagation of the magmatic intrusion within the sill-like structures.

The best correlation between the THD and ANT images is achieved at a seismic period of 1.2 s, corresponding to $\sim$1 km; however, the spatial correlation is persistent at least down to $\sim$ 1.7 km (2 s). The maxima values of the THD results describe a spatial pattern coinciding with the high-velocity structure between Solfatara and Pisciarelli, the area where most of the background seismicity is located during the 2011-2013 period.

The proposed combined application of SAR and seismic interferometry techniques represents a good option to quantitatively model in space and time the characteristics and nature of the deformation source; indeed, it can provide a new perspective to understand the origin of real-time deformation signal at volcanoes where magma propagation within sills is expected, as for the Campi Flegrei Caldera case.