Geophysical Research Abstracts
Vol. 20, EGU2018-2795-1, 2018
EGU General Assembly 2018

Ambient noise imaging of the 2011-2013 unrest at Campi Flegrei: progressive shift in hydrothermal activity towards the east bounded by the Neapolitan Yellow Tuff rim.

Luca De Siena (1), Carmelo Sammarco (1), David Cornwell (1), Mario La Rocca (2), Francesca Bianco (3), Lucia Zaccarelli (4), and Hisashi Nakahara (5)

(1) University of Aberdeen, School of Geosciences, Geology and Petroleum Geology, Aberdeen, United Kingdom (lucadesiena@abdn.ac.uk), (2) Dipartimento di Biologia, Ecologia e Scienze della Terra, Universit\'a della Calabria, Italy, (3) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Napoli-Osservatorio Vesuviano, Via Diocleziano 328, 80124 Napoli, Italy, (4) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Bologna, Bologna, Italy, (5) Department of Geophysics, Graduate School of Science, Tohoku University, 6-3, Aramaki-Aza-Aoba, Aoba-ku, Sendai 980-8578, Japan

Seismicity at Campi Flegrei has been low-magnitude and sparse since the end of the last significant seismic unrest (January 1985). It has thus provided insufficient datasets for the application of passive seismic imaging and monitoring methods, hinting at a general thermal and stress change of the volcano. Deformation and geochemical markers show that Campi Flegrei caldera (Naples, Southern Italy) is in a stage that may, or may not, evolve towards conditions more favourable to an eruption but for sure deserve a scientific effort to improve the knowledge of the active processes in the caldera. Here, surface wave tomography using ambient seismic noise data reconstructs frequency-dependent group velocity maps during this period. Cross-correlations are affected by high anisotropic noise, with noise sources that can be traced back to the seashore between 0.4 and 1.3 Hz. We compared linear stacks with those obtained with the MSNoise and Phase Weighted Stacking methods. We then applied a careful manual selection of the cross-correlations obtained with the last method, selecting symmetric, causal, and acausal components depending on noise quality and source distribution.

The 1 Hz cross-correlations show increased symmetry for inter-station distances up to 7 km: this is the approximate diameter of the Neapolitan Yellow Tuff rim, the primary scattering anomaly in the caldera. The rim increases scattering efficiency and cross-correlation retrieval inside it while producing spurious phases outside of it. Computer for Seismology and FTAN automatically picked the peak amplitudes of the dispersion curves; pickings were checked manually and corrected depending on the agreement between two methods and quality. The final selection (73 station pairs) is the input for obtaining group velocity maps and tests. These are extracted and performed with an iterative nonlinear tomography scheme, comprising the Fast Marching Method and a subspace inversion technique constrained between 0.5 km/s and 2.5 km/s. We test the velocity maps using checkerboard, spike and stability tests, performed with different selection qualities.

The comparison of the velocity patterns with the best-resolved 2005-2016 earthquake hypocenters, data from fumaroles, deformation patterns, and previous travel-time tomography imaging shows a shift of the low-velocity anomalies towards the eastern part of the caldera, with relevant anomalies under recent vents, opened at Pisciarelli. The most significant low-velocity patterns correlate with the areas affected by repeated seismic swarms in 1983-84, the feasible magmatic source heating the hydrothermal. Low velocities are bounded by the Neapolitan Yellow Tuff rim, which acts as a barrier and channel for hot deep materials raised to the surface during the 1983-84 unrest under Pozzuoli. The results suggest a progressive shift of the zones affected by the highest hazard towards the East of the caldera.