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Multi-resolution S- and P-wave attenuation images of Campi Flegrei: application of novel methods and verification of the tomographic results.

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Passive, high resolution attenuation tomography is used to image the geological structure in the first upper 5 km of shallow crust beneath the Campi Flegrei caldera, Southern Italy. The data set used is composed by 246 local, small magnitude earthquakes recorded at a maximum number of 15 three component, high dynamical range, digital seismic stations. Relocations of the earthquake sources were obtained on the base of the tomography deduced P- and S- velocity model of Battaglia et al. (2008). Single-path inverse-Q for S direct waves was estimated for each source-receiver path using a novel application of coda-normalization method; a modified slope decay method was used instead for direct P-waves. Inversion was carried out using a multi-resolution method, which ensures a minimum cell size resolution of 500 meters in the zones with sufficient ray coverage, and 1000 meters outside these zones. Robustness, stability and checkerboard tests guarantee an optimal reproduction of the synthetic input in a wide area located in the center of the Campi Flegrei caldera, in the depth range between the surface and about 3000 m. The attenuation images are compared with the velocity images obtained by Battaglia et al. (2008) showing high attenuation vertical structures extending between the surface and a depth of about 3000 m below sea level. These structures are interpreted as corresponding to gas reservoirs beneath Solfatara and San Vito, and to intense fluid circulation beneath Mofete, Mt. Nuovo and Astroni-Agnano.The method is also able to image the upper part of the conduit connecting the deep (7 km) magma reservoir to the hydrothermal basins and gas reservoirs under Pozzuoli-Solfatara.