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# A three-dimensional QP imaging of the shallowest subsurface of Campi Flegrei offshore caldera, southern Italy

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We build a three-dimensional attenuation image of the shallowest subsurface of Campi Flegrei caldera, a resurgent caldera located 15 km west of Naples, southern Italy.
Extracting tstar (t*) measurements from an active seismic dataset can be achieved by a spectral ratio method which has been intensively used for earthquakes. The applicability of such measurement has to be validated for active seismic datasets which have a narrower frequency band compared to frequency band of quakes.
The validation, as well as the robustness, of such extraction for narrow Ricker source wavelet has been checked through many synthetic and realistic tests. These tests allow us to conclude that this measurement is valid as long as 1) short signal time window are chosen to perform the spectral analysis; 2) the effects caused by heterogeneities of the sampled medium on the seismic spectra have to be taken into account in the description of elastic Green's function. Through such a deconvolution strategy, contributions of the fine velocity structure on signal amplitudes have been significantly removed: in case of suspicious behavior of the spectrum ratio, the measurement is disregarded.
This procedure, a kind of deconvolution of the phase propagation imprint, is expected to leave nearly untouched the attenuation signature of seismic traces we are interested in.
Such refined measurement approach based on the spectral ratio method has been applied to the real active seismic SERAPIS database providing us a reasonable dataset of 11,873 differential t* measurements (dt*).
These data are used for imaging anelastic properties of Campi Flegrei caldera through a linearized, iterative, damped attenuation tomography.
Based on configuration of sources and receivers, an attenuating volume as large as 13 x 13 x 1.5 km3 has been imaged. The tomography, with a resolution of 1 km in the horizontal directions and 0.5 km in the vertical direction, allowed to image important features whose reliability has been assessed by means of a proper resolution study.
Mainly, the off-shore part of Campi Flegrei caldera turns out to be characterized by an average QP about 70, interpreted as water-saturated volcanic and marine sediments. An arc-like, low-QP structure at 0.5-1 km depths well matches the buried rim of Campi Flegrei caldera, already imaged by previous geophysical investigation studies. The retrieved anelastic properties lead to interpret
the rim of caldera as a densely fractured, fluid-saturated rock volume. Several high-QP bodies, overlapping submerged volcanic edifices as Miseno Bank and Pentapalummo Bank, are interpreted as the combination of consolidated volcanic materials and magma-cooled material. Finally, the spatial, heterogeneous distribution of high- and low-QP bodies in the inner caldera is correlated with low-VP values and may reflect either differences in the percentage of fluid saturation of sediments or the presence of vapor state fluids beneath fumarole manifestations.