



The source of the ground deformation at Campi Flegrei caldera during the last sixteen years: constraints from SBAS-DInSAR time series analysis and Finite Element models

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Campi Flegrei caldera, located near the highly populated city of Naples, Southern Italy, is characterized by continuing slow subsidence and intermittent uplift phases. The source and the pressure fluctuations at depth are not well constrained, as most of the first order interpretations of the measured geodetic signals are based on simplified models, which assume the Earth's crust as a homogeneous half-space. However, the consideration of the 3-dimensional characteristics of the subsurface might help to attain a more realistic and quantitative assessment of the reservoir behavior of this volcanic area.

We combine advanced geodetic monitoring techniques, referred to as the SBAS-DInSAR approach, with 3-D mechanically heterogeneous finite element models based on seismic tomography data. The results of our integrated study assess the characteristic of the deformation at Campi Flegrei caldera between 1992 and 2008. A rather small source located in the center of the caldera at about 3 km depth is able to well explain the observed ground displacement over space and time. We also demonstrate that the assessment of the source location is independent on the consideration of 3-D heterogeneities, while the evaluation of its strength might be strongly affected. Thus, we propose a new method to retrieve fast and reliable interpretations taking also into account mechanical heterogeneities.

Combining our results with previous independent geophysical interpretations, we identified the source responsible for the subsidence trend and of the last uplift episodes over the past sixteen years. The results of this study are of interest particularly for the quantitative evaluation of the unrest phases at Campi Flegrei caldera, and have also general implications for other volcanic areas, where the application of a similar approach might be considered.