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Audiomagnetotellurics-Magnetotelluric (AMT-MT) survey of the Campi Flegrei inner caldera

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In the framework of the EU project MED-SUV, an audiomagnetotellurics-magnetotelluric (AMT-MT) survey in the frequency band 0.1-100kHz was performed in the eastern border of the Campi Flegrei inner caldera comprising the area where seismicity is concentred in the last decade. This survey was aimed to provide new insights on the electrical resistivity structure of the subsoil.
Among all the collected MT soundings, twenty-two, on a total of forty-three, were selected along a WSW-ENE alignment that crosses the main fumarole emissions (Solfatara, Pisciarelli and Agnano) and used for 2D regularized inversion. The obtained model is characterized by a quite narrow resistivity range that well matches typical range of enhanced geothermal environment as largely documented in the international literature. In particular focusing on the Solfatara and Pisciarelli districts the resistivity distribution clearly calls to mind the behavior of a high temperature geothermal system with a very conductive cap in the shallower part. Here the presence of gaps in this conductor just in correspondence of the main superficial emissions describes the inflow and outflow pathway of the shallow fluids circulation. A high resistive reservoir appearing at a depth of about 500 m b.s.l.. WithinWithin this region we selected a vertical resistivity profile just in correspondence of a Vp/Vs profile versus depth coming from a passive seismic tomography (Vanorio et al., 2005). The comparison of the two behaviors shows a clear anti-correlation between the two physical parameters (high resistivity and low Vp/Vs) in the depth range 500-1000 m supporting the interpretation that an over-pressurized gas bearing rocks under supercritical conditions constituting the reservoir of the enhanced geothermal system. On the eastern side of this resistive plume up to 2.5 km of depth is present a local relative conductive unit underneath the Pisciarelli area. In the same volume most of the recent (from 2005 up to date) micro-earthquake hypocenters are confined suggesting that in this volume geothermal fluid, pushed by the reservoir pressure and mixed with the powerful aquifer (testified in the well CF23), propagates in widespread pores and cracks triggering microseismicity.
The present resistivity model is limited to 3 km of depth due to the adopted frequency range, thus does not investigate the magma feeding system of the Plegrean Field caldera that seismic imaging suggest to be a large magmatic sill within the basement formations at about 7.5 km of depth (Zollo et al., 2008). On the contrary it well image for the first time with higher resolution than in the past the geothermal system underneath Solfatara-Pisciarelli districts giving insights of the whole hydro-geothermal circulation.