The multi-2D seismic imaging of the Solfatara Volcano, Italy, inferred by seismic attributes.

Sergio Gammaldi¹, Amir Ismail², Teresa Chiuso¹, and Aldo Zollo¹

¹Università di Napoli Federico II, Department of Physics “Ettore Pancini”, Italy.
²Helwan University, Geology Department, Faculty of Science, Egypt.

The imaging of seismic reflection data provides a powerful high-resolution method for studying volcano structure and fluids presence. The shallow structure of the Solfatara crater, a surface marker of deep magmatic activity inside Campi Flegrei caldera (Southern Italy), is characterized in terms of seismic profile and attributes. The main contribution of this work is to provide a detailed and improved seismic reflection image of the Solfatara crater and the identification of gas accumulation. The profiles are deployed along the NNE-SSW directions, the first, and the second orthogonal to the last. The two profiles are 400 m long acquired during the active experiment RICEN (Repeated Induced Earthquake and Noise) performed in the framework of the EU project MEDSUV between May and November 2014. Pre-stack processing of the seismic data has been performed in order to remove the noisy traces, low-frequency noise and reduce the ground roll phases. A very detailed velocity analysis for the NMO correction has been performed with the integration of information derived from the Vp velocity model previously obtained by the non-linear Bayesian technique. After having applied residual statics and DMO corrections, the CMP gathering, the post-stack Kirchhoff migration technique was performed to produce the final seismic profiles in time and depth. Once having obtained the post-stack migrated imaged, the energy, root mean square, envelope and sweetness attributes were computed for defining the maximum and minimum value of amplitude zones. In addition, other attributes as the time-gain attribute in order to interpret the deep reflectors and the variance attribute to define the faults, discontinuities, and chaotic zones have been evaluated. To enhance fluids identification the Amplitude Versus Offset (AVO) variation technique has been further applied to identify the gas zone in the explored sections. By integrating all information from the original seismic profile, seismic attributes and geophysical investigation relative to the Solfatara volcano, the multi-2D image presents the fluids trapped in the Solfatara crater at depths between 10 to 50 m below the surface of the crater and their migration pathways up to 150 meters depth.