The Borehole Experiment: Investigation of Cortical Structures Through 3D Array Techniques

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Over the last few years it is growing the need to monitor the volcanic activity with modern technology in order to mitigate volcanic hazard through the detection of any possible precursor phenomena. The use of high performance seismic stations, such as borehole instruments, may increase the signal to noise ratio (SNR), improving the capability to detect very small signals. Over the past 40 years much attention has been given to the use of seismic arrays to measure the slowness vector of coherent signals. The main advantage of seismic arrays consists in their ability to detect weak or emergent signals, and to allow for an effective noise reduction through multichannel waveform stacking. A reliable prediction of the ray-path back-propagated from the recording site to the source is strongly limited by the poor knowledge of the local shallow velocity structure. Usually in volcanic environments the propagation of seismic signals through the shallow layers is strongly affected by lateral heterogeneity, attenuation, scattering, and interaction with the free surface. Driven by these motivations, on May 2014, in collaboration with the colleagues of Osservatorio Vesuviano (INGV), we deployed a 3D seismic array in the area where the borehole seismic station called Pozzo Pitarrone is installed at a depth of about 130 meters. This will improve our knowledge about:

- the structure of the top layer and its relationship with geology;
- analysis of the signal to noise ratio (SNR) of volcanic signals as a function of frequency;
- study of seismic ray-path deformation caused by the interaction of the seismic waves with the free surface;
- evaluation of the attenuation of the seismic signals correlated with the volcanic activity.

The results of these analyses will improve the general knowledge of wave propagation in the shallow layers and will give a new contribution to the seismic monitoring of Etna volcano.

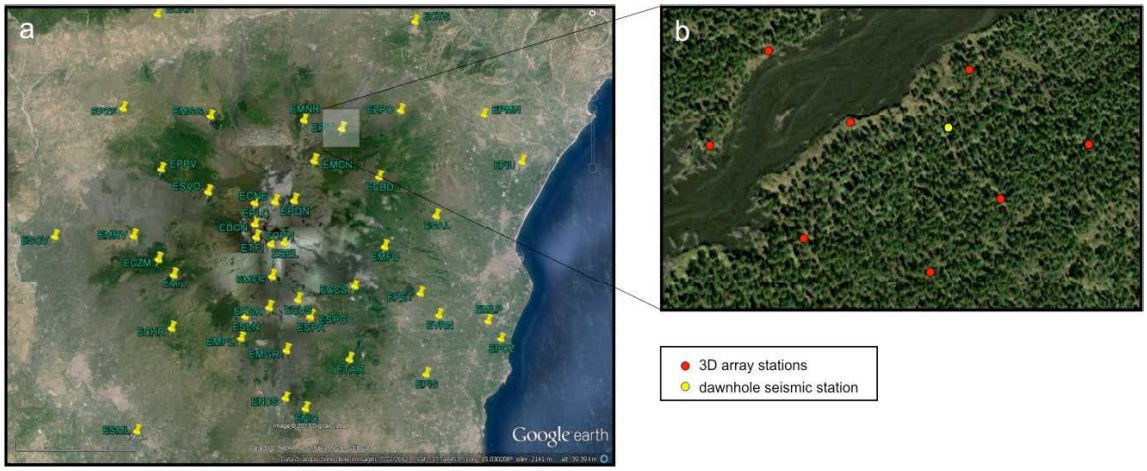

Figure 1. Map of Mt. Etna with location of the seismic permanent network (a), and 3D seismic array in the area of Pozzo Pitarrone (b).