Title: Microsismicity versus Seismodiversity: detailed investigation of the Mt. Vesuvius seismicity by seismological analysis with multichannel techniques and on broadband signals

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Research program

The research project proposal has as its fundamental purpose the detailed analysis of the Mt. Vesuvius microseismicity occurred in recent years to understand volcano dynamics and its structural characteristics. The seismicity of the volcanic area of interest was characterized by volcano-tectonic events (VT, Volcano Tectonic) of small magnitude (MD <3), often occurring in low energy swarms, and by some low frequency events (LF, Low Frequency) from deeper depths (La Rocca and Galluzzo, 2016). The high seismic background noise and the moderate/low amplitude of the recorded signals constitute the well-known obstacles that reduce the ability to analyze with standard seismological methods of analysis in urbanized volcanic areas (Del Pezzo et al., 2013). For this reason, over the past 10 years, the use of high dynamic range instrumentation and broad band sensors for the seismic surveillance, monitoring and research purpose has allowed the collection of high quality data. In addition, the availability of array data (VAS array, Vesuvius Array South) provided an additional investigation tool to analyze in detail this low energy seismicity (La Rocca and Galluzzo, 2014). The proposed study provides as a starting point the localization of the seismic events taking into consideration all the possible recordings and, where possible, the localizations carried out with array techniques. The localization techniques used may be both absolute and relative localization methodologies (Hawthorne and Ampuero, 2017) in order to obtain estimates of hypocentral coordinates with high precision. Array analysis will be carried out with techniques operating in the time domain (Zero Lag) and in the frequency domain (Beam Forming, High Resolution). The knowledge of the detailed localization of the seismic events in question will allow an accurate study about the source of the seismicity, applying methodologies for seismic source analysis (spatial extension of the sources, focal mechanisms, stress drop, corner frequency). The results obtained from seismological studies can be compared with deformation studies (gravitational phenomena of the volcanic complex) as well as with volcanological studies to better understand the internal structure of the volcano and its dynamics. Furthermore, the definition of seismogenic structures or volumes will provide a result of interest for the definition of the seismic and volcanic risk of a heavily populated area.

Proposal for a PhD position

A position for a PhD will be required for a candidate who can carry out seismological research. The three-year work program will be divided into a first phase concerning bibliographic research, study of the analysis techniques to be used and implemented and preparation of the data set; a second phase which will consist of data analysis and drafting of scientific works. The dataset useful for the purposes of this project is available from INGV-Oss. Vesuviano and consists of the signals collected in the last ten years at Vesuvius from the seismic network (in transmission and offline) and from the signals recorded by the VAS array. These are some hundreds of VT

earthquakes and some cases of low frequency LF seismic events recorded with wide band sensors and good signal / noise ratio to at least 10 three-component digital simic stations. The analysis techniques will be developed, implemented and applied in the INGV-Oss. Vesuviano laboratories. Vesuvius. During the course of study, the PhD student will be placed in a context of a research group together with researchers from other Italian and foreign universities.

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Duration of the project 36 months (2020-2023).