SESSION 56- *Microzonation in volcanic regions: key challenges and future direction*

Conveners
Nardone Lucia INGV-Osservatorio Vesuviano, Naples, Italy
Maurizio Vassallo INGV-Osservatorio Vesuviano, Naples, Italy
Iolanda Gaudiosi, CNR-IGAG, Rome, Italy
Stigliano Francesco, CNR-IGAG, Rome, Italy

Session Description

The session aims to explore the innovative methodologies, scientific and technical challenges, and future perspectives of seismic microzonation in volcanic areas, which represent some of the most complex contexts for seismic hazard assessment and urban risk mitigation.

Volcanic regions are often characterized by strong lithological heterogeneity (e.g., lava flows in contact with unconsolidated materials), by active tectono-volcanic dynamics (such as ground uplift), and by geomorpological instabilities like landslides, liquefaction, and volcanic fractures and frequently by high population density. Moreover, in these areas, seismic signals exhibit extremely complex characteristics, making their interpretation, localization, and discrimination a critical challenge for microzonation. This combination of factors makes the definition of realistic hazard scenarios, local seismic response, and site effects particularly challenging.

The main objectives of the session are to:

(1) discuss the technical and scientific difficulties involved in defining: i) geological and geophysical models of the subsoil; ii) realistic seismic scenarios in volcanic contexts; iii) mapping the effects of earthquakes on geomorphological instabilities (i.e. landslides, liquefaction and volcanic fracture);

(2) propose integrated multidisciplinary and multiscale approaches that combine geological, geophysical and geotechnical data to better define the local geological configuration and local seismic hazard;

(3) propose advanced approaches and integrated methodologies, including geophysical surveys, geotechnical analyses, and numerical modelling;

(4) promote the utility of seismic microzonation results into urban planning and emergency management;

(5) outline future perspectives and shared frameworks to improve microzonation practices in urban areas located in volcanic contexts;

The session also aims to highlight the relevance of seismic microzonation as a key tool for reducing seismic risk in volcanic areas, where exposure is often amplified by urban concentration, the presence of critical infrastructures (i.e hospitals, public buildings, pipelines, ecc), and the interaction between seismic and volcanic hazards.

The main goal is to deepen the scientific and practical aspects needed to improve the quality of analyses and studies and their effectiveness in land-use planning and risk management.

By promoting dialogue among geologists, geophysicists, engineers, urban planners, and decision-makers, the session aims to outline shared strategies and more effective practices for seismic microzonation in volcanic contexts, contributing to a more informed and sustainable approach to territorial management.

Key themes of the session include:

- *the characterization of volcanic soils and their dynamic properties, through seismic investigations (spectral ratio techniques, array methods, down-hole tests), borehole data, and geotechnical data;*
- *the modelling of site effects related to pyroclastic deposits, altered lavas, and irregular morphologies, both surface and buried, including hydrothermal alteration processes;*
- *the integration of multidisciplinary data in 2D (and, where possible, 3D) numerical simulations to improve the accuracy of local seismic response;*
- *the joint assessment of seismic and volcanic hazards, considering both ground motion amplification and potential instabilities induced by volcanic processes (e.g., surface fracturing or ground deformation);*
- *digital innovation and real-time monitoring, using GIS platforms and open data for risk evaluation and management.*