SESSION 49- Site Response in Geotechnical Earthquake Engineering: From Modeling to Engineering Practice

Conveners

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Session Description

Local site conditions, including stratigraphy, soil characteristics, and basin geometry, play a critical role in how earthquake energy affects a region. These factors can significantly alter incoming seismic waves, leading to localized ground motion amplification or modification. Accurately capturing these site effects, along with considerations for soil nonlinearity and liquefaction potential, is essential for robust engineering design and the development of reliable seismic hazard and risk products.

This session focuses on the advanced modeling, analysis, and application of Site Response within Geotechnical Earthquake Engineering and risk assessment frameworks, seeking contributions that move beyond basic site parameter acquisition. We invite advanced research and applications in the following areas:

• Geotechnical Site Response Modeling and Analysis: Focus on sophisticated analytical and numerical methods to simulate dynamic soil behavior. This includes 1D, 2D, and 3D modeling techniques (e.g., equivalent-linear, nonlinear, or fully coupled effective stress analyses) for complex site

• structures and deep basins. Contributions should emphasize strategies for accurately capturing strain-compatible soil responses and best practices for selecting and implementing input ground motions.

• Quantifying Uncertainty and Variability: Research focused on distinguishing and managing aleatory and epistemic uncertainty stemming from uncertain soil parameters, variations in input-motion selection, and differences in model formulation. We emphasize methods that provide results directly applicable to Ground Motion Models (GMMs) and Probabilistic Seismic Hazard Analysis (PSHA).

• Liquefaction and Cyclic Softening: Site-specific methods for assessing liquefaction triggering and the resulting ground failure/softening consequences. Contributions should explore the integration of these effects with site-response analyses and their implications for the performance of critical infrastructure and urban risk evaluations.

• Tools, Data, and Emerging Technologies: Works focused on developing and sharing open datasets, efficient processing workflows, and new methods, such as those leveraging Machine Learning (ML) or Artificial Intelligence (AI), to infer, interpolate, or regionalize site-response characteristics, especially where recorded data is sparse.

The session is designed to be cross-disciplinary, encouraging participation from seismologists, geotechnical earthquake engineers, and structural/risk analysts. By bringing together worldwide case studies and advanced methodological developments, the session aims to help define good-practice guidelines for future work on site response, basin effects, and liquefaction-prone soils within the European Seismological Commission (ESC) community.