ADVANCING VULNERABILITY MODELLING FOR REGIONAL RISK ASSESSMENT

Special Session – 18th European Conference on Earthquake Engineering (ECEE 2026)

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SESSION OVERVIEW

With rapid urbanization and the increasing concentration of populations and assets in hazard-prone areas, **strengthening the resilience of civil infrastructure**, particularly residential buildings and exposed communities, has become a **global priority**. Natural hazards such as earthquakes and their secondary perils continue to pose significant risks, highlighting the urgent need for **advanced loss and vulnerability models** to support regional-scale risk assessments.

This session focuses on the **latest advancements in vulnerability modeling**, with an emphasis on quantifying key decision variables such as **environmental impact, economic losses, displaced populations, and fatalities** that are critical for event response and probabilistic event-based risk to support better evidence-based decision-making in disaster risk reduction by **understanding the full spectrum of potential risks**, including uncertain and extreme events in addition to their environmental consequences.



KEY TOPICS:

- Consequence modelling (e.g., damage-to-loss ratios, storey loss functions) for regional applications
- Analytical and/or empirical fragility and vulnerability functions for structural and non-structural components and building content for global building classes
- Damage-dependent vulnerability models for assessing losses under earthquake sequences (mainshock–aftershock), where structural damage accumulation is expected
- Methods and datasets to quantify losses, displacement, downtime, fatalities, and recovery trajectories
- Integration of embodied carbon and environmental costs into loss modeling to capture sustainability implications of damage, repair, and reconstruction
- Case studies validating models through real-world applications across diverse geographies

By convening experts from earthquake engineering, hazard sciences, social sciences, and catastrophe risk modeling, this session aims to foster interdisciplinary collaboration and advance state-of-the-art tools that directly inform decision-making. Attendees will gain valuable insights into strategies for assessing and enhancing the resilience of infrastructure systems and exposed populations, while supporting more effective preparedness, response, recovery, and equitable risk transfer worldwide.

CONVENORS



AL MOUAYED BELLAH NAFEH
Physical Vulnerability Lead
GEM Foundation



KARIM ALJAWHARI
Physical Vulnerability Modeller
GEM Foundation



GIANROCCO MUCEDERO
Research Fellow, Civil Engineer
IUSS Pavia