SS-32: Advancing Multi-Hazard Risk Frameworks through Life-Cycle Assessment for Sustainable and Resilient Built Environments

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Description

Communities and the built environment are increasingly exposed to multiple and interacting nature-based hazards, including earthquakes, floods, landslides, fires, and windstorms, whose combined impacts can produce severe cascading and compound events. Understanding how these hazards interact is crucial for accurately characterizing the evolving vulnerability and exposure of structures and urban systems.

While earthquakes arise from tectonic processes, climate change is modifying the frequency, intensity, and spatial distribution of weather- and climate-related hazards, amplifying the likelihood of multi-hazard scenarios and aggravating risk at regional and urban scales. The coexistence and potential overlap of these processes can trigger complex sequences such as earthquake-induced landslides, post-seismic fires, or climate-driven flooding and degradation, posing major challenges for performance-based design, risk assessment and mitigation, and infrastructure management. The session aims to advance multi-hazard risk and life-cycle assessment methodologies that explicitly capture such interactions through probabilistic modelling, vulnerability and exposure analyses, and life-cycle performance evaluation of the built environment. Emphasis will be placed on integrating sustainability metrics, climate adaptation, and life-cycle assessment within multi-hazard frameworks to promote risk-informed, sustainable, and climate-resilient decision-making across engineering and policy domains.

Topics of Interest

- Integrated multi-hazard and multi-risk modelling frameworks
- Cascading and compound hazard interactions (e.g., earthquake–fire, earthquake–landslide, flood–storm)
- Probabilistic, scenario-based, and hybrid modelling approaches
- Vulnerability and fragility analysis under multiple hazards
- Structural control and energy dissipation systems
- AI data-driven approaches for multi-hazard life-cycle risk analysis
- Climate-change impacts on hazard frequency, exposure, and vulnerability
- Life-cycle performance, optimisation, and sustainability assessment
- Integration of environmental and socio-economic indicators in risk governance