SESSION 58- *AI-Enhanced Real-Time Seismic Intelligence for Earthquake and Tsunami Early Warning*

Conveners

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Session Description

Rapid advances in artificial intelligence (AI), machine learning (ML), and real-time computational seismology are reshaping the future of earthquake and tsunami early warning systems worldwide. In recent years, deep learning–based seismic detection, multi-sensor data fusion, high-frequency GNSS integration, and edge-AI technologies have significantly improved the speed, reliability, and robustness of early warning capabilities. This session aims to bring together researchers, operational agencies, and developers working at the

intersection of **seismology, data science, geophysics, hazard monitoring, and AI-driven modeling**, with an emphasis on next-generation algorithms and real-time seismic intelligence.

This session invites contributions that develop, evaluate, or operationalize **AI-enhanced approaches** for earthquake and tsunami early warning. Submissions may include innovative methods, benchmark datasets, model validation studies, real-time system performance assessments, and regional or global operational implementations.

Topics of interest include, but are not limited to:

- AI/ML algorithms for **real-time earthquake detection**, phase picking, and rapid location

- Deep learning methods for **magnitude estimation**, finite-fault characterization, and inversion

- AI-assisted tsunami early warning, rapid inundation modeling, and real-time hazard forecasting

- Intelligent sensor networks, mobile phones, IoT/edge computing, and distributed early warning architectures

- Multi-modal data fusion integrating seismic, GNSS, strong-motion, InSAR, and environmental sensors

- Hybrid physics-based + AI frameworks for early warning and rapid impact assessment

- System reliability, uncertainty quantification, robustness, and false alarm reduction using AI

- Real-time shaking estimation, automated damage modeling, and predictive loss forecasting

- Case studies from operational early warning systems and cross-border early warning collaborations

Session Goals

The primary objective of this session is to foster collaboration among seismologists, computer scientists, hazard modelers, early-warning operators, and AI researchers. By highlighting both scientific advances and operational challenges, the session aims to accelerate the development of next-generation early warning systems and promote interdisciplinary solutions with real-world impact.

Participants are encouraged to submit contributions that present **new methodologies**, **operational evaluations**, **algorithmic innovations**, and **applications demonstrating measurable improvements** in warning speed, accuracy, reliability, and public utility.