SESSION 44- Seismology in the Era of Artificial Intelligence

Conveners
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Session Description

Artificial Intelligence (AI) is reshaping seismology by accelerating data analysis, improving detection capabilities, and enabling scalable solutions for complex geophysical problems. Modern seismic monitoring systems—dense arrays, ocean-bottom networks, nodal deployments, and Distributed Acoustic Sensing (DAS)—now generate massive data streams that require automated, intelligent processing. This session highlights innovative AI and Machine Learning (ML) applications that advance observational, theoretical, and applied seismology, while promoting physically interpretable and reliable scientific outcomes. We invite contributions on AI-driven earthquake detection, phase picking, signal classification, denoising, and automated catalog generation. Studies estimating source parameters—including magnitude, moment tensor, focal mechanisms, and rupture characteristics—using deep learning or hybrid physics–ML approaches are strongly encouraged. We also welcome works implementing transformer models, graph neural networks, generative AI, self-supervised learning, and physics-informed neural networks designed for scalable seismic analysis. AI-enhanced seismic imaging is a key focus. Submissions may include neural network-assisted tomography, surrogate or ML-accelerated full-waveform inversion, subsurface property emulation, or structure detection from multimodal geophysical datasets (e.g., seismic, geodetic, InSAR, gravimetric). We emphasize methods that prioritize uncertainty quantification, model transferability across regions, explainability, and robustness in challenging conditions such as sparse or noisy data environments. Applications supporting seismic hazard mitigation are encouraged, including intelligent earthquake early warning (EEW), ground-motion prediction, induced seismicity

monitoring, aftershock forecasting, rapid impact assessment, and decision-support frameworks. Topics addressing ethical AI, reproducibility, dataset transparency, open-source model sharing, and computational infrastructures that promote accessible and scalable seismic AI are also welcome.

This session aims to bridge seismology, data science, and computational engineering to define emerging best practices and accelerate the development of next-generation intelligent seismic systems with societal impact.