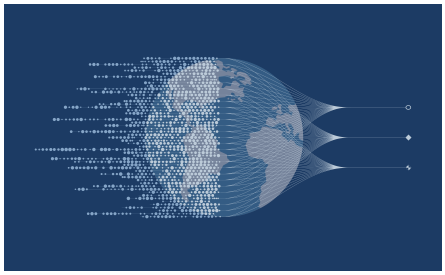

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Seismic Risk Evaluation of Nuclear Research Reactors in Indonesia: Enhancing Monitoring and Nuclear Test Verification

Thursday 11 September 2025 10:00 (1 hour)

Indonesia, located at the intersection of major subduction zones and active fault systems, such as the Sunda Trench, Lembang and Cimandiri Faults, is vulnerable to seismic hazards that pose risks to critical infrastructure, including nuclear research reactors.

This study evaluates seismic risks at three reactor sites — Kartini (Yogyakarta), Swabesi (Serpong) and TRIGA 2000 (Bandung) — using probabilistic seismic hazard analysis (PSHA) based on the 2009–2024 earthquake catalogue from BMKG, incorporating data from 6 Auxiliary IMS stations in Indonesia as part of the CTBTO's monitoring network.

The analysis integrates fault-based models, ground motion prediction equations and site-specific soil amplification effects to estimate peak ground acceleration (PGA) for a 475-year return period. TRIGA 2000 faces the highest seismic hazard (PGA ~0.40g), influenced by the Lembang and Cimandiri Faults. Kartini Reactor experiences moderate risk (PGA ~0.35g), while Swabesi Reactor, with a lower PGA (~0.20g), faces significant amplification effects due to soft soils. The results align with Mangkoesobroto (1998) and Parithusta (2018), emphasizing fault-based hazards and soil amplification.

This study explores integrating these reactors into Indonesia's seismic network to enhance low-magnitude event detection linked to underground nuclear tests. Strategically located near active faults, these reactors can strengthen regional monitoring and support nuclear test verification under the CTBTO.

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