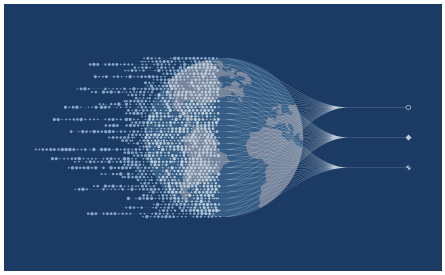

ID: **O3.5-157** Type: **Oral**

# of Underground Nuclear Explosions Using Phase Picking Techniques in Seismic Analysis

Accurate phase picking detection is crucial in seismic analysis, particularly in detecting underground nuclear explosions. Due to the overlapping wave characteristics, differentiation between seismic events caused by nuclear detonations and natural earthquakes is challenging. This study focuses on developing and applying advanced phase-picking techniques to identify and analyze nuclear explosions using seismic data.
The research incorporates traditional methods such as STA/LTA for detecting P- and S-wave arrivals, alongside modern machine learning algorithms like PhaseNet for enhanced accuracy and automation. The study also integrates amplitude ratio analysis (P/S and volume/surface wave ratios) and spectral discrimination to distinguish nuclear events from natural seismic sources.
Additionally, data from the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) monitoring site in Indonesia (site SIJI) were analysed. Results show that the signal to noise ratio (SNR) achieved using PhaseNet was 25.02 dB, significantly higher than the 8.216 dB obtained using STA/LTA.
Results demonstrate that automated phase picking with deep learning models outperforms traditional approaches in detecting weak signals from nuclear tests, even in noisy environments. Furthermore, combining phase picking with statistical amplitude analysis significantly improves event classification accuracy. This methodology enables precise source characterization, including event location, magnitude and source type, contributing to global efforts in nuclear test monitoring.

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Session Classification: O3.5 Analysis of Seismic, Hydroacoustic and Infrasound Monitoring Data

Track Classification: Theme 3. Monitoring and On-Site Inspection Technologies and Techniques: T3.5 Analysis of Seismic, Hydroacoustic and Infrasound Monitoring Data