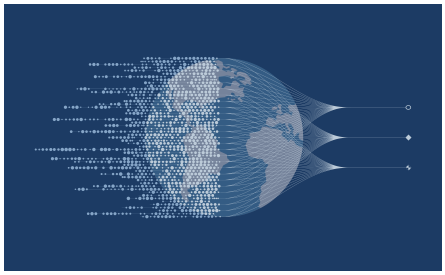

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3-D Seismic Wavefield Simulations to Characterize IMS Monitoring Capabilities

Improving global capabilities for seismic detection of underground nuclear tests may require upgrading and expanding instrument networks in regions of importance, as well as assessing vulnerabilities such as data loss from key monitoring stations. This study uses numerical wavefield propagation software SPECFEM to quantify International Monitoring System (IMS) network performance. We simulate seismic wavefields from declared and hypothetical nuclear tests, as well as tectonic events of similar magnitude and location, through 3-D models of regional and global Earth structure. Resultant synthetic waveforms are combined with realistic station-dependent noise and processed with standard discrimination techniques to determine minimum yield and distance in which explosions can be discriminated from earthquakes. Initial synthetic comparisons with declared North Korean nuclear test data show a promising fit, suggesting synthetic waveforms can be used in such a manner. This framework is also used to quantify the impacts of additional monitoring locations in areas of critical importance, rearrangement of existing monitoring arrays and the removal of key monitoring stations to mimic data or station loss scenarios. This work was supported by the Nuclear Arms Control Technology (NACT) Program at Defense Threat Reduction Agency (DTRA) and cleared for release.

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