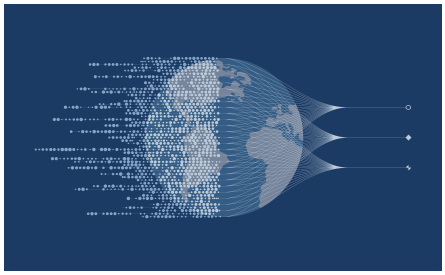

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# of Explosions in Earthquakes: Case Studies with Spotlight Detectors

In 2012, the National Research Council concluded that earthquake signals cannot effectively mask those produced by explosions. We test that conclusion with multi-channel correlation detectors (correlators) that use records of ground motion (templates) sourced by explosions to detect smaller signals from similar, collocated sources. Our test applies these detectors against thousands of signals with a waveform injection method. This method amplitude-scales a template waveform over a grid of amplitude values, adds these waveforms into a target data stream at times that create interference with background seismicity and processes their sum with a correlator. We apply this method to explosion templates sourced in Nevada state (USA) and recorded by the multi-channel array NVAR. Our study thereby compares correlator performance when we deliberately inject templates into earthquake signals, relative to baseline operation that processes target waveforms injected into data that is absent of known seismicity. We find that a correlator that uses an explosion-sourced template, and that can reliably detect a 1.7 ton, shallowly buried explosion in background noise (a 0.97 detection rate), is unlikely to detect the same event in noisy earthquake interference (a 0.37 detection rate). We thereby demonstrate that earthquake seismicity can hide explosion signals.

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