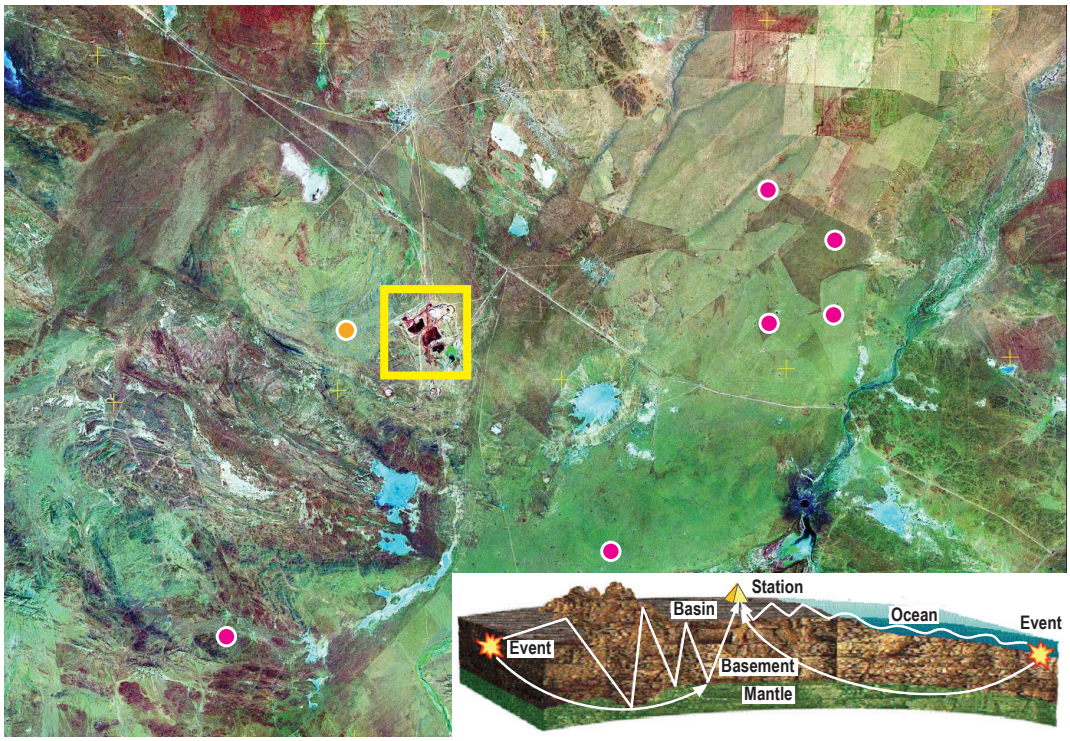
GNEM: Ground-Based Nuclear Explosion Monitoring

Research & Engineering

Earth & Environmental Sciences

Los Alamos NATIONAL LABORATORY EST.1943



We provide ground-based monitoring technologies for detecting, locating and identifying nuclear explosions to deter proliferation through analysis of seismic and infrasonic data on local, regional and global scales.

Left: *Satellite image showing estimated locations for single seismic events (red dots) and improved location by cluster analysis (orange dot). A new open pit mine (yellow box) is the probable source.*

Inset: *Conceptual 3D model showing global teleseismic monitoring (>2000 km) and regional seismic signal paths. Many stations record signals (white lines) that travel over long paths in a uniform, deep Earth while other paths are more complicated due to crustal geological variations.*

Background

Develop technical solutions for NNSA in support of the Air Force Technical Application Center (AFTAC) and other US government agencies' goals, objectives and requirements for nuclear explosion monitoring. We provide techniques and methodologies to detect, locate, and identify nuclear explosions with high confidence resulting in a low false-alarm rate. Our research involves the analysis of teleseismic, regional, and sub-regional seismic signals, and global and regional infrasonic data.

Capabilities

Deliver and demonstrate integrated research products as part of the NNSA GNEM Knowledge Base (KB) deliveries to AFTAC as well as providing developmental research products and reports. These deliveries include data from the US Atomic Energy Detection System seismic stations and other seismic stations such as the Comprehensive Test Ban Treaty Organization's International Monitoring System. Research results are presented to AFTAC's Seismic Review Panel three times a year, and published in the annual Monitoring Research Review (https://www.nemre.nnsa.doe.gov/proceedings)

Future Applications

As the requirements for event detection, location, and identification of lower and lower yield explosions, the population of seismic events increases exponentially which demands improved automated signal processing. The ability to monitor nuclear explosions effectively in specific regions is a priority. One of the key challenges in understanding the national security threat is determining an accurate explosion yield. To accomplish these goals global 3D and regional geophysical characterization and an analytical explosion source model along with continued signal calibration efforts are necessary.

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Right: The infrasound "spider" array, located at the Elgin Field Observatory, Ontario, Canada, detects low frequency acoustic waves generated by atmospheric explosions..

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