



Seismology in MTV

MTV Kickoff Meeting

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Introduction and Motivation

Seismology is useful for

- Detecting earthquakes and explosions
- Locating earthquakes and explosions
- Discriminating between earthquakes and explosions
- Estimating the size of earthquakes and explosions



Introduction and Motivation

Seismological monitoring and analysis is imperfect

- Many small seismic events are not detected
- Location uncertainties are routinely large (many km)
- Discrimination methods do not always work
- Seismological yield estimates disagree
- Understanding of elastic waves from UNEs is incomplete



Mission Relevance

Improved seismological capabilities will

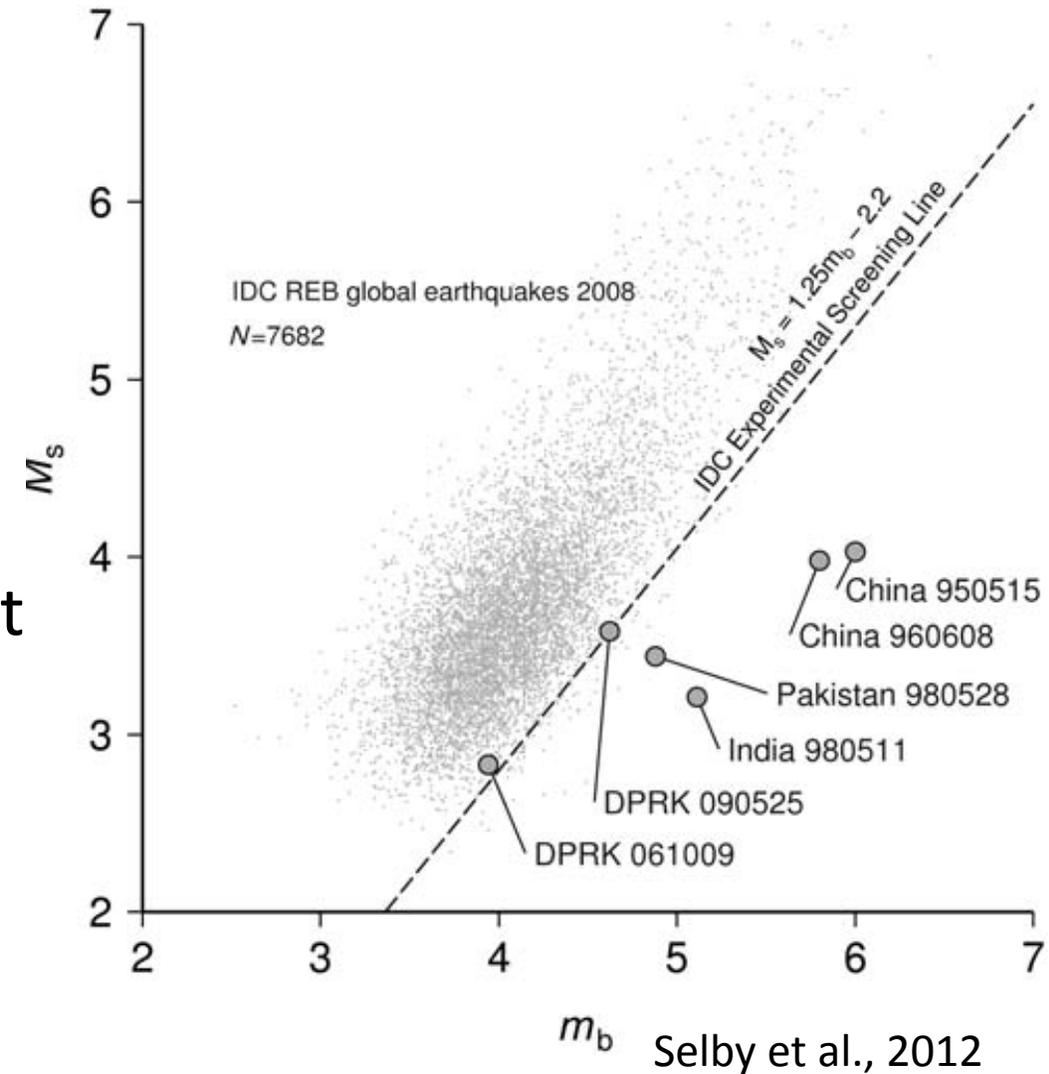
- Enhance the ability to monitor nuclear testing
- Improve the characterization of underground nuclear tests
- Build confidence and trust in monitoring capabilities



Technical Work Plan

Understanding the mb-MS discriminant

- Improved model for wave excitation
- Modern analysis of UNEs using legacy data
- Comparison with Source Physics Experiment

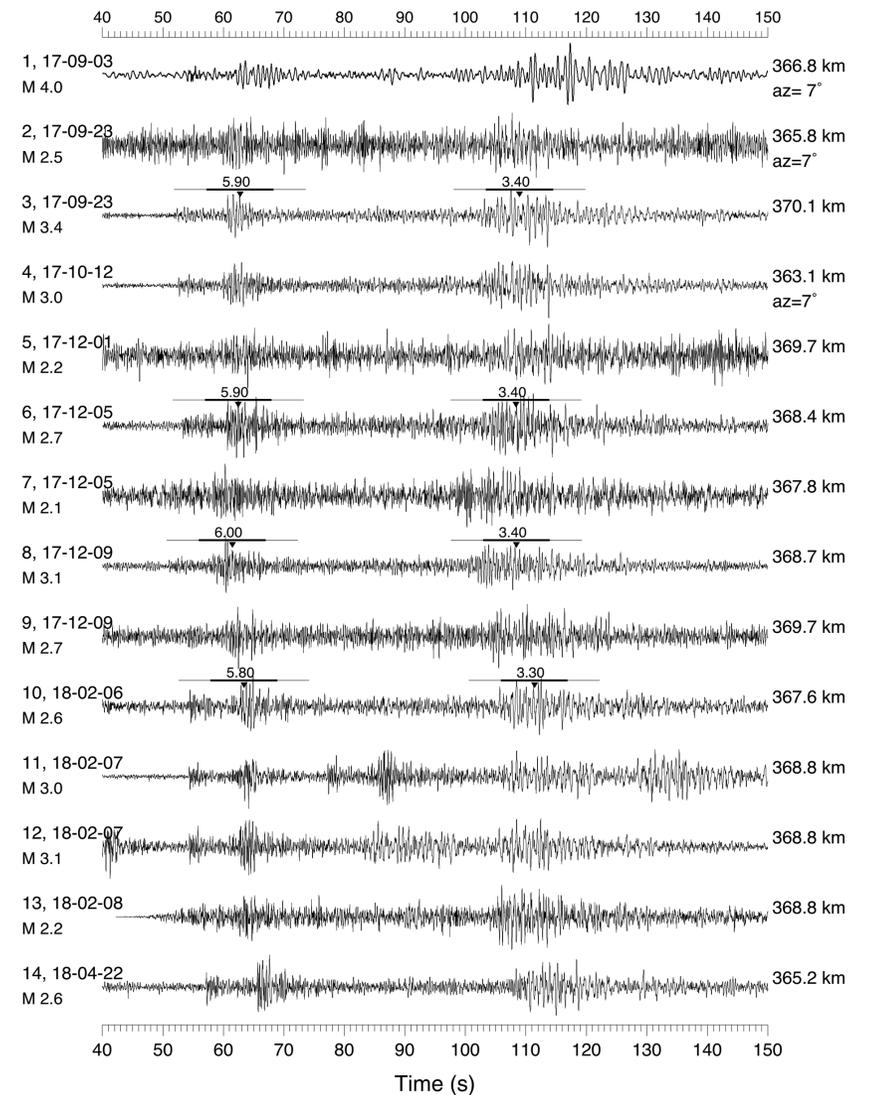


Technical Work Plan

Improved discrimination of sources

- Data discovery in relevant geographical areas
- Application of spectral discriminants
- Tuned multiparameter discriminants

Vertical Records at MDJ from 14 Small Shocks around North Korean Test Site



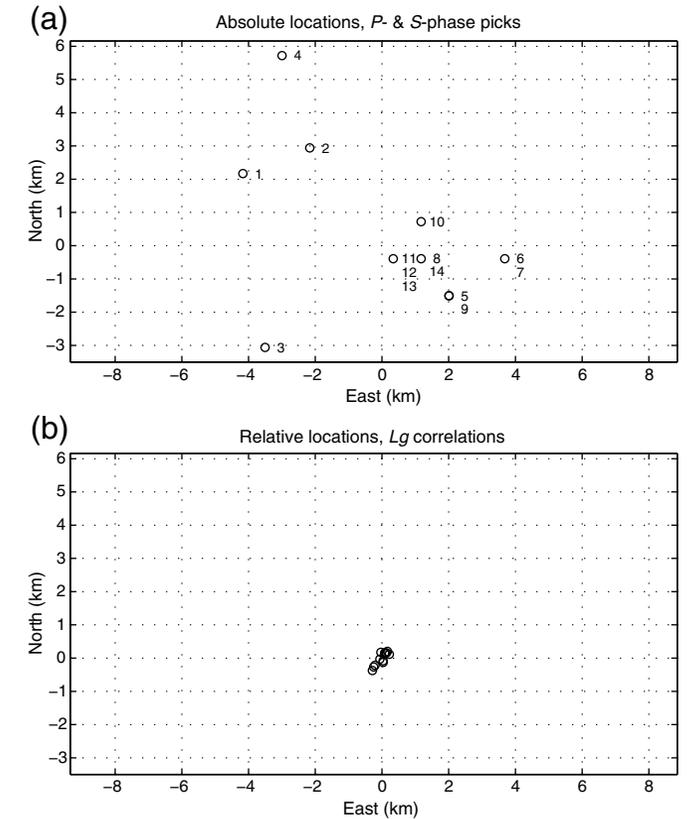
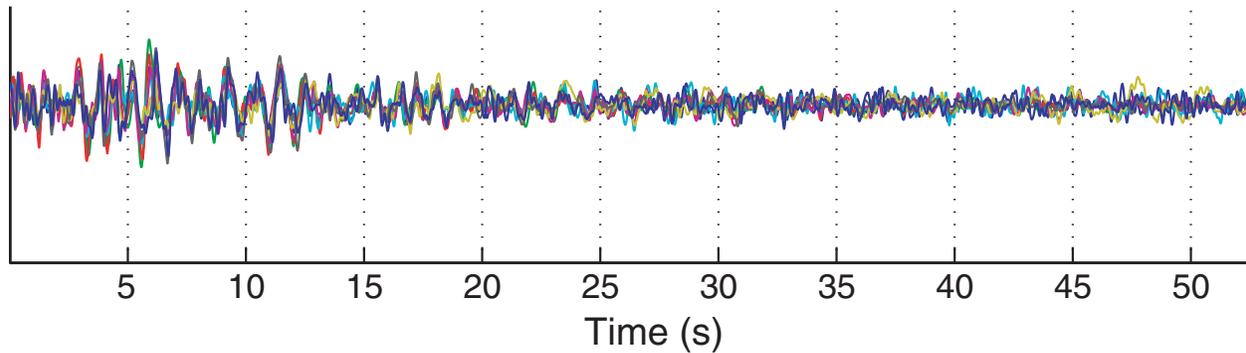
Kim et al., 2018



Technical Work Plan

Improved event detection and location

- Event cross-correlation for relative location
- Continuous correlation for detection
- Data mining in relevant geographical areas



Schaff et al., 2018

Expected Impact

- Better physical understanding of mb-MS discriminant
- Improved characterization of historical UNEs using legacy data
- Enhanced methods of continuous event detection using modern correlation techniques
- Enhanced methods of event location and discrimination in selected geographical areas
- Characterization of seismicity near existing and possible nuclear test sites



MTV Impact

- New and continued collaborations with LLNL, LANL, SNL
- Synergies with other technologies (infrasound, radioxenon)
- Training of students in monitoring seismology
- Engagement with national and international organizations concerned with improved global seismological monitoring
- Participation in efforts to preserve and utilize legacy seismological data for UNEs



Conclusion

The seismological research will

- Enhance the ability to monitor nuclear testing
- Improve the characterization of underground nuclear explosions
- Build confidence and trust in monitoring capabilities
- Engage and train young seismologists

The Columbia team: Göran Ekström, Paul Richards, Won-Young Kim, David Schaff, Jack Wilding (recent Columbia BA)



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