Observing Earthquake Today to better Protect for Tomorrow

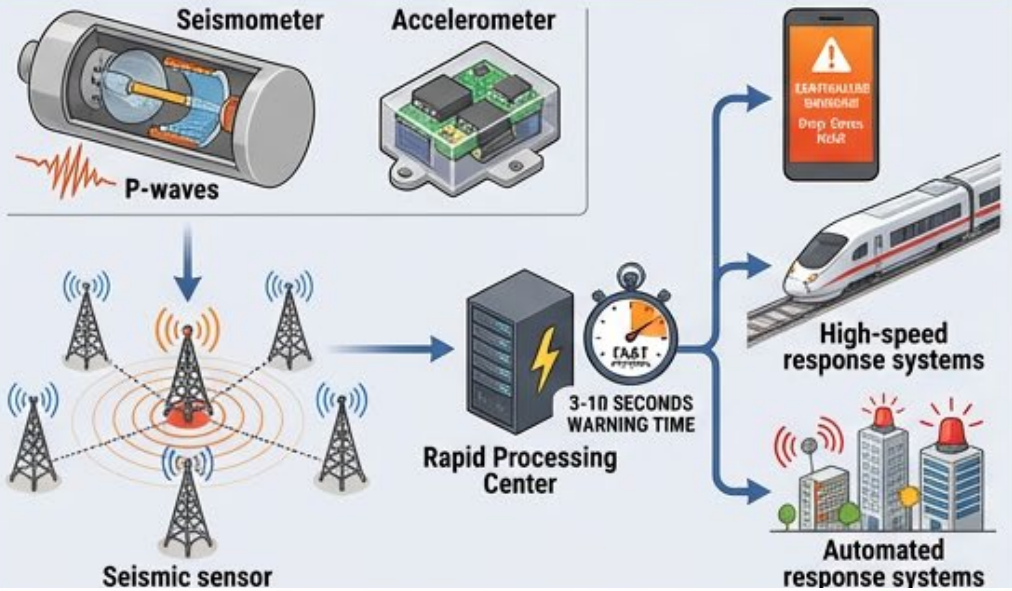
Patinya Pornsopin

World Meteorological Day 2026
presented on March 23, 2026 at TMD.

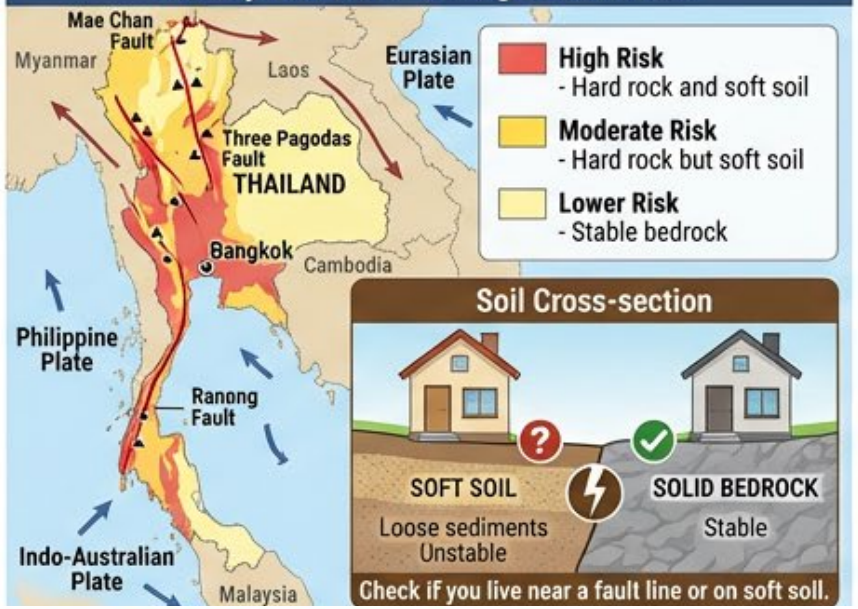
Observing Earthquake Today to better Protect for Tomorrow

OBSERVING TODAY (Awareness)

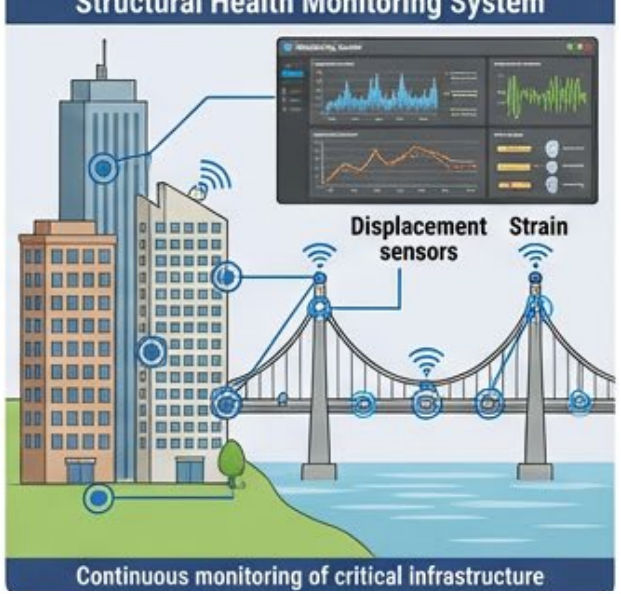
Early Warning System – Seconds Save Lives



Identify Your Risk – Geologic Observation

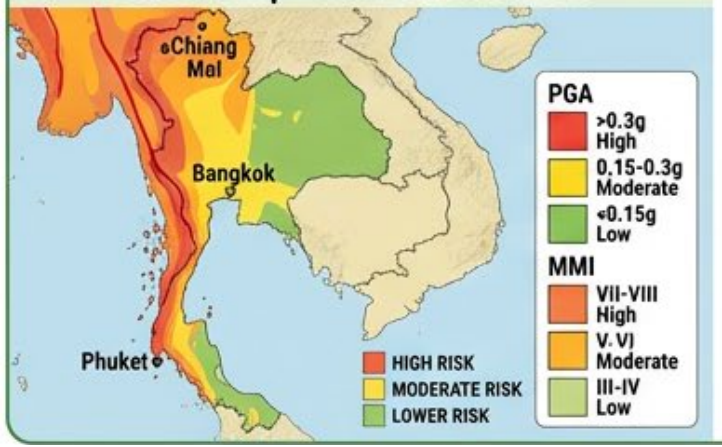


Infrastructure Monitoring – Structural Health Monitoring System

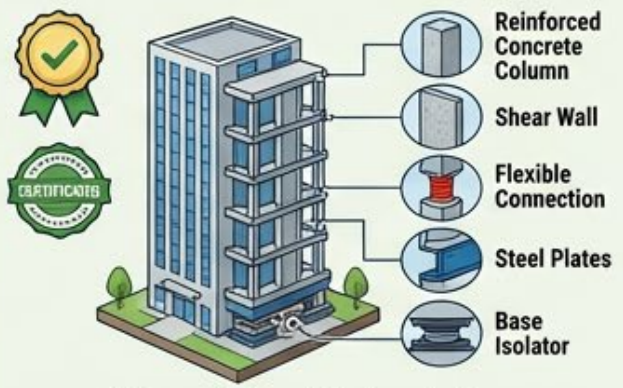


PROTECTING TOMORROW (The Action)

Hazard Map - Know Your Risk Zone



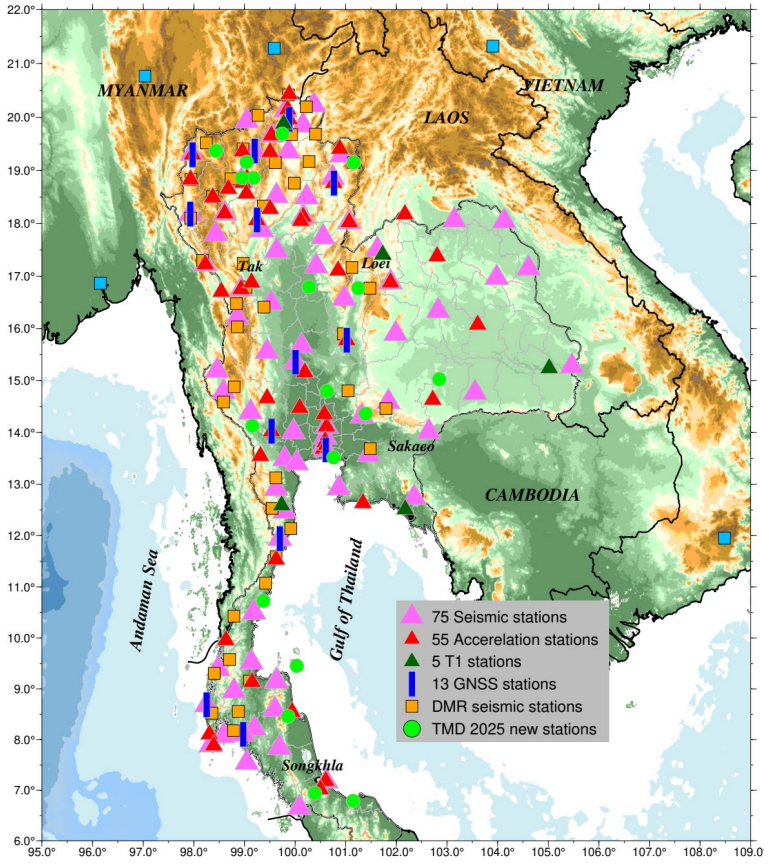
Engineering & Building Codes

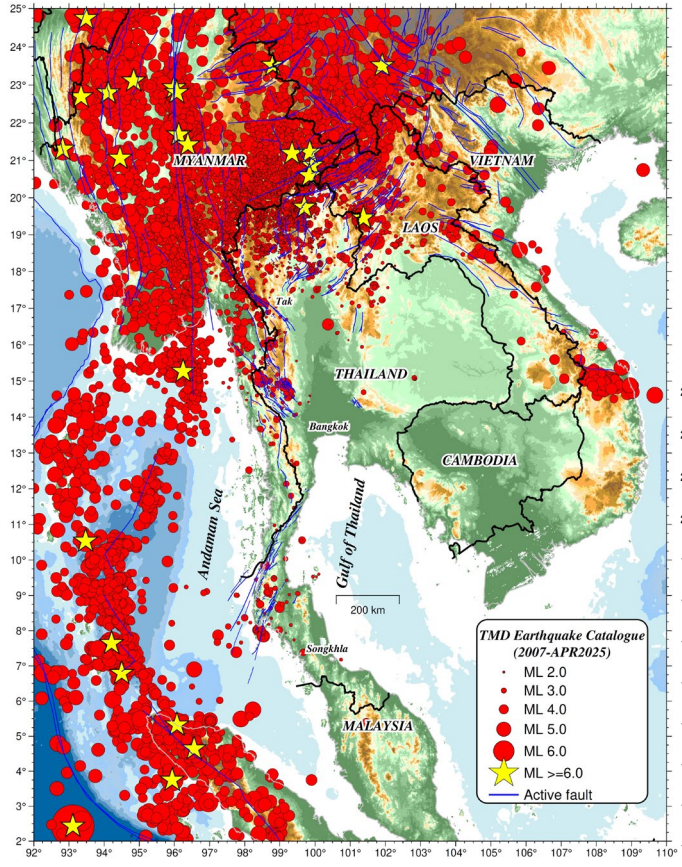


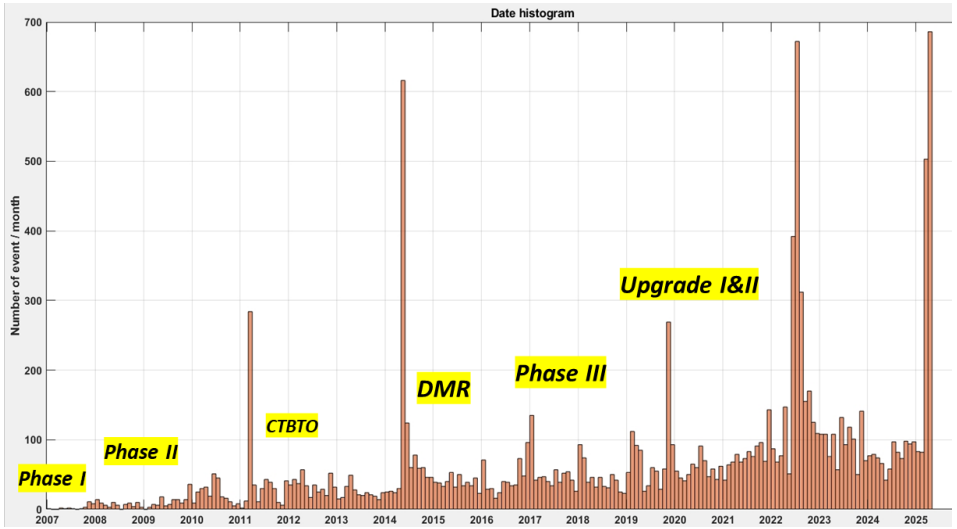
Mitigation

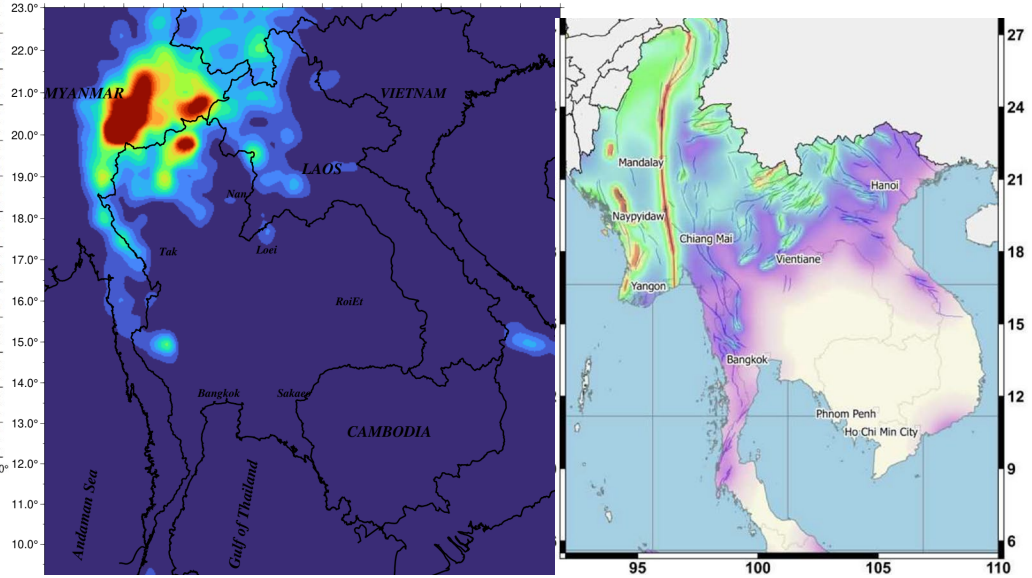
Community Resilience

We can’t stop an earthquake, but we can use observation data to ensure protection for tomorrow!



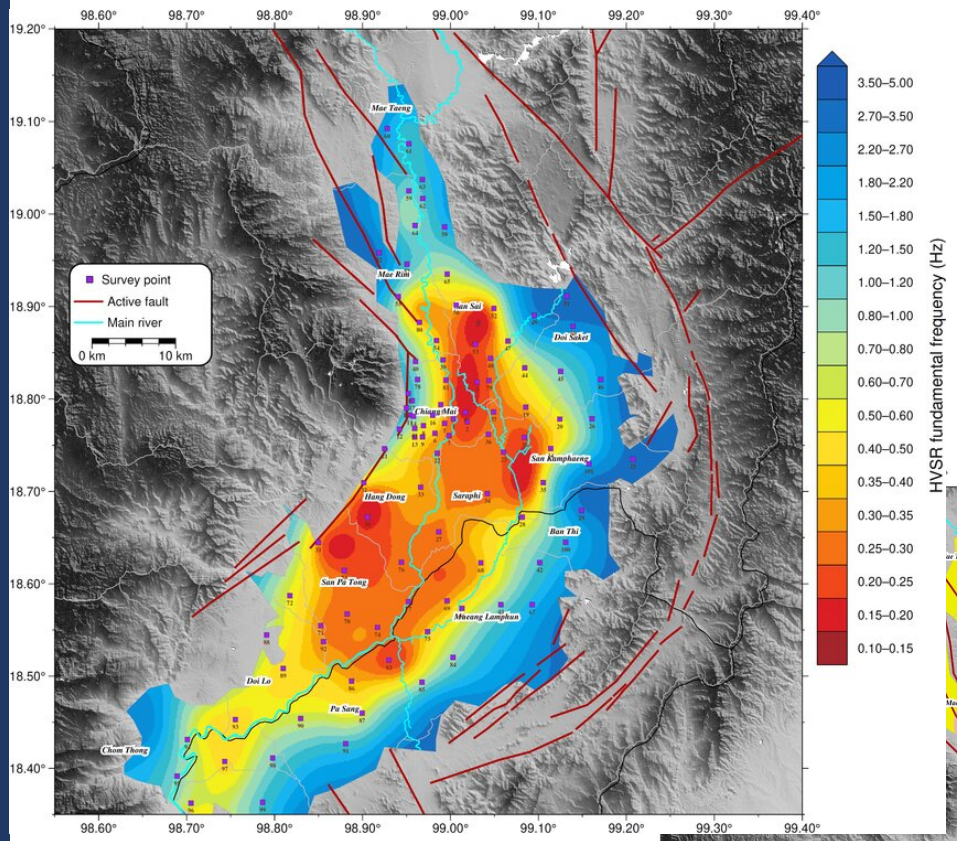


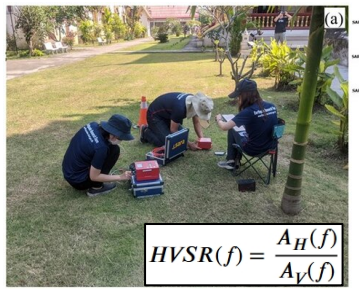


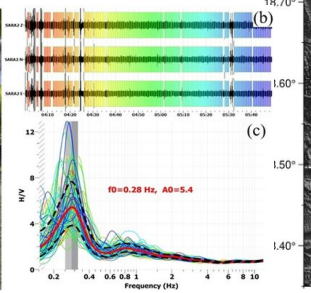


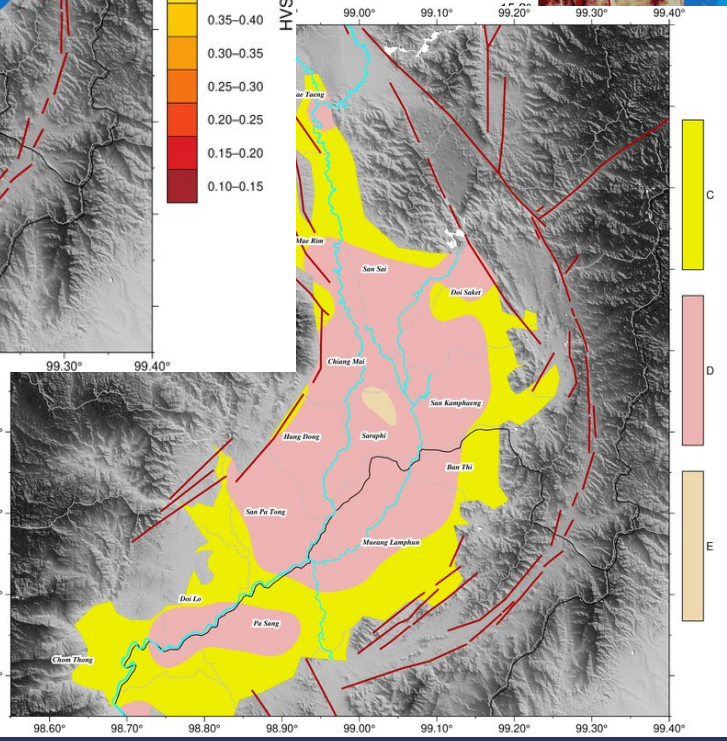
Identify a Risk

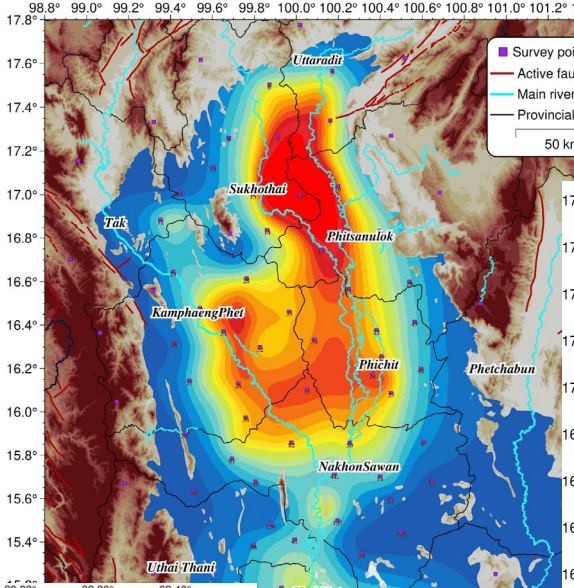
โครงการฯที่เกี่ยวข้องที่ได้รับทุนจาก สกสว. ที่ผ่านมา

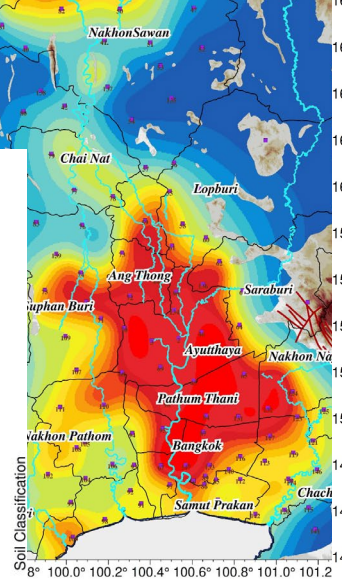


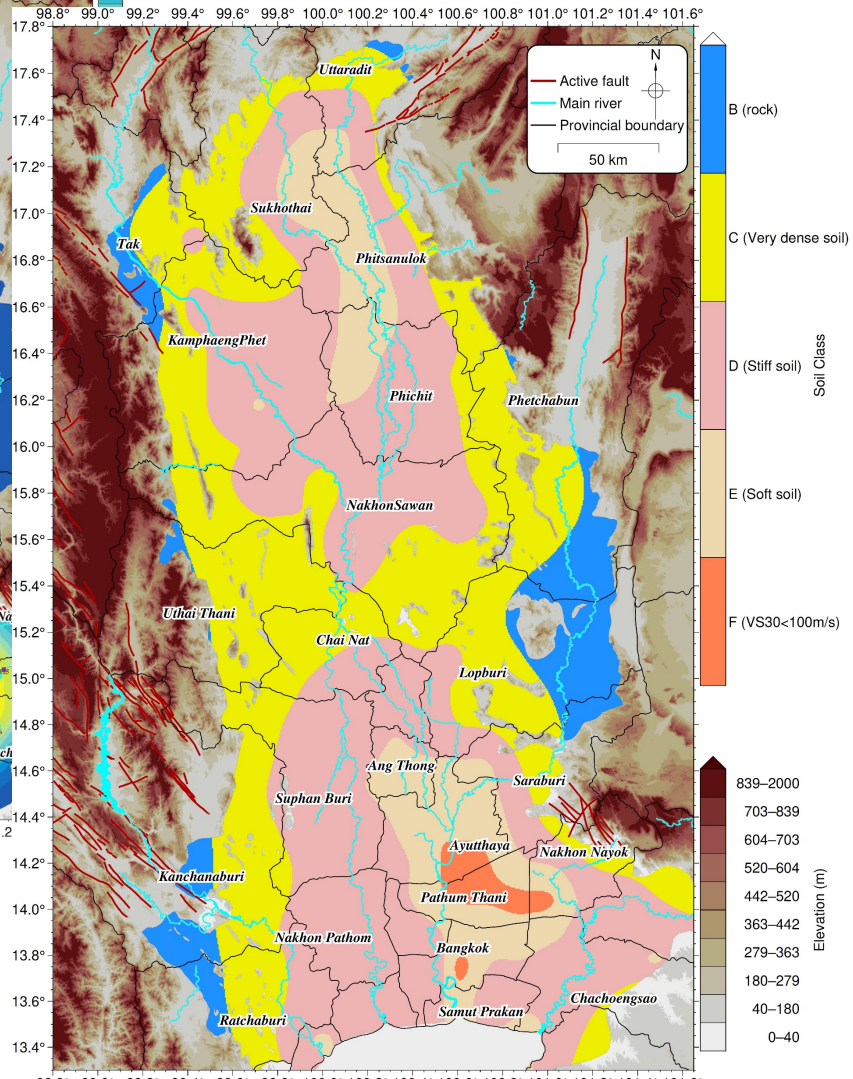




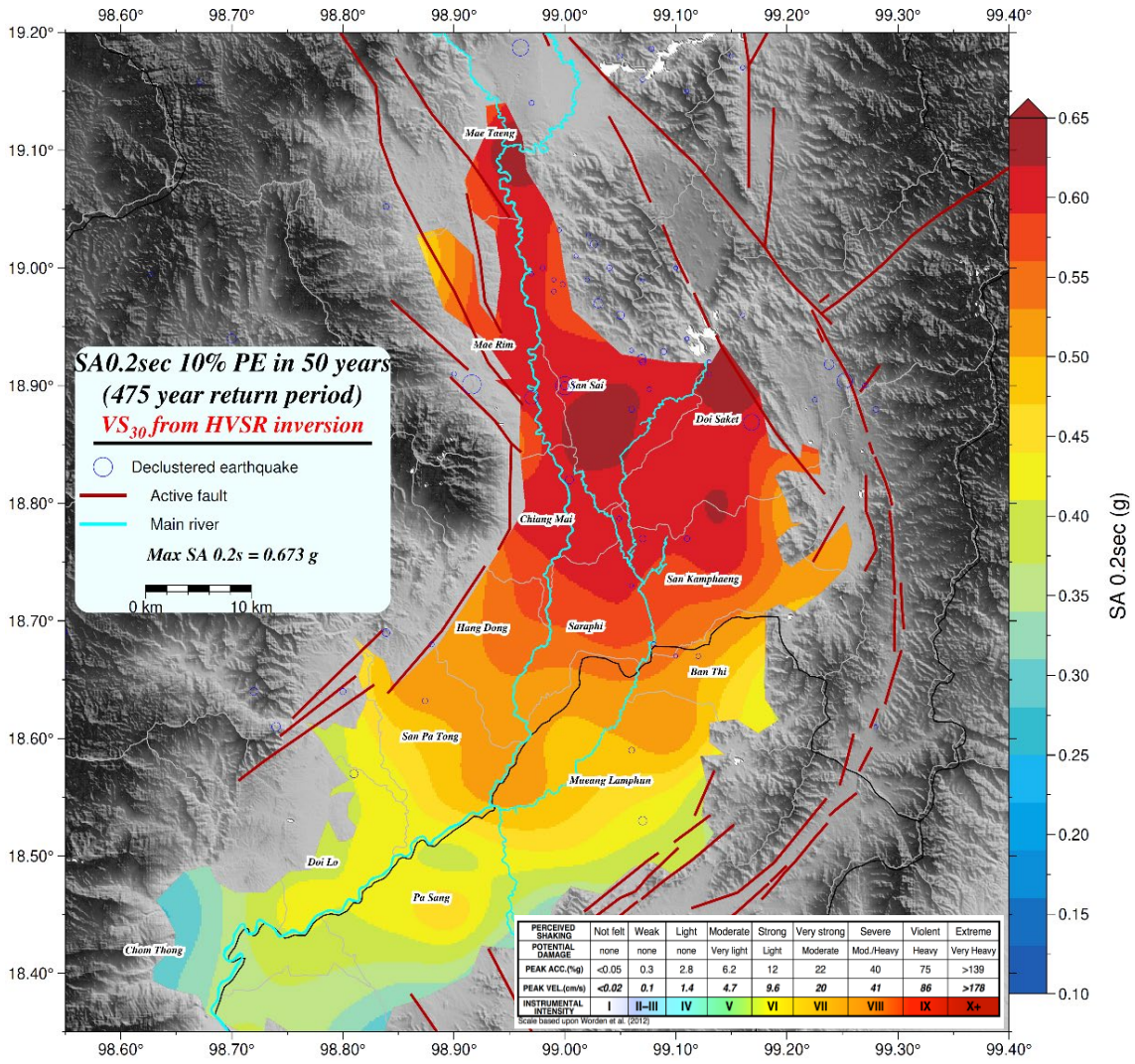


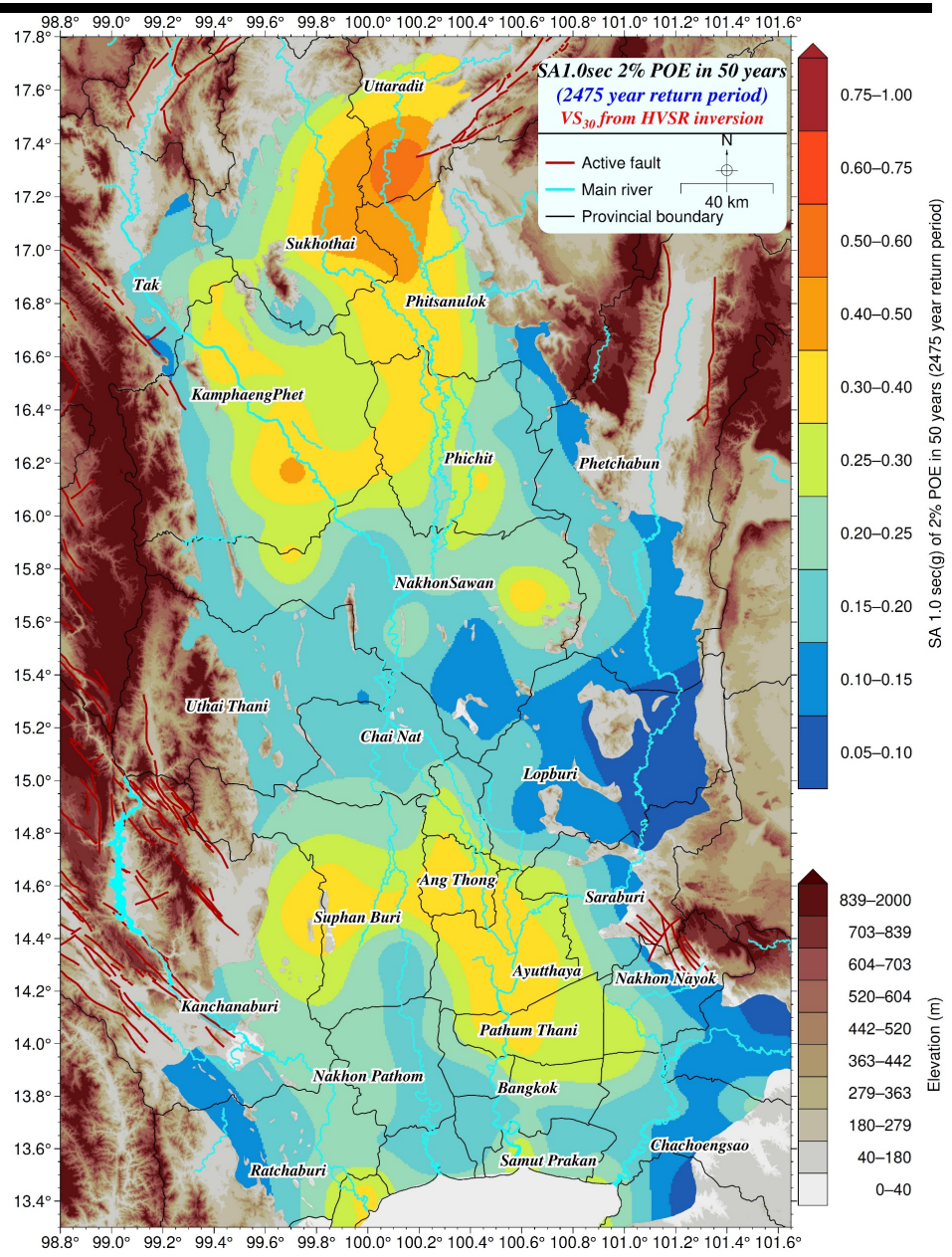






Hazard Map – Know your risk zone





Pornsopin, P., Pananont, P., Furlong, K. P., Chaila, S., Promsuk, C., Kamjudpai, C., & Phetkongsakul, K. (2024). Seismic Microzonation Map of Chiang Mai Basin, Thailand. *Trends in Sciences*, *21*(3), Article 7370. https://doi.org/10.48048/tis.2024.7370

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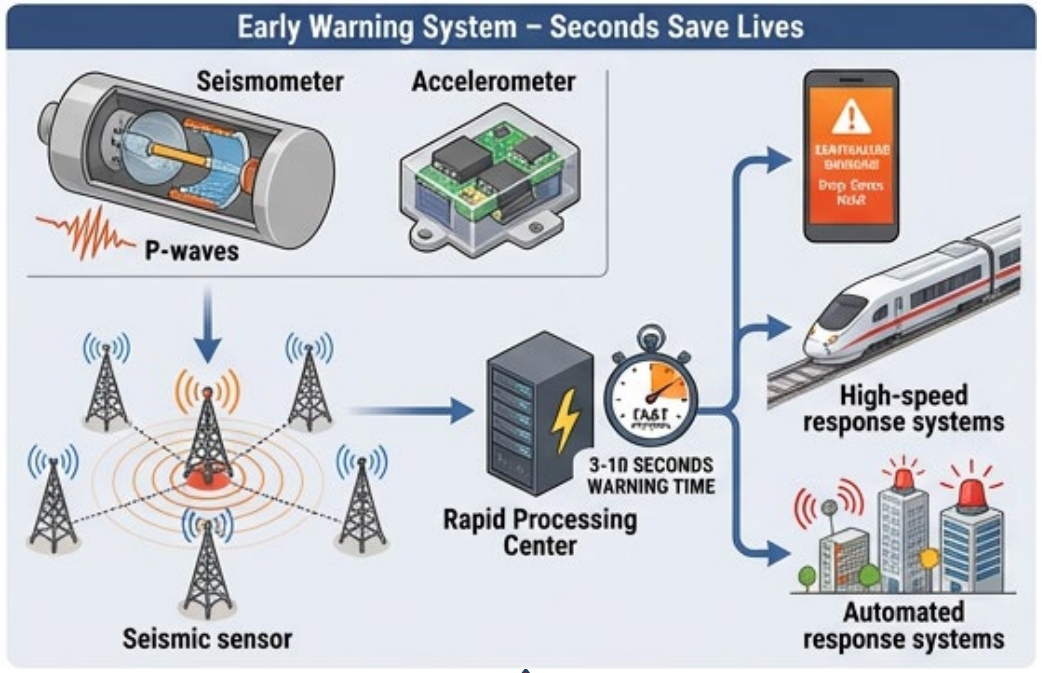
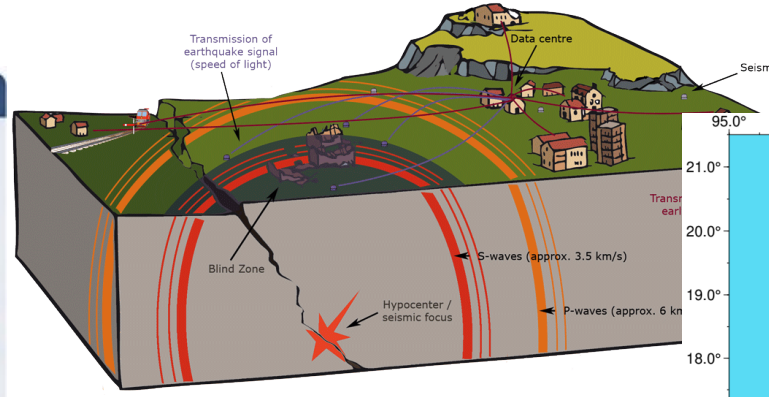
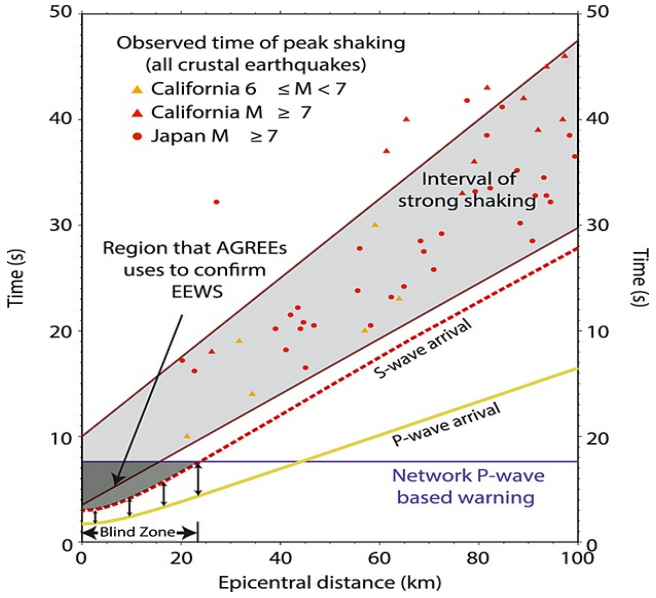
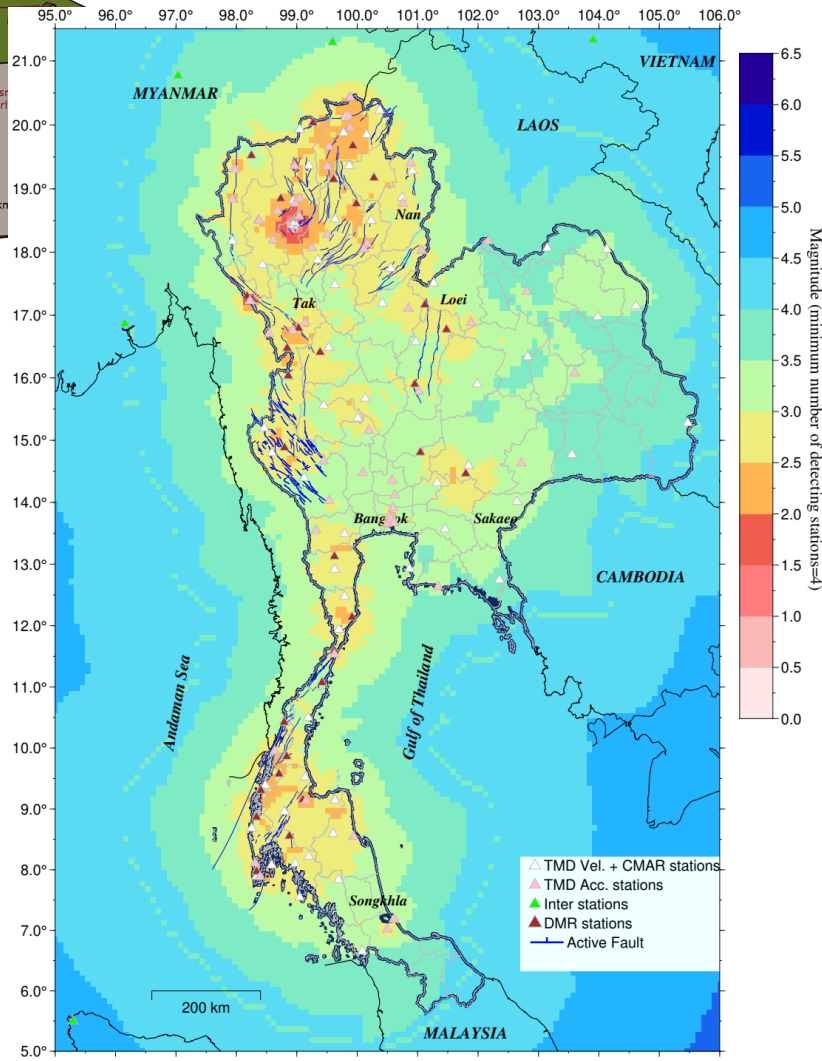
Earthquake Early Warning (EEW)









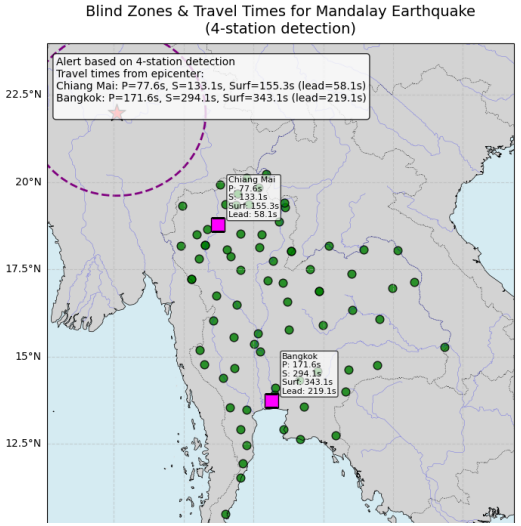
Times

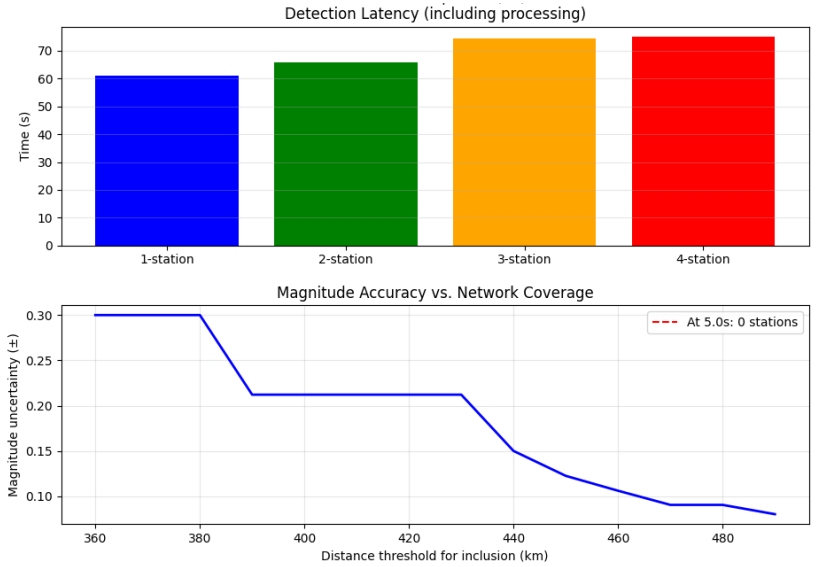
- Communication, Network streaming
- Density of seismic station?
- EEW software? Fast estimation!

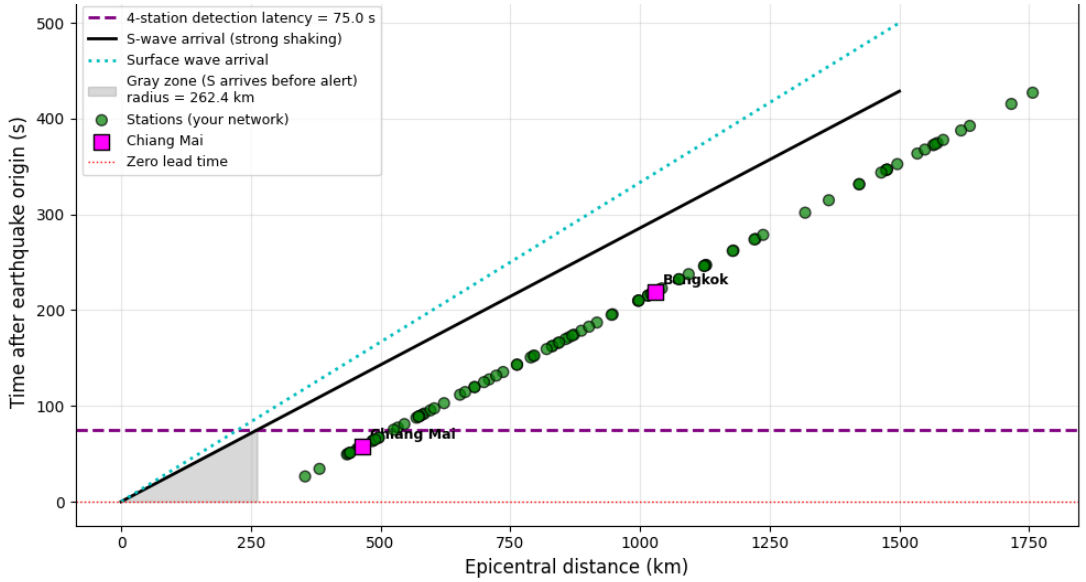
- small packet sizes
- Small sample rates
- Direct to EEW server

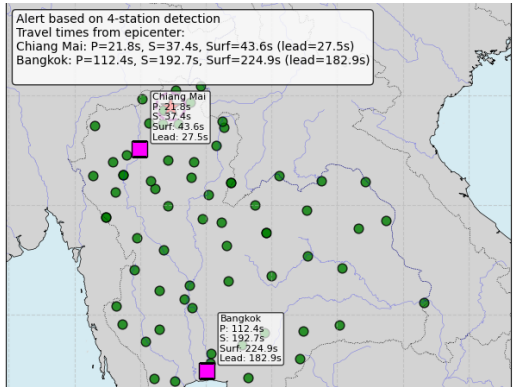
- Detection performance of seismic network

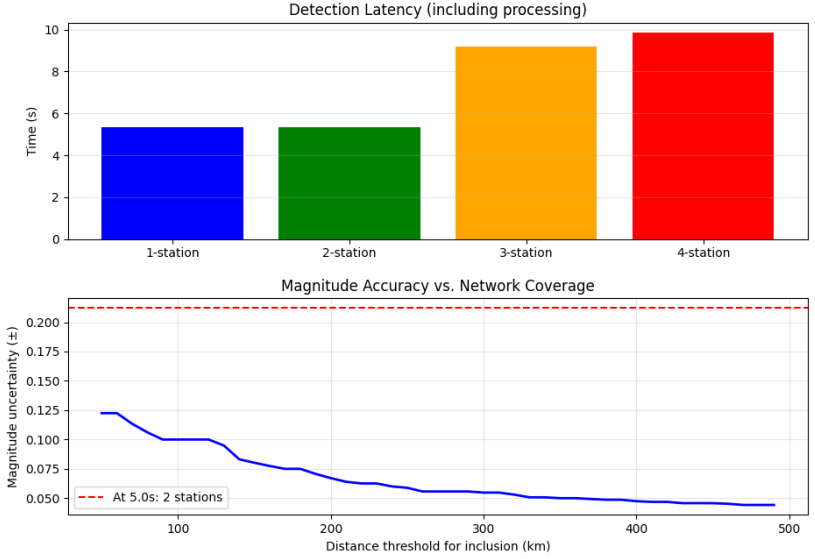
Earthquake Early Warning (EEW)

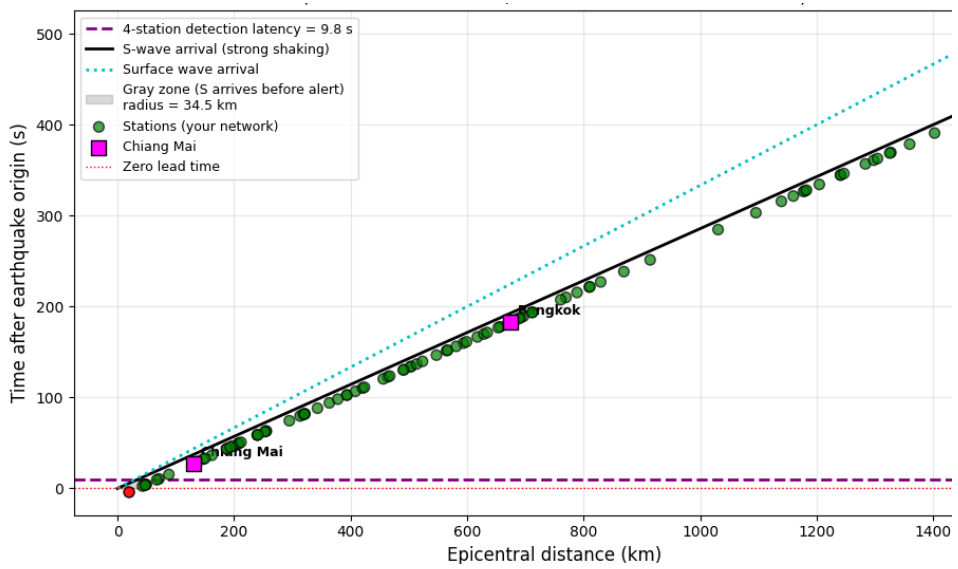




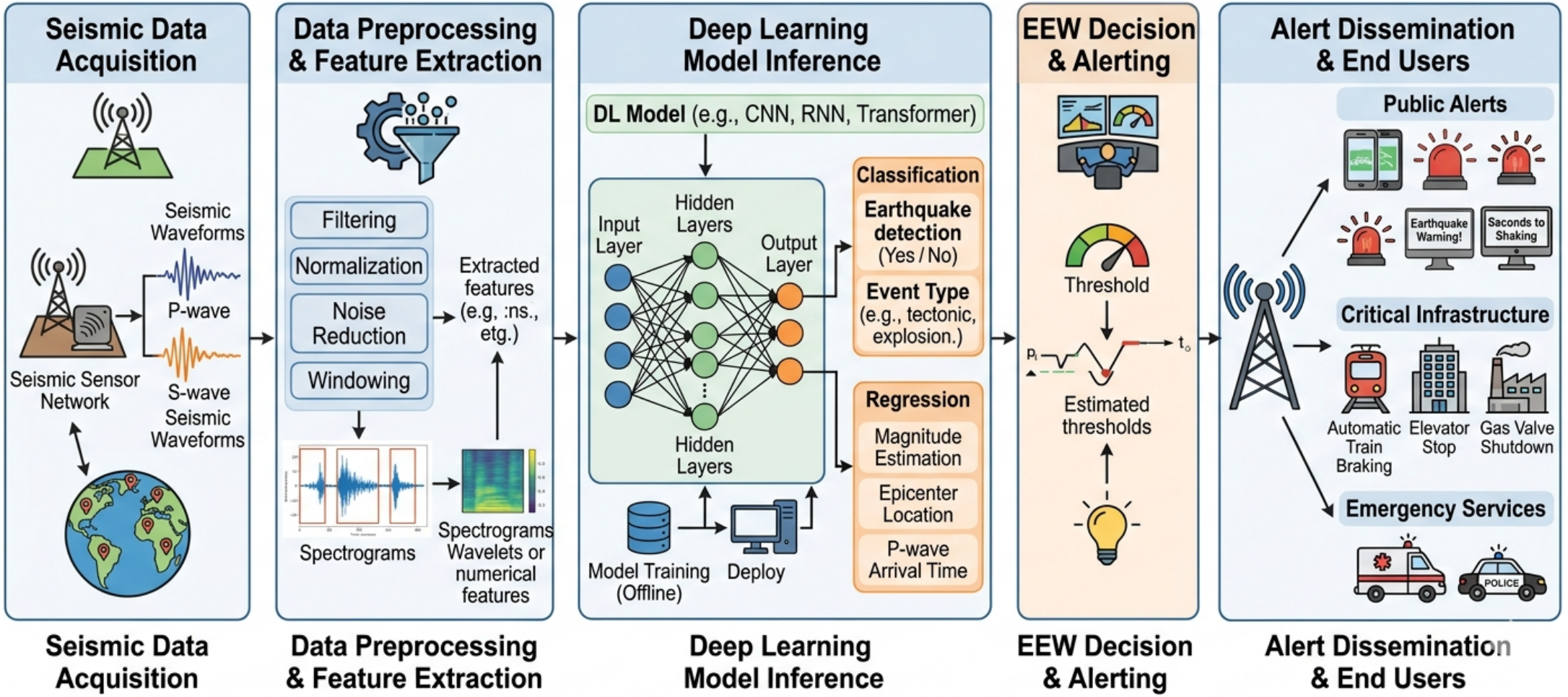




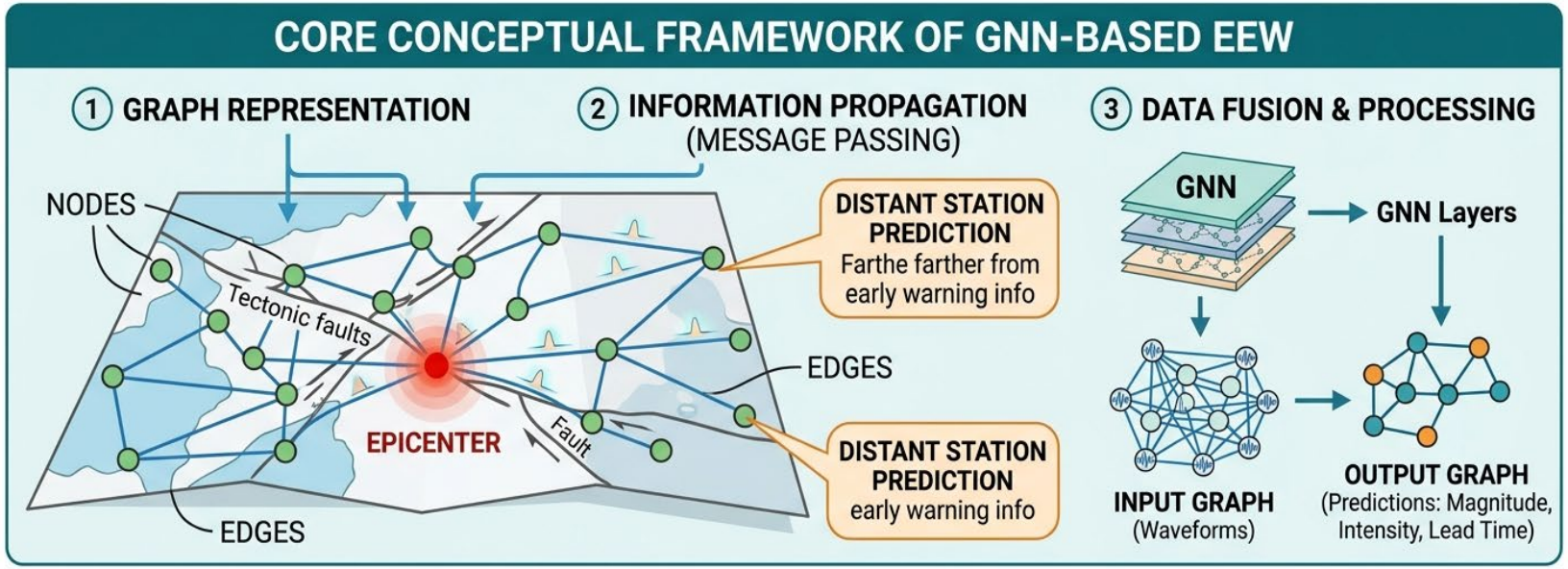


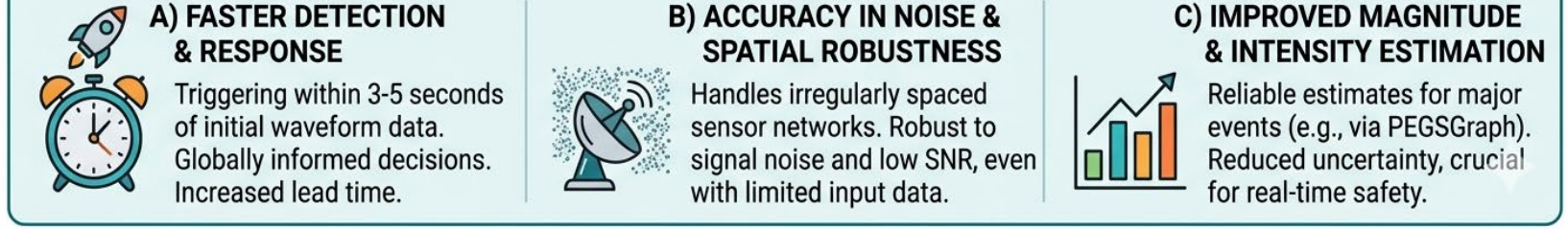


Deep learning –Based EEW



Graph Neural Networks (GNNs) -Based EEW



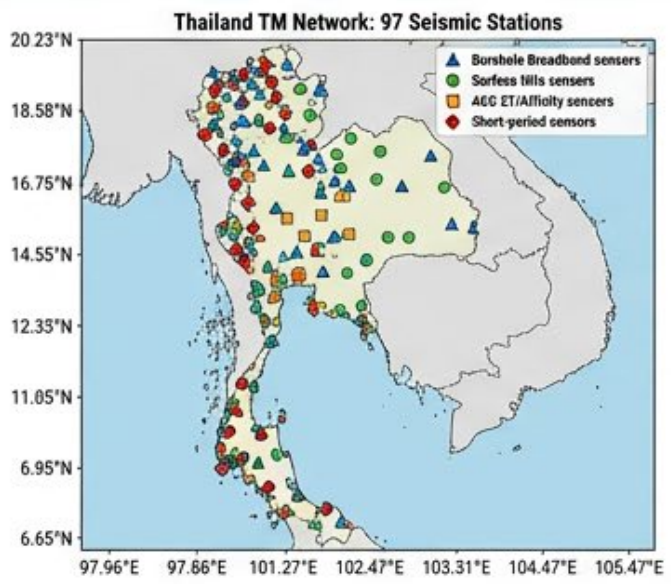


Graph Representation:
Nodes (V): Each node represents a seismic station recording 3-component waveform data (North-South, East-West, Up-Down).
Edges (E): Edges represent the spatial relationships or "links" between these stations, which can be pre-defined by distance or learned dynamically by the network.

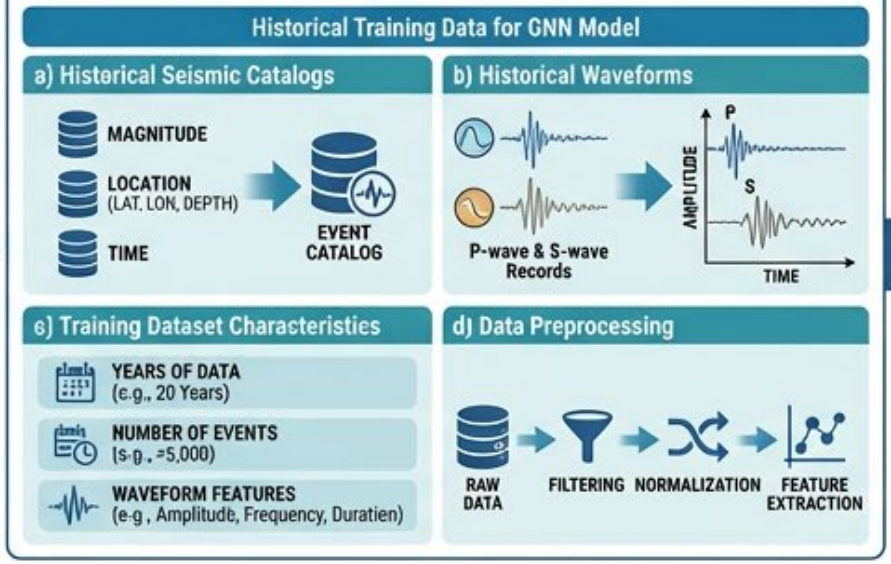
Faster Detection: By exploiting locally available data from the first few stations to "trigger," GNNs can make globally informed predictions using very short time windows (e.g., just 3-5 seconds of initial waveform).

Graph Neural Networks (GNNs) -Based EEW

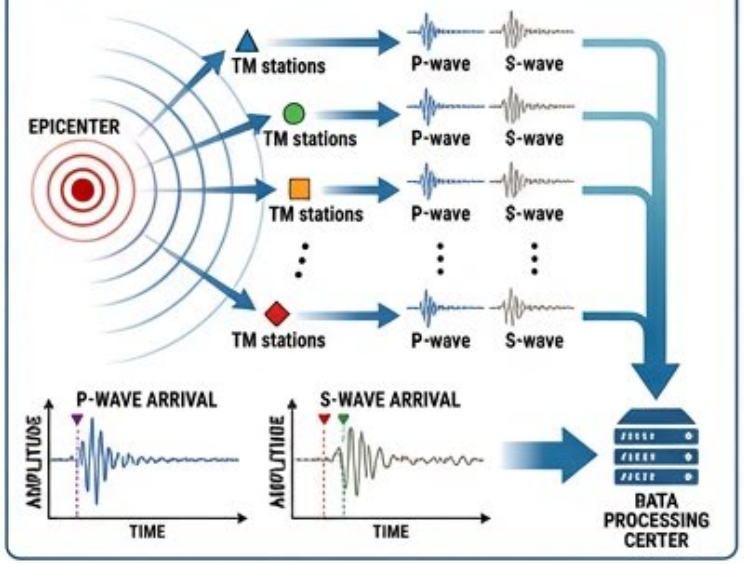
PANEL 1: THAILAND SEISMIC STATION NETWORK (TM Network)



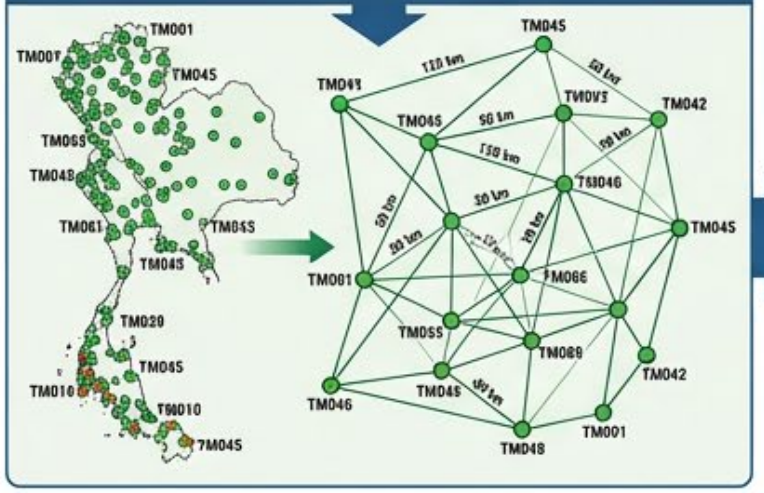
PANEL 2 HISTORICAL TRAINING DATA FOR GNN MODEL



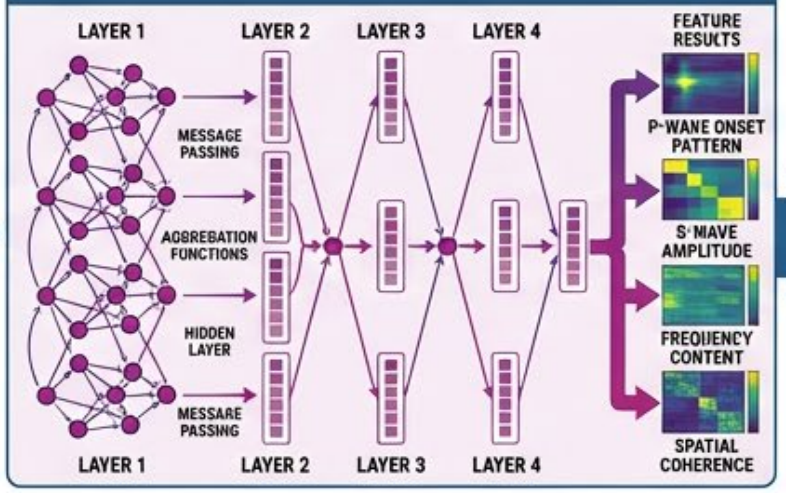
PANEL 3 REAL-TIME DATA COLLECTION



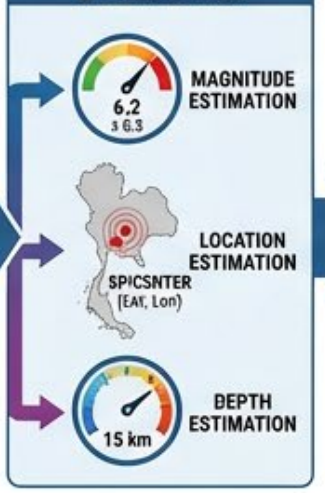
PANEL 4 GRAPH CONSTRUCTION



PANEL 5 GNN PROCESSING



FEATURE EXTRACTION & PREDICTION



PANEL 7 EARLY WARNING ALERT DISSEMINATION

LEGEND: Borehole Broadband sensors · Surface MEMS sensors · ACC ST/Affinity sensors · Short-period sensors · YEARS OF DATA (e.g., 20 Years) · NUMBER OF EVENTS (e.g., >5,000) · WAVEFORM FEATURES · RAW DATA · FILTERING · NORMALIZATION · FEATURE EXTRACTION · MOBILE APPS · TRAFFIC LIGHTS · BUILDINGS · EMERGENCY SERVICES · PUBLIC ALERTS

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