The 2025 M7.7 Myanmar Earthquake and its effect on Thailand

Yoshio Okamoto

yossi.okamoto@gmail.com

http://yossi-okamoto.net/

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Today’s Outline

Part 1

- What is Science?
- What is the 2025 Myanmar earthquake?
- Myanmar earthquake recorded by our seismographs
- Why was Bangkok so strongly shaken?

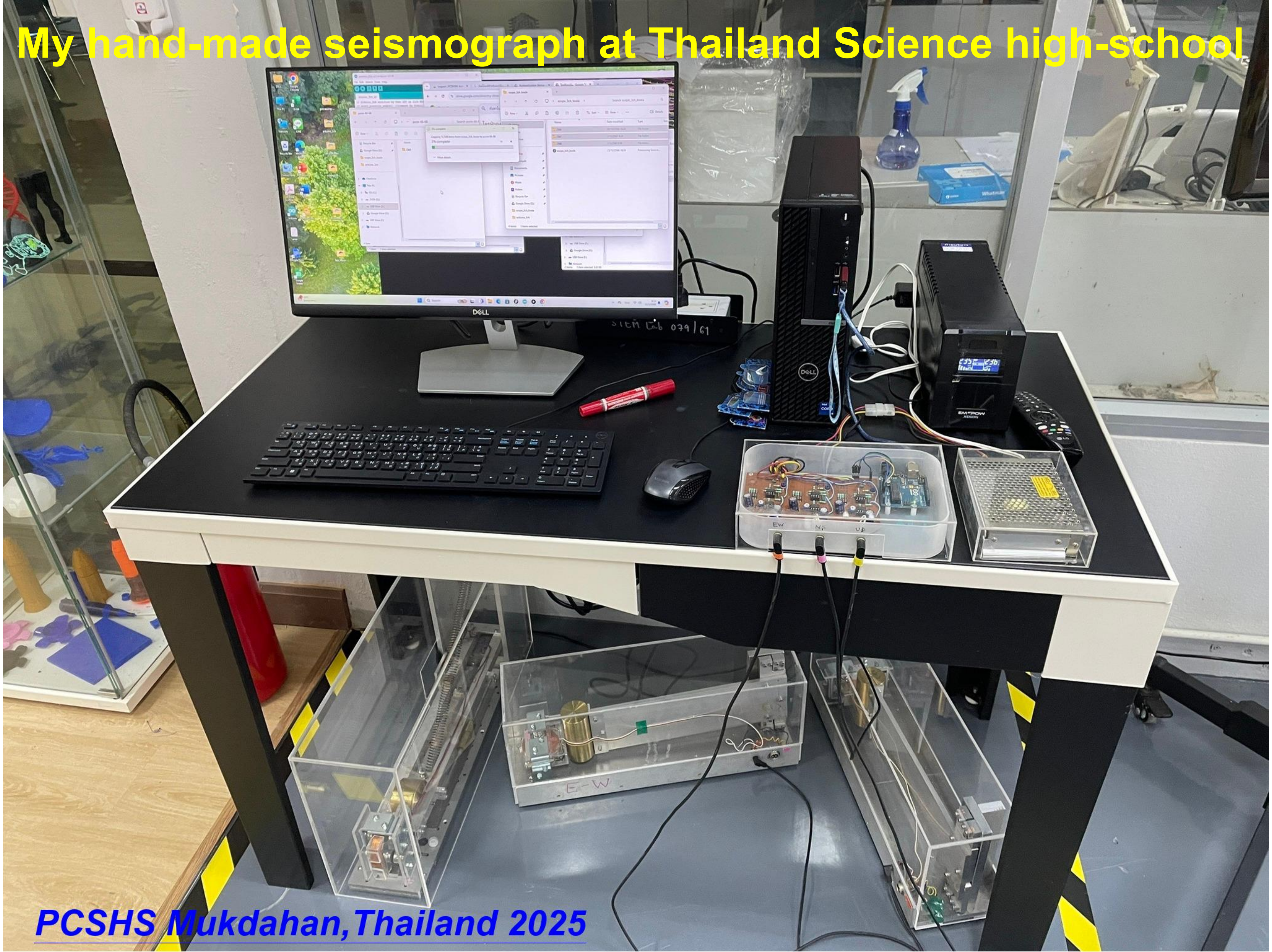
Part 2

- How to find the Epi-center?

Part 3

- Earthquakes around Northern Thailand
- Past - Present - Future

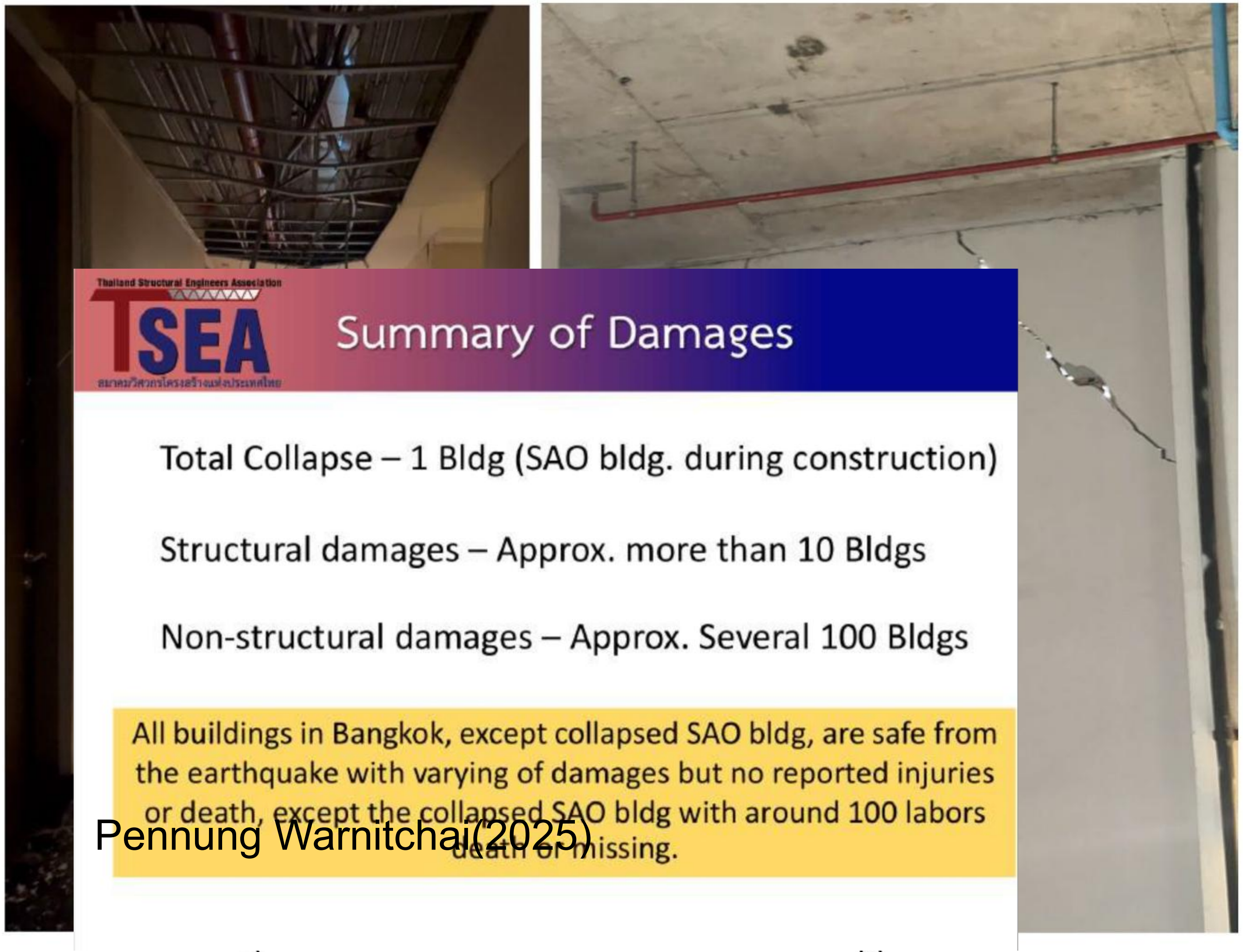
My hand-made seismograph at Thailand Science high-school



PCSHS Mukdahan,Thailand 2025


The waves just arrived at PCSHS
Mukdahan 28 Mar.2025
Video Recorded by Baramade Simphorn at PCSHS Mukdahan

Fig. 15 Severe damage observed at shear wall including vertical bar buckling and concre the lower stories of a 25-story building due to lack of seismic detailing with horizontal rei of about 300 mm spacing



a) b)

Fig. 16 a) A partial failure of suspended ceiling in a high-rise building was commonly observed damages due to lack of horizontal bracing, b) non-structural damage to a large infill wall was also widely reported, indicating out of plane failure pattern from the boundary frame

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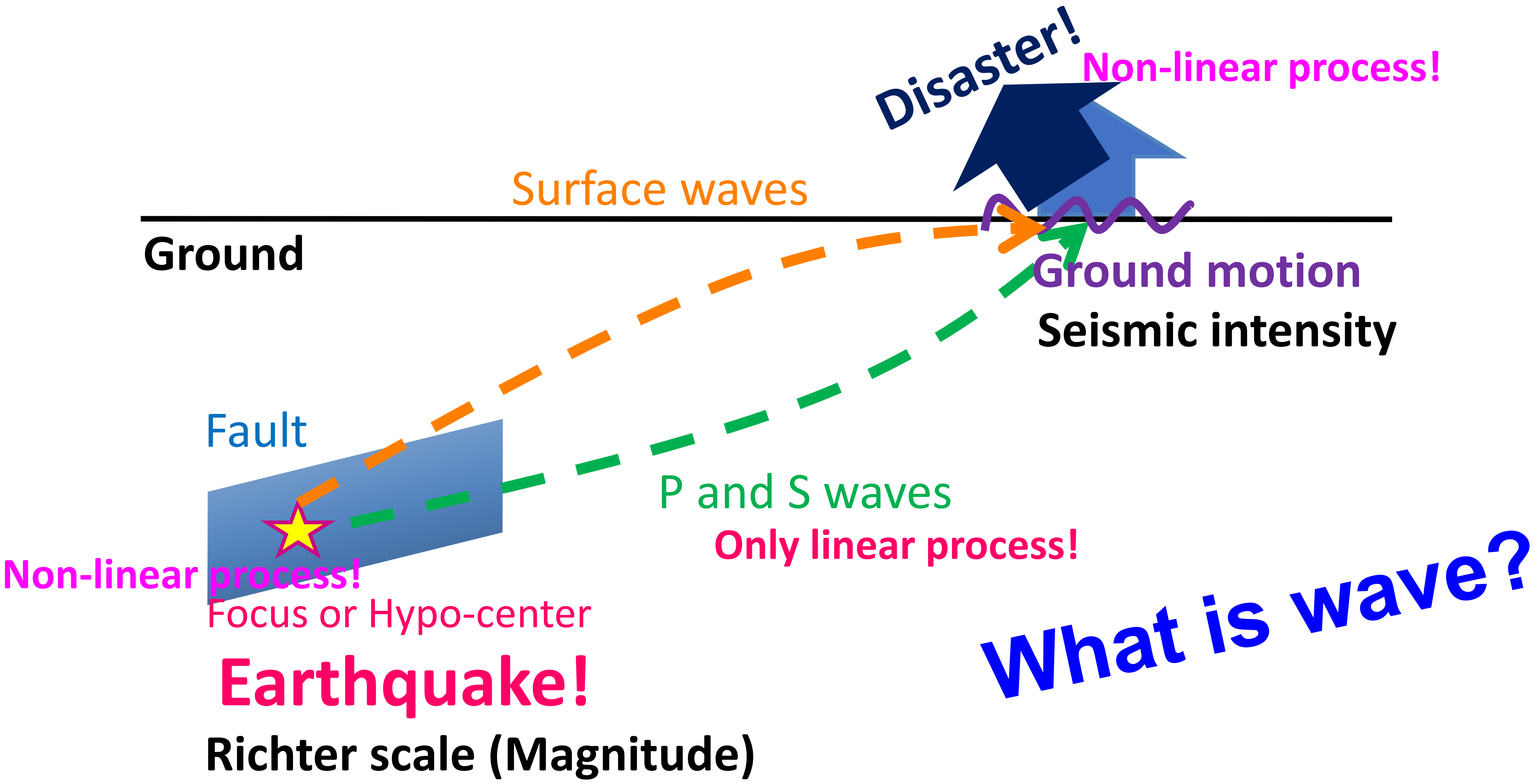
Earthquake: cause and result



Why the Bangkok ground so strongly shaken even far from the epi-center??

We can explain the strong shaking using "Wave Physics."

Cause of the strong shaking in Bangkok

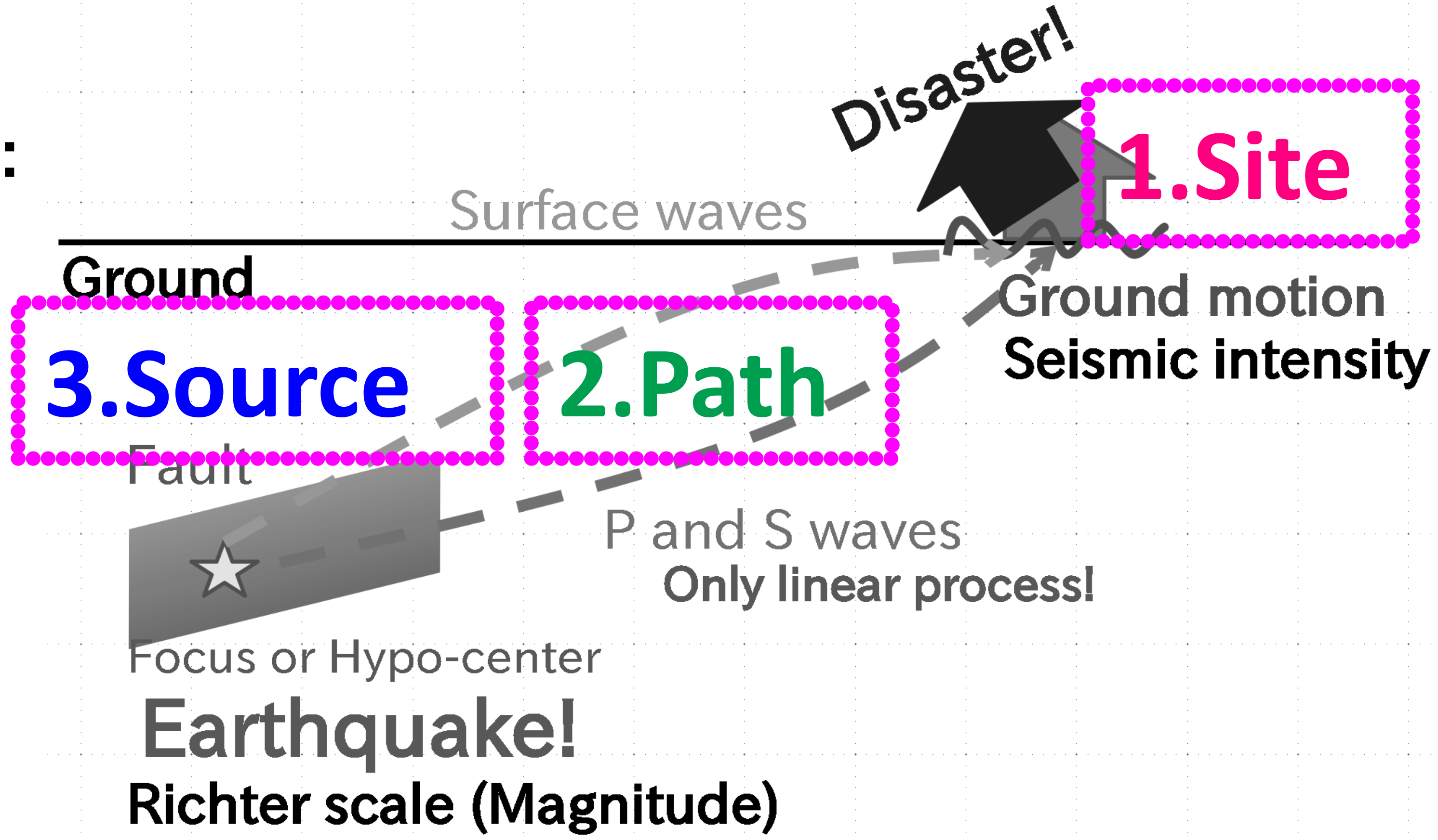
- I) **Thick soft sediments** amplify the shaking
- ii) The long-period waves **survive at long distances.** → **"Rayleigh scattering"**
- iii) **Resonance** of the buildings at the free oscillation periods
- iv) **Directivity** of S-wave radiation pattern
- v) **Supershear rupture**?

Why Strong Shaking Was Observed in Bangkok, Thailand (Approx. 1,000 km from the Epicenter)?

1. Site-Specific Amplification: The Bangkok Basin Effect

2. Path: Low Attenuation Rate (Long-Distance Wave Propagation)

3. Source Characteristics: Directivity and Supershear Rupture

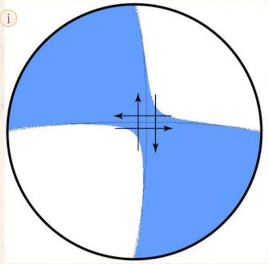


From USGS Web Site

USGS science for a changing world — The 2025 M 7.7 Mandalay, Burma (Myanmar) Earthquake

Background | Regional Tectonics | Indian Plate Collision | Escape Tectonics | Seismicity of Southeast Asia | 28 March 2025, M 7.7 Mandalay,... | Coulomb Stress Modeling | Significance of the Mw 7.7 Man... | Disclaimer | Data Sourc...

28 March 2025, M 7.7 Mandalay, Burma (Myanmar) Earthquake



Focal mechanism of the 28 March 2025, **M** 7.7 Mandalay earthquake determined from W-phase inversion (Duputel et al, 2012). See Appendix for a tutorial on focal mechanisms. Arrows show the direction of motion for each of the nodal plate (fault).

The 28 March 2025, **M** 7.7 earthquake (yellow star) near Mandalay, Burma (Myanmar), occurred in a region of the Sagaing fault that had not seen notable seismicity (**M** 5.5 and larger) since 1900. The focal mechanism of the mainshock combined with the distribution of aftershocks indicate that faulting occurred on the Sagaing fault.

USGS Event Summary

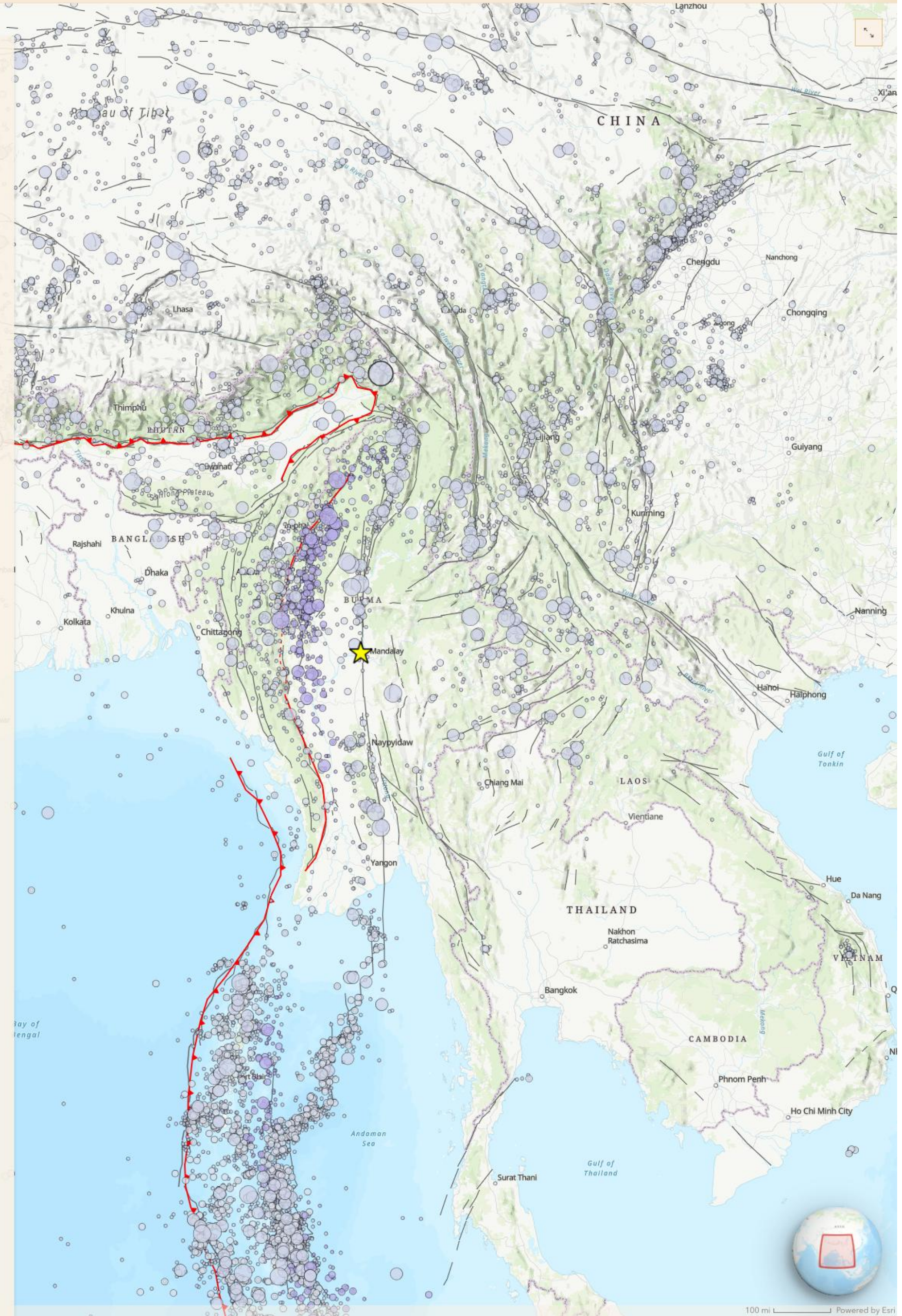
The full range of USGS earthquake information products related to this earthquake are found by clicking here.

Click below to view the locations of the mainshock and **M** *4.5 and larger aftershocks located by the United States Geological Survey (USGS).*

USGS mainshock and aftershocks

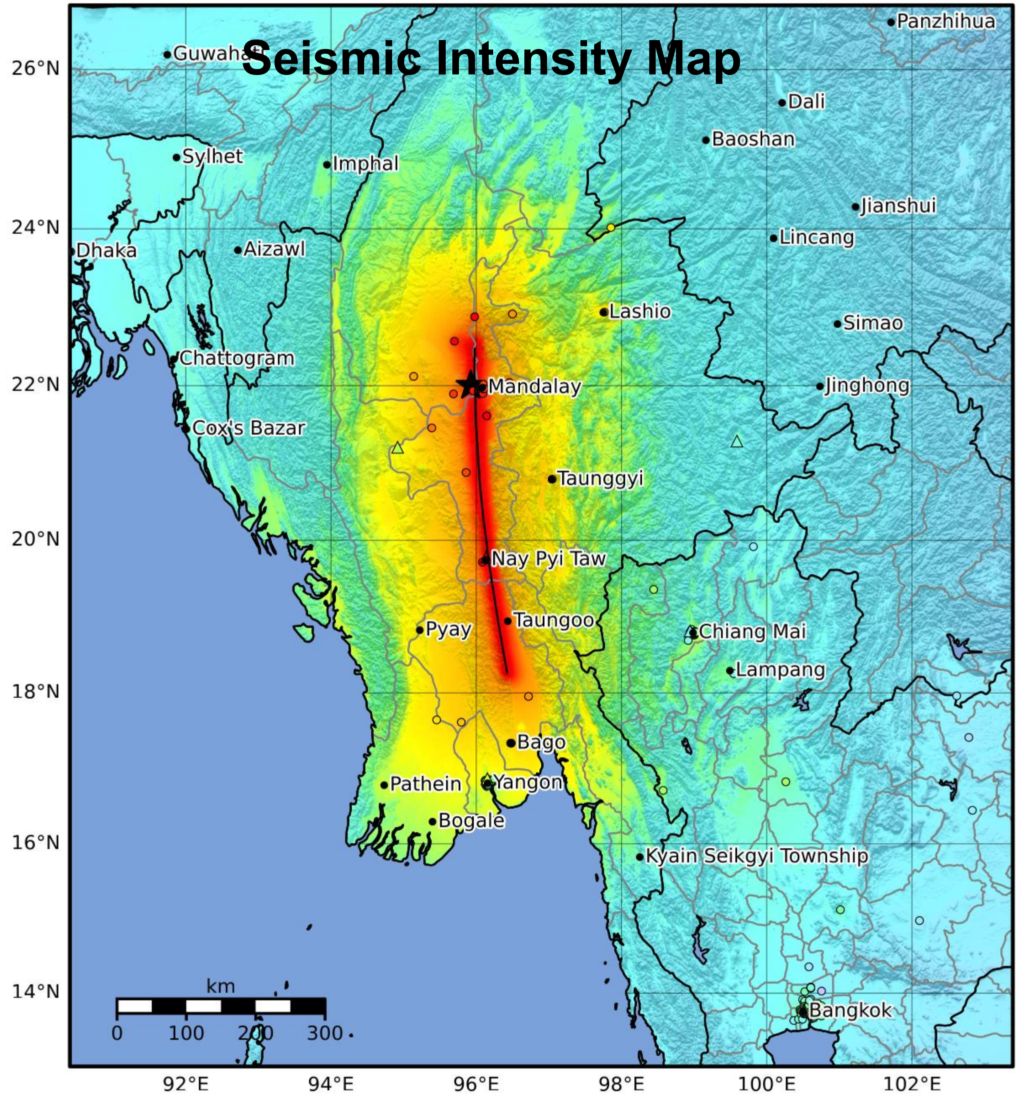
This general region has experienced similar large strike-slip earthquakes with six other **M** 7 and larger earthquakes occurring within about 150 miles (250 km) of the March 28, 2025 earthquake since 1900.

Click on "M 7 and larger earthquakes" to view the largest events in this broad region of southeast Asia



Seismic Intensity Map

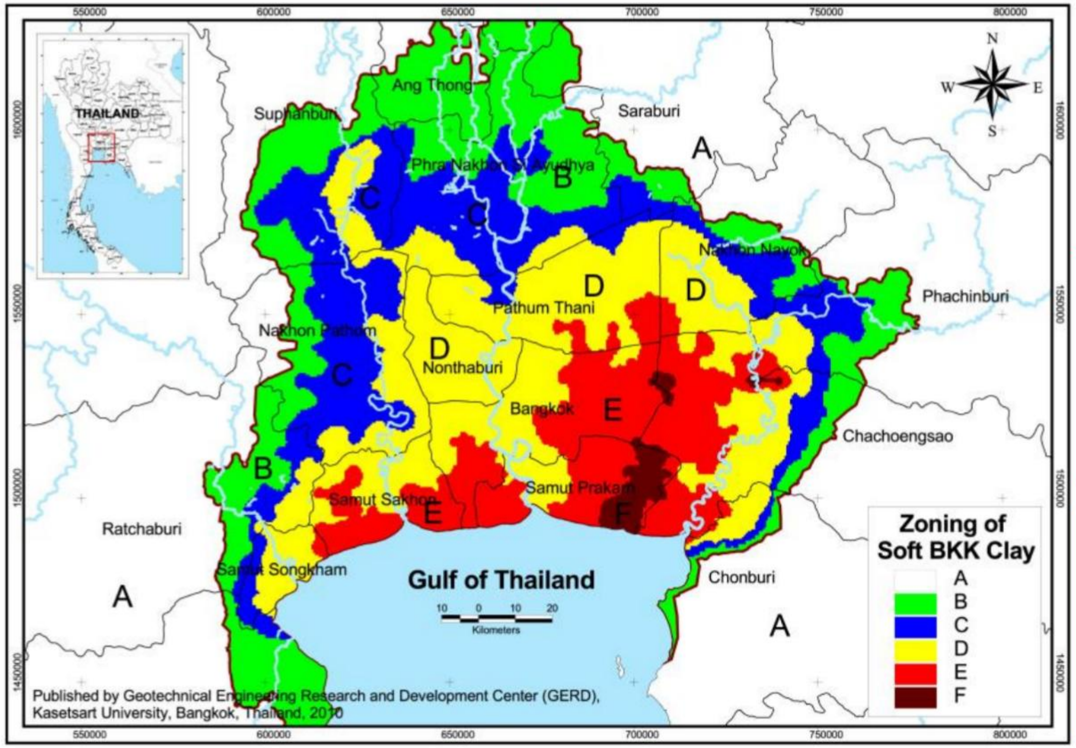
Macroseismic Intensity Map USGS
ShakeMap: 2025 Mandalay, Burma (Myanmar) Earthquake
Mar 28, 2025 06:20:52 UTC M7.7 N22.00 E95.92 Depth: 10.0km ID:us7000pn9s



SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	None	None	None	Very light	Light	Moderate	Moderate/heavy	Heavy	Very heavy
PGA(%g)	<0.0464	0.297	2.76	6.2	11.5	21.5	40.1	74.7	>139
PGV(cm/s)	<0.0215	0.135	1.41	4.65	9.64	20	41.4	85.8	>178
INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based on Worden et al. (2012) — Version 21: Processed 2025-04-16T05:13:29Z

△ Seismic Instrument ○ Reported Intensity ★ Epicenter ▭ Rupture



soft clay > 18 m.
Wn > 100 %
LL > 100 %
PI > 60 %
γ_t < 1.45 t/m^3

soft clay 14-18 m.
Wn 80-100 %
LL 80-100 %
PI 50-60 %
γ_t 1.45-1.55 t/m^3

soft clay 10-14 m.
Wn 60-80 %
LL 60-80 %
PI 30-50 %
γ_t 1.55-1.65 t/m^3

soft clay 0-3 m. **A**
Wn 0-20 %
LL 0-20 %
PI 5-10 %
γ_t 1.85-2.15 t/m^3

soft clay 3-6 m. **B**
Wn 20-40 %
LL 20-40 %
PI 10-20 %
γ_t 1.75-1.85 t/m^3

soft clay 6-10 m.
Wn 40-60 %
LL 40-60 %
PI 20-30 %
γ_t 1.65-1.75 t/m^3

Fig.15 Zoning of Soft Bangkok Clay

Warakorn Mairaing and Cherdpun Amonkul (2010)

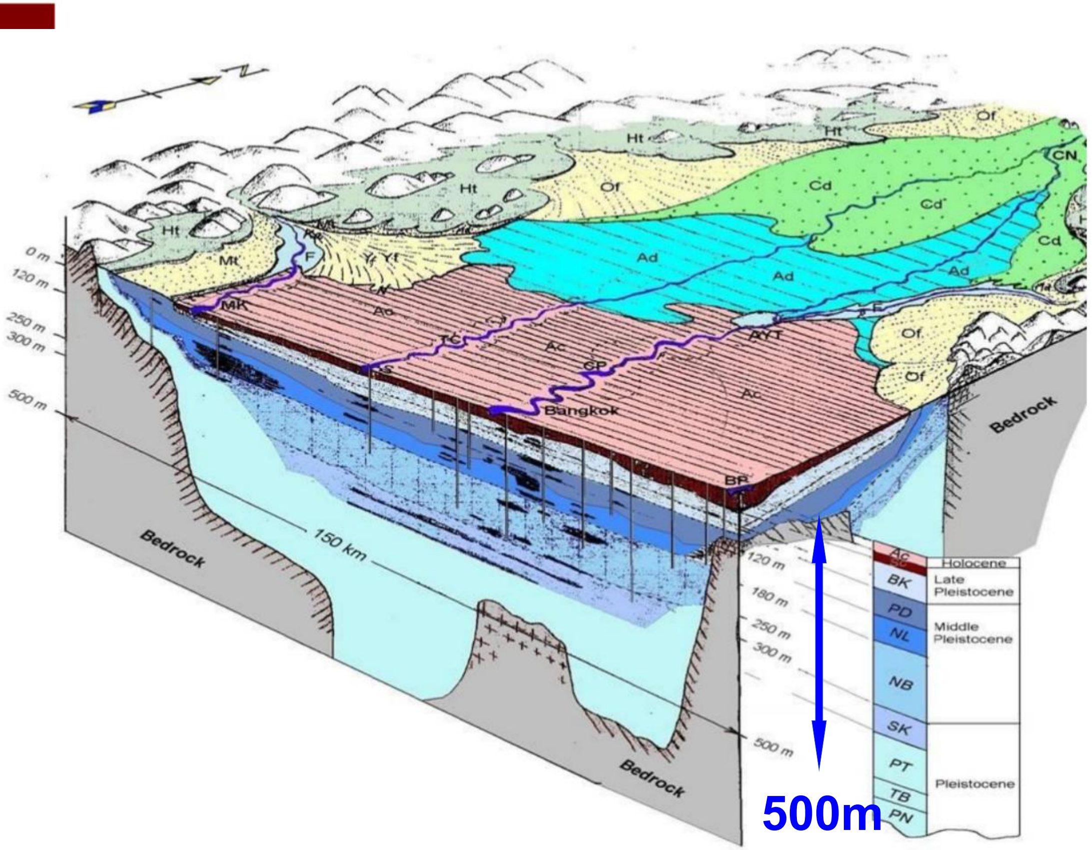


Fig.7 Schematic cross-section of lower Chao Phraya Basin (JICA, 1999)

https://www.gerd.eng.ku.ac.th/Paper/Paper_Other/Mairaing/%28EIT-Japan%29Soft%20Bangkok%20Clay%20Zoning.pdf

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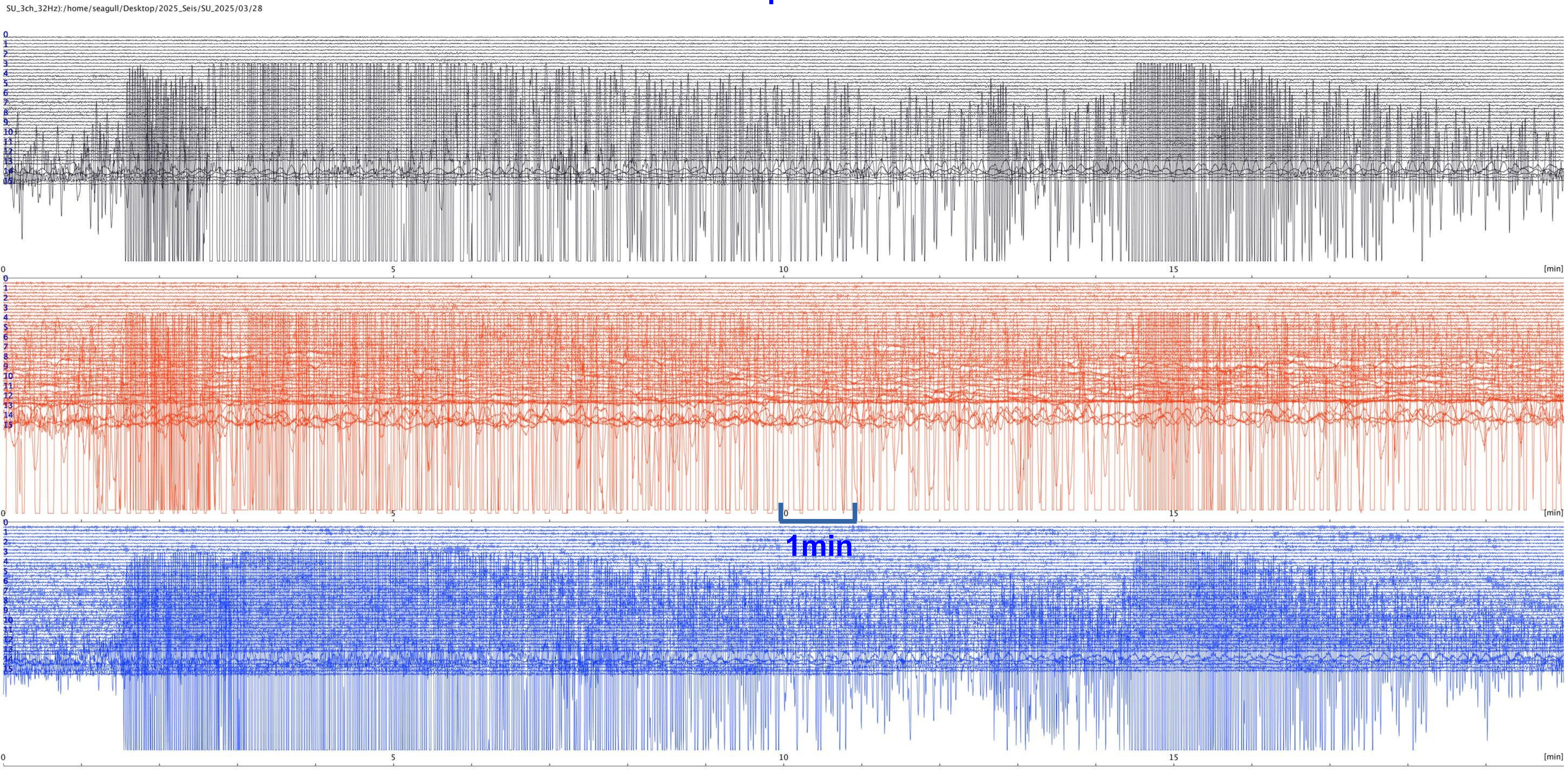
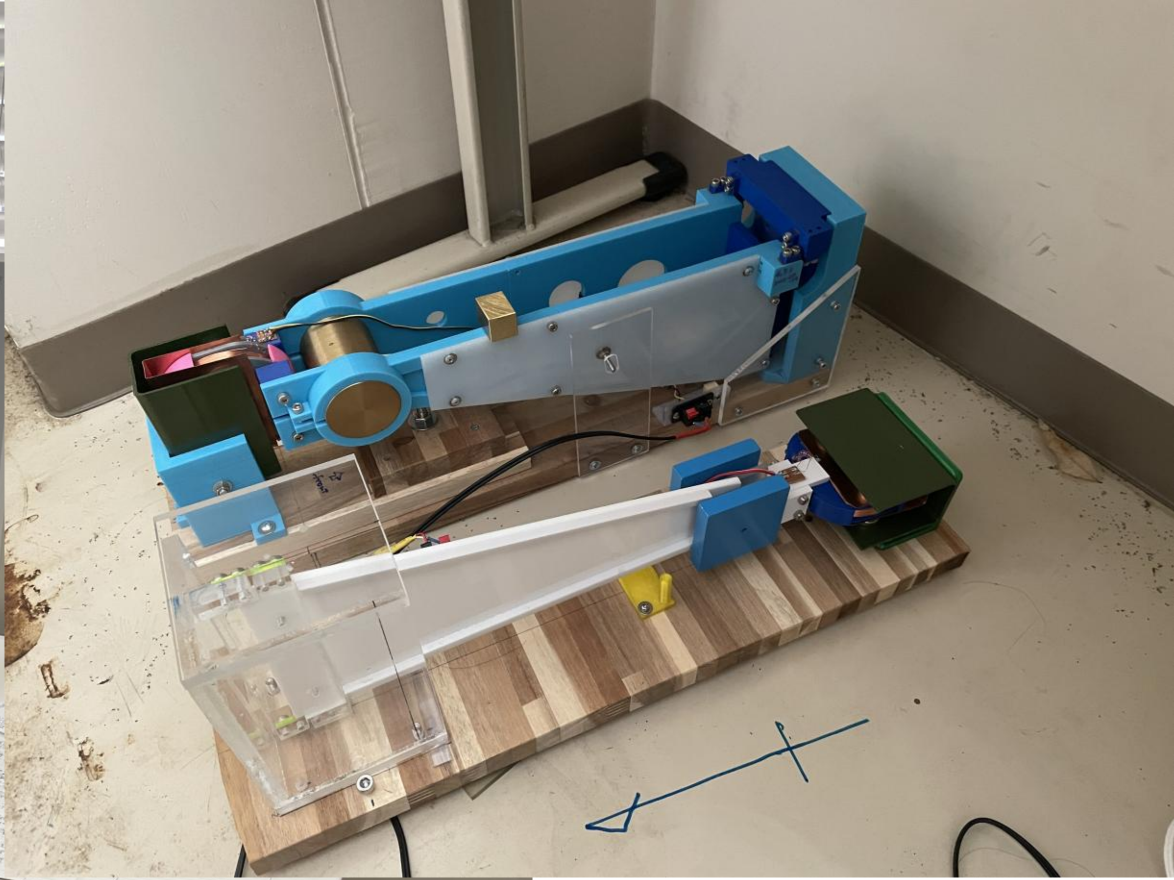
Our seismographs in Thailand

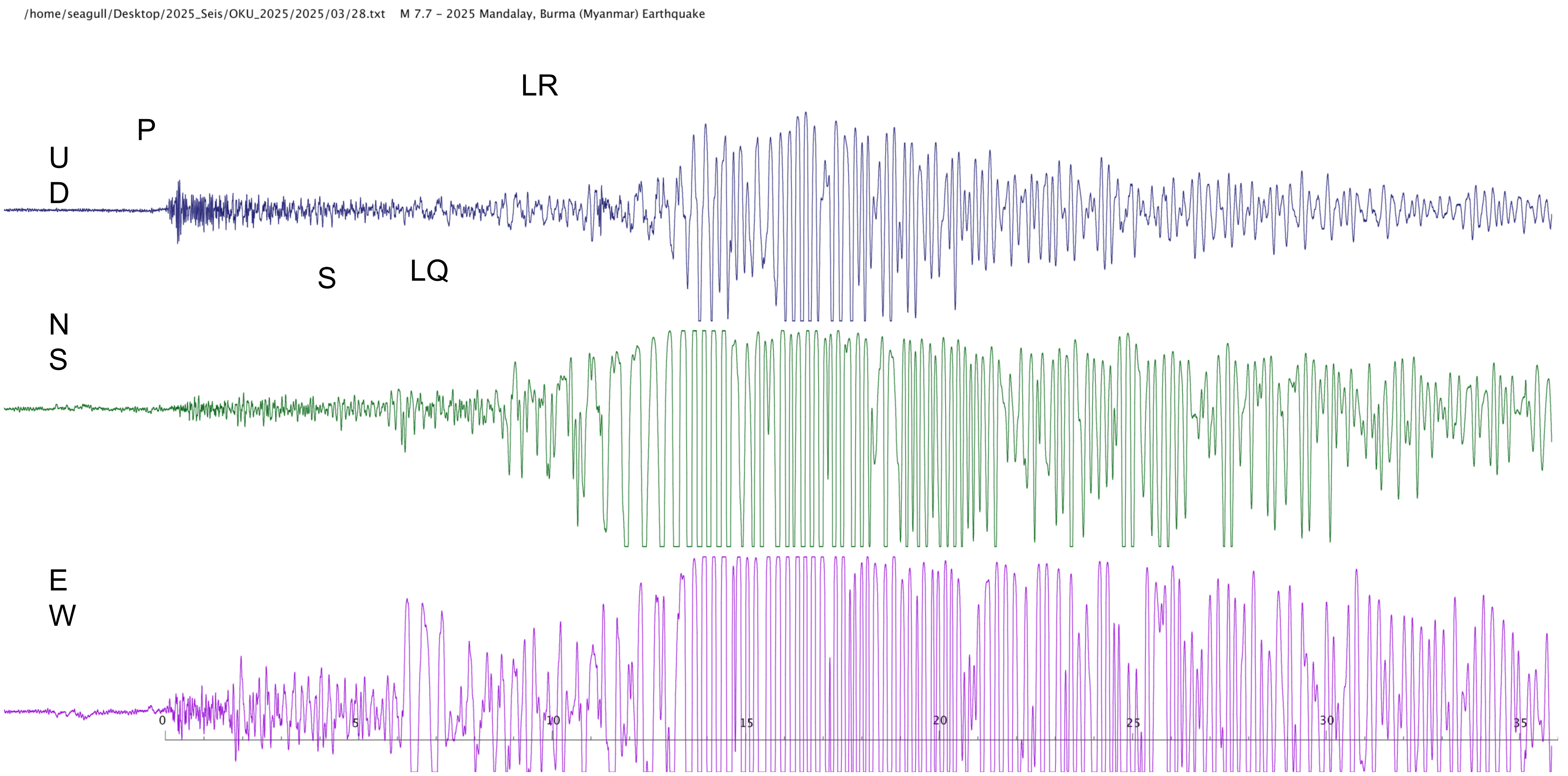
Prof. Ohm and our seismographs at Silpakorn Univ. Physics Labo.

at Silpakorn Univ. Nakon Pathom Thailand

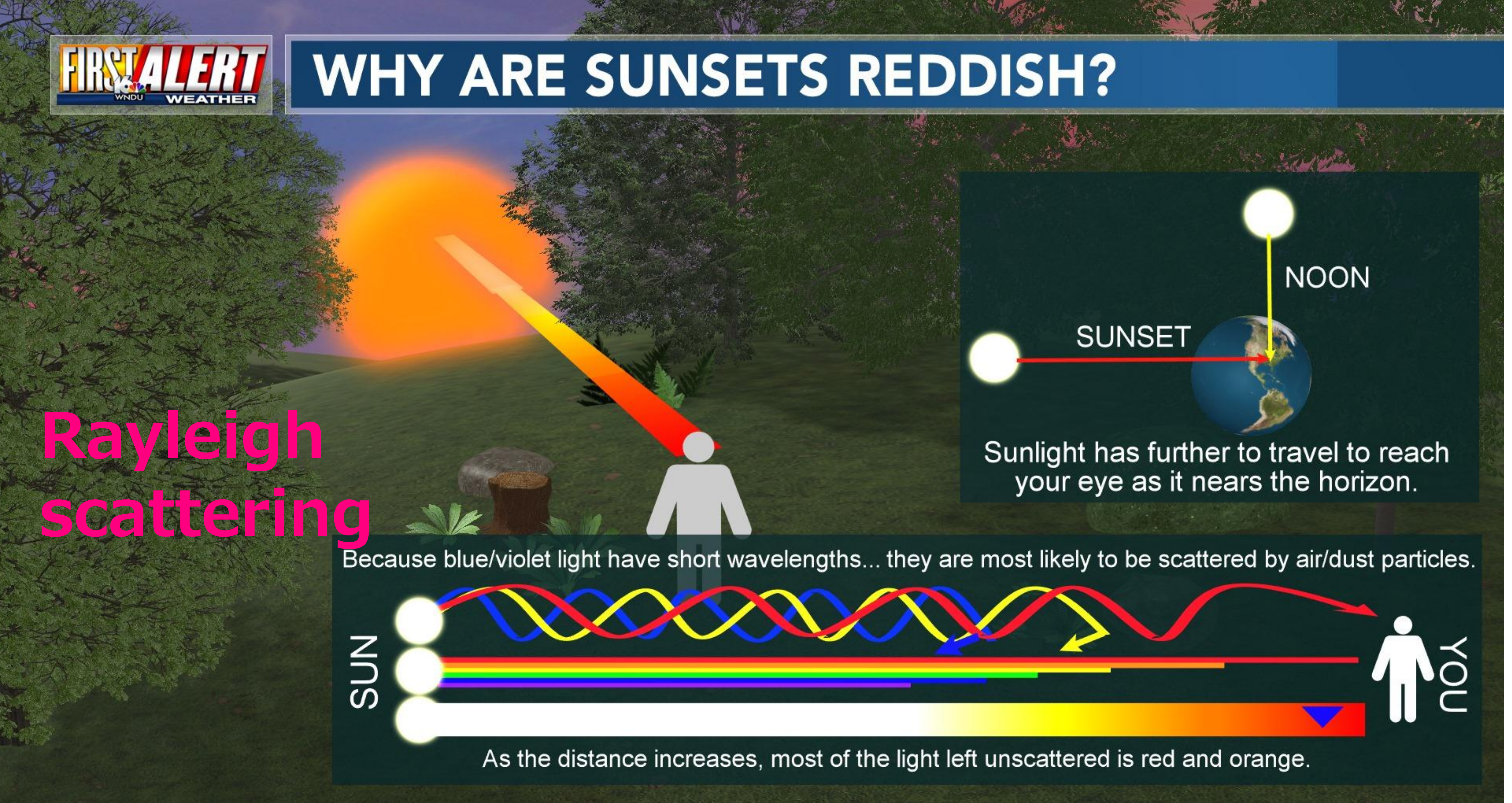




Our seismographs in Osaka-Kyoiku Univ.


/home/seagull/Desktop/2025_Seis/OKU_2025/2025/03/28.txt M 7.7 - 2025 Mandalay, Burma (Myanmar) Earthquake
LR
P
U
D
S
LQ
N
S
E
W
0
5
10
15
20
25
30
35

Rayleigh scattering

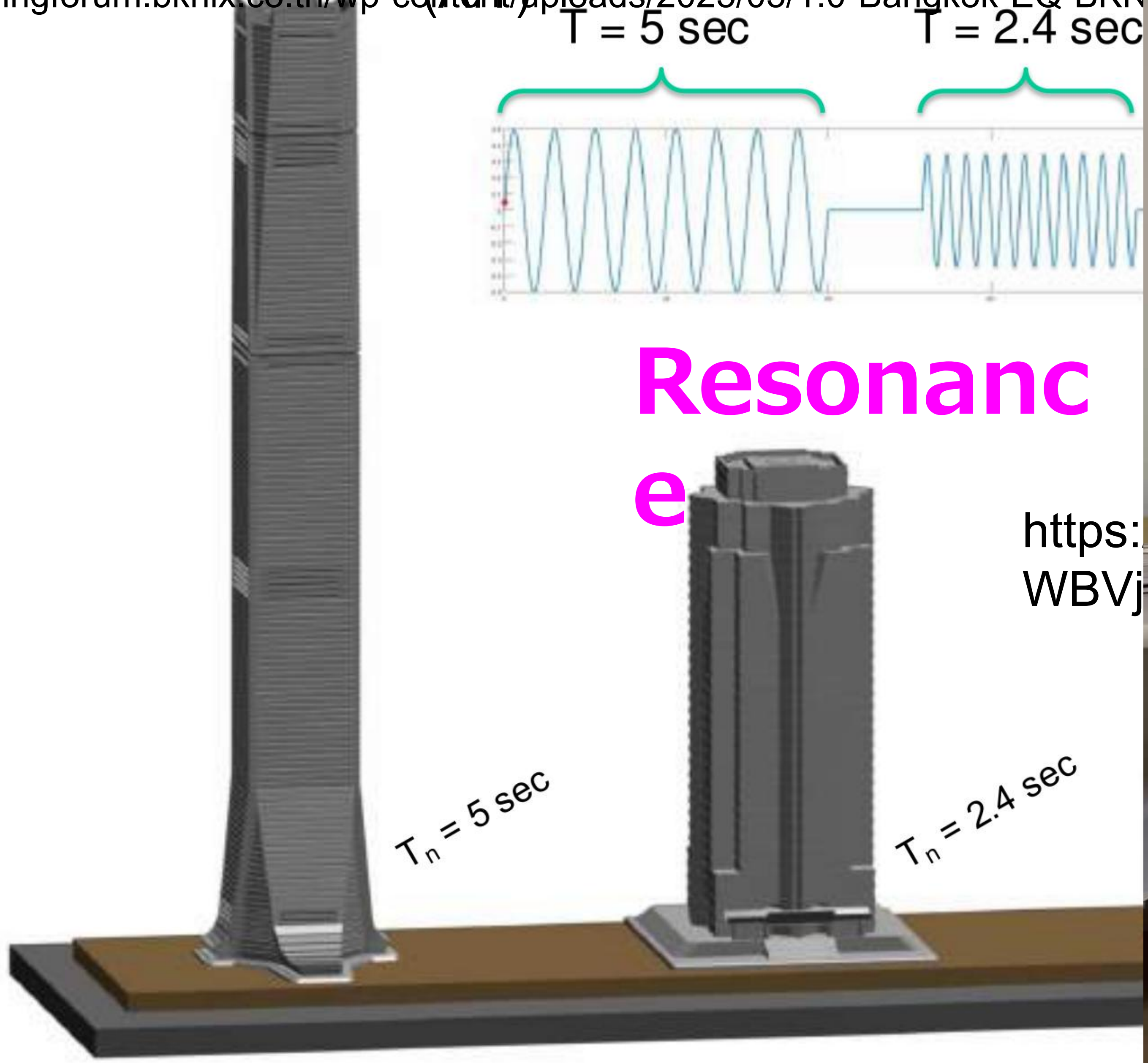


https://scontent.fbkk5-4.fna.fbcdn.net/v/t1.6435-9/90872969_10158111371936130_1499070682976223232_n.jpg

Resonance Effect

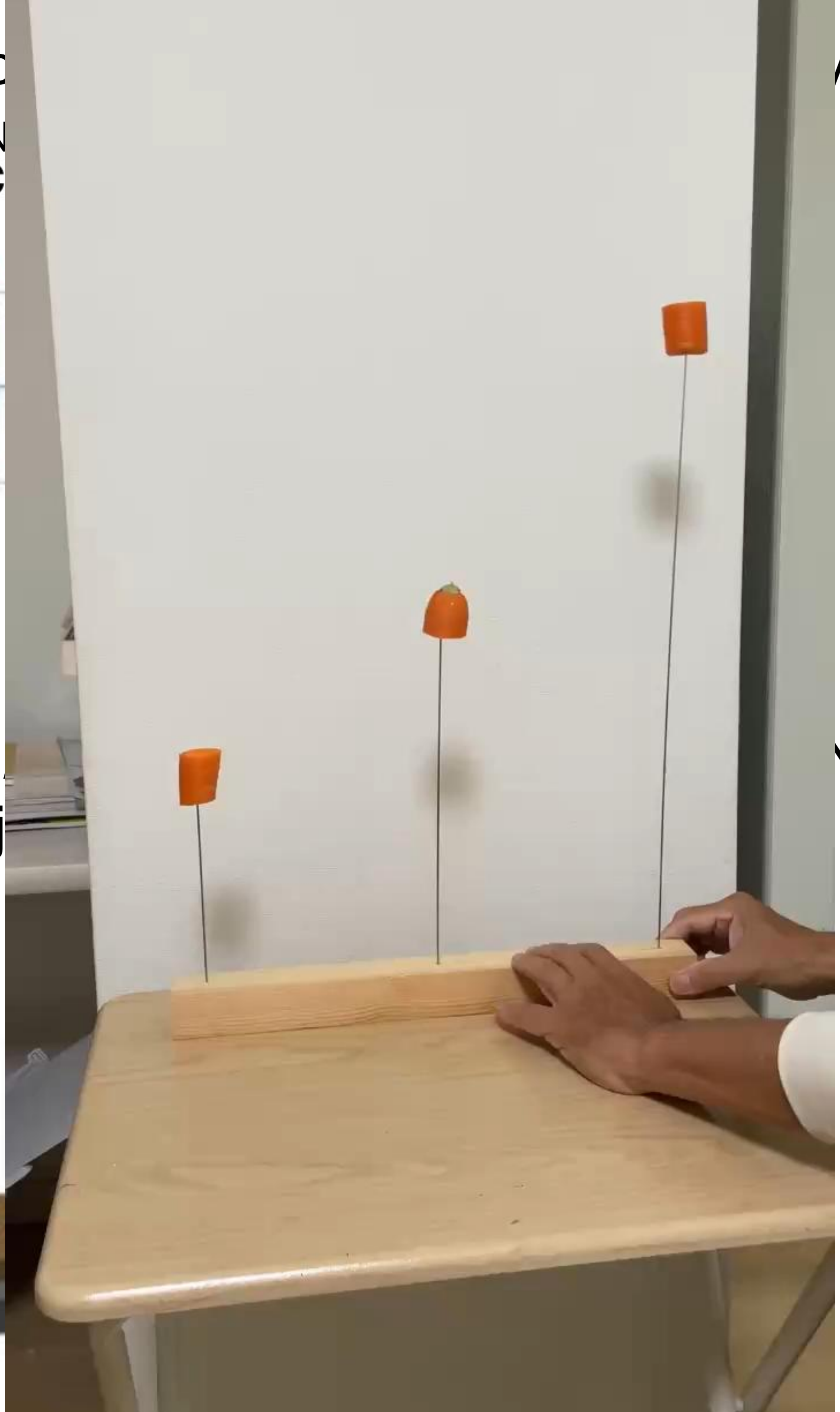
By Pennung Warnitchai, Professo
(AIT)

https://peeringforum.bknix.co.th/wp-content/uploads/2025/05/1.0-Bangkok-EQ-BKN

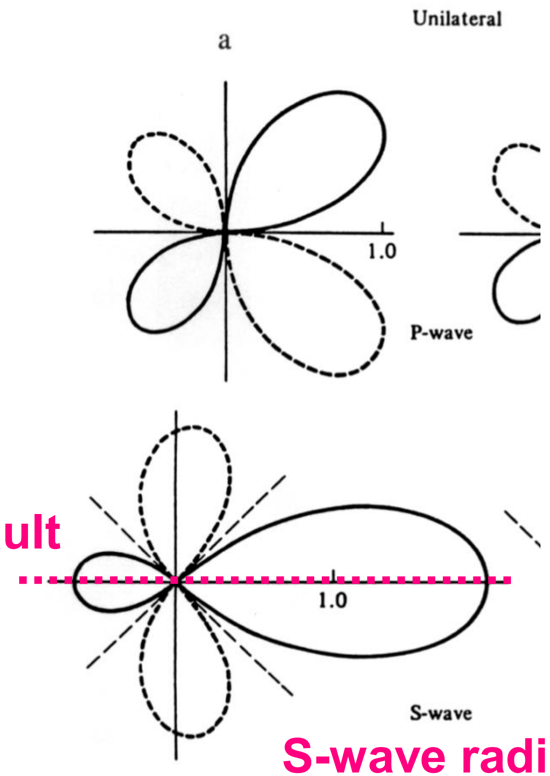


**Resonanc
e**

https:
WBVj

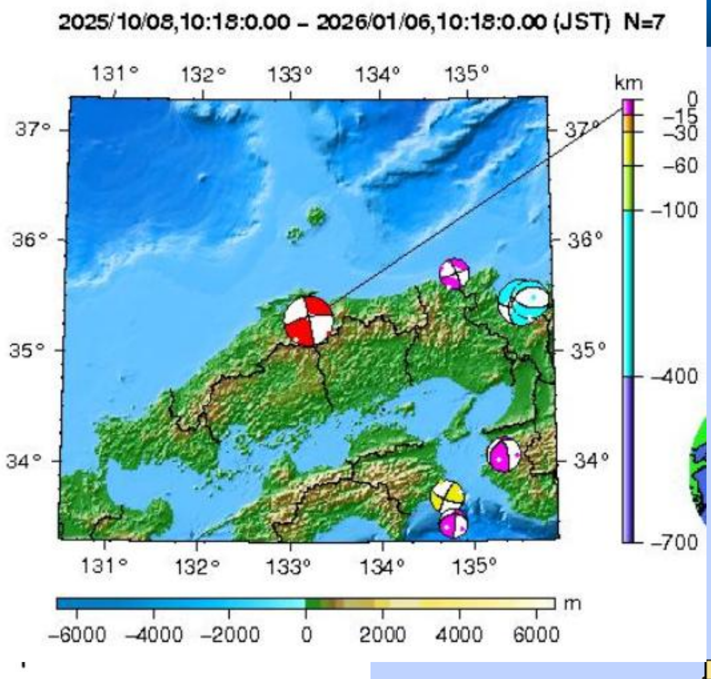


Fault

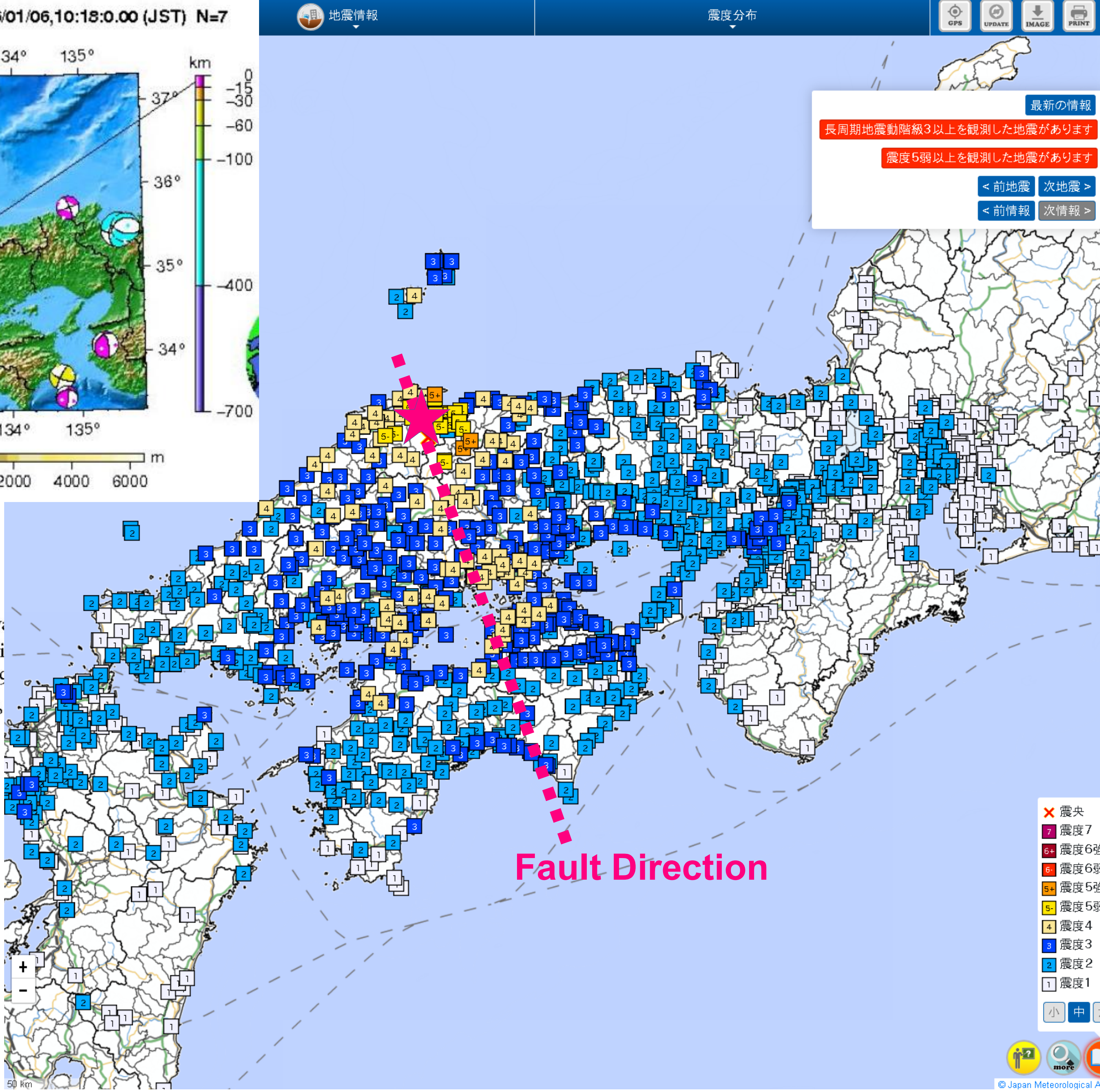


S-wave radiation pattern

FIGURE 5.4 Radiation pattern showing the variability of compressional and horizontal shear-wa
a fault rupture propagating from left to right. The diagrams on the left are for a rupture propagati
times the shear-wave velocity and those on the right are for a rupture propagation velocity of 0.9
wave velocity. (From Lay, T. and Wallace, T.C. 1995. *Modern Global Seismology*, Academic Press,
permission.)



Directivity



Fault Direction

Macroseismic Intensity Map USGS
ShakeMap: 2025 Mandalay, Burma (Myanmar) Earthquake
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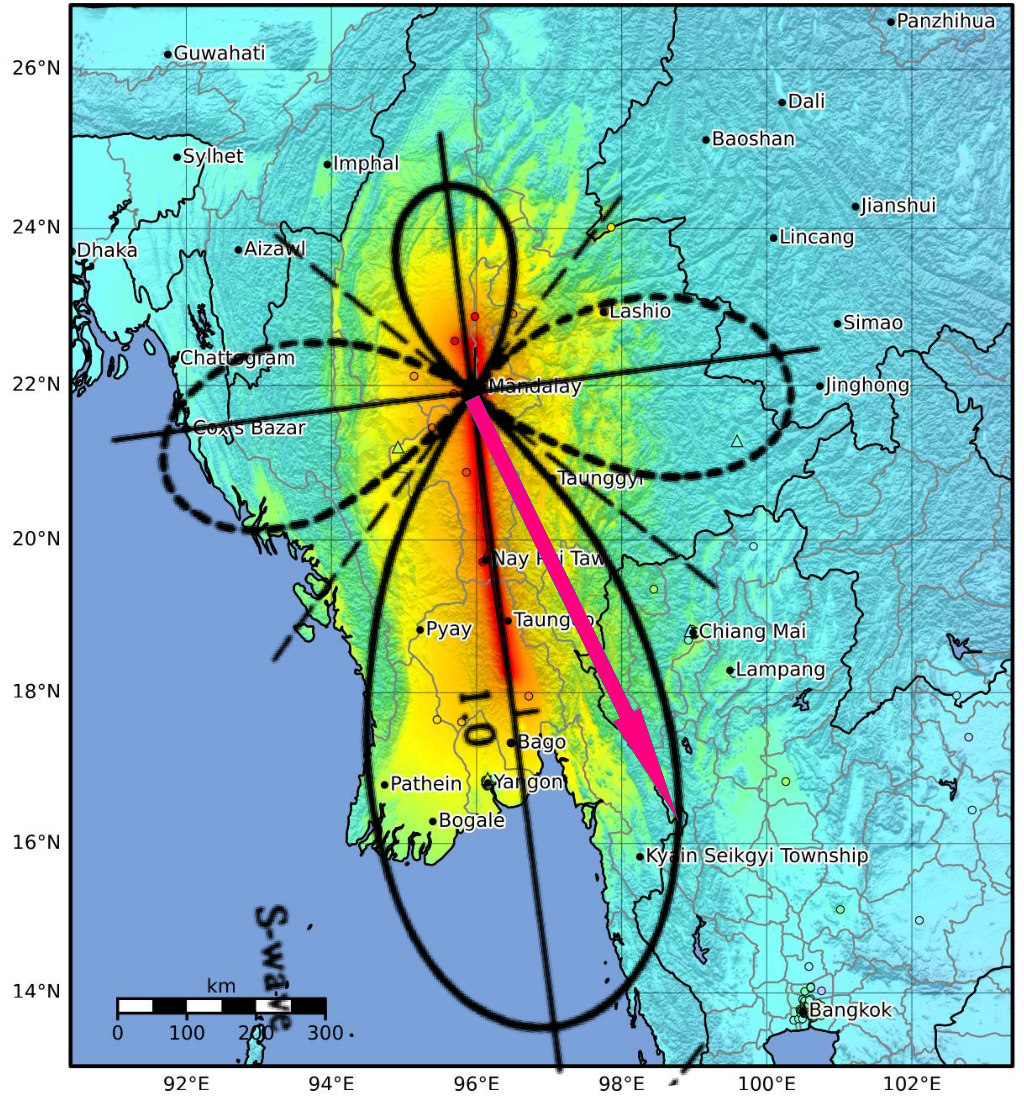

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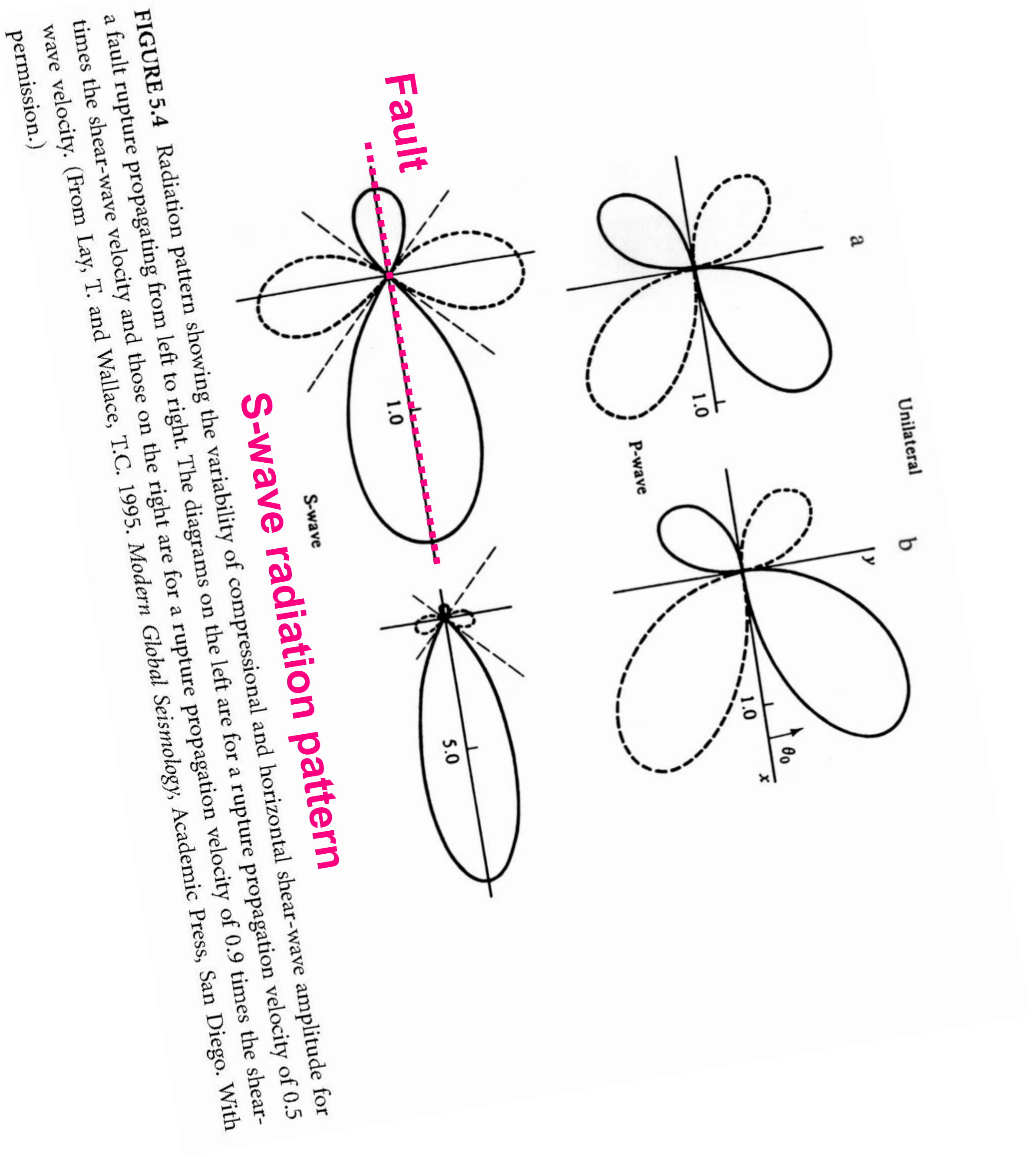
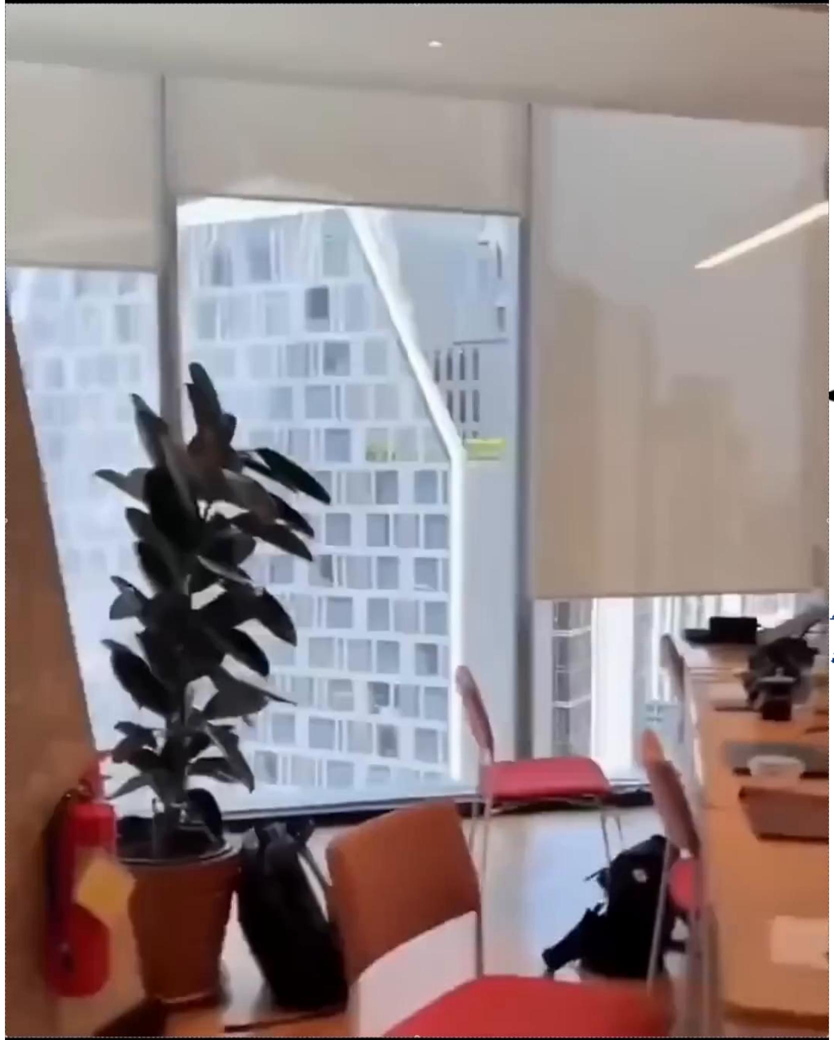
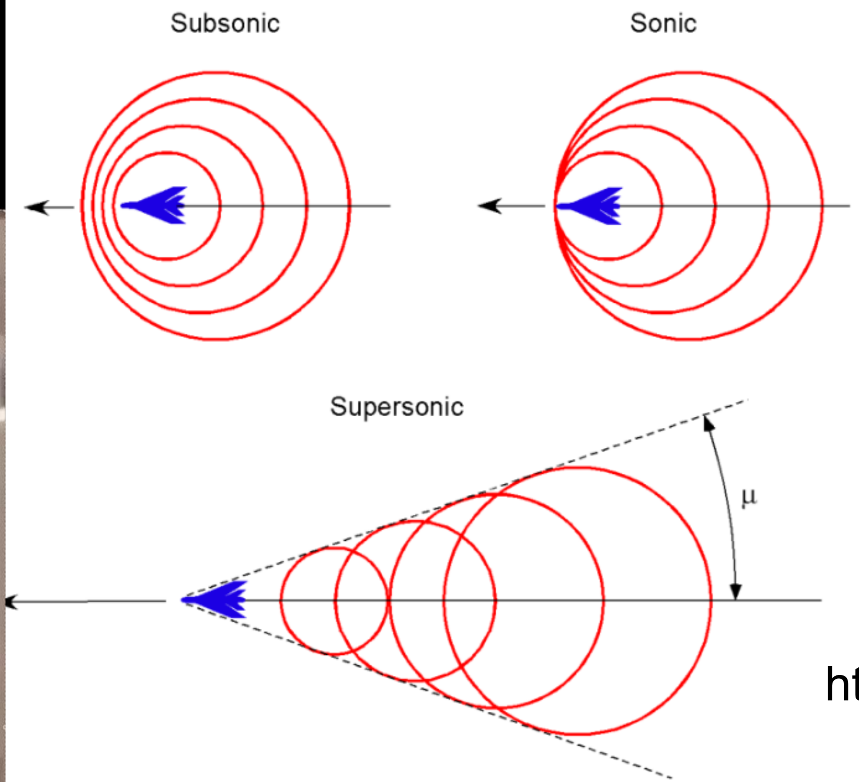


FIGURE 5.4 Radiation pattern showing the variability of compressional and horizontal shear-wave amplitude for a fault rupture propagating from left to right. The diagrams on the left are for a rupture propagation velocity of 0.5 times the shear-wave velocity and those on the right are for a rupture propagation velocity of 0.9 times the shear-wave velocity. (From Lay, T. and Wallace, T.C. 1995. *Modern Global Seismology*, Academic Press, San Diego. With permission.)





https://hiroike.hida-ch.com/e1077578.html

As an airplane approaches the speed of sound, pressure waves merge ahead of it, and at supersonic speeds, a Mach cone forms at the nose.

Supersonic Shock Wave

https://eaglepubs.erau.edu/introductiontoaerospaceflightvehicles/chapter/supersonic-flight-vehicles/

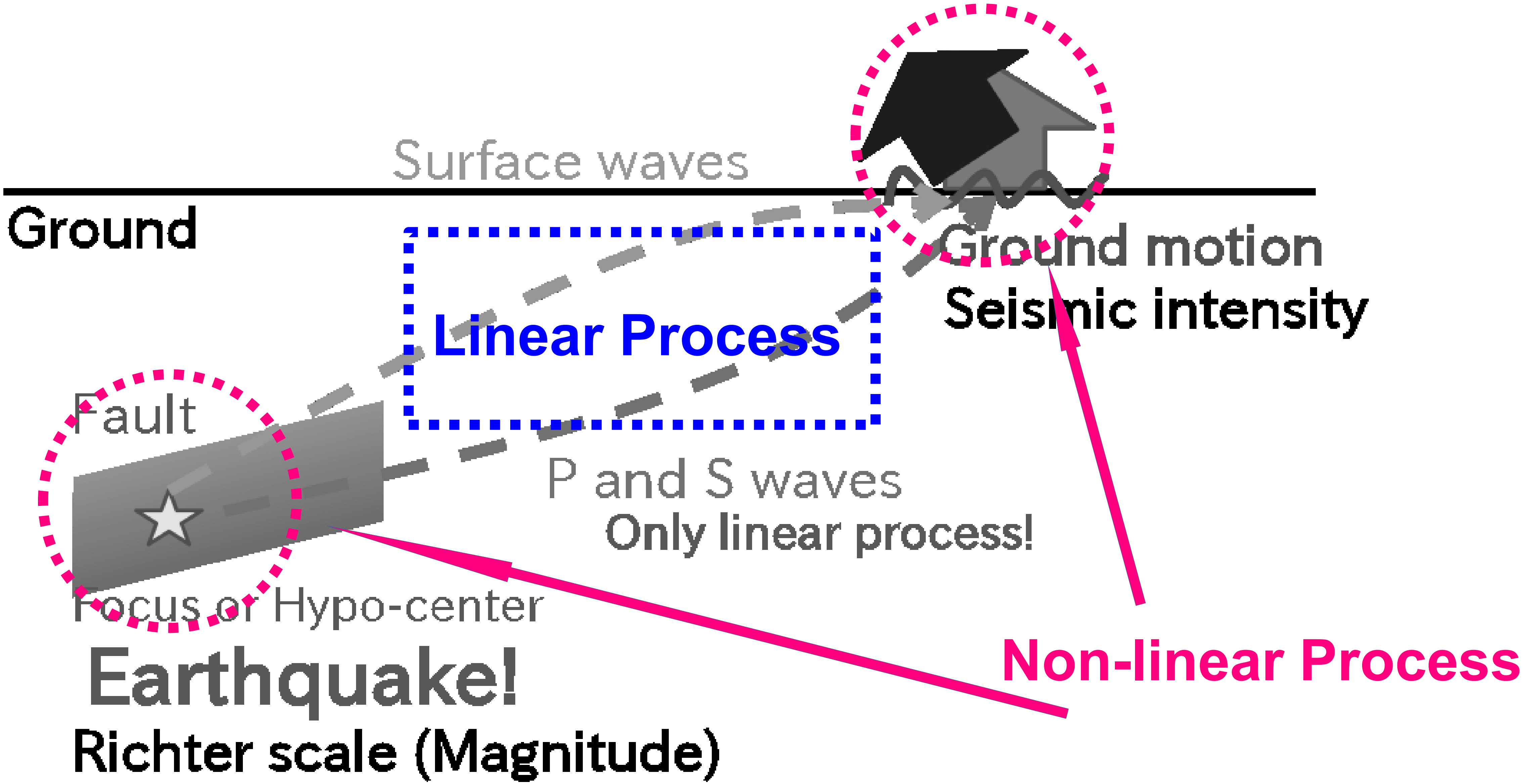
Supershear Rupture

https://www.youtube.com/shorts/Wk9QVPk_IpQ

Wave Physics

- I) The strong shaking at Bangkok is explained by a simple wave physics: propagation, amplification, resonance, scattering, directivity, super-sonic etc.
- ii) But **the collapse of building is essentially non-linear process.** → so this forecast is very difficult.
- iii) Also, **the earthquake sources is complicated non-linear process.** → the difficulty of earthquake forecast.
- I hope that many students try to challenge this unsolved target!!

Wave Physics and Rupture



Acknowledgments and References

We thank the staff of Thailand University. and science high schools that maintain our seismographs.

Particularly, Prof. Ohm and Prof. Worrapass at Solpakorn Univ. and Mr. Niwat and Mr. Pao at PCSHS Mukdahan.

The movies in our presentation are provided by Dr. Chachawal at Phayao Univ. and Mr. Baramade Simphore.

<References> Only the main papers are listed.

Teraphan Ornthammarath et.al. (2025), 2025 Far-field_ground_motion_characteristics_of_the_Ban.pdf

Praveen K. Malhotra (2025), M7.7-2025MyanmarEarthquakeGroundMotioninBangkok.pdf

Takemura, S., Furumura, T. & Saito, T. Distortion of the apparent S-wave radiation pattern in the high-frequency wavefield: Tottori-Ken Seibu, Japan, earthquake of 2000. Geophysical Journal International 178, 950–961 (2009).