The strong earthquake ground motion in Sumatra

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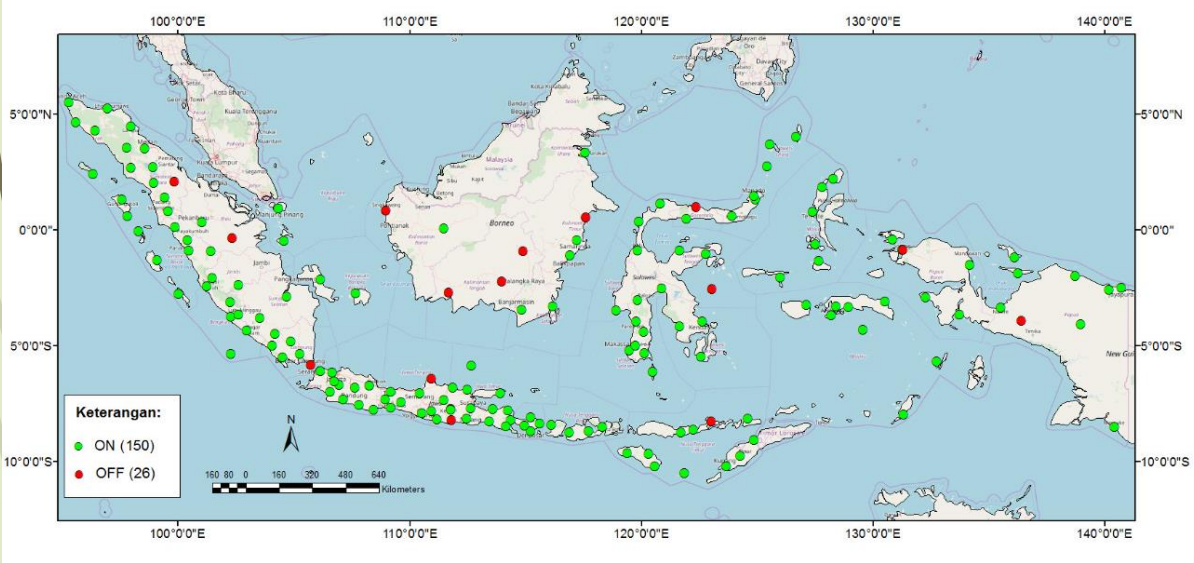
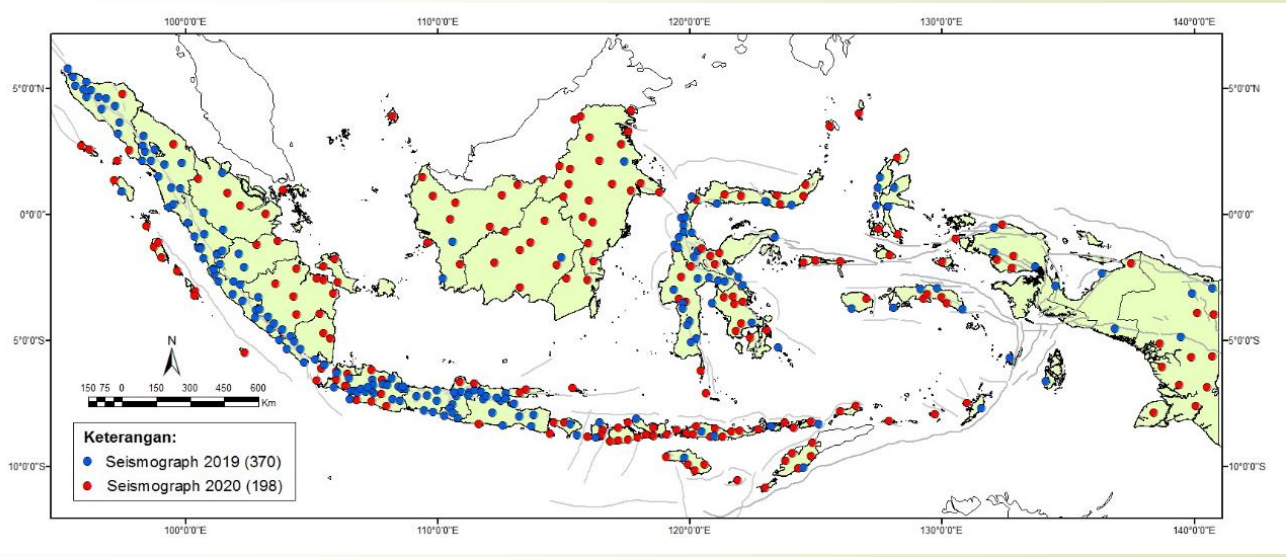
Highlights

- **The strong motion database** of 77 events (2616 waveforms) with Mw > 5.5 from 2009 to 2017.
- We classified the earthquakes based on their locations and focal mechanism solutions into **crustal, interplate and intraplate events**.
- Interestingly, **intraplate events caused larger ground motion at higher frequencies**.
- At some stations, **site effects** significantly influenced the ground motion.

Broadband Seismometer

BMKG Seismic Network (Sept 2019)



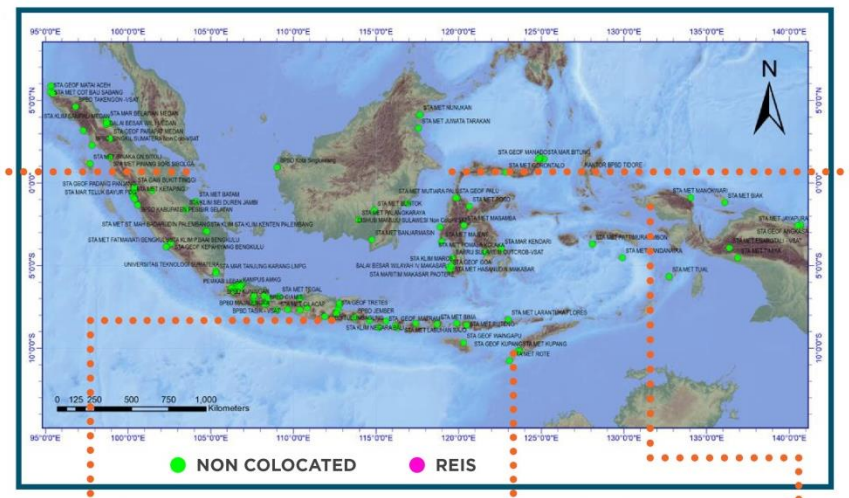


Strong Motion Accelerometer

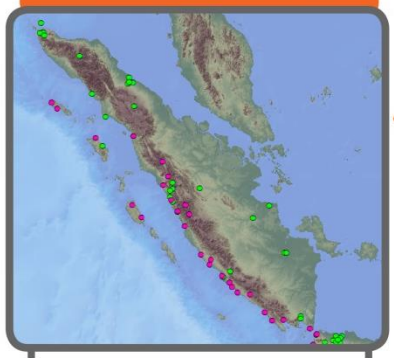
EXISTING
352
s/d 2019

Planning
1052
s/d 2029

121 NON COLOCATED | **73** REIS

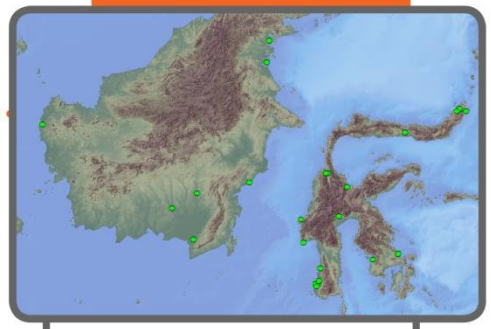


WILAYAH SUMATERA



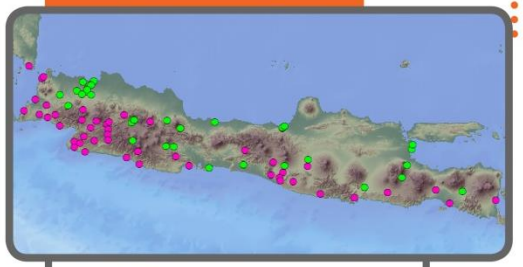
30 NON COLOCATED | 26 REIS

WILAYAH KALIMANTAN & SULAWESI



25 NON COLOCATED | - REIS

WILAYAH JAWA

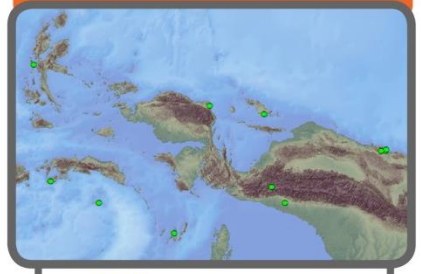


38 NON COLOCATED | 45 REIS

WILAYAH BALI & NUSA TENGGARA

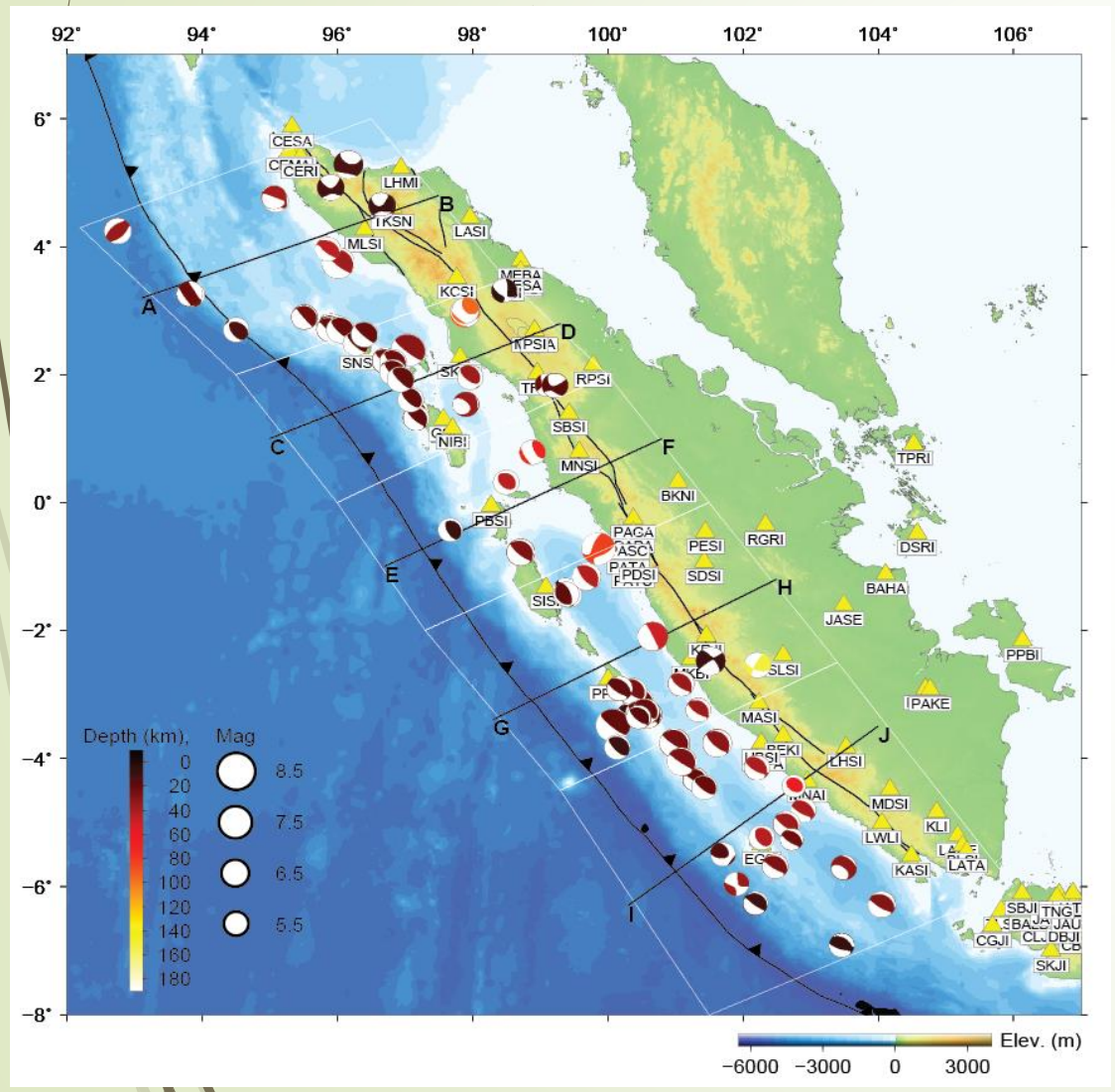
17 NON COLOCATED | 2 REIS

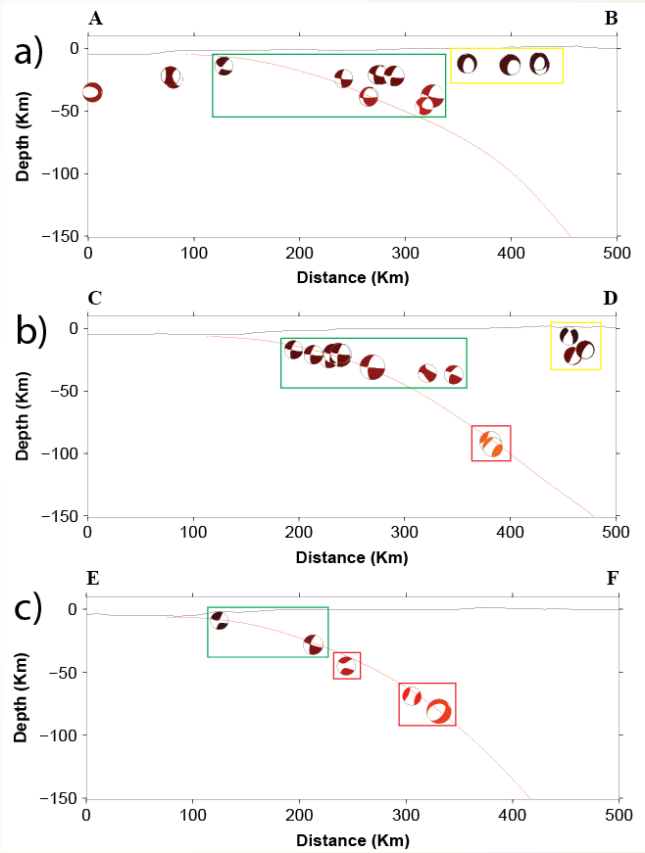
WILAYAH MALUKU & PAPUA

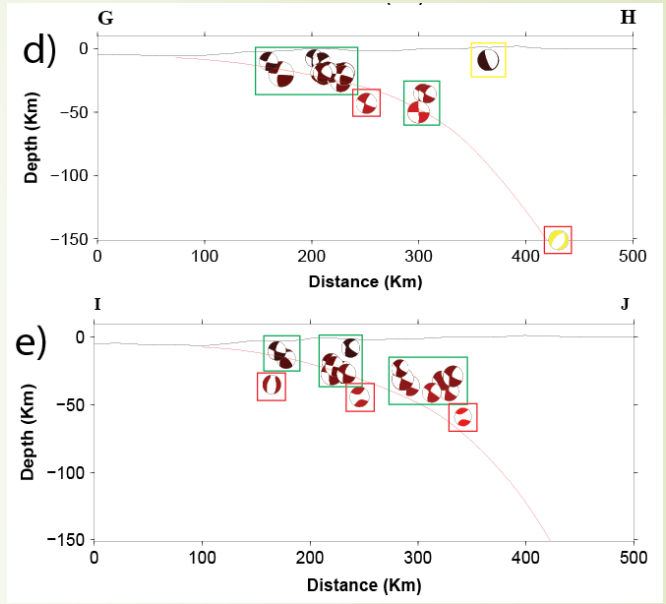


11 NON COLOCATED | - REIS

Strong earthquakes (M5.5+) distribution in Sumatra (2009–2017)

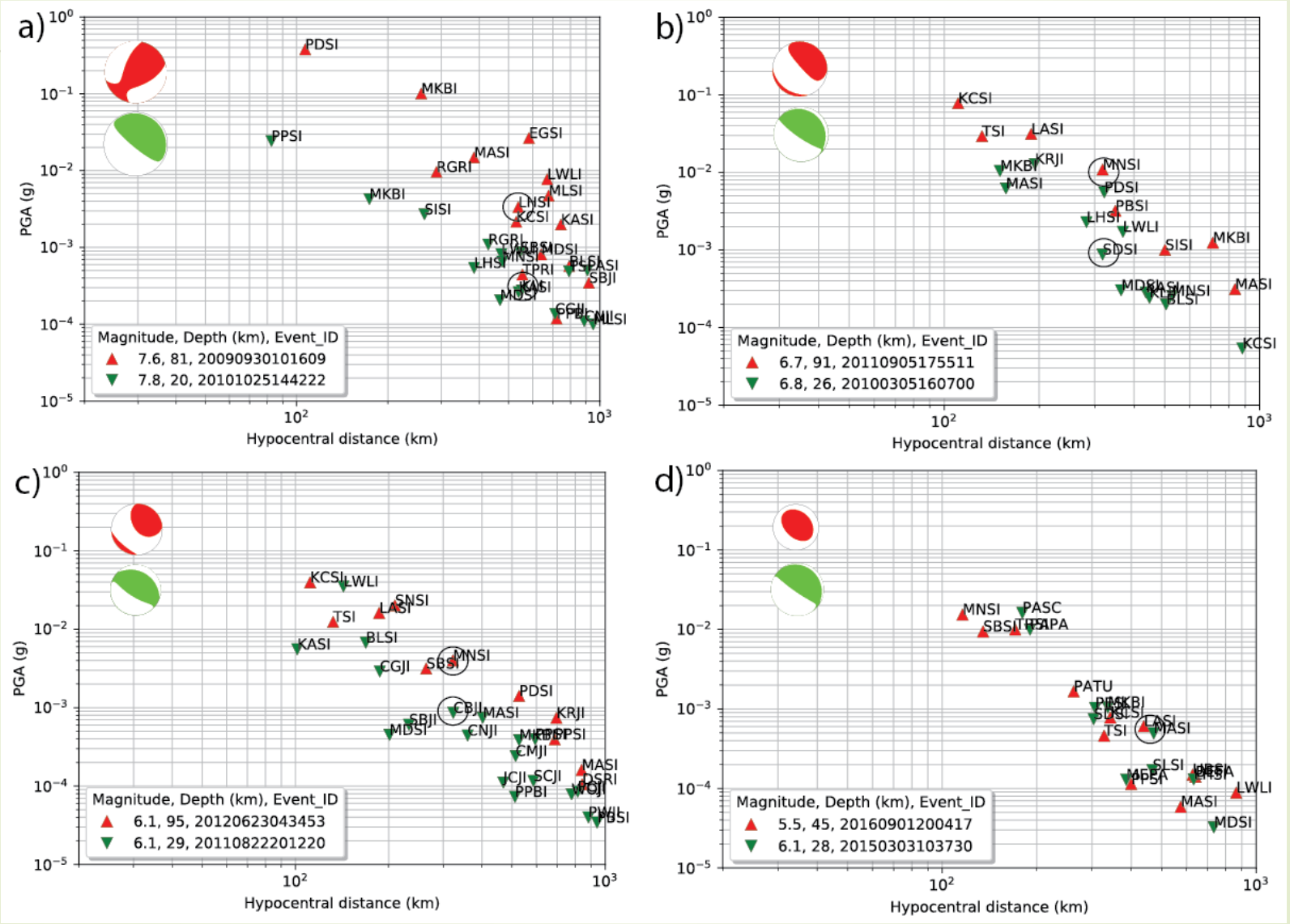




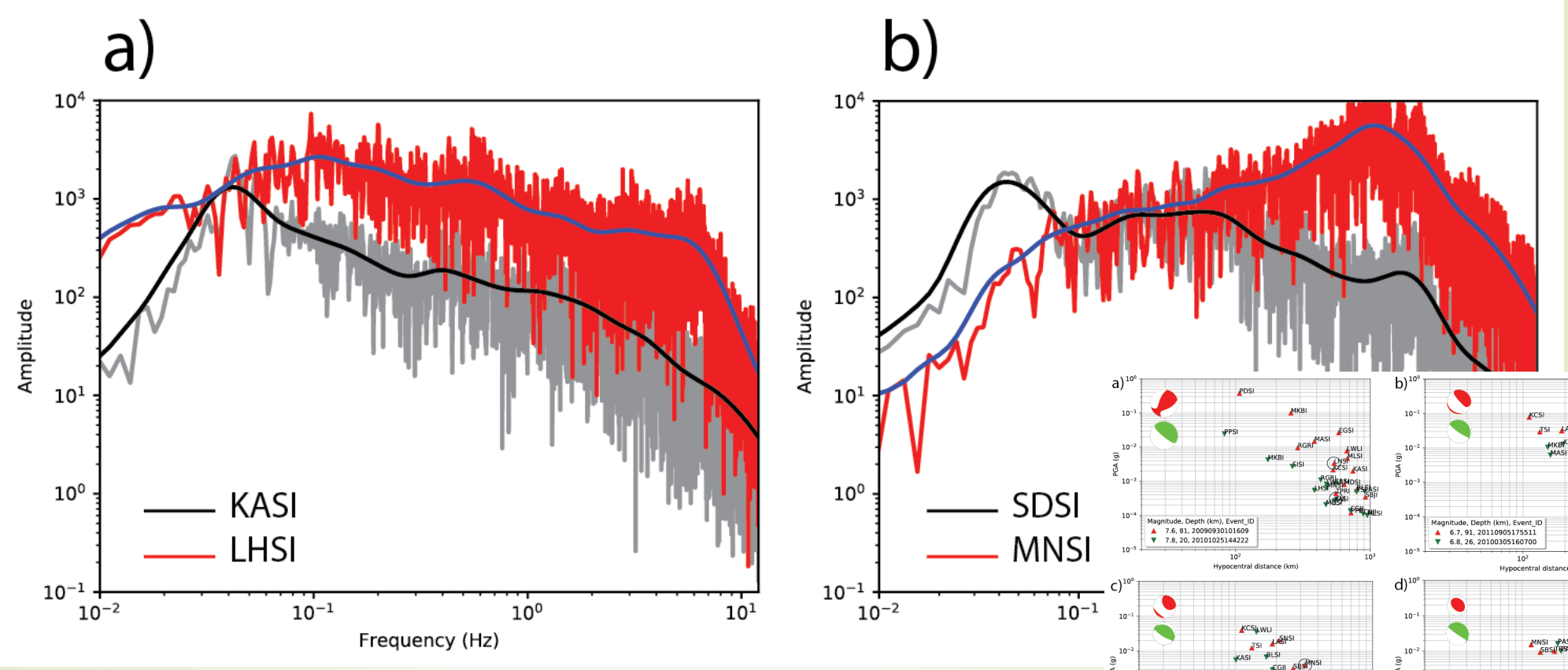


Squares
Yellow : Crustal events
Blue : Interplate
Red : Intraplate

Intraplate events caused larger PGA



Spectral amplitudes of the corresponding stations and events



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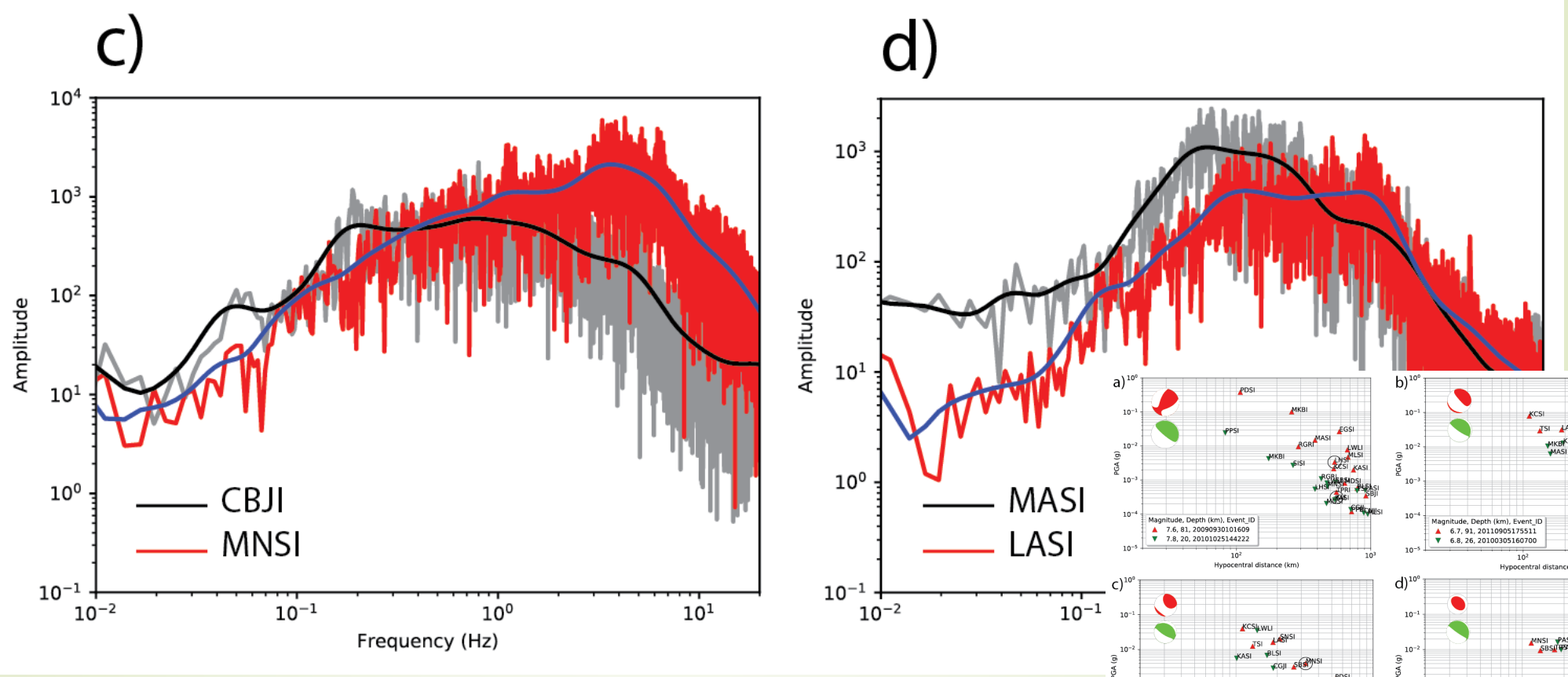
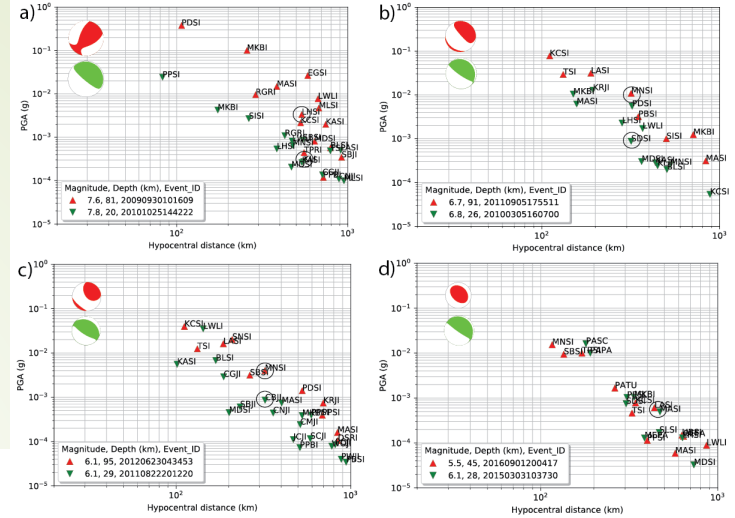
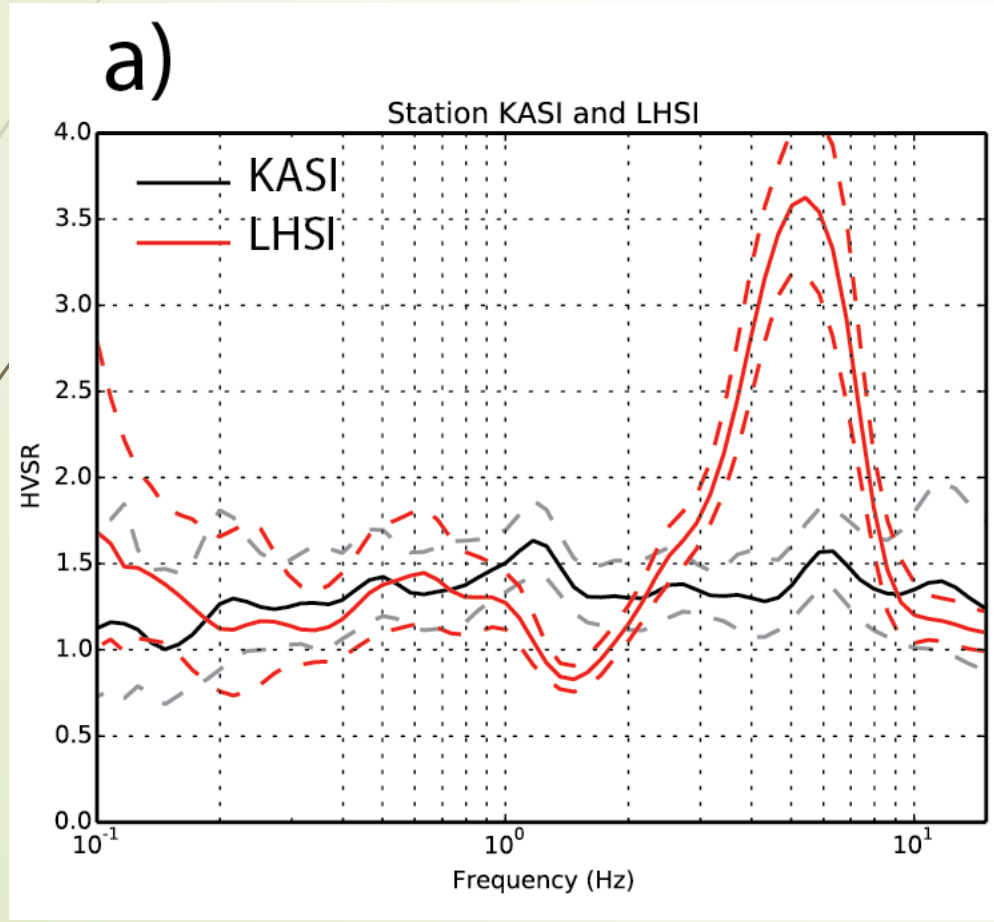
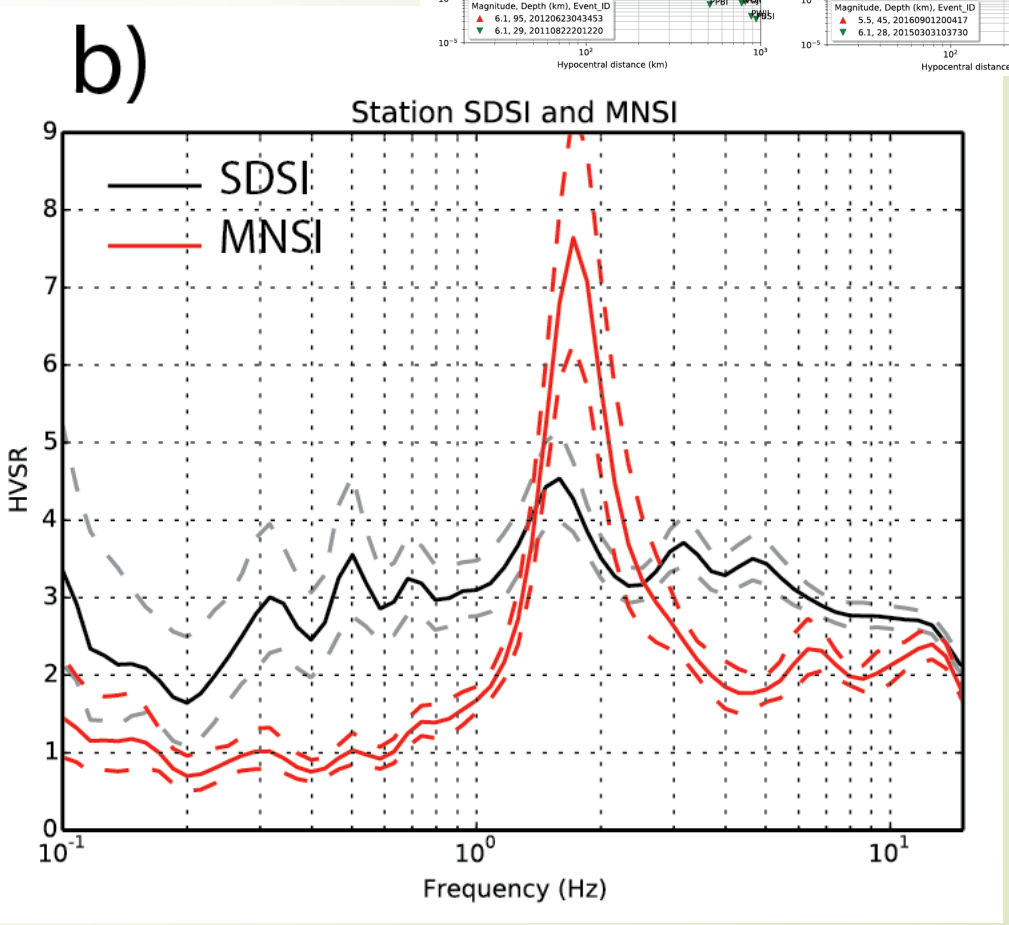


HVSRs for the corresponding stations and events







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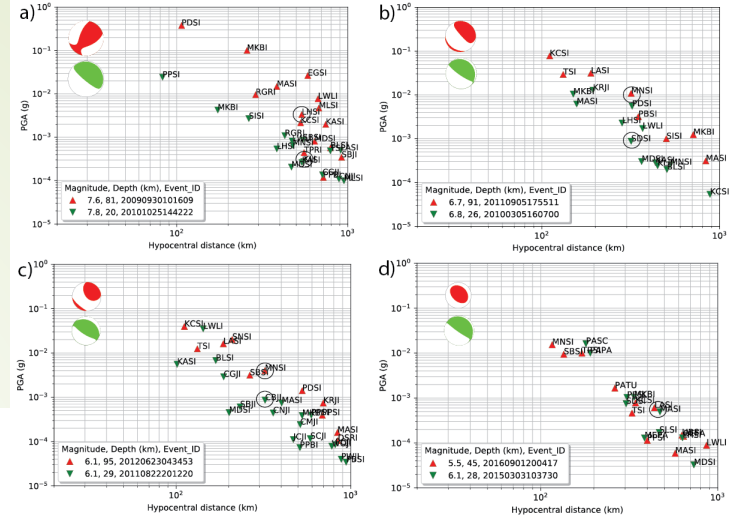
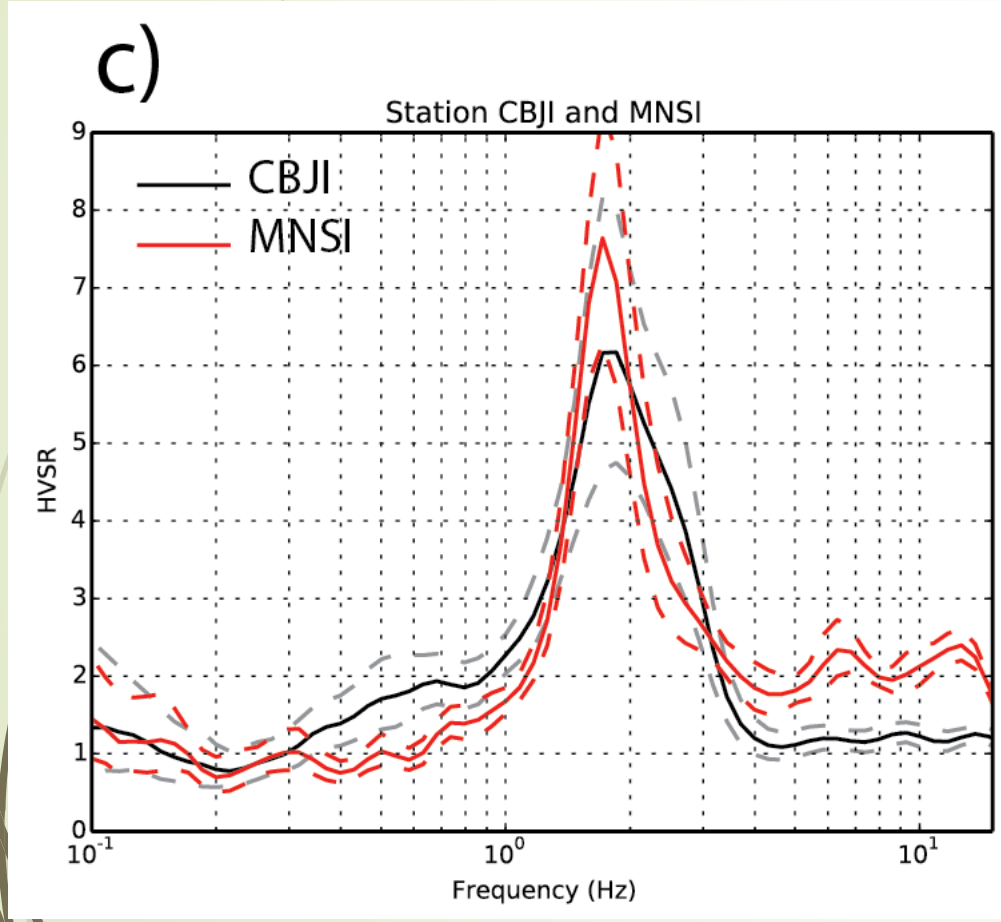
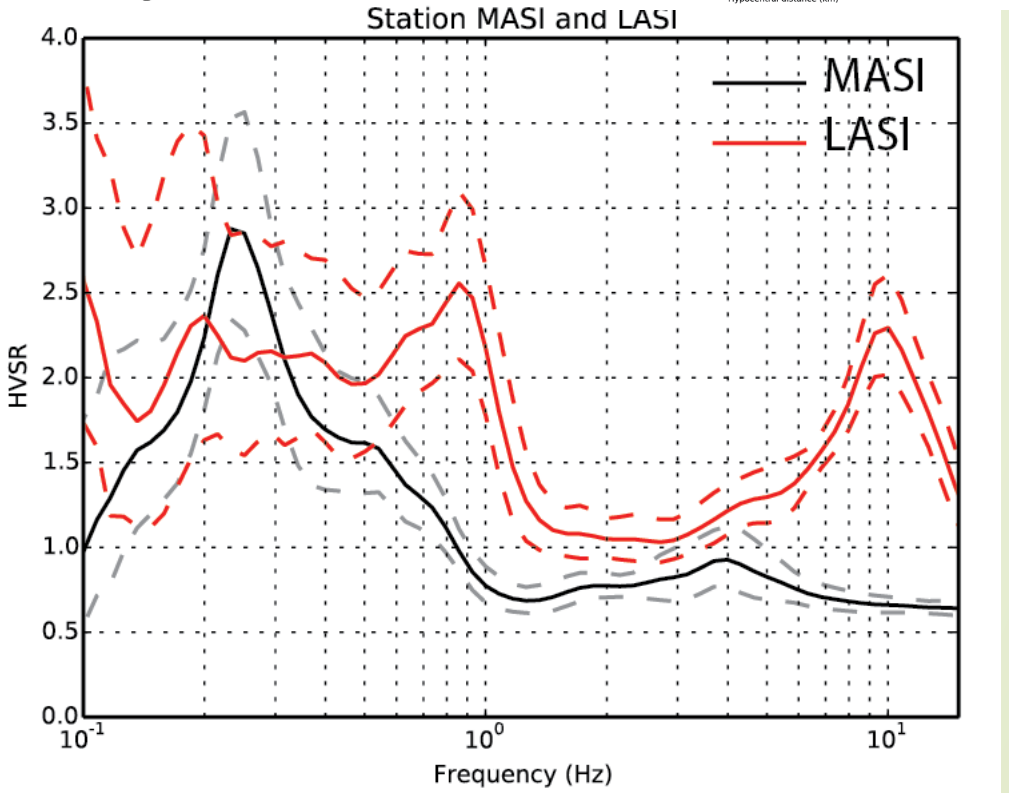
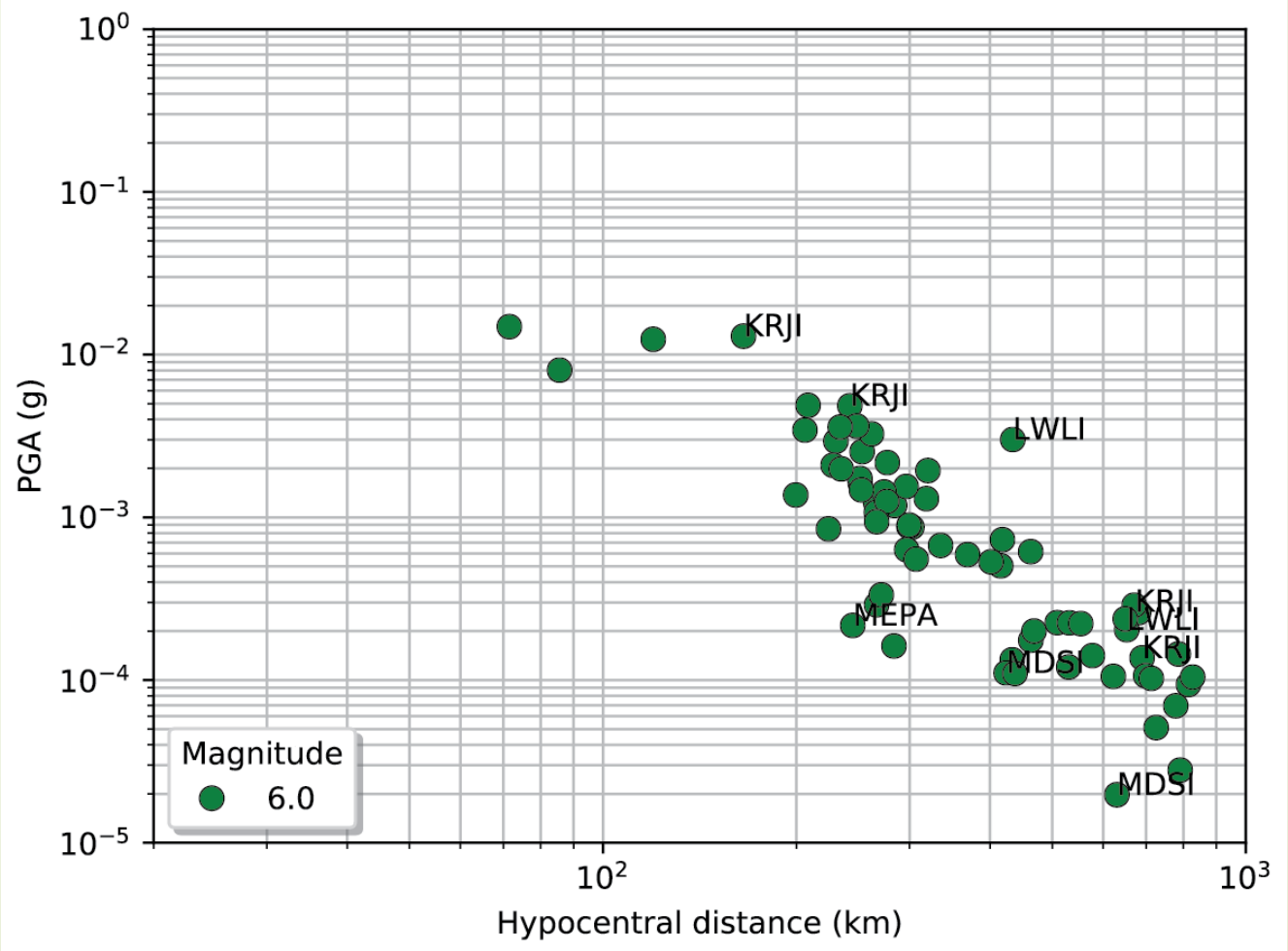






Which stations are influenced by the site effects?



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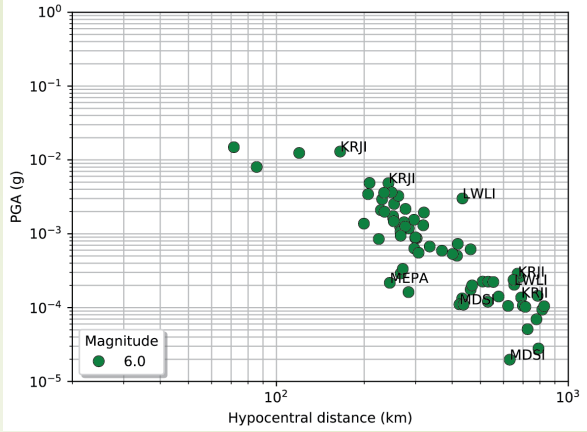

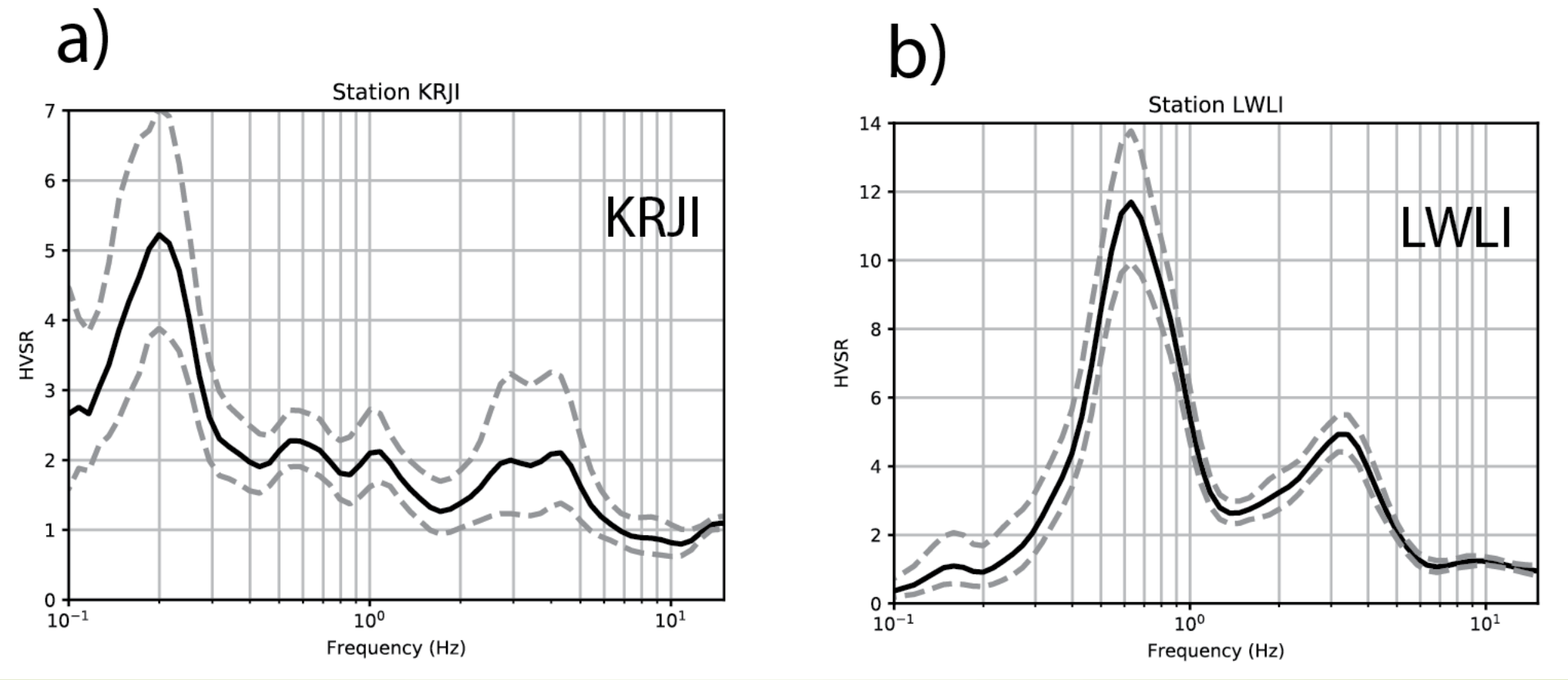

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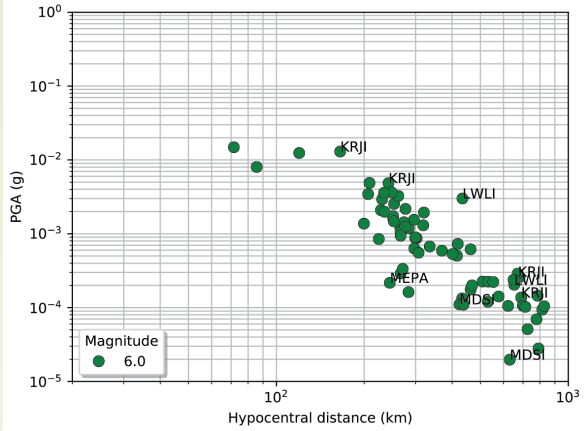
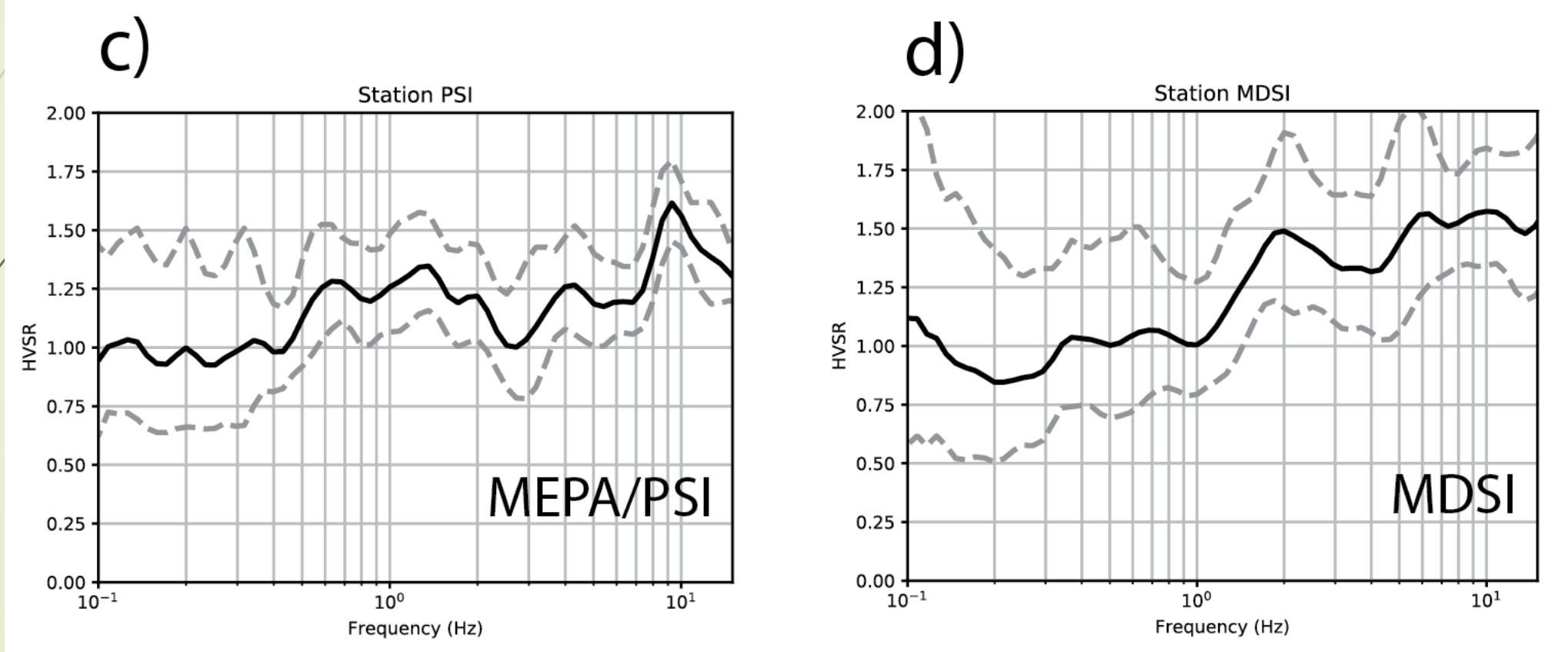
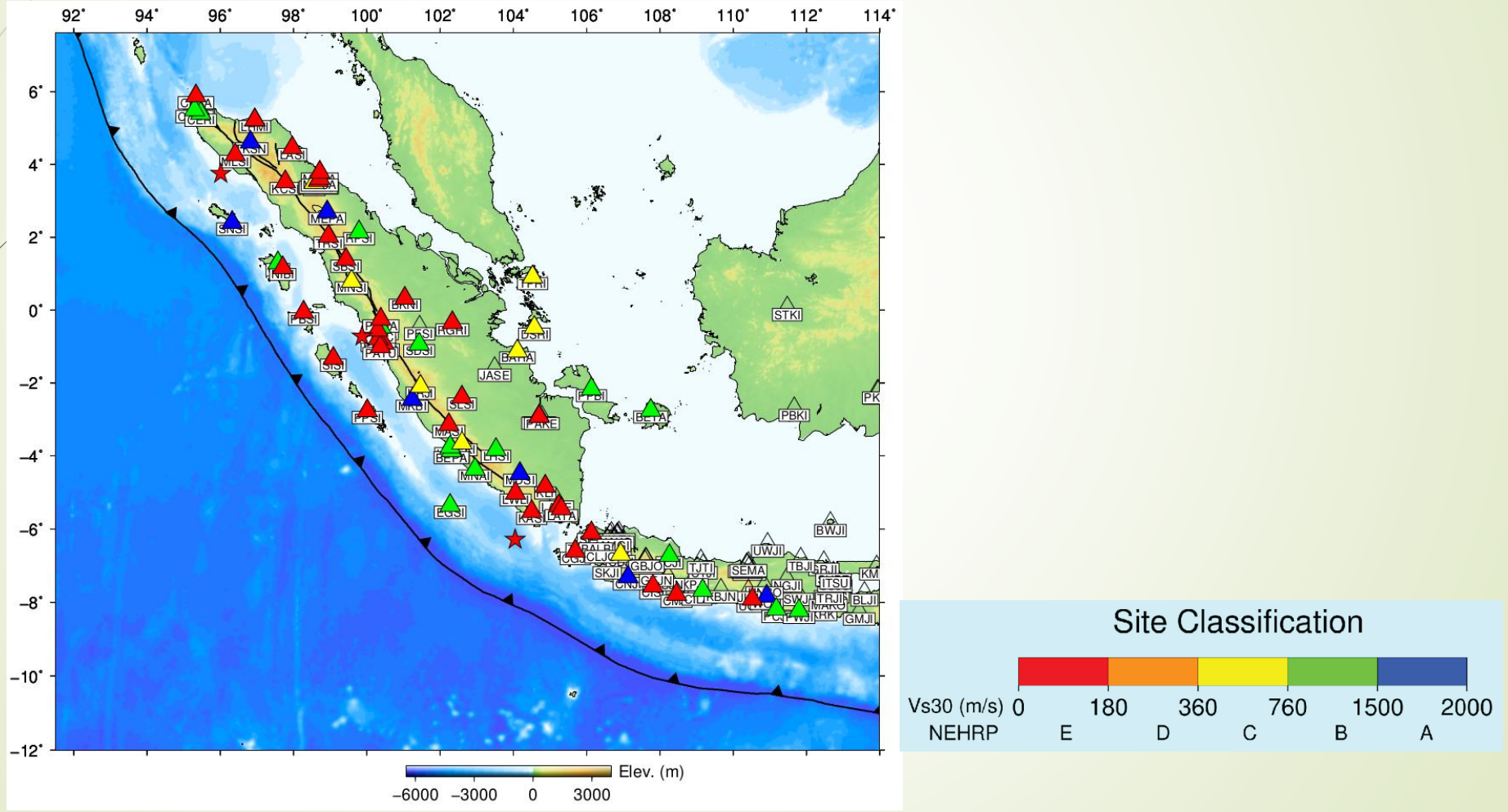
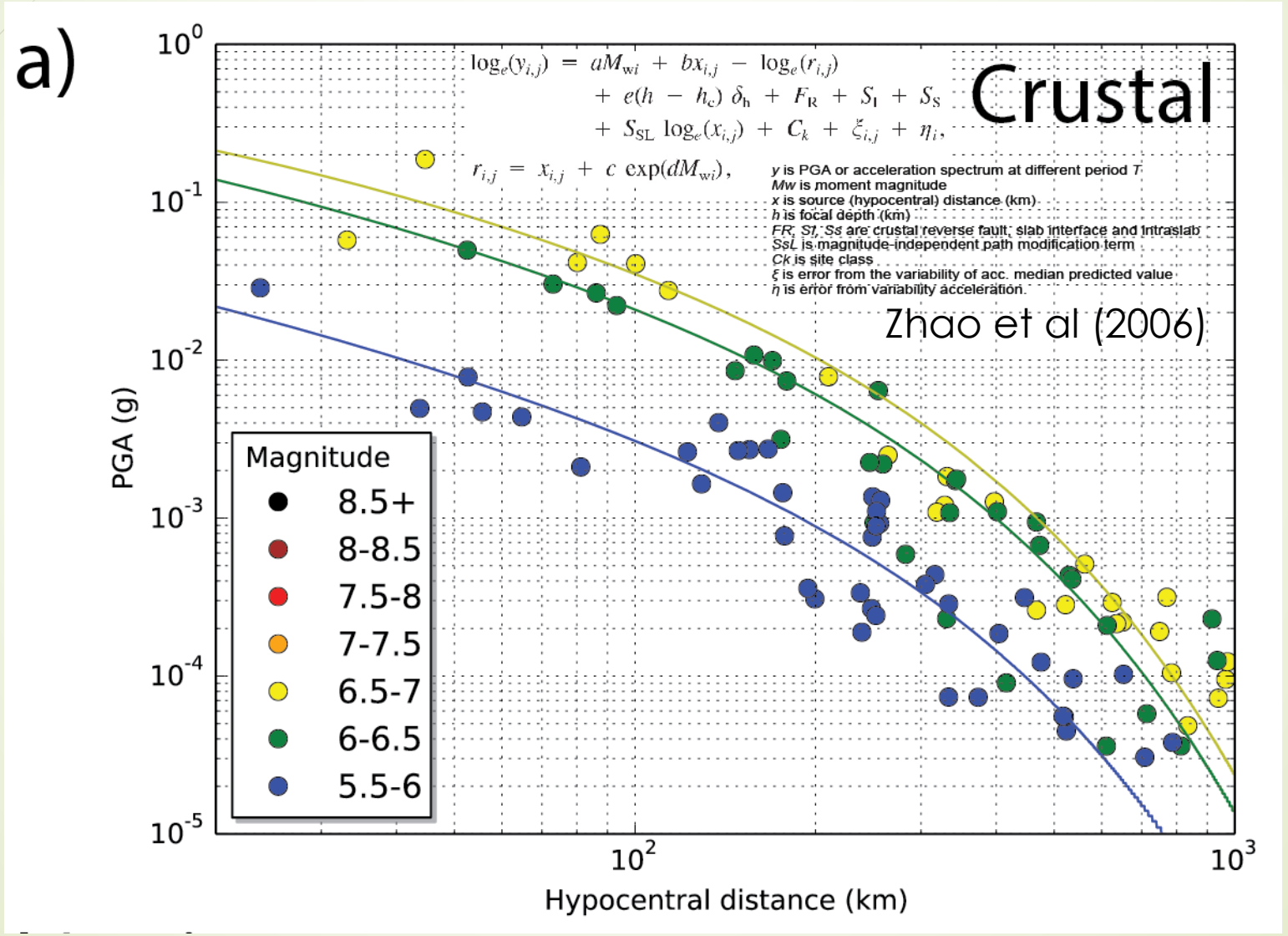




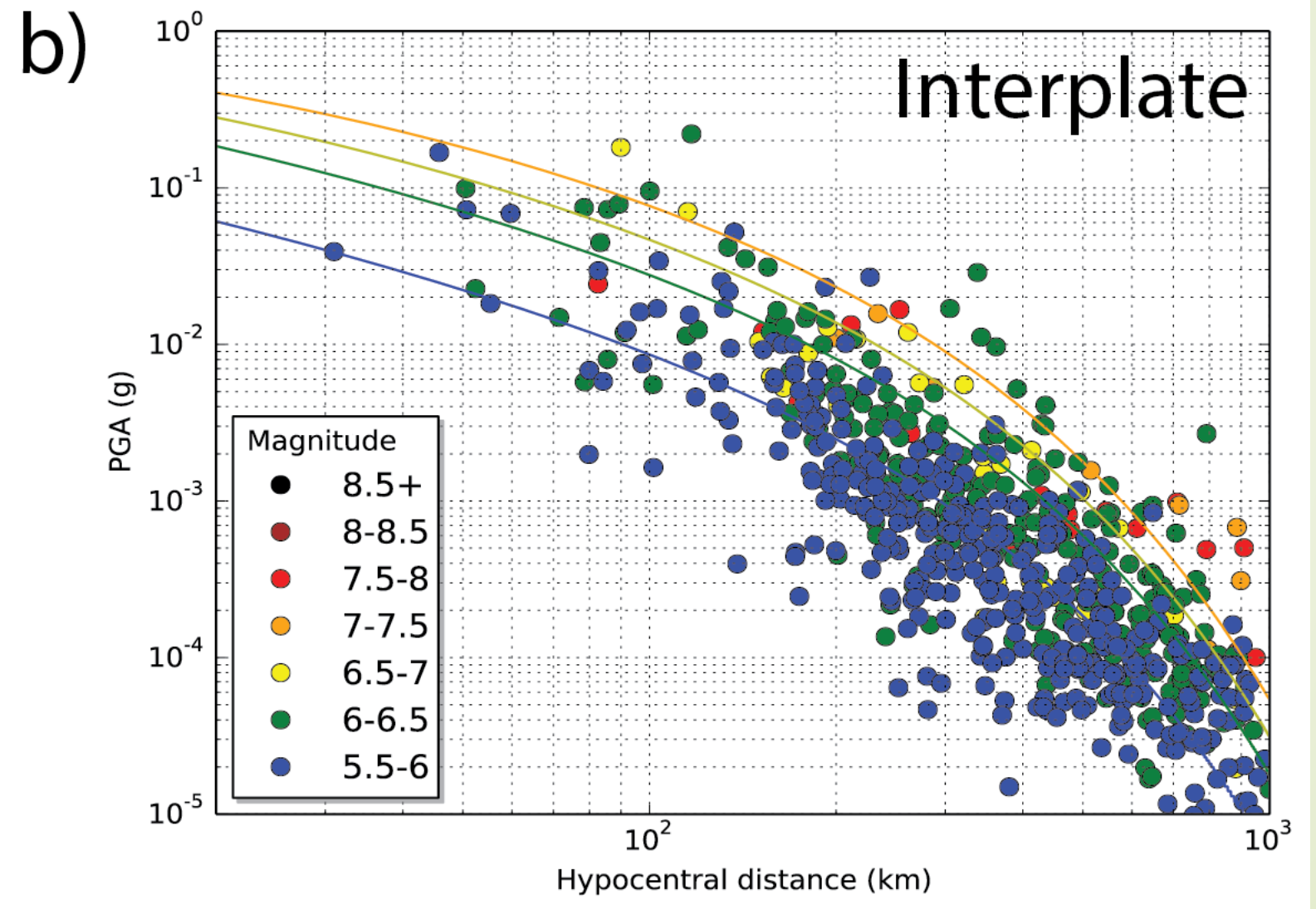
Site classifications for Sumatra stations



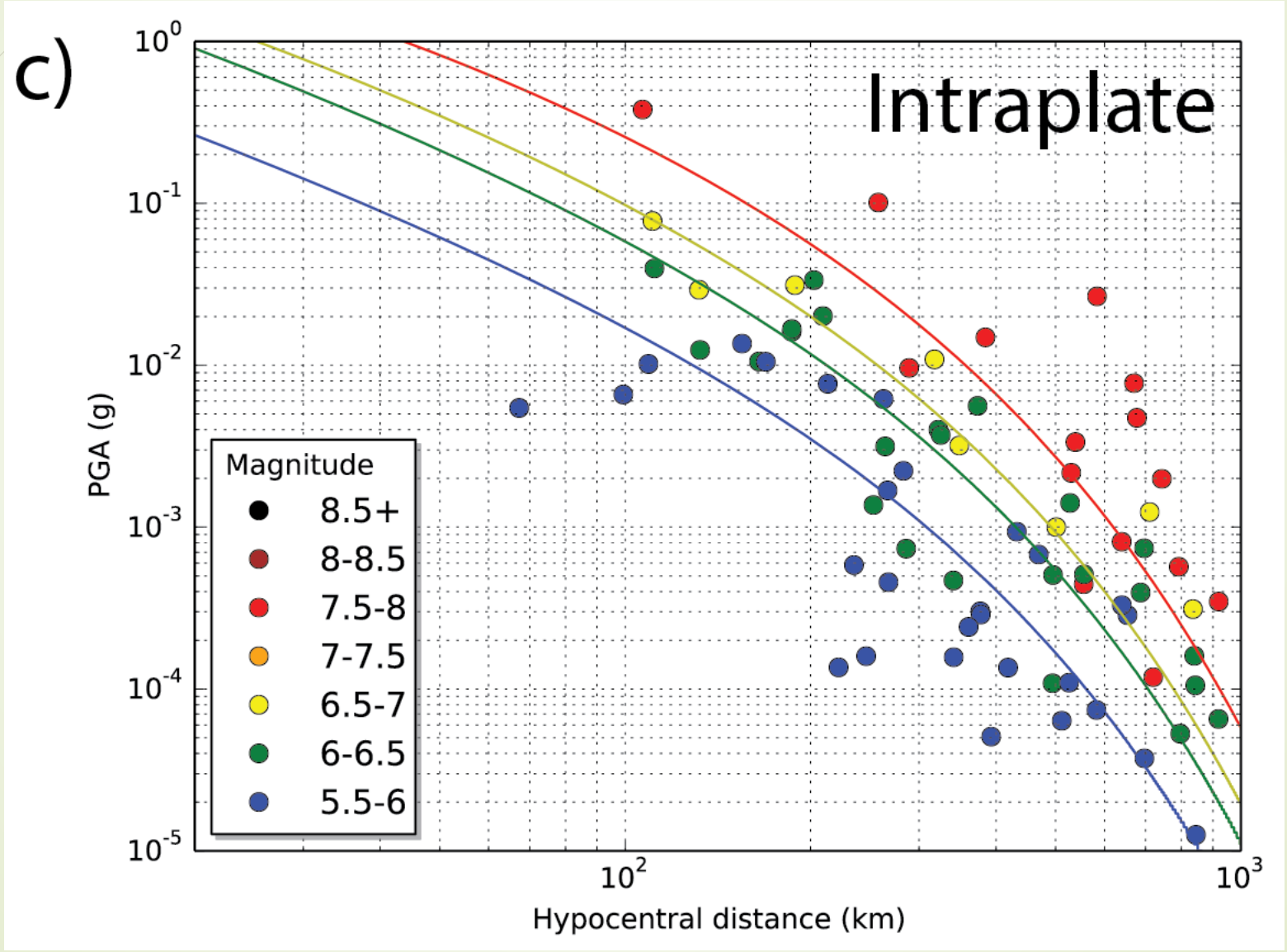
GMPE for Sumatra (Crustal events)



GMPE for Sumatra (Interplate events)



GMPE for Sumatra (Intraplate events)



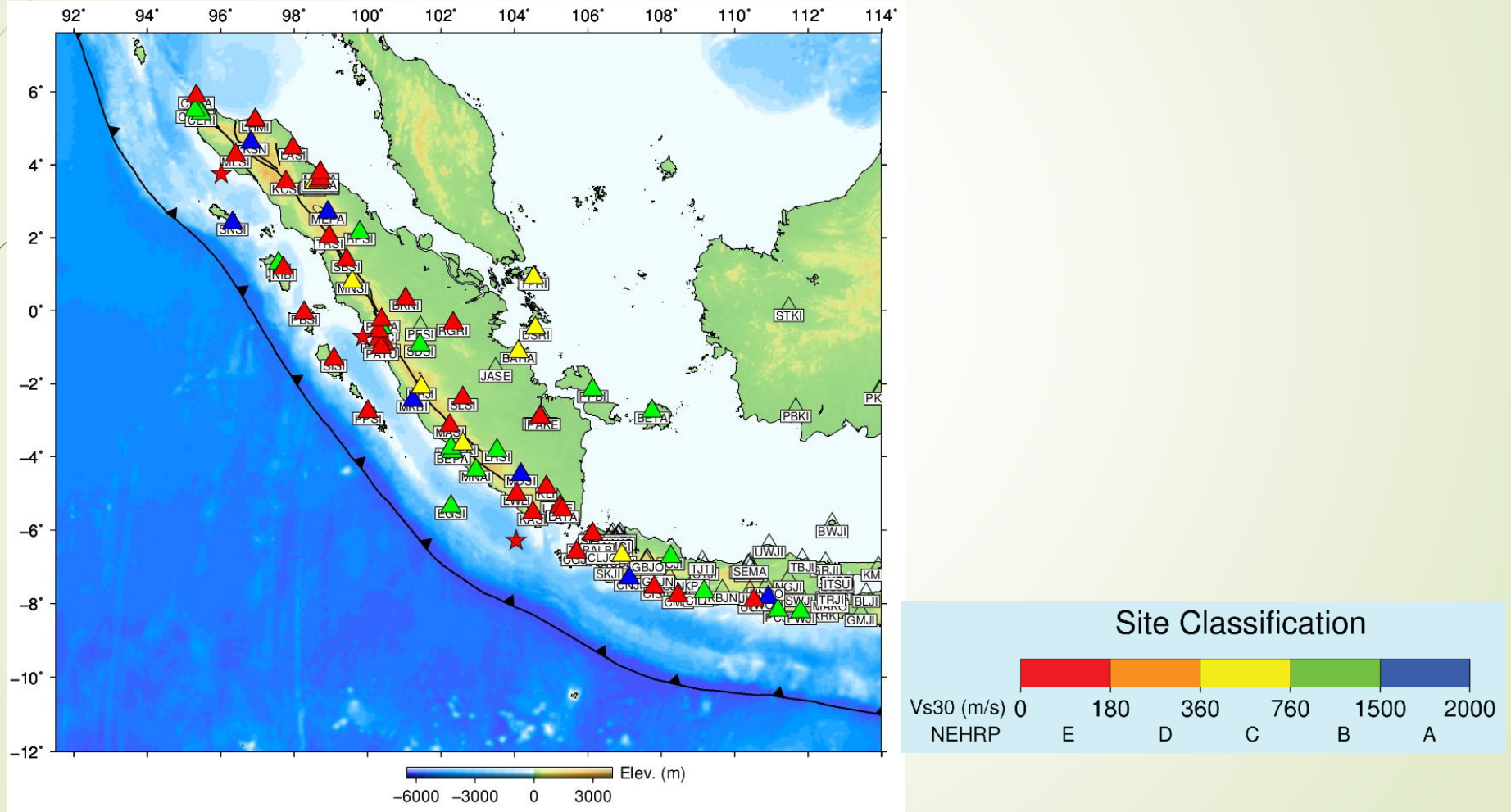
Summary

- Intraplate events caused larger ground motion at higher frequencies
- Several stations record the earthquake with the influence of site effects
- HVSR method is robust for the site class identification
- KRJI (Kerinci) and LWLI (Liwa) stations are the examples of stations located on the soft soil
- MEPA/PSI (Parapat) and MDSI (Muara Dua) are the typical stations located on the rock
- Zhao et al (2006) GMPE equations is appropriate for Sumatra region

Thank you!

Extra slides

Site classifications for Sumatra stations



Site Class Definitions Used in the Present Study and the Approximately Corresponding NEHRP Site Classes

Site Class	Description	Natural Period	V_{30} Calculated from Site Period	NEHRP Site Classes
Hard rock			$V_{30} > 1100$	A
SC I	Rock	$T < 0.2$ sec	$V_{30} > 600$	A + B
SC II	Hard soil	$0.2 = T < 0.4$ sec	$300 < V_{30} = 600$	C
SC III	Medium soil	$0.4 = T < 0.6$ sec	$200 < V_{30} = 300$	D
SC IV	Soft soil	$T = 0.6$ sec	$V_{30} = 200$	E + F