

**4<sup>TH</sup> ICRMCE, SOLO, 11-12 JULY 2018**

# **Determination of the seismicity and peak ground acceleration for Lombok Island: An evaluation on tectonic setting**

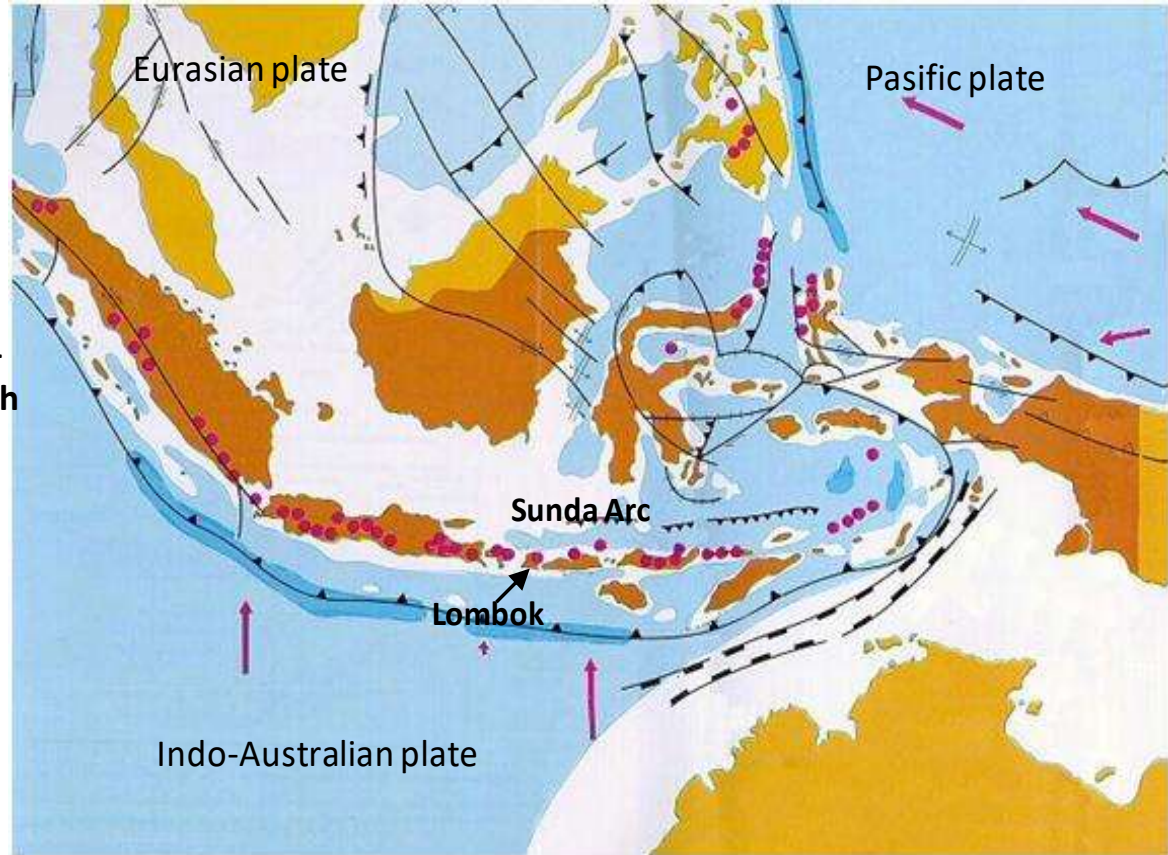


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# INTRODUCTION: TECTONIC OF INDONESIA

- Indonesia is one of the most seismically active parts in the world, due to three tectonic plates collide one to the other, creating seismic events almost every day
- Lombok Island is located at the west part of Sunda Arc that Indo-Australian plate subducts beneath Eurasian plate.
- Earthquake events around the island were generated by two seismic sources: southern subduction mega-thrust and northern back-arc thrust. These two sources fashioned different types of seismic events. The subduction tends to generate deep; conversely the back-arc thrust tends to generate shallow seismic events.



# METHODS:

1. To determine the seismicity of Lombok Island, using equations:

- Gutenberg-Richter relationship (1949):

$$\text{Log } N_{(M)} = a - bM$$

- Likelihood :

$$b = \log e / (M_{\text{ave}} - M_0)$$

- Esteva & Villaverde (1973):

$$\text{PGA} = 5600 * \text{EXP}(0.6Ms) * (R+40)^2 \text{ (cm/sec}^2\text{)}$$

- McGuire (1977):

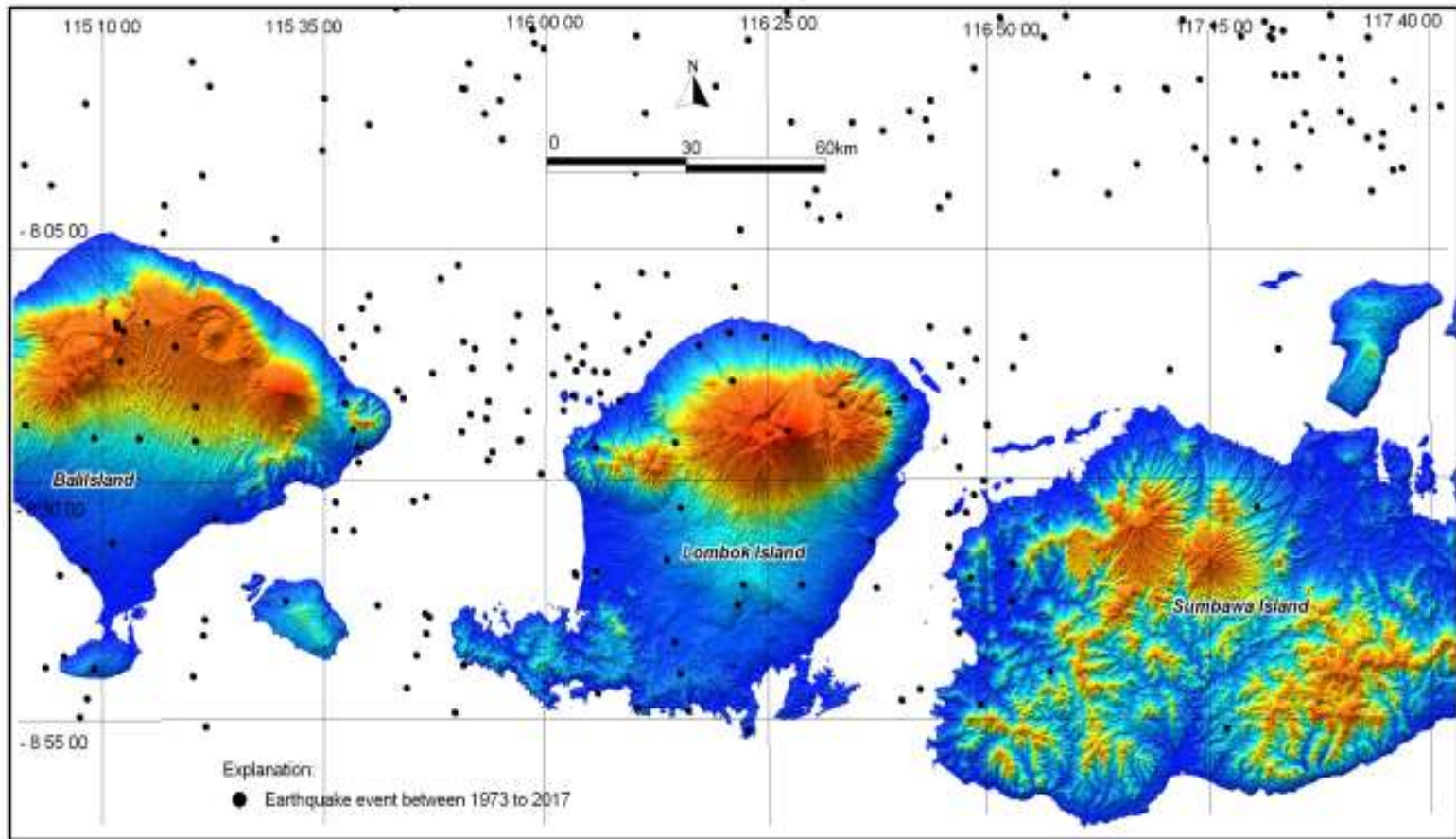
$$\text{PGA} = 472.3 * 10^{0.278Ms} * (R+25)^{-1.301} \text{ (gal)}$$

- Joyner-Boore (1988):

$$\text{PGA} = 10^{([0.71 + 0.23(M-6) - \text{Log}(r) - 0.0027(r)])} \text{ (g)}$$

2. The PGA data obtained from three attenuation models were, therefore, plotted on the geological structure map of Lombok Island to reconstruct the tectonic setting of the Island.

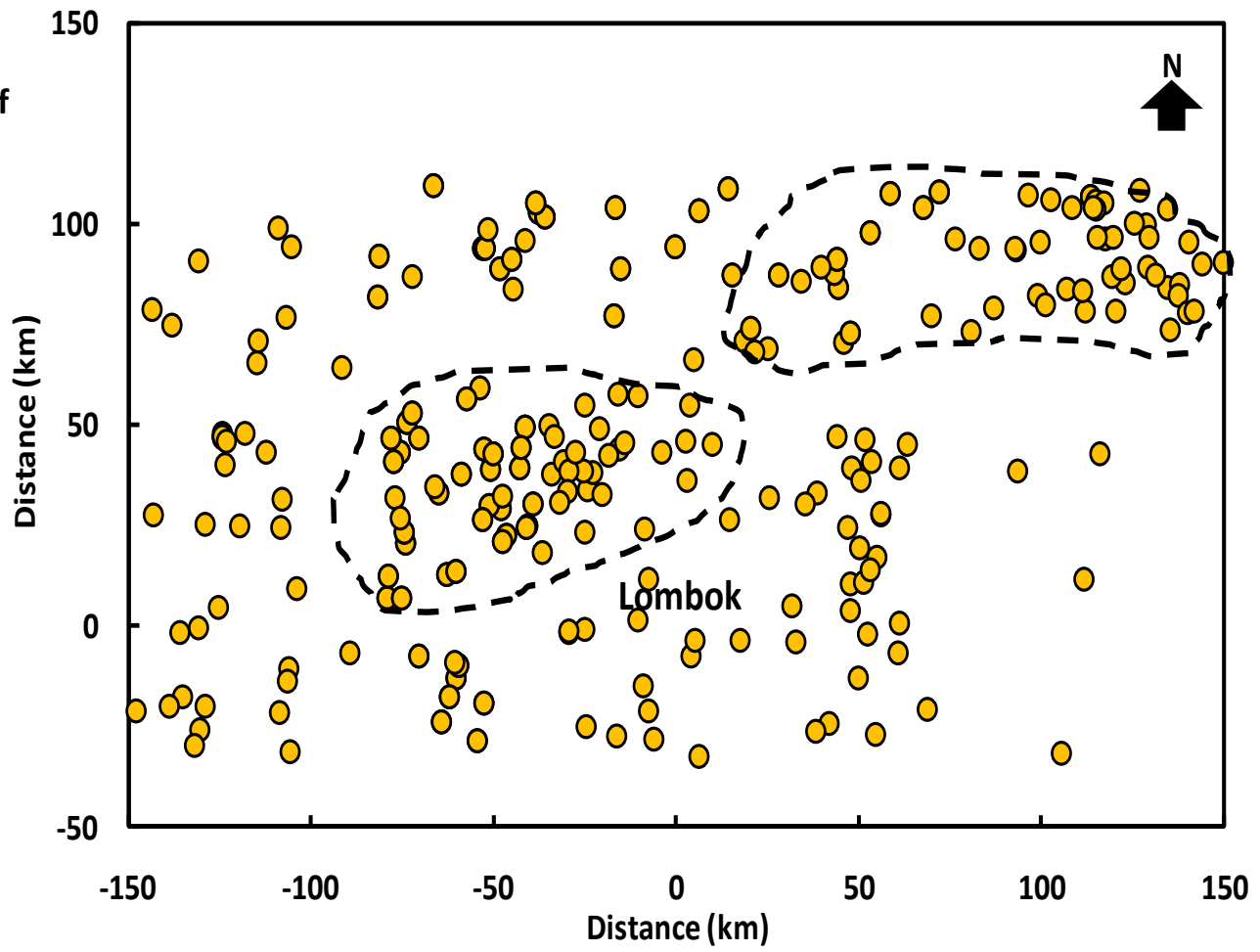
# RESULTS: DISTRIBUTION OF EARTHQUAKES AROUND LOMBOK ISLAND



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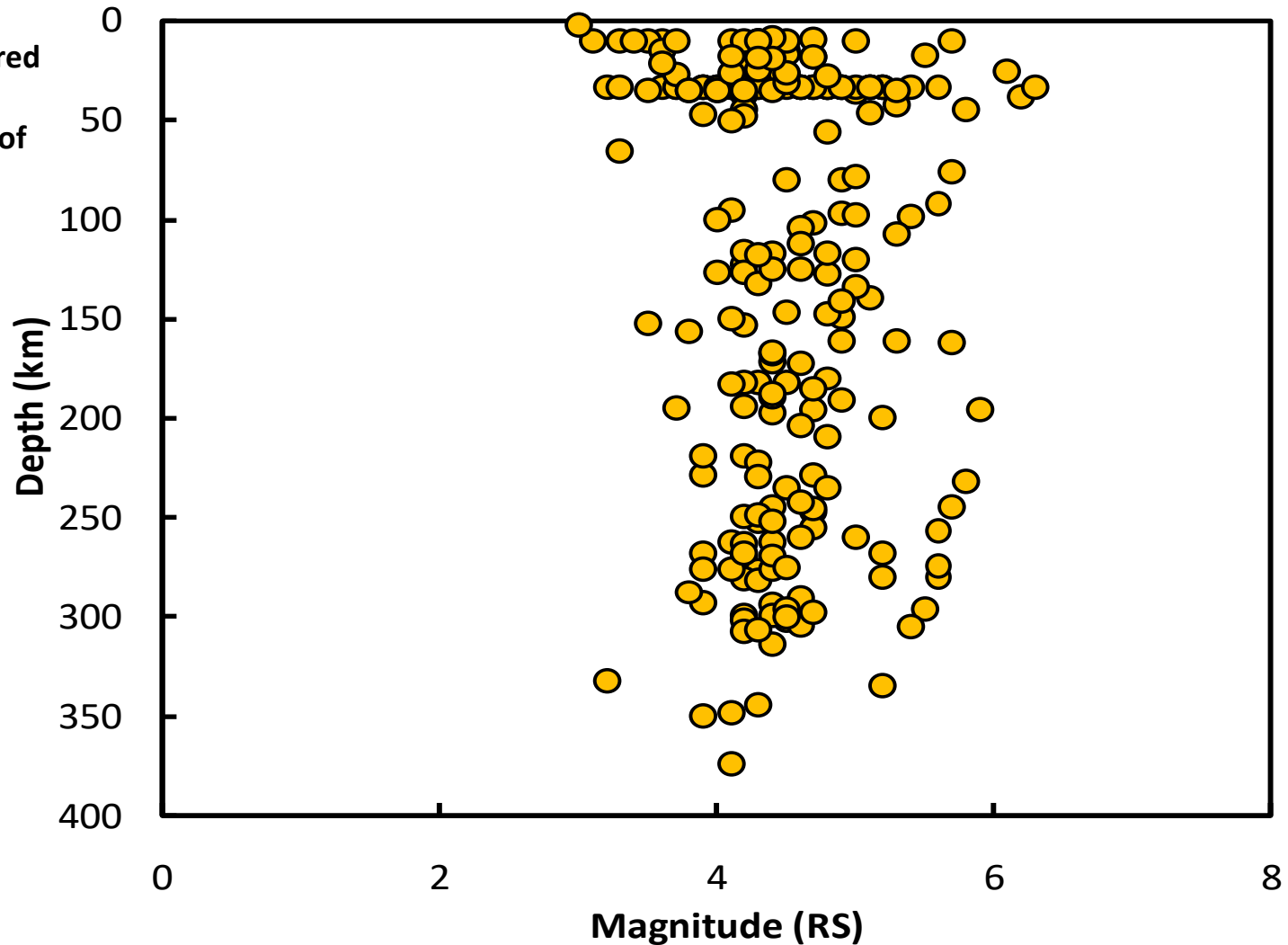
## CONCENTRATION OF EARTQUAKES AROUND 150 Km of LOMBOK ISLAND

• Earthquake events randomly concentrated on northern part of Lombok Island



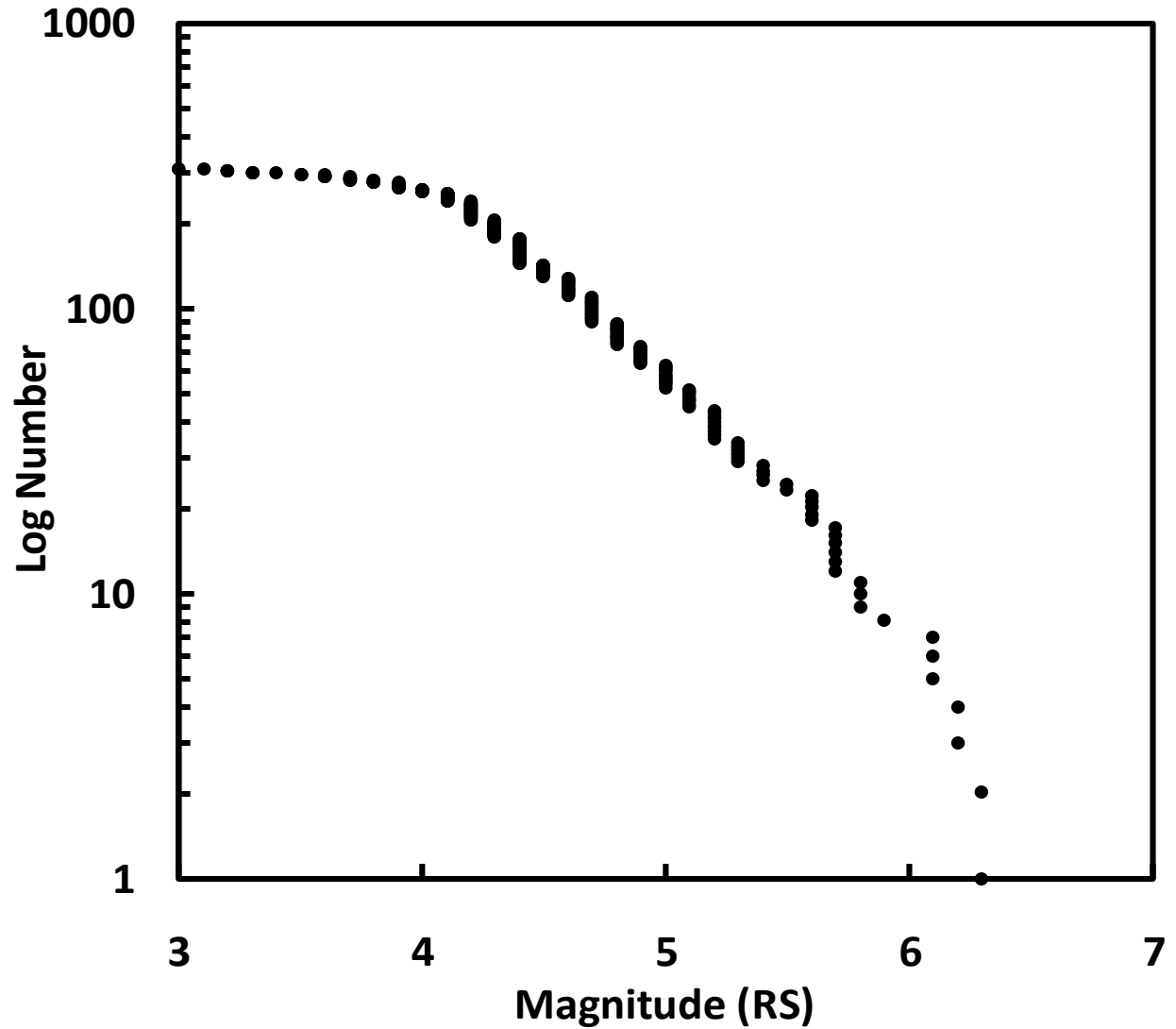
# DEPTH AND MAGNITUDE OF EARTHQUAKE EVENTS AROUND LOMBOK ISLAND

- Earthquake events occurred at depths of 33 - 400 Km
- Mostly had a magnitude of >3.0 RS



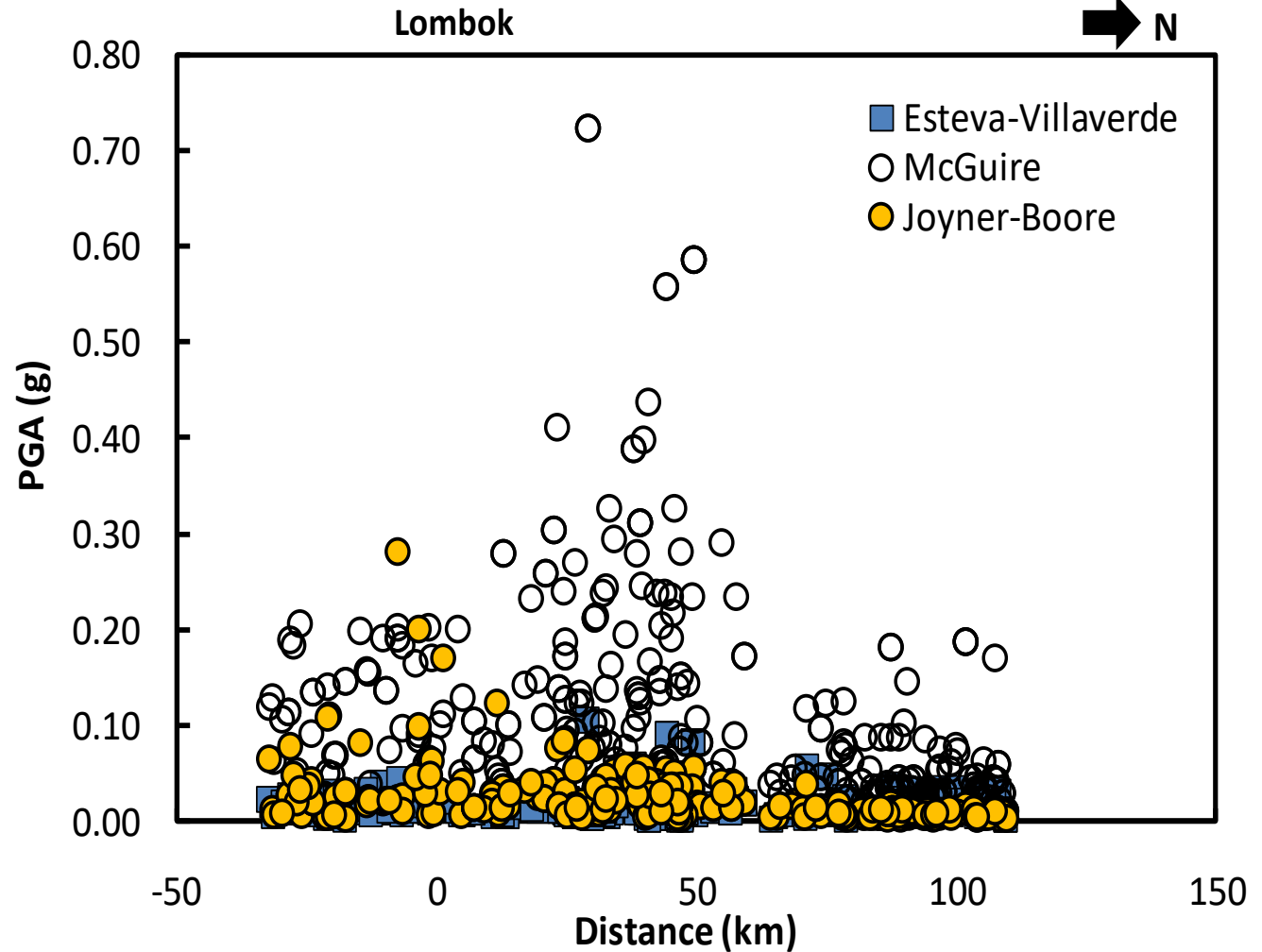
# SEISMICITY OF LOMBOK ISLAND

- The  $a$ - and  $b$ -values: 3.62 and -0.53
- The maximum likelihood of  $b$ -value: -0.66
- Category: medium to high seismic events



# PEAK GROUND ACCELARATION OF EARTHQUAKE EVENTS

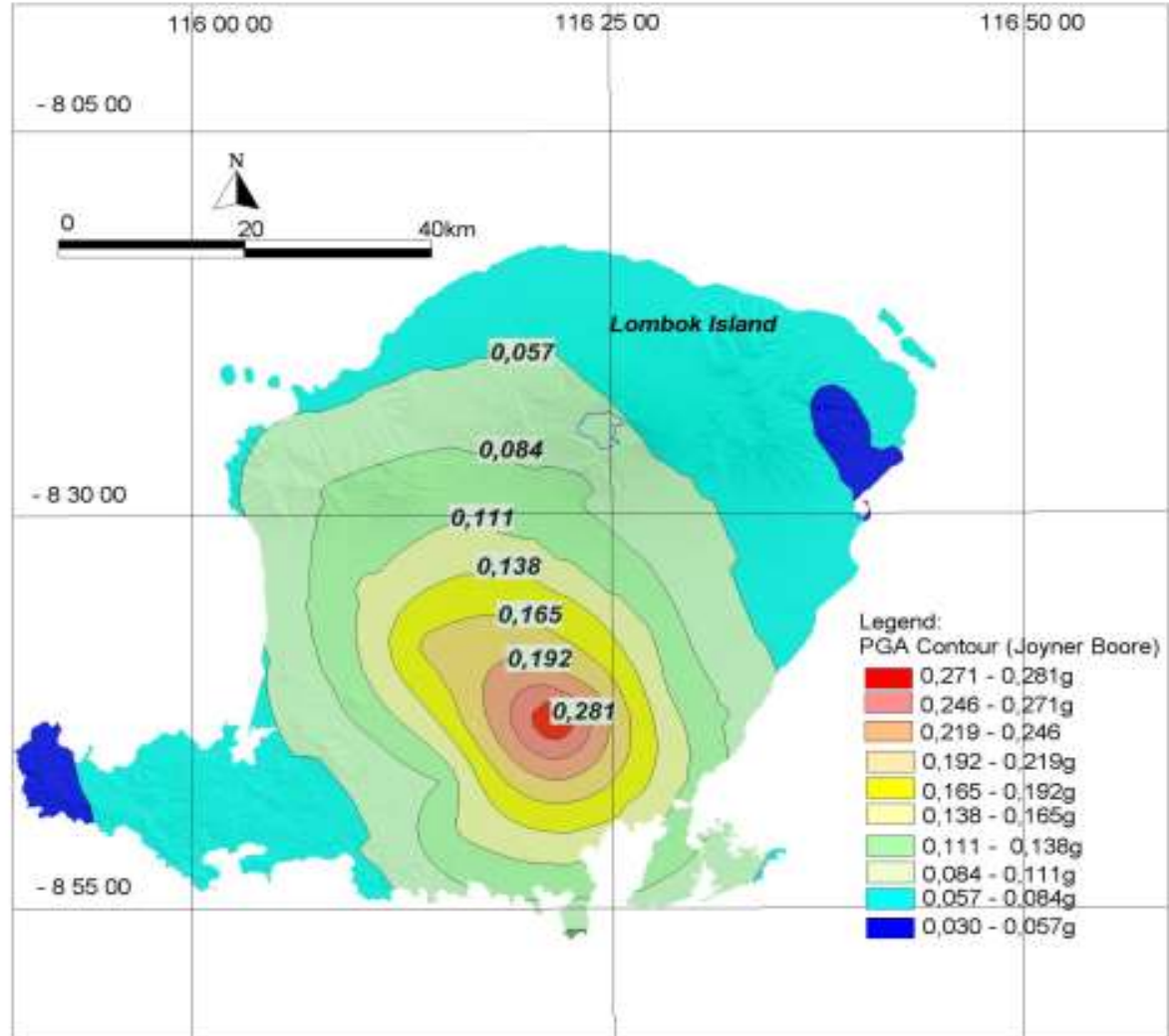
- The PGA values are between 0.003g and 0.11g
- The Esteva-Villaverde produced low PGA
- The McGuire PGA: 0.01 - 0.72g
- The Joyner-Boore: 0.003 - 0.28g





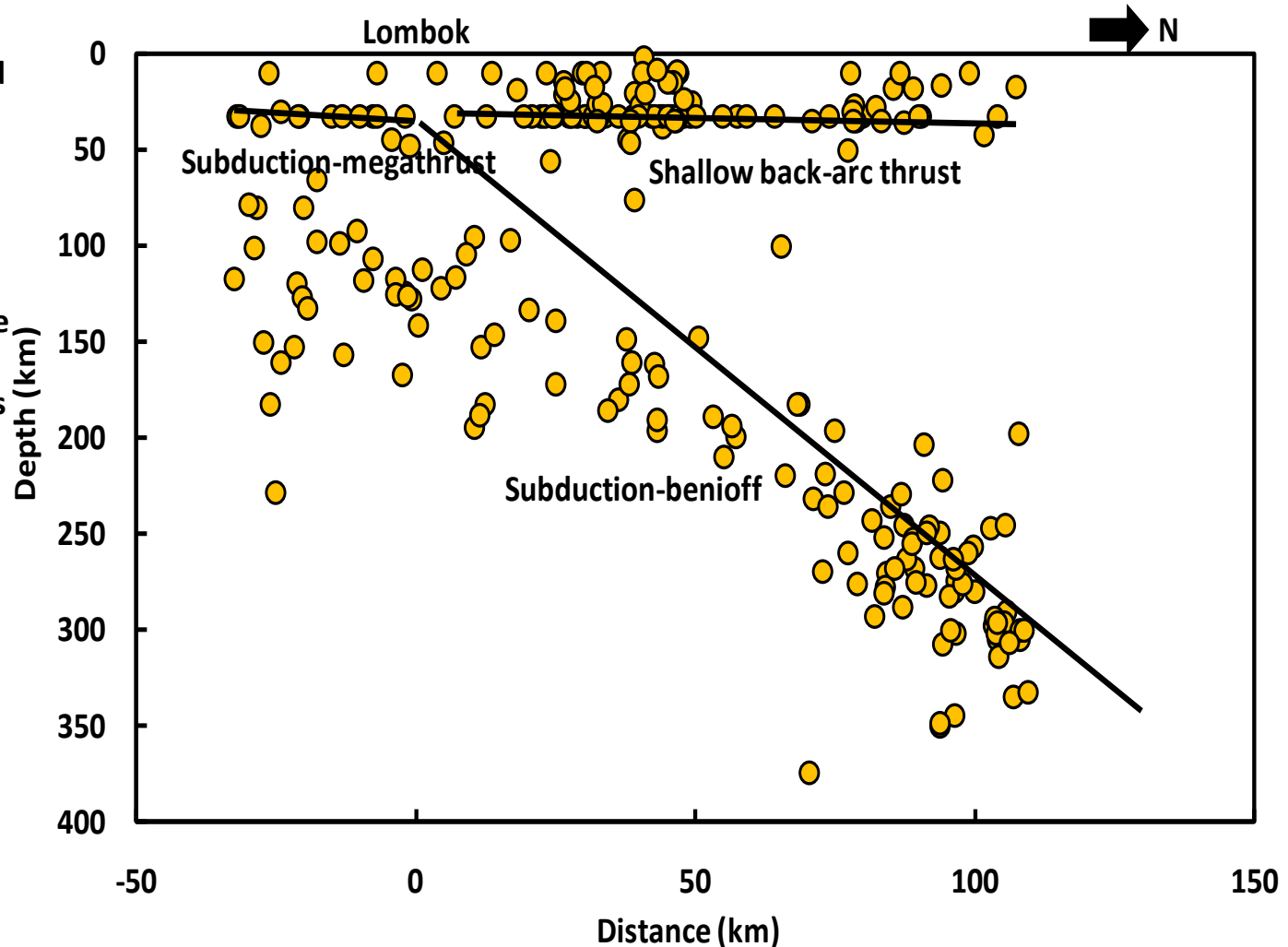
# MAP OF PGA OF LOMBOK ISLAND

- The Joyner-Boore equation may indicate the influence of magnitude, distance, and site characterization that is suitable to Lombok Island.
- The PGA data were then plotted on the map, in which the maximum PGA data are concentrated on the south-east part of the island.

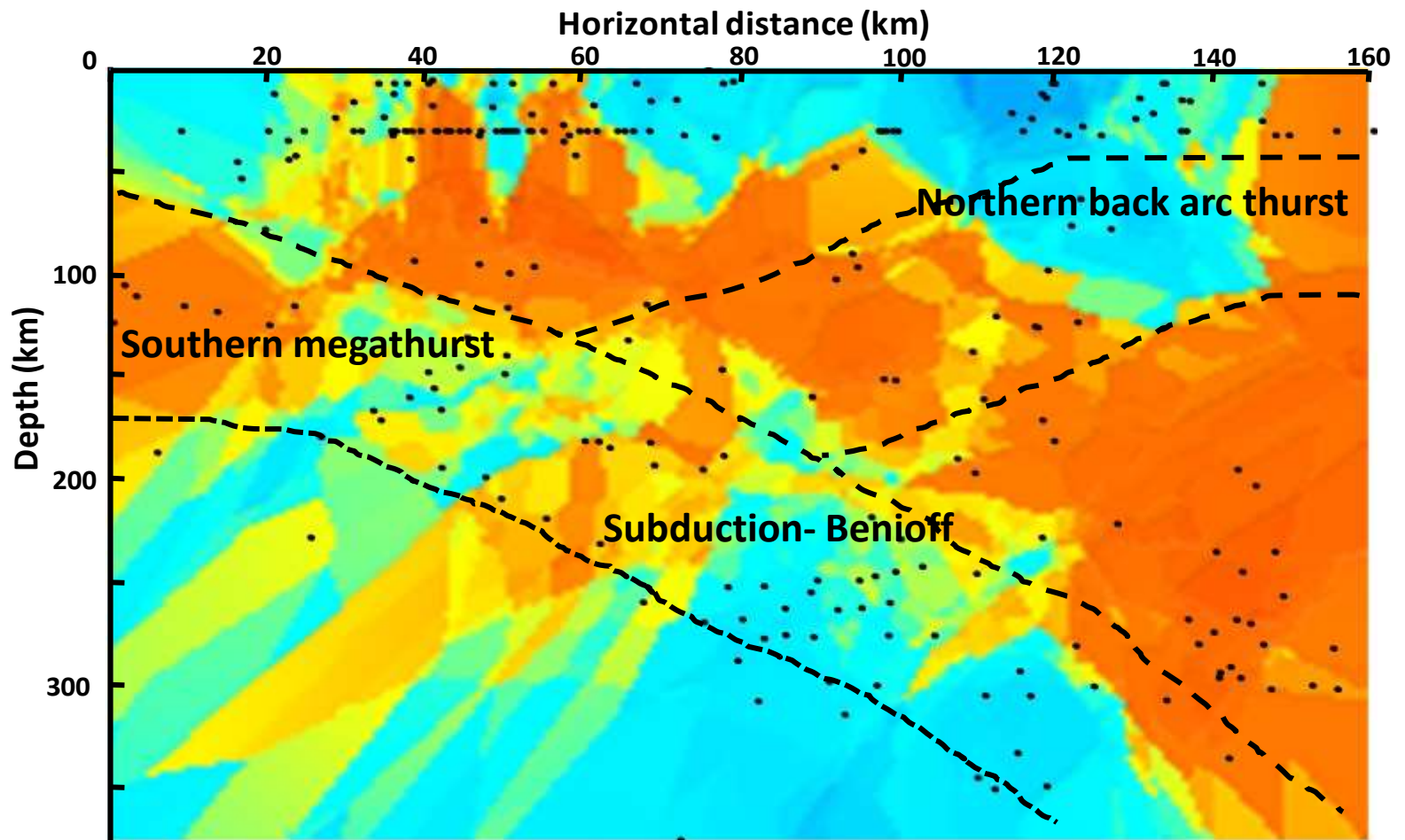


# TECTONIC SETTING OF LOMBOK ISLAND

- The tectonic pattern of Lombok Island is developed by the south subduction mega-thrust and north back-arc thrust, as a consequence of the compression between Australian Continental Plate and Eurasian Plate [1].
- The south subduction tends to produce deep earthquakes; whereas the north back-arc thrust tends to produce shallow earthquakes.
- The Benioff zone may develop at depths of 150 km, similar to the called Benioff-Wadati zone.
- The zone may be inclined with an angle of  $67^{\circ}$  downward north.



# RECONSTRUCTION OF TECTONIC SETTING OF LOMBOK ISLAND



# CONCLUSION:

## GEOLOGICAL STRUCTURE OF LOMBOK ISLAND

- Lombok Island is categorized into medium to high seismicity.
- The attenuation of Joyner-Boore may represent ground motion of seismic event characteristics of the island, since the deep Benioff mixed with shallow back-arc thrust earthquakes dominantly occurred around the island.
- Based on Harding's tectonic model: Sinistral strike-slip fault may develop on the crustal basement on the direction of NE – SW caused by main horizontal tectonic forces working on the direction of  $N 171^{\circ}E - N 351^{\circ}E$ .

