

# Modello 3D delle strutture sismogeniche: vantaggi e limiti

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**Nuovi studi sulla pericolosità sismica regionale**

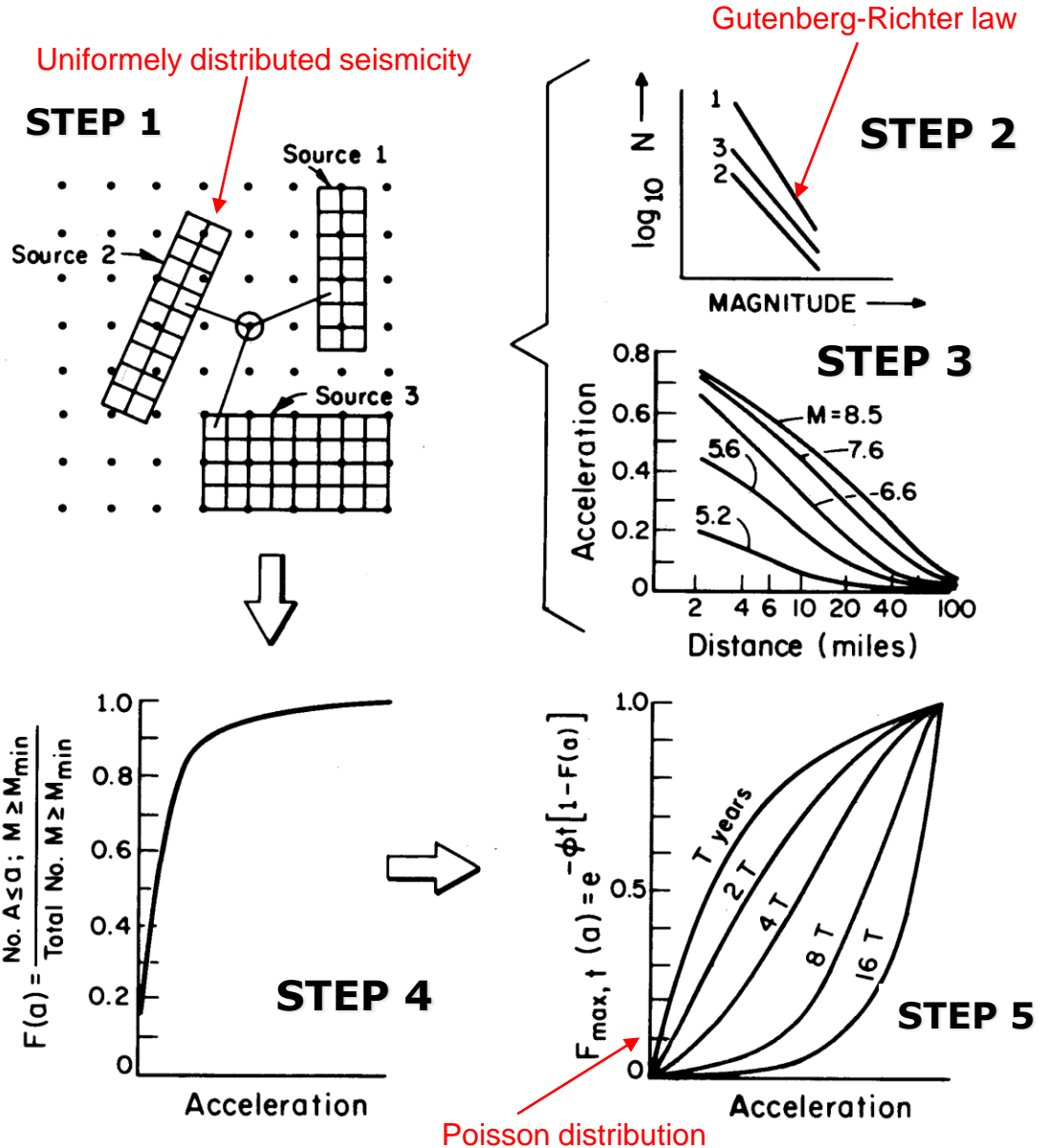
Bologna, **5 dicembre 2017**  
viale della Fiera, 8 - Sala "20 maggio 2012"

# The 5 steps of PSHA

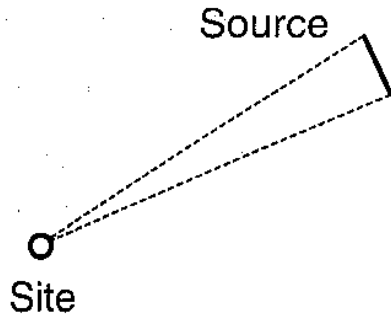
## The actual steps in PSHA computation

- 1) Definition of SZs
- 2) Seismicity characterisation
- 3) Attenuation relation
- 4) Probability of ground motion exceedence
- 5) Probability of ground motion exceedence in T yrs

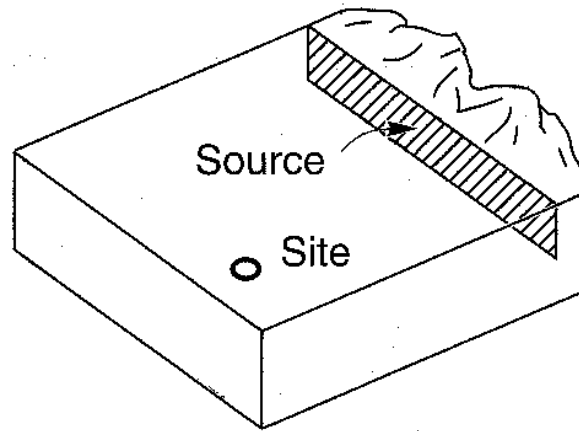
(from Algermissen & Perkins, 1976)



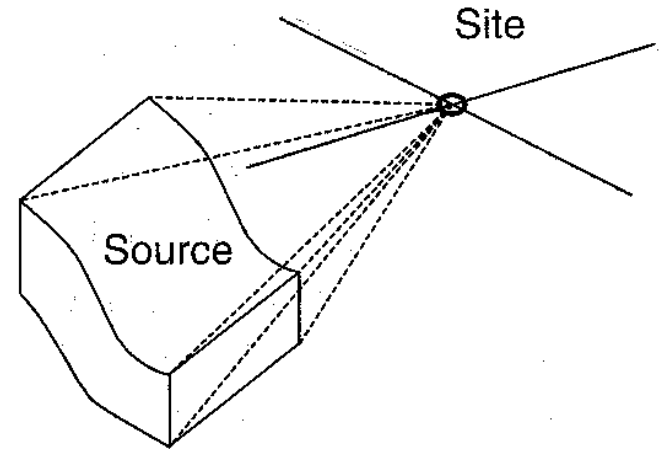
# Types of seismic sources



(a)



(b)



(c)

Examples of different earthquake source geometries:

a) short fault that can be modelled as a **point** source;

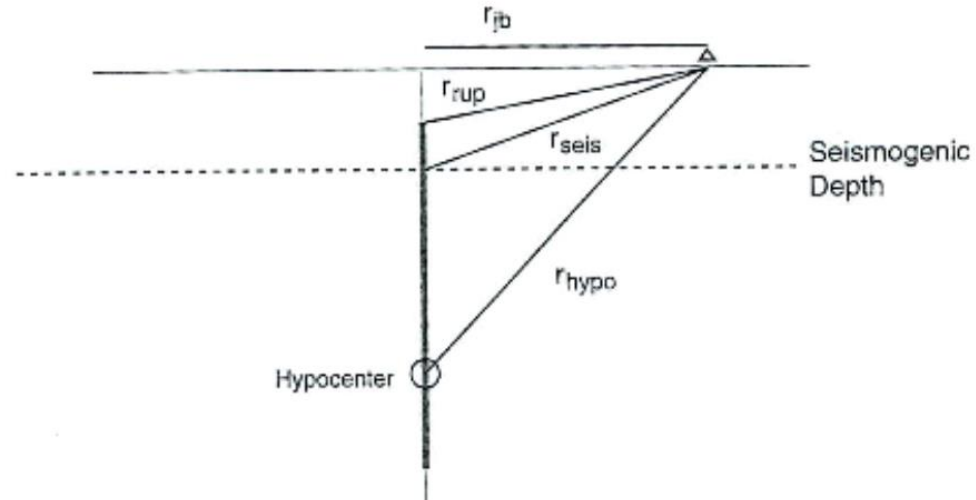
b) shallow fault that can be modelled as a **linear** source;

c) 3D source zone can be modelled as an **area** source (seismogenic zone)

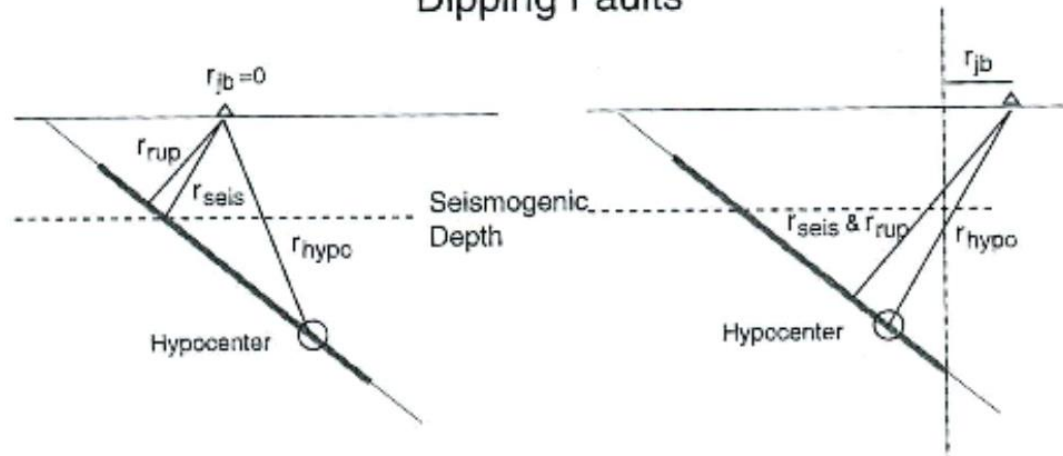
(from Kramer, 1996)

# Metriche per la distanza

## Vertical Faults



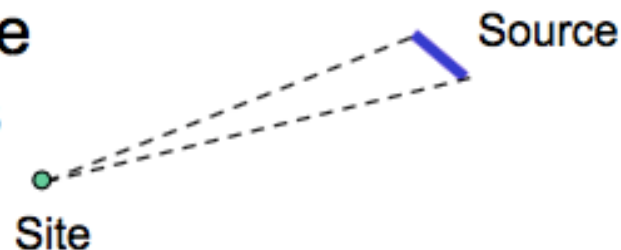
## Dipping Faults



# Source geometry (1)

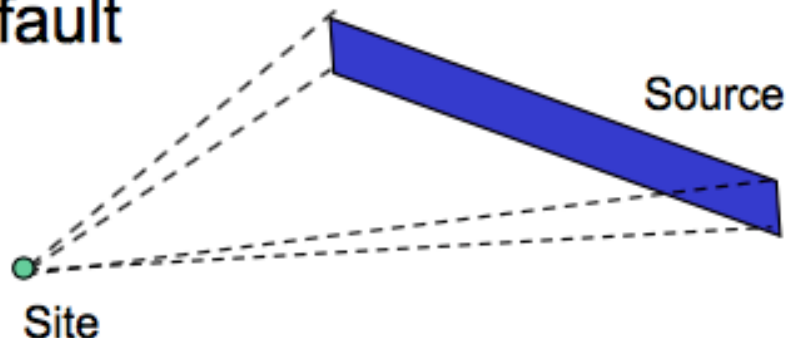
## Point source

Constant source-site distance  
Volcanos, distant short faults



## Linear source

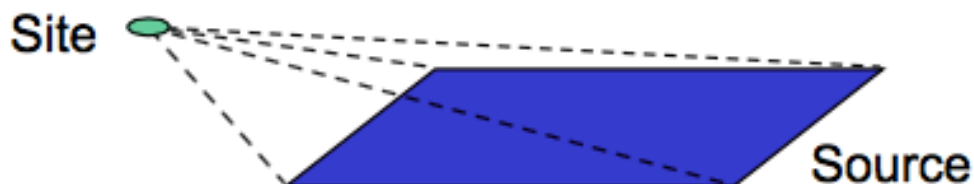
One parameter controls distance  
Shallow, distant fault



# Source geometry (2)

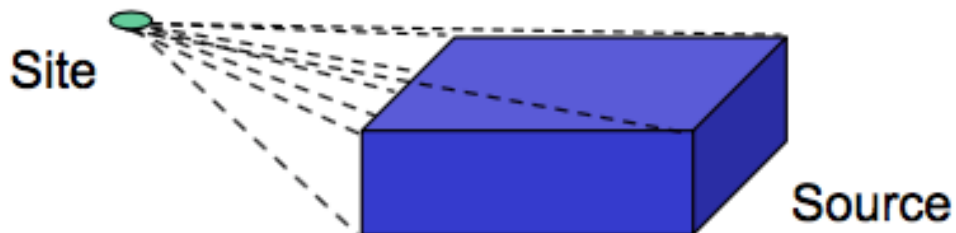
## Areal source

Two geometric parameters control distance  
Constant depth crustal source

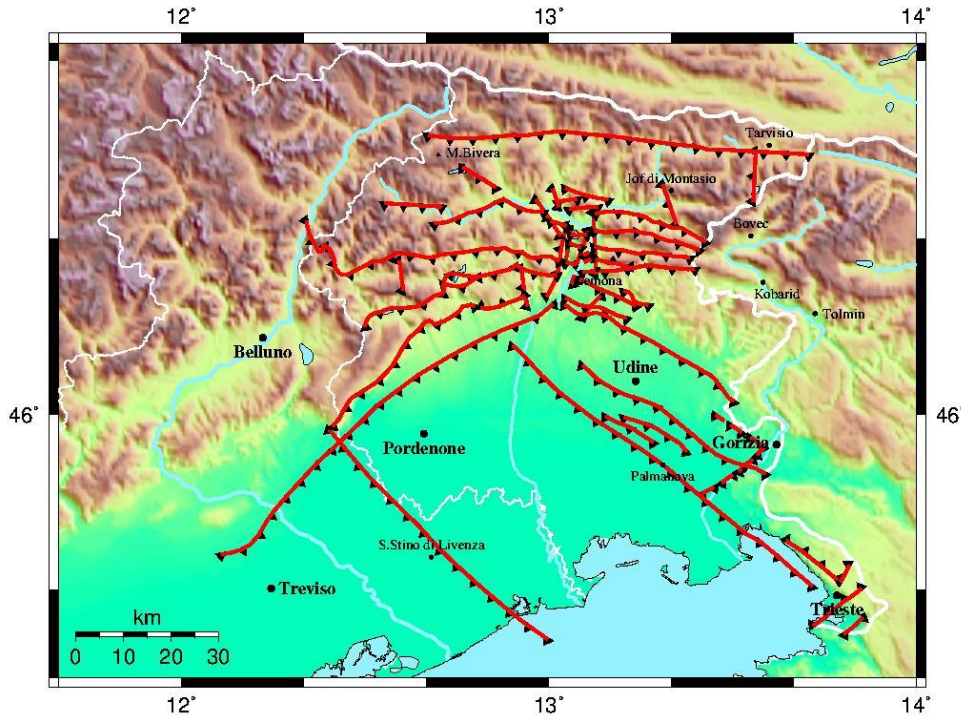


## Volumetric source

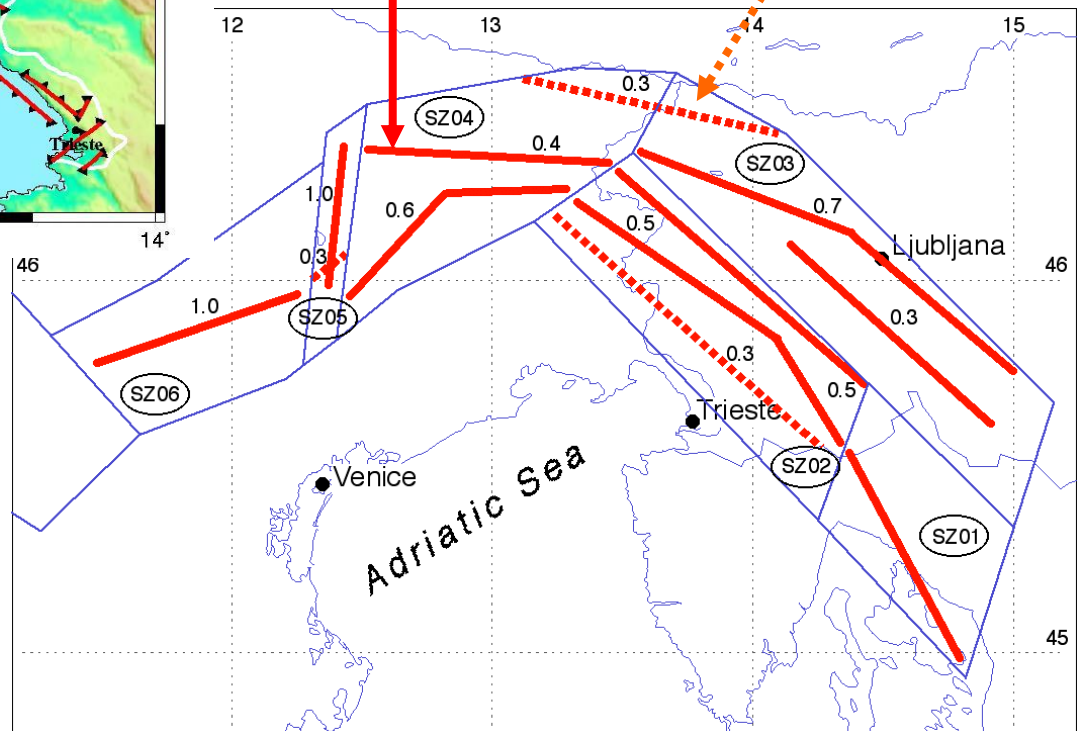
Three parameters control distance



# Principal faults in Friuli - Venezia Giulia



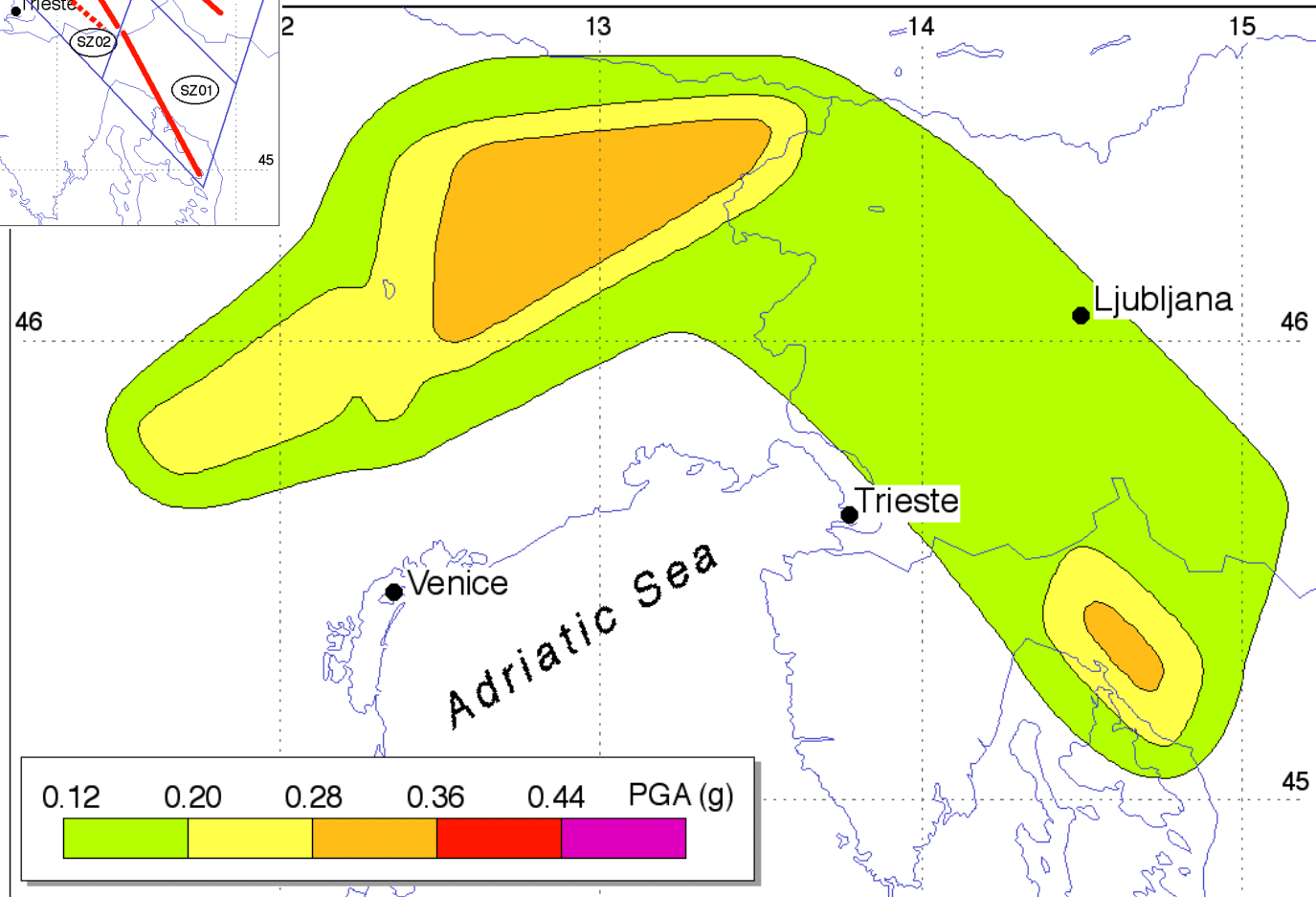
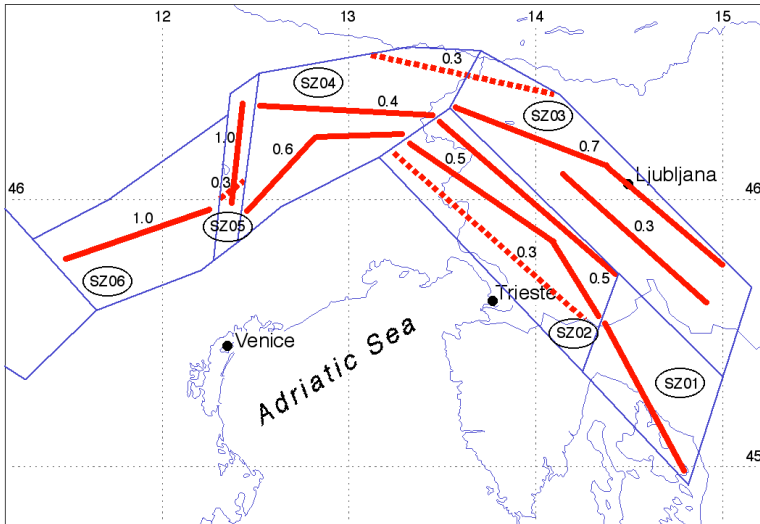
Neotectonic fault  
Seismogenic fault



Tectonic scheme for PSHA



# PGA with a 475-yr return period (1)

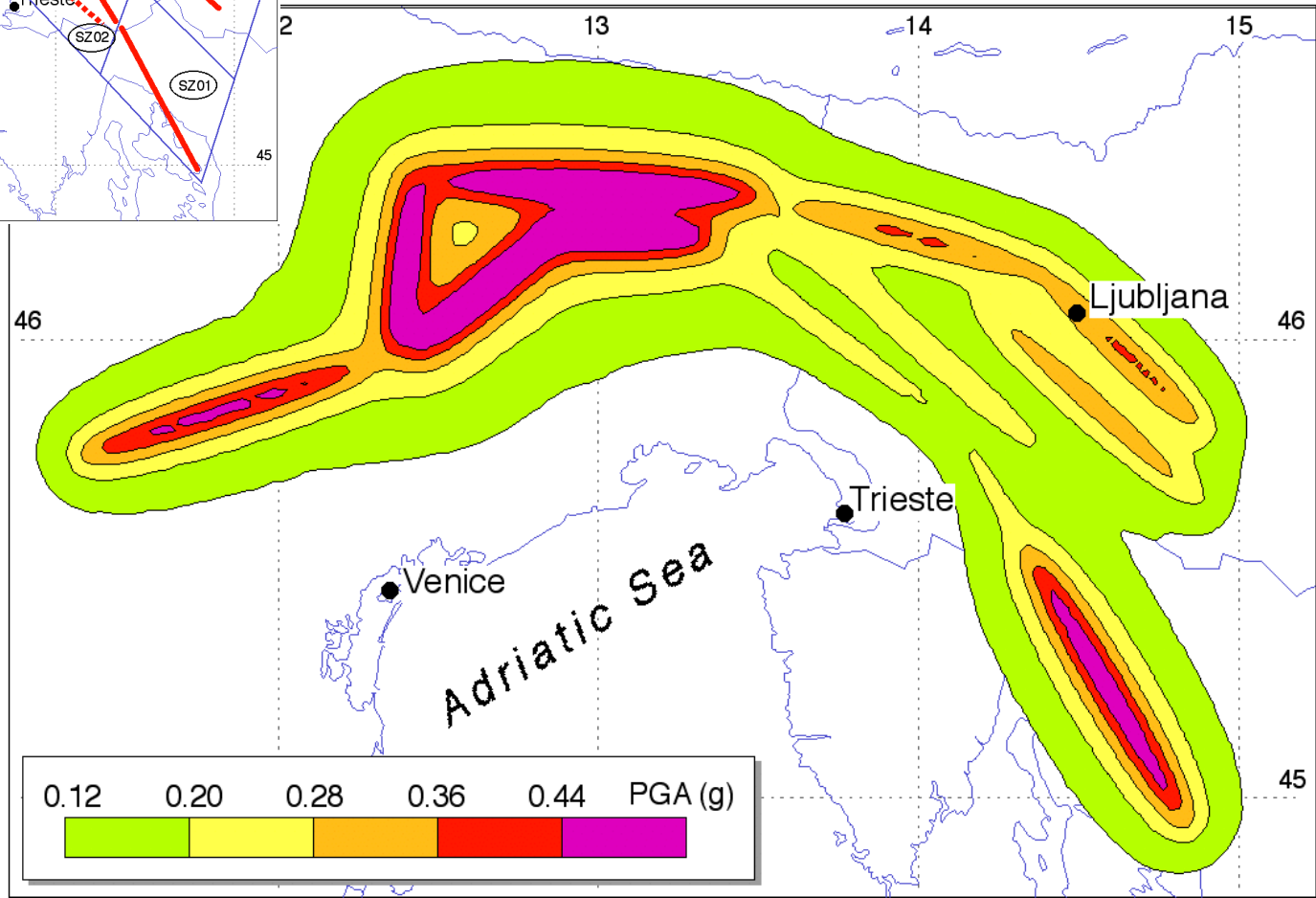
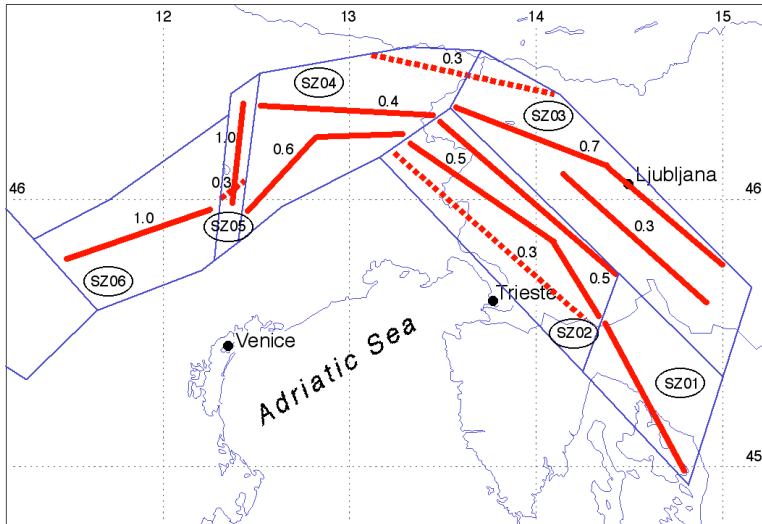


Computed considering  
seismogenic zones





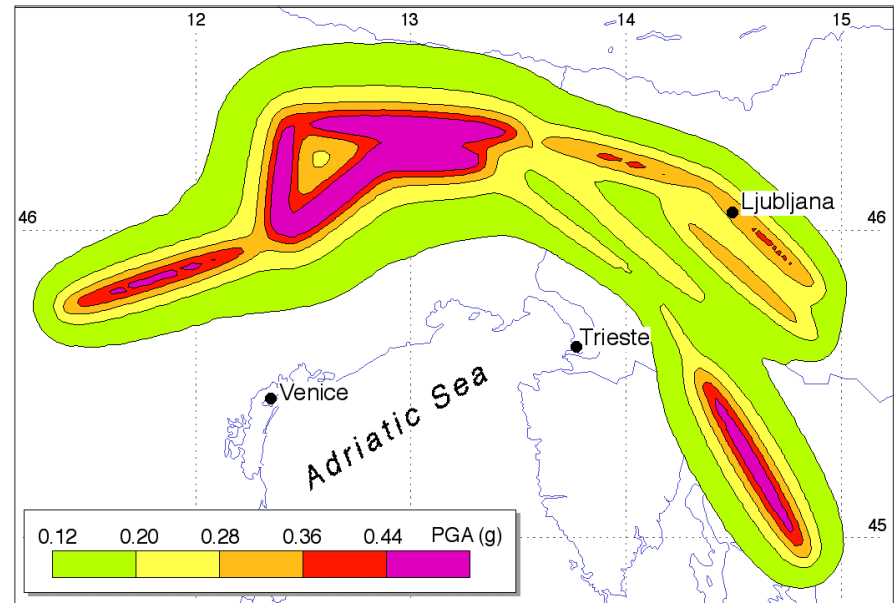
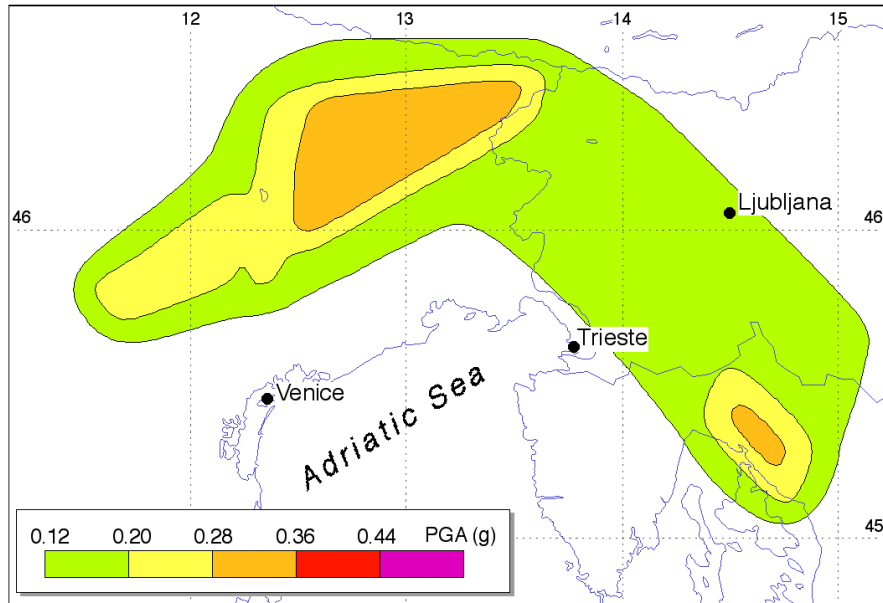
# PGA with a 475-yr return period (2)



Computed considering  
seismogenic faults  
only

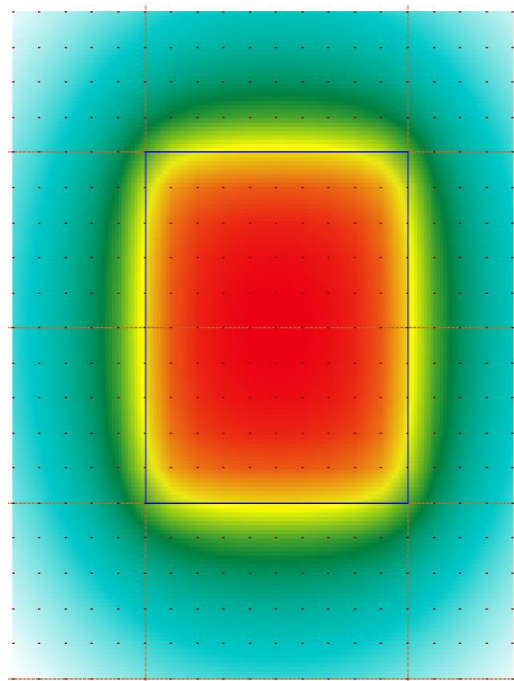


# PGA with a 475-year return period (3)

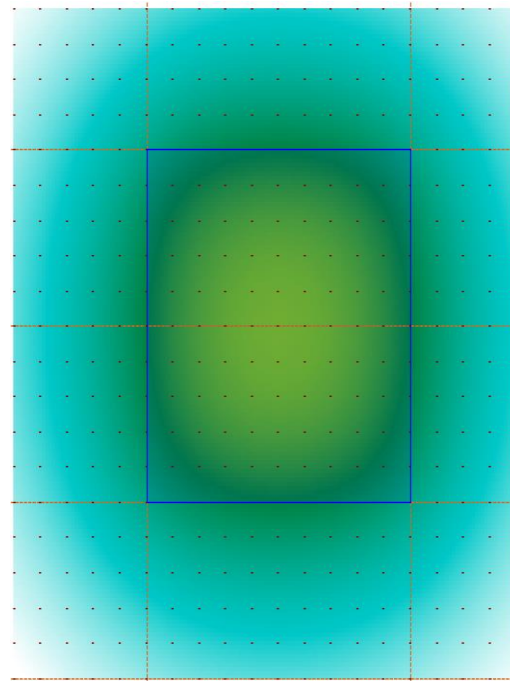


The differences are remarkable but are caused by the different knowledge applied: the association of earthquakes to faults is questionable.

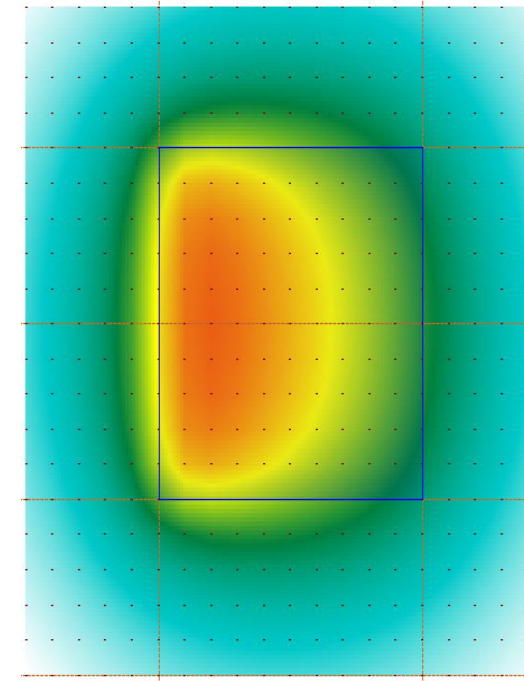
# Effetto in superficie di una sorgente semplice



Orizzontale a 0 km



Orizzontale a 30 km

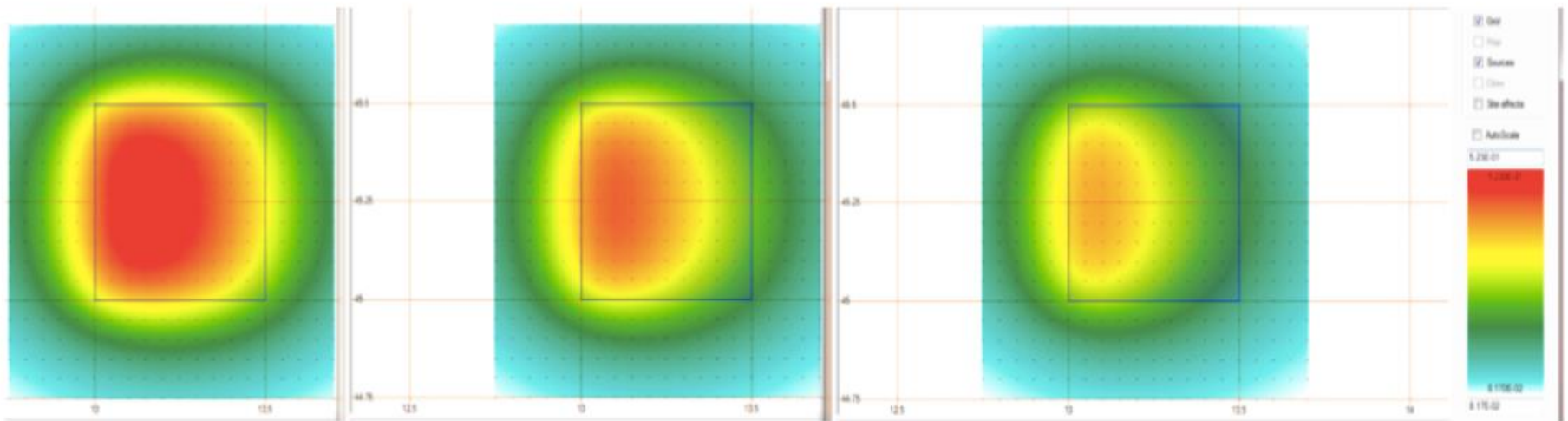


Inclinata verso est  
0-30 km



# Zone inclinate (1)

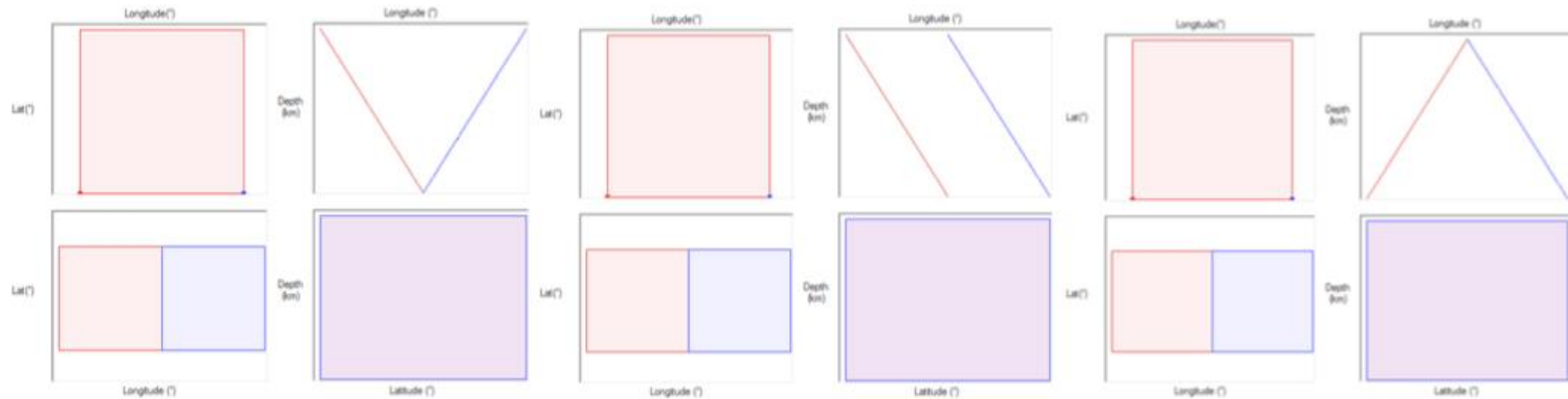
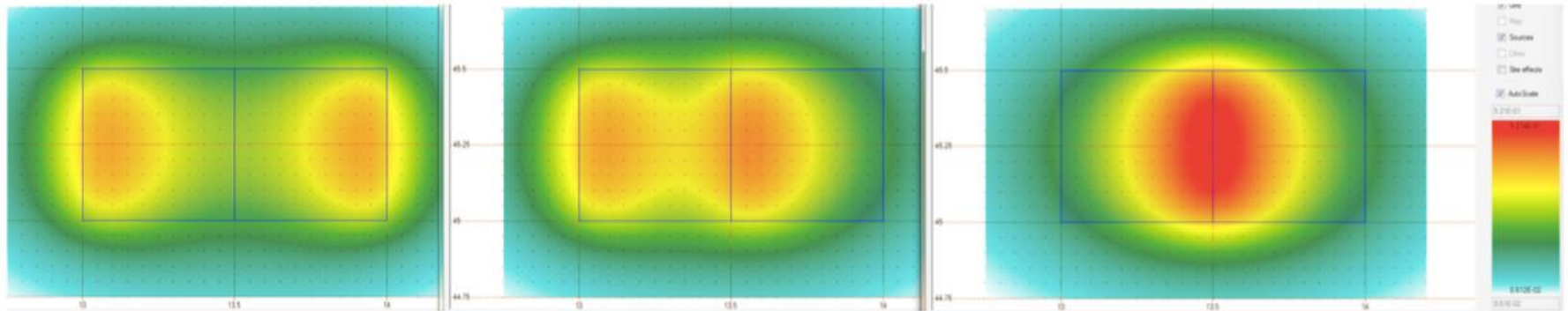
## 1 ZONA



Test su una zona con dip crescente da sinistra verso destra: la profondità del lato E della zona assume i 3 valori di 15, 25 e 35km. La scala di colori è la medesima per tutte e tre le figure.

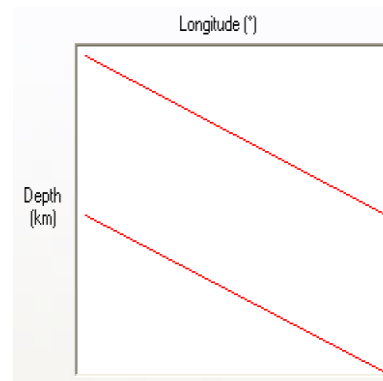
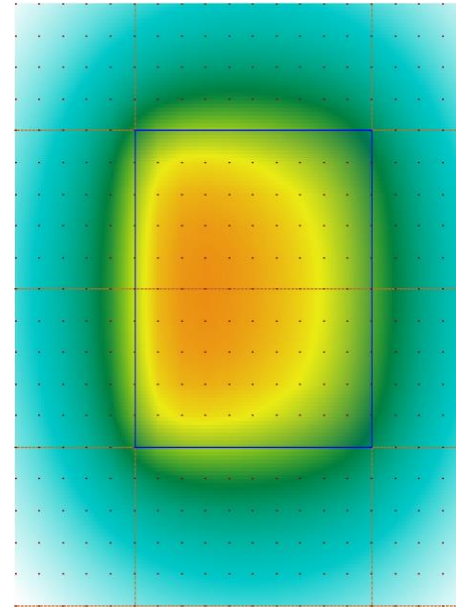
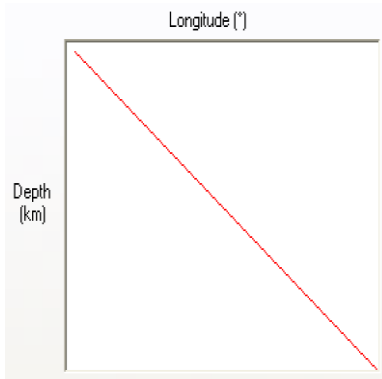
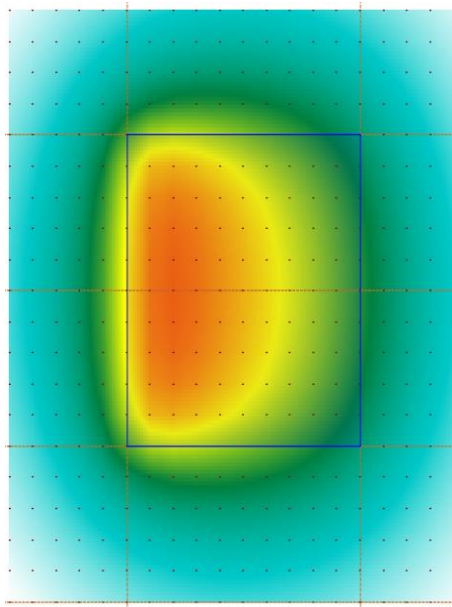
# Zone inclinate (2)

## 2 ZONE ADIACENTI



Test su due zone adiacenti con 3 situazioni di angolo di dip diverse. La scala di colori è la medesima per tutte e tre le figure. Nelle figure sottostanti la corrispondente visione 3D delle 3 diverse configurazioni.

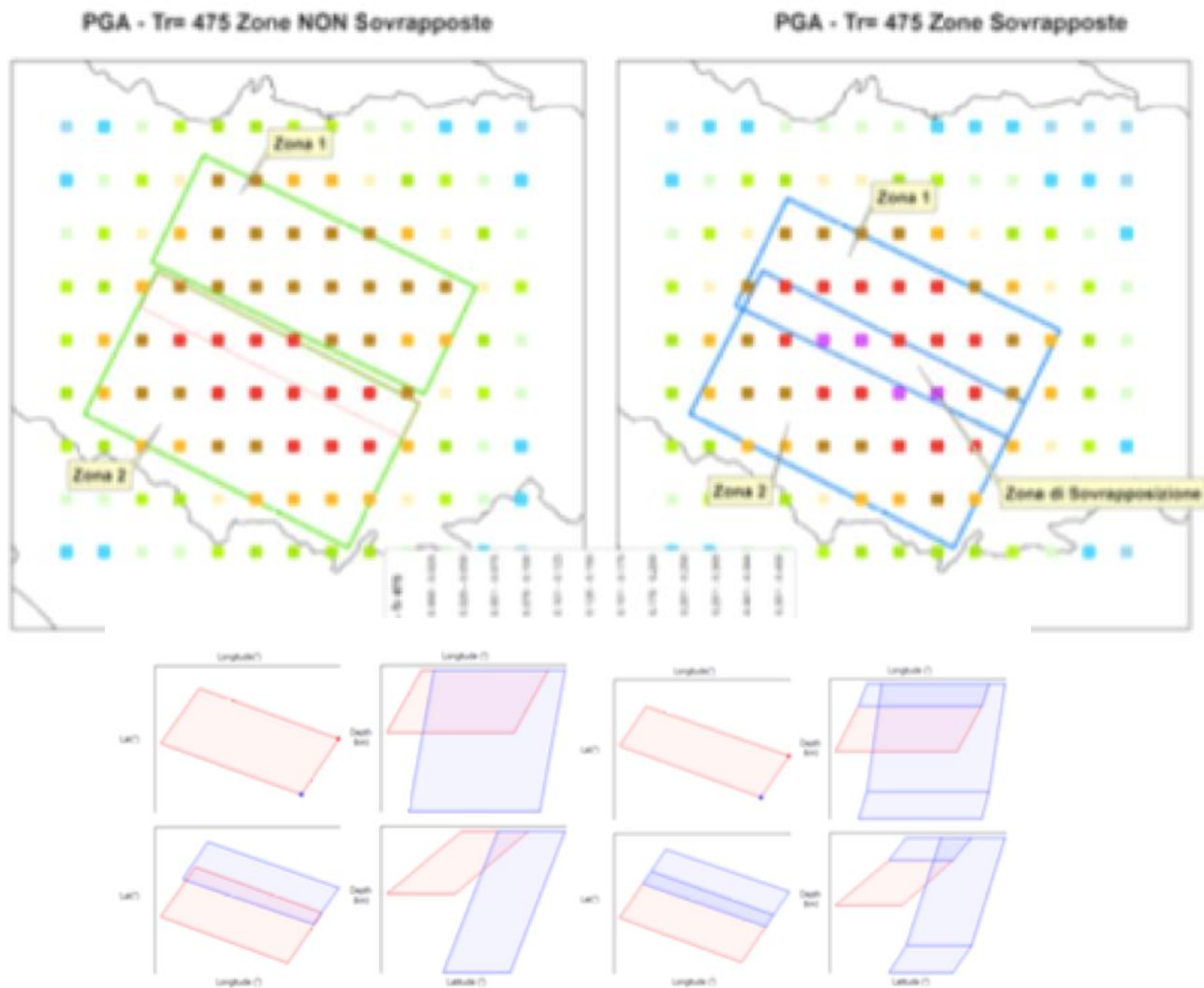
# Zone inclinate (3)



1 strato inclinato vergente est 0-30 km

2 strati inclinati sovrapposti vergenti est 0-15 e 15-30 km

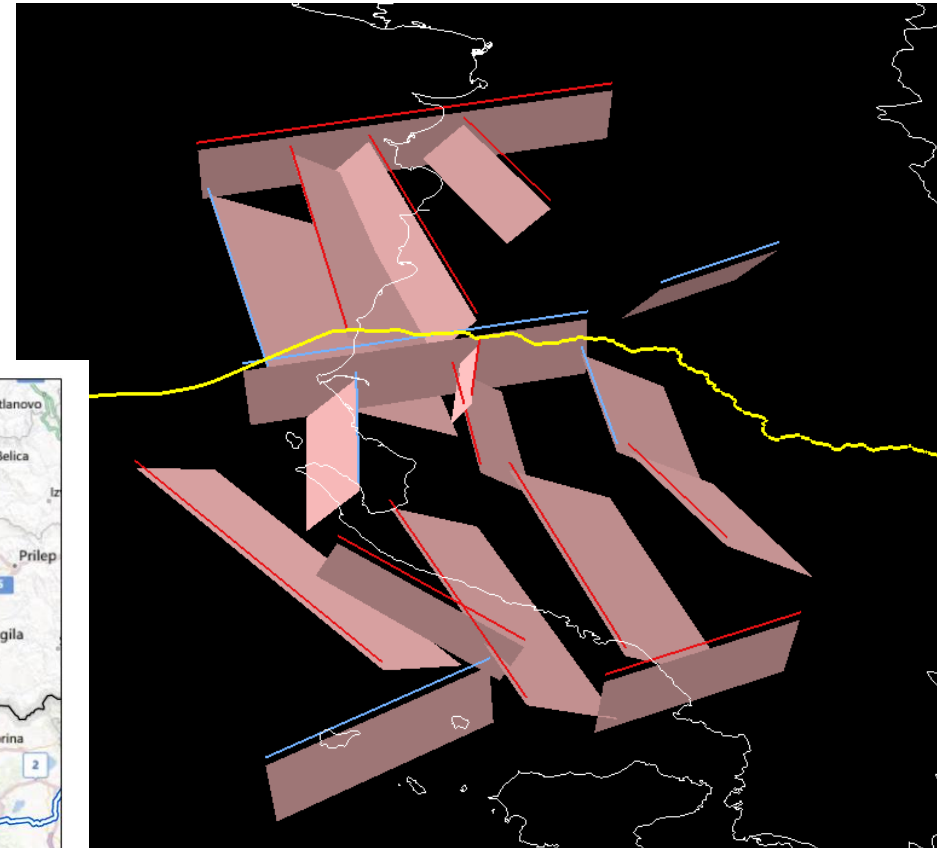
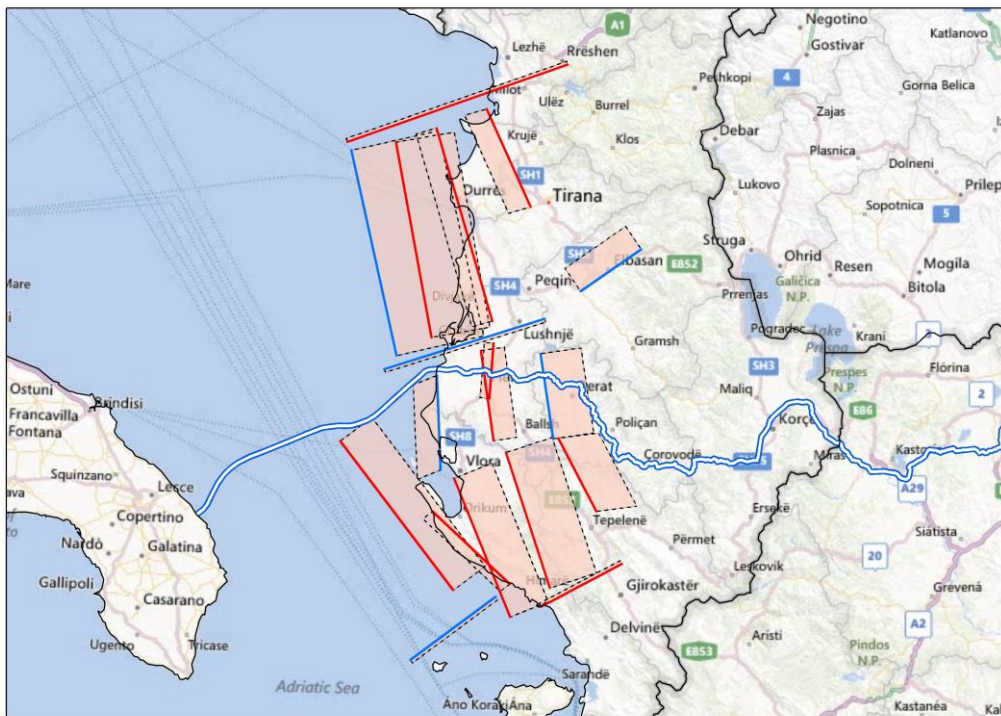
# 2 zone con sovrapposizione



2 zone adiacenti a diversa profondità

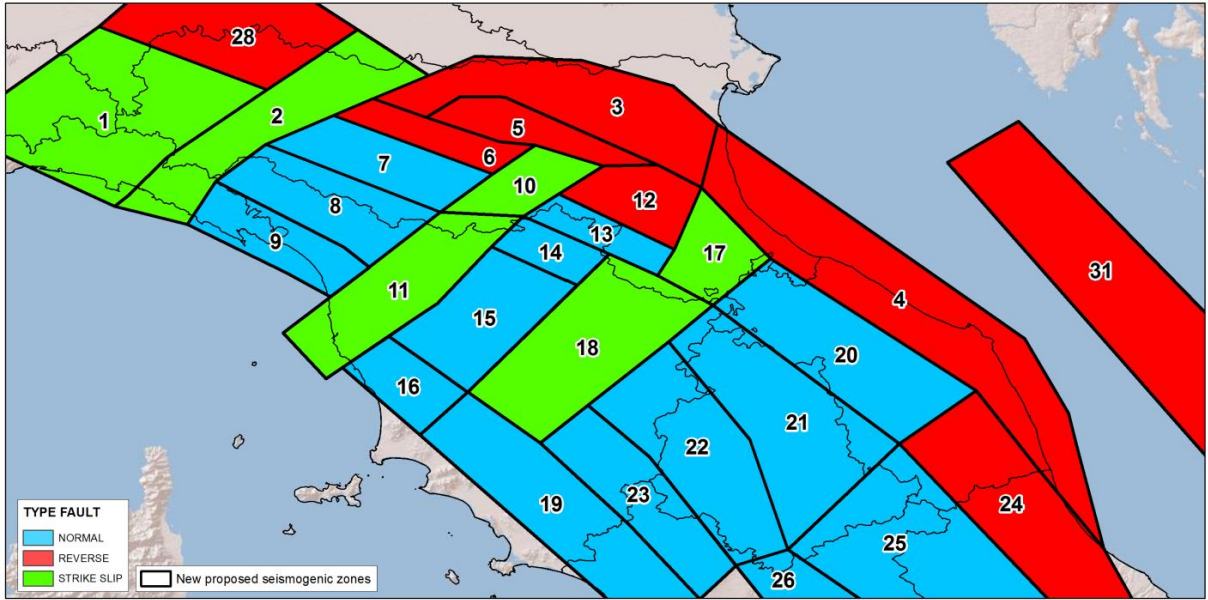
2 zone a diversa profondità con parziale sovrapposizione

# Esempio di geometria 3D

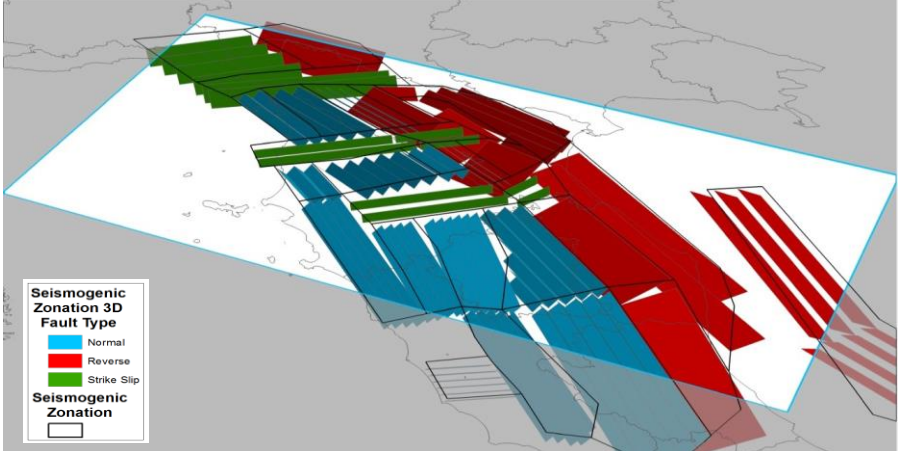
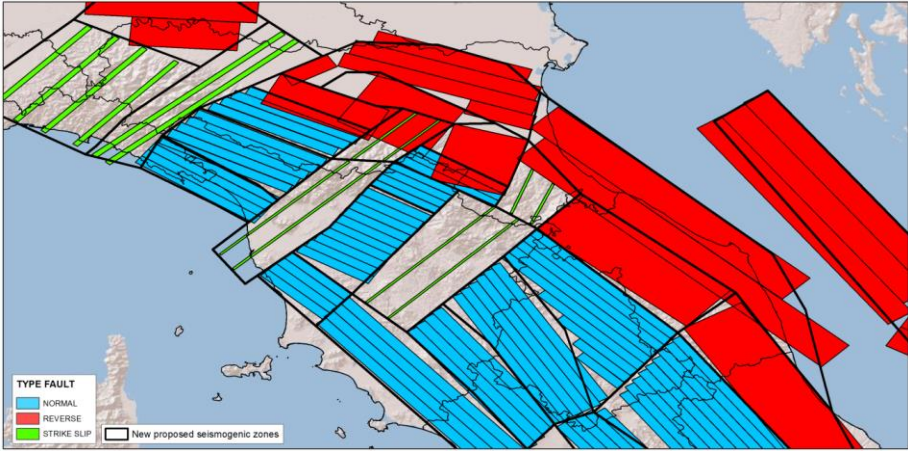




# Modello di sorgenti per l'Appennino settentrionale



2D



3D





**FINE**