

Modello 3D delle strutture sismogeniche: vantaggi e limiti

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Nuovi studi sulla pericolosità sismica regionale

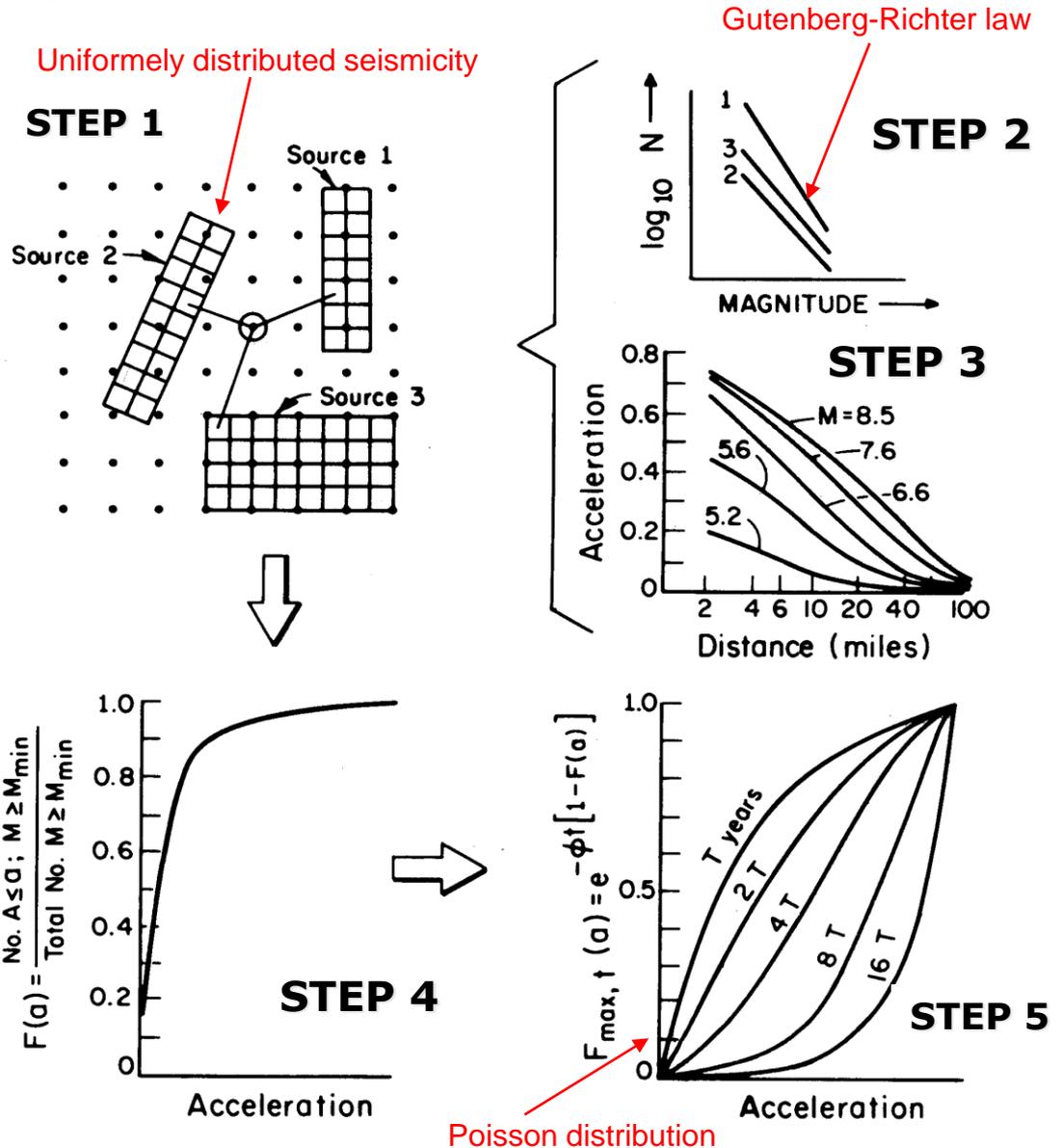
Bologna, **5 dicembre 2017**
viale della Fiera, 8 - Sala "20 maggio 2012"

The 5 steps of PSHA

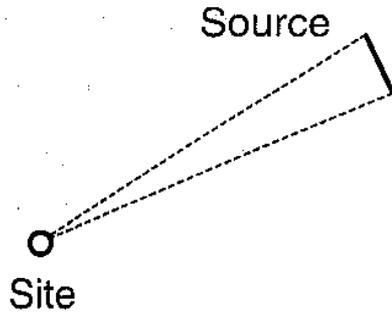
The actual steps in PSHA computation

- 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

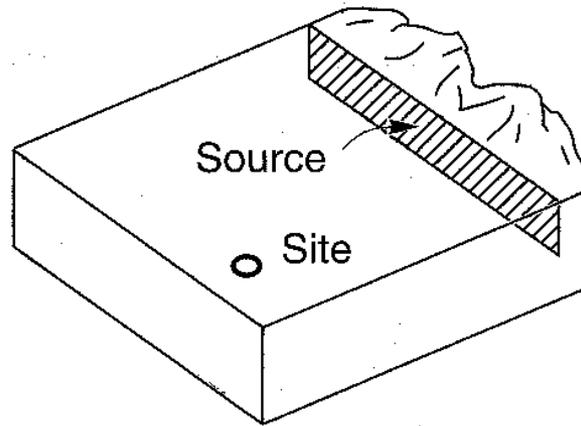
(from Algermissen & Perkins, 1976)



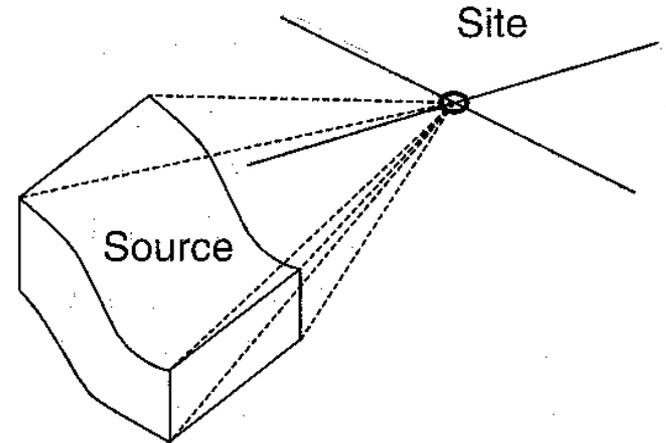
Types of seismic sources



(a)



(b)



(c)

Examples of different earthquake source geometries:

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

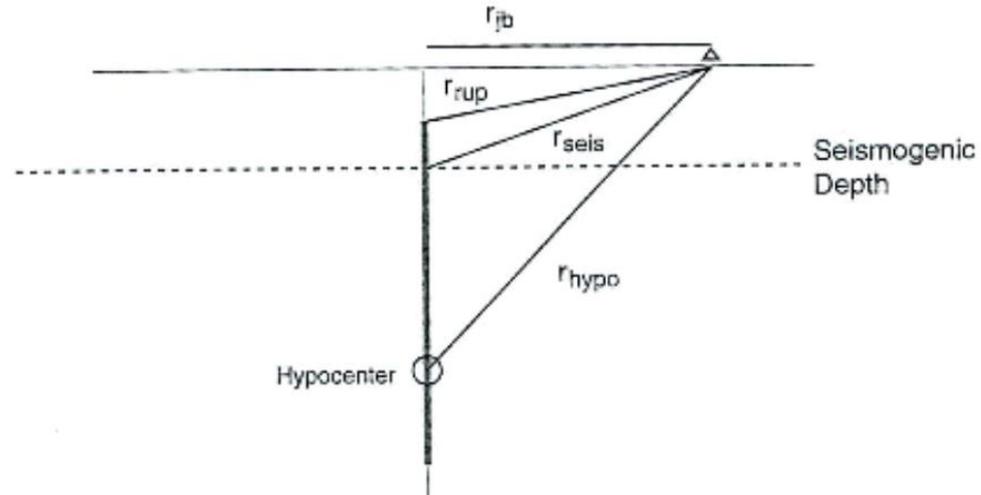
b) shallow fault that can be modelled as a **linear** source;

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

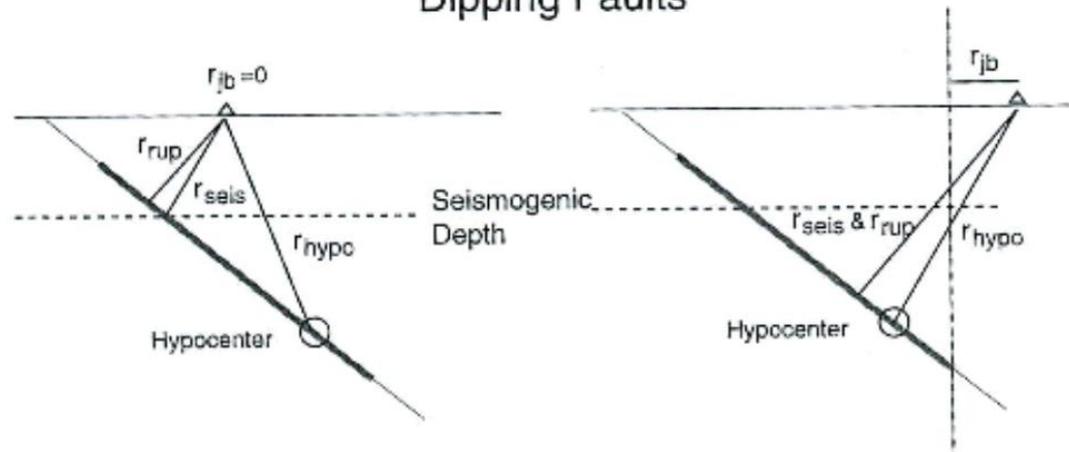
(from Kramer, 1996)

Metriche per la distanza

Vertical Faults



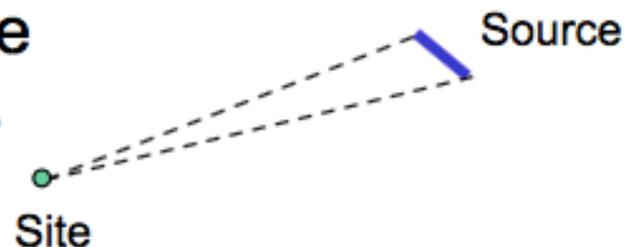
Dipping Faults



Source geometry (1)

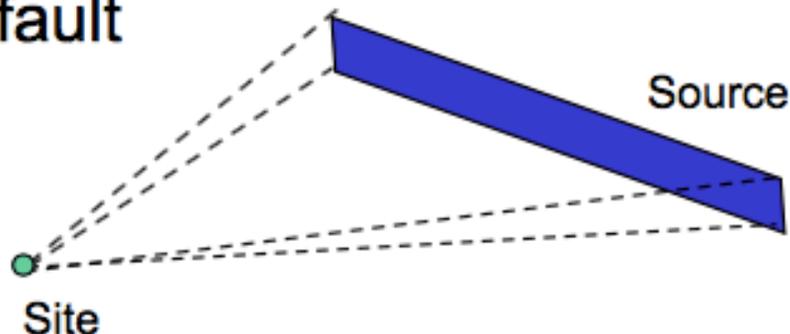
Point source

Constant source-site distance
Volcanos, distant short faults



Linear source

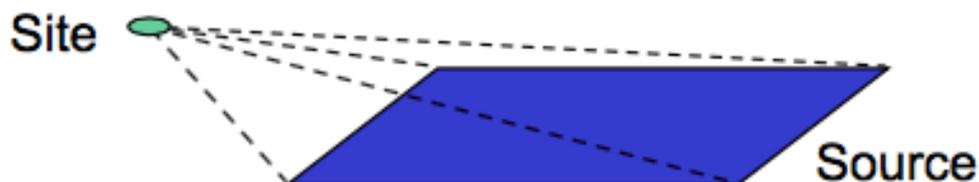
One parameter controls distance
Shallow, distant fault



Source geometry (2)

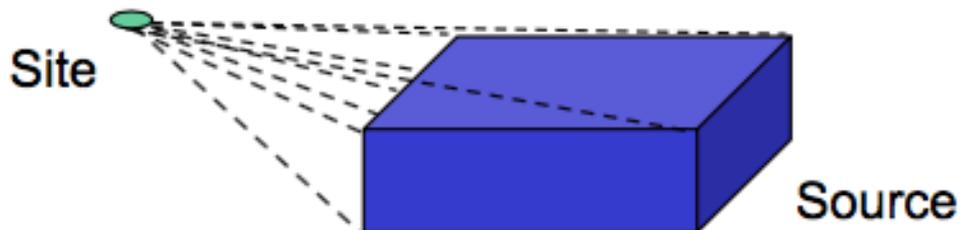
Areal source

Two geometric parameters control distance
Constant depth crustal source

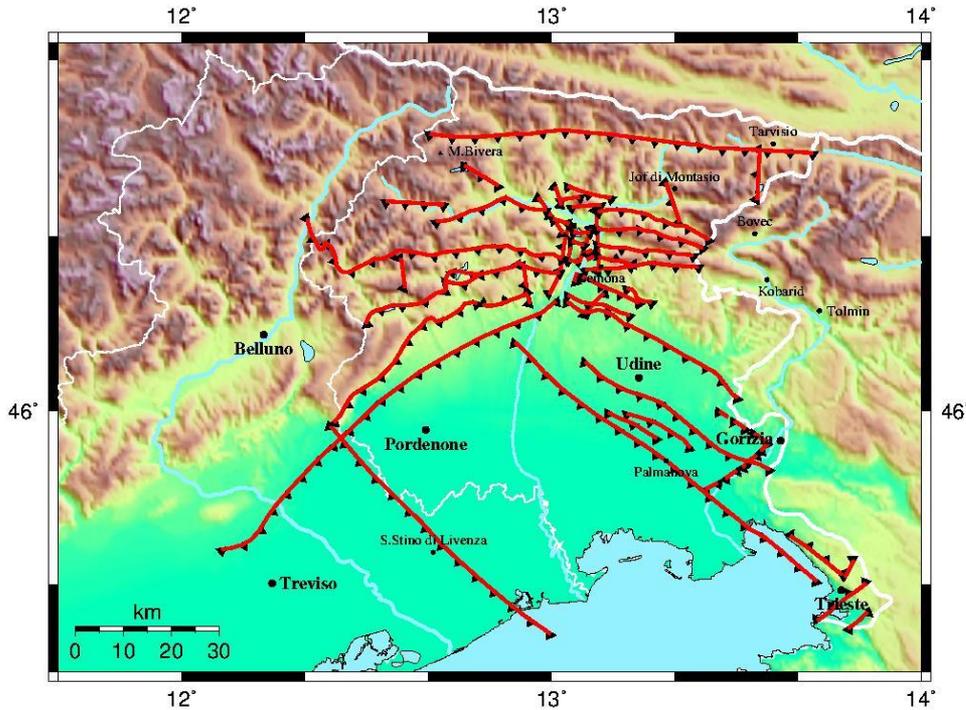


Volumetric source

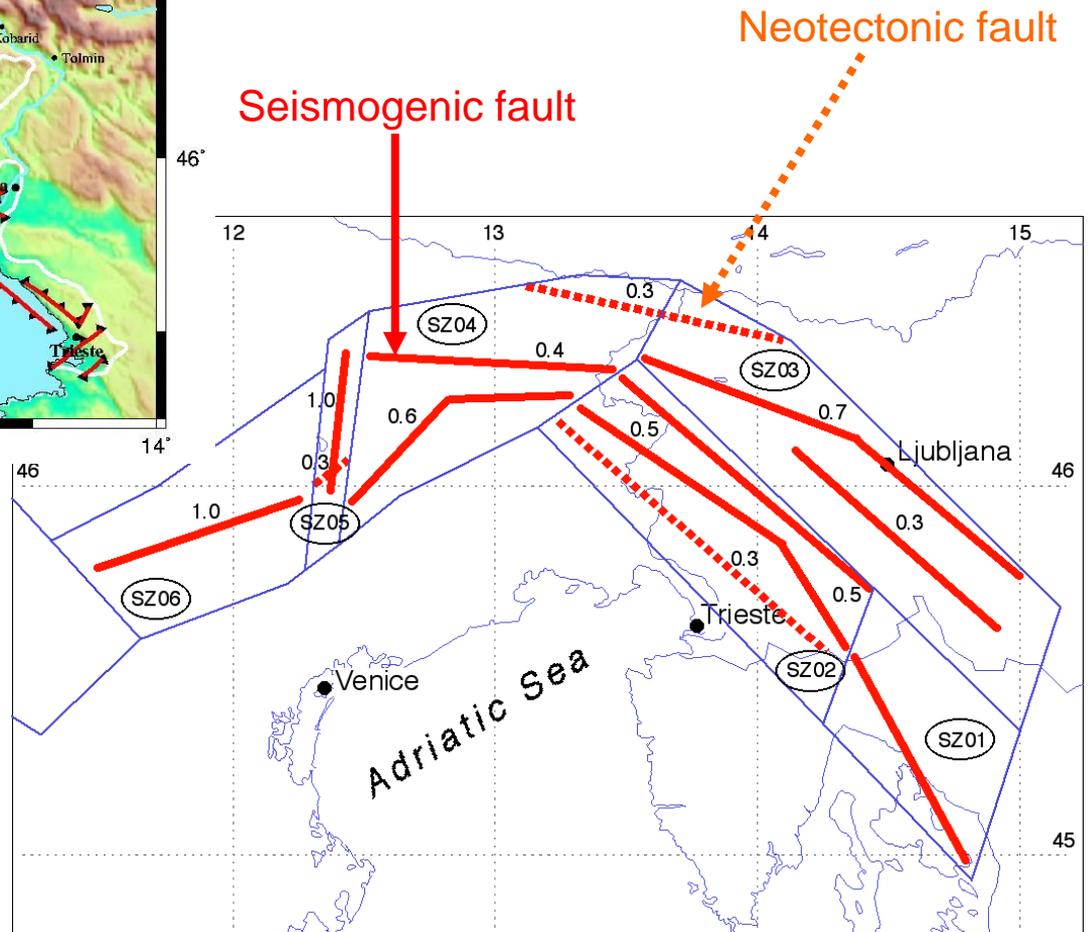
Three parameters control distance



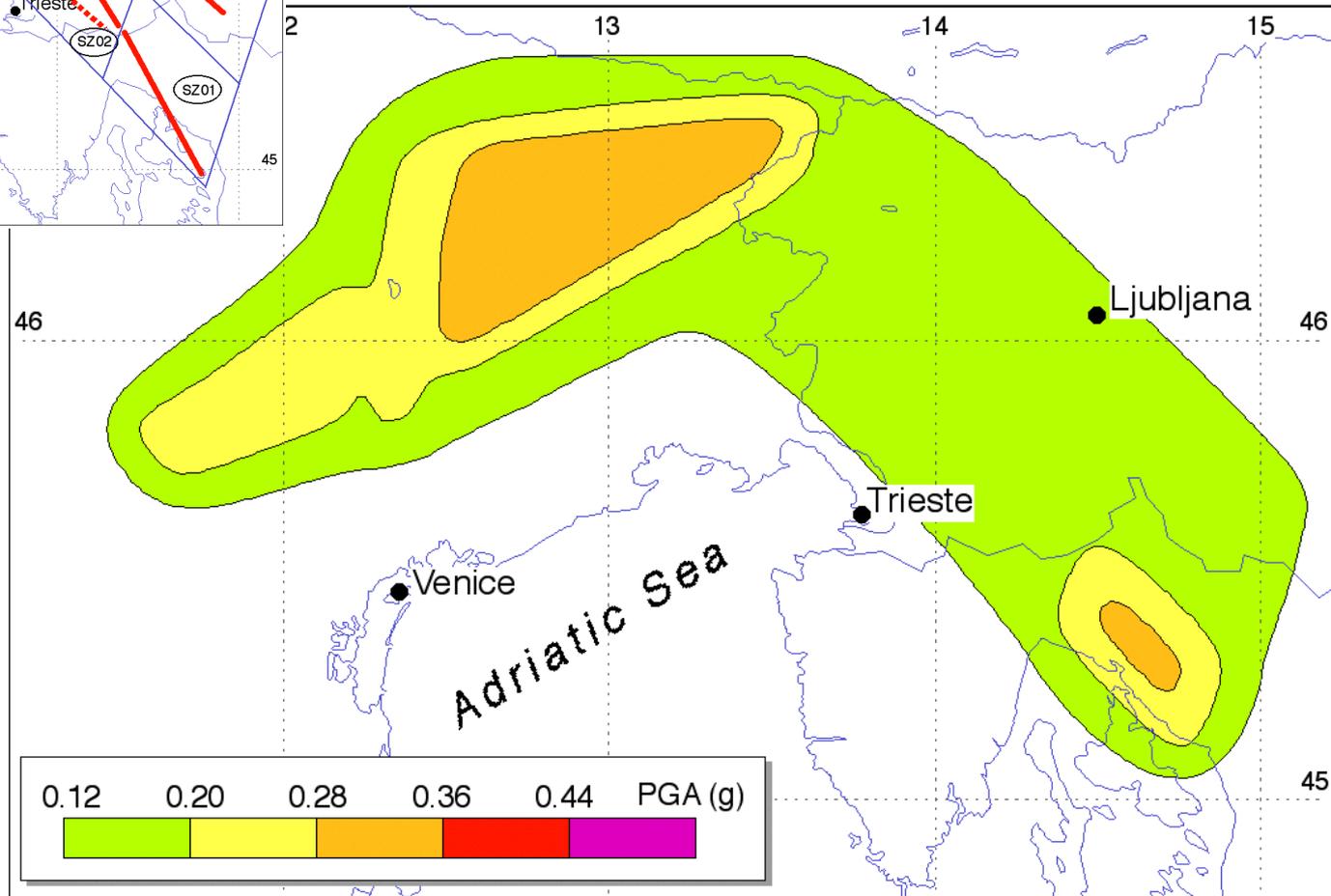
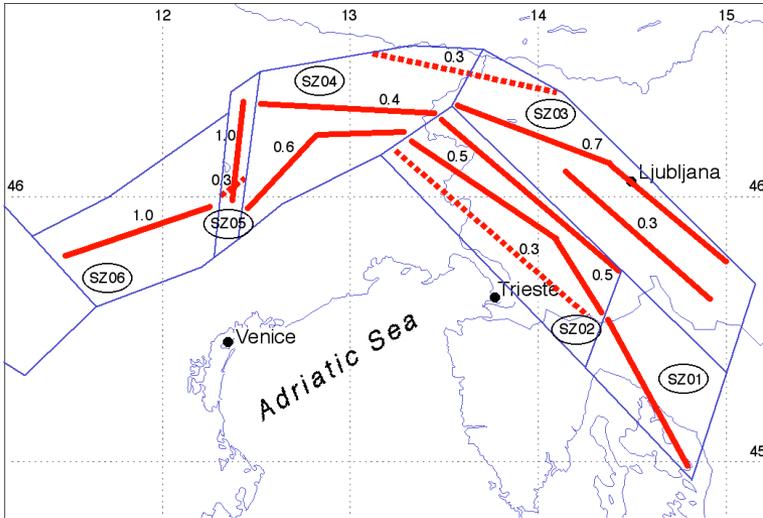
Principal faults in Friuli - Venezia Giulia



Tectonic scheme for PSHA



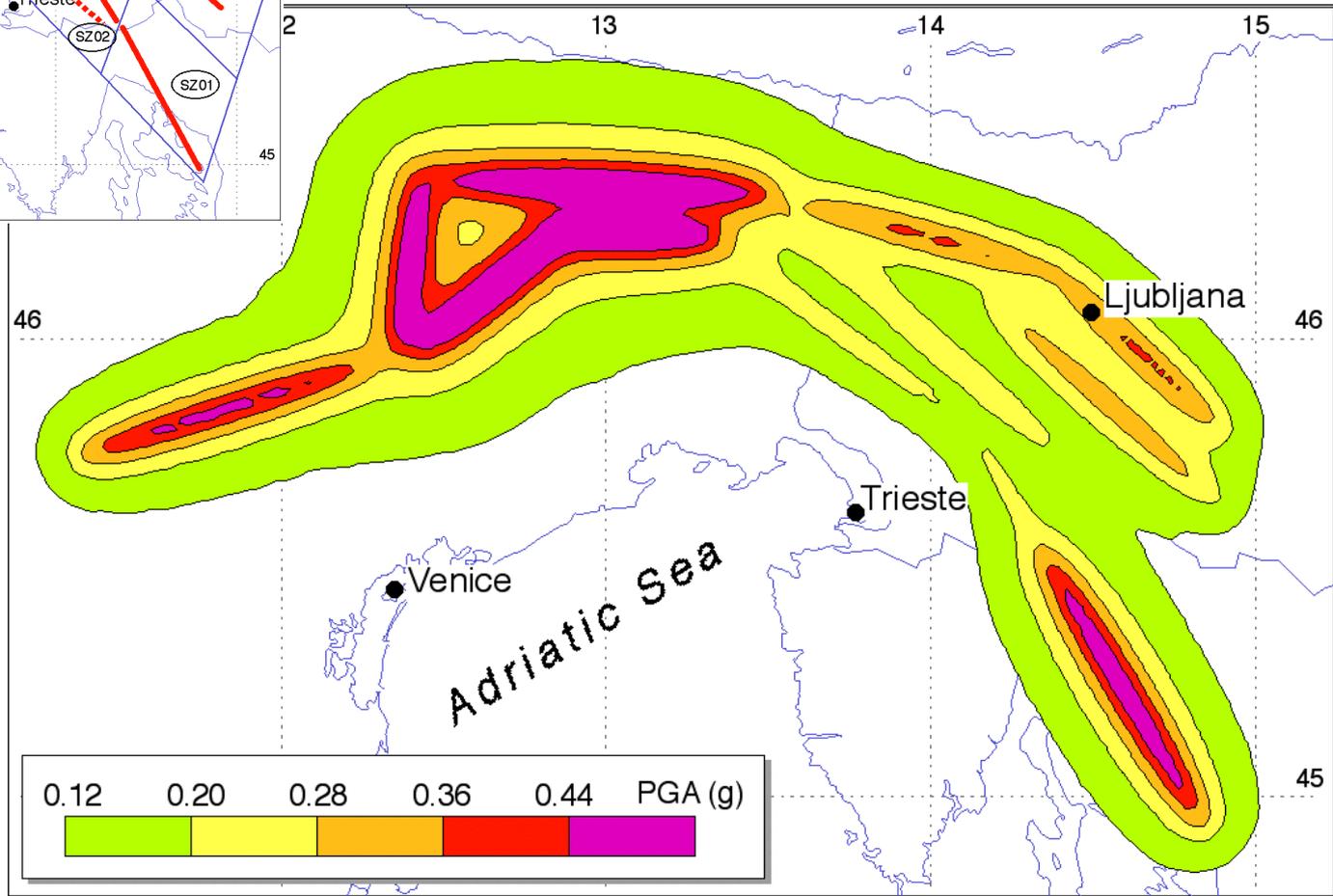
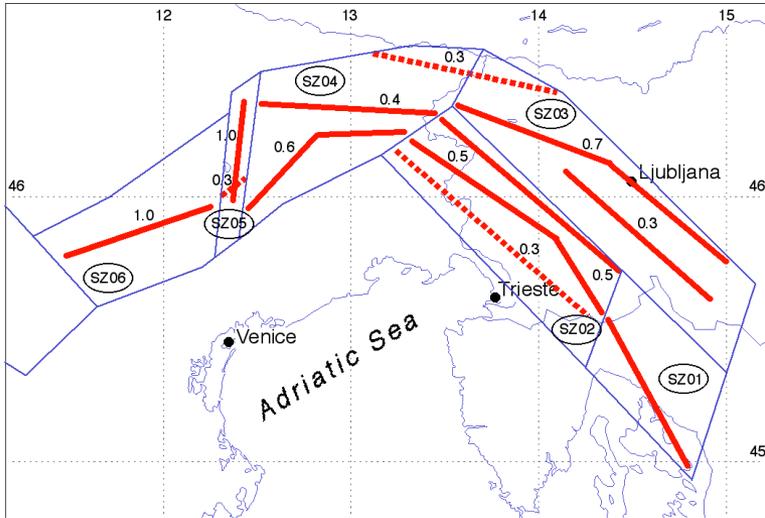
PGA with a 475-yr return period (1)



Computed considering
seismogenic zones



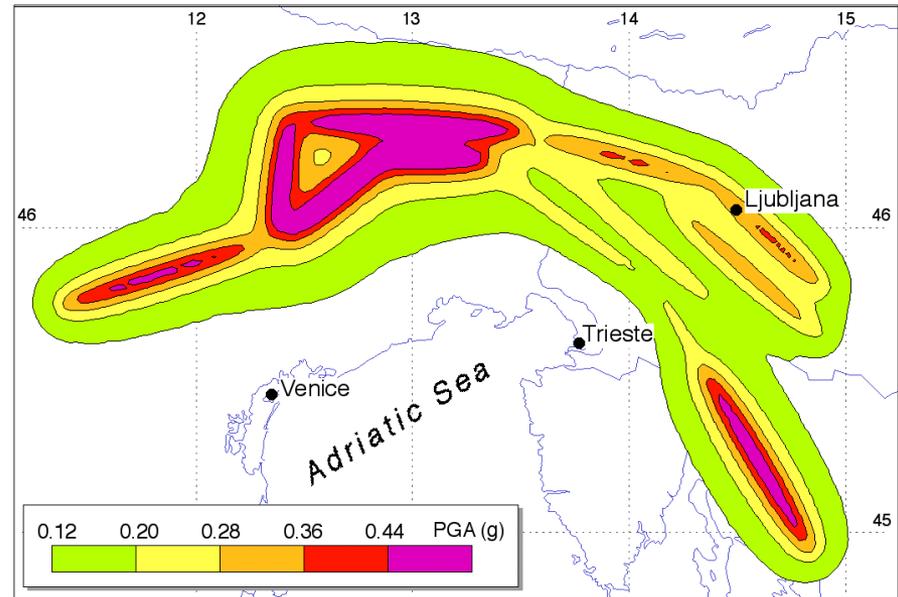
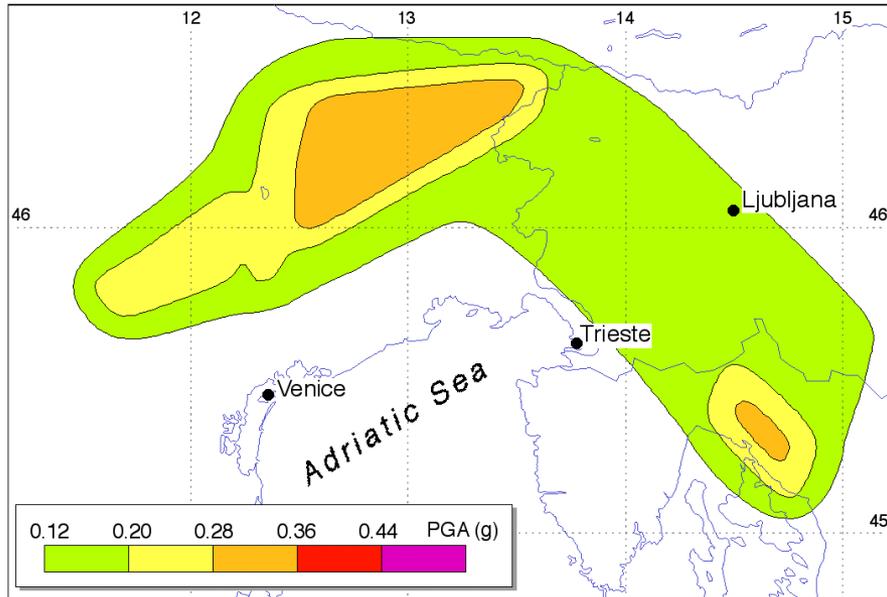
PGA with a 475-yr return period (2)



Computed considering
seismogenic faults
only

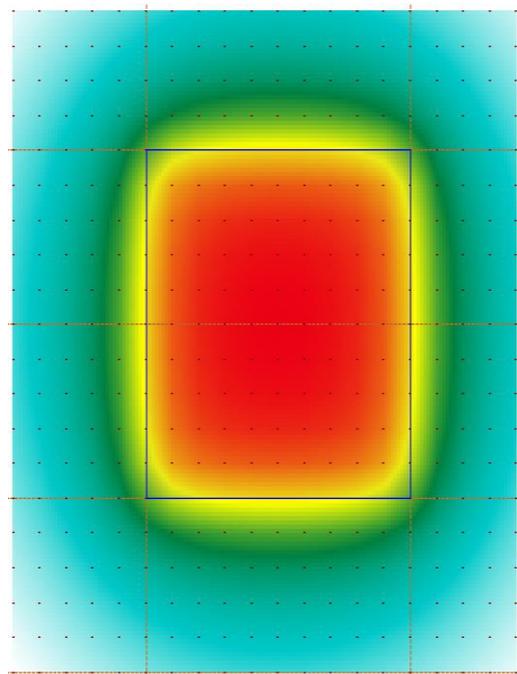


PGA with a 475-year return period (3)

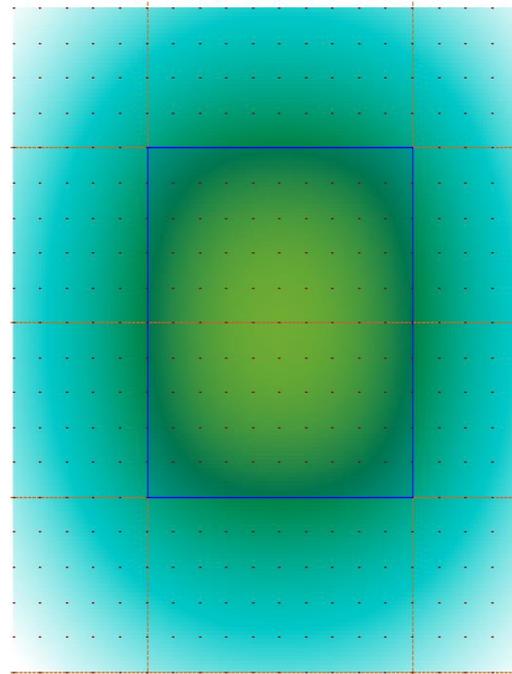


The differences are remarkable but are caused by the different knowledge applied: the association of earthquakes to faults is questionable.

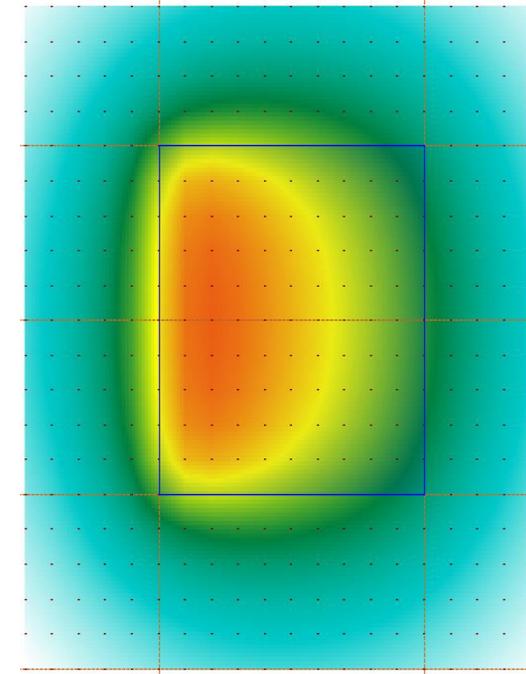
Effetto in superficie di una sorgente semplice



Orizzontale a 0 km



Orizzontale a 30 km

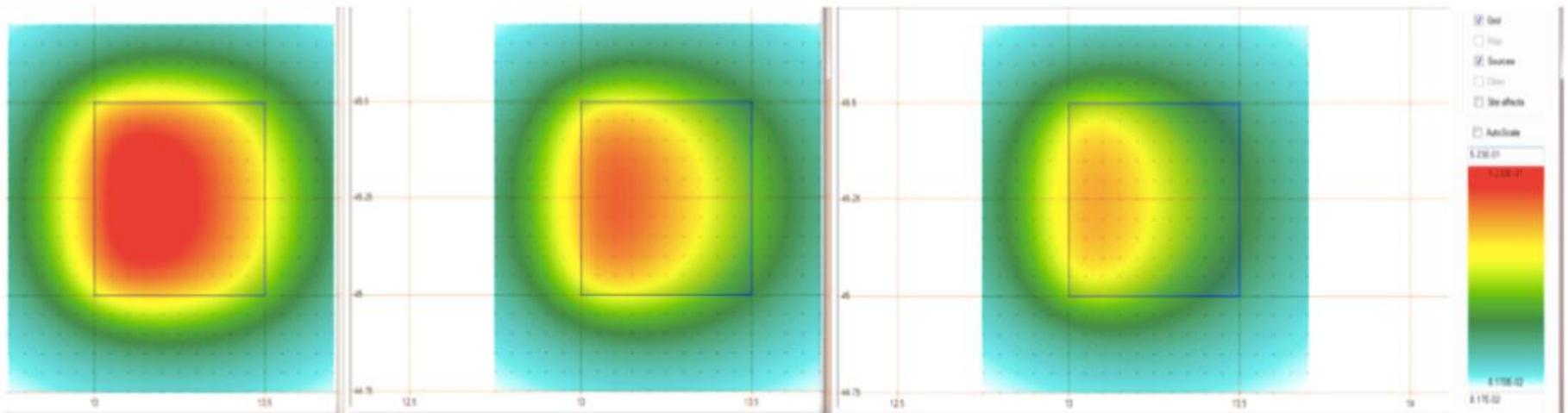


Inclinata verso est
0-30 km



Zone inclinate (1)

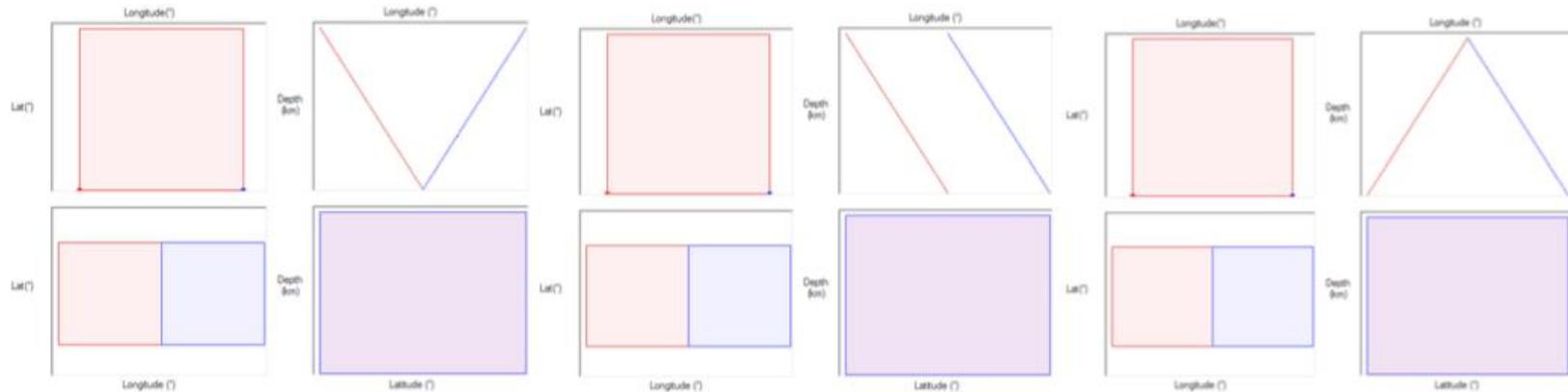
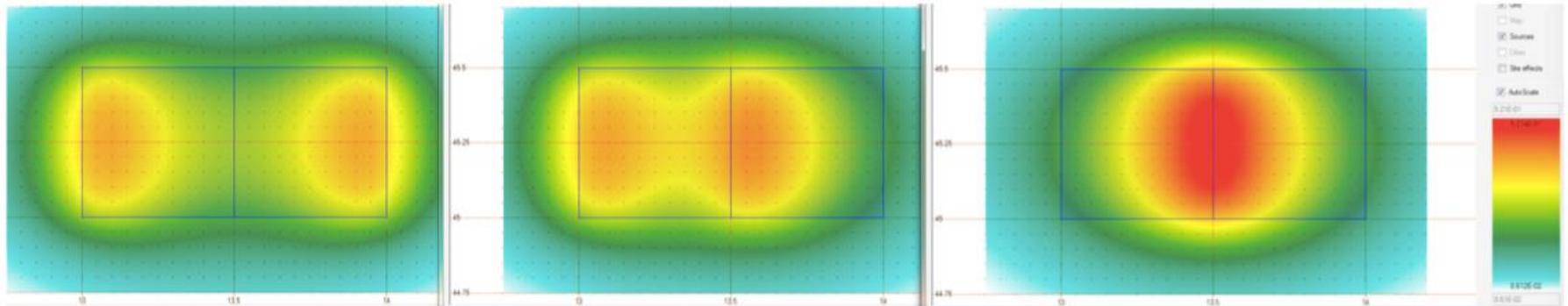
1 ZONA



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.

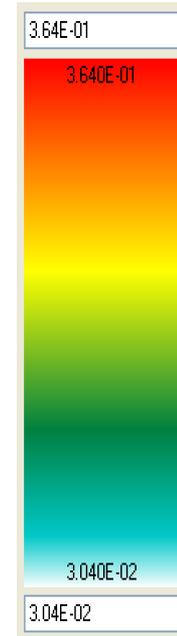
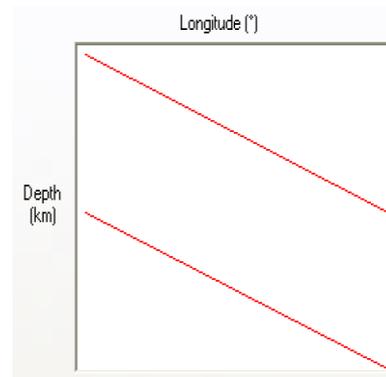
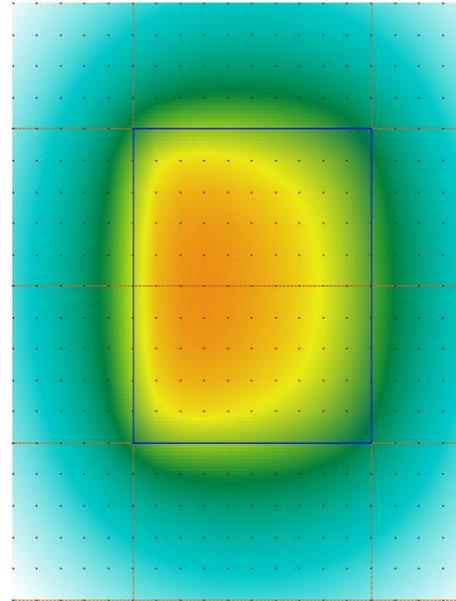
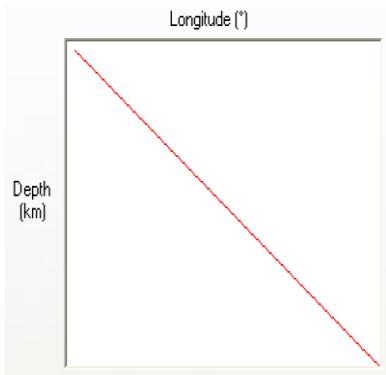
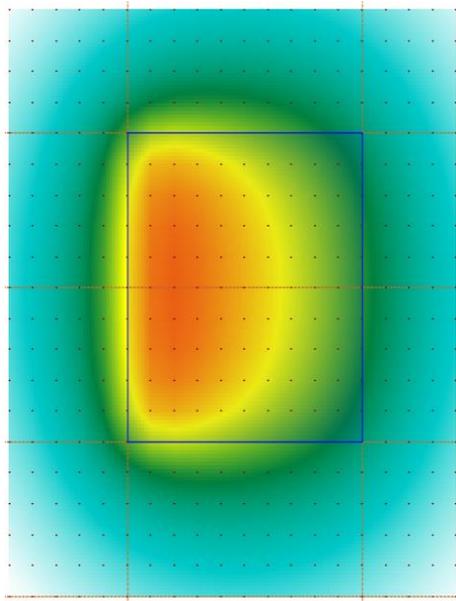
Zone inclinate (2)

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.

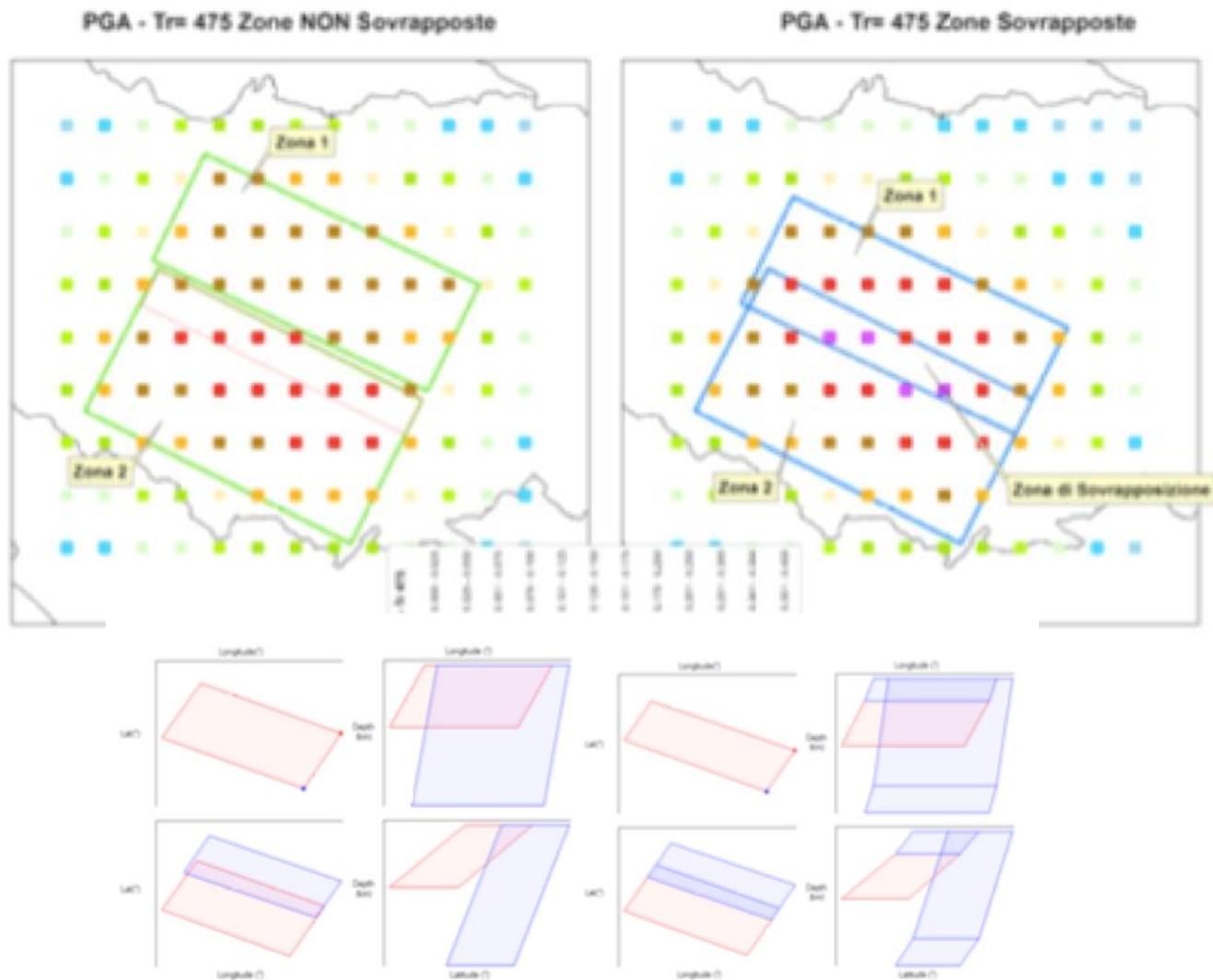
Zone inclinate (3)



1 strato inclinato vergente est 0-30 km

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

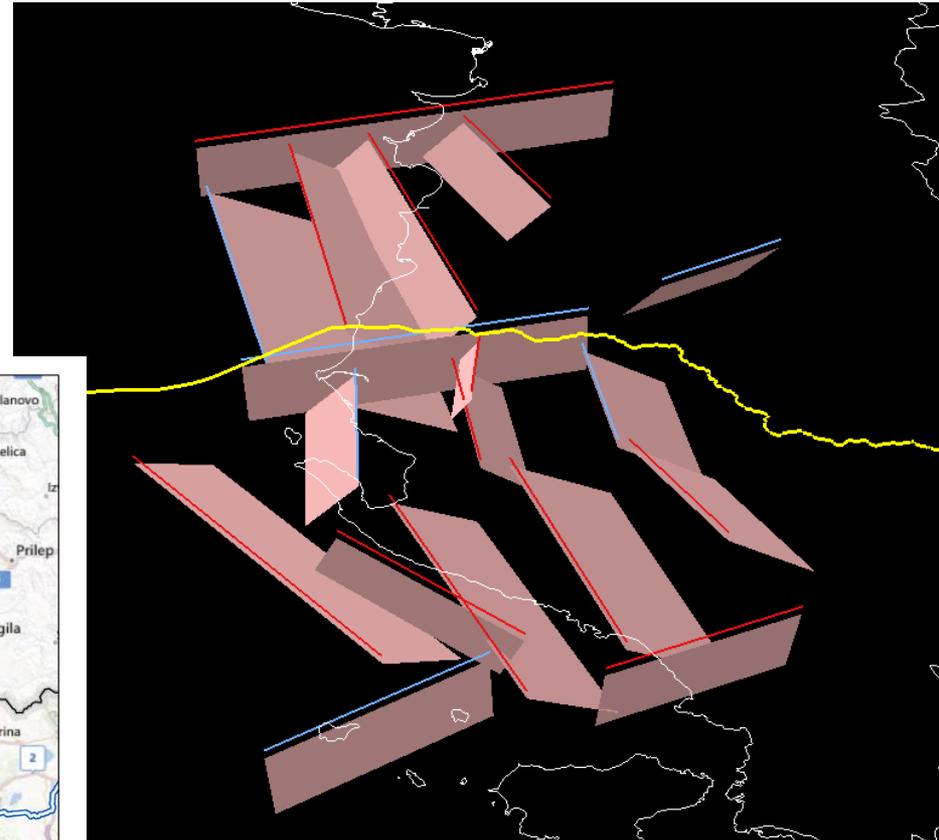
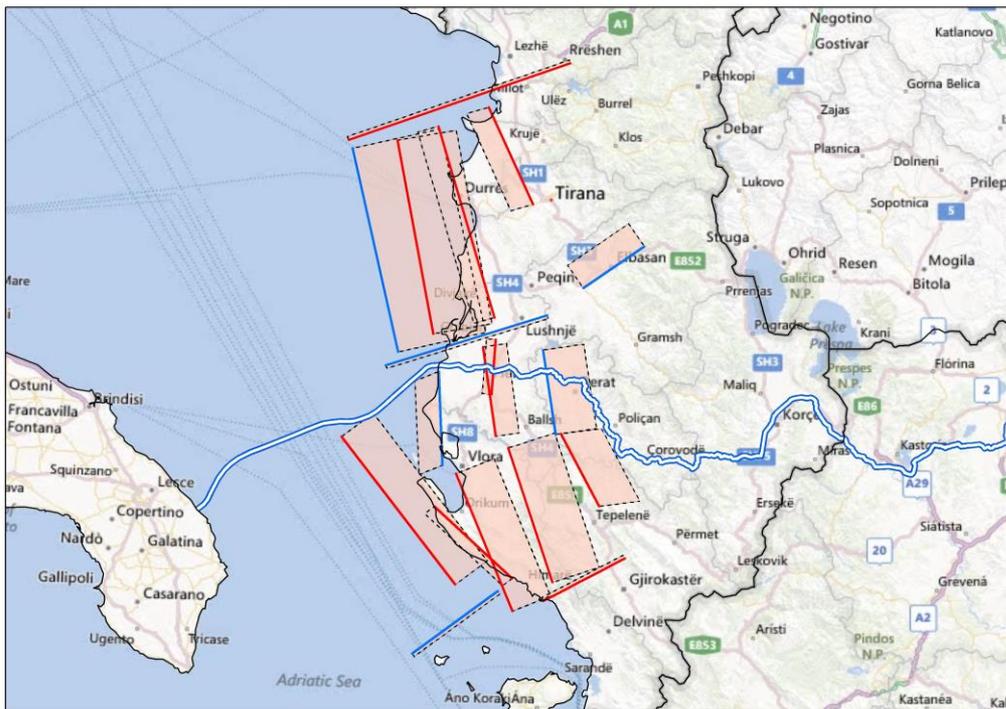
2 zone con sovrapposizione



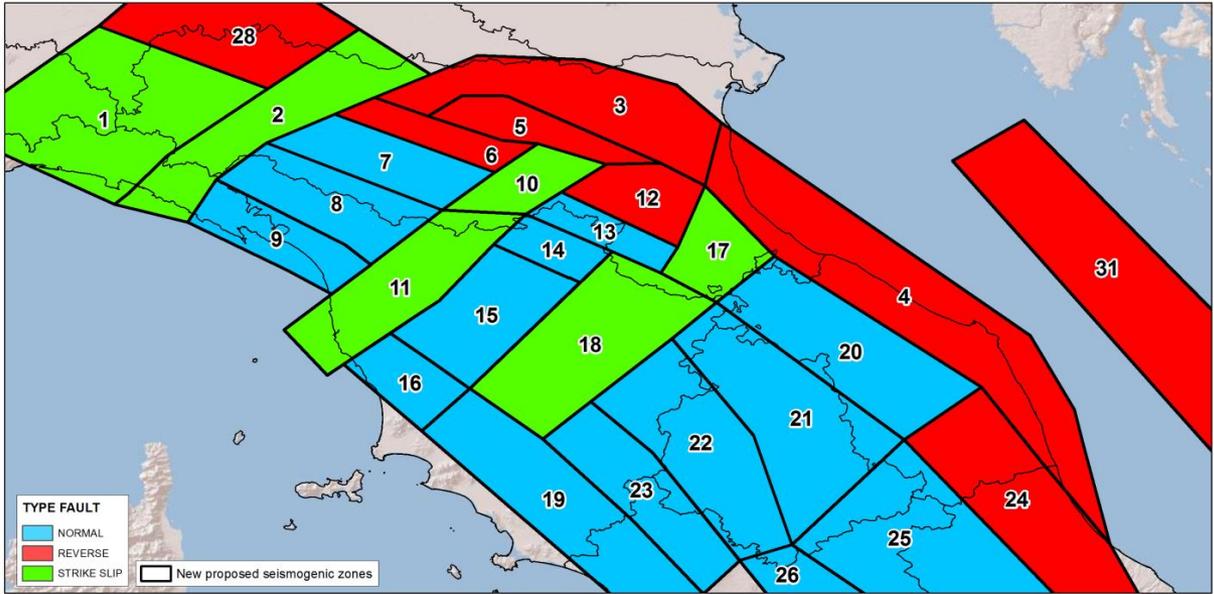
2 zone adiacenti a diversa profondità

2 zone a diversa profondità con parziale sovrapposizione

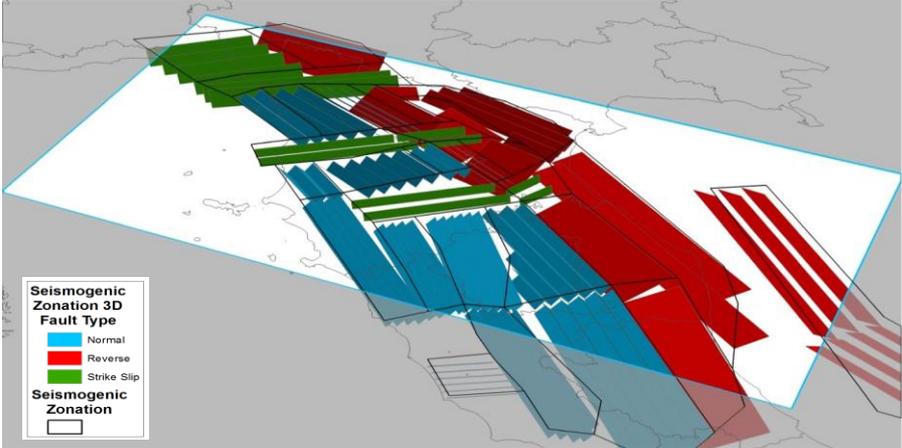
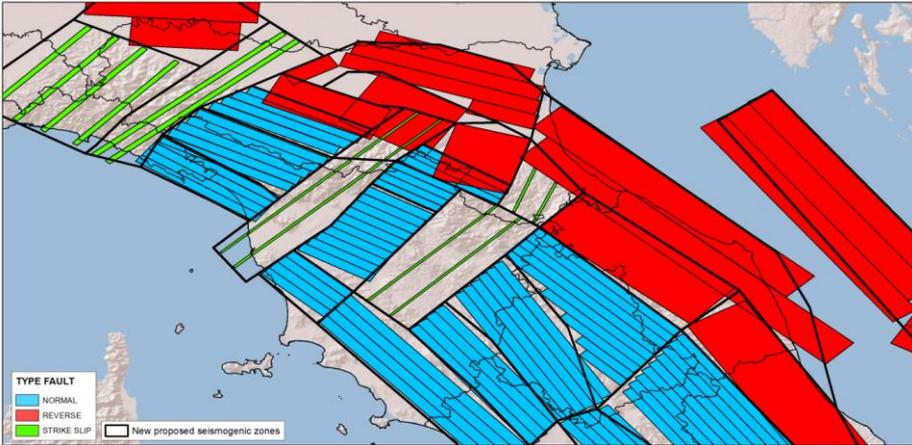
Esempio di geometria 3D



Modello di sorgenti per l'Appennino settentrionale



2D



3D





FINE