

I Beni Culturali dopo il sisma: situazione attuale e prospettive
Giornata di Studi – Ferrara, 28 Settembre 2012

I terremoti nella Pianura Padana Emiliana: Origine, evoluzione e stato attuale

Gilberto Saccorotti

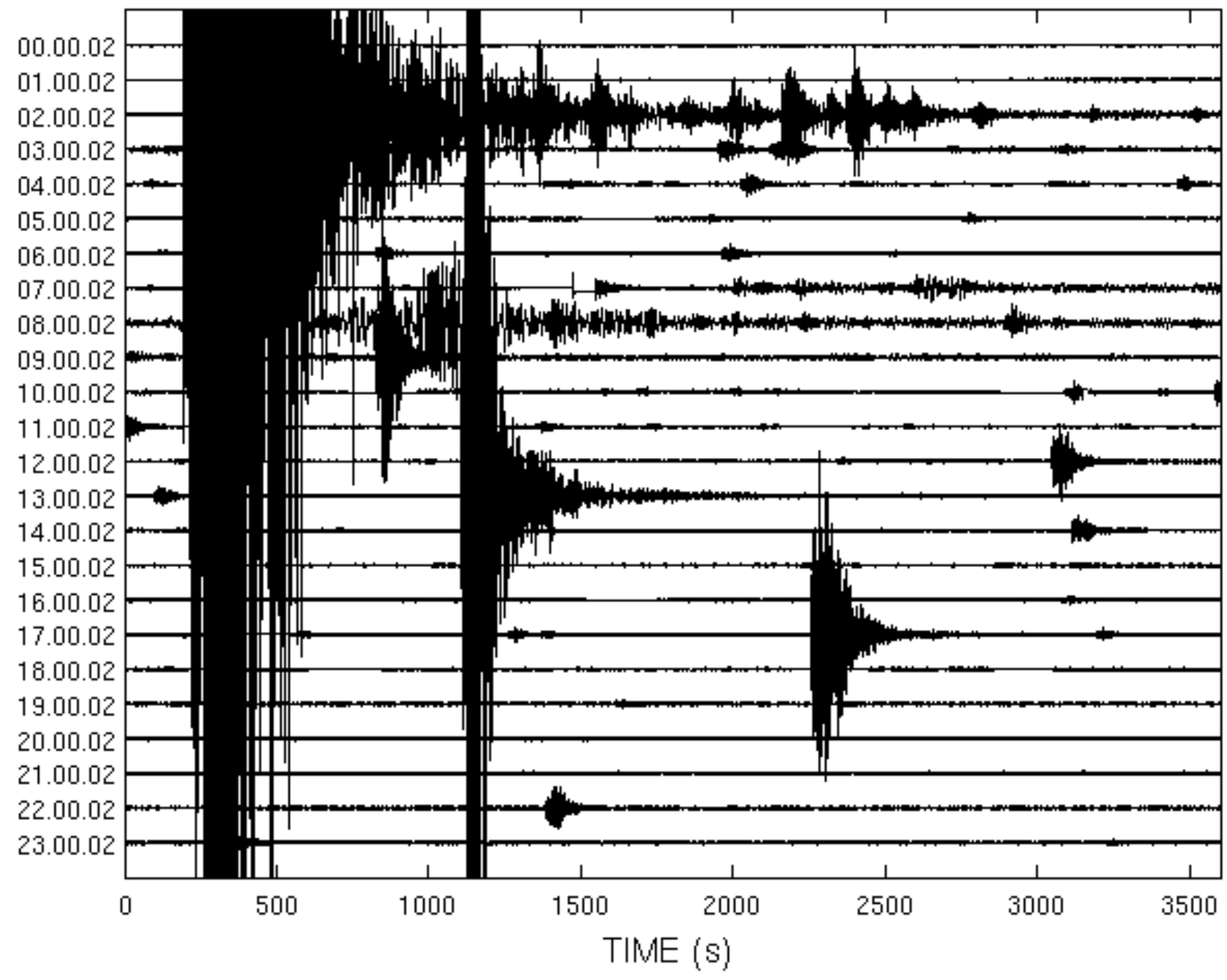
Istituto Nazionale di Geofisica e Vulcanologia
Fondazione Prato Ricerche



Istituto Nazionale di
Geofisica e Vulcanologia



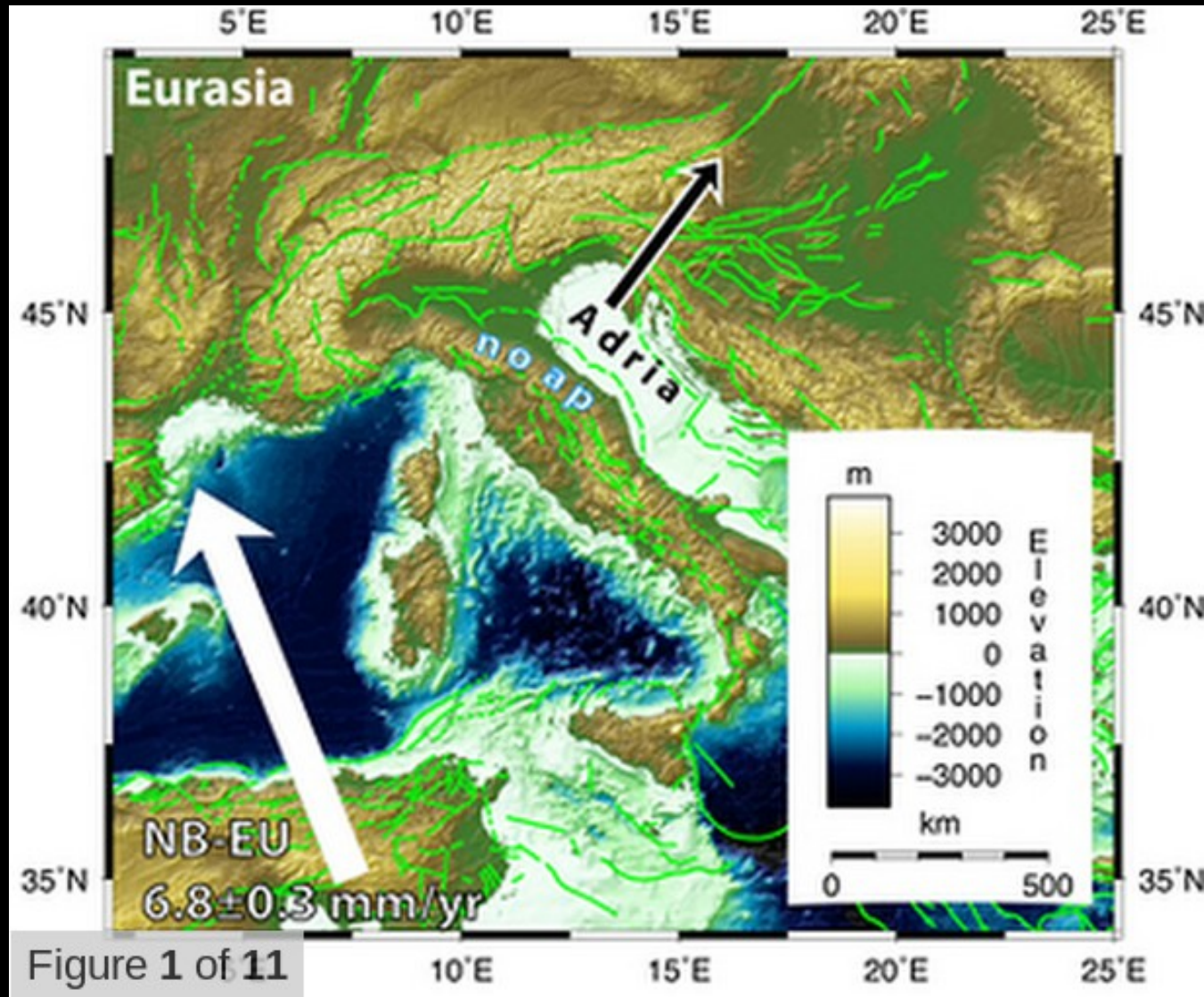
OSSC.HHZIV 20-May-2012



ARGOMENTI

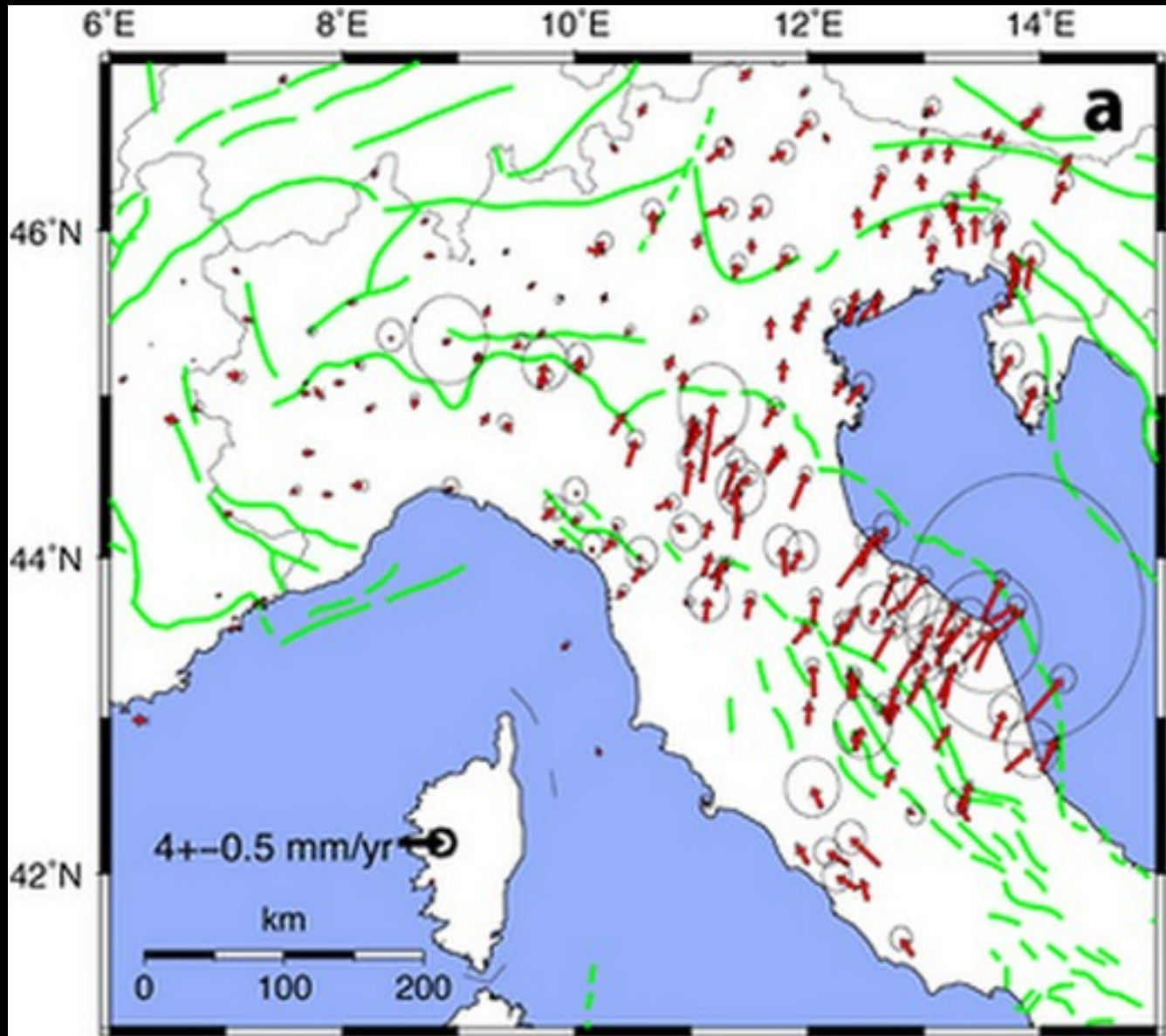
- Contesto Geodinamico e Sismotettonico
- La sismicità storica e strumentale
- Descrizione della sequenza
- Caratteristiche della sorgente
- La pericolosità sismica dell'area

Contesto Geodinamico



R. A. Bennett, E. Serpelloni et al., JGR 2012

Geodinamica e Sismotettonica

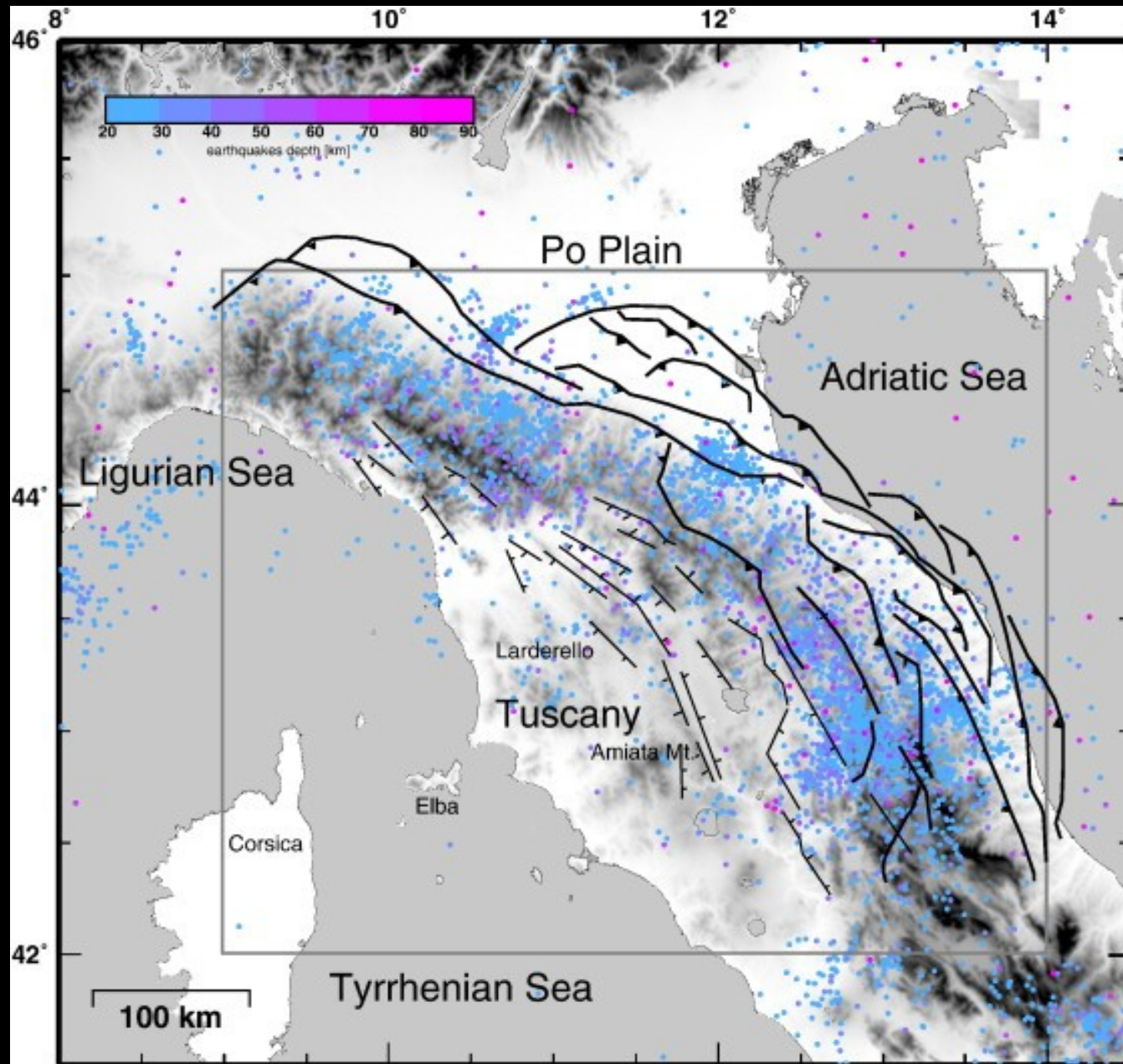


Distensione e compressione si alternano su distanze ~ 50-100 km.

Il blocco NAPE si muove verso NE più velocemente di Adria.

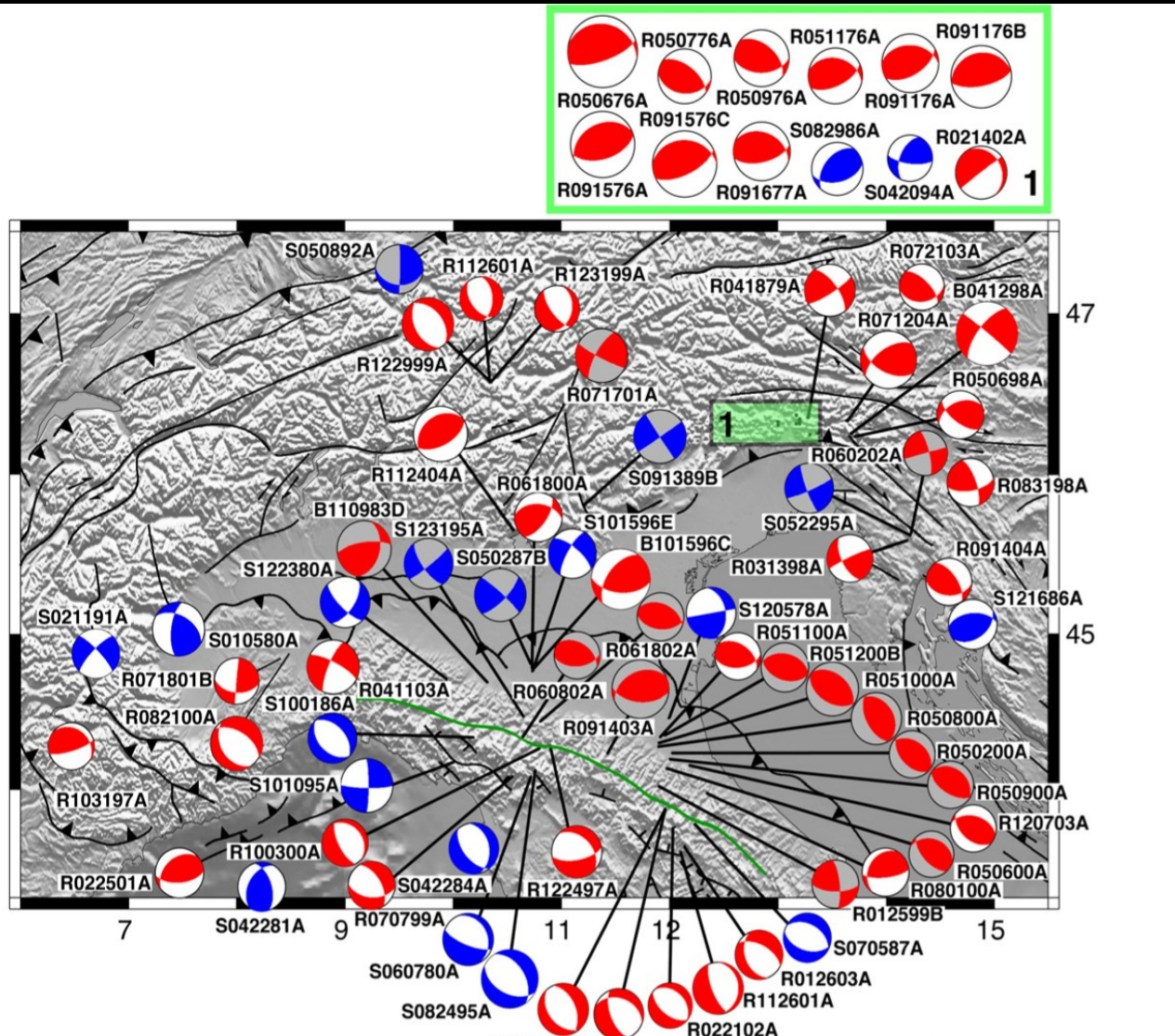
Compressione → Fronte NE
Distensione → Fronte interno (Tirrenico)
Mugello, Garfagnana...

Geodinamica e Sismotettonica



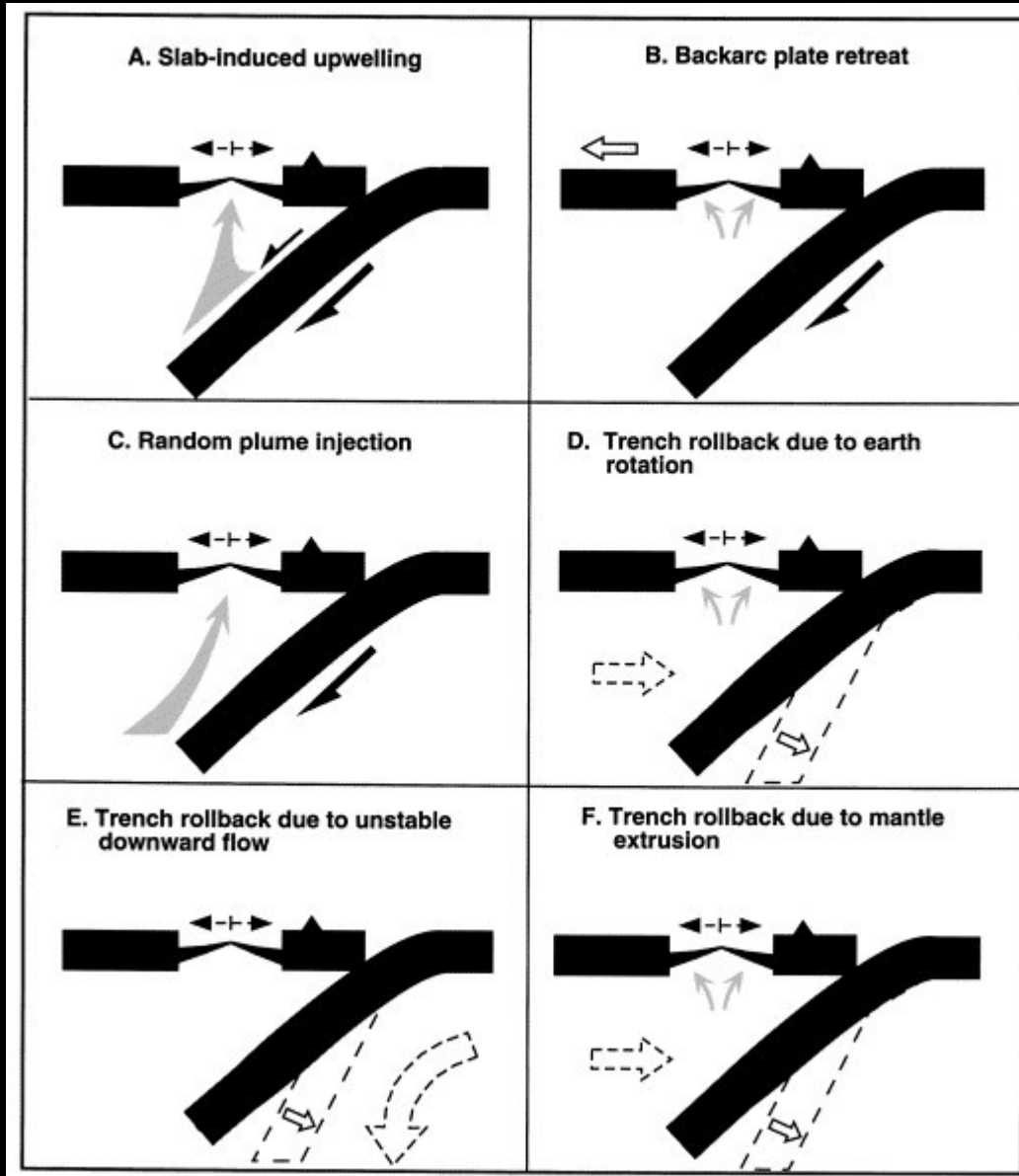
Meccanismi di sorgente dei forti terremoti

Pondrelli et al., EPSL, 2006



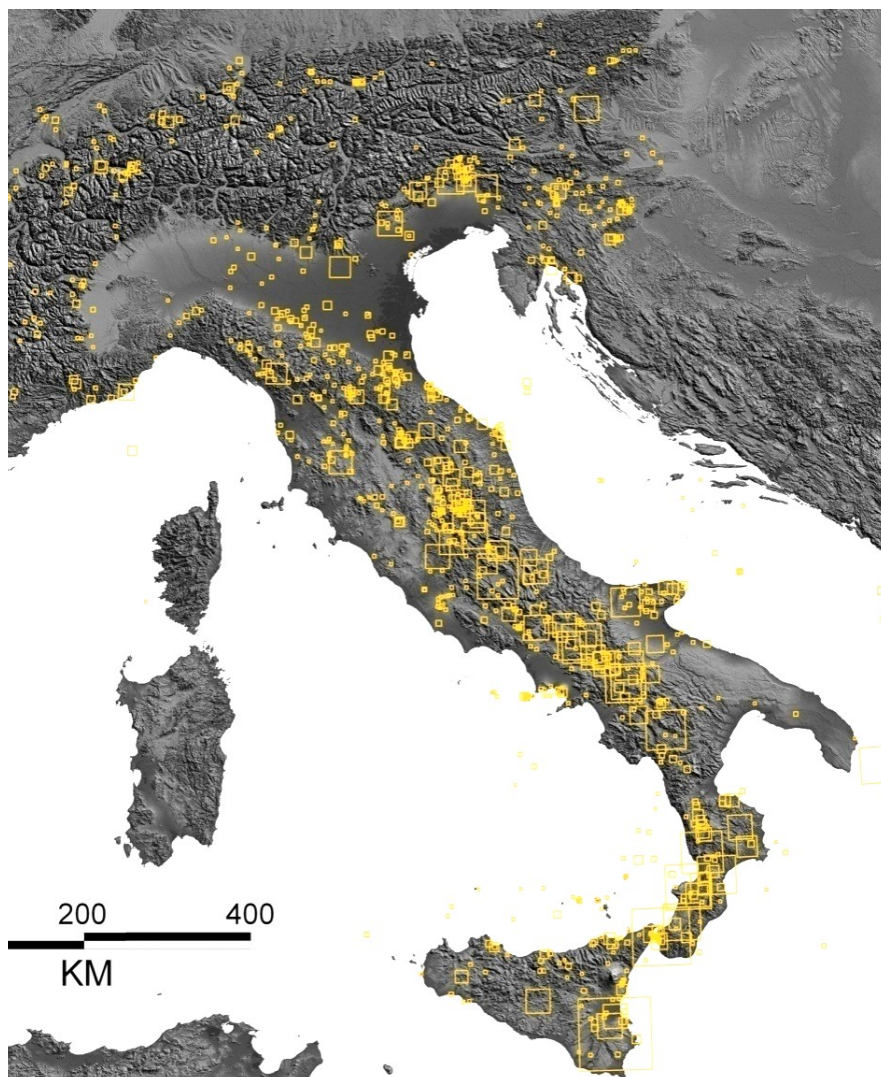
Meccanismi focali dei forti ($M > 4$) terremoti: compressione nella piana del Po, estensione al margine tirrenico .

Modelli Interpretativi

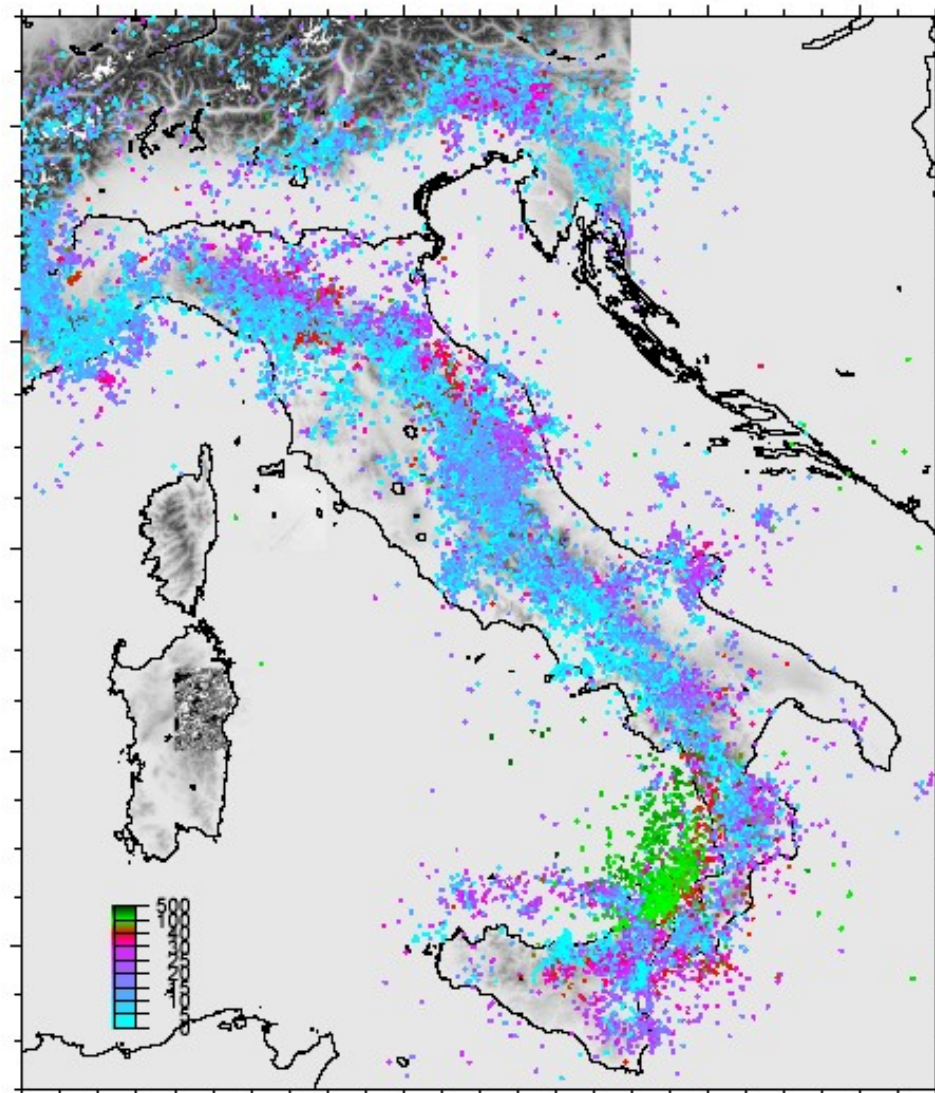


Diversi modelli, tutti relazionati con la dinamica della placca di Adria in subduzione, possono spiegare la coesistenza di regimi compressivi e distensivi.

Sismicità Storica



(217 A.C - 1981)



(1981-2010)

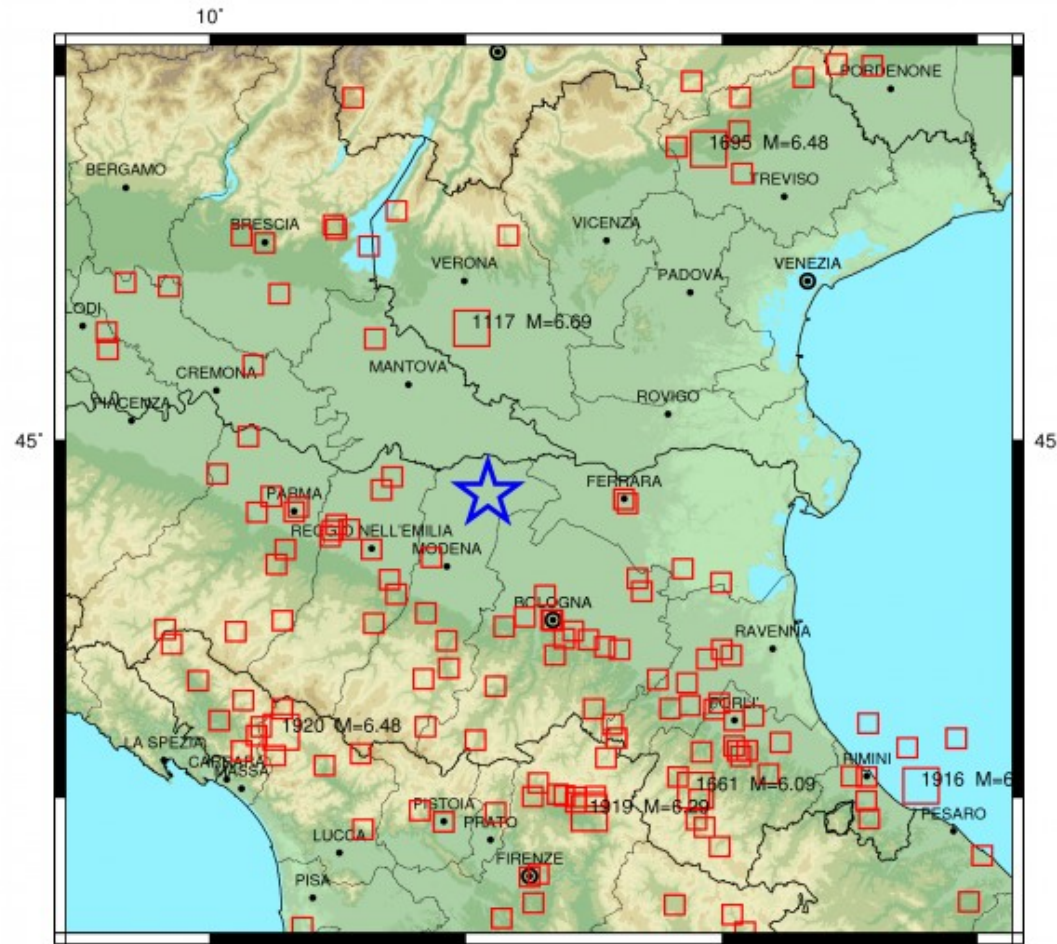
Sismicità Storica (1000dc-1981dc)

Sismicità Storica

Evento del 2012-05-29 07:00:03 (UTC) – Magnitudo 5.8

Cataloghi della Sismicità Storica usati: cpt11

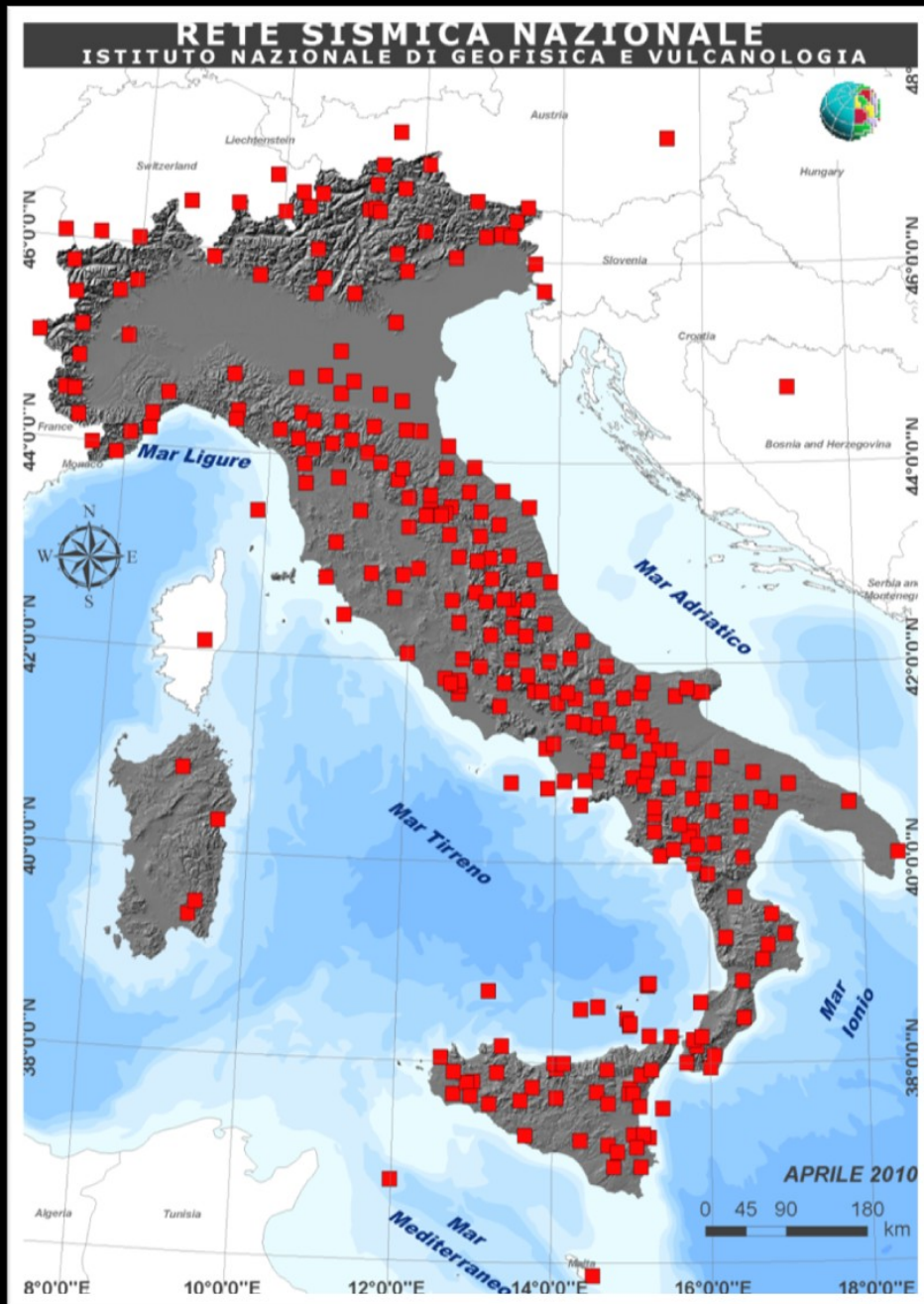
Soglia di Magnitudo Storici: 5.0 (etichetta ≥ 6.0)



Legenda Terremoti Storici



Sismicità Strumentale: La Rete Sismica Nazionale



~300 stazioni

~10000 terremoti localizzati per anno in Italia

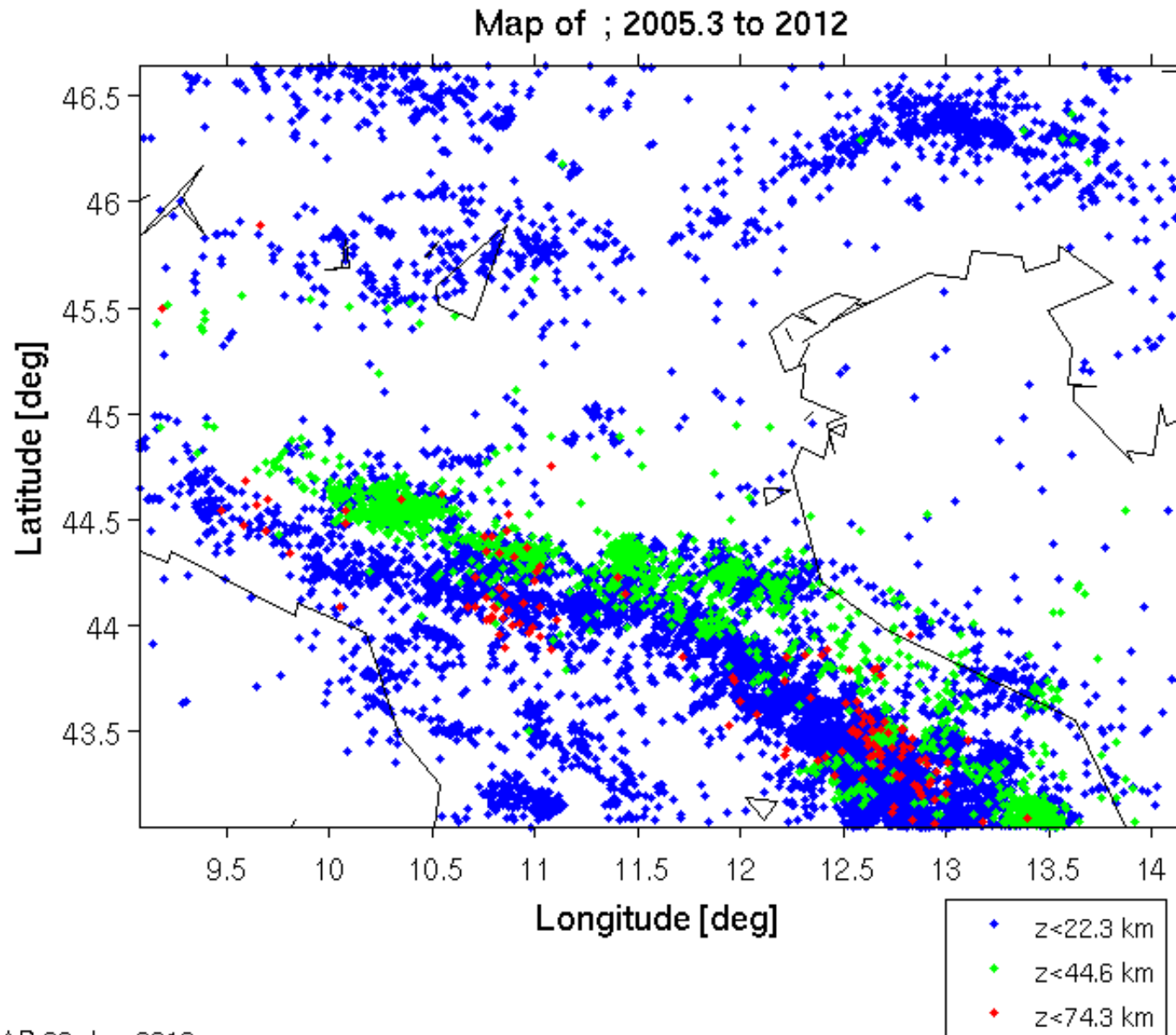
500-1000 terremoti comunicati per anno

Tutti i dati **pubblici** (iside.rm.ingv.it)

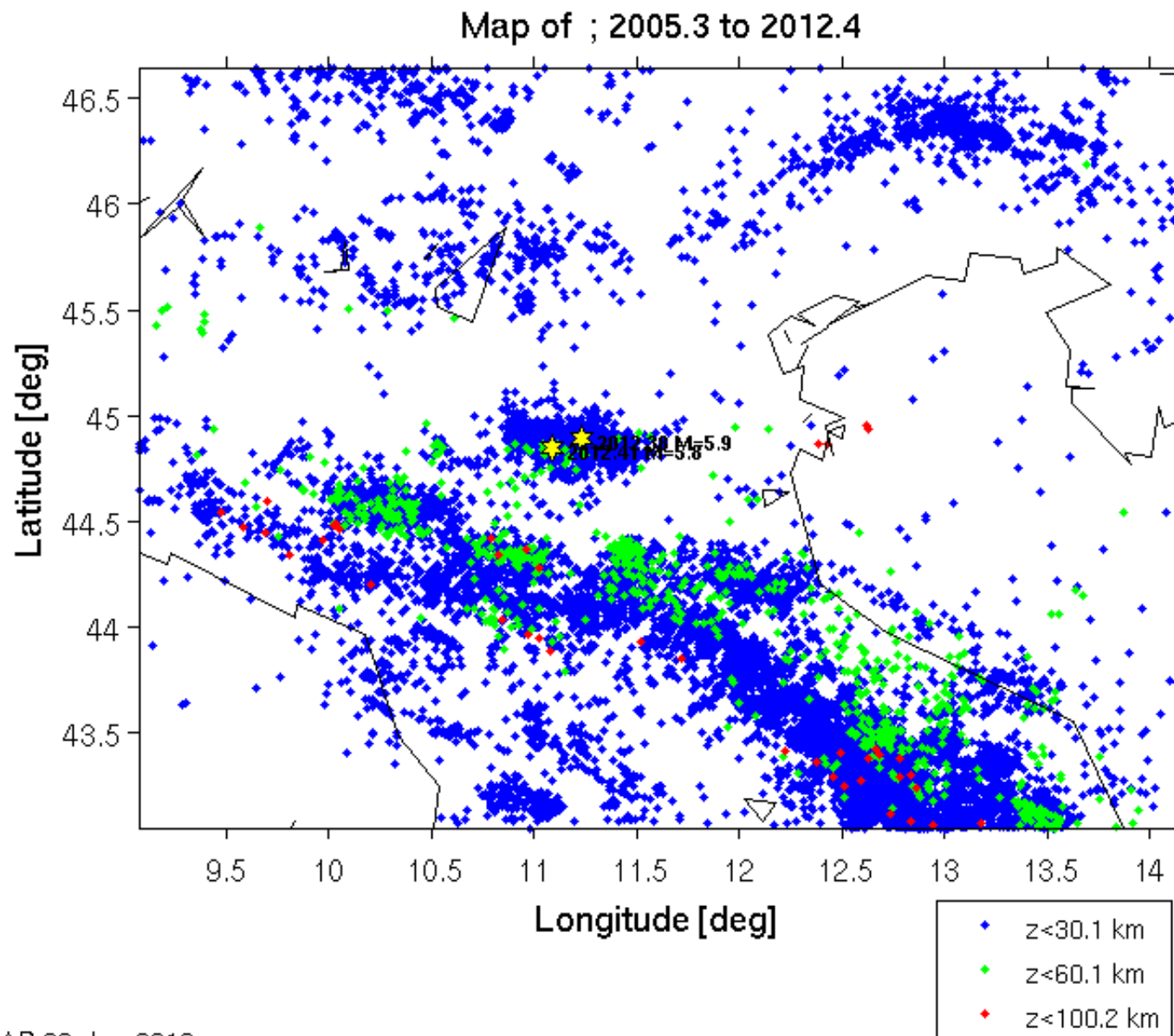
Sala Sismica Centro Nazionale Terremoti



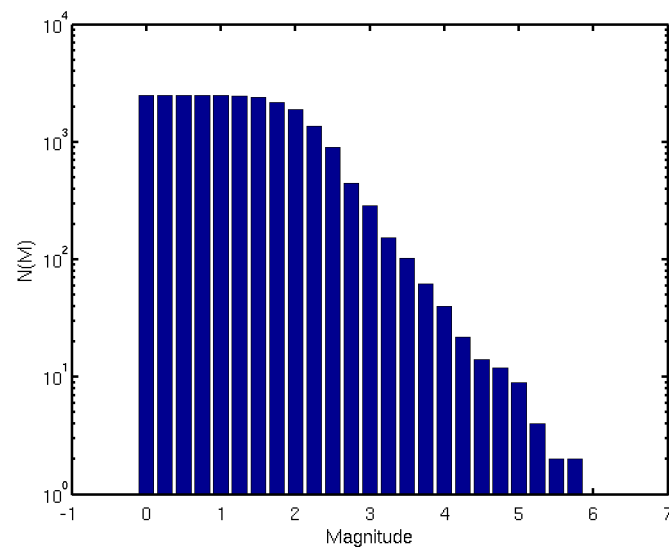
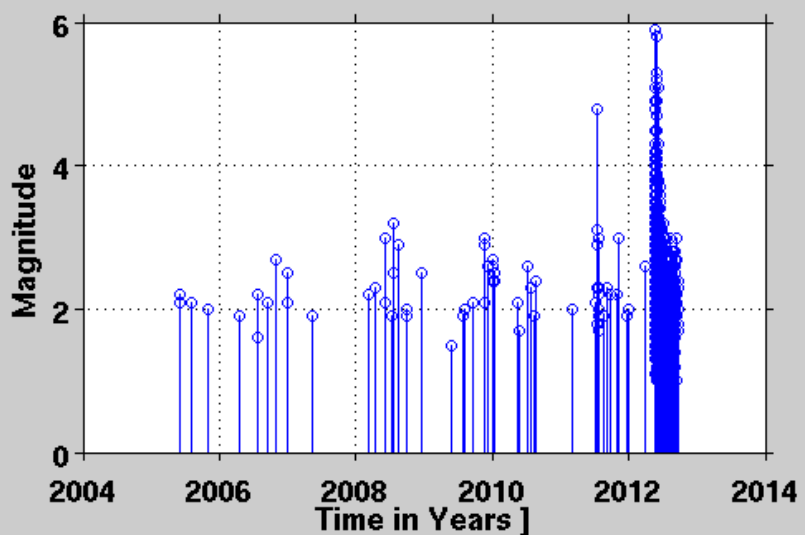
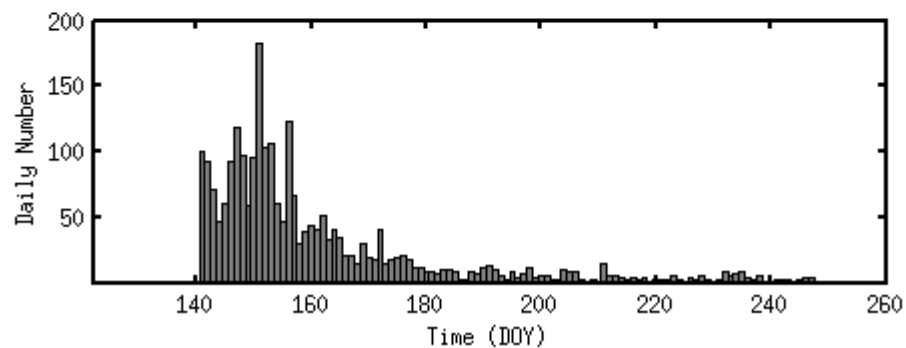
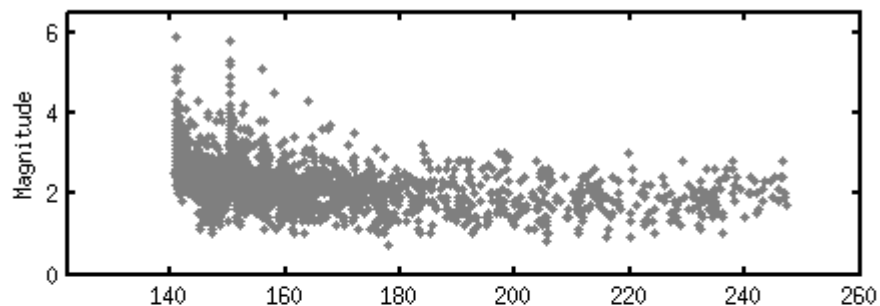
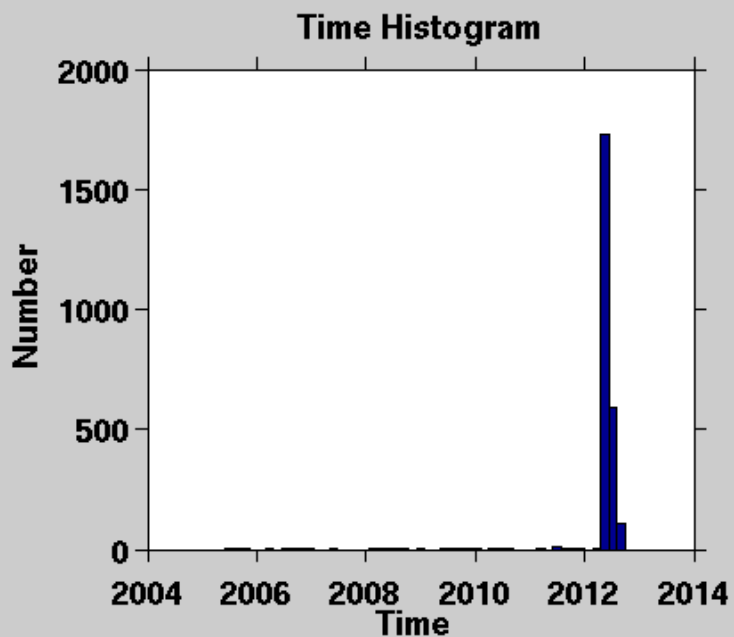
Sismicità Strumentale (2005-12.31.2011)



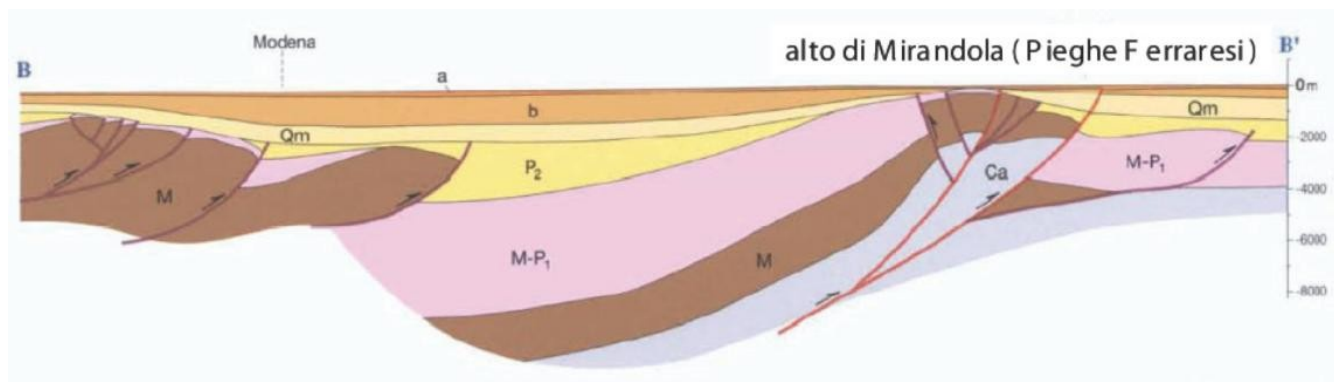
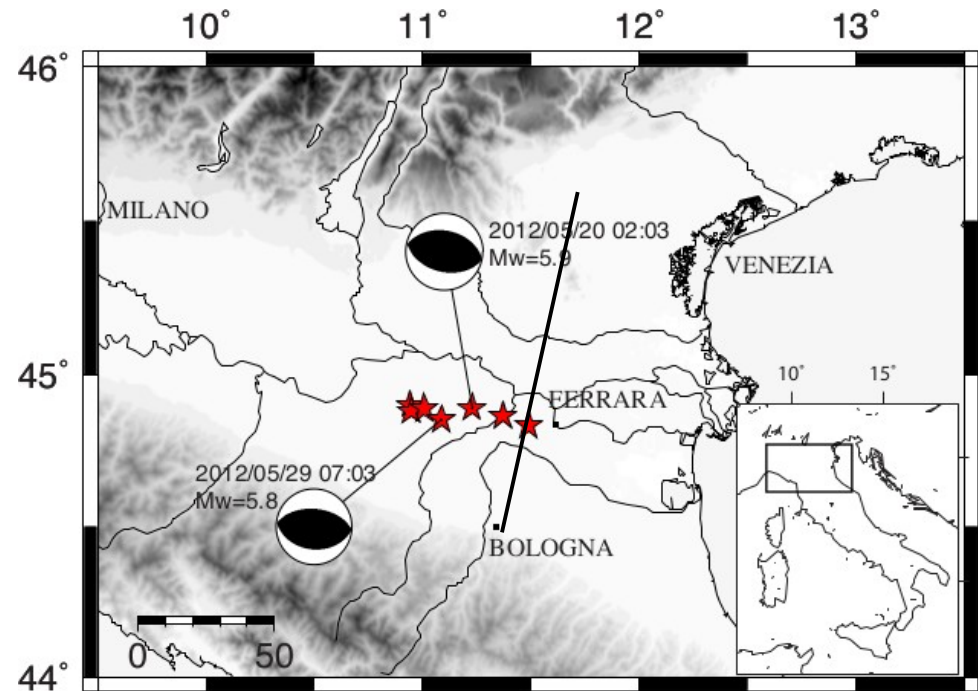
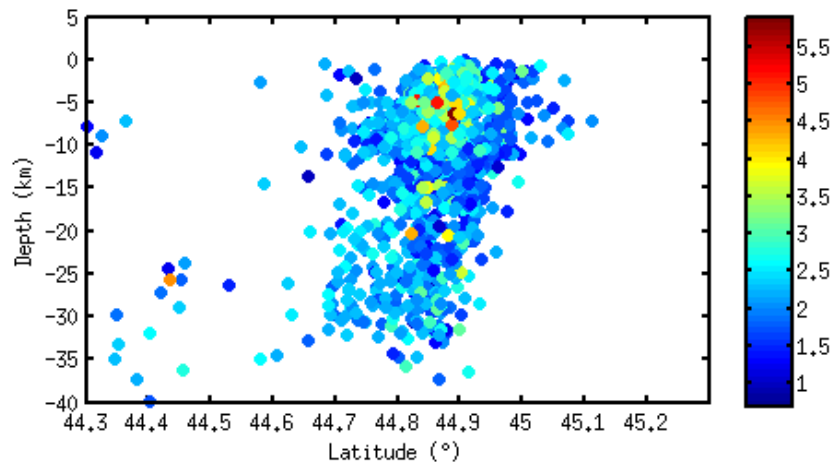
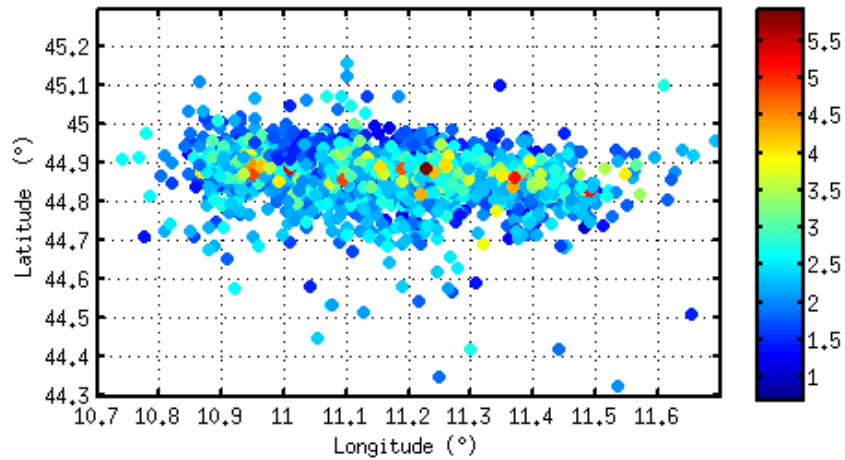
Sismicità Strumentale (1.1.2012-attuale)



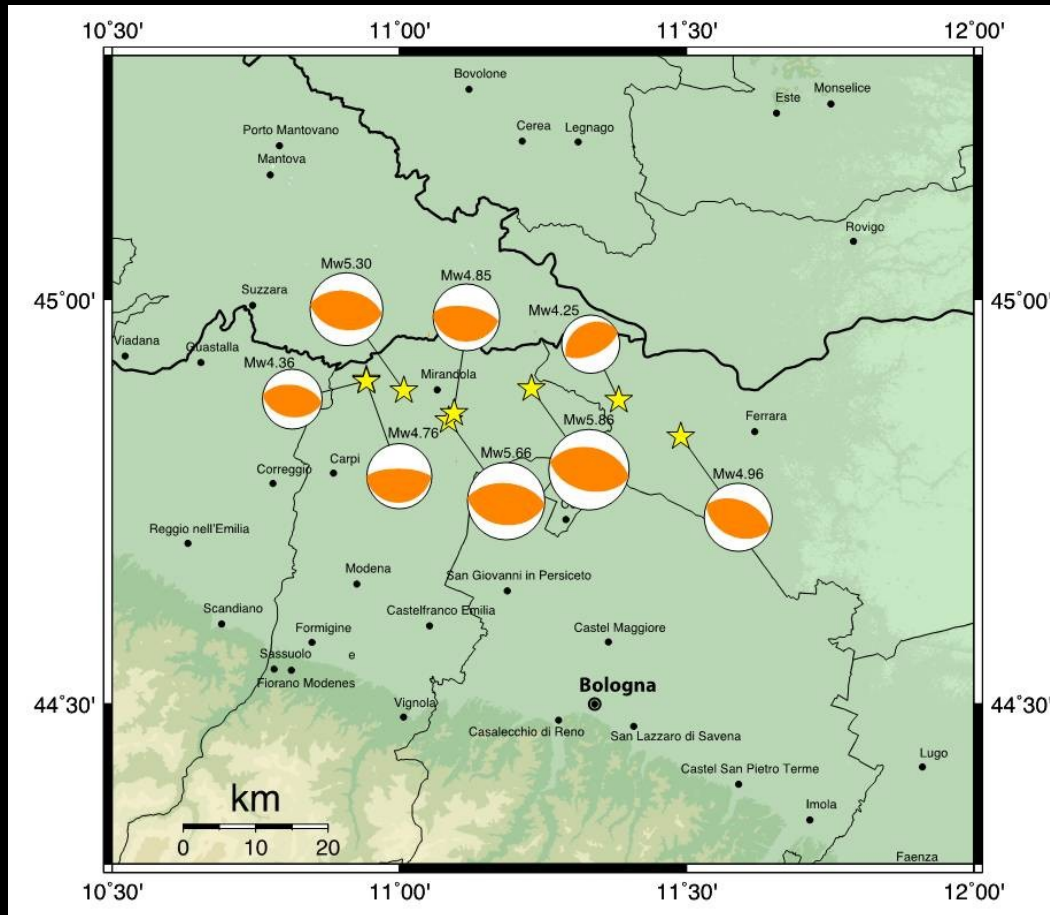
Evoluzione Temporale (2005-presente)



Individuazione delle superfici di rottura

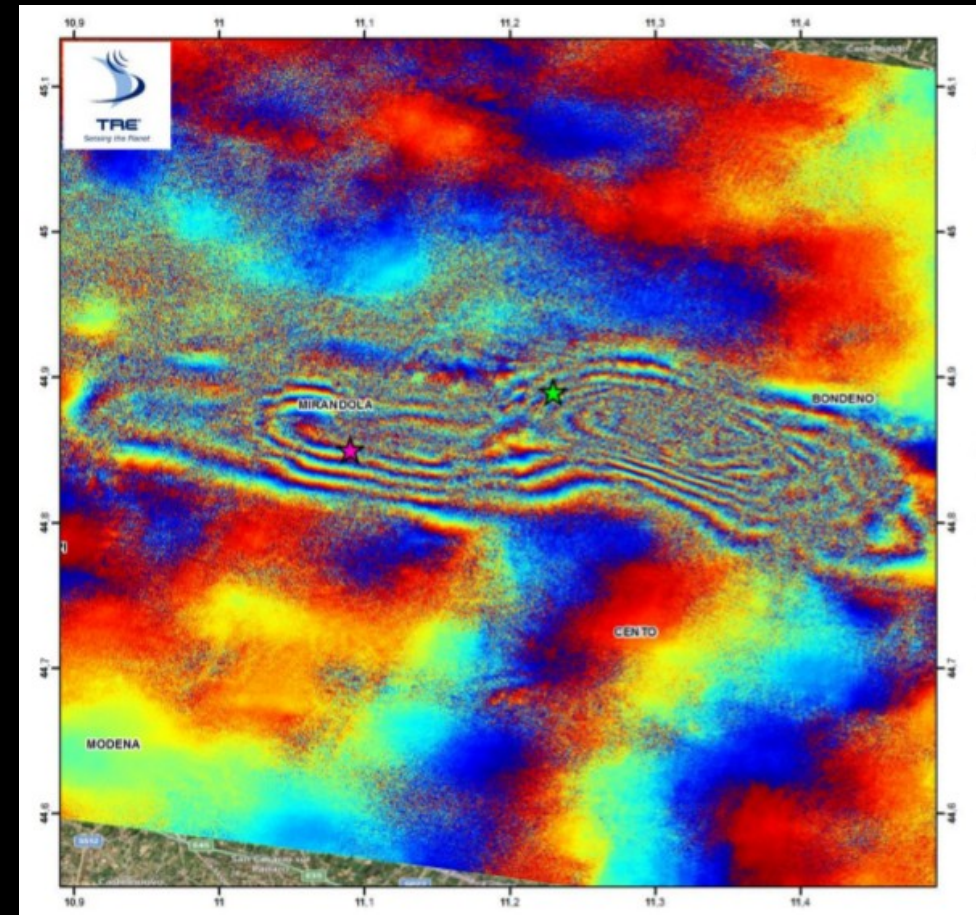


Soluzioni dei Piani di Faglia



Soluzioni TDMT

(da Scognamiglio et al., Rapp. Int. INGV –
Giugno 2012)



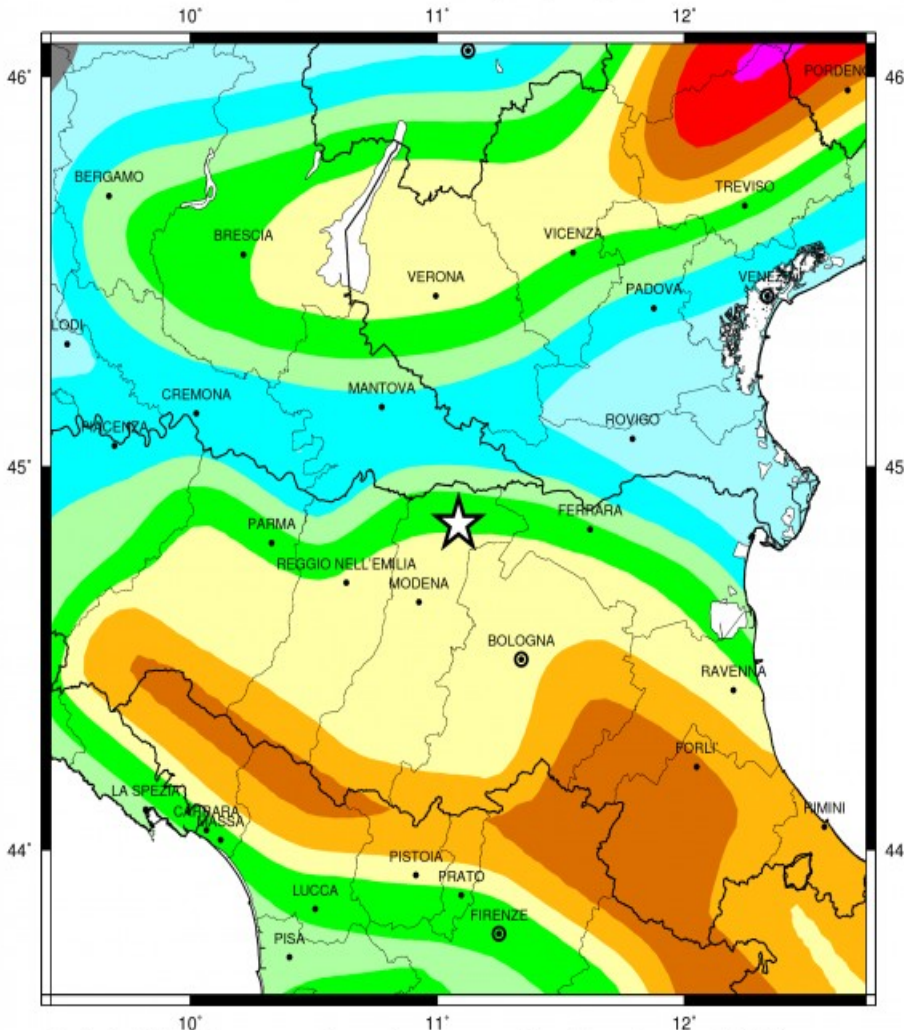
Immagini SAR

(da Atzori et al., Rapp. Int. INGV – Giugno
2012)

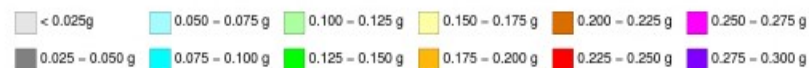
Pericolosità sismica dell'area

Mappa di Pericolosità Sismica

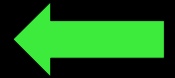
Evento del 2012-05-29 07:00:03 (UTC) Magnitudo 5.800000



Pericolosità Sismica espressa in accelerazione massima del suolo con probabilità di eccedenza del 10% in 50 anni riferita a suoli rigidi



10% probabilità di
PGA > 0.15 g
nei prossimi 50 anni



29 Maggio 2012:

0.30g Cento
0.29g Mirandola

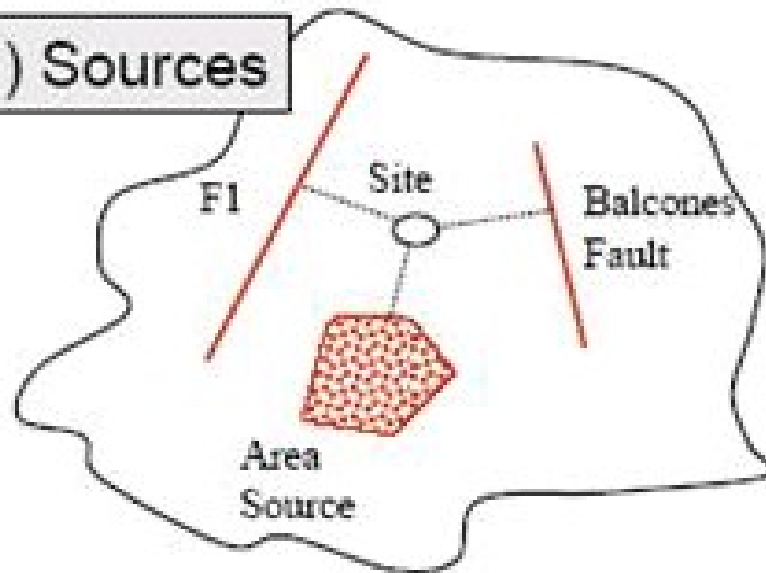


20 Maggio 2012

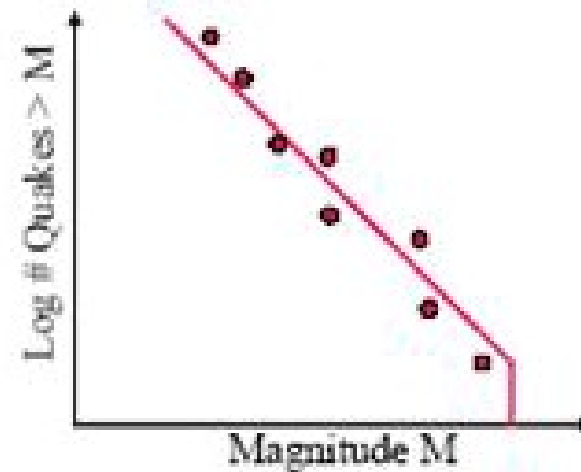
0.26g Mirandola

Valutazione della pericolosità sismica

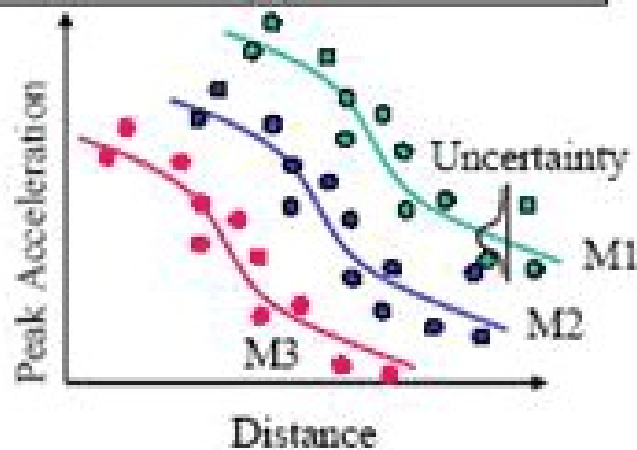
(1) Sources



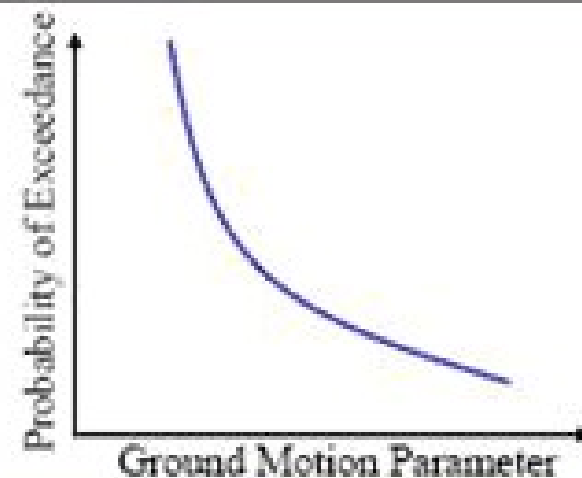
(2) Recurrence



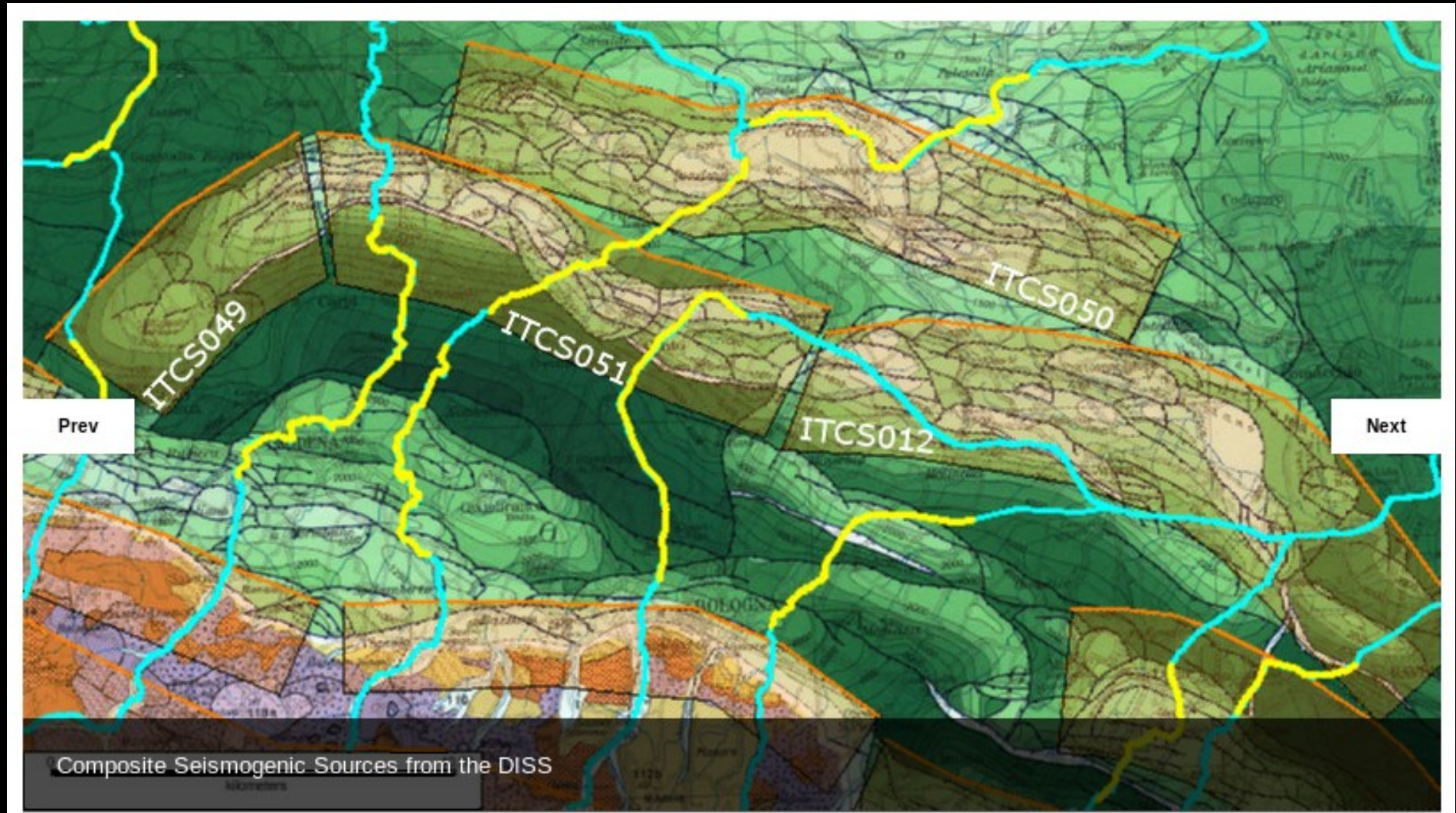
(3) Ground Motion



(4) Probability of Exceedance



Le sorgenti: Il Database Italiano delle Strutture Sismogenetiche (DISS)









DISS 3.1.1: Seismogenic Source ITIS107 - Mirandola

[Source Info Summary](#)[Commentary](#)[References](#)[Pictures](#)

General information

Code	ITIS107
Name	Mirandola
Compiled By	Burrato, P., E. Carminati, C. Doglioni and D. Scrocca
Latest Update	19/09/2007 

Parametric information

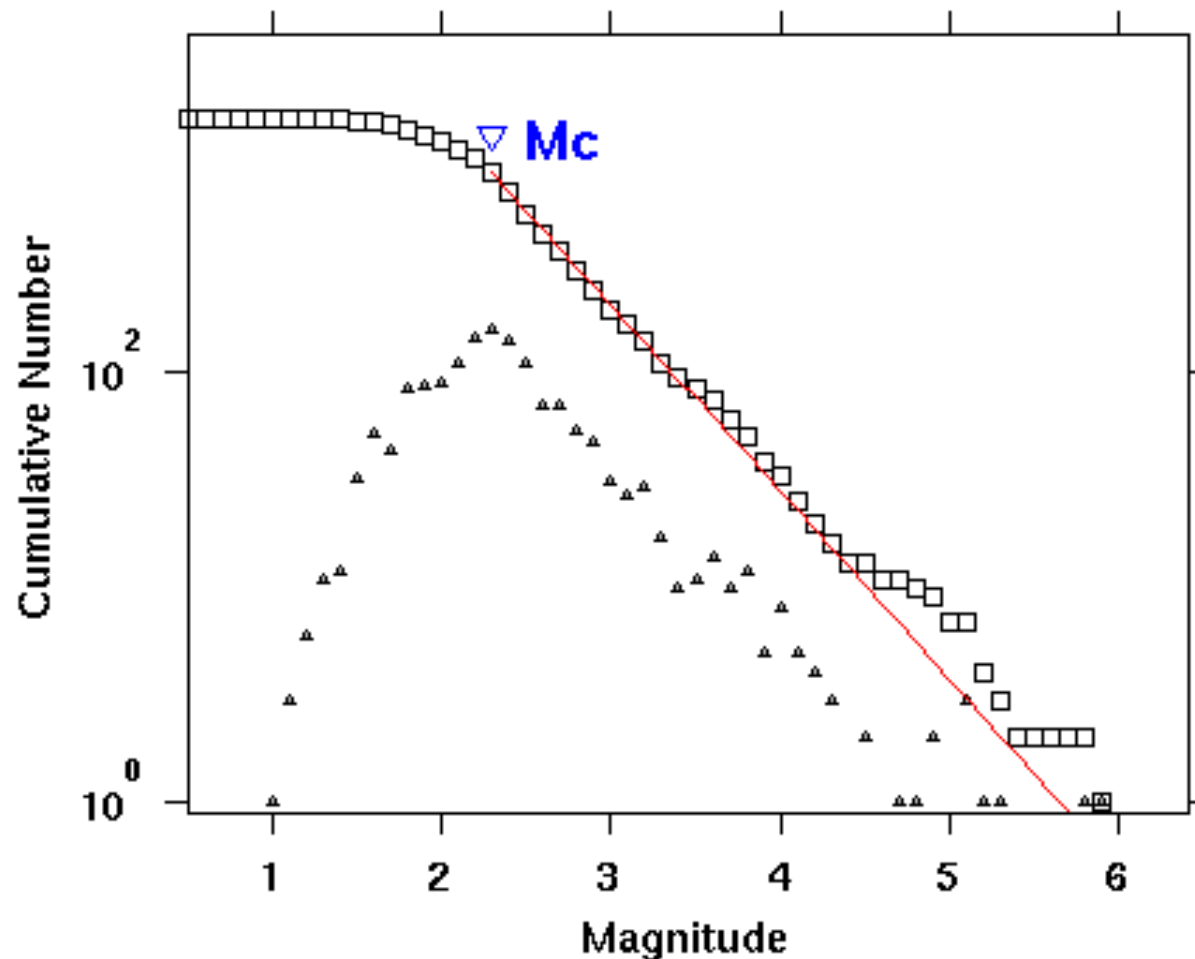
	Parameter	Qual.	Evidence
Location (Lat/Lon)	44.8396 / 11.1351	OD	Based on geological and geomorphological observations.
Length (km)	8.7 	OD	Based on geological and geomorphological observations.
Width (km)	5.8	OD	Based on geological and geomorphological observations.
Min Depth (km)	3.9	LD	Based on geological and seismological data.
Max Depth (km)	7.6	LD	Based on geological and seismological data.
Strike (deg)	113 	OD	Based on geological and geomorphological observations.
Dip (deg)	40	LD	Based on surface displacement modeling constrained by subsurface data.
Rake (deg)	90	EJ	Inferred from geological data, constrained by orientation of T axes.
Slip Per Event (m)	0.45	ER	Calculated from Mo using the relationship from Hanks and Kanamori (1979).
Slip Rate (mm/y)	0.25 - 0.5	OD	Based on growth strata analysis.
Recurrence (y)	900 - 1800	EJ	Inferred from slip rate and average displacement.
Magnitude (Mw)	5.9 	ER	Inferred from slip rate and average displacement.

Q-keys: LD = Literature Data; OD = Original Data; ER = Empirical Relationship; AR = Analytical Relationship; EJ = Expert Judgement

Associated earthquake

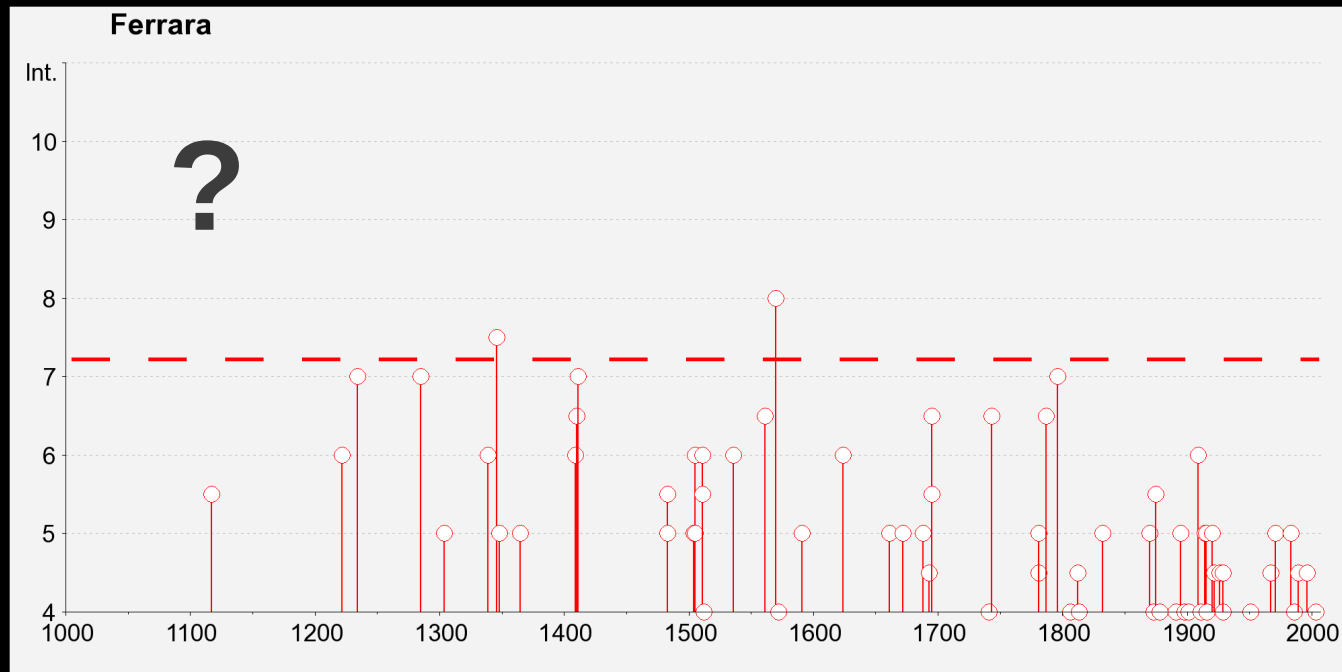
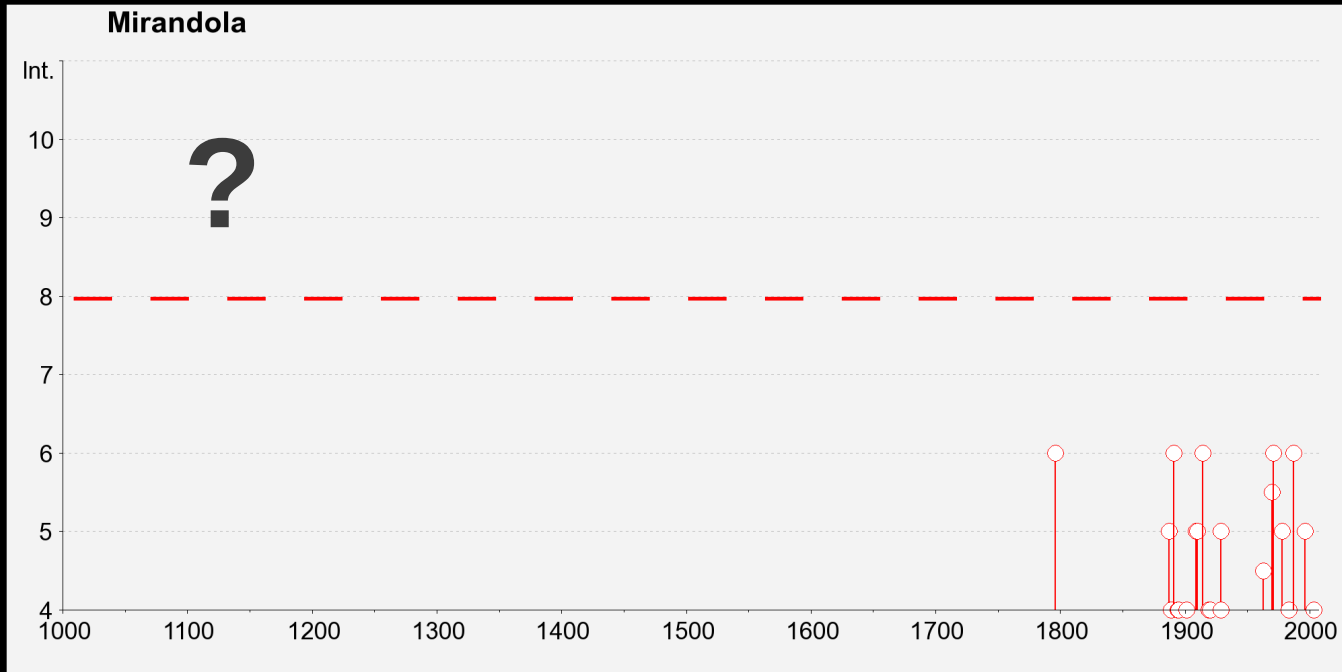
Latest Eq	Unknown	See "Commentary" for information.
Penultimate Eq	Unknown	See "Commentary" for information.
Elapsed Time	-9999	See "Commentary" for information.

Legge di ricorrenza strumentale



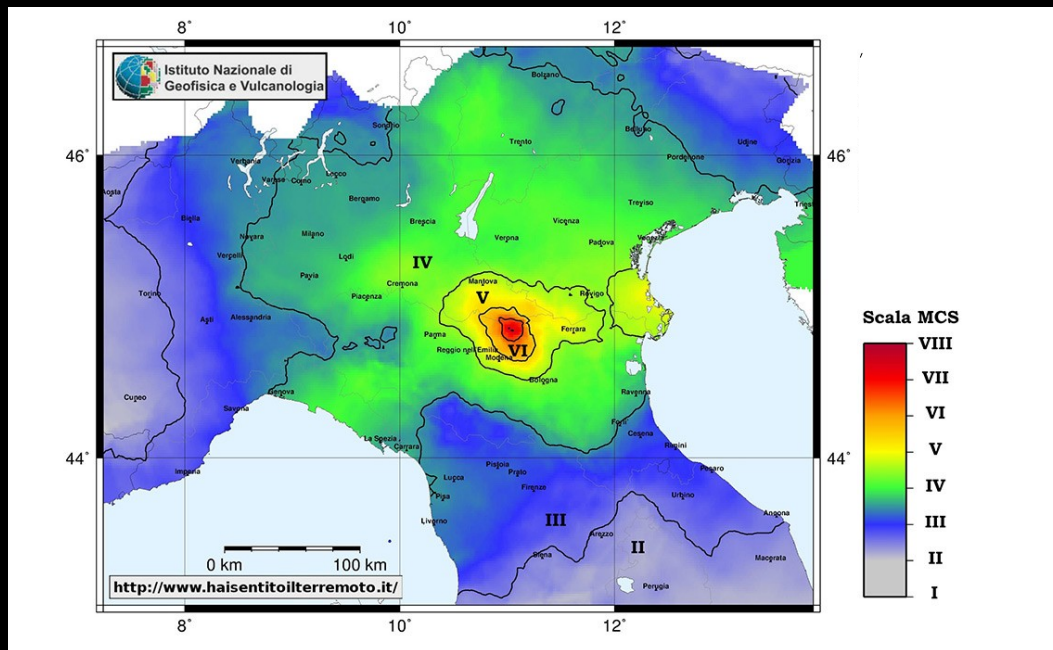
Maximum Likelihood Solution
b-value = 0.875 ± 0.03 , a value = 4.94, a value (annual) = 5.6
Magnitude of Completeness = 2.3

Completezza dei cataloghi storici

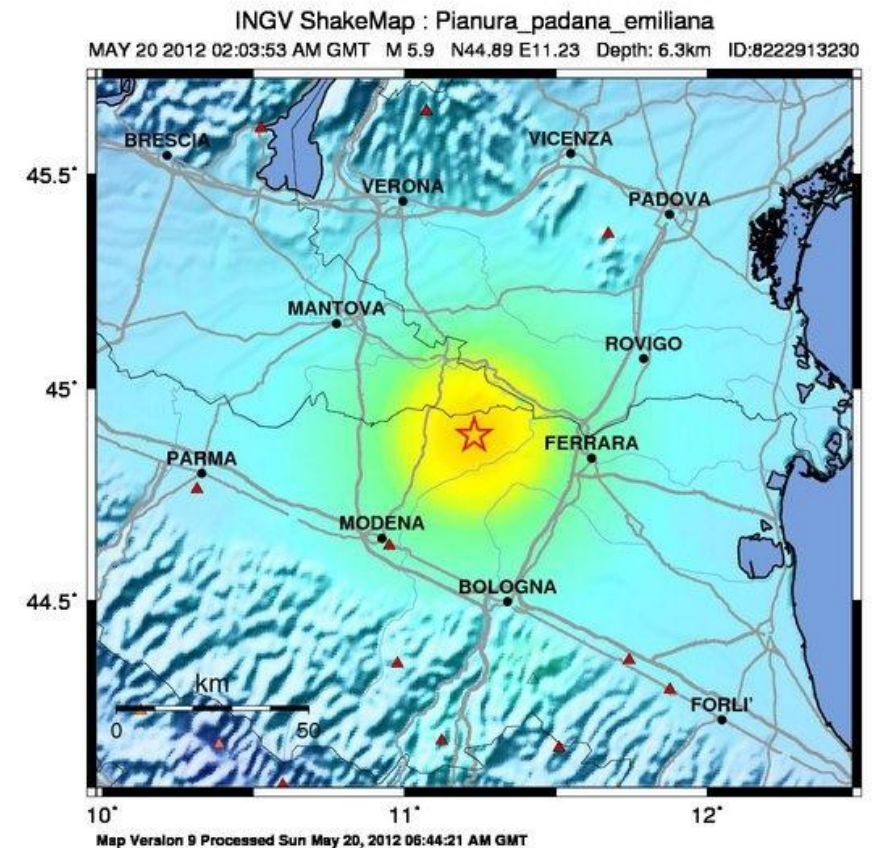


Gli effetti della propagazione

Risentimento calcolato sulla base delle registrazioni strumentali.



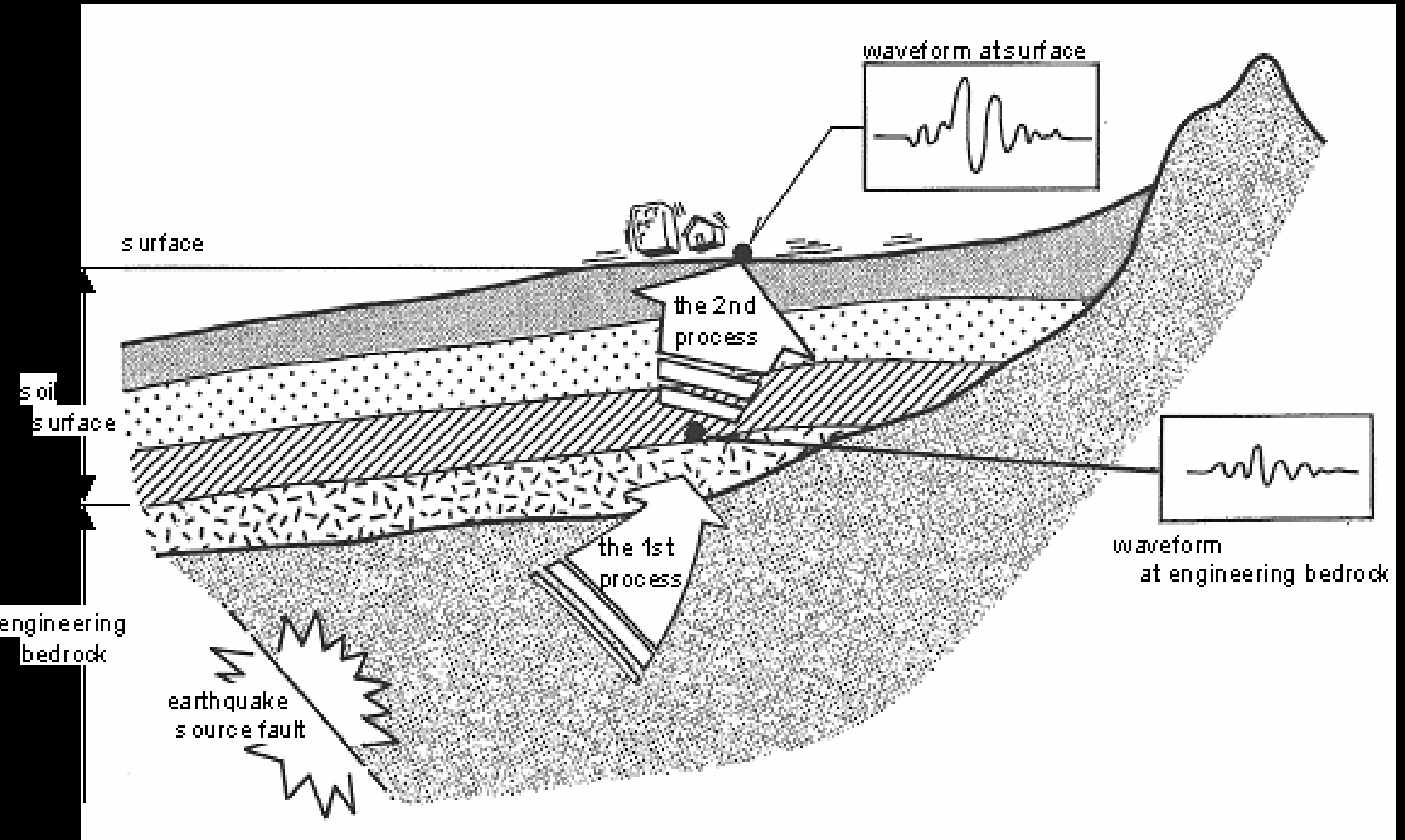
Distribuzione effettiva del risentimento sulla base di ~7500 questionari distribuiti on-line



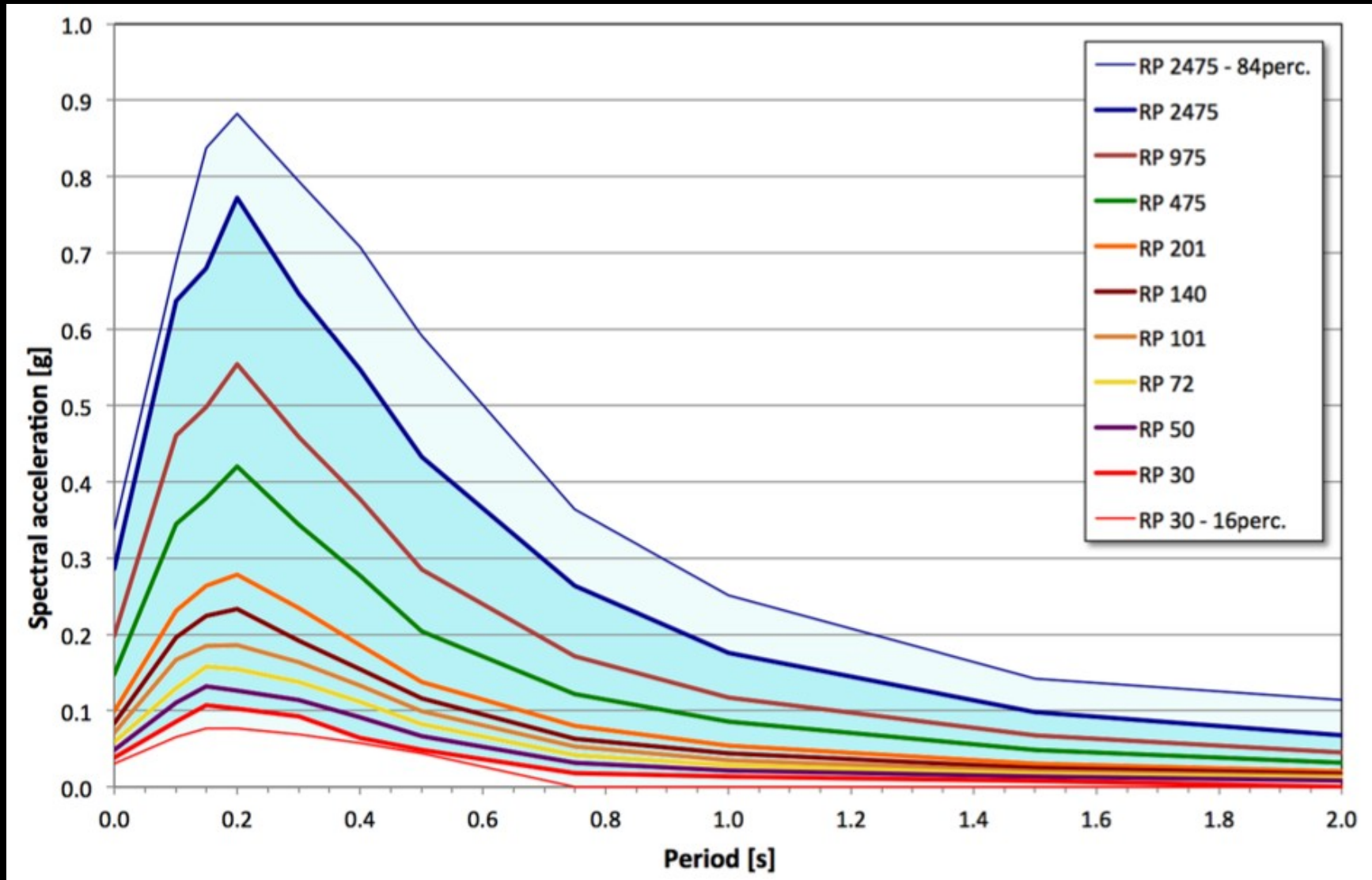
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.1	0.5	2.4	6.7	13	24	44	83	>156
PEAK VEL.(cm/s)	<0.07	0.4	1.9	5.8	11	22	43	83	>160
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Wald, et al.; 1999

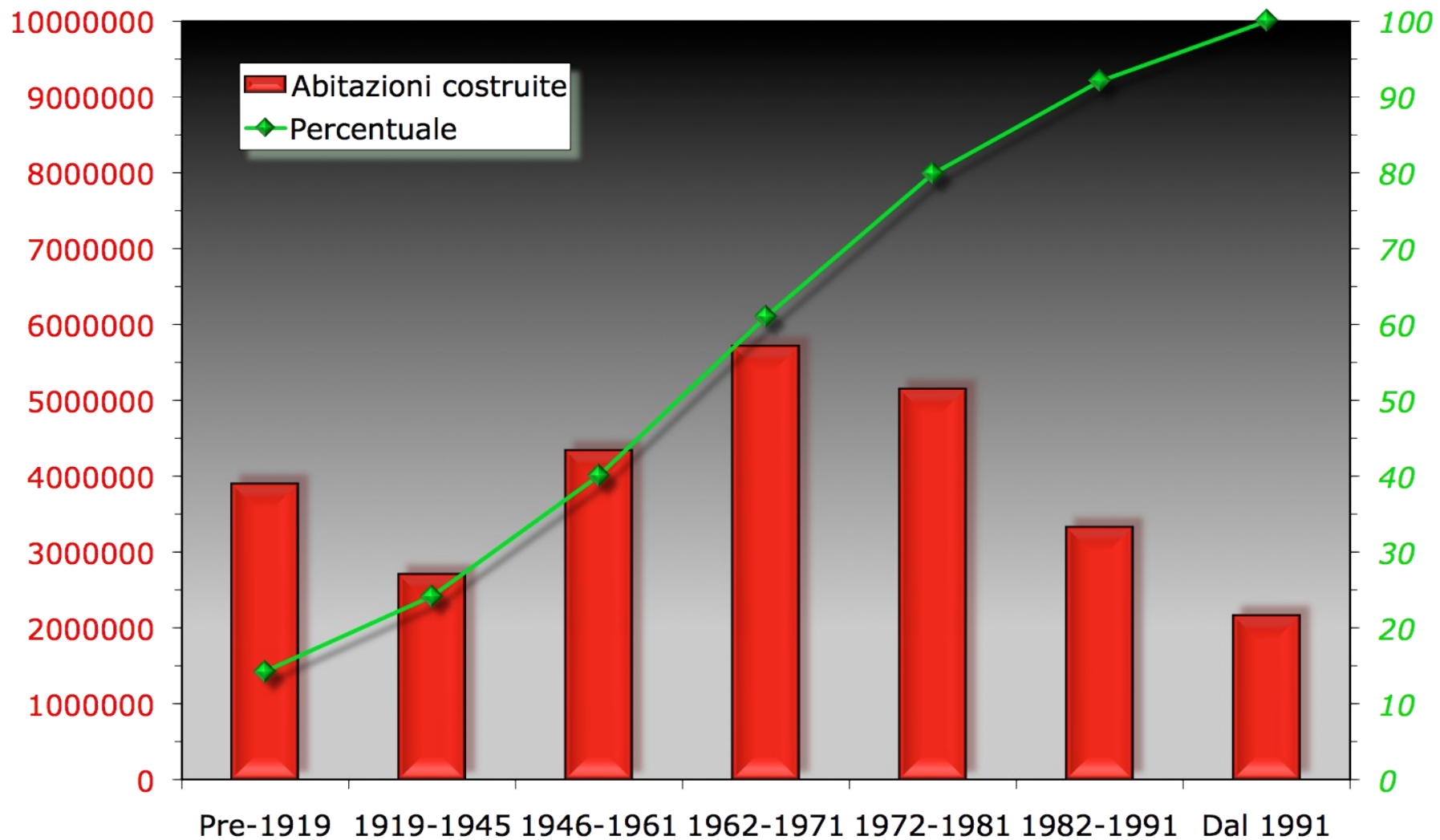
Gli effetti del sito



Grandi Incertezze



(da Meletti et al., *Annals of Geophysics*, in press)



Età del patrimonio edilizio in Italia (dati censimenti Istat)

Grazie per l'attenzione



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