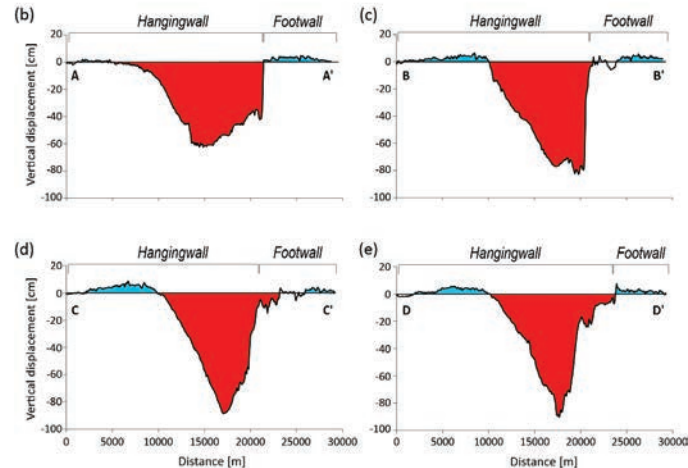
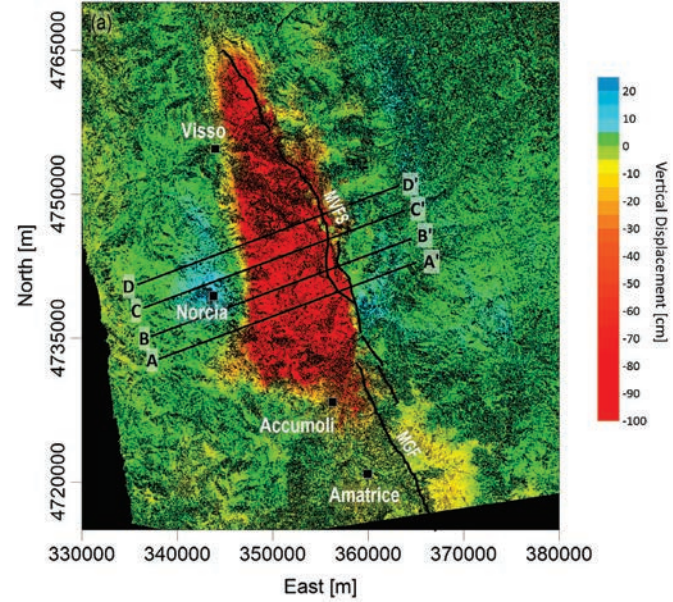
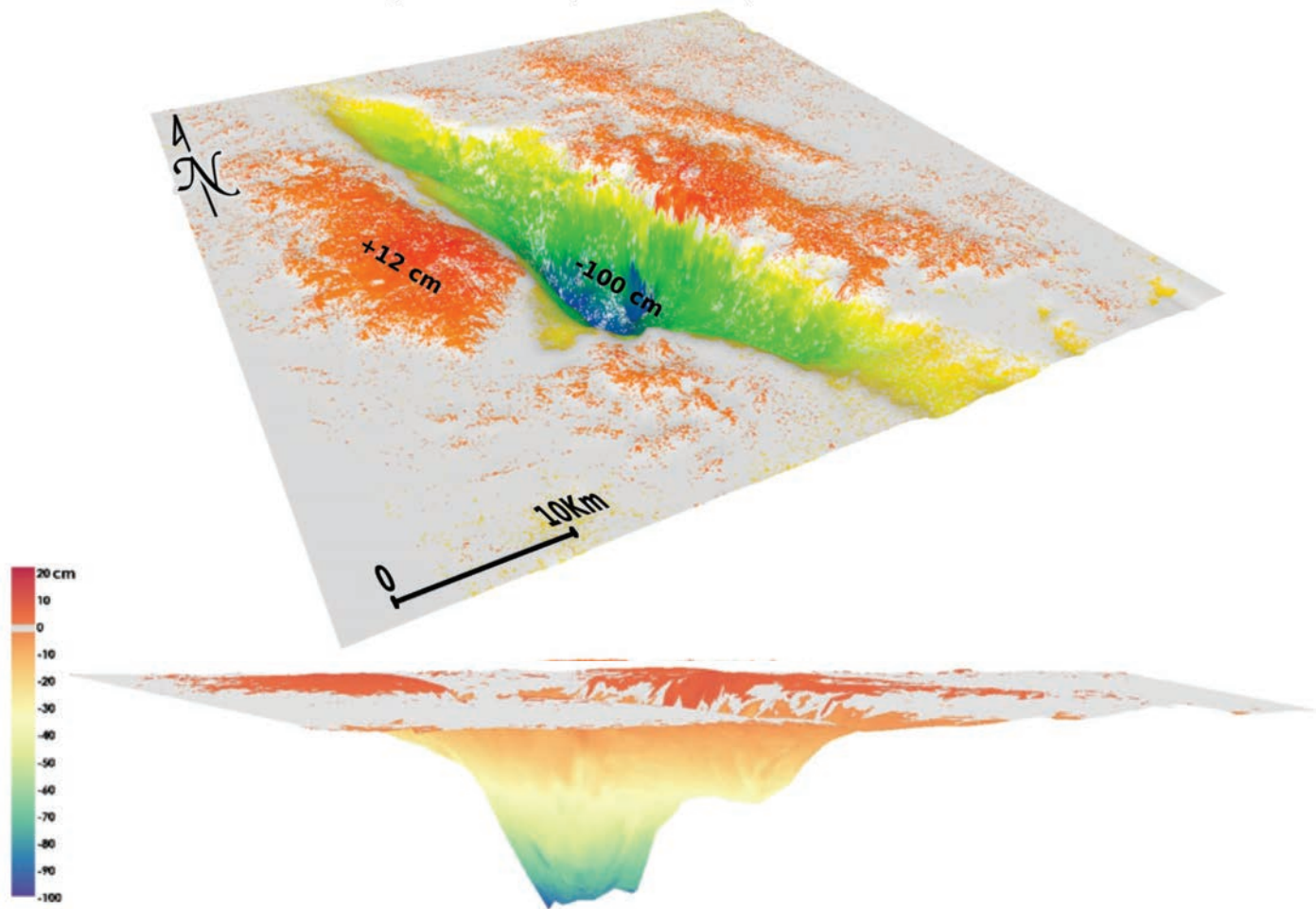
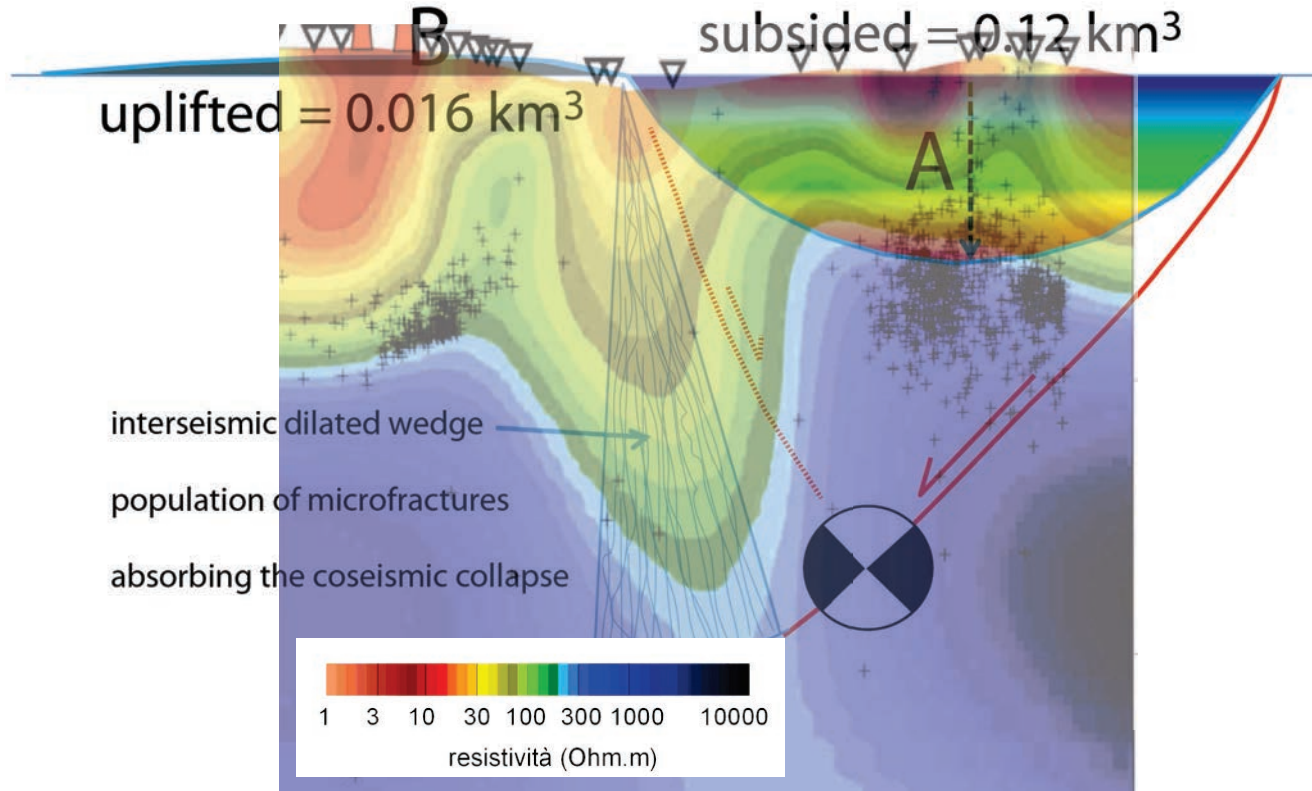


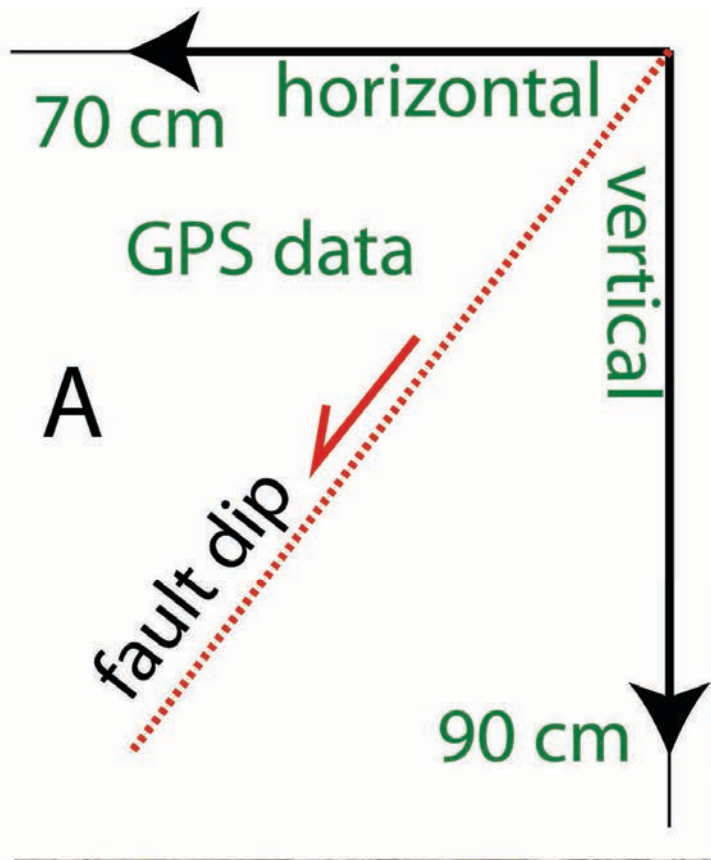




VERTICAL COSEISMIC MOTION

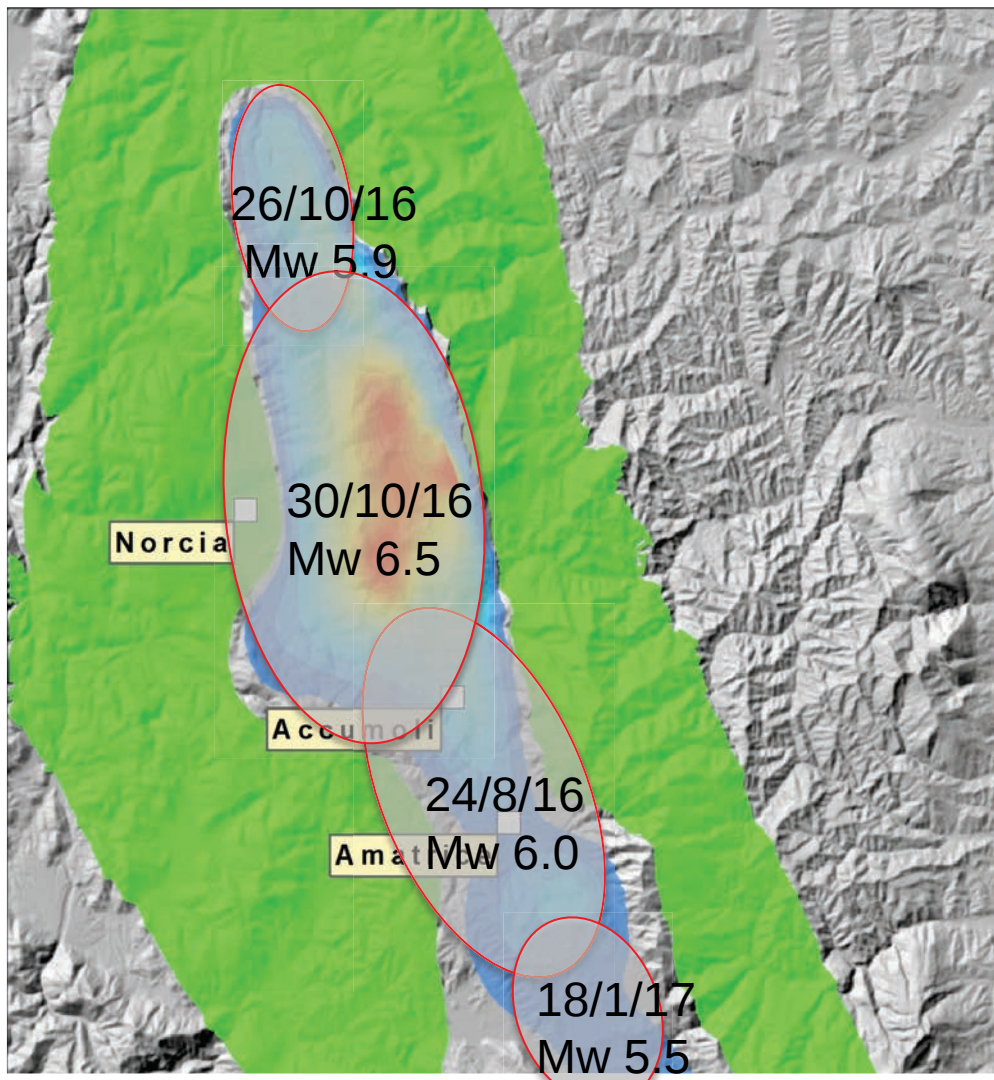
$$A \approx 7.5B$$



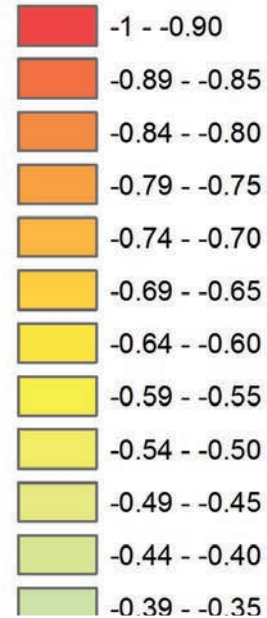


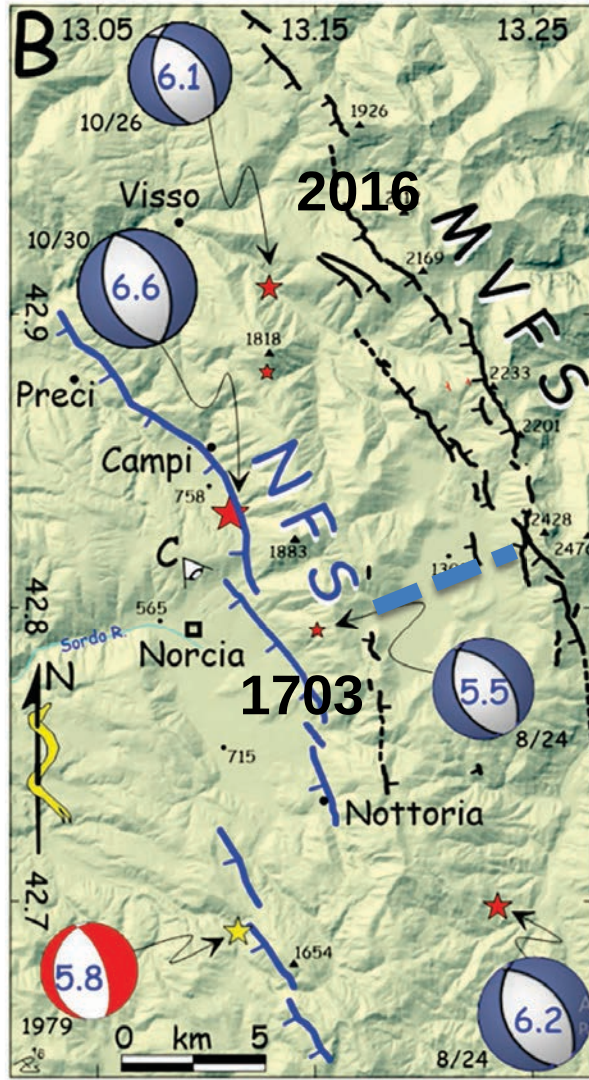
2016-2017
6000 km³

Vertical displacement m

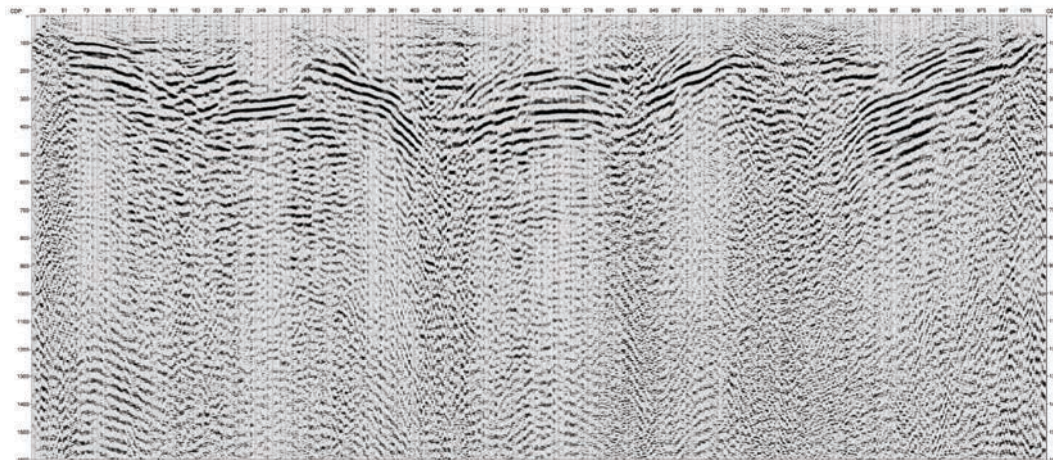


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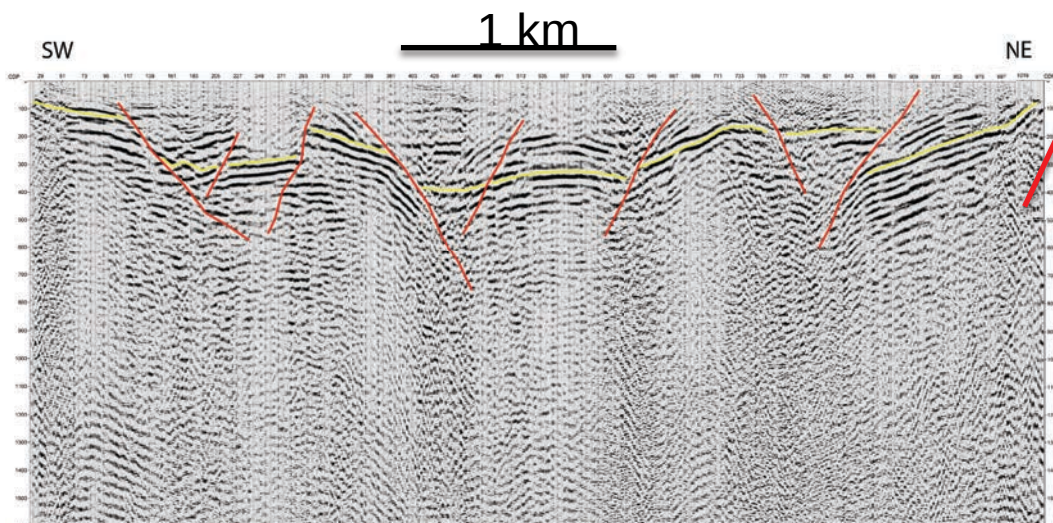




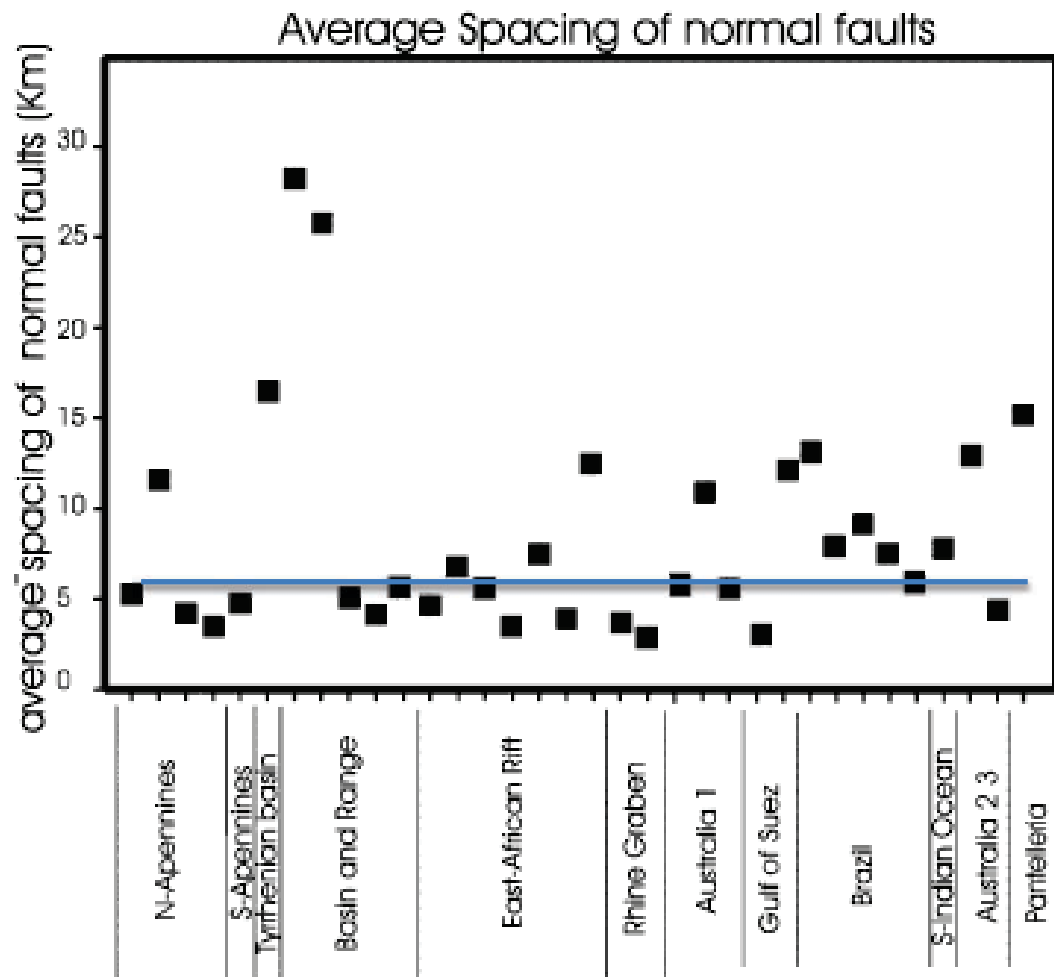
Galli et al. 2018
Tectonophysics



Mt. Vettore

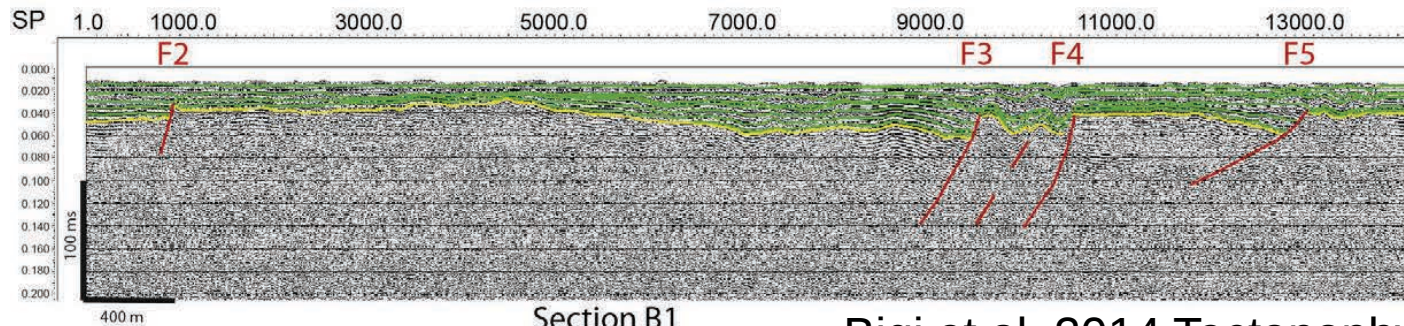
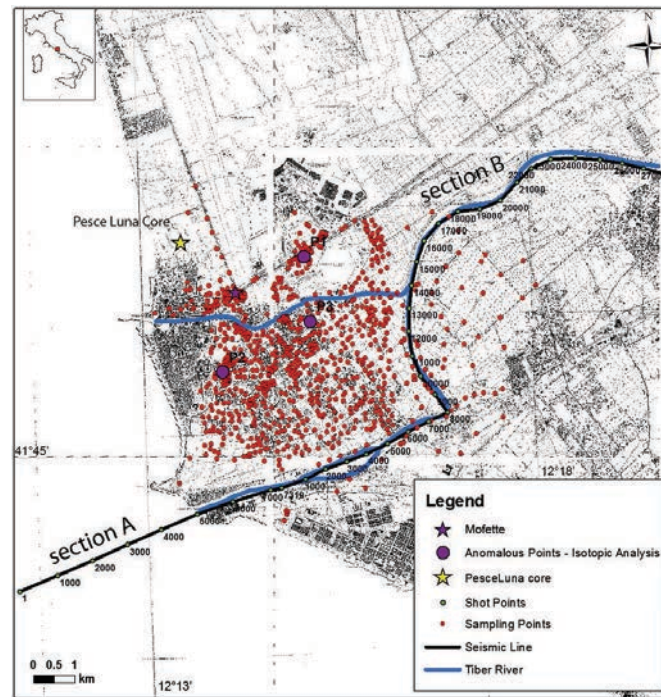






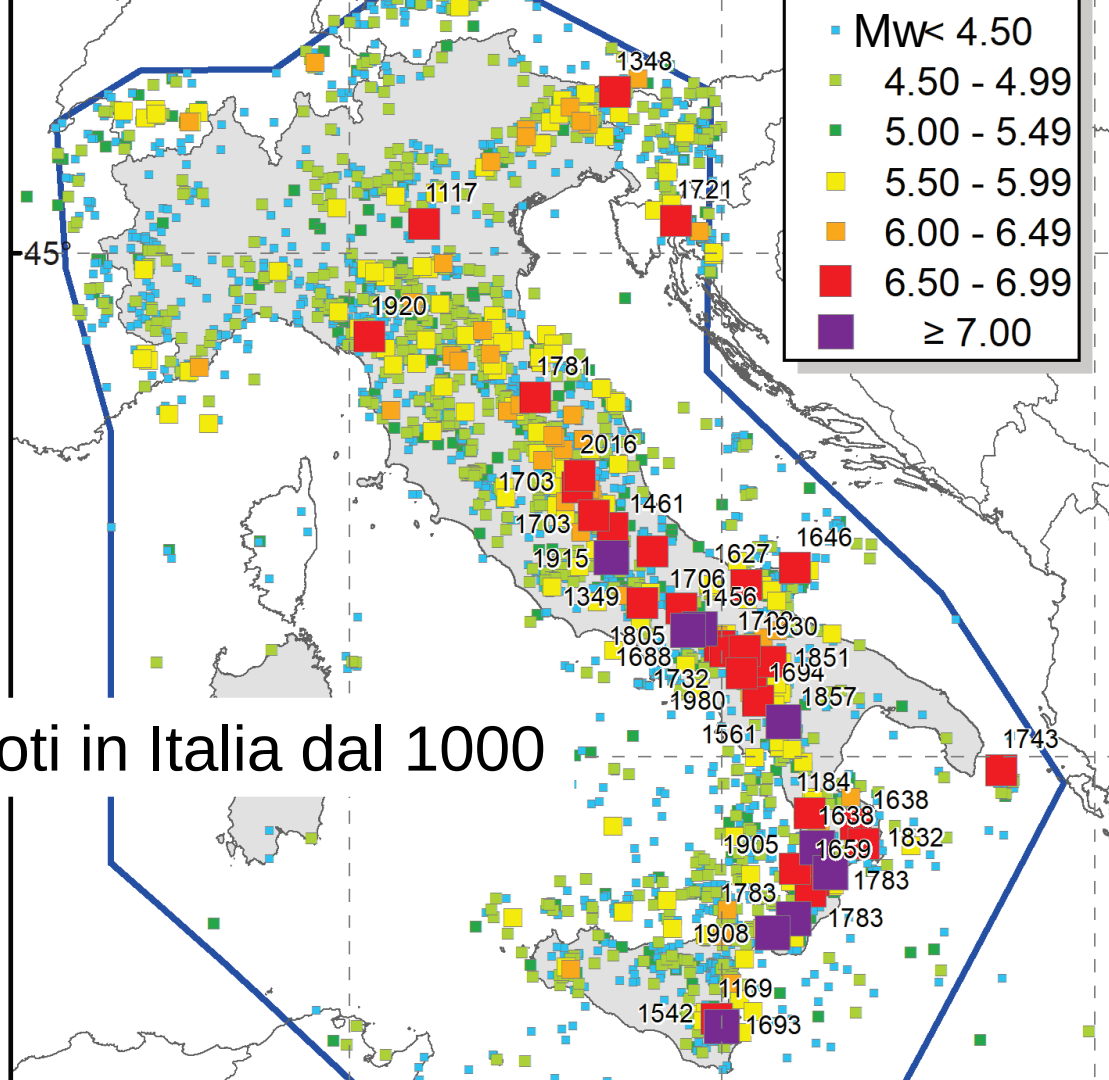






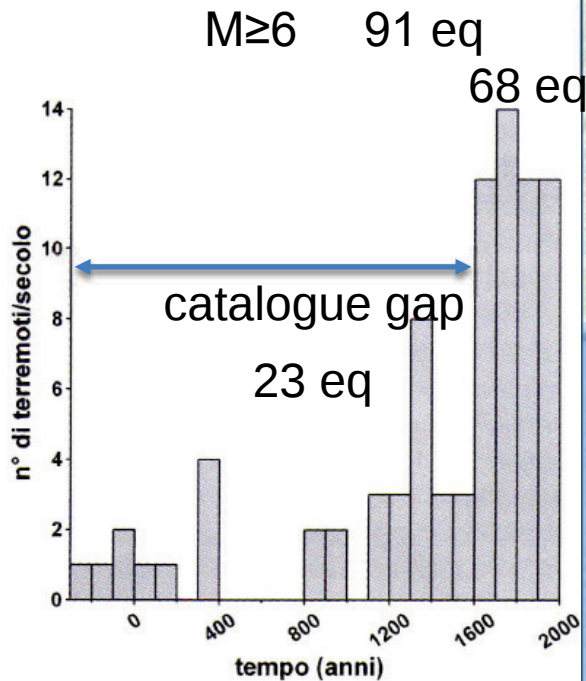


INGV

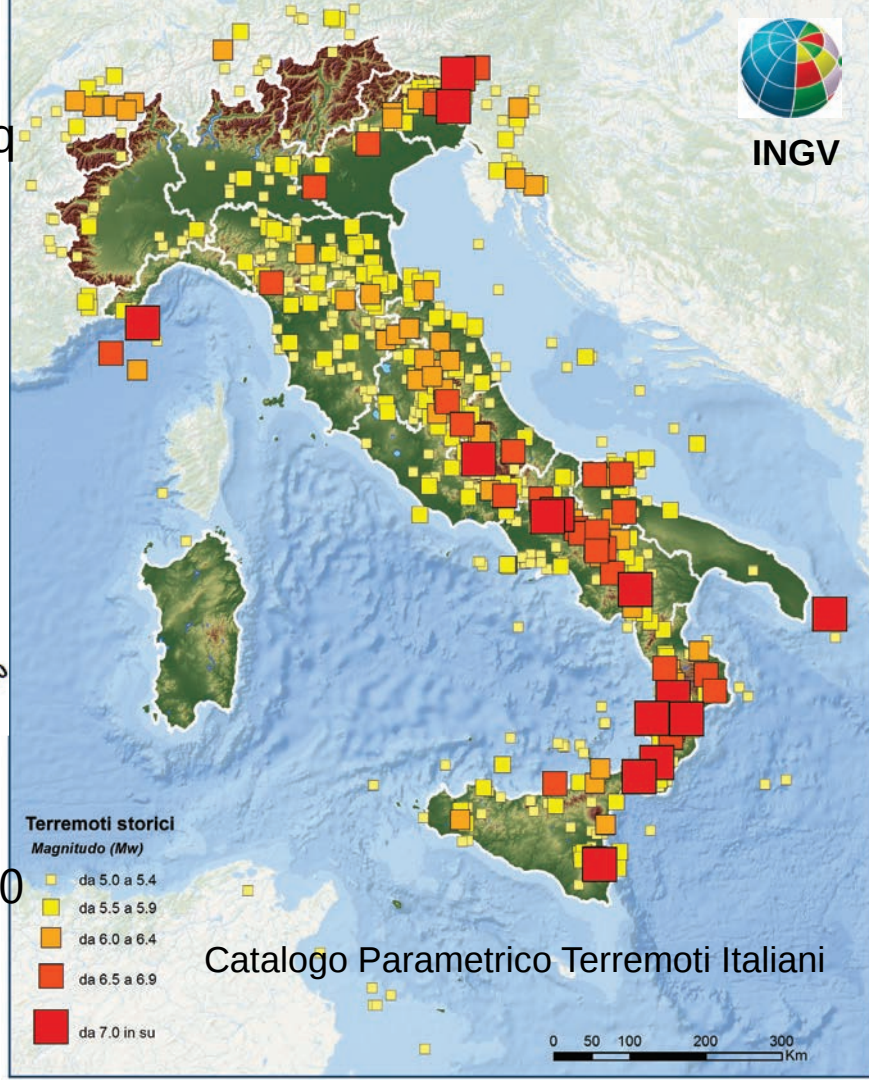


Terremoti in Italia dal 1000

CPTI



Should be about 170
80 eq missing



Terremoti dal 1000 al 2017

$\geq M5$ = 742

$\geq M6$ = 91

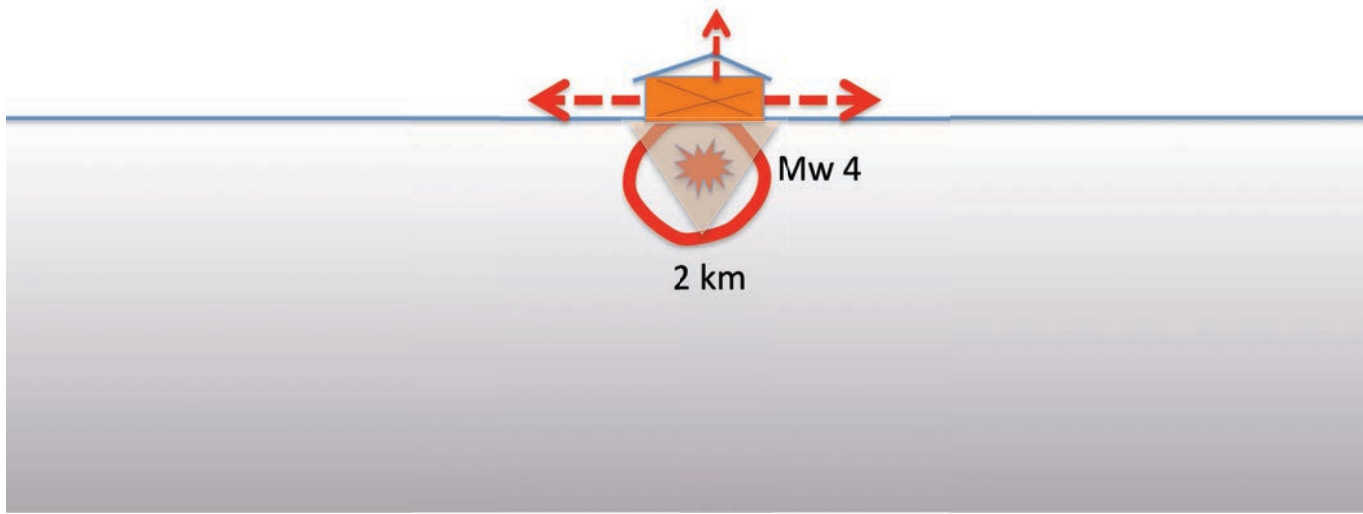
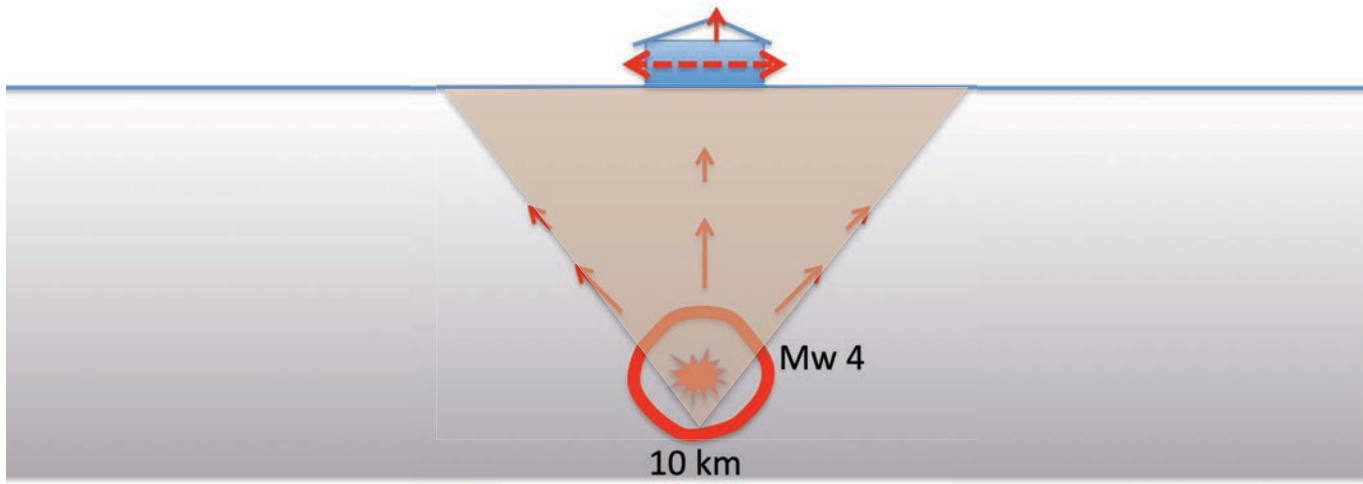
$\geq M 6.5$ = 39

Terremoti dal 1600 al 2017

$\geq M5 = 624$ = 1560 su 10 secoli

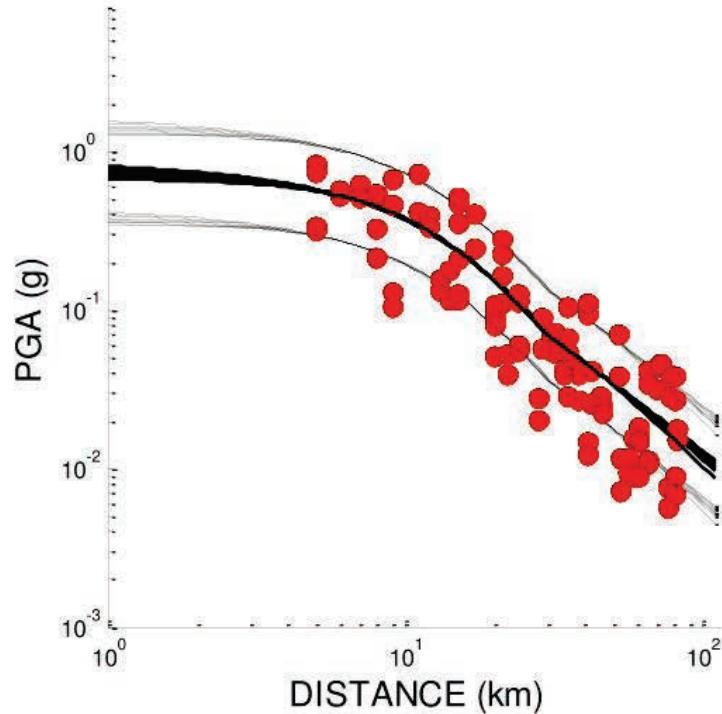
$\geq M6 = 68$ = 170 su 10 secoli

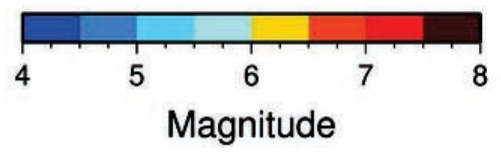
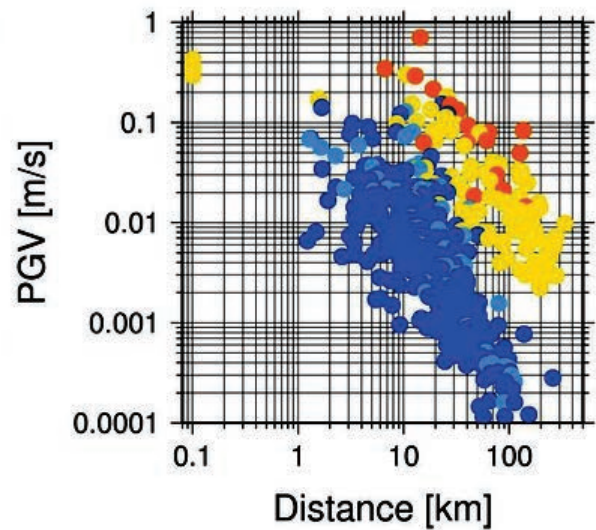
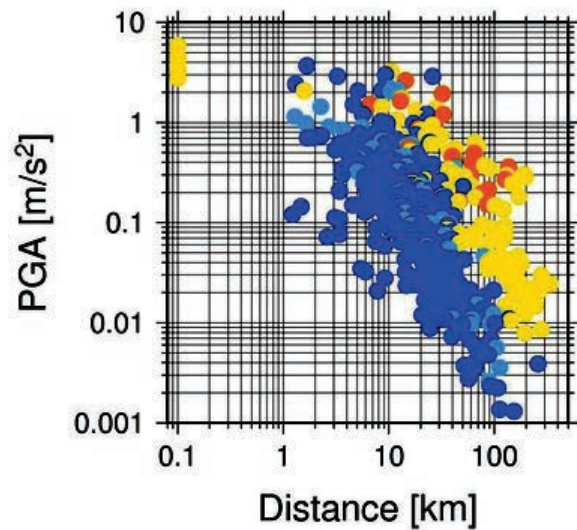
$\geq M 6.5 = 30$ = 75 su 10 secoli

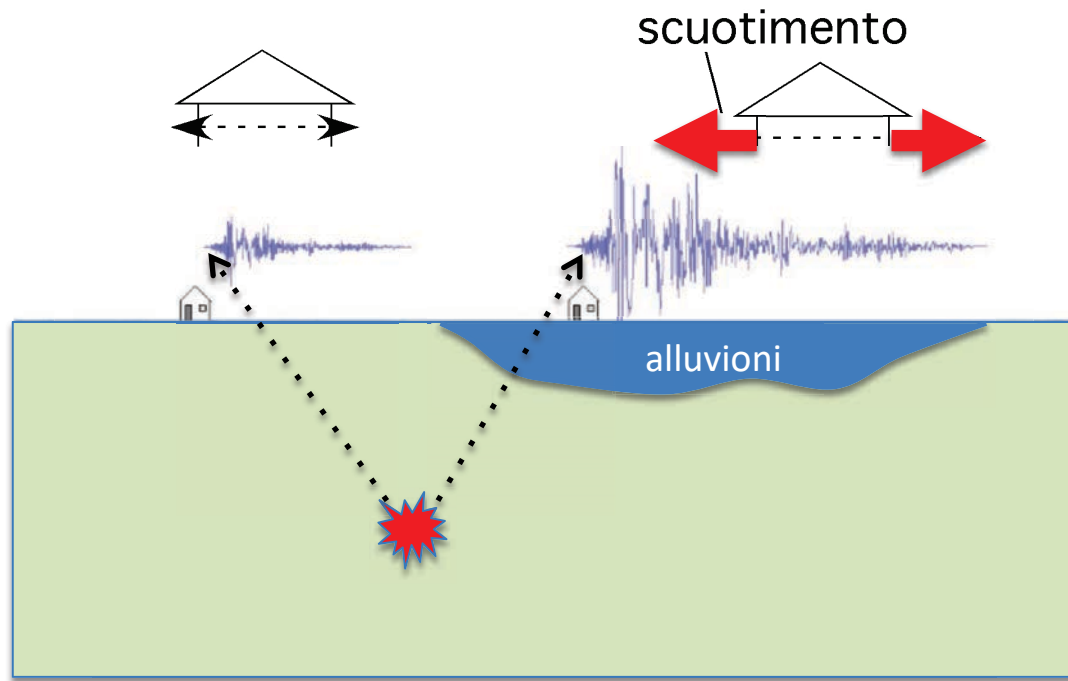




GMPE ($M_w 6.5$) with 50 – 90% cumul energy

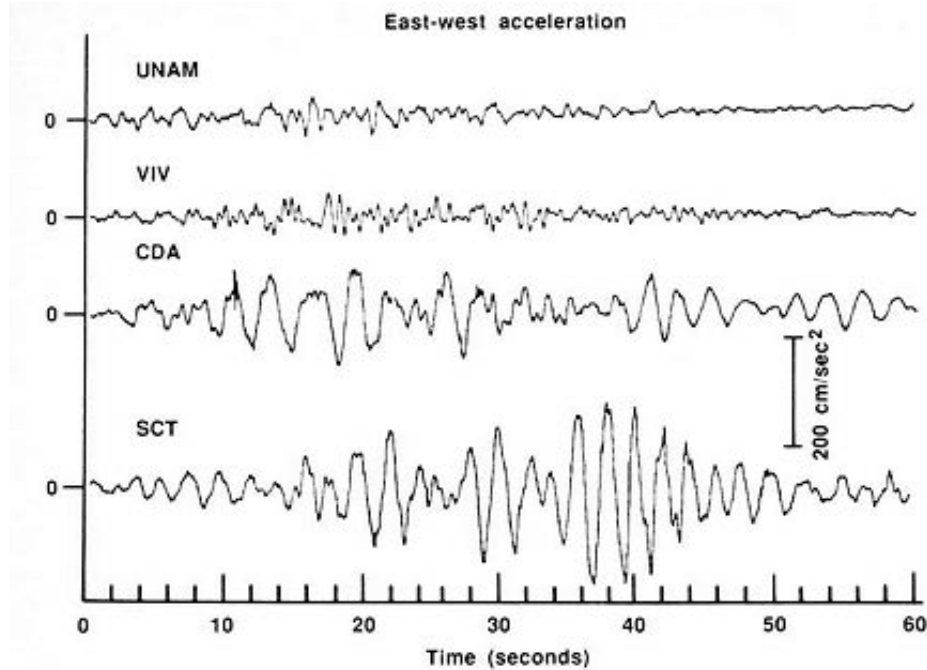






Strong-motion Records from Mexico City 1985

M 8 - 400 km dall'epicentro

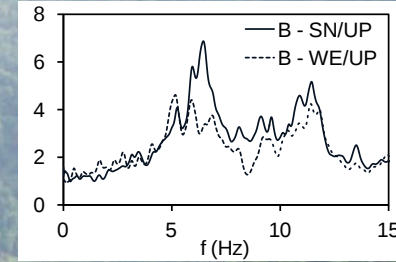
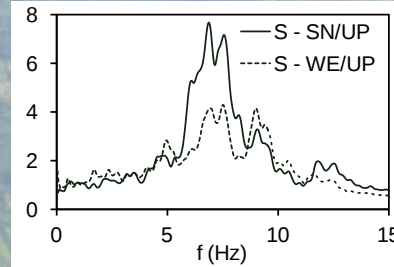
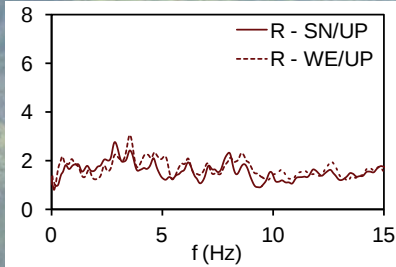


hard rock hills

old lake bed

Anderson et al., 1986

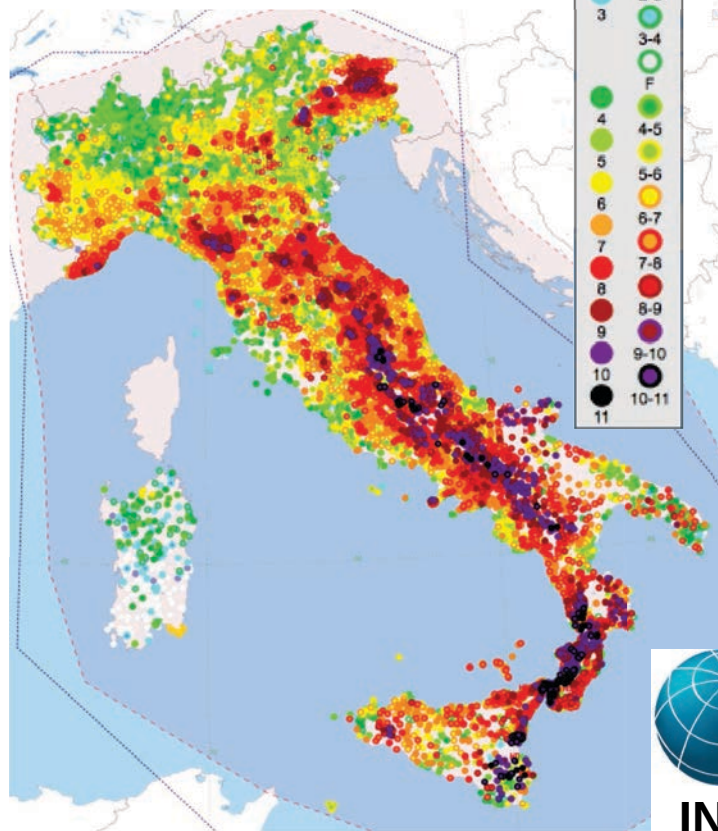
Risposta sismica locale



Ai 3 siti si hanno differenti risposte allo stesso evento sismico

Array velocimetrico a Belmonte Castello (FR): Receiver Functions di registrazioni di aftershocks del sisma dell'Aquila, 2009

Earthquakes after 1000 AD

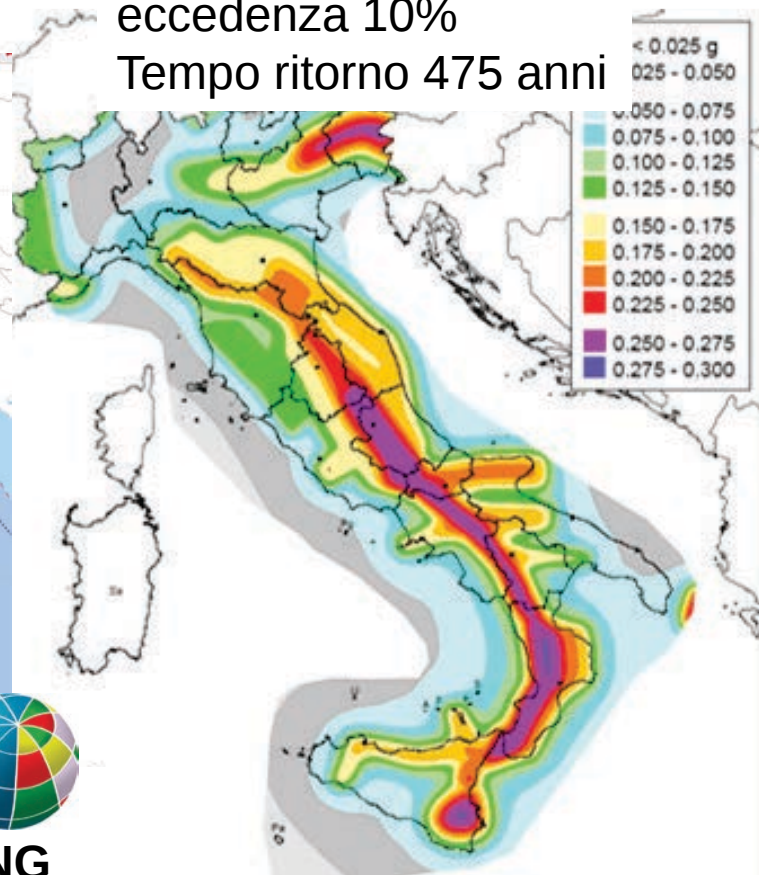


ING

50 anni

eccedenza 10%

Tempo ritorno 475 anni



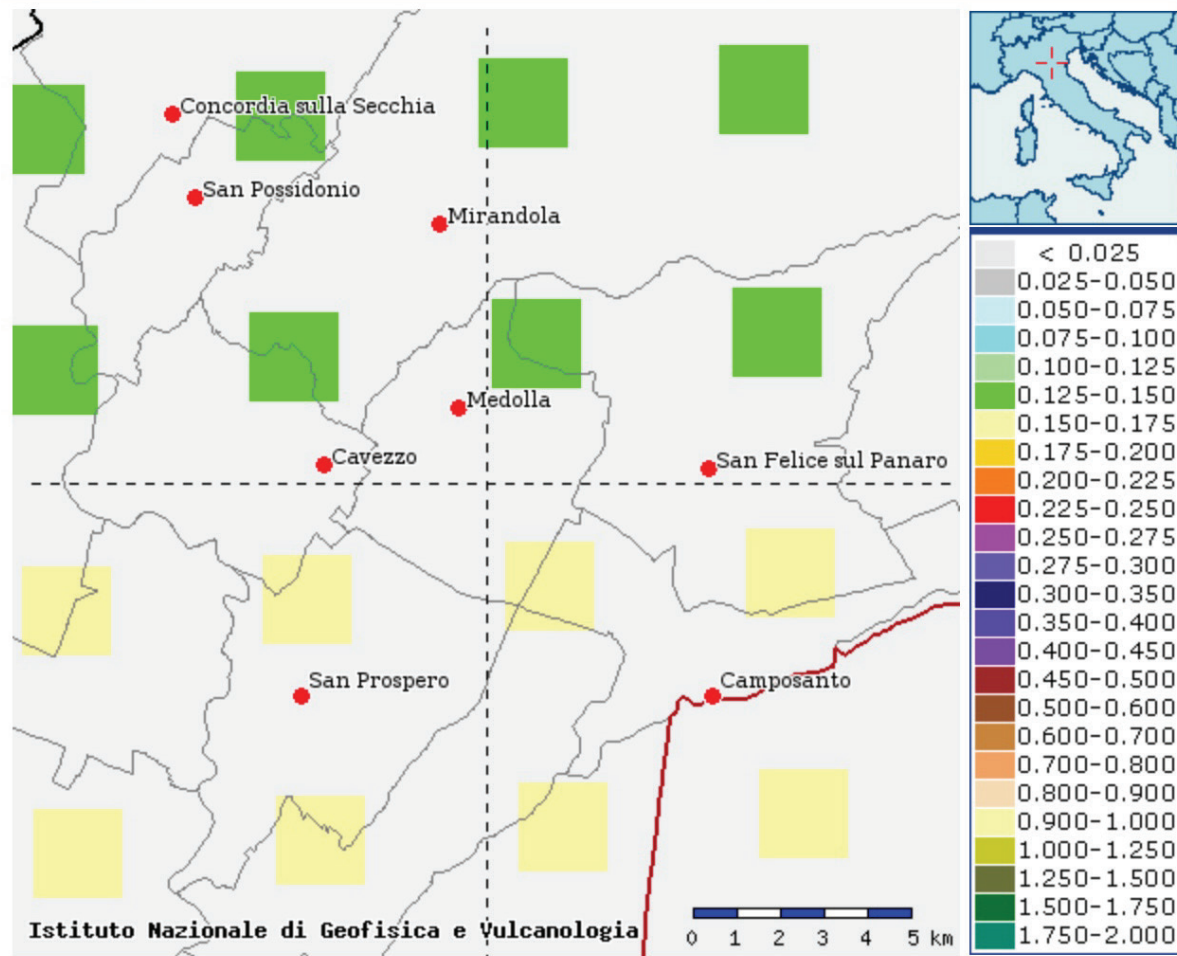
Catalogo Parametrico Terror

V

Carta

della Pericolosità Sismica

Mappe interattive di pericolosità

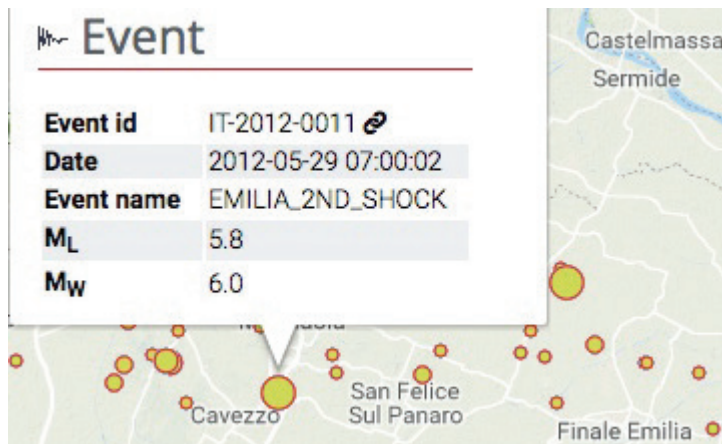


GROUND MOTION



	Località	SOIL CLASS	repi [km]	mean value		comp.	PGA [g]	DS-95 (s)	IH (cm)	Tm (s)	comp.	PGA [g]	DS-95 (s)	IH (cm)	Tm (s)
				PGA [g]											
RNG	SSU Sassuolo	A*	56	0.020	WE	0.0223	29.47	7.7	0.56	NS	0.0175	30.3	7.2	0.542	
	TGG Tregnago	A*	75	0.007	WE	0.0091	17.45	0.9	0.152	NS	0.006	25.51	0.8	0.195	
	PVF Pavullo del Frignano	A*	71	0.004	WE	0.0029	68.17	3.8	1.488	NS	0.0051	23.59	4.2	1.419	
	SMP San Marcello Pistoies	A*	98	0.005	WE	0.0041	24.61	2	0.568	NS	0.0052	19.55	2.9	0.752	
	MDG Modigliana	A*	93	0.010	WE	0.0093	16.79	1.8	0.33	NS	0.011	18.02	2.1	0.353	
	MDT Modigliana (Trevbio)	A*	97	0.009	WE	0.009	25.78	3.9	0.613	NS	0.0082	19.53	3.9	0.54	
	MRR Marradi	A*	97	0.007	WE	0.0064	20.96	1.6	0.319	NS	0.0073	18.46	1.6	0.345	
	BSZ Borgo San Lorenzo	A*	98	0.002	WE	0.0016	35.5	0.8	0.839	NS	0.0019	19.49	0.7	0.535	
	ISD Isola Della Scala	B*	49	0.015	WE	0.0136	36.75	7.8	0.633	NS	0.0167	50.4	10	0.836	
	MRZ Marzabotto	B*	60	0.003	WE	0.0033	16.7	1.1	0.452	NS	0.0036	36.62	1.6	0.569	
	BRH Brisighella	B*	87	0.013	WE	0.0139	32.09	5	0.518	NS	0.0116	35.69	4.5	0.574	
	GAI Gaiolo	B*	99	0.018	WE	0.0244	16.03	3.2	0.288	NS	0.014	19.97	2.1	0.261	
	CSP Castel San Pietro Terme	B*	64	0.014	WE	0.0118	36	8.7	1.233	NS	0.0176	42.26	15.6	1.346	
	PTV Pontevico	B*	100	0.011	WE	0.0098	13.26	4.7	0.539	NS	0.0114	38.53	5.8	0.75	
	MRN Mirandola	C*	17	0.285	WE	0.2836	5.26	101.4	0.462	NS	0.2872	5.93	155.5	0.667	
	ZPP Zola Predosa Piana	C*	42	0.019	WE	0.0154	39.57	11.9	0.93	NS	0.023	22.21	20.3	1.016	
	MNS Monselice	C*	57	0.018	WE	0.0183	12.67	1.8	0.176	NS	0.0173	14.97	1.9	0.179	
	CPC Copparo Cuccanile	C*	52	0.029	WE	0.0235	35.6	16.7	0.959	NS	0.0354	26.07	22.8	0.925	
INGV	ALF Alfonsine	C*	78	0.028	WE	0.0307	15.82	14.5	0.775	NS	0.0257	53.42	12.8	0.936	
	SRP Sorbolo	C*	63	0.033	WE	0.0426	13.84	13.9	0.593	NS	0.0253	25.32	9.4	0.561	
	MDC Medicina	C*	56	0.030	WE	0.0239	22.1	12.7	0.839	NS	0.0381	24.92	18.3	0.799	
	PAR Parma	C*	76	0.007	WE	0.0074	25.96	4.6	0.726	NS	0.0059	25.73	3.6	0.697	
	MDN Modena	C	40	0.037	WE	0.0407	24.71	19.4	0.665	NS	0.034	31.01	14.9	0.653	
	NVL Novellara	C	41	0.049	WE	0.0478	14.2	10.2	0.35	NS	0.0508	11.49	9.4	0.334	
	FRE1 Firenzuola	C	87	0.008	WE	0.0089	27.44	2.4	0.467	NS	0.0068	23.87	3.4	0.587	
	ARG Argenta	D	56	0.021	WE	0.0246	20.48	13.5	0.848	NS	0.0174	31.43	10.1	0.852	
	BRIS BRISIGHELLA	A*	85.4	0.008	WE	0.0113	49.95	5.5	1.153	NS	0.0063	55.94	6.1	1.209	
	SFI ZOCCA	A*	63.2	0.005	WE	0.004	26.52	3.3	0.93	NS	0.0053	81.02	4.9	1.355	
	ZEN8 SAN ZENO DI MONT.	A*	92.1	0.007	WE	0.0069	21.58	0.9	0.246	NS	0.0075	14.16	1.7	0.322	
	ZOVE ZOVIENEDO	A*	65.9	0.016	WE	0.0156	16.44	1.3	0.177	NS	0.0167	17.42	1.6	0.202	
	BOI FAENZA	C*	84.4	0.033	WE	0.0114	79.53	7.6	1.569	NS	0.0155	103.55	10	1.378	
	FIR IMOLA	C*	71.7	0.015	WE	0.014	53.18	7.5	1.367	NS	0.0157	72.72	9	1.651	
	MRTV MARITTOVA	C*	45.5	0.021	WE	0.0196	54.14	15.2	0.972	NS	0.0217	45.05	16	0.844	
	FIR NOVI DI MODENA	C*	36.6	0.035	WE	0.0299	40.94	16.9	0.893	NS	0.0421	8.31	17.9	0.731	
	OPPE OPPEANO	C*	46.6	0.017	WE	0.0174	38.05	3.7	0.379	NS	0.0175	68.24	4.7	0.538	
	SANR SANDRIGO	C*	88.6	0.024	WE	0.0238	23.24	2.7	0.215	NS	0.0238	25.29	3.6	0.244	
	TREG TREGNAGO	C*	70.5	0.013	WE	0.0083	24.1	1	0.181	NS	0.0194	22.59	1.5	0.218	

Subsoil classification type C at Mirandola. Soil amplification factor $S_s = 1.2-1.5$ given by Italian Code 2008. Expected maximum acceleration $0.150 \times 1.5 = 0.225g$. Maximum recorded horizontal acceleration at Mirandola = $0.2872g$ for the May 20 earthquake.

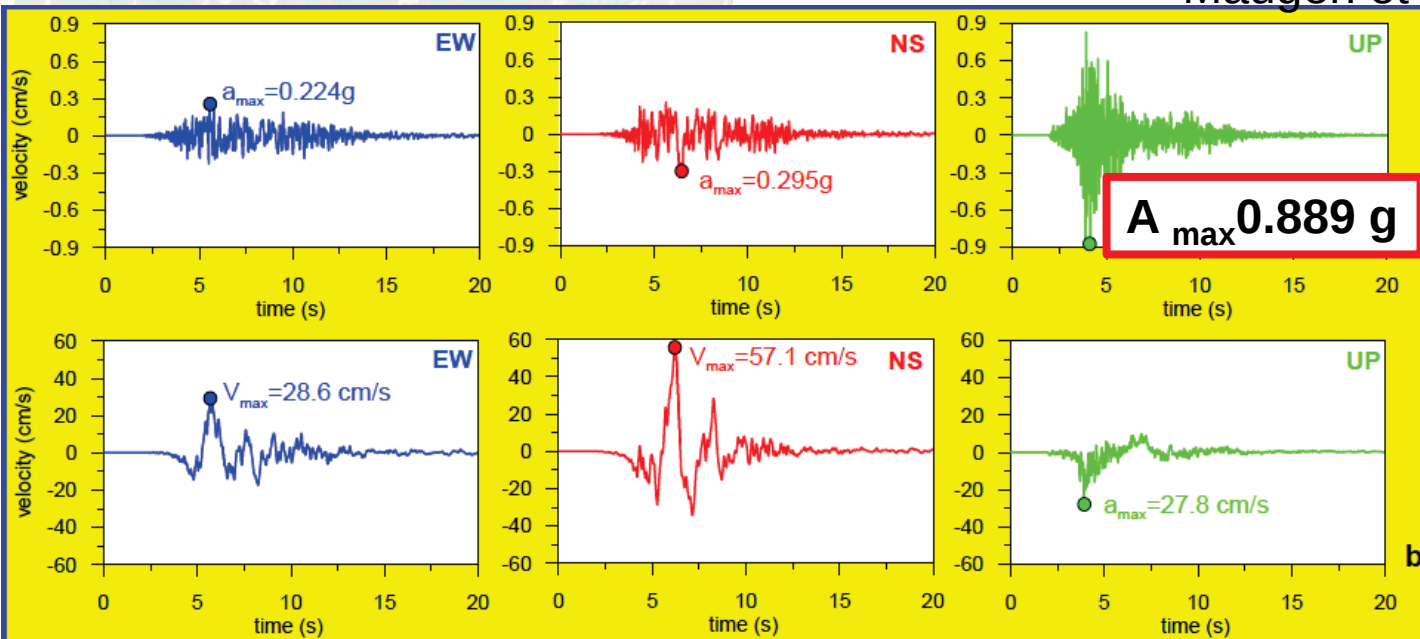


Mirandola station 29 May 2012

Stazione RAN su suolo C

Amplificazione $1.125 \times 1.5 = (0.18-0.20)$

Maugeri et al.



Station	Date	<i>PGA</i> (cm/s²)	<i>PGV</i> (cm/s)
AMT	2016/08/24	851.2	45.18
CLO	2016/10/30	590.5	69.58
CNE	2016/10/30	487.2	41.66
FCC	2016/10/30	938.5	81.76
IV.T1213	2016/10/30	883.5	62.03
IV.T1214	2016/10/30	623.7	56.24

NORCIA - 30/10/2016		
	Misurata [cm/s ²]	NTC 2008 - SLV [cm/s ²]
Componente orizzontale	850	459
Componente verticale	869	212

AMATRICE - 24/08/2016		
	Misurata [cm/s ²]	0.225-0.250 NTC 2008 - SLV [cm/s ²]
Componente orizzontale	851	461
Componente verticale	391	213

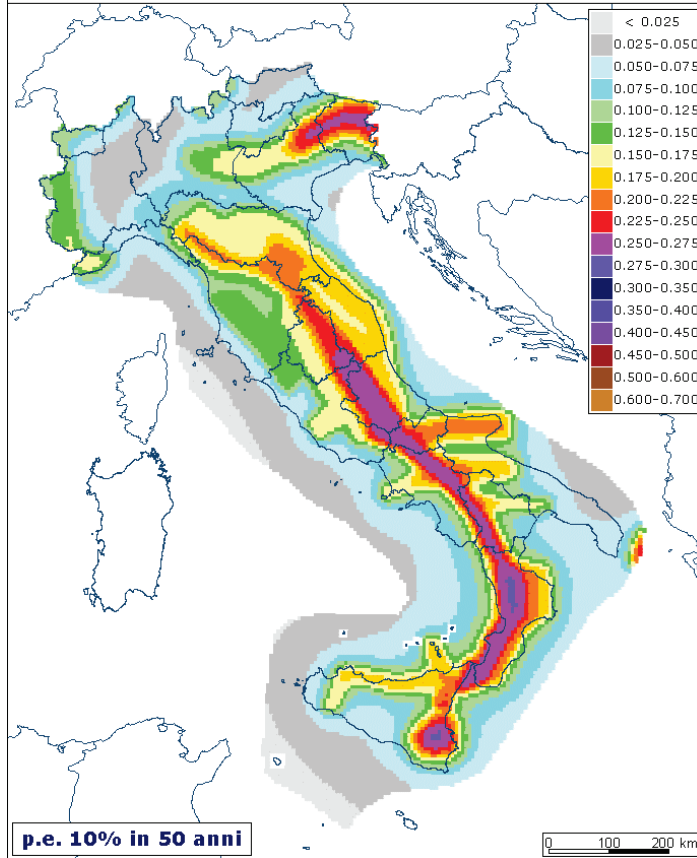
L'AQUILA - 06/04/2009		
	Misurata [cm/s ²]	NTC 2008 - SLV [cm/s ²]
Componente orizzontale	644	462
Componente verticale	487	215



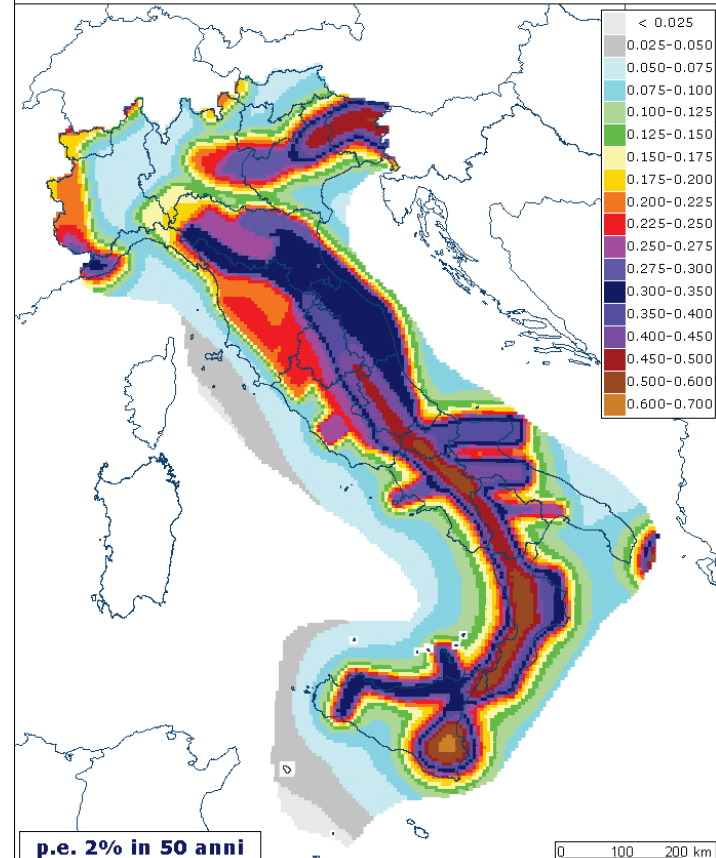
INGV



ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA



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PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

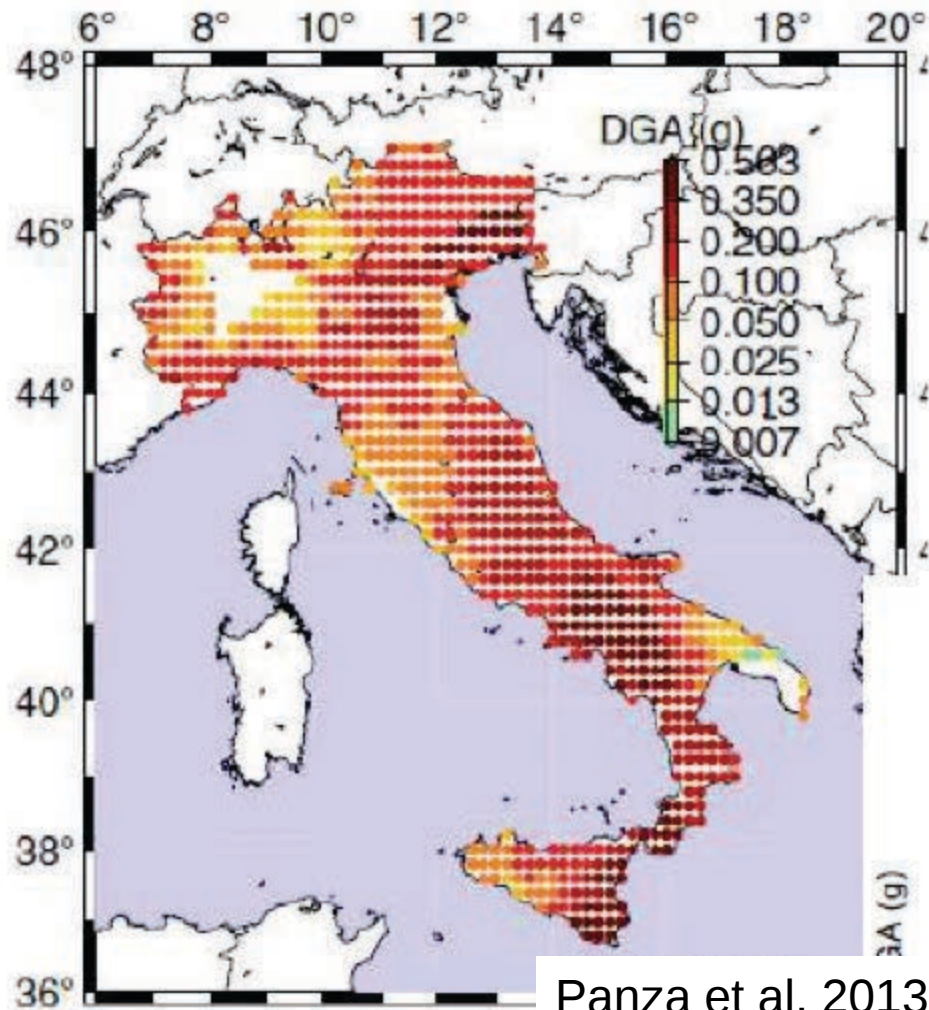


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Panza et al. 2013