

7th EUREGEO

Bologna | Italy | June 12th - 15th 2012

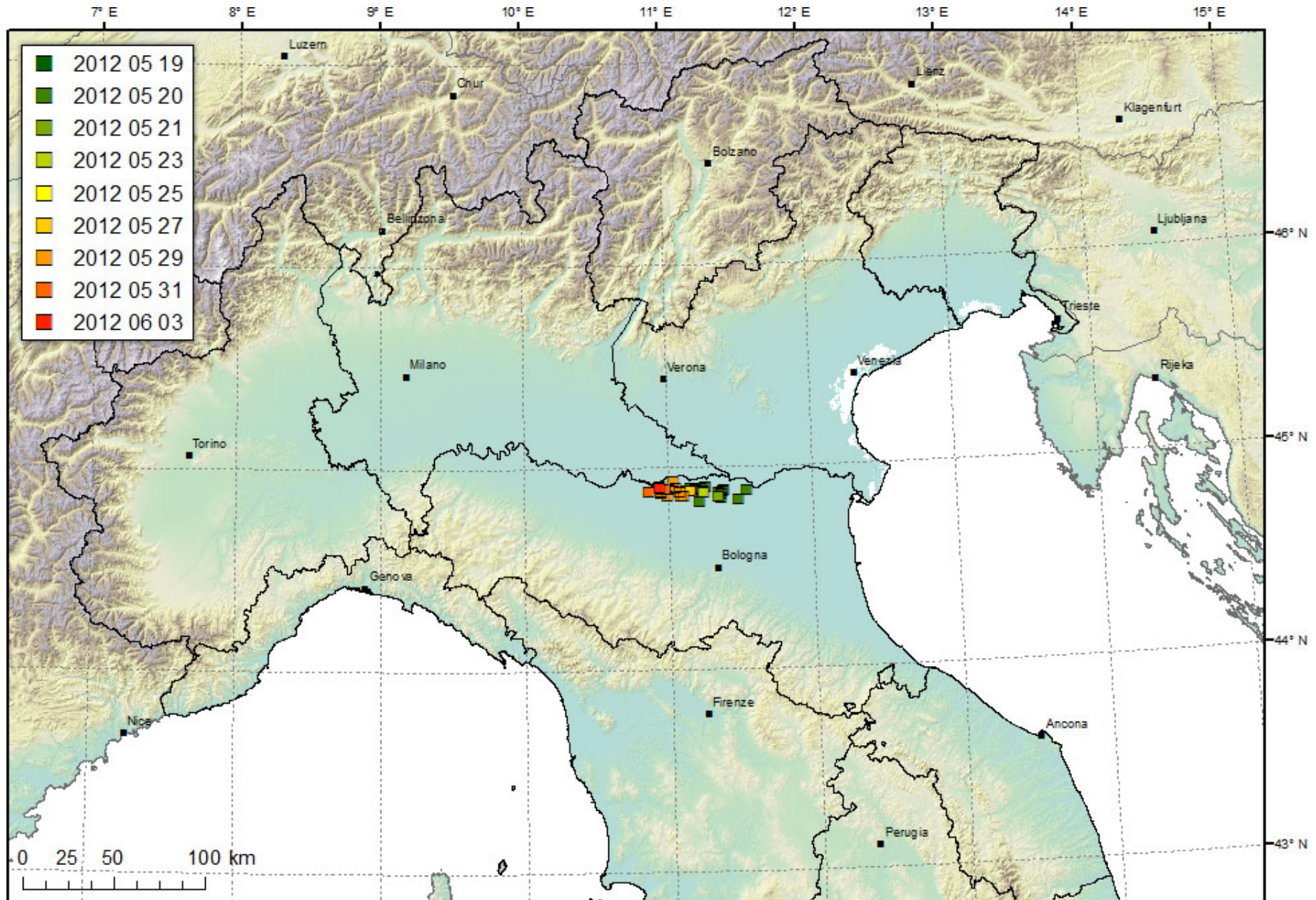
The building up process of a macroseismic intensity database

M. Locati and D. Viganò

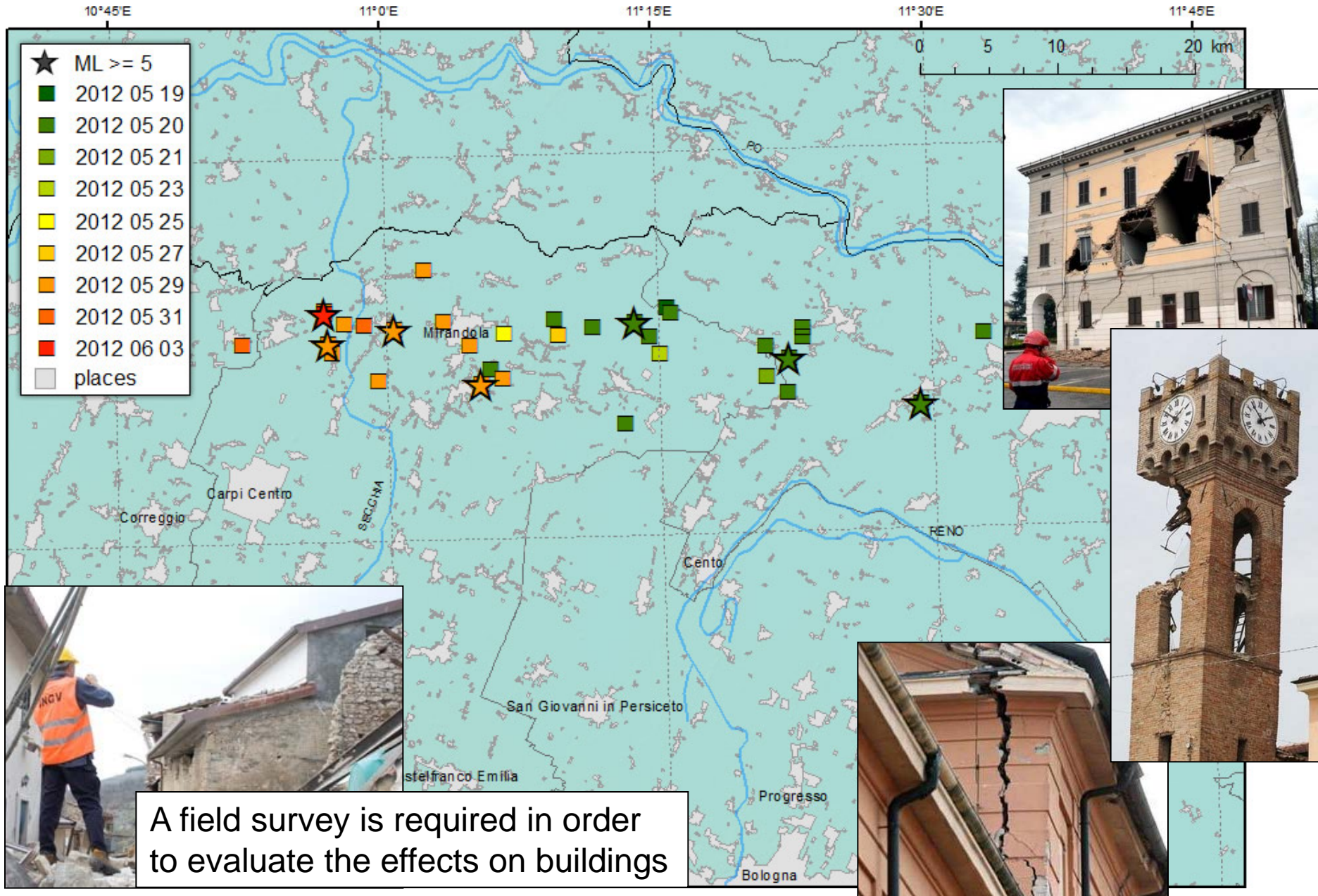


INGV Milano

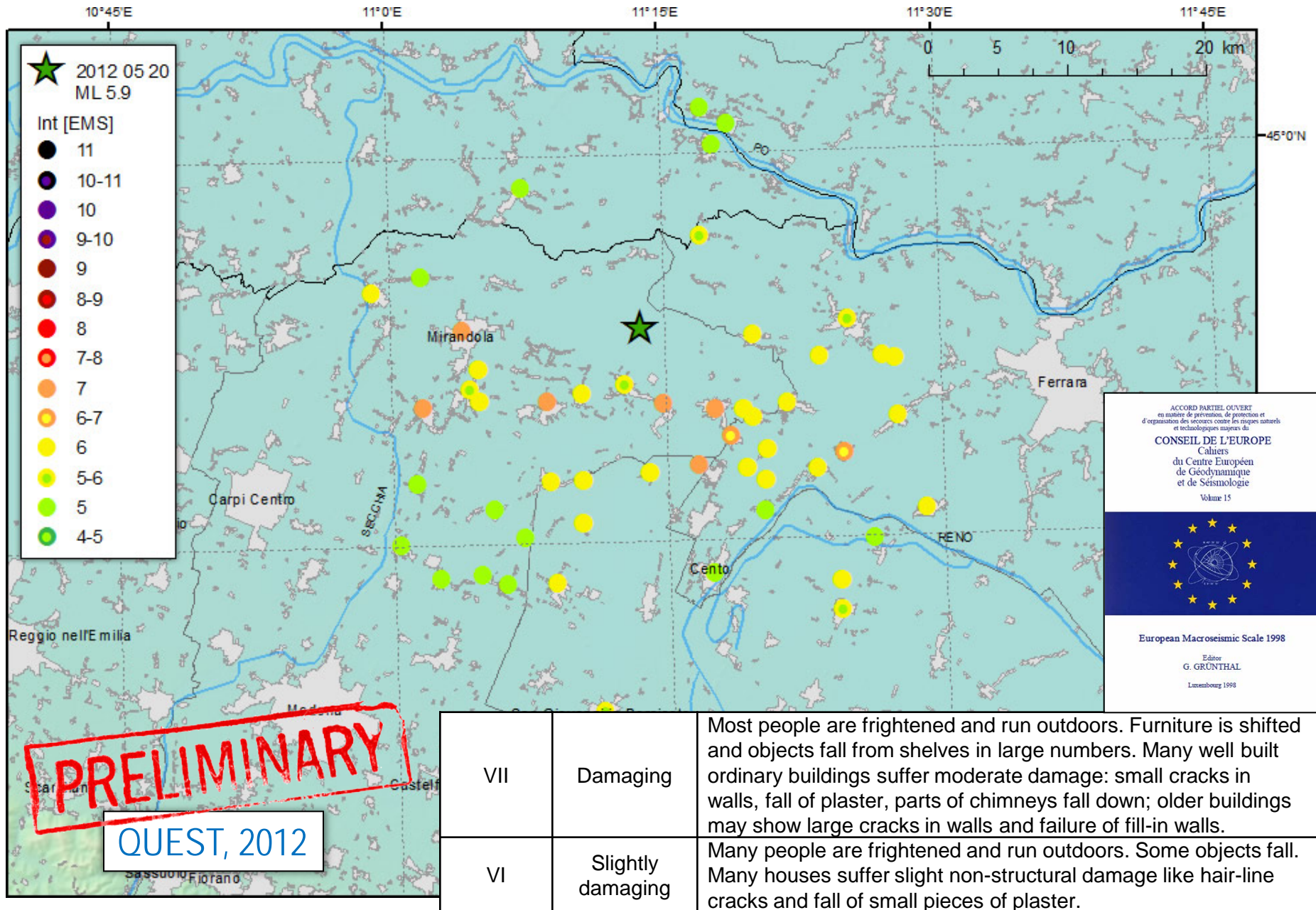
When an earthquake occurs we usually see the map of epicentres



How do we assess the macroseismic intensity?



Macroseismic Data Point (MDP) map of the 20th May 2012



Macroseismic Data Point (MDP) map of the 15th October 1996

[DBMI11 homepage](#)
[Presentazione](#)
[Consultazione per località](#)
[Mappa dei terremoti](#)

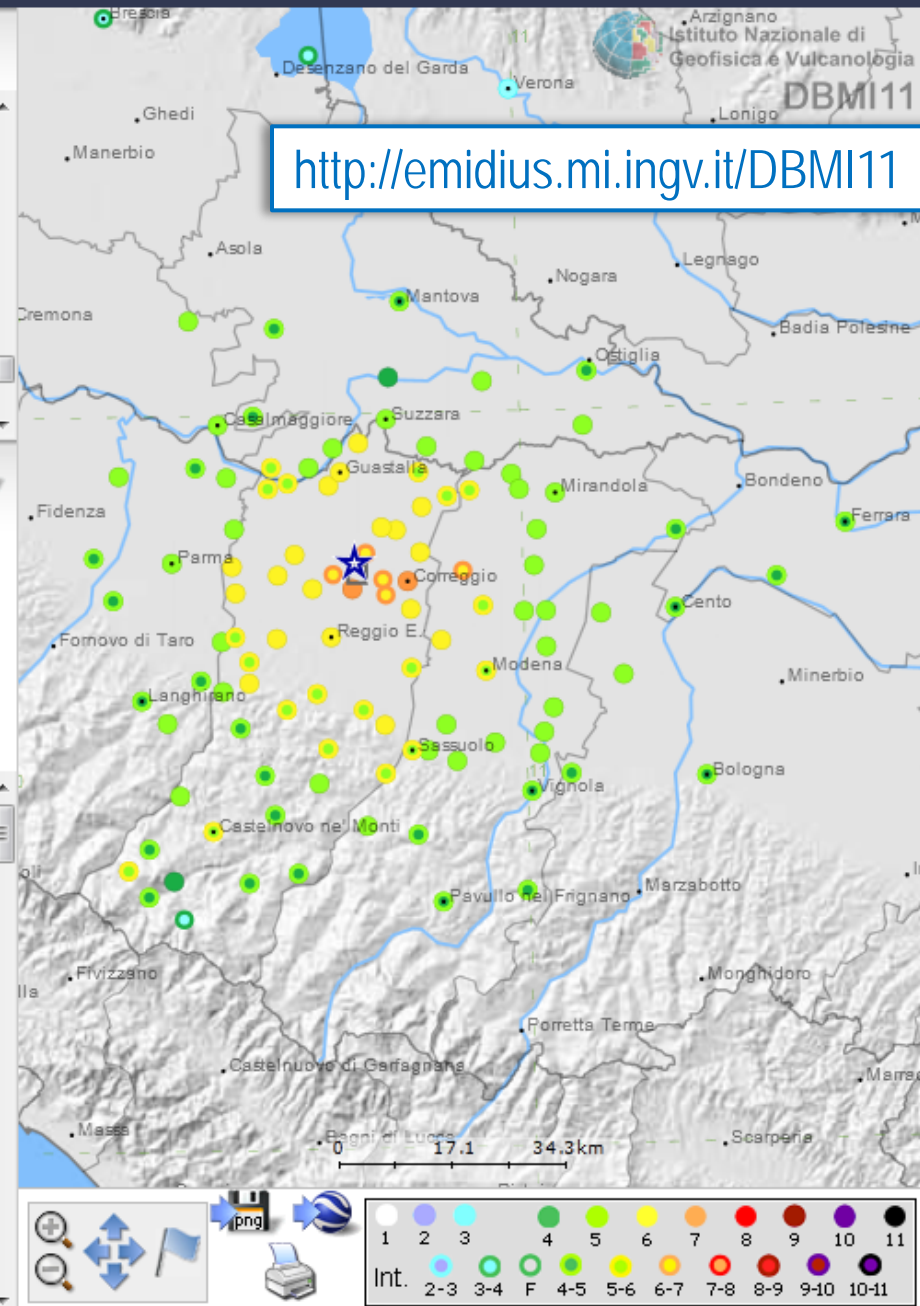
Seleziona il terremoto facendo click sulla data.

Data	Ax	Np	Io	Mw
1995 11 21 04:04	Torinese	64	5-6	4.46 ±0.15
1996 02 27 11:13	Barcis	150	5	4.48 ±0.11
1996 04 03 13:04	Irpinia	557	6	4.93 ±0.09
1996 04 13 13:00	CLAUT-BARCIS	164	5-6	4.62 ±0.10
1996 04 27 00:38	Cosentino	123	6-7	4.86 ±0.11
1996 10 15 09:56	Correggio	135	7	5.41 ±0.09
1996 12 02 13:01	C.DA LUMINARIA	42	6	3.71 ±0.26
1997 03 19 23:10	Matese	284	6	4.55 ±0.09
1997 05 12 13:50	MASSA MARTANA	57	6	4.79 ±0.17
1997 05 12 22:13	Reggiano	56	4-5	4.22 ±0.27
1997 06 09 14:10	Vibonese	69	6	4.47 ±0.14
1997 07 08 08:13	Cosentino	52	5	4.31 ±0.18
1997 07 15 08:51	Appennino umbro-marchigiano	22	4-5	3.69 ±0.21

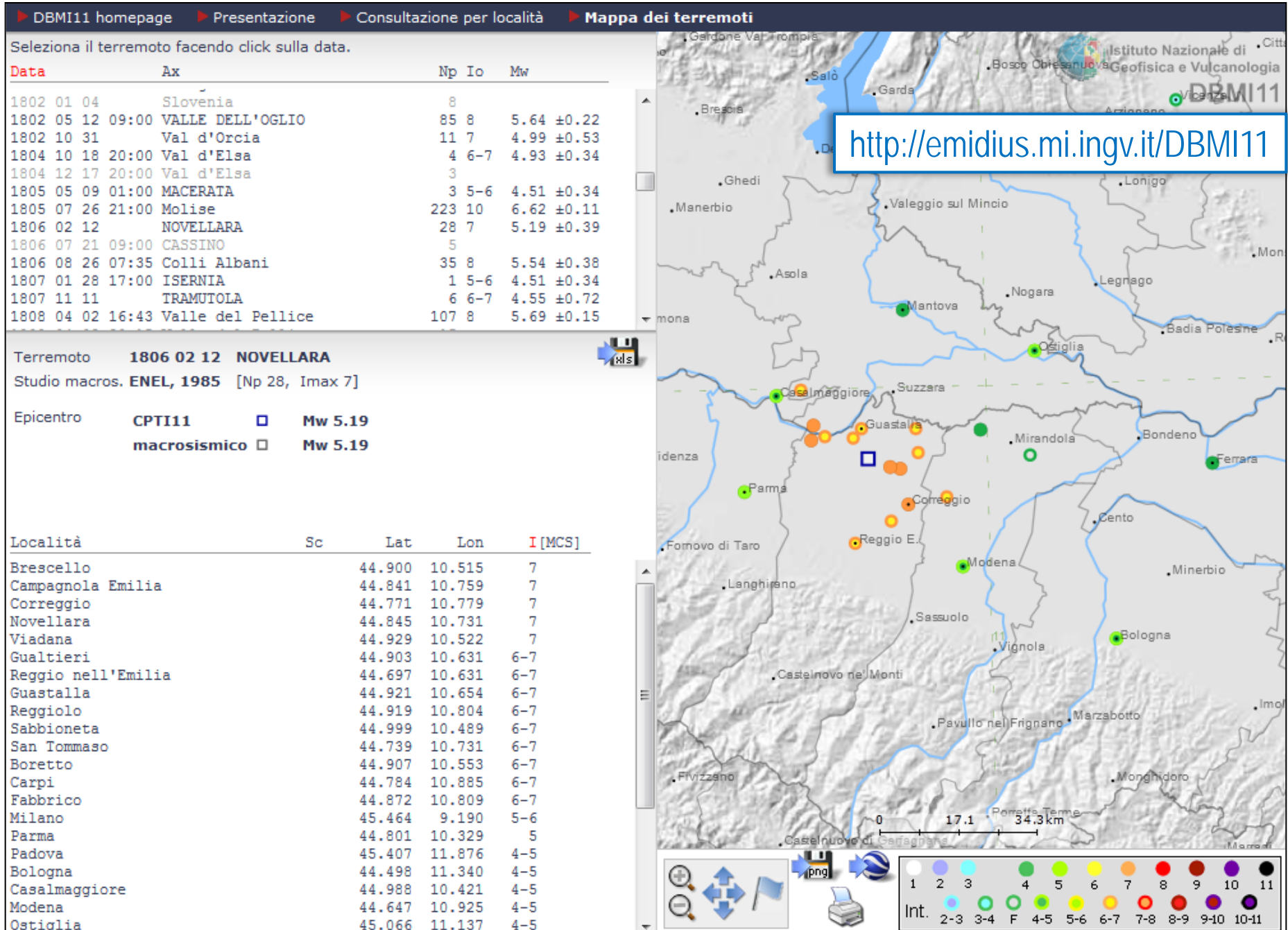
Terremoto **1996 10 15 09:56:02 Correggio**
 Studio macros. **Camassi et al., 1996** [Np 135, Imax 7]

Epicentro **CPTI11** ★ **Mw 5.41**
macro-sismico □ **Mw 5.18**
strumentale ☆ **Mw 5.41**

Località	Sc	Lat	Lon	I [MCS]
Bagnolo in Piano		44.762	10.673	7
Correggio		44.771	10.779	7
Argine		44.782	10.637	6-7
Budrio		44.753	10.737	6-7
Carpi		44.784	10.885	6-7
Fosdondo		44.774	10.732	6-7
Santa Maria della Fossa		44.810	10.700	6-7
Campagnola Emilia		44.841	10.759	6
Quattro Castella		44.636	10.473	6
Campogalliano		44.690	10.841	6
Campegine		44.782	10.531	6
Casalgrande		44.576	10.730	6
Reggio nell'Emilia		44.697	10.631	6
Rio Saliceto		44.810	10.804	6
Castelnovo di Sotto		44.810	10.564	6
Cavriago		44.696	10.527	6
San Martino in Rio		44.733	10.784	6
Sant'Ilario d'Enza		44.759	10.450	6
Fabbrico		44.872	10.809	6
Gattatico		44.795	10.444	6
Gualtieri		44.903	10.631	6



Macroseismic Data Point (MDP) map of the 12th February 1806



Macroseismic Data Point (MDP) map of the 19th March 1624

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[Presentazione](#)
[Consultazione per località](#)
[Mappa dei terremoti](#)

Seleziona il terremoto facendo click sulla data.

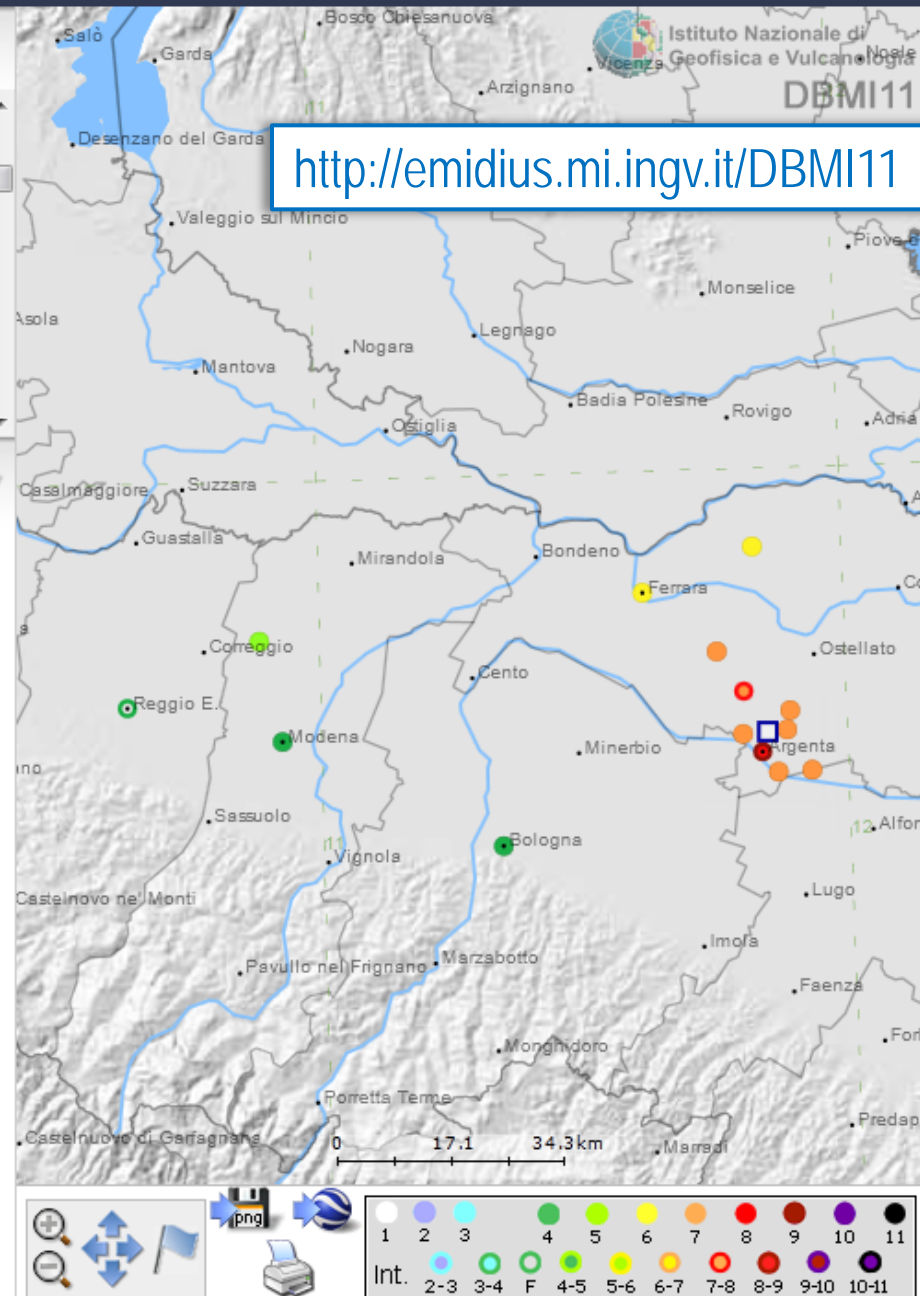
Data	Ax	Np	Io	Mw
1612 10 14	ROSSAIO DI VICO	1	1	3.00 ±1.02
1613 08 25 05:00	Naso	2	8	5.57 ±0.34
1614 08	PERUGIA	1	6-7	4.93 ±0.34
1621 08 09	CALABRIA	1		
1622 05 05 11:00	Slovenia	3	7-8	5.35 ±0.34
1624 03 19 19:45	Argenta	18	7-8	5.47 ±0.49
1624 10 03 17:00	Mineo	4	8	5.57 ±0.34
1625 09	Venosa	1	8-9	5.78 ±0.34
1625 12 05	RIMINI	1	6	4.72 ±0.34
1626 04 04 12:45	Girifalco	7	9	6.03 ±0.82
1627 07	ACCUMOLI	1	7-8	5.35 ±0.34
1627 07 30 10:50	Gargano	65	10	6.66 ±0.20
1627 07 30 11:05	San Severo	1		
1627 08 07 16:40	Gargano	5		

Terremoto **1624 03 19 19:45 Argenta**

Studio macros. **Guidoboni et al., 2007** [Np 18, I_{max} 8-9]

Epicentro **CPTI11** **Mw 5.47**
macro-sismico **Mw 5.47**

Località	Sc	Lat	Lon	I [MCS]
Argenta		44.615	11.837	8-9
Portomaggiore		44.698	11.805	7-8
Bando		44.644	11.885	7
Belriguardo		44.753	11.756	7
Boccaleone		44.640	11.801	7
Filo		44.588	11.930	7
San Biagio		44.587	11.866	7
Trava		44.670	11.892	7
Copparo		44.894	11.830	6
Ferrara		44.836	11.618	6
Carpi		44.784	10.885	5
Ravenna		44.417	12.198	5
Venezia		45.438	12.335	5
Bologna		44.498	11.340	4
Modena		44.647	10.925	4
Padova		45.407	11.876	F
Reggio nell'Emilia		44.697	10.631	F
Cento		44.727	11.289	NC



Macroseismic Data Point (MDP) map of the 17th November 1570

[DBMI11 homepage](#)
[Presentazione](#)
[Consultazione per località](#)
[Mappa dei terremoti](#)

Seleziona il terremoto facendo click sulla data.

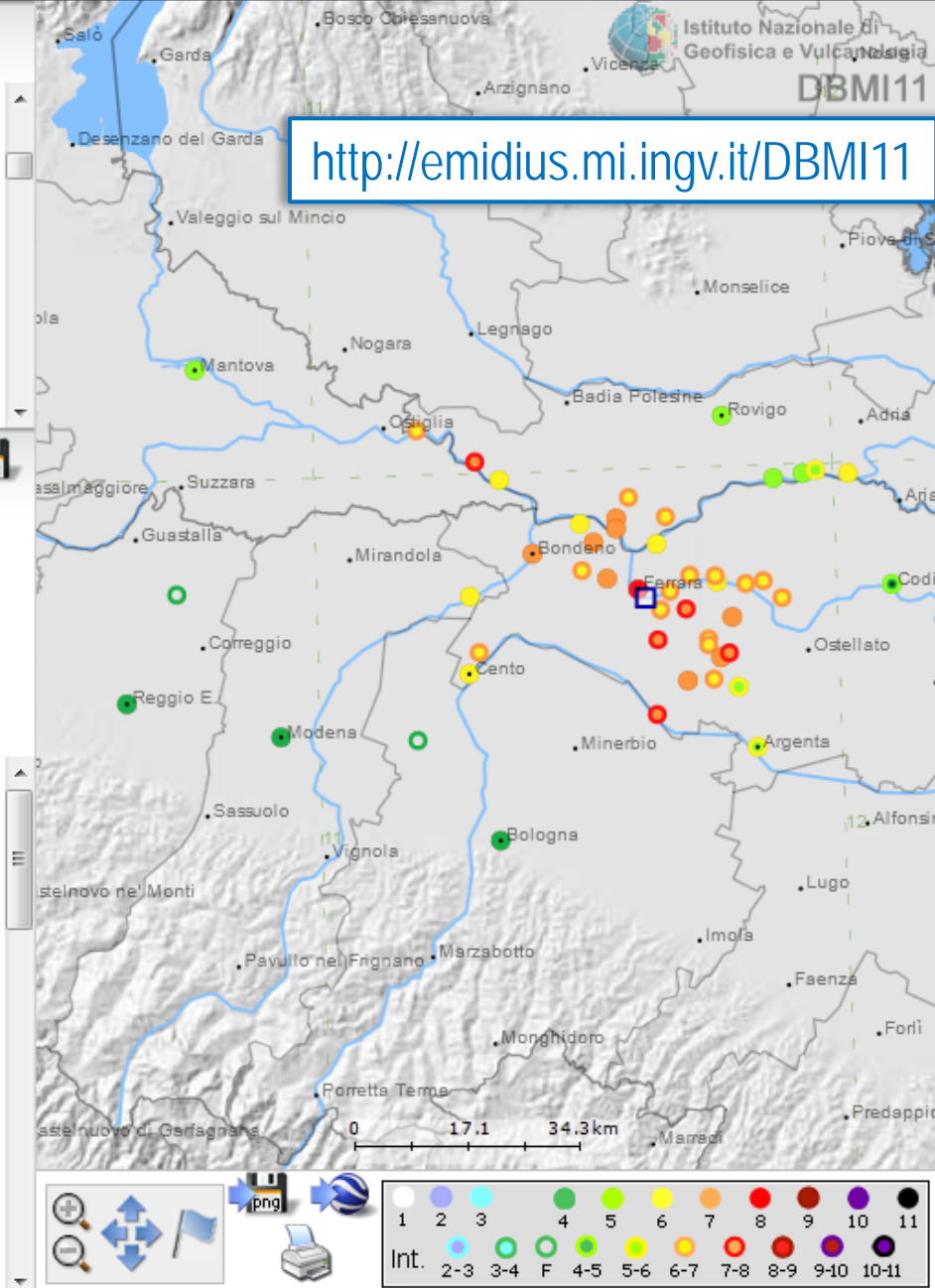
Data	Ax	Np	Io	Mw
1561 07 31 20:10	Vietri sul Mare	5	8	5.57 ±0.34
1561 08 19 15:50	Vallo di Diano	32	10	6.83 ±0.28
1561 11 24 01:25	Ferrara	5	5-6	4.51 ±0.34
1564 07 20	ALPI MARITTIME	18	8-9	5.68 ±0.51
1566 11 30	RANDAZZO	2	4-5	4.09 ±0.34
1570 11 17 19:10	Ferrara	60	7-8	5.46 ±0.25
1572 06 04 22:00	PARMA	8	6	4.72 ±0.34
1574 03 17 03:40	FINALE EMILIA	4	6	4.72 ±0.34
1575 06 05	NAPOLI	1	6-7	4.93 ±0.34
1576 09 26 05:10	Bergamo	1	5-6	4.51 ±0.34
1578	SCIACCA	1	7	5.14 ±0.34
1582 05	POZZUOLI	1	7-8	5.35 ±0.34
1584 03 01	DRONERO	1	6-7	4.93 ±0.34
1584 09 10 20:30	Appennino tosco-emiliano	18	9	5.80 ±0.33

Terremoto **1570 11 17 19:10 Ferrara**

Studio macros. **Guidoboni et al., 2007** [Np 60, Imax 8]

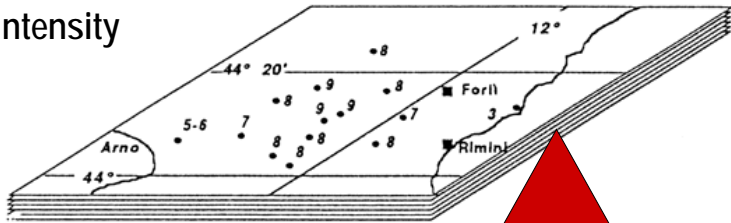
Epicentro **CPTI11** **Mw 5.46**
macrosismico **Mw 5.46**

Località	Sc	Lat	Lon	I [MCS]
Ferrara		44.836	11.618	8
Castelmassa [Massa Superiore]		45.017	11.311	7-8
Cona		44.807	11.709	7-8
Gaibanella		44.766	11.653	7-8
Gambulaga		44.745	11.789	7-8
Santa Maria Codifiume		44.664	11.647	7-8
Cassana		44.852	11.559	7
Masi Torello		44.794	11.797	7
Gurzone		44.934	11.580	7
Occhiobello		44.920	11.579	7
Runco		44.739	11.773	7
San Nicolò		44.709	11.708	7
Bondeno		44.889	11.417	7
Casaglia		44.902	11.535	7
Formignana		44.842	11.859	6-7
Fossalta		44.851	11.767	6-7
Melara		45.062	11.200	6-7
Quartiere		44.710	11.758	6-7
Sabbioncello San Vittore		44.839	11.825	6-7
Aguscello		44.807	11.660	6-7
Tresigallo		44.818	11.894	6-7

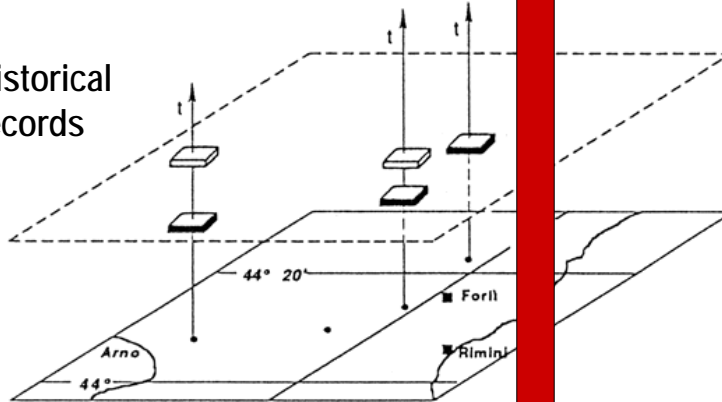


Historical earthquake studies: obtaining MDPs from the past

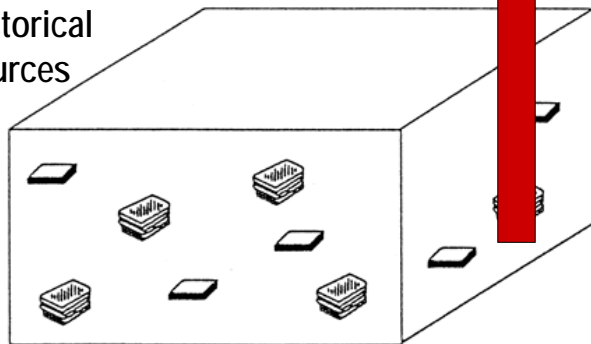
Macroseismic intensity



Historical records



Historical sources



Stucchi & Albini, 1992

Historical earthquake study "Guidoboni et al., 2007"

CFTI 4 MED CATALOGUE of STRONG EARTHQUAKES in ITALY 461 B.C. – 1997 and MEDITERRANEAN AREA 760 B.C. – 1500
 An Advanced Laboratory of Historical Seismology – E.Guidoboni, G.Ferrari, D.Mariotti, A.Comastri, G.Tarabusi, G.Valensise

Currently shown earthquakes: STRONG + Query INFO HELP CREDITS

1:12000000

Map Layers management

- Show legends (All)
 - Earthquake Felt Localities
 - Earthquake Box
 - Earthquake Location
 - Felt Localities (Selected only)
 - Earthquakes (Selected only)
 - Earthquakes Boxes
 - Earthquakes
 - Administrative
 - Topography

Keymap

The application is loading. Please wait...

1570 November 17, 19:10 GMT

The Catalogue of Strong Italian Earthquakes describes this earthquake sequence under the following heading:

Date	Time	Lat	Lon	Rel	Io	Imax	Sites	Nref	Me	Rme	Location	Country	New	Unk
1570 11 17	19:10	44.817	11.633	b	7.5	8	60	239	5.5	!	Ferrara	Italy		

Comments 14

Demography elements
 Administrative historical affiliations
 Full Chronology Of The Earthquake Sequence
 State of earthquakes review

Bibliography 239

Adriani G.	Istoria de' suoi	
Amiani P.M.	Memorie storiche	
Anonimo	Copie d'une lettre	
Anonimo	Diario parmigiano	
Anonimo	Diario e orologio	

Felt Localities 60

Location	Country	Intensity
Ferrara	(FE)	VIII
Cona	(FE)	VII-VIII
Galbanella	(FE)	VII-VIII
Gambulaga	(FE)	VII-VIII
Massa Superiore	(RO)	VII-VIII
Santa Maria Codifume	(FE)	VII-VIII

Major earthquake effects

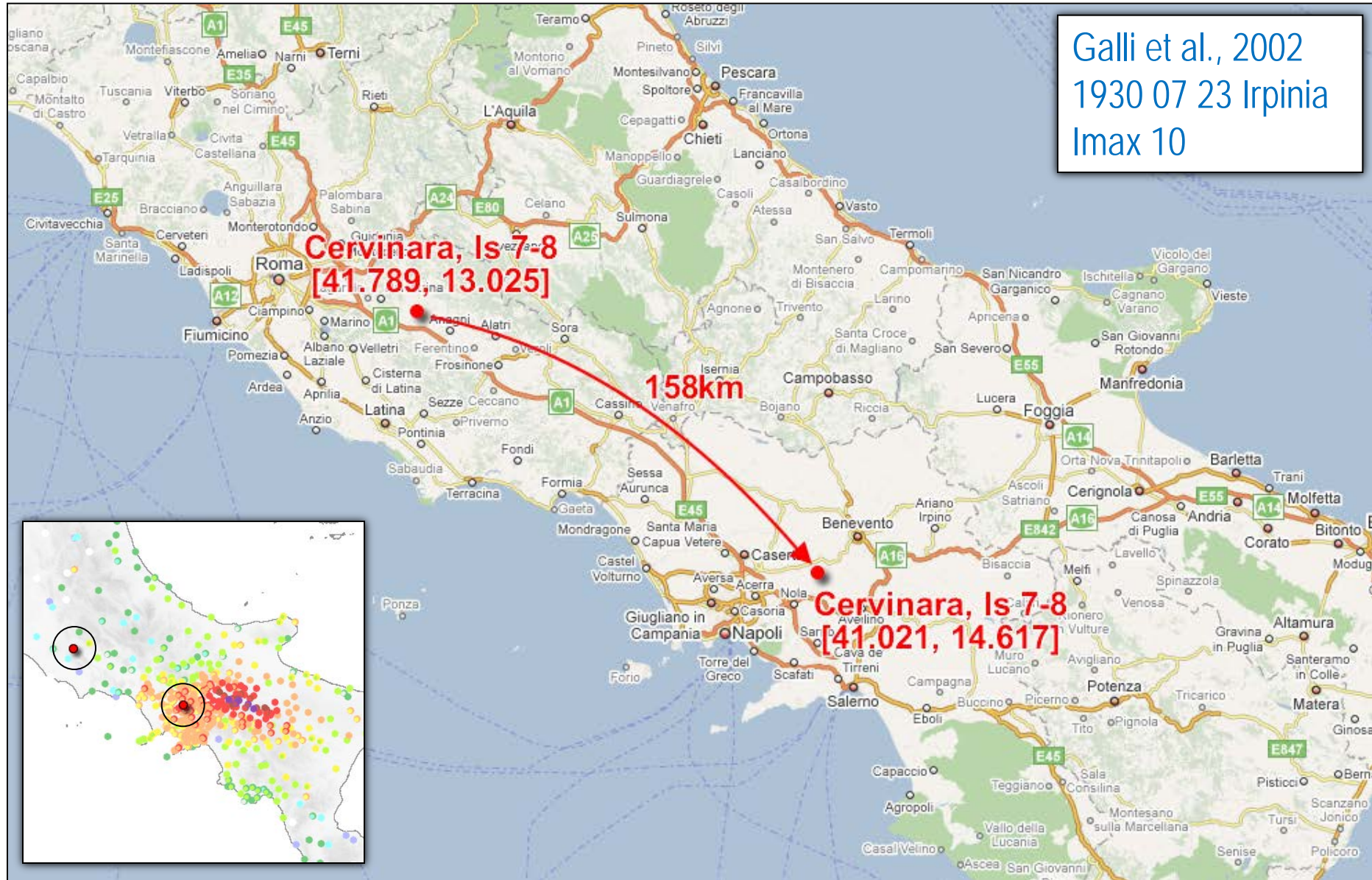
Le fonti ferraresi ricordano concordemente una lunga serie di scosse iniziata nelle prime ore del 17 novembre e continuata per tutta la giornata. Le quattro più forti sono ricordate con precisione oraria: la prima avvenne alle ore 9:30 italiane (1:40 GMT ca.) e causò il crollo di molti merli, terrazzini e comignoli, che cadendo danneggiarono molti tetti. Numerose repliche si susseguirono durante la stessa notte e nella mattinata successiva; fra queste le più forti furono quella delle ore 20 italiane (12:10 GMT ca.), che scosse violentemente le case, lesionando leggermente le murature, e quella delle ore 24 (16:10 GMT ca.), che causò il crollo di comignoli e cornicioni e gravi lesioni nelle murature. La scossa principale avvenne alle ore 3

Istituto Nazionale di Geofisica e Vulcanologia SGA Sterea Geofisica Ambiente

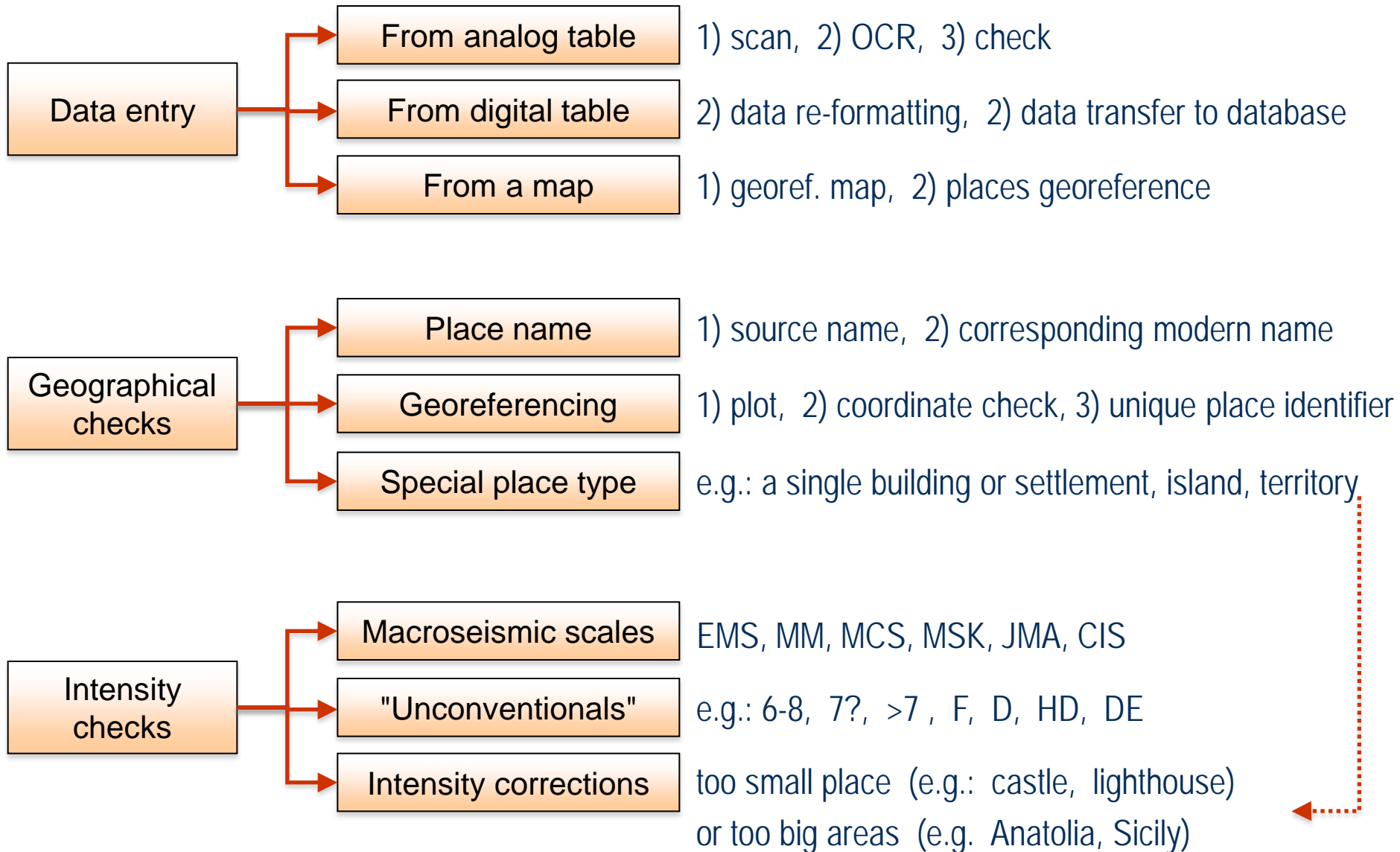
<http://storing.ingv.it/cfti4med/>

Already georeferenced places must be checked

Galli et al., 2002
1930 07 23 Irpinia
Imax 10



Summary



midop

Macroseismic Intensity Data Online Publisher

A tool created and developed by INGV since 2006 for easily publish MDP data on the Internet.

It generates a website with:

- epicentres overview map
- single earthquake MDP map
- seismic histories
- maximum intensity map
- references information
- downloadable tables
- export to Google Earth & QuakeML

Advantages:

- safe from web attacks
(only html with JavaScript pages)
- standard web server
(no database server required)
- internal geographical maps
(no need of external web resources)
- websites can be browsed offline

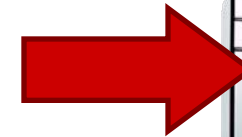
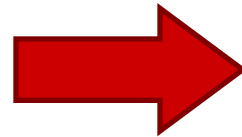
<http://www.emidius.eu/MIDOP/>

Publishing MDP data on the Web: the MIDOP tool

Development PC

Public Webserver

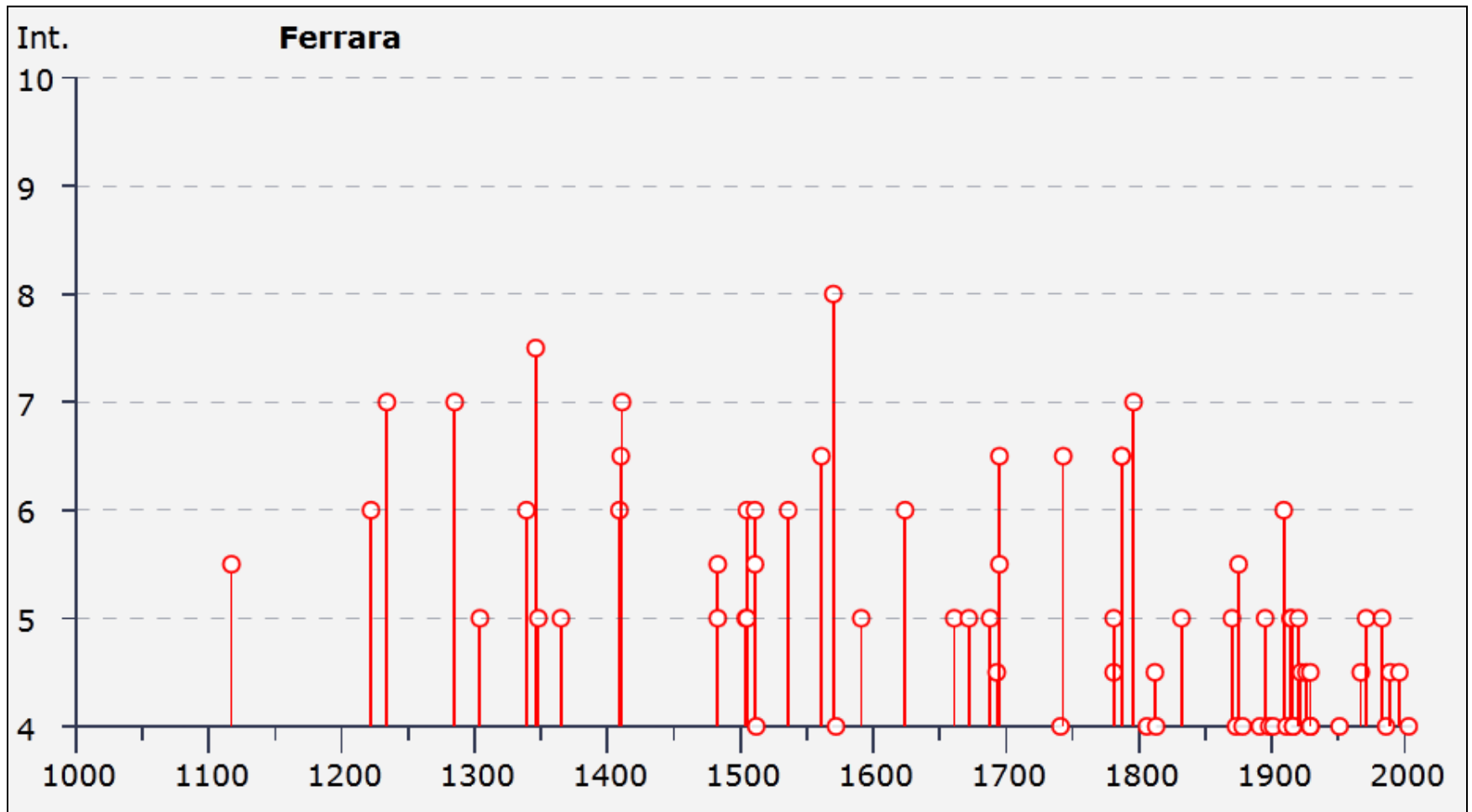
Client browser



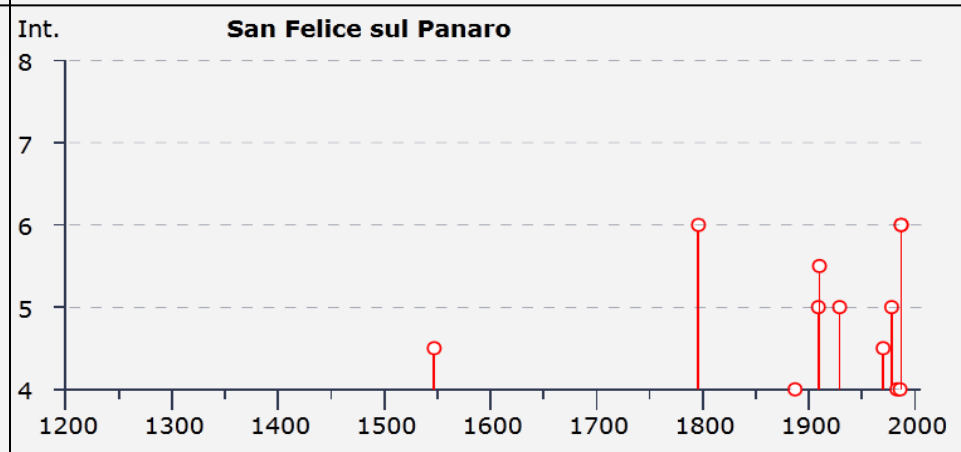
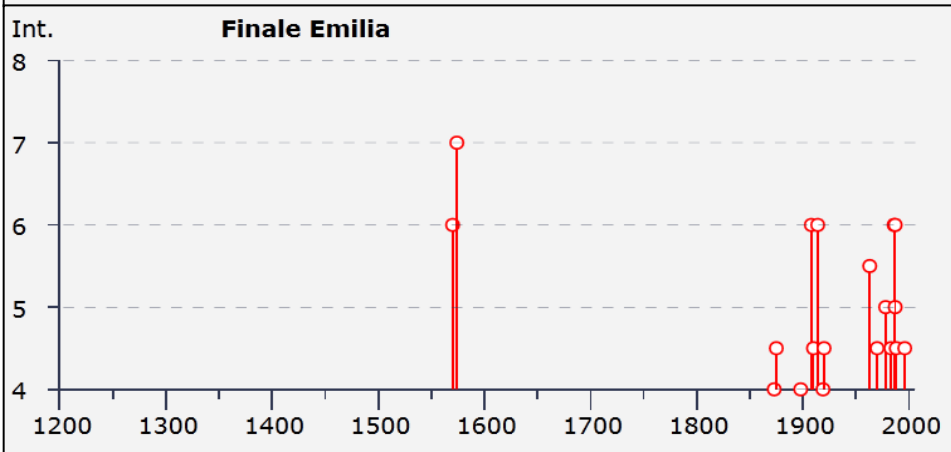
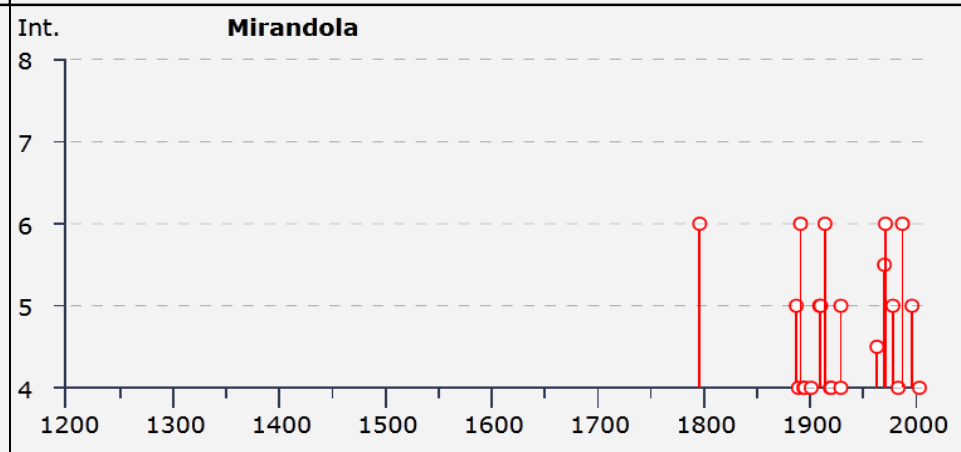
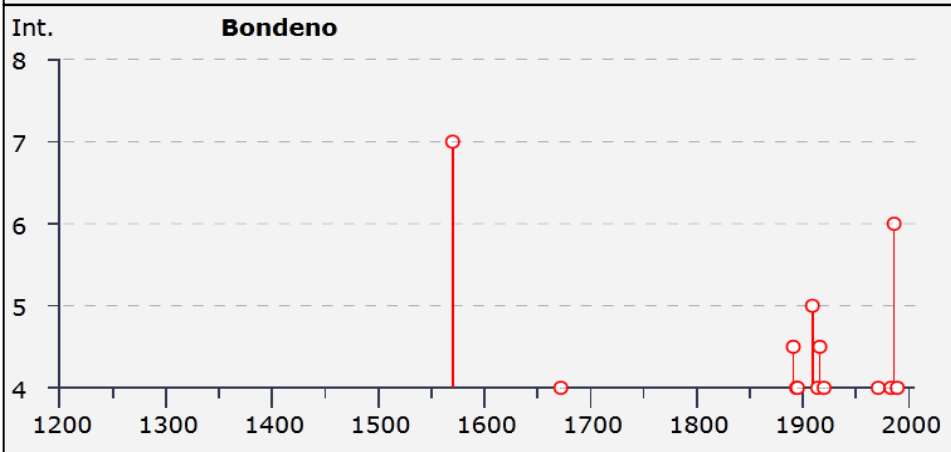
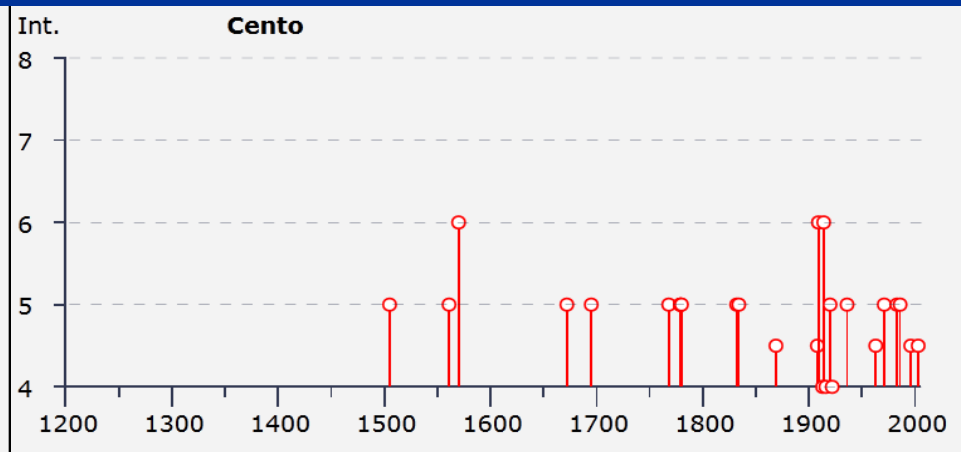
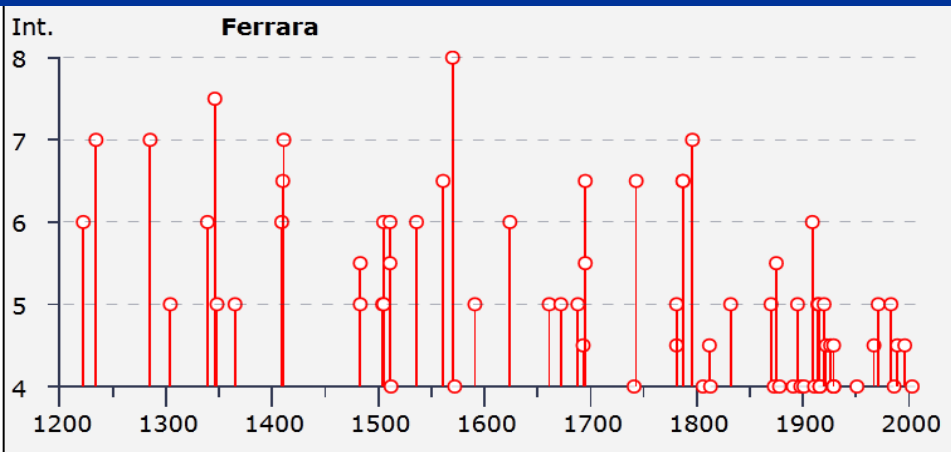
1. List of earthquakes
2. List of MDPs

<http://www.emidius.eu/MIDOP/>

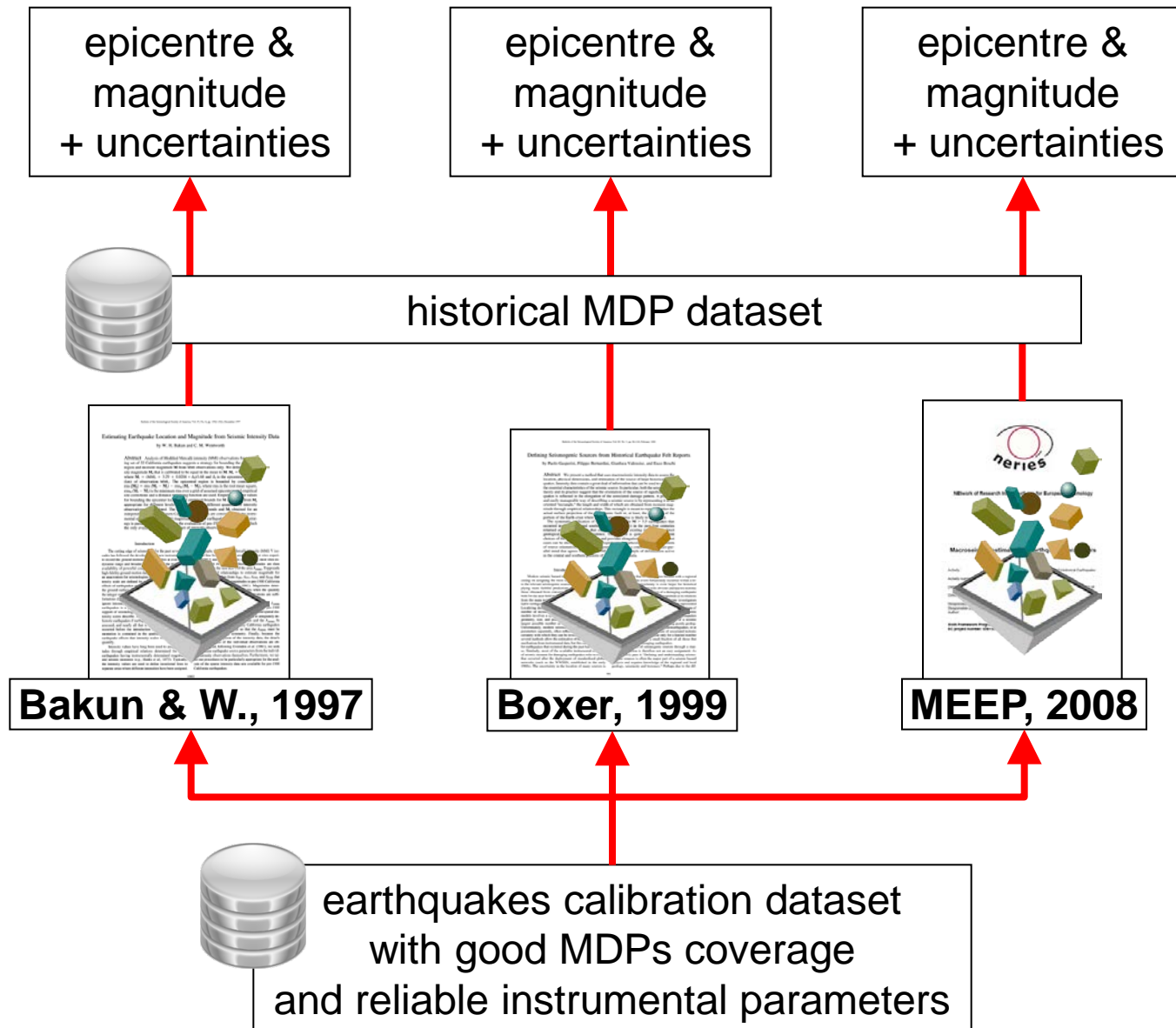
Output example: place seismic histories



Output example: place seismic histories



Example of use: earthquakes parameters assessment





homepage

DBMI11

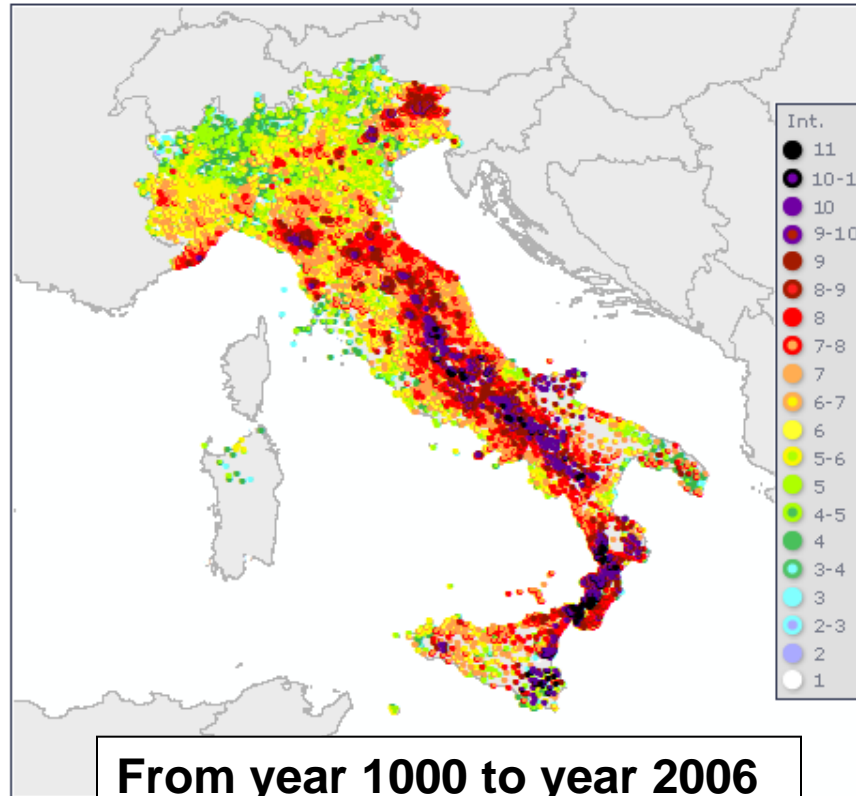
il database macrosismico
utilizzato per la compilazione
di CPTI11

► **Presentazione**

► **Consultazione
per terremoto**

► **Consultazione
per località**

► **CPTI11**



► **DBMI08aq**

► **DBMI04**

► **25 ottobre 1972, Passo Cisa**

► **6 aprile 2009, Aquilano**

► **Invia un commento**

From year 1000 to year 2006

86071 MDPs

1683 earthquakes (Mag \geq 4.5)



homepage

DBMI11

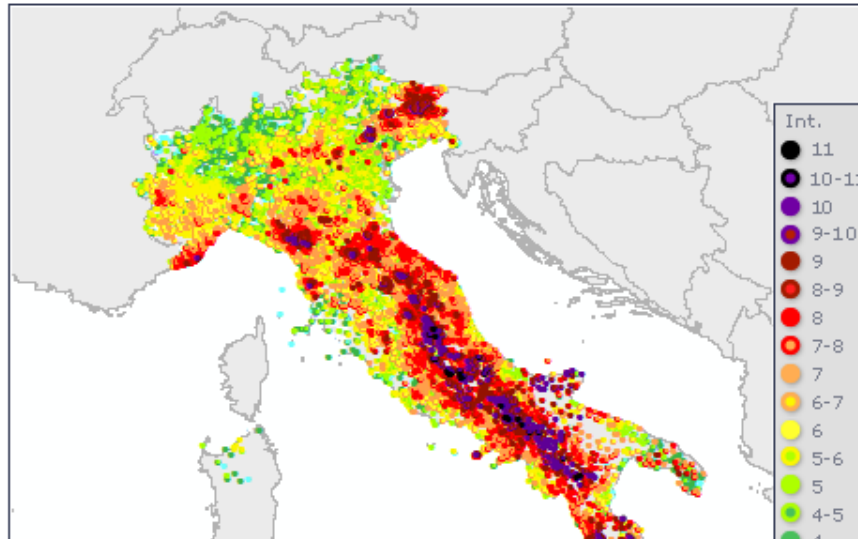
il database macrosismico
utilizzato per la compilazione
di CPTI11

► **Presentazione**

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► **CPTI11**



► **DBMI08aq**

► **DBMI04**

► **25 ottobre 1972, Passo Cisa**
► **15 aprile 2009, Aquilano**

Intensity data supporting the parameters of
CPTI11
Catalogo Parametrico dei Terremoti Italiani 2011

From year 1000 to year 2006

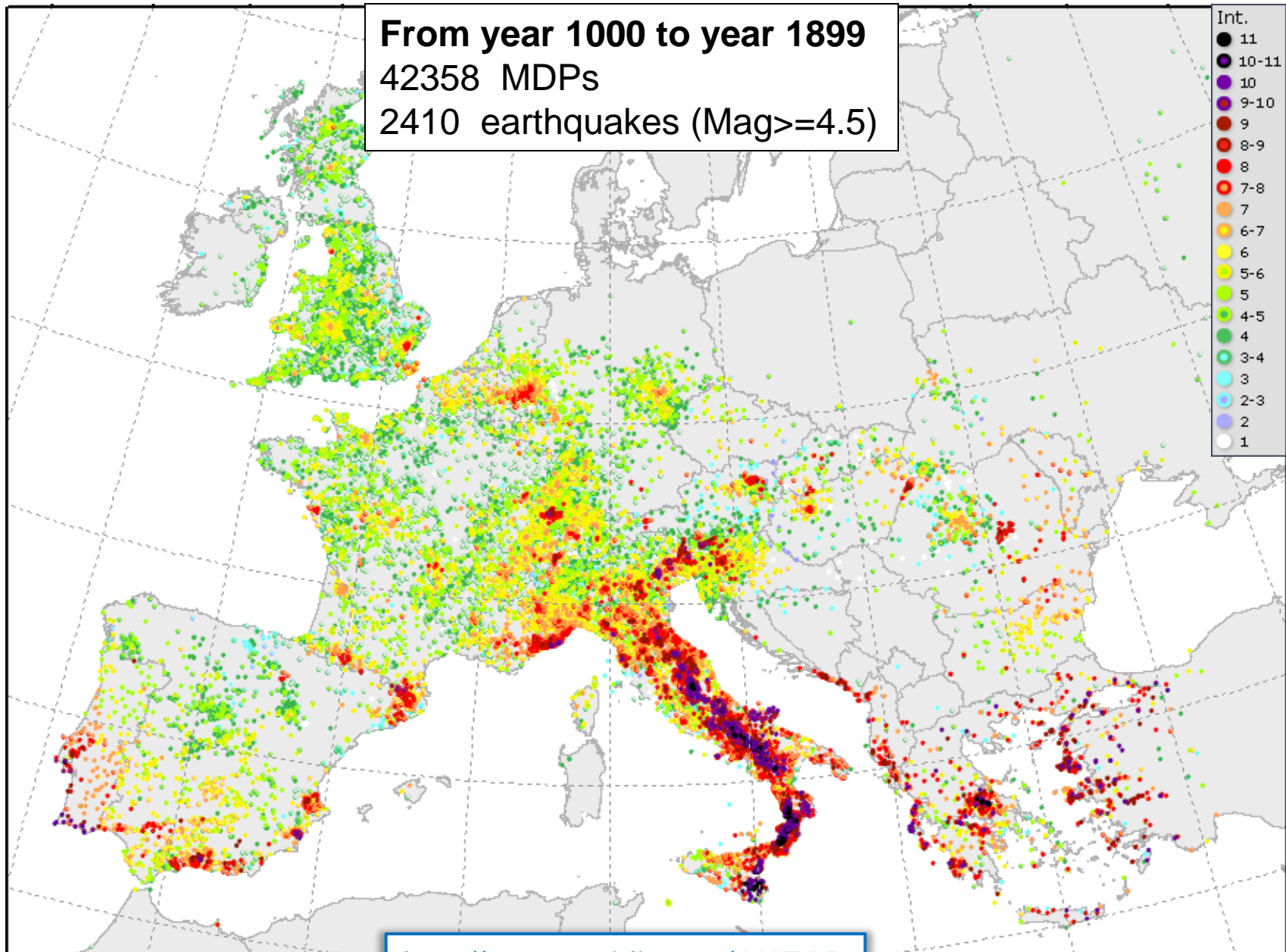
86071 MDPs

1683 earthquakes (Mag \geq 4.5)

► **Invia un commento**

AHEAD, the European Archive of Historical Earthquake Data

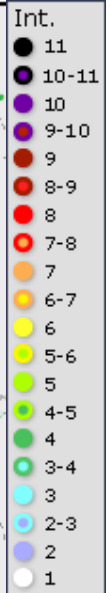
From year 1000 to year 1899
42358 MDPs
2410 earthquakes (Mag \geq 4.5)



<http://www.emidius.eu/AHEAD>

AHEAD, the European Archive of Historical Earthquake Data

From year 1000 to year 1899
42358 MDPs
2410 earthquakes (Mag \geq 4.5)



Intensity data supporting the parameters of
SHEEC
SHARE European Earthquake Catalogue

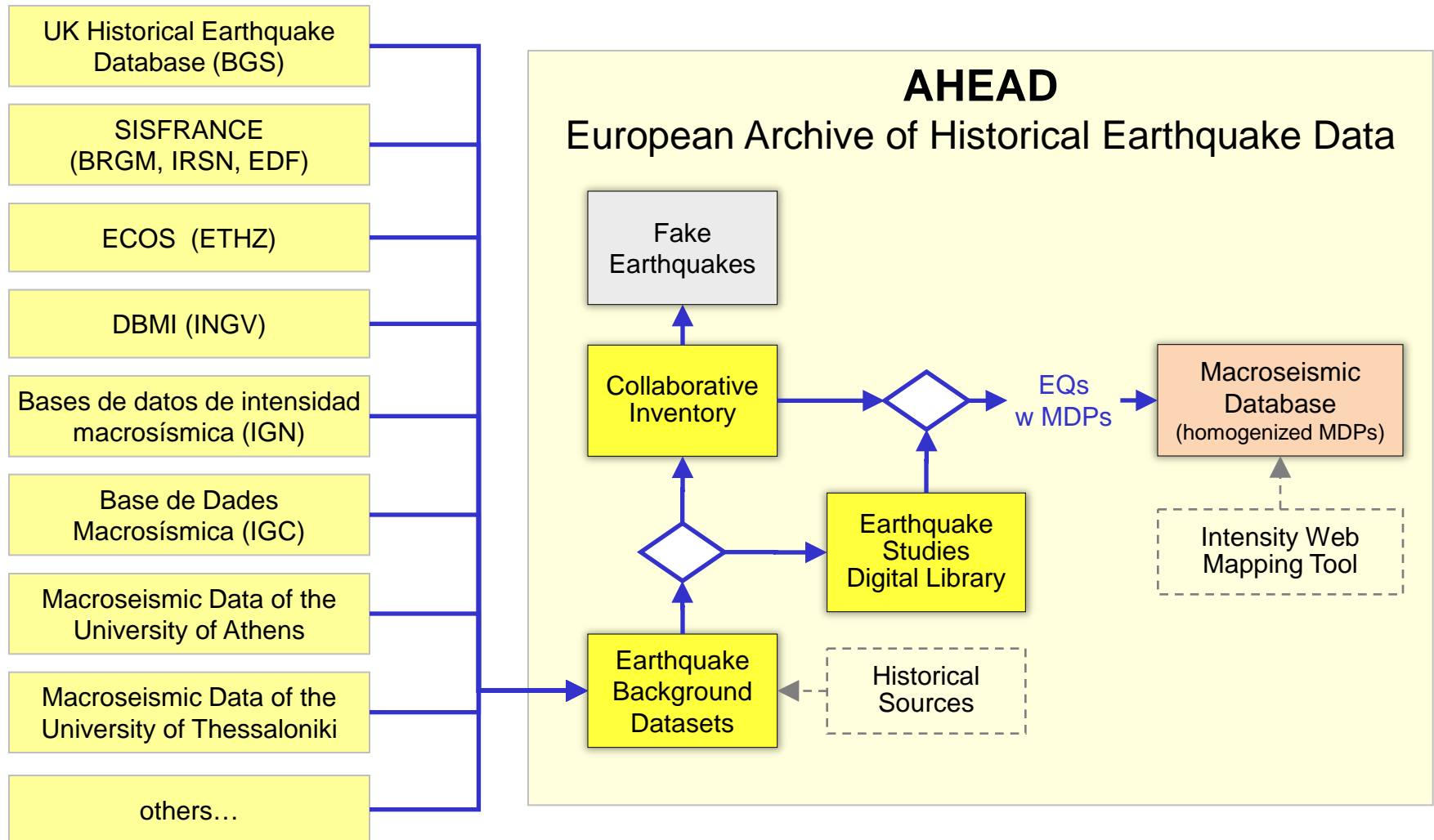
<http://www.emidius.eu/AHEAD>

AHEAD, the European Archive of Historical Earthquake Data

EC Projects NERIES (2006-2010) and SHARE (2009-2012)

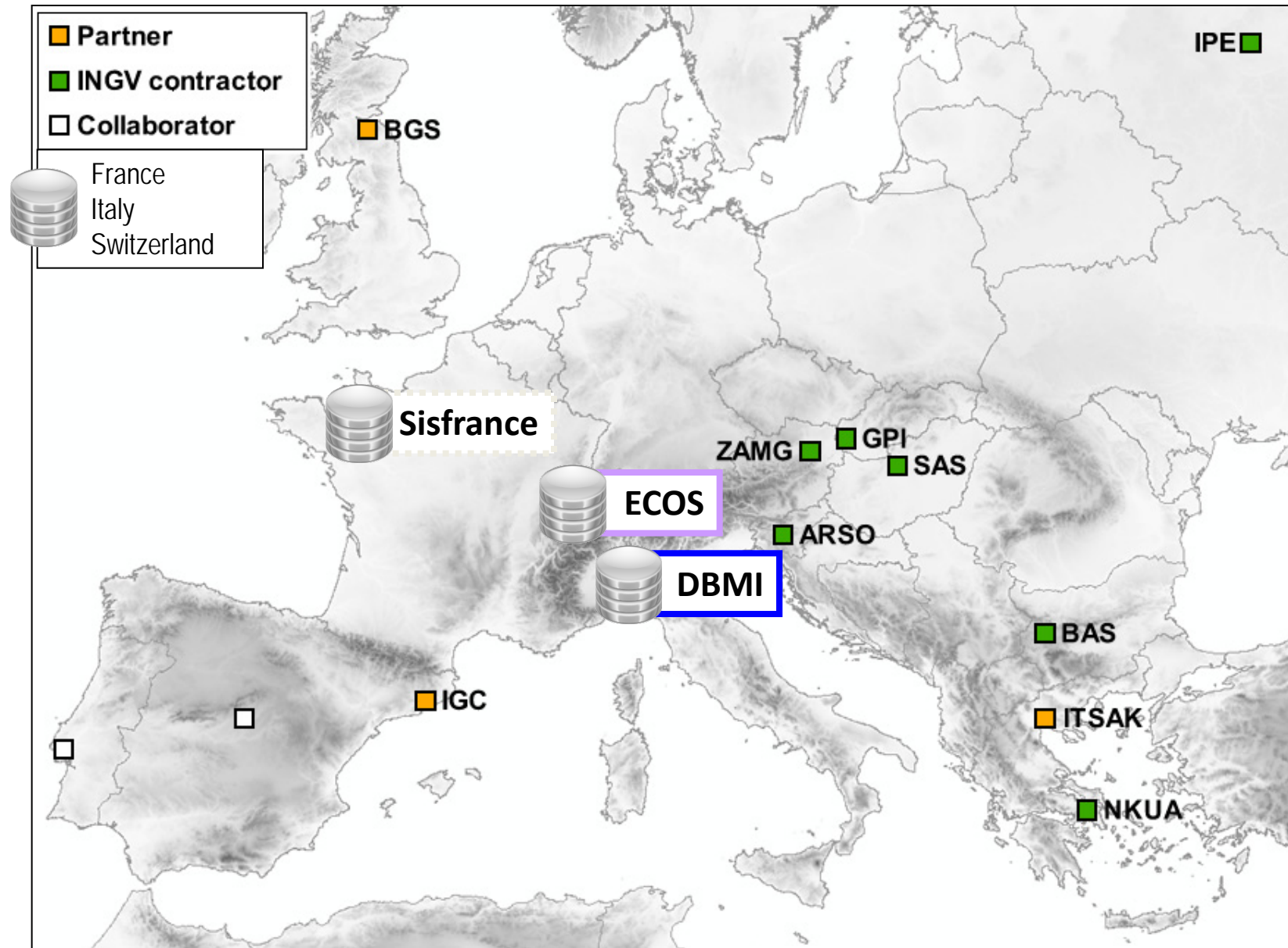
NERIES Module NA4, "Distributed Archive of Historical Earthquake Data"

SHARE WP3, Task 3.1, "European earthquake database"



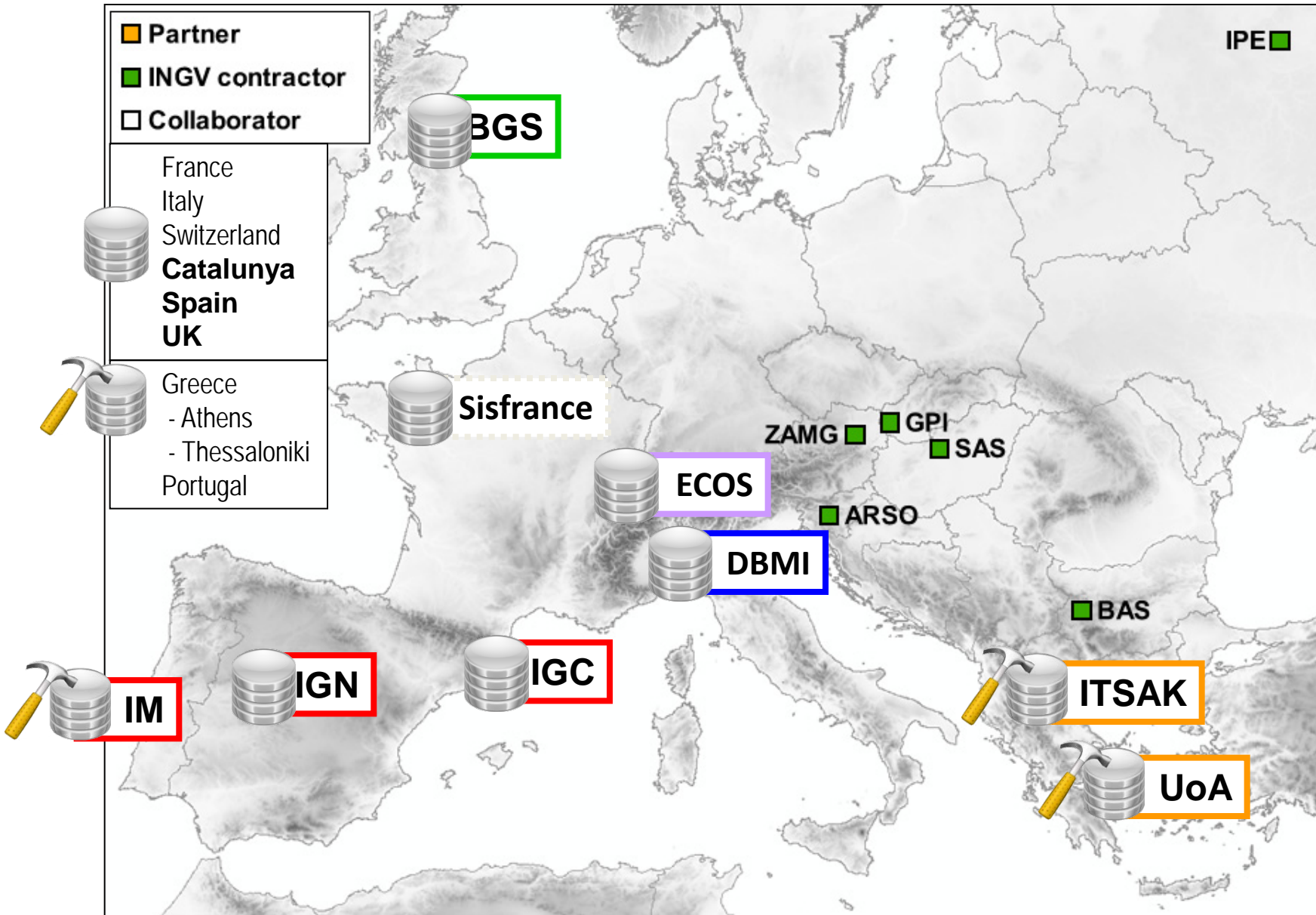
AHEAD, the European Archive of Historical Earthquake Data

Online databases before 2006



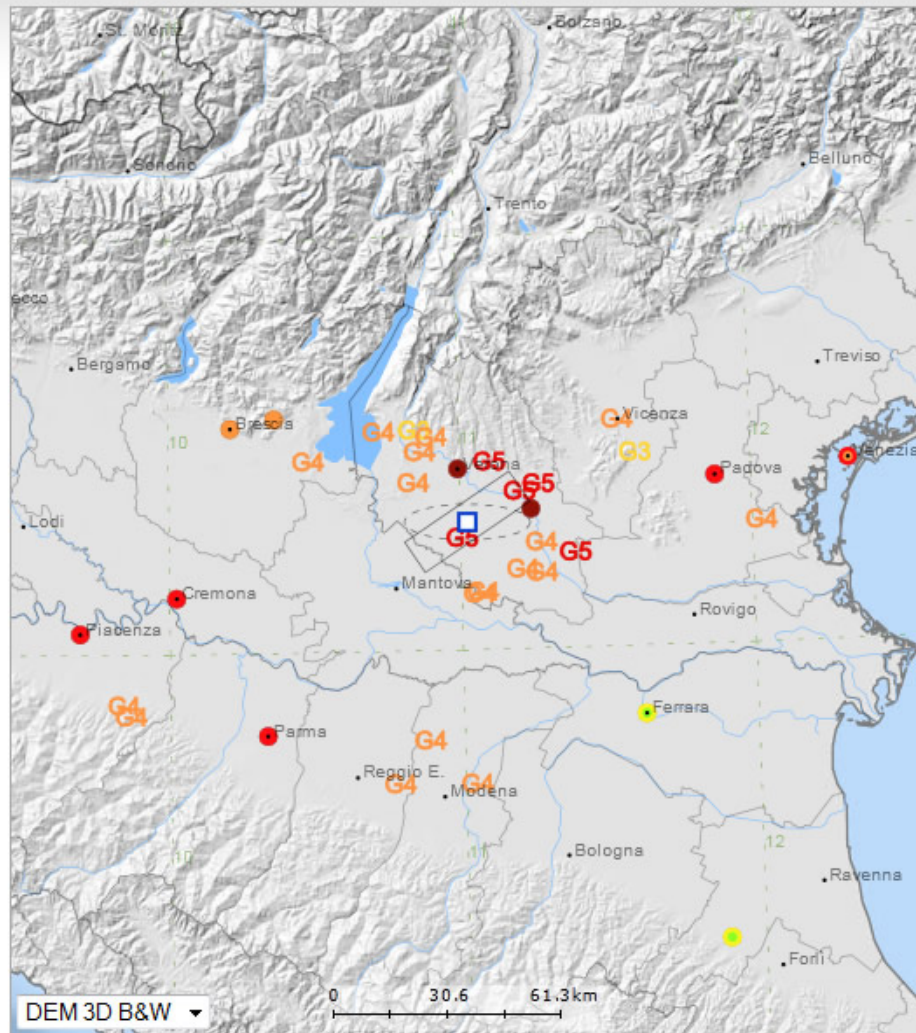
AHEAD, the European Archive of Historical Earthquake Data

Online databases now, 2012



AHEAD, the European Archive of Historical Earthquake Data

AHEAD Archive of Historical Earthquake Data



3 January 1117, 15:15 **Veronese**

[Catalogues](#) [Studies](#) [Seismicity](#) [Add a comment](#)

Guidoboni et al., 2007

Reported date: 3 January 1117, 15:15

[▶ full reference](#)

▶ 55 MDPs Imax 9

Guidoboni et al., 2005

[abstract](#)

Reported date: 3 January 1117, 15h

[▶ full reference](#)

▶ 55 MDPs Imax 9

Galli, 2005

[abstract](#)

Reported date: 3 January 1117

[▶ full reference](#)

Camassi & Stu., 1997

Reported date: 3 January 1117, 13h

[▶ full reference](#)

Boschi et al., 1997

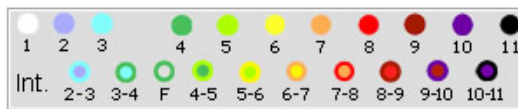
Reported date: 3 January 1117, 13h

[▶ full reference](#)

▶ 85 MDPs Imax 9

Alexandre, 1990

Reported date: 3 January 1117



AHEAD, the European Archive of Historical Earthquake Data

AHEAD Archive of Historical Earthquake Data

3 January 1117, 15:15 Veronese

Catalogues Studies Seismicity Add a comment

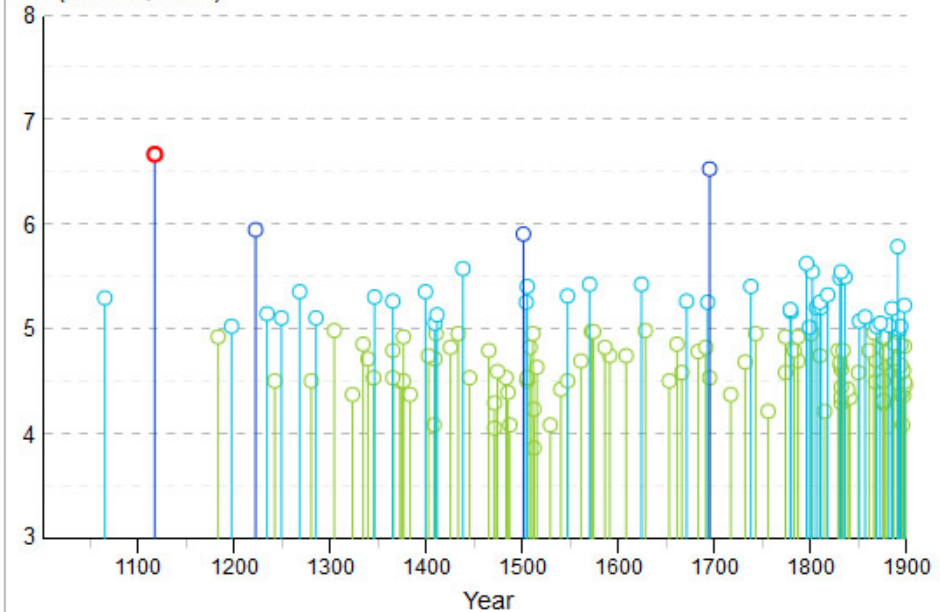
Create a seismicity buffer

- by radius (km, max 500)

- by drawing a polygon

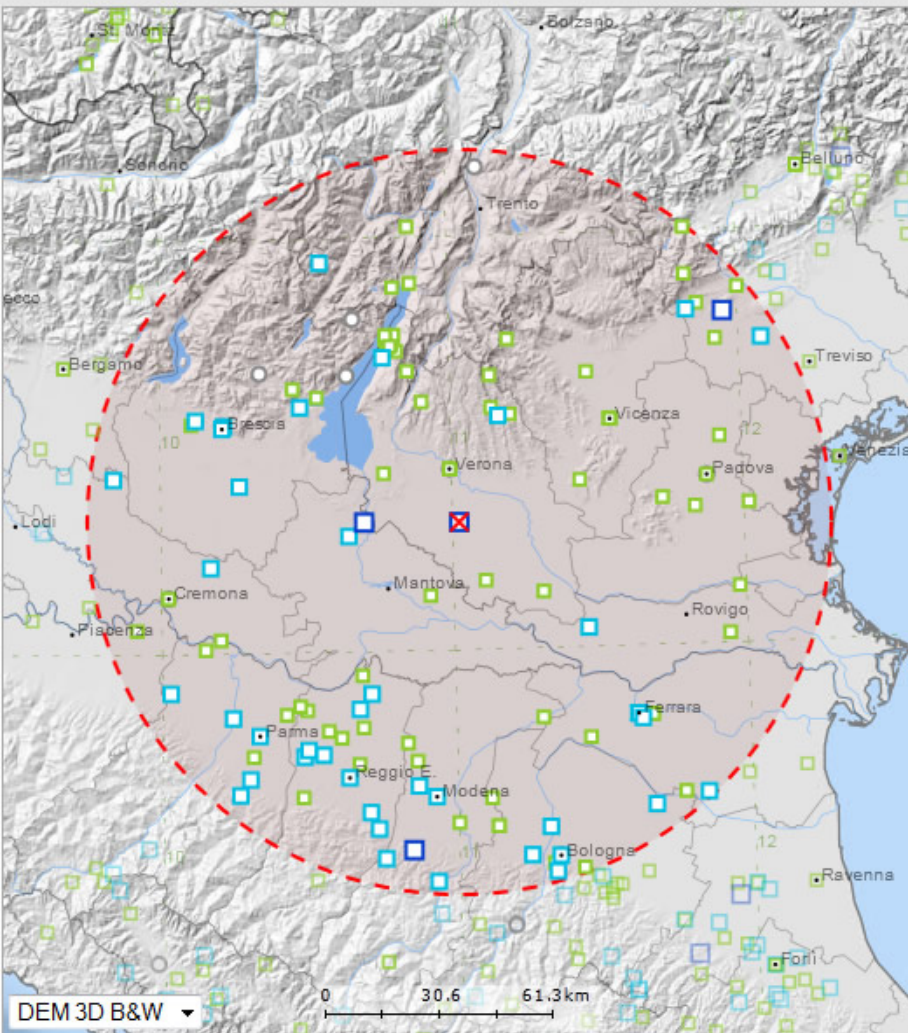
158 earthquakes selected

Mw (SHEEC, 2011)



- 1000-1300
- 1301-1500
- 1501-1600
- 1601-1750
- 1751-1830
- 1831-1875
- 1876-1899

- extra large Mw >= 7.00
- large 5.80 <= Mw < 7.00
- medium 5.00 <= Mw < 5.80
- small Mw < 5.00
- not determined



DEM 3D B&W km

Int.

Global Earthquake Model (GEM), Tools for compiling the Global Earthquake History

a Global Component project that will produce a common set of definitions, strategies, standards, quality criteria and formats

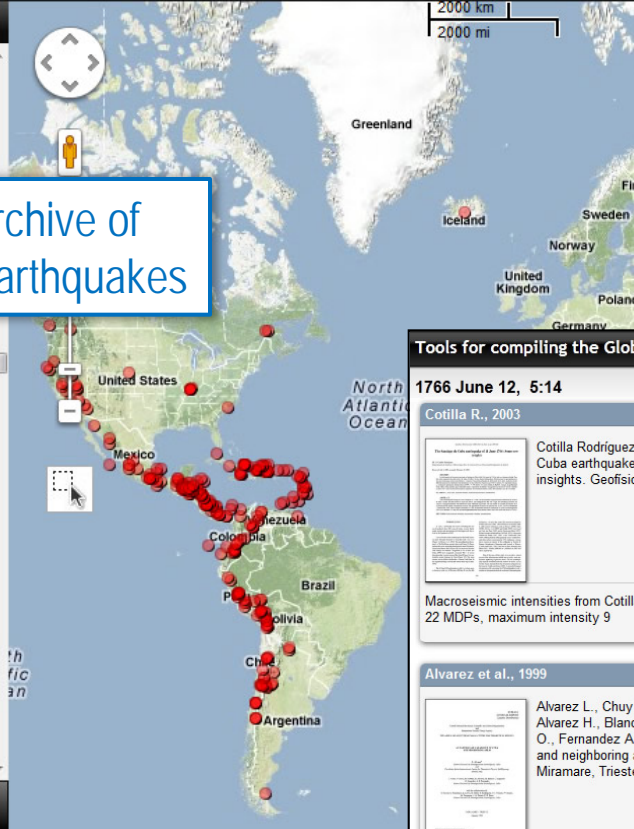
INGV & BGS coordination
 Activity: 2010 - ongoing
 Time-window: 1000-1903
 Magnitude: ≥ 7

Tools for compiling the Global Earthquake History

Date	Area	Cou	info
1763 03 11 12	Aomori Pref. (Hachinohe)	JP	(i)
1763 03 15 14	Aomori Pref. (Hachinohe)	JP	(i)
1764 07	Trujillo	HN	(i)
1765 04	San Martin	SV	(i)
1765 10 24			
1766 03 08 18	Aomori, Hiroasaki		
1766 05 22	Istanbul		
1766 06 12 05 14			
1766 08 05	Marmara Sea	TR	(i)
1766 10 21 09		VE	(i)
1769 08 29 15	Oita, Miyazaki and Kumamoto Pref.s	JP	(i)
1769 10 24 13	BAIKAL	RU	(i)
1770 06 04 00 15		HT	(i)
1771 04 24 08	Yae-yama mountain, Miyako Islands	JP	(i)
1772 06 15		GT	(i)
1773 07 29		GT	(i)
1773 09 07		GT	(i)
1773 12 13		GT	(i)
1776 03 30		GT	(i)
1776 04 21		MX	(i)
1776 05 30 17 15		SV	(i)
1776 07 06		SV	(i)

listed earthquakes 715
selected 0

Global Archive of Historical Earthquakes



Source	Year	Mo	Da	Ho	Mi	Lat	Lon	Dep	M	TM	Int
EMME011	1008	04	27	18		34.600	47.400		7.00	S	
EMME011	1033	12	05			32.500	35.500		7.00	S	
ZHAAL999	1038	01	15			38.400	112.900		7.30	W	10
SHELE997	1052	06	02			36.200	58.000	16	7.00	S	
SBEAL005	106										
SHEEC011	106										
EMME011	106										
UTSUoI	109										
UTSUoI	109										
SHEEC011	1107	02	12	03		45.700	26.600	150	7.10	W	8
SBEAL005	1114	11				37.300	36.500	40	7.70	S	9
SBEAL005	1114	11				37.300	38.500	40	7.40	S	8-9
EMME011	1115					31.870	44.410		7.10	W	9-10
ZHAAL999	1125	09	06			36.100	103.700		7.00	W	9
SHEEC011	1126	08	08			45.700	26.600	150	7.10	W	8

Global Parametric Earthquake Catalog

Tools for compiling the Global Earthquake History

1766 June 12, 5:14

Cotilla R., 2003

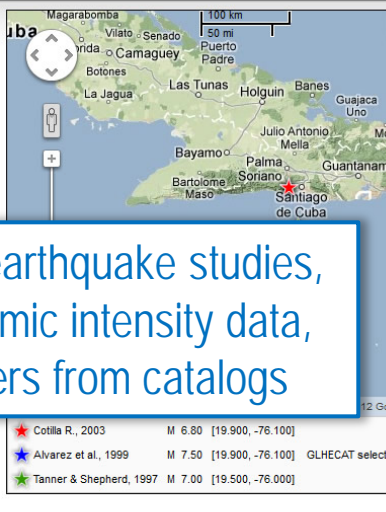
Cotilla Rodriguez M.O., 2003. The Santiago de Cuba earthquake of 11 June 1766: Some new insights. *Geofisica Internacional*, 42, 4, 589-602.

Macroseismic intensities from Cotilla R., 2003: 22 MDPs, maximum intensity 9

Alvarez et al., 1999

Alvarez L., Chuy T., Garcia Alvarez H., Blanco M., Escobar O., Fernandez A.I., 1999. The 1766 earthquake and neighboring areas. *ICGAGLR Miramare, Trieste*, 60 pp.

Tanner & Shepherd, 1997



Historical earthquake studies, macroseismic intensity data, parameters from catalogs

a Global Component project that will produce a common set of definitions, strategies, standards, quality criteria and formats

INGV & BGS coordination
Activity: 2010 - ongoing
Time-window: 1000-1903
Magnitude: ≥ 7

Thank you!

mario.locati@mi.ingv.it

Date	Area	Cou	info
1763 03 11 12	Aomori Pref. (Hachinohe)	JP	(i)
1763 03 15 14	Aomori Pref. (Hachinohe)	JP	(i)
1764 07	Trujillo	HN	(i)
1765 04	San Martin	SV	(i)
1765 10 24		GT	(i)
1766 03 08 18	Aomori, Hirosaki	JP	(i)
1766 05 22	Istanbul	TR	(i)
1766 06 12 05 14		CU	(i)
1766 08 05	Marmara Sea	TR	(i)
1766 10 21 09		VE	(i)
1769 08 29 15	Oita, Miyazaki and Kumamoto Pref.s	JP	(i)
1769 10 24 13	BAIKAL	RU	(i)
1770 06 04 00 15		HT	(i)
1771 04 24 08	Yae-yama mountain, Miyako Islands	JP	(i)
1772 06 15		GT	(i)
1773 07 29		GT	(i)
1773 09 07		GT	(i)
1773 12 13		GT	(i)
1776 03 30		GT	(i)
1776 04 21		MX	(i)
1776 05 30 17 15		SV	(i)
1776 07 06		SV	(i)

listed earthquakes 715
selected 0

SHELE997	1052	06	02			36.200	58.000	16	7.00	S	
SBEAL005	1063	07	30			34.400	36.200	32	6.90	S	8
SHEEC011	1063	09	23			40.867	27.411		7.10	W	
EMME011	1068	03	18	08	30	28.500	36.700		7.00	Mf	8
UTSUoI	1096	12	11	08		34.000	137.500		8.30		
UTSUoI	1099	02	16	06		33.000	135.500		8.20		
SHEEC011	1107	02	12	03		45.700	26.600	150	7.10	W	8
SBEAL005	1114	11				37.300	36.500	40	7.70	S	9
SBEAL005	1114	11				37.300	38.500	40	7.40	S	8-9
EMME011	1115					31.870	44.410		7.10	W	9-10
ZHAAL999	1125	09	06			36.100	103.700		7.00	W	9
SHEEC011	1126	08	08			45.700	26.600	150	7.10	W	8

Tools for compiling the Global Earthquake History

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Cotilla R., 2003

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Magarabomba
Vilato
Senado
Yrida
Camaguey
Botones
La Jagua
Las Tunas
Holguin
Banes
Guajaca Uno
Julio Antonio Mella
Guantanamo
Palma Soriano
Santiago de Cuba
Bayamo
Barclonnette
Maso

Montego Bay
Rio Bueno
Lacovia
Jamaica
Tombstone
May Pen
Kingston
Hayes

Cotilla R., 2003 M 6.80 [19.900, -76.100]
Alvarez et al., 1999 M 7.50 [19.900, -76.100] GLHECAT selected
Tanner & Shepherd, 1997 M 7.00 [19.500, -76.000]