



The Friuli Venezia Giulia accelerometric network RAF and its integration with the RAN.

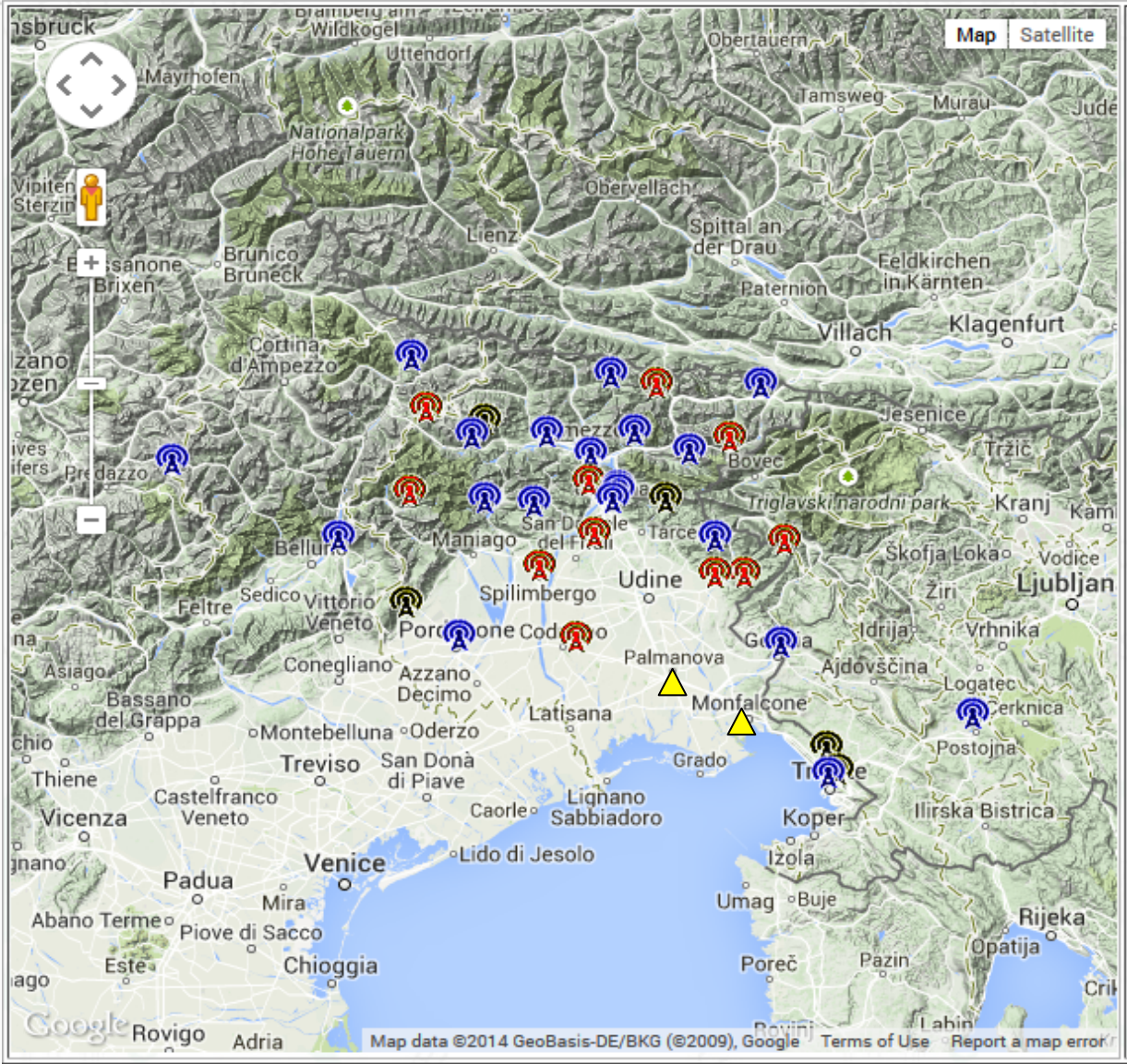
Giovanni Costa

*Seismologia Research and Monitoring group, Department of Mathematics and Geosciences,
University of Trieste, Italy;*



SeisRaM
Seismological Researcher
and Monitoring group

Giovanni Costa, Piero Falconer, Lorenzo Furlan, Antonella Gallo, Lara Tiberi, Blaž Vičič, Giuliana Zoppé



1993 - 2000



2000 -



2011 -



Friuli Venezia Giulia Accelerometric Network (RAF)



National Accelerometric Network (RAN)



Stations of NE Italy Broadband Network (NI)

The RAN is of the [Dipartimento della Protezione Civile](#),
Presidenza del Consiglio dei Ministri, Roma

The VINO and TRI stations are managed in collaboration
with OGS. TRI is a MedNet station. The NE Italy BB
Network is managed in collaboration with the Istituto
Nazionale di Oceanografia e di Geofisica Sperimentale -
OGS, Trieste

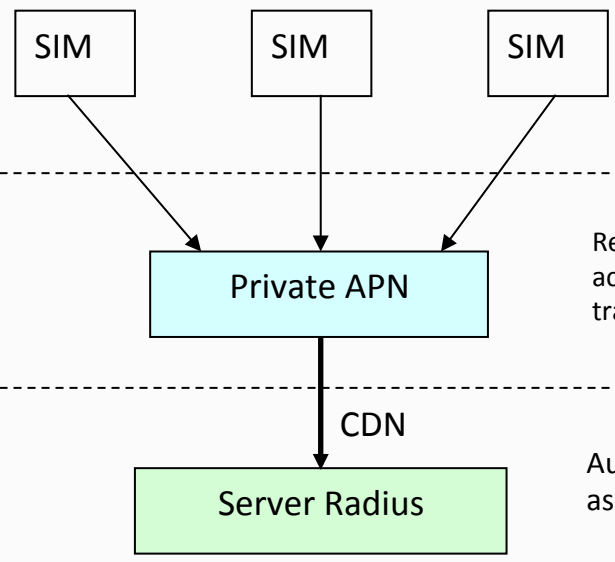


trasmissione dati GPRS

Stazioni

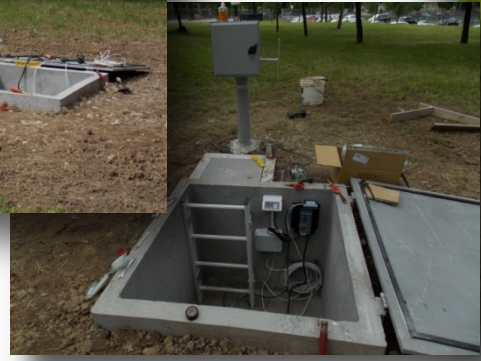
Telecom

DPC



Registrazione della SIM
accesso alla rete GPRS
tramite APN dedicato

Autenticazione della SIM
associazione IP statico





UNIVERSITÀ DEGLI STUDI DI TRIESTE
SeisRaM
Seismological Research and Monitoring Group

2016

Seismic stations manage by SeisRaM (Seismological and Research and Monitoring) group in Friuli Venezia Giulia and Veneto regions





PURA seismic station - Passo Pura (1420 m s.l.m.)

University of Trieste
Department of Mathematics and Geosciences
Trieste - Via Weiss, 2
040-5582124
ceola@units.it

Stazione di Gemona - DE


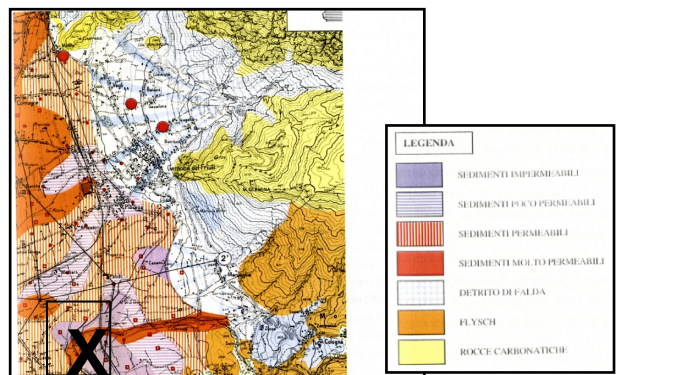
Codice	Latitudine	Longitudine	Quota sim (m)
GEDE	46.254	13.124	180

Estratto CTRN *Veduta satellite*

SENSORE: Kinemetrics EpiSensor.
SISTEMA DI ACQUISIZIONE: Kinemetrics Etna.
COLLEGAMENTO: modem GSM, modalità dial-up.
GEOLOGIA: nel bacino sedimentario.
TOPOGRAFIA: pianura.

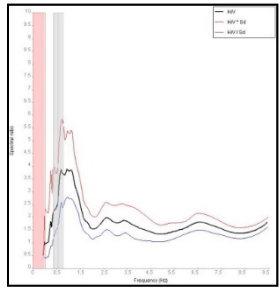
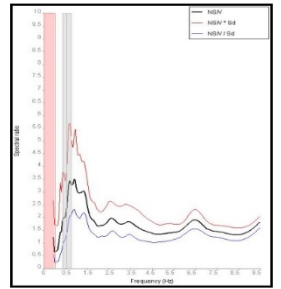
Note. La stazione è operativa nella configurazione attuale dall'inverno 1999/2000, a poca distanza dall'installazione precedente, codice GETM, attiva dal 1994 al 1999. È installata sul basamento preesistente di una piccola costruzione.





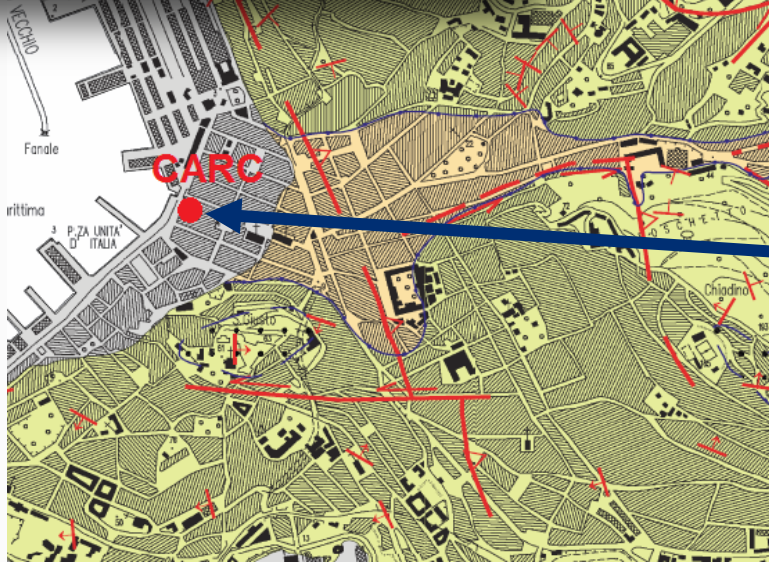
LEGENDA

- SEDIMENTI IMPERMEABILI
- SEDIMENTI POCO PERMEABILI
- SEDIMENTI PERMEABILI
- SEDIMENTI MOLTO PERMEABILI
- DETRITO DI FALDA
- FLYSCH
- ROCCE CARBONATICHE




Estratto dalla Carta della Tettonica superficiale di F. GIORGETTI & S. STEFANI (1989)

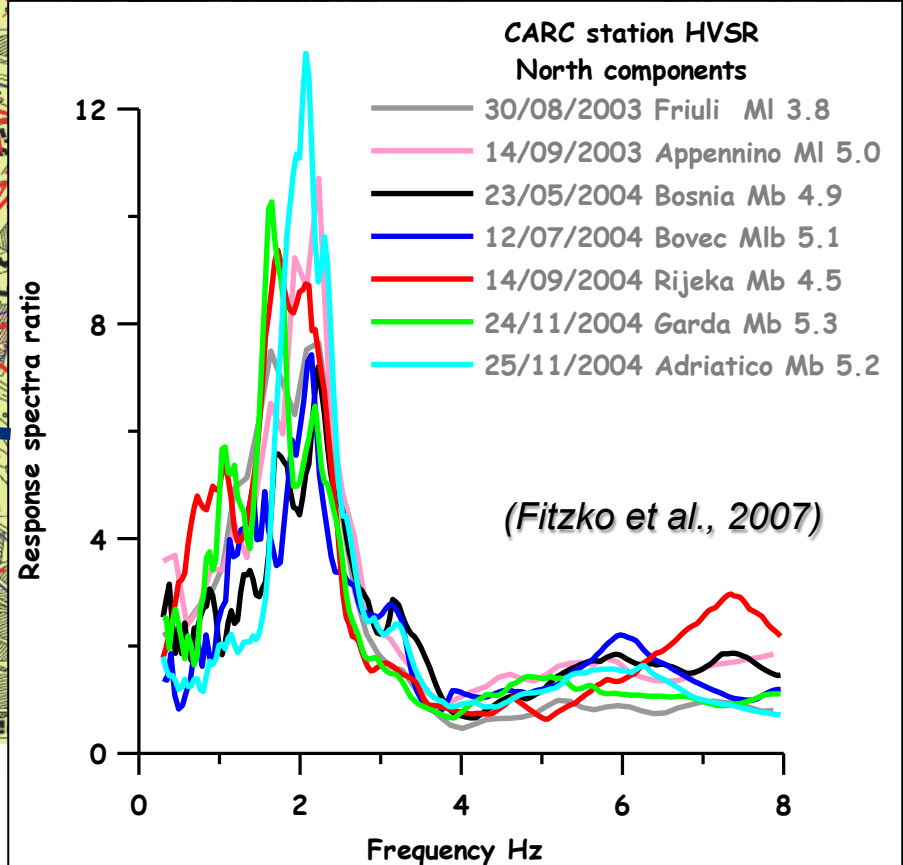





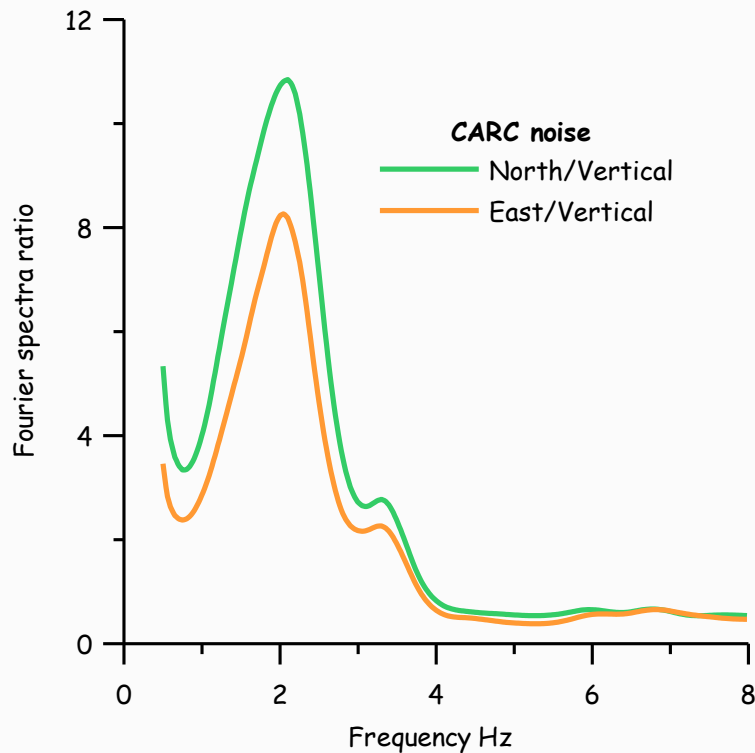


(Cucchi et al., 2013)

-  Antropico (Attuale)
-  Unità dei depositi ubiquitari (Pleistocene sup. - Attuale) - UIN
-  Flysch di Trieste (Luteziano sup.) - FT



Stazione CARC - Borgo Teresiano - Trieste



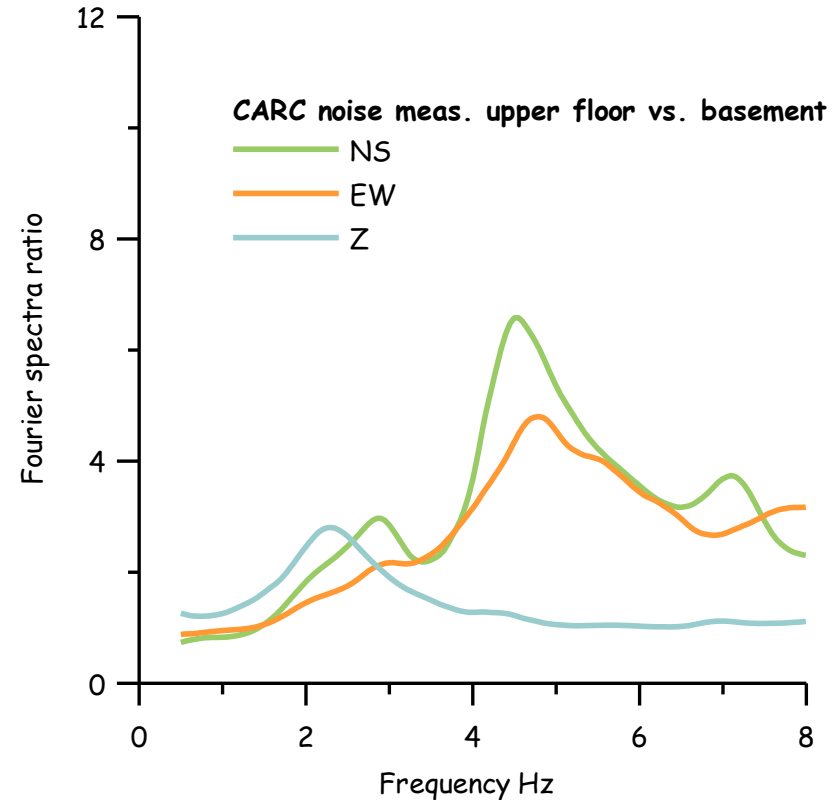
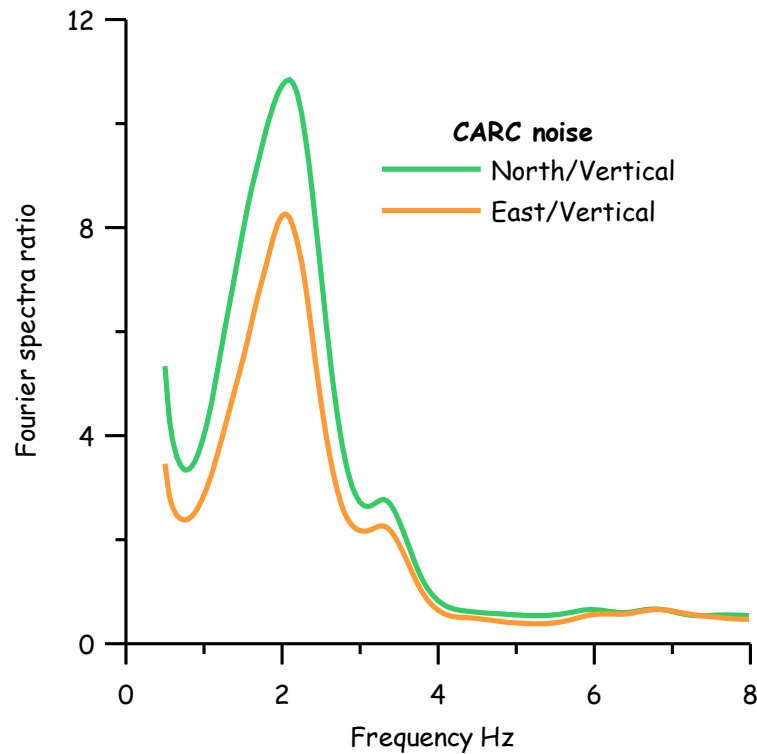
(Fitzko et al., 2007)



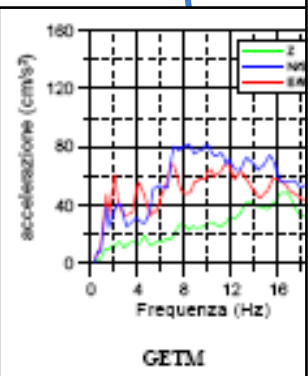
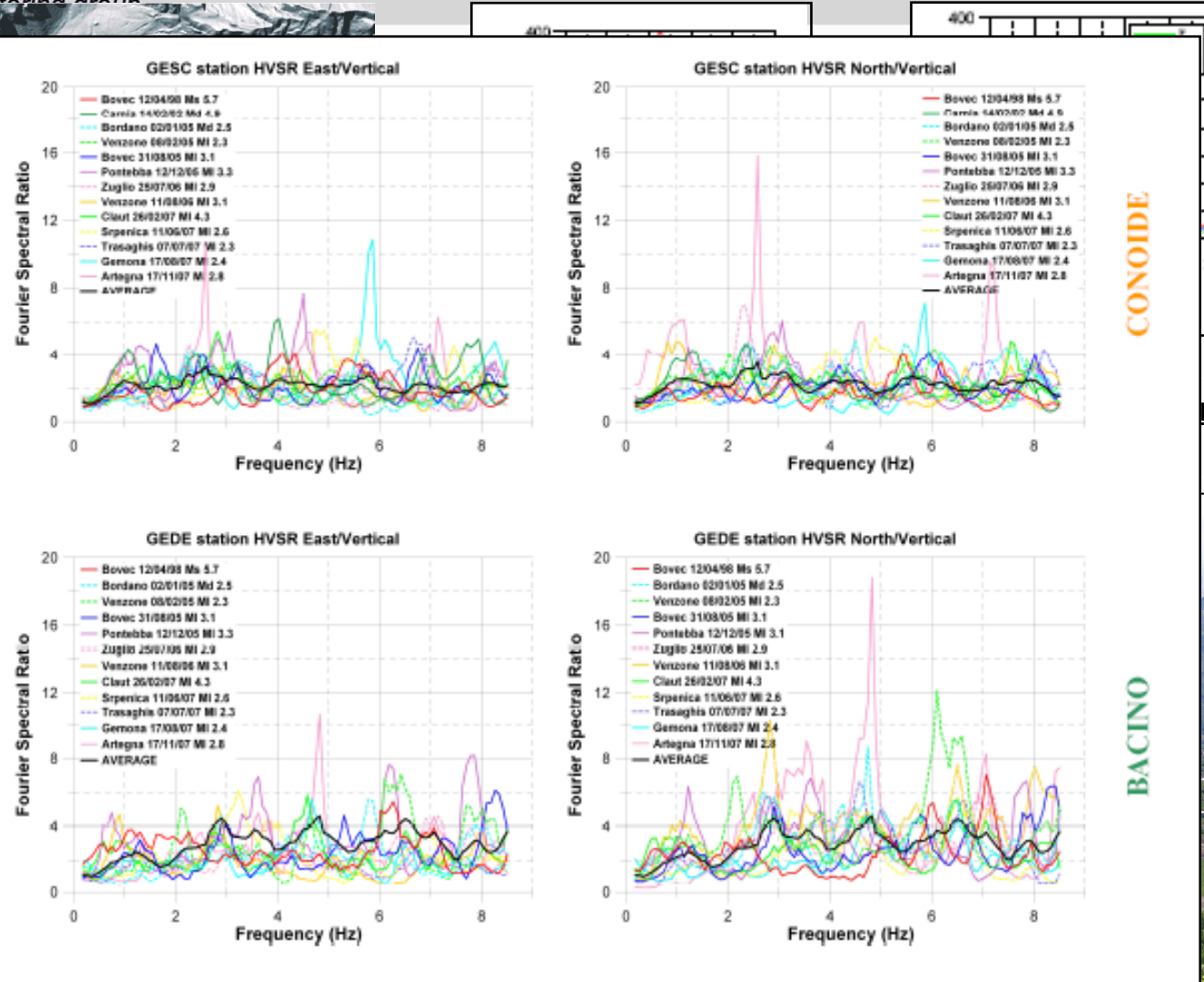
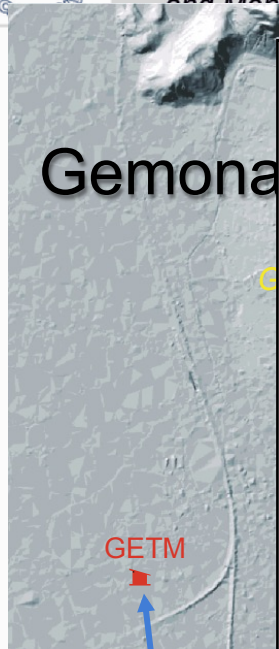
Stazione CARC - Borgo Teresiano - Trieste



(Fitzko et al., 2007)



Stazione CARC - Borgo Teresiano - Trieste



Rapporti spettrali con il metodo HVSRR

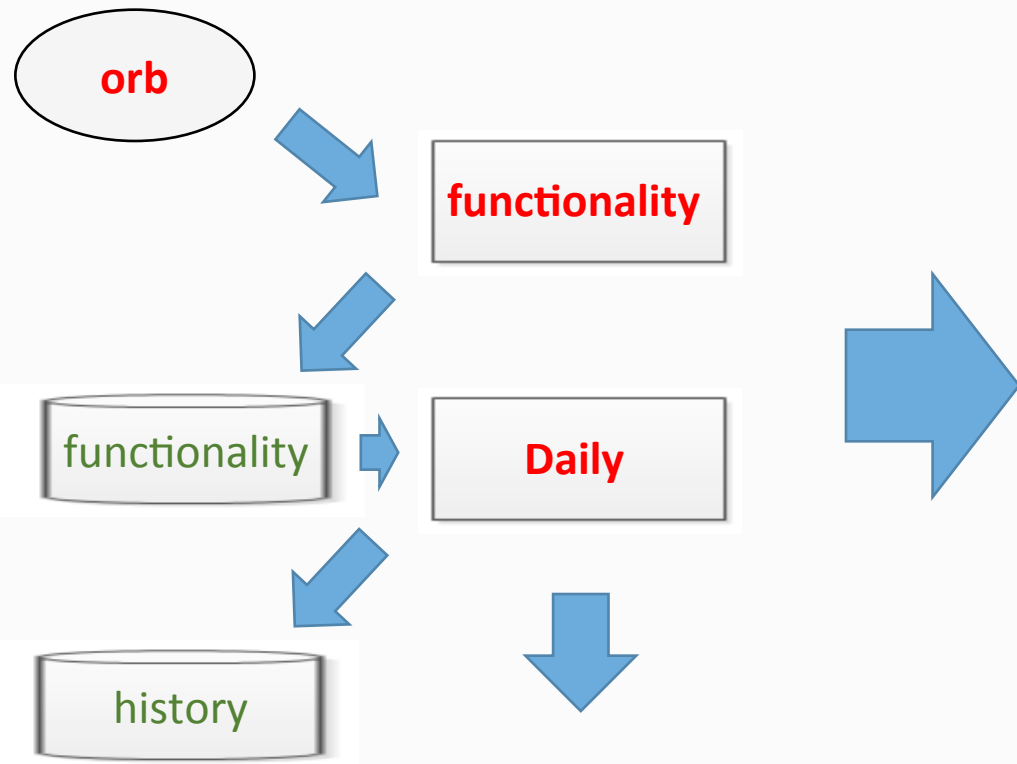
risposta



Evento Bovec – K
spettri di risposta (damping 5%)



Daily report



Funzionalità_RF20160514.xml

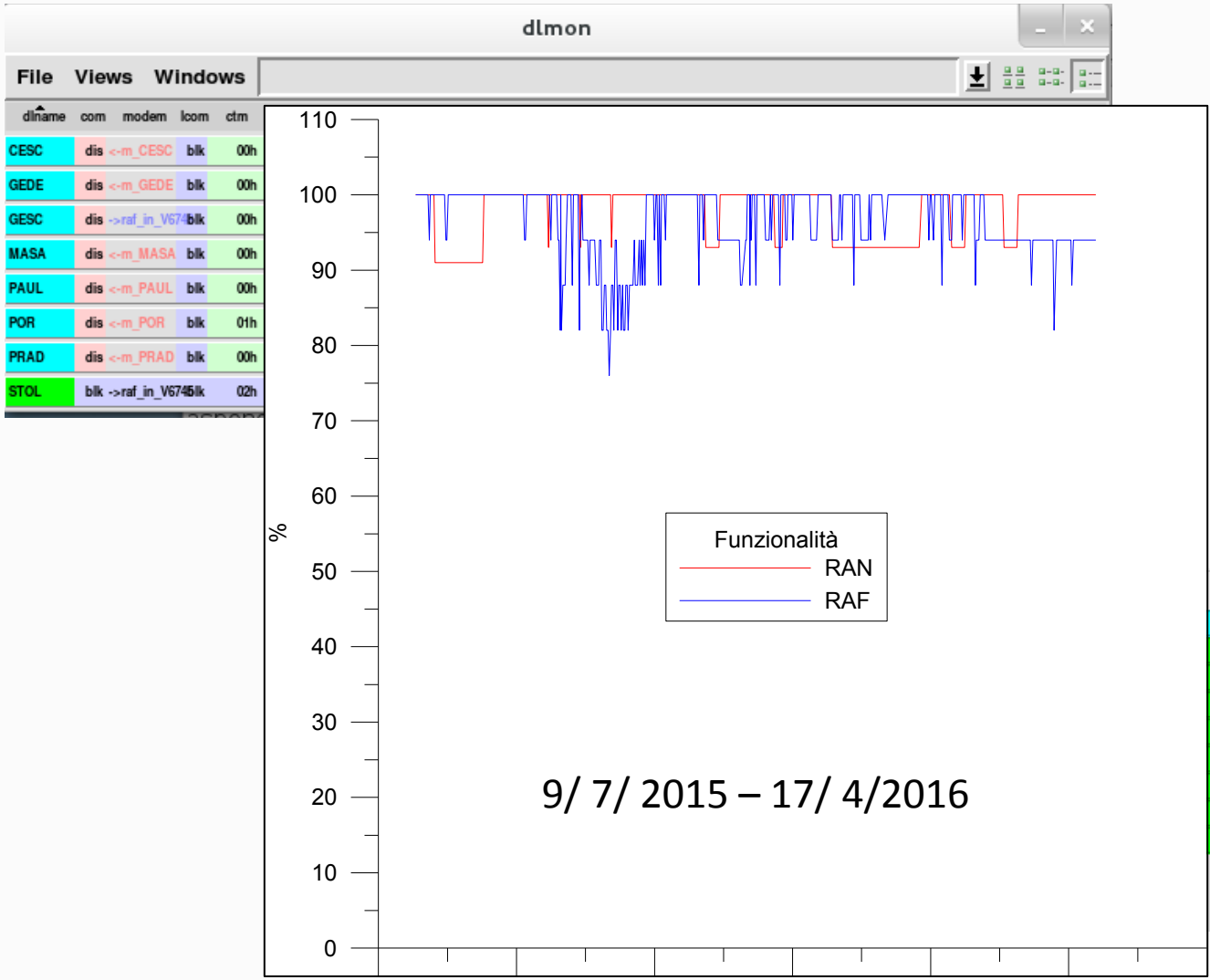
FVG RAF daily report 14/05/2016 12:05:02
University of Trieste - Italy

Analyzed stations: 17
No working stations: 1
FUNCTIONALITY: 94%

No working stations:
PURA - Information not available!

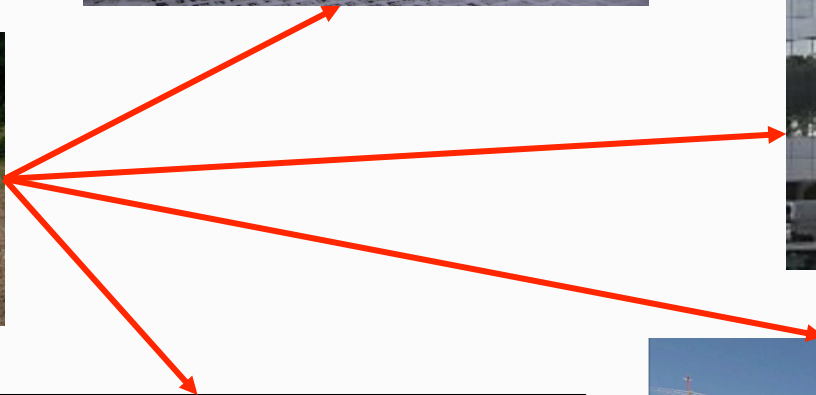
Alerted stations:
DST2 - Clock latency: 6660.0
CARC - Connection latency: 4
CESC - Battery discharging

Procedure implemented by SeisRaM group, University of Trieste, Italy - ver: Daily8.6.xpy - 2014 - costa@units.it



reset delay	#reset	SIM s/n
12407:54:26	0	CCID:8939010000626169534
12407:53:56	0	CCID:89390100001200546501
12407:53:55	0	CCID:89390100001211720111
12407:53:49	0	CCID:8939010000969040540
12407:54:27	0	CCID:89390100001200546477
12404:34:57	0	CCID:89390100001200546196
12407:54:28	0	CCID:89390100001200546162
12407:53:55	0	CCID:89390100001200546089

Last update: 2016/04/18 14:13:11.338



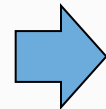
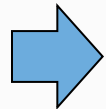
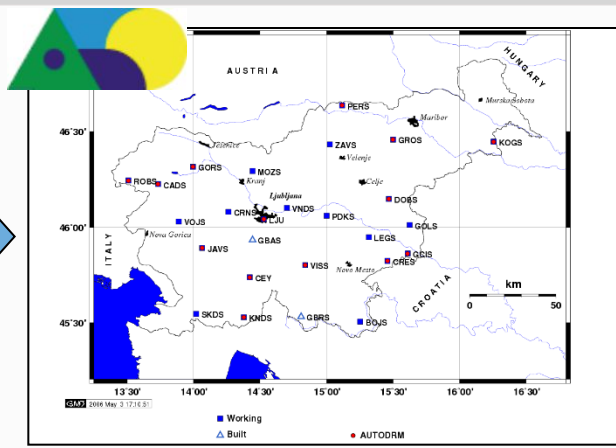
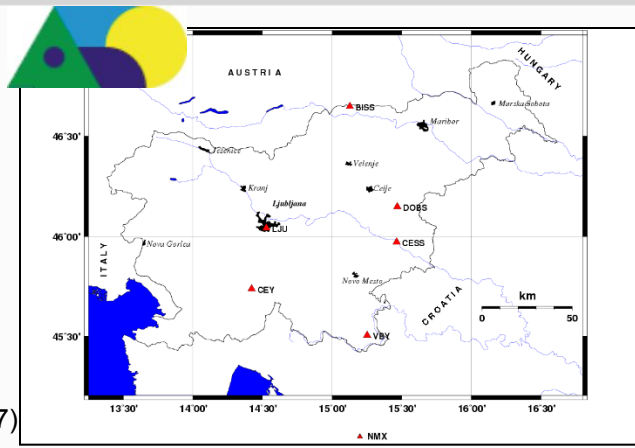
CE³RN
Central and Eastern European
Earthquake Research Network





BOVEC 1998

Živčić, (Susans, 2007)



THE INTERREG IIIA PROJECTS
"TRANS-NATIONAL SEISMOLOGICAL NETWORK IN THE SOUTH-EASTERN ALPS"

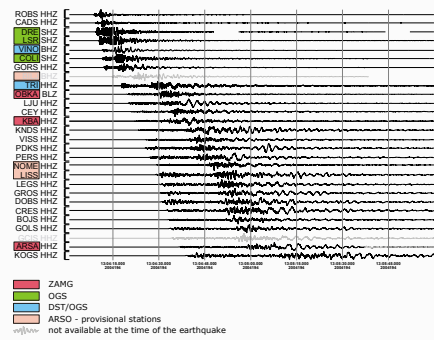
Trans-National Seismological Networks in the South-Eastern Alps

FASTLINK

CE3RN



BOVEC 2004



**Trans-National Seismological
DATABASE
2003-2016**



2008

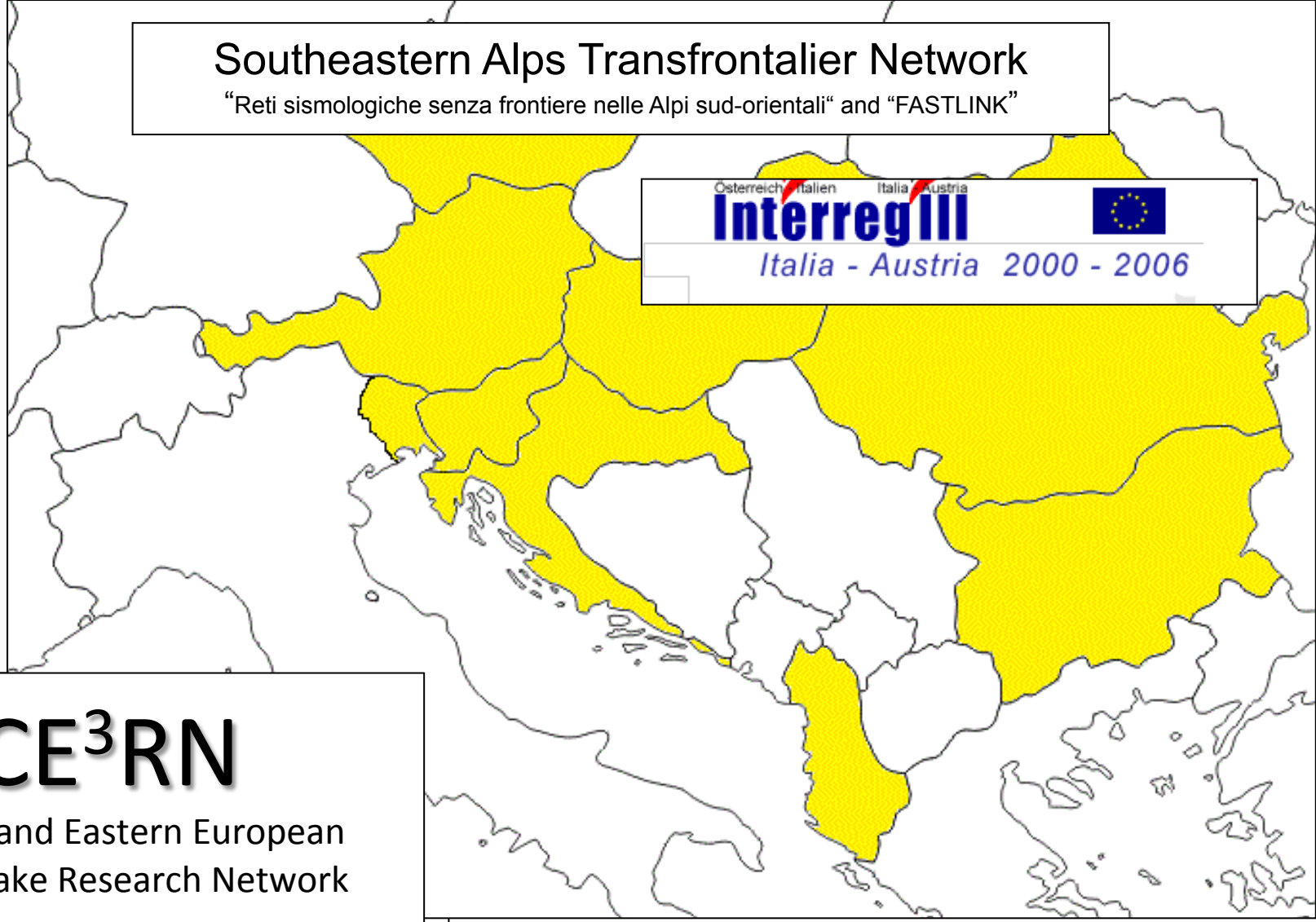
Southeastern Alps Transfrontalier Network
"Reti sismologiche senza frontiere nelle Alpi sud-orientali" and "FASTLINK"

Osterreich Italien Italia Austria
Interreg III
Italia - Austria 2000 - 2006



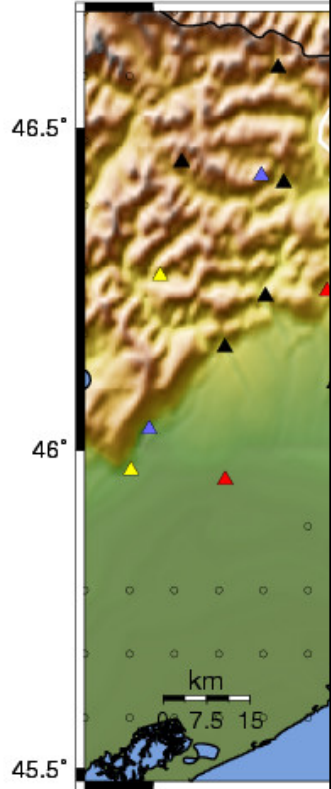
CE³RN

Central and Eastern European
Earthquake Research Network



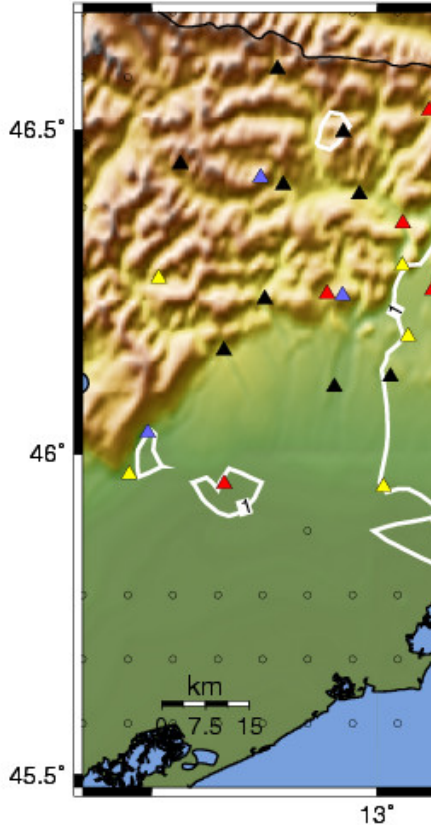


DST Peak
Sun Apr 12, 1998 12:55:32 PM



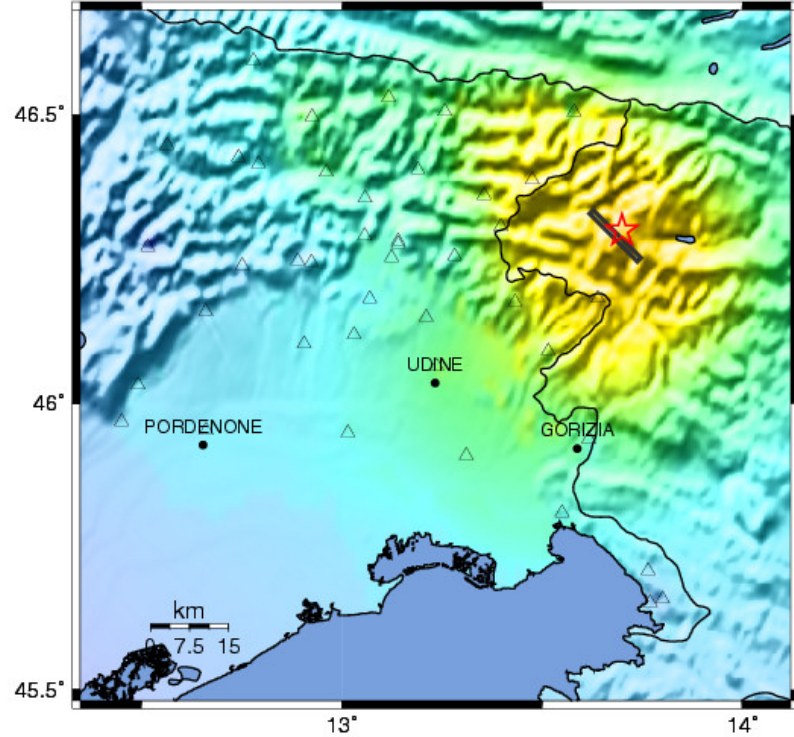
Processed: Wed Oct 31, 2007 12:07:06 PM CST

DST Peak Velocity Magnitude
Sun Apr 12, 1998 12:55:32 PM CDT M 5.7



Processed: Wed Oct 31, 2007 12:07:06 PM CST

DST Rapid Instrumental Intensity Map Epicenter: BOVEC
Sun Apr 12, 1998 12:55:32 PM CDT M 5.7 N46.30 E13.70 Depth: 15.2km ID:9804121055



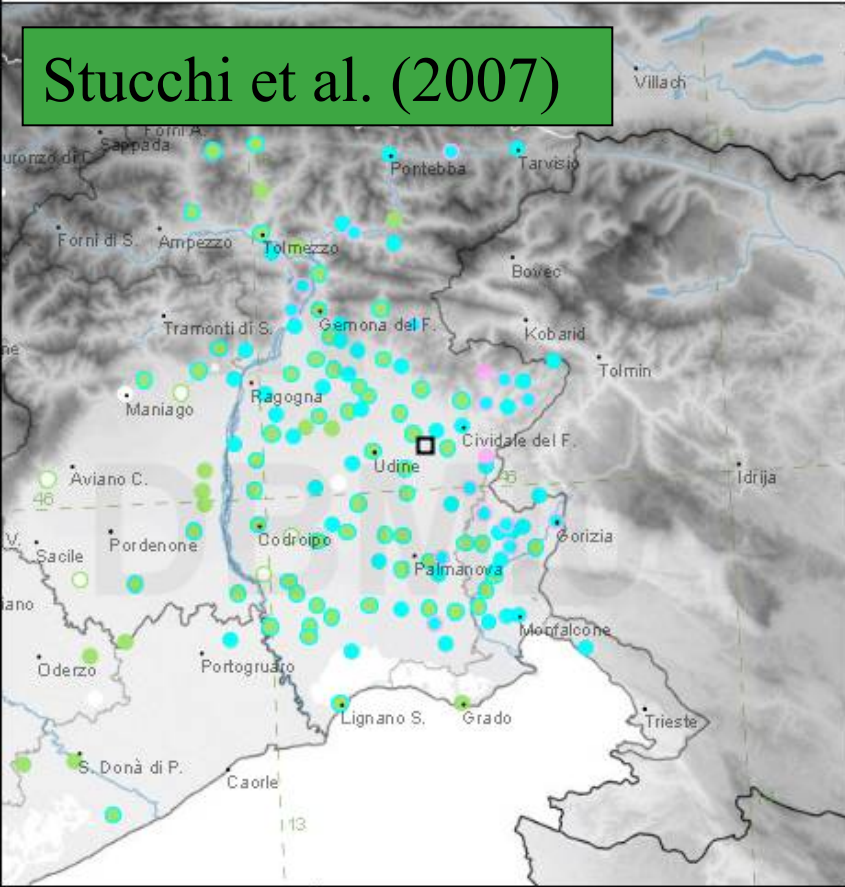
Processed: Wed Oct 31, 2007 12:07:06 PM CST, - NOT REVIEWED BY HUMAN

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.07	.07-0.4	0.4-0.9	0.9-2.0	2.0-4.5	4.5-10	10-23	23-53	>53
PEAK VEL.(cm/s)	<.03	.03-0.2	0.2-0.6	0.6-1.7	1.7-4.7	4.7-13	13-36	36-100	>100
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+



Terremoto del 12.4.1998 Io 6 Mw 5.70
Area epicentrale SLOVENIA-FRIULI - Studio BMING (BMING)

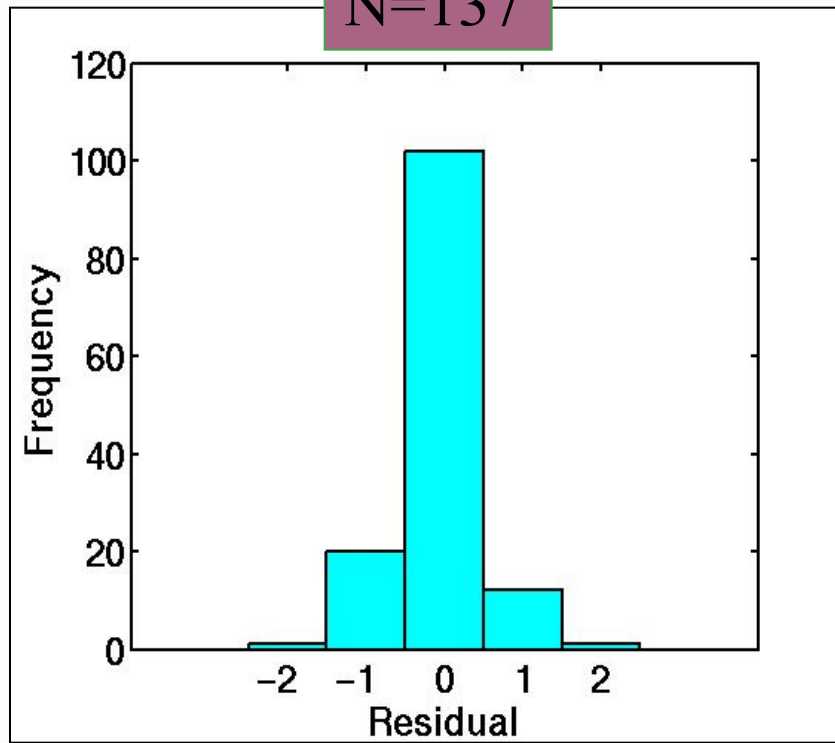
Stucchi et al. (2007)



$$Misfit = \frac{\sum_{i=1}^N |I_{COM} - I_{OBS}|}{N} = 0.264$$

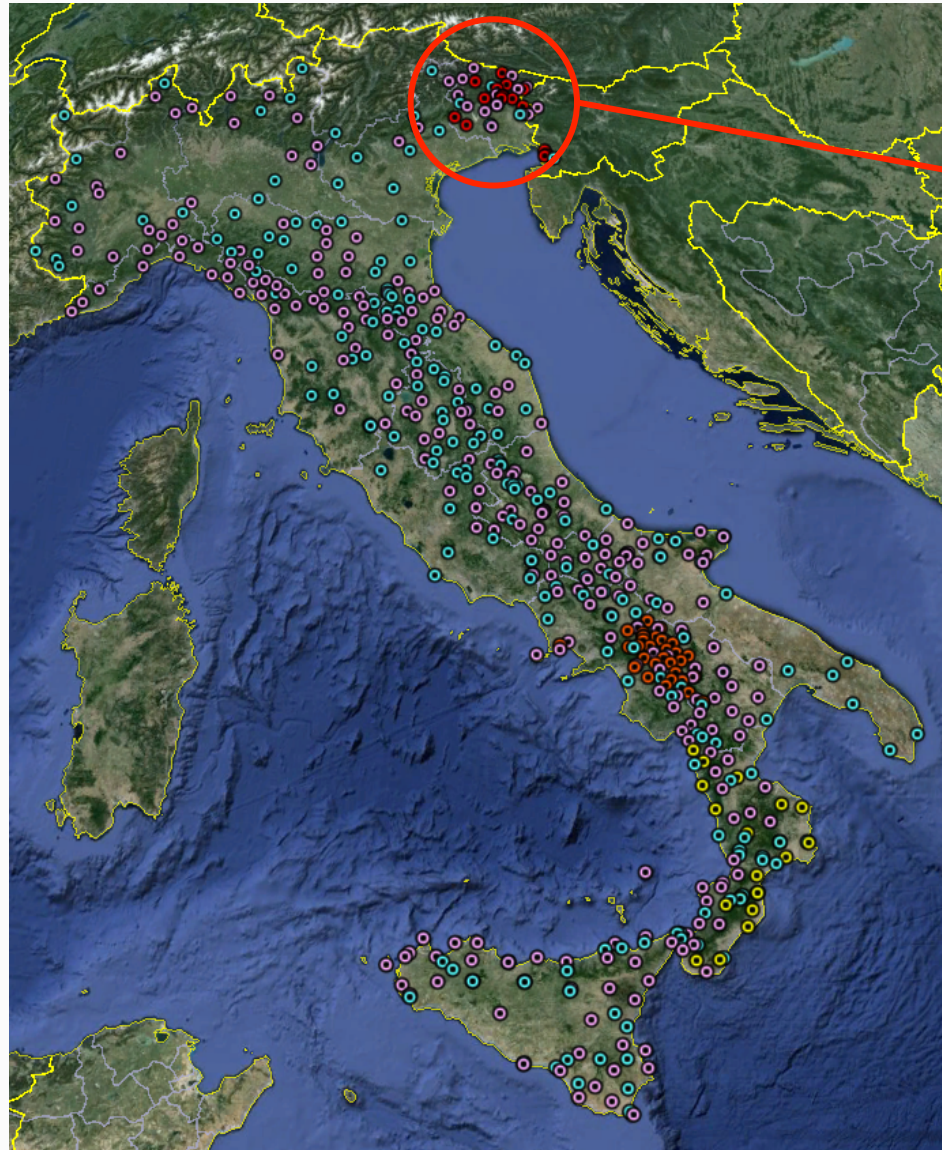


N=137





RAN








RAF

Friuli Venezia Giulia
Accelerometric Network – RAF



SeisRaM

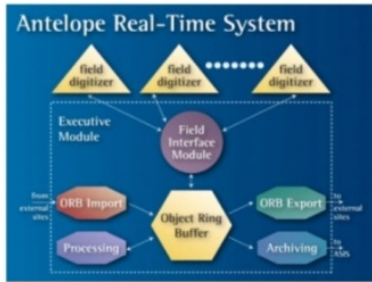
-  RAN - Syscom
-  RAN - Kinematics
-  RAN - CESI
-  RAF
-  ISNet



Real-time system



RAF regional network
(Costa et al., 2010)



DPC

(Zambonelli et al., 2011; Gorini et al., 2010)

RAN Syscom network

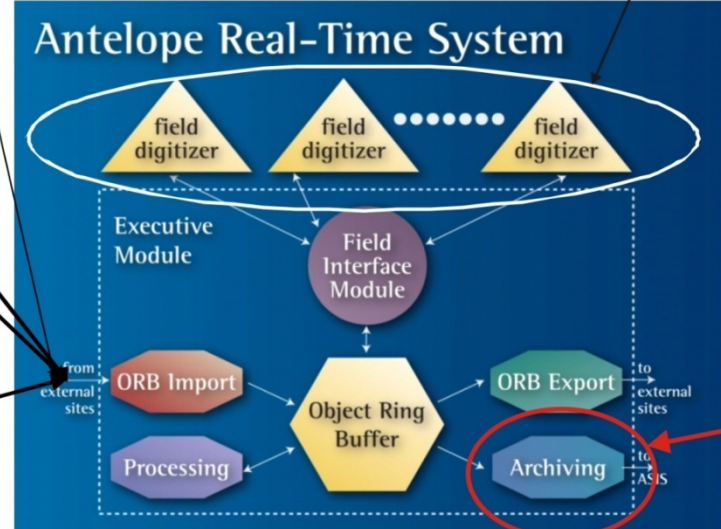
RAN Cesi regional network

RAN Kinematics network

sys2orb

cesi2orb

isnet2orb



(BRTT - Bolder Real Time System)



Fast strong motion data analysis

A fast seismic data analysis is essential to provide useful information to Authorities which make decisions immediately after a strong earthquake occurrence. During a strong earthquake, the modern accelerometers are the only instruments which can provide near source high-quality data that are important both for scientific (e.g. a better understanding of the source characteristic) and for civil protection purposes (e.g. a rapid provision of information on ground motion parameters to Authorities).

Automatic and fast techniques have been developed by the University of Trieste for the automatic real-time strong motion data analysis. These techniques have tested at University of Trieste using the VBB and strong-motion data of the Central and Eastern European Earthquake Research Network (CE3RN). Starting from 2012 this technique has been installed and optimized in the data acquisition centre of the National Department of Civil Protection of Italy (DPC) in Rome to process the near real-time data of the National Accelerometric Network (RAN).



Fast strong motion data analysis

The developed procedure estimates in real time the seismic moment, moment magnitude and corner frequency of events recorded by a network comprising broad-band, velocimeter and accelerometer sensors.

Engineering and damage parameters

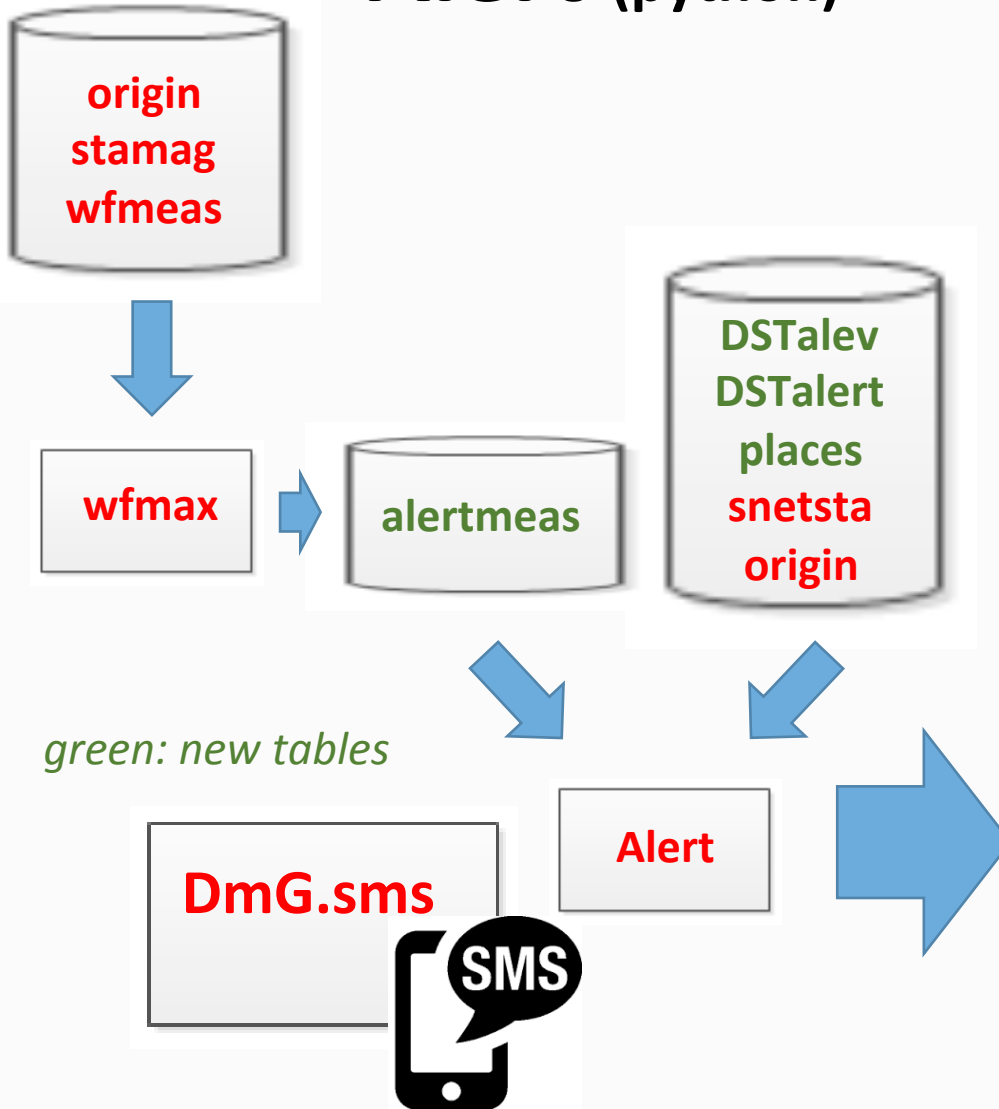
PGA, PGV, PGD, PSA, duration, Arias, Housner, RMSA, intensity of zero crossing, Saragoni index, damage factor, etc.

are also obtained in near real-time, archived and sent by e-mail to the Civil Defence Authorities.

The procedure produces reliable results even for small-magnitude events (≈ 2).



Alert (python)



10/05/2016 05:26:01 ORID: 340278 EVID: 340278

PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

Earthquake AUTOMATIC REPORT

Dipartimento della Protezione Civile - Rome - Italy
Rete Accelerometrica Nazionale
RAN

WARNING:
These information are preliminary
and may be revised when more data are available.

Event: CENTRAL ITALY
Origin time: 2016/05/10 03:25:12
Latitude: 42.900 Longitude: 12.784
Depth: 20 km
Magnitude MI: 2.7
Hostname: aspendpc5
nass: 5
PGA max: 4
Min distance:

sta	net	styp	dist	ch	pgv (cm/s)
TRE	IT	A	2	(N)	7.2e-02
FOPC	IT	A	5	(Z)	1.2e-02
FOC	IT	A	9	(E)	4.6e-02
GNU	IT	A	11	(E)	7.9e-03
LSS	IT	A	21	(N)	2.6e-03

Nearest cities:
Terni 20 km

Procedure implemented by SeisRaM group, University of Trieste, Italy, under the agreement with DPC - Alert_3.03 - 2016



dbmw (fortran90)

Signal pre-processing

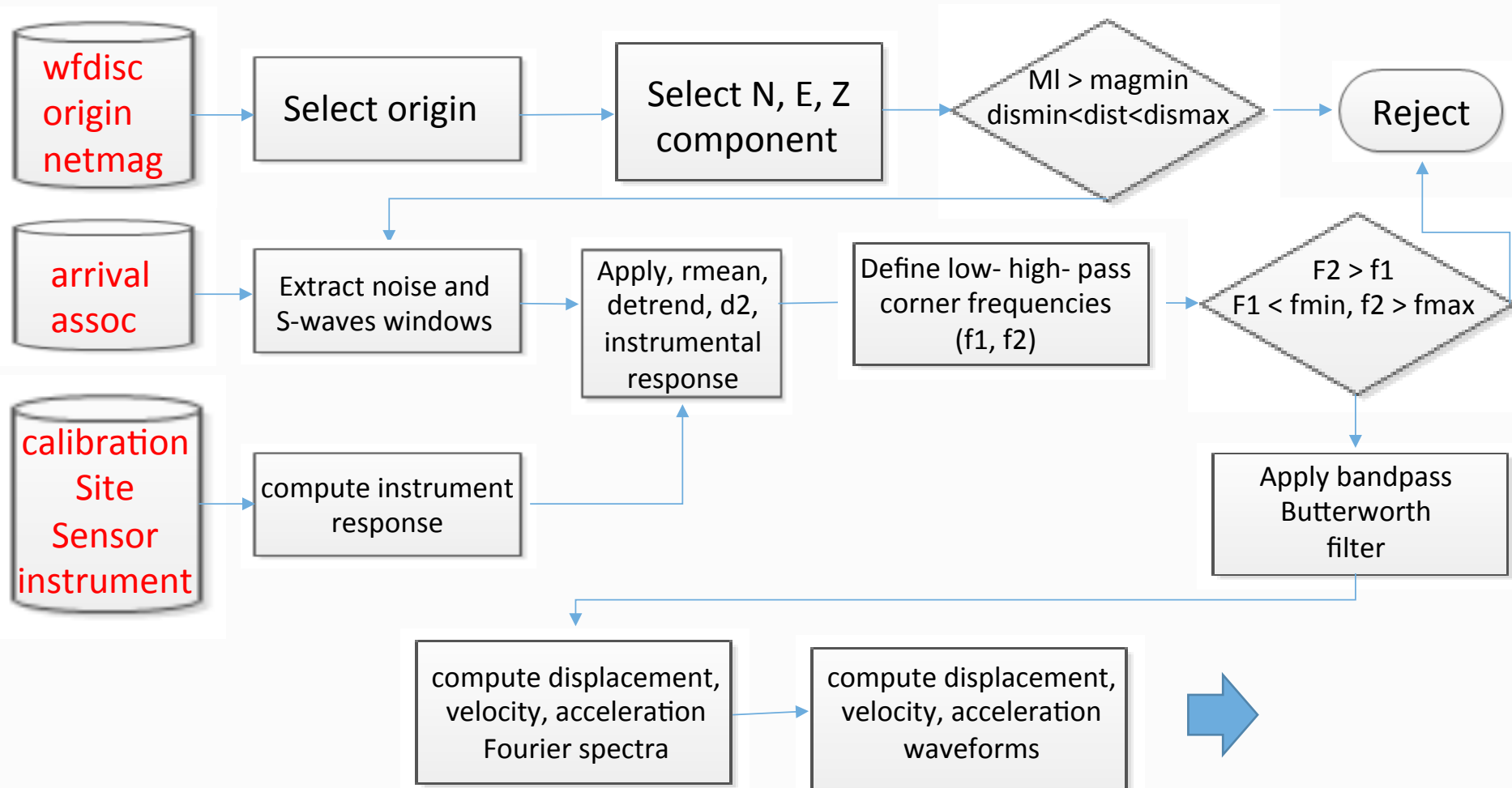
Seismic Moment, f_0 , stress drop, Mw computation

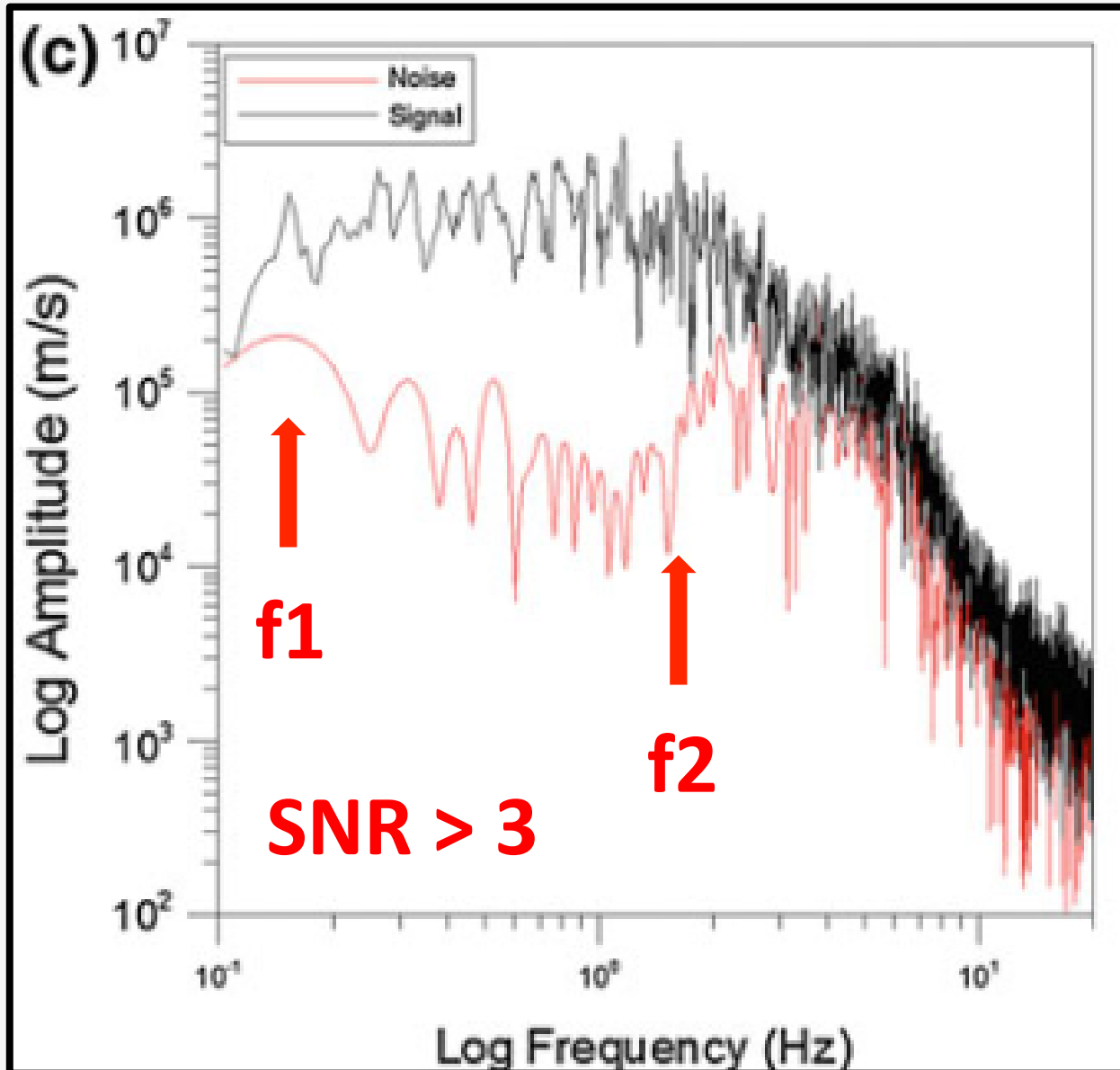
Response spectra and Ground Motion Parameters



dbmw (fortran90)

Signal pre-processing







Sc

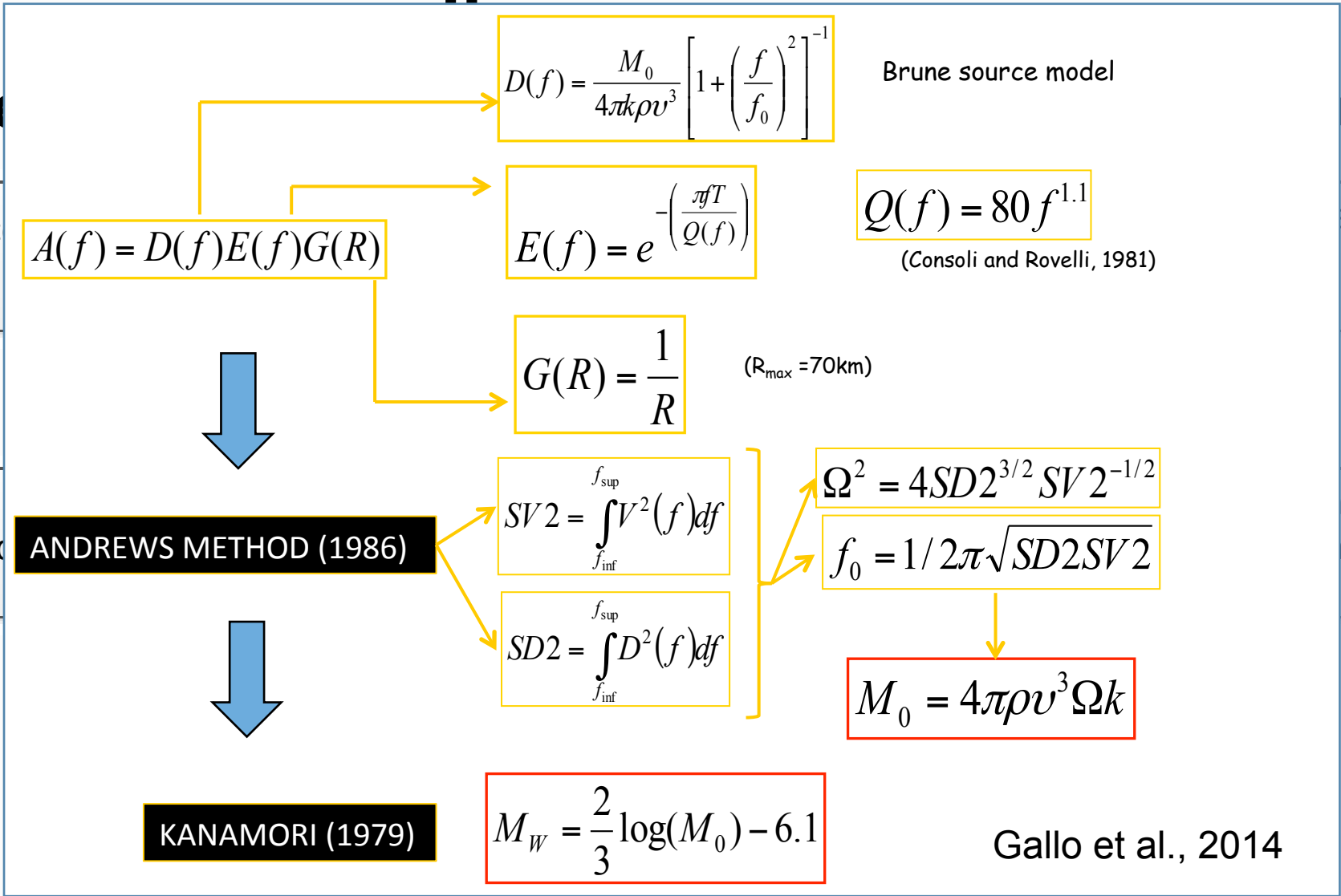
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on

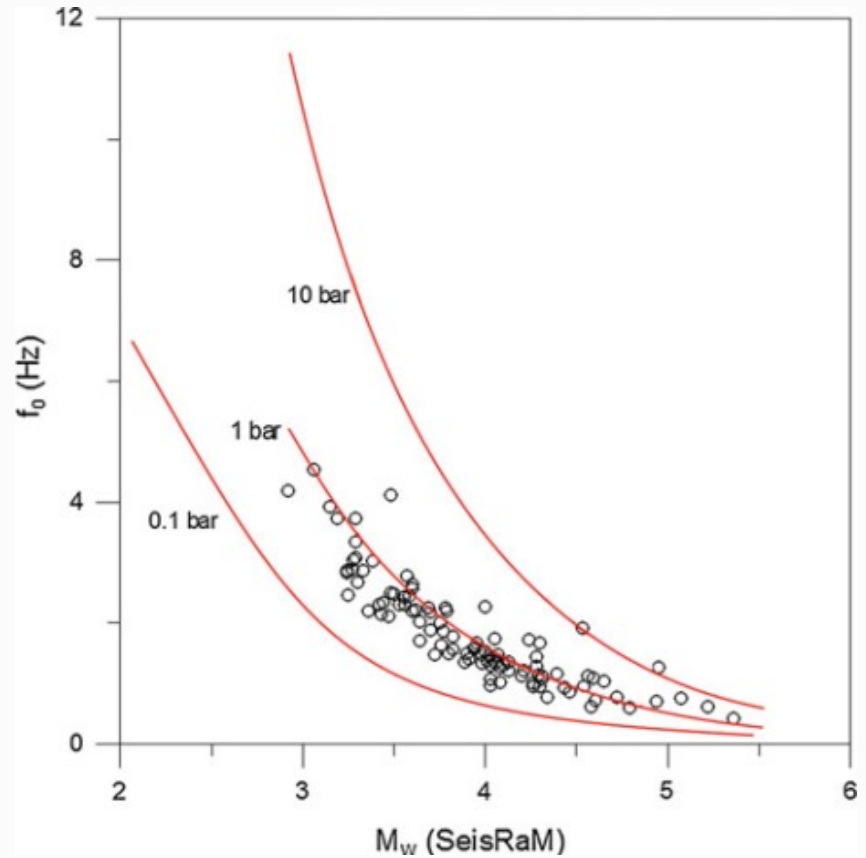
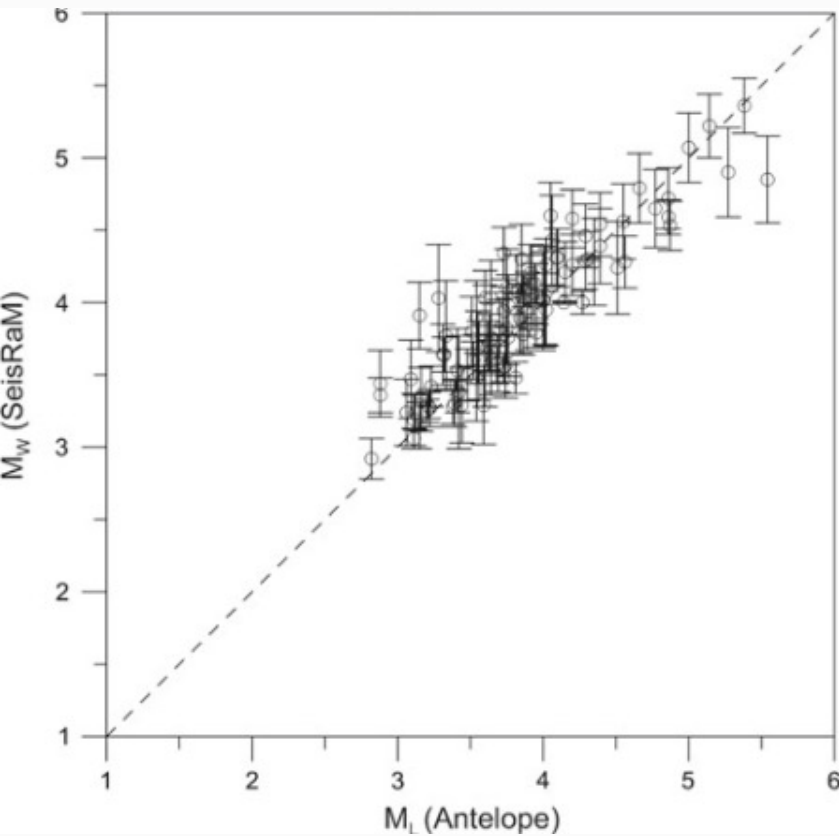
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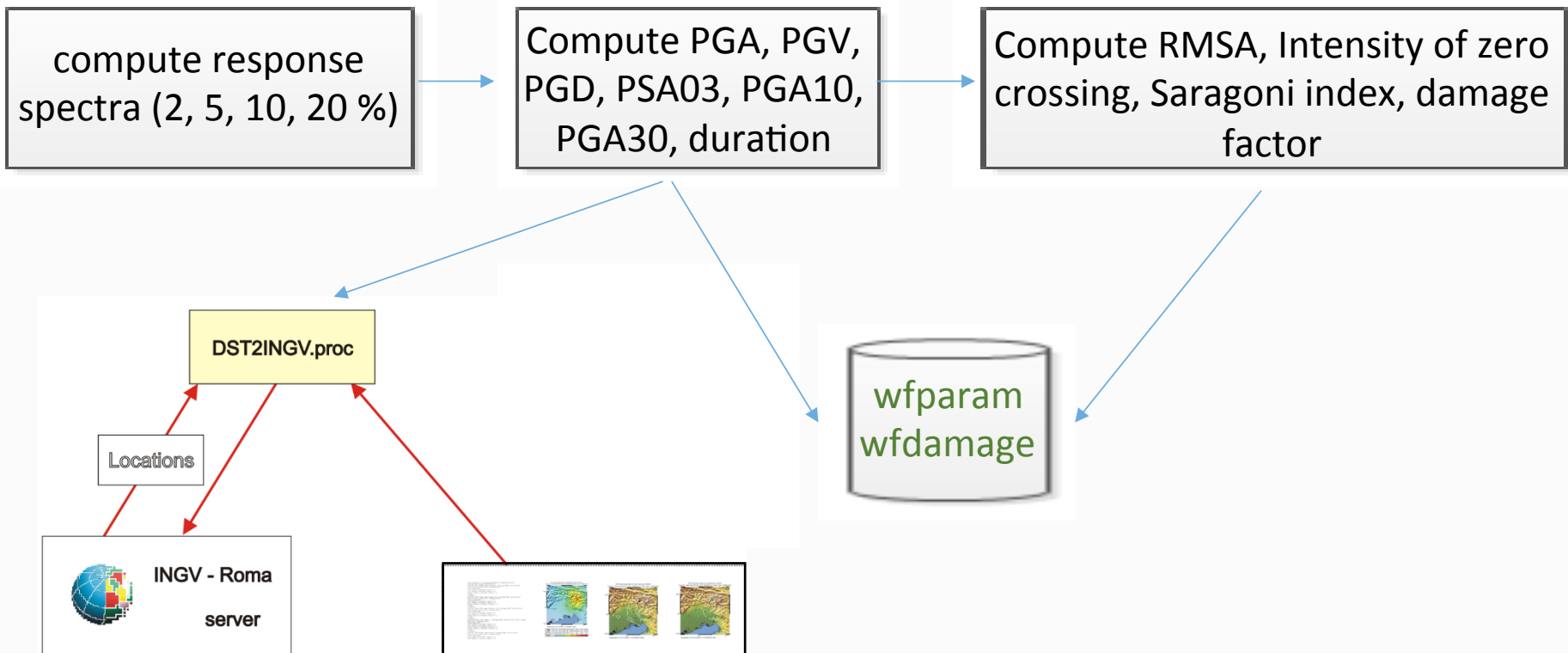
SEISMIC MOMENT AND MOMENT MAGNITUDE COMPUTATION





dbmw (fortran90)

Response spectra and Ground Motion Parameters





new dbmw (c)

Fortran90

C

~~orb2wf~~

orb2wf

Select N, E, Z
components
From "chan"

o	sta	chan	ondate	edepth	hang	vang	descrip
	SOV	HGZ	2005299	0.0000	0.0	0.0	cfx_4041 4041
	SOV	HGY	2005299	0.0000	325.0	90.0	cfx_4041 4041
	SOV	HGX	2005299	0.0000	55.0	90.0	cfx_4041 4041
	ATP	HGZ	2005298	0.0000	0.0	0.0	cfx_4031 4031
	ATP	HGY	2005298	0.0000	278.0	90.0	cfx_4031 4031
	ATP	HGX	2005298	0.0000	8.0	90.0	cfx_4031 4031
	CZR	HGZ	2005299	0.0000	0.0	0.0	sara_4021 4021
	CZR	HGY	2005299	0.0000	47.0	90.0	sara_4021 4021
	CZR	HGX	2005299	0.0000	137.0	90.0	sara_4021 4021
	KRO	HGZ	2005300	0.0000	0.0	0.0	sara_4011 4011
	KRO	HGY	2005300	0.0000	338.0	90.0	sara_4011 4011
	KRO	HGX	2005300	0.0000	68.0	90.0	sara_4011 4011
	BOV	HGZ	2005298	0.0000	0.0	0.0	cfx_4001 4001
	BOV	HGY	2005298	0.0000	215.0	90.0	cfx_4001 4001
	BOV	HGX	2005298	0.0000	305.0	90.0	cfx_4001 4001

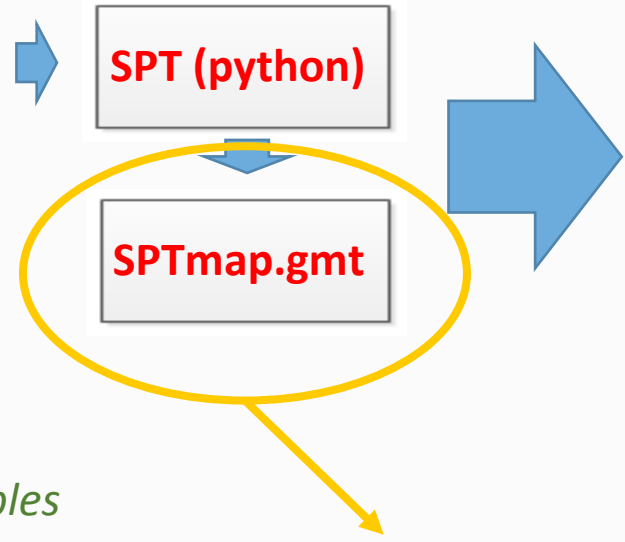


Rotate
components
to N and E

Energy
computation



SPT



green: new tables

future development: python

03/04/2014 12:05:11 ORID: 618 EVID: 389

PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

Earthquake AUTOMATIC REPORT

Dipartimento della Protezione Civile - Rome - Italy
Rete Accelerometrica Nazionale
RAN

WARNING:
These information are preliminary
and may be revised when more data are available.

Event: NORTHERN_ITALY
Origin time: 2012/05/29 07:00:03
Latitude: 44.851 Longitude: 12.250
Magnitude MI: 5.8
AGENCY: INGV

Seismic Moment: 1
Mw: 5.8
AGENCY: UniTS

Records analyzed by procedure: SPT
Selected limits: max distance: 100 km, min PGA to show: 0.05 cm/s², max PGV to show: 10 cm/s
Records inside the selected limits: 100 inside the limits: 185

Nearest station: MRN distance: 3.81 km
HGZ - PGA=895.78 cm/s², PGV=21.64 cm/s

Procedure implemented by SeisRaM group, University of Trieste, Italy - ver: SPT_1.24 - 2014 - costa@units.it



SeisRaM

Seismological Researcher
and Monitoring group

Antelope User Group meeting Rome, Maj 18-20, 2016



AUG

Antelope Users Group

22/04/2014 13:07:07

ORID: 22386715 EVID: 22153020



Earthquake AUTOMATIC REPORT

University of Trieste - Italy
SeisRaM group
data from CE3RN (ARSO, OGS, UniTS, ZAMG)

WARNING:

These information are preliminary
and may be revised when more data are available.

Event: KNEZAK
Origin time: 2014/04/22 08:58:27
Latitude: 45.633 Longitude: 14.258
Magnitude MI: 4.7
AGENCY: UniTS

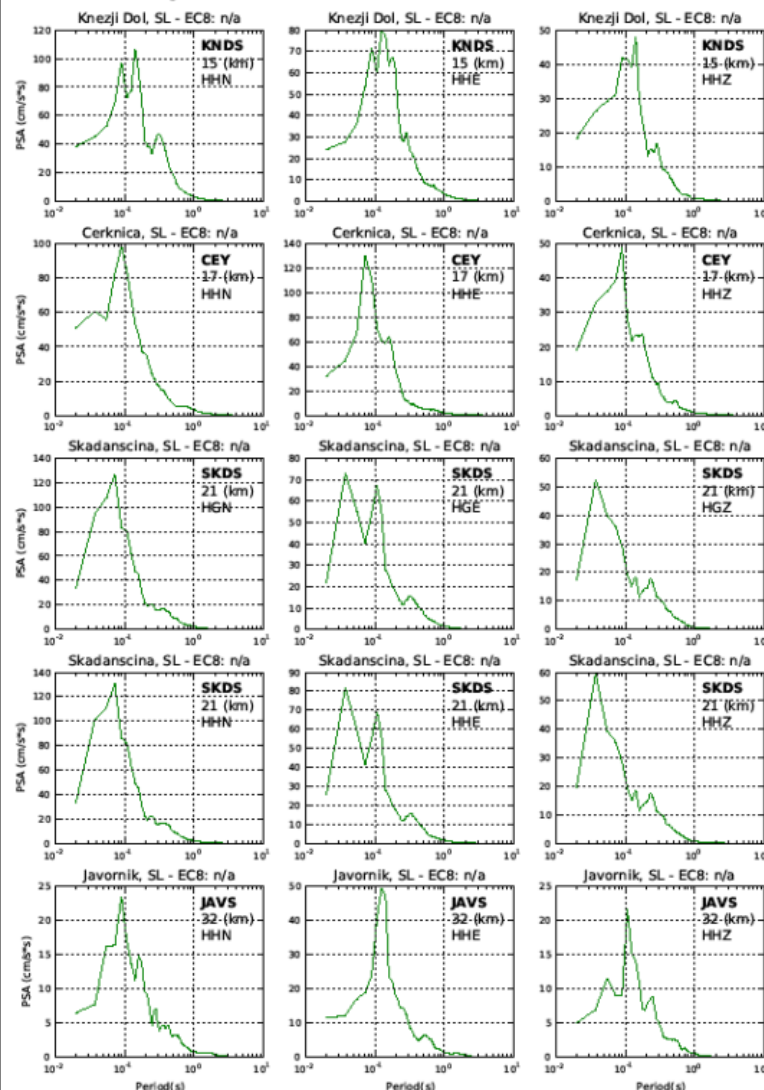
Seismic Moment: 2.67e+16 Nm
Mw: 4.5
AGENCY: UniTS

Records analyzed by procedure: 153
Selected limits: max distance=150. km min PGA= 0.1 cm/s*s
min PGA to show response spectra= 0.1 cm/s*s
Records inside the selected limits: 150 response spectra inside the limits: 150

Nearest station: KNDS distance: 15.23 km
HHN - PGA=37.72 cm/s*s, PGV=0.82 cm/s
Max recorded PGA: 47.72 cm/s*s Station: CEY Cerknica, SL
HHN - distance=17.31 km, PGV=0.75 cm/s

Procedure implemented by SeisRaM group, University of Trieste, Italy - ver: SPT_1.25 - 2014 - costa@units.it

Event: KNEZAK - Origin time: 2014/04/22 08:58:27 Lat:45.633 Lon:14.258 MI = 4.7



Spectral Acceleration SA (damping 5%) (thin green line)
Predicted SA - return period of 475 years as in the Italian Technical norms for buildings (NTC08) (red line)
Recorded smoothed spectral acceleration following the criteria suggested by Working Group MS (2008) (thick green line)



Event: KNEZAK - Origin time: 2014/04/22 08:58:27 Lat:45.633 Lon:14.258 MI = 4.7 Agency: UniTS
Seismic moment: 2.670e+16 Nm - Mw = 4.5 Agency: UniTS

sta	chan	dista	filter	PGA	EPA	PGV	PGD	PSA03	PSA10	PSA30	EC8	location
		km	Hz	cm/s ²	cm/s ²	cm/s	cm	cm/s ²	cm/s ²	cm/s ²		
KNDS	HHN	15	0.1-50.0	37.72	18.21	0.82	0.05	46.81	3.25	0.34	na	Knezji Dol, SL
KNDS	HHE	15	0.1-50.0	23.92	13.69	0.69	0.06	27.62	3.59	0.28	na	Knezji Dol, SL
KNDS	HHZ	15	0.1-50.0	17.14	6.61	0.33	0.02	15.04	0.78	0.11	na	Knezji Dol, SL
CEY	HHN	17	0.1-50.0	47.72	10.45	0.75	0.05	17.87	3.40	0.32	na	Cerknica, SL
CEY	HHE	17	0.1-50.0	30.33	9.38	0.70	0.04	11.35	1.94	0.22	na	Cerknica, SL
CEY	HHZ	17	0.1-50.0	17.83	4.48	0.27	0.02	9.18	0.86	0.12	na	Cerknica, SL
SKDS	HGN	21	0.1-50.0	30.76	9.61	0.62	0.04	15.55	2.15	0.20	na	Skadancina, SL
SKDS	HGE	21	0.1-50.0	19.71	7.32	0.44	0.03	14.50	1.60	0.14	na	Skadancina, SL
SKDS	HGZ	21	0.1-50.0	13.09	4.50	0.27	0.02	10.94	0.76	0.10	na	Skadancina, SL
SKDS	HHN	21	0.2-50.0	30.33	9.88	0.65	0.03	15.58	2.16	0.22	na	Skadancina, SL
SKDS	HHE	21	0.2-50.0	21.62	7.46	0.43	0.02	14.51	1.65	0.16	na	Skadancina, SL
SKDS	HHZ	21	0.1-50.0	13.35	4.49	0.27	0.02	10.97	0.77	0.10	na	Skadancina, SL
JAVS	HHN	33	0.1-50.0	6.13	2.86	0.14	0.02	4.66	0.80	0.15	na	Javornik, SL
JAVS	HHE	33	0.1-50.0	11.36	6.15	0.31	0.03	10.40	1.63	0.20	na	Javornik, SL
JAVS	HHZ	33	0.1-50.0	4.70	2.64	0.12		5.09				
DST2	HHN	36	0.1-47.0	7.46	4.97	0.27	0.02	9.90				
DST2	HHE	36	0.1-46.4	9.09	4.13	0.20	0.01	8.00				
DST2	HHZ	36	0.1-47.8	4.49	2.65	0.12		5.70				
GBAS	HHN	37	0.1-50.0	3.23	1.26	0.07		2.35				
GBAS	HHE	37	0.1-50.0	3.71	1.43	0.07		3.31				
GBAS	HHZ	37	0.1-50.0	2.43	0.96	0.06		1.56				
TRI	HHN	39	0.1-47.3	12.38	1.97	0.15		2.33				
TRI	HHE	39	0.1-45.6	13.66	3.60	0.19		4.30				
TRI	HHZ	39	0.1-47.5	31.18	4.24	0.34		5.12				
GBRS	HHN	45	0.1-50.0	11.89	3.11	0.20		2.86				
GBRS	HHE	45	0.1-50.0	15.31	3.81	0.25		4.30				
GBRS	HHZ	45	0.1-50.0	4.42	1.12	0.07		1.75				
VISS	HHN	49	0.1-50.0	3.78	2.32	0.13	0.01	4.22				
VISS	HHE	49	0.1-50.0	3.68	2.00	0.10		2.71				

dista = epicentral distance
filter = automatic band pass butterworth filter
EC8 = site classification (Eurocode from ITACA)

PGA,PGV,PGD = peak ground acceleration and velocity
EPA = effective peak acceleration
PSA03,PSA10,PSA30 = spectral acceleration

Event: KNEZAK - Origin time: 2014/04/22 08:58:27 Lat:45.633 Lon:14.258 MI = 4.7 Agency: UniTS
Seismic moment: 2.670e+16 Nm - Mw = 4.5 Agency: UniTS

sta	chan	dista	filter	Td	PGV/PGA	RMSA	v0	Pd	Id	Housner	Arias	EC8	location
		km	Hz	s	s	cm/s ²	1/s	cm ² /s	cm/s	cm	cm/s		
KNDS	HHN	15	0.1-50.0	3.10	0.02	7.03	225.53	4.94	2.68	0.24	na	na	Knezji Dol, SL
KNDS	HHE	15	0.1-50.0	4.30	0.03	5.05	175.84	6.60	2.29	0.18	na	na	Knezji Dol, SL
KNDS	HHZ	15	0.1-50.0	5.82	0.02	2.45	170.08	6.25	0.99	0.06	na	na	Knezji Dol, SL
CEY	HHN	17	0.1-50.0	4.67	0.02	5.93	320.00	4.63	1.90	0.26	na	na	Cerknica, SL
CEY	HHE	17	0.1-50.0	5.78	0.02	5.24	252.25	7.43	1.91	0.25	na	na	Cerknica, SL
CEY	HHZ	17	0.1-50.0	8.03	0.02	2.52	218.18	10.70	0.76	0.08	na	na	Cerknica, SL
SKDS	HGN	21	0.1-50.0	4.37	0.02	7.04	415.12	11.42	1.90	0.35	na	na	Skadancina, SL
SKDS	HGE	21	0.1-50.0	5.63	0.02	4.20	311.98	11.49	1.33	0.16	na	na	Skadancina, SL
SKDS	HGZ	21	0.1-50.0	8.31	0.02	2.76	250.66	18.01	0.80	0.10	na	na	Skadancina, SL
SKDS	HHN	21	0.2-50.0	4.58	0.02	7.24	399.34	12.21	1.91	0.38	na	na	Skadancina, SL
SKDS	HHE	21	0.2-50.0	5.59	0.02	4.52	316.35	12.42	1.29	0.18	na	na	Skadancina, SL
SKDS	HHZ	21	0.1-50.0	8.01	0.02	2.91	255.56	19.07	0.80	0.11	na	na	Skadancina, SL
JAVS	HHN	33	0.1-50.0	14.61	0.02	0.85	92.16	12.71	0.56	0.02	na	na	Javornik, SL
JAVS	HHE	33	0.1-50.0	6.92	0.03	1.93	163.75	7.22	0.97	0.04	na	na	Javornik, SL
JAVS	HHZ	33	0.1-50.0	13.39	0.03	0.71	105.49	11.55	0.39	0.01	na	na	Javornik, SL
DST2	HHN	36	0.1-47.0	14.76	0.04	1.37	111.59	13.69	0.90	0.04	A	A	DST-Trieste_station
DST2	HHE	36	0.1-46.4	17.05	0.02	1.31	101.23	15.93	0.59	0.05	A	A	DST-Trieste_station
DST2	HHZ	36	0.1-47.8	18.82	0.03	0.89	116.84	27.43	0.42	0.02	A	A	DST-Trieste_station
GBAS	HHN	37	0.1-50.0	17.75	0.02	0.61	99.07	30.41	0.21	0.01	na	na	Gornja Brezovica, SL
GBAS	HHE	37	0.1-50.0	16.73	0.02	0.61	102.00	25.26	0.22	0.01	na	na	Gornja Brezovica, SL
GBAS	HHZ	37	0.1-50.0	17.07	0.02	0.46	110.28	24.66	0.20		na	na	Gornja Brezovica, SL
TRI	HHN	39	0.1-47.3	21.71	0.01	1.69	101.70	33.98	0.41	0.10	A	A	TRI-Trieste_station
TRI	HHE	39	0.1-45.6	22.66	0.01	2.58	90.25	57.66	0.53	0.24	A	A	TRI-Trieste_station
TRI	HHZ	39	0.1-47.5	25.99	0.01	9.15	179.03	207.24	0.84	3.49	A	A	TRI-Trieste_station
GBRS	HHN	45	0.1-50.0	16.55	0.02	2.27	86.01	35.58	0.61	0.14	na	na	Gornja Briga, SL
GBRS	HHE	45	0.1-50.0	15.47	0.02	2.88	87.82	33.79	0.68	0.21	na	na	Gornja Briga, SL
GBRS	HHZ	45	0.1-50.0	18.57	0.02	0.85	106.62	43.55	0.25	0.02	na	na	Gornja Briga, SL
VISS	HHN	49	0.1-50.0	12.92	0.03	0.74	116.91	14.44	0.45	0.01	na	na	Visnje, SL
VISS	HHE	49	0.1-50.0	13.73	0.03	0.67	103.20	17.68	0.31		na	na	Visnje, SL

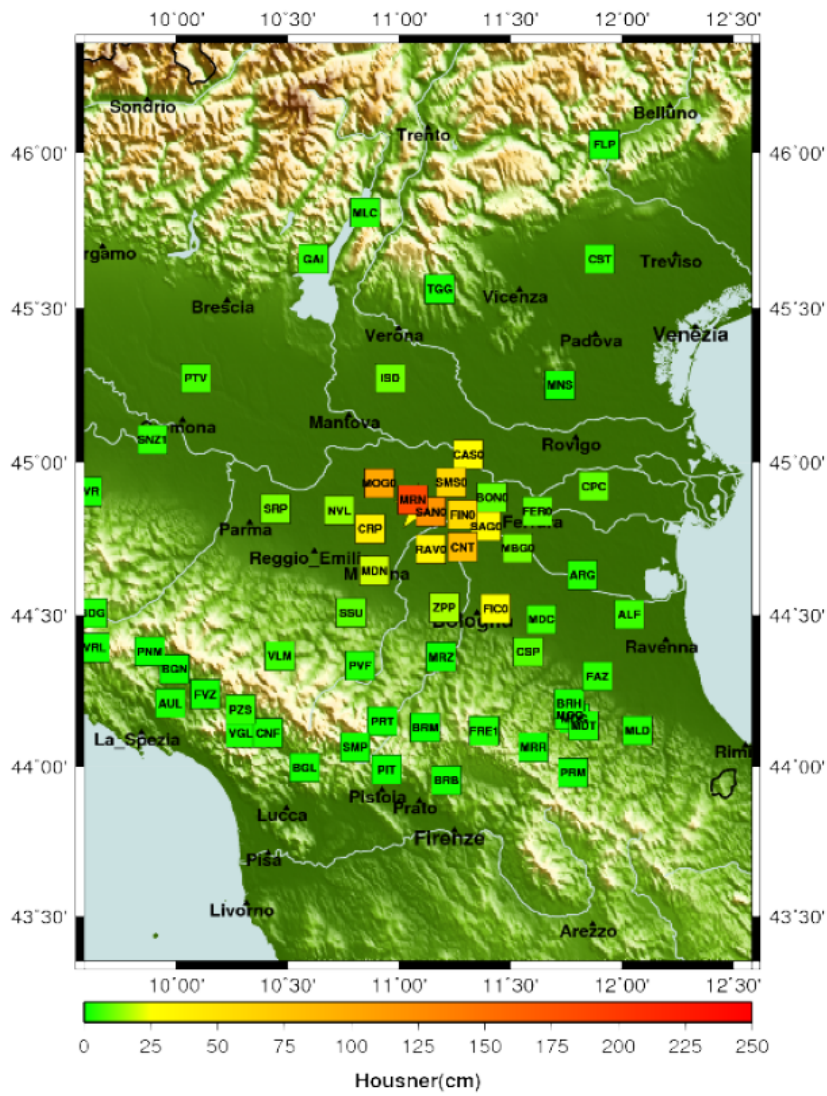
dista = epicentral distance
filter = automatic band pass butterworth filter
Td = duration (Trifunac and Bardy, 1975)
PGA,PGV = peak ground acceleration and velocity

RMSA = root mean square acceleration
v0 = intensity of zero crossing
Pd = Saragoni index
Id = damage factor

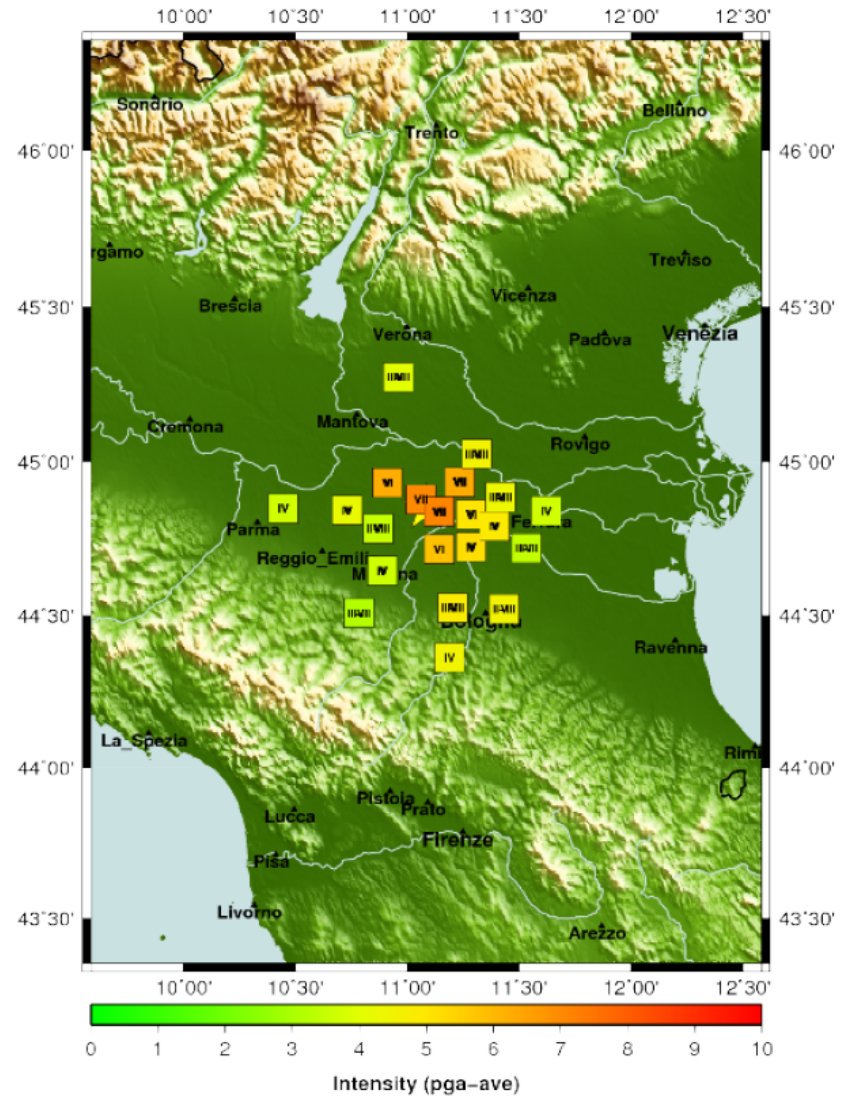
Housner = Housner spectral intensity
Arias = Arias intensity
EC8 = site classification (Eurocode8 from ITACA)



2012/05/29 07:00:03 MI:5.8 NORTHERN_ITALY



2012/05/29 07:00:03 MI:5.8 NORTHERN_ITALY





Event: **NORTHERN** - Origin time: 2012/05/29 07:00:03 Lat:44.851 Lon:11.086 MI = 5.8 Agency: INGV
Seismic moment: 1.130e+18 Nm - Mw = 5.8 Agency: UniTS

sta	chan	dista km	filter Hz	PGA cm/s*s	EPA cm/s*s	PGV cm/s	PGD cm	PSA03 cm/s*s	PSA10 cm/s*s	PSA30 cm/s*s	EC8	location
MRN	HGN	4	0.1-50.0	296.92	267.39	50.05	16.75	711.99	344.55	156.01	C	Mirandola
MRN	HGE	4	0.1-50.0	251.19	214.60	24.34	8.70	508.27	174.41	72.37	C	Mirandola
MRN	HGZ	4	0.1-50.0	895.78	239.98	21.64	5.86	381.48	87.98	25.17	C	Mirandola
SAN0	HGN	4	0.1-50.0	238.52	201.70	31.15	10.91	531.08	198.90	122.31	na	San_Felice_sul_Panaro
SAN0	HGE	4	0.1-50.0	152.70	148.42	23.65	6.08	388.62	208.71	81.58	na	San_Felice_sul_Panaro
SAN0	HGZ	4	0.1-50.0	327.18	134.34	9.01	3.55	295.06	42.03	20.32	na	San_Felice_sul_Panaro
SMS0	HGN	15	0.1-50.0	187.27	141.93	13.04	4.48	337.50	168.40	36.21	na	San_Martino_Spino
SMS0	HGE	15	0.1-50.0	177.15	238.06	15.51	4.11	606.28	137.93	28.43	na	San_Martino_Spino
SMS0	HGZ	15	0.1-50.0	122.37	52.29	3.08	0.97	106.20	17.54	7.95	na	San_Martino_Spino
RAV0	HGN	16	0.1-50.0	94.78	73.04	9.59	3.78	248.98	138.27	20.17	na	Ravarino
RAV0	HGE	16	0.1-50.0	57.84	42.25	5.55	1.32	105.47	74.58	8.96	na	Ravarino
RAV0	HGZ	16	0.1-50.0	64.19	27.69	1.65	1.35	92.1				
FIN0	HGN	16	0.1-50.0	247.46	195.48	15.89	3.00	505.5				
FIN0	HGE	16	0.1-50.0	212.39	178.21	14.65	3.01	366.6				
FIN0	HGZ	16	0.1-50.0	208.85	54.58	3.17	0.87	119.9				
MOG0	HGN	16	0.1-50.0	161.37	175.17	20.21	5.77	461.6				
MOG0	HGE	16	0.1-50.0	252.91	227.59	25.65	2.92	578.8				
MOG0	HGZ	16	0.1-50.0	125.22	89.73	4.27	1.43	248.8				
CRP	HGN	19	0.1-50.0	172.60	109.54	7.27	1.96	193.3				
CRP	HGE	19	0.1-50.0	128.17	86.17	8.94	2.11	192.2				
CRP	HGZ	19	0.1-50.0	85.82	42.72	2.26	0.77	76.6				
CNT	HGN	21	0.1-50.0	301.71	245.93	14.63	2.55	1011.1				
CNT	HGE	21	0.1-50.0	215.22	259.72	17.15	3.38	781.1				
CNT	HGZ	21	0.1-50.0	67.00	55.26	2.68	0.50	280.8				
SAG0	HGN	25	0.1-50.0	66.74	62.56	6.09	2.15	177.7				
SAG0	HGE	25	0.1-50.0	84.09	86.95	7.10	1.45	291.1				
SAG0	HGZ	25	0.1-50.0	67.09	35.01	1.94	0.56	75.5				
CAS0	HGN	26	0.1-50.0	42.08	40.79	7.50	3.50	113.3				
CAS0	HGE	26	0.1-50.0	71.49	69.43	6.16	2.74	172.2				

dista = epicentral distance
filter = automatic band pass butterworth filter
EC8 = site classification (Eurocode from ITACA)

PGA,PGV,P
EPA = effe
PSA03,PSA



Event: **NORTHERN** - Origin time: 2012/05/29 07:00:03 Lat:44.851 Lon:11.086 MI = 5.8 Agency: INGV
Seismic moment: 1.130e+18 Nm - Mw = 5.8 Agency: UniTS

sta	chan	dista km	filter Hz	Td s	PGV/PGA s	RMSA cm/s*s	v0 1/s	Pd cm*s	Id cm/s	Housner cm	Arias cm/s	EC8	location
MRN	HGN	4	0.1-50.0	6.98	0.17	103.65	108.02	0.01	5.05	186.41	120.07	C	Mirandola
MRN	HGE	4	0.1-50.0	7.54	0.10	77.17	115.84		7.35	101.21	71.95	C	Mirandola
MRN	HGZ	4	0.1-50.0	5.22	0.02	187.28	304.31		9.46	49.74	293.44	C	Mirandola
SAN0	HGN	4	0.1-50.0	6.55	0.13	69.39	76.95		4.24	119.10	50.50	na	San_Felice_sul_Panaro
SAN0	HGE	4	0.1-50.0	6.62	0.15	52.14	71.20		4.98	80.70	28.79	na	San_Felice_sul_Panaro
SAN0	HGZ	4	0.1-50.0	4.44	0.03	76.06	232.21		8.72	29.86	41.13	na	San_Felice_sul_Panaro
SMS0	HGN	15	0.1-50.0	8.76	0.07	46.51	82.01		7.76	60.31	30.32	na	San_Martino_Spino
SMS0	HGE	15	0.1-50.0	6.12	0.09	66.42	93.06		9.83	60.30	43.26	na	San_Martino_Spino
SMS0	HGZ	15	0.1-50.0	6.70	0.03	33.49	173.56		19.94	12.12	12.02	na	San_Martino_Spino
RAV0	HGN	16	0.1-50.0	13.40	0.10	17.39	38.05		4.46	34.32	6.49	na	Ravarino
RAV0	HGE	16	0.1-50.0	13.13	0.10	11.66	42.50		5.56	21.83	2.86	na	Ravarino
RAV0	HGZ	16	0.1-50.0	9.21	0.03	12.37	88.10		13.30	6.52	2.25	na	Ravarino
FIN0	HGN	16	0.1-50.0	9.14	0.06	41.24	61.45		3.96	52.00	24.91	na	Finale_Emia
FIN0	HGE	16	0.1-50.0	9.03	0.07	43.83	63.90		5.58	57.50	27.78	na	Finale_Emia
FIN0	HGZ	16	0.1-50.0	5.59	0.02	58.03	146.69		28.47	14.94	30.14	na	Finale_Emia
MOG0	HGN	16	0.1-50.0	6.52	0.13	59.12	63.96		6.99	102.93	36.49	na	Moglia
MOG0	HGE	16	0.1-50.0	7.18	0.10	66.03	59.71	0.01	4.83	95.01	50.16	na	Moglia
MOG0	HGZ	16	0.1-50.0	9.13	0.03	31.66	83.42		17.13	22.43	14.66	na	Moglia
CRP	HGN	19	0.1-50.0	12.99	0.04	30.50	49.02		9.64	32.63	19.36	na	Carpi
CRP	HGE	19	0.1-50.0	12.85	0.07	27.14	54.01		8.26	38.53	15.15	na	Carpi
CRP	HGZ	19	0.1-50.0	10.61	0.03	20.22	80.68		22.38	11.62	6.94	na	Carpi
CNT	HGN	21	0.1-50.0	5.76	0.05	65.78	96.79		5.65	55.61	39.94	na	Cento
CNT	HGE	21	0.1-50.0	4.20	0.08	79.24	138.10		7.15	82.42	42.22	na	Cento
CNT	HGZ	21	0.1-50.0	8.98	0.04	17.86	83.85		15.97	9.60	4.59	na	Cento
SAG0	HGN	25	0.1-50.0	17.43	0.09	13.91	35.97		8.29	27.31	5.40	na	Sant_Agostino
SAG0	HGE	25	0.1-50.0	16.61	0.08	17.95	36.00		8.96	27.53	8.57	na	Sant_Agostino
SAG0	HGZ	25	0.1-50.0	10.65	0.03	13.29	75.40		14.43	7.08	3.01	na	Sant_Agostino
CAS0	HGN	26	0.1-50.0	18.53	0.18	13.32	23.58		10.42	27.93	5.27	na	Castelmassa
CAS0	HGE	26	0.1-50.0	17.80	0.09	16.35	26.00	0.01	10.82	26.81	7.62	na	Castelmassa

dista = epicentral distance
filter = automatic band pass butterworth filter
Td = duration (Trifunac and Bardy, 1975)
PGA,PGV = peak ground acceleration and velocity

RMSA = root mean square acceleration
v0 = intensity of zero crossing
Pd = Saragoni index
Id = damage factor

Housner = Housner spectral intensity
Arias = Arias intensity
EC8 = site classification (Eurocode8 from ITACA)



03/04/2014 12:05:11



ORID: 618 EVID: 389

Earthquake AUTOMATIC REPORT

Dipartimento della Protezione Civile - Rome - Italy
Rete Accelerometrica Nazionale
RAN

WARNING:

These information are preliminary
and may be revised when more data are available.

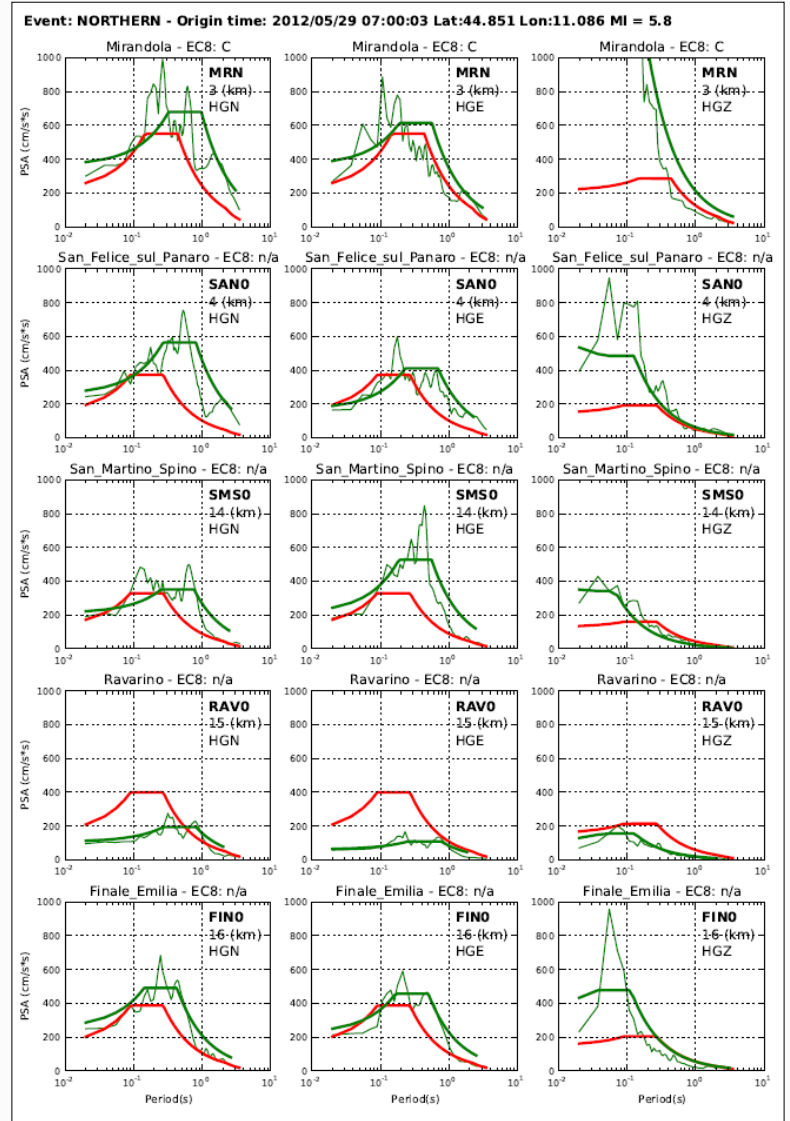
Event: NORTHERN_ITALY
Origin time: 2012/05/29 07:00:03
Latitude: 44.851 Longitude: 11.086
Magnitude MI: 5.8
AGENCY: INGV

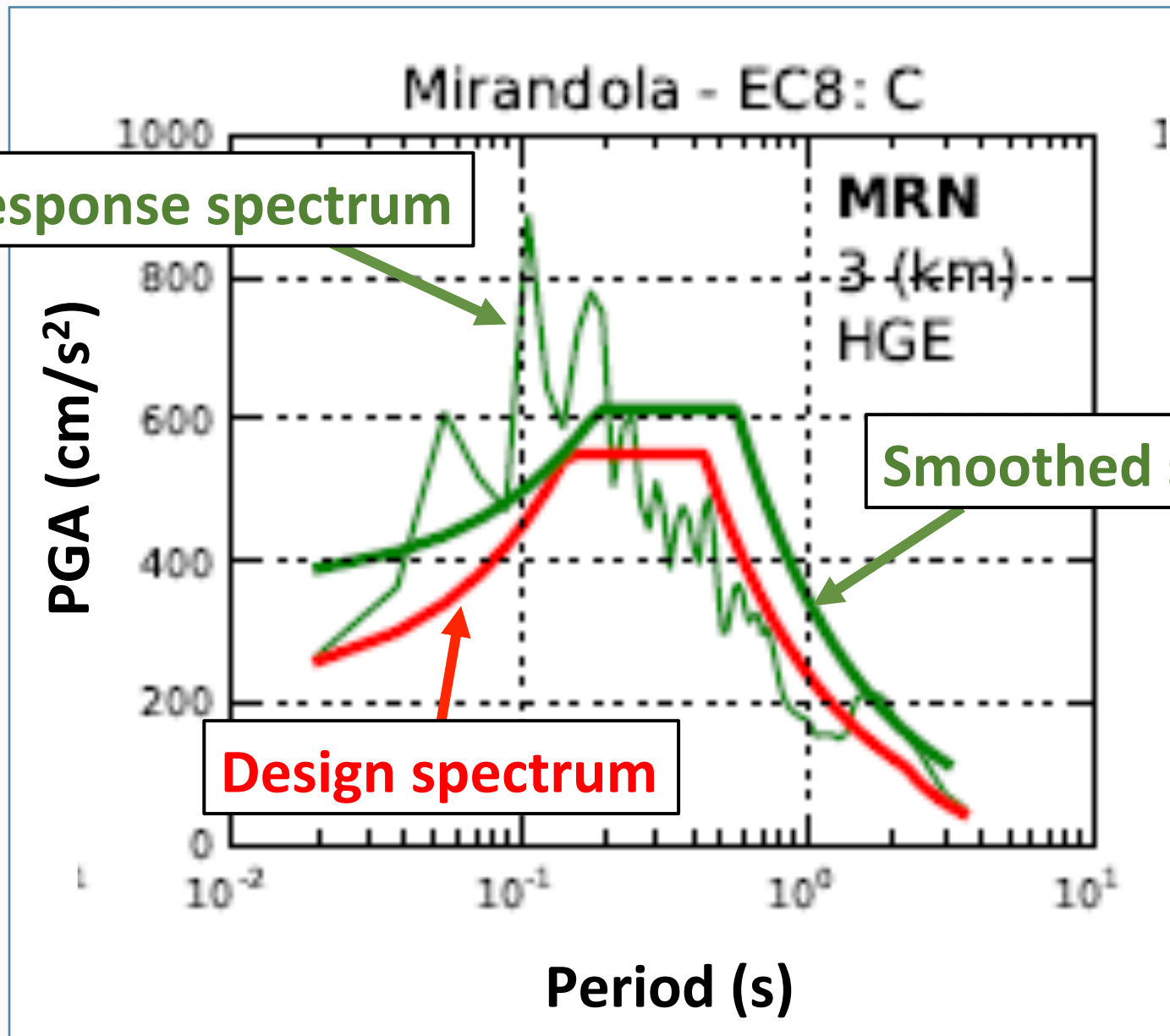
Seismic Moment: $1.13e+18$ Nm
Mw: 5.8
AGENCY: UniTS

Records analyzed by procedure: 197
Selected limits: max distance=150. km min PGA= 0.1 cm/s*s
min PGA to show response spectra= 0.1 cm/s*s
Records inside the selected limits: 185 response spectra inside the limits: 185

Nearest station: MRN distance: 3.81 km
HGZ - PGA=895.78 cm/s*s, PGV=21.64 cm/s

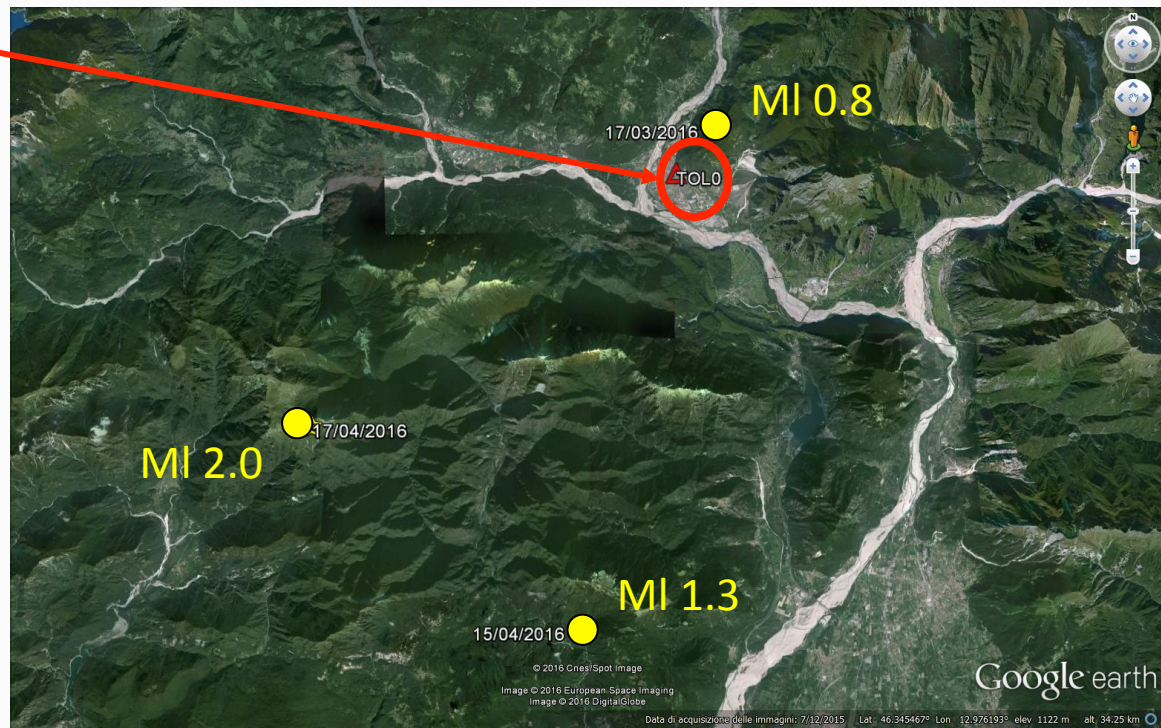
Procedure implemented by SeisRaM group, University of Trieste, Italy - ver. SPT_1.24 - 2014 - costa@units.it





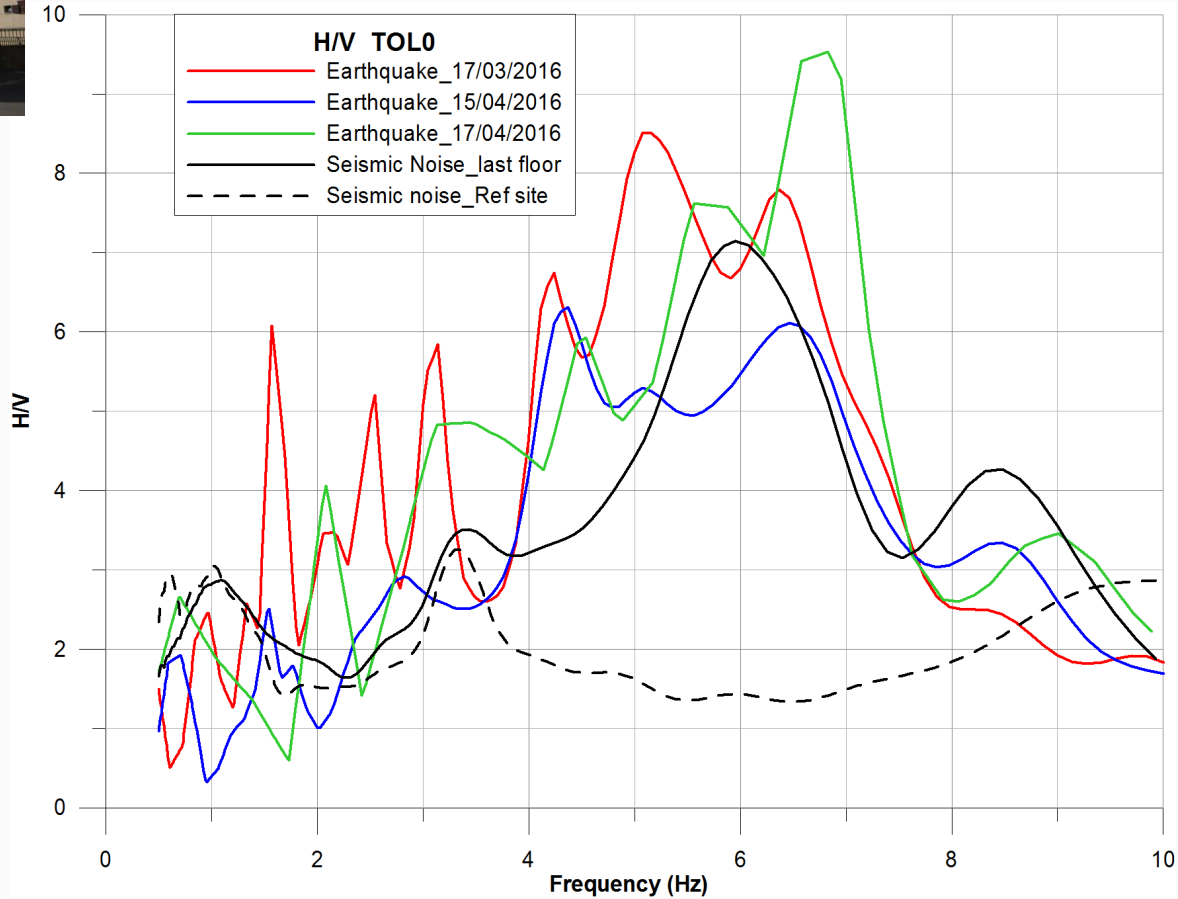


Tolmezzo





Tolmezzo





SeisRaM
Seismological Researcher
and Monitoring group

Antelope User Group meeting
Rome, Maj 18-20, 2016



SeisRaM
Seismological Researcher
and Monitoring group

Giovanni Costa, Piero Falconer, Lorenzo Furlan, Antonella Gallo, Lara Tiberi, Blaž Vičič, Giuliana Zoppé

Thank you for your attention.

<http://rtweb.units.it>