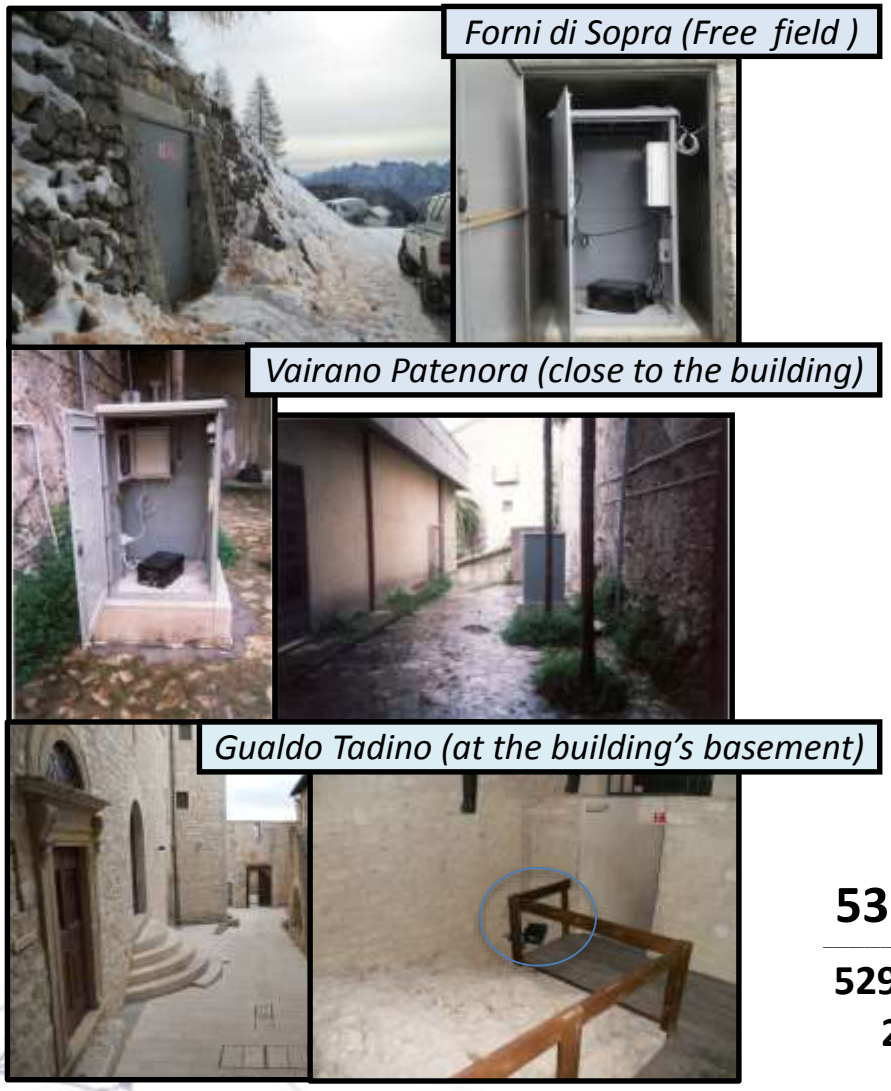
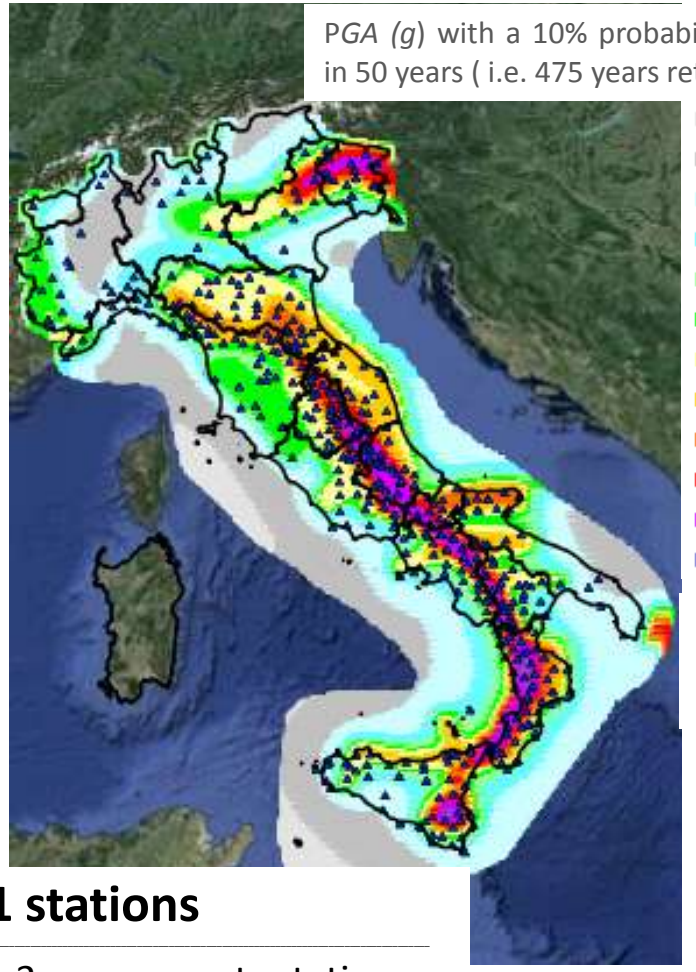
RAN – ITALIAN STRONG MOTION NETWORK

Antelope Users Group meeting Rome, 18-20 May 2016

RAN – Italian strong motion network (**FDSN** code «**IT**»)



RAN vs Italian seismic hazard map



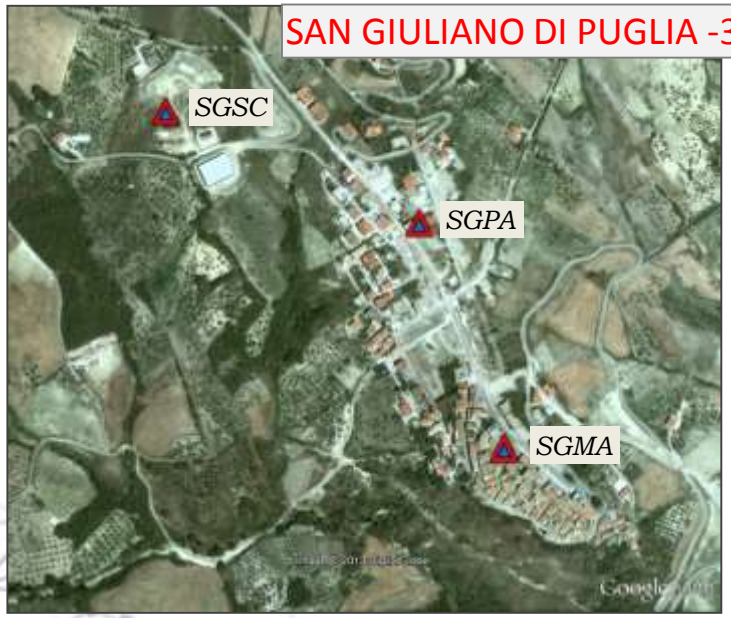
531 stations

529 3-components stations

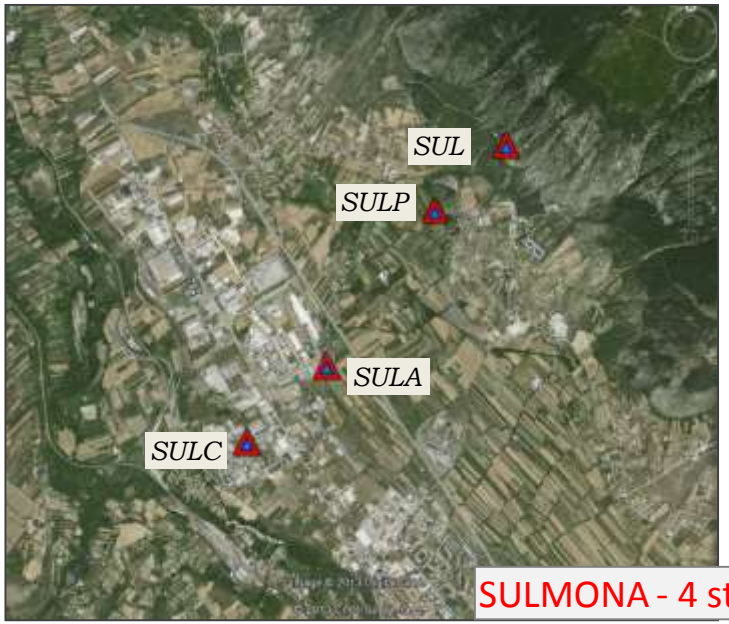
2 6-components stations

RAN – Urban arrays

L'AQUILA – 6 stations



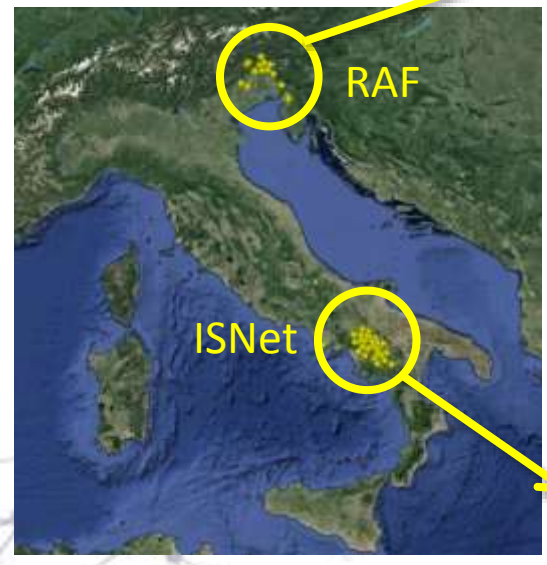
SAN GIULIANO DI PUGLIA -3 stations



SULMONA - 4 stations

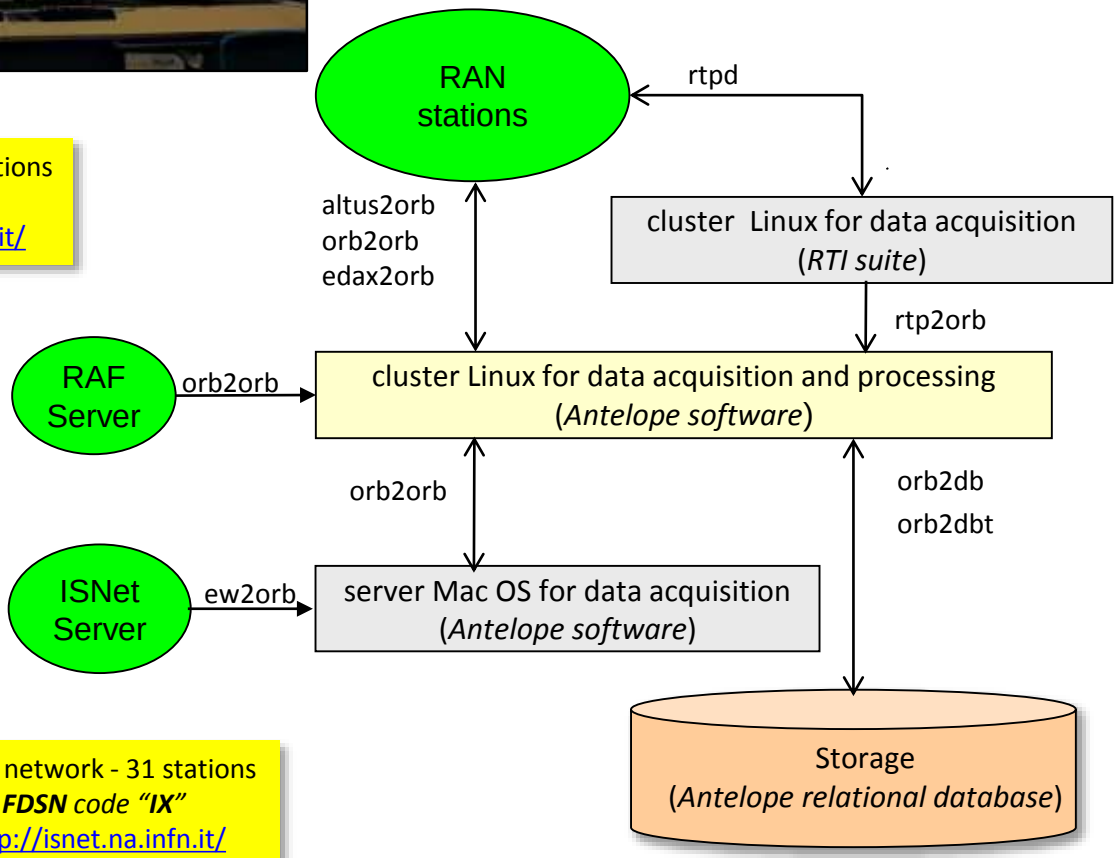
RAN – data center

- Antelope 5.5 is running
- receives data from RAN stations and from RAF and ISNet networks



RAF network - 14 stations
***FDSN** code "**RF**"*
http://rtweb.units.it/

ISNet network - 31 stations
***FDSN** code "**IX**"*
http://isnet.na.infn.it/



RAN – use of data (in long term)

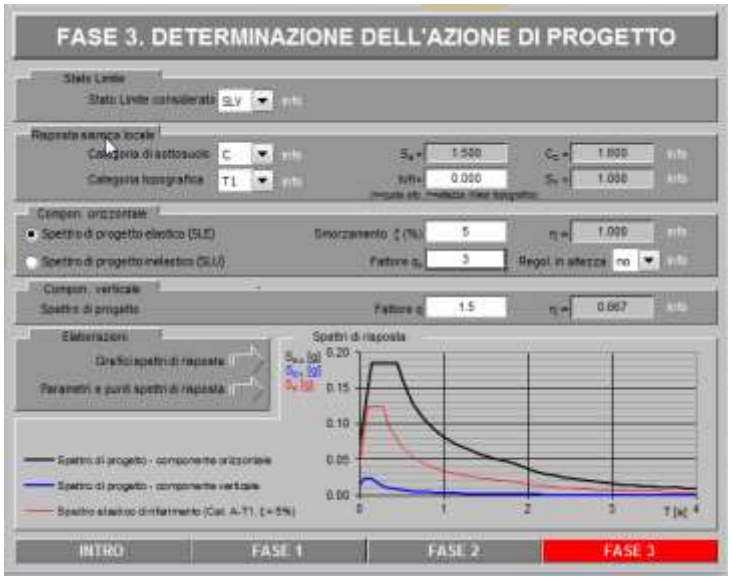
❑ Technical Regulations for Buildings

The response spectrum for building design is "***site specific***", calculated according to

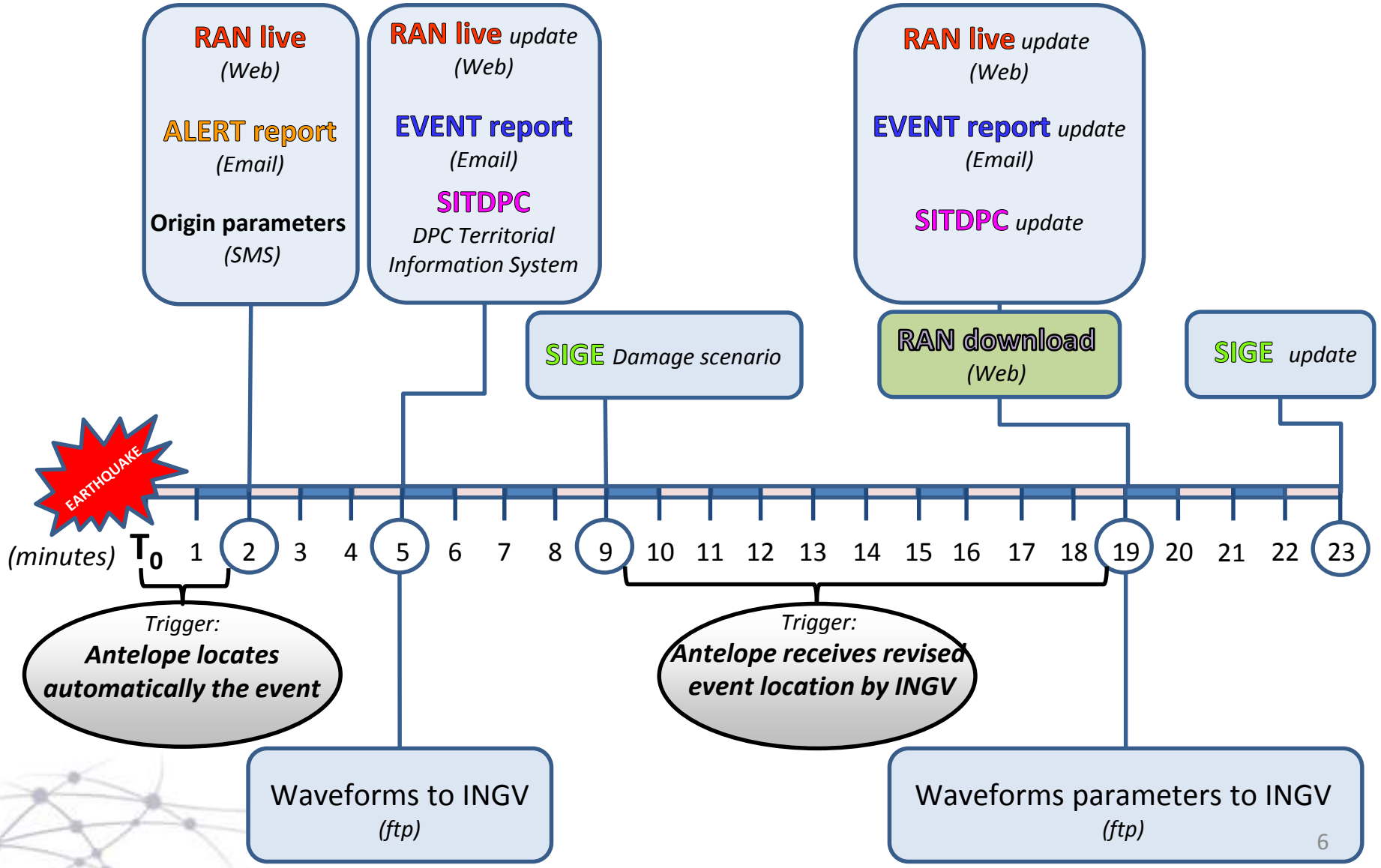
- Seismic hazard at the site
- Site effects evaluation

Consiglio Superiore dei Lavori Pubblici

(http://www.cslp.it)



RAN – use of data (in short term)



RAN – use of data (in short term)

DPC-RAN: OriginTime=2016/04/25 07:47:52 Ml=3.4 Place=Prato lat=44.0502 lon=11.3149 depth=10.0 nrec=9
maps.google.com/maps?q=44.0502,11.3149
25 apr

Origin parameters
(*SMS*)

25/04/2016 09:55:18 ORID: 340212 EVID: 340212

PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

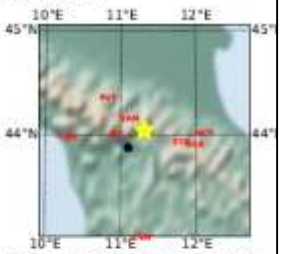
Earthquake AUTOMATIC REPORT

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: 2016/04/25 07:47:52
Latitude: 44.050 Longitude: 11.315
Depth: 10 km
Magnitude Ml: 3.4
Hostname: aspendpc5
nass: 10

Nearest cities:
Prato 25 km
Firenze 32 km
Pistoia 34 km
Bologna 50 km



PGA max: 3 cm/s*s channel: HGZ
Min distance: 9 km station: BRM

sta	net	stype	dist	EvAz	Phase	Time	TRes	SNR	Ml	pga (cm/s*s) ch	pgv (cm/s) ch
BRM	IT	A	9	119	P	07:47:54.990	-0.9	111.5	3.0	2.9 (E)	3.6e-02 (N)
PIT	IT	A	16	77	P	07:47:58.080	0.2	53.3	3.7	n/a	n/a
STF	IT	A	21	295	P	07:47:59.000	-0.7	88.2	3.4	< 1.0 (N)	4.7e-03 (N)
PVF	IT	A	26	129	P	07:48:02.900	1.8	37.2	3.3	< 1.0 (E)	1.6e-03 (N)
BGR	IT	A	30	289	P	07:48:02.910	-0.3	53.7	3.6	< 1.0 (E)	3.6e-03 (E)
MCS	IT	A	33	276	P	07:48:04.000	0.5	37.0	3.4	< 1.0 (E)	3.7e-03 (N)
CME	IT	A	42	82	P	07:48:07.105	0.6	35.1	3.7	< 1.0 (N)	1.3e-03 (Z)
CVM	IT	A	61	1	P	07:48:13.020	0.4	17.3	3.4	< 1.0 (E)	5.9e-04 (N)
LSP	IT	A	82	92	P	07:48:14.010	0.8	25.0	3.5	< 1.0 (Z)	5.8e-04 (Z)
FDS	IT	A	147	261	P	07:48:33.225	-0.6	5.8	3.8	< 1.0 (N)	1.2e-04 (Z)

ALERT report
(*Email*)

25/04/2016 09:56:19 ORID: 340212 EVID: 340212

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: 2016/04/25 07:47:52
Latitude: 44.050 Longitude: 11.315
Magnitude Ml: 3.4
AGENCY: DPC

Seismic Moment: 1.11e+15 Nm
Mw: 3.8
AGENCY: DPC

Records analyzed by procedure: 101
Selected limits: max distance=100. km min PGA= 1.0 cm/s*s
min PGA to show response spectra= 1.0 cm/s*s
Records inside the selected limits: 8 response spectra inside the limits: 8

Nearest station: BRM distance: 18.13 km
HGE - PGA=2.71 cm/s*s, PGV=0.04 cm/s
Max recorded PGA: 3.22 cm/s*s Station: MRR Marradi
HGN - distance=23.16 km, PGV=0.05 cm/s

Procedure implemented by SeisRaM group, University of Trieste, Italy - ver. SPT - 2015

EVENT report
(*Email*)

RAN – data center

An **automatic procedure**

- ❑ runs in Antelope environment
- ❑ is triggered by a new event (new record in table “origin”) in Antelope database
- ❑ generates and transmits

Event parameters (*SMS*)

ALERT report (*Email*)

EVENT report (*Email*)

Antelope database schema was modified.

New tables

- ➢ for the management of the procedure
- ➢ for storing waveform parameters (as Mw and response spectra)

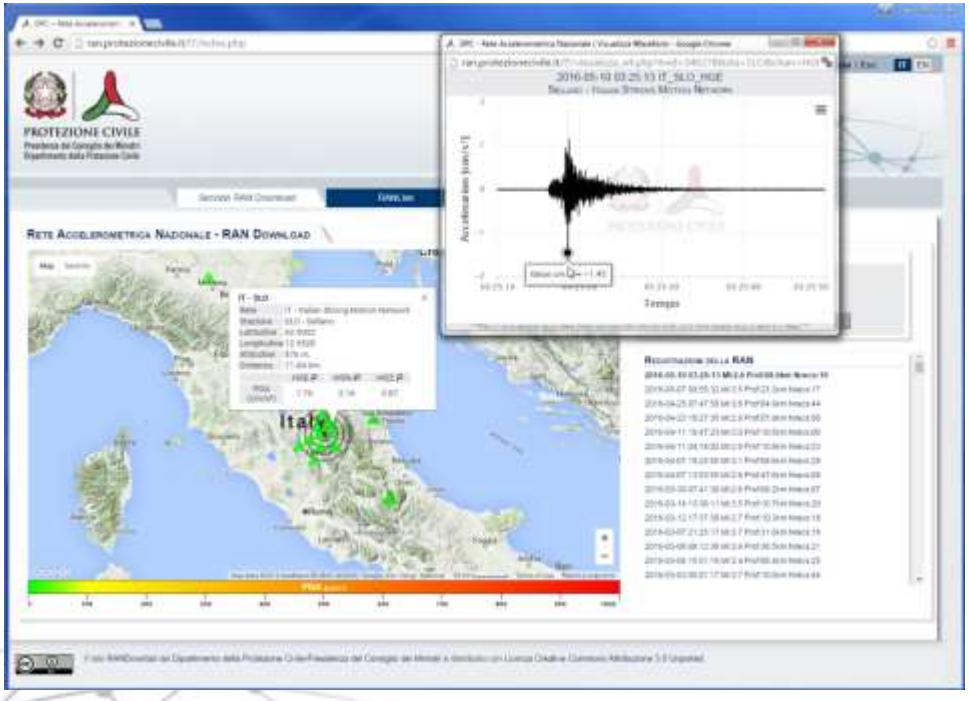
RAN – use of data (in short term)

RAN download

(Web)

Public access

http://ran.protezionecivile.it/IT/live.php



RAN live

(Web)

Restricted access

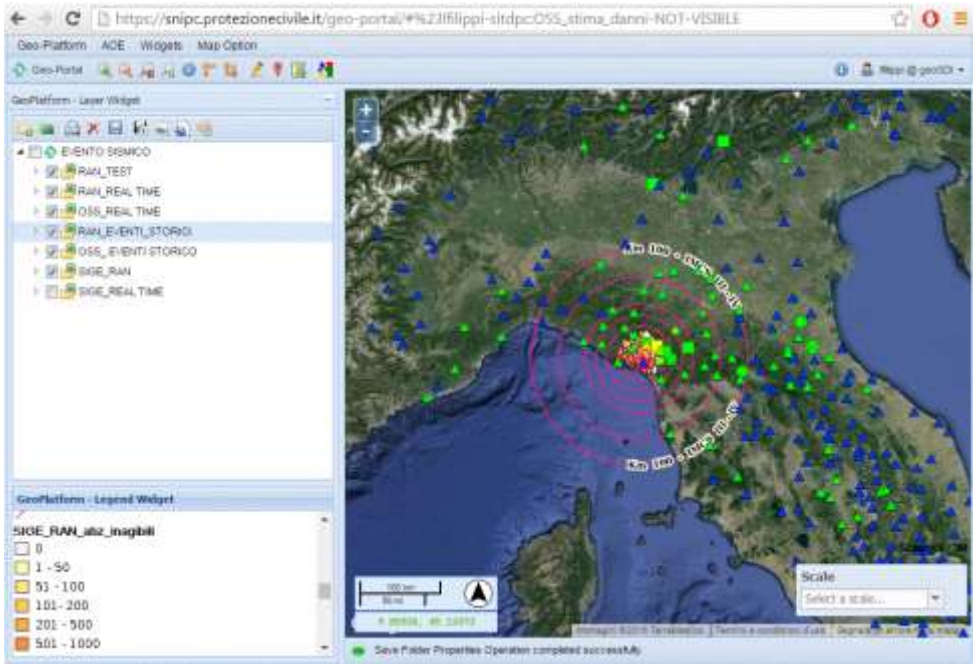
http://ran.protezionecivile.it/IT/index.php

RAN – use of data (in short term)

SITDPC

DPC Territorial Information System

- ✓ SITDPC is a DPC tool of analysis and decison-making
- ✓ SITDPC integrates data from different databases or Standard Web Services available from ***SNIPC Components*** and ***Operative Structures***.



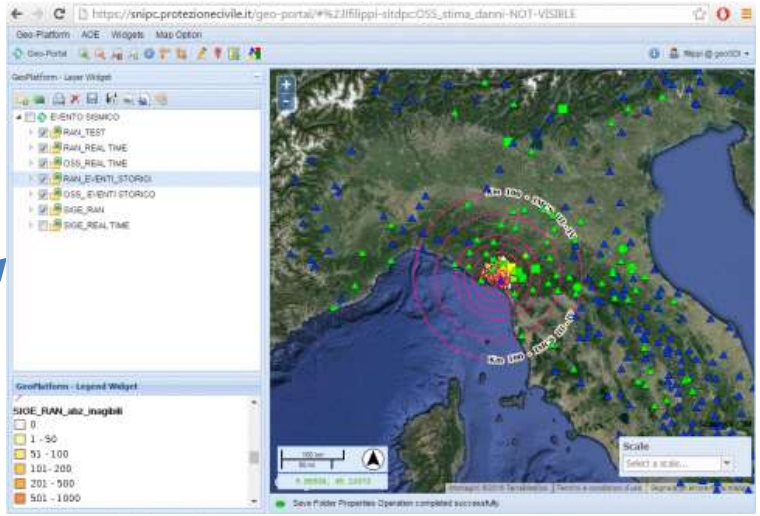
SNIPC *(National Service of Civil Protection)* is coordinated by **DPC**	
Components: National and local administrations, Public boards and professional associations, Institutes and scientific research groups with civil protection purposes, associated groups of volunteers, …	***Operative Structures***: Fire Department and Forestry corps, Armed Forces and Police Forces, National groups of scientific research, Italian Red Cross and National Health Service , Voluntary service, ….

RAN – data center

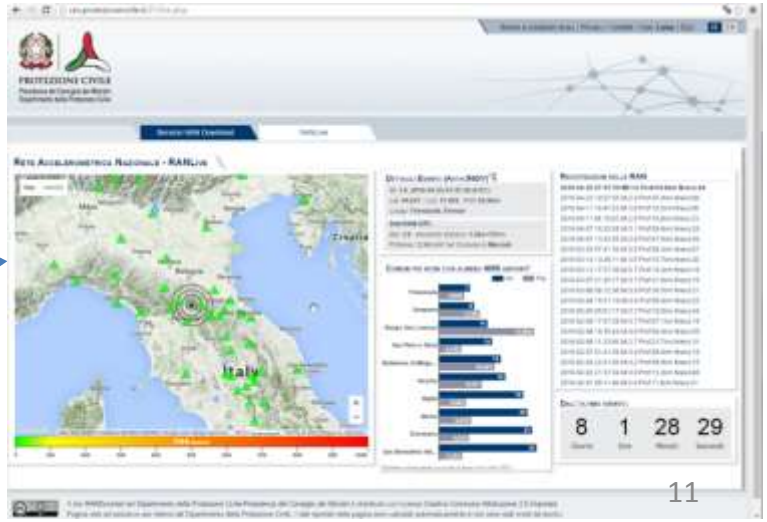
SyncMySql exportData
(data synchronization)

dedicated Views
(Layers)

SITDPC



RAN live / RAN download



dedicated tables

RAN – data center

MySQL

- Tables
  - ant_affiliation
  - ant_assoc
  - ant_eventi
  - ant_geosite
  - ant_instrument
  - ant_netmw
  - ant_network
  - ant_origini
  - ant_polsite
  - ant_sensor
  - ant_site
  - ant_sitechan
  - ant_stage
  - ant_wfparam
  - colori
  - distanze
  - distanze_temp
  - downloads
  - permessi
  - places
  - sync
  - utenti
  - wffiles
- Views
  - sitdpc_last_event
  - sitdpc_PGA_last_event
  - sitdpc_site
  - sitdpc_site_full

views for **SITDPC**

ant_instrument
inid: int
insname: char(50)
instype: char(6)
band: char(1)
samprate: decimal...
ncalib: decimal(10,...
dir: char(64)
dfile: char(32)
rsptype: char(6)
lddate: datetime

ant_netmw
orid: int
evid: int
netmw: decimal(7,...
sigmamw: decima...
netm0: float
netf0: decimal(7, 2)
neteqR: decimal(7...
usta: int
rjsta: int
3 more columns...

ant_stage
sta: char(6)
chan: char(8)
time: datetime
endtime: datetime
stageid: int
ssident: char(16)
gnom: decimal(20,...
iunits: char(16)
ounits: char(16)
6 more columns...

ant_site
sta: char(6)
ondate: char(50)
offdate: char(50)
location: geometry
lat: decimal(9, 4)
lon: decimal(9, 4)
elev: decimal(9, 4)
staname: char(50)
lddate: datetime

ant_wfparam
orid: int
sta: char(6)
chan: char(8)
filter: char(30)
time: decimal(17, 5)
endtime: decimal(...
ml: decimal(7, 2)
dista: decimal(7, 2)
PGA: decimal(15, 6)
7 more columns...

ant_polsite
sta: char(6)
country: char(50)
region: char(50)
province: char(50)
municipality: char(...
maintenance: char...
lddate: datetime

ant_origini
evid: int
orid: int
location: geometry
lat: decimal(9, 4)
lon: decimal(9, 4)
time: datetime
ml: decimal(7, 2)
nass: int
depth: decimal(9, 4)
3 more columns...

ant_sitechan
sta: char(6)
chan: char(8)
ondate: char(8)
offdate: char(8)
ctype: char(4)
edepth: decimal(9,...
hang: decimal(6, 1)
vang: decimal(6, 1)
descrip: char(50)
2 more columns...

ant_sensor
sta: char(6)
chan: char(8)
time: datetime
endtime: datetime
inid: int
chanid: int
jdate: char(7)
lddate: datetime

ant_assoc
arid: int
orid: int
sta: char(6)
phase: char(8)
delta: decimal(8, 3)
lddate: datetime

ant_geosite
sta: char(6)
time: datetime
ec8: char(3)
quality: char(3)
auth: char(15)
lddate: datetime

ant_eventi
evid: int
prefor: int
auth: char(15)
place: varchar(255)
parameters: enum
lddate: datetime

Datascope tables

«ad hoc» tables

places
idlayer: tinyint
place: char(70)
province: char(30)
region: char(45)
state: char(35)
cod_istat: int
cod_cat: char(4)
population: int
surface: decimal(9,...
4 more columns...

utenti
id: int UNSIGNED
nome: varchar(50)
cognome: varchar(...
username: varchar...
password: varchar(...
email: varchar(80)
istituto: varchar(80)
data_registrazione:...
ultima_modifica: d...
3 more columns...

wffiles
id: int UNSIGNED
evid: int
orid: int
nomefile: char(50)
extascii: char(4)
extsac: char(4)
extplot: char(4)
sta: char(4)
chan: char(3)
4 more columns...

downloads
id: int UNSIGNED
id_utente: int
evid: int
nome_file: varchar...
tipo_file: varchar(10)
data_download: da...

distanze
orid: int
place: char(70)
cod_istat: int
distance: double
population: int

distanze_temp
orid: int
place: char(70)
cod_istat: int
distance: double
population: int

sync
nome_tabella: text
last_upd: datetime
freq_upd: tinyint
inzio_upd: tinyint

colori
param: char(10)
valore: smallint
R: smallint
G: smallint
B: smallint

RAN – use of data (in short term)

SIGE

Damage scenario

Elaborated on the basis of :

- origin parameters of the event (lat lon depth magnitude)
- empirical relationships (M_L *vs* M_W) & (M_W *vs* I_{MCS})
- territorial data
- ….

<u>No instrumental data</u> .

(Damage scenario Summary)

PROTEZIONE CIVILE

PRESIDENZA DEL CONSIGLIO DEI MINISTRI
Dipartimento della Protezione Civile
Ufficio III - Rischio sismico e vulcanico

RAPPORTO SUL TERREMOTO

Evento sismico:
Data evento = 21/06/2013
Ora evento = 10:33:56
Magnitudo evento: Mw = 5.38 ; Ml = 5.2
Intensita' epicentrale = 7.3
Posizione epicentro:
Longitudine = 10.133
Latitudine = 44.154
Profondita' = 9.98

Comune epicentrale:
Comune epicentrale: Fivizzano
Capoluogo di comune più vicino all'epicentro: Minucciano

Dati sintetici di esposizione nell' area colpita (Imcs >= VI):[1]

Totale comuni	5
Totale abitanti comuni	25144
Totale abitazioni comuni	14827

Impatto complessivo su abitazioni e popolazione:[1]

	Val.16%	Val. med	Val. 84%
Abitazioni con danno D1	912	4646	16087
Abitazioni con danno D2	430	2378	7864
Abitazioni con danno D3	116	752	2741
Abitazioni con danno D4	16	127	554
Abitazioni con danno D5	0	7	43

	Val.16%	Val. med	Val. 84%
Totale abitazioni crollate (D5)	0	7	43
Totale abitazioni inagibili (D5+D4+D3)	132	886	3338
Totale residenti in abitazioni crollate	0	8	74
Totale residenti in abitazioni inagibili	126	1162	6398
Somma prodotti superf.x liv. di danno (mq)	32088	186869	642735

1 Primo scenario di danno prodotto da DPC-SIV con SceMCS (vers. 07/2015) utilizzando come dati di ingresso i soli parametri Magnitudo e coordinate epicentrali (Fonte INGV) e usando:
. conversioni Magnitudo locale (Ml) - Magnitudo Momento (Mw) - Intensità macrosismica (Imcs_Ipo):
Mw = 1.066*Ml - 0.164 (Gasperini 2013)
Imcs_Ipo = (2.1258*Mw) - 4.1135 (cpt611) per epicentri in aree vulcaniche: Imcs_Ipo = (2.2251*Mw) - 2.2617
. conversione del valore dell'Intensità epicentrale per profondità ipocentrali (Prof_Ipo) superiori a 20 km: Imcs_0 = Imcs_Ipo - 0.0259*(Prof_Ipo - 20)
. Attenuazione I_mcs:
per Ml<=5.5 Gomez Capera 2006: Iris= Imcs_0 - (-1.3096 + 1.1833*(DIST**(1.0/3.0))) in aree vulcaniche: Iris= Imcs_0 - (-0.486 + 1.4066*(DIST**(1.0/3.0)))
per Ml>5.5 Pasolini 2008: Iris= Imcs_0 – (0.0086*(D - 3.91)+1.037*(math.log(D) - math.log(3.91))) dove D = math.sqrt((DIST - D0)**2.0 + (3.91 * 3.91)) e D0 = 2.0 * Ml - 13.0 [km] è il plateau
. DPM versione 1999
. Soglia selezione comuni coinvolti: Imcs>=6.0 Gestione incertezze: varianza DPM e ±0.25 sull'intensità (per I>5.5)

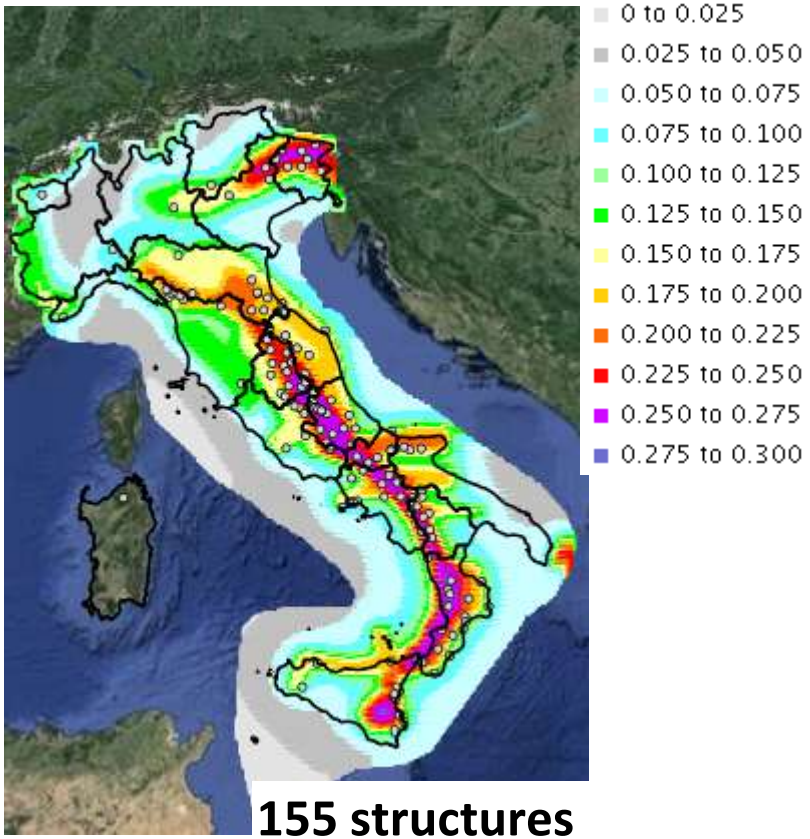
RAN – integration of OSS data (test phase)

- The RAN and OSS projects were designed and implemented separately for several reasons.
  RAN and OSS data centers are different

- The "near field" (NF) sensor of OSS monitoring systems is installed in site condition of many RAN stations

OSS vs Italian seismic hazard map

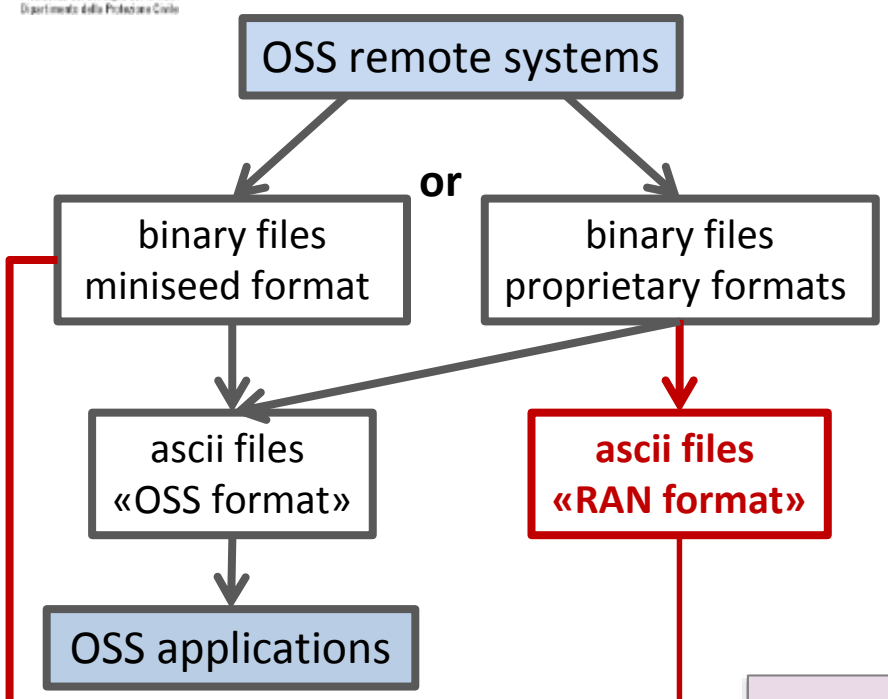
Peak Ground Acceleration (*PGA in g*) with a 10% chance of exceedance in *50 years.*



155 structures

3049 accelerometric sensors
65 displacement sensors

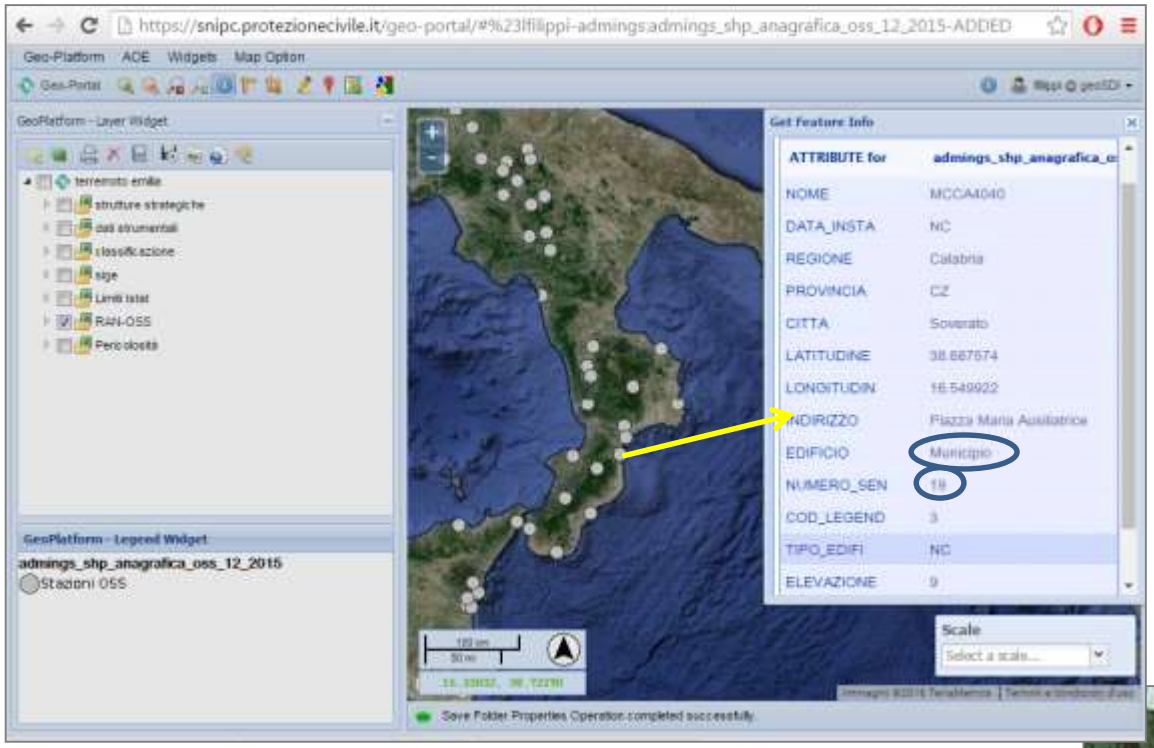
RAN – integration of OSS data (test phase)



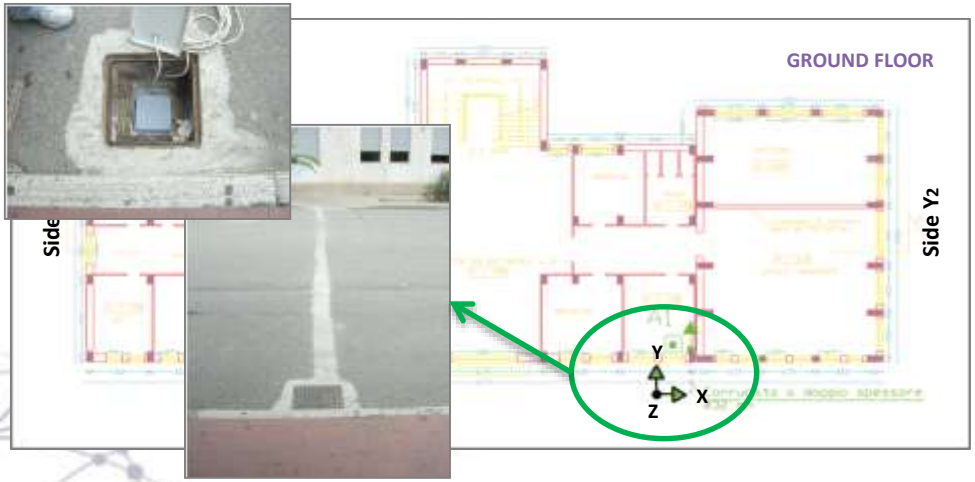
ascii file «RAN format»

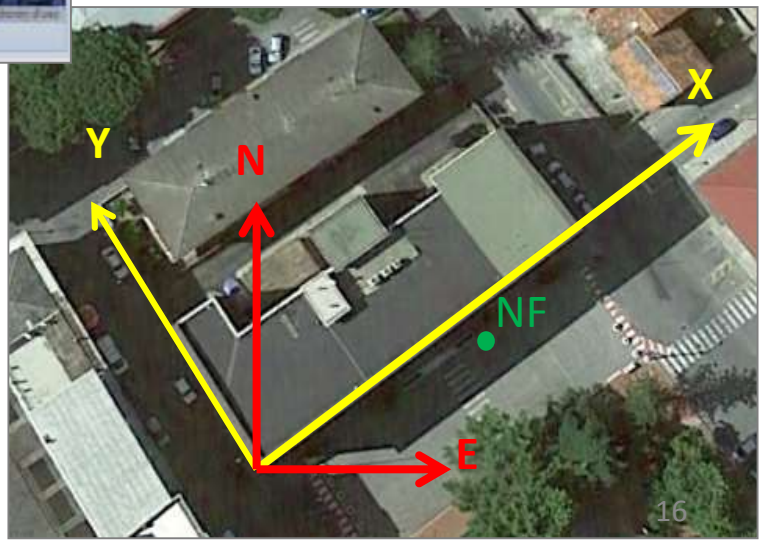
```
SERIAL=4010                 # IDENTIFICATIVO DI SERIE DATALOGGER
CHANNEL=NF-Y                # IDENTIFICATIVO CANALE OSS
TIME=2015/11/17 7:13:09.735 # TEMPO PRIMO CAMPIONE
NSAMPLE=18000               # NUMERO DI CAMPIONI
SAMPLING= 200               # FREQUENZA DI CAMPIONAMENTO
DYNAMIC=24                  # DINAMICA 16,18,24,..
SEGTYPE=A                   # TIPO SENSORE: A=ACC. V=VELOC.
VPP=10                      # FONDO SCALA PICCO PICCO. +/-5v = 10v
SENSIBILITY=1.015           # COSTANTE DI TRASDUZIONE V/g
GAIN=1                      # GUADAGNO
USER1=                      # COMMENTI 64 CARATTERI X ANTELOPE
USER2=                      # COMMENTI 64 CARATTERI X ANTELOPE
INFO1=                      # ULTERIORI INFORMAZIONI
INFO2=

-1532                       # DATI IN COUNT
-1538
......
......
SERIAL=4010                 # IDENTIFICATIVO DI SERIE DATALOGGER
CHANNEL=NF-X                # IDENTIFICATIVO CANALE OSS
........
........
SERIAL=4010                 # IDENTIFICATIVO DI SERIE DATALOGGER
CHANNEL=NF-Z                # IDENTIFICATIVO CANALE OSS
........
........
```

RAN – integration of OSS data (test phase)



SOV - Soverato
Town hall building

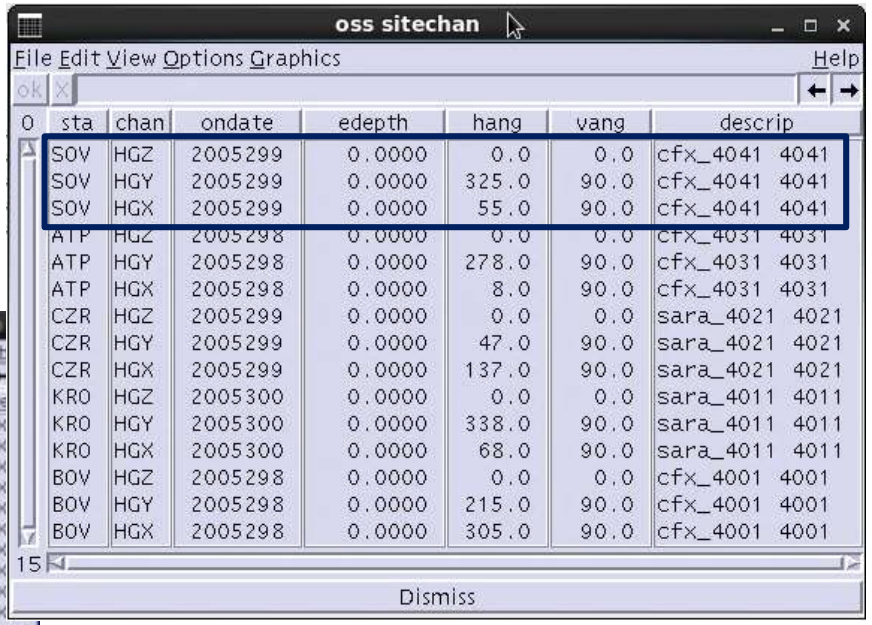


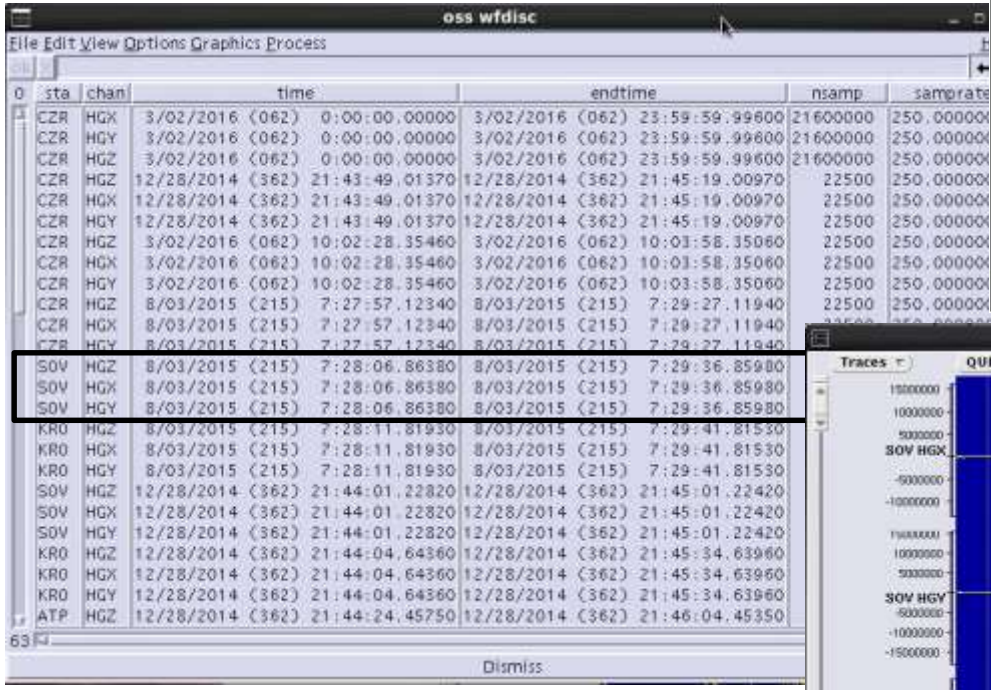


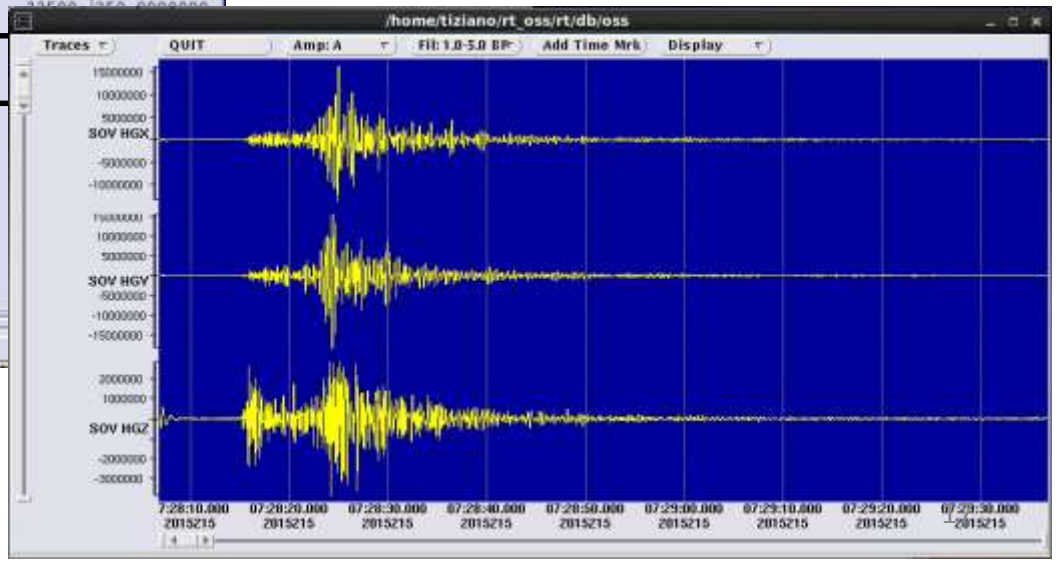
PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

RAN – integration of OSS data (test phase)

www.protezionecivile.gov.it







RAN – future developments

- Streaming data sharing and metadata sharing
  - Seedlink server
  - a web service for metadata download

- Integration of OSS data
  - to modify the automatic procedure in order to rotate OSS data before elaboration with RAN data

- Improve data security and data center operational continuity

The RAN data center will be upgraded in order to accomplish the Operational Continuity Plan that DPC has designed, by law.

- As first step, the servers at RAN data center will be virtualized and moved into IT infrastructures installed at the basement of the DPC's building.

- As second step, the Antelope database will be replicated and syncronizated in the “disaster&recovery” site o DPC.