The integrated RAF-RAN accelerometric network in Friuli Venezia Giulia.

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A B S T R A C T

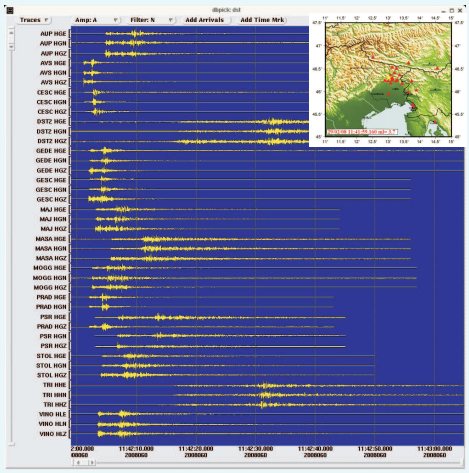
Since 2003 an agreement between the National Civil Defence (DPC) and the Regional Civil Protection (FVG-PC) has been signed in order to co-ordinate and integrate on the Friuli Venezia Giulia territory the National Accelerometric Network (RAN) and the Friuli Venezia Giulia Accelerometric Network (RAF). This co-operation will lead to the installation of new RAN accelerometric stations in the area and, in particular, will allow to automatically send RAN and RAF data to the DPC headquarters in Rome and to DST, through the FVG-PC data center. As FVG-PC consultant for the strong ground motion issue (network, data, studies), the DST collaborates to the sites selection and to the management of the new RAN stations. DST has recently performed detailed noise measurements in order to give a local geological classification of the recording sites.

The RAF-RAN integrated network is configured to record accelerations at several important sites in the seismic area of Friuli Venezia Giulia and near its borders with Slovenia and Austria. The network geometry is built up taking into account also other seismological agencies and networks operating in Friuli Venezia Giulia (OGS) as well as in Austria (ZAMG) and Slovenia (ARSO). The data recorded in real-time, or quasi real-time, by the network, are collected and exchanged through the datacenters by the Antelope software.

Antelope also analyzes and stores the collected waveforms in a database containing the signals recorded by this network and by the integrated transfrontier seismic network of the Southeastern Alps.

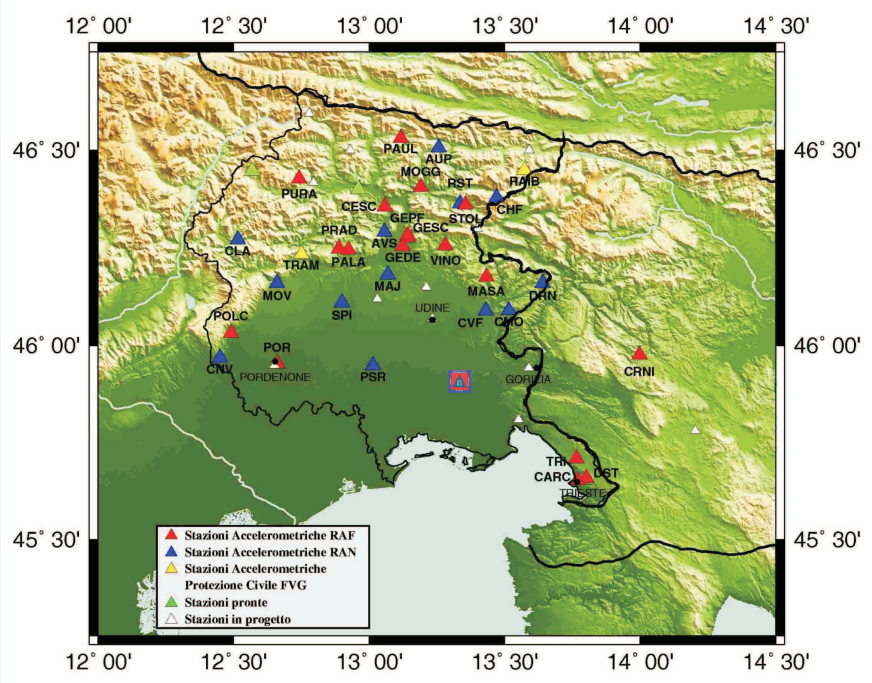
An automatic procedure has been developed by DST to extract in real-time the ground motion parameters (PGA, PGV, PSA03, PSA10, PSA30, Arias and Housner intensities) and to exchange these data with other partners of the Project INGV-DPC S3. The ground motion parameters are used also to generate regional real time ShakeMaps, to compute regional weak motion GMPEs and possible ground-shaking scenarios. The collected waveforms are also used to study the physics of the seismic source, to estimate site effects and to perform microzonation analyses.

At DST an accelerometric database with RAF data as of today about 700 digital 3-component records, related to about 400 events - has been maintained since 1993.



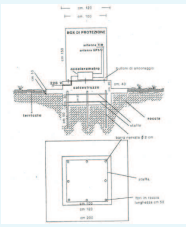
Example of waveforms recorded by RAF-RAN stations. On the right top the map with earthquake location (yellow star) and recording stations of transfrontalier network (red triengles).

Scheme of the links between RAF, RAN Networks, Centro Funzionale Regionale del Friuli Venezia Giulia, Centro Funzionale Centrale di SAPE in Rome, Centro Competenza INGV, and DST in Trieste.



The map with the RAN (blue triangles) and RAF (red, yellow and green triangles) accelerometric stations. The white triangles represent the planned stations will be built in the near future.

SITE PREPARATION



RST

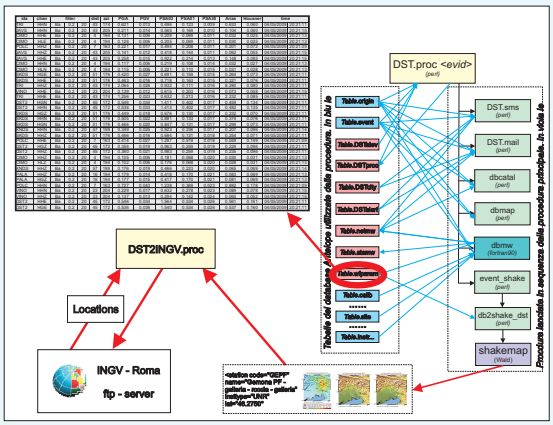
STOL

ETNA

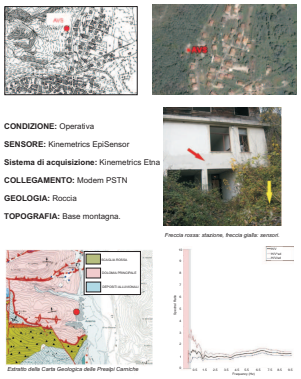
The RAF station of Stolvizza (STOL), the RAN station of val Resia (RST), the design of a typical construction of a RAF-RAN station and the instrument mainly used in the networks (Kinemetrics Etna).

The software Antelope® (BRTT, Boulder) is used to collect, analyze and exchange the data. A fully automatic procedure has been recently implemented at DST to compute several waveform parameters, normally used in earthquake engineering, such as peak ground acceleration and velocity (PGA, PGV), peak spectral amplification at 0.3, 1.0 and 3.0 seconds (PSA03, PSA10, PSA30), Arias and Housner intensities. Moment magnitude, Mw, is also computed in real time and inserted in the database. All the stored data are later on revised by DST researchers.

Another procedure has been written in order to automatically exchange the ShakeMaps data (kml, jpg, files) with the ftp server of INGV in Rome.



Stazione di Avasinis (Trasaghis)



Example of a sheet of a RAF-RAN station with thelocation, local geological map and the results of noise measurement at the site.

Code	Site	Latitude Longitude	Quote (m)	EC8 class	Instrumentation	Code	Site	Latitude Longitude	Quote (m)	EC8 class	Instrumentation
AUP	Aupa	46.506 13.256	904	A	Kinemetrics Etna – Kinemetrics EpiSensor	MASA	Masarolis	46.177 13.432	640	B	Kinemetrics Etna – Kinemetrics EpiSensor
AVS	Avasinis	46.295 13.050	206	A	Kinemetrics Etna – Kinemetrics EpiSensor	MOGG	Moggio	46.486 13.190	387	A	Kinemetrics Makalu – Kinemetrics EpiSensor
CARC	Trieste	45.653 13.767	206	A	Quanterra Q330 – Kinemetrics EpiSensor	MOV	Montereale Valcellina	46.155 12.655	320	A	Kinemetrics Etna – Kinemetrics EpiSensor
CESC	Cesclans	46.356 13.058	355	B	Kinemetrics K2 – Kinemetrics FB23	PALA	Cima Pala	46.246 12.924	1080	A	Quanterra Q330 – Kinemetrics EpiSensor Streckeisen STS-2
CHF	Sella Nevea	46.389 13.472	1160	B	Kinemetrics Etna – Kinemetrics EpiSensor	PAUL	Paularo	46.530 13.116	640	A	Kinemetrics Makalu – Kinemetrics EpiSensor
CLA	Claut	46.271 12.514	627	B	Kinemetrics Etna – Kinemetrics EpiSensor	POLC	Polcenigo	46.033 12.490	40	B	Quanterra Q330 – Kinemetrics EpiSensor Guralp CMG 40T
CMO	Castelmonte	46.094 13.521	685	A	Kinemetrics Etna – Kinemetrics EpiSensor	POR	Pordenone	45.954 12.661	49	C	Kinemetrics Etna – Kinemetrics EpiSensor
CRNI	Crni vrh (SLO)	45.977 13.997	785	A	Kinemetrics SSA1 – Kinemetrics FB23	PRAD	Pradis	46.248 12.888	520	A	Kinemetrics Etna – Kinemetrics EpiSensor
CVF	Cividale del Friuli	46.092 13.429	110	B	Kinemetrics Etna – Kinemetrics EpiSensor	PSR	Passariano	45.949 13.014	35	C	Kinemetrics Etna – Kinemetrics EpiSensor
DRN	Drenchia	46.166 13.641	728	A	Kinemetrics Etna – Kinemetrics EpiSensor	PURA	Passo Pura	46.427 12.742	1417	A	Quanterra Q330 – Kinemetrics EpiSensor Streckeisen STS-2
DST	Trieste	45.660 13.800	86	A	Quanterra Q330 – Kinemetrics EpiSensor Streckeisen STS-2	RST	Stolvizza	46.363 13.354	600	A	Kinemetrics Etna – Kinemetrics EpiSensor
GEDE	Gemona-Depuratore	46.255 13.126	180	C	Kinemetrics Etna – Kinemetrics EpiSensor	SPI	Spilimbergo	46.108 12.906	100	C	Kinemetrics Etna – Kinemetrics EpiSensor
GEPF	Gemona Pz.za del Ferro	46.277 13.141	255	A	Quanterra Q330 – Kinemetrics EpiSensor Guralp CMG 40T	STOL	Stolvizza	46.361 13.432	570	A	Kinemetrics Etna – Kinemetrics EpiSensor
GESC	Gemona Scuglars	46.283 13.141	320	B	Kinemetrics Etna – Kinemetrics EpiSensor	TRI	Trieste	45.709 13.764	161	A	Quanterra Q4120 – Kinemetrics EpiSensor Streckeisen STS-1
MAJ	Majano	46.182 13.069	177	C	Kinemetrics Etna – Kinemetrics EpiSensor	VINO	Villanova	46.256 13.281	608	A	Quanterra Q4120 – Kinemetrics EpiSensor Guralp CMG 3T

RAN-RAF stations

REFERENCES

▪ Costa, G., L., Moratto,and P. Suhadolc (2009). The Friuli Venezia Giulia Accelerometric Network - RAF. Bull. Earthquake Eng. Doi:10.1007/s10518-009-9157-y.

▪ Moratto,L., G., Costa, and P. Suhadolc (2009).Real-time generation of ShakeMaps in the South-Eastern Alps, Bull. Seism. Soc. Am. 99-4, 2489-2501.

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