NISBAS – The Network of Italian Surface-Borehole Accelerometers and Seismometers

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NISBAS – The Network of Italian Surface-Borehole Accelerometers and Seismometers

NISBAS is the information system aimed at organizing, archiving and accessing to seismological data of coupled surface-borehole stations

The availability of coupled surface-borehole seismological data are useful for:

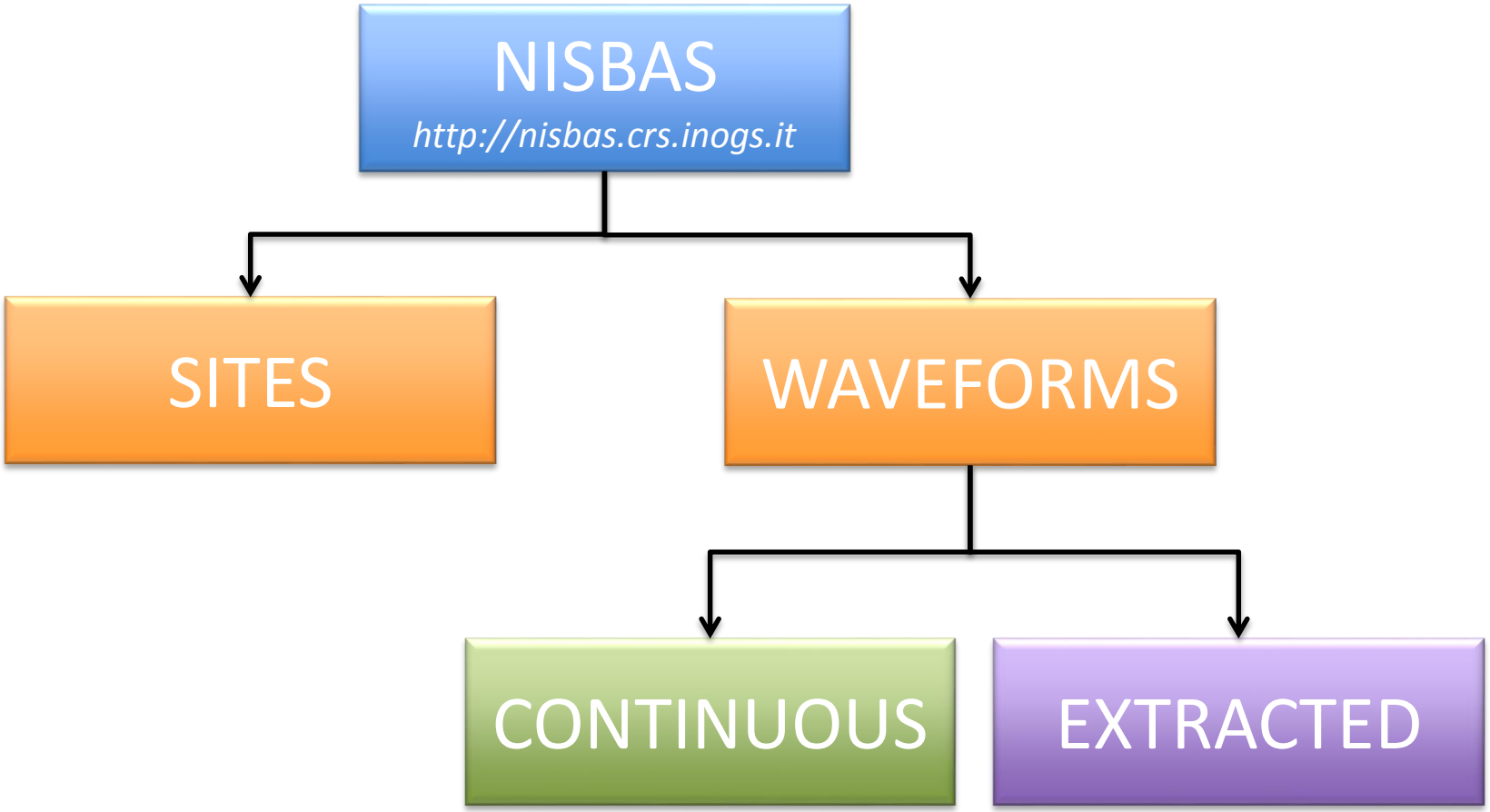
- Site response analysis in the case of lack of outcrop rock reference site

- Better understanding of ground motion attenuation and site effects with implications for ground-motion prediction equation, seismic code provisions and seismic PSHA studies

NISBAS DB structure inspired by OASIS (*http://oasis.crs.inogs.it*) and ITACA (*http://itaca.mi.ingv.it*)

NISBAS v. 1.0 (May, 2015): *http://nisbas.crs.inogs.it*

NISBAS structure



NISBAS sites

Three institutions cooperated in the installation and maintenance of the NISBAS stations:

The National Institute of Oceanography and Experimental Geophysics – OGS

The Geological Seismic Soil Survey of Emilia-Romagna Region RER

The Institute of Methodologies for Environmental Analysis (IMAA) of the Italian National Research Council (CNR) CNR-IMAA.

Station code	Station name	Network code	Lon	Lat	Borehole depth (m)	Data Download
ED01	Susegana S. Lucia	EV	12.289	45.834	153	Continuous
FERB	Ferrara borehole	NI	11.540	44.900	130	Continuous
IMAA	Tito Scalo	BA	15.724	40.601	35	Event
MIRB	Mirandola	NI	11.063	44.877	31, 126	Continuous
MSN	Marsico Nuovo	BA	15.730	40.425	76	Event
STIN	San Stino	NI	12.772	45.715	100	Continuous
TOPP	Pian del Toppo	NI	12.817	46.198	150	Continuous

Stations belong to 3 different networks:

- the North-East Italy Regional Broad Band Seismic Network **NI**
- the University of Basilicata and CNR-IMAA network **BA**
- the Collalto permanent network **EV**

Stations search

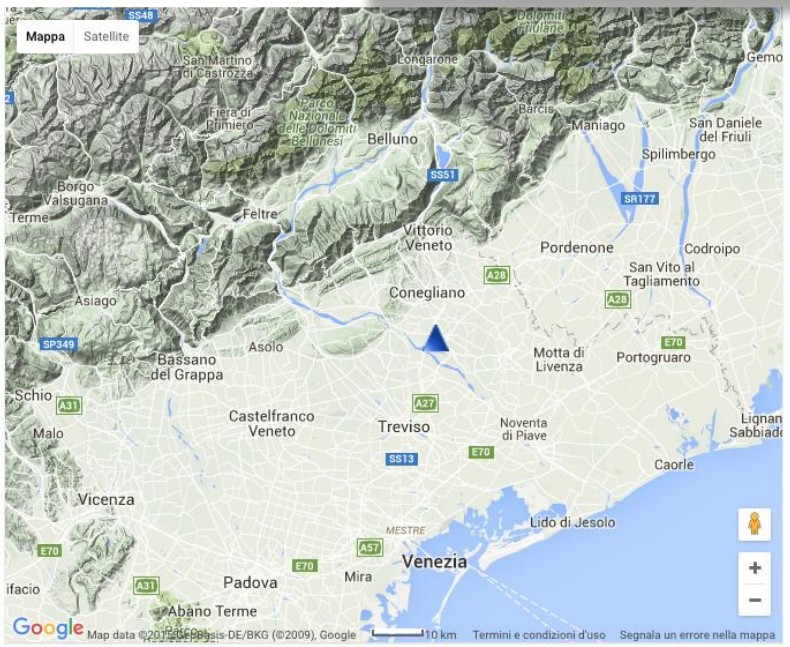
Network Type		
Network Code		-- select network --
Station Code	contains	
Station Name	contains	
Latitude (e.g. 45.27)	from [≥]:	to [<]:
Longitude (e.g. 12.7)	from [≥]:	to [<]:
Region	contains	
Province	contains	
EC8		-- Any value --
Sensor	contains	-- Any value --
Depth	>=	
Installation type		-- Any value --
Housing		-- Any value --
Morphology		-- Any value --
Number of Recordings	>=	

Search

Show station labels

Network Code	Stat. Code	Station Name	Latitude	Longitude	Elev [m.a.s.l.]	Municipality	EC8	Sensors (*)=out of service	Housing	# of records	Station recordings
BA (Temp)	IMAA	Tito Scalo CNR-IMAA	40.601000	15.724000	828	TITO	D	SM(*)		8	
BA (Temp)	MSN	Marsico Nuovo CNR-IMAA	40.425000	15.730000	791	MARSICO NUOVO	B	SM	Building Borehole	46	
NI (Perm)	MIRB	Mirandola Borehole	44.877455	11.062789	17	MIRANDOLA	C	SM	Borehole Borehole	0	
NI (Perm)	FERB	Ferrara Borehole	44.900000	11.540000	7	FERRARA	C	BB,SM(*)	Borehole	0	
NI (Perm)	STIN	SAN STINO	45.714830	12.771910	1	SANTO STINO DI LIVENZA		SP,BB(*)		0	
NI (Perm)	TOPP	PIAN DEL TOPPO	46.198488	12.817060	258	TRAVESIO		SM	Borehole	0	
EV (Perm)	ED01	SUSEGANA S. LUCIA	45.834582	12.289224	54	SANTA LUCIA DI PIAVE	B	SP(*),BB(*)	Borehole	0	

NISBAS sites



ED01 - Susegana S. Lucia

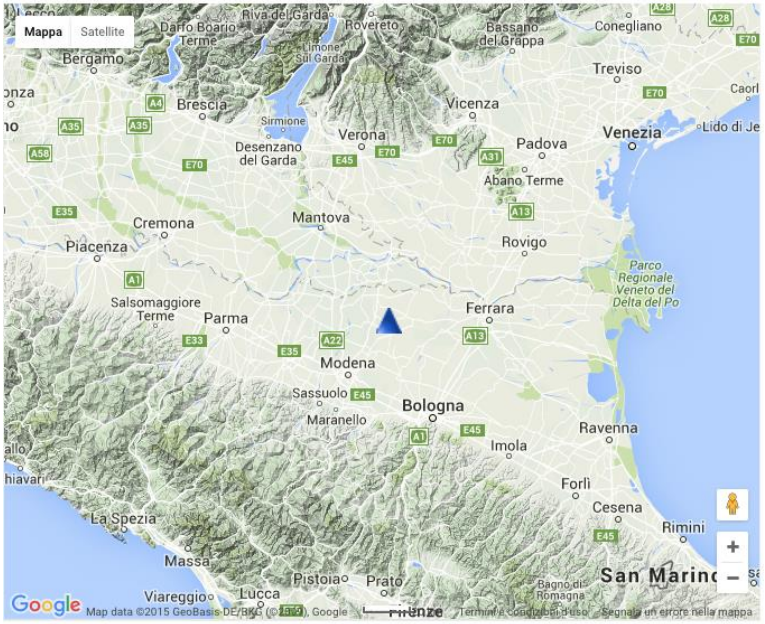
ED01. The station ED01 - Susegana S. Lucia (TV) belongs to the Collalto permanent network EV, which aims at monitoring the natural and the induced seismicity of a gas storage activity in Veneto Region.

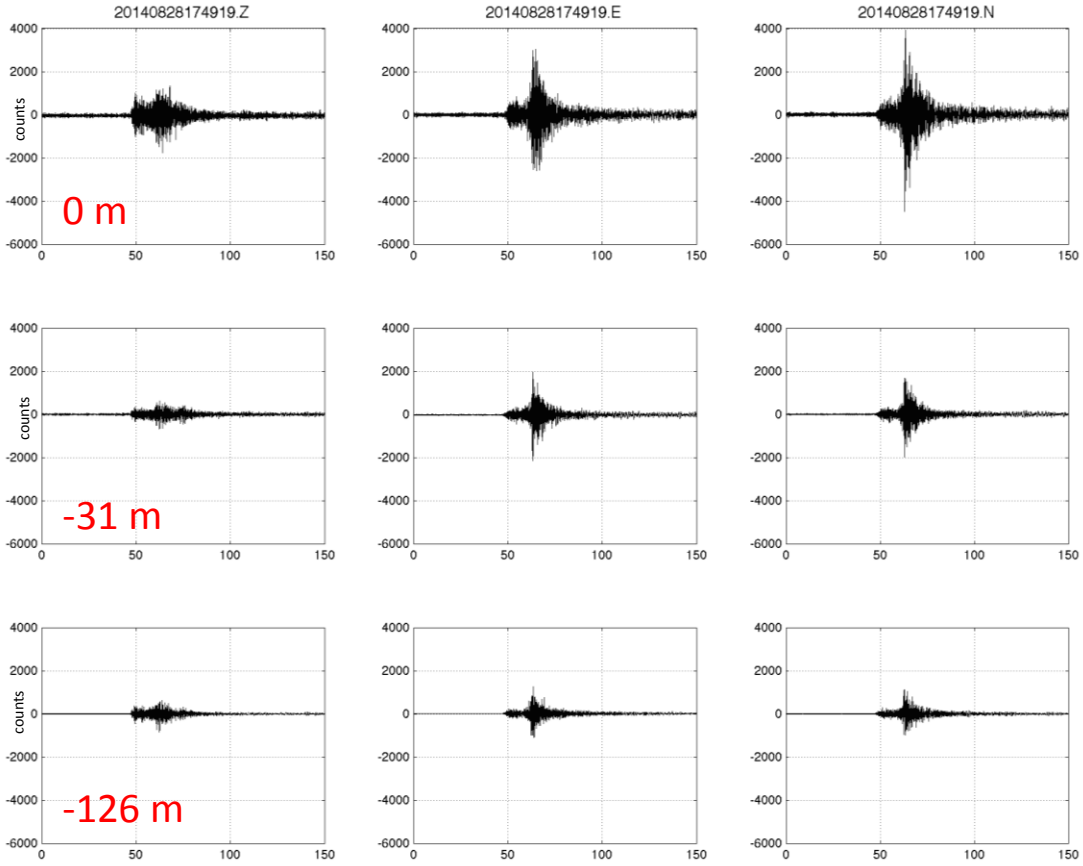
3-channel DM24-Guralp data logger, equipped with a compact seismometer (Guralp CMG-SP1, T=10 s, fmax=100 Hz) installed at 153 m depth.

Data are acquired in continuous mode from December 2011, with a sampling rate of 200 Hz.

NISBAS sites

MIRB – Mirandola Borehole





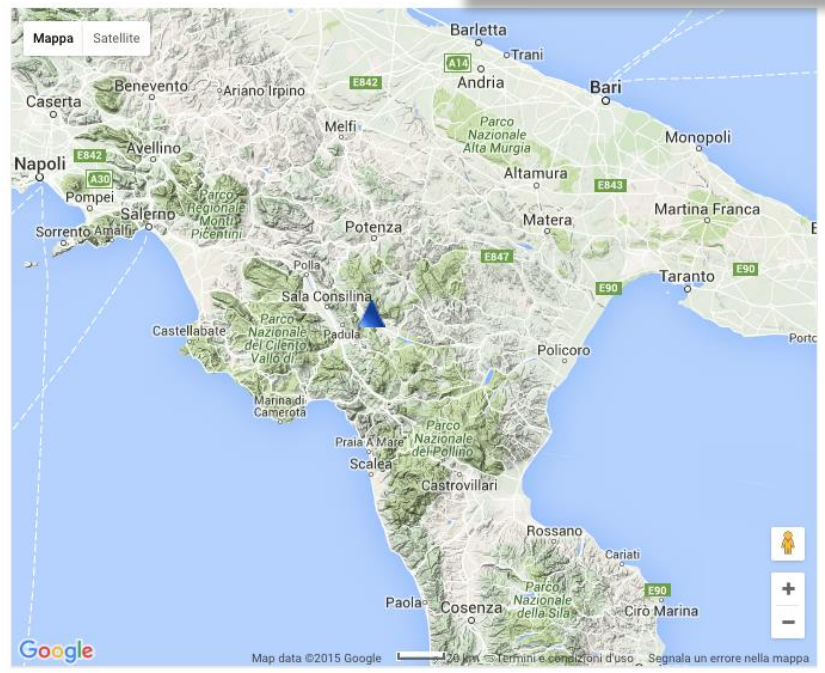
MIRB. Mirandola Borehole, is located in the epicentral area of the May 2012 Emilia sequence

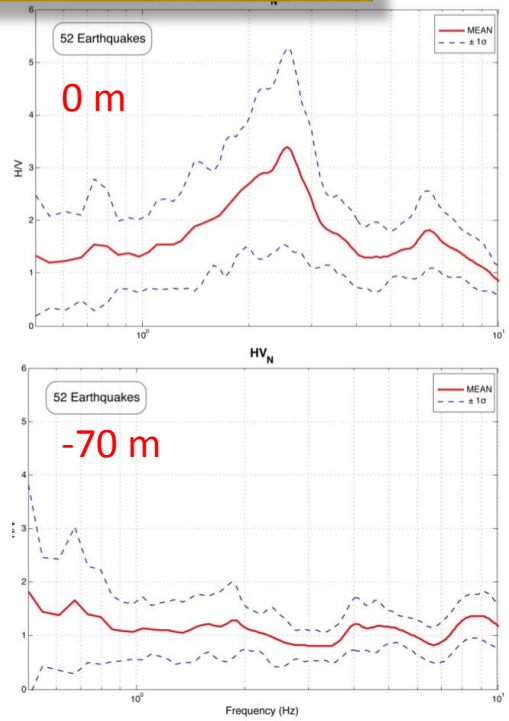
Equipped with three Sara Force Balance accelerometers SA10, one at the surface, another one at 31 m depth, and the third at 126 m depth, respectively. The sensor at 126 m lies within a rock formation.

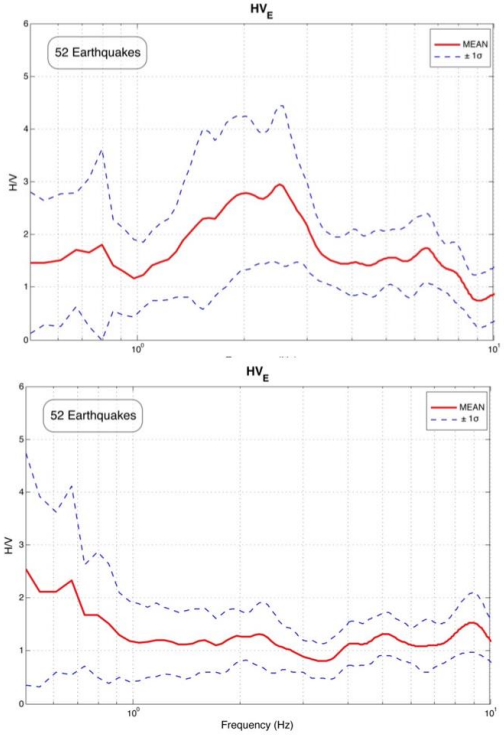
Data are acquired in continuous mode with a sampling rate of 100 Hz.

NISBAS sites

MSN– Marsico Nuovo







MSN. Marsico Nuovo station is located in the High Agri Valley, a Quaternary NW-SE trending intermontane basin located in the axial zone of the Southern Apennines thrust belt (southern Italy).

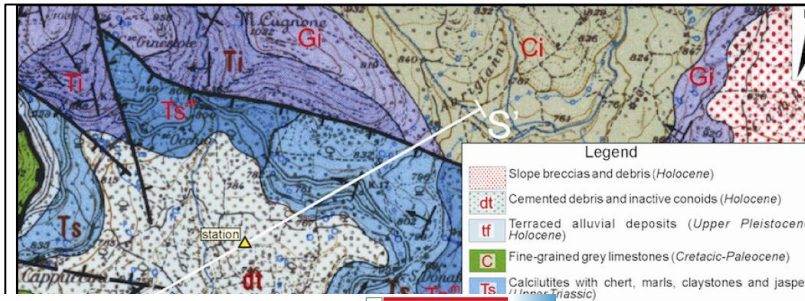
The station is a 6-channel K2-Kinemetrics data logger, equipped with a surface accelerometer (1g FBA ES-DECK Episensor) and a borehole accelerometer (1g shallow borehole Episensor) installed on the seismic bedrock at the bottom of a 70 m deep borehole.

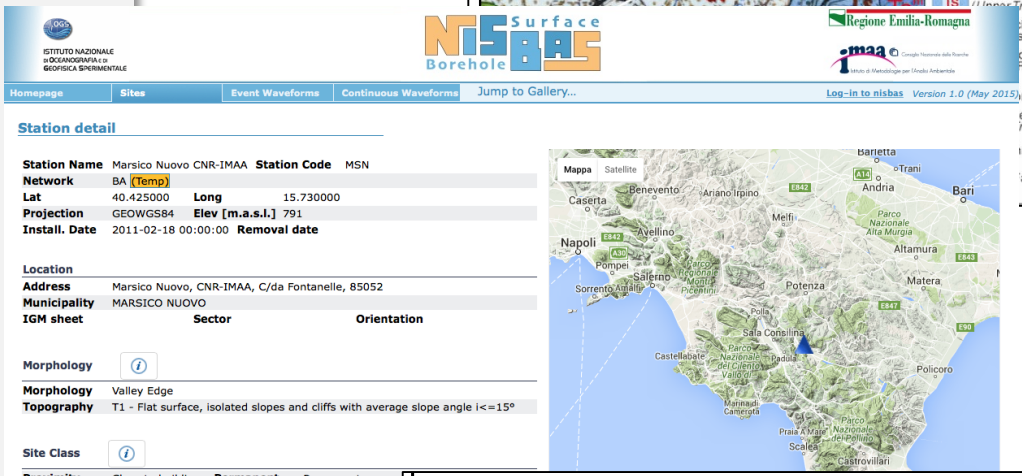
The data acquisition started on 18 February 2011.

NISBAS sites

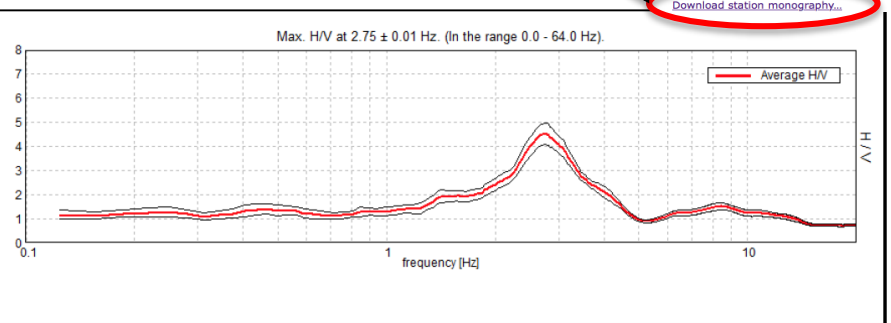
Characterization of the recording site:

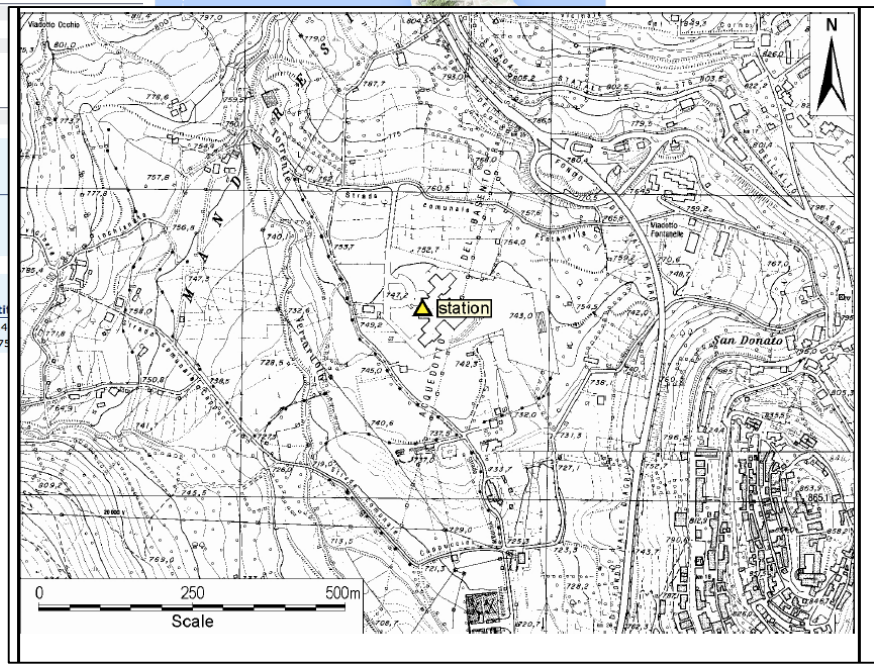
- General Information
- Geographical Information
- Geomorphology
- Geology
- Microtremor H/V spectral ratio
- Site classification
- Synthesis of information





Station monography





NISBAS data

ISTITUTO NAZIONALE DI OCEANOGRAFIA E DI GEOFISICA SPERIMENTALE

NISBAS Surface Borehole

Regione Emilia-Romagna

imaa Consiglio Nazionale delle Ricerche – Istituto di Metodologie per l'Analisi Ambientale

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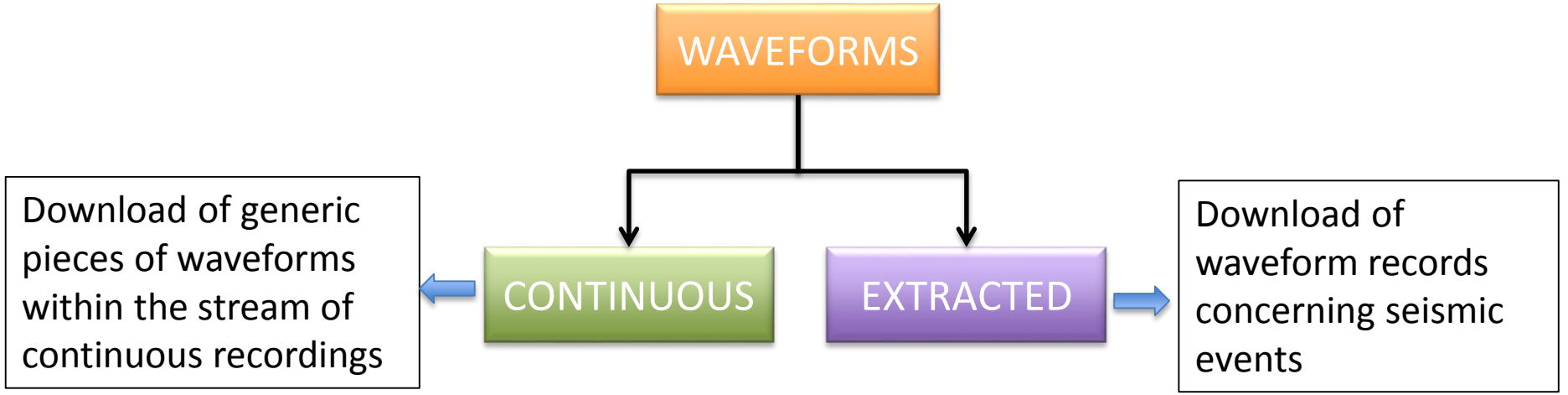
Data avaliability and access mode

Network Code	Station Code	Data download	Data Availability[1]	Access Mode
NI	MIRB	Continuous	06/2014-	Free
NI	FERB	Continuous	06/2012-	Free
NI	STIN	Continuous	06/2014-	Free
NI	TOPP	Continuous	03/2015-	Free
BA	IMAA	Event	2006	Free
BA	MSN	Event	2011-2014	Restricted
EV	ED01	Continuous	12/2011-	Free



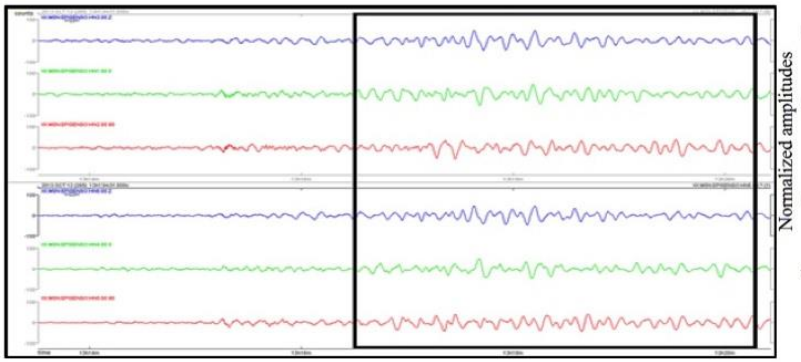
Misalignment angle correction of borehole seismic sensor

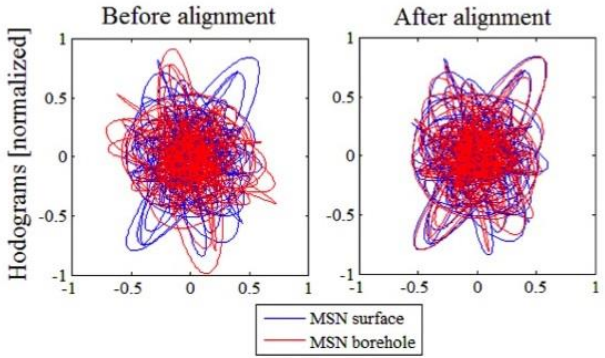
Evaluation of the misalignment angle of borehole seismic sensors, taking as reference the sensor at surface (oriented by traditional methods)

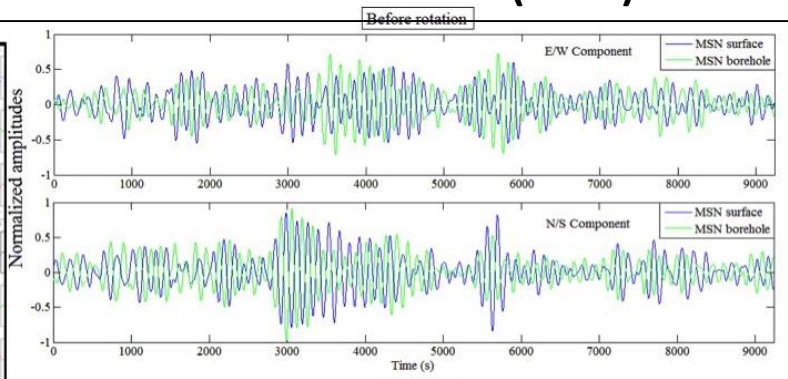
Method developed and described by Grigoli et al. (2012)

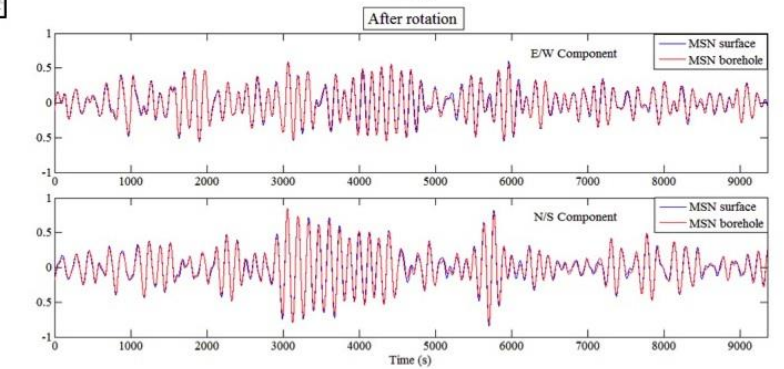
1) Teleseismic events with epicentral distances of at least 5000 km from the station;
2) Regional events with epicentral distances up to 1000 km from the station;
3) Mw>=6 and enough energy to be recorded simultaneously by all sensors.

Correction of the azimuthal rotation of the borehole sensor at Marsico Nuovo (MSN).









Misalignment angle correction of borehole seismic sensor results

Station	Sensor depth (m)	Misaligment angle (°)
ED01	153	8
IMAA	35	180
MSN	76	135
MIRB	31, 126	120, 7

Misalignment angles range from some tens up to hundred degrees, and they are not necessarily correlated to the sensor depth.

It is important to apply the correction to the borehole data in order to reduce errors in the analysis procedure

Conclusions and Acknoledgements

NISBAS was created with the aim of organizing, archiving, and providing access to seismological data recorded by coupled seismological accelerometers/seismometers installed at the surface and in boreholes.

They represent a valuable resource of data that may be of interest for the scientific community.

Through a web interface (*http://nisbas.crs.inogs.it*), the user can retrieve detailed information about the seismological stations as well as either download generic pieces of waveforms taken from the stream of continuous recordings or seismograms related to specific events.

Version 1.0 was realized within the research DPC-INGV-S2 Project “Constraining Observation into Seismic Hazard”, deliverable D2.2 Surface/borehole seismic data. The project is the 3rd S2 Project funded in the frame of DPC INGV agreements.