Introduction to the Strong-motion seismology session

Lucia Luzi

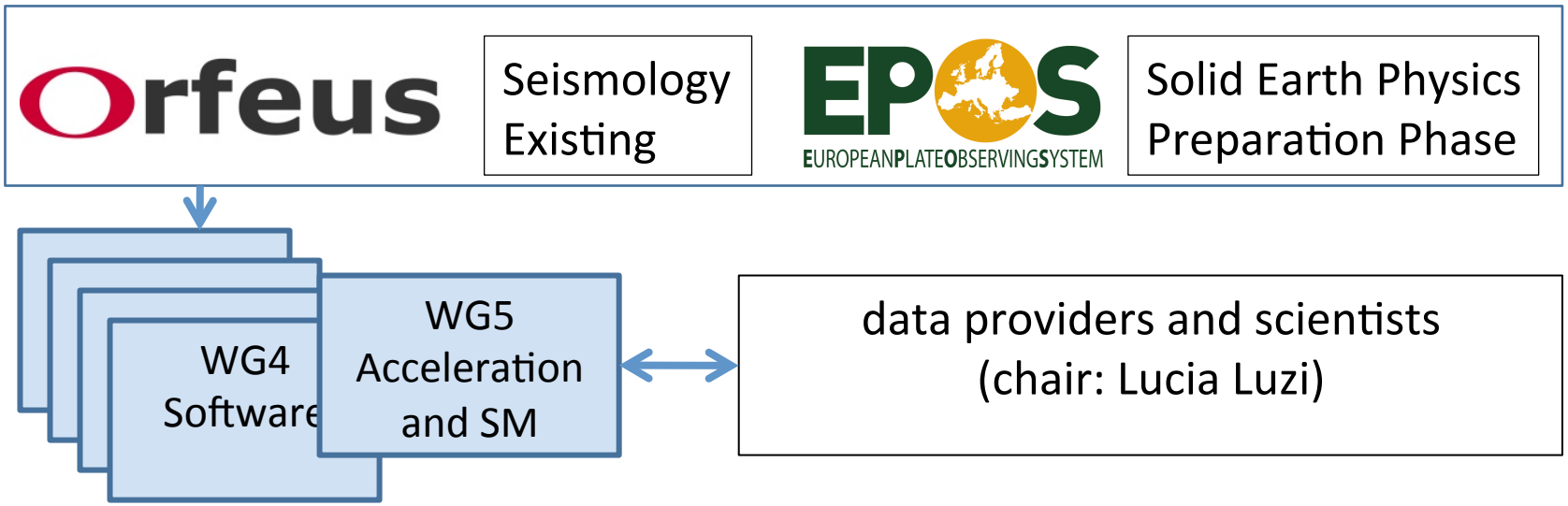
Summary

- ORFEUS WG5
- Session programme
- ESM and RRSM as site repositories

European coordination of acceleration and strong-motion data

ORFEUS (Observatories and Research Facilities for European Seismology), is the non-profit foundation that aims at co-ordinating and **promoting digital, broadband (BB) seismology** in the European-Mediterranean area.

Extension to SM seismology Proposed at the 2012 ORFEUS coordination workshop



WG5 Acceleration and SM data
Data providers and scientists: chair Lucia Luzi

Proposed responsibilities

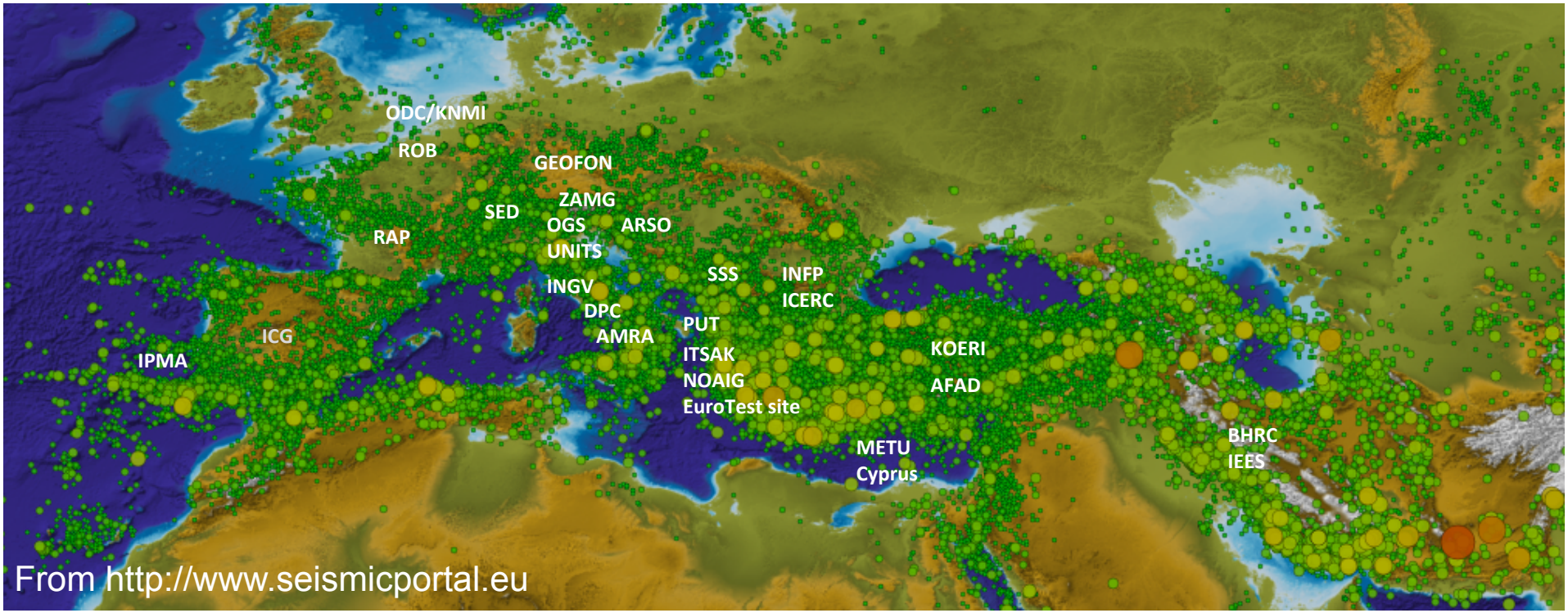
- Setting rules for data dissemination
- MoU's between data providers (extending the Consortium)
- Collaborating with EPOS for the preparation of projects
- Contacting similar establishments in the other parts of the world
- **Ensure quality of metadata and waveforms:**
  - Checking the quality of processed data of the partner institutions
  - Suggestion/development of the state-of-the-art techniques for metadata compilation and data processing
- **Ensure IT development improvements:**
  - Data transfer, optimum data dissemination techniques etc
  - Coordinate with related activities of ORFEUS/EPOS

The group

- A preliminary board has been created in **June 2013** with representatives of **Greece**, **Turkey**, **Italy**, **France**, **Switzerland** and **Iceland**
- In **2014 Spain, Romania, Austria, Belgium, Portugal, Germany, Serbia, Albania** joined the group and **Iran** asked to participate to meetings
- On October **2014 Romania (NIEP)** become a new EIDA node
- **Turkey (KOERI)** become an **EIDA node in 2015**
- **Greece (NOA)** applied to become a **new EIDA node**
- The **infrastructures** and **governance** of **ORFEUS** will be soon included in **EPOS**

International workshop on strong-motion and acceleration data
(Ankara 12-13 May 2014)

Facilitating integrated data access
Establish a common data policy



Bucharest 2015: Site characterization

State of the art: *L. Luzi* (INGV - Milano)

ESM and station book as repositories for site characterization

Network operator perspective: *D. Faeh* (ETH - Zurich)

Station characterization: example from SED network

User perspective: *K. Pitilakis* (Aristotle University - Thessaloniki)

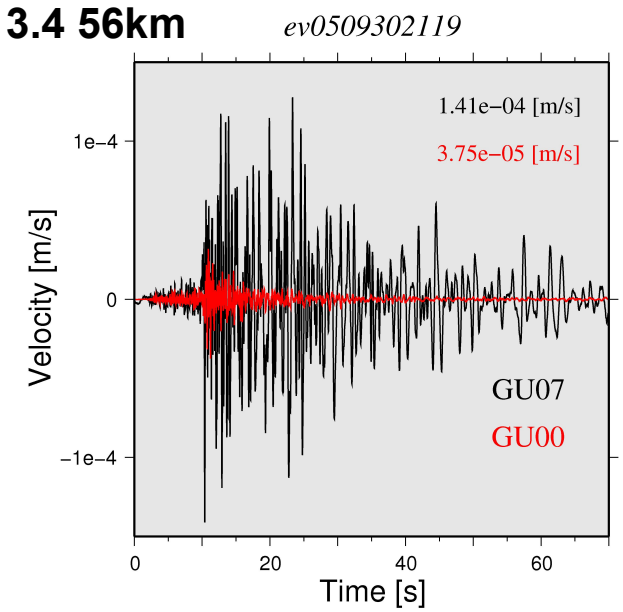
Site characterization and seismic codes

Why site characterization

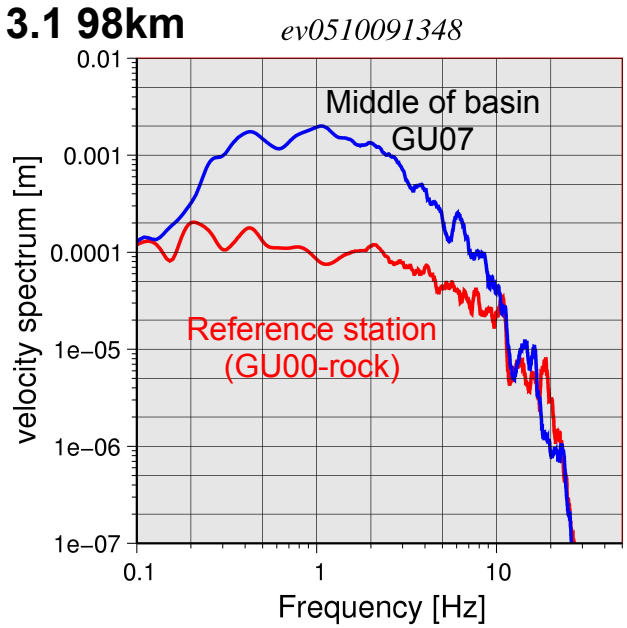
- The geotechnical characteristics of the uppermost soil layers can significantly modify the amplitude and the spectral content of the recorded ground motion induced by an earthquake.
- Local site effects play a fundamental role in determining the spatial variability of the seismic hazard for a given area
- Strong-motion waveforms cannot be properly interpreted without adequate knowledge of the main geophysical and geotechnical properties of the site where they have been recorded.

Example: Gubbio (central Italy)

Temporal domain: peak values, duration, etc



Spectral domain: Fourier spectra, response spectra, etc



Site characterization

Different levels of site characterization can be categorized as follows (from Michel et al. 2014):

- **simplified geological** and **geotechnical** classification (e.g., design code approach);
- **geophysical characterization** using a single parameter (e.g., $\mathbf{VS_{30}}$, $\mathbf{f_0}$);
- **1D profiling** of the linear elastic and eventually inelastic parameters;
- **full microzonation** using advanced 2D/3D models and nonlinear response analysis.

Site characterization studies

- **Japan**: velocity profiles from borehole logging are available for every KiK-net station (Aoi et al., 2004)
- **Taiwan**: sites of the whole network classified (Lee et al., 2001)
- **Iran:** 138 sites with site category and about 50 Vs_{30} (Zaré et al., 1999)
- **Turkey**: 236 sites of AFAD were investigated with MASW, and 153 boreholes were drilled (Sandıkkaya et al., 2009). Project "Compilation of National Strong-Motion Database in Accordance with International Standards"

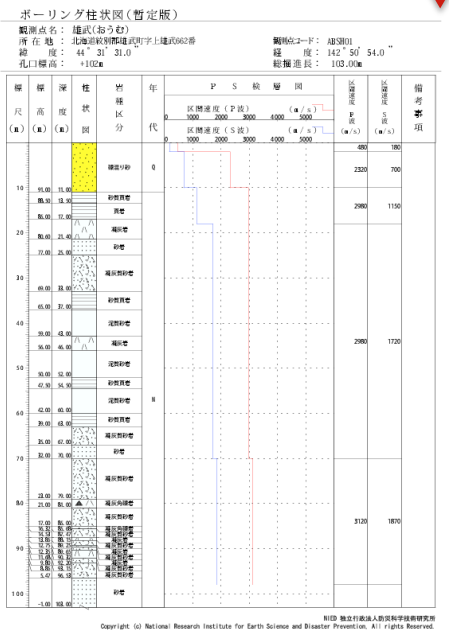
Site characterization studies

- **United States**: geophysical site characterizations at 191 strong-motion stations USGS ARRA-funded project (Yong et al., 2013)
- **Italy**: 154 Vs /Vp profiles or site characterization of all stations based on geological surface are available in the Italian strong motion database (projects funded by DPC)
- **Switzerland**: site characterization promoted within the renewal project of the Swiss Strong Motion Network. In Michel et al (2014) example for 30 stations

Data availability

Information is accessible through the web but in different formats (Tables, papers, reports, etc.)

No standardization



Kik-Net

Site AZ.PFO

Location: Cecil and Ida Green Pinon Flat Observatory, Riverside County, California

Latitude: 33.61167 **Longitude:** -116.45943
(Station coordinates from site GPS survey, WGS84 coordinate system)

V_{S30} (measured): 763 m/s (±10% beneath seismic line)

V_{S30} (adjusted to more accurately reflect seismic station conditions): 848 (average S-wave velocity between 1 and 31 m adjusting for assumed sensor depth).

NEHRP Site Class: B/C (significant lateral velocity variation in the immediate site vicinity will result site class ranging from C to B. Adjusting V_{S30} for seismic station conditions will result in site class ranging from C/B to B).

Geomatrix Code: IGA

Geologic Conditions/Observations: Seismic station located on Mesozoic (Cretaceous) granitic rock (quartz diorite, granodiorite).

Site Conditions: Rural site. Relatively flat terrain in site vicinity with gradual topographic decline to south.

Geophysical Methods Utilized: HVSR, Seismic Refraction (P- and S-wave), MASW (Rayleigh wave), MALW (Love wave)

Geophysical Testing Arrays:

1. Array PFO-1 (48 channel MASW array utilizing 4.5 Hz vertical geophones spaced 1.5 m apart for a length of 70.5 m, forward and reverse shot locations with multiple source offsets and source types and center shot location).
2. Array PFO-1 (48 channel MALW and S-wave seismic refraction array utilizing 4.5 Hz horizontal geophones spaced 1.5 m apart for a length of 70.5 m, forward and reverse shot locations with multiple source offsets and multiple interior shot locations). Coincident with MASW array of same name.
3. Array PFO-2 (48 channel P-wave seismic refraction array utilizing 4.5 Hz vertical geophones spaced 3 m apart for a length of 141 m, forward and reverse shot locations with multiple source offsets and multiple interior shot locations using accelerated weight drop energy source). Arrays PFO-1 and PFO-2 have a common center and orientation.
4. Three HVSR measurement locations: two distributed along array PFO-2 and the other adjacent to the seismic station.

ESM and station book as repositories for site characterization

Station metadata

Station description: net code, station code, lat, lon, elevantion, start, end, address, country, etc.

Housing / building details: housing type, type of installation, building type, no. storeys…

Images: photos, maps

Morphology: morphology class, topographic class

Instrumentation: Instrumentation history, instrumentation description

Station metadata (geotechnical/geophysical)

- **Geology**: surface geology description
- **Borehole data**: stratigraphic logs
- **Gotechnical data**: NSPT logs ….
- **Geophysical data**: Vs/Vp logs, dispersion curves…
- **Site response functions**: HVSR, SSR
- **Site classification**: Vs_{30}, site class…

http://esm.mi.ing.it

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ESM - European Strong-Motion database

within NERA

News

2015 ORFEUS Annual Observatory Coordination meeting Workshop (21 – 24 September 2015, Bucharest, Romania).

July 2015: The version 0.1 of ESM has been released.

March 2015: ESM processing web frontend has been published. Link is available in the "Tools" section below.

ESM info

- *User manual*
- *Contributing Networks*
- *Contacts*
- *Credits*
- *Glossary*

Links

- *Strong-Motion Databases*

Tools

- *Processing web frontend* - a web interface for waveform processing on ESM database. Registered users can select waveforms, do their own processing and save the resulting waveforms on their personal computer.
- *dyna-convert.py* - python code to convert ESM files to the most popular seismic formats (MSEED, SAC, GSE, SEGY, among others). Requires *ObsPy*.

ESM *release 0.1*

The Demo version of the European Strong-Motion database (ESM) has been developed in the framework of the European *Project NERA* (Network of European Research Infrastructures for Earthquake Risk Assessment and Mitigation), Network Activity 3: *Networking acceleration networks and SM data users*. The database is maintained by *WG5* of *ORFEUS*.

ESM allows users to query earthquake and station information and download earthquake waveforms and response spectra for events with magnitude ≥ 4.0 mainly recorded in the European-Mediterranean and the middle-East regions.

ESM is fully compatible with the *European Integrated Data Archive (EIDA)*, a distributed data centre established to securely archive seismic waveform data and related metadata, based on international seismological standards. ESM also includes: *European Strong-Motion Database* (FP5 1998-2002), the *ITalian ACcelerometric Archive (ITACA)*, the *Strong Ground Motion Database of Turkiye* and the *HEllenic Accelerogram Database (HEAD)*.

Read more...

Data search

Waveforms | Stations | Events

Records compatible with target spectra

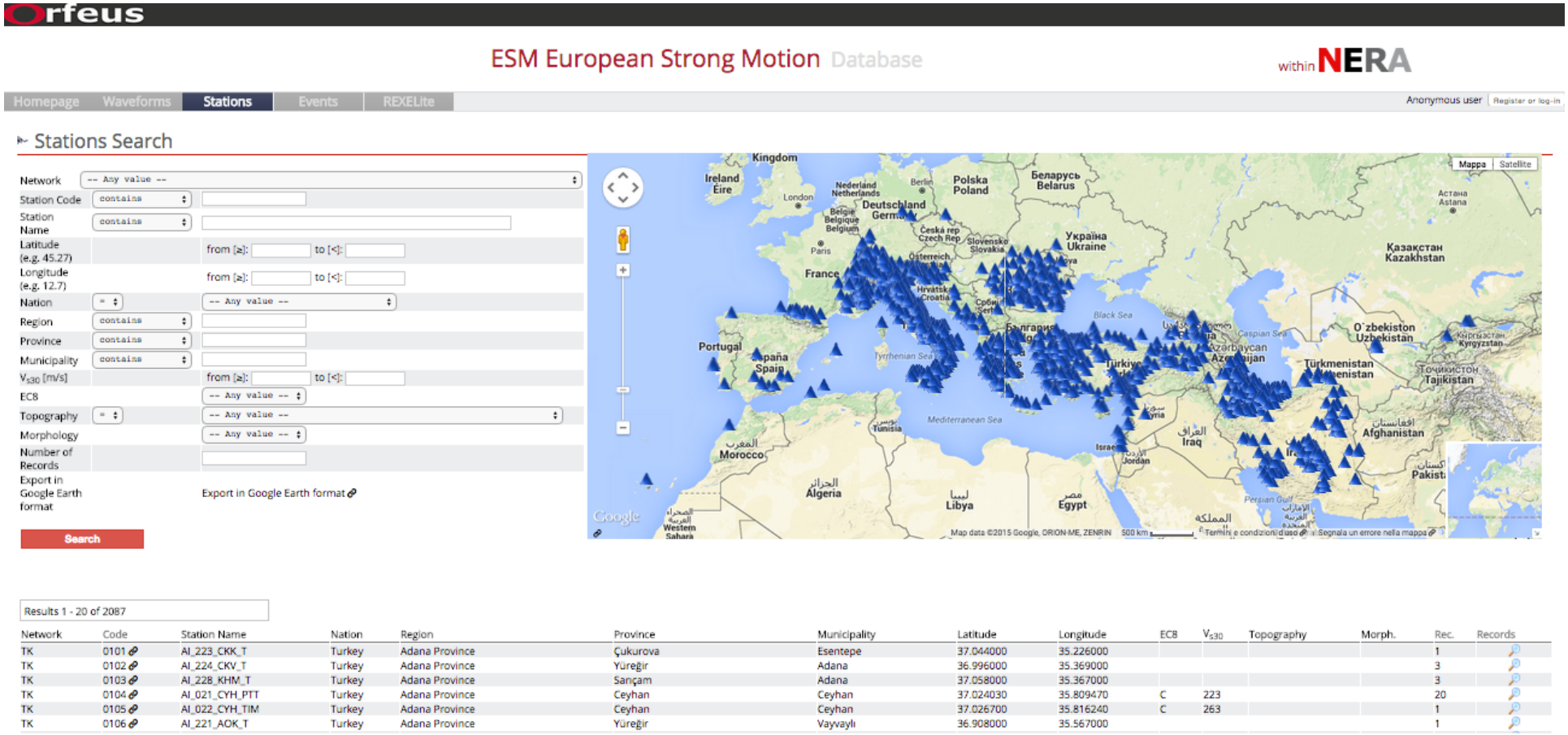
REXELite

References

The Database should be acknowledged as: "ESM working group (2015), *European Strong-Motion database, version 0.1*, Network Activity 3: *Networking acceleration networks and SM data users*. Project NERA (www.nera-eu.org)"

License

ESM as station metadata repository



Aim

- **ESM** contains only stations hosting **strong - motion instruments**, therefore it is oriented to the earthquake engineering / engineering seismology applications
- **ESM** contains **metadata** that can be related to **site response**

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ESM European Strong Motion Database

within NERA

Homepage | Waveforms | Stations | Events | REXELite

Anonymous user | Register or log-

Station Detail

Station Name	*L'AQUILA - V. ATERNO - CENTRO VALLE*		Station Code	AQV	
Network	IT - Italian Strong Motion Network [DPC]				
Type	Permanent				
Lat	42.37722	Long	13.34389	Projection	GEOWGS84
Elev [m.a.s.l.]	692	Install. Date	1997-01-01	Removal date	
Macros. records					

Location

Address	Strada Statale 80, 67100 L'Aquila, Province of L'Aquila, Italy
Nation	Italy
Region	Abruzzo
Province	Province of L'Aquila
Municipality	L'Aquila

Housing

Sensor Id	Housing type	Location	Installation
00	Fiberglass box	Free-field	

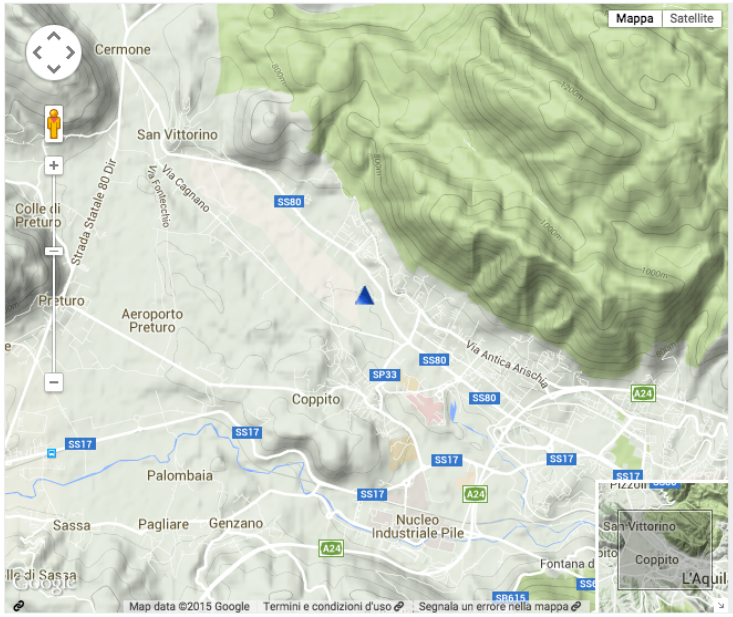
Notes

Site Class

EC8 Code	B		
V_{S30} m/sec	474.0	Ref	S6_2004-2006
Estimation	Cross-hole measurement	Quality	High

Morphology

Morphology	Valley centre		
Topography	T1 - Flat surface, isolated slopes and cliffs with average slope angle i<=15°		
Map	IGM sheet 139, sector II, orientation SE	Scale	1:25000



Geotechnical logs

Id	Reference	Latitude	Longitude	Nspt profile	Vs/Vp profile	Cu profile
1	S6_2004-2006					

Stratigraphy

Id	Reference	Latitude	Longitude	Detail
1	DBDAI.1	42.377049	13.343855	

Search Again | Station Records | Monography

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ESM European Strong Motion Database within NERA

Homepage | Waveforms | Stations | Events | REXELite

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Vs / Vp Profile

Network	IT - Italian Strong Motion Network [DPC]		
Station code	AQV		
Log code	1		
Lat		Long	Projection name
Elev [m.a.s.l.]			
Estimate type	Cross-hole measurement		
Reference	S6_2004-2006		

Vs profile

Code	Top [m from g.l.]	Bottom [m from g.l.]	Vs [m/s]	Vp [m/s]
1	0.0	1.0	294.0	
2	1.0	2.0	294.0	
3	2.0	3.0	375.0	
4	3.0	4.0	417.0	
5	4.0	5.0	341.0	
6	5.0	6.0	417.0	
7	6.0	7.0	417.0	
8	7.0	8.0	536.0	
9	8.0	9.0	577.0	
10	9.0	10.0	625.0	
11	10.0	11.0	625.0	
12	11.0	12.0	625.0	
13	12.0	13.0	682.0	
14	13.0	14.0	577.0	
15	14.0	15.0	667.0	
16	15.0	16.0	667.0	
17	16.0	17.0	625.0	
18	17.0	18.0	682.0	
19	18.0	19.0	500.0	
20	19.0	20.0	600.0	
21	20.0	21.0	600.0	
22	21.0	22.0	625.0	
23	22.0	23.0	600.0	
24	23.0	24.0	385.0	
25	24.0	25.0	326.0	
26	25.0	26.0	577.0	
27	26.0	27.0	455.0	
28	27.0	28.0	333.0	
29	28.0	29.0	326.0	
30	29.0	30.0	556.0	
31	30.0	31.0	556.0	

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ESM European Strong Motion Database

within NERA

Homepage | Waveforms | Stations | Events | REXELite

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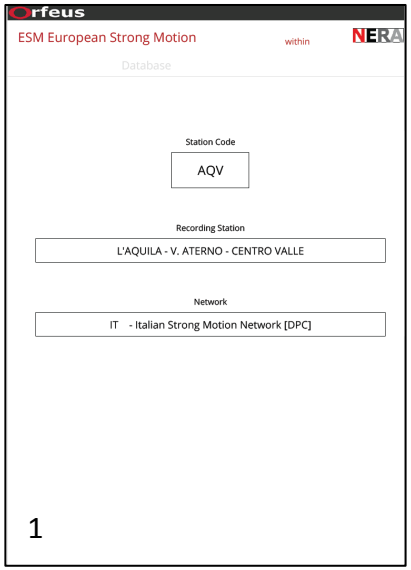
Detail And Profiles For Stratigraphy

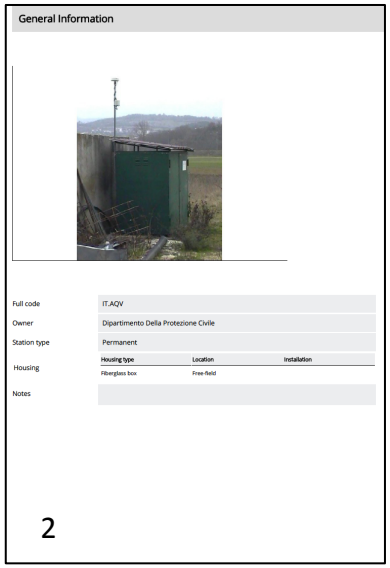
Network	IT - Italian Strong Motion Network [DPC]
Station code	AQV
Code	1
Latitude	42.377049
Longitude	13.343855
Projection	Geographic coordinates referred to WGS84
Elev [m.a.s.l.]	639.0
Reference	DBDAI.1

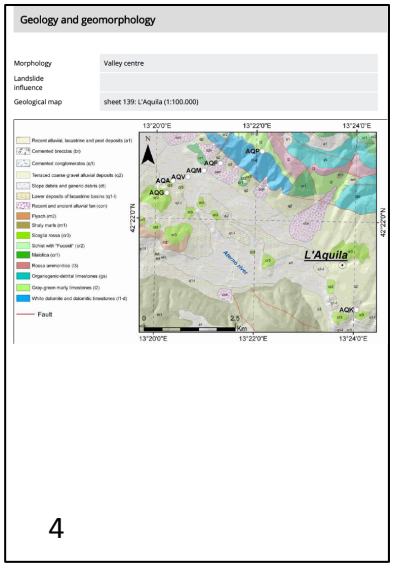
Layer

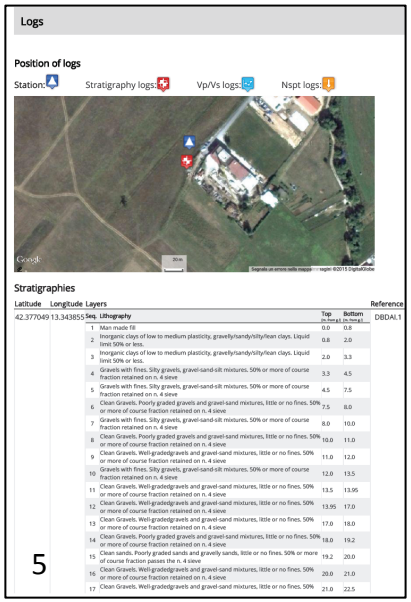
Sequence	Lithography	Top [m. from g.l]	Bottom [m. from g.l]	Description
1	Man made fill	0.0	0.8	Terreno di riporto antropico costituito da argilla limosa di colore marrone scuro mediamente consistente con inclusi litici calcarei eterometrico.
2	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays. Liquid limit 50% or less.	0.8	2.0	Argilla e argilla limosa di colore marrone scuro mediamente consistente con scarsi inclusi litici calcarei e tracce di ossidazione
3	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays. Liquid limit 50% or less.	2.0	3.3	Argilla e argilla limosa di colore marrone scuro mediamente consistente con scarsa materia organica e tracce di ossidazione. Presenza di inclusi litici verso il letto
4	Gravels with fines. Silty gravels, gravel-sand-silt mixtures. 50% or more of course fraction retained on n. 4 sieve	3.3	4.5	Ghiaia calcarea eterometrica in matrice limosa di colore avana passante a matrice argillosa di colore scuro verso il letto. ciottoli calcarei di dimensioni comprese tra 2 e 10 cm mediamente arrotondati ed appiattiti.
5	Gravels with fines. Silty gravels, gravel-sand-silt mixtures. 50% or more of course fraction retained on n. 4 sieve	4.5	7.5	Ghiaia calcarea eterometrica in matrice limosa di colore avana passante a matrice sabbiosa di colore giallastro verso il letto. ciottoli calcarei di dimensioni comprese tra 2 e 15 cm mediamente arrotondati ed appiattiti.
6	Clean Gravels. Poorly graded gravels and gravel-sand mixtures, little or no fines. 50% or more of course fraction retained on n. 4 sieve	7.5	8.0	Ghiaia calcarea eterometrica sciacquata. ciottoli calcarei di dimensioni decimetriche mediamente arrotondati ed appiattiti.
7	Gravels with fines. Silty gravels, gravel-sand-silt mixtures. 50% or more of course fraction retained on n. 4 sieve	8.0	10.0	Ghiaia calcarea fine monometrica in abbondante matrice sabbiosa fine di colore giallastro, con presenza diffusa di ciottoli calcarei di dimensioni decimetriche. Clasti di dimensioni medie di circa 0.5-1 cm mediamente arrotondati ed appiattiti.
8	Clean Gravels. Poorly graded gravels and gravel-sand mixtures, little or no fines. 50% or more of course fraction retained on n. 4 sieve	10.0	11.0	Ghiaia calcarea eterometrica sciacquata. ciottoli calcarei di dimensioni comprese tra 2 e 10 cm mediamente arrotondati ed appiattiti.
9	Clean Gravels. Well-gradedgravels and gravel-sand mixtures, little or no fines. 50% or more of course fraction retained on n. 4 sieve	11.0	12.0	Ghiaia calcarea fine monometrica, con rari ciottoli calcarei di dimensioni decimetriche. Clasti di dimensioni medie di circa 0.5-1 cm mediamente arrotondati ed appiattiti.
10	Gravels with fines. Silty gravels, gravel-sand-silt mixtures. 50% or more of course fraction retained on n. 4 sieve	12.0	13.5	Ghiaia calcarea eterometrica in scarsa matrice limosa di colore biancastro. Clasti di dimensioni comprese tra 2 e 5 cm mediamente arrotondati ed appiattiti.
11	Clean Gravels. Well-gradedgravels and gravel-sand mixtures, little or no fines. 50% or more of course fraction retained on n. 4 sieve	13.5	13.95	PROVA SPT1
12	Clean Gravels. Well-gradedgravels and gravel-sand mixtures, little or no fines. 50% or more of course fraction retained on n. 4 sieve	13.95	17.0	Ghiaia calcarea fine monometrica, con ciottoli calcarei di dimensioni decimetriche, in matrice sabbioso-limosa di colore avana. Clasti mediamente arrotondati ed appiattiti.
13	Clean Gravels. Well-gradedgravels and gravel-sand mixtures, little or no fines. 50% or more of course fraction retained on n. 4 sieve	17.0	18.0	Ghiaia calcarea fine monometrica con sabbia grossolana. Clasti di dimensioni medie di circa 0.5-1 cm mediamente arrotondati ed appiattiti. Presenza di rari ciottoli calcarei di dimensioni decimetriche.

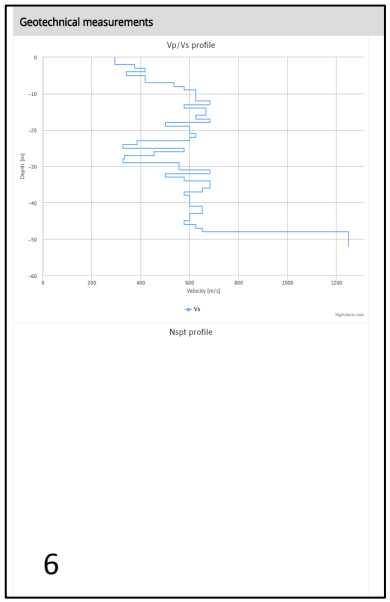
Station report

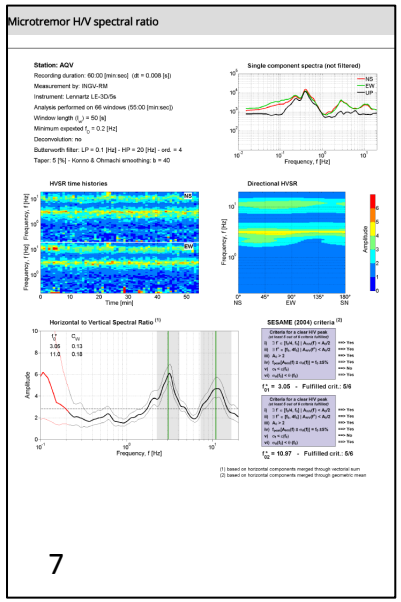


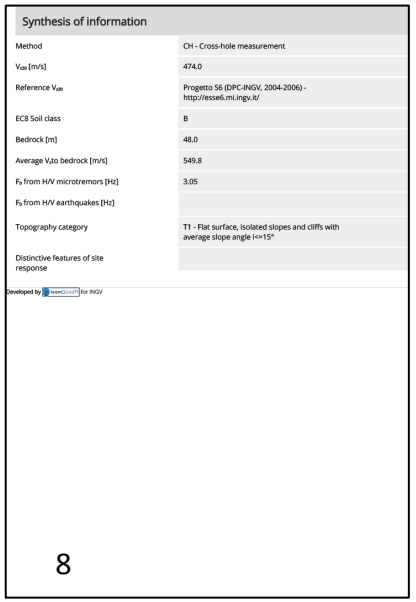












Station book as site repository

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RRSM Interface

About Station Book

Station Book Orfeus Data Center

within NERA

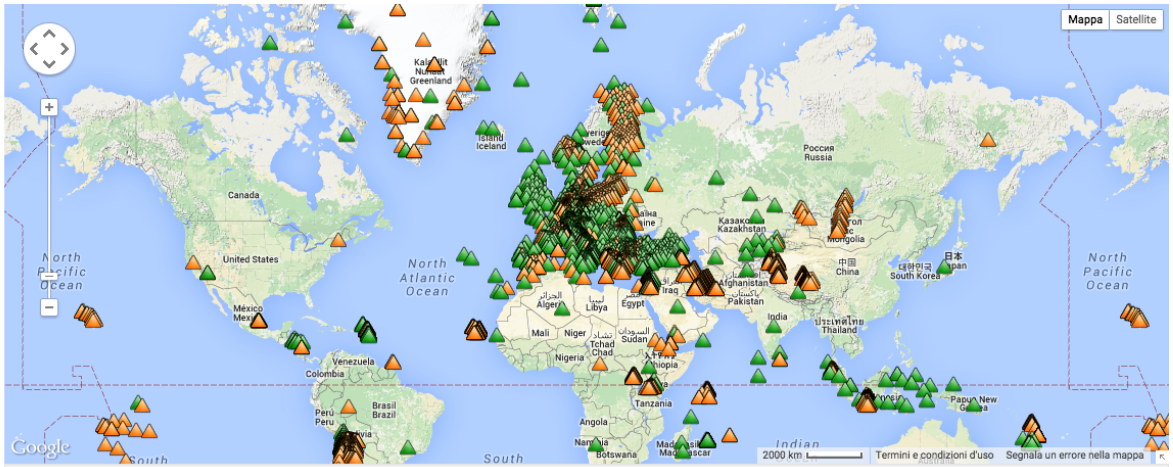
Home | Search Stations | Select by Network | Manage Network(s)

Station Book Home

www.orfeus-eu.org/stationbook

European Station Book

All stations by time frame



Station types: open, closed

Showing 1 to 10 of 5,124 rows << Previous Next >> Display 10 rows

Net	Sta	Lat [°]	Lon [°]	Elev [m]	Open	Rest.	Country	Station Name	Affiliation	Start	End	Info
1B	BUMA	0.6944 N	30.0663 E	984	No	No	Uganda	Temp Uganda Station Buma	Temp Uganda	2006	2006	details
1B	BURO	0.8609 N	30.1708 E	980	No	No	Uganda	BURO	Temp Uganda	2006	2006	details
1B	BWRA	0.0339 N	29.7663 E	1228	No	No	Uganda	Temp Uganda Station BWRA	Temp Uganda	2008	2008	details
1B	HARU	0.0002 N	29.7611 E	1096	No	No	Uganda	Uganda Network	Temp Uganda	2006	2006	details

Aim

- **RRSM** contains waveforms from stations instrumented with **different sensors** (short period, broad-band, accelerometric)
- Contains both **metadata on instrument response** as well as **metadata** that are **related to site response**

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RRSM Interface

About Station Book

Station Book Orfeus Data Center

within NERA

Home | Search Stations | Select by Network | Manage Network(s)

Station Book Home / Select by Network / Network / Station

Station Detail

- Select by Network
  - Network KO
    - Station AKDN
      - *Description*
      - *Station Details*
      - *Station Pictures*
      - *Housing & Building details*
      - *Instrumentation History*
      - *Borehole*

Metadata files EIDA

- Dataless SEED
- SC3 Inventory XML
- FDSN Station XML

Description EIDA data & Ownership

Network	KO	**Latitude [°]**	35.297000 N	**Country**	-
Station Code	AKDN	**Longitude [°]**	32.968300 E	**Station Name**	Akdeniz-KKKTC
Affiliation	Kandilli Observatory BB and SM Stations	**Elevation [m]**	85	**Description**	Akdeniz-KKKTC
Shared / Restric.	Yes / No	**Owner Name**	-	**Owner Phone**	-
Start	2008	**Owner Department**	-	**Owner Email**	-
End	-	**Owner Agency**	-	**Owner Address**	-

Station Details Morphology, Ground type, Geology, etc.

Geological Unit -

Morphology Class -

Classes: T1, T2, T3, T4; *based on the Italian building code*

Morphology Description -

Ground type EC8 -

EC8 types: A,B,C,D,E,S_1,S_2; *more info here*

Groundwater Depth [m] -

Vs 30 [m/s] -

f_0 [Hz] -

Fundamental frequency at the site

Amp(f_0) -

H/V amplitude at f_0

Basin Flag -

Bedrock Depth [m] -

Depth to the engineering bedrock (with Vs ~ 800 m/s)

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RRSM Interface

About Station Book

Station Book Orfeus Data Center

within NERA

Map

Legend

2 ms

Station Pictures

No pictures found

Housing & Building details by sensor location

Loc	Streams	Lat [°]	Lon [°]	Elev [m]	Start	End	Housing Class *	Housing Desc	In Building	No Storeys	Distance to Building [m]
--	HNE,HNN,HNZ	35.297000 N	32.968300 E	85	2008	-	-	-	-	-	-

(*) Housing Class: Borehole, Bridge, Building, Cave, Dam, Free field, OtherStructure, Tunnel, Underground shelter or Urban free field; *following these details*

Instrumentation History Dataloggers and sensors by location and stream (EIDA)

Showing **1** to **3** of **3** rows << Previous Next >> Display 10 rows

Loc	Stream	Loc TimeFrame	Stream TimeFrame	Datalogger	Sensor	Gain	Unit	Type
	HNE	2008-01-01 / -	2008-01-01 / -	AKDN.2008.001.HNE	100	79664.1	M/S**2	
	HNN	2008-01-01 / -	2008-01-01 / -	AKDN.2008.001.HNN	100	79664.1	M/S**2	
	HNZ	2008-01-01 / -	2008-01-01 / -	AKDN.2008.001.HNZ	100	79664.1	M/S**2	

Showing **1** to **3** of **3** rows << Previous Next >>

Copy CSV Excel PDF Print

Filter rows:

3 ms

Borehole

Borehole No
Number of layers 0

Latitude [°] -
Longitude [°] -

Depth [m] -
Bedrock Depth [m] -

BoreHole Layers

Metadata files EIDA

Dataless SEED

SC3 Inventory XML

FDSN Station XML

Information contained in EIDA


```
▼<FDSNStationXML xmlns="http://www.fdsn.org/xml/station/1" schemaVersion="1.0">
  <Source>SeisComP3</Source>
  <Sender>ODC</Sender>
  <Created>2015-09-16T09:10:07</Created>
 ▼<Network code="IV" startDate="1980-01-01T00:00:00" restrictedStatus="open">
   <Description>Italian Seismic Network</Description>
  ▼<Station code="APEC" startDate="2014-02-06T12:00:00" restrictedStatus="open">
    <Latitude>43.55846</Latitude>
    <Longitude>12.41991</Longitude>
    <Elevation>488</Elevation>
   ▶<Site>...</Site>
    <CreationDate>2014-02-06T12:00:00</CreationDate>
   ▶<Channel code="HHE" startDate="2014-02-06T12:00:00" restrictedStatus="open"
    locationCode="">...</Channel>
   ▶<Channel code="HHN" startDate="2014-02-06T12:00:00" restrictedStatus="open"
    locationCode="">...</Channel>
   ▶<Channel code="HHZ" startDate="2014-02-06T12:00:00" restrictedStatus="open"
    locationCode="">...</Channel>
   ▶<Channel code="HNE" startDate="2014-02-06T12:00:00" restrictedStatus="open"
    locationCode="">...</Channel>
   ▶<Channel code="HNN" startDate="2014-02-06T12:00:00" restrictedStatus="open"
    locationCode="">...</Channel>
   ▶<Channel code="HNZ" startDate="2014-02-06T12:00:00" restrictedStatus="open"
    locationCode="">...</Channel>
   </Station>
  </Network>
 </FDSNStationXML>
```

FDSN StationXML

The **FDSN StationXML schema** and related documents are maintained by the International Federation of Digital Seismograph Networks (FDSN, http://www.fdsn.org).

StationXML is a schema definition for representing the Standard for the Exchange of Earthquake (**SEED**) **metadata** in XML.

SEED and **StationXML** are maintained by **FDSN Working Group II** (WG-II).

Approved schema are http://www.fdsn.org/xml/station/

Are we satisfied with these repositories?

No:

- Information is duplicated but can be different (EIDA stations)
- No interoperability
- No common standards

Are we satisfied with station XML?

SEED

↓

FDSN StationXML

```
▼<FDSNStationXML xmlns="http://www.fdsn.org/xml/station/1" schemaVersion="1.0">
  <Source>SeisComP3</Source>
  <Sender>ODC</Sender>
  <Created>2015-09-16T09:10:07</Created>
 ▼<Network code="IV" startDate="1980-01-01T00:00:00" restrictedStatus="open">
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    <Longitude>12.41991</Longitude>
    <Elevation>488</Elevation>
   ▶<Site>...</Site>
    <CreationDate>2014-02-06T12:00:00</CreationDate>
   ▶<Channel code="HHE" startDate="2014-02-06T12:00:00" restrictedStatus="open"
     locationCode="">...</Channel>
   ▶<Channel code="HHN" startDate="2014-02-06T12:00:00" restrictedStatus="open"
     locationCode="">...</Channel>
   ▶<Channel code="HHZ" startDate="2014-02-06T12:00:00" restrictedStatus="open"
     locationCode="">...</Channel>
   ▶<Channel code="HNE" startDate="2014-02-06T12:00:00" restrictedStatus="open"
     locationCode="">...</Channel>
   ▶<Channel code="HNN" startDate="2014-02-06T12:00:00" restrictedStatus="open"
     locationCode="">...</Channel>
   ▶<Channel code="HNZ" startDate="2014-02-06T12:00:00" restrictedStatus="open"
     locationCode="">...</Channel>
  </Station>
 </Network>
</FDSNStationXML>
```
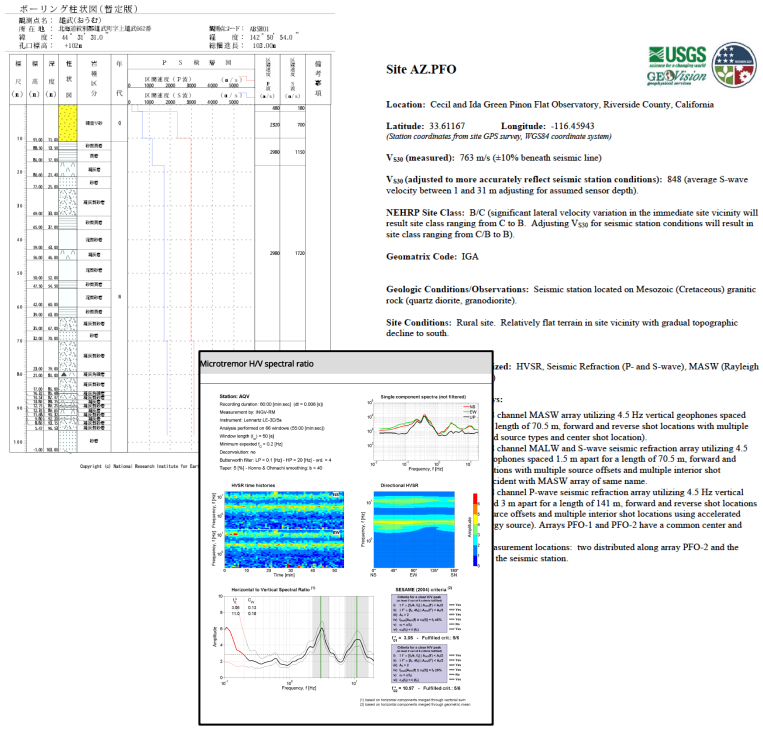

No geotechnical or geophysical info

Various repositories (files + images)



Station xml extension (proposal by Philip Kästli)

Conclusion

- Geotechnical characteristics of the uppermost soil layers are fundamental
- Few stations have been characterized in the world
- Few station metadata are standardized and available (station xml format)
- Additional metadata are required in the station xml (e.g. Vs_{30}, 1D geophysical profiles)

Discussion

- No idea about station metadata available at single observatories
- Quantification of man-power needed to collect and uniform site metadata
- One or multiple repositories (e.g. federated approach as EIDA?)

Dedicated project?

EPOS?

Proposed actions

- Inventory of the station metadata available at each observatory
- Define all the necessary station metadata
- Extension of the station xml format

Setting a new EPOS working group on site characterization?

Thank you!

FDSN StationXML: current version

```
▼<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:fsx="http://www.fdsn.org/xml/station/1"
 targetNamespace="http://www.fdsn.org/xml/station/1" elementFormDefault="qualified" attributeFormDefault="unqualified" version="1.0">
 ▶<xs:annotation>...</xs:annotation>
  <!--  Root element  -->
  <xs:element name="FDSNStationXML" type="fsx:RootType"/>
  <!--  Type definitions  -->
 ▶<xs:complexType name="RootType">...</xs:complexType>
 ▶<xs:complexType name="NetworkType">...</xs:complexType>
 ▶<xs:complexType name="StationType">...</xs:complexType>
  <!--  End StationType -->
 ▶<xs:complexType name="ChannelType">...</xs:complexType>
  <!--  End ChannelType  -->
 ▶<xs:complexType name="GainType">...</xs:complexType>
 ▶<xs:group name="FrequencyRangeGroup">...</xs:group>
 ▶<xs:complexType name="SensitivityType">...</xs:complexType>
 ▶<xs:complexType name="EquipmentType">...</xs:complexType>
 ▶<xs:complexType name="ResponseStageType">...</xs:complexType>
 ▶<xs:complexType name="LogType">...</xs:complexType>
 ▶<xs:complexType name="CommentType">...</xs:complexType>
 ▶<xs:complexType name="PolesZerosType">...</xs:complexType>
 ▶<xs:complexType name="FIRType">...</xs:complexType>
 ▶<xs:complexType name="CoefficientsType">...</xs:complexType>
 ▶<xs:complexType name="ResponseListElementType">...</xs:complexType>
 ▶<xs:complexType name="ResponseListType">...</xs:complexType>
 ▶<xs:complexType name="PolynomialType">...</xs:complexType>
 ▶<xs:complexType name="DecimationType">...</xs:complexType>
  <!--  The following elements represent numbers.  -->
 ▶<xs:attributeGroup name="uncertaintyDouble">...</xs:attributeGroup>
 ▶<xs:complexType name="FloatNoUnitType">...</xs:complexType>
 ▶<xs:complexType name="FloatType">...</xs:complexType>
  <!--  Derived from FloatType.  -->
 ▶<xs:complexType name="SecondType">...</xs:complexType>
 ▶<xs:complexType name="VoltageType">...</xs:complexType>
 ▶<xs:complexType name="AngleType">...</xs:complexType>
 ▶<xs:complexType name="LatitudeBaseType">...</xs:complexType>
 ▶<xs:complexType name="LatitudeType">...</xs:complexType>
 ▶<xs:complexType name="LongitudeBaseType">...</xs:complexType>
 ▶<xs:complexType name="LongitudeType">...</xs:complexType>
 ▶<xs:complexType name="AzimuthType">...</xs:complexType>
 ▶<xs:complexType name="DipType">...</xs:complexType>
 ▶<xs:complexType name="DistanceType">...</xs:complexType>
 ▶<xs:complexType name="FrequencyType">...</xs:complexType>
 ▶<xs:group name="SampleRateGroup">...</xs:group>
 ▶<xs:complexType name="SampleRateType">...</xs:complexType>
 ▶<xs:complexType name="SampleRateRatioType">...</xs:complexType>
 ▶<xs:complexType name="PoleZeroType">...</xs:complexType>
 ▶<xs:simpleType name="CounterType">...</xs:simpleType>
 ▶<xs:complexType name="PersonType">...</xs:complexType>
 ▶<xs:complexType name="SiteType">...</xs:complexType>
 ▶<xs:complexType name="ExternalReferenceType">...</xs:complexType>
  <!--  Simple types  -->
 ▶<xs:simpleType name="NominalType">...</xs:simpleType>
 ▶<xs:simpleType name="EmailType">...</xs:simpleType>
 ▶<xs:complexType name="PhoneNumberType">...</xs:complexType>
 ▶<xs:simpleType name="RestrictedStatusType">...</xs:simpleType>
 ▶<xs:complexType name="UnitsType">...</xs:complexType>
 ▶<xs:complexType name="BaseFilterType">...</xs:complexType>
 ▶<xs:complexType name="ResponseType">...</xs:complexType>
 ▶<xs:complexType name="BaseNodeType">...</xs:complexType>
</xs:schema>
```