Orfeus

Observatories and Research Facilities for European Seismology

ORFEUS
Status and future plans

Alberto Michelini
contributions: Reinoud Sleeman, Lucia Luzi, Angelo Strollo

Dubrovnik
October 25, 2016

Status

1. What it is
2. What are the aims
3. Who are the participants
4. What are the activities

Future plans

1. Change the internal organization of the Foundation
2. Stepping from Data to Data-Products
3. Close relationship with EPOS

What it is

- **Foundation based in The Nederlands** (The Organization is a non-taxable and non-profit inter-European foundation registered in the European country where the ORFEUS Data Center (ODC) is located.)
- **Founded in 1987** (At the start of the digital era when the first broadband sensors were becoming available)
- **Structured with**
  - Board of directors (BoD) consisting of representatives of the corporate founders (CF)
  - Executive Committee appointed by the BoD
  - Officers (Chair BoD, President ExeCom, Secretary, Treasurer, ...)

ORFEUS plan launched at 1986: realized in 1987

ORFEUS
SCIENCE PLAN

Observatories and Research Facilities for European Seismology

editors
Guust Nolet (Utrecht University)
Barbara Romanovicz (IPG, Paris)
Rainer Kind (Graefenberg Observatory)
Erhard Wielandt (ETH, Zurich)

Orfeus Data Center

Observatories & Research Facilities for European Seismology

Data Center director:
Bernard Dost

Data Center host:
University of Utrecht
The Netherlands

ExeCom & Secretariat

ORFEUS Executive Committee (ExeCom)	
Alberto Michelini (president)	INGV, Italy
John Clinton	ETH, Switzerland
Susana Custódio	Instituto Dom Luiz, Portugal
Thomas Meier	University of Kiel, Germany
Nicos Melis	NOA, Greece
Helle Pedersen	RESIF, France
Frederik Tilmann	GFZ, Germany

ORFEUS Secretary General (interim)	
Lucia Luzi	INGV, Italy
Reinoud Sleeman	KNMI, Netherlands
Angelo Strollo	GFZ, Germany

Board of Directors

ORFEUS Board of directors	
Wolfgang Lenhardt (president)	Austria
Brian Baptie	UK
Reynir Bödvarsson	Sweden
Michel van Camp	Belgium
Fernando Carrilho	Portugal
Bernard Dost	Netherlands
Winfried Hanka	Germany
Annakaisa Korja	Finland
Constantin Ionescu	Romania
Anastasia Kiratzi	Greece (Earthquake Planning and Protection Organization)
Alessia Maggi	France
Salvatore Mazza	Italy
Lars Ottemöller	Norway
Haluk Özener	Turkey
Peter Voss	Denmark
Stefan Wiemer	Switzerland
Rémy Bossu (observer)	EMSC
Stefano Parolai (observer)	ESC
Dmitry Storchak (observer)	ISC

AIM & Objectives

From Statutes (1987)

AIM:

Article 2.

1. The principal objectives of the foundation are: To promote digital seismology in Europe in all aspects, especially the research of seismic waves in a broad frequency range (so called 'broad-band seismology').
2. The foundation will try to reach its goal by:
    a. The exploitation of a European data center for storage and exchange of seismic recordings of digital 'broad-band' seismometers.
    b. Advice in matters of location and setting up of seismological stations.
    c. Stimulation of the development of portable 'broad-band' seismographs.
    d. Cooperation with organisations inside and outside Europe in the field of digital seismology.
3. The foundation is obliged, insofar as within her competence and in agreement with the aim described in sub 1, to render to participants, as referred to in article 6 hereafter.

From Bylaws

Section 3. The objectives of the Corporation are:

- To promote all aspects of broad-band seismology in Europe.
- To operate a European Data Center for archiving and exchanging digital broad-band seismometer recordings (waveform data)
- To guide in matters concerning station location and design.
- To stimulate development of portable broad-band seismometer instrumentation
- To cooperate with intra- and extra-European societies and organizations on global coordination of matters concerning digital broad-band seismology.

Aims

To **promote digital seismology** in Europe in all aspects, especially the **research of seismic waves** in a broad frequency range (so called '**broad-band seismology**').

The foundation reaches its goals by:

a. Operation of a **European Data Center** for archiving and exchanging digital broad-band seismometer recordings (waveform data)
b. Providing **guidance** in matters concerning **station location and design**.
c. **Stimulation** of the development of **portable 'broad-band' seismographs**.
d. **Cooperation** with **intra- and extra-European societies** and **organizations on global coordination of matters concerning digital broad-band seismology**.

Therefore….

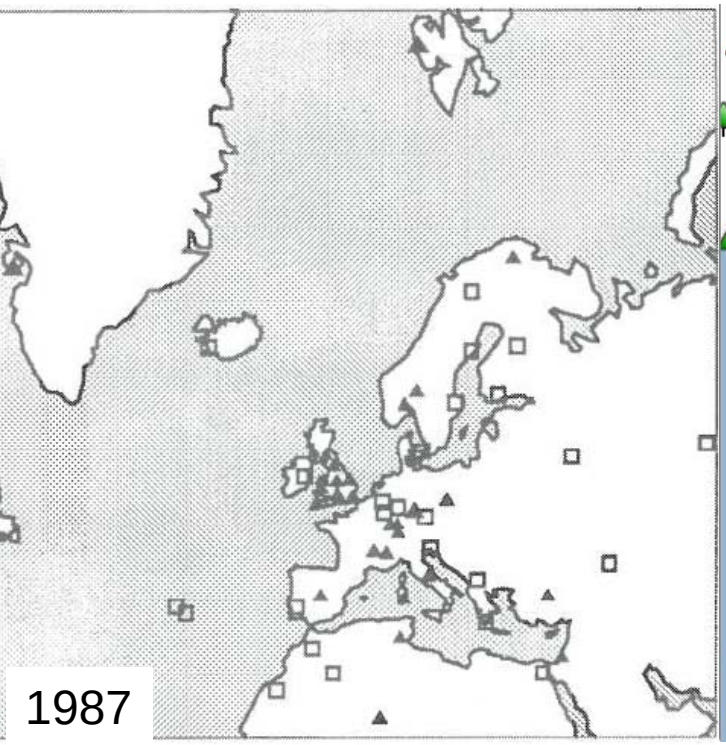
- To serve European Seismology through **collecting**, **archiving** and **making accessible** high quality **seismological data** and **products**
- Keep **close contact with the network operators** to **leverage** and **homogenize** their **activities**
- Providing **data management**, **archiving** and **quality control services** to **network operators for their data**

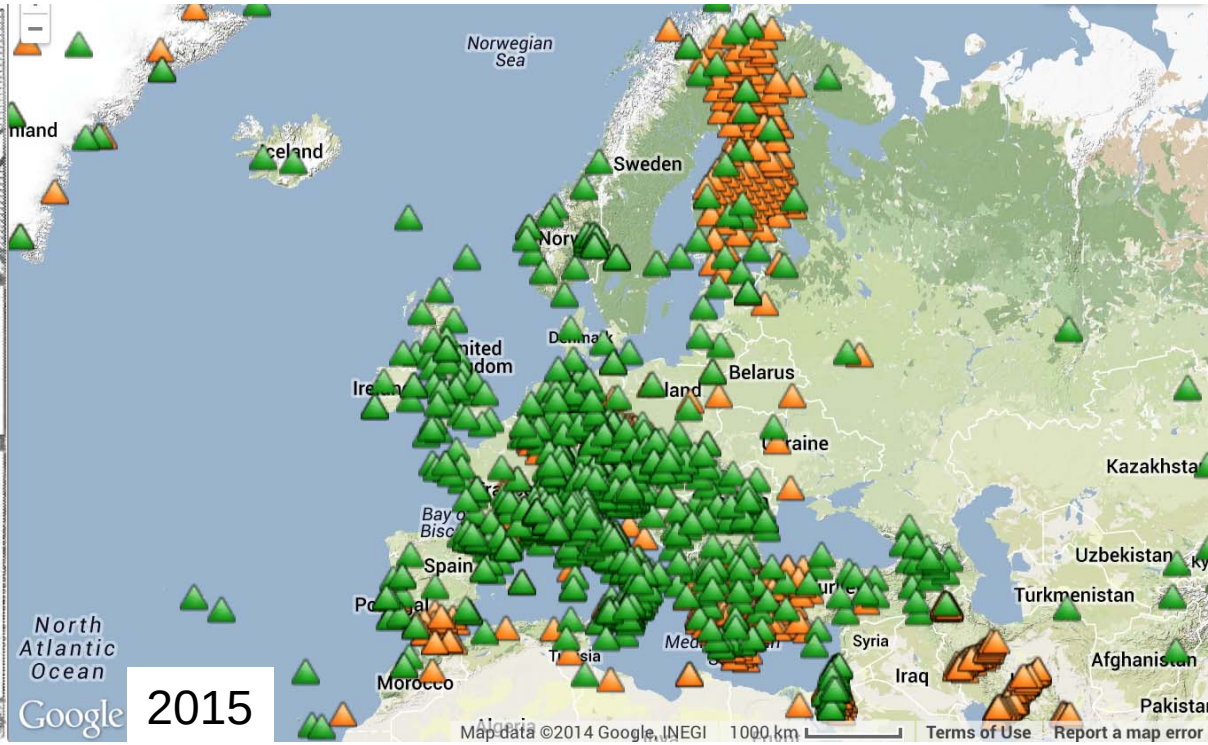
Data exchange 1988 - ~ 2003 & Data management in 1990

Data media

Access to the Data Center

Broadband seismic stations in operation in the European region





~ 30 stations open access

~ 6000 open access station
(in operation: green; closed: orange)

Participants

- 63 institutions/organizations
  (http://www.orfeus-eu.org/organization/participation.html)
- 82 FDSN registered permanent networks,
  60 registered temporary networks
- 6000+ stations (permanent and temporary experiments)

Activities

Integrated access to European seismological data

- Data gathering
- Quality Control (time series, metadata, time, …)
- Archival (multiple data centres; data identifications: DOI, PID)
- Access and exchange (standardized and fast)
- …more products and services to come…

Available Data

EIDA European Integrated Data Archive

Networks	Overview of all permanent and temporary networks in EIDA
Stations	Access to the EIDA station database
Webservices	FDSN webservices to retrieve EIDA data
GUI	Interactive webaccess to EIDA waveform data and metadata

The ORFEUS Data Center (ODC) is one of the **EIDA nodes** that archives waveform data and metadata from European seismic networks. The data archive from ODC includes waveform data from 1988 to present. ODC is hosted by the Royal Netherlands Meteorological Institute (KNMI).

Strong Motion Data products

RRSM	Rapid Raw Strong Motion - system to automatically provide strong motion parameters
ESM	European Strong Motion - provides access to reviewed strong motion engineering parameters

EIDA Station Book detailed station information

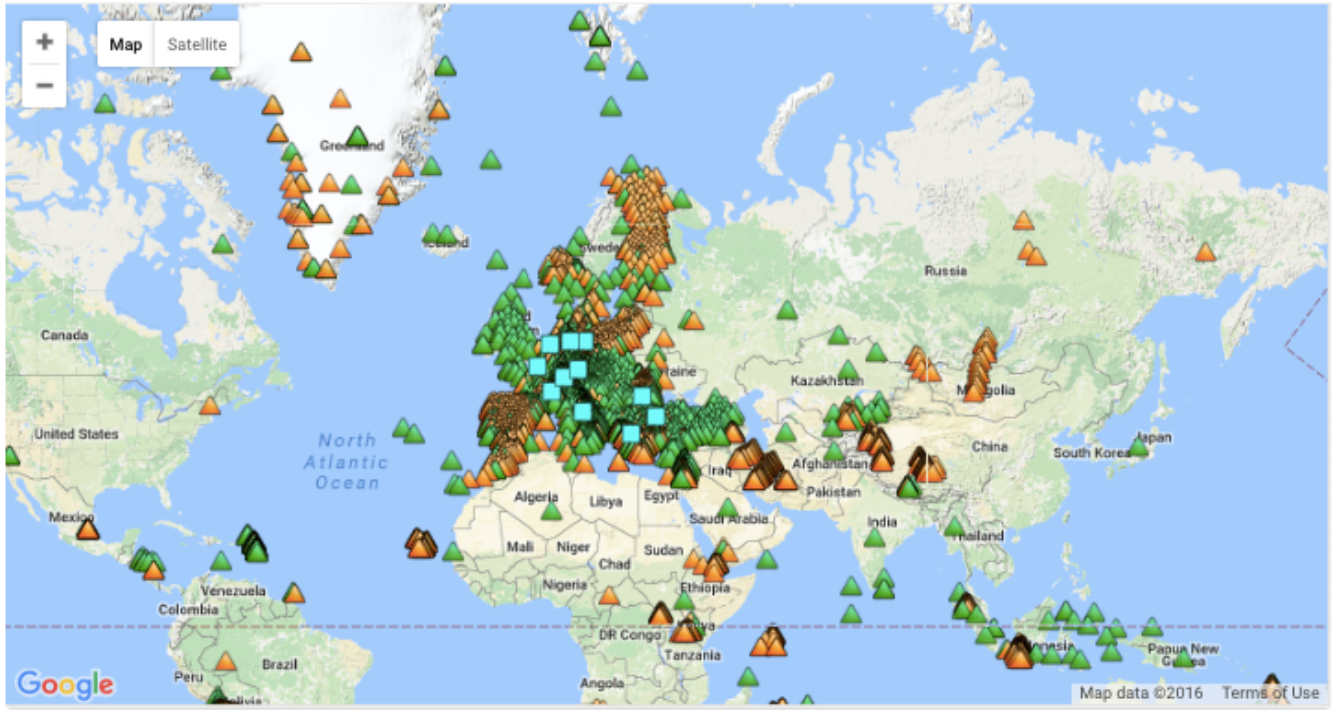
StationBook	Station Inventory for EIDA stations

European Integrated Data Archive EIDA

EIDA, an initiative within ORFEUS, is a distributed data center established to (*a*) securely archive seismic waveform data and metadata gathered by European research infrastructures, and (*b*) to provide transparent access to the archives by the geosciences research communities. EIDA is **organized and managed** by the EIDA Management Board (EMB).

EIDA nodes are data centres which collect and archive data from seismic networks deploying broad-band sensors, short period sensors, accelerometers, infrasound sensors, and other geophysical instruments. Networks and stations contributing data to EIDA are listed in the **EIDA network list** and **station database**. EIDA runs a **monitoring tool** to keep track of the status of the system and the usage in terms of data download.

EIDA Data Portal | FDSN Webservices | Station Book



Operational and Closed Stations

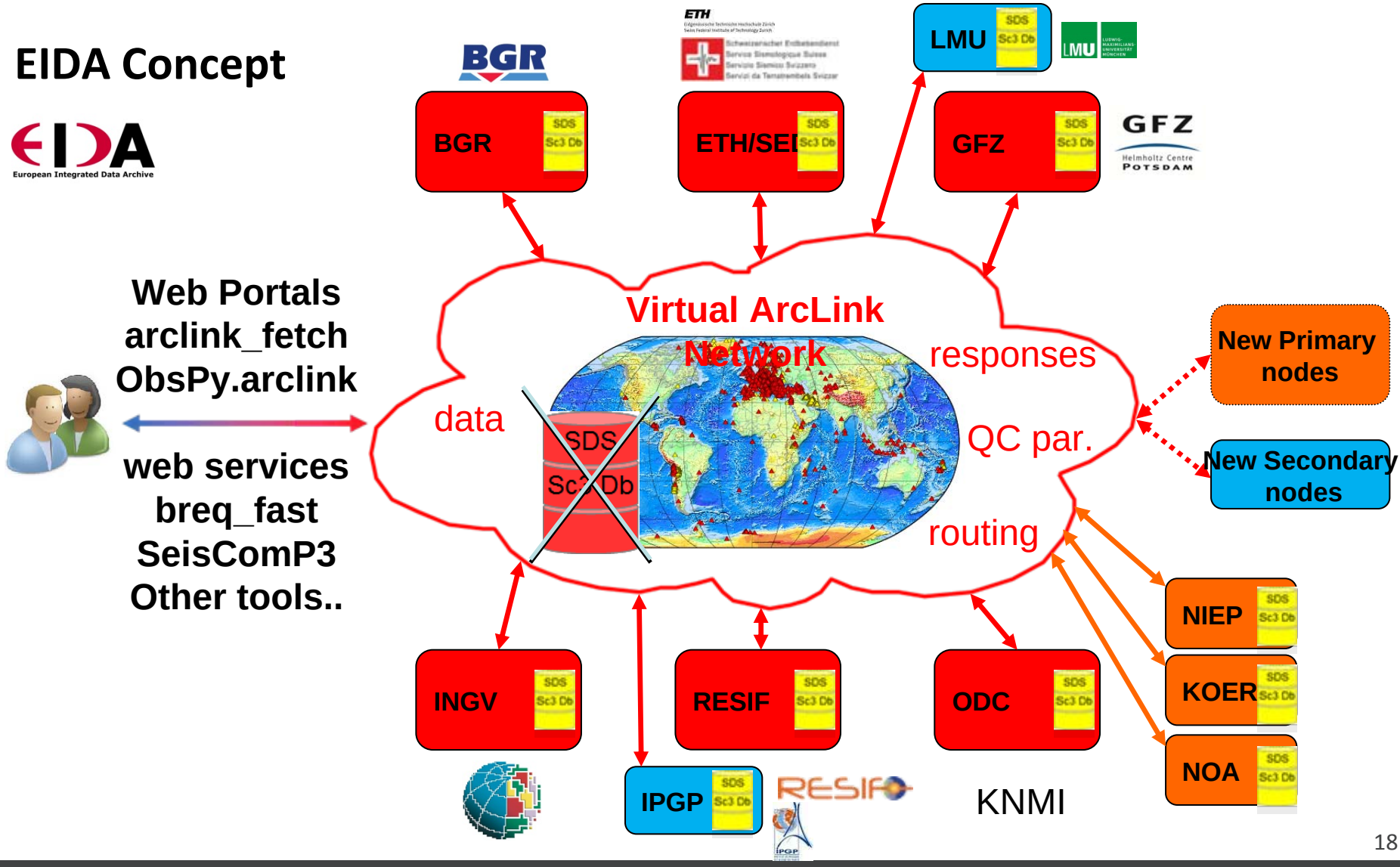
Show station labels (max. 100 stations in window)

Operational Station | Closed Station | EIDA Nodes

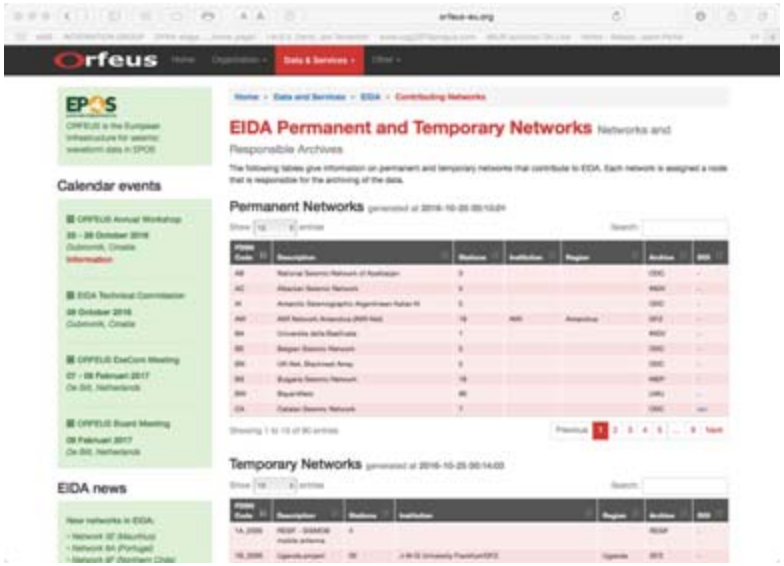
This map shows 6331 EIDA stations. Green triangles represent stations that are in operation (2357) according to the current metadata, while the orange triangles indicate stations that have stopped operation (3974). ORFEUS Data Center updates this map daily (last update: 2016-10-25 00:18:03 UTC).

EIDA Concept

EIDA
European Integrated Data Archive



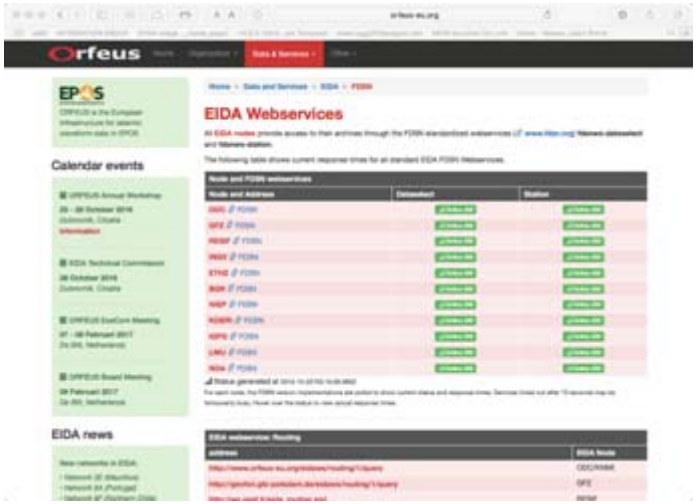
Networks



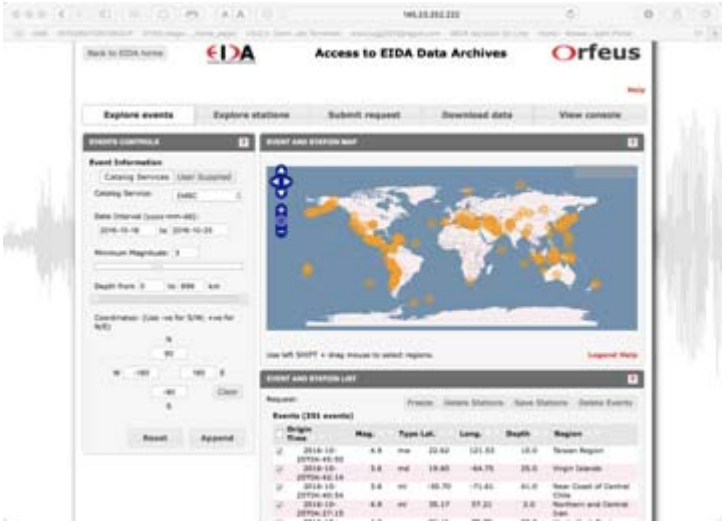
Stations

http://www.orfeus-eu.org/data/eida/

Web Services

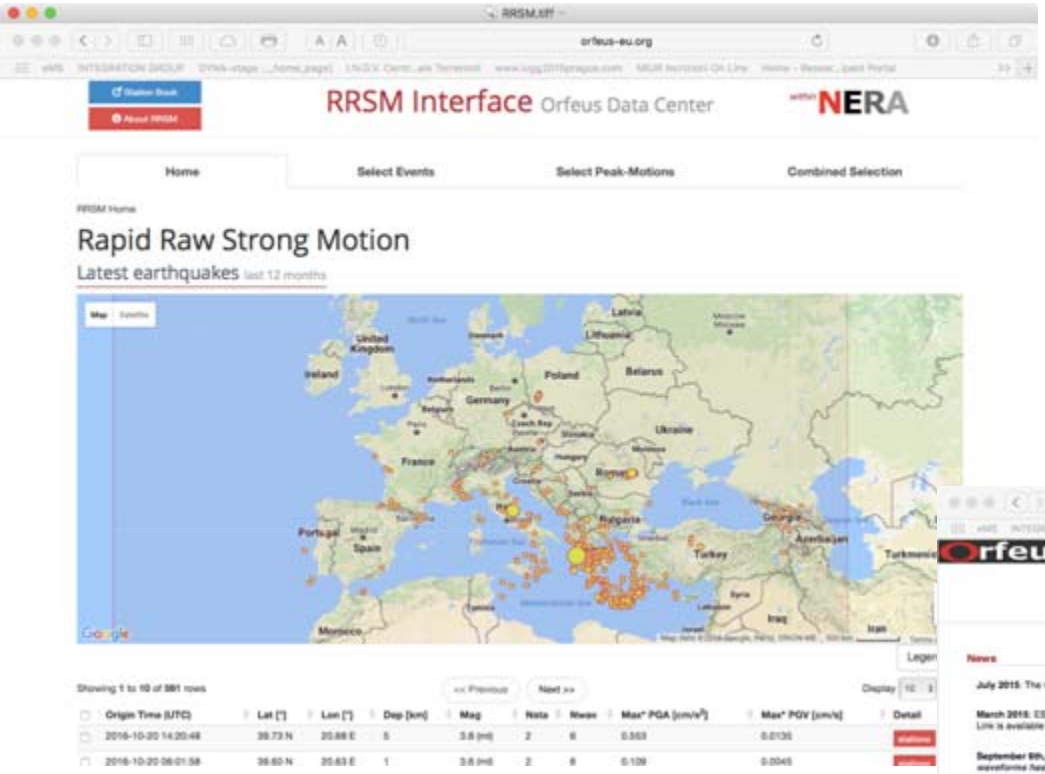


Graphics User Interface

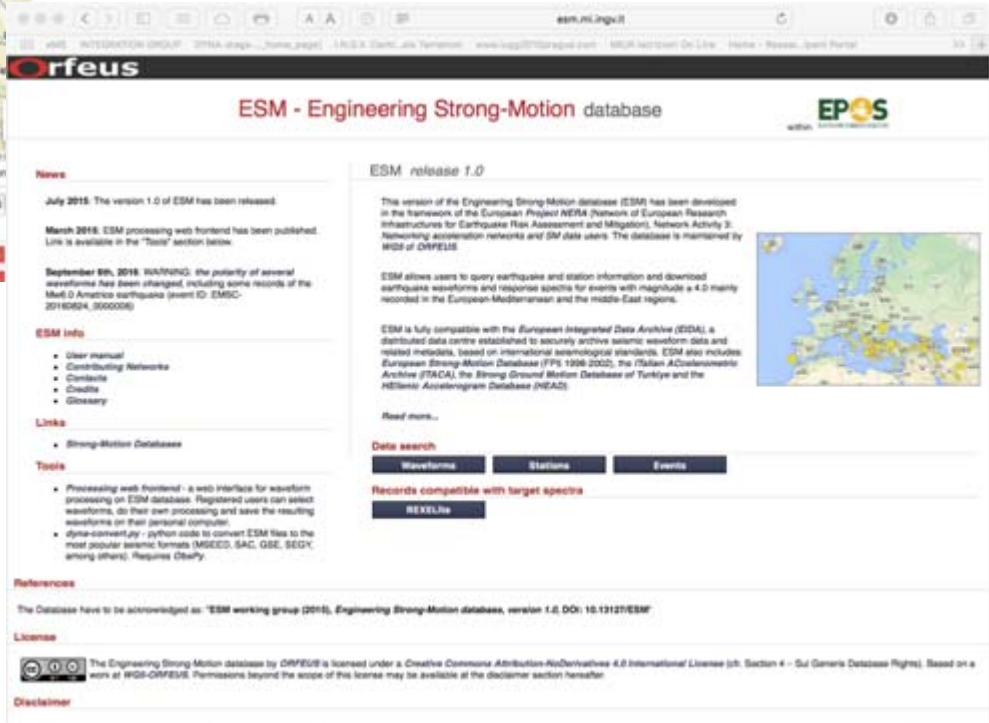


Strong Motion portals

http://www.orfeus-eu.org/opencms/rrsm/index.html



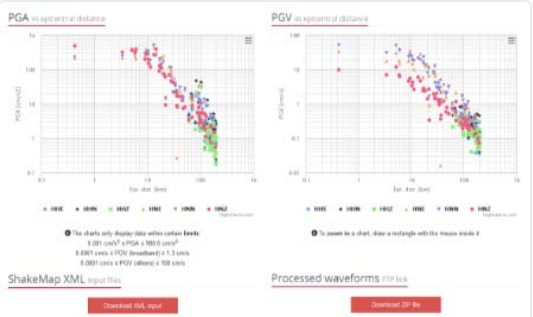
http://esm.mi.ingv.it



Strong Motion Data Portals

The Rapid Raw Strong Motion (RRSM) is a fully **automated** system, based on **EIDA**, that provides earthquake information and engineering parameters including PGA and PGV within minutes of any event.

The Engineering Strong-Motion database (ESM) is a **reviewed** archive of accelerometric waveforms from events with magnitude >= 4.0 recorded in Europe and middle-East since 1969. It provides unprocessed acceleration time-series, manually processed acceleration, velocity and displacement time-series, acceleration and displacement response spectra, and relevant engineering parameters.



Rapid Raw Strong Motion RRSM

The RRSM portal allows users to query earthquake information, peak ground motion parameters, response spectral amplitudes and to select and download earthquake waveforms within minutes after an earthquake with magnitude ≥ 3.5 occurring in the European-Mediterranean region.

Reference:
Introducing the European Rapid Raw Strong-Motion Database
C. Cauzzi et. al., 2016, Seismol. Res. Lett. 87, 4, doi: 10.1785/0220150271

Engineering Strong Motion ESM

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.

Reference:
The Engineering Strong-Motion Database: A Platform to Access Pan-European Accelerometric Data
L. Luzi et. al., 2016, Seismol. Res. Lett. 87, 4, doi: 10.1785/0220150278

ELECTRONIC SEISMOLOGIST

The Engineering Strong-Motion Database: A Platform to Access Pan-European Accelerometric Data

by Lucia Luzi, Rodolfo Puglia, Emiliano Russo, Maria D'Amico, Chiara Felicetta, Francesca Pacor, Giovanni Lanzano, Ufuk Çeken, John Clinton, Giovanni Costa, Llambro Duni, Esmael Farzanegan, Philippe Gueguen, Constantin Ionescu, Ioannis Kalogeras, Haluk Özener, Damiano Pesaresi, Reinoud Sleeman, Angelo Strollo, and Mehdi Zare

ABSTRACT

This article describes the Engineering Strong-Motion Database (ESM), developed in the framework of the European project Network of European Research Infrastructures for Earthquake Risk Assessment and Mitigation (NERA, see Data and Resources). ESM is specifically designed to provide end users only with quality-checked, uniformly processed strong-motion data and relevant parameters and has done so since 1969 in the Euro-Mediterranean region. The database was designed for a large variety of stakeholders (expert seismologists, earthquake engineers, students, and professionals) with a user-friendly and straightforward web interface.
Users can access earthquake and station information and download waveforms of events with magnitude ≥ 4.0 (unprocessed and processed acceleration, velocity, and displacement, and acceleration and displacement response spectra at 5% damping). Specific tools are also available to users to process strong-motion data and select ground-motion suites for code-based seismic structural analyses.

INTRODUCTION

The repeated attempts of building unified engineering strong-motion databases in Europe are motivated by the increasing demand for strong-motion data, which are one of the primary sources of information used by engineering seismologists and earthquake engineers to predict ground shaking and to perform structural seismic analysis. Figure 1 summarizes the evolution of strong-motion data archiving in Europe since 1998.

The first coordinated collection of pan-European strong-motion data was established within the framework of the European Strong- Motion Database (ESD), supported by the European Commission during the 5th Framework Programme (1998–2002). The latest database version (Ambraseys, Douglas, *et al.*, 2004; Ambraseys, Smit, *et al.*, 2004) contains about 2000 strong-motion records in the time span 1973–2008.

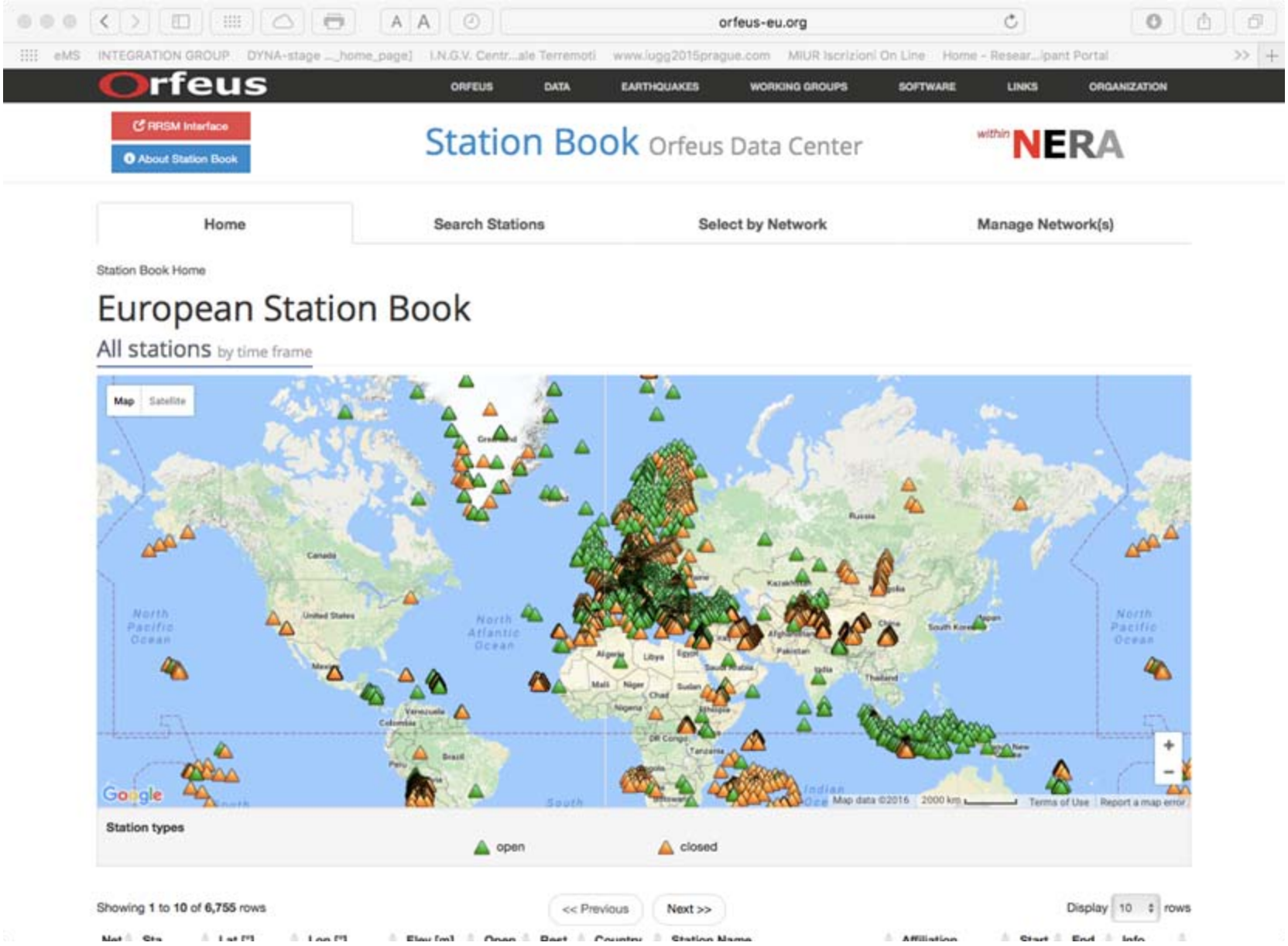
During the 6th Framework Programme of the European Commission, within the Network of Research Infrastructures for European Seismology (NERIES) project (2006–2010, see Data and Resources), a new collection of accelerometric waveforms recorded in the Euro-Mediterranean region was promoted. At that time, only digital data were selected and 8000 waveforms, recorded in the time span 1995–2009 and in the 1.0–7.4 magnitude range, were gathered and uniformly processed with a fixed cutoff frequency of 0.1 Hz (Rosa *et al.*, 2011). Data were obtained mainly from Swiss, French, and Spanish collections, with the addition of sparse digital waveforms from Italian, Turkish, or Greek databases. Unfortunately, data are no longer available on the Web.

An additional strong-motion data collection was promoted within the Seismic Harmonization in Europe (SHARE) project (7th Framework Programme of the European Commission, 2010–2014) with the goal of testing the performance of candidate ground-motion prediction equations for the probabilistic seismic-hazard map of Europe (Yenier *et al.*, 2010). Accelerograms were gathered from European or regional databases (e.g., the National Strong-Motion Network of Turkey [TR-NSMN], described in Akkar *et al.*, 2010; ITalian ACcelerometric Archive [ITACA] v.1.0, described in Luzi *et al.*, 2008 and Pacor, Paolucci, Luzi, *et al.*, 2011) as well as from worldwide databases (e.g., K-Net and KiK-net, see Data and Resources; the Next Generation Attenuation [NGA] database, Chiou *et al.*, 2008; and a dataset compiled by Cauzzi and Faccioli, 2008). Neither metadata update nor uniform processing has been applied to waveforms (Yenier *et al.*, 2010). This databank contains 14,193 records from 2448 events in the 3.0–8.0 magnitude range, and only a flat file with strong-motion parameters is distributed at European Facilities for Earthquake Hazard & Risk (EFEHR; see Data and Resources).

A recent attempt to gather European strong-motion data was carried out within the Seismic Ground Motion Assessment (SIGMA) project (see Data and Resources). The Reference Database for Seismic Ground-Motion in Europe (RESORCE) database (Akkar *et al.*, 2013), compiled within the Seismic Ground-Motion Assessment (SIGMA) project, contains pan-European strong-motion data and has the goal of improving seismic-hazard assessment in France and neighboring countries. The RESORCE database includes 5882 multicomponent and uniformly processed accelerograms from 1814 events in the

Station Book Portal

http://www.orfeus-eu.org/opencms/stationbook/index.html



Future plans

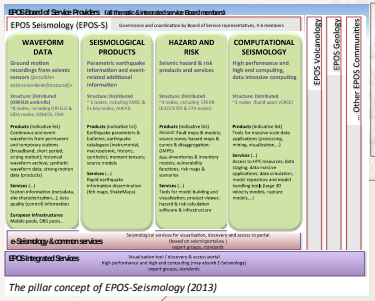
1. Change the internal organization of the Foundation
2. Stepping from Data to Data-Products
3. Close relationship with EPOS
   - The EPOS Thematic Core Service (EPOS -TCS)

Sustainable access to data, products, services and software from the European seismological Research Infrastructures: the EPOS TCS Seismology

F Haslinger[1], A Dupont[2], A Michelini[3], A Rietbrock[4], R Sleeman[5], S Wiemer[1], R Basili[3], R Bossu[2], E Cakti[6], F Cotton[7], W Crawford[8], J Diaz[9], T Garth[4], M Locati[3], L Luzi[3], R Pinho[10], K Pitilakis[11], A Strollo[7]

(1) ETH Zürich, Switzerland, (2) EMSC, France, (3) INGV, Italy, (4) U-Liverpool, UK, (5) KNMI, Netherlands, (6) KOERI, Turkey, (7) GFZ Potsdam, Germany, (8) IPGP, France, (9) CSIC, Spain, (10) EUCENTRE, Italy, (11) AUTH, Greece

Correspondence: F Haslinger, haslinger@sed.ethz.ch



The pillar concept of EPOS-Seismology (2013)

Easy, efficient and comprehensive access to data, data products, scientific services and scientific software is a key ingredient in enabling research at the frontiers of science. Organizing this access across the European Research Infrastructures in the field of seismology, so that it best serves user needs, takes advantage of state-of-the-art ICT solutions, provides cross-domain interoperability, and is organizationally and financially sustainable in the long term, is the core challenge of the implementation phase of the Thematic Core Service (TCS) Seismology within the EPOS-IP project.

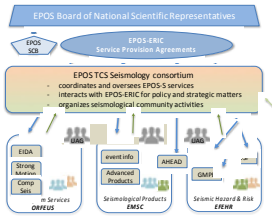
Building upon the existing European-level infrastructures ORFEUS for seismological waveforms, EMSC for seismological products, and EFEHR for seismological hazard and risk information, and implementing a pilot Computational Earth Science service starting from the results of the VERCE project, the work within the EPOS-IP project focuses on improving and extending the existing services, aligning them with global developments, to at the end produce a well coordinated framework that is technically, organizationally, and financially integrated with the EPOS architecture.

This framework needs to respect the roles and responsibilities of the underlying national research infrastructures that are the data owners and main providers of data and products, and allow for active input and feedback from the (scientific) user community. At the same time, it needs to remain flexible enough to cope with unavoidable challenges in the availability of resources and dynamics of contributors.

The Governance Challenge

Active seismological research groups and national infrastructures can be found in almost every country of Europe, and on the European scale the existing coordinating infrastructures like ORFEUS or EMSC have members from more than 20 countries and 50 individual institutions. In addition, specific institutions have over the last years built data and product services on various specific topics, often sponsored by EC projects and with the aim of being or becoming 'European' with some authoritativeness. Overall, the financial resources that are supporting the services under EPOS-Seismology today amount to ~3 MEUR / year, made up of institutional contributions, national (project) support, and EC project funding. Securing this level of funding, and at the same time ensuring that the scientific community, who is the main target user of these services, regards this as being money well spent, is the main challenge in building a sustainable TCS EPOS-Seismology.

Apart from the proper technical and scientific implementation of the services currently existing or foreseen, the active engagement of the user community will be a key factor for the success of EPOS-S.



Governance model for EPOS-Seismology and its interactions with EPOS-ERIC
EPOS SCB: Service coordination board, representatives of all EPOS TCS
UAG: User Advisory Groups, user representatives from the scientific community providing feedback and advice on services

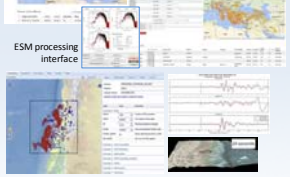
Waveform Services

ORFEUS provides governance and coordination of the EPOS-S Waveform Services, organizes community interaction and feedback.

EIDA, the **E**uropean **I**ntegrated **D**ata **A**rchive, organizes the coordinated archival and distribution of seismological data from permanent as well as temporary stations.
Through federated nodes, ***waveforms*** as well as ***station information*** (metadata) can be accessed. Users can filter their selection by any combination of stations, events, region, time either by using interactive web-GUIs or with the FDSN standard **webservices** *fdsnws_dataselect*, *fdsnws_station*.
The ***waveform*** (quality) ***metadata*** service developed by ODC *odcws_wfmetadataselect* will be implemented at all EIDA nodes.

Within the Waveform Services, ***integration of OBS data in EIDA*** and relevant metadata extensions will be discussed and implemented during EPOS-IP.
Coordination of European mobile pools, including harmonization of data policies, deployment planning and conduct, and data & metadata curation will also be addressed.

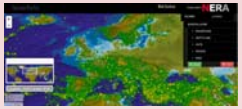
Access to Strong Motion data and parameters via RRSM or ESM web GUIs (webservices in preparation)


ESM processing interface

Computational Seismology Services, building upon the 3D waveform simulator platform developed in the VERCE project, will also be organized and coordinated within the EPOS-S Waveform Services.
In close collaboration with EPOS-ICS, computational seismology services will be expanded to further applications, and ***HPC, grid, and cloud services provision*** will be coordinated.

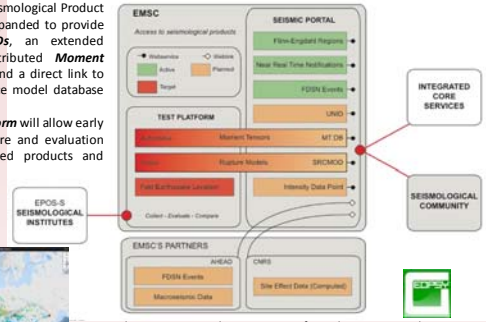
Seismological Products

EMSC-CSEM is responsible for governance and coordination of the EPOS-S Seismological Products services



Event information and event ***parameters,*** contributed by EMSC member networks and institutions, are available via a web-GUI at seismicportal.eu, as well as with the FDSN standard *fdsnws_event* **webservice**. Through its governance mechanisms EMSC also addresses issues of authoritativeness and harmonization of parameter evaluation.

Within EPOS-IP, Seismological Product Services will be expanded to provide ***uniform event IDs***, an extended database of contributed ***Moment Tensor solutions***, and a direct link to the ***SRCMOD*** source model database (Mai, 2012).
The new ***Test Platform*** will allow early community exposure and evaluation of newly developed products and services.



AHEAD, the European **A**rchive of **H**istorical **E**arthquake **D**ata, is a consortium of currently 9 institutions. Access to **historical earthquake data** is provided via a web-GUI. A fdsnws_event compatible *webservice* will be implemented during EPOS-IP.

Starting from the GEOPSY package, a new interactive platform to perform ***site characterization modeling*** from ambient seismic noise recordings will be developed and made accessible within EPOS-S.

Hazard and Risk Services

The EFEHR consortium organizes and coordinates the seismic Hazard and Risk services under EPOS-S.

The EFEHR portal www.efehr.org provides ***access*** to the ***harmonized European Hazard and Risk model*** via interactive web-GUIs as well as OGC compliant web services. EFEHR can also host and provide access to ***national hazard models***.
In addition to hazard model output (maps, curves, spectra) also the ***hazard model input data*** and computational information (logic tree, openquake workflow) are accessible.
Close coordination with GEM, the Global Earthquake Model, ensures international integration and interoperability.

EDSF, the **E**uropean **D**atabase of **S**eismogenic **F**aults, maintains the ***harmonized integrated database of seismogenic faults*** and their parameters, and provides access to the database via a web-GUI. New **webservices** to access seismogenic fault data are being built during EPOS-IP.

New services that will be implemented during EPOS-IP include
- a European database and web-services for ***Ground Motion Prediction Equations*** (GMPE)
- a European ***geotechnical engineering information*** database and webservice
- a European Database of ***strong motion records in buildings***
- an interface to ***Earthquake Risk***

GMPE services

User Advisory Groups
regularly (continuously) assess and review services on functionality, usefulness, relevance, and may propose changes, additions, removal, etc.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 676564

Sustainable access to data, products, services and software from the European seismological Research Infrastructures: the EPOS TCS Seismology

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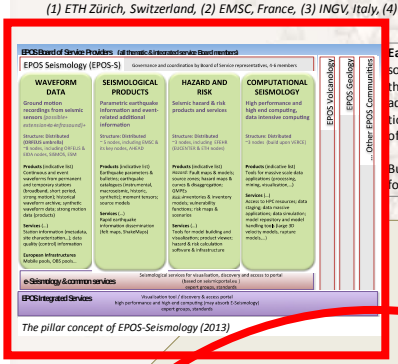
(1) ETH Zürich, Switzerland, (2) EMSC, France, (3) INGV, Italy, (4) U-Liverpool, UK, (5) KNMI, Netherlands, (6) KOERI, Turkey, (7) GFZ Potsdam, Germany, (8) IPGP, France, (9) CSIC, Spain, (10) EUCENTRE, Italy, (11) AUTH, Greece

Correspondence: F Haslinger, haslinger@sed.ethz.ch

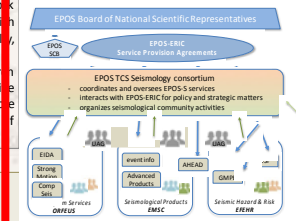


The pillar concept of EPOS-Seismology (2013)

Easy, efficient and comprehensive access to data, data products, scientific services and scientific software is a key ingredient in enabling research at the frontiers of science. Organizing this access across the European Research Infrastructures in the field of seismology, so that it best serves user needs, takes advantage of state-of-the-art ICT solutions, provides cross-domain interoperability, and is organizationally and financially sustainable in the long term, is the core challenge of the implementation phase of the Thematic Core Service (TCS) Seismology within the EPOS-IP project.

Building upon the existing European-level infrastructures ORFEUS for seismological waveforms, EMSC for seismological products, and EFEHR for seismological hazard and risk information, and implementing a pilot Computational Earth Science service starting from the results of the VERCE project, the work within the EPOS-IP project focuses on improving and extending the existing services, aligning them with global developments, to at the end produce a well coordinated framework that is technically, organizationally, and financially integrated with the EPOS architecture.

This framework needs to respect the roles and responsibilities of the underlying national research infrastructures that are the data owners and main providers of data and products, and allow for active input and feedback from the (scientific) user community. At the same time, it needs to remain flexible enough to cope with unavoidable challenges in the availability of resources and dynamics of contributors.



Governance model for EPOS-Seismology and its interactions with EPOS-ERIC
EPOS SCB: Service coordination board, representatives of all EPOS TCS
UAG: User Advisory Groups, user representatives from the scientific community providing feedback and advice on services

The Governance Challenge

Active seismological research groups and national infrastructures can be found in almost every country of Europe, and on the European scale the existing coordinating infrastructures like ORFEUS or EMSC have members from more than 20 countries and 50 individual institutions. In addition, specific institutions have over the last years built data and product services on various specific topics, often sponsored by EC projects and with the aim of being or becoming 'European' with some authoritativeness. Overall, the financial resources that are supporting the services under EPOS-Seismology today amount to ~3 MEUR / year, made up of institutional contributions, national (project) support, and EC project funding. Securing this level of funding, and at the same time ensuring that the scientific community, who is the main target user of these services, regards this as being money well spent, is the main challenge in building a sustainable TCS EPOS-Seismology.

Apart from the proper technical and scientific implementation of the services currently existing or foreseen, the active engagement of the user community will be a key factor for the success of EPOS-S.

Waveform Services

ORFEUS provides governance and coordination of the EPOS-S Waveform Services, organizes community interaction and feedback.

EIDA, the **E**uropean **I**ntegrated **D**ata **A**rchive, organizes the coordinated archival and distribution of seismological data from permanent as well as temporary stations.

Through federated nodes, ***waveforms*** as well as ***station information*** (metadata) can be accessed. Users can filter their selection by any combination of stations, events, region, time either by using interactive web-GUIs or with the FDSN standard **webservices** *fdsnws_dataselect*, *fdsnws_station*.

The ***waveform*** (quality) ***metadata*** service developed by ODC *odcws_wfmetadataselect* will be implemented at all EIDA nodes.

Within the Waveform Services, ***integration of OBS data in EIDA*** and relevant metadata extensions will be discussed and implemented during EPOS-IP.

Coordination of European mobile pools, including harmonization of data policies, deployment planning and conduct, and data & metadata curation will also be addressed.

Access to Strong Motion data and parameters via RRSM or ESM web GUIs (webservices in preparation)

ESM processing interface

Computational Seismology Services, building upon the 3D waveform simulator platform developed in the VERCE project, will also be organized and coordinated within the EPOS-S Waveform Services.

In close collaboration with EPOS-ICS, computational seismology services will be expanded to further applications, and ***HPC, grid, and cloud services provision*** will be coordinated.

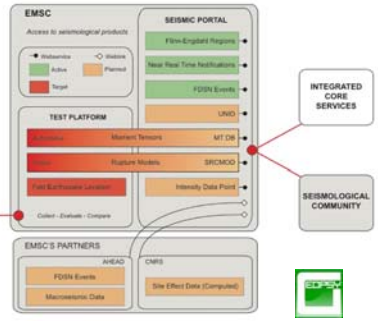
Seismological Products

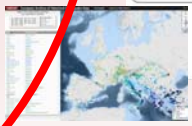
EMSC-CSEM is responsible for governance and coordination of the EPOS-S Seismological Products services

Event information and event ***parameters,*** contributed by EMSC member networks and institutions, are available via a web-GUI at seismicportal.eu, as well as with the FDSN standard *fdsnws_event* **webservice**. Through its governance mechanisms EMSC also addresses issues of authoritativeness and harmonization of parameter evaluation.

Within EPOS-IP, Seismological Product Services will be expanded to provide ***uniform event IDs***, an extended database of contributed ***Moment Tensor solutions***, and a direct link to the ***SRCMOD*** source model database (Mai, 2012).

The new ***Test Platform*** will allow early community exposure and evaluation of newly developed products and services.





AHEAD, the European **A**rchive of **H**istorical **E**arthquake **D**ata, is a consortium of currently 9 institutions. Access to **historical earthquake data** is provided via a web-GUI. A fdsnws_event compatible *webservice* will be implemented during EPOS-IP.

Starting from the GEOPSY package, a new interactive platform to perform ***site characterization modeling*** from ambient seismic noise recordings will be developed and made accessible within EPOS-S.

Hazard and Risk Services

The EFEHR consortium organizes and coordinates the seismic Hazard and Risk services under EPOS-S.

The EFEHR portal www.efehr.org provides ***access*** to the ***harmonized European Hazard and Risk model*** via interactive web-GUIs as well as OGC compliant web services. EFEHR can also host and provide access to ***national hazard models***.

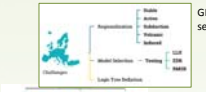
In addition to hazard model output (maps, curves, spectra) also the ***hazard model input data*** and computational information (logic tree, openquake workflow) are accessible.

Close coordination with GEM, the Global Earthquake Model, ensures international integration and interoperability.

EDSF, the **E**uropean **D**atabase of **S**eismogenic **F**aults, maintains the ***harmonized integrated database of seismogenic faults*** and their parameters, and provides access to the database via a web-GUI. New **webservices** to access seismogenic fault data are being built during EPOS-IP.

New services that will be implemented during EPOS-IP include

- a European database and web-services for ***Ground Motion Prediction Equations*** (GMPE)
- a European ***geotechnical engineering information*** database and webservice
- a European Database of ***strong motion records in buildings***
- an interface to ***Earthquake Risk***



GMPE services

Geotechnical information

SM data from structures

User Advisory Groups

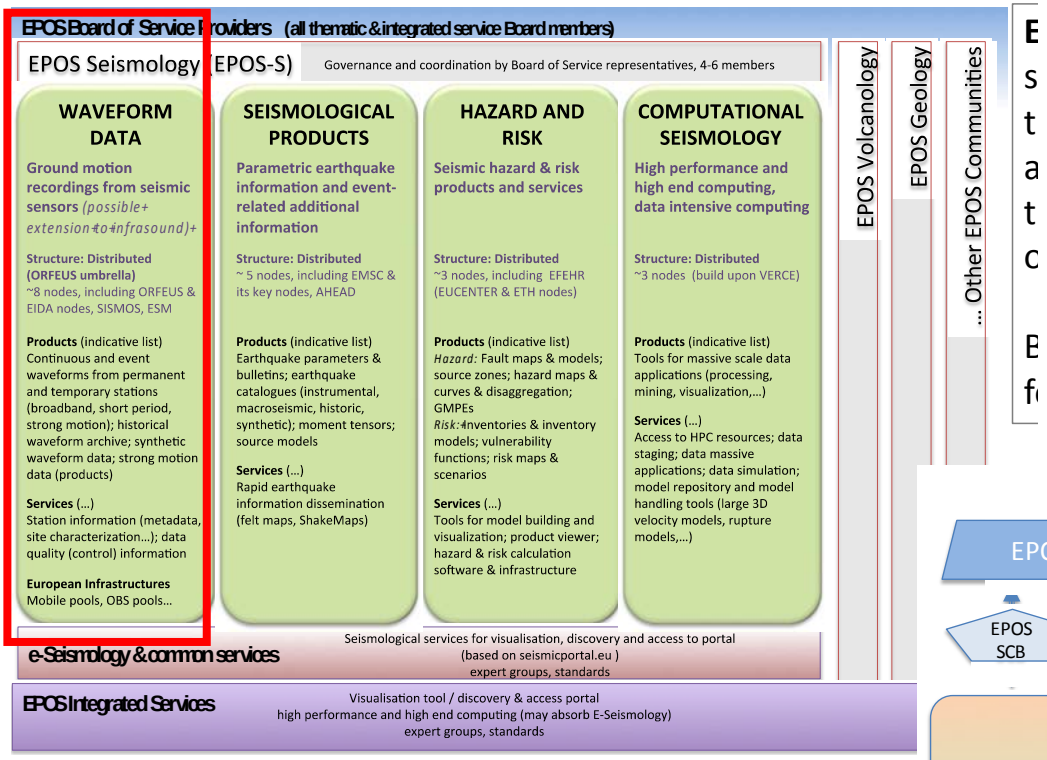
regularly (continuously) assess and review services on functionality, usefulness, relevance, and may propose changes, additions, removal, etc.

EPOS Integrating European Research Infrastructures for solid Earth Science

EUROPEAN PLATE OBSERVING SYSTEM www.epos-ip.org | info@epos-ip.org | epos@ingv.it

HORIZON 2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 676564



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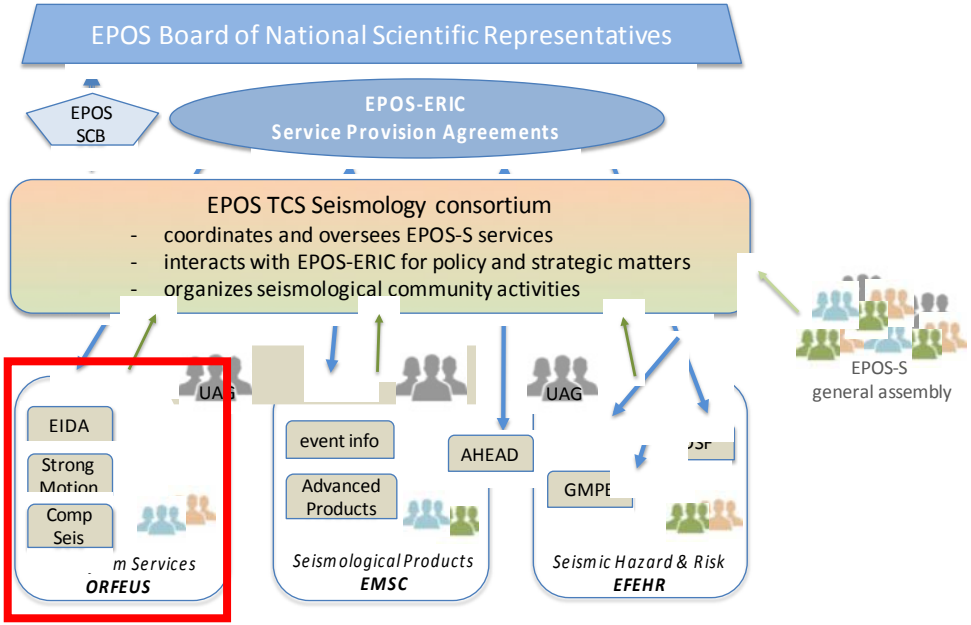

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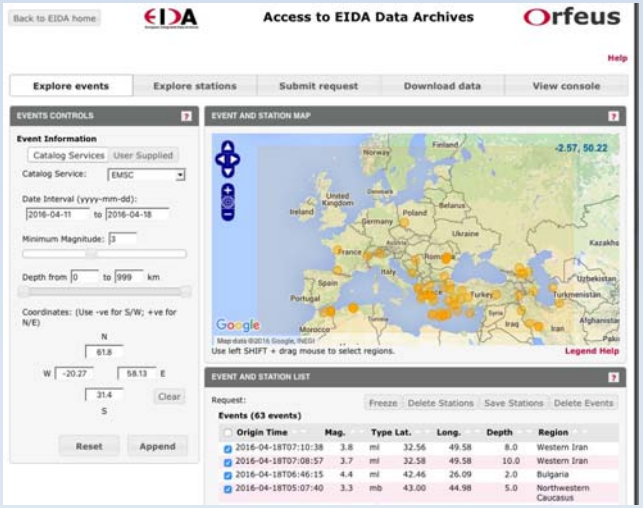

Orfeus
Observatories and Research Facilities for European Seismology

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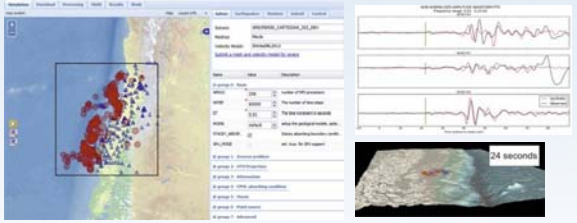


ORFEUS Mission - 1

(from the draft of the new Bylaws)

Coordination role

- **Develop and coordinate waveform data products**, as prioritized by ORFEUS scientific users and as endorsed by the Board of Directors (BoD).

- **Coordinate a European data distribution system**, which includes the ODC, and *provides support for seismic networks in archiving and exchanging digital seismic waveform data*.

- **Integrate seismic waveform data, products and services into** the broader Earth science community through the **European Plate Observing System (EPOS)**.

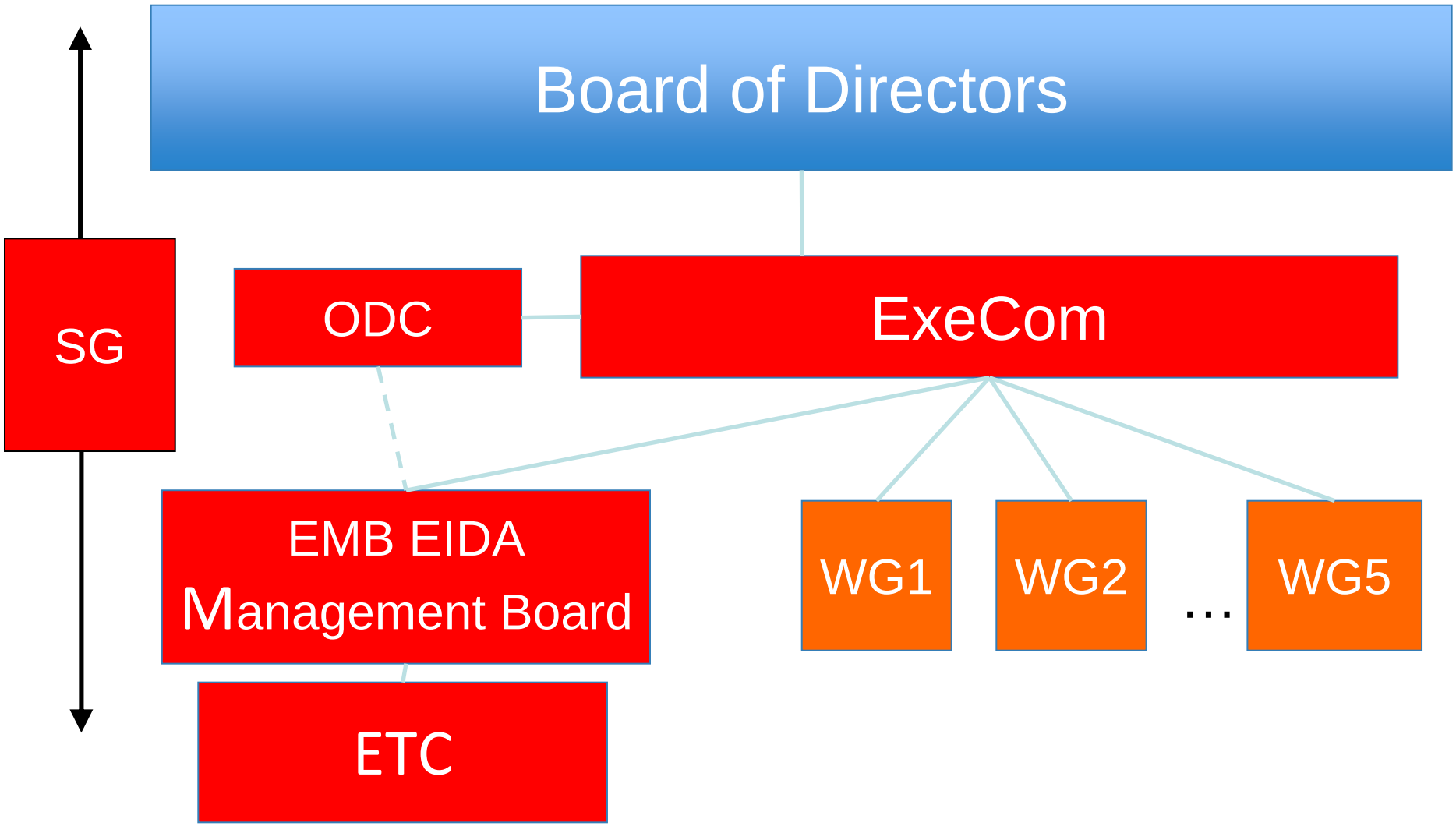
ORFEUS Mission - 2

(from the draft of the new Bylaws)

Management role

- **Promote best practice for seismic network operation**, *data quality control and data management* across Europe (i.e., reference point).

- **Drive large-scale collaborative projects** within the European observational seismological community (e.g., past projects like NERIES, NERA and new ones in the future)

- **Cooperate with international societies** and organizations on the global coordination of matters **concerning waveform seismology**, with specific focus on **developing standards and interoperability** (e.g., FDSN).

Old (current!) Organization