

Observatories and **R**esearch **F**acilities for **E**uropean **S**eismology



UPDATES ON SEISMIC NETWORKS AND COORDINATED WAVEFORM DATA SERVICES & PRODUCTS IN EUROPE

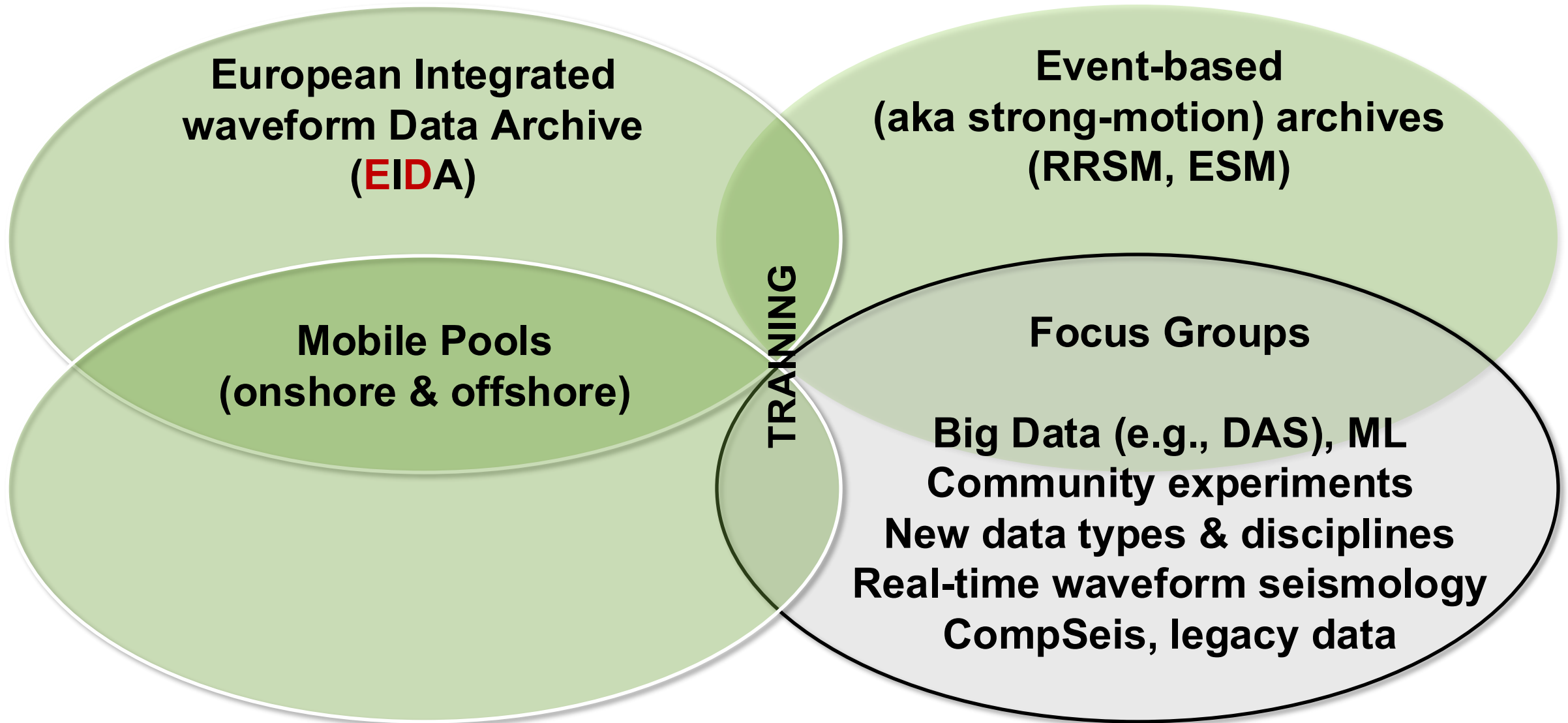
Carlo Cauzzi on behalf of ORFEUS

Acknowledgements

**ORFEUS BoD, ExeCom, BoP,
SMCs, IDGs, UAG, ODC staff,
and all data providers and users of ORFEUS services.**



ORFEUS-promoted data services/products & activities





Webinterface

Graphical Interface for waveform and metadata



Webservices

APIs for data and metadata access.



Data Quality

Interfaces for data quality visualization.



Station Book

Access to the entire EIDA station inventory.

<https://www.fdsn.org/networks/citation/>

- **New node 2024:**
BGS (UK)

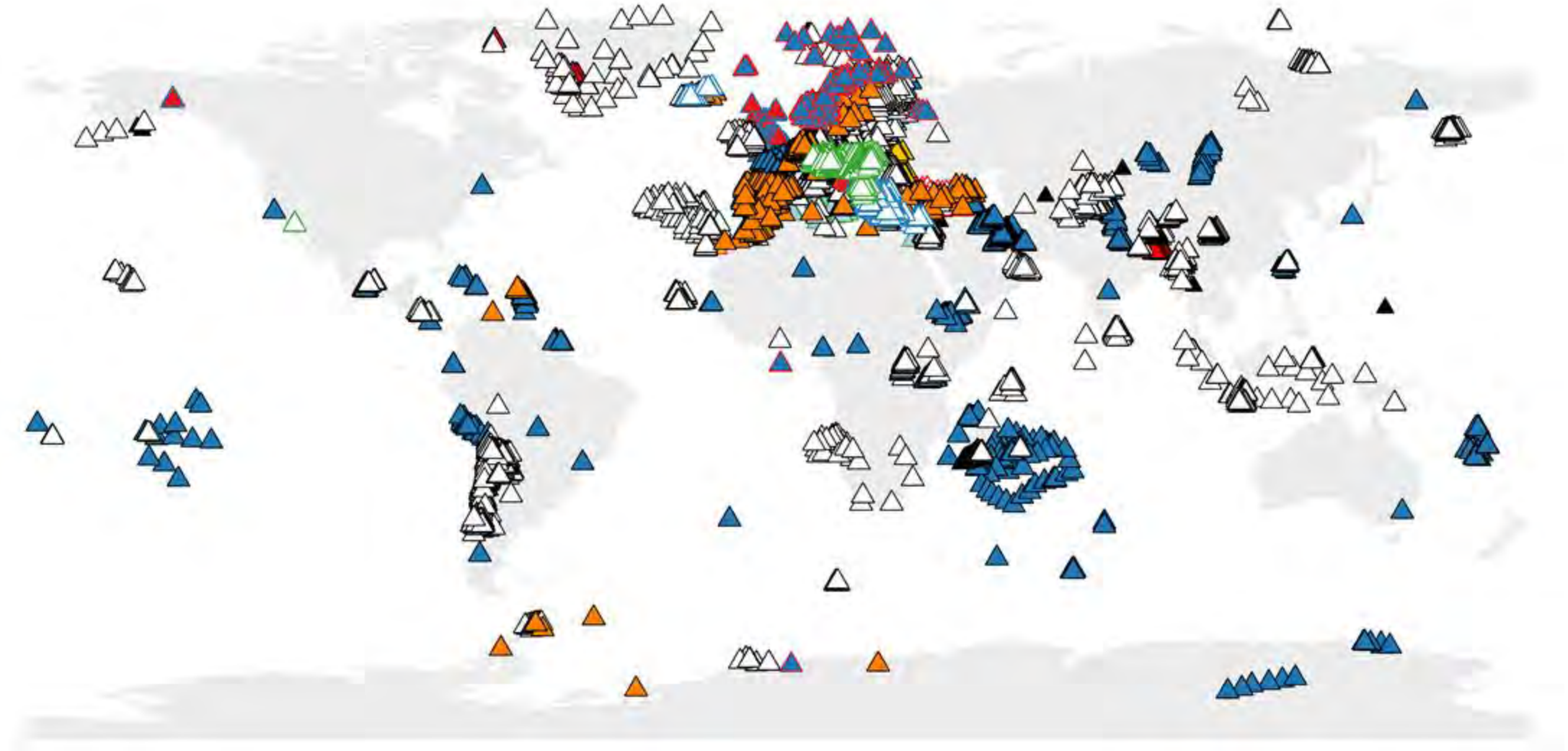
- **Approved in 2024:**
IGN (Spain)

- **Candidates:**
IPMA (Portugal),
AFAD (Türkiye),
[IMO (Iceland)]

Global collaborations: FDSN, EarthScope, etc.

- **~ 31,4k** stations (~5,3k in operation) – **were 21,5k** BB, SM, SP, OBS, infrasound, gravity, DAS ...
- **~750TB**
- Focus on Euro-Med, yet global experiments included
- **~145 permanent networks; ~370 temporary networks** -> supplier letters to **EIDA** nodes -> MoU with **ORFEUS**





EIDA/ORFEUS data access

Web Interfaces for data discovery and interactive usage: e.g., <https://orfeus-eu.org/webdc3/>

Web Services for programmatic data access: <https://www.orfeus-eu.org/data/eida/webservices/>

For each EIDA node

- **FDSN webservice `fdsnws-dataselect`**
Provides waveform data in MSeED format
<https://www.orfeus-eu.org/fdsnws/dataselect/1/query>
- **FDSN webservice `fdsnws-station`**
Provides station metadata in XML and text format.
<https://www.orfeus-eu.org/fdsnws/station/1/query>
- **FDSN webservice `fdsnws-availability`**
Provides data availability for channels and time windows.
<https://www.orfeus-eu.org/fdsnws/availability/1/query>
- **EIDA webservice `eidaws-routing`**
Provides routes to different EIDA data and services
<https://www.orfeus-eu.org/eidaws/routing/1/query>
- **EIDA webservice `eidaws-wfcatalog`**
Provides metadata and quality parameters of wf data
<https://www.orfeus-eu.org/eidaws/wfcatalog/1/query>
- **Coming soon: EIDA SeedPSD (see S02p-113)**

- **EIDA `Federator`**
Provides a single, unified access point to the entire EIDA
<http://federator.orfeus-eu.org/fdsnws/station/1/query>
<http://federator.orfeus-eu.org/fdsnws/dataselect/1/query>
<http://federator.orfeus-eu.org/eidaws/wfcatalog/1/query>
<https://federator.orfeus-eu.org/fdsnws/availability/1/query>
- **Obspy**
- **Jupyter notebooks**
- **`fdsnws_scripts`**
- **Usage examples available at:**
<https://www.orfeus-eu.org/data/eida/webservices/examples/workflow>

From the EIDA WebDC interface ...

<http://www.orfeus-eu.org/webdc3>

ORFEUS Data Center WebDC3 Web Interface

Explore events Explore stations Submit request Download data Console Information

Stations Controls Use this to add channels to your request. The selection can be made based on the currently selected events or by network/station codes.

Event and Station Map Here the events and stations you choose will be displayed. Use the mouse to drag the map around. Use the Ctrl-Mouse to draw areas for limiting the search of events and stations when the appropriate modules are enabled.

Station Information
Browse Inventory
User Supplied

Networks
Year from 1980 to 2020
Network Type: All nets
Network Code: CB (1980) - Stational B
* = temporary network; + = restricted access

Stations
by Code by Region
by Events
Filter stations by station code: All Stations

Streams
by Code by Sampling
Choose the desired set of channels.
Use SHIFT and CTRL to extend the set.
HQ
HH
LH
BH
Reset Append

Event and Station List Use these tables to check which events and stations have been selected by your search criteria. You can interactively remove unwanted items. Your final request will be built from the currently displayed information.

Request: Freeze Delete Stations Save Stations Delete Events

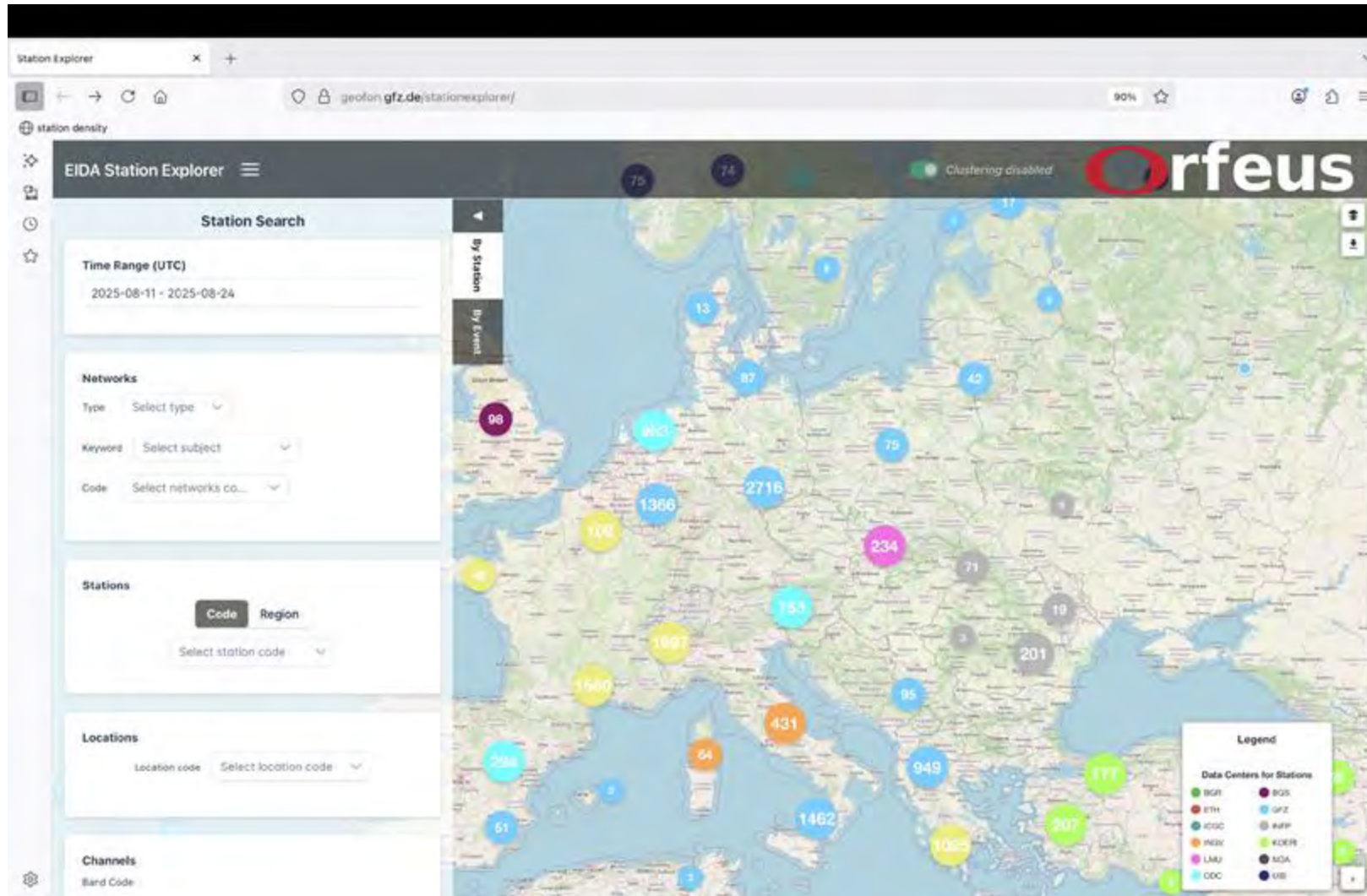
Events (-)
No Events loaded

Stations (270 stations)

Network	Station	Lat	Long	O/R Streams
☒	CH ACB	47.39	8.25	☐ BHE,BHN,BH2 ☐ BHE,EHN,EH2 ☐ HGE,HGN,HG2 ☐ HHE,HHN,HH2 ☐ LHE,LHN,LH2 ☐ SHE,SHN,SH2
☒	CH AIGLE	46.34	6.95	☐ BHE,BHN,BH2 ☐ HGE,HGN,HG2 ☐ HHE,HHN,HH2 ☐ LHE,LHN,LH2
☒	CH BLANZ	47.52	7.55	☐ BHE,BHN,BH2

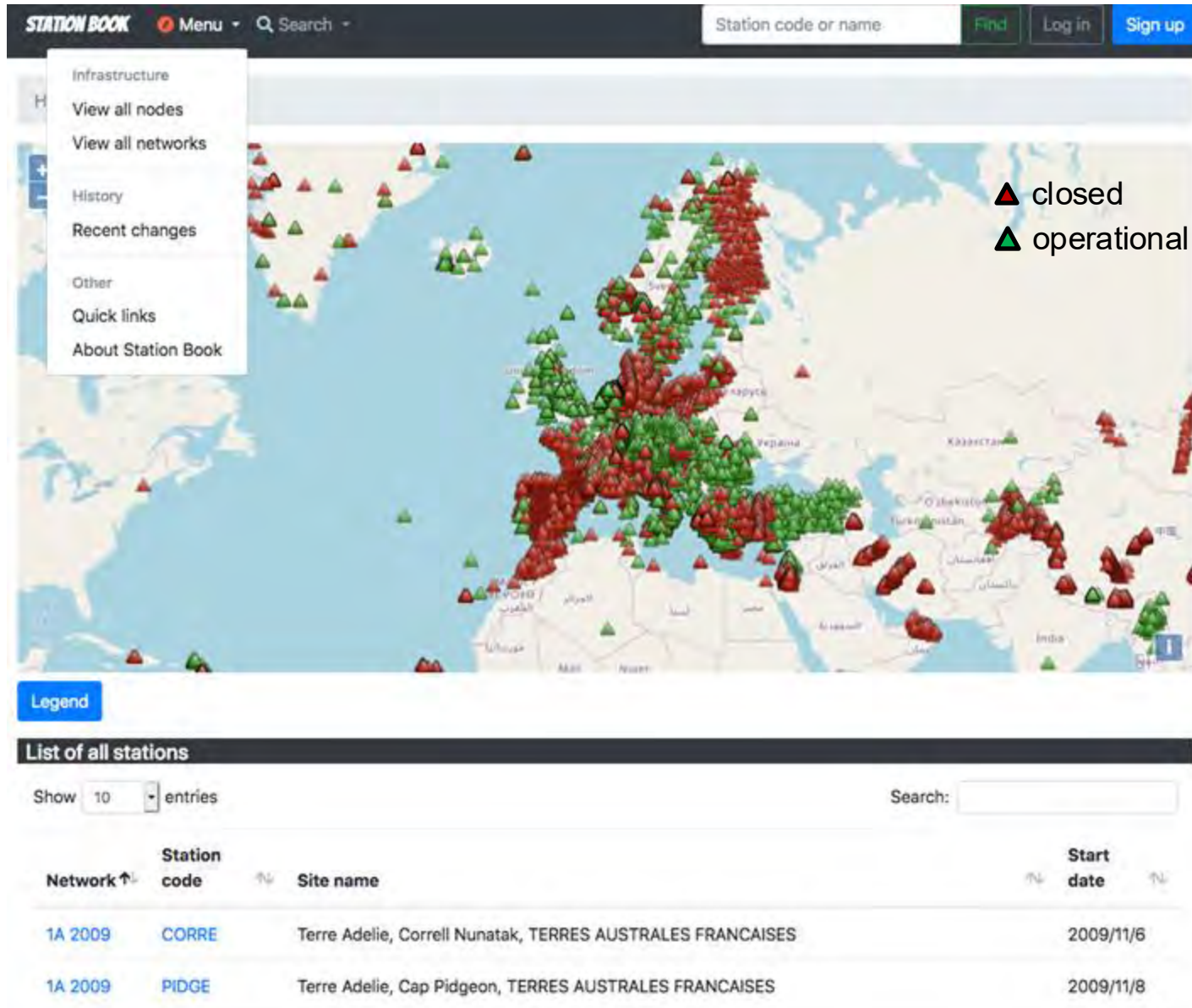
- Data discovery and interactive access
- Allows for:
 - searching **events** in global and regional catalogues;
 - searching **stations** contributing to the EIDA federated archive;
 - downloading **raw waveform** data (SEED format) and **associated metadata** (SEED and XML) for user-defined time windows, including OT-based start and end times.

... to the Station Explorer



Integrates **quality** and **availability** information

The EIDA Station Book



<http://orfeus-eu.org/stationbook/>

- Allows discovery and download of metadata of stations contributing to EIDA.
- Data providers can edit advanced metadata (e.g. geophysical characteristics of the recording sites).
- Open source and based on state-of-the-art technology with flexibility to add/incorporate additional metadata.

EIDA (meta)data quality and availability tools

<http://orfeus-eu.org/data/eida/quality/>

Home » Data and Services » EIDA » Data Quality

Data Quality European Integrated Data Archive

EIDA offers a collection of interfaces for visualizing waveform data, waveform metrics, station metadata, data availabilities. Besides visual interfaces the **EIDAWS-WFCatalog** provides an API that exposes the EIDA waveform catalogue for the contents of the European Integrated Data Archive.



Data Metrics

Graphical interface showing daily waveform metrics.



Data Availability

Graphical interface showing daily data availability.

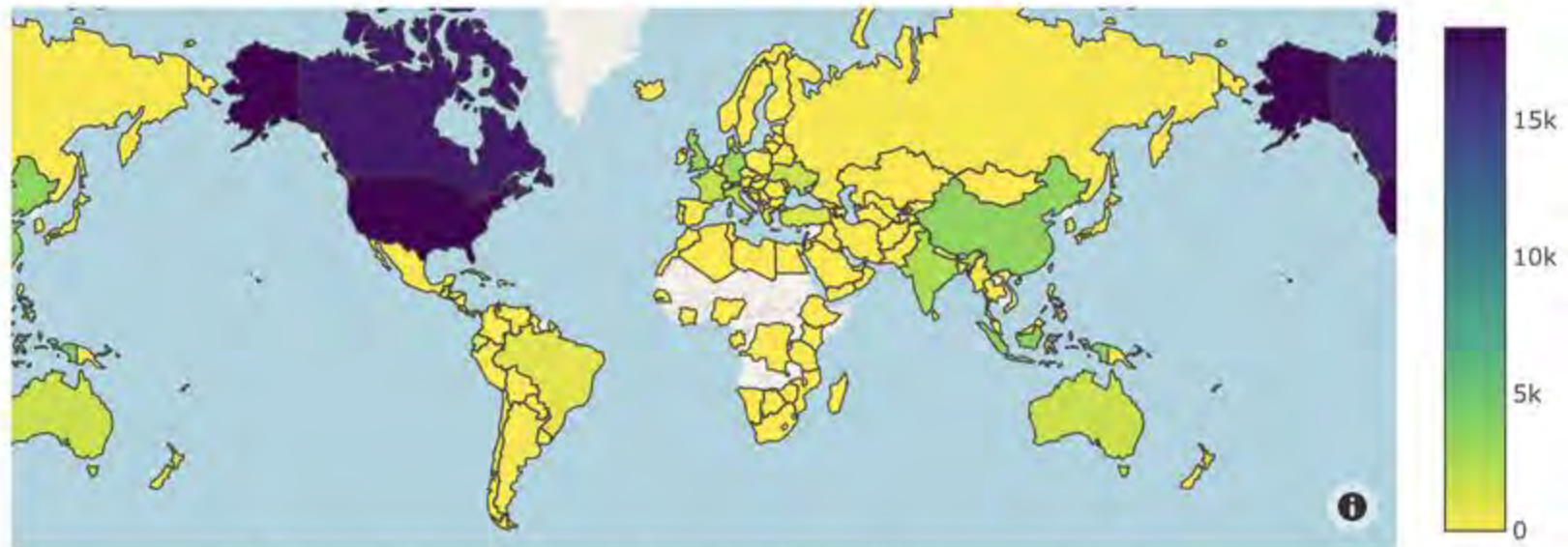
EIDA statistics dashboard

<https://www.orfeus-eu.org/data/eida/stats/>

Last 12 month (only “dataselect”):

- 73k unique users
- 723 TB shipped

Number of unique users* per country



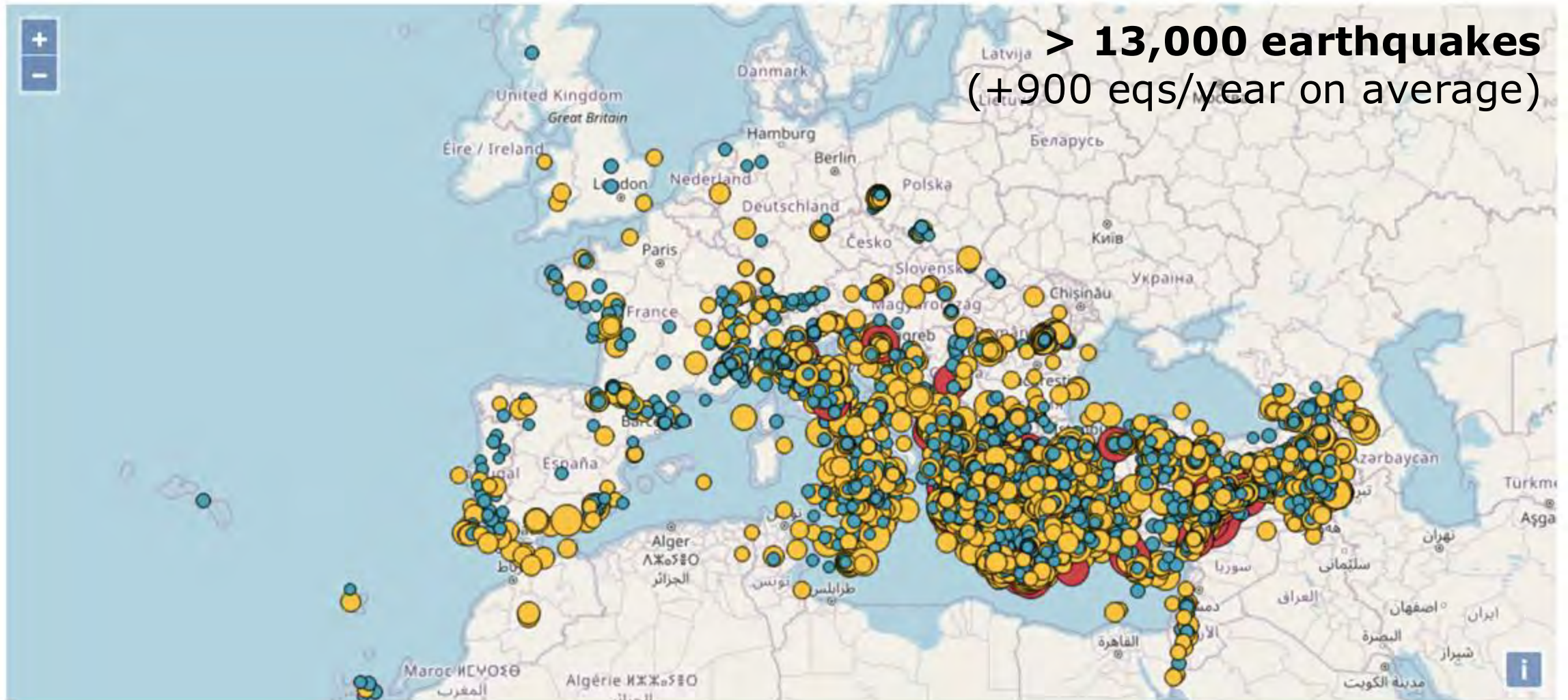
The above plot shows the number of unique users of EIDA services from each country.

**Important note: Unique users are estimated based on anonymised distinct IP addresses of the clients issuing requests.*

ORFEUS-EIDA & EarthScope Coordination Activities

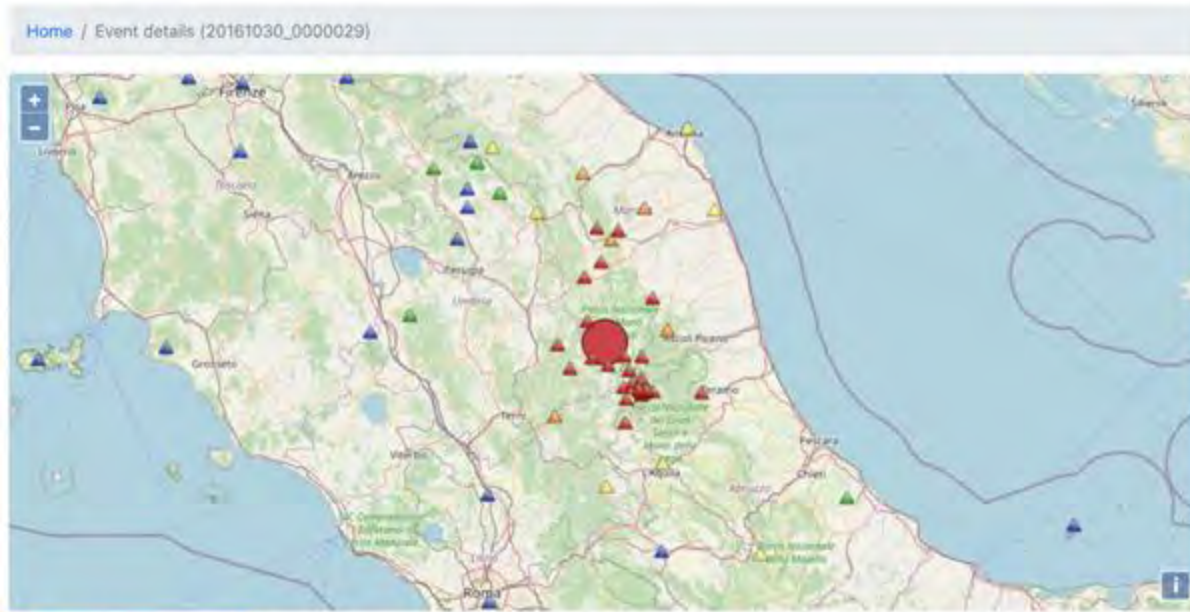
- Sponsored by Geo-INQUIRE
- Goal: align data management strategies/policies towards standardisation at FDSN level
- “Plenary” meetings so far: Vienna & Corfu 2024, Vienna 2025, Lisbon 2025 ... + activities in subgroups (also beyond USA-EU)
- Core Topics:
 - Big Data management & access (e.g., DAS, nodes), ML-ready datasets
→ **WG II & S02p-103 & S02p-118**
 - AAI → **WG III & S02p-101**
 - Q/A via PSDs → **S02p-113**

The **R**apid **R**aw **S**trong-**M**otion Database RRSM

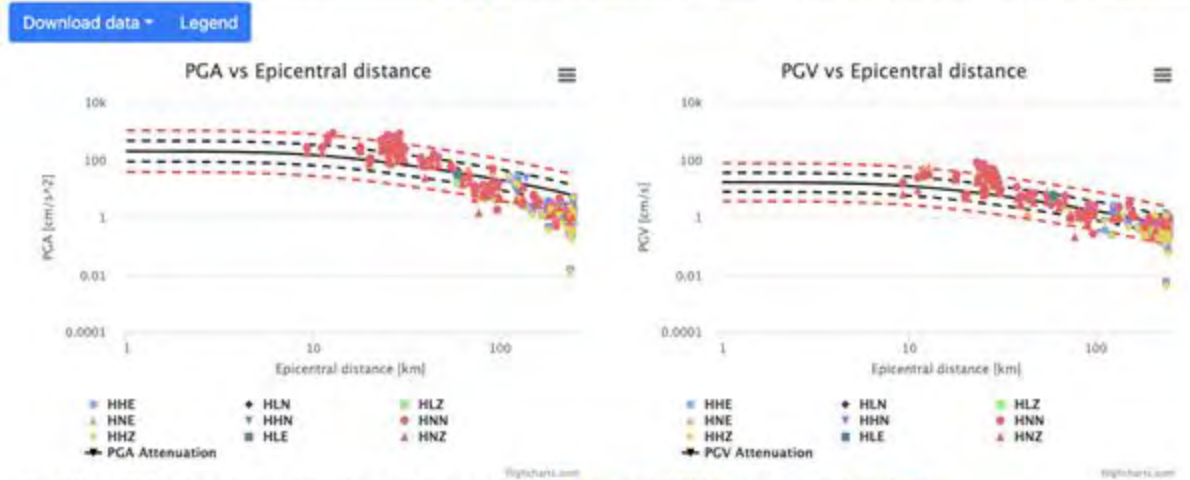


Cauzzi et al. (SRL 2016); Lanzano et al. (SRL 2021)
Automatic processing based on SeisComP3 module *scwfparam*
To be discontinued (?) when semi-automated ESM ready

The Rapid Raw Strong-Motion Database RRSM



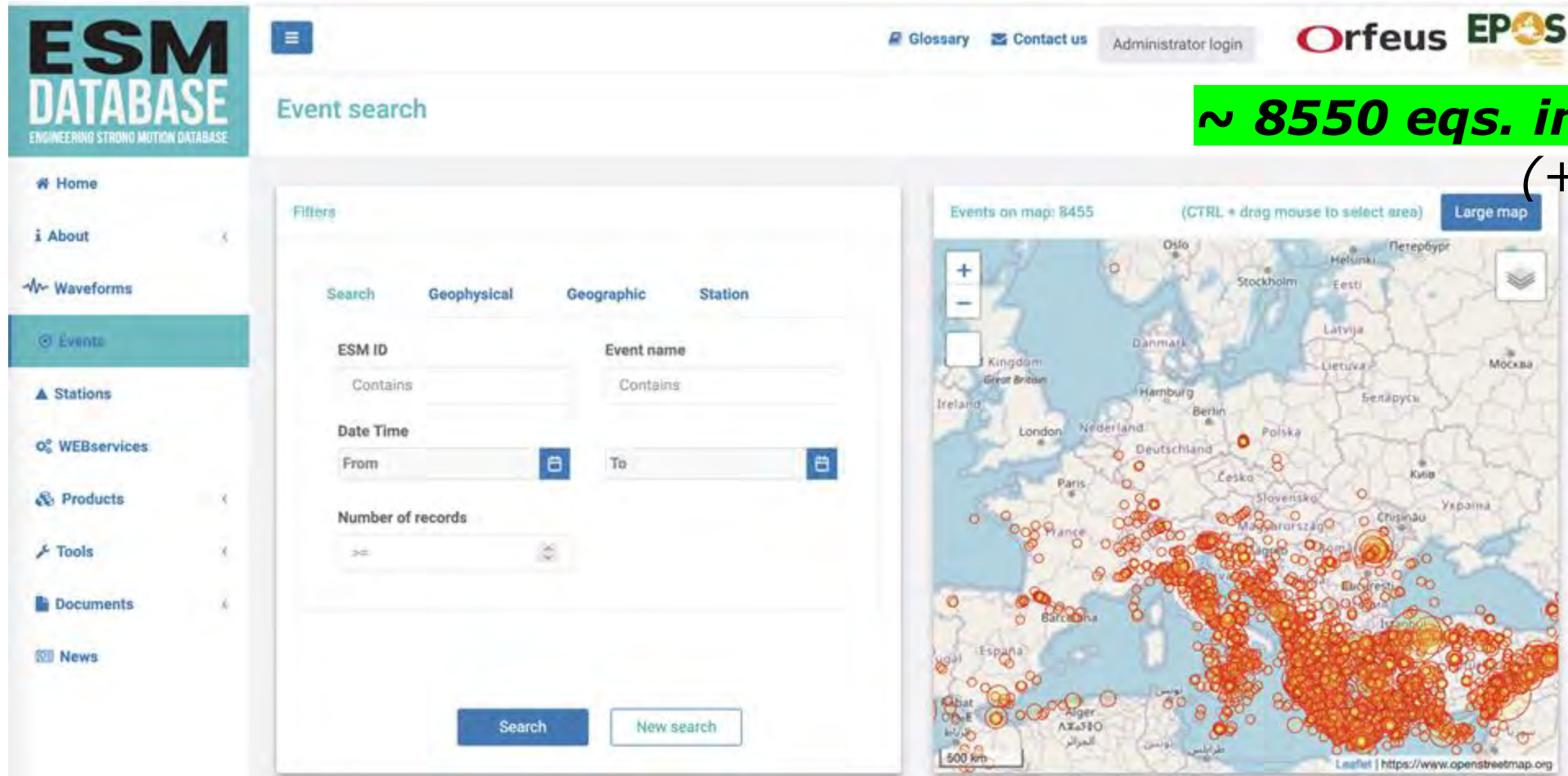
- Triggering by EMSC reports of any earthquake with **M (any scale) ≥ 3.5** in the Euro-Med region
- Collection of input data in **near-real-time** from EIDA
- Based on **ad-hoc Web Services**, delivers PGA, PGV, SA(T), SD(T), raw and processed waveforms in SEED format
- **Web Services** deliver input files to USGS-style ShakeMap, raw and processed waveforms, event and peak-motion information in various formats.



The PGV and PGA attenuation models belong to the generic GMPE of [Kotha et al., 2020](#) implemented in [Open Quake](#).

The Engineering Strong-Motion Database ESM

<https://www.orfeus-eu.org/data/strong/> & <https://esm-db.eu/>



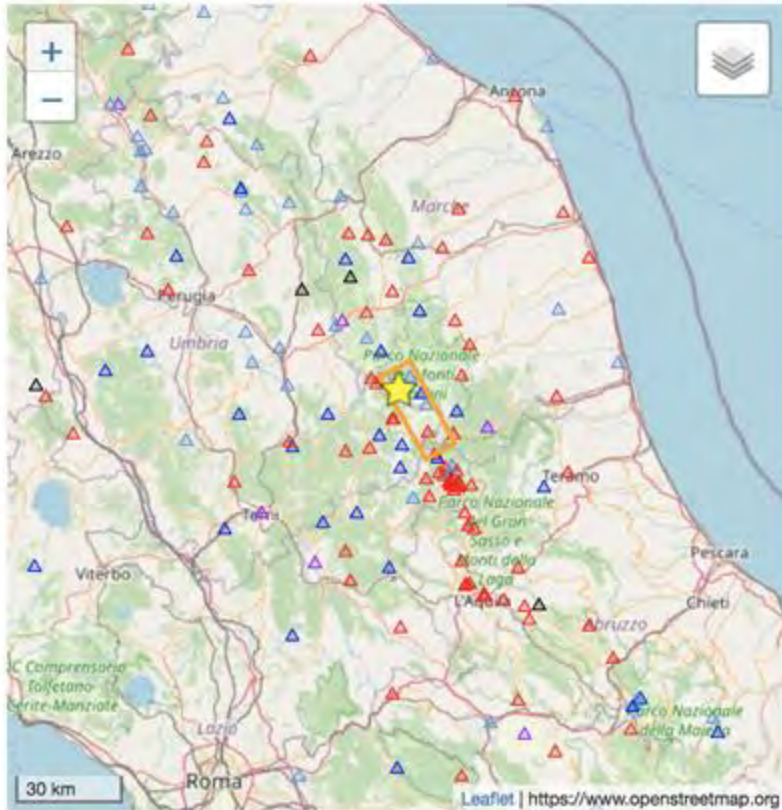
The screenshot displays the ESM Database website. On the left is a navigation menu with links: Home, About, Waveforms, Events (highlighted), Stations, WEBServices, Products, Tools, Documents, and News. The main content area is titled 'Event search' and includes a 'Filters' section with tabs for Search, Geophysical, Geographic, and Station. The Search tab is active, showing fields for 'ESM ID' (Contains), 'Event name' (Contains), 'Date Time' (From/To), and 'Number of records'. A 'Search' button is at the bottom. To the right is a map of Europe with numerous orange circles representing earthquake locations. Above the map, it says 'Events on map: 8455' and '(CTRL + drag mouse to select area)'. A 'Large map' button is in the top right corner of the map area. The Orfeus EPOS logo is in the top right corner of the website header.

~ 8550 eqs. in total
(+1140)

Luzi et al. (SRL 2016); Lanzano et al. (SRL 2021)

Finalising transition to semi-automated processing,
Mascandola et al. (SRL 2023)

The Engineering Strong-Motion Database ESM



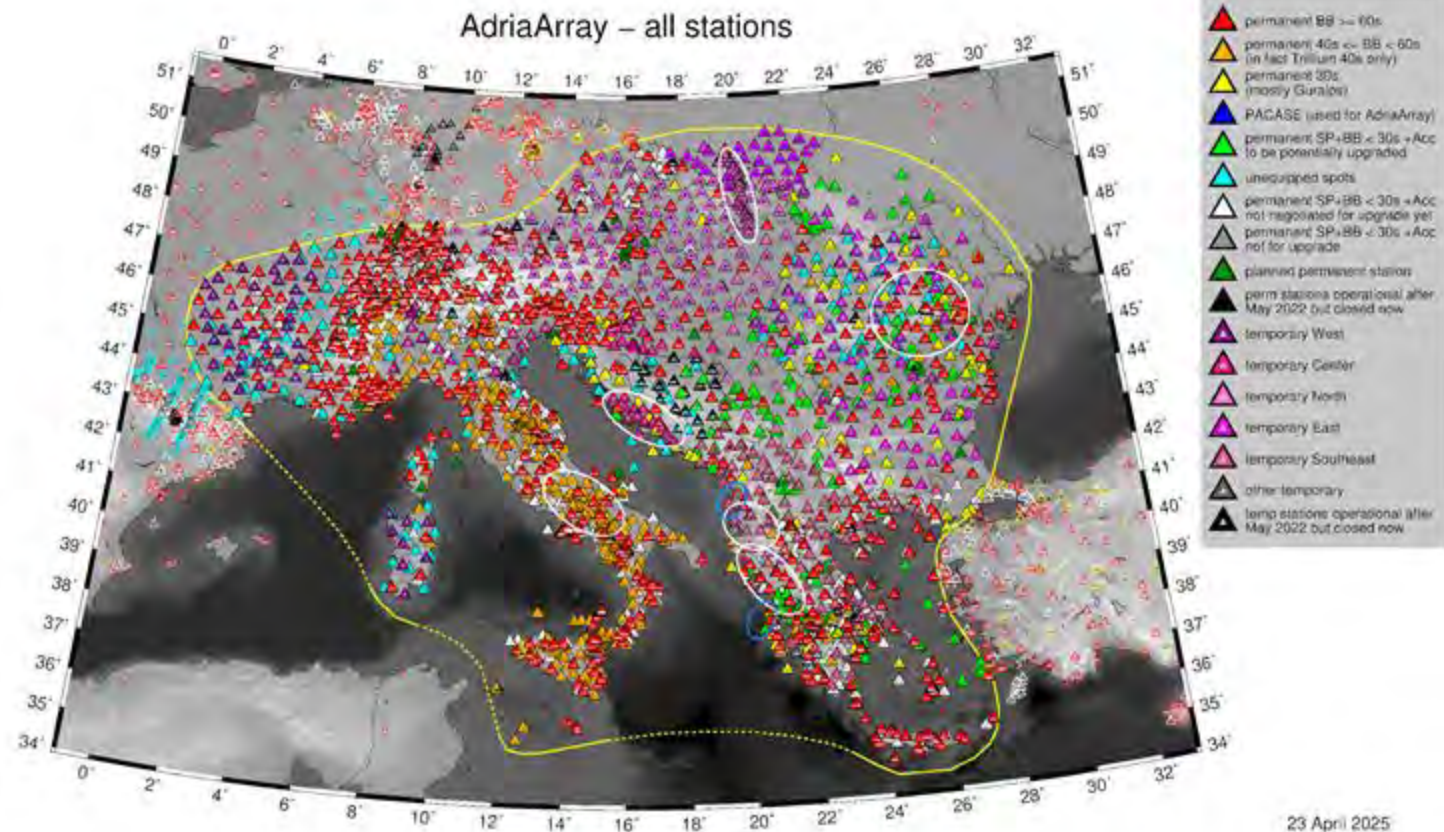
- First EMSC magnitude and location, updated using the best manual solution, including finite fault if available; **M (any scale) ≥ 4**
- Input data from EIDA & other Euro-Med SM datasets = **~4760 SM stations**
- **Coming soon: BB stations**
- Delivers PGA, PGV, selected spectral ordinates, response spectra, engineering parameters, raw and processed waveforms - also spectrum-compatible (REXELWeb) - in engineering formats including ASCII and SAC
- **Web Services** deliver manually revised input files to USGS-style ShakeMap (event, peak-motion and fault data), raw and processed waveforms, event and peak-motion information; spectrum-compatible wf - in various formats https://esm-db.eu/#/data_and_services/web_services

ORFEUS Mobile Instrument Pools Group

- <https://orfeus-eu.org/data/mobile/>
- Key goals:
 - Enhance availability of instruments for users
 - Improve information about and access to instruments
 - Increase utilisation of the instruments
 - Support large international experiments
 - Improve expertise on and availability of new instrument types
- Focus on facilities with established governance, management, and transparent access policies
- Current products:
 - best practices for field work, data management, and QC of temporary deployments (<https://u.ethz.ch/pOoYE>);
 - FAIR-compliant OBS (meta)data: OBS info (<https://obsinfo.readthedocs.io/en/latest/>)

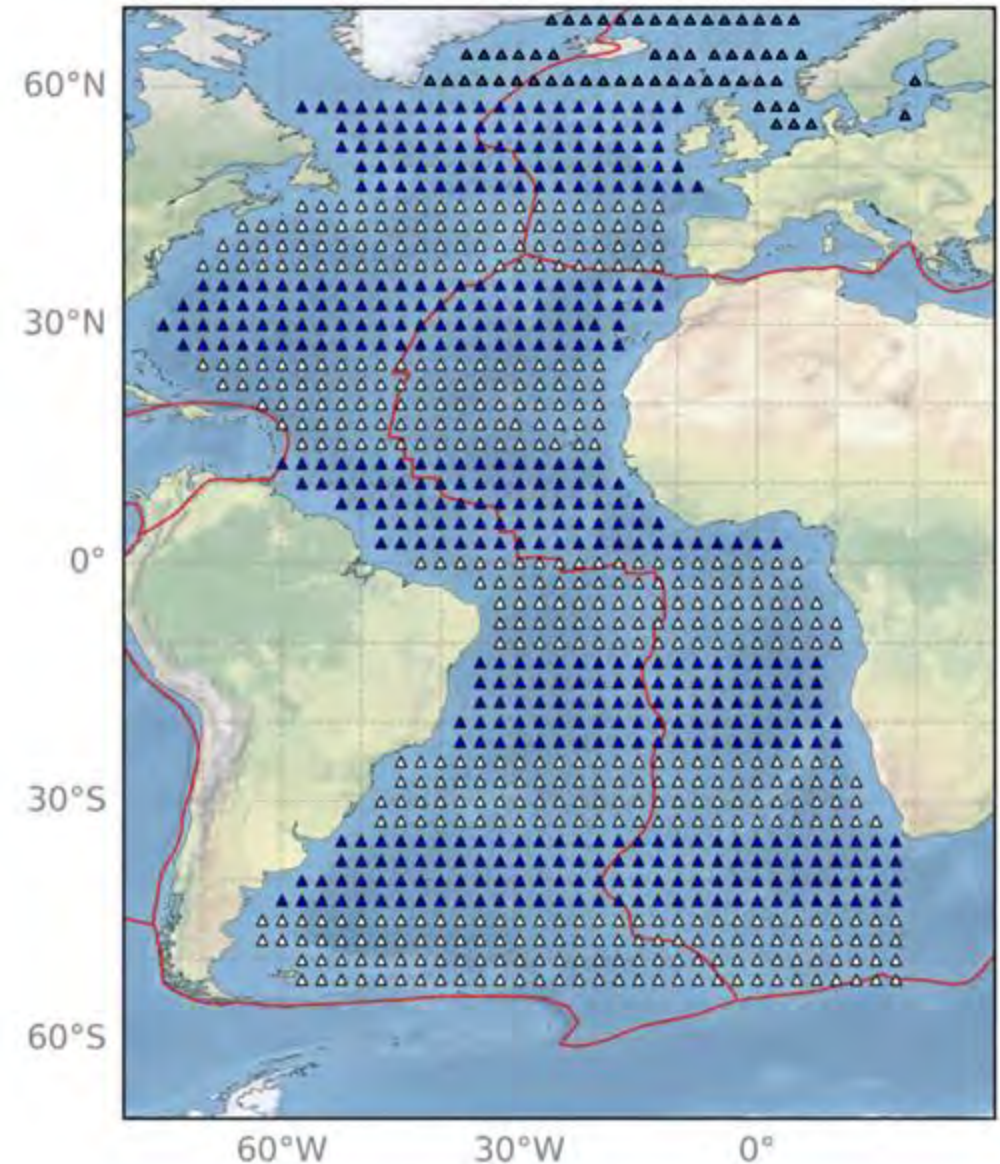
Support to AdriaArray

- All data in EIDA, _ADARRAY virtual network
- Integration in ORFEUS ReadTheDocs
- Integration in ORFEUS Forum
- Financial support to workshops



AtlanticArray

- Vision set, community building ongoing, looking for funding opportunities. **Contact: Ana Ferreira @ UCL**
- **ORFEUS** roles:
 - financial support to workshops;
 - session e.g. @ ORFEUS WS24/25;
 - lobbying for involvement in EC projects.



Euro-Med Stations Contributing to ORFEUS-related Data Services/Products

EIDA contributing
networks:

[https://www.orfeus-eu.org/
data/eida/networks/](https://www.orfeus-eu.org/data/eida/networks/)

ESM contributing
networks:

[https://esm-db.eu/#/about/who/
contributing_networks](https://esm-db.eu/#/about/who/contributing_networks)

