SERA
Seismology and Earthquake Engineering
Research Infrastructure Alliance for Europe

DELIVERABLE

D21.1 Assessment report of VA External Board on VA1-VA5

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Summary

This report presents the mid-project individual evaluation by the VA external board of the 5 virtual access (VA) activities carried out within the SERA project.

Under H2020 framework, VA ensures free-of-charge access to e-infrastructures delivering widely-used services (e.g., computing or communication infrastructure, data services…) in order to facilitate scientific research. SERA project includes 5 such VA:

- VA1: Access to parametric data and earthquake products operated by EMSC
- VA2: Access to seismic waveform data operated by ORFEUS/KNMI
- VA3: Access to the European Strong Motion database, the European Archive of Historical Earthquake Data, and the European Database of Seismogenic Faults operated by INGV
- VA4: Access to earthquake hazard and risk tools and products operated by EFHER/ETHZ
- VA5: Access to data and products of anthropogenic seismicity by IGPAS

The main objectives of the H2020 partial financial support to these activities are service improvement, development of their usage and integration in the EPOS (European Plate Observing System) initiative.

Each of these external evaluation reports presented in this deliverable is based on the individual reports prepared by the VA operator and compiled in D20.1 and submitted to an external evaluator. They provide an independent evaluation of the quality of the offered services and possible guidance for further improvement during the second part of the SERA project.

The evaluation panel (VA-EP) is composed by:

- VA coordinator (Rémy Bossu, EMSC)
- Paul Earle (NEIC/USGS) - VA1 reviewer
- J. Wassermann (Univ. Munich) - VA2 reviewer
- David Wald (IRIS) - VA3 reviewer
- John Douglas (University of Strathclyde) - VA4 reviewer
- Marcelo Assumpçao (Univ. of São Paulo) - VA5 reviewer

VA1: Access to parametric data and earthquake products operated by EMSC

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April 10, 2020

Evaluation of EMSC Activities within the SERA project

This outside evaluation of the European-Mediterranean Seismological Centre (EMSC) covers data quality and the traffic monitoring of the services provided by the European-Mediterranean Seismological Centre (EMSC). Previous visits to EMSC and frequent operational and scientific interactions between the EMSC and the USGS National Earthquake Information Center have left me impressed with EMSC's ability to expand their public real-time services and the scope of their scientific data services by streamlining their processing and automating tasks.

EMSC Data Collection

EMSC service expansion and data access under SERA has been impressive for near real-time scientific information collection. Maintaining data imports and high-level collaborations with 96 institutes in numerous countries around the globe is labor intensive and EMSC's success with a limited staff is impressive. The continued demand for faster, higher-quality, and more diverse information has necessitated tighter collaboration with contributing external agencies. To better facilitate data collection, EMSC has adopted standards used by a range of contributing institutions. Under SERA, EMSC has evaluated the effectiveness of their information collection and embraced new technologies such as USGS's PDL distribution system and GFZ's HMB messaging system.

Beyond collection of traditional seismic information generated by observatories, EMSC leverages their mobile app and webpages to harvest important information for rapid earthquake detection and impact assessment including, eyewitness experiences via felt reports, comments or pictures. The documented increase in felt-report collection and impressive geographic coverage are a great benefit to the scientific community. Of note is the Albanian earthquake sequence in November 2019, where EMSC collected 58k felt reports in 7 days.

Traffic monitoring of EMSC dissemination system

EMSC has expanded its use of social media and web technologies for distribution of information. Given the vast number of earthquakes that occur daily, monitoring agencies must be selective in the events that they chose to highlight for the media and the public. EMSC has implemented effective algorithms to rapidly identify if an earthquake is significant and distribute (and gather) information about the event. The algorithms draw on a diverse set of inputs including increases in EMSC web-site visits, official tsunami warnings, and systems that monitor for increases in social media traffic. I regularly access the EMSC webpages and Twitter account @LastQuake and find the performance of both impressive. I also use the EMSC mobile application "lastquake" and appreciate its intuitive design and focus on providing targeted, understandable information to the user.

During the SERA project, EMSC has taken an integrated, targeted approach to the use of social media. Message content is tailored for the different distribution services. For example, Twitter is used for dissemination of rapid information and links are provided to invite witnesses to contribute information. Facebook is use for alerts, sharing basic earthquake knowledge and informing people of recent topical information. Very few agencies have taken the effort to understand the strengths and weaknesses of different forms of social media. EMSC has excelled at this.

All of EMSC's services are seeing substantial growth, their Twitter followers have nearly double in a year and a half with and their tweets have received up to 20 million views in a month. The use of their LastQuake phone app continues to increase seeing a five-fold increase since mid-2018. Increasing the LastQuake user base is key because it promotes user engagement and substantially increases the number of felt reports EMSC collects. The increased userbase also helps EMSC detect earthquakes faster than using seismologically based observations by monitoring for concurrent, geographically co-located, launches of the app.

I was most impressed and surprised by the widespread use of the FDSN-event webservices. Webservices require a somewhat advanced user so I was impressed by the global distribution and number of users. It would be very interesting to investigate what these users are using the data for. The services EMSC provides through the seismic portal and website continue to be of great use to the scientific community.

EMSC has a clear vision for moving forward. Their recent improvements to infrastructure and codebase represent a huge effort and will put them on good footing for future increases in their userbase and services. They have plans for serving the wide-ranging needs of their diverse user base and they embrace new technologies. Their continued vision and ingenuity clearly place them as a leader in the seismological community.

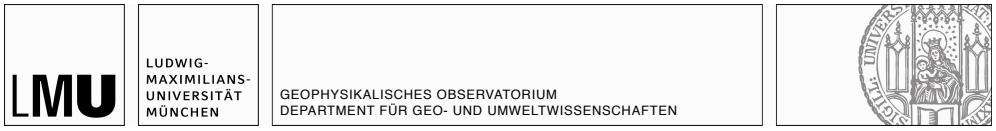
Sincerely,

Paul Earle, Ph.D.

Director of 24/7 operations

USGS National Earthquake Information Center

VA2: Access to seismic waveform data operated by ORFEUS/KNMI



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WP19 VA2: Access to seismic waveforms at ORFEUS/KNMI

The current report is an update of the activities within the WP19 VA2 and accounts for a tome range from October 2018 to February 2020. It summarises the the latest improvements in the implementation of the FDSN web services (FDSNws) and the development of additional tools and services to access non-standard seismological data.

The introduction summarises nicely the impressive station and thus data holding of ORFEUS/ EIDA. The success of this very European solution of distributed data holding is mainly based on the successful implementation of “easy to use” services to access the data and meta data. In the light of constantly growing archives and an increasing number of contributing national and regional data centers, the development of unified ways to access data is of vital importance.

The main part of the report documents updated statistics on the use of the now established FDSNws which demonstrates nicely the acceptance of the implemented algorithms. This acceptance of FDSNws made it also possible to disconnect the now outdated arclink routing service.

As already stated in the previous report, the development of an EIDAws-mediator which makes data selections across the complete EIDA network of nodes based on advanced user criterion possible is of tremendous importance of the future success of EIDA. The briefly mentioned EIDA-federator, a single entry for all data services at the different EIDA nodes is a very important first step towards this very necessary tool. The authors also briefly mention the testing of the EIDA authentication web service with is needed to safely distribute restricted data sets to the authorised users and thus again increase the impact and usability of the OREUS/EIDA platform.

The next part of the report describes updates on the development of interactive web portals. The report clearly demonstrates the importance of the ORFEUS web page as the entry point into the EIDA eco-system. While the EIDA web interface (GUI) update is still in development, the the Station Books appears to be already pretty mature and the main updates are of technical nature. Especially the information about the geological site conditions are very valuable and it would be a major step forward if the Station Book not only extracts automatically the data from FDSNws but could be also used for data filtering in future (e.g., select hard rock sites only).

The report also documents an important increase of the usage of web services rather the the heavily used arclink mechanism over the last year which shows the high acceptance of the community using these new mechanisms for data retrieval.
The next part of the report describes advances in the development of interactive web portals. While three of them, the ORFEUS web page as landing page, the EIDA web interface and the EIDA station books are mainly (but still important) continuations of already existing interactive tools, the RRSM tool for a fast evaluation of potentially relevant (i.e., damaging) earthquakes is a very timely development urgently needed by the seismological community and agencies.
The last development described in the report is a visualization of the already mentioned EIDAws-wf-catalog, which makes it possible to interactively search for the best dataset and also possibly to identify problematic stations.
In summery I'm impressed by the development and belief that the developed tools in this project will be a nucleus for much more within the next years

Best regards,

Joachim Wassermann

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VA3: Access to the European Strong Motion database, the European Archive of Historical Earthquake Data, and the European Database of Seismogenic Faults operated by INGV

By David J. Wald, U.S. Geological Survey

The D20.1 report (deliverable) documents the user statistics for access to engineering seismology data and services in the form of three tools: i) European Strong Motion Database (ESM); ii) European Archive of Historical Earthquake Data (AHEAD); and iii) European Database of Seismogenic Faults (EDSF). The report describes the nature of these three services and how well these portals are being used based on webpage and download statistics.

The report documents a year of usage and highlights efforts to provide web services and alternatives for heavy GIS users by making use of Open Geospatial Consortium (*OGC*) standards, in particular, including in the form of a QGIS plugin. Some of these new services are work-in-progress so they are not yet represented in the summary statistics. Statics employ AWStats, an open-source, customizable tool that provides web, streaming, download and mail server statistics.

European Strong Motion Database (ESM). ESM is an impressive portal and service for engineers and seismologists. I have used the portal. EMS is not only state-of-the-art, but I have encouraged USGS, California Geological Survey, COSMOS and other ground motion data center personnel to adopt EMS standards and protocols. The web services are impressive and the ESM strong-motion flat-file up to 2018 is a great resource. The portal's Event Search is very user-friendly and useful, and the ability to search or download events based in INGV, USGS, or EMSC Id's is particularly impressive.

I have not explored the engineering and design portion of the site, and it's not clear how well regarded or widely used those elements are. From a statistic perspective, it is not likely used by many, but they would be important engineering application users.

European Archive of Historical Earthquake Data (AHEAD). I had seen but not used AHEAD since my own research needs entail more recent macroseismic data that AHEAD's historical collection. However, I'm impressed with the access, shared data across multiple agencies, and the functionality of the portal. This is a valuable resource. USGS would be well served to accomplish such a task for the US, and despite our short history, we've not been able to accomplish this.

European Database of Seismogenic Faults (EDSF). I was unaware of this portal, and here, too, I am impressed. The interactive maps are absolutely beautiful. I've made sure USGS personnel working on our PSHA and Q-Faults databases are aware of this work and I've alerted our web team to the really nice legend on the maps. I really like how they display the down-dip projections in both the web services and shapefile downloads. I noticed that clicking on an individual fault in the SHARE database/shapefiles doesn't give you any references for the geologic data used to parameterize a given fault (although it looks like there are lots of such references on the DISS page for Italian faults. It's nice that "debated seismogenic source" as a layer on this viewer is provided.

Statistics. Since these services are hosted on separate web servers, statistics are presented thus. I'm not a big fan of webpage views, hits, or download volume, but *unique users* is an informative metric. That said, the *growth* in the number of views over time is, in fact, useful to document.

EMS: It's difficult to get a meaning of *bandwidth*: This could me big files or many downloads, so the absolute values are not particularly useful, but the volume is impressive, I guess. There must be a better way of gauging file/data usage than transfer size. The high usage from Cameroon could also use some explaining.

AHEAD: Increasing from 500 to 800 users per month in 2017, up to 600 to 1800 users per month (Fig. 18) is impressive. The analysis of the used bandwidth (Fig. 21) clearly reflect that today most of the data is transferred using web services and the vast majority of requests to AHEAD web pages and services still comes Italy, but that is not unexpected. Though there are relatively few users per earthquake (<200; AHEAD Table 2), they are likely important ones. Effectively, this is a niche product, so the unique number of users is not expected to be very high. Nonetheless it is being used widely given it niche.

EDSF: Here, too, I think web statistics are not as useful as simply viewing the portal and evaluating the content, which is quite impressive.

VA4: Evaluation of access to Earthquake Hazard and Risk Tools and Products (EFHER/ETHZ)

Evaluation report on the services offered by European Facility for Earthquake Hazard and Risk as described in the SERA Deliverable D18.3

The European Facility for Earthquake Hazard and Risk (EFEHR, http://www.efehr.org/en/home/) aims to diffuse data, models, tools and expertise relevant for assessment of seismic hazard and risk in Europe. This short evaluation report is an update of my reports from March 2014 and October 2018 when I previously reviewed EFEHR. The comments in my report from March 2014 on the overall aim of EFEHR and the high value of that aim still hold.

Currently EFEHR contains static webpages briefly explaining: EFEHR's goals, seismic hazard, seismic risk, exposure, vulnerability and contributing projects, as well as links to related services (e.g. EU Database of Seismogenic Faults). The principal data that can currently be accessed are the results of SHARE (European Seismic Hazard Model 2013), GSHAP, EMME and the Swiss National Hazard Map. In the coming months it is planned to provide access to the European Seismic Hazard Model 2020 through EFEHR.

This will be a valuable addition – it is important that EFEHR continues to grow. As noted in my 2018 review, a future goal could be to add other national hazard maps (e.g. the UK will shortly publish an updated seismic hazard map) to EFEHR so that they can be easily accessed and compared to regional studies. As more hazard models become available on EFEHR it would be a useful new feature to be able to compare them directly on this website (e.g. allow hazard curves from the same location but from more than one study to be drawn on the same graph and to overlay hazard maps from different studies).

The results available on EFEHR include hazard curves, uniform hazard spectra and hazard maps, as well as many of the inputs used to derive these results and also supporting documentation. This is an excellent resource and, to my knowledge, the only free online resource worldwide providing such rich hazard results in a transparent manner (although the USGS does provide an excellent tool for US hazard maps: https://earthquake.usgs.gov/hazards/interactive/).

EFEHR has already triggered much research (as evidenced by the large number of citations of its data listed in D18.3). This research will continue to be produced in the future, especially as more hazard models are added to EFEHR.

EFEHR is also invaluable in better communicating seismic hazard to decision-makers and the general public. The statistics on the use of EFEHR (e.g. many thousands of requests per month from a wide variety of countries) shows that there is considerable interest in the information available on the website.

As suggested in my 2018 review, it could be useful to survey users of EFEHR about why they are using the site and to ask for their comments and suggestions. This would allow EFEHR to be better tailored to their needs. Currently the knowledge needed to access and understand the information provided by EFEHR is quite high, which means that the general public and decision-makers may not find it as useful as it could be.

Therefore, another suggestion for the future is to provide improved documentation (e.g. in the form of a wiki similar to Wikipedia) on the various inputs to hazard models (e.g. seismic source zones, ground-motion models and logic trees) and the various outputs (e.g. how uniform hazard spectra are produced) for non-experts. Much of the material that could go into this documentation is already in the public domain but tailoring it to EFEHR and bringing it closer to the source of the data may help less-experienced users make sense of the data provided on EFEHR.

An additional objective could be to increase EFEHR's rank on internet searches for words such as "seismic hazard", "PSHA" and "earthquake" to increase the amount of traffic that the website receives. Including improved documentation on EFEHR may lead to an increase in its traffic.

Since my previous report, the presentation and functionality of the web tools have been much improved. The functionality of the web-tools was one of my criticisms in my previous review (I noted that it looked a little old-fashioned and clunky) so it is good that this aspect has been worked on. The new web tools are more attractive, easier to use and have better functionality than the previous version. It is also commendable that the various webservices follow community and industry standards for increased interoperability.

The SERA Deliverable D18.3 is a good report that summarises the current state of EFEHR well. Some minor editorial comments are included within an annotated version of this deliverable that was sent to the authors before this formal review. These suggested editorial changes have been addressed in the final version of D18.3.

In conclusion, I believe that EFEHR continues to be a great resource in the diffusion of knowledge on hazard posed by earthquakes and it should be commended and continued.

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7th April 2020

VA5: Evaluation of access to data and products of anthropogenic seismicity (IGPAS)

Evaluation of the Technical Report M19-M34 WP22 - VA5
Platform for Anthropogenic Seismicity Research (IS-EPOS)

The IS-EPOS platform for Anthropogenic Seismicity is very useful for researchers dedicated to this socially important topic . Seismologists can upload their data and carry out several statistical and seismological analyses, as well as interact with other researchers. The platform is continuously evolving with more episodes being uploaded.

The increased number of users and nine more uploaded datasets ("episodes") demonstrate the usefulness of the platform, not only for European seismologists but also for a wider international community. Many important and useful statistical tools are now available. Data uploading by users and conversion to the platform format (mat files) has been improved. I tried several tools like visualization of time series, catalog filtering, calculation of *b*-values, stress inversion from focal mechanisms. They were generally easy to use, although some fine tuning needs to be done to make the process more user-friendly. An important tool, cross-correlation, has been added since the previous report in 2018.

It is interesting to see the increased number of registered users and higher frequency of applications run in the platform. However, the total number of uploaded episodes is still not that many (36 cases by the time of the Report), compared to all cases reported in the literature. One of the platform goals (to my understanding) is to facilitate comparison from different episodes, so that more cases need to be uploaded. Considering that comparison between many different episodes is necessary to allow more reliable hazard estimates (such as maximum magnitudes, or finding most important triggering parameter, for example), I recommend to continue promoting the platform in conferences and workshops, and invite people to contribute their datasets. This was done in the last period (M19-M34) with several workshops and presentations , but I guess it is a continuous need.

The number of papers in the reference list increased significantly. Also, there are now clear recommendations on how to cite the use of the IS-EPOS, in a future publication, for users of the platform.

Over all, the AH platform shows an excellent potential and will be very useful for the scientific community.

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27-March-2018

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