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## Plan Overview

*A Data Management Plan created using DMPonline*

**Title:** European Fault-Source Model 2020 (EFSM20): online data on fault geometry and activity parameters

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**Funder:** European Commission

**Template:** DCC Template

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### Project abstract:

The [European Fault-Source Model 2020 \(EFSM20\)](#) is a product of the EU H2020 Project SERA (WP25-JRA3). It is designed to fulfill the requirements related to active faulting of the 2020 update of the European Seismic Hazard Model (ESHM20) following the probabilistic framework established for the 2013 European Seismic Hazard Model (ESHM13).

EFSM20 has two main categories of seismogenic sources: crustal faults and subduction systems. Crustal faults are meant to provide the hazard model with seismicity rates in various tectonic contexts, including onshore and offshore active plate margins and plate interiors. Subduction systems are intended to provide the hazard model with both slab interface and intraslab seismicity rates. The model covers an area encompassing a buffer of 300 km around all target European countries (except for Overseas Countries and Territories, OTCs) and a maximum of 300 km depth for slabs.

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**Start date:** 01-05-2017

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### Copyright information:

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# European Fault-Source Model 2020 (EFSM20): online data on fault geometry and activity parameters

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## Data Collection

### What data will you collect or create?

The compilation of EFSM20 will exploit the wealth of information available from Earth Science studies, including, but not limited to, earthquake geology, seismology, seismotectonics, and geodynamics. The main purpose of such datasets is the geometric reconstruction of potential earthquake sources and estimating their activity rates. Re-used data will mainly come from the scientific literature.

The generated dataset will be an integrated data product from complex analyses or community-shared data harmonization.

The dataset will be compiled and distributed using open-source GIS software and open file formats. The data volume will be limited to a few megabytes which will pose no problem for long-term preservation and access.

### How will the data be collected or created?

Generated and re-used data will most often be geospatial data providing the location of potential seismogenic faults, their geometry, and their behavior. Parameters detailing geometry and behavior will be linked to the spatial data in tabulated attributes. There is no community standard for this type of data; however, the dataset structure will follow prescriptions dictated by the needs of the earthquake hazard modelers.

For data available for download, there will be a different folder for each format. Each folder will be named with the dataset acronym followed by the format's name (e.g., EFSM20\_GeoJSON). Each file will be named with the dataset acronym (EFSM20) followed by an abbreviation identifying the subset (e.g., "CF" for crustal faults) and the proper format extension (e.g., ".geojson"). Details about the naming rules will be given in the dataset documentation. The same naming rules will be applied to the OGC web service layers.

Once the dataset is published, there will only be one version of its final release. Additional versions are not planned. If an update becomes necessary, a different DOI will identify it.

The quality control of the distributed data will be carried out according to a multi-step workflow described in the [data quality assurance](#) document available in the documentation section of the [EDSF portal](#).

## Documentation and Metadata

### What documentation and metadata will accompany the data?

The EFSM20 dataset will be accompanied by comprehensive documentation addressing the data structure, the definition of variables, and the units of measurement.

Metadata will be openly available and contain enough information (direct link) to enable the user to access the data.

Provisions for metadata will include:

- metadata offered with the DOI as required by [DataCite](#);
- metadata offered through the [INGV Open Data Portal](#);
- metadata offered through the standard OGC protocol [CSW](#);
- EPOS-DCAT-AP when the dataset will be mapped in the [EPOS ICS-C portal](#);
- INSPIRE if the dataset will be mapped in the Italian ["Repertorio Nazionale dei Dati Territoriali"](#).

## Ethics and Legal Compliance

### How will you manage any ethical issues?

There is no ethical reason that could impact data distribution and sharing. A disclaimer will be associated with the dataset to remove legal liability from the data owner and publisher. Users will also be cautioned to consider the nature of the dataset carefully before using it for decisions concerning personal or public safety or business involving substantial financial or operational consequences.

No personal data will be collected or distributed with the dataset.

## **How will you manage copyright and Intellectual Property Rights (IPR) issues?**

The EFSM20 dataset will be distributed under the [Creative Commons Attribution 4.0 International \(CC BY 4.0\)](#) license terms. Users can request additional permissions to use the dataset by [contacting the persons indicated on the website](#).

## **Storage and Backup**

### **How will the data be stored and backed up during the research?**

The data will be stored in the server that publishes the static file and in the server that issues the OGC services.  
The data will be backed up using a storage server connected to the INGV private network.  
To back up the database, we will use the standard PostgreSQL tool "pg\_dump."  
Since EFSM20 will be a single-version release and will not be updated, there is no need to schedule an automatic backup procedure.  
The entire website where EFSM20 is published is regularly backed-up.  
The responsible for the backup and recovery procedure is Roberto Vallone (INGV).  
In case of an incident with the publishing server, data will be recovered by restoring the database and the files from one of the multiple backup services. In particular, the database will be restored using the standard "pg\_restore" tool of PostgreSQL.

### **How will you manage access and security?**

All EFSM20 data will be openly accessible.  
SSL transfer for HTTP (HTTPS) is implemented and is chosen per default for all hosted services on the [EDSF Installation](#) where EFSM20 is published.  
No sensitive data will be stored.

## **Selection and Preservation**

### **Which data are of long-term value and should be retained, shared, and/or preserved?**

EFSM20 data and metadata stored in the INGV repositories will remain available indefinitely.  
EFSM20 is an integrated data product; as such, all the raw and processed data used to compile the EFSM20 dataset will remain with their owners.  
EFSM20 will initially be used to devise the input dataset for the 2020 update of the European Seismic Hazard Model. In the future, EFSM20 will likely be used to carry out earthquake hazard analyses (e.g., ground shaking or tsunami), earthquake scenarios, or seismotectonic and geodynamic models.

### **What is the long-term preservation plan for the dataset?**

The datasets will be deposited in two INGV servers installed on two different institutional premises for security reasons. Since the EFSM20 main dataset and envisaged derived products should not occupy more than 1 GB of disk storage and the file formats will presumably remain common for many years, the storage cost can be considered negligible.

## **Data Sharing**

### **How will you share the data?**

The standard OGC protocols WMS and WFS will be adopted to guarantee interoperability with other datasets or spatial data.  
The EFSM20 datasets will be available as downloadable files in popular formats (GeoJSON files, ESRI shapefiles, MapInfo Tables), facilitating users' combining and analyzing EFSM20 with other geographically referenced data in a desktop Geographic Information System (GIS).

The already reserved DOI <https://doi.org/10.13127/efsm20> will permanently identify the EFSM20 main dataset. Child DOIs (e.g.,...efsm20/"*derived dataset name*") will identify additional derived datasets or products.

#### **Are any restrictions on data sharing required?**

The entire EFSM20 dataset will be made openly accessible with no restrictions except for properly using the citation prescribed by the attribution license.

### **Responsibilities and Resources**

#### **Who will be responsible for data management?**

The persons responsible for the data management, curation, preservation, and distribution are the [contact persons](#) that will be indicated on the website.

#### **What resources will you require to deliver your plan?**

Storage, archiving, re-use, and security costs will partly be covered by EPOS and INGV institutional funding. When additional resources are necessary, they will be sought through project funding.

## Planned Research Outputs

### Publication - "The 2020 European Seismic Hazard Model: Overview and Results"

Abstract. The 2020 update of the European Seismic Hazard Model (ESHM20) is the most recent and up-to-date assessment of seismic hazard for the Euro-Mediterranean region. The new model, publicly released in May 2022, incorporates refined and cross-border harmonised earthquake catalogues, homogeneous tectonic zonation, updated active faults datasets and geological information, complex subduction sources, updated area source models, a smoothed seismicity model with an adaptive kernel optimised within each tectonic region and a novel ground motion characteristic model. ESHM20 supersedes the 2013 European Seismic Hazard Model (ESHM13, Wössner et al 2015) and provides full sets of hazard outputs such as hazard curves, maps, and uniform hazard spectra for the Euro-Mediterranean region. The model provides two informative hazard maps that will serve as a reference for the forthcoming revision of the European Seismic Design Code (CEN EC8) and provides input to the first earthquake risk model for Europe (Crowley et al., 2021). ESHM20 will continue to evolve and act as a key resource for supporting earthquake preparedness and resilience throughout Euro-Mediterranean region under the umbrella of the European Facilities for Seismic Hazard and Risk Consortium (EFEHR Consortium).

### Journal article - "The European Fault-Source Model 2020 (EFSM20): geologic input data for the European Seismic Hazard Model 2020,"

#### Dataset - "European Fault-Source Model 2020 (EFSM20): 3D triangular meshes"

EFSM20-Meshes is derived from the European Fault-Source Model 2020 (EFSM20), and its compilation aims to replicate the geometry of its fault sources with triangular meshes as closely as possible. The adopted procedure includes the following steps. 1) extract triplets of spatial coordinates (latitude, longitude, depth) of evenly spaced points resting on the EFSM20 fault planes; 2) obtain triangles through Delauney triangulation; 3) remove spurious triangles. The results of this procedure can be replicated through a dedicated PyQGIS tool. EFSM20-Meshes was designed to provide the users of the European Fault-Source Model 2020 (EFSM20) with 3D geometric realizations of the fault sources made by triangular meshes. Triangular meshes are useful for several applications of earthquake modelling that require a discretization of the fault plane, e.g., heterogeneous slip distributions. EFSM20-Meshes was created to fulfil the objectives of the Geo-INQUIRE project and is hosted, maintained, and distributed by INGV through the EDSF installation (<https://seismofaults.eu/>) operated under the auspices of the EPOS-ERIC, TCS EPOS-Seismology, EFEHR Consortium, and the EPOS-MIUR Joint Research Unit.

#### Dataset - "European Fault-Source Model 2020 (EFSM20): online data on fault geometry and activity parameters"

The European Fault-Source Model 2020 (EFSM20) was initially compiled in the framework of the EU Project SERA, Work Package 25, JRA3. EFSM20 includes only faults deemed capable of generating earthquakes of magnitude equal to or larger than 5.5 and aims at ensuring a harmonized input for use in ground-shaking hazard assessment in the Euro-Mediterranean area, namely the European Seismic Hazard Model 2020 (ESHM20). The EFSM20 database is hosted, maintained, and distributed by INGV through the EDSF installation (<https://seismofaults.eu/>) operated under the auspices of the EPOS-ERIC, TCS EPOS-Seismology, EFEHR Consortium, and the EPOS-MIUR Joint Research Unit. The compilation of this dataset relies heavily on the scientific literature on active faults, seismotectonics, paleoseismology, tectonic geomorphology, and all other disciplines related to active tectonics. Studies of historical or recent earthquake ruptures are key to understanding the seismogenic behavior of active faults. Original and legacy data, not necessarily published in journal articles, also form the knowledge base to characterize seismogenic faults. Among these, seismic reflection profiles, well logs, data collected in field reconnaissances, dating of sedimentary units, and geological data in the broadest sense also play a critical role. Several parameters associated with the seismogenic faults are derived by numerical modeling (e.g., slip rate derived from geologic restoration) or analytical/empirical relations (e.g., earthquake magnitude derived from fault scaling relations).

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## Planned research output details

| <b>Title</b>                                           | <b>DOI</b>                     | <b>Type</b>     | <b>Release date</b> | <b>Access level</b> | <b>Repository(ies)</b> | <b>File size</b> | <b>License</b>                                 | <b>Metadata standard(s)</b> | <b>May contain sensitive data?</b> | <b>May contain PII?</b> |
|--------------------------------------------------------|--------------------------------|-----------------|---------------------|---------------------|------------------------|------------------|------------------------------------------------|-----------------------------|------------------------------------|-------------------------|
| The 2020 European Seismic Hazard Model: Overview a ... | 10.5194/nhess-24-3049-2024 ... | Publication     | 2024-01-04          | Open                | None specified         |                  | Creative Commons Attribution 4.0 International | None specified              | No                                 | No                      |
| The European Fault-Source Model 2020 (EFSM20): geo ... | 10.5194/nhess-24-3945-2024 ... | Journal article | 2024-11-19          | Open                | None specified         |                  | Creative Commons Attribution 4.0 International | None specified              | No                                 | No                      |
| European Fault-Source Model 2020 (EFSM20): 3D tria ... | 10.13127/efsm20/meshes ...     | Dataset         | 2024-11-04          | Open                | None specified         |                  | Creative Commons Attribution 4.0 International | None specified              | No                                 | No                      |
| European Fault-Source Model 2020 (EFSM20): online ...  | 10.13127/efsm20 ...            | Dataset         | 2022-01-01          | Open                | None specified         |                  | Creative Commons Attribution 4.0 International | None specified              | No                                 | No                      |