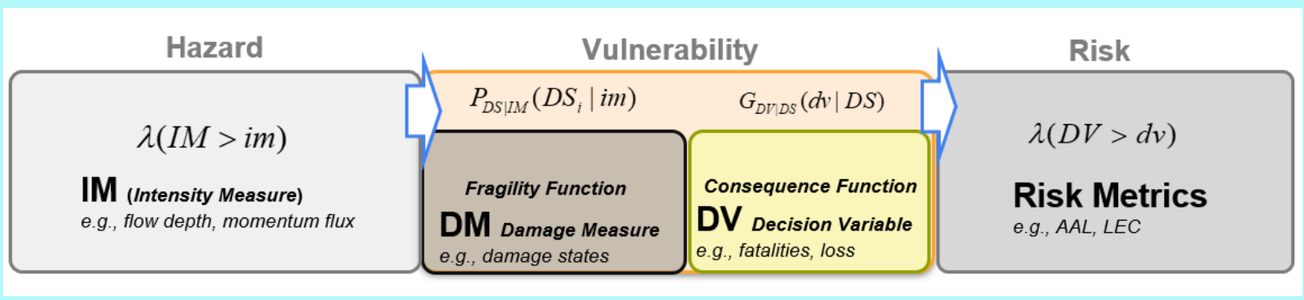
ETRiS Newsletter
Issue 1 – Jan 2025
www.eurotsunamirisk.org

Who are we?

The European Tsunami Risk Service (ETRiS) is a DDSS (Data, Data Products, Services, and Software) service for tsunami risk provided by the University College London (UCL). This service is part of the Thematic Core Service tsunami (TCS Tsunami) and is integrated into the Integrated Core Service Data Portal of the European Plate Observing System (EPOS-ICS-C). The primary objective of this service is the provision of virtual access to DDSS for Probabilistic Tsunami Risk Analysis (PTRA).

ETRiS acknowledges funding from Project GeoINQUIRE (2022-2026) funded by the European Commission under project number 101058518 within the HORIZON-INFRA-2021-SERV-01 call. In year 2024, it has also received funding from EPOS ERIC through the Tsunami Thematic Core Service (TCS). These contributions are gratefully acknowledged.

Forward Probabilistic Framework (PTRA)



Behrens, J., Løvholt, F., Jalayer, F., Lorito, S., Salgado-Gálvez, M.A., Sørensen, M., Abadie, S., Aguirre-Ayerbe, I., Aniel-Quiroga, I., Babeyko, A. and Baiguera, M., 2021. Probabilistic tsunami hazard and risk analysis: A review of research gaps. Frontiers in Earth Science, 9, p.628772

The ETRiS Team:

Responsible, Probabilistic Tsunami Risk Analysis
Fatemeh JALAYER
f.jalayer@ucl.ac.uk

Validation, Post processing, and empirical fragility and vulnerability modelling:
Hossein EBRAHIMIAN
hossein.ebrahimianchelehkhaneh@unina.it

Analytical Fragility modeling
Jingren Wu
jingren.wu@ucl.ac.uk

Manager, Probabilistic Evacuation Modelling (using ABM)
Saeed SOLTANI
saeed.soltani@univ-grenoble-alpes.fr

Words from the Responsible for the European Tsunami Risk Service.

This past year, the world marked the 20th anniversary of the Indian Ocean Earthquake and Tsunami on December 26th 2004, one of the most devastating disasters in modern history, in terms of loss of life. These 20 years have been significant for development of Disaster Risk Reduction Frameworks (Hyogo and then Sendai) and the implementation of the Tsunami Early Warning Systems across different regions. The start of year 2025 also marks halfway through the Ocean Decade 2020-2030. Thinking about the goals of the Ocean Decade Tsunami Program, understanding tsunami hazard and risk, people-centred early warning, and preparedness stand out as the key principles. Considering the polyhedric nature of tsunami risk, it is crucial to pinpoint meaningful ways in which understanding of tsunami risk should be enhanced and elaborated. Thinking about a road map to future tsunami risk products, the following priority areas can be identified: human exposure and evacuation modelling, physical vulnerability, social vulnerability indicators, and systemic risk and resilience. Being a service providing virtual access to data and data products, ETRiS follows closely the latest research trends in the above priority areas, aiming to make the risk-related data, models, and tools as accessible and reproduceable as possible to the researchers and risk modellers. Parallel to development of new data products and services for ETRiS, we remain committed towards improving the FAIRness of our datasets, where FAIR stands for Findability, Accessibility, Interoperability, and Reusability.

One of the distinctive features of ETRiS products is that they are derived through a systematic model selection and characterisation of uncertainties based on the available data. However, data availability is a major bottleneck for the development of tsunami risk products. Since its constitution in 2022, ETRiS has been focused on empirical fragility and vulnerability models for the physical assets. The empirical vulnerability products are bound geographically to regions where tsunami damage data in the aftermath of destructive tsunami events are available. This means that other methods (e.g., the analytical and numerical methods) are needed to fill in the geographical gaps of data availability for fragility and vulnerability curves. Regional analytical fragility models for different typologies of physical assets also will rely on very detailed information about the built environment and their features. Socio-economic loss modelling also suffers from the lack of asset-specific geo-localised data and often renders it necessary to work with coarse-level aggregated loss data and generic loss models. The ETRiS team is currently working on development of analytical fragility curves for different classes of European coastal buildings. During year 2025, we would like to explore new areas for service provision regarding the provision of tools and models for digital tsunami evacuation modelling. Finally, user training is one of the priority areas for our team, please stay tuned for our next online training event as part of the project GEO-INQUIRE. This event will be announced through ETRiS and Geo-INQUIRE website and communication channels.

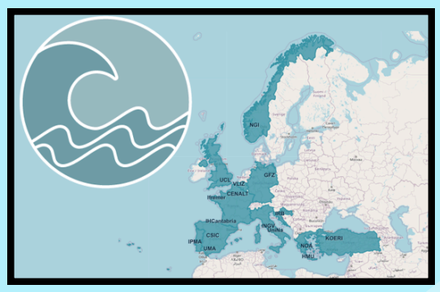
Fatemeh Jalayer is a researcher in the field of geophysical hazard risks, specializing in multi-risk analysis, tsunami risk modeling, and probabilistic seismic hazard assessment. She leads the European Tsunami Risk Service (ETRiS), a platform dedicated to collecting, standardizing, and disseminating data, data products, software, and services related to tsunami risk analysis.

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European Tsunami Risk Service

ETRiS in 2024

Jan

Feb



Mar

Apr



May

Jun



Jul

Aug

Sep



Oct



Nov

Dec



Constitution of the TCS Tsunami
15-16 February 2024

On February 15-16, with the signing of the TCS Tsunami Consortium Agreement by 18 national research institutions across Europe during the first Consortium Board meeting in Potsdam, the Thematic Core Services (TCS) Tsunami became fully operational!

EGU 24 presentation
14-19 April 2024

Scenario-based Probabilistic Tsunami Risk Analysis for Coquimbo Bay
F. Jalayer, H. Ebrahimian, P. Catalan, N. Zamora, and S. Soltani

Focusing on Coquimbo Bay, which was affected by the 2015 Illapel tsunami, this study demonstrates how the uncertainties are quantified and propagated from the tsunami source level all the way towards risk metrics such as the economic losses. We have chosen a range of near-field tsunami scenarios with moment magnitude between 8.6<Mw<9.3 from a subduction interface zone on the Nazca–South American plate interface running parallel to the Chilean coastline. We have worked with a large set of stochastic scenarios generated compatible with the scaling laws, with variable slip distribution according to a prescribed correlation structure. We have estimated the seismicity rate through different sources: paleo seismic data, historical catalogue, and moment balancing and have combined the resulting probability distributions through a logic tree approach. This has led to scenario-based hazard and risk curves with confidence intervals for different points of interest in the port city of Coquimbo.

WCEE 24 presentation
June 30 - Jul 5, 2024

Probabilistic Tsunami Evacuation modeling for City of Catania, Eastern Sicily
F. Jalayer, S. Soltani, S. Ghaffarian, S. Lorito, M. Volpe, B. Brizuela, F. Løvholt, H. Ebrahimian, F. Romano, and S. Gibbons

The study presents a tsunami evacuation model for the City of Catania, Eastern Sicily, using Agent-Based Modeling (ABM) to simulate the evacuation response. A detailed digital model of the evacuation environment, including buildings, open spaces, roads, and shelters, was developed. Evacuation probabilities were evaluated under tsunami inundation scenarios derived from Probabilistic Tsunami Hazard Analysis (PTHA), considering factors like population preparedness, age, gender, disabilities, and access to warning alerts. Preliminary results of the Probabilistic Tsunami Evacuation Modelling using the Monte Carlo Simulation scheme were extracted and discussed for selected scenarios.

WCEE 24 presentation
June 30 - Jul 5, 2024

Analytical Tsunami Fragility Assessment of a Reinforced Concrete Frame Using Cloud Analysis
J. Wu, F. Jalayer, H. Ebrahimian, M. Volpe, and S. Lorito

This work presents the analytical fragility assessment of an existing building using the Cloud Analysis (CA) procedure, which was originally proposed for seismic response assessment. CA relies on simple regression of structural response estimated from nonlinear dynamic analysis against intensity for a set of ground motion records for the derivation of seismic fragility curves. Considering that this method has not been widely adopted for tsunami fragility assessment, this study aims to explore the feasibility of using CA to develop tsunami fragility curves. The case study building adopted was a two-story reinforced concrete moment-resisting frame located in Italy, which was constructed in the 1960s and designed only for gravity loads. An extensive set of simulated tsunami inundation scenarios in the Catania Plain, Italy, was adopted for the nonlinear time-history analysis. The scenarios, which have been used for probabilistic tsunami hazard assessment for this site, include tsunamis generated by earthquakes in the Mediterranean Sea considering: i) both near and distant earthquakes from the site; ii) both crustal and subduction earthquakes; and iii) earthquakes with moment magnitudes from 6.0 to 9.0. A refined three-dimensional nonlinear model of the case study building was analysed in OpenSees to investigate the structural response under tsunami loading. This has rarely been done in previous studies, which mostly relied on static analysis for tsunami response assessment. In this study, the tsunami actions included both the hydrostatic forces and the hydrodynamic effects, considering also the influence of breakaway infill walls. Finally, tsunami fragility curves were developed based on CA, along with discussions on the choice of proper intensity measures and the applicability of CA procedure to the development of tsunami fragility curves.

GEM-EGU Summer School
9-13 September2024

The GEM-EGU Summer School on GeoHazards Risk, taking place at the University of Aveiro, Portugal, from September 9–13, 2024, with a comprehensive training program on earthquake-induced hazards, including ground shaking, liquefaction, landslides, and tsunamis. During this school, participants will learn to perform hazard and risk analyses, with Prof. Fatemeh Jalayer from ETRiS presenting a course on vulnerabilities to tsunamis.

Inauguration of the Global Tsunami Model Association
26 September

On September 26th in Rome, 18 participants of the Foundational Assembly inaugurated the Global Tsunami Model Association by signing the prepared Articles of Association. Prof. Fatemeh Jalayer from ETRiS was selected as the Deputy Chair.

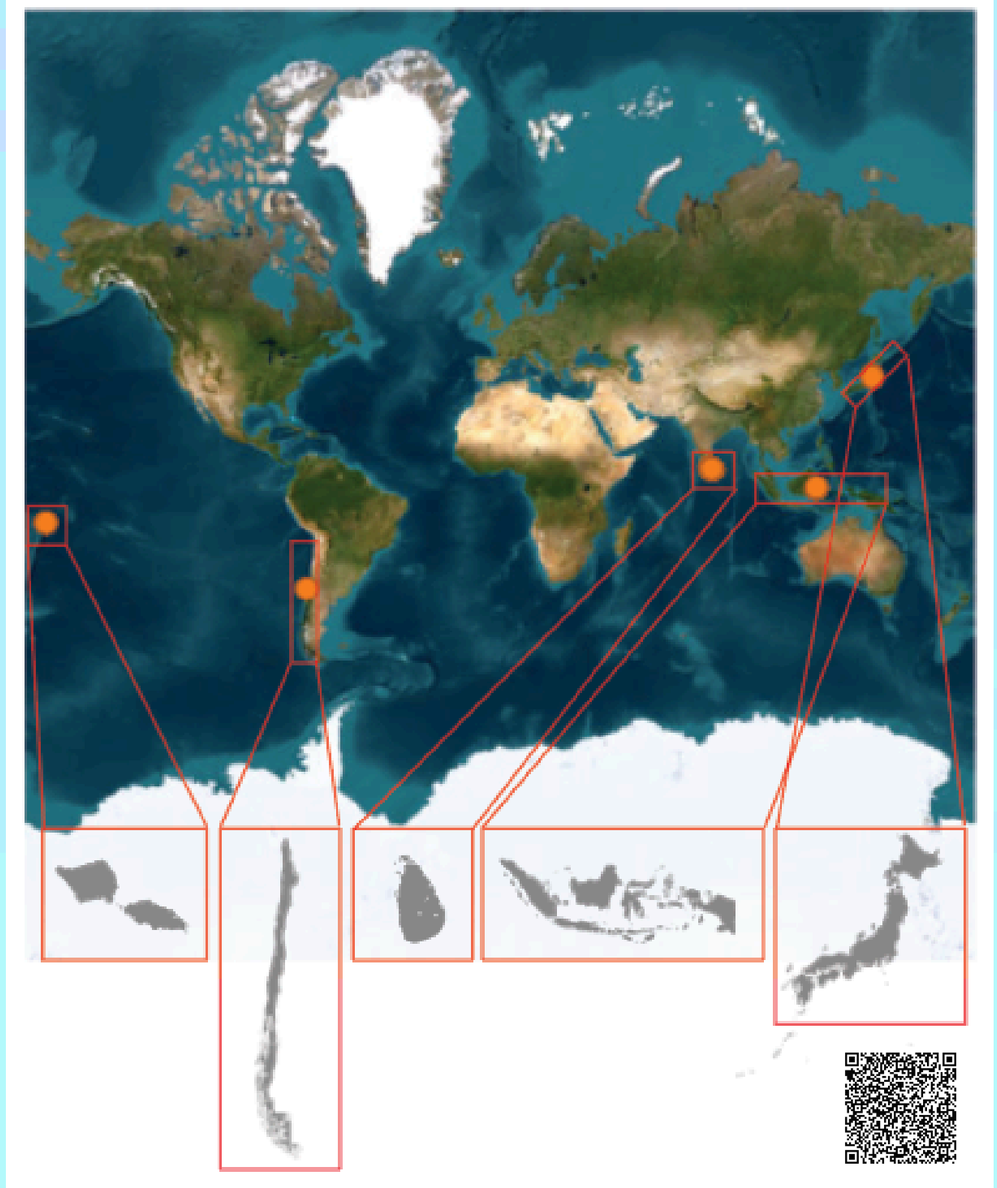
EFEHR Scientific Session
27-29 November

On November 27th, Fatemeh Jalayer presented “Simulation-based procedure for Class Tsunami Fragility Assessment: Using data, data products, software and services within EPOS” at the 102nd Journées Luxembourgeoises de Géodynamique (JLG) & EFEHR Scientific Session 2024.

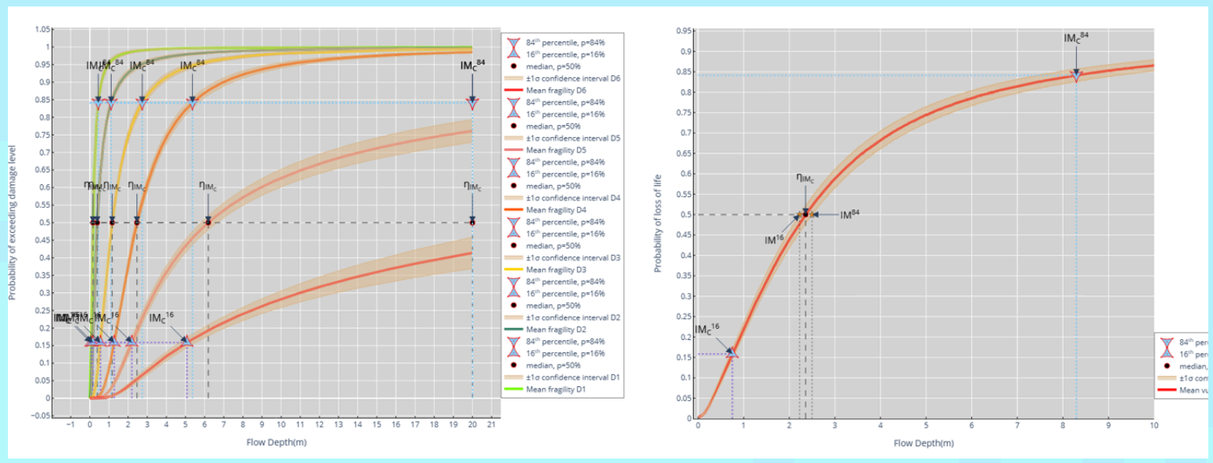
EPOS EUROPEANPLATEOBSERVINGSYSTEM
Geo-iNQUIRE
TSUNAMI

ETRiS Data and Data Product

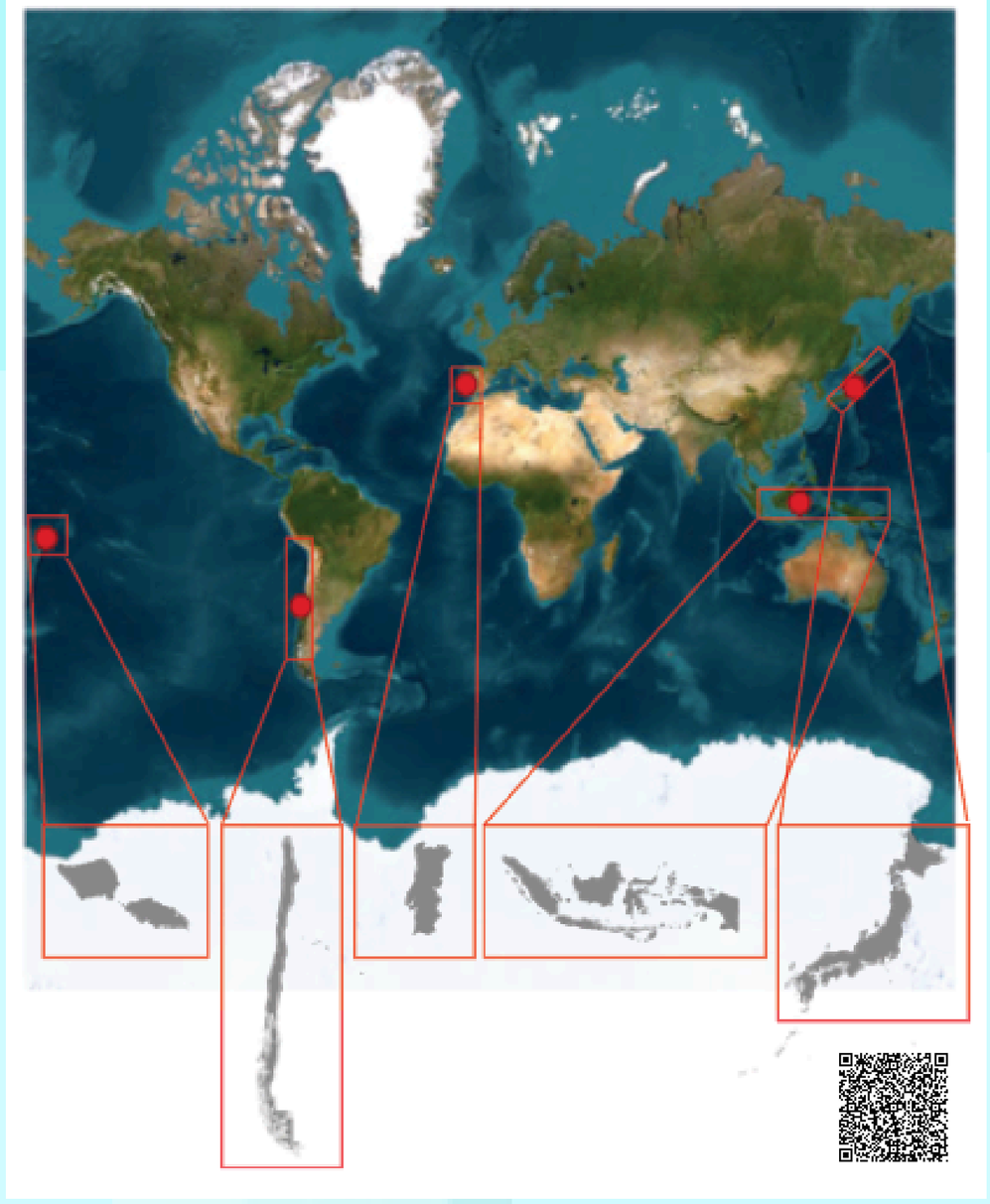
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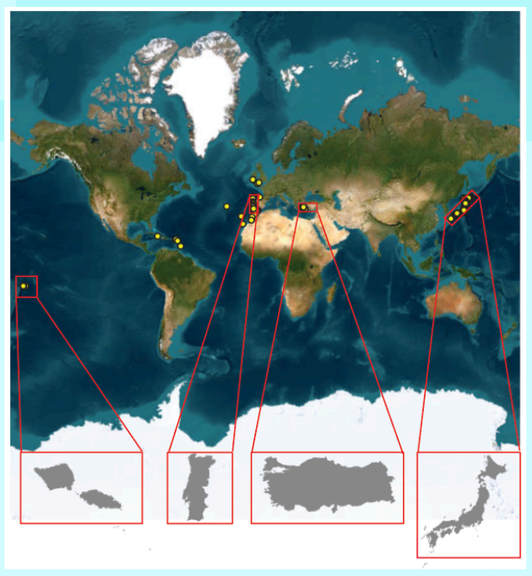


By the end of 2024, **162** empirical fragility curves related to five tsunami events are available in the ETRiS repository and integrated into the EPOS portal. For each building type, three different model functions are provided. The events include the Indian Ocean (2004, 1 building type), South Pacific (2009, 3 building types), Chile (2010, 1 building type), Tohoku (2011, 25 building types), and Sulawesi-Palu (2018, 4 building types) tsunamis.



By the end of 2024, **54** vulnerability curves related to five tsunami events are available in the ETRiS repository and integrated into the EPOS portal. For each building type, three different model functions are provided. The events include the Lisbon (1775, no building type, utilizing fatalities as the risk metric), South Pacific (2009, 3 building types), Chile (2010, 1 building type), Great Japan Earthquake and Tsunami (2011, 9 building types), and Sulawesi-Palu (2018, 4 building types) tsunamis.





ETRiS also provides access to datasets of tsunami intensity measures (IM), damage (DM), and fatalities (DV) collected from past tsunami events and published in the literature. By end of 2024, data from Turkey, Portugal, Japan, and Samoa Tsunamis have been collected and included in our database.

Event	Country	Reference	Data	N data
2017 Bodrum Eq	Turkey	Dogan et al., 2019	Runup	25
2020 Samos Eq	Turkey	Dogan et al., 2021	Inundation distance Height Runup	123
2009 Samoan Eq	Samoa	Ressee et al., 2011	Flow depth Damage stateS	201
1775 Lisbon Eq	Portugal*	Santos & Kashimura, 2015	Runup Damage and Fatalities	129
2011 Tohoku Eq	Japan	Mori et al. 2011, ...	Height Runup	5907

EPOS EUROPEAN PLATE OBSERVING SYSTEM

Geo-INQUIRE

TSUNAMI

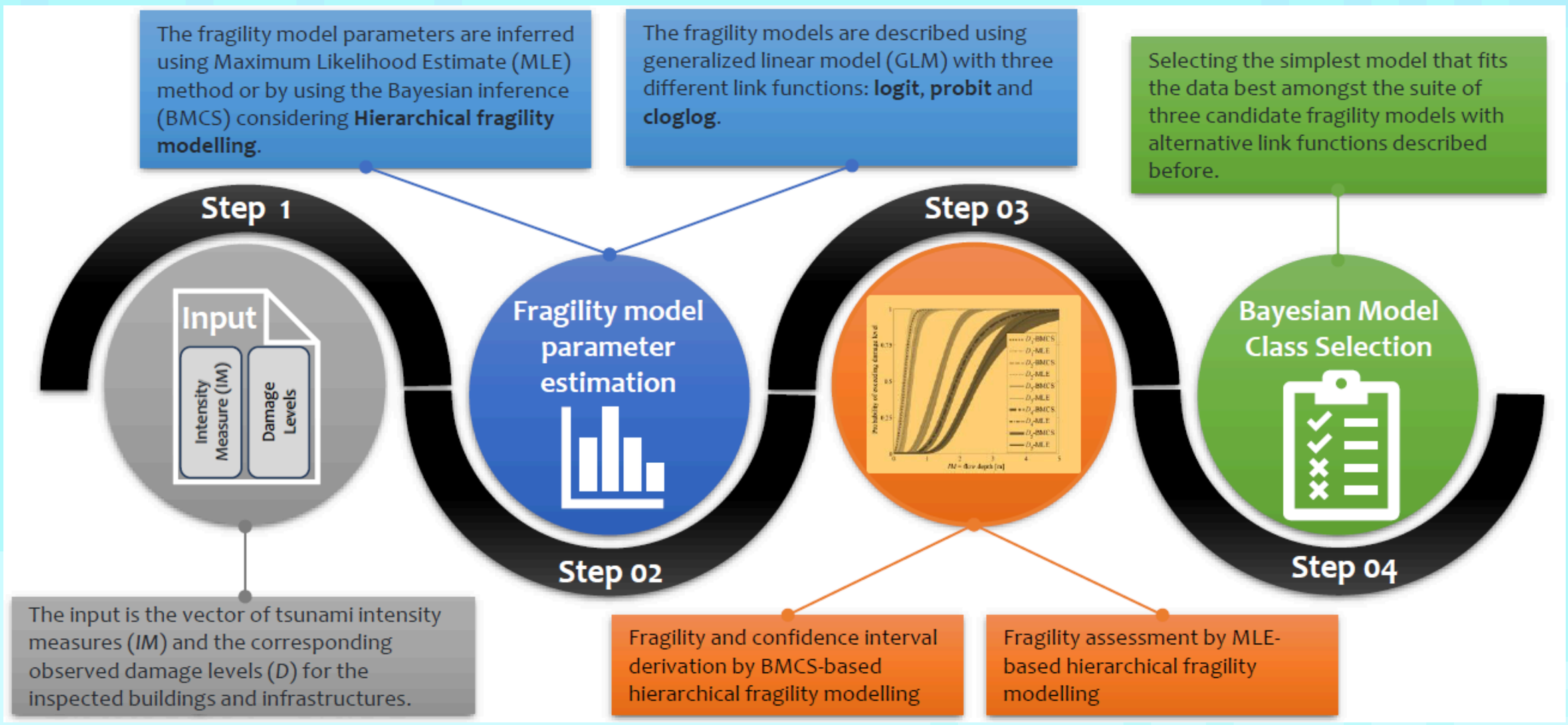
ETRiS Risk Toolkit

The **Tsunami Risk Modeller's Toolkit (TRMTK)**, is a library of Matlab and Python scripts and Jupyter notebooks to compute and visualize the empirical fragility assessment using generalized linear regression model and Bayesian model class selection.

ComputeFrag is a code for computing robust fragility curves using a generalized regression model considering Hierarchical fragility modeling. This code calculates fragility curves based on maximum likelihood estimation methods (basic and hierarchical modeling) or using Bayesian model class selection (BMCS) to estimate fragility curves with their corresponding confidence bands for a set of mutually exclusive and collectively exhaustive damage states and different classes of buildings or infrastructure. The code utilizes Bayesian model class selection (BMCS) to identify the best link model to employ in the generalized linear regression scheme.

The Jupyter notebook "**VisualizeFragility**.ipynb" is utilized for the visualization of fragility curves accessible on this service. To get started, place the desired .csv file—downloaded from either the EPOS-ICS platform or directly from our GitHub repository—in the same directory as the code, and update the file name within the notebook. To visualize the statistics of the fragility curves, it's essential to specify the fragility curve corresponding to the desired damage level.

Similarly, the Jupyter notebook "**Visualize Vulnerability**.ipynb" facilitates the visualization of vulnerability curves provided by this service.

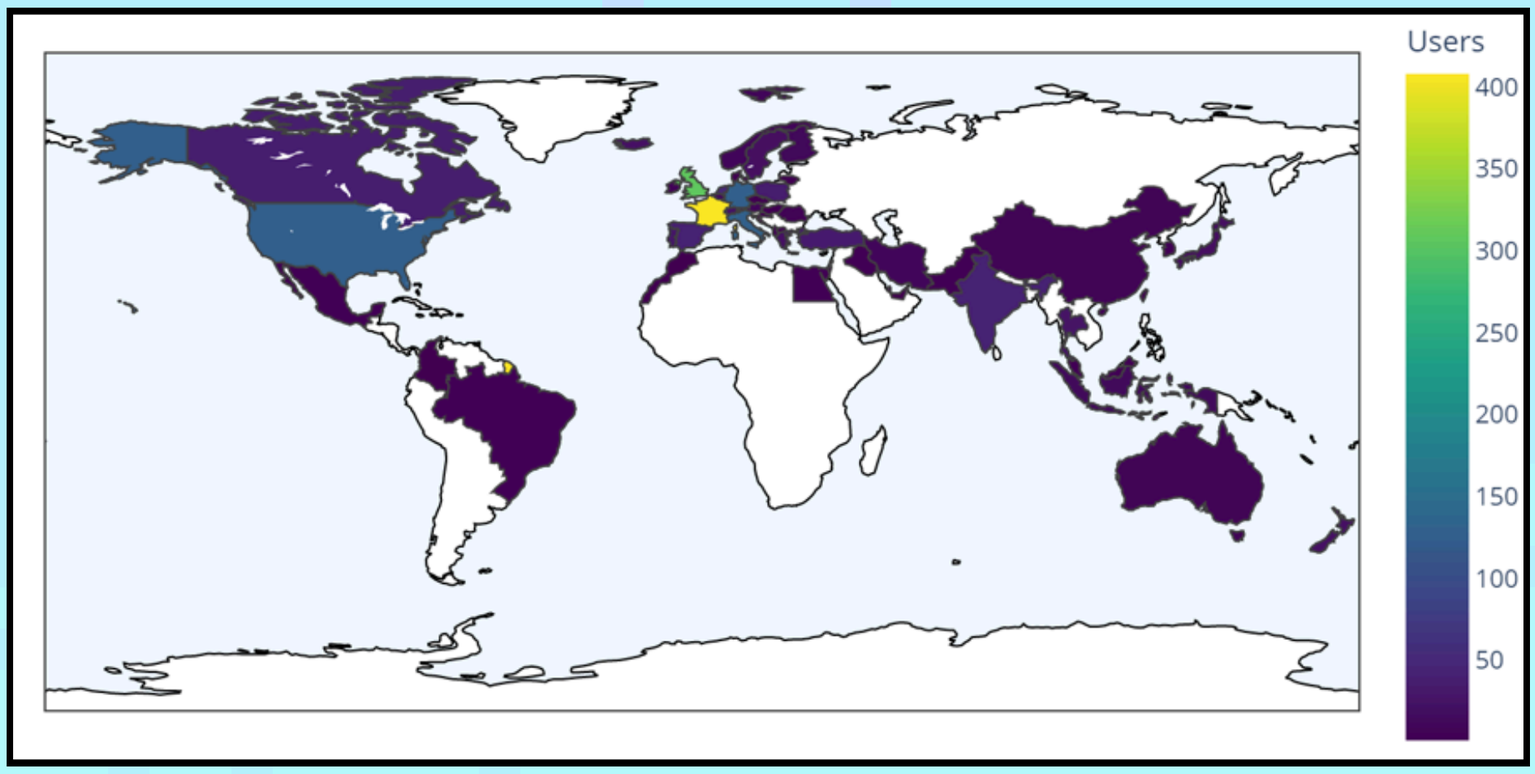


https://github.com/eurotsunamirisk/trmtk

Training materials on the concepts of forward probabilistic hazard and risk analysis and hands-on demos for using the toolkit, can be found within the service or on the GeoInquire website.

https://eurotsunamirisk.org/training-activities-and-materials/

ETRiS User Statistics



In 2024, ETRiS has users from **57** countries, from Japan to Mexico, New Zealand to Lithuania, and everywhere in between. Our diverse community also includes users from Iraq, Samoa, Réunion (France) and Aruba.

Of these users, 48.15% are from Europe, while 51.85% come from the rest of the world—showing our growing global reach.

In 2024, ETRiS recorded **3,207** views, with a daily average ranging from a maximum of **25** users to a minimum of **3** users per day. This represents an increase of **45.8%** compared to the **2,199** views in 2023.

