WELCOME TO THE NEWSLETTER

The aim of this newsletter is to share relevant updates on METIS activities, recent progress and important events. This first edition proposes an overview of the achievements since the start of the project in September 2019. For more information on any of the topics of this newsletter, please get in contact with us!

The first 18 months of the project were very rich, and we were able to enjoy our first in person meeting, hosted by partner IUSS in Pavia in November 2021 despite the persisting COVID-19 crisis difficulties.

The year 2022 is shaping up to be even more enriching with many exciting technical deliverables, a second in-person plenary in Greece on June 6-7, and many other METIS related events.

Unfortunately, despite the slow of the pandemic, Europe faces new challenges. We express our strongest support for our two Ukrainian partners, Energorisk and SSTC NRS, who are going through an incredibly difficult time.

Irmela Zentner (project coordinator), the project office & work package leaders

WORK PACKAGE PROGRESS

WP2 - DISSEMINATION, EXPLOITATION & TRAINING

The main achievement of WP2 has been the End Users Survey and its post processing results, which was submitted and approved in month 12. In total there were 17 respondents including industrial organisations, research organisations and regulators. These were mostly based in Europe, with responses received from France, Spain and the UK. All areas of expertise were covered, including PSA Hazard, Structural engineering, Fragility and Geotechnical engineering. This group wanted well validated software that was easy to use with clear documentation, strong maintenance support and that would easily interface with existing tools. Additionally, this project should provide more flexible and open tools, and help train the next generation to implement international guidance and methodologies.

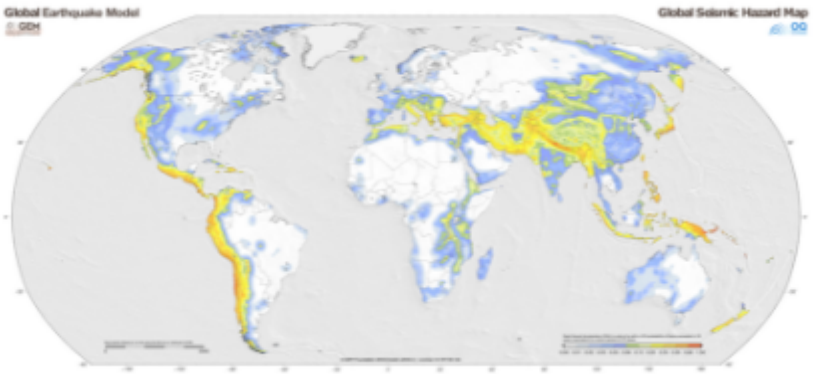
WP3 - CASE STUDY FOR IMPLEMENTATION & APPLICATION OF METIS RESULTS

The objective of WP3 is to define a case study site to ensure that all METIS developments, scientific and engineering results are tested and assessed. Extensive work including technical reviews, the collection of industrial contacts

and experts' opinions has been carried out to select the case study for the METIS project. The case study selected is the Ukrainian Zaporozhye Nuclear Power Plant (ZNPP) but is located at an appropriate site in central Italy. This proposed hybrid case study was the best compromise to evaluate all the outputs produced by WPs 4-6 to support the implementation of the full and final seismic Probabilistic Safety calculations performed in WP7.

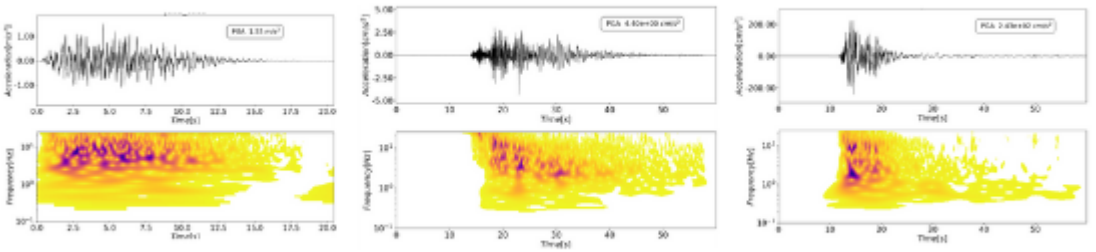
WP4 - SEISMIC HAZARD ANALYSIS

The goals of WP4 is to develop new methodologies and tools for probabilistic seismic hazard analysis (PSHA) and, when possible, to apply them in the METIS case study. During the first year, most of the work focused on methodological research. An approach was created for calibrating declustering algorithms to create catalogues with the largest number of independent earthquakes, generalised approaches for developing non-ergodic ground motion models and a non-ergodic model for California against intensity data was tested. A Bayesian method for estimating the weights associated with a set of ground motion models accounting for epistemic uncertainty was developed and new ways of propagating epistemic uncertainty were explored. An innovative approach for performing vector valued PSHA was conceptualised and a methodology to compute conditional spectra in the OpenQuake Engine was implemented. Various approaches for the calculation of seismic hazard accounting for the contribution of foreshocks and aftershocks were tested. Progress was made on physics-based methods for simulating ground motion on rock by defining performance criteria for evaluating different approaches, extending the application of the SCEC broadband platform to Europe, parametrising a 3D-stochastic ground motion simulation model, calibrating various methods against observations (e.g., 2007 Niigata-ken Chuetsu-oki or, 2009 L'Aquila earthquakes) and creating a database of strong-motion simulations. Finally, procedures were developed for PSHA testing and model validation and verification with a focus on comparing the performance of national and regional models for Europe.



WP5 - GROUND MOTION SELECTION FOR ENGINEERING ANALYSES INCLUDING SITE RESPONSE

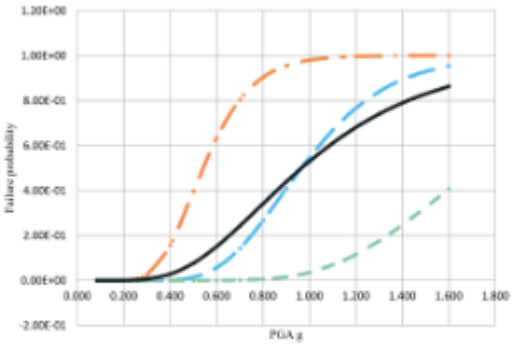
WP5 is the link between seismic hazards (WP4) and response assessment (WP6) and deals with the selection of ground motions consistent with the former and appropriate for use in the latter. Most of the WP5 work done to date is related to creating and assembling a large pool of rock ground motion records to be used for hazard-consistent selection. To this end, the adequacy of real but scaled records, synthetic records, and records from soil sites to be used on rock were explored and a battery of tests was defined to evaluate their appropriateness for engineering analysis. Furthermore, to enforce hazard consistency, tools for ground motion selection were investigated and developed based on state-of-the-art methodologies, such as the Conditional Spectrum approach and related variants. The results obtained will be summarised in the deliverable that should be submitted in May 2022. In addition, work was started on the hazard consistent ground motion selection for seismic sequences that will be used in WP6 to derive damage-dependent fragility curves for systems, structures and components (SSC) structures.



WP6 - BEYOND DESIGN & FRAGILITY ANALYSIS

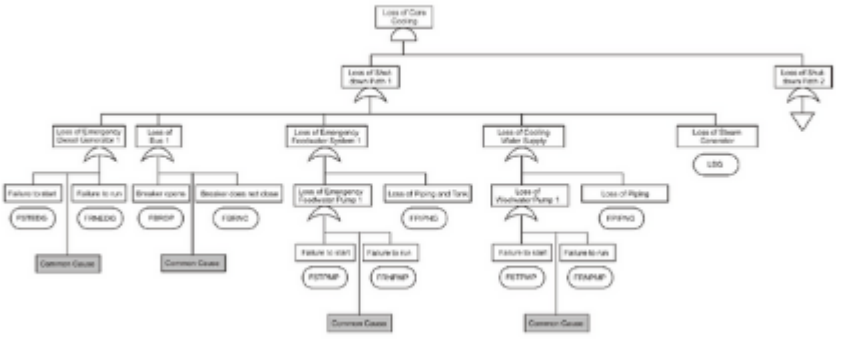
Within WP6 the first deliverable has been completed. This deliverable focused on the definition and classification of systems, structures and components (SSCs) of nuclear power plants, in order to perform generic fragility analysis or detailed specific fragility analysis. This resulted in a list of SSCs being selected for the METIS case study, for detailed plant-specific fragility assessment. Based on these, models for the case study will be created for the most relevant SSCs.

Furthermore, validation and verification criteria to evaluate the accuracy of the models and failure criteria will be developed. The current ongoing work also focuses on the selection of failure relevant ground motion intensity parameters for reduction of uncertainty in response results.



WP7 - PSA TOOLS & METHODOLOGY

The generic objective of the WP7 is to develop and implement new assessment methodologies that allow for the review of hazard and fragility data (prepared under WP3, WP4 and WP6), as well as multi-unit assessment. WP7 activities include the ongoing development of a new representation format for seismic probabilistic safety assessments (PSA) models using codes Andromeda and open-source SCRAM. Integrated modelling environments Andromeda/SCRAM have progressed, and a new repository has been created to host SCRAM-NG (SCRAM New Generation), the opensource code has been compiled and evaluated by using a test case. It contains most concepts of a complete PSA: event trees, fault trees, various kinds of basic events, common cause failures, etc. The first deliverable of WP7 - Specification of the PSA format - is scheduled for submission in February 2022. Other WP7 activities are related to further development of the seismic PSA tool, as well as to strategise for the consideration of aftershocks in seismic PSA.



LEARN MORE ABOUT METIS

THE SECOND PLENARY MEETING

This picture was taken at the second plenary meeting, following the first one that was held fully virtually in April 2021. It was a hybrid project meeting (mix of in-person and virtual participants) held over two days 22-23 November 2021 and attended by 50 participants. Since the start of the project, this is the first meeting which has been held in-person.

FIND OUT MORE

UPCOMING EVENTS

5 - 6 APRIL / CODE_ASTER & SALOME_MECA TRAINING

General introduction to code with sessions dedicated to nonlinearities and structural elements modelling.

30 MAY - 2 JUNE / FISA 2022 & EURADWASTE'22 CONFERENCE

The Euratom Conferences FISA 2022 – EURADWASTE ’22, organised by the French Presidency of the Council of the EU and the European Commission, will take place from 30 May to 3 June 2022 in Lyon, France. The main objective is to present progress and key achievements of the **Euratom research and training projects** carried out since 2019 and to stimulate discussions on the state of play of research and innovations, challenges, and opportunities, as well as exploring future perspectives.

31 MAY - 2 JUNE / SIGMA2 CLOSING SYMPOSIUM

This meeting will present an overview of scientific results obtained in the program, their impact on current seismic hazard assessment and earthquake engineering practice, and perspectives for future developments.

6 - 7 JUNE / THIRD METIS PLENARY MEETING

This will be the third plenary meeting, it will be a hybrid project meeting (mix of in-person and virtual participants) and will be held over two days 6-7 June 2022. This meeting will be hosted by our partners NTUA in Greece. We are hoping that with the easing of travel restrictions even more participants will be able to attend in person, than the previous meeting in November 2021.

8 - 9 JUNE / METIS SUMMER SCHOOL ON SEISMIC FRAGILITY

The METIS Summer School on Seismic Fragility, will be held in person at Athens (Greece) from 8-9 June 2022. It will be organized by the Institute of Steel Structures at the Zografou Campus of the National Technical University of Athens. The school will span two days. The first focuses on methodologies and approaches for seismic fragility assessment, especially as it pertains to high-importance infrastructure, such as nuclear power plants. Issues of record and intensity-measure selection, as well as industry-standard approaches will be discussed. The second day will comprise practical sessions with hands-on training via Excel, Matlab, and Python, using simple tools to perform data-fitting and derive fragilities.

The School is targeted at PhD/Master students and other early career researchers. The participation to the school is free. Participants are expected to cover their travel and accommodation costs, and bring their own laptops. The maximum number of participants is 20.

Applications to the summer school can be submitted by e-mail to Mrs. E. Vourlakou (lambdalab.ntua@gmail.com). The application deadline is May 15th, 2022.

13 - 14 JUNE / CODE_ASTER & SALOME_MECA TRAINING

Session dedicated to seismic analysis (onsite EDF R&D Paris-Saclay).

20 - 23 JUNE / METIS SUMMER SCHOOL ON SEISMIC HAZARD ANALYSIS

Applications are now being accepted for the METIS Summer School on Seismic Hazard Analysis, to be held at in Pavia (Italy) from 20-23 June 2022.

The Global Earthquake Model Foundation (GEM) and the University School for Advanced Studies (IUSS) will host a summer school on probabilistic seismic hazard analysis. The school organised under the auspices of the METIS project (EU Euratom research and training program 2014-2018, grant agreement n°94512 - metis-h2020.eu), will be held in person and will consist of a series of lectures and hands-on laboratories.

The goal of the school is to introduce the participants to the calculation of probabilistic seismic hazard and to recent methodologies developed in the framework of the METIS project.
The topics offered will include an introduction to the main functionalities of the OpenQuake Engine and GEM's tools for building components of a hazard input model, aftershock PSHA, vector-valued PSHA and the

conditional spectrum approach, time-histories selection for engineering applications. The School is targeted at PhD/Master students and other early career researchers.

The participation to the school is free. Participants are expected to cover their travel and accommodation costs. The maximum number of participants is 20.

Applications to the summer school can be submitted by filling the form. The application deadline is March 31st, 2022.

10 - 15 JULY / SMIRT26

SMIRT26 (26th International Conference on Structural Mechanics in Reactor Technology) is to be held from July 10th-15th 2022 at Potsdam/Berlin, Germany. The conference is co-organised by one of the METIS partners, the University of Kaiserslautern and is an in-person event. METIS will be present in the special session dedicated to Challenges and recent advances of EU and international research projects.

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OUR PARTNERS

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