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Seismic Hazard Harmonization in Europe

Project Acronym: SHARE

SP 1-Cooperation

Collaborative project: Small or medium-scale focused research project

THEME 6: Environment

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D6.5 – Portal design specification document

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	X
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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1. Introduction

The main objective of SHARE is to provide an community-based seismic hazard model for the Euro-Mediterranean region and providing a sustainable mechanism for future updates as new scientific sound methods and data are available. The project aims to establish new standards in Probabilistic Seismic Hazard Assessment (PSHA) practice by a close cooperation of leading European seismologists and engineers. In particular, the project employs state-of-the art Information Technology (IT) to disseminate the data and results to expert and interested non-expert users such as the media and general public.

Access to data and results will be granted to the public and specialist through a single entry point, the SHARE Portal via the project web-page at: www.share-eu.org. SHARE ensures full technical compatibility with the portal technology adopted for portals in the seismological community. In cooperation with the European-Mediterrannen Seismologcial Centre (EMSC) and the foundation for Observatories and Research Facilities for European Seismology (ORFEUS), we ensure compatibility so that portlets are consumable in the different portals. SHARE designs its portal as the base for a single access point to European seismic hazard data that will be further enhanced within the FP7-funded project "Network of European Research Infrastructures for Earthquake Risk Assessment and Mitigation " (NERA) to serve the expert seismological, engineering seismology and engineering community as well as non-expert communities. SHARE started to design a facility for hazard and risk assessment as the European component of the Global Earthquake Model Foundation (GEM) and will in cooperation with NERA cooperatively ensure the implementation of the European Facility for Hazard and Risk (EFEHR) as primary access to hazard and risk data and results in Europe.

The portal technology applied for this purpose is a highly dynamic environment. This implies that the infrastructure is required to adopt changes in the applied technologies such as software and also to accommodate for upcoming user-needs and usage demands.

1.1 Scope

This document provides an update to the design specifications of the SHARE Portal as outlined in deliverable D6.2 and describes functionalities of the initial implementation of the

portal. The portal will serve as the central access point for the project data and results. The requirements for the design of the portal are guided to ensure a user-friendly interface for users with all levels of skills, fast performance and high availability:

1. the portal shall be modular, highly scalable, extensible, and flexible as needs develop over time;
2. the portal can be easily customized to provide the general public, scientists and engineers, policy makers, and other users with appropriate data and access given their different roles;
3. the portal can be used to interconnect with other relevant projects and institutions such as GEM, NERIES, SERIES, SYNER-G, GEISIR, EMSC, OneGeology and others via shared portlets and back-end Web services (see www.seismicportal.eu);
4. the portal will provide access to all data sets, model definitions, data schemata, reports, and other project products via any standard Web browser without the user to know where the products themselves are held.

2 A short system overview

The SHARE project implements state-of-the-art and homogenized seismic hazard assessment approach to the Euro-Mediterranean area. The project aims to build a framework for a *living and openly accessible hazard model* that ensures 1) the capability to reproduce results of the hazard assessment and 2) a mechanism to update the hazard model in all aspects of the assessment: the data collection, the model building procedure, the hazard assessment software, the hazard results, and the user interfaces to manage data, run hazard calculations and view results, as an integrated system ready for validation, replication and modification in all its aspects.

The access to the SHARE model will be given through the Web-portal as the single access point presenting input data, output data and model results as required by seismological and engineering needs but also public needs. Some aspects of data management and hazard calculation have web-mounted user interfaces integrated in a portal.

This architecture of the IT infrastructure is extensively described in deliverable D6.2 and D6.3.

2.1 Functional overview

The SHARE portal is the public interface of a complex system connecting databases of seismic hazard information with a computational engine for seismic hazard assessments. The portal provides the following minimum functionalities:

- authentication of the user and authorization for a user specific profile to accessible data and functionalities.
- browsing capabilities for the logic tree structure of released model versions, and of the definitions and results for each logic tree end path.
- access to hazard maps of Europe, calculated for different intensity measurement types (such as PGA, PGV, SA for different frequency bands) and return periods, for hazard models as well as for its individual logic tree branches.
- capability to browse site-specific hazard curves and hazard spectra, each for the hazard model as for its individual logic tree branches.
- view hazard input data (such as seismic source zone, earthquake catalog, ground motion prediction equations).

- enable the end-user to create summary fact sheets on the selected results (hazard map, curves, spectra).

With the technical principles for data storage, middleware, data exchange formats, and hazard assessment software, SHARE has the principal option to manage input data, compute seismic hazard data, view hazard models, and trigger hazard calculation directly from the web front-end.

2.2 Implementation procedure

The implementation schedule for the Portal is coordinated by SED-ETHZ. The technologies and the scheduling of the single software components are discussed with the partners and the appropriate tasks are divided according to the expertise of the partner resources. The prime goal of the initial implementation is to have one of the portlets being functional – the efforts are coordinated with the scientific work and the conceptual setup of obtaining data from the SHARE databases needs to be consistent with the definition of provided data according to a common data scheme. As for example this scheme is yet not existent for some parts, the first implementation is limited to display a fully defined hazard map. In time sequence, the IT-team builds the portlets for the hazard map, the hazard curve, the hazard portlet and then disaggregation. Support portlets will be set up towards the end of the project.

3 The Portal

The project portal serves as the single access point to the projects data and results. The portal serves dynamic content on the project via interactive access to data and results of the project and includes also static information essential for the user to understand the presented material. Access to the portal will be provided by links from the project web-page www.share-eu.org. For the development period and until a first community-based hazard model is available, the portal can be access via: http://portal.share-eu.org:8080.

In technical terms, these various tasks are outlined as **usecases** that define the requirements for each of the single portlet. SHARE scientists define the usecases. The workflow that serves the data is discussed with the IT-specialists. The basis for the discussion is a free online mockup tool accessible through www.lumzy.com. Snapshots from the design tool are found in the Appendix, section 4, on portlet design.

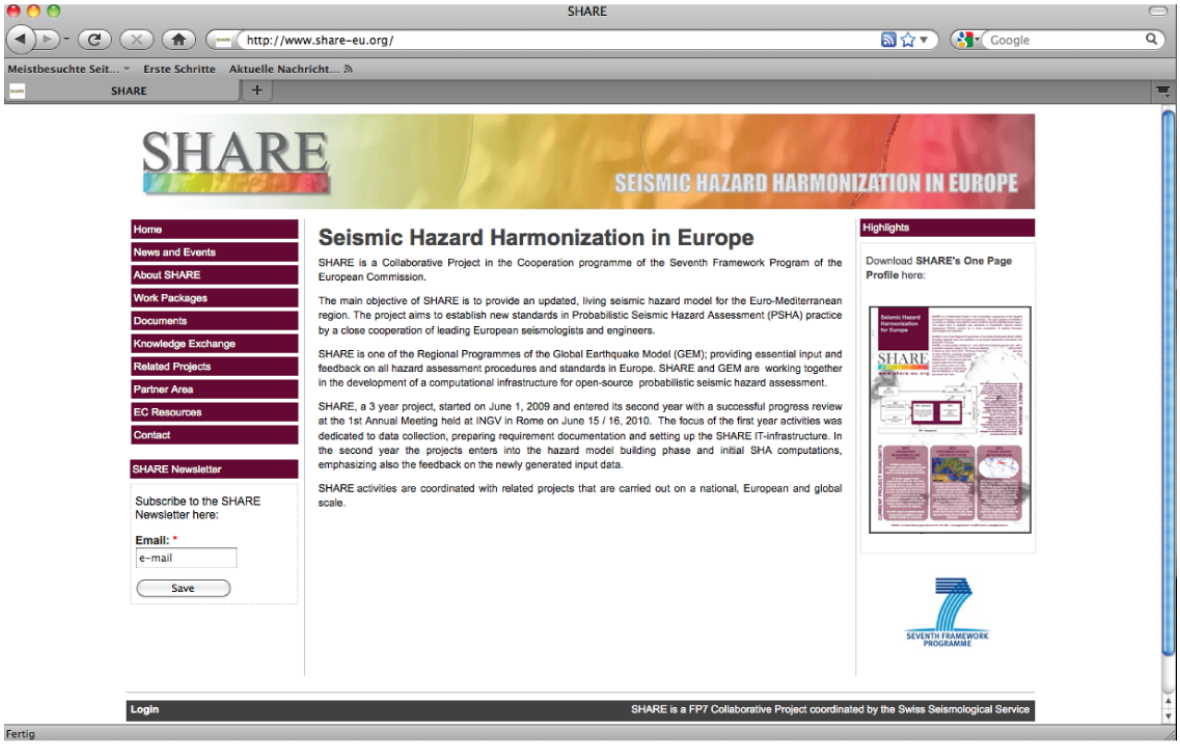
3.1 Corporate Identity

There are two aspects concerning the corporate identity – Graphical and non-Graphical. Graphical aspect refers to the colours, corporate logos and patterns. Non-graphical aspects are the choice of portlets, placement of portlet(s) on the various areas of the portal and the portlets themselves.

Graphical aspects are combined into a template, more precisely a Velocity template. We provide a "SHARE template" that inherits the design considerations already made for setting up the SHARE web page (Figure 1). The use of templates ensures that the portal as it stands can be transferred and used by other projects and authoritative hazard service to display hazard results. Templates are created using HTML, CSS and AJAX scripts

The non-graphical aspect is achieved using concept of portlet layouts. This aspect could be "locked/setup" by the system designer based on the user profiles.

A) SHARE Web-page



B) SHARE Portal

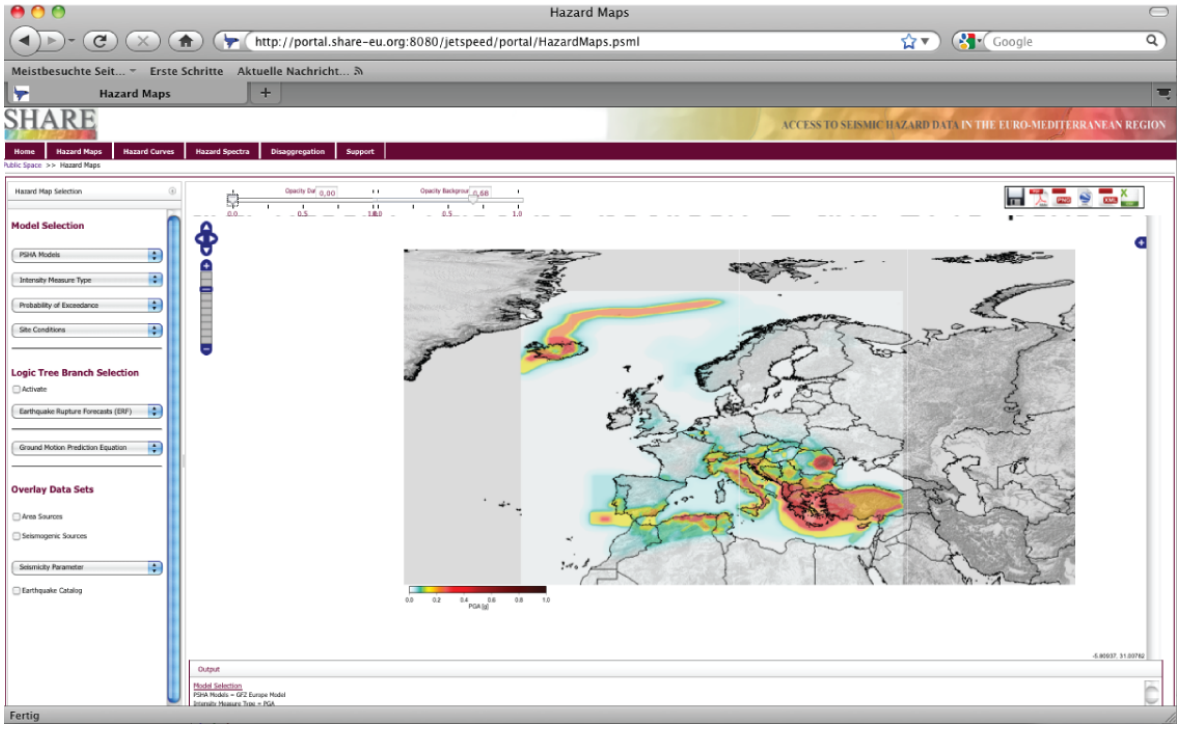


Figure 1: SHARE Corporate identity on A) for the web-page at share-eu.org and B) for the portal at portal.share-eu.org.

3.2 User-system interaction: Portlet outline in terms of usecases

The following portlets to be implemented during the project:

1. Hazard Model Portlet: Static access to hazard model information
2. Hazard Map Portlet (HMP): Interactive access to pre-computed hazard maps
3. Hazard Curve Portlet (HCP): Interactive access to pre-computed hazard curves
4. Hazard Spectra Portlet (HSP): Interactive access to pre-computed hazard spectra
5. Hazard disaggregation Portlet (HDisP): Interactive access to data showing site-dependent hazard disaggregation results.
6. Data Viewer Portlet (DVP): Interactive access to data of the hazard model; examples are access to base-information on regional seismicity (faults, source zones, earthquake catalog(s)), a logic tree explorer.
7. User Guide Portlet (UGP): A portlet that serves intuitive instructions on how to use the portal for various applications, outlining the workflow to reach these purposes.

In deliverable D6.2 we outlined the various portlets. The ones listed above are those that will be implemented during the project during with the priority according to the listing.

We define the design and functionality together with a mockup-tool (Appendix) and implement the GUI accordingly. The GUI remains subject to change for the purpose of a more user-friendly navigation when tools from the open-source community become available.

The portal has assigned general sections in the general layout (Figure 2). We define the uppermost section as the Coorporate Identity bar. Just below, the portlet selection bar offers to switch between the different portlets. The main section is divided in a parameter selection box section to the left – in this example of Figure 2 giving the hazard map selection options – and a display section to the right, in the example displaying a hazard map. The section below the display section is containing the option to display the log window showing the history and the selection of the parameters. Details of the implementation are only outlined for the hazard map portlet (HMP) in the next section.

3.3 Usecase: Hazard Map Portlet (HMP)

The HMP allows the user to access pre-computed results of the PSHA models – that includes test calculations, intermediate calculations of the entire model and the final model - that display information on seismic hazard measures.

User interests:

The user is interested in results of a seismic intensity measure type (IMT) for a particular region. Information on a particular site is obtained through the HCP. The model selection procedure follows an internal logic which turns on / off available options in the more detailed selection process. The logic also implies that availability of data layers change; the user may only overlay data that was used to build the selected hazard model.

The user is presented with a pre-computed hazard map in the extent of the region showing the exceedance probability for a default IMT. The map extends over most 2/3 of the screen size (Figure 2) including **map controls** (zoom and display options) and an **overview map** that can be toggled on / off. The **layer control** allows to overly data set that are independent of the PSHA model (Model independent overlay options). **Export Utilities** are provided in the top right section giving the choice of exporting the data in various formats and also as a printable fact sheet (details below).

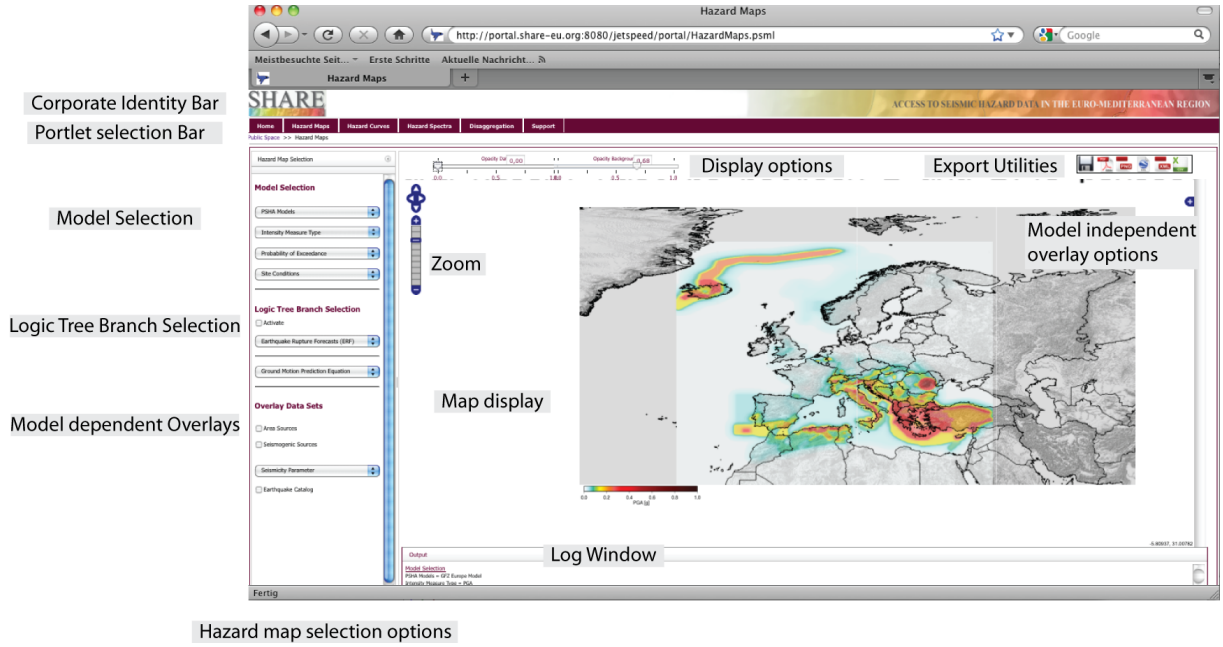


Figure 2: Initial Hazard Map Portlet (HMP) implementation.

Map controls

The user can choose via the **map controls** his region of interest. The map controls use the MapServer-Technology and allow to:

- zoom in and out
- grab the map and move
- move using arrows
- fall back to global map extent
- turn on/off overview map

The **overview map** shows the extent of the map on the pre-computed map extent. The map can be toggled on and off.

Export Utilities:

The export utilities give the user the opportunity to save what has been selected. The window shall be able to be minimized and maximized. Two options shall be implemented:

1. **Save data to Ascii**:

   Save the data that is displayed in a common format (maybe just ascii) including a header with the information from the LOG-Window

2. **PDF export:**

   Generate a one A4 page summary pdf-file. The pdf-file shall contain the map displayed on the web-browser without the control buttons on it. The pdf shall also contain information on what is displayed, so the choices from the model selection and the layer selection shall be printed nicely on the pdf.

3. **KML export**:
   Export the selected model and data as shown in the map to KML that can be displayed on Google Earth. The KML data shall also enable to choose data to be displayed or not on Google Earth, so it shall contain a tree utility to select.
4. Further export options to be defined based on upcoming user needs.

Model independent overlay option (Layer control):

Model independent data is information that is previously stored or that can be aggregated via webservice. Data that can feed here is for example:

- Topography model
- Country borders and name
- City borders, cities and city names
- Rivers
- Street maps
- Satellite maps

Model selection

The hazard model to be displayed can be chosen through various drop-down menus. The choices are dependent on each other and the workflow is defined via logical steps. The drop-boxes can only be used in sequence and become active depending on the previous selection:

1. **PSHA model**:
   Select the PSHA model version. For example, choose between different iteration of the PSHA model for the European-Mediterranean region that were produced during the FP-7 SHARE project. Additionally, national PSHA models or pre-existing models
2. **Probability of Exceedance (PoE)**:
   Select probability of exceedance level corresponding to a specific return period. *Default: 10% in 50 years (475y)*
3. **Intensity measure type (IMT)**:
   Select IMT such as PGA [g], PGV [m/s], PGD [m], SA [g] at a particular frequency, EMS98 intensity and so on. *Default: PGA [g]*
4. **Site condition**:
   Select between different soil condition if available. *Default: reference bedrock*

For a detailed specification on the access to single logic tree branches , details on the logic-tree definition are needed. This will be defined in future.

Logic Tree Branch Selection:

As the logic tree is yet not fully defined, this section of the portal is not yet implemented. The section can be activated with a checkbox and then single branches of the Earthquake Ruture Forecast (ERF) and the logic tree for the Ground Motion Prediction Equations (GMPE) can be chosen.

Model dependent overlay options:

In addition, different layers that display data used to compute the particular PSHA can be added. Examples of these data sets are:

- earthquake catalog
- seismic source zonation
- earthquake activity rates
- b-values
- completeness levels
- prevailing type of faulting
- ground motion attenuation
- Maximum possible magnitude
- Maximum observed magnitude
- individual active faults
- composite seismogenic sources
- a regional overview of models implemented ground motion attenuation

LOG-Window:

The LOG-Window displays the model and layer selections by the user. The window shall be a dynamic, so similarly to the **Overview map** the user can toggle it to a size that the content can be read or to only view it only as a button.

3.4 System design

A brief system design of the SHARE Portal is presented here. The major components are

- Database server (see system design document)
- JEE Application server, containing the Servlet container
- Enterprise Information Portal, containing the Portlet container
- LDAP server
- Map server (see system design document)
- Web Services - * (Interoperability, Security) (see system design document)
- The Database server is running Postgresql 8.3 (with postgis extensions). The postgis extensions are essential for handling spatial information. The database server will be backed up on the ETH Zürich roboter, every evening. (see system design document)
- JBoss 5.1.x, an JEE application server running on a virtual machine is the share production instance. All the web applications (individually mapped to a usecase/functionality).
- Jetspeed 2.2.x, is an Enterprise Information Portal has an in-built Portlet container (Pluto 2.0, which is JSR-286 complaint). Each of these portlets contain the necessary GUI for data/user input and output.
- An LDAP server (openLDAP 2.4.x) will provide the required Access Control mechanism and forms a common user/resource directory.
- UMN MAPSERVER 5.4 is a widely used open source mapserver product. The *SHARE* mapserver will provide the maps on-demand. In addition, another open source product, (see system design document)

"OpenLayers 2.8" will be used to add interactivity to the SHARE hazard maps. Web Service protocols are to be used to achieve SOA. It is used to exchange data between: Portlets (Portal) ↔ Web-Application(Services), Web-Application (Services) ↔ entry points for XML-binding(Data Access) and for Data Services an open source product (from Apache Software Foundation) "Axis2 1.5" is to be used for WS-I and WS-Security protocols.

3.5 Portal design

The Portal framework used is "Jetspeed 2.x" and the portlet container is "Pluto 2.x". . The data transfer format used are as follows:

- XML (& its variants) are the data transfer technologies used
- Web Services (using SOAP, WSDL,...) would be used as transfer mechanism
- KML format will be used for the visualization of 3D geospatial data in programs like Google Earth, Worldwind (NASA)
- GML (the OGC Geography Markup Language) is an XML grammar for expressing geographical features. It is delivered by WMS and WFS services.

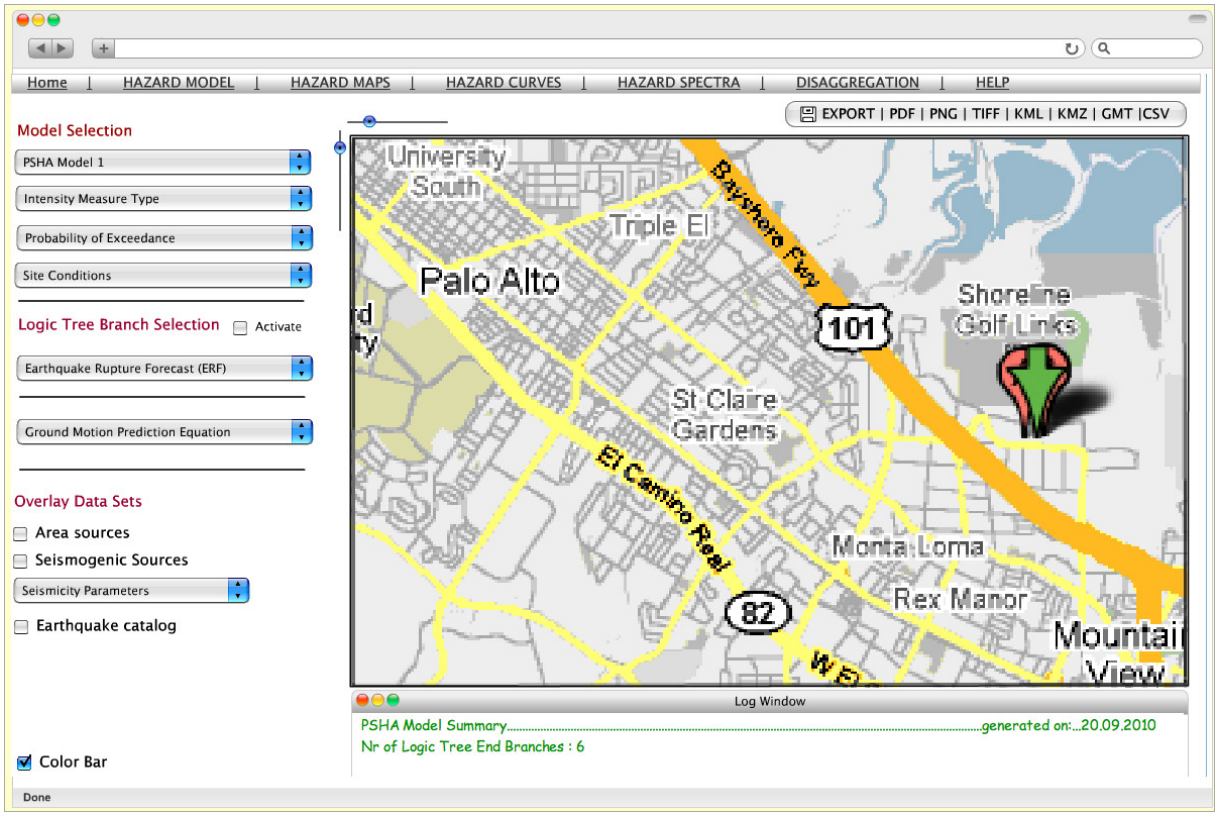
There are "Portlet Producers" and "Portlet Consumers". The Portlet Producers are organizations which take-in data from existing databases/repositories and implement a certain functionality/service using portlet technologies. The Portlet Consumer is the SHARE Portal, which uses the functionalities to supplement its services. This is a value addition to some special clients/users, who would like their services to be hosted on the SHARE portal. This also provides a mechanism to "outsource" the development of certain portlet development and consume portlets from other resources such as www.seismicportal.eu.

The SHARE Portal will not consume data directly from external software agents (for e.g., as a data web service). All data entering the SHARE system has to undergo an Inconsistency/Reality check (a service not available as a portlet).

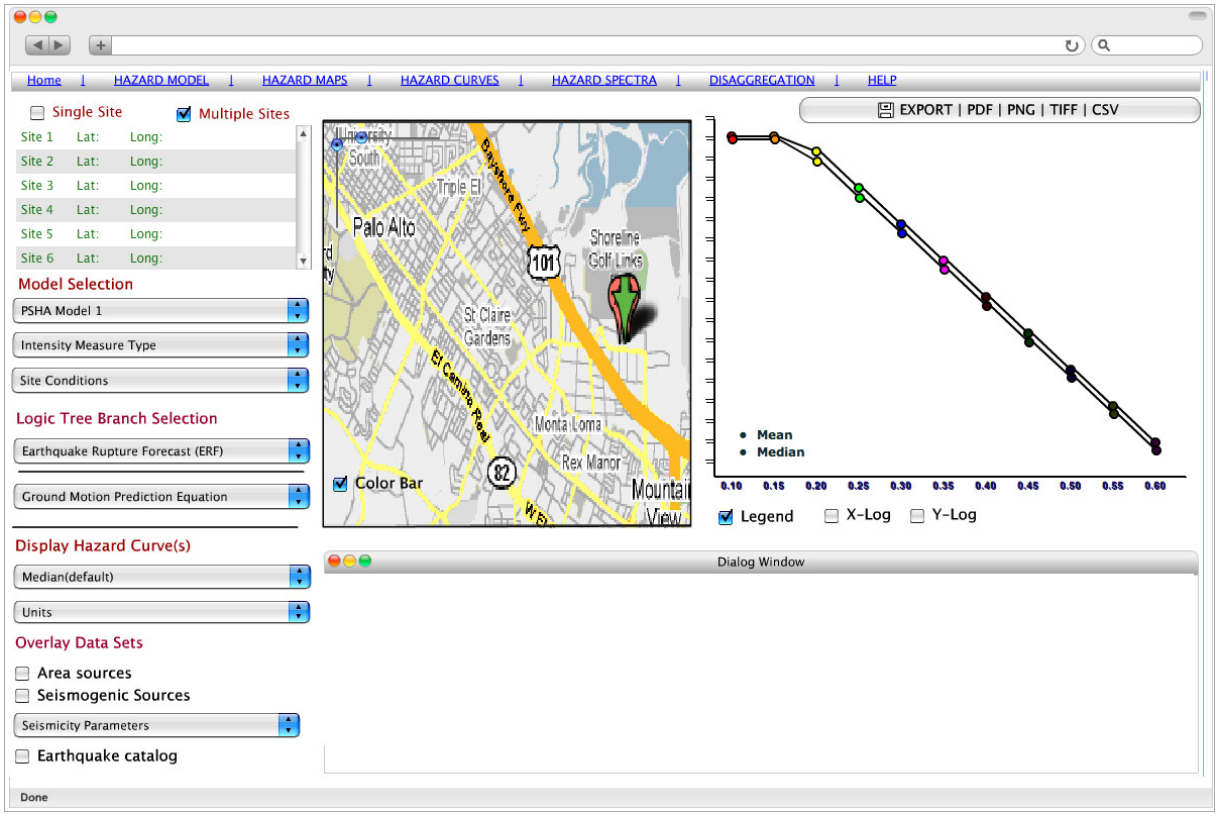
4 Appendix – Snapshots from the Web-based Portal-Mockup tool

This appendix shows snapshots from the web-based portal-mockup tool located at www.lumzy.com.

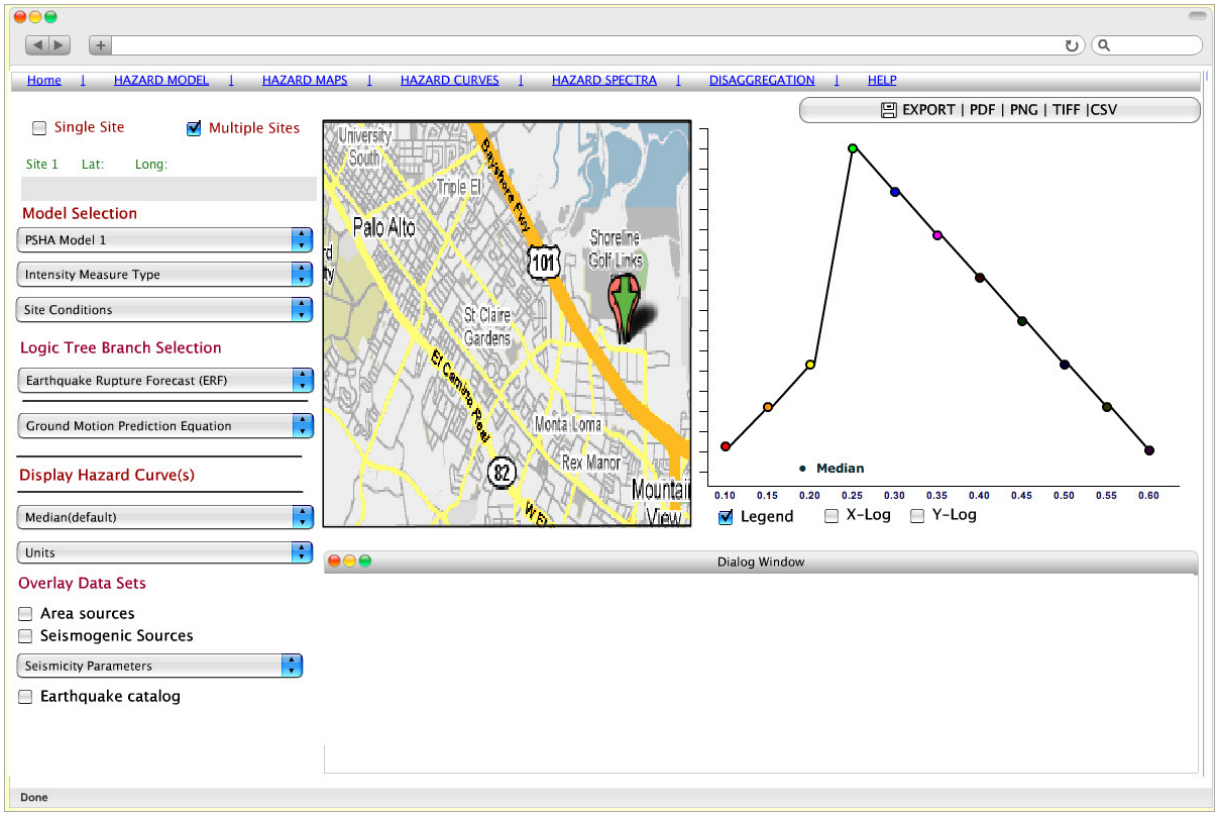
4.1 Hazard Map Portlet Design



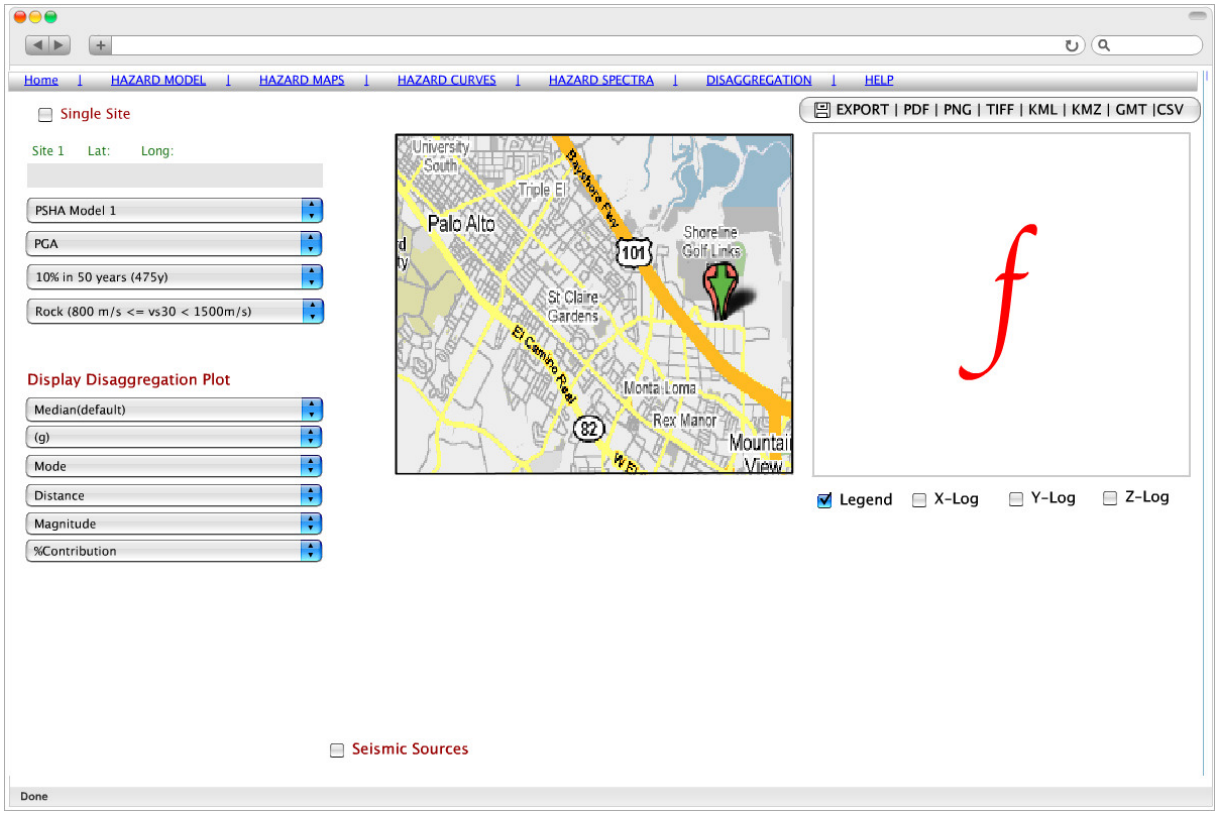
4.2 Hazard Curve Portlet Design



4.3 Hazard Spectra Portlet design



4.4 Hazard Disaggregation Portlet Design



5 Appendix - Glossary

Term definition for technical expressions:

Term	Definition
SDD	Software Design Document
ROI	Return Of Investment
FOSS	Free Open Source Software
SOA	Service Oriented Architecture
ORM	Object Relation Mapping
UI	User Interface
GUI	Graphical User Interface
VM	Virtual Machine
GA	General Availability
RC	Release Candidate
OASIS	Organization for the Advancement of Structured Information Standards
WMS	Web Map Service, an OGC standard to provie localized imaginery for mapping purposes over a web service, along with specified metadata
WFS	Web Feature Service
KML	"Keyhole Markup Language", an XML dialect introduced by Google to describe vectorbased and rasterbased geodata. Compared to GML, KML concentrates on visualization, while GML allows for generic object properties.
GML	"Geography Markup Lnaguage". An XML dialect of the Open Geospatial Consortium and ISO to describe spatial data along with sensor- or measurement data. GML is used e.g. for WFS payloads.
WEB Service	A web based data or functionality service identified by an uniform ressource identifier (URI), and described in its capabilities by an XML (WDSL) document.
Portlet	A portlet is a software component that produces a part of a user interface e.g. as html code, for display by a portal server in a portal. Portlets following the JSR 168 and JSR 168 standards are deployable in most existing portal servers, and allow standardized inter-portlet communication (JSR 268)
OGC	"Open Geospatial Consortium", an NGO invested in standardisation and interoperability of spatial information and related service
JSR	Java Specification Request
REST	Representational State Transfer

Table 1: Term definitions.

Abbreviations for projects, initiatives, and institutions:

Term	Definition	Web presence
EMME	Earthquake Model of the Middle-East	www.emme-gem.org
EMSC	European-Mediterranean Seismological Center	www.emsc-csem.org
GEISIR	Geothermal Engineering Integrating Mitigation of Induced Seismicity in	http://www.geiser-fp7.eu

	Reservoirs	
GEM	Global Earthquake Model	www.globalearthquakemodel.org
NERA	Network of European Infrastructures for Earthquake Risk Assessment and Mitigation	
NERIES	Network of Research Infrastructures for European Seismology	www.neries-eu.org
SERIES	Seismic Engineering Research infrastructures for European Synergies	
SYNER-G	Systemic Seismic Vulnerability and Risk Analysis for Buildings, Lifeline Networks and Infrastructures Safety Gain	http://www.vce.at/SYNER-G/

Table 2: Abbreviations for related projects, initiatives and institutions.