

**Methodology document for the WHO
e-atlas of disaster risk.
Volume 1. Exposure to natural hazards
Version 2.0**

Seismic hazard distribution map



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Preface

Being able to conduct geographically based risk assessment at the sub national level requires being in a position to spatially distribute all the elements reported in following conceptual formula¹:

$$\text{Risk} \propto \frac{\text{Hazard} \times \text{Vulnerability}}{\text{Capacity}}$$

This process being very much driven by the type of hazard faced by the population and/or the key infrastructures in a given country the World Health Organization has been working, since 2006 on the development and improvement of an electronic atlas which could stimulate ministries of health and other health stakeholders to improve their disaster management capacity as well as serve as the entry point for conducting sub national geographically based risk assessments.

The WHO e-atlas of disaster risk models the distribution of natural hazards and population's exposure and provides baseline data and maps needed to advocate for resources to improve disaster preparedness; aid emergency response measures; and assist in identifying, planning and prioritizing areas for mitigation activities.

The first version of the e-atlas published in 2008 covered the WHO Eastern Mediterranean Region (22 countries) and five natural hazards (flood, seismic [earthquake], landslide, heat and wind speed) and was distributed to more than 500 users.

Encouraged by this success, working in close collaboration with the WHO Regions and taking advantage of the establishment of the Vulnerability and Risk Analysis and Mapping programme (VRAM), it was decided to publish a second version of the e-atlas that would, this time, also the 46 countries forming the WHO African Region as well as 32 countries of the WHO European Region (due to limited resources, this version of the e-atlas focuses on Central Europe only).

Building on the successful collaboration established between the Taroudant polydisciplinary faculty of Ibn Zohr University, Agadir, Morocco and the VRAM, most of the models used in the first version of the e-atlas have been improved and heat replaced by heat wave, a current preoccupation of many ministries of health.

In order to allow for any other region or country to also apply the models on their own it has been decided to document not only the research behind the models but also provide users with a protocol that would allow them to generate the final hazard distributions maps. The present series of methodology document is the result of this documentation.

¹ Modified from: Office of the United Nations Disaster Relief Co-ordinator (UNDRO). *Mitigating natural disasters. phenomena, effects and options. A manual for policy makers and planners*. New York, United Nations, 1991.

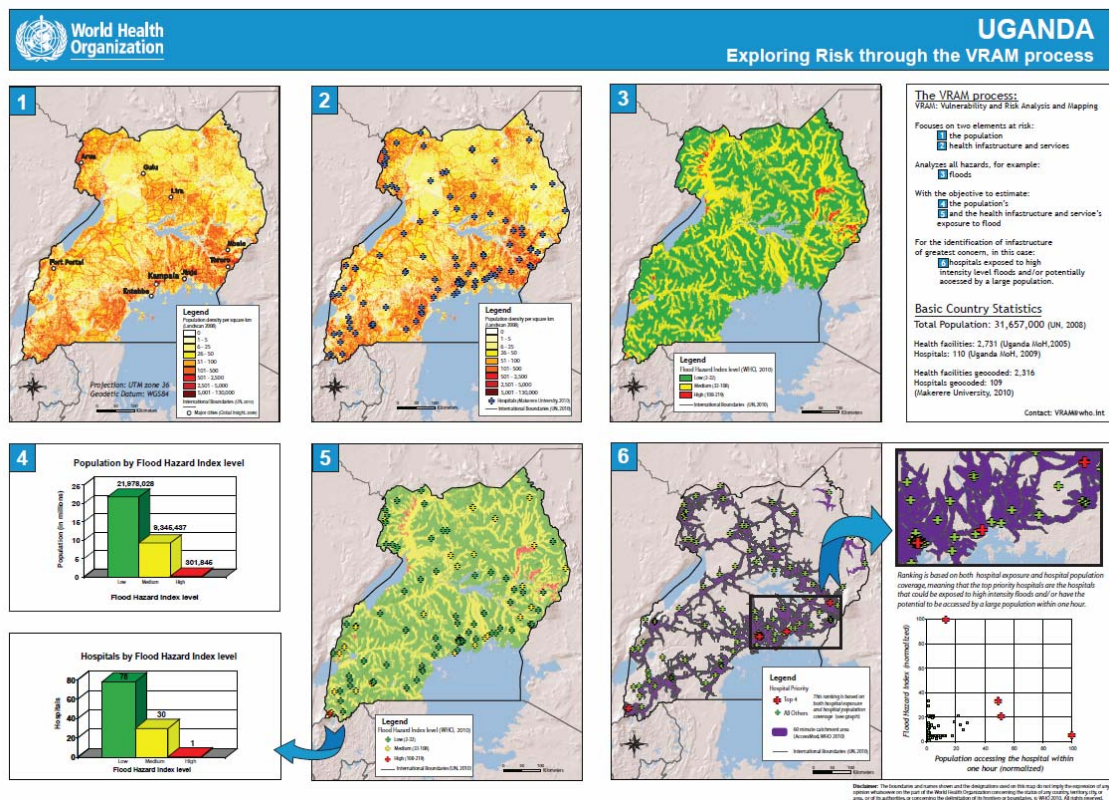
It is important to underline that the hazard distribution maps resulting from the application of these models are nevertheless only the first step of a process allowing countries to assess their risk at the sub national level.

Analysing vulnerability and capacity require a process which is difficult to be applied at the level of a region for the following reasons:

- availability of desegregated data
- incompatibility of indicators from one country to an other
- important differences in terms of health context between one country and another.

WHO has therefore been looking at having the vulnerability, capacity and therefore indirectly risk analysis, conducted on a country by country basis.

In this context, the VRAM is supporting Member States and partners to strengthen their capacity in order to conduct such analysis and have it presented in a manner such as the figure below.



The result of such analysis is then to be integrated in the country Disaster Risk Reduction (DRR) and Health Emergency Preparedness and Response Programmes (HEPRP) and serve, among other things, to build safer hospital, improve mass casualties' management and help specialized units within health Organizations (including MoH) for public health planning.

At the same time, the baseline data, information and maps collected or produced through the process can be used by health authorities and partners to take informed decisions in times of crises.

1. Introduction

This document describes the methodology and protocol developed by the Taroudant polydisciplinary faculty of Ibn Zohr University in close collaboration with the VRAM and then used to generate and document maps presenting the spatial distribution of seismic hazard for the *WHO e-atlas of disaster risk, volume 1: exposure to natural hazards, Version 2.0*.

The seismic hazard distribution map used in the atlas has been extracted from the global seismic risk data developed in the context of the Global Seismic Hazard Assessment Project (GSHAP), on which three other layers have been overlaid:

- the past significant earthquakes,
- the past significant volcanic eruptions,
- the tectonic plate boundaries.

This document aims at GIS technicians willing to better understand the method behind the creation of these maps part of the WHO e-atlas of disaster risk and/or willing to apply this method to their own data and country.

The method presented here is similar to the one used for generating the first version of the *WHO e-atlas of disaster risk, volume 1: exposure to natural hazards*, except that some of the datasets has been updated since then.

The methods outlined in this document could be applied to other geographic areas than those already covered in this new version of the e-atlas. The availability of pre-existing hazard data required minimal data preparation and manipulation to create the final map for the atlas.

2. Software used to perform the work

The implementation of the processes described in this document requires the following software running on a personal computer running Windows:

- ArcView 3.x with the Spatial Analyst 1.1 extension, both developed by the Environmental Systems Research Institute (Esri) Inc., for the geospatial operations
- Generic Mapping Tools for Windows open-source collection of tools for manipulating geographic and Cartesian datasets. Available from <http://gmt.soest.hawaii.edu/> [Accessed December 15, 2010].

3. Description of the data

The three datasets that have been used are described in this chapter.

3.1 The Global Seismic Hazard Assessment Project (GSHAP)

The Global Seismic Hazard Assessment Program (GSHAP) was launched in 1992 by the International Lithosphere Program (ILP) with the support of the International Council of Scientific Unions (ICSU) and endorsed as a demonstration programme within the framework of the United Nations International Decade for Natural Disaster Reduction (UN/IDNDR). The GSHAP project terminated in 1999.

The dataset which resulted from this project is freely downloadable from the GSHAP home page at: <http://www.seismo.ethz.ch/GSHAP/> [Accessed December 15, 2010].

Four main elements have been combined together through the use of a probabilistic model [Giardini et al., 1999].

- *Earthquake catalogues and databases* is a compilation of a uniform database and catalogue of seismicity for the historical (pre-1900), early-instrumental (1900–64) and instrumental periods (1964–today).
- *Earthquake source characterization* is a master seismic source model to describe the spatial–temporal distribution of earthquakes, using evidence from earthquake catalogues, seismotectonics, paleoseismology, geomorphology, mapping of active faults, geodetic estimates of crustal deformation, remote sensing and geodynamic models.
- *Strong seismic ground motion* is derived from the evaluation of ground-shaking as a function of earthquake size and distance, taking into account propagation effects in different tectonic and structural environments and using direct measures of the damage caused by the earthquake (the seismic intensity) and instrumental values of ground motions.
- *Computation of seismic hazard* is computed from the probability of occurrence of ground shaking in a given time period, to produce maps of seismic hazard and related uncertainties at appropriate scales.

The resulting map contains the global distribution of the peak ground acceleration (PGA), at a 6-minute resolution (0.1°) and expressed in m/s^2 , with a 10% chance of exceedance (90% chance of non-exceedance) of some ground motion parameter for an exposure time of 50 years and a corresponding return period of 475 years.

An advantage of the use of these data is that PGA is proportional to the horizontal force and is the most commonly mapped ground motion parameter. A second advantage of PGA-based models is that PGA is used as a reference for the construction of buildings that should be able to withstand an earthquake.

The data are in Generic Mapping Tools (GMT) **.grd** format. Using these data in a Windows environment requires the installation of a Unix/Linux emulator and GMT or GMT for Windows. The dataset must then be written to ASCII grid format to be imported into ArcView and then interpolated using a high-power inverse distance weighted (IDW) interpolation.

3.2 Other layers overlaid on top of the GSHAP layer

The following three layers have been overlaid on top of the GSHAP database for the user to take into account the seismic events which occurred after the last update of this database:

- The Significant Earthquakes Database (SED) which provides precise locations, magnitudes, intensities and effects of major earthquakes from 2150 BCE to present;
- The Significant Volcanic Eruption Database which is a global listing of over 500 significant eruptions which includes information on the latitude, longitude, elevation, type of volcano, and last known eruption. A significant eruption is classified as one that meets at least one of the following criteria: caused fatalities, caused moderate damage (approximately \$1 million or more), with a Volcanic Explosivity Index (VEI) of 6 or larger, caused a tsunami, or was associated with a major earthquake;
- The Tectonic Plate Boundaries Database. This data set was created by the PLATES Project of the University of Texas to aid in research into plate tectonic and geologic reconstructions and modelling

These datasets are all housed at the US National Geophysical Data Center (NGDC) and available online from: <http://www.ngdc.noaa.gov/mndc/struts/form?t=101650&s=1&d=1> or (<http://map.ngdc.noaa.gov/website/seg/hazards/viewer.htm> [Accessed December 15, 2010].

4. Preparation of the data

4.1 GSHAP data


1. Access and download the GSHAP dataset called **gshap_globe.grd.bz2** at <http://www.gfz-potsdam.de/portal/gfz/Struktur/Departments/Department+2/sec26/services/GSHAP-Data> [Accessed December 15, 2011].
2. Extract the contents **gshap_globe.grd**.
3. Install Generic Mapping Tools for Windows to gain access to the GMT routines. There is also a lot of solid guidance from <http://gmt.soest.hawaii.edu/> [Accessed December 15, 2010]
4. With Win4GMT (Graphic Interface for Generic Mapping Tools) , use the `grd2xyz` function from Programs>Convert or >Extract Subsets of Data on **gshap_globe.grd**. The resulting file **GSHAP.xyz** contains ASCII x,y,z triplets of the GSHAP data.
5. Open **GSHAP.xyz** in Microsoft Word and add column headings (Lon, Lat, PGA) to the ASCII data; save the file as **GSHAP.txt**.
6. In ArcView, add this table and run a query to select the points within the area covered by this version of the e-atlas **st_ar_int_bord.shp**, by using the Table>Query option and entering the following formula in the box: ([Lon] >= -25) and ([Lon] <= 92) and ([Lat] >= -46) and ([Lat] <= 64)
7. Export the results of the query to dBase format; save the table **st_ar_gshape.dbf**.

8. Create the spatial data from these tabular data **st_ar_gshape.dbf** by using View>Add Event Theme.
9. Make the event theme active and choose Theme>Convert to Shapefile; save as **st_ar_gshape_pst.shp**
10. Load the shapefile and, using Surface>Interpolate Grid, interpolate a raster with the cell size set to 0.1°. Use inverse-weighted distance interpolation (IDW) with the power set to 10 and a fixed search radius of 0.00000001° (to minimize the effect of surrounding cells on the value of a cell). The resulting raster cells will have values that approximated the values of the *x,y* coordinates to five decimal places.
11. Resample the resulting grid to fit the characteristics of the other layers (0.008333°; approximately 1 km of resolution at the equator) and save the result as **st_ar_seis_ucl**. The metadata for this layer are presented in Annex 1.
12. Reclassify this grid containing the peak ground acceleration (m/s²) into the five hazard intensity levels presented in Table 1, and save the resulting grid under **st_ar_sei_cl** . The metadata for this layer are presented in Annex 1.

Table 1. Seismic hazard intensity levels and corresponding GSHAP PGA ranges

Hazard intensity level	Peak ground acceleration (m/s²)
Very low	0–0.2
Low	0.2–0.8
Medium	0.8–2.4
High	2.4–4
Very high	>4

4.2 Significant Earthquakes Database

1. Access the database at <http://map.ngdc.noaa.gov/website/seg/hazards/viewer.htm> [Accessed December 15, 2010].
2. Click on the ArcIMS Interactive Map.
3. Under layers, click on the “All Significant Earthquake” and “Significant Volcanic Eruptions” buttons to make the list of these layers visible and active
4. Click on the select by rectangle  to select the features “All Significant Earthquake” and “Significant Volcanic Eruptions” within the area covered by this version of the atlas

5. Click on the Extract tool to download a zipped Shapefile containing “All Significant Earthquake “Significant Volcanic Eruptions” and “tectonic plate boundaries” and save as **st_ar_signi_quakes_volcano_plates.zip**
6. Unzip the downloaded file and rename each shapefile as **st_ar_signi_quakes.shp**, **st_ar_signi_volcanoes.shp**, and **st_ar_plates.shp**.

The associated metadata for these 3 layers can respectively be found in Annex 2, 3 and 4.

5. Creation of the maps

The maps presented in the atlas are built by overlaying the location of the past significant earthquakes and volcanic eruptions coming from the Significant Earthquake Database (SED) as well as the location of the significant seismic events extracted from the World Stress Map (WSM) dataset on top of the GSHAP layer. The map resulting from the application of this approach for the European Region is reported in Figure 1. Please refer to the e-atlas DVD itself for the maps covering the other two WHO Regions. The associated metadata for these layers can be found in Annex 5.

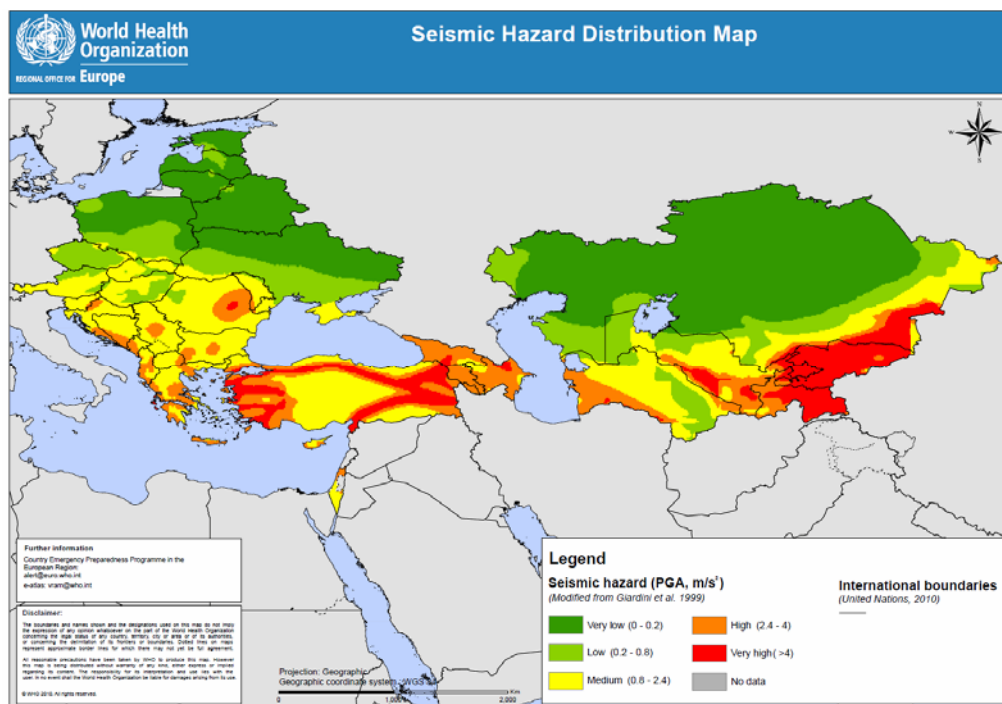


Figure 1. Seismic hazard distribution map for the countries of the European Region covered in this version of the *WHO e-atlas of disaster risk*

References

Giardini D, Grünthal G, Shedlock KM, Zhang P, 1999. The GSHAP Global Seismic Hazard Map. *Annali di geofisica*, 42:1225–30.

Heidbach O, Tingay M, Barth A, Reinecker J, Kurfeß D, Müller B, 2009. The 2009 release of the World Stress Map (available online at <http://dc-app3-14.gfz-potsdam.de/>; [Accessed December 15, 2010]).

Annex 1. Metadata for the peak ground acceleration distribution layer

Dataset title	Spatial distribution of the peak ground acceleration for the WHO Regions (Africa, Eastern Mediterranean and part of Europe)
Theme keywords	WHO, Africa, Eastern Mediterranean, Europe, natural disaster, Geographic Information System (GIS), natural hazard,, earthquakes, seismic, peak ground acceleration
Dataset topic category	Seismic
Geographic location	The layer cover a total of 100 countries (22 for the Eastern Mediterranean, 46 for Africa and 32 for Europe)
Publication date	1999
Data exchange format	ArcView grid
Filename	st_ar_seis_ucl
Dataset edition	Second edition
Abstract	This layer contains the spatial distribution of the peak ground acceleration for the WHO Regions (Africa, Eastern Mediterranean and part of Europe)
Lineage	This layer has been extracted from the Global Seismic Hazard Assessment Project (GSHAP) dataset as described in the Methodology for the preparation of the seismic hazard distribution map document that can be found in the first volume (2nd edition) of the <i>WHO e-atlas of disaster risk for the WHO Regions (Africa, Eastern Mediterranean and part of Europe)</i>
Data quality comments	During the compilation of the global seismic hazard map, worldwide seismic hazard values were updated. Specifically, when seismic hazards exist in a region that extends across international boundaries, the hazard values have been adjusted to account for differences in how seismicity is measured from country to country
Source map format	Digital map
Source map name	Global seismic hazard map
Distributor	US Geological Survey, Swiss Seismological Service,

	International Lithosphere Program
Spatial representation type	Grid
Map projection	Unprojected (Geographic)
Reference system	WGS 84 datum
Geographic box	X min: -25.358747°, X max: 91.8287° Y min: -46.978931°, Y max: 63.459827°
Resolution	30 arc-seconds (0.008333°)
Access and use constraints	All GSHAP products and maps are available freely and are not covered by copyright, provided that the source is cited
Acknowledgement	Global Seismic Hazards Assessment Program (GSHAP)
Online linkage	http://www.seismo.ethz.ch/GSHAP/index.html
Dataset language	English
Dataset character set	ASCII
Metadata provider	WHO Mediterranean Centre for Health Risk Reduction (WMC)
Metadata contact	El Morjani Zine El Abidine BP 3566 Poste Talborjt 80000 Agadir Morocco Telephone: +212 528 28 55 30 email: elmorjaniz@gmail.com
Metadata date	20110301
Metadata language	English
Metadata character set	ASCII
Metadata standard	ISO 19115

Annex 2. Metadata for the past significant earthquakes database

Dataset title	Spatial distribution of the past significant earthquake database for the WHO Regions (Africa, Eastern Mediterranean and part of Europe)
Theme keywords	WHO, Africa, Eastern Mediterranean, Europe , Geographic Information System (GIS), earthquakes, seismic, seismology
Dataset topic category	Seismic
Geographic location	The layer covers a total of 100 countries (22 for the Eastern Mediterranean, 46 for Africa and 32 for Europe)
Publication date	2010
Period	2150 BC to 2010
Data exchange format	ArcView shapefile
Filename	st_ar_signi_quakes.shp
Abstract	<p>This data layer represents significant historical earthquake location for WHO Regions (Africa, Eastern Mediterranean and part of Europe). This dataset contains information on destructive earthquakes from 2150 B.C. to the 2010 that meet at least one of the following criteria: Moderate damage (approximately \$1 million or more), 10 or more deaths, Magnitude 7.5 or greater, Modified Mercalli Intensity X or greater, or the earthquake generated a tsunami.</p>
Lineage	<p>The process used to extract the significant earthquake database layer for the WHO Regions (Africa, Eastern Mediterranean and part of Europe) is described in section 4.2 of the Methodology for the preparation of the seismic hazard distribution map document that can be found in the first volume (2nd edition) of the <i>WHO e-atlas of disaster risk for the WHO Regions (Africa, Eastern Mediterranean and part of Europe)</i></p>
Source map format	Digital map
Source map name	Significant earthquakes
Distributor	National Oceanic and Atmospheric Administration/National Environmental Satellite Data and Information Service/ National Geophysical Data Center, U.S. Department of Commerce (NOAA/NESDIS/NGDC)
Spatial representation type	Vector

Geometric object type	Point
Map projection	Unprojected (geographic)
Reference system	WGS-84 datum
Geographic box	X min: -25.358747°, X max: 91.8287° Y min: -46.978931°, Y max: 63.459827°
Access and use constraints	None
Acknowledgements	National Geophysical Data Center / World Data Center (NGDC/WDC) Significant Earthquake Database, Boulder, CO, USA
Online linkage	http://map.ngdc.noaa.gov/website/seg/hazards/viewer.htm , www.ngdc.noaa.gov/hazard/sig_srch.shtml
Dataset language	English
Dataset character set	ASCII
Metadata provider	WHO Mediterranean Centre for Health Risk Reduction (WMC)
Metadata contact	El Morjani Zine El Abidine BP 3566 Poste Talborjt 80000 Agadir Morocco Telephone: +212 528 28 55 30 email: elmorjaniz@gmail.com
Metadata date	20110401
Metadata language	English
Metadata character set	ASCII
Metadata standard	ISO 19115

Annex 3. Metadata for the past significant volcanic eruptions database

Dataset title	Spatial distribution of the significant volcanic eruption database for the WHO Regions (Africa, Eastern Mediterranean and part of Europe)
Theme keywords	WHO, Africa, Eastern Mediterranean, Europe , Geographic Information System (GIS), Volcanoes, volcanic, eruption.
Dataset topic category	Seismic
Geographic location	The layer covers a total of 100 countries (22 for the Eastern Mediterranean, 46 for Africa and 32 for Europe)
Publication date	2010
Period	435 BC to 2010
Data exchange format	ArcView shapefile
Filename	st_ar_signi_volcanoes.shp
Abstract	<p>This data layer represents significant volcanic eruption location for WHO Regions (Africa, Eastern Mediterranean and part of Europe). A significant eruption is classified as one that meets at least one of the following criteria: caused fatalities, caused moderate damage (approximately \$1 million or more), with a Volcanic Explosivity Index (VEI) of 6 or larger, caused a tsunami, or was associated with a major earthquake.</p>
Lineage	<p>The process used to extract the significant volcanic eruption database layer for the WHO Regions (Africa, Eastern Mediterranean and part of Europe) is described in section 4.2 of the Methodology for the preparation of the seismic hazard distribution map document that can be found in the first volume (2nd edition) of the <i>WHO e-atlas of disaster risk for the WHO Regions (Africa, Eastern Mediterranean and part of Europe)</i></p>
Source map format	Digital map
Source map name	Significant volcanic eruption
Distributor	National Oceanic and Atmospheric Administration/National Environmental Satellite Data and Information Service/ National Geophysical Data Center, U.S. Department of Commerce (NOAA/NESDIS/NGDC).
Spatial representation type	Vector

Geometric object type	Point
Map projection	Unprojected (geographic)
Reference system	WGS-84 datum
Geographic box	X min: -25.358747°, X max: 91.8287° Y min: -46.978931°, Y max: 63.459827°
Access and use constraints	None
Acknowledgements	National Geophysical Data Center / World Data Center (NGDC/WDC) Significant Volcanic Eruptions Database, Boulder, CO, USA
Online linkage	http://map.ngdc.noaa.gov/website/seg/hazards/viewer.htm
Dataset language	English
Dataset character set	ASCII
Metadata provider	WHO Mediterranean Centre for Health Risk Reduction (WMC)
Metadata contact	El Morjani Zine El Abidine BP 3566 Poste Talborjt 80000 Agadir Morocco Telephone: +212 528 28 55 30 email: elmorjaniz@gmail.com
Metadata date	20110401
Metadata language	English
Metadata character set	ASCII
Metadata standard	ISO 19115

Annex 4. Metadata for the tectonic plate boundaries database

Dataset title	Spatial distribution of the tectonic plate boundaries for the WHO Regions (Africa, Eastern Mediterranean and part of Europe)
Theme keywords	WHO, Africa, Eastern Mediterranean, Europe , Geographic Information System (GIS), tectonic, plate
Dataset topic category	Seismic
Geographic location	The layer covers a total of 100 countries (22 for the Eastern Mediterranean, 46 for Africa and 32 for Europe)
Publication date	1998
Data exchange format	ArcView shapefile
Filename	st_ar_plates.shp
Abstract	This data layer represents the plate boundaries dataset for WHO Regions (Africa, Eastern Mediterranean and part of Europe). It contains attributes such as the name and type of the boundary. This data set was created by the PLATES Project of the University of Texas to aid in research into plate tectonic and geologic reconstructions and modelling
Lineage	The process used to extract the tectonic plate boundaries database layer for the WHO Regions (Africa, Eastern Mediterranean and part of Europe) is described in section 4.2 of the Methodology for the preparation of the seismic hazard distribution map document that can be found in the first volume (2nd edition) of the <i>WHO e-atlas of disaster risk for the WHO Regions (Africa, Eastern Mediterranean and part of Europe)</i>
Source map format	Digital map
Source map name	Global Tectonic Plate Boundaries
Distributor	National Oceanic and Atmospheric Administration/National Environmental Satellite Data and Information Service/ National Geophysical Data Center, U.S. Department of Commerce (NOAA/NESDIS/NGDC).
Spatial representation type	Vector
Geometric object type	Lines
Map projection	Unprojected (geographic)

Reference system	WGS-84 datum
Geographic box	X min: -25.358747°, X max: 91.8287° Y min: -46.978931°, Y max: 63.459827°
Access and use constraints	None
Acknowledgements	PLATES Project, University of Texas Institute for Geophysics and National Geophysical Data Center / World Data Center (NGDC/WDC)
Online linkage	http://map.ngdc.noaa.gov/website/seg/hazards/viewer.htm
Dataset language	English
Dataset character set	ASCII
Metadata provider	WHO Mediterranean Centre for Health Risk Reduction (WMC)
Metadata contact	El Morjani Zine El Abidine BP 3566 Poste Talborjt 80000 Agadir Morocco Telephone: +212 528 28 55 30 email: elmorjaniz@gmail.com
Metadata date	20110501
Metadata language	English
Metadata character set	ASCII
Metadata standard	ISO 19115

Annex 5. Metadata for the intensity level of seismic hazard distribution layer

Dataset title	Spatial distribution of the intensity level of seismic hazard for the WHO Regions (Africa, Eastern Mediterranean and part of Europe)
Theme keywords	WHO, Africa, Eastern Mediterranean, Europe, natural disaster, Geographic Information System (GIS), natural hazard,, earthquakes, seismic, peak ground acceleration
Dataset topic category	Seismic
Geographic location	The layer cover a total of 100 countries (22 for the Eastern Mediterranean, 46 for Africa and 32 for Europe)
Publication date	20110301
Data exchange format	ArcView grid
Filename	st_ar_sei_cl
Dataset edition	Second edition
Abstract	This dataset contains the spatial distribution of the intensity level of seismic hazard for the WHO Regions (Africa, Eastern Mediterranean and part of Europe) according to five intensity levels (very low, low, medium, high and very high)
Lineage	The intensity level of seismic hazard distribution map has been extracted from the Global Seismic Hazard Map using the process described in the Methodology for the preparation of the seismic hazard distribution map document that can be found in the first volume (2nd edition) of the <i>WHO e-atlas of disaster risk for the WHO Regions (Africa, Eastern Mediterranean and part of Europe)</i>
Data quality comments	During the compilation of the global seismic hazard map, worldwide seismic hazard values were updated. Specifically, when seismic hazards exist in a region that extends across international boundaries, the hazard values have been adjusted to account for differences in how seismicity is measured from country to country
Source map format	Digital map
Source map name	Global seismic hazard map
Distributor	US Geological Survey, Swiss Seismological Service, International Lithosphere Program

Spatial representation type	Grid
Map projection	Unprojected (Geographic)
Reference system	WGS 84 datum
Geographic box	X min: -25.358747°, X max: 91.8287° Y min: -46.978931°, Y max: 63.459827°
Resolution	30 arc-seconds (0.008333°)
Access and use constraints	All GSHAP products and maps are available freely and are not covered by copyright, provided that the source is cited
Acknowledgement	Global Seismic Hazards Assessment Program modified by WHO (2011)
Disclaimer	All reasonable precautions have been taken by WHO to produce this layer. However this layer is being distributed without warranty of any kind, either express or implied, regarding its content. The responsibility for its interpretation and use lies with the user. In no event shall the World Health Organization be liable for damages arising from its use
Online linkage	<u>Under</u> construction
Dataset language	English
Dataset character set	ASCII
Metadata provider	WHO Mediterranean Centre for Health Risk Reduction (WMC)
Metadata contact	El Morjani Zine El Abidine BP 3566 Poste Talborjt 80000 Agadir Morocco Telephone: +212 528 28 55 30 email: elmorjaniz@gmail.com
Metadata date	20110301
Metadata language	English
Metadata character set	ASCII
Metadata standard	ISO 19115