

**The role of geological cartography
in the assessment
of natural hazards:
the new EC-funded database
of European seismogenic sources**

**G. Valensise, J. Woessner,
L. Danciu, D. Giardini,
and the SHARE Consortium**

SHARE



Seismic Hazard Harmonization in Europe



ETH

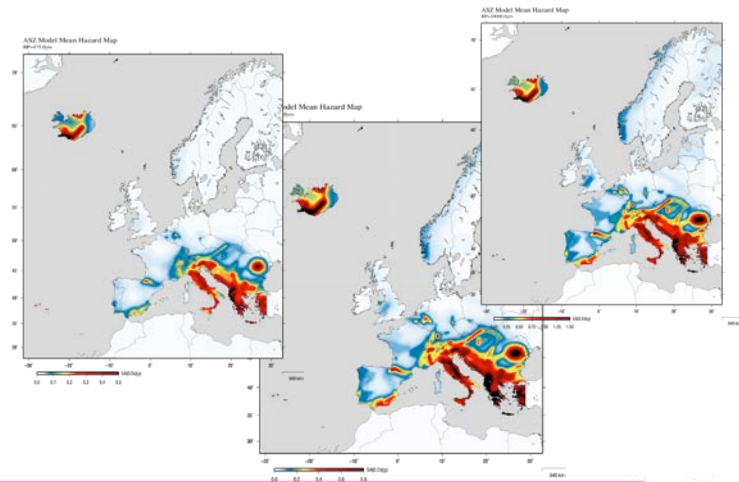
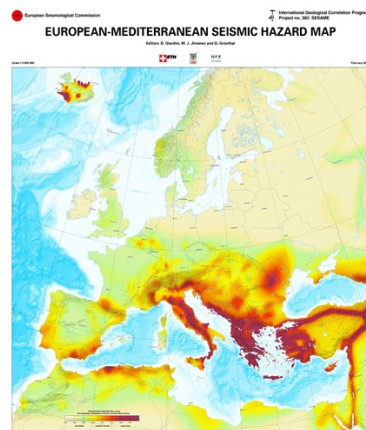
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

June 2009 – May (November) 2012

www.share-eu.org

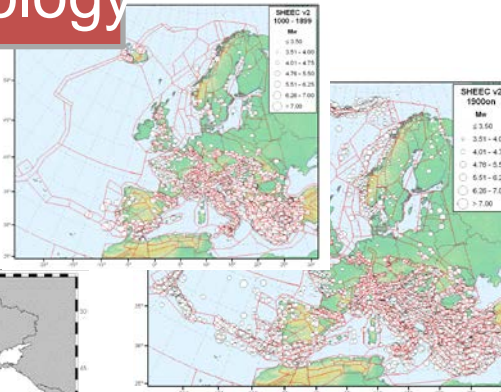
General Objectives

- **Harmonize** hazard assessment across national borders
 - On data level and procedural level
- Keep close connection with **engineering requirements** (for revision of EC8 and national annexes and future revision)
- Create a **community-based time-independent (rock)** hazard model with **update mechanism** for the whole Euro-Mediterranean region

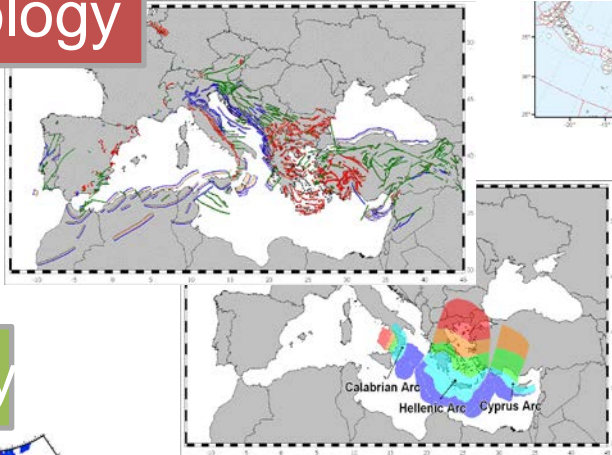


Model Ingredients

Seismology

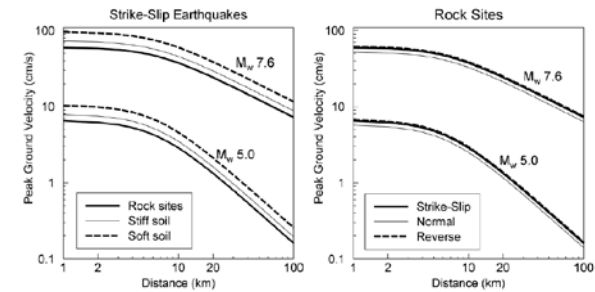


Geology

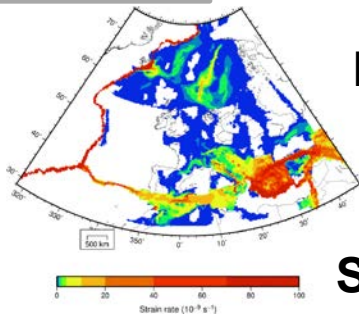


Seismicity

Ground Motion Prediction Equations



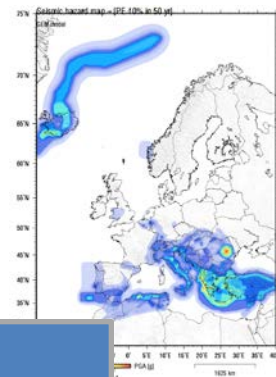
Geodesy



Fault / Deformation Model

Strain Model

SHARE Hazard Model



SHARE Consortium – 18 Beneficiaries

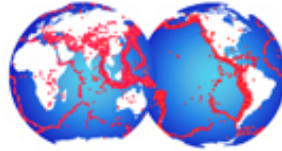


More than 300 contributing scientists
from virtually all of Europe (participants & elicited experts)

Integration / Collaboration

Global

A public - private partnership



GEM

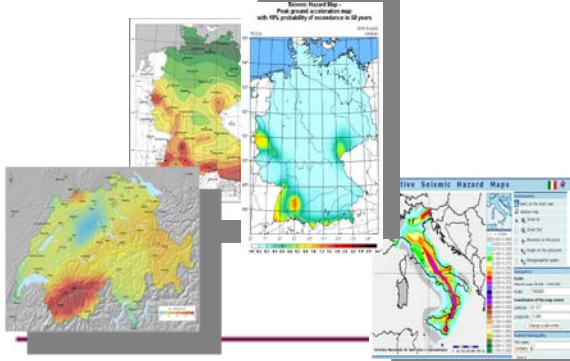
Global Earthquake Model

Regional components



SHARE

National / Bilateral SHA projects

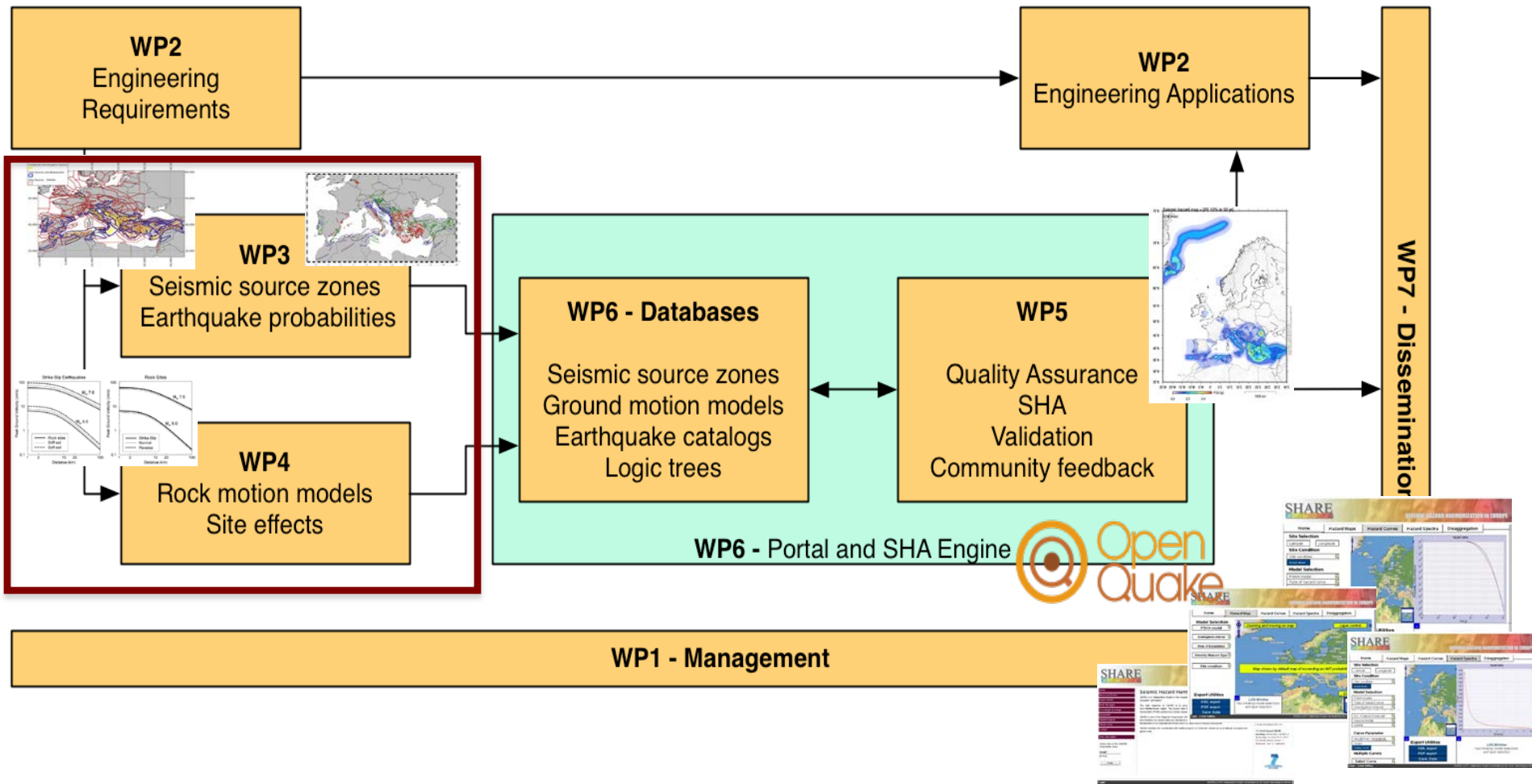


EU-Projects: NERIES, SAFER, TRANSFER, LESSLOSS, SYNER-G, SERIES, NERA

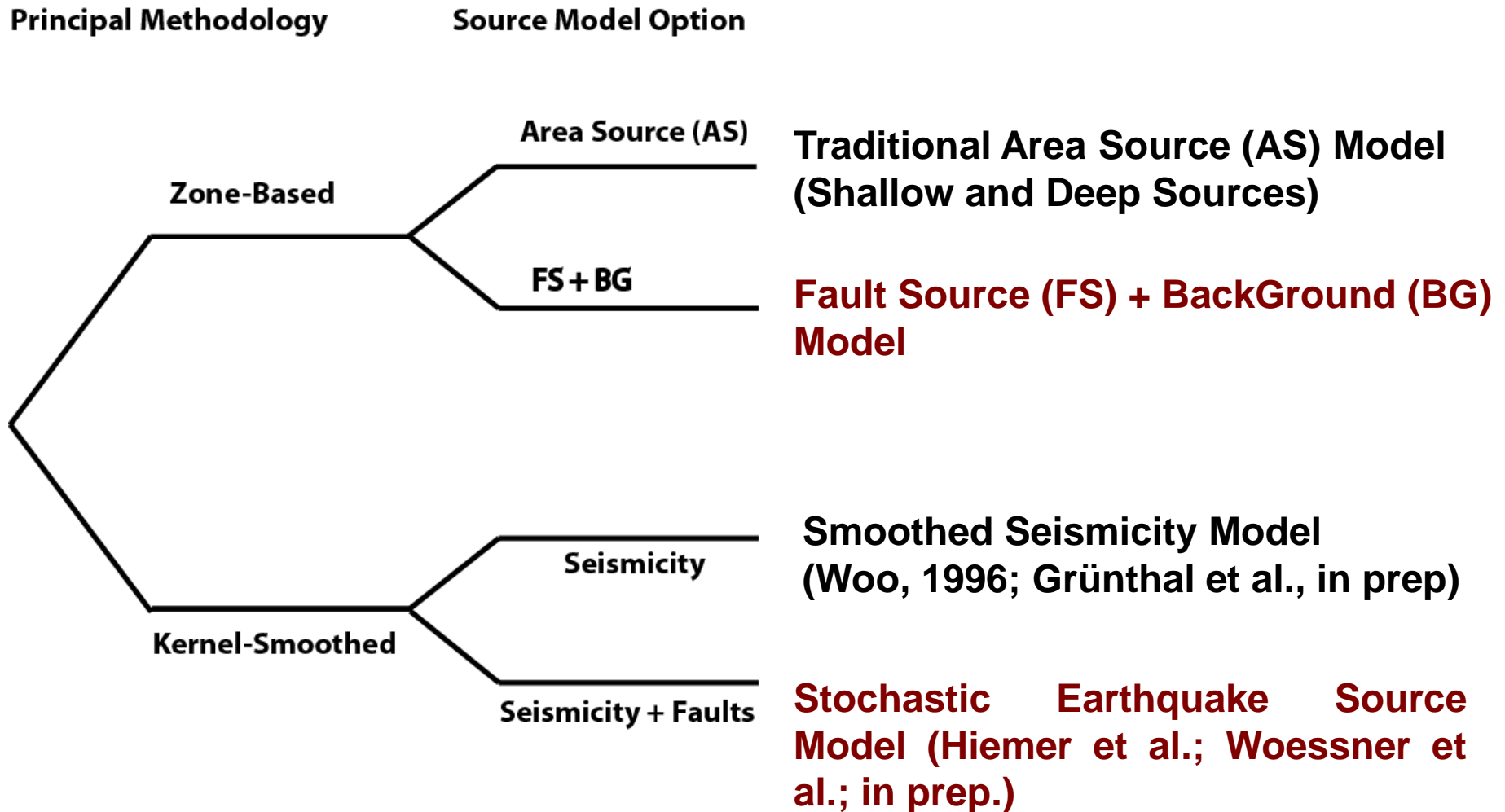


An FP7 Collaborative Project on Seismic Hazard Harmonization in Europe

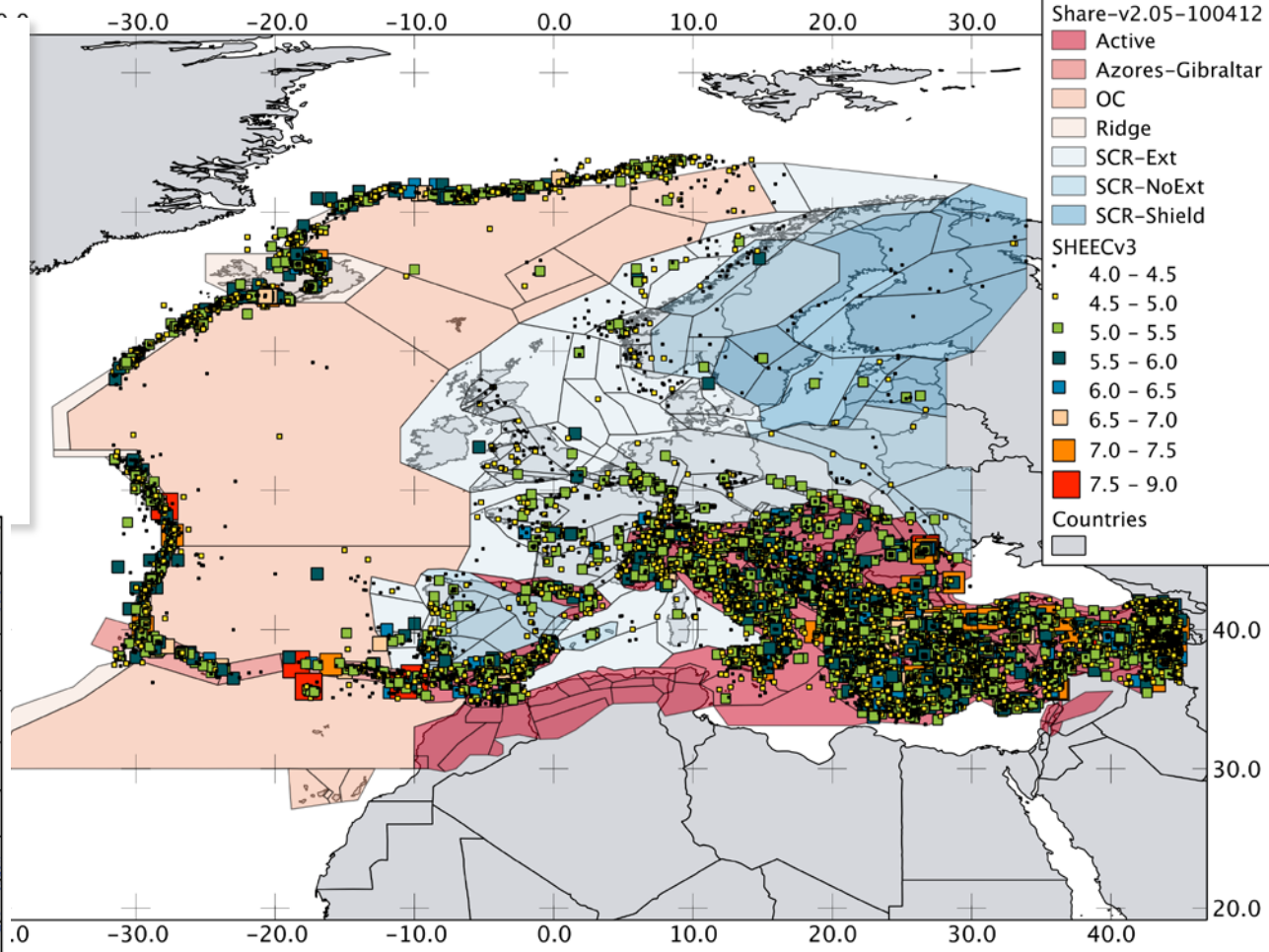
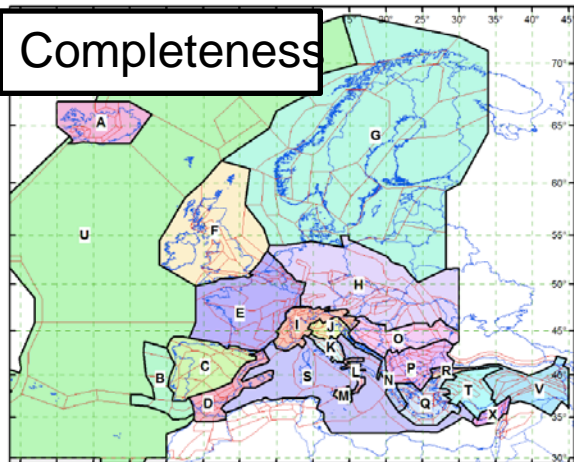
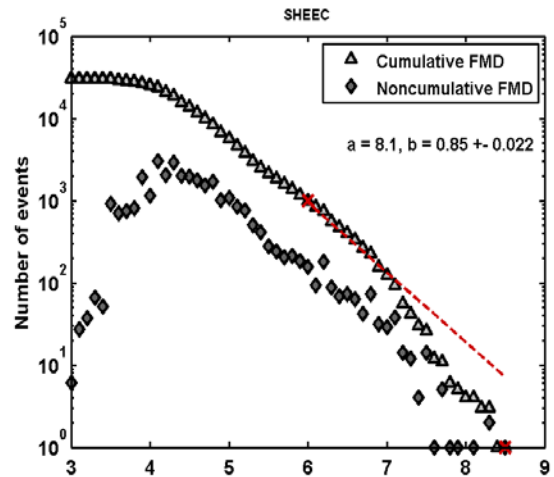
Project Structure and Workflow



Building the SHARE Source Model



SHare European Earthquake Catalogue (SHEEC)

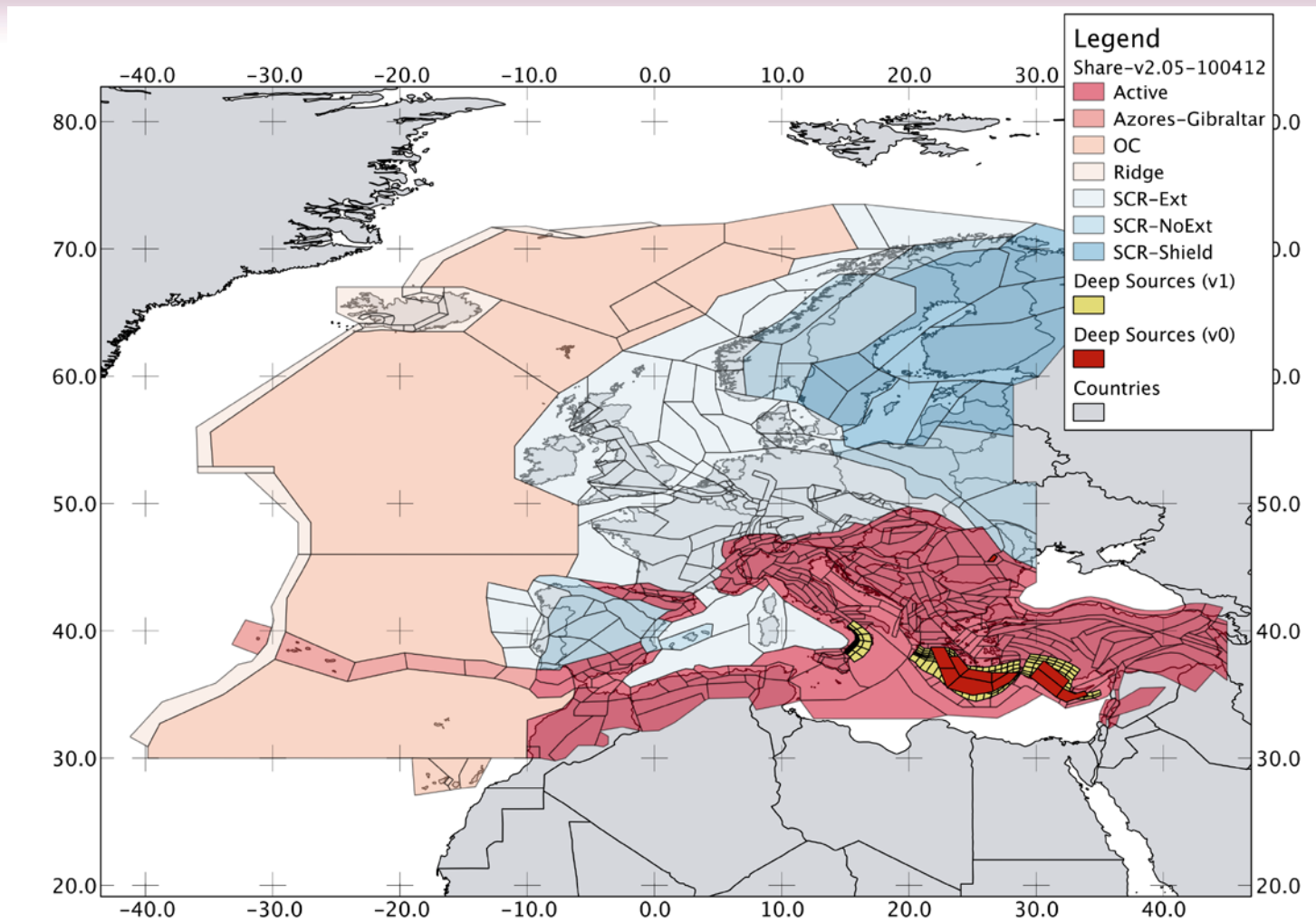


Period: 1000-2007

$M_W \geq 3.5$, homogeneously assessed

Headed by G. Grünthal (GFZ) and M. Stucchi (INGV)

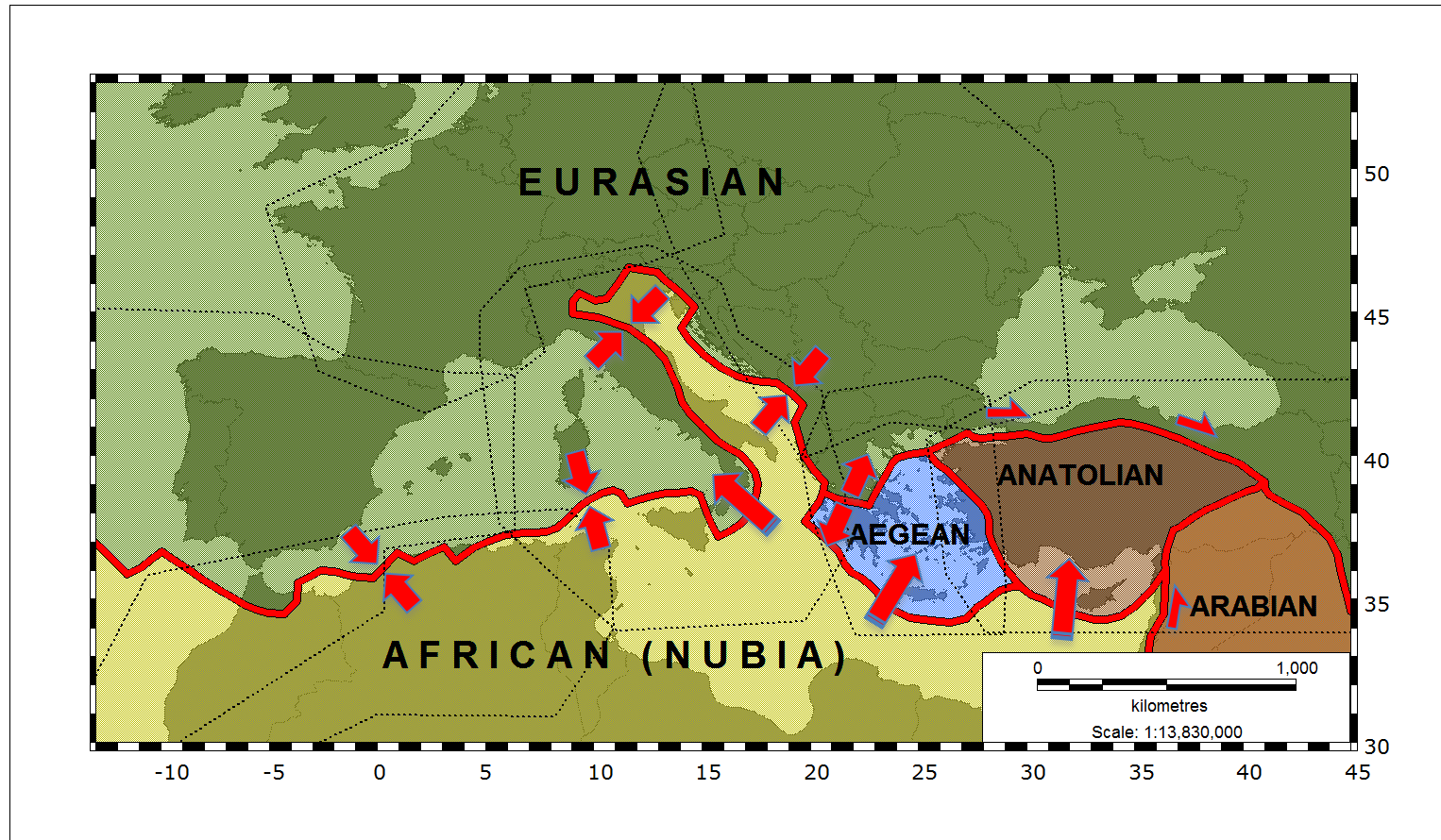
Area Source Model



Headed by R. Arvidsson (GFZ) and R. Basili (INGV)

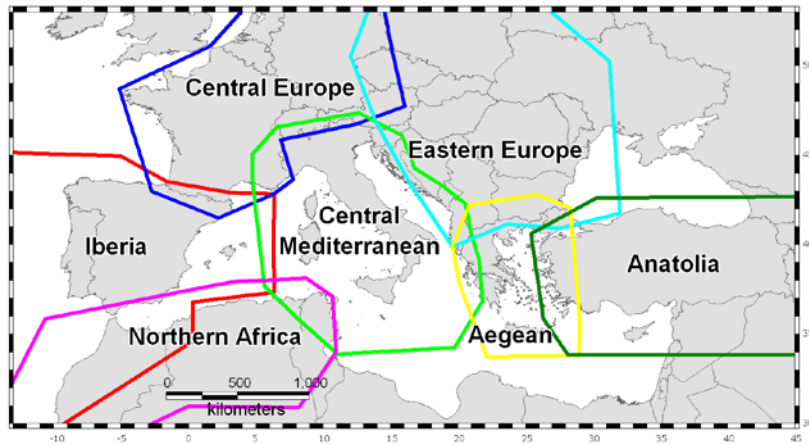
Seismogenic Source Model: *how to*

Plate tectonics



Seismogenic Source Model: *how to*

Regional subdivision of the SHARE Project area for Task 3.2



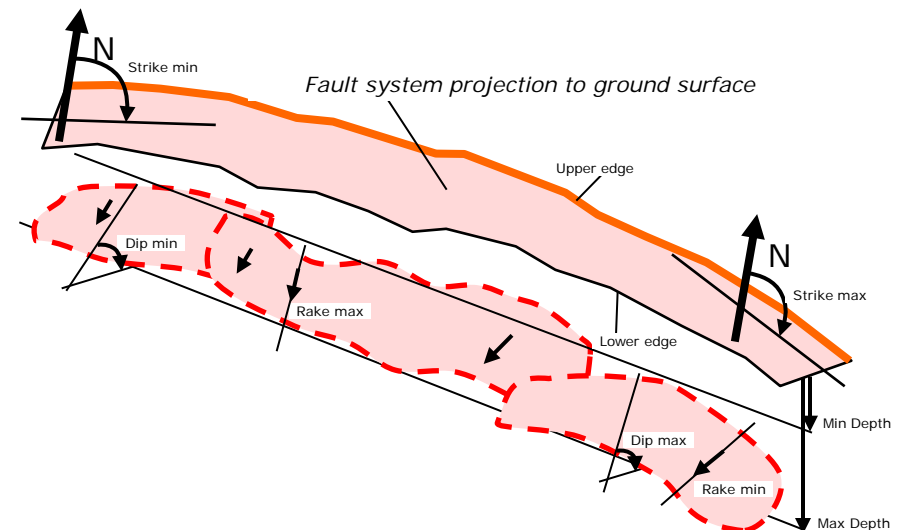
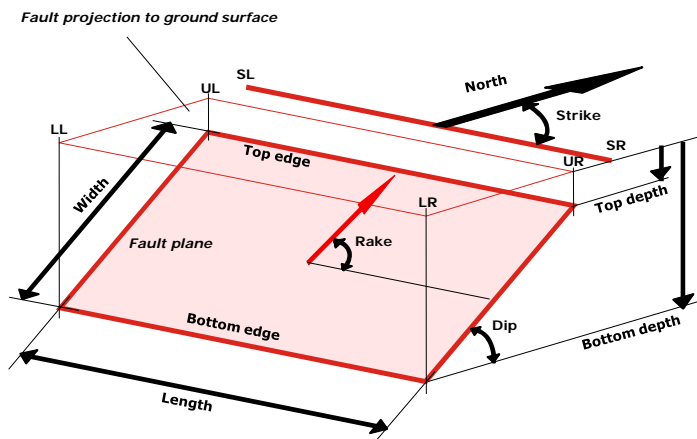
Region	Institution	Scientist in charge	Main compiler
Central Mediterranean	INGV, Italy	G. Valensise	DISS Working Group INGV, Italy
Northern Africa	CRAAG, Algeria	K. Yelles	P. Petricca INGV, Italy
Iberia	IST, Portugal	J. Fonseca	E. S. Nemser IST, Portugal
Central Europe	ROB, Belgium	T. Camelbeeck	D. Garcia Moreno ROB, Belgium
Eastern Europe	MSO, Montenegro NIEP, Romania	B. Glavatovic M. Radulian	V. Kastelic INGV, Italy
Aegean	NKUA, Greece AUTH, Greece	K. C. Makropoulos S. Pavlides	S. Sboras DST, University of Ferrara, Italy
Anatolia	KOERI, Turkey	M. Erdik	M. B. Demircioglu KOERI, Turkey

Seismogenic Source Model: *how to*

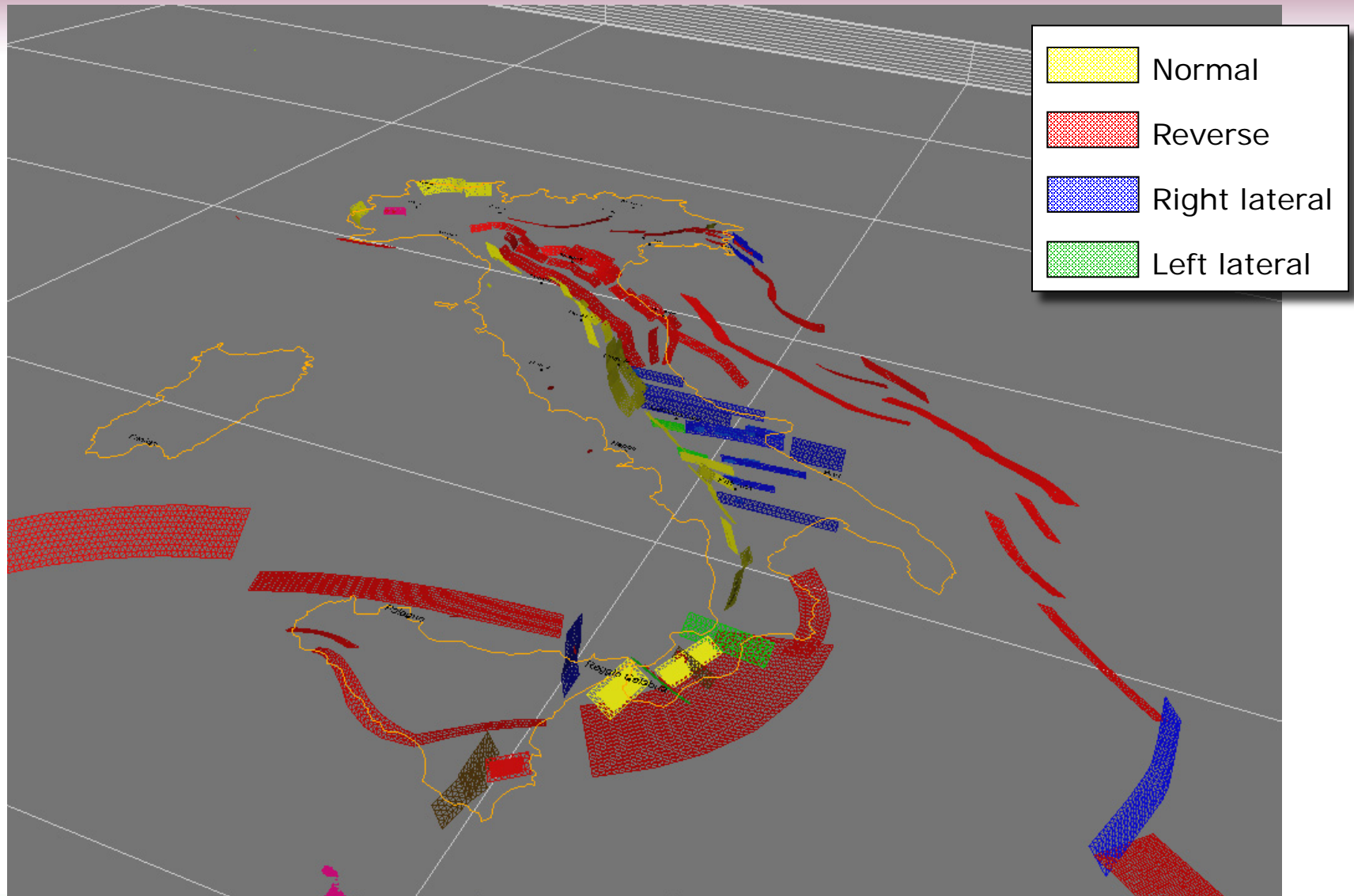
The SHARE fault database provides **two alternative source models** inherited from the DISS v.3 (Basili et al., 2008, 2009).

(1) the **Individual Seismogenic Source**, a simplified representation of a fault plane that released, or is deemed to release in the future, a specific earthquake. This type of source is thought to have "characteristic" behaviour with respect to rupture length/width and expected magnitude.

(2) the **Composite Seismogenic Source**, an elongated region containing an unspecified number of aligned seismogenic sources that cannot be singled out. This type of seismogenic source is not associated with a specific set of earthquakes or earthquake distribution.



Seismogenic Source Model: *how to*



Seismogenic Source Model: *how to*

Database compilation progression

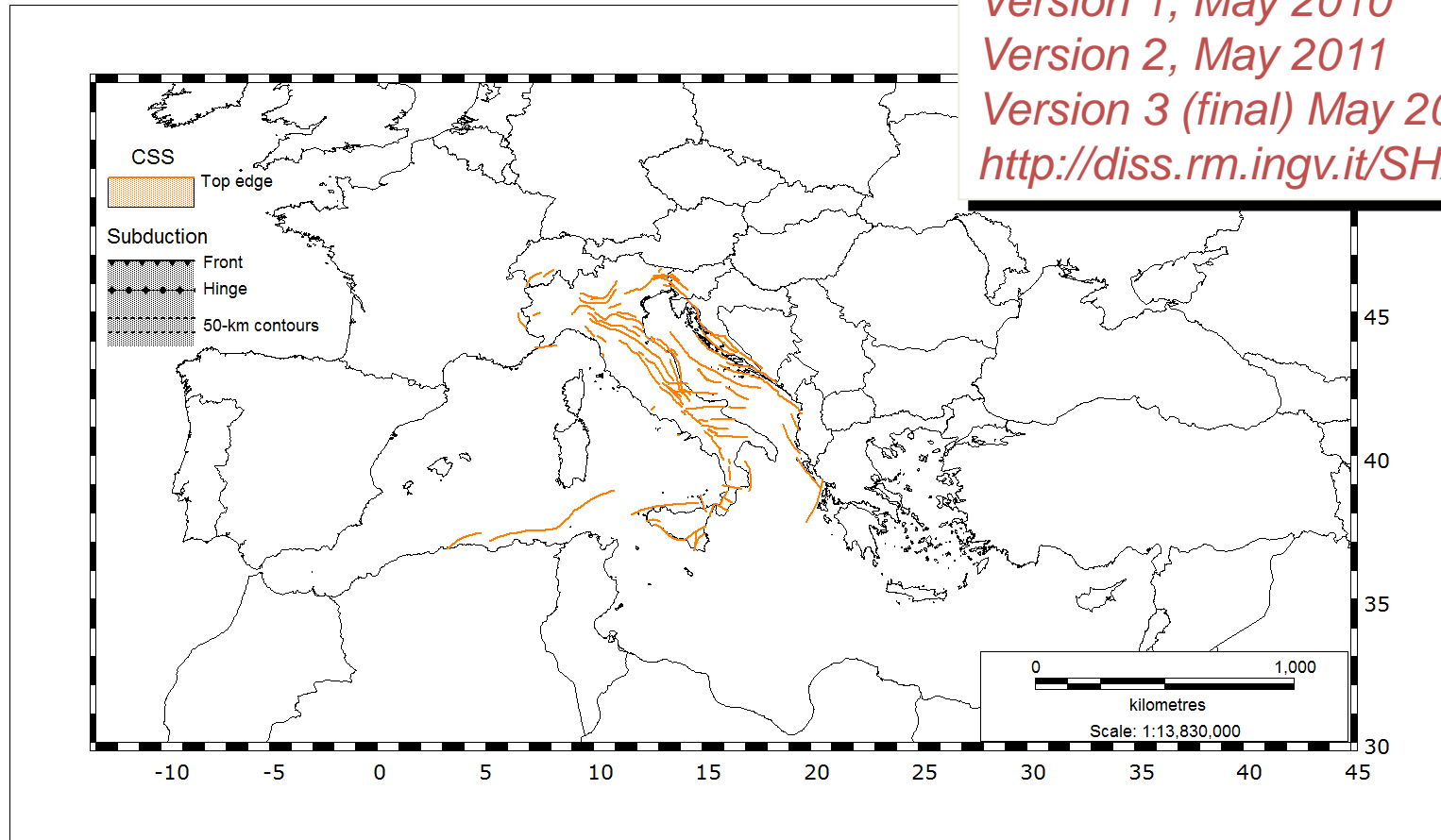
Version 0, May 2009

Version 1, May 2010

Version 2, May 2011

Version 3 (final) May 2012

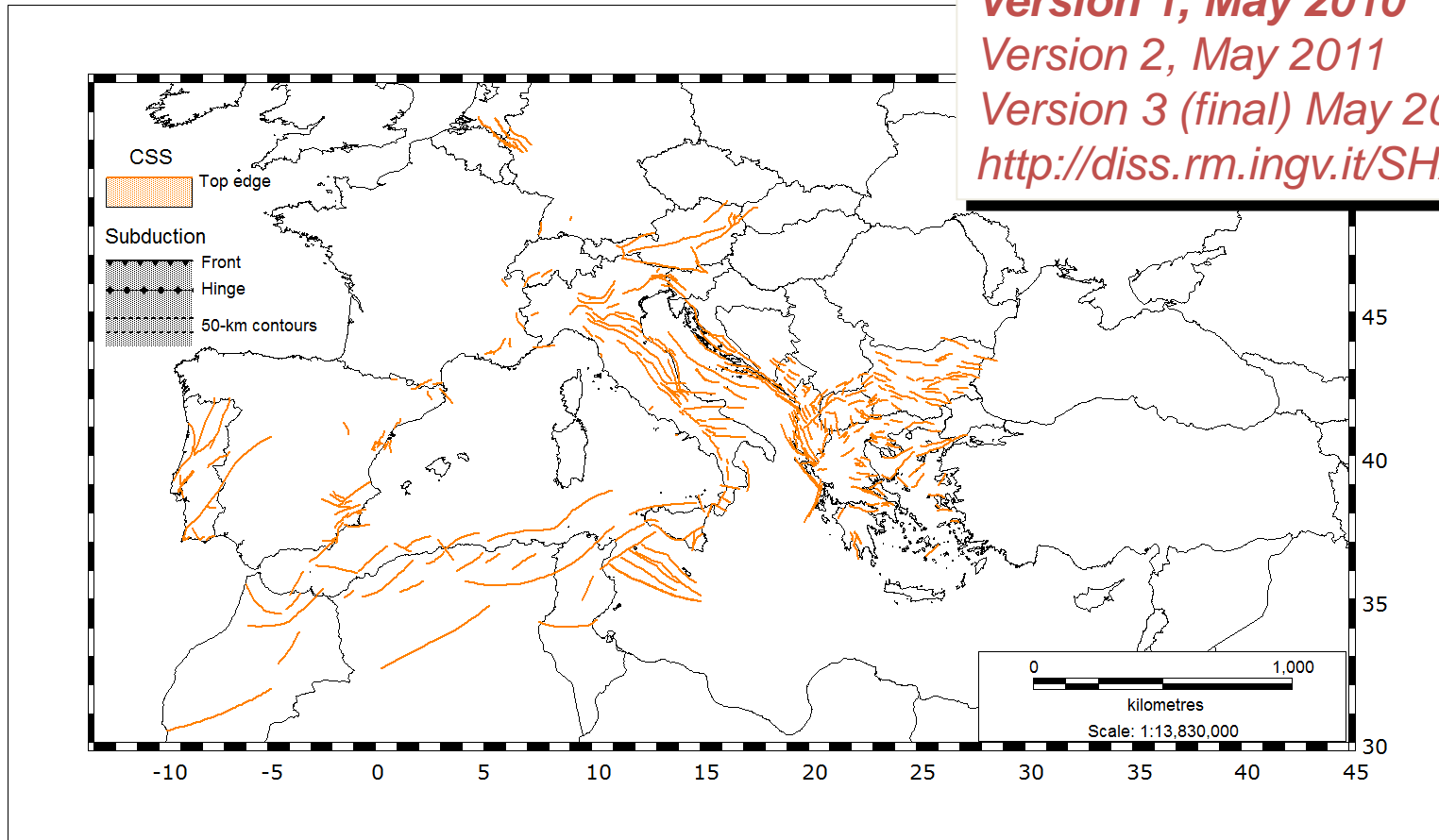
<http://diss.rm.ingv.it/SHARE/>



Seismogenic Source Model: *how to*

Database compilation progression

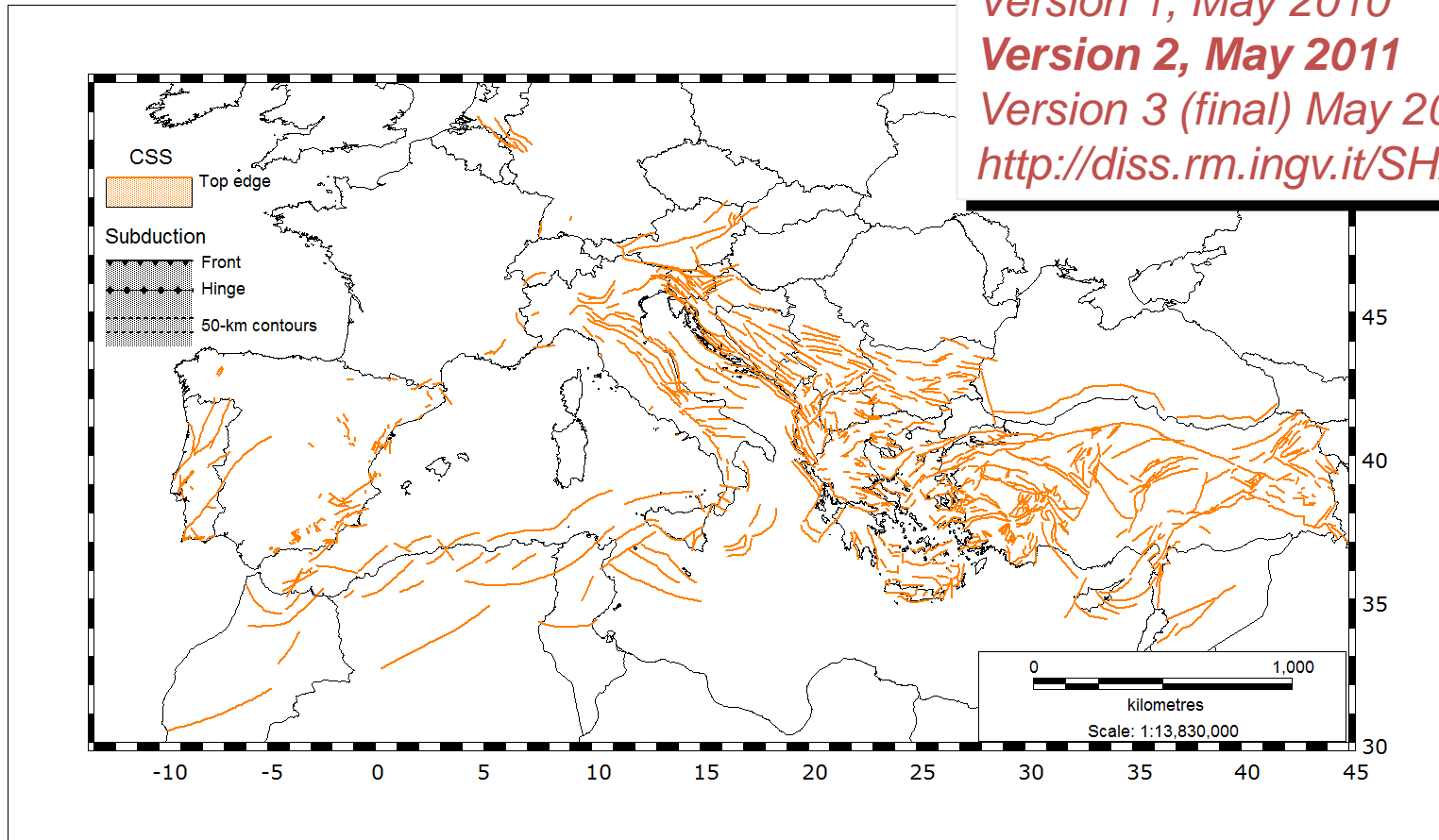
Version 0, May 2009
Version 1, May 2010
Version 2, May 2011
Version 3 (final) May 2012
<http://diss.rm.ingv.it/SHARE/>



Seismogenic Source Model: *how to*

Database compilation progression

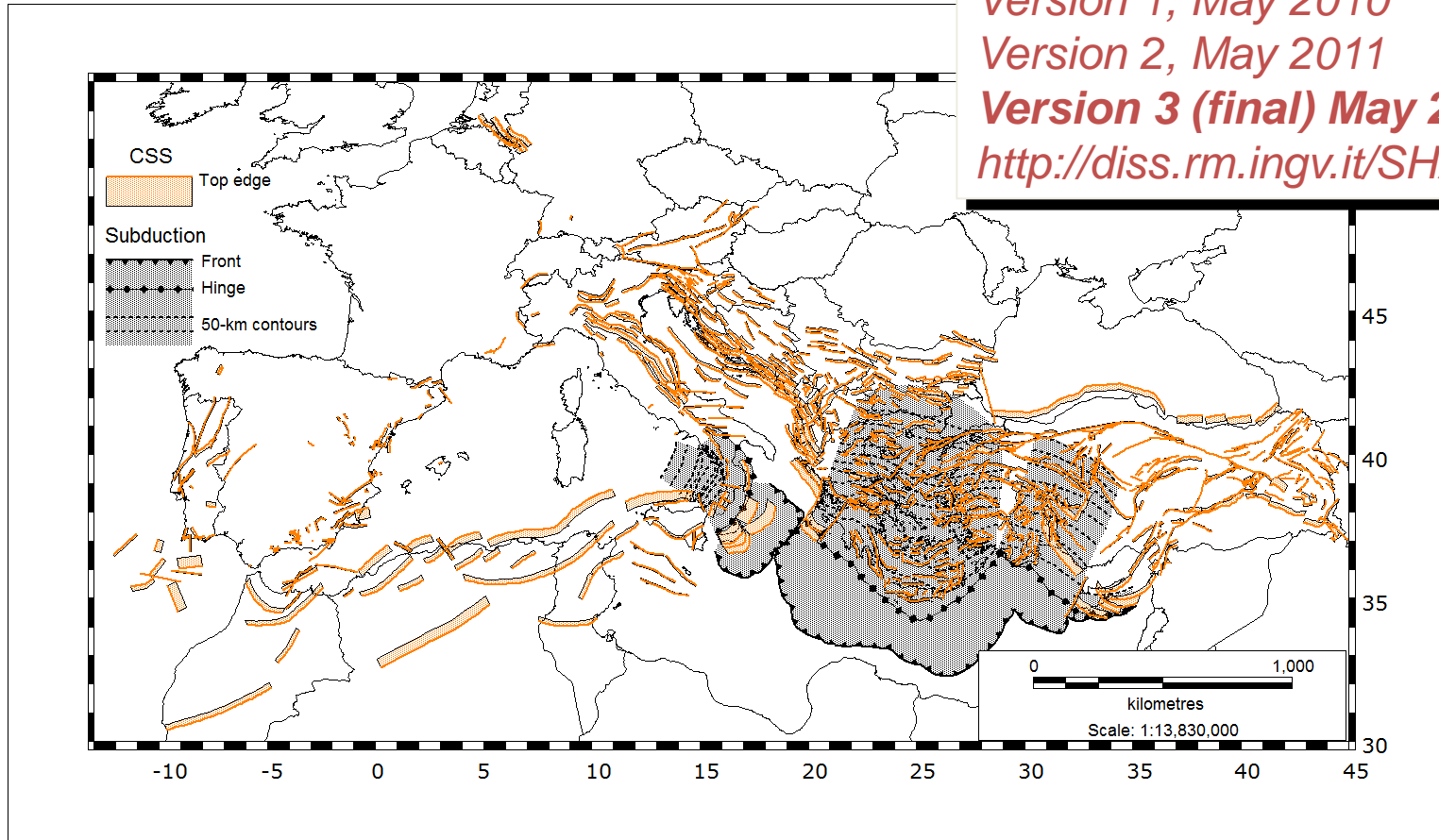
Version 0, May 2009
Version 1, May 2010
Version 2, May 2011
Version 3 (final) May 2012
<http://diss.rm.ingv.it/SHARE/>



Seismogenic Source Model: *how to*

Database compilation progression

Version 0, May 2009
Version 1, May 2010
Version 2, May 2011
Version 3 (final) May 2012
<http://diss.rm.ingv.it/SHARE/>

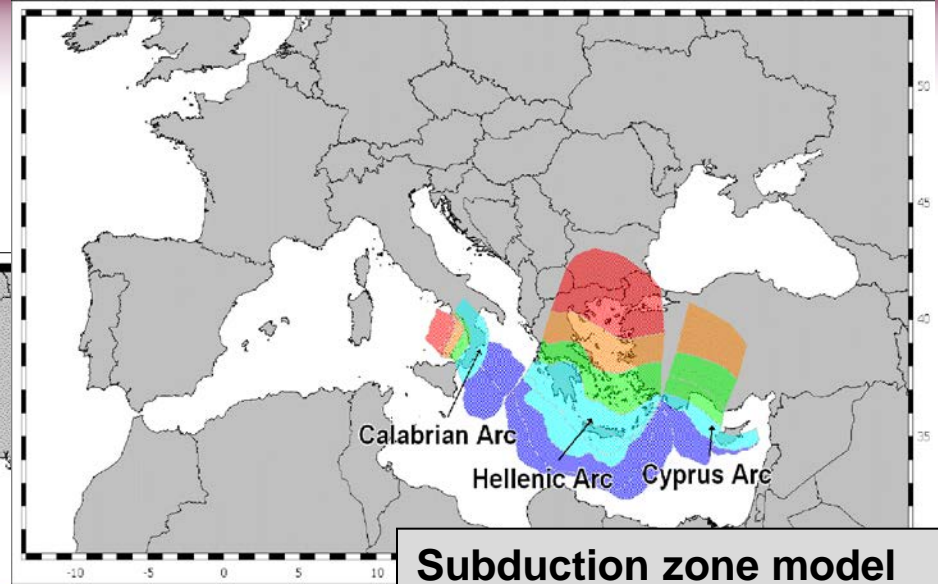
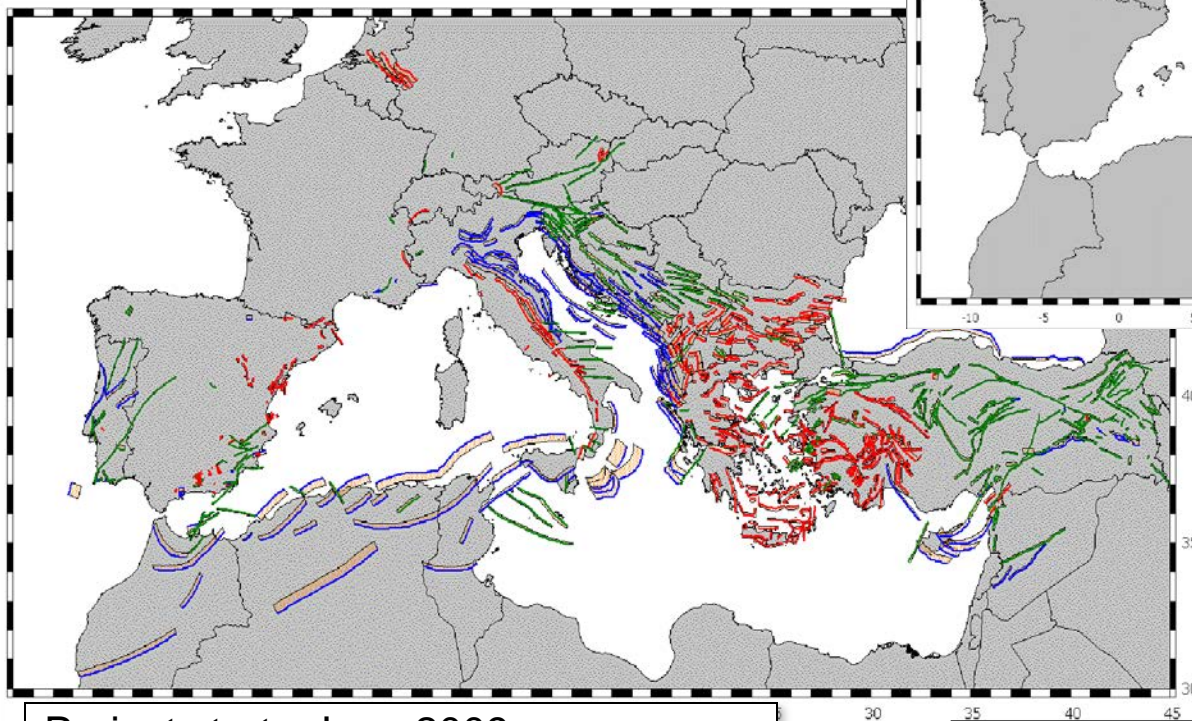


1,128 records for ~63,775 km of crustal faults + 3 subductions

Seismogenic Source Model: *how to*

Primary faulting style

- Normal
- Reverse
- Strike-slip and oblique



Subduction zone model

Project start - June 2009:

- 98 data records,
 - ~8500 km of faults
- (Basili et al., 2008, *Tectonophysics*)

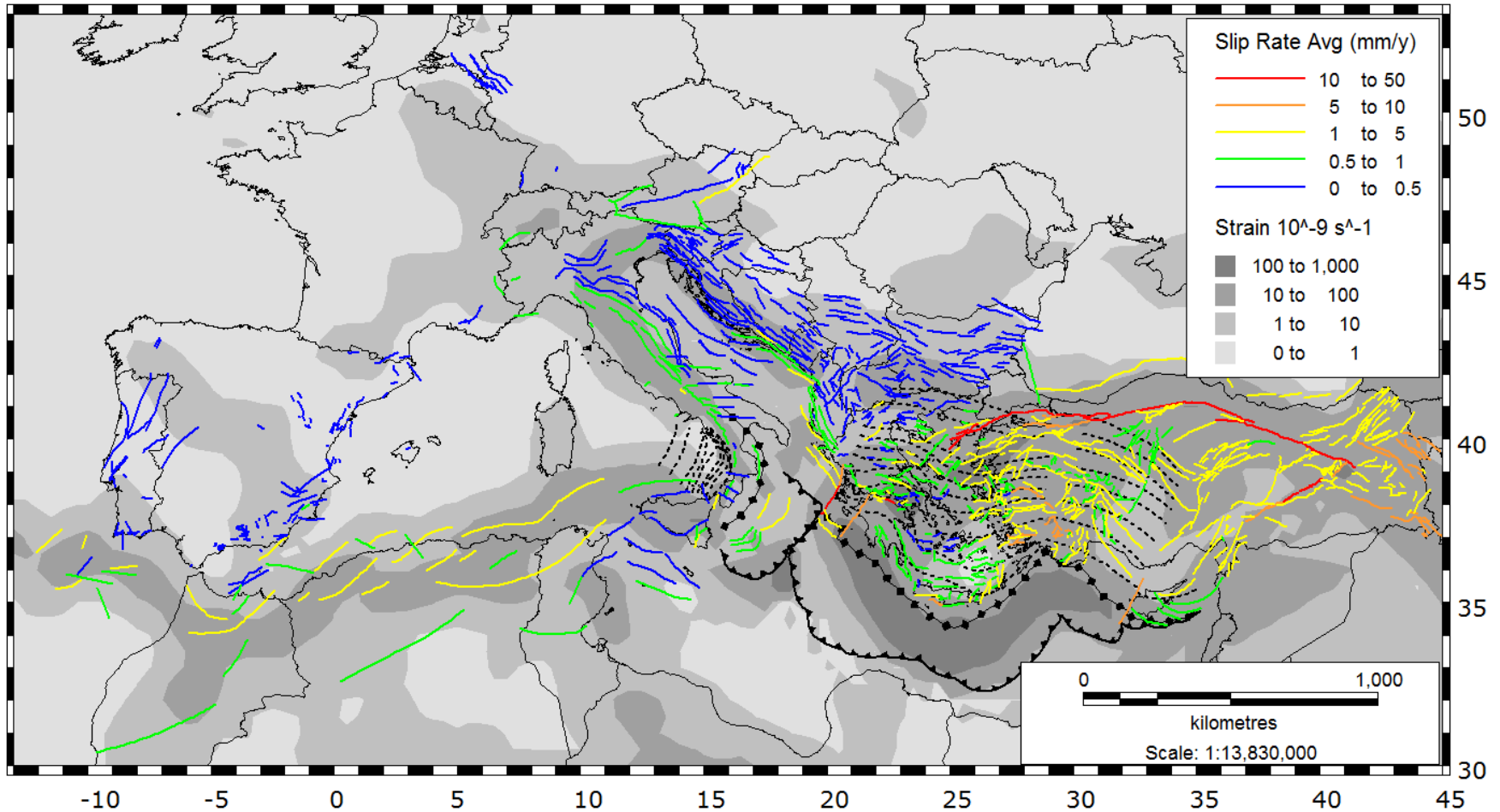


Project end – May 2012:

- 1128 data records
- ~64000 km of faults

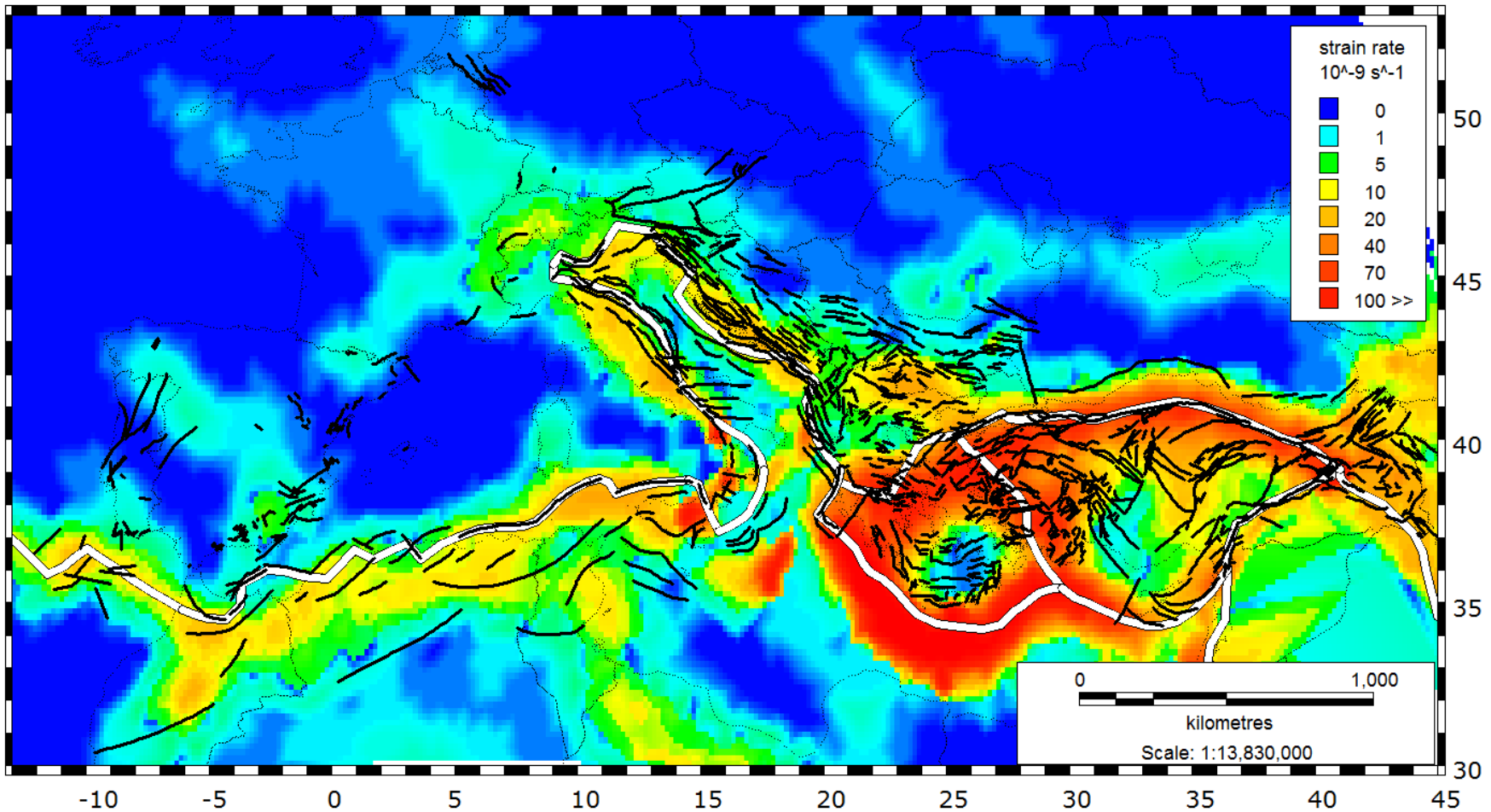
Access at: <http://diss.rm.ingv.it/diss>

Fault parameterization: *Slip rate*



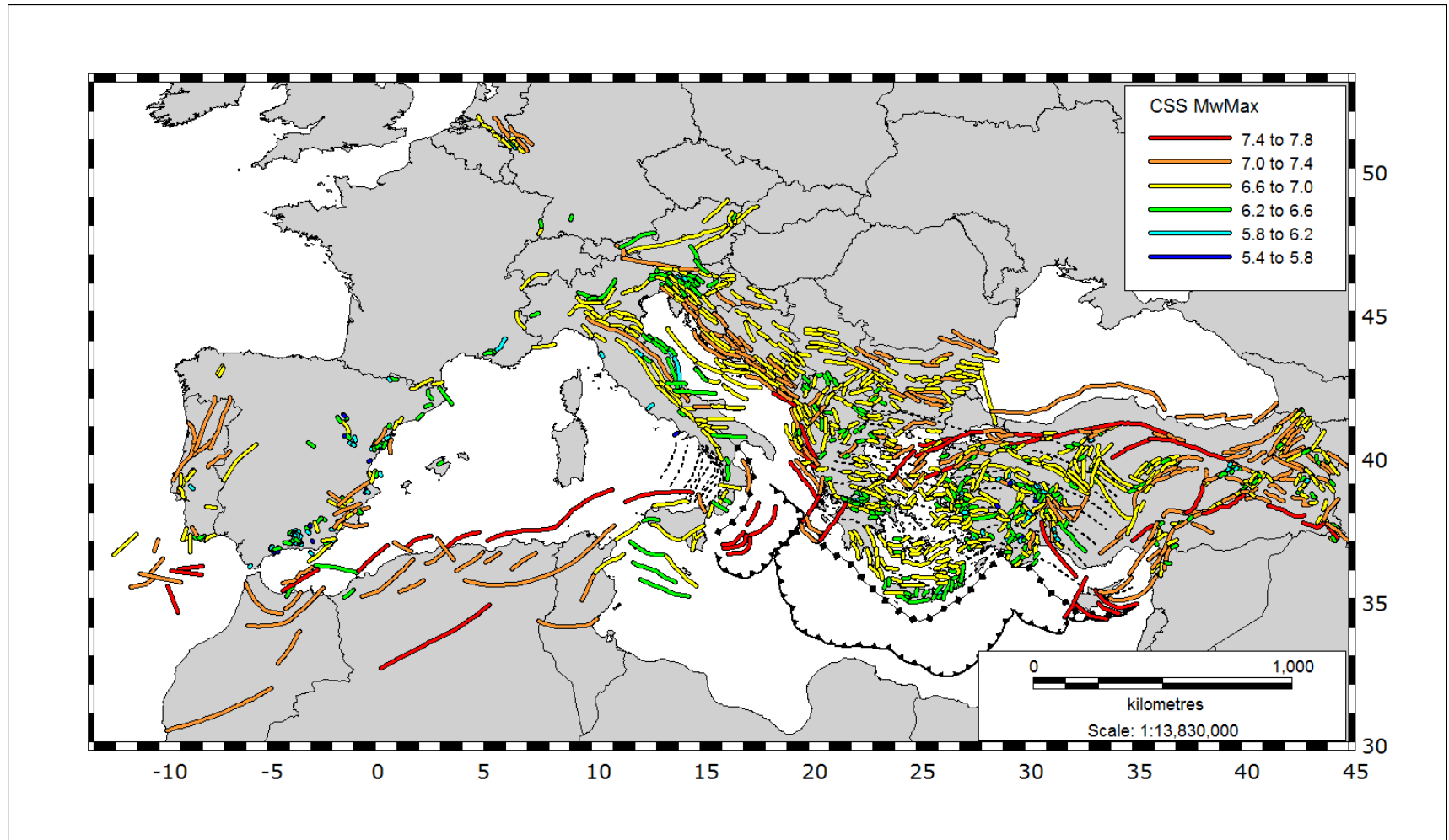
Basili et al; Barba and Carafa, INGV

Fault parameterization: *Strain rate*

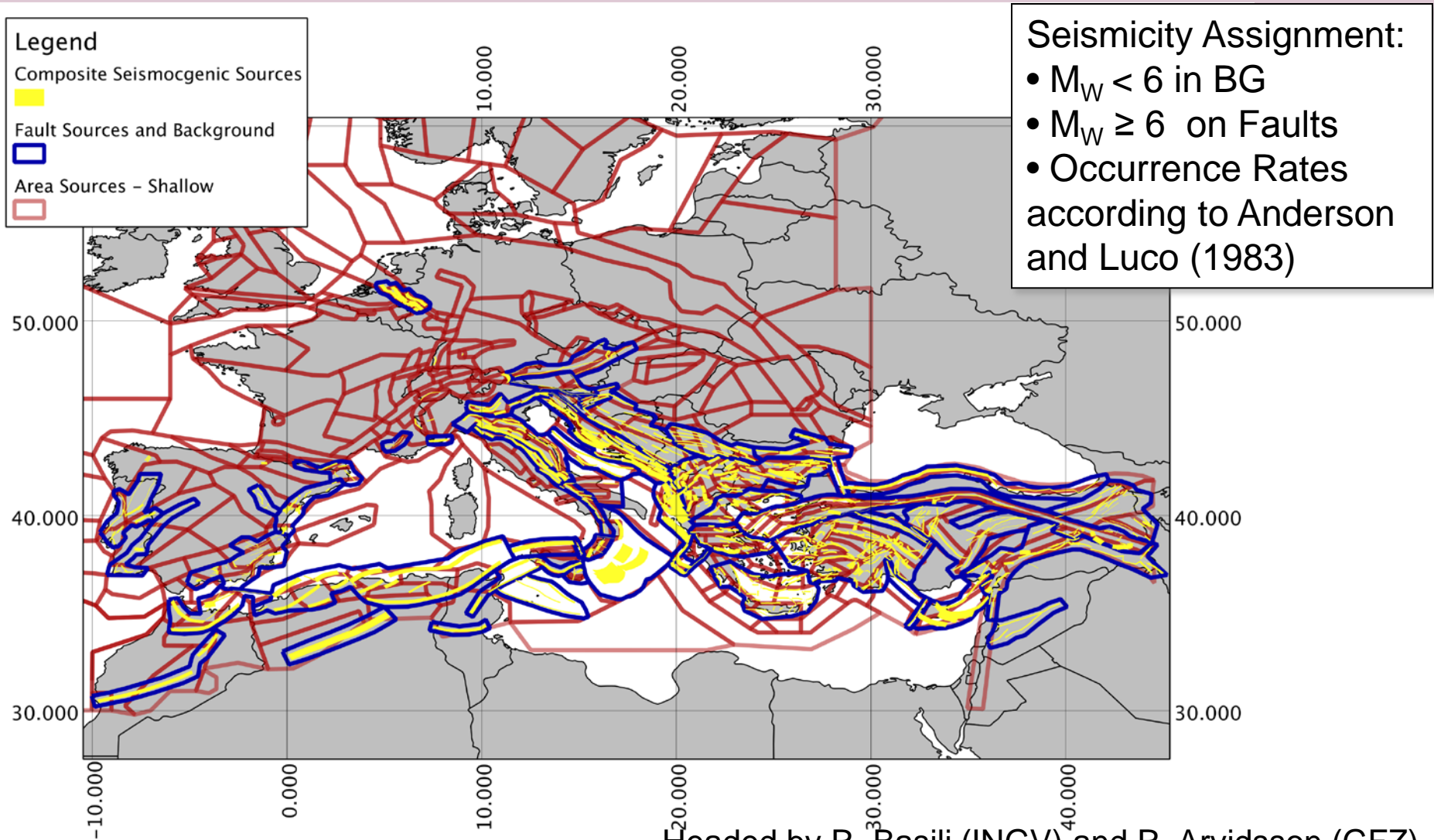
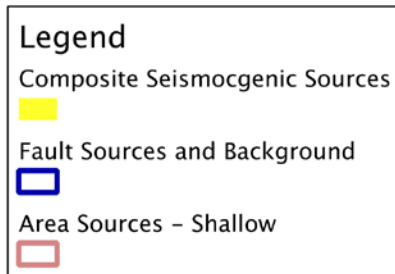


Basili et al; Barba and Carafa, INGV

Fault parameterization: *M*_{max} distribution



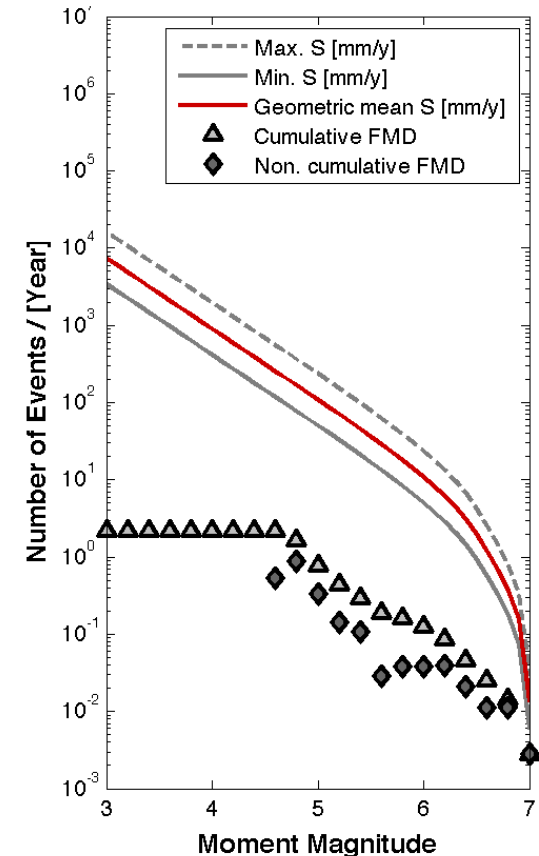
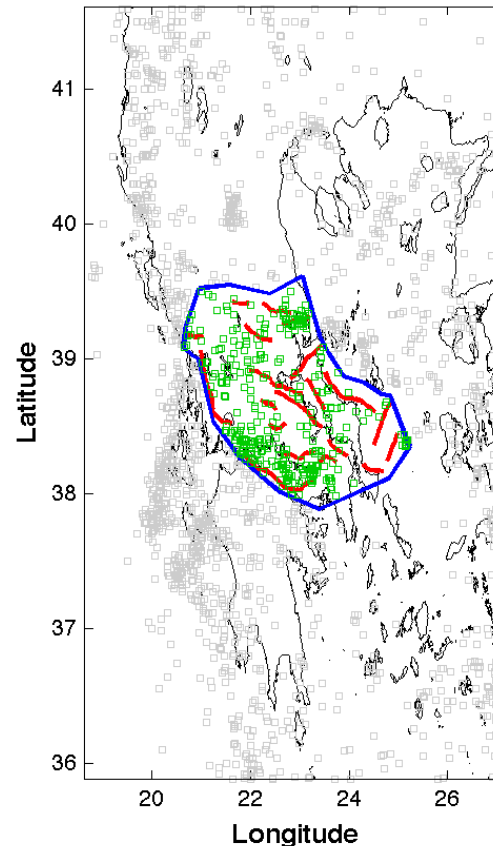
Fault Sources and Background Model (FSBG)



Headed by R. Basili (INGV) and R. Arvidsson (GFZ)

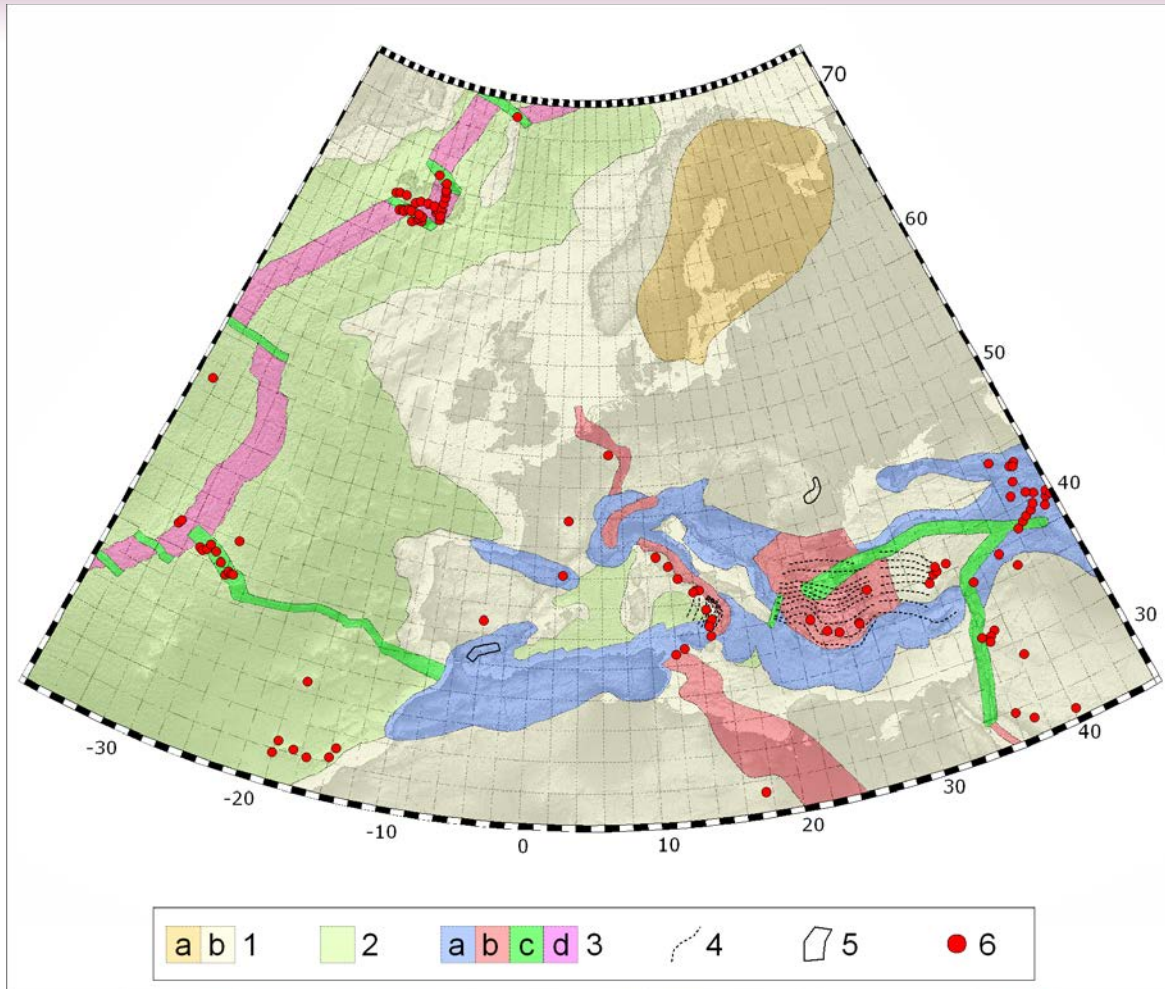
Activity Rates on Fault Sources

- Activity rates determined using Anderson and Luco (1983) model based on geologic slip rates
- Uncertainties are large
- Comparison to recorded earthquakes often shows large difference, in general overestimation of rates compared to observed catalog (due to aseismic components?)



Bungum, Musson, Woessner, Danciu; NORSAR, BGS, ETH

Seismotectonic Map



- Regionalization used for appropriate selection of
 - Mmax model
 - Ground motion prediction equations (GMPEs)

Delavaud et al., 2012, J. Seis.

Current Project Status: Model and Hazard Re-Assessment

Single Logic Tree
Branches

/ Epistemic
Uncertainties

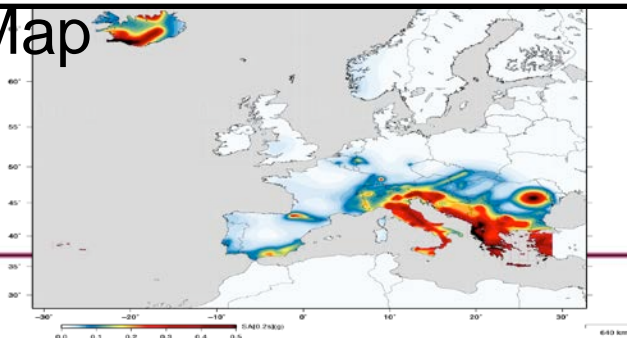
ASZ-branch01-Hazard Map CF2008(ASC) & CA2003 (SCR)
SA0.20(sg)-(10%30yrs)

0.00 0.05 0.10

0.00 0.05 0.10 0.15 0.20 0.25 0.30 SA 0.2s(sg) 40 km

Mean/ Median Hazard

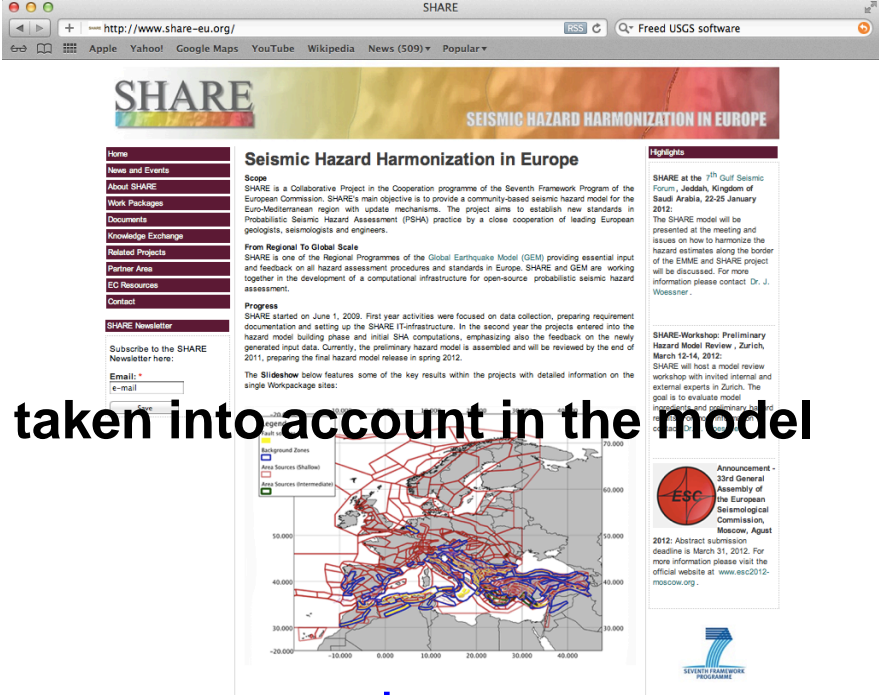
Map



Date	Project
Jan. / Feb.	1 st PSHA computation and model assessment
March 12-14	1 st Review meeting, Zurich
August	2 nd Review, ESC2012, Moscow
October	Final PSHA
November 30	SHARE Project End

SHARE: Summary

- We create a **community-based time-independent hazard model with update mechanism** for Euro-Mediterranean region
- SHARE includes **new source models** on the Euro-Mediterranean scale:
 - Fault-based source model
 - Smoothed Seismicity model
- **(Up-to-date) selection of GMPEs**
- **Moment balancing** is prominently taken into account in the model building process
- Assumed result dissemination:
November 2012



The screenshot shows the SHARE website homepage. The main heading is "SHARE SEISMIC HAZARD HARMONIZATION IN EUROPE". The page includes a navigation menu on the left with links for Home, News and Events, About SHARE, Work Packages, Documents, Knowledge Exchange, Related Projects, Partner Area, EC Resources, and Contact. The main content area features a map of Europe with seismic hazard zones. The right sidebar contains a "Highlights" section with news about the 13th Gulf Seismic Forum and a "SHARE-Workshop: Preliminary Hazard Model Review" announcement. The bottom right corner features the ESC logo and an announcement for the 33rd General Assembly of the European Seismological Commission.

www.share-eu.org

