

Return Period:
500 Years

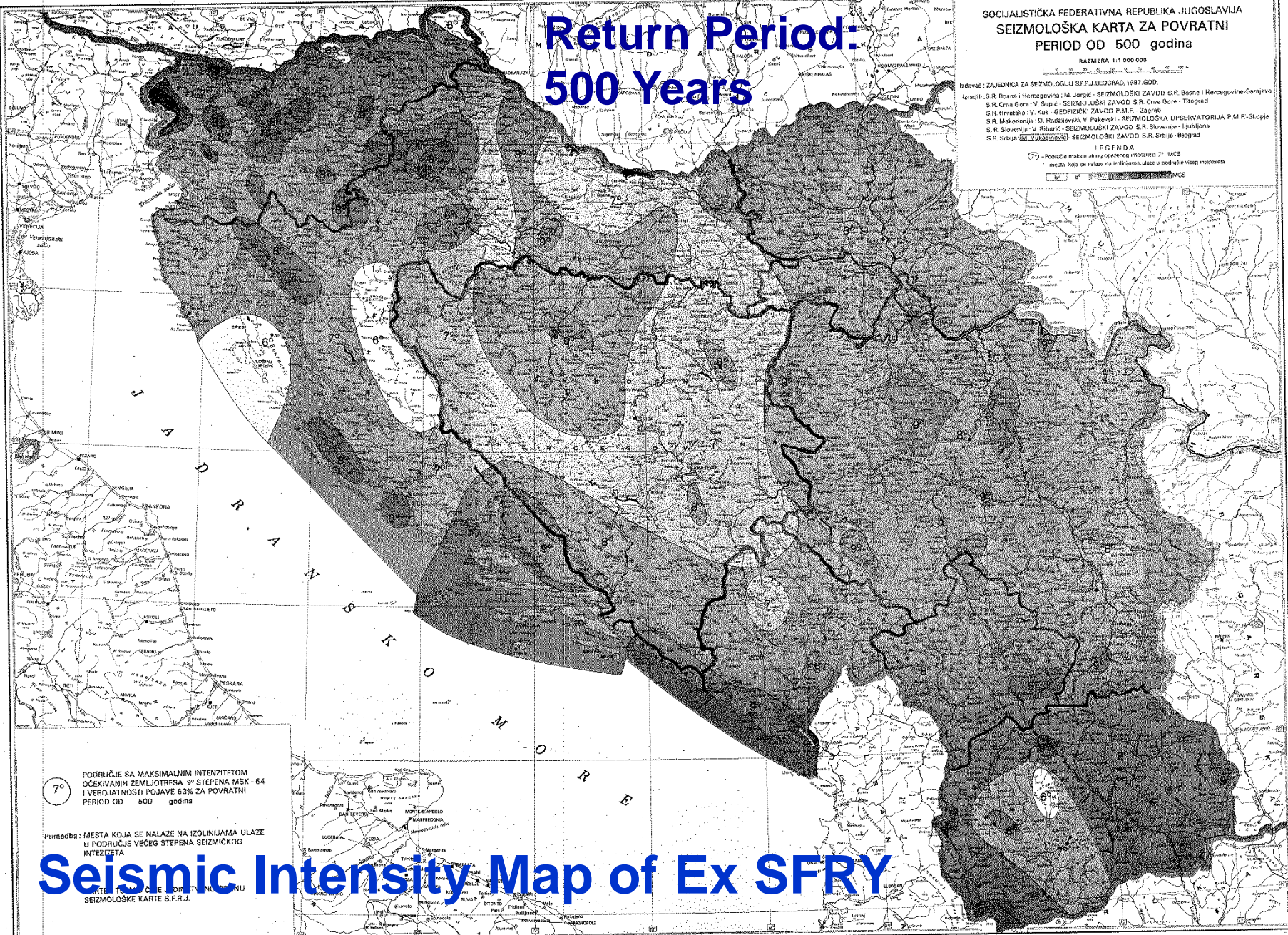
SOJALISTIČKA FEDERATIVNA REPUBLIKA JUGOSLAVIJA
SEIZMOLOŠKA KARTA ZA POVRATNI
PERIOD OD 500 godina

RAZMERA 1:1 000 000

Izdavač: ZAJEDNICA ZA SEIZMOLOGIJU S.F.R.J. BEOGRAD, 1987. GOD.
Izradili: S.R. Bosna i Hercegovina - M. Jargić - SEIZMOLOŠKI ZAVOD S.R. Bosna i Hercegovine-Sarajevo
S.R. Crna Gora - V. Đupić - SEIZMOLOŠKI ZAVOD S.R. Crne Gore - Titograd
S.R. Hrvatska - V. Kuk - GEOFIZIČKI ZAVOD P.M.F. - Zagreb
S.R. Makedonija - D. Hadžijeovski, V. Pekević - SEIZMOLOŠKA OPSERVATORIJA P.M.F. - Skopje
S.R. Slovenija - V. Ribarič - SEIZMOLOŠKI ZAVOD S.R. Slovenije - Ljubljana
S.R. Srbija - M. Vukobratović - SEIZMOLOŠKI ZAVOD S.R. Srbije - Beograd

LEGENDA

- 70 - Područje maksimalnog očekivanog intenziteta 7° MCS
- * - mesta koja se nalaze na izoliranim ulazima u područje višeg intenziteta



70°
PODRUČJE SA MAKSYMALNIM INTENZITETOM
OČEKIVANIH ZEMLJOTRESA 9° STEPENA MSK - 64
I VEROJATNOSTI POJAVE 63% ZA POVRATNI
PERIOD OD 500 godina

Primerdaba: MESTA KOJA SE NALAZE NA IZOLIRANJAMA ULAZE
U PODRUČJE VEĆEG STEPENA SEIZMIČKOG
INTEZITETA

Seismic Intensity Map of Ex SFRY

IZDANA U SKOPJU U OKTOBRI 1987. GODINE
SEIZMOLOŠKE KARTE S.F.R.J.

Major Earthquakes Affecting Macedonia /Period 1900-1995/



Seismic Zone	Year	M_{occ}	I_o	M_{exp}
1. Skopje-Vitina	1963	6.1	9	6.5
2. Tetovo-Gostivar	1960	5.7	8	6.1
3. Debar-Peskopija	1967	6.6	9	6.9
4. Ohrid-Korca	1911	6.7	9	6.9
5. Valandovo-Dojran	1931	6.7	10	6.9
6. Pehcevo-Kresna	1904	7.8	10	7.9
7. Titov Veles	1922	5.5	7-8	5.8
8. Kicevo-Krusevo	1988	4.4	6-7	5.8
9. Bitola-Florina	1920	5.3	7	5.7
10. Tikves-Mrezicko	1955	5.1	7-8	6.0

I_o - *Epicentral Intensity*

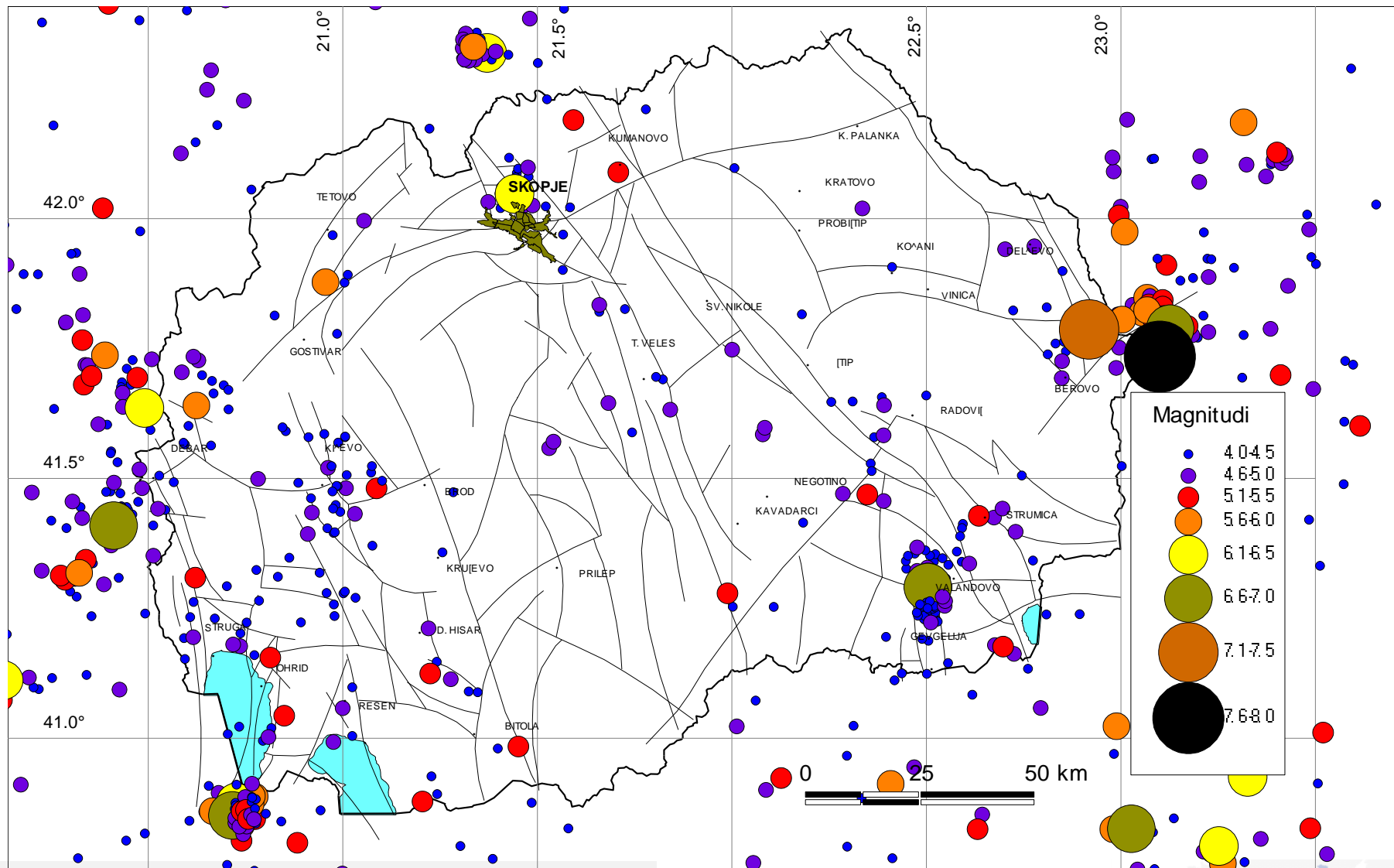
M_{occ} - *Occurred Magnitude*

M_{exp} - *Maximum expected magnitude*

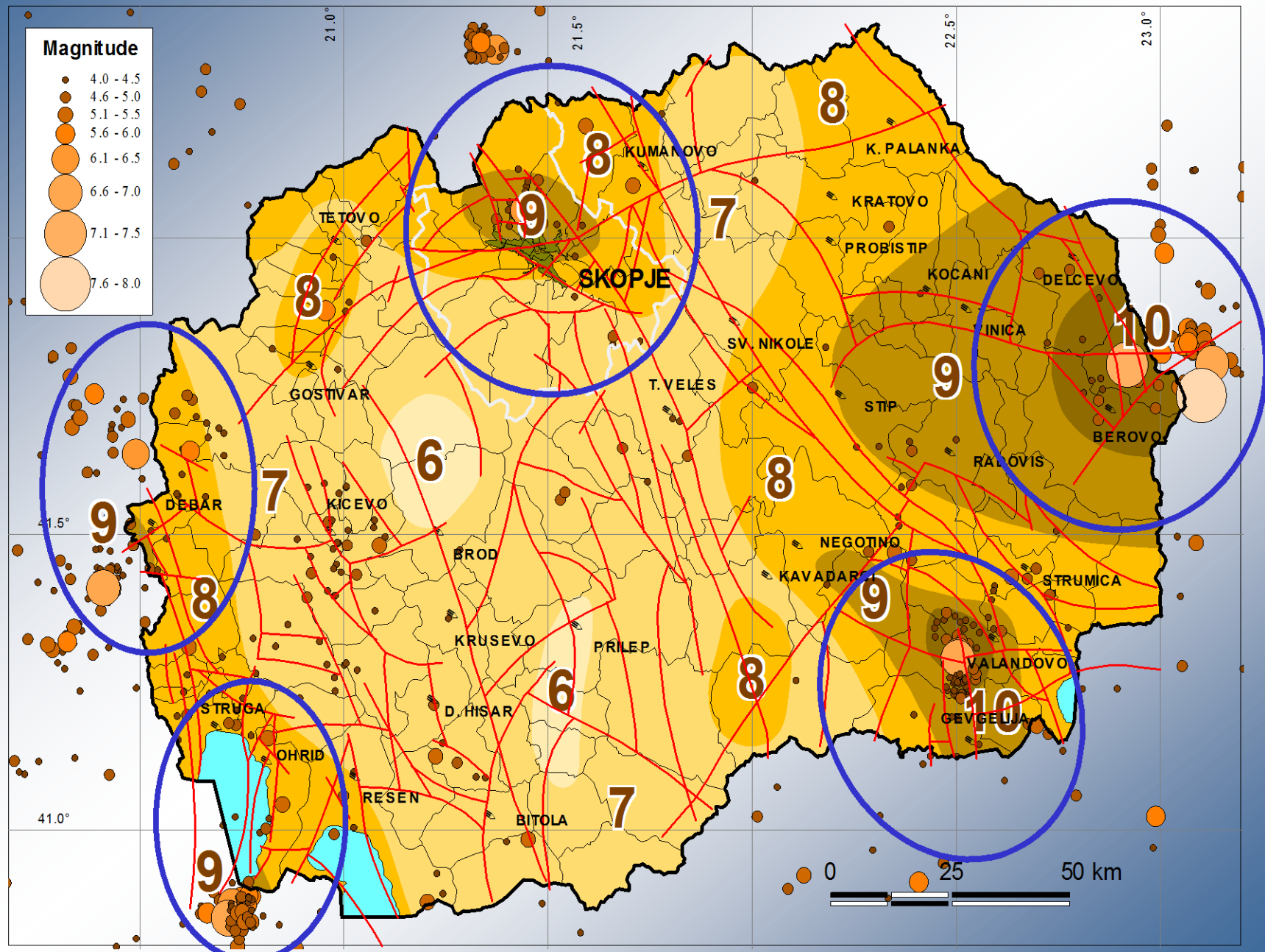




SEISMOTECTONIC MAP OF MACEDONIA



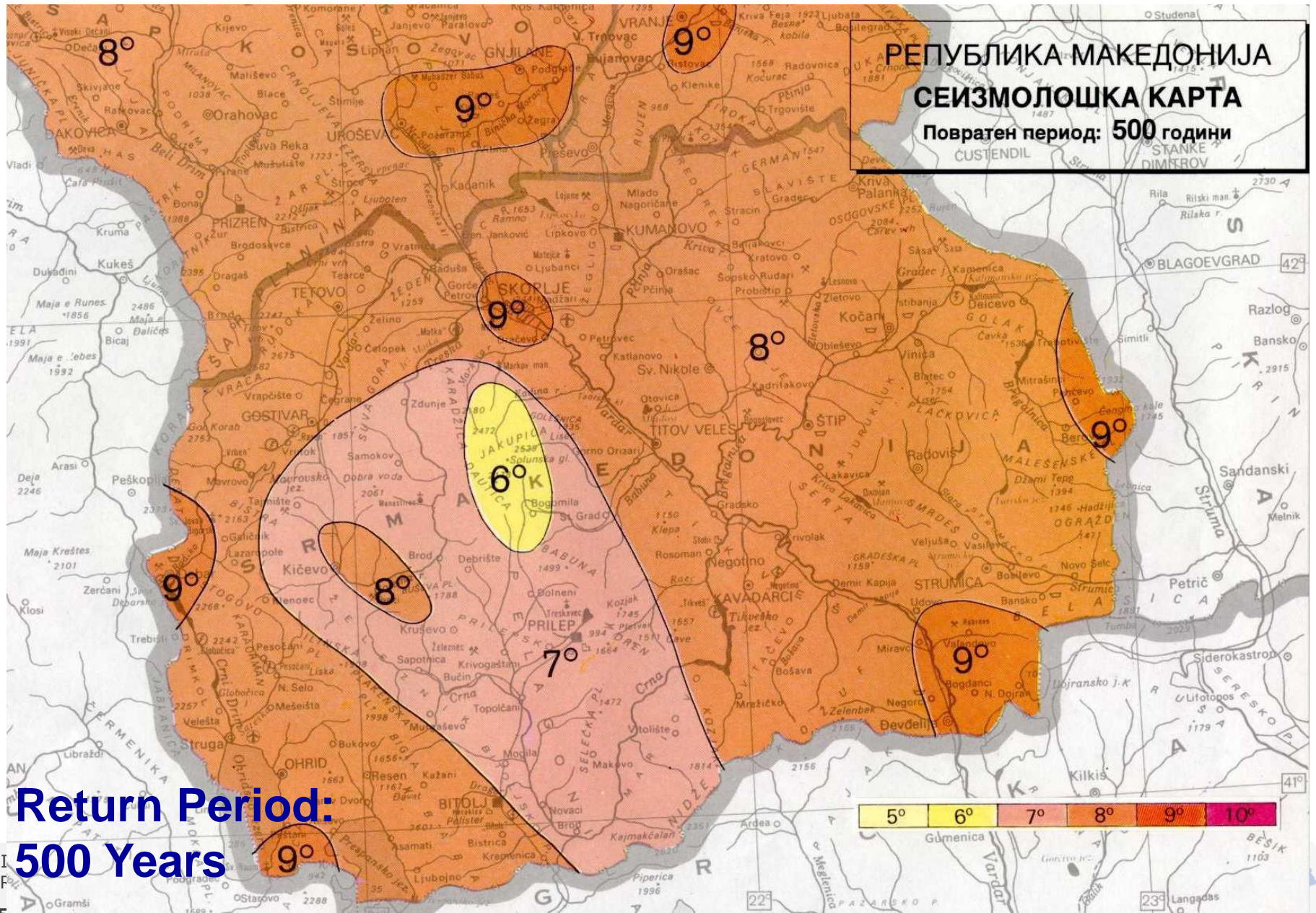
Seismotectonic and Maximum Observed Seismic Intensity Map



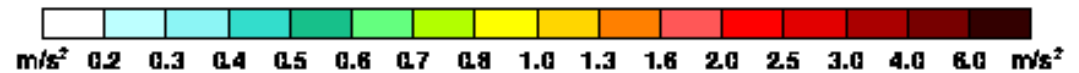
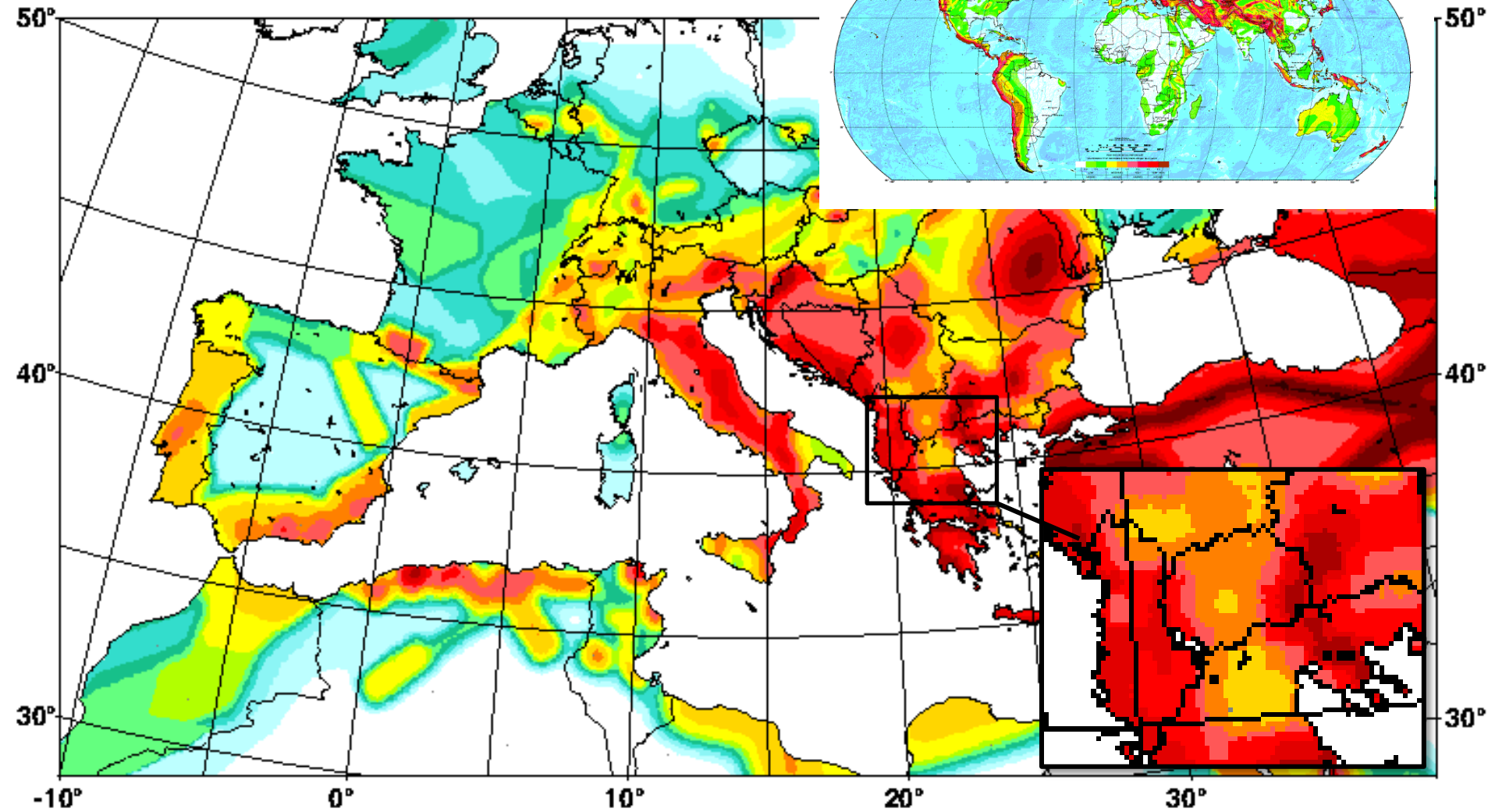
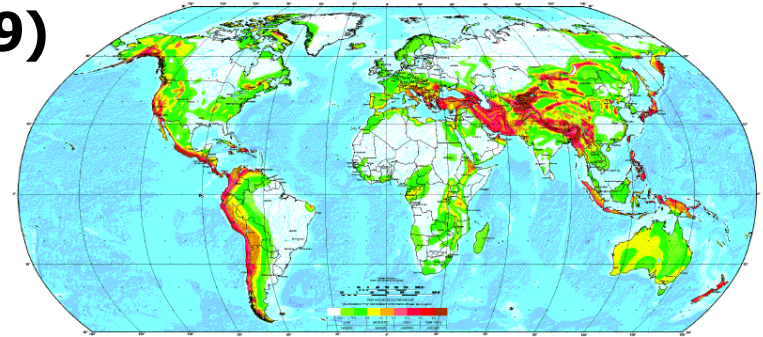
Seismic Intensity Map of Macedonia



European
Commission



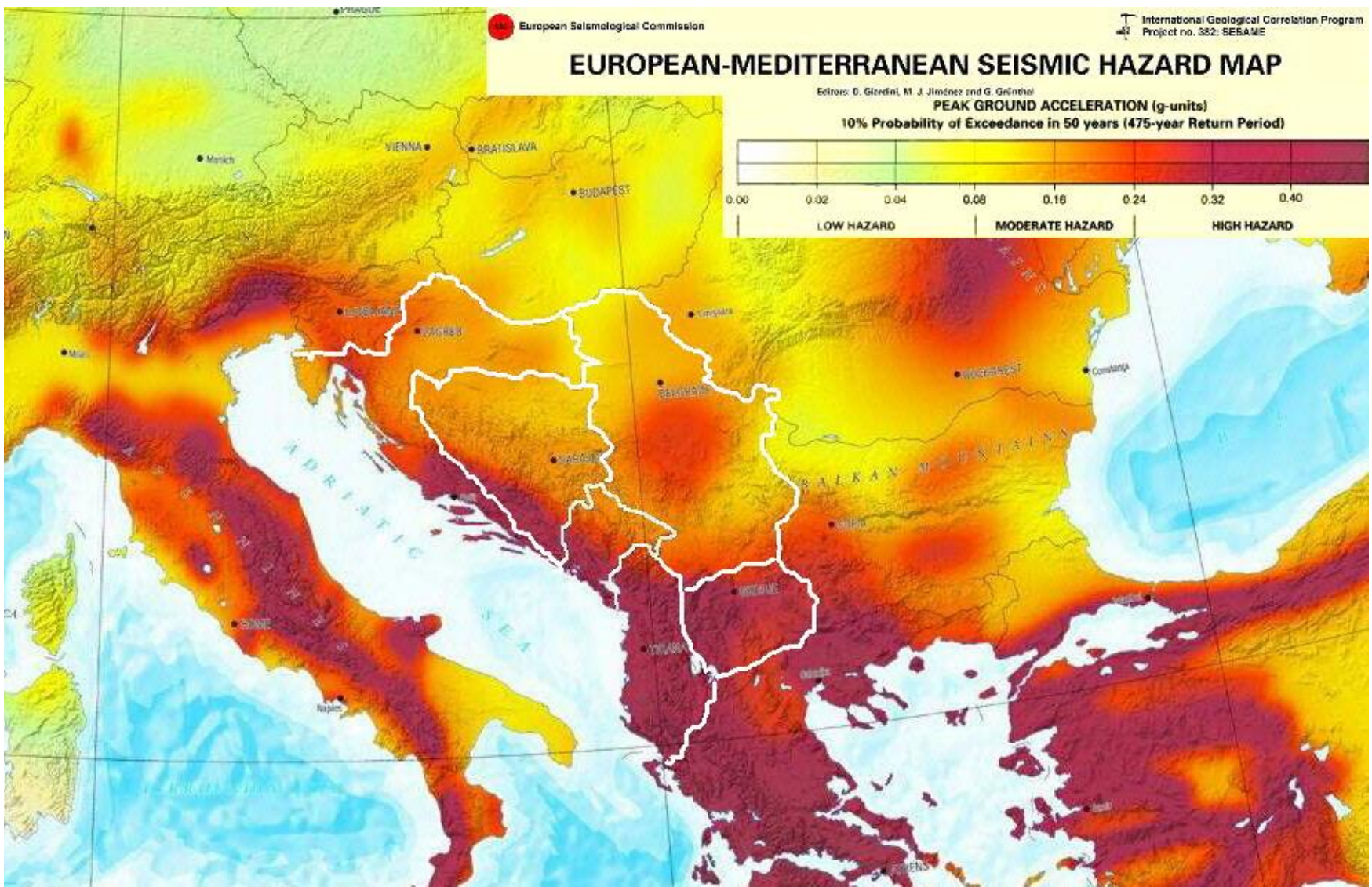
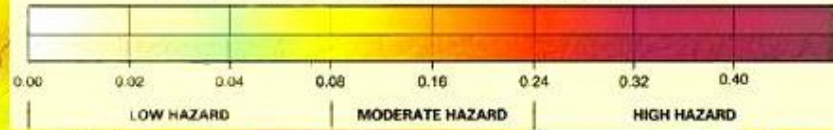
GSHAP Regional Seismic Hazard (1999)



EUROPEAN-MEDITERRANEAN SEISMIC HAZARD MAP

Editors: D. Giardini, M. J. Jiménez and G. Grünthal

PEAK GROUND ACCELERATION (g-units)
10% Probability of Exceedance in 50 years (475-year Return Period)



COUNTRIES/INSTITUTIONS INVOLVED (2006)



ALBANIA

Polytechnic University of Tirana
Institute of Geosciences, Energy, Water and Environment



BOSNIA AND HERZEGOVINA

1 | Federal Institute for Hydrometeorology | Center for Seismology | Sarajevo
2 | Hydrometeorological Institute of Republic of Srpska | Sector for Seismology | Banja Luka



CROATIA

University of Zagreb, Geophysical Department



MACEDONIA

1 | University Ss. Cyril and Methodius in Skopje
Institute of Earthquake Engineering and Engineering Seismology (IZIIS)
2 | University Ss. Cyril and Methodius in Skopje
Faculty of Natural Sciences | Seismological Observatory



MONTENEGRO

Montenegro Seismological Observatory



SERBIA

Seismological Survey of Serbia



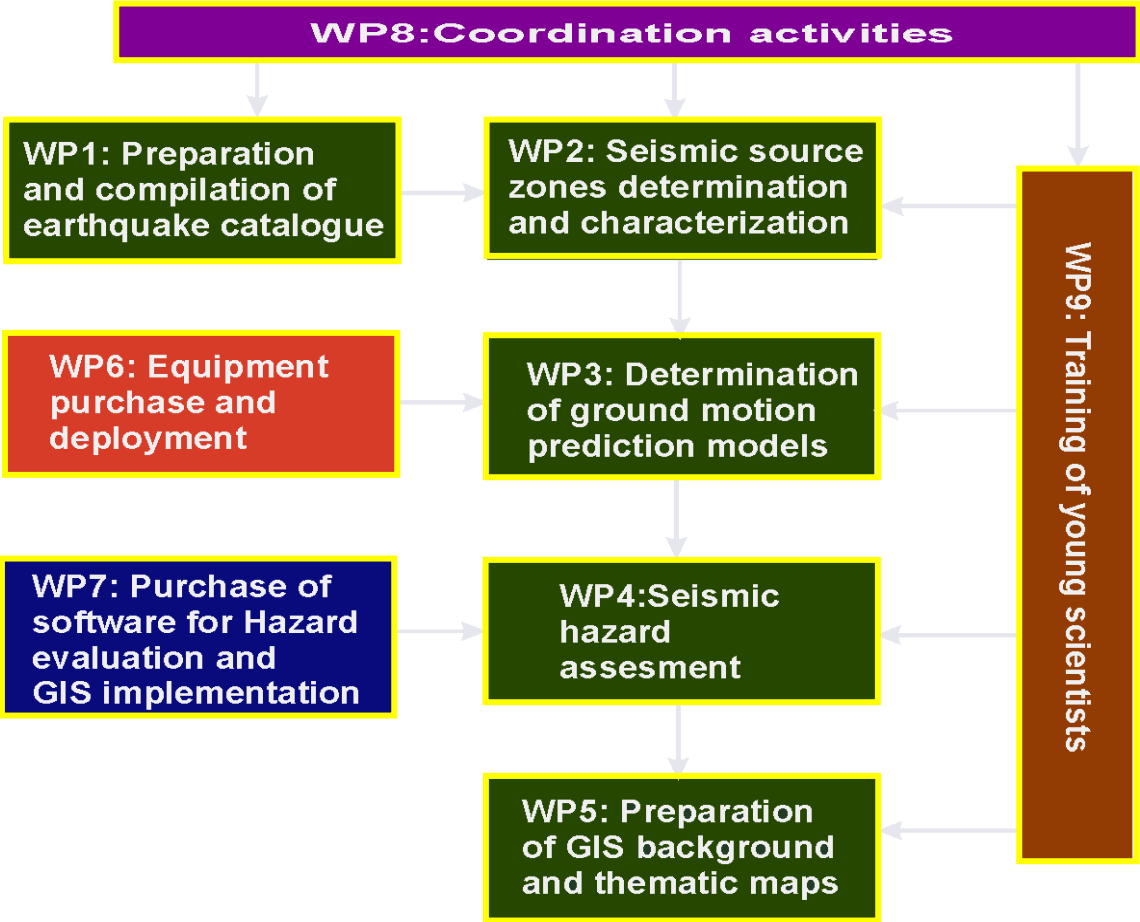
TURKEY

Middle East Technical University



HARMONIZATION OF SEISMIC HAZARD MAPS FOR THE WESTERN BALKAN COUNTRIES (Project number: SfP – 983054); BSHAP – I (2006)

Flow Chart of Project Activities



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Sinan Akkar

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Branislav Glavaticovic

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Shyqyry Aliaj

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Amer Zoranic

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 Department of Geophysics, Faculty of Sciences,
 University of Zagreb, Zagreb, Croatia

Vlado Kuk

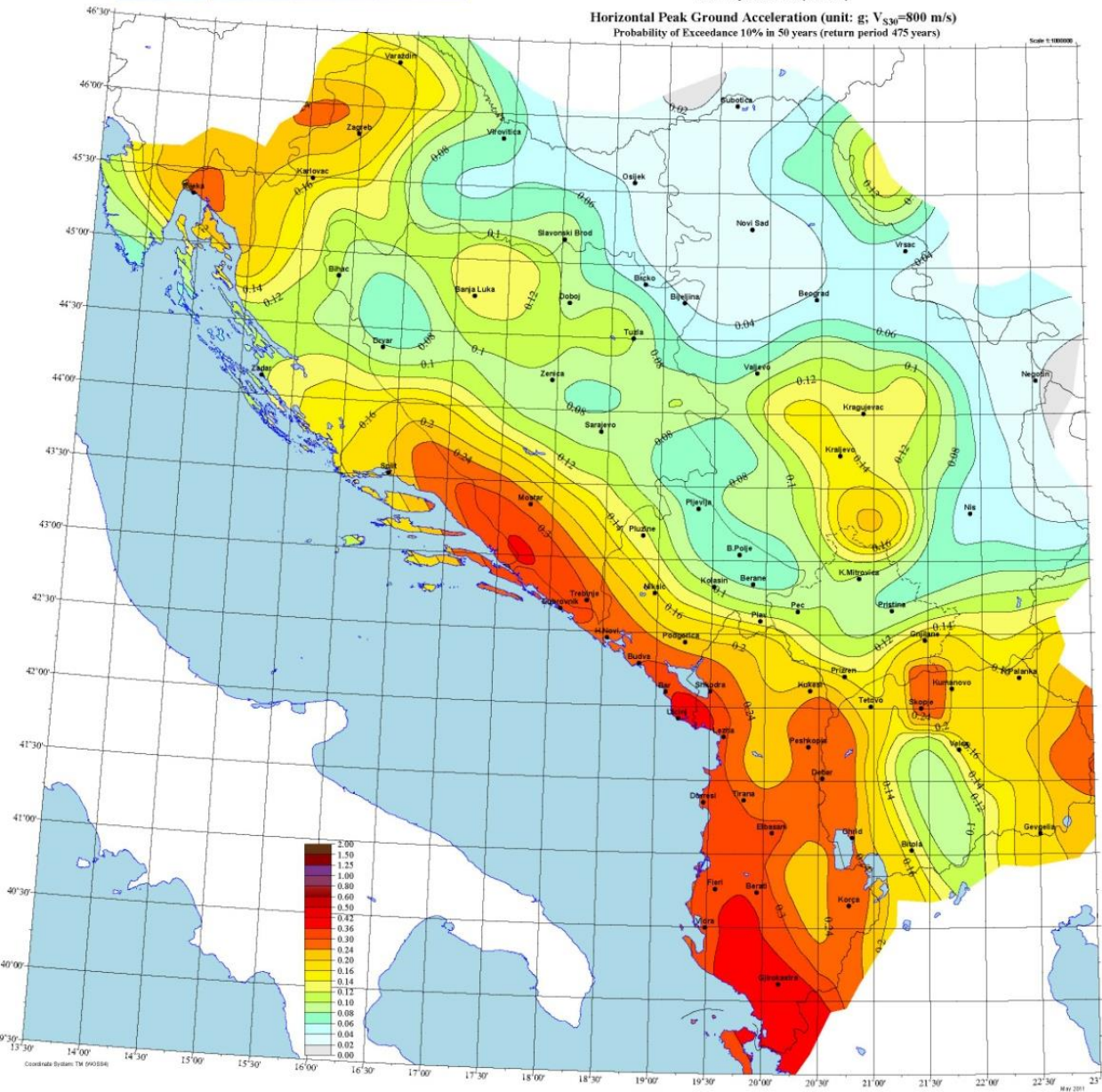
Prof. Dr. Mihail Garevski
 Institute of Earthquake Engineering and Engineering
 Seismology at the University "Ss. Cyril and Methodius",

Mihail Garevski

Svetlana Kovacevic, MS
 Seismologica Survey of Serbia, Belgrade, Serbia

Svetlana Kovacevic

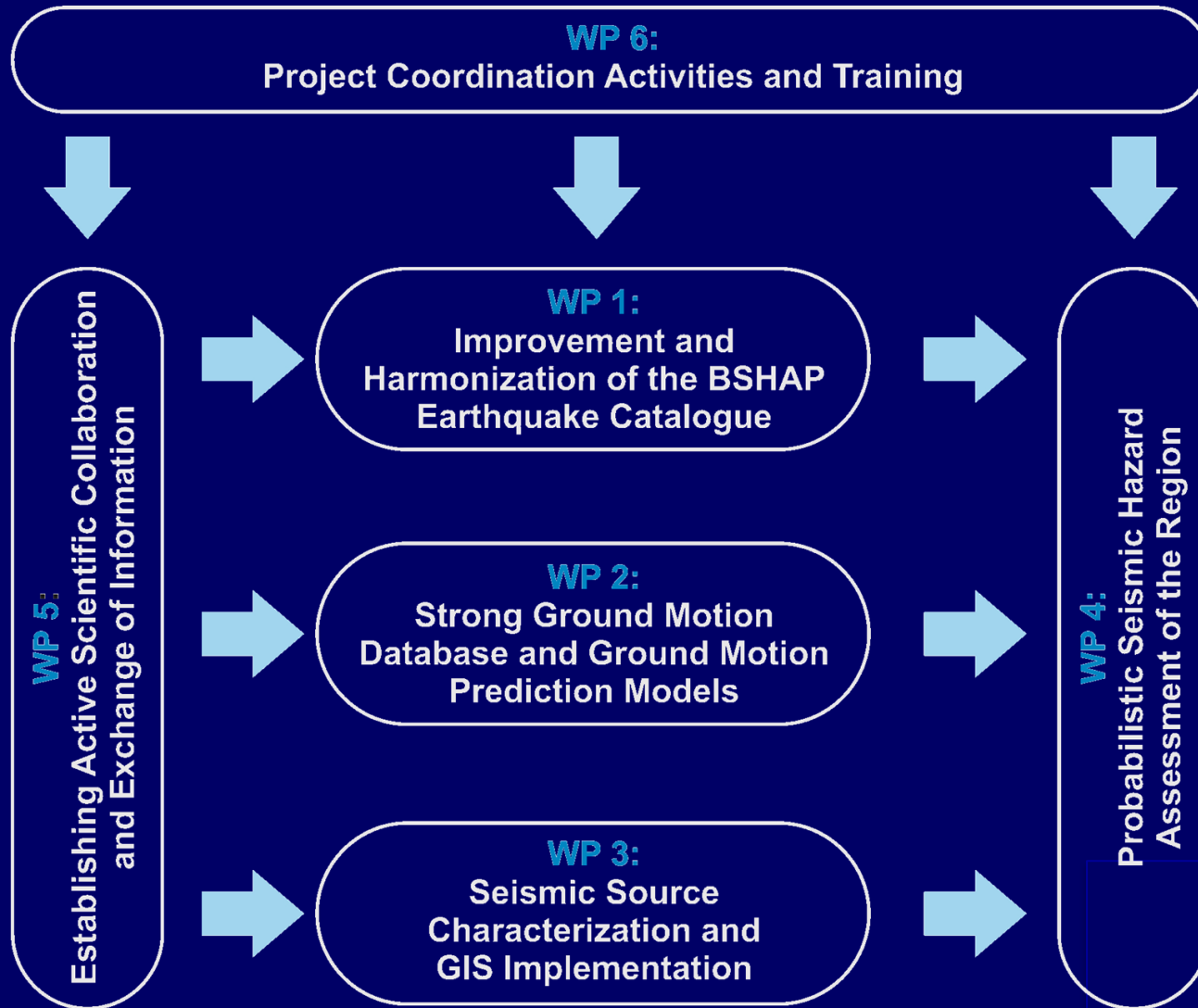
Horizontal Peak Ground Acceleration (unit: g; $V_{S30}=800$ m/s)
Probability of Exceedance 10% in 50 years (return period 475 years)



- CIRCULAR SMOOTHING
Logic three
5 GMPEs, $w=0.2$ each
- CF2008-PGA
 - BINDI2009-PGA
 - BA2008-PGA
 - AB2012-PGA
 - AM2005a-PGA

NATO SfP 984374, BSHAP II (2012)

Working Packages



Improvements in the Harmonized Seismic Hazard Maps for the Western Balkan Countries

General

- [Objectives](#)
- [Background](#)
- [End Users](#)
- [Earthquake Catalogue](#)
- [Accelerometric Databank](#)
- [Seismic Source Characterization](#)
- [Seismic Hazard Maps](#)
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SfP #983054

BSHAP

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Improvements in the Harmonized Seismic Hazard Maps for the Western Balkan Countries



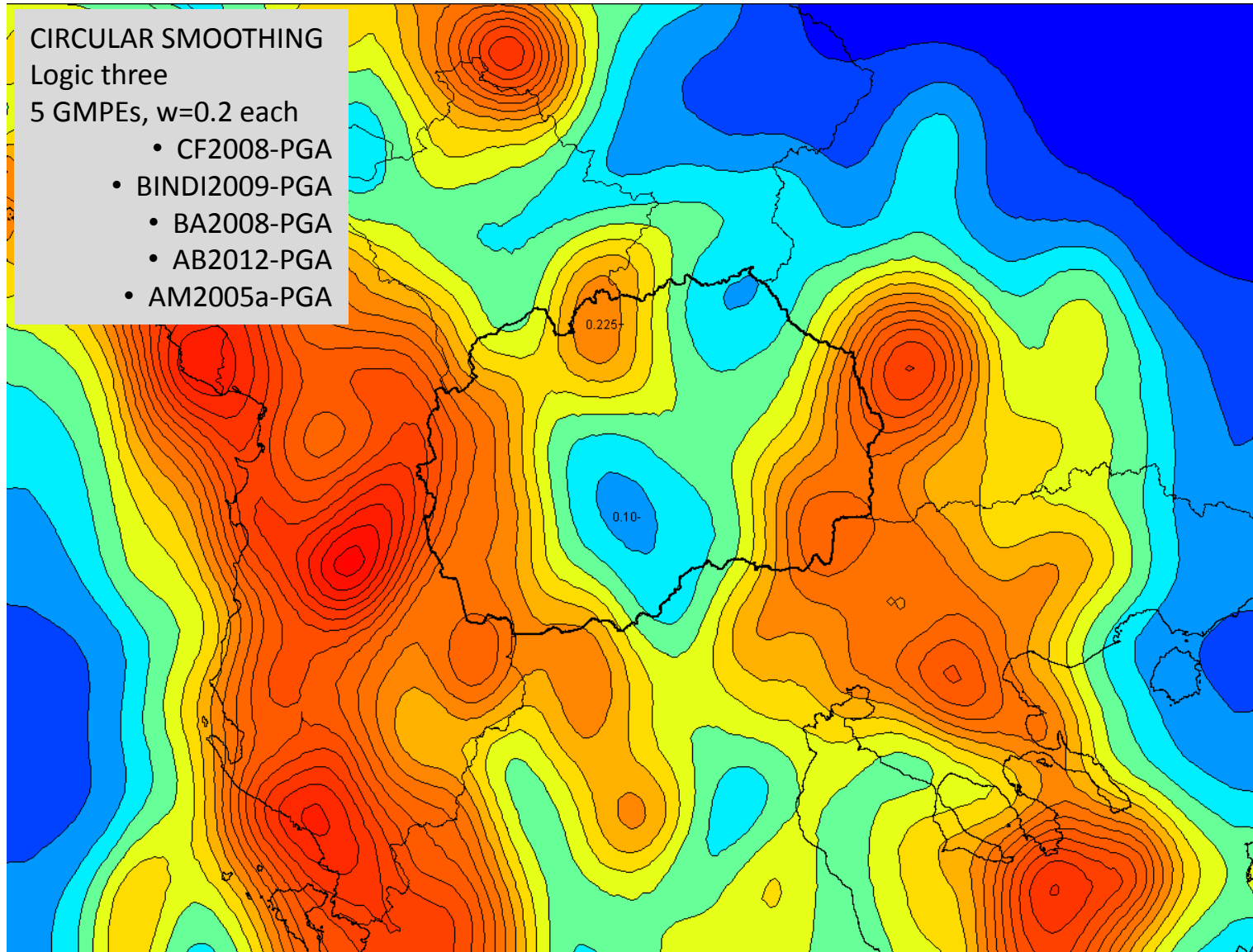
	Turkey / Zeynep Gülerce NPD		
	Macedonia / Radmila Salic PPD		
	Albania / Neki Kuka		
	Bosnia and Herzegovina / Hazim Hrvatovic		
	Croatia / Snjezana Markusic		
	Montenegro / Jadranka Mihaljevic		
	Serbia / Vladan Kovacevic		

CIRCULAR SMOOTHING

Logic three

5 GMPEs, $w=0.2$ each

- CF2008-PGA
- BINDI2009-PGA
- BA2008-PGA
- AB20012-PGA
- AM2005a-PGA

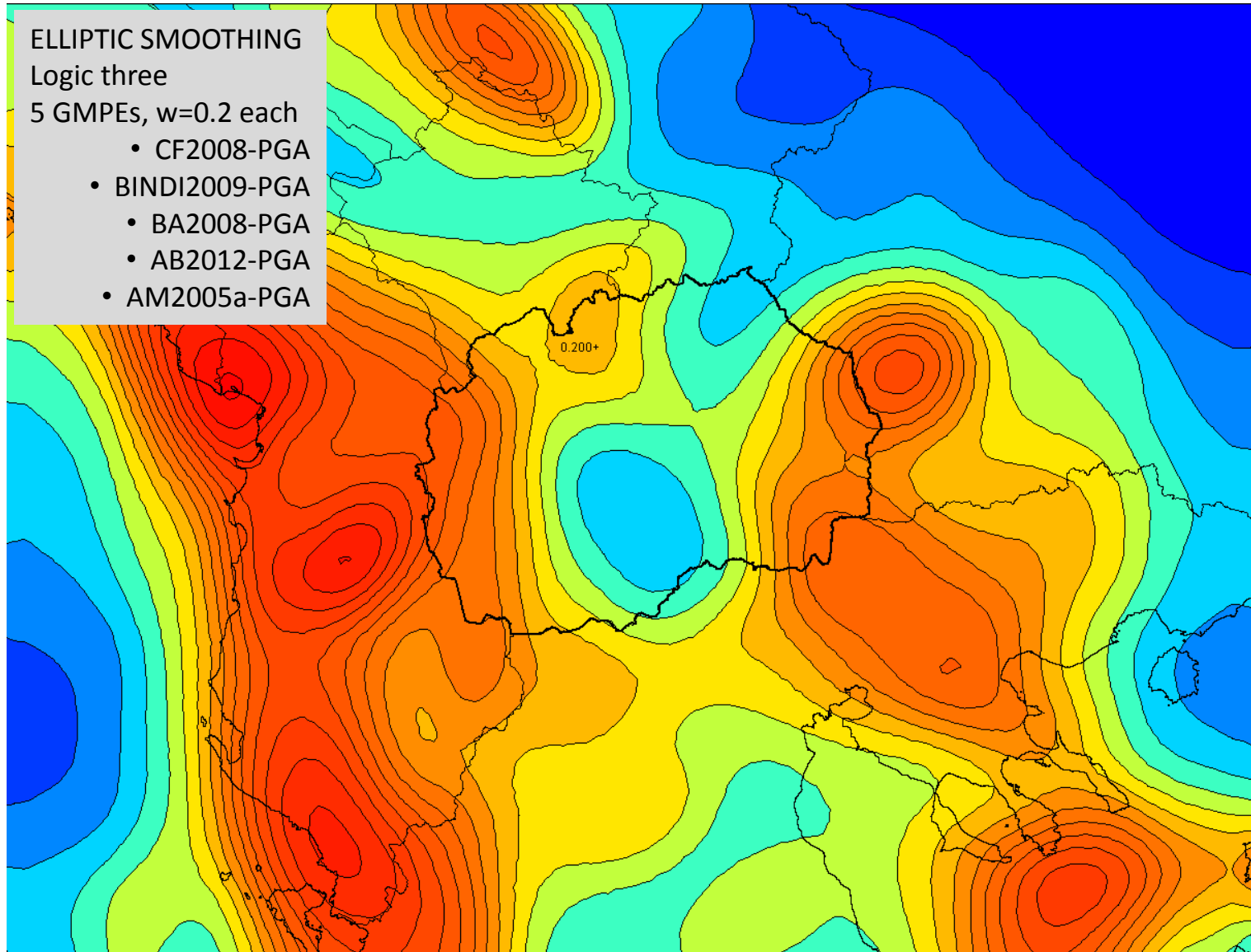


ELLIPTIC SMOOTHING

Logic three

5 GMPEs, $w=0.2$ each

- CF2008-PGA
- BINDI2009-PGA
- BA2008-PGA
- AB2012-PGA
- AM2005a-PGA



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Associate Participants



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Belgium



Ecuador



Germany



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New Zealand



Norway



Singapore



Switzerland



Turkey



TEM



United Kingdom



United States



Chile



Japan



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Montenegro Seismological Observatory, Podgorica



Serbia *Svetlana Kovacevic* Seismological Survey of Serbia,
Belgrade



Slovenia *Dr. Barbara Šket-Motnikar,*
Environmental Agency of Slovenia, Ljubljana

2011

Balkans



Funded by the U.S.
Office of Foreign
Disaster Assistance

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Geofisica e Vulcanologia, Italy

Graeme Weatherill, GEM Foundation

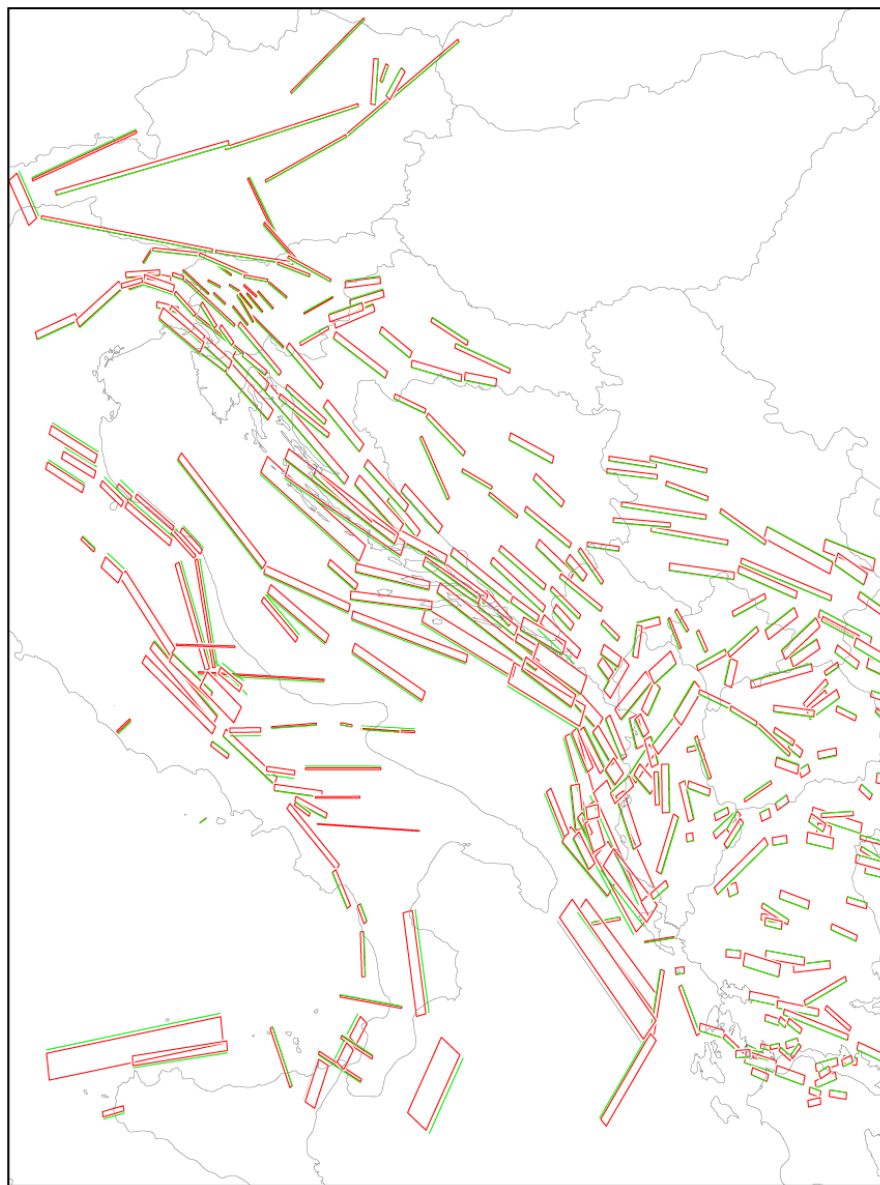
Gottfried Grünthal, GFZ Postdam

Gari Mayberry, US Office of Foreign
Disaster Assistance

Volkan Sevilgen, USGS and
Seismicity.net

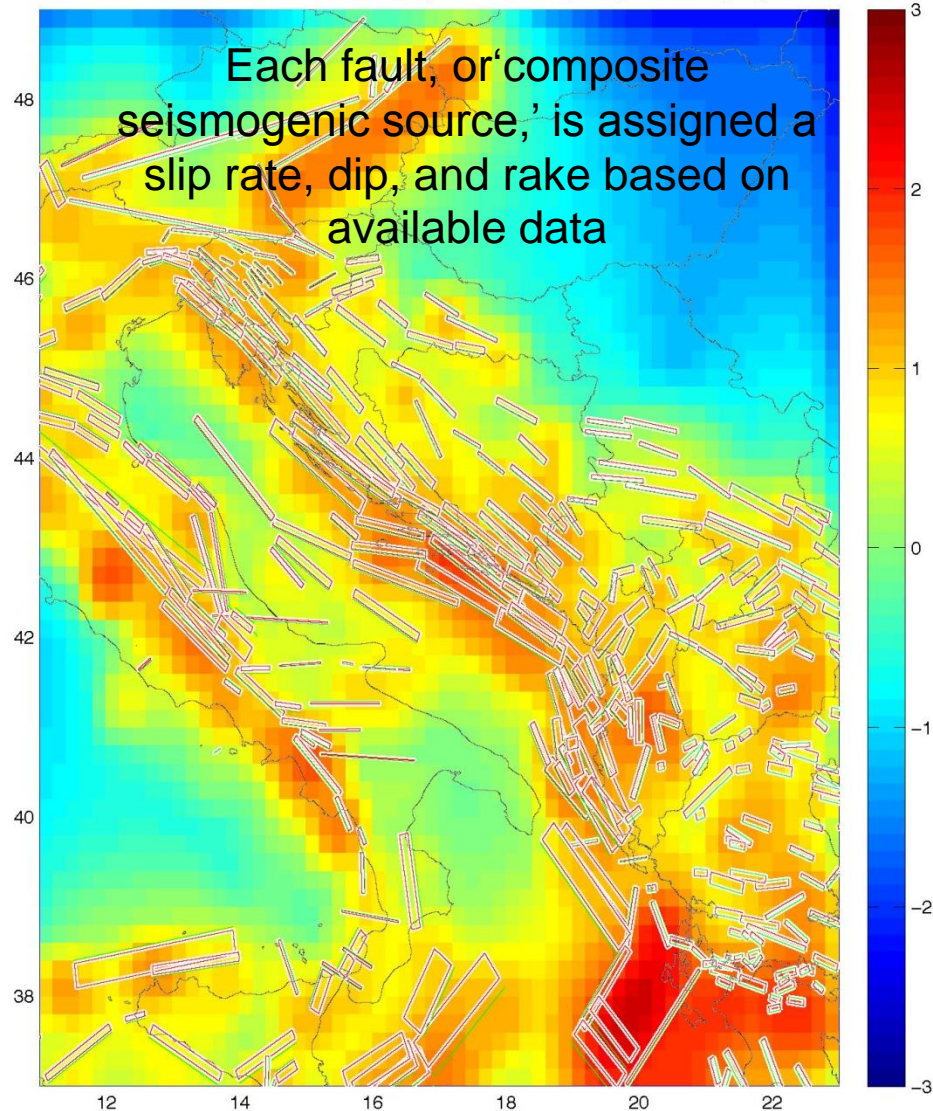
Ross S. Stein, USGS Geophysicist
and GEM Science Board Chair

SHARE (Seismic Hazard Harmonization of Europe) Faults

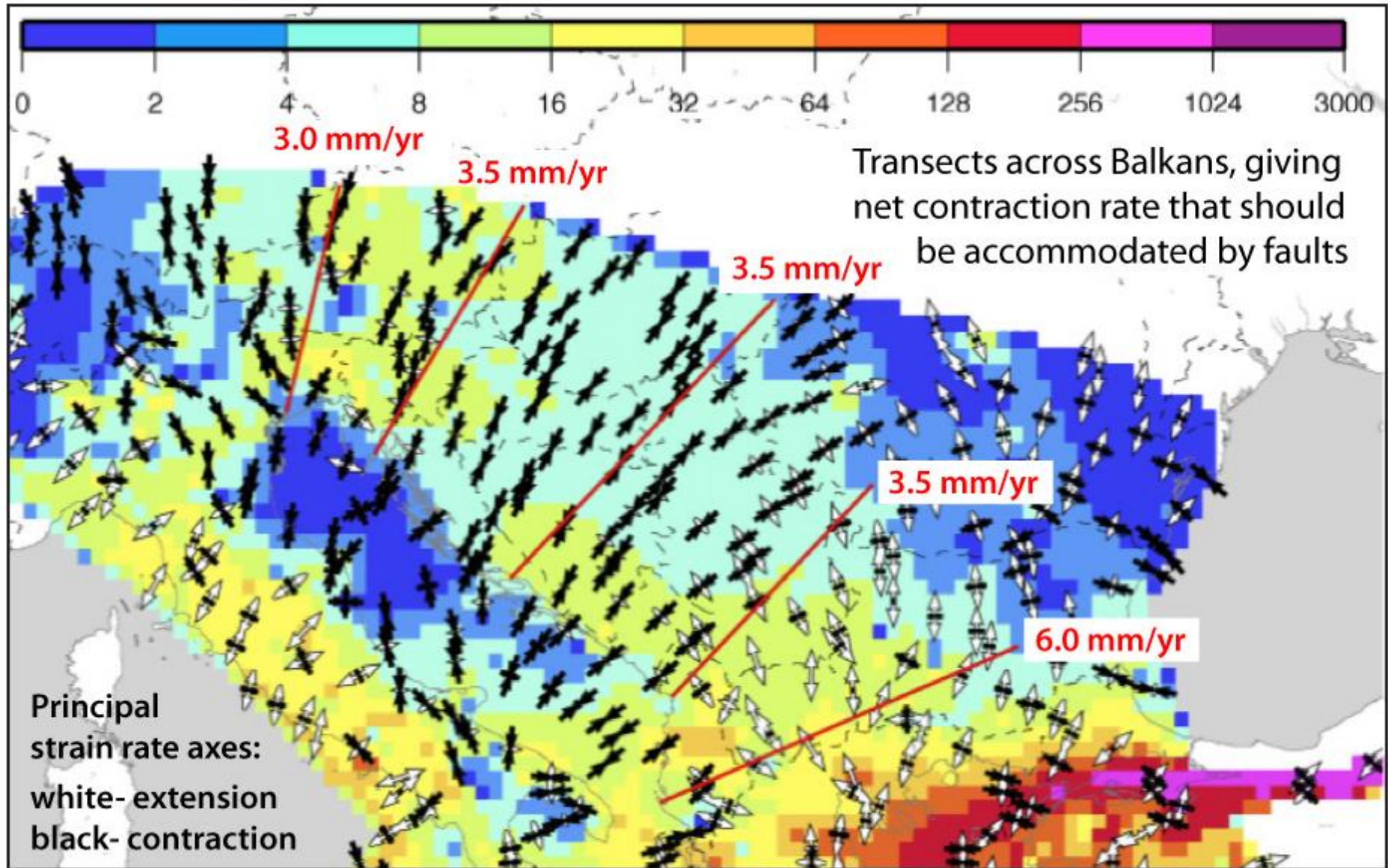


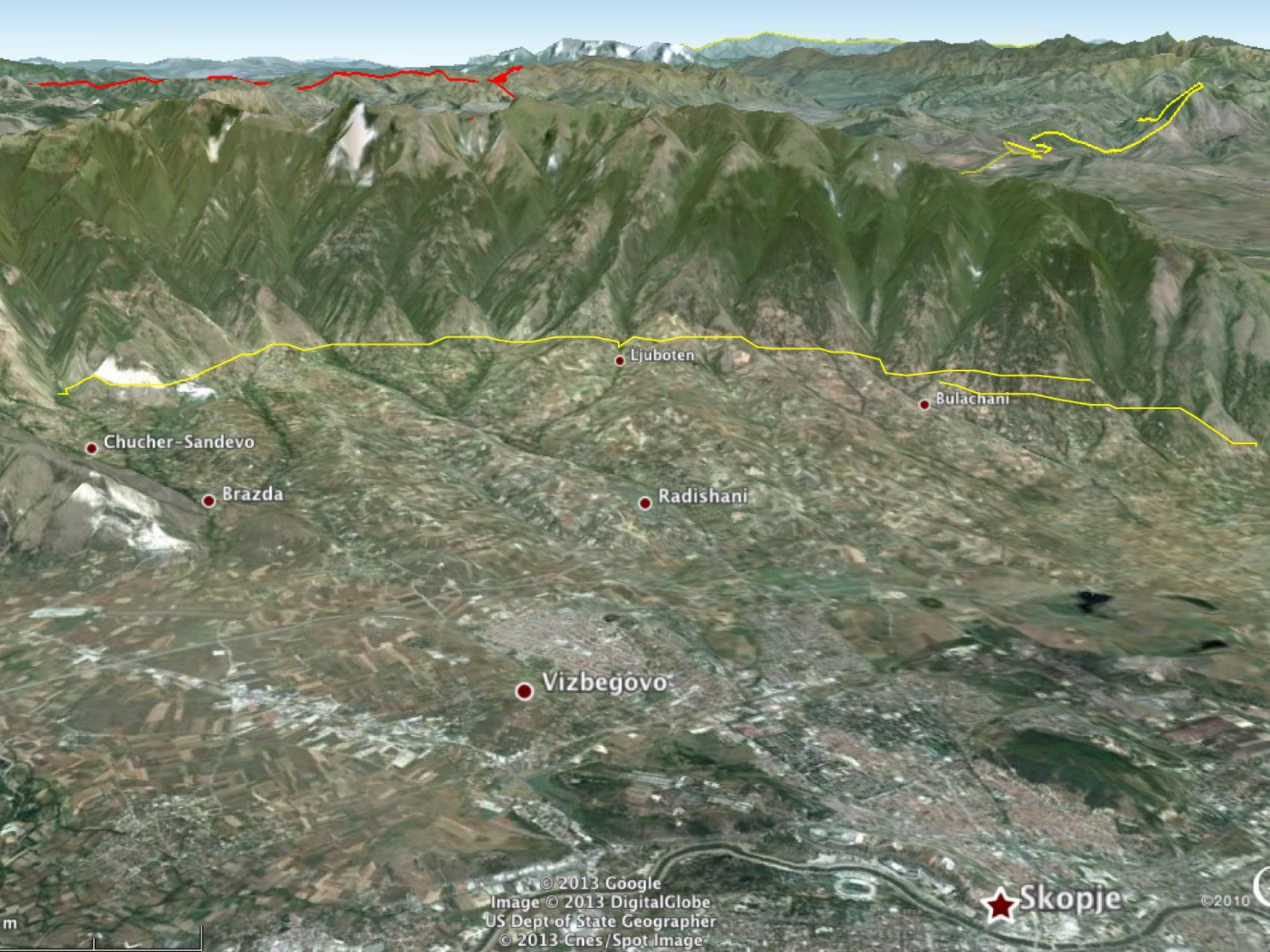
Share Faults
(NE dipping fault)
surface projection

Strain Rate from SHARE Faults (second invariant, in log nanostrain/year)



Global Strain Rate Model Helps Regional Modelers Hunt for Local Faults





Chucher-Sandevo

Brazda

Vizbegovo

Ljuboten

Radishani

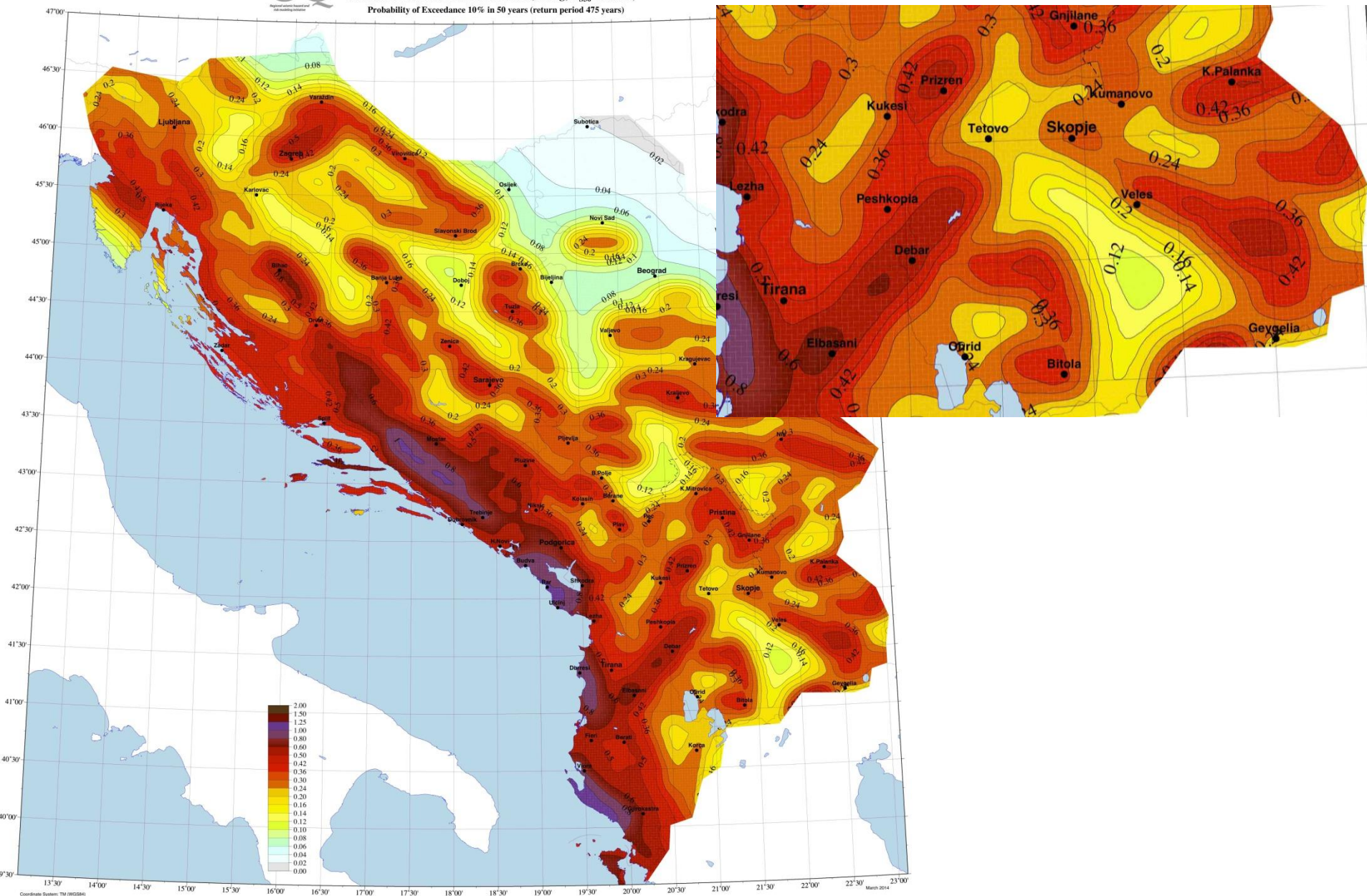
Bulachani

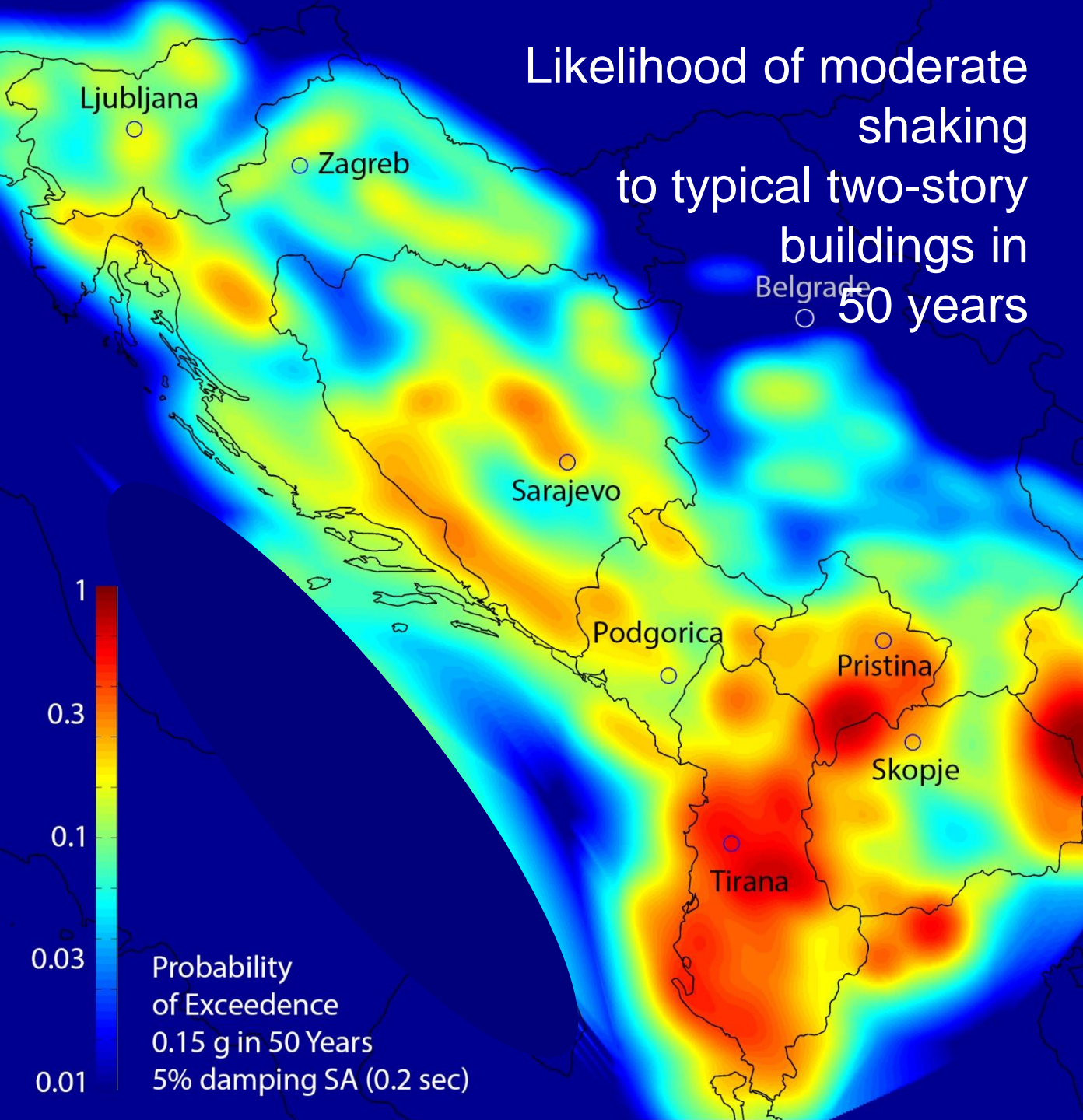
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SEISMIC HAZARD MAPPING OF THE BALKANS
Horizontal Peak Ground Acceleration (unit: g; $V_{S30}=800$ m/s)
Probability of Exceedance 10% in 50 years (return period 475 years)





Preliminary BalkansOQ Seismic Hazard Model Based on strain rate and BalkansOQ faults with max slip rates, but without smoothed seismicity

Probability scale bar:
1 = certain
0.3 = 30% probability
0.1 = 10% probability