



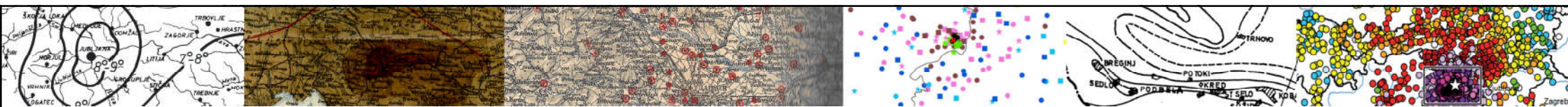
The power of non-instrumental seismological data

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Non-instrumental seismological data (macroseismic data) give us the information about the effects the earthquake had on

- people
- objects
- buildings
- nature





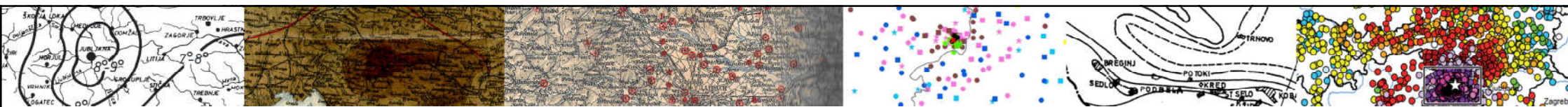
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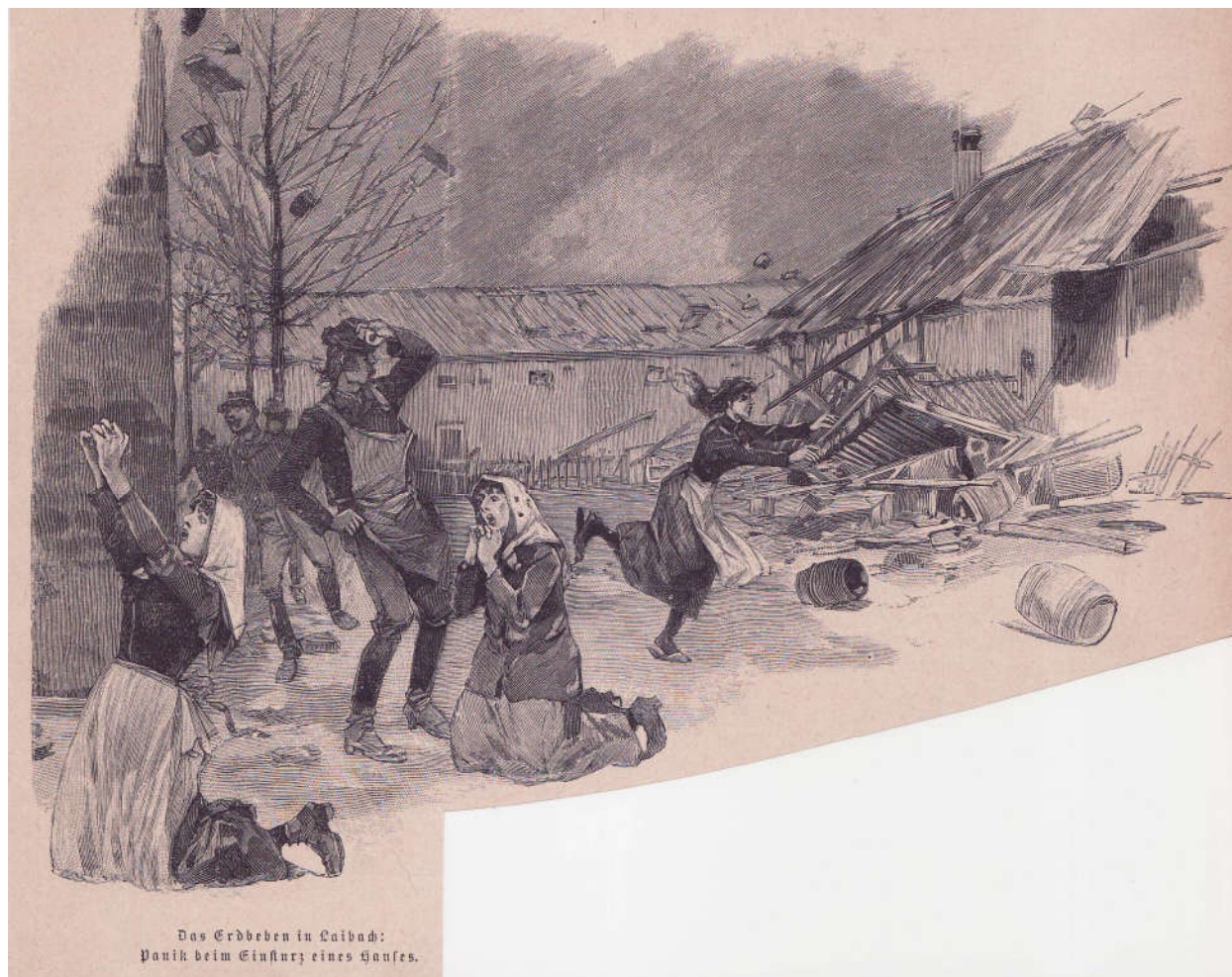
The importance of macroseismic data, even in modern times of plentiful instruments, is manifold:

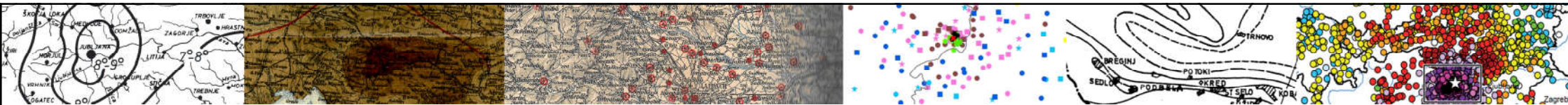
- it is easy to collect the data with small investment (questionnaires, web pages, apps)
- no previous training of the observers is necessary
- everyone can be an observer and every building is an instrument
- macroseismic data give us the possibility to compare the recent earthquakes with the historical ones
- they help us to calibrate magnitude formulas for historical earthquakes
- very useful for seismic hazard research





Macroseismic data collection and evaluation in Slovenia started in an organized way in **1896**, after Ljubljana earthquake (14 April 1895).





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Poziv

glede uredbe potresnega opazovanja na Kranjskem.

Malo je znanstev, v katerih je treba strokovnjaku toliko pomoči širnih krogov, kakor če ima zasledovati bistvo potresov, kajti vsak tak pojav se da preiskovati le na podlagi mnogih pojedinih opazovanj, pridobljenih iz vseh krajev potresnega ozemlja. V mnogih deželah starega in novega sveta je zatorej opazovanje potresov dandanes urejeno po premišljenem načrtu, in od tod so vedi že prirasla znamenita spoznanja.

Odkar je meseca aprila l. 1895. grozna potresna katastrofa zadela našo ožjo domovino in se je pozornost vseh obrnila na tajno podzemeljsko silo, se čuti »Muzejsko društvo za Kranjsko« poklicano, da opazovanje potresov v svojem okrožju tako uredi, kakor je dandanes v naših sosednih deželah, v Hrvaški (od l. 1881.), na Koroškem in Štajerskem, urejeno na korist znanosti, pa tudi — to trdno upamo — na splošno korist človeštvu; saj so že dostikrat čisto znanstvene preiskave porodile iznenadne praktične uspehe.

Cesarska akademija znanostij na Dunaju se je iz enakih nagibov istočasno odločila, da uredi potresno opazovanje temeljito in trajno po vseh avstrijskih deželah. »Muzejsko društvo za Kranjsko« bo torej v tej stvari delovalo za cesarsko akademijo, in akademija bo društvo podpirala.

Zatorej uljudno pozivljemo vse one, ki pritrjujejo vzajemni nakani cesarske akademije in Muzejskega društva, naj blagovolijo sodelovati, da se namera zvrši.

Izvestja muzejskega društva za Kranjsko, 1896, št. 1

— 35 —

Vsak poročevalec prevzame le to preprosto nalogo: kadarkoli se v njegovem bivališču prigodi zemeljski potres, naj popiše, kako se je potres pojavil, in sicer kolikor je opazil sam, ali pa zvedel od znancev. Poročilo naj se pošlje kolikor moči kmalu potem »Muzejskemu društvu za Kranjsko v Ljubljani.«

To bode skrbelo, da se došla poročila že v društvenih publikacijah znanstveno uporabijo; ob enem pa bodo cesarski akademiji znanostij vsaki čas na razpolaganje.

Naj bi naša zasnova rodila zanimanje, delo in uspeh!

Odbor Muzejskega društva za Kranjsko.

A. Senekovič,
c. kr. gimn. ravnatelj,
predsednik.

Navod
za poročanje o potresih.

Poročilo bo prav dostikrat imelo dovolj prostora na poštni dopisnici; redkeje bo dosti obširno za pismo.

Poročilo bodi kolikor moči tako sestavljeno, da odgovarja na ta-le vprašanja, ako ne na vsa, vsaj na nekatera:

1. Na katerem kraju, kateri dan, katero uro in minuto se je potres začutil? Ura, po kateri se opazuje, naj se kolikor moči kmalu primerja z bližnjo kolodvorsko ali brzojavsko uro in pove naj se, na katero uro se nanaša zaznamovani čas.
2. Koliko sunkov se je pojavilo in v katerih presledkih? Koliko časa so trajali sunki, kako dolgo se je vsled njih še treslo?
3. Kakovo je bilo gibanje? (Udarec od spodaj, kratek sunek od strani, polagoma zibanje, valovanje ali le trepetanje itd.) Ali je bilo gibanje različno ob različnih sunkih?
4. Od katere strani neba je gibanje prišlo, kolikor se je smer začutila in kolikor se je spoznala po nihanju zaznanih stvari, n. pr. visečih svetilk?

3*

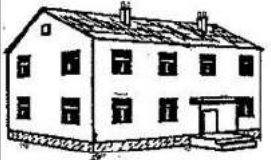
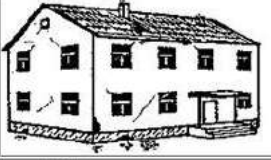





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European macroseismic scale – a powerful new tool



Classification of damage to masonry buildings	
	Grade 1: Negligible to slight damage (no structural damage, slight non-structural damage) Hair-line cracks in very few walls. Fall of small pieces of plaster only. Fall of loose stones from upper parts of buildings in very few cases.
	Grade 2: Moderate damage (slight structural damage, moderate non-structural damage) Cracks in many walls. Fall of fairly large pieces of plaster. Partial collapse of chimneys.
	Grade 3: Substantial to heavy damage (moderate structural damage, heavy non-structural damage) Large and extensive cracks in most walls. Roof tiles detach. Chimneys fracture at the roof line; failure of individual non-structural elements (partitions, gable walls).
	Grade 4: Very heavy damage (heavy structural damage, very heavy non-structural damage) Serious failure of walls; partial structural failure of roofs and floors.
	Grade 5: Destruction (very heavy structural damage) Total or near total collapse.

Type of Structure	Vulnerability Class						
	A	B	C	D	E	F	
MASONRY	<ul style="list-style-type: none"> ○ rubble stone, fieldstone ○— adobe (earth brick) ○— simple stone ○— massive stone 						
	<ul style="list-style-type: none"> ○— unreinforced, with manufactured stone units ○— unreinforced, with RC floors ○— reinforced or confined 						
	REINFORCED CONCRETE (RC)	<ul style="list-style-type: none"> ○— frame without earthquake-resistant design (ERD) ○— frame with moderate level of ERD ○— frame with high level of ERD ○— walls without ERD ○— walls with moderate level of ERD ○— walls with high level of ERD 					
		STEEL	<ul style="list-style-type: none"> ○— steel structures 				
		WOOD	<ul style="list-style-type: none"> ○— timber structures 				

○ most likely vulnerability class; — probable range;range of less probable, exceptional cases



1995

- 4842 observers
- 32 felt earthquakes
- Imax VI EMS-92
- sent 11170 questionnaires
- returned 70%

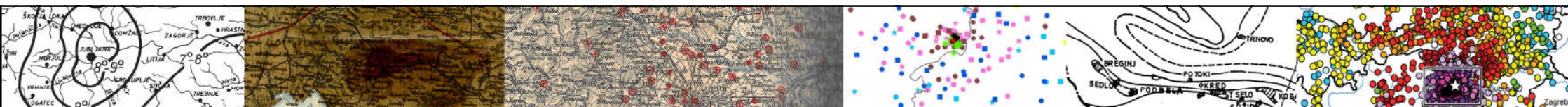
GDPR!



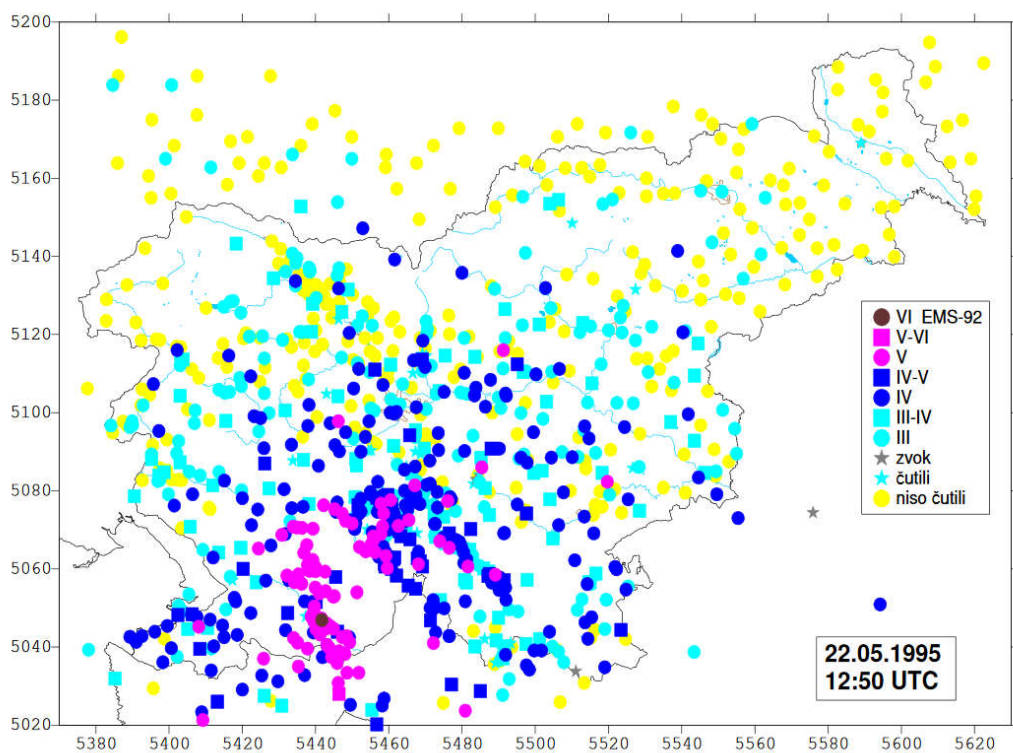
2019

- 2432 observers
- 975 paper, 1457 web
- 141 felt earthquakes
- Imax IV-V EMS-98
- sent 1886 paper and 7163 e-mail questionnaires (9049)
- returned 84% paper and 42% e-mail

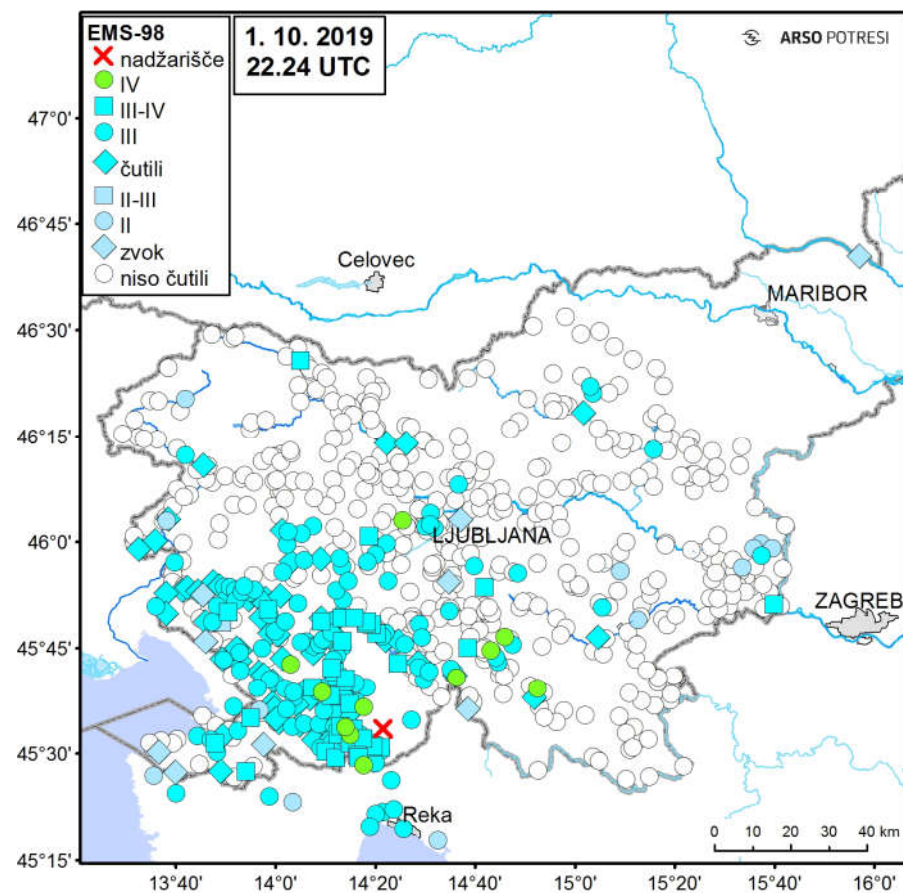
total 10135
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Strongest earthquakes in 1995 and 2019



M 4.7

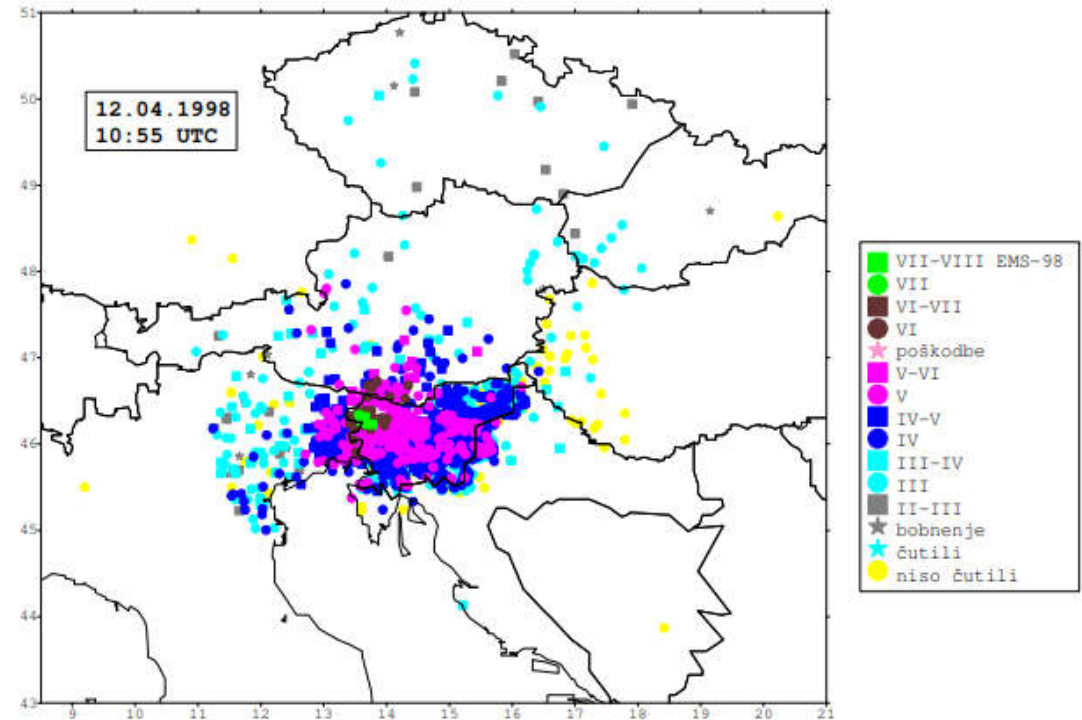


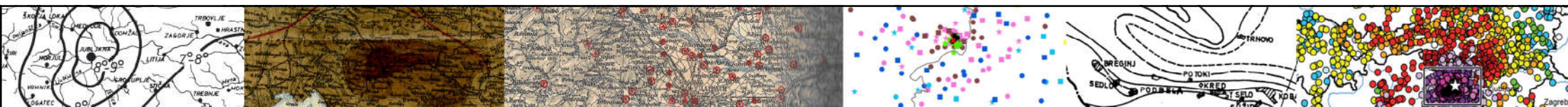
M 3.4



The strongest earthquakes in 1995 - 2020 were
 12 April 1998 **Mw 5.7** I_{max} VII-VIII EMS-98
 1981 IDPs

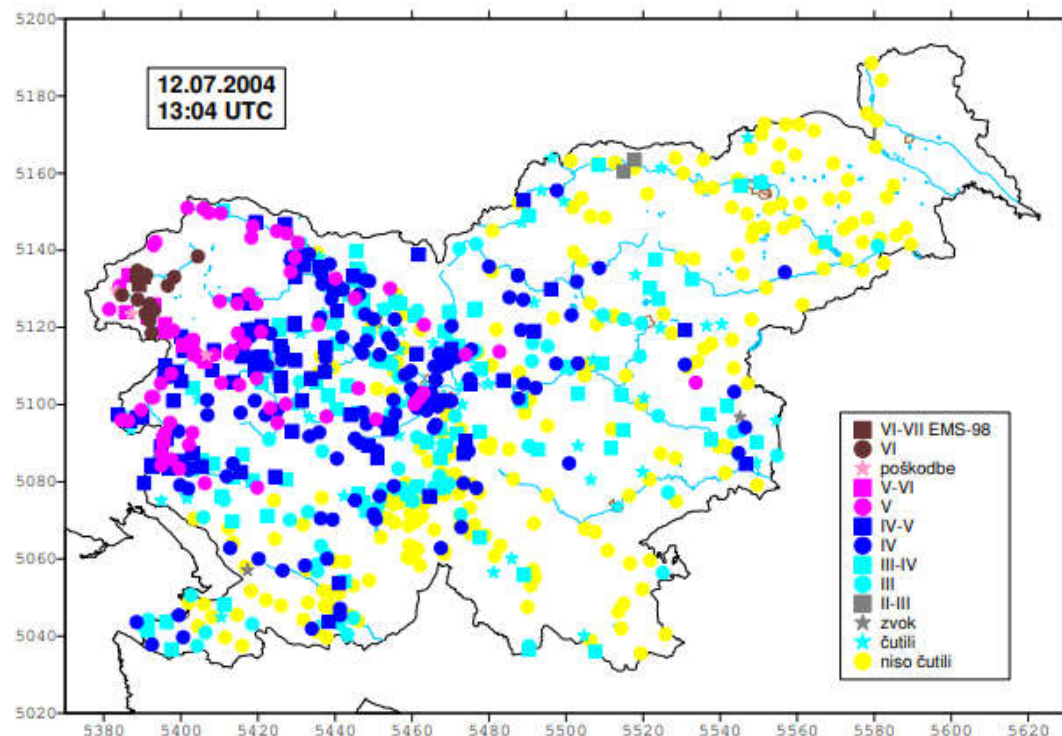
M in XX c.





The strongest earthquakes in 1995 - 2020 were
 12 July 2004 Mw 4.9 I_{max} VI-VII EMS-98
 771 IDPs

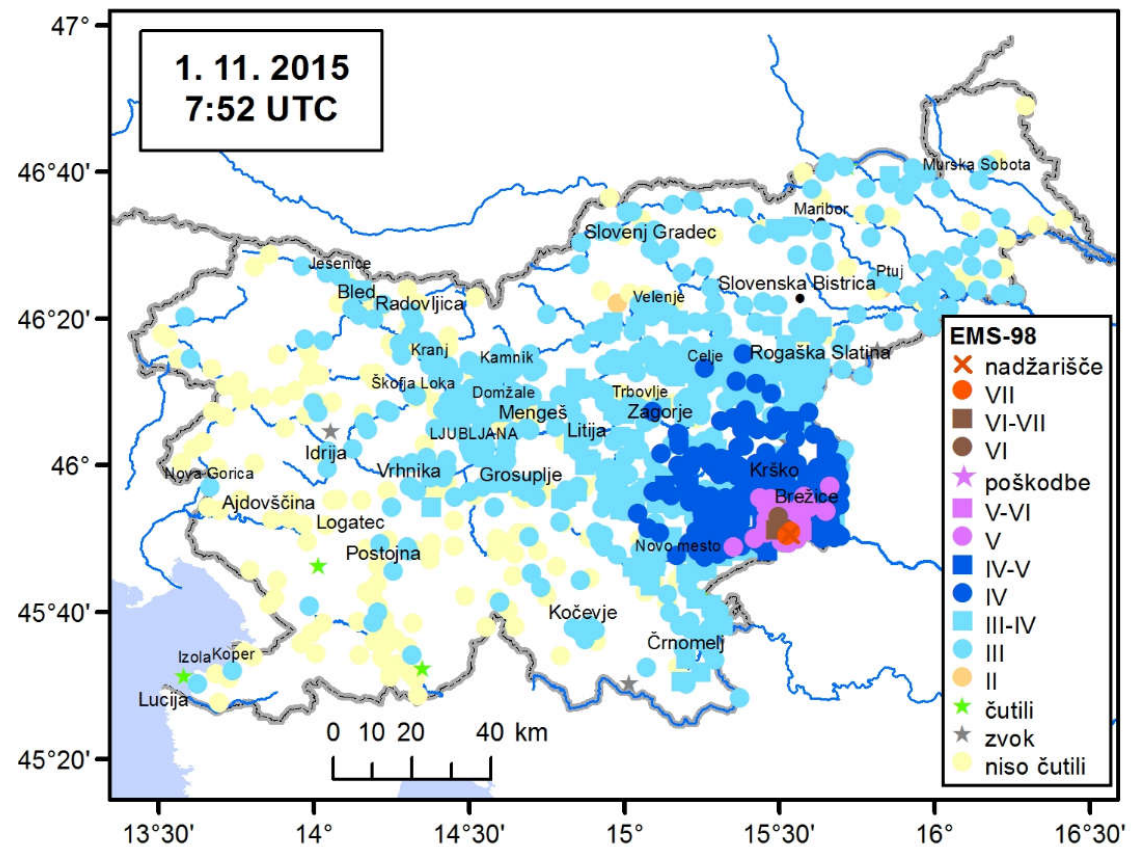
victims in XXI c.
 1 dead





The strongest earthquakes in 1995 - 2020 were
 1 November 2015 Mw 4.2 **Imax VII EMS-98**
 1145 IDPs

intensity in XXI c.



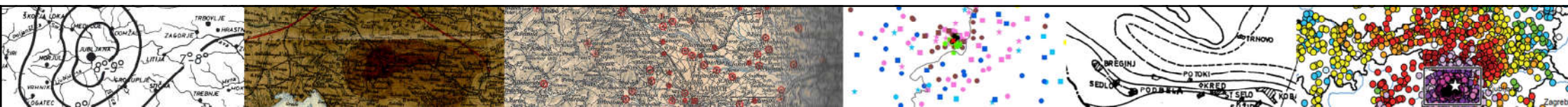


One of the strongest historical earthquakes evaluated in last 25 years:

29 January 1917

2 dead





Mjesto *Brdovac* Kotar *Zagreb* ✓
 1. Potres bio dne? *29/I 1917.* u *9* sati *15* m. pos. pod.
 2. Motritelj je bio za potresa u *svetlu* ¹⁰ *budavi* ¹⁰

Mjesto: *Kudaci* Kotar: *Zagreb* ✓
 1. Potres je bio dne *29/I* u *10* sati *—* min. prije podne, poslije podne
 2. Gdje se je nalazio motritelj za potresa: u kući, na polju i t. d.? *u školi*
 3. Je li bilo tutnjave prije, za ili poslije potresa? *poslije potresa*

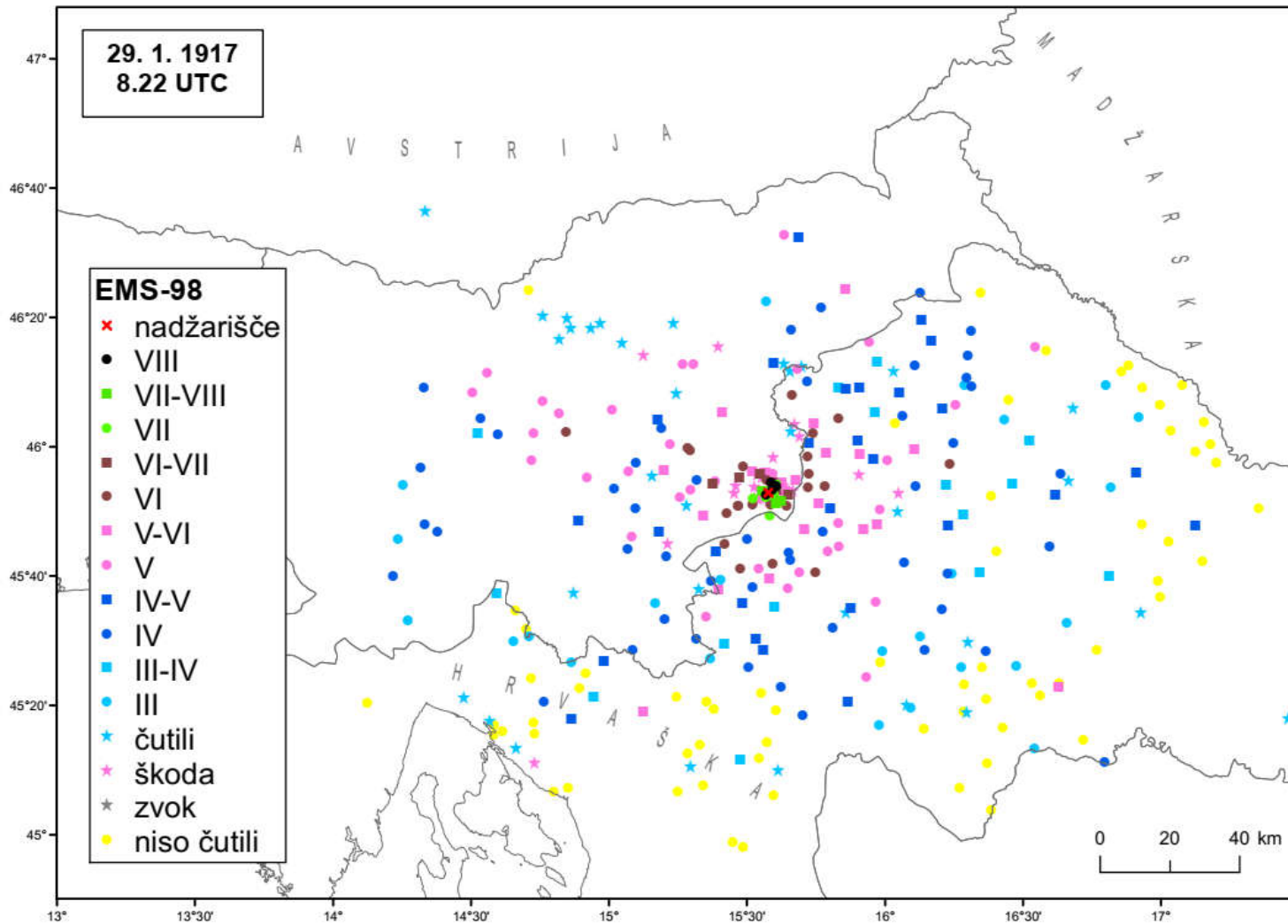
stavo.
 — Potres. Danes dopoldne ob 9. in 37 minut je bilo čutiti dva kratka zaporedna potresna sunka s presledkom le dveh do treh sekund. Večina ljudi potresa sploh občutila ni. Smer vzhod-zapad. — Potres se je ponovil potem ob 11. in 33 minut ter je trajal kakih dve sekundi.
 Prigoni (seimi) za plemensko žl-

Potres.
Velike poškodbe v Brežicah in drugih krajih ob Savi.
 Dne 29. januarja dopoldne okroglo ob pol 10. uri zgodil se je potres, ki se je v vseh naših krajih, zlasti pa v mestih in vaseh ob Savi, močno čutil ter je tudi precejšnjo škodo napravil.

Nb. Agram, 29. Jänner. Ein ziemlich heftiger Erdstoß wurde hier heute vormittags verspürt. Das Beben begann um 9 Uhr 23 Min. 8 Sec. und währte 10 Sekunden. Das Erdbeben richtete keinerlei Schaden an, nur einige Häuser zeigten Deckensprünge. Es wurde auch in der Umgebung verspürt.

29 January 1917
 08.22 UTC

With
 macroseismic
 data, we can set
 the earthquake
 parametres:
 origin time
 intensity
 co-ordinates
 magnitude
 depth

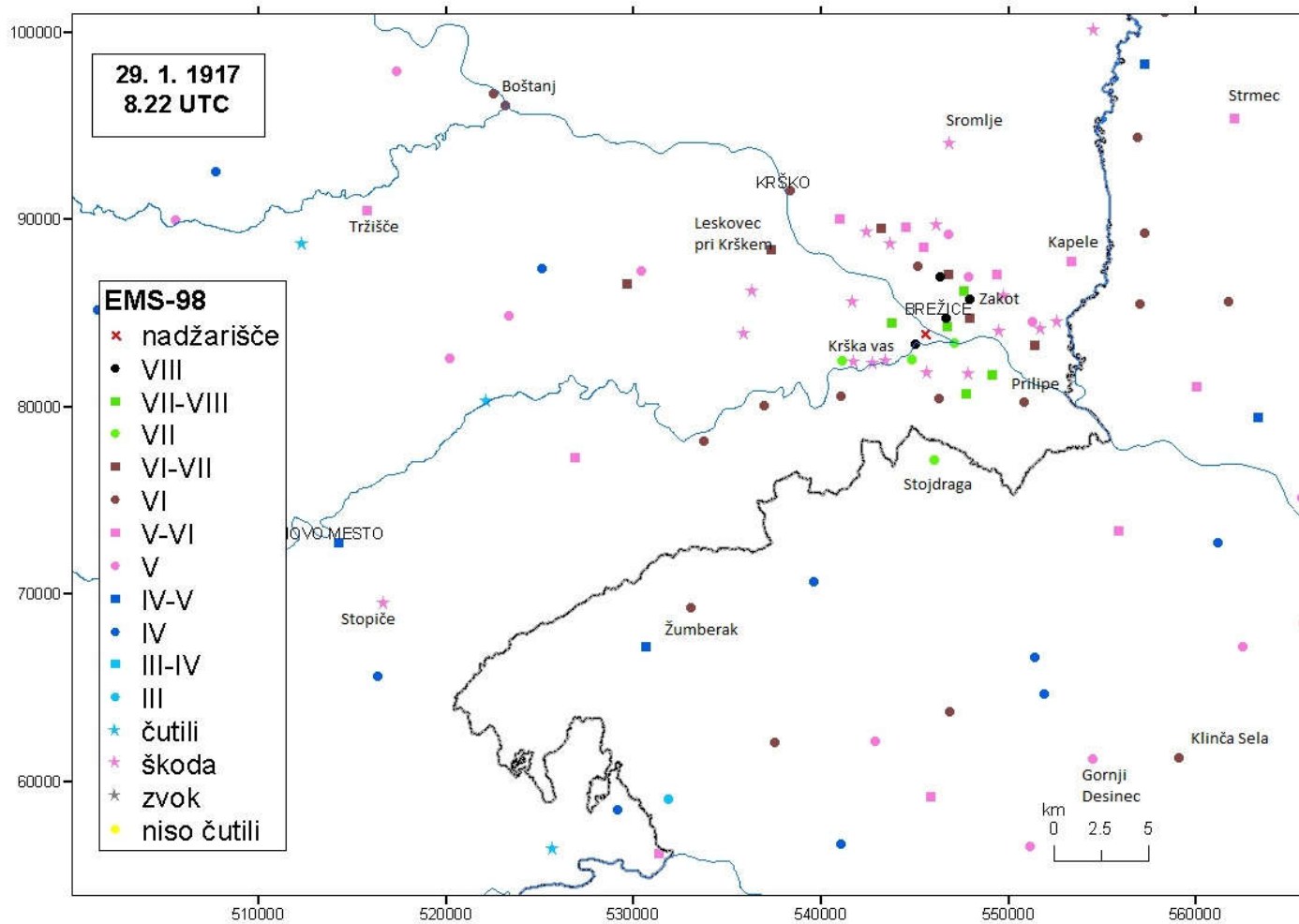


With
macroseismic
data, we can set
the earthquake
parametres:
origin time
intensity
co-ordinates
magnitude
depth

Imax VIII EMS-98

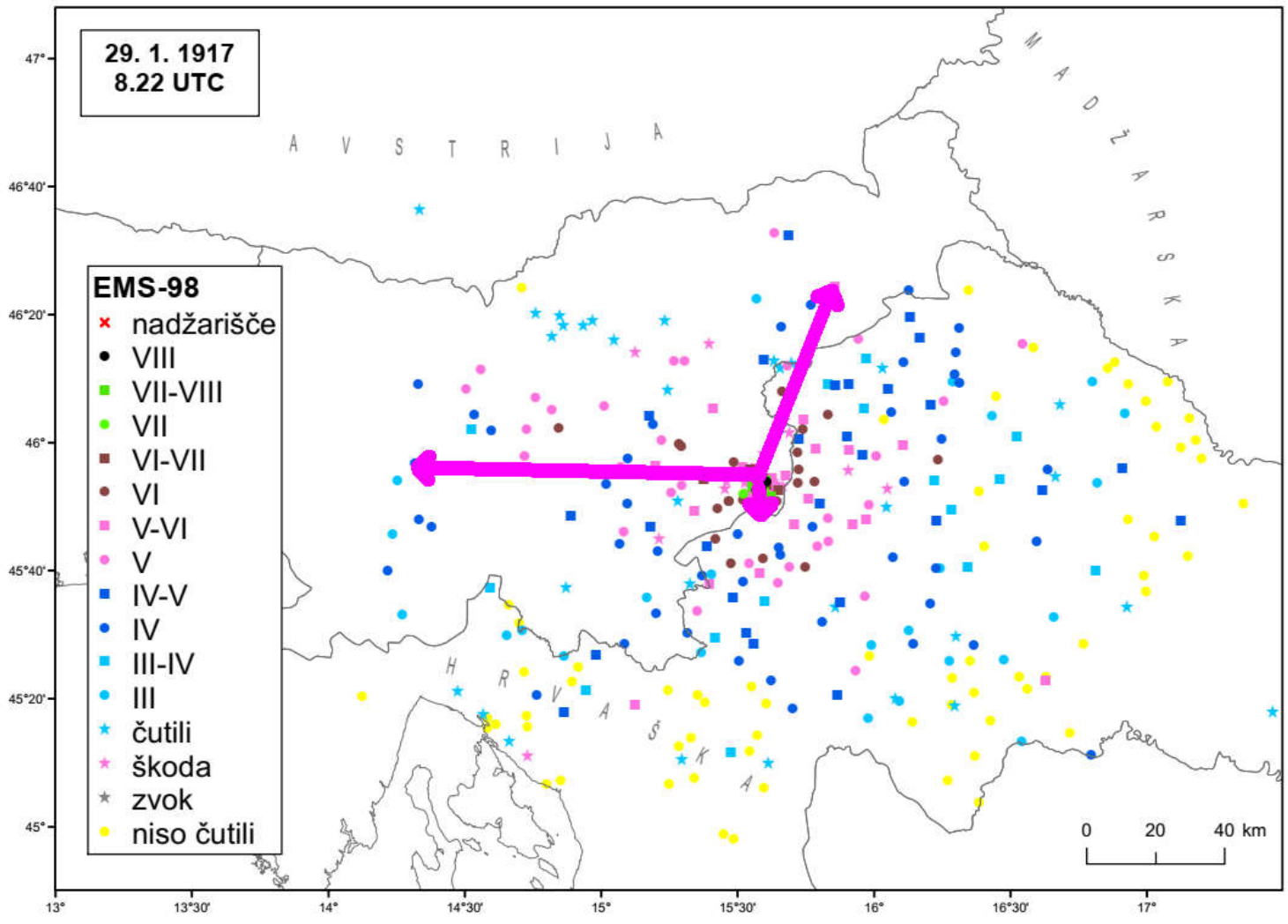


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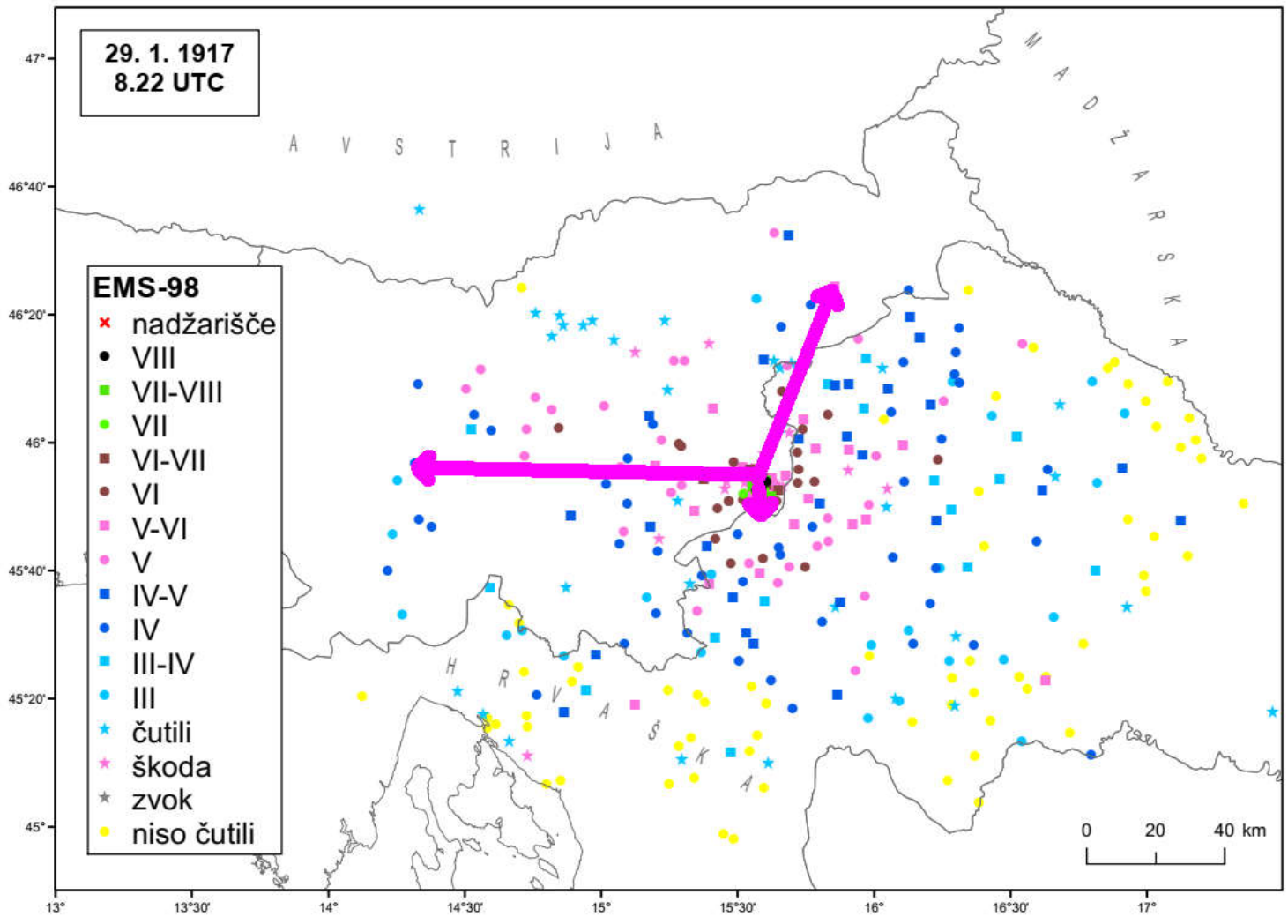
With
macroseismic
data, we can set
the earthquake
parameters:
origin time
intensity
co-ordinates
magnitude
depth

Epicentral co-ordinates
45.90 N 15.58 E



With
macroseismic
data, we can set
the earthquake
parametres:
origin time
intensity
co-ordinates
magnitude
depth

Mm 5.0



With
macroseismic
data, we can set
the earthquake
parametres:
origin time
intensity
co-ordinates
magnitude
depth

shallow
less than 5 km

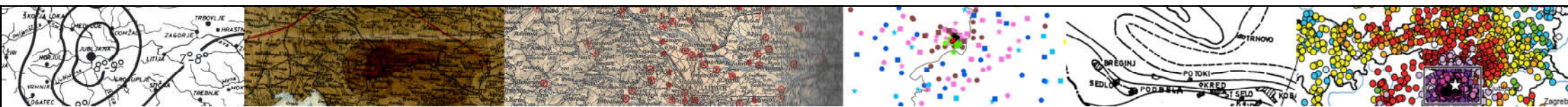


Why am I telling you all this?

Because an earthquake – a strong one –
can happen anytime

... and you can be an observer!





If you feel an earthquake, please report about your experience at



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<http://potresi.arso.gov.si/vprasalnik>



https://www.emsc-csem.org/Earthquake/Contribute/choose_earthquake.php?lang=en



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Thank you!