



Project funded by  
EUROPEAN UNION

**REDACT**  
Rapid Earthquake Damage Assessment Consortium



# REDAS - Sistemul de estimare rapidă a daunelor provocate de cutremure și Aplicația de smartphone REDACT

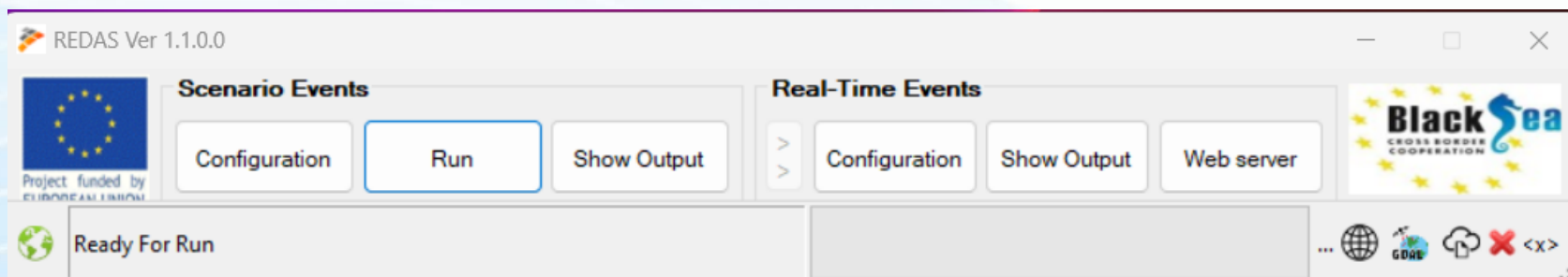


*Seminar – Rezultatele Proiectului REDACT, 30 iunie 2023*

Common borders. Common solutions.

## Caracteristici:

- **REDAS = Rapid Earthquake Damage Assessment System**
- **Coordonator: Gebze University (în special Yasin Fahjan și Can Zulfikar)**
- **Scris în C#, cu resurse adiționale: GDAL și EGIS**
- **Ultima versiune: 1.1**



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## Caracteristici:

- **Conține 5 module distincte:**
  - Estimare hazard prin intermediul ecuațiilor de predicție a mișcării solului (GMPE)
  - Shakemap
  - Estimare pagube clădiri
  - Estimare probleme geotehnice (alunecări de teren, susceptibilitate lichiefiere)
  - Conducte
- Funcționează atât în timp real cât și pentru scenarii
- Poate utiliza date de la stații seismice: PGA, SA, PGV precum și detalii despre cutremure în format .xml (ShakeMap)

**Date partajate pe Cloud**

*Timp (aproape) real*



- 📁 **Cutremure**
  - Event ID1
    - Event Trigger xml Files
    - Station Data xml Files

- 📁 **Date operationale**
  - Hărți cu falii
  - Hărți Vs30
  - Funcții de fragilitate și vulnerabilitate
  - Zone de activare REDAS
  - Coeficienți și ponderi pentru GMPE

📄 Event ID> Grid Based Damage Data

**REDAS pe server partener**

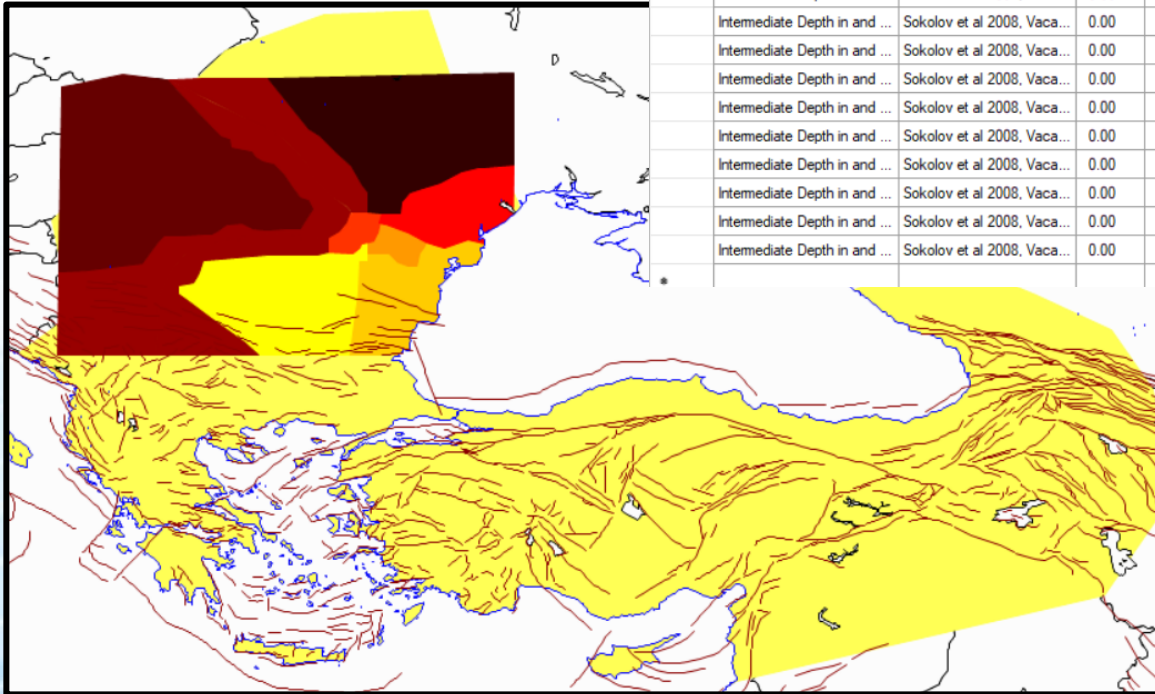
- Server local**
- 📁 **Bază de date**
    - Clădiri
    - Populație
    - Conduce

**Processing .....**

- Rezultate: pe server local**
- 📄 Hărți de intensitate
  - 📄 Hărți PGA, PGV, PSA
  - 📄 Clădiri afectate
  - 📄 Rată de reparații pentru conduce
  - 📄 ....

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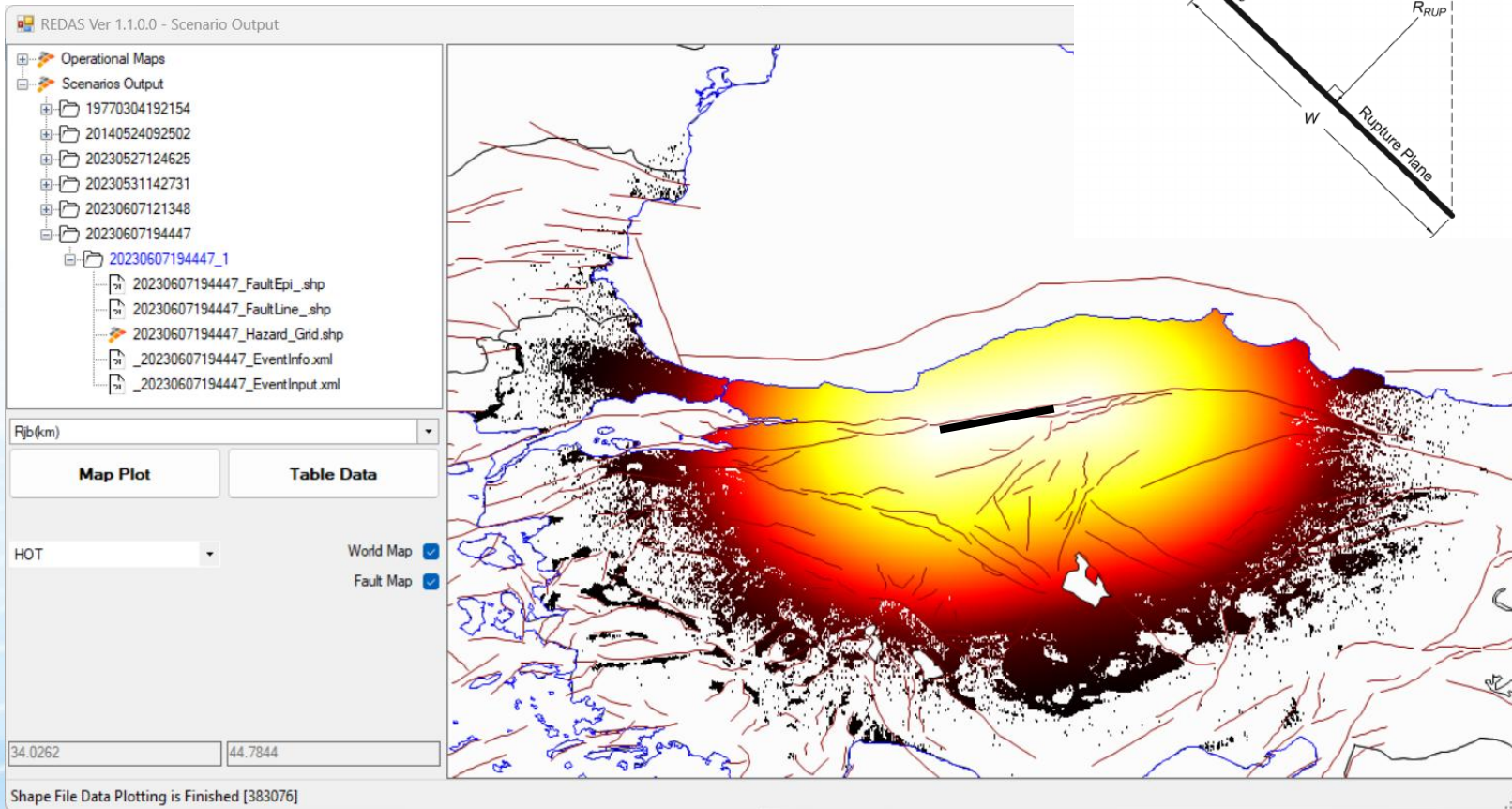
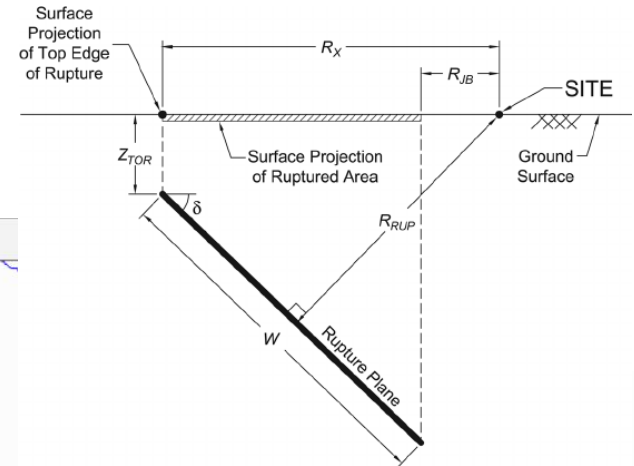
## Ecuatii de Predicție a Mișcării Solului (GMPE)



ZONE	GMPE	BSSA14	CB14	ASK14	CY14	KAH15	BWTB21	BWOB21	SKV08	VAC15	ZMIN
Crustal earthquakes in and...	Boore et al (2014), Cauzz...	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.000
Crustal earthquakes in Vra...	Boore et al (2014), Cauzz...	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.000
Crustal earthquakes in and...	Boore et al (2021) with a...	0.00	0.00	0.00	0.00	0.34	0.33	0.33	0.00	0.00	0.000
Intermediate Depth in and ...	Sokolov et al 2008, Vaca...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	60.000
Intermediate Depth in and ...	Sokolov et al 2008, Vaca...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	60.000
Intermediate Depth in and ...	Sokolov et al 2008, Vaca...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	60.000
Intermediate Depth in and ...	Sokolov et al 2008, Vaca...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	60.000
Intermediate Depth in and ...	Sokolov et al 2008, Vaca...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	60.000
Intermediate Depth in and ...	Sokolov et al 2008, Vaca...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	60.000
Intermediate Depth in and ...	Sokolov et al 2008, Vaca...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	60.000
Intermediate Depth in and ...	Sokolov et al 2008, Vaca...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	60.000
Intermediate Depth in and ...	Sokolov et al 2008, Vaca...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	60.000
Intermediate Depth in and ...	Sokolov et al 2008, Vaca...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	60.000

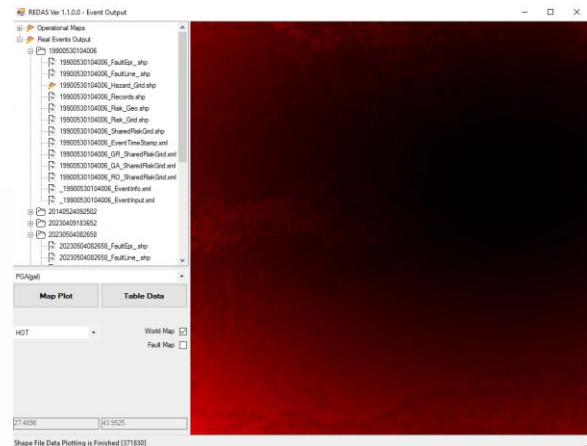
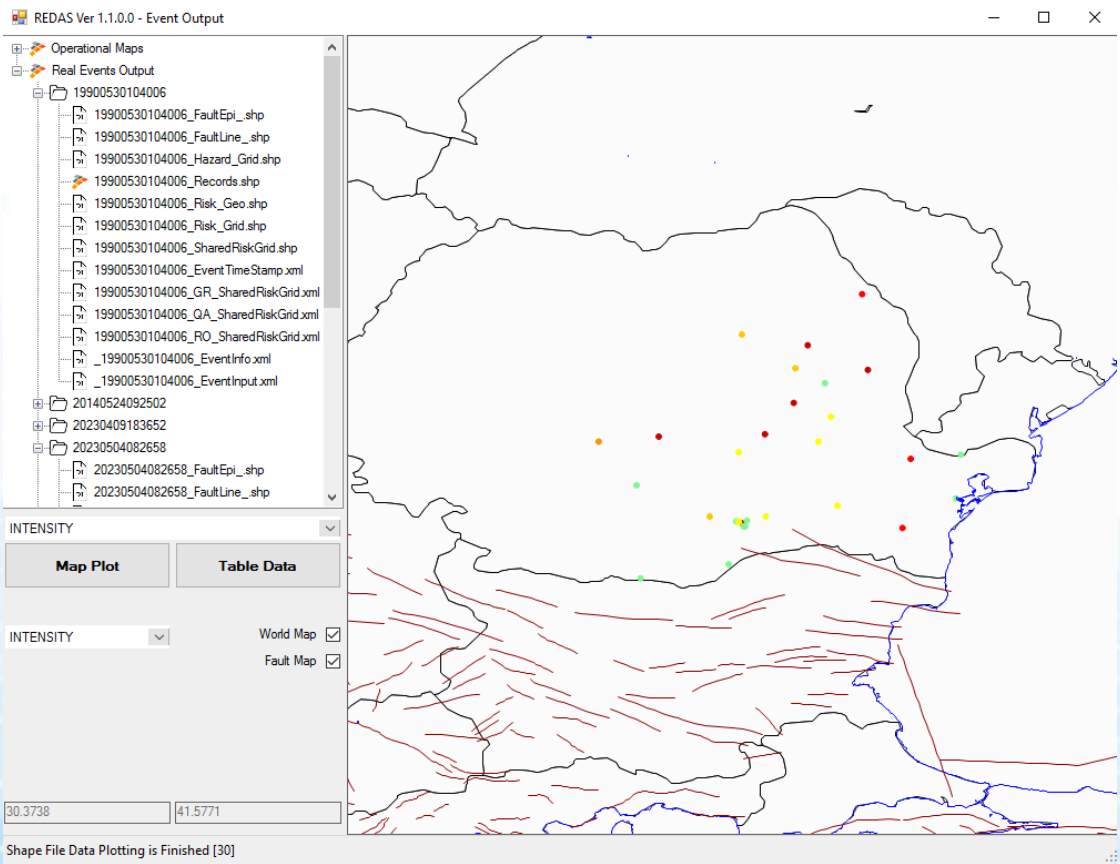
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## Calculul distanței de rupere



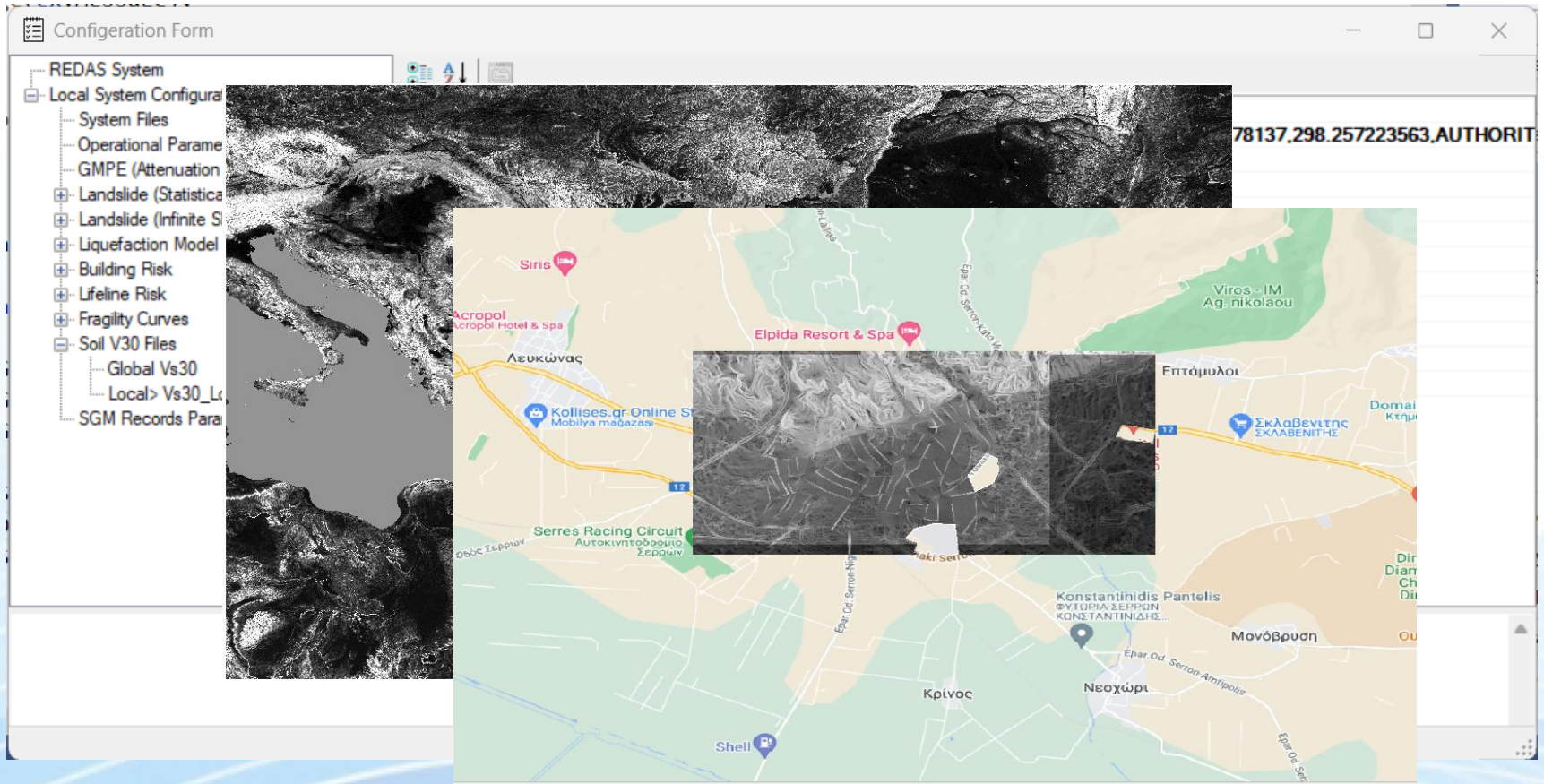
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## Date de la stații seismice



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## Distribuția Vitezei Undelor S ale Solului, Vs30

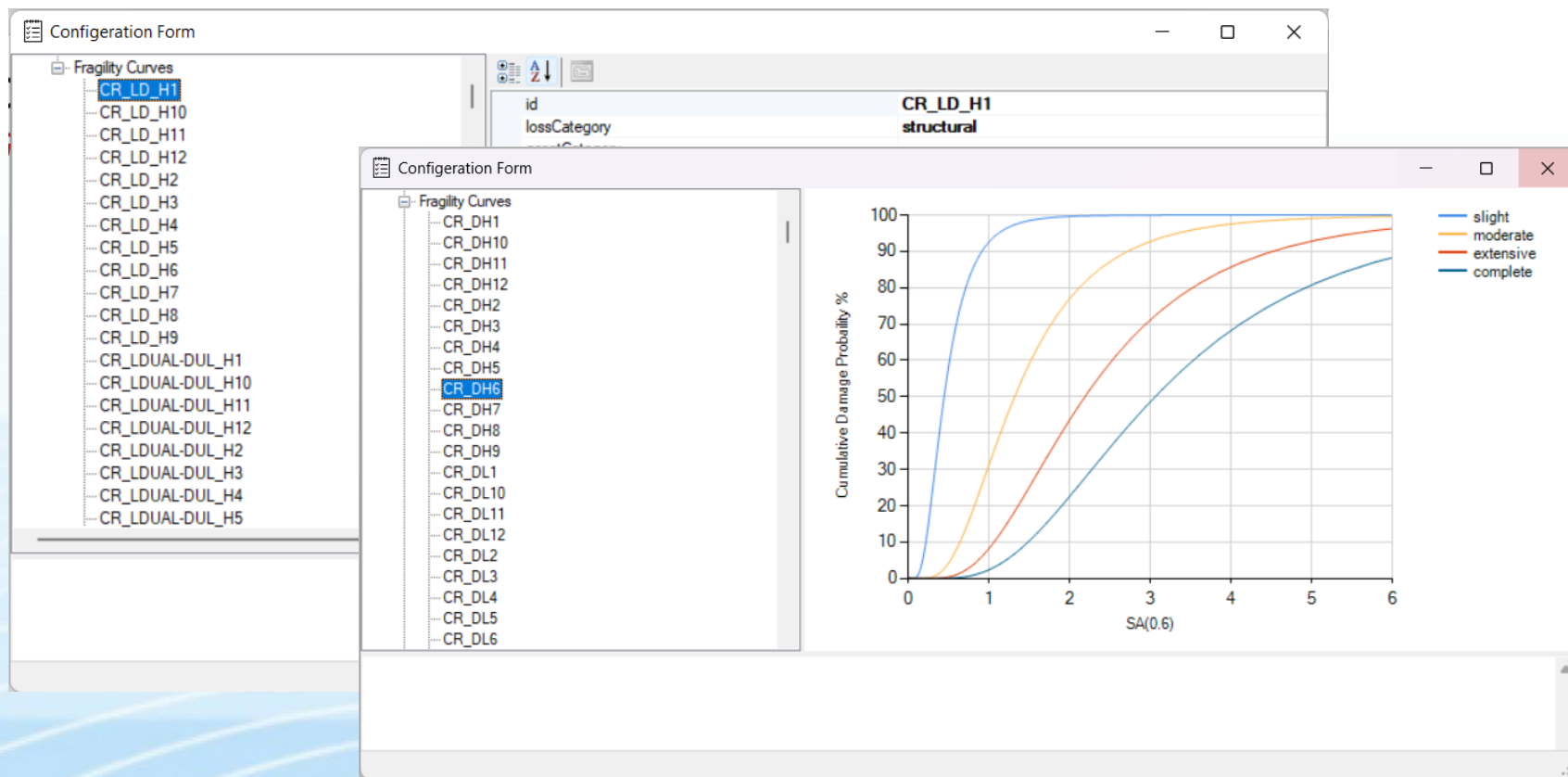


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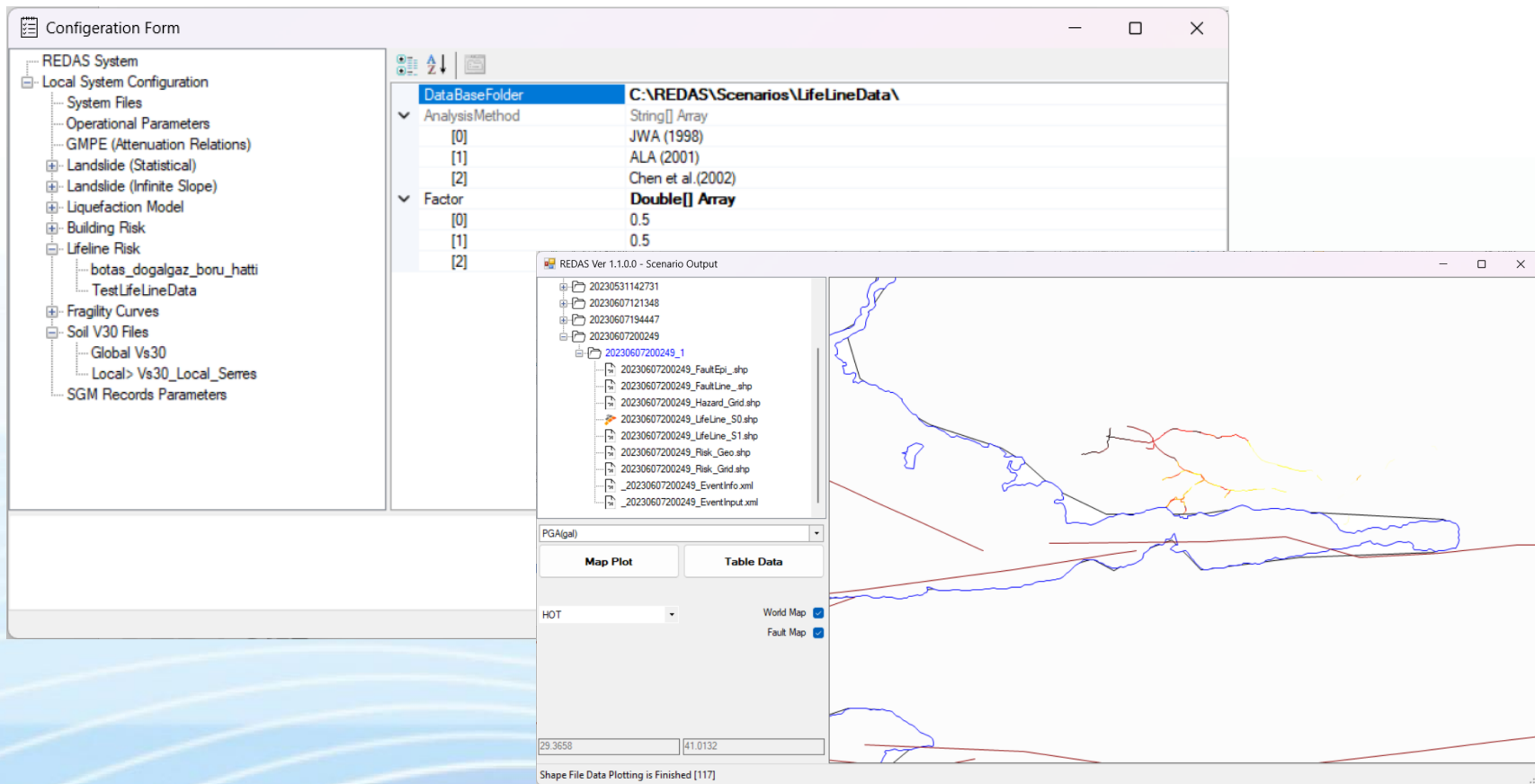
## Funcții de fragilitate

Martins L, Silva V (2020) Development of a fragility and vulnerability model for global seismic risk analyses. *Bulletin of Earthquake Engineering* 19: 6719–6745.



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## Estimarea ratei de reparații necesare pentru conducte

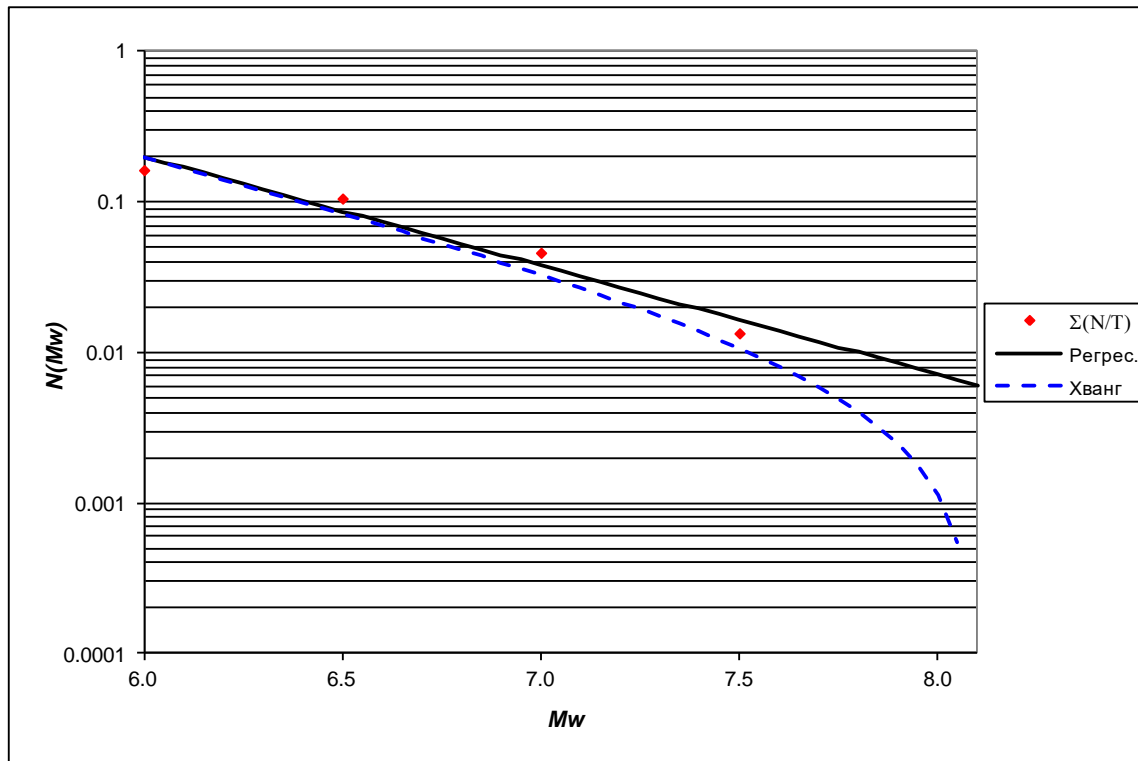


The screenshot displays the REDAS software interface, divided into several windows:

- Configuration Form:** Shows a tree view of system settings. The 'Local System Configuration' is expanded, showing options like 'System Files', 'Operational Parameters', 'GMPE (Attenuation Relations)', 'Landslide (Statistical)', 'Landslide (Infinite Slope)', 'Liquefaction Model', 'Building Risk', 'Lifeline Risk', 'Fragility Curves', 'Soil V30 Files', and 'SGM Records Parameters'.
- Parameter List:** A table showing configuration parameters:
 

Parameter	Value
DataBaseFolder	C:\REDAS\Scenarios\LifeLineData\
AnalysisMethod	String[] Array
[0]	JWA (1998)
[1]	ALA (2001)
[2]	Chen et al.(2002)
Factor	Double[] Array
[0]	0.5
[1]	0.5
[2]	
- Scenario Output:** A list of generated files for scenario 20230607200249\_1, including:
  - 20230607200249\_FaultEpi\_.shp
  - 20230607200249\_FaultLine\_.shp
  - 20230607200249\_Hazard\_Grid.shp
  - 20230607200249\_LifeLine\_S0.shp
  - 20230607200249\_LifeLine\_S1.shp
  - 20230607200249\_Risk\_Geo.shp
  - 20230607200249\_Risk\_Grid.shp
  - \_20230607200249\_EventInfo.xml
  - \_20230607200249\_EventInput.xml
- Map Plot:** A map showing the geographical distribution of the scenario output, with various colored lines representing different data layers. The map includes a 'World Map' and 'Fault Map' checkbox, and a 'HOT' dropdown menu.

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### Guttenberg-Richter

$$\lg N(M_w \geq 6.0) = 3.64 - 0.72 \cdot M_w$$

### Hwang

$$N(\geq m) = e^{\alpha - \beta m} \frac{1 - e^{-\beta(M_{\max} - m)}}{1 - e^{-\beta(M_{\max} - M_{\min})}}$$

$$M_{\min} = 6.0$$

$$M_{\max} = 8.1$$

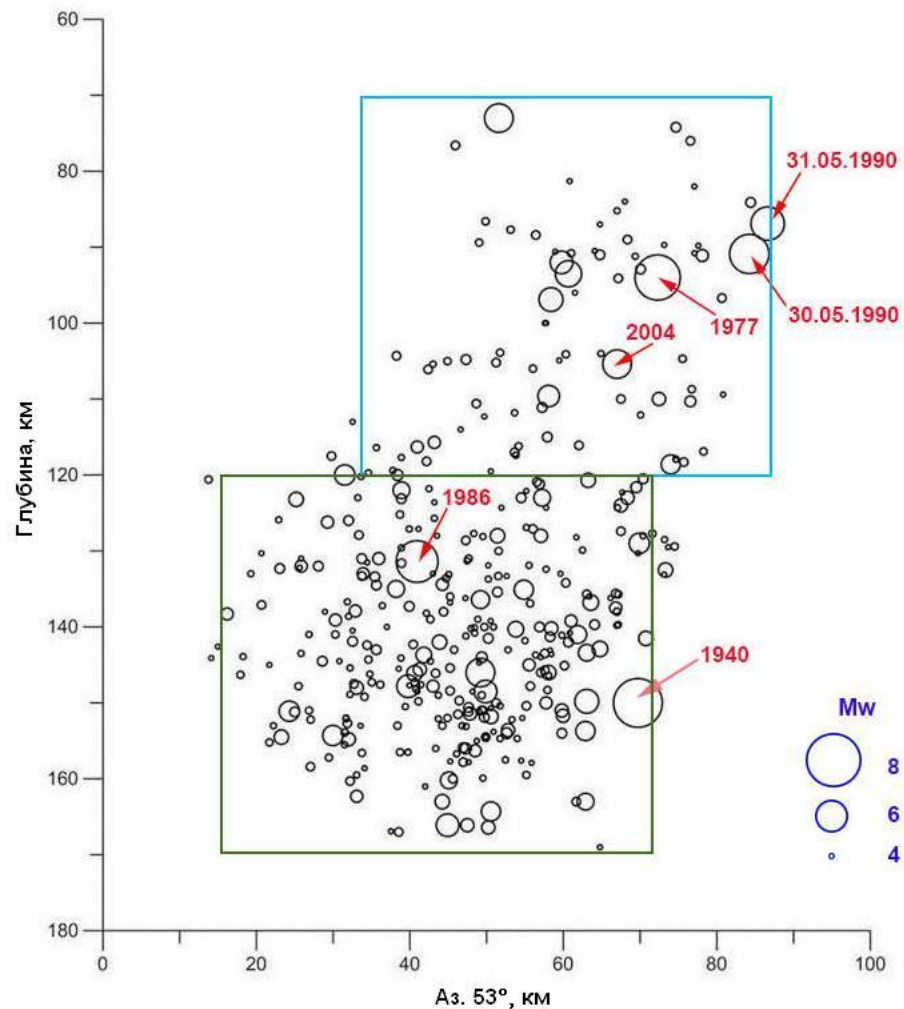
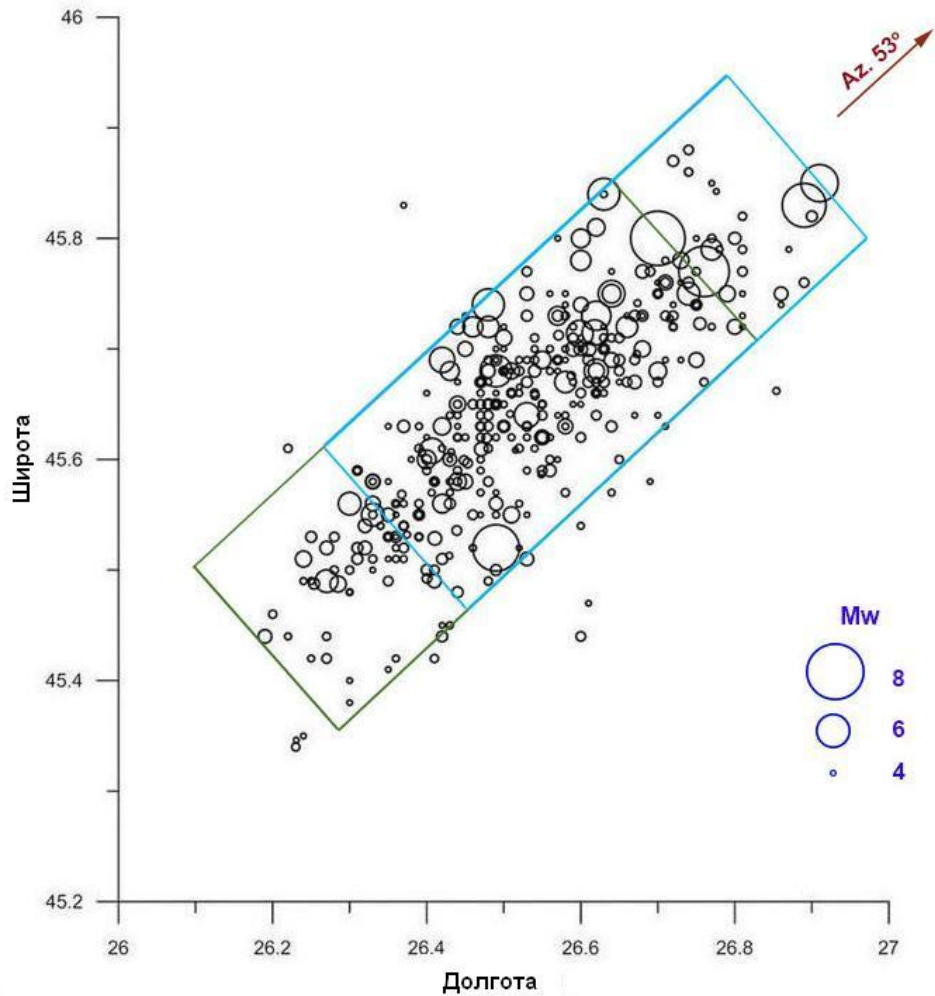
$$\alpha = 8.37$$

$$\beta = -1.66$$

$$n = 85$$

$M_w$	Frequency		Period	
	G-R	Hwang	G-R	Hwang
6.0	0.2002	0.2002	4.996	4.996
6.5	0.0871	0.0836	11.48	11.96
7.0	0.0379	0.0328	26.38	30.46
7.5	0.0165	0.0107	60.61	93.06
7.6	0.014	0.0081	71.58	122.9
7.7	0.0118	0.0059	84.54	168.7
7.8	0.01	0.0041	99.84	246.4
<b>7.9</b>	<b>0.0085</b>	<b>0.0025</b>	<b>117.9</b>	<b>403.9</b>
8.0	0.0072	0.0011	139.3	880.9
8.1	0.0061	7E-17	164.5	1E+16

*M<sub>w</sub> = 7.9 provides a period of 404 years closest to the 500-year period, which guarantees no more than a 12% probability of exceeding the calculated impacts within 50 years.*

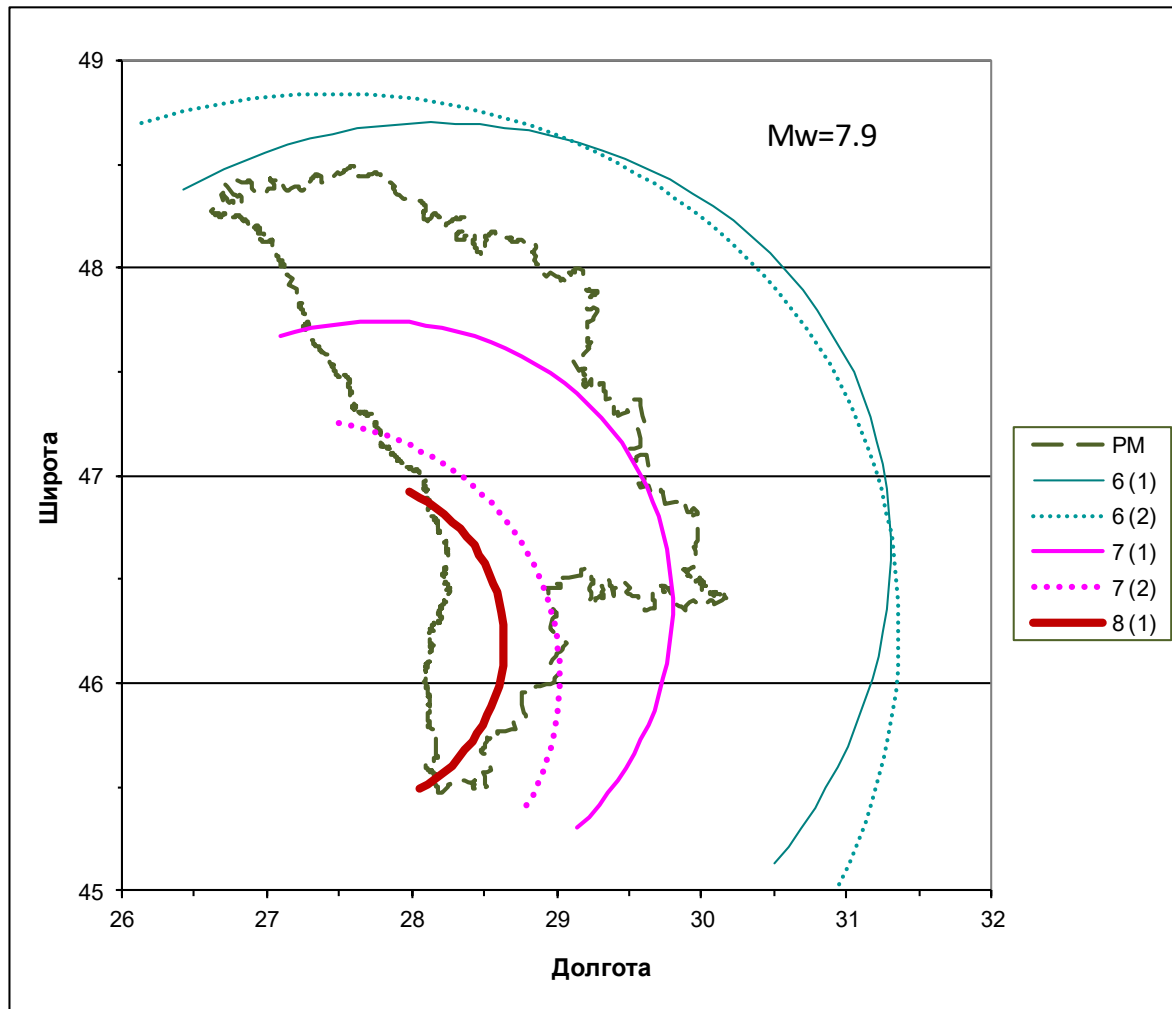


Epicenters of Vrancea earthquakes with  $M_w \geq 6$  for the period 1968-2018.

Data	Time	N	E	$H, \text{ км}$	$M_w$
10.11.1940	01:39:07.00	45.8	26.7	150	7.7
4.03.1977	19:21:54.10	45.77	26.76	94	7.4
30.08.1986	21:28:37.00	45.52	26.49	131	7.1
30.05.1990	10:40:06.40	45.83	26.89	90.9	6.9
31.05.1990	00:17:47.90	45.85	26.91	86.9	6.4
27.10.2004	20:34:36.00	45.84	26.63	105	6.0

n=372

# Două scenarii: SW & NE



- Isoseisme cutremurului calculat cu  $M_w=7,9$  pentru zonele inferioare (1) și superioare (2) ale regiunii seismogene Vrancea.

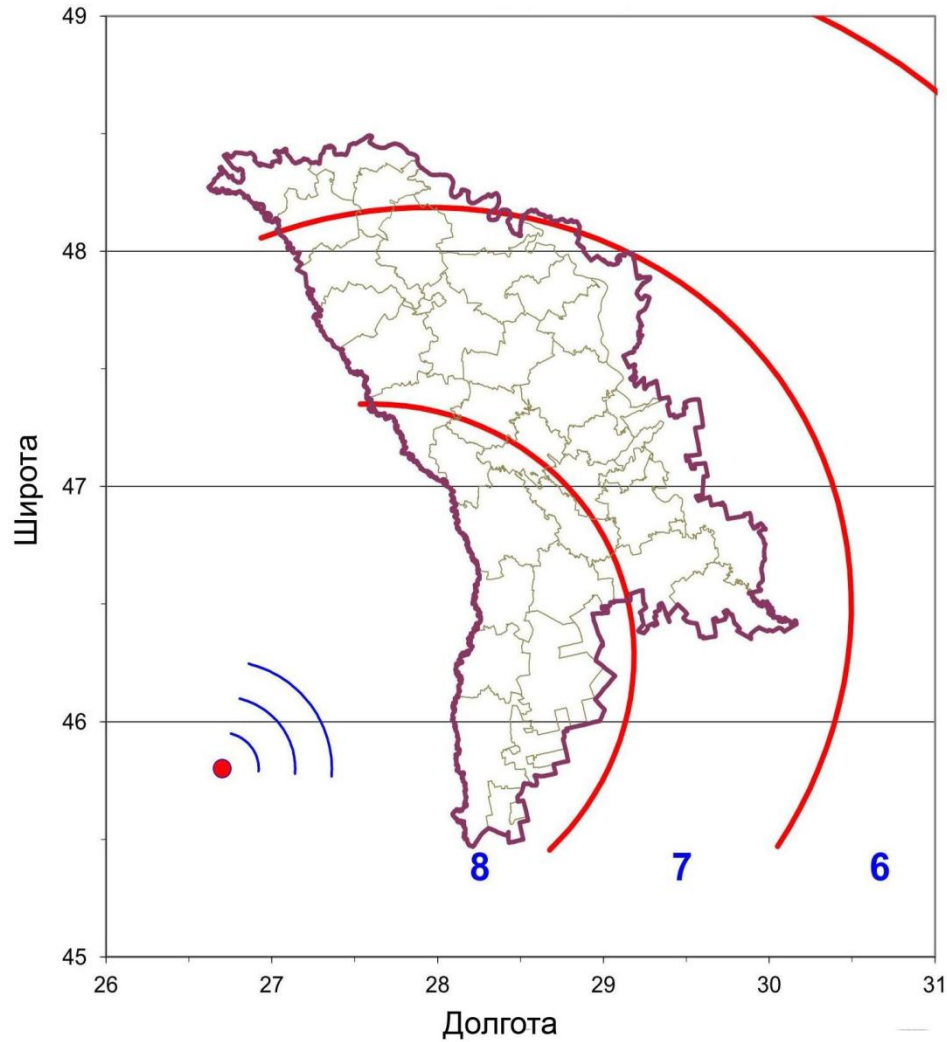
The equations of the macroseismic field

$$I = 1.084 M_w - 6.85 \lg R + 1.54 \cos \gamma + 13.7 \pm 0.35$$

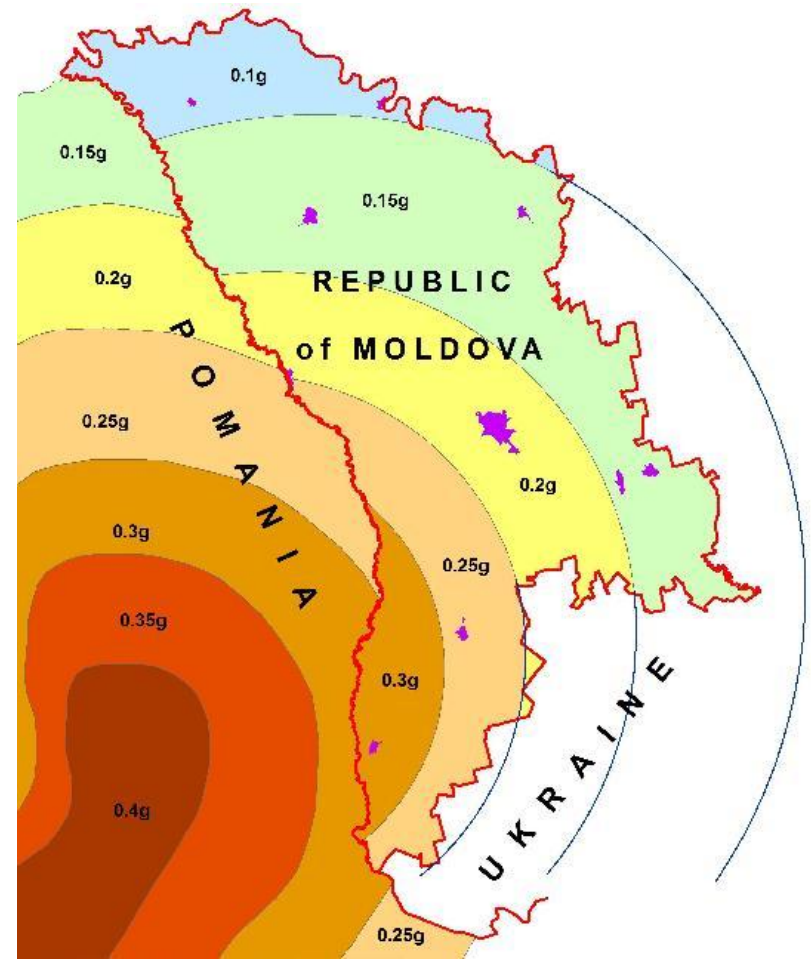
$$I = 0.922 M_w - 3.44 \lg R + 0.24 \cos \gamma + 7.27 \pm 0.34$$

$$n=278; \quad r=0.9$$

$$n=1073; \quad r=0.9$$



Harta intensității pentru un cutremur calculat cu  $M_w=7,9$ .



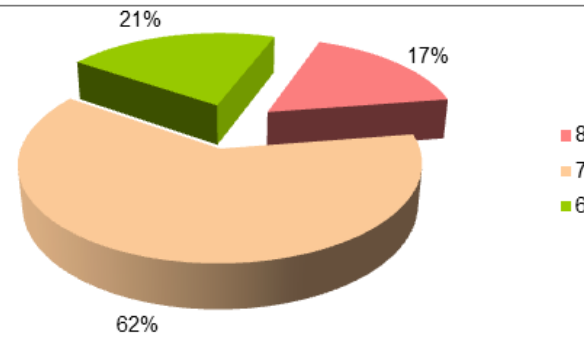
ecuație referitoare la accelerația vibrațiilor solului în fracțiuni de g și intensitatea

$$A = 0.039 e^{(0.5247 \cdot I)} / 9.81$$

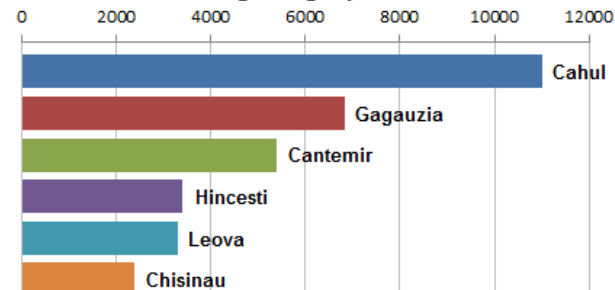
# Statistici de Impact

raion	gospodar	rezidenti	I	a	d_m	deteriorate	raniti	ucisi	eveniment
Cahul	32881	105319	8,1	272	3,17	11000	4172	254	manual
Gagauzia	40148	134536	7,8	229	2,76	6840	2016	101	26,5
Cantemir	15535	52109	8	266	3,17	5400	2081	129	45,6
Hincesti	32313	103779	7,6	207	2,57	3400	775	25	120
Leova	15182	44700	7,8	234	2,87	3290	946	51	7,9
Chisinau	209701	662839	7,1	165	1,94	2380	834	0	
Ungheni	33005	101073	7,2	175	2,36	2210	342	0	
Taraclia	11343	37361	7,8	239	2,9	2100	603	29	
Cimislia	16107	49295	7,5	200	2,57	1490	276	4	
Nisporeni	17270	53153	7,4	194	2,53	1490	262	4	
Calarasi	21501	64404	7,2	167	2,21	1170	168	0	
Ialoveni	27477	93155	7,3	180	2,06	1070	183	0	
Straseni	25559	82677	7,2	168	2,08	1070	169	0	
Falesti	27779	78258	7	151	2,06	1060	136	0	
Transnistria	139166	392672	6,6	125	1,56	1060	134	0	
Causeni	26046	96375	7,1	161	2,04	900	151	0	
Basarabca	7768	23013	7,5	197	2,45	660	107	1	
Singerei	26430	79814	6,8	139	1,88	600	86	0	
Criuleni	22167	70656	7	153	1,89	530	80	0	
Anenii Noi	24612	78997	7	157	1,92	520	82	0	
Orhei	33230	101498	6,9	143	1,8	500	75	0	
Telenesti	19884	61150	6,9	143	1,86	470	68	0	
Glodeni	18069	51308	6,8	136	1,8	370	53	0	
Stefan-Voda	20741	62072	6,9	143	1,78	370	53	0	
Dubasari	8788	29274	6,8	141	1,74	160	27	0	
Tighina	33035	86842	6,9	149	1,35	150	16	0	
Floresti	28895	76458	6,5	121	1,56	130	16	0	
Riscani	21286	59229	6,6	122	1,7	130	14	0	
Rezina	14359	42485	6,6	126	1,68	110	15	0	
Balti	39316	102456	6,7	132	1,37	70	8	0	
Drochia	28916	74442	6,4	114	1,47	40	6	0	
Soldanesti	13128	36744	6,5	119	1,49	30	3	0	
Briceni	26792	70026	6,1	97	1,2	0	0	0	
Donduseni	15579	37855	6,2	103	1,3	0	0	0	
Edinet	27324	72609	6,3	106	1,36	0	0	0	
Ocnita	19045	47426	6,1	96	1,07	0	0	0	
Soroca	28939	77660	6,3	107	1,38	0	0	0	
<b>Total</b>	<b>1169316</b>	<b>3493719</b>	<b>7</b>	<b>159</b>	<b>1,97</b>	<b>50770</b>	<b>13957</b>	<b>598</b>	

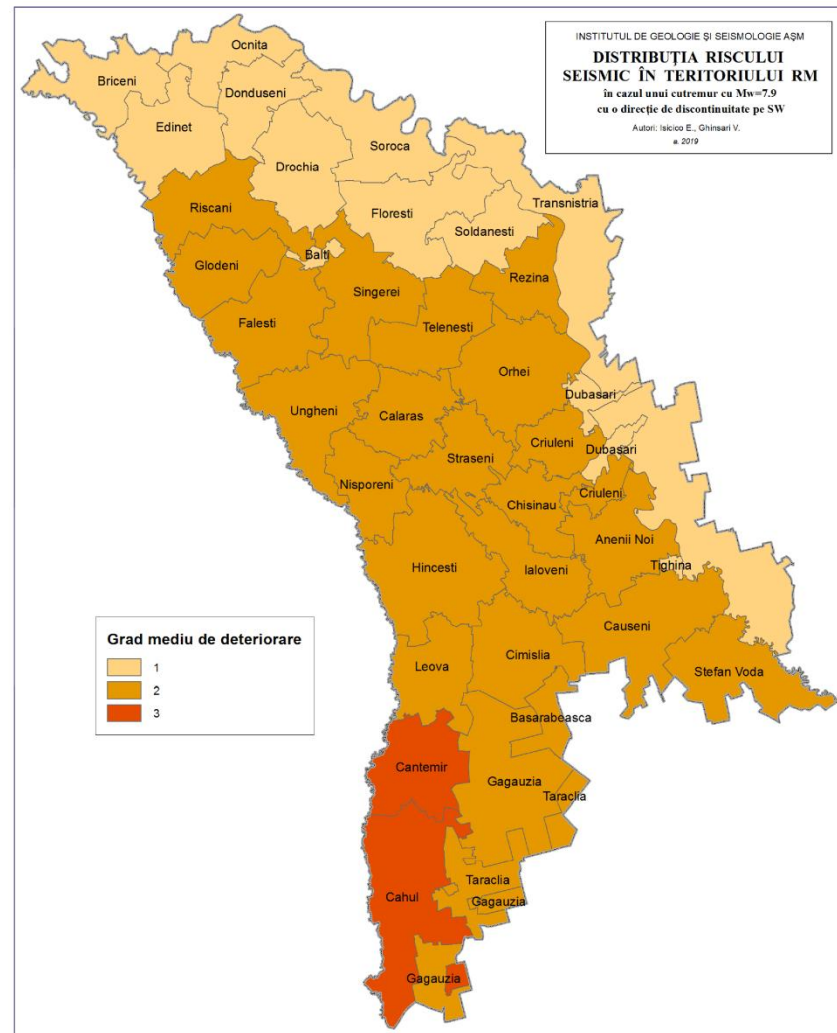
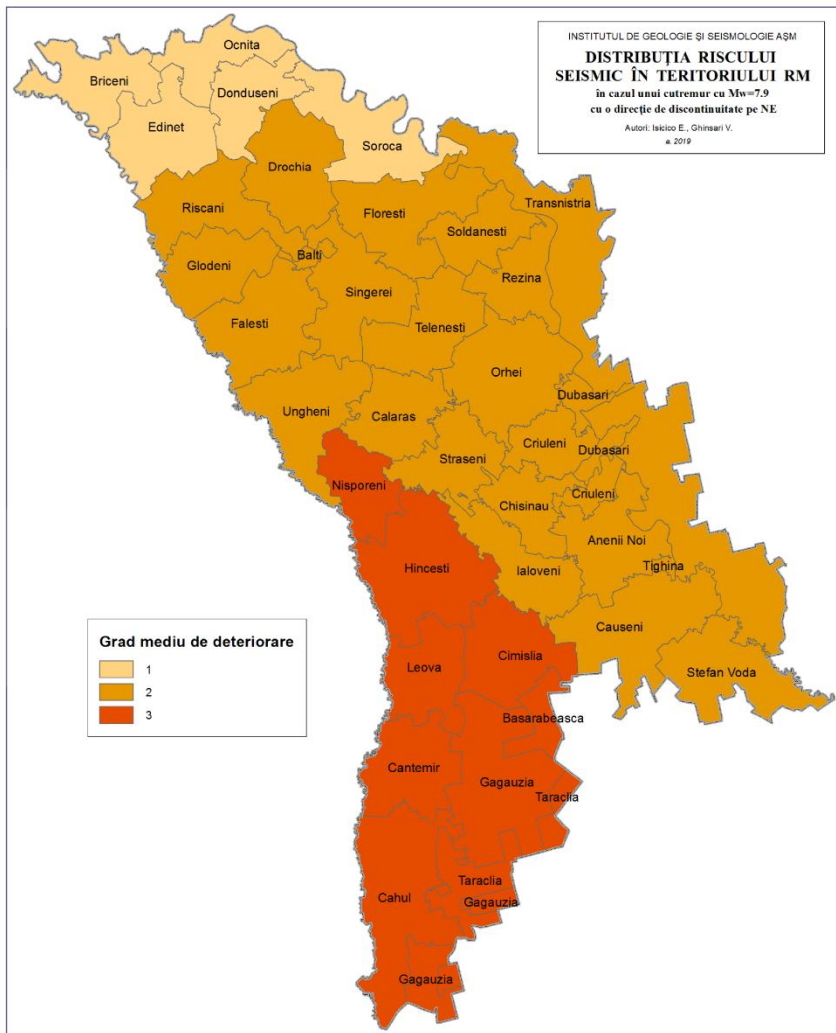
Intensitate in localitatile RM



Distrugerea gospodariilor

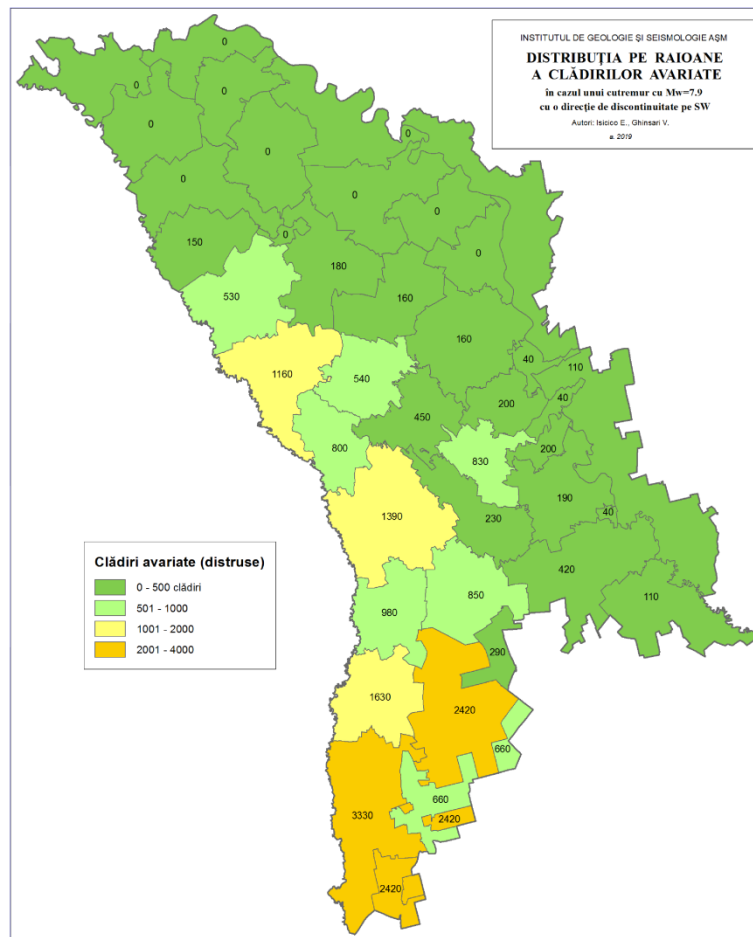
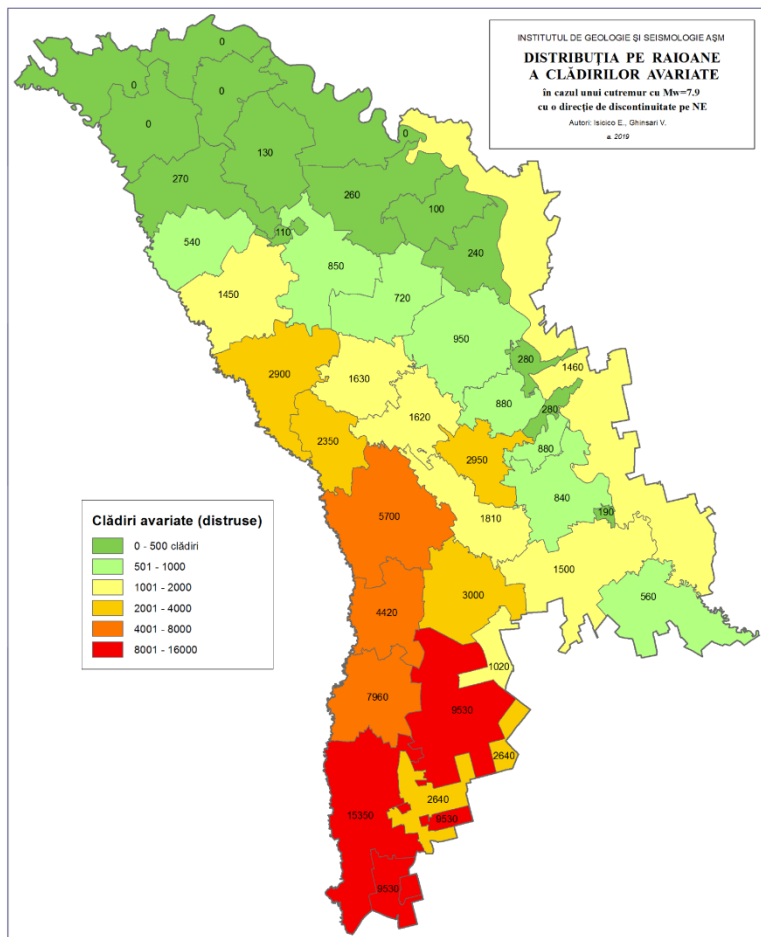


# Distribuția riscului Seismic în Republica Moldova





# Distribuția clădirilor deteriorate pe raioane

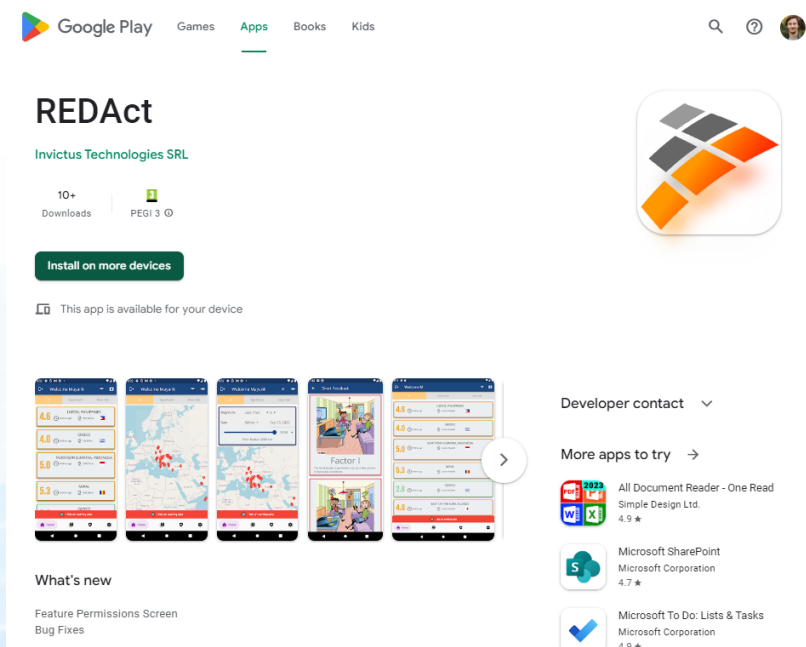


## Cerințele aplicației REDACT:

- Informații rapide despre cutremurele produse în zona Mării Negre și locații sigure + notificări
- Colectarea informațiilor de la utilizatori: cum au simțit cutremurul?
- Educație în domeniul cutremurelor, prin intermediul quiz-urilor și resurselor EduHub REDACT
- Informații cu privire la proiect
- Începutul dezvoltării: 2022 Februarie
- Ultima versiune: 1.04
- Coordonator: OUC.
- Dezvoltator aplicației: RedVector (România)

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- Disponibilă prin Google Play și iOS App Store

Google Play Games Apps Books Kids

## REDACT

Invictus Technologies SRL

10+ Downloads PEGI 3 G

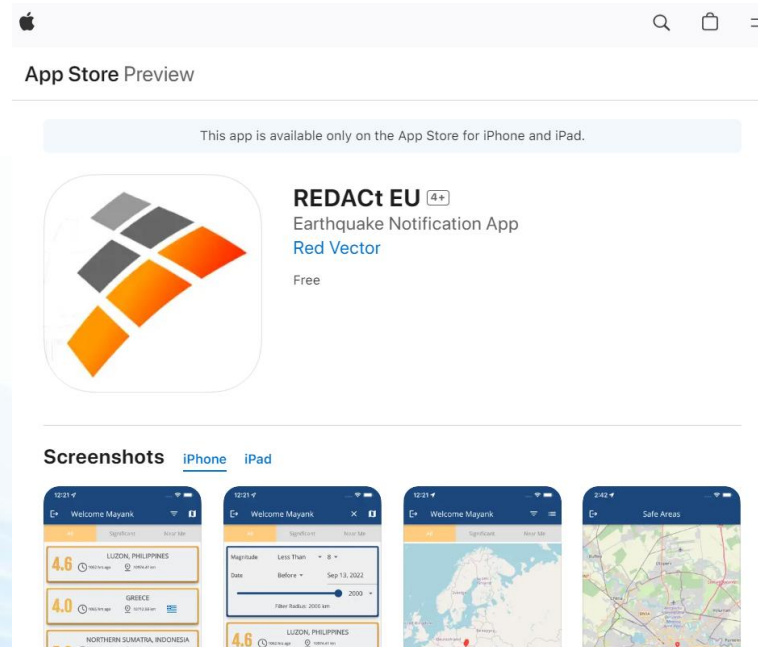
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Developer contact

More apps to try

- All Document Reader - One Read Simple Design Ltd. 4.9 ★
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App Store Preview

This app is available only on the App Store for iPhone and iPad.

## REDACT EU

Earthquake Notification App  
Red Vector

Free

Screenshots iPhone iPad

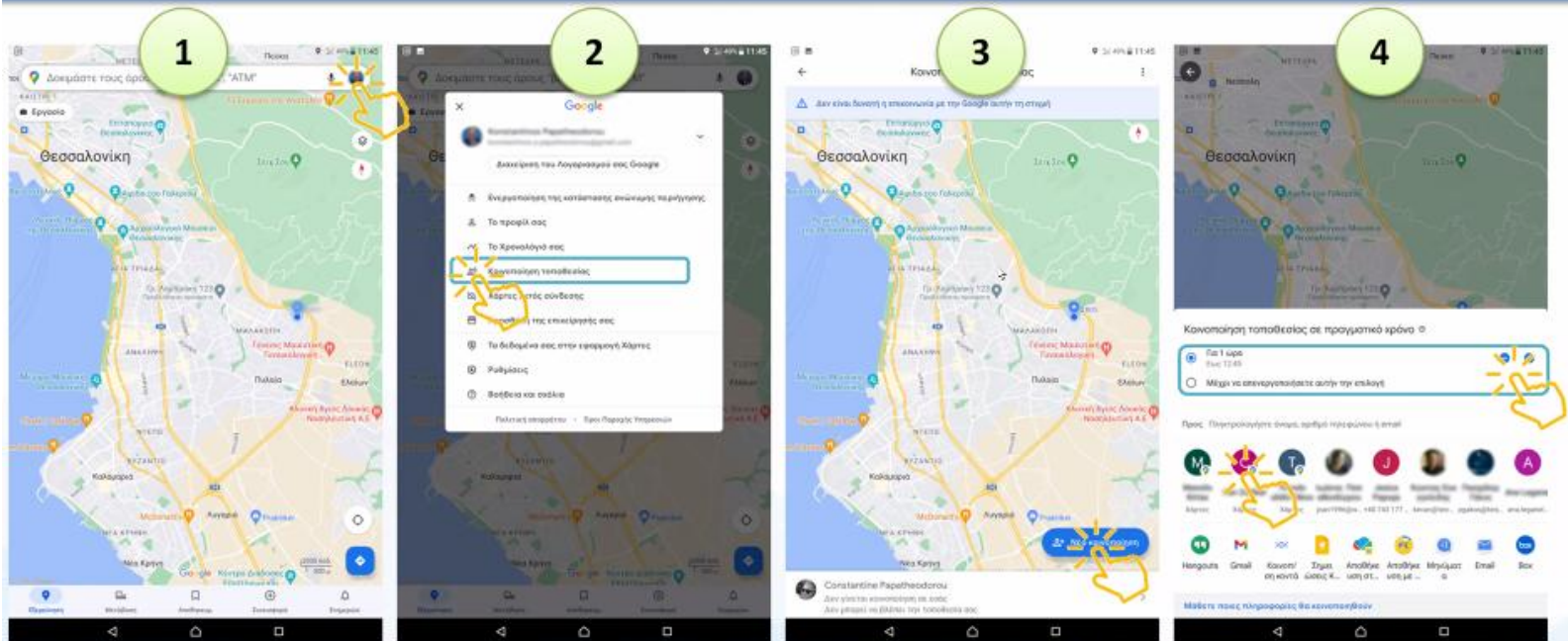
<https://play.google.com/store/apps/details?id=ro.redvector.redacteu>

<https://apps.apple.com/ie/app/redact-eu/id6448019597>

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# REDACT Smartphone app

## Location Sharing in Real-Time



CREATE a **Google account** and make sure that everyone you want to share location with, has one

Open **Google MAPS** and sign-in

TAP **Profile Picture** & then **"Location Sharing"**

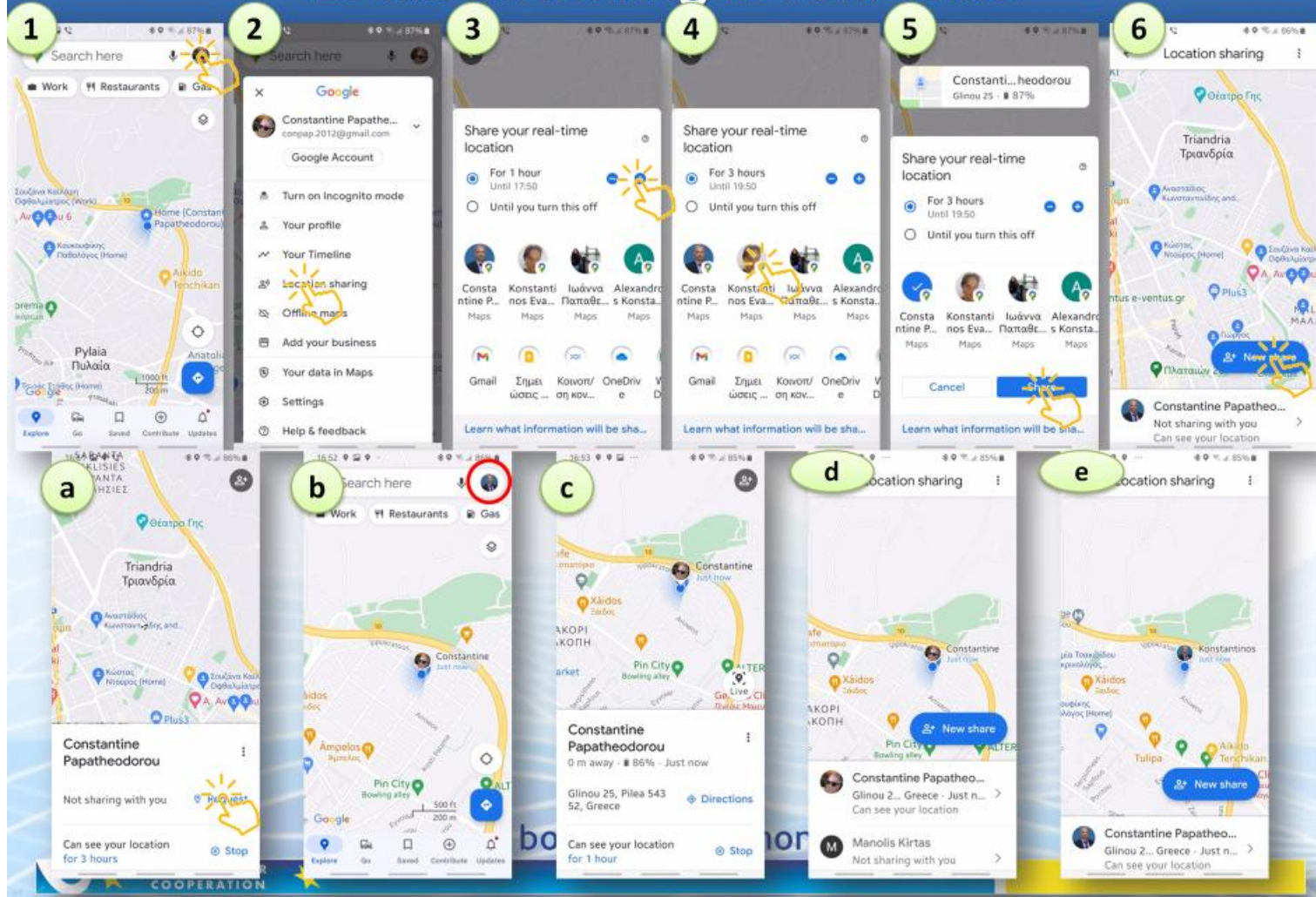
Select **DURATION**, Tap **"New Share"** and **ADD** the people you want to share with

Tap **"SHARE"**

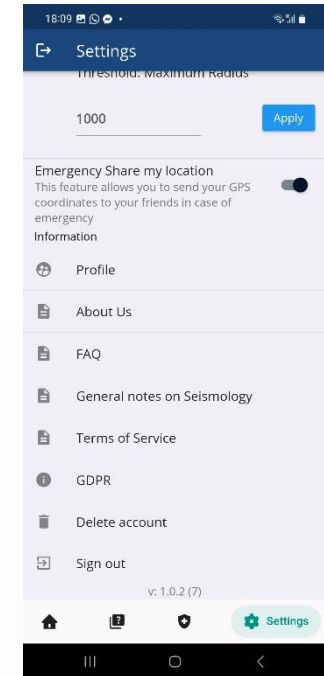
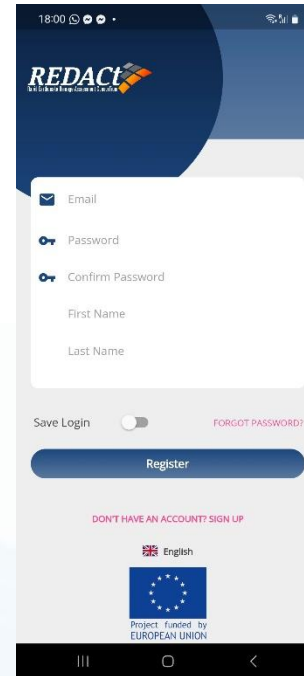
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# REDACT Smartphone app

## Location Sharing in Real-Time

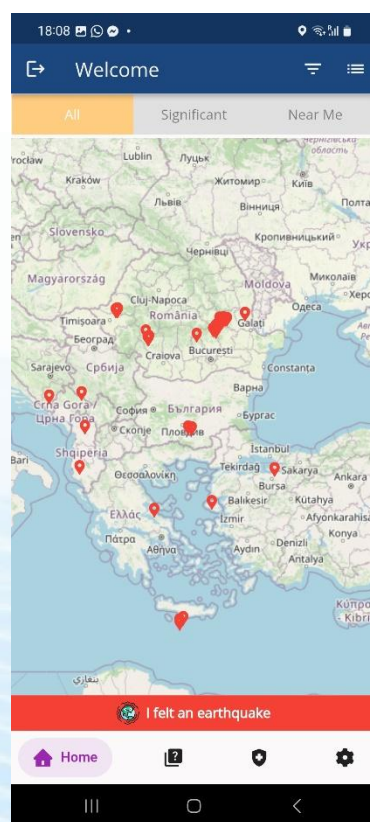
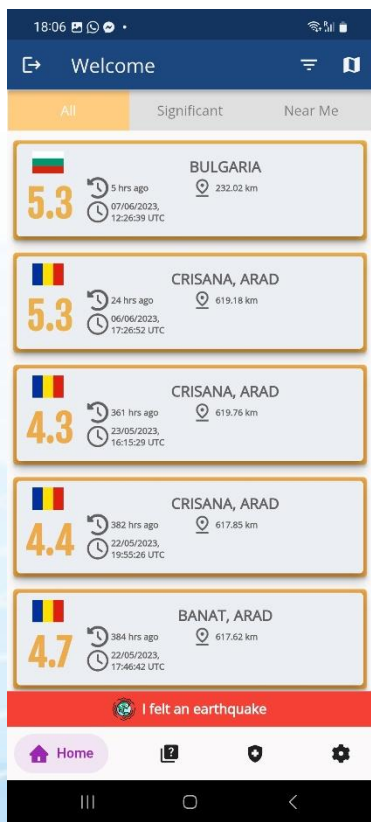


- Descărcare și utilizare gratuită
- Manual de utilizare
- Operează în cele 3 limbi ale partenerilor REDACT (Greacă, Română și Turcă) + engleză
- Login facil și respectarea politicilor GDPR
- Ușor de utilizat



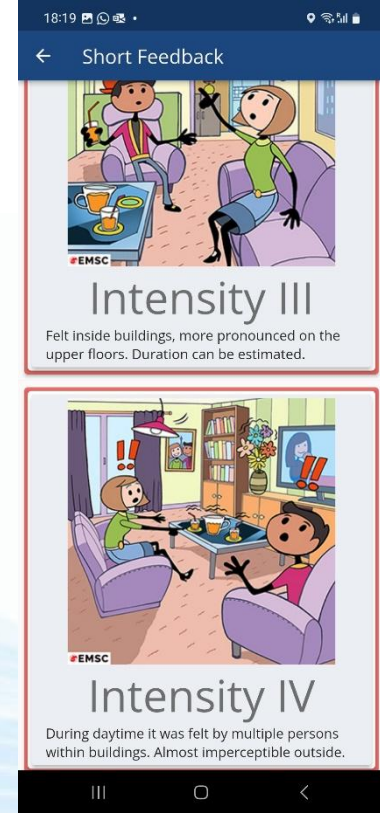
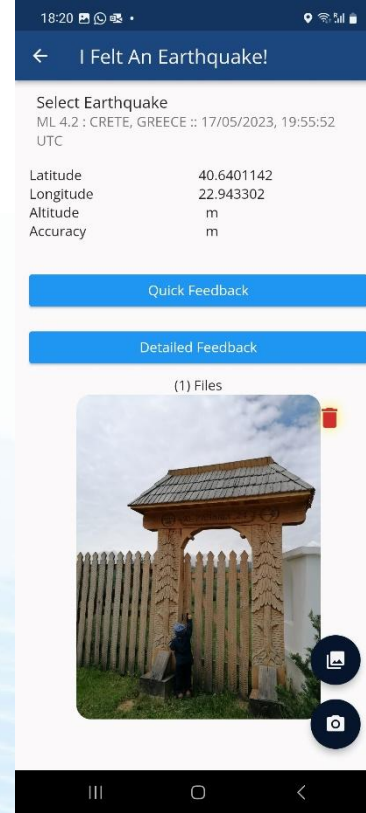
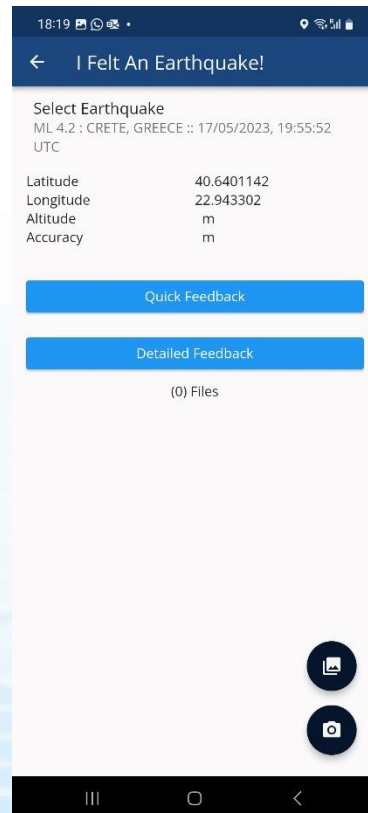
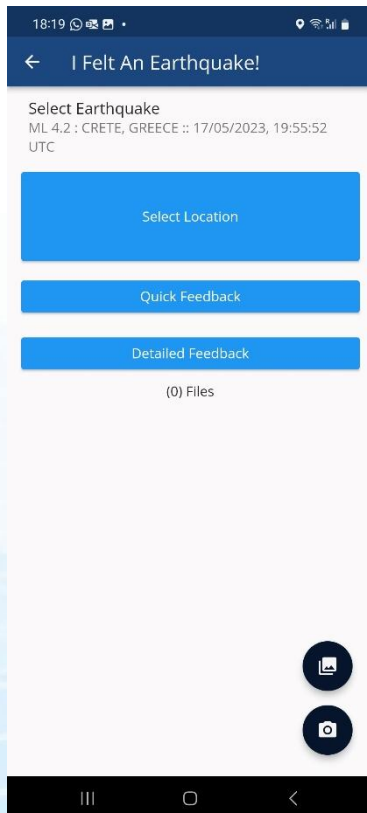
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- **Conține informații cu privire la cutremurele recente (listă și hartă) și opțiuni de filtrare**



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## ■ Opțiuni de a trimite feedback (“Did you feel it?”)



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## ■ Opțiuni de a trimite feedback (“Did you feel it?”)

19:15 Detailed Feedback

1) Was it difficult to maintain your balance?

19:15 Detailed Feedback

3) Which were the effects on old constructions?

If it applies. Old means generally built before 1990

19:15 Detailed Feedback

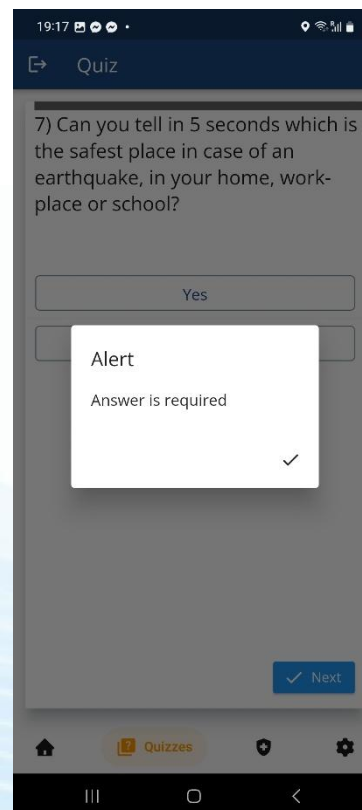
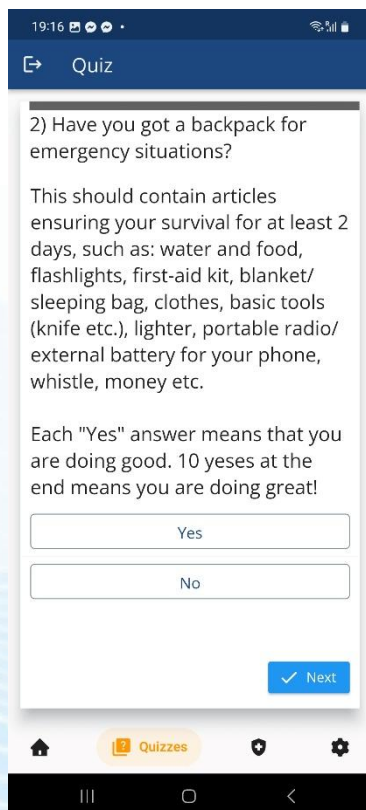
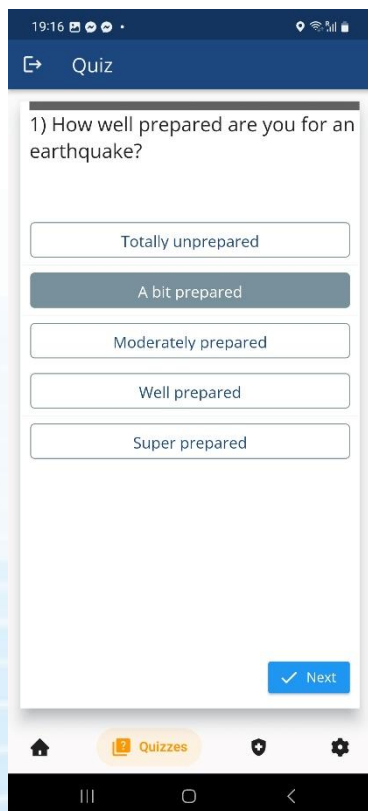
5) Where were you at the moment of the earthquake?

19:16 Detailed Feedback

6) How did you perceived the shaking of the earthquake?

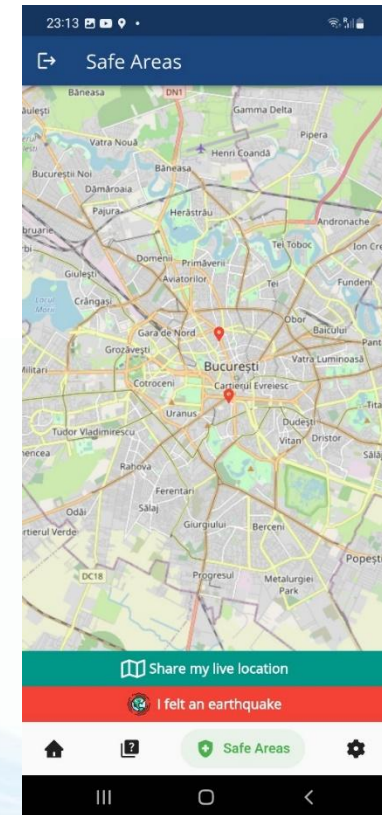
Common borders. Common solutions.

## ■ Zonă de quizz-uri și răspunsuri la întrebări frecvente



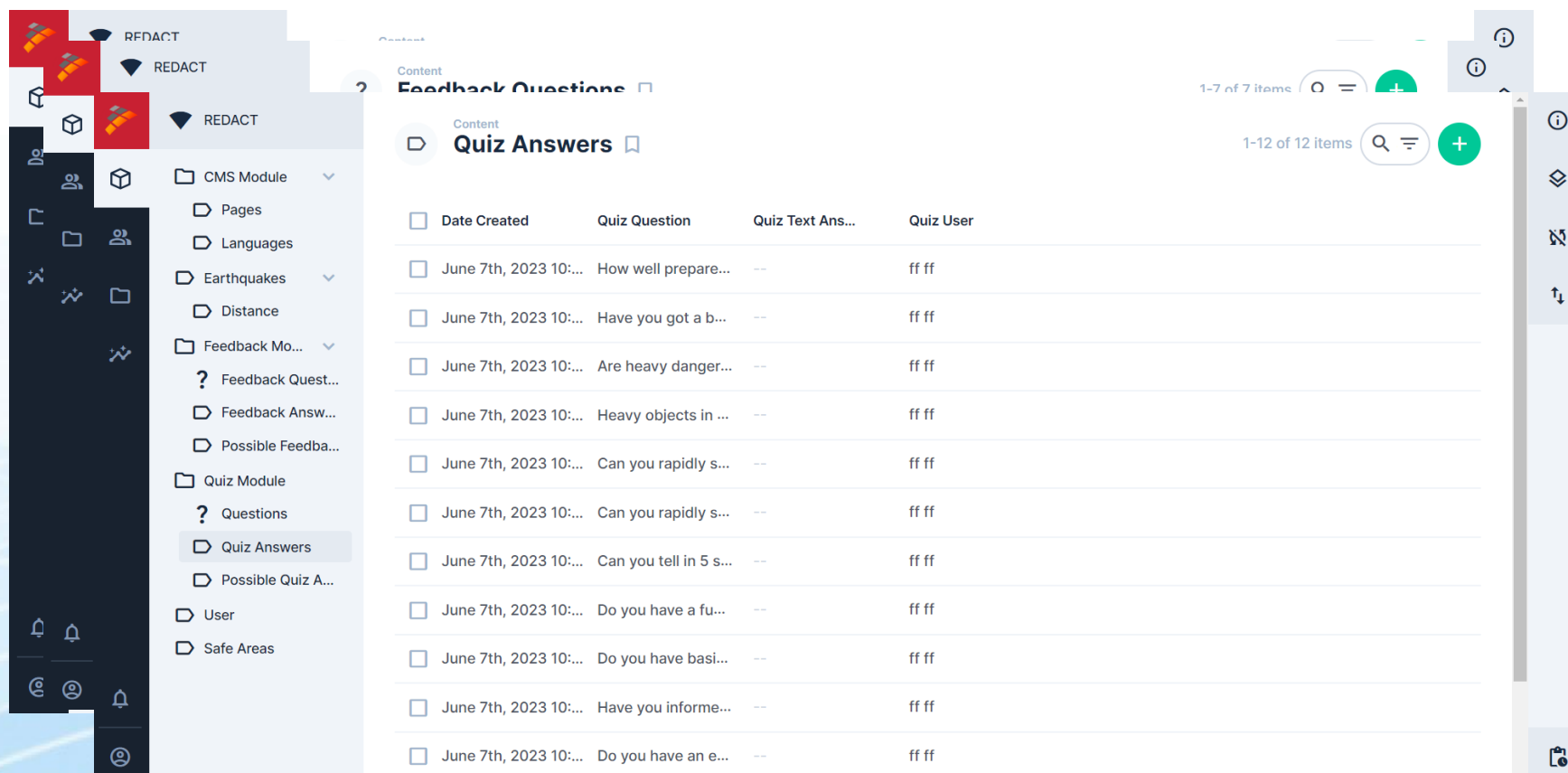
Common borders. Common solutions.

- **Vizualizarea zonelor declarate ca fiind sigure de către autorități**
- **Linkuri pentru distribuirea locației și transmiterea de SMS-uri predefinite („Sunt în siguranță”) unei liste de contacte favorite**
- **Distribuirea informațiilor despre cutremure pe rețele de socializare**



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- Interfață de backend pentru managementul utilizatorilor, listei de cutremure, întrebările puse sau informației generale



The screenshot displays the REDACT mobile application's backend interface. On the left, a dark navigation menu lists various modules: CMS Module, Pages, Languages, Earthquakes, Distance, Feedback Module, Feedback Questions, Feedback Answers, Possible Feedback, Quiz Module, Questions, Quiz Answers (highlighted), Possible Quiz Answers, User, and Safe Areas. The main content area shows a table titled 'Quiz Answers' with the following data:

Date Created	Quiz Question	Quiz Text Ans...	Quiz User
June 7th, 2023 10:...	How well prepare...	--	ff ff
June 7th, 2023 10:...	Have you got a b...	--	ff ff
June 7th, 2023 10:...	Are heavy danger...	--	ff ff
June 7th, 2023 10:...	Heavy objects in ...	--	ff ff
June 7th, 2023 10:...	Can you rapidly s...	--	ff ff
June 7th, 2023 10:...	Can you rapidly s...	--	ff ff
June 7th, 2023 10:...	Can you tell in 5 s...	--	ff ff
June 7th, 2023 10:...	Do you have a fu...	--	ff ff
June 7th, 2023 10:...	Do you have basi...	--	ff ff
June 7th, 2023 10:...	Have you informe...	--	ff ff
June 7th, 2023 10:...	Do you have an e...	--	ff ff

Common borders. Common solutions.

## Dezvoltări viitoare:

- Îmbunătățirea traducerilor
- Rezolvarea unor probleme: recuperarea parolei, afișarea hărții cu locații, compatibilitate cu anumite versiuni de Android etc.
- Adăugarea mai multor resurse educaționale
- Conectarea și la alte liste armonizate de cutremure: REDACT (pentru platforma REDAS), EMSC

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Rapid Earthquake Damage Assessment Consortium



# Vă Mulțumim pentru atenție!



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