



Boğaziçi University  
Kandilli Observatory and Earthquake Research Institute  
Department of Earthquake Engineering

**Kahramanmaraş - Gaziantep Türkiye  
M7.7 Earthquake, 6 February 2023  
(04:17 GMT+03:00)**

**Strong Ground Motion and Building Damage Estimations  
Preliminary Report (v6)**

*Ufuk Hancılar, Karin Şeşetyan, Eser Çaktı, Erdal Şafak*

*Nesrin Yenihayat, Fatma S. Malcıoğlu, Kökcan Dönmez, Tuğçe Tetik, Hakan Süleyman*

16.02.2023 (v6)

13.02.2023 (v5), 09.02.2023 (v4), 08.02.2023 (v3), 07.02.2023 (v2), 06.02.2023 (v1)

## What is new?

### V6 (16.02.2023):

All ground shaking distribution maps (intensity, PGA, PGV, Sa0.2 and Sa1.0) updated with the incorporation of station recordings!

Damage estimations updated with the new ground motion inputs!

It is estimated that approximately 50% of the buildings in the central district of Kahramanmaraş city is in (moderate+extensive+complete) damage state!

More info on more strong ground motion recordings!

PGA, PGV, PGD, AI, CAV, Dur(5-95), FAS, acc. resp. spectra.

## Previous Versions

### V5 (13.02.2023):

Updated maps of ground shaking distribution and building damage estimations!

A fault rupture of 290 km length corresponding to the Erkenek, Pazarcık and Amanos segments of the East Anatolian Fault Zone (Emre et al., 2018) and station recordings within a distance of 100 km from the fault are considered in the ground motion and damage estimations.

Estimated intensity of the earthquake higher than XI on MMI scale!

More than 100,000 buildings in (D3+D4+D5) damage states!

### V4 (09.02.2023):

More info on the strong ground motion recordings!

Acc-vel-disp time histories, FAS and horizontal resp. spectra plots updated and vertical resp. spectra plots added!

Maps showing the PGA values of the stations along with the active fault lines provided!

Aftershock activity map presented!

PGA and PGV residual analyses with four GMPEs for the M7.7, M7.6 and M6.6 (6 Feb 2023) earthquakes provided!

### V3 (08.02.2023):

More info on the strong ground motion recordings!

Strong ground motion records, downloaded fom AFAD website and processed! Acc-vel-disp time histories, FAS and elastic acc. resp. spectra plots!

Kahramanmaras city scale building damage estimation with different methods: Modified Acceleration-Displacement Response Spectrum Method, Capacity Spectrum Method and Displacement Coefficient Method.

**It is estimated that approximately 40% of the Kahramanmaraş's building inventory in (moderate+extensive+complete) damage state!**

**V2 (07.02.2023):**

**Ground motion distribution maps with different GMPEs and intensity prediction equations!**

**Regional scale damage estimation maps with different ground motion inputs!**

**Kahramanmaraş city scale damage estimation maps with different ground motion inputs!**

**Acceleration, velocity and displacement time history plots, Fourier amplitude spectra plots of the recorded data!**

**V1 (06.02.2023):**

**Rapid estimation of spatial distributions of strong ground motion parameters!**

**Intensity based, regional scale, rapid building damage estimation!**

**Spectral acceleration-displacement based rapid building damage estimation for Kahramanmaraş city!**

**Note:**

**The information provided in this report is presented for scientific research purposes.**

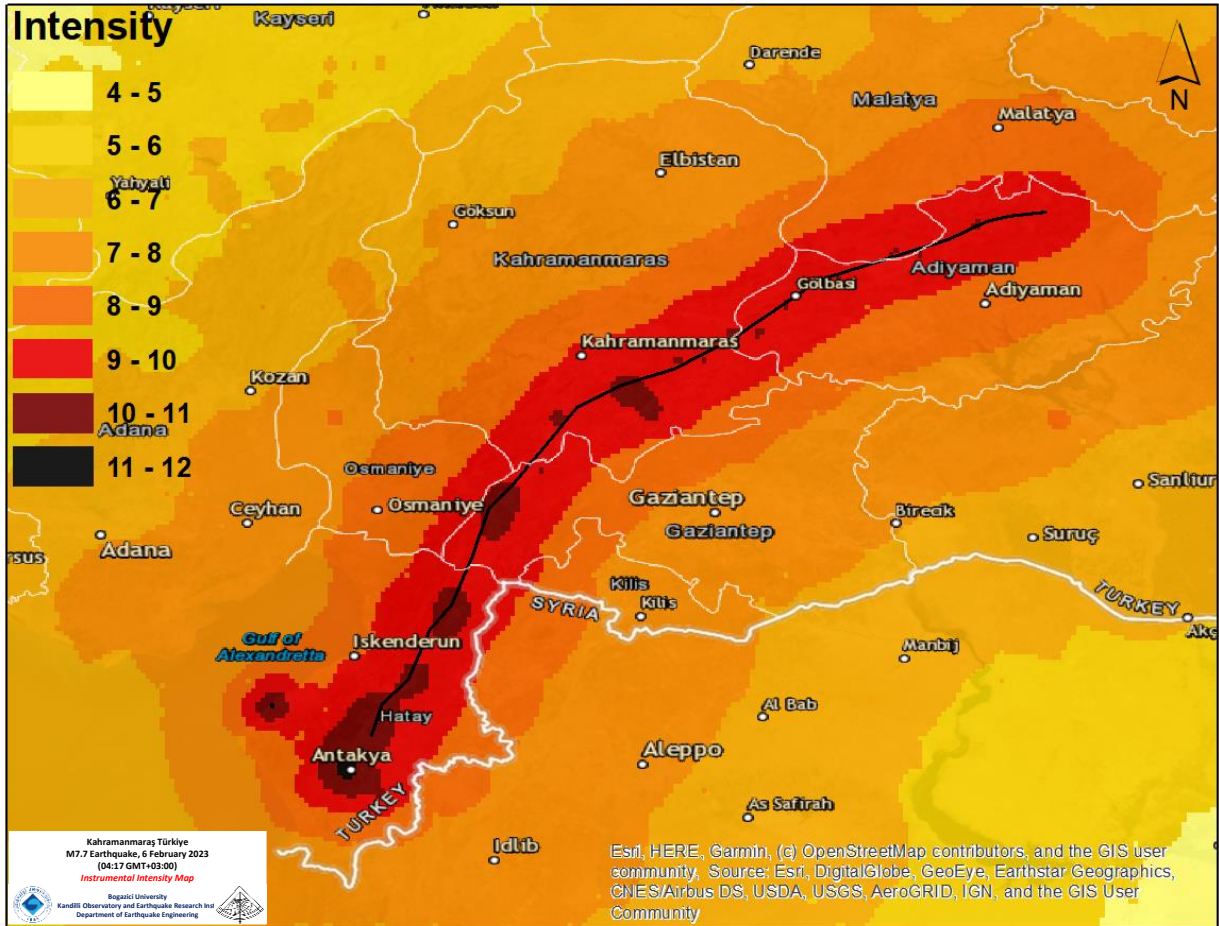
**Ground motion and building damage estimation analyses conducted with ELER (Earthquake Loss Estimation Routine) software.**

**<https://eqe.boun.edu.tr/en/eler-tool>**

## GROUND SHAKING DISTRIBUTION MAPS (Bias Corrected)

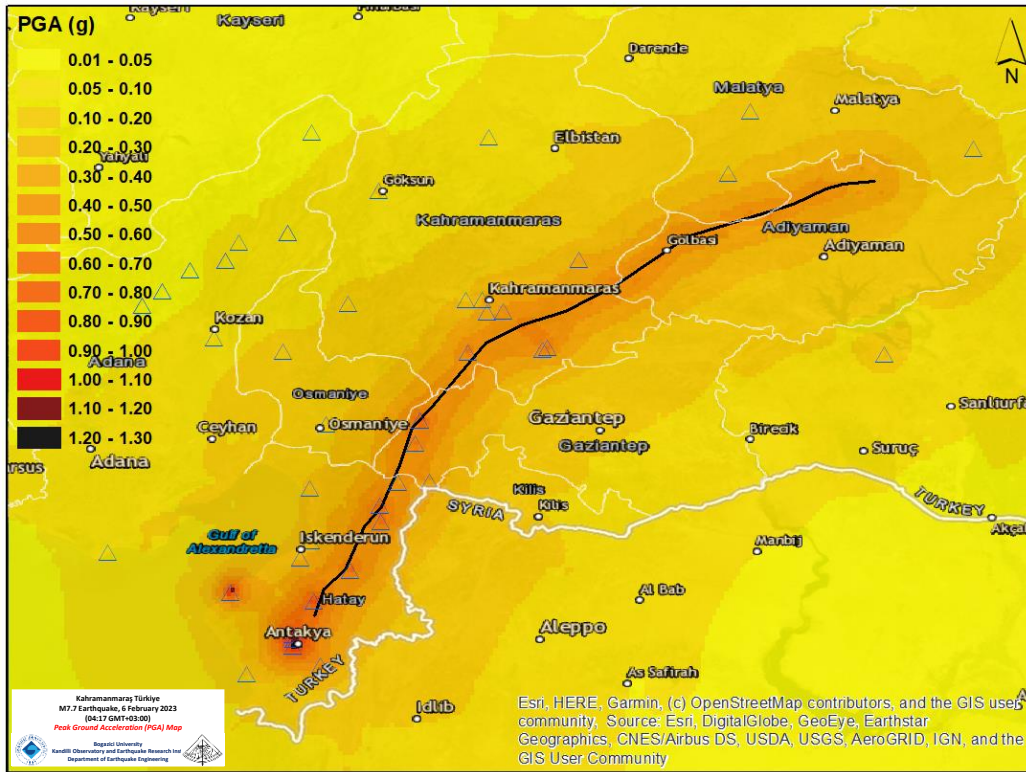
- A fault rupture of 290 km length corresponding to the Erkenek, Pazarcık and Amanos segments of the East Anatolian Fault Zone (MTA), represented by a solid black line on the maps, is considered.
- Recorded data from 50 stations of AFAD are incorporated in the estimations of PGA, PGV and Sa.
- GMPE: CY2014.
- Intensity Prediction Equation: BA2014.

### Intensity Map

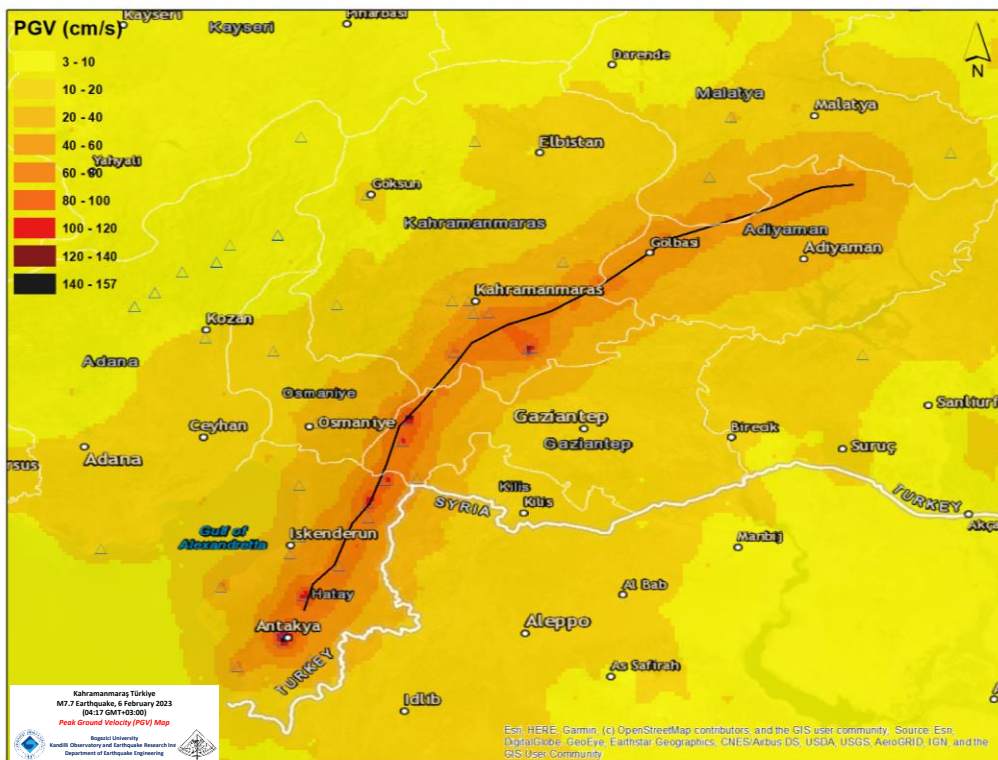




## Peak Ground Acceleration Map



## Peak Ground Velocity Map

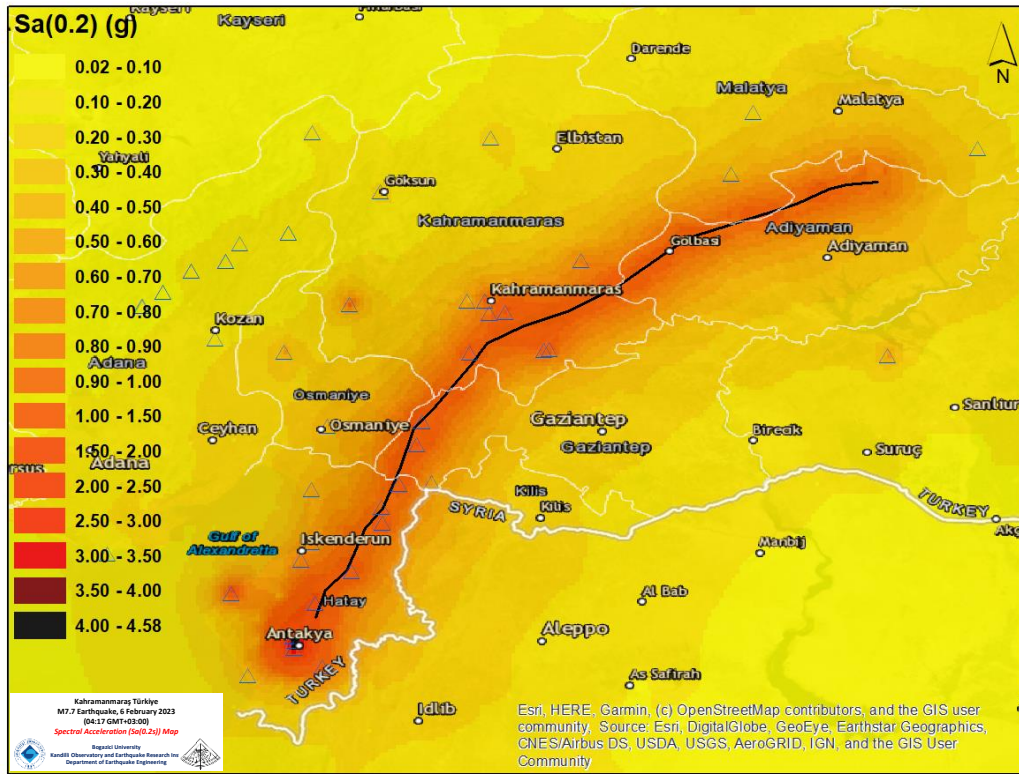


Blue triangles on the maps show station locations.

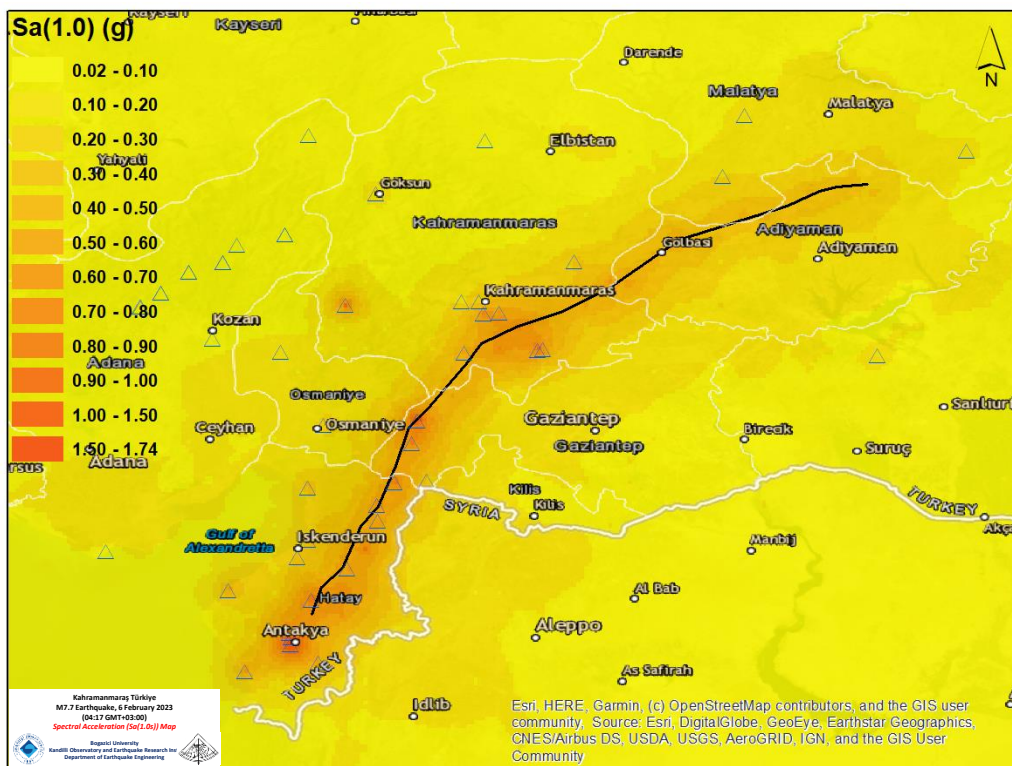
6 February 2023 (04:17) Kahramanmaraş-Türkiye M7.7 Earthquake

Preliminary Report (v6)

### Spectral Acceleration (Sa(0.2)) Map



### Spectral Acceleration (Sa(1.0)) Map

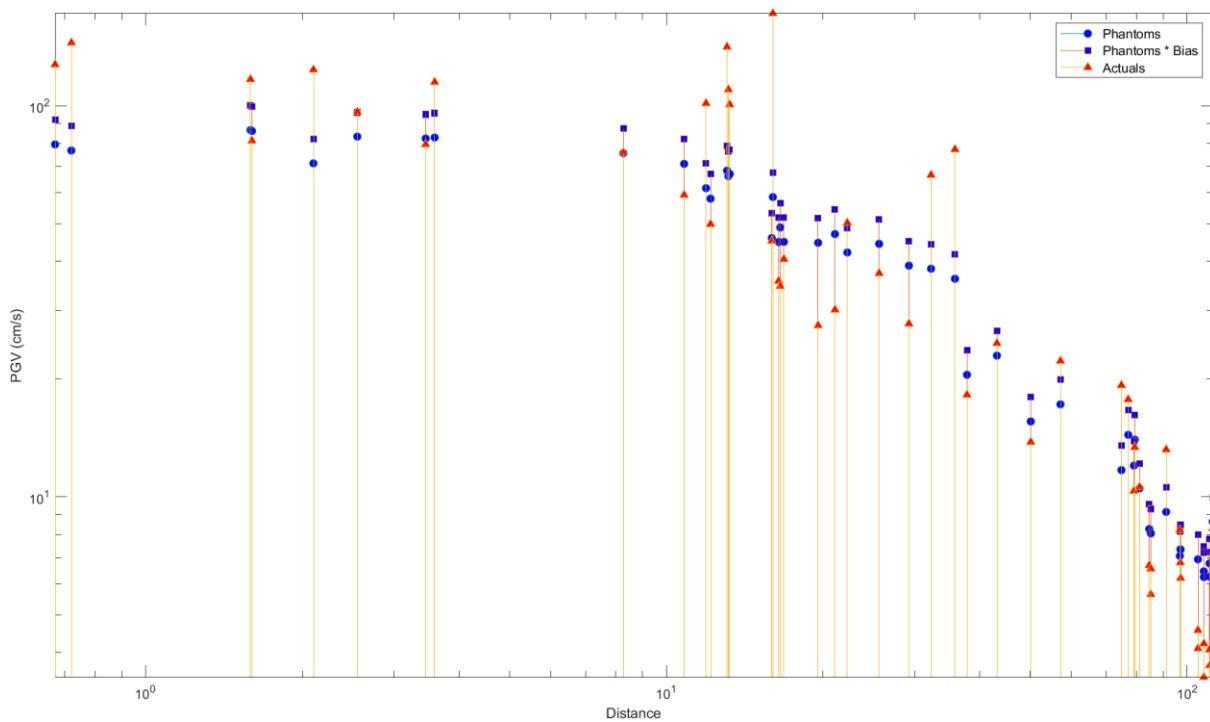
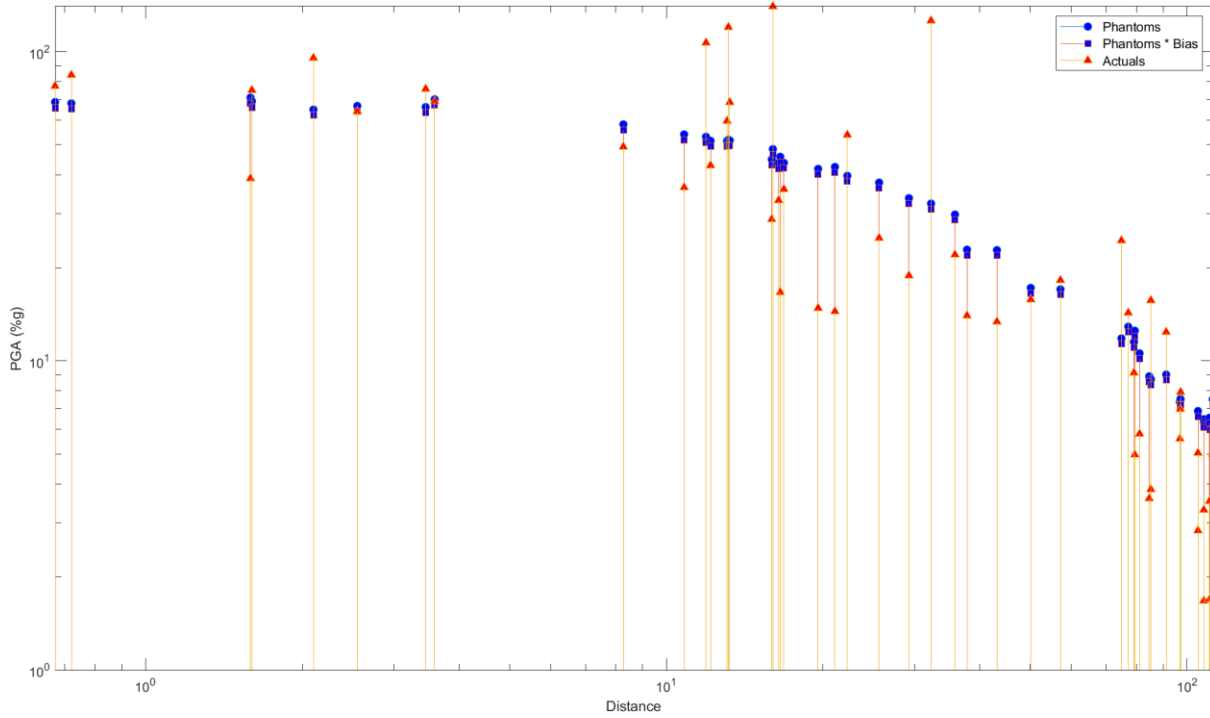


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6 February 2023 (04:17) Kahramanmaraş-Türkiye M7.7 Earthquake

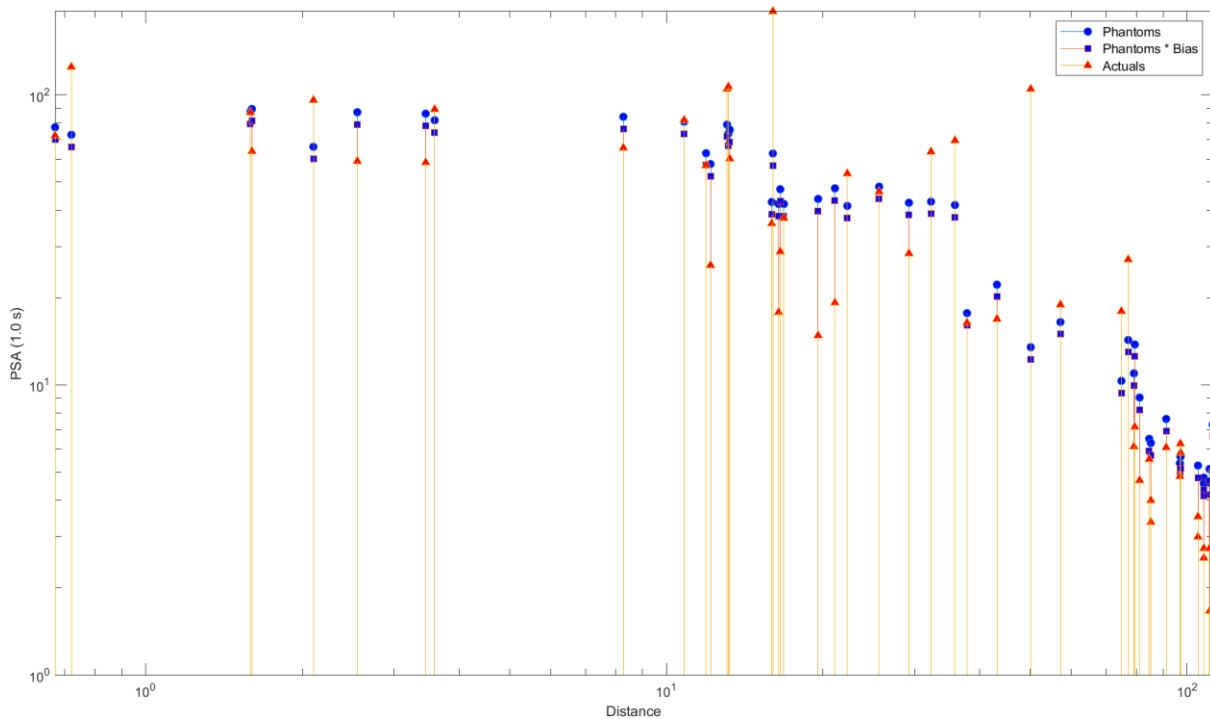
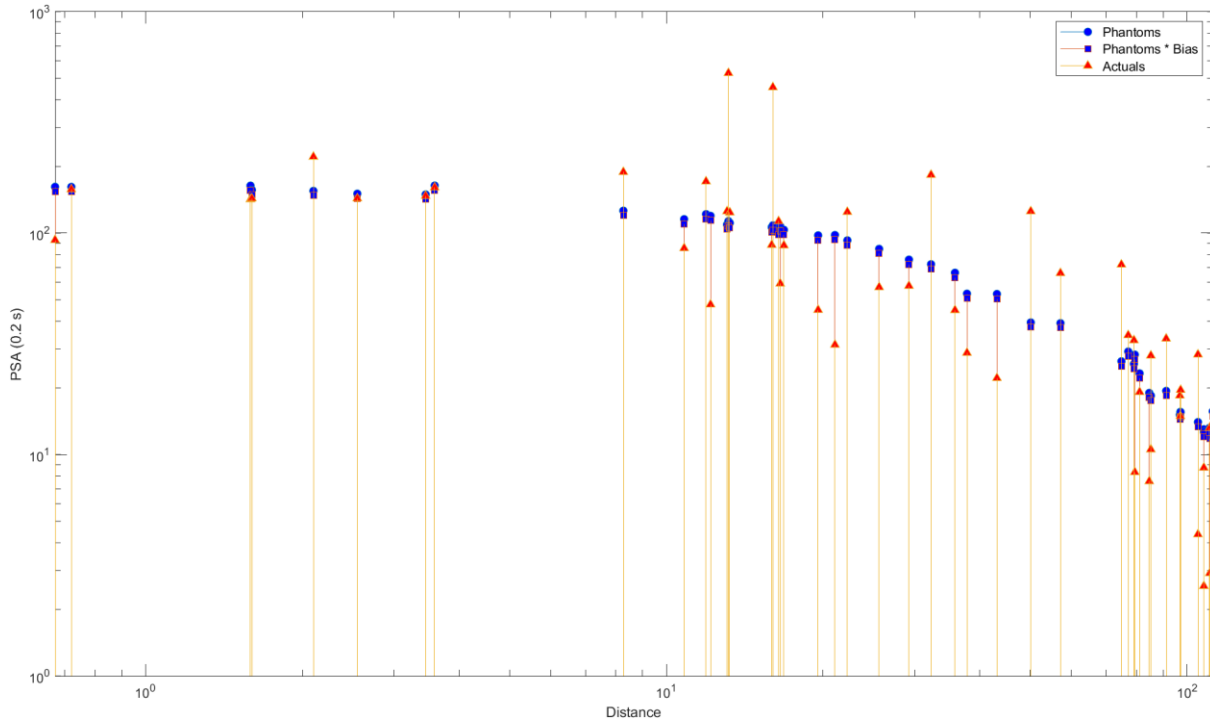
Preliminary Report (v6)

### Bias Correction Graphs (PGA, PGV)



Actuals: Recorded values  
Phantoms: Estimated values

### Bias Correction Graphs (Sa0.2, Sa1.0)



Actuals: Recorded values  
Phantoms: Estimated values



## INTENSITY BASED ESTIMATION of BUILDING DAMAGE DISTRIBUTION (REGIONAL SCALE)

### Estimated Number of Damaged Buildings\*

Damage Grade	BA2014	WQHK1999	AK2007	Average
DG4+DG5	84,055	12,816	25,863	40,911
DG3+DG4+DG5	193,838	48,500	91,021	111,120

\*within the map extent

### Damage Grade Definitions (EMS98)

DG3: Substantial to heavy damage

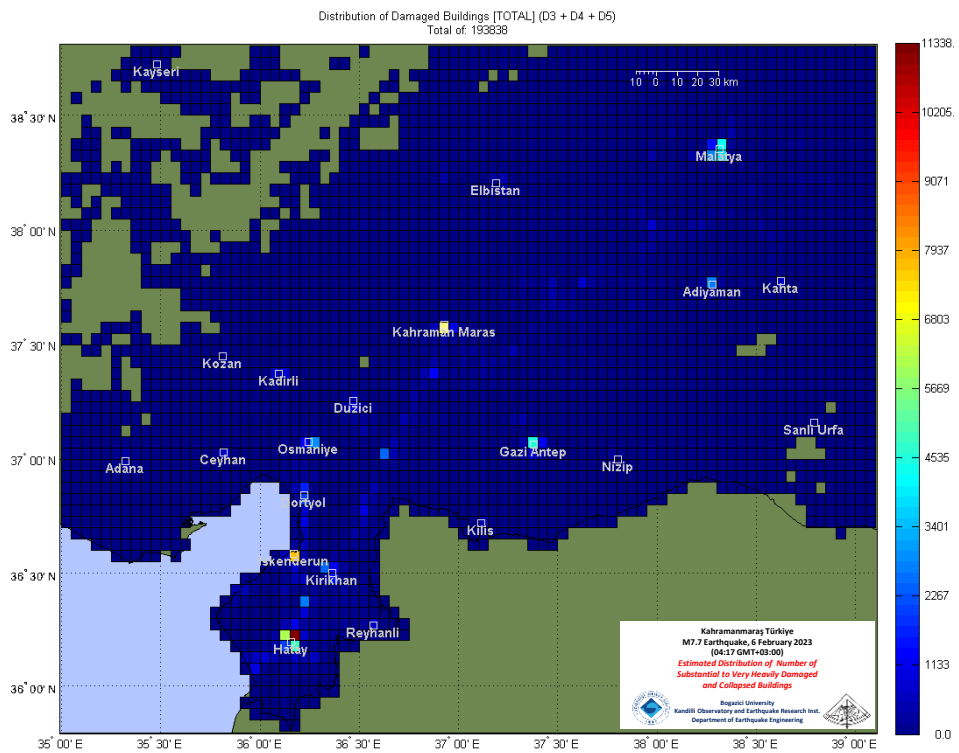
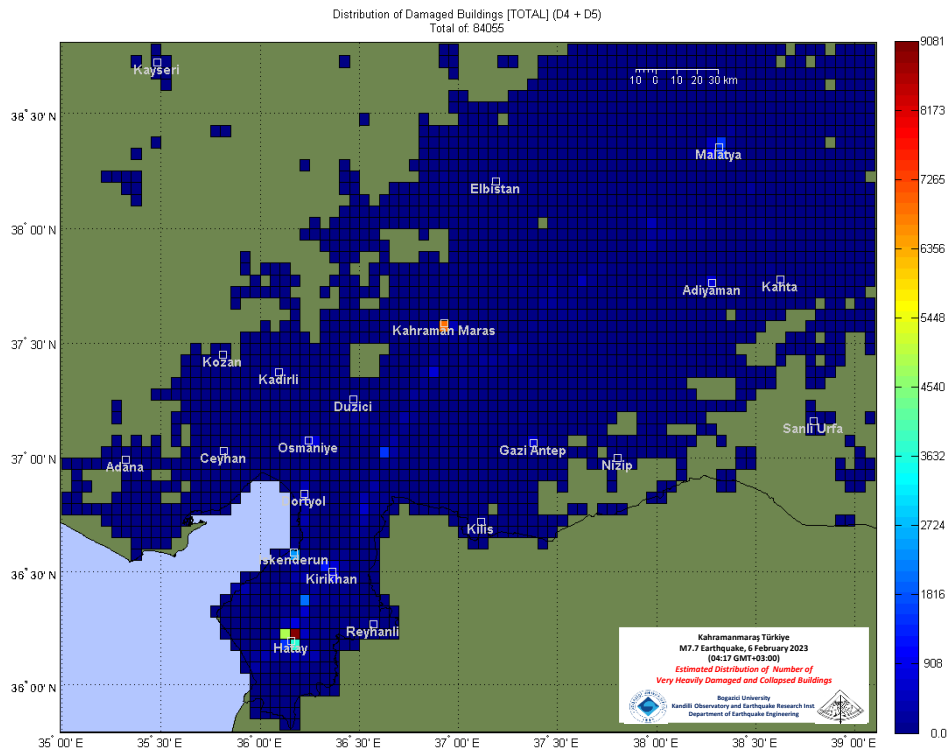
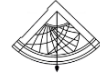
DG4: Very heavy damage

DG5: Destruction

Spatial distributions of the number of damaged buildings estimated with the BA2014-intensity input presented in the following maps.

### Officially announced numbers as of 16.02.2023:

**Collapsed, to be immediately demolished and heavily damaged buildings: 67,209 buildings in Adana, Adiyaman, Diyarbakir, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Osmaniye and Şanlıurfa.**



## SPECTRAL ACCELERATION-DISPLACEMENT BASED ESTIMATION of BUILDING DAMAGE DISTRIBUTION for KAHRAMANMARAS CITY

It is estimated that approximately 50% of the city central district's building inventory in (moderate+extensive+complete) damage state.

Damage State	CSM	MADRS-4	CM	Average	% of total number of buildings
<b>Complete</b>	3336	1476	1946	<b>2253</b>	<b>5%</b>
<b>Extensive</b>	6805	5344	6704	<b>6284</b>	<b>14%</b>
<b>Moderate</b>	12153	13660	15157	<b>13657</b>	<b>30%</b>
<b>Slight</b>	10215	12478	12151	<b>11615</b>	<b>25%</b>
<b>None</b>	13289	12840	9840	<b>11990</b>	<b>26%</b>

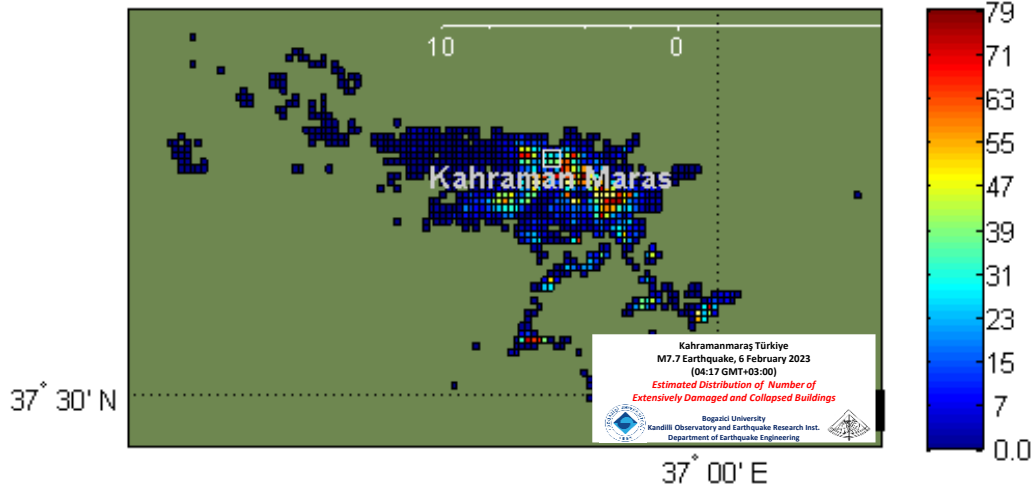
Spatial distributions of the number of damaged buildings from CSM method presented in the following maps.

**Officially announced numbers as of 16.02.2023:**

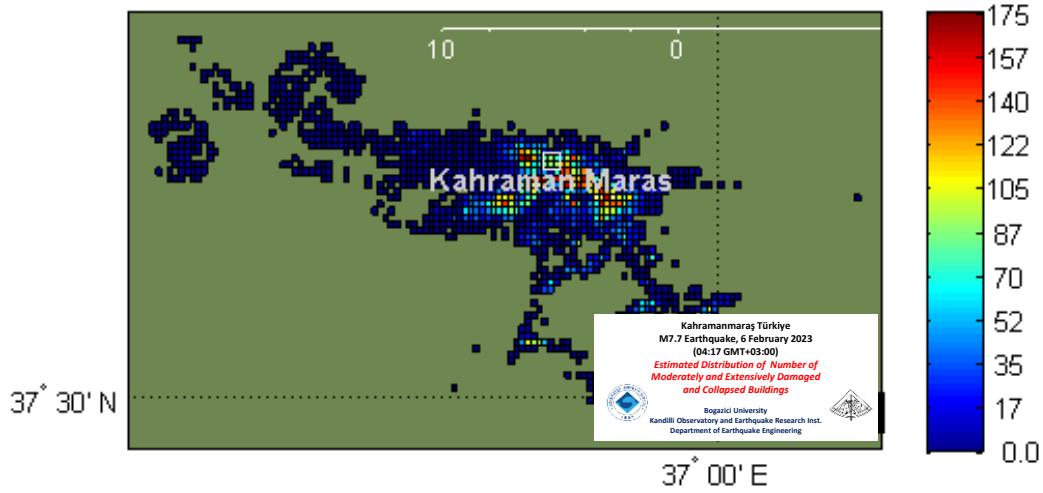
**Collapsed, to be immediately demolished and heavily damaged buildings: 13,864 buildings in entire Kahramanmaraş city (total number of inspected buildings is 74,560).**



Distribution of Damaged Buildings [TOTAL] (Ext + Com)  
Total of: 10141

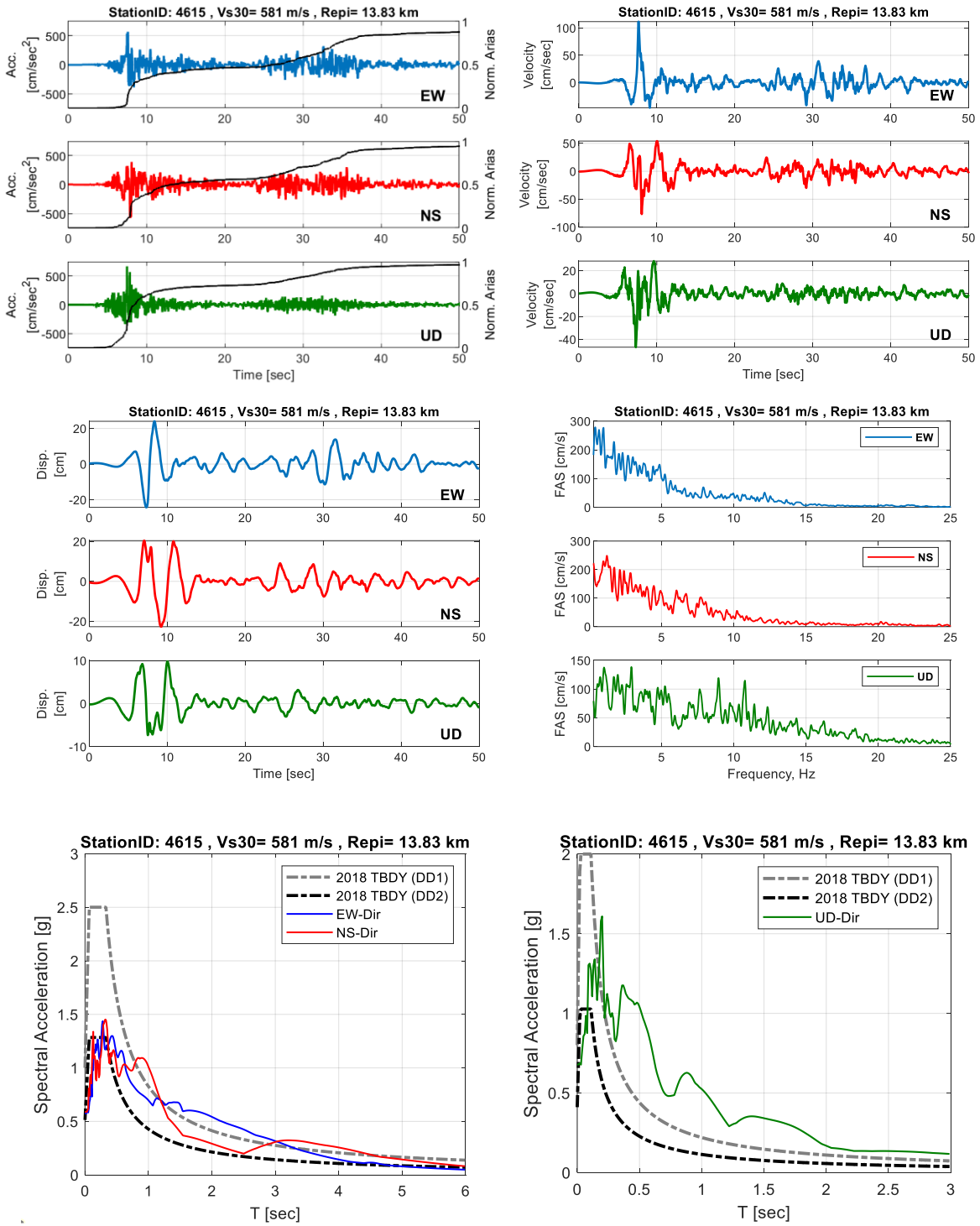


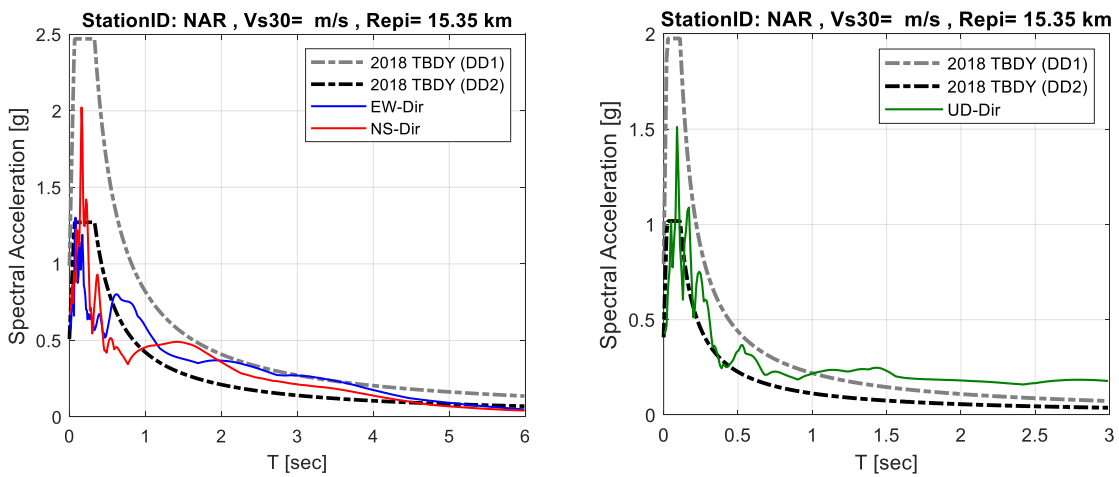
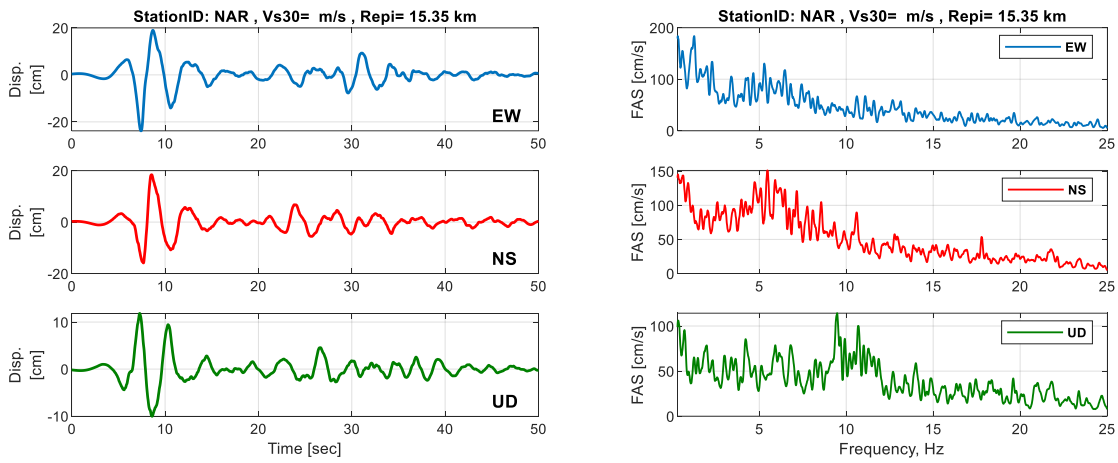
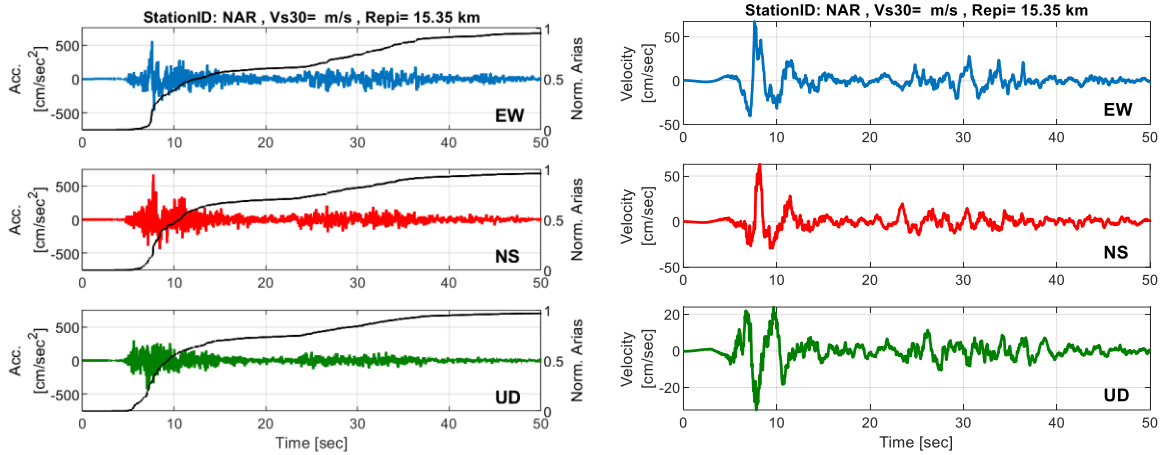
Distribution of Damaged Buildings [TOTAL] (Mod + Ext + Com)  
Total of: 22294

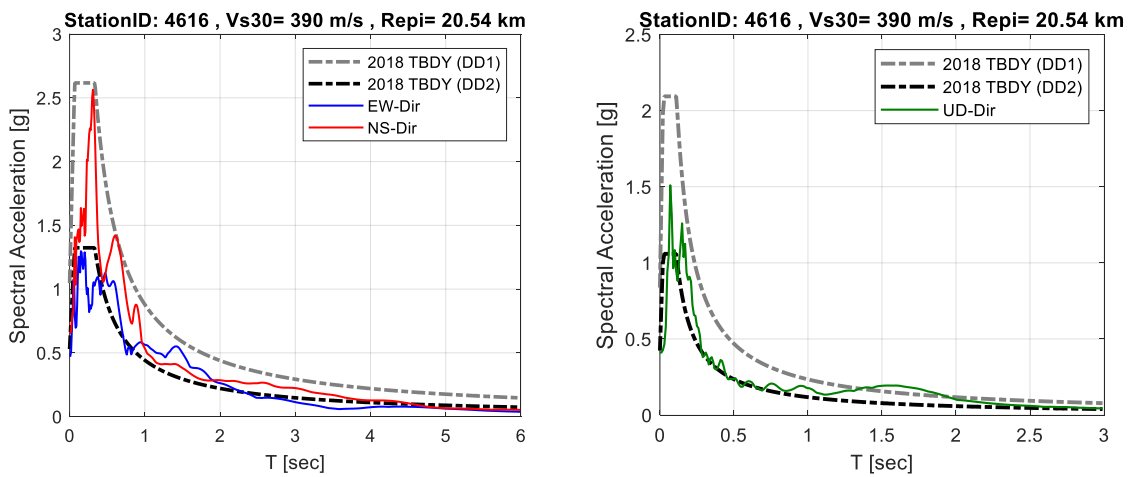
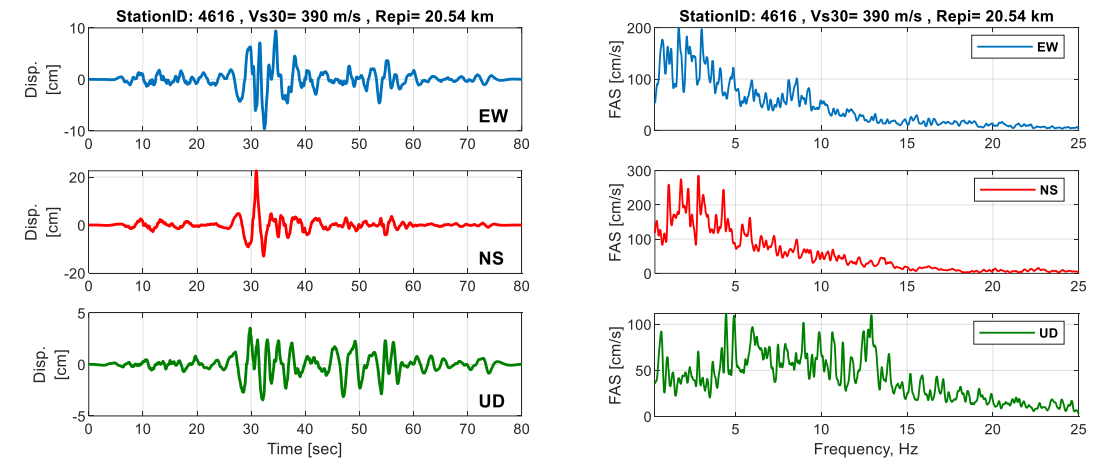
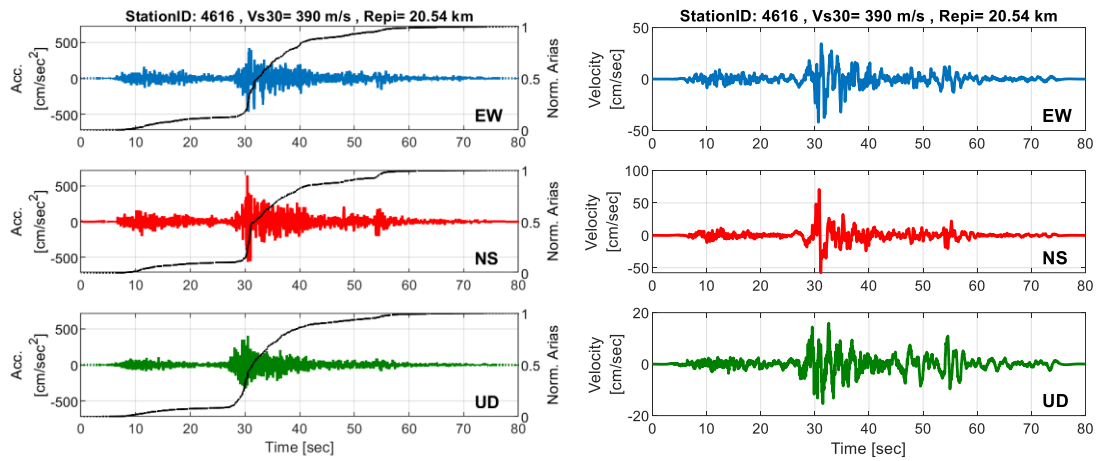
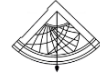


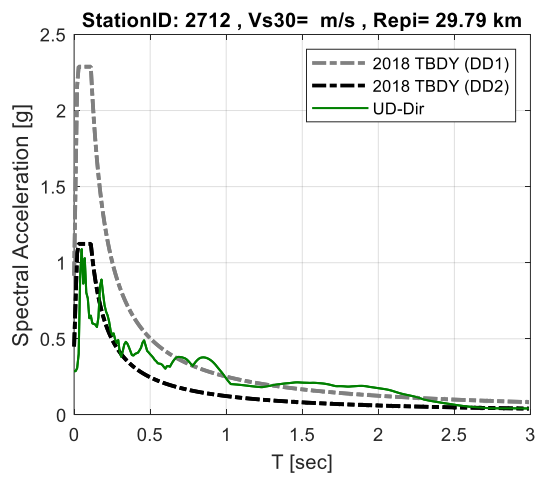
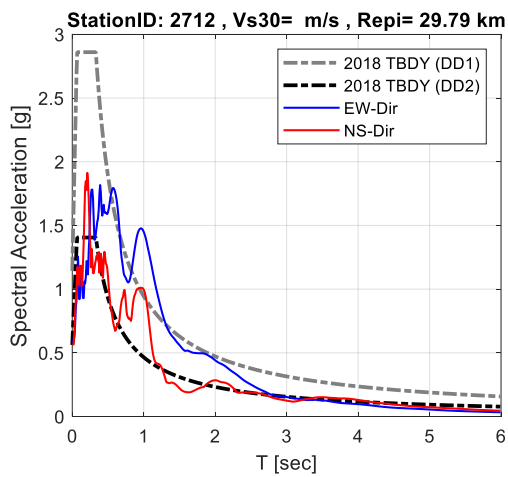
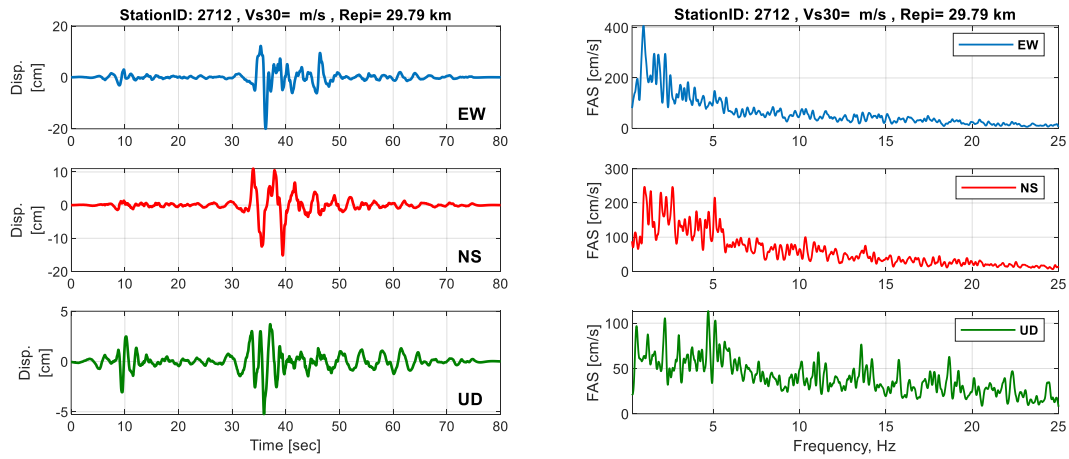
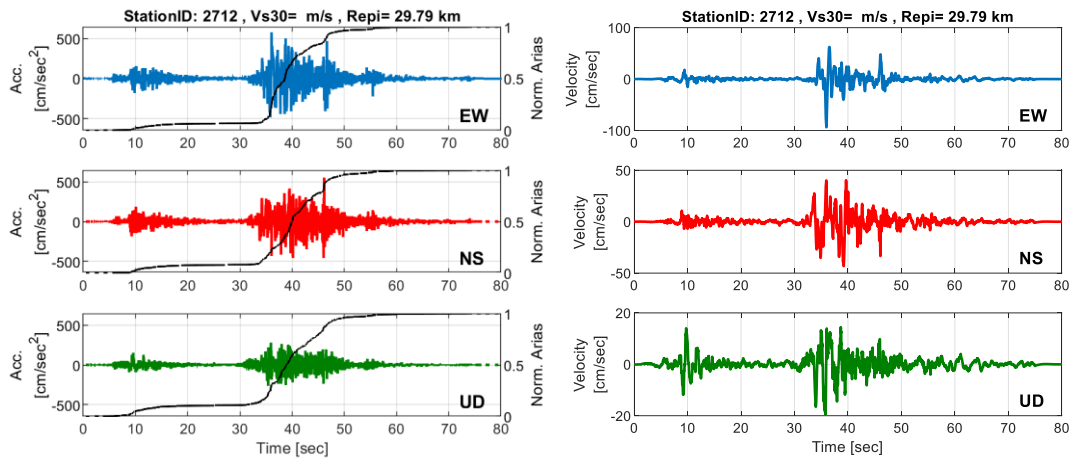
## STRONG GROUND MOTION RECORDINGS

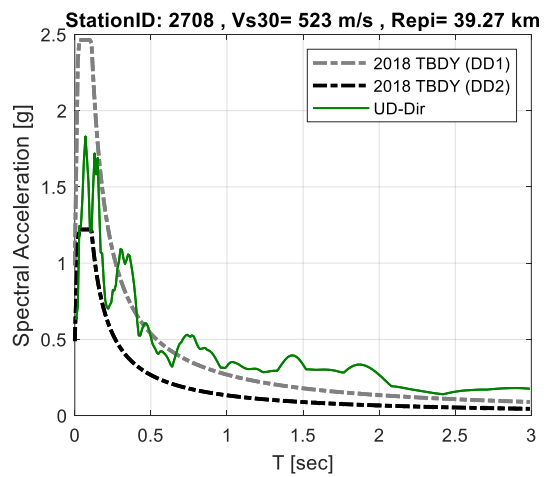
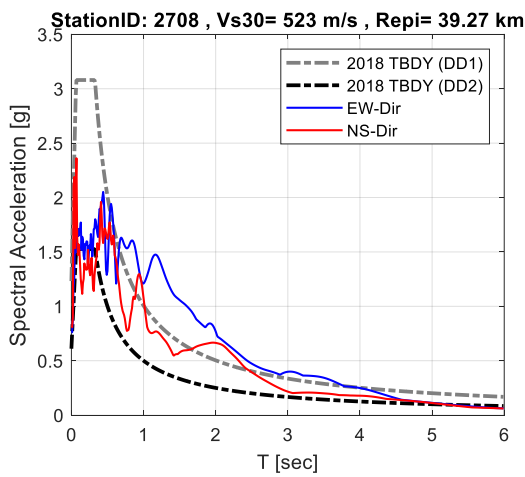
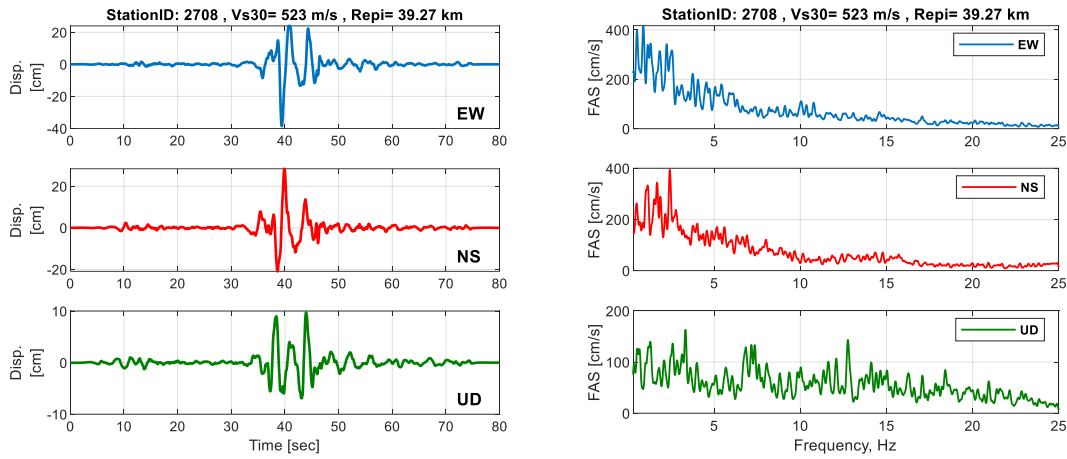
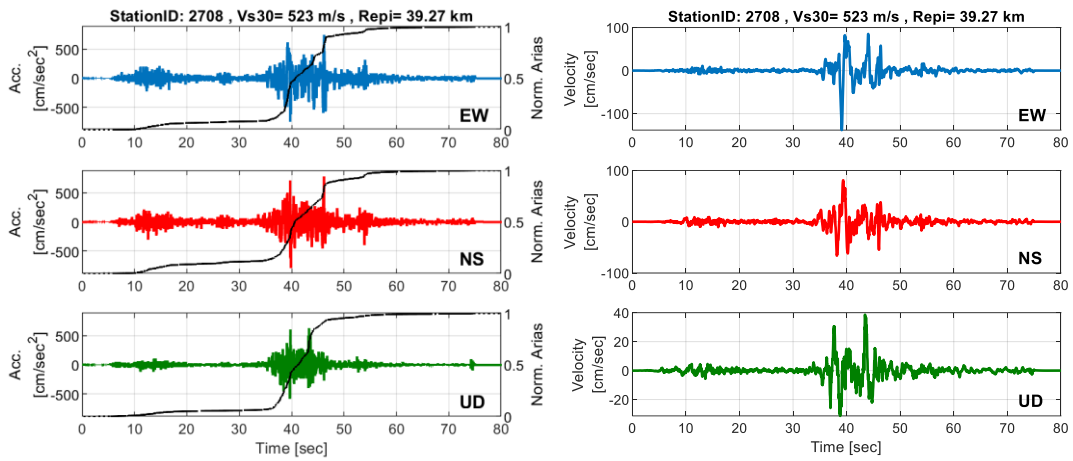
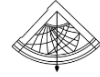
The recorded data processed in the frequency range of 0.2-25 Hz. Displacements subject to update, current plots do not consider permanent displacements.

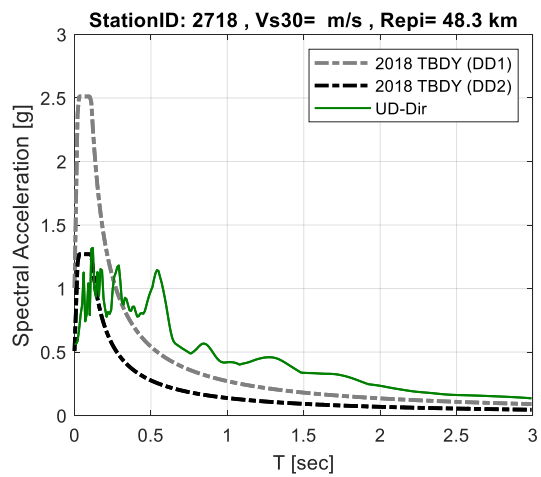
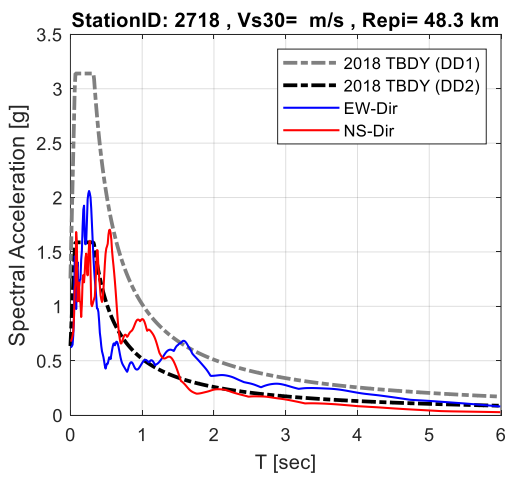
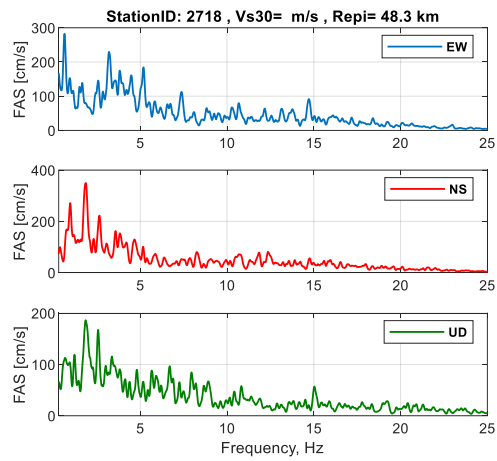
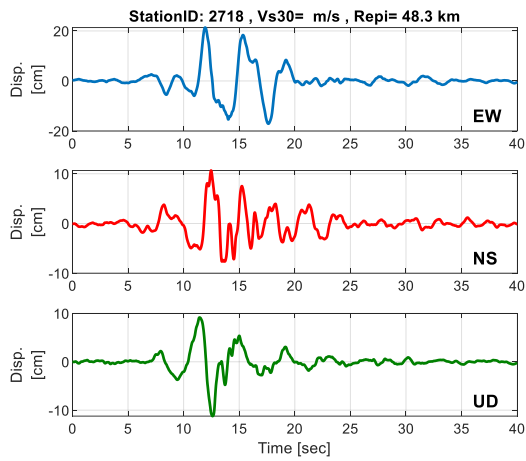
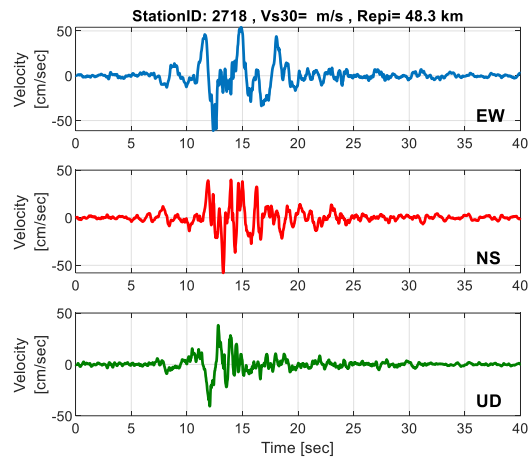
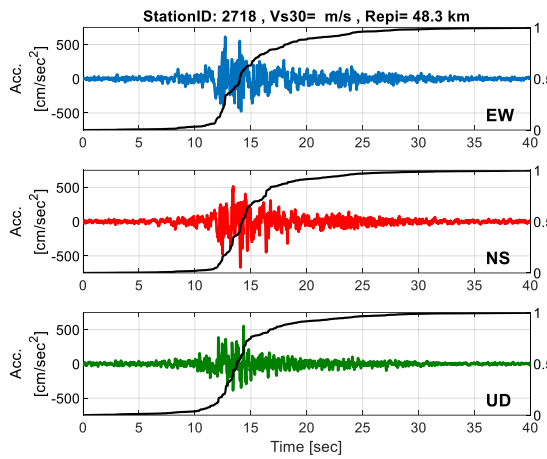
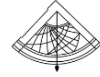




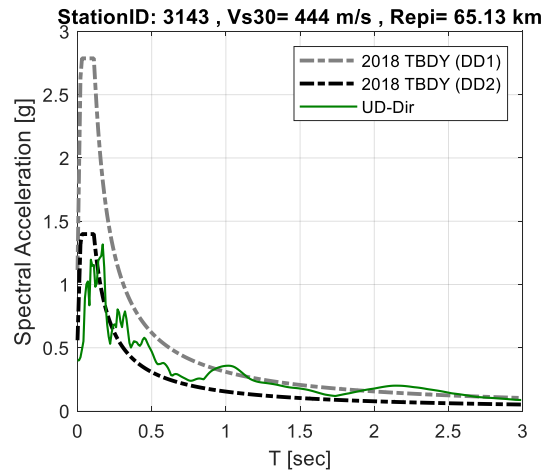
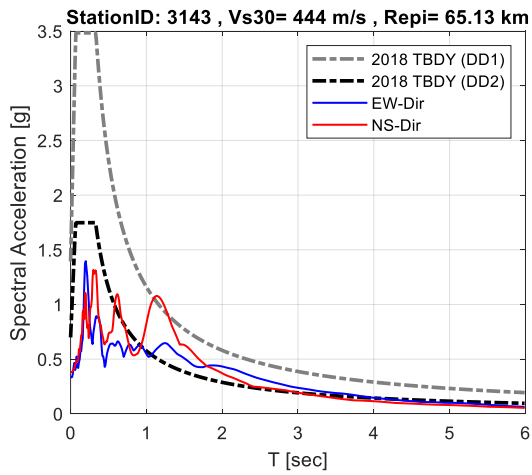
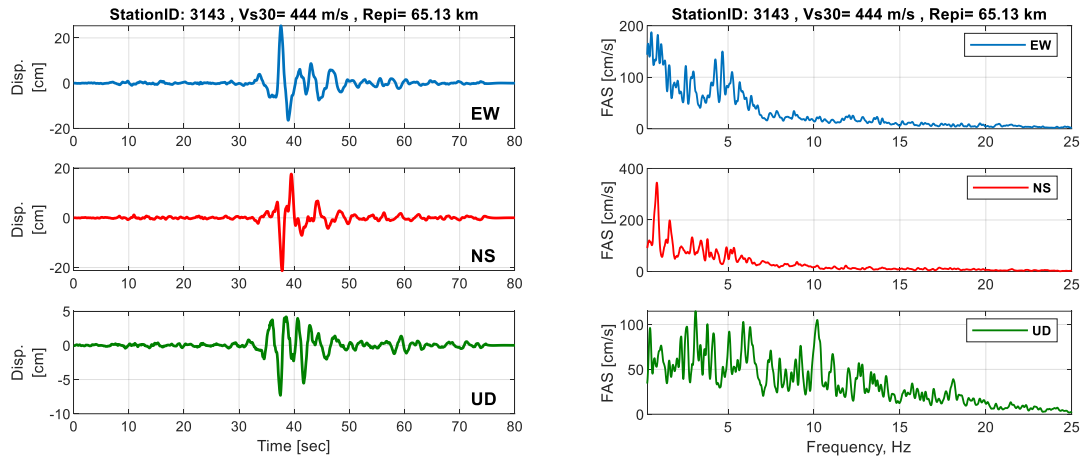
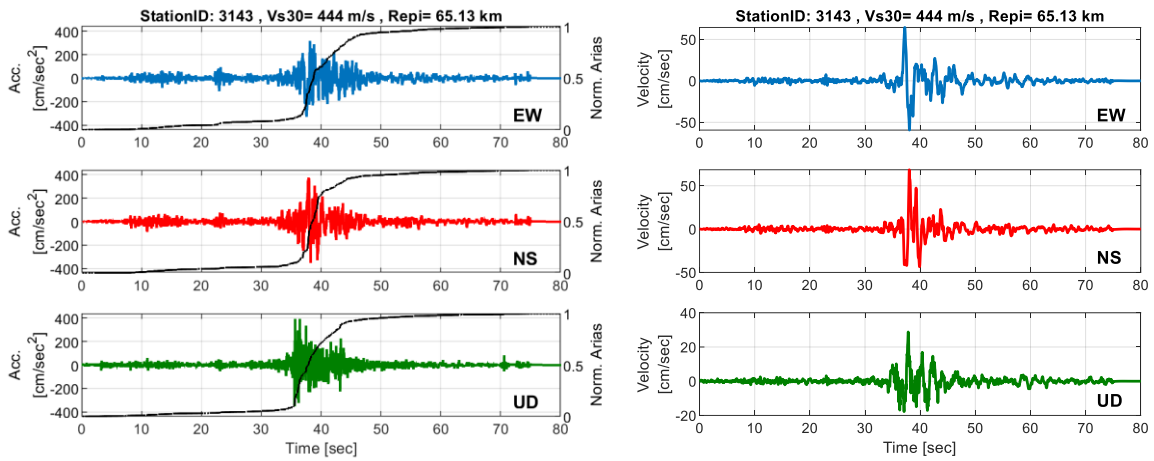


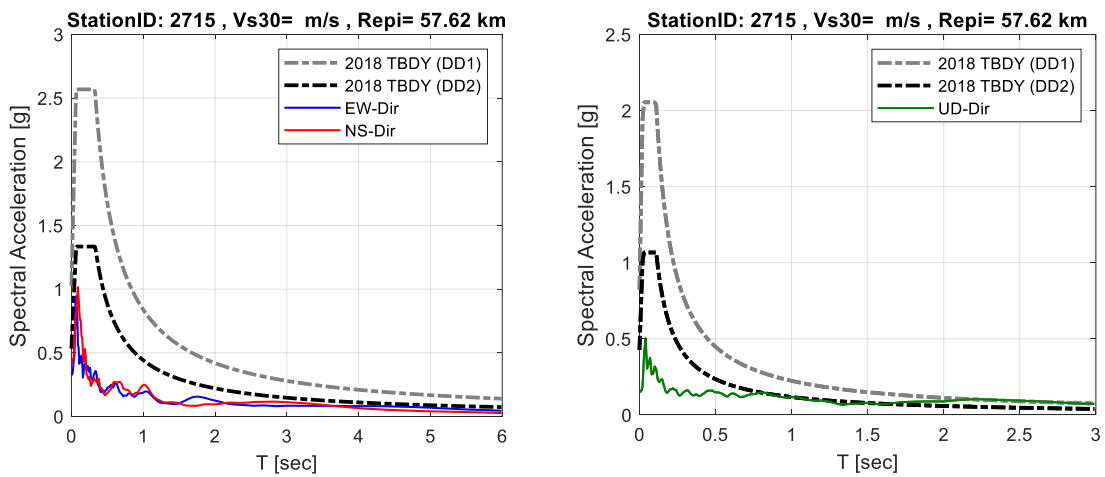
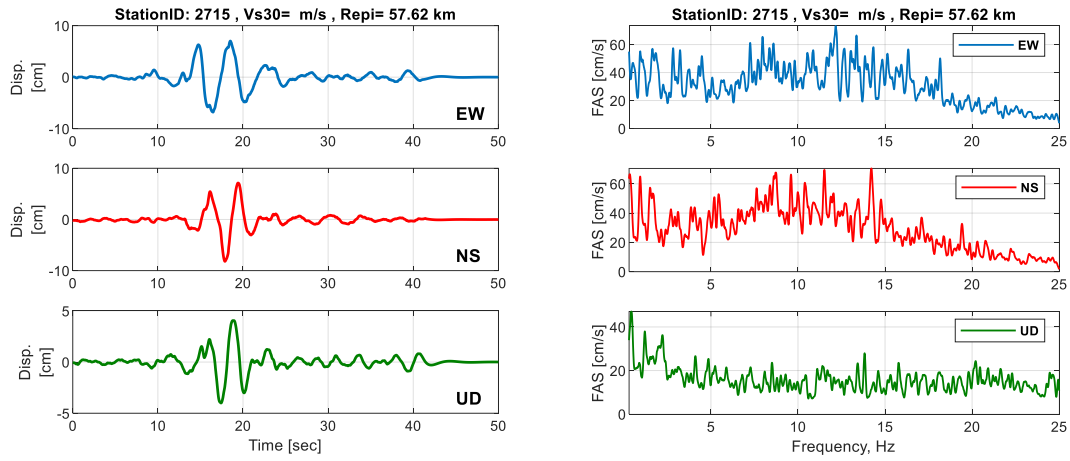
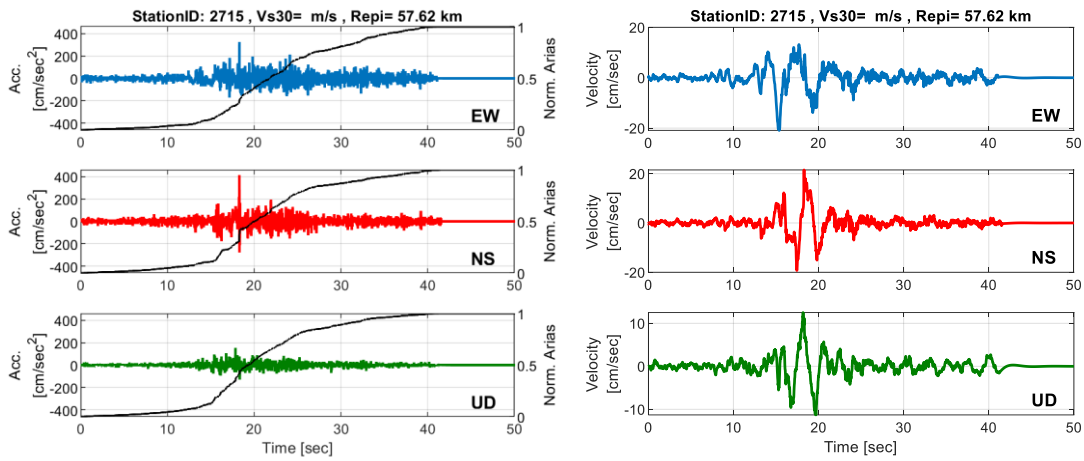


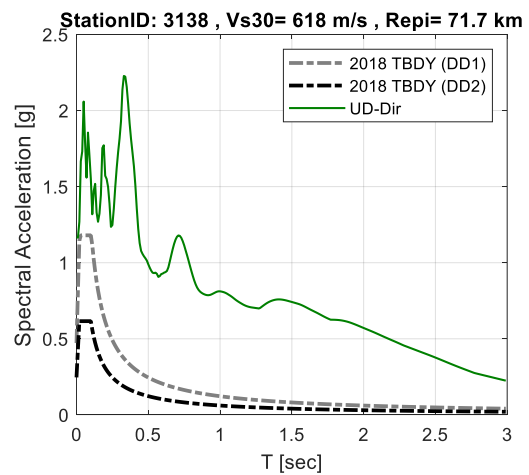
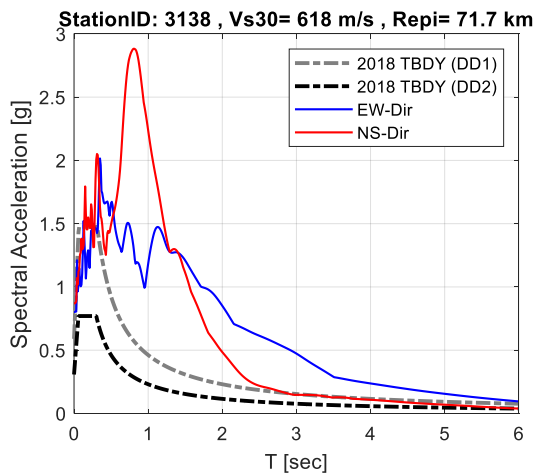
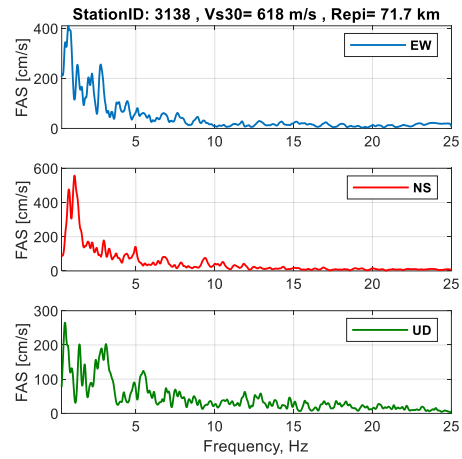
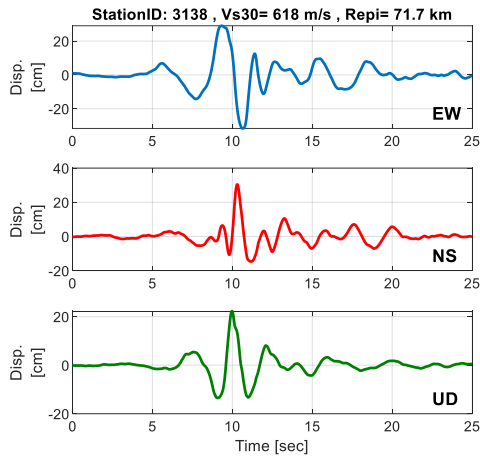
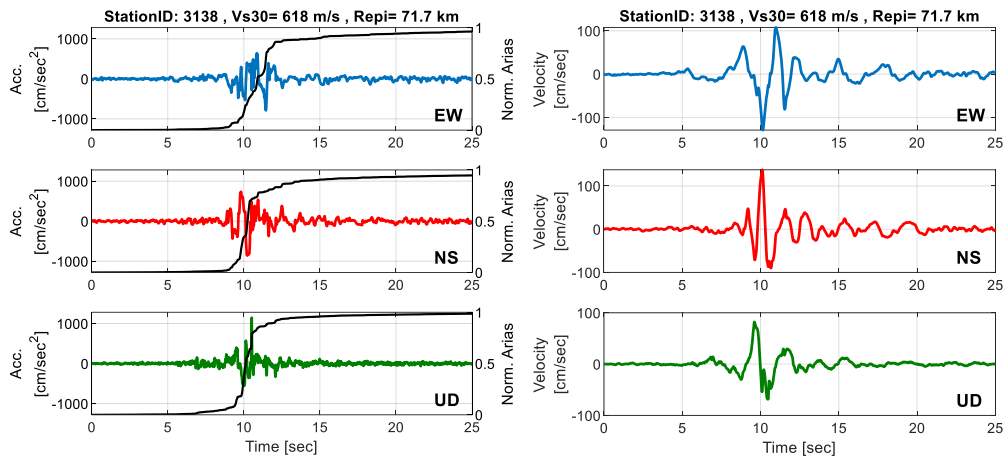


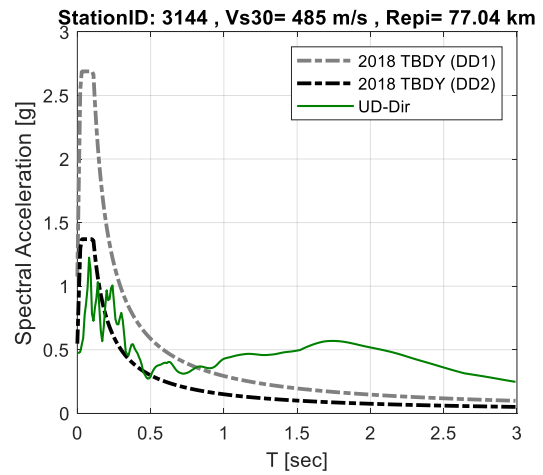
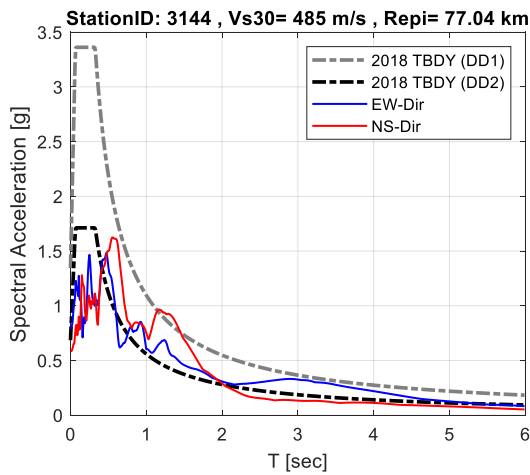
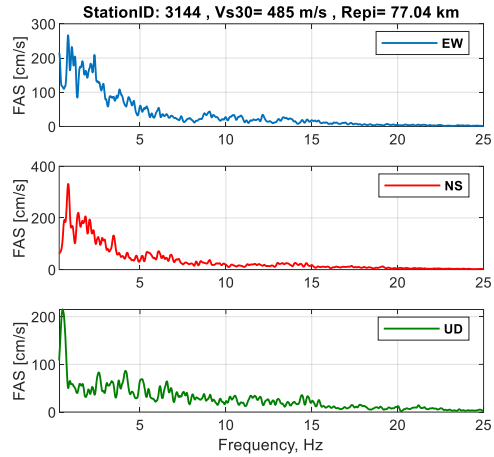
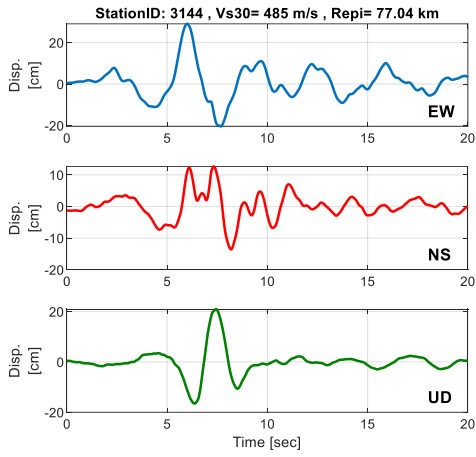
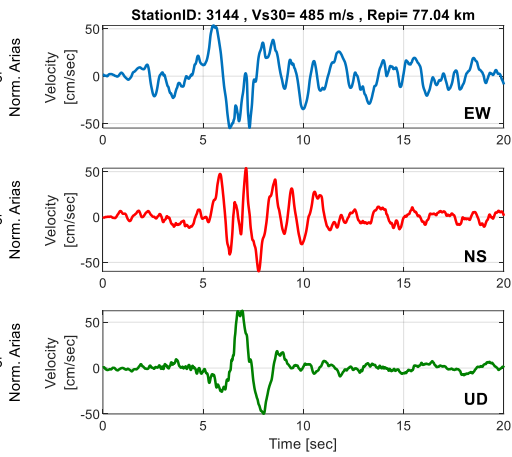
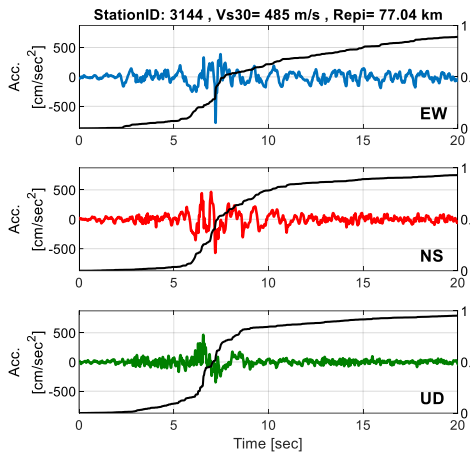
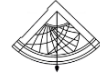


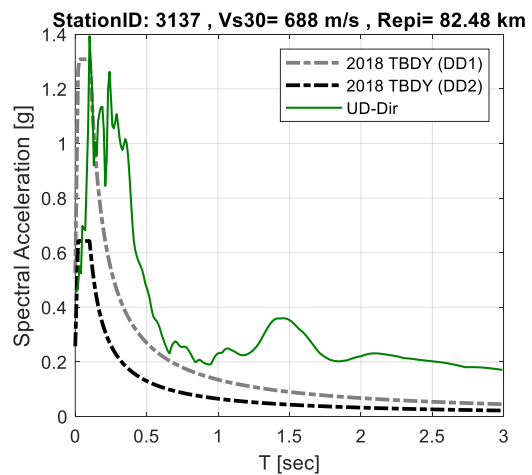
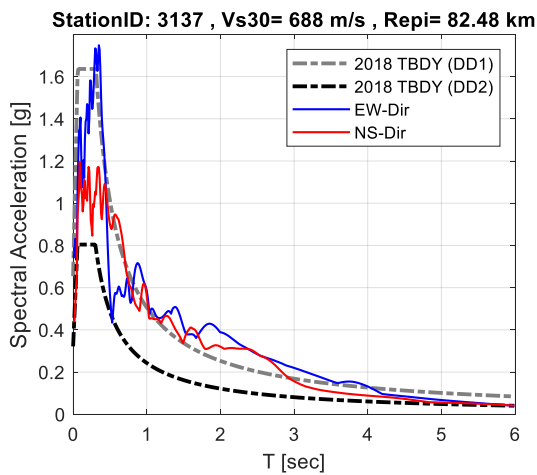
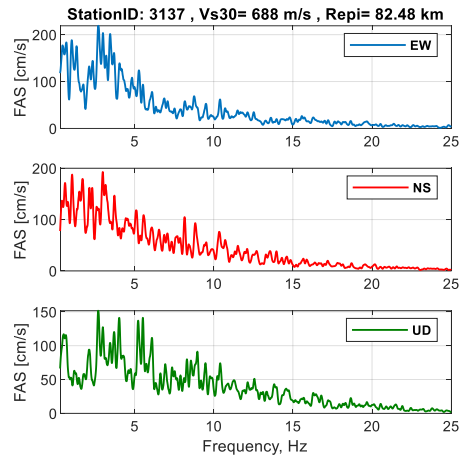
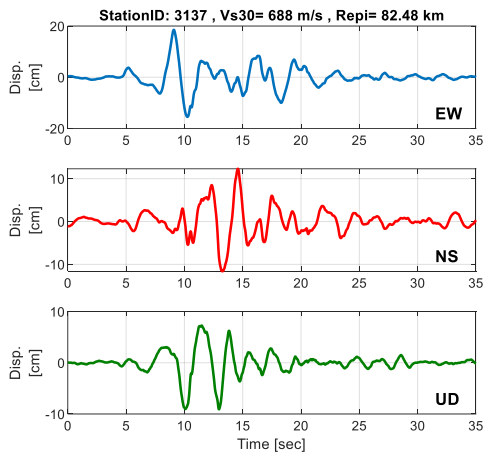
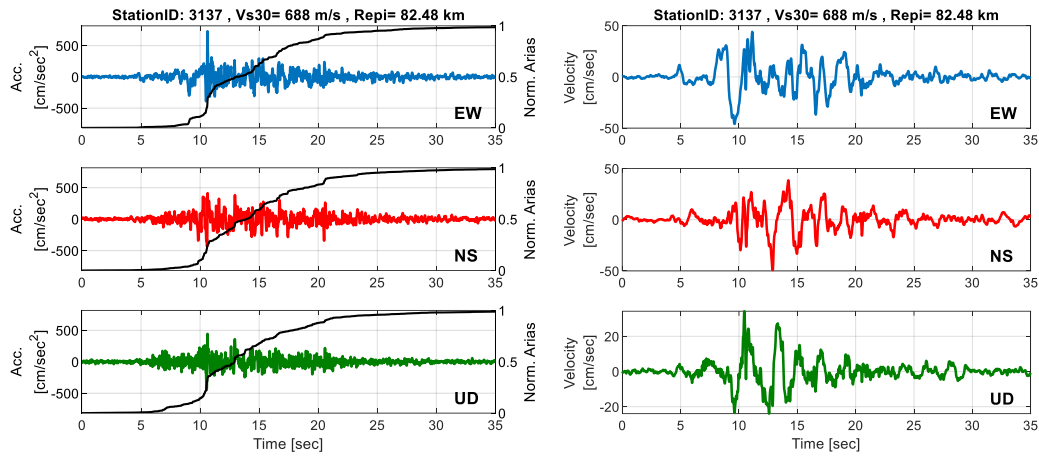


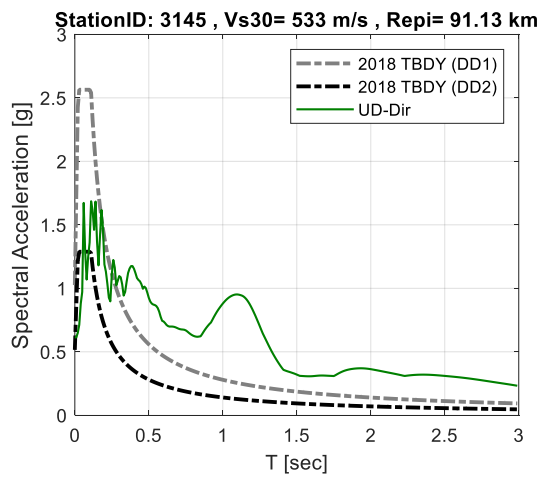
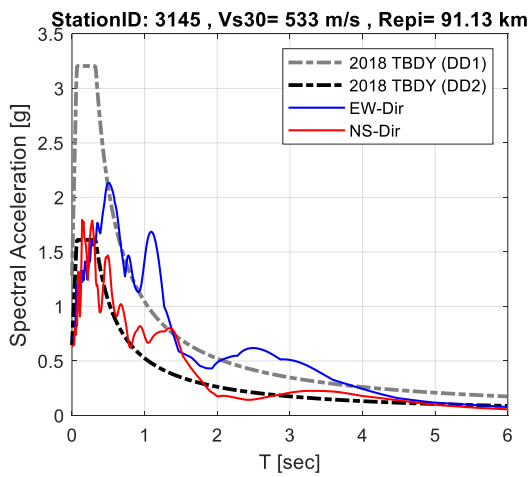
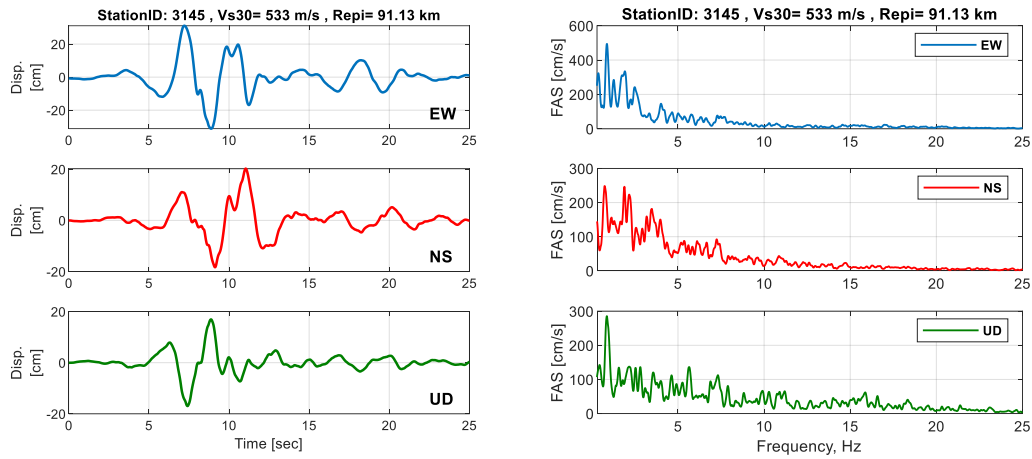
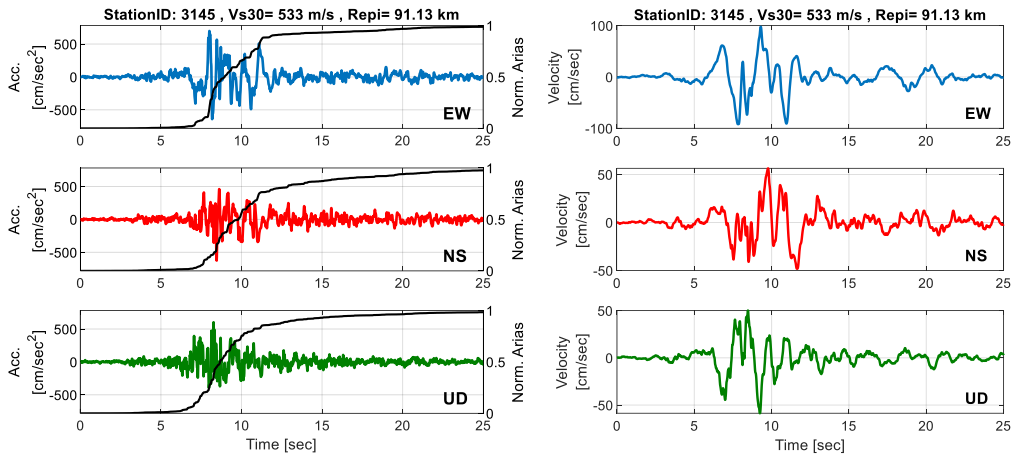


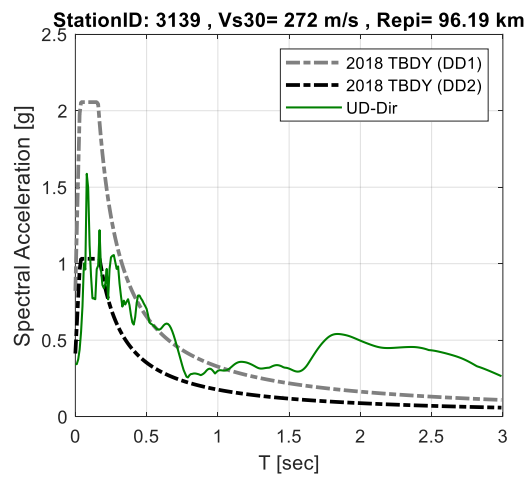
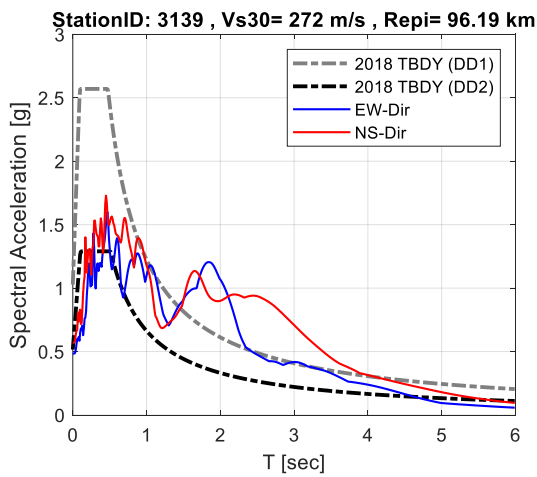
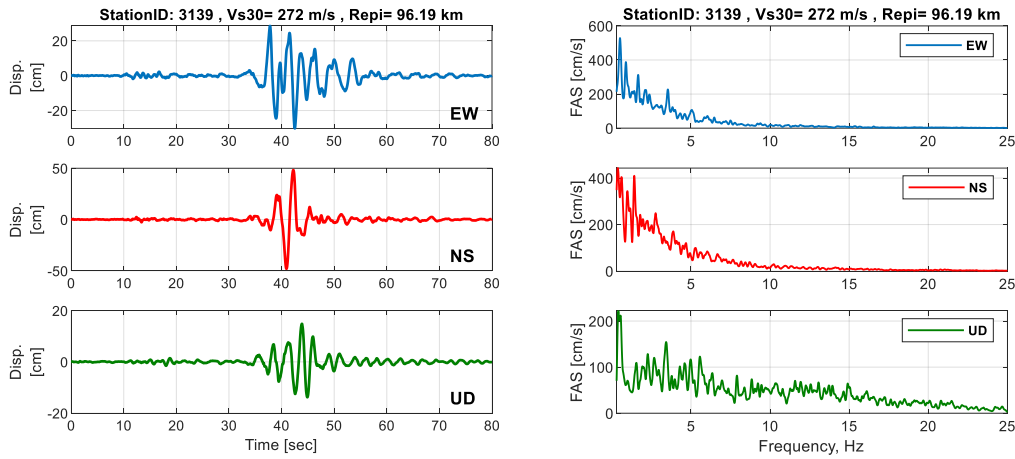
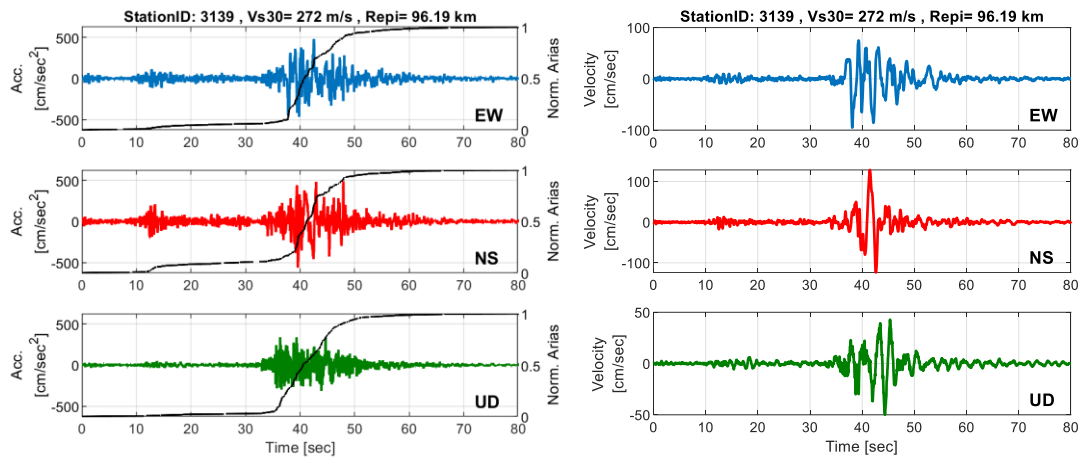




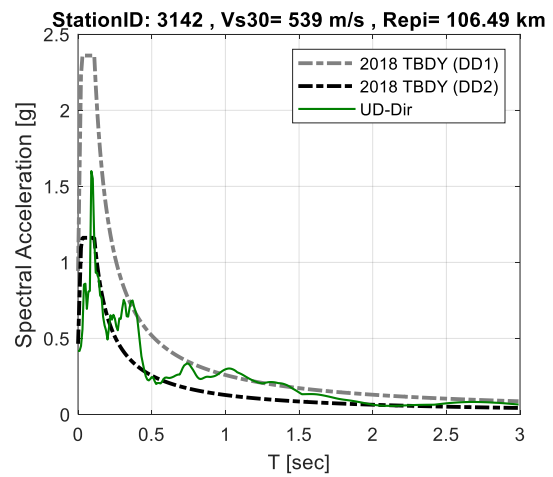
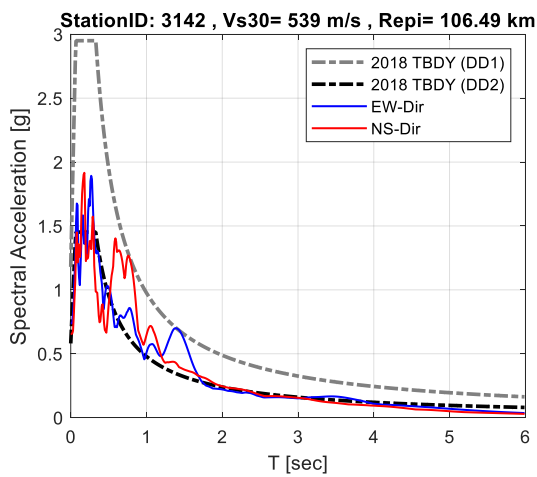
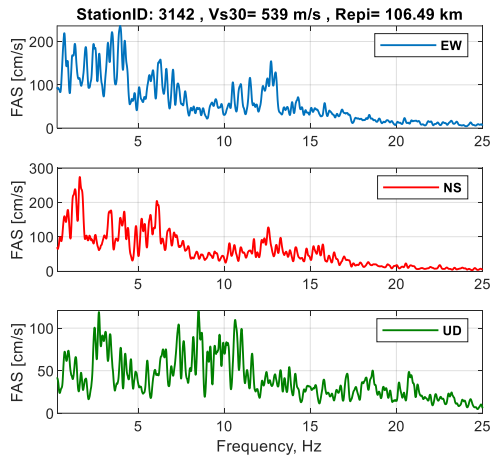
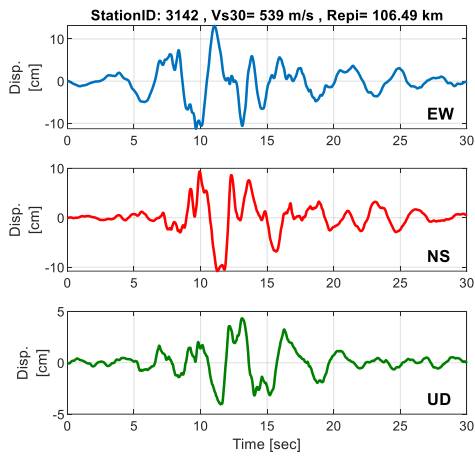
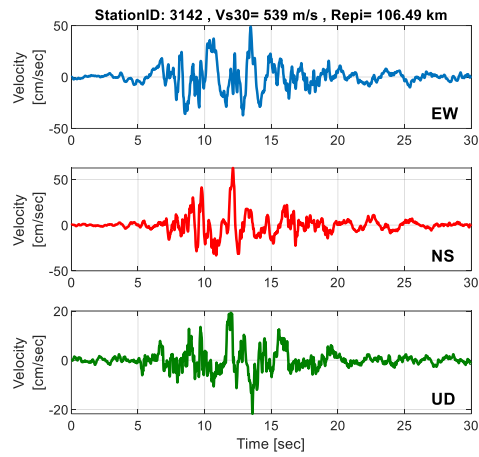
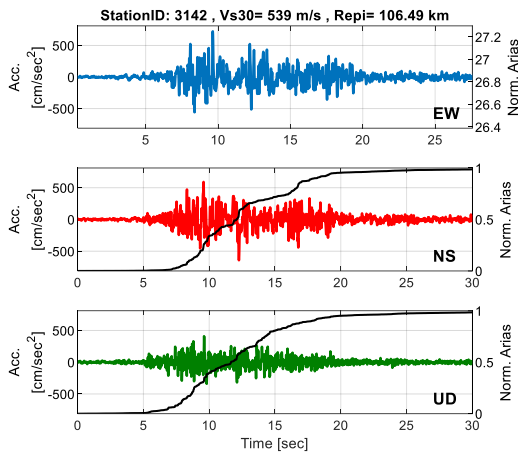


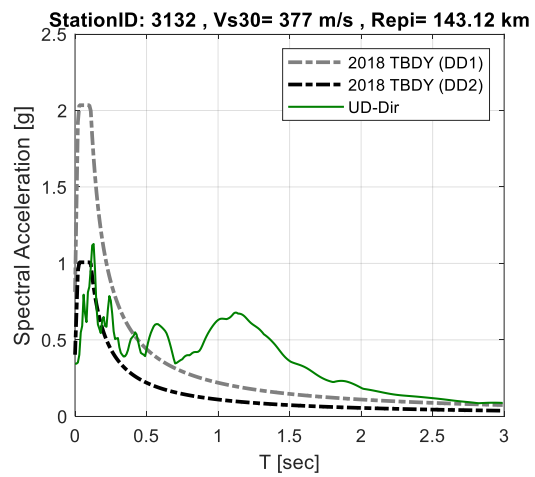
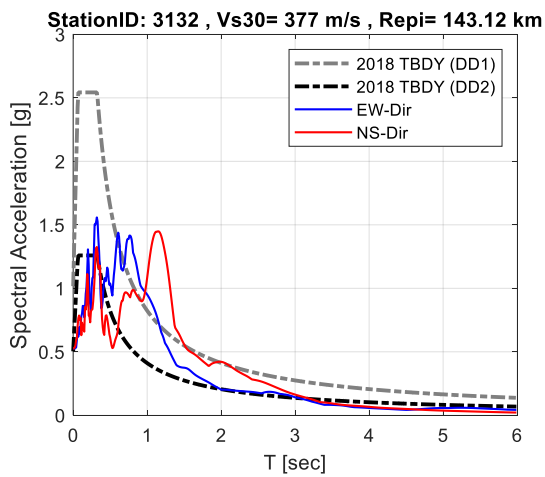
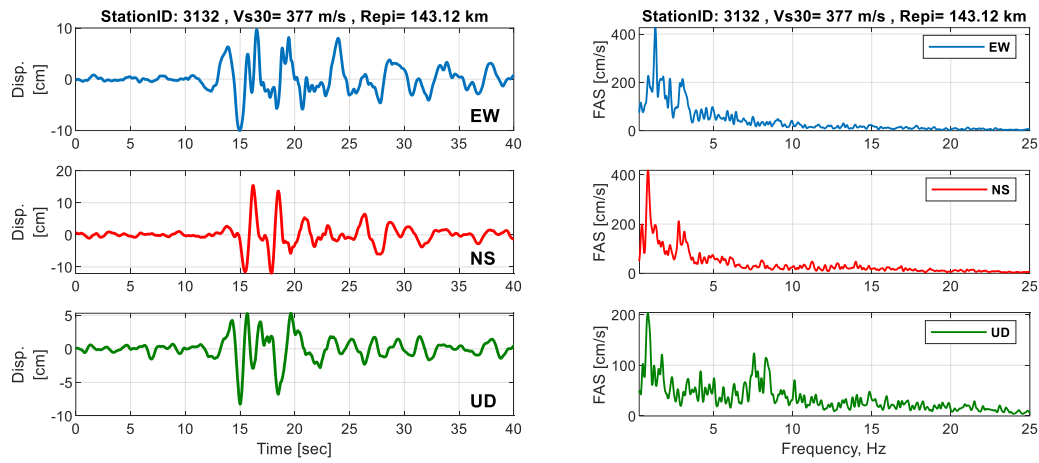
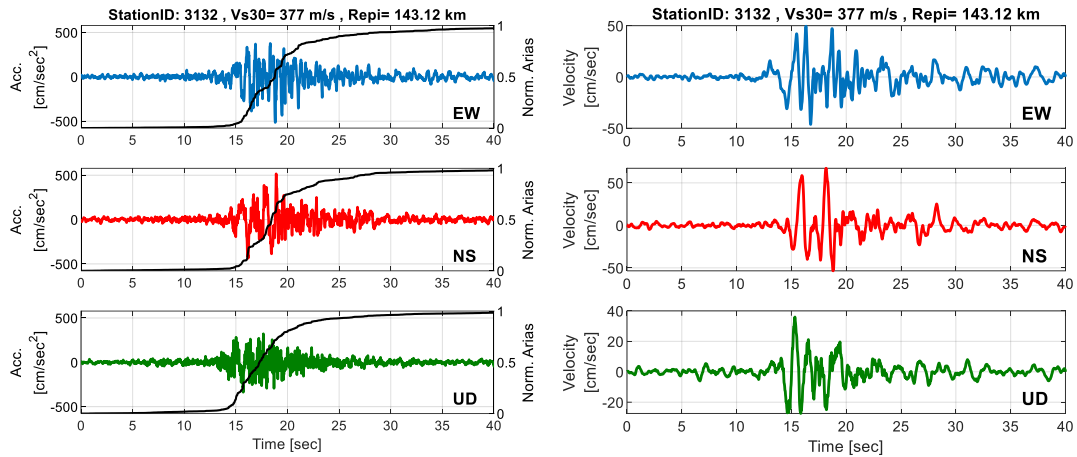


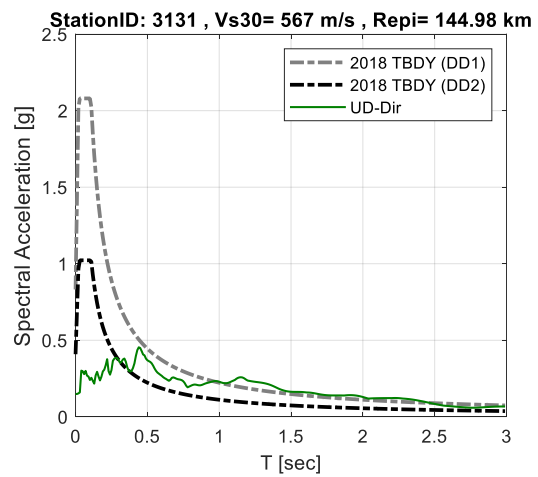
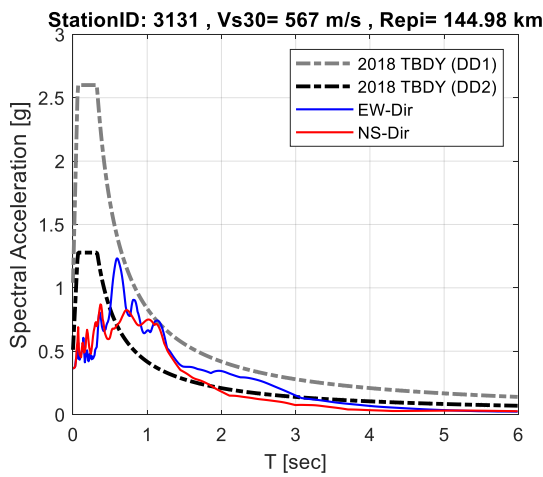
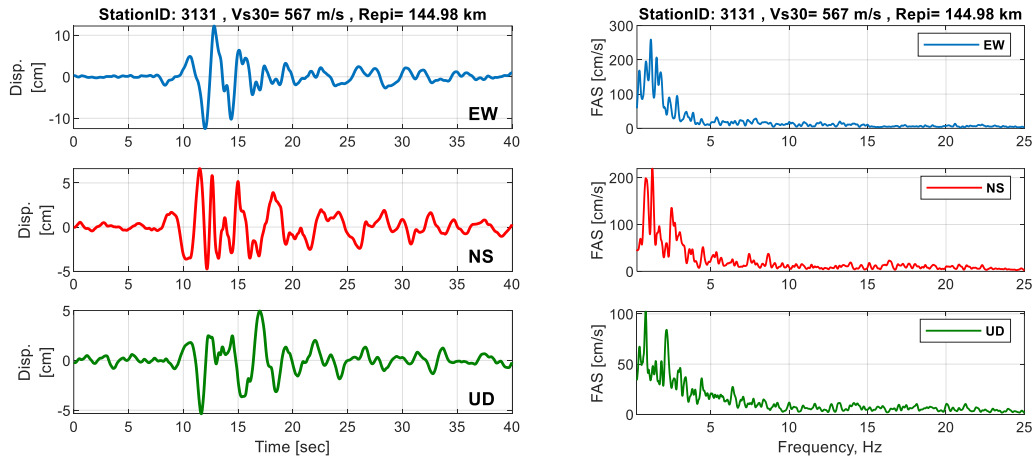
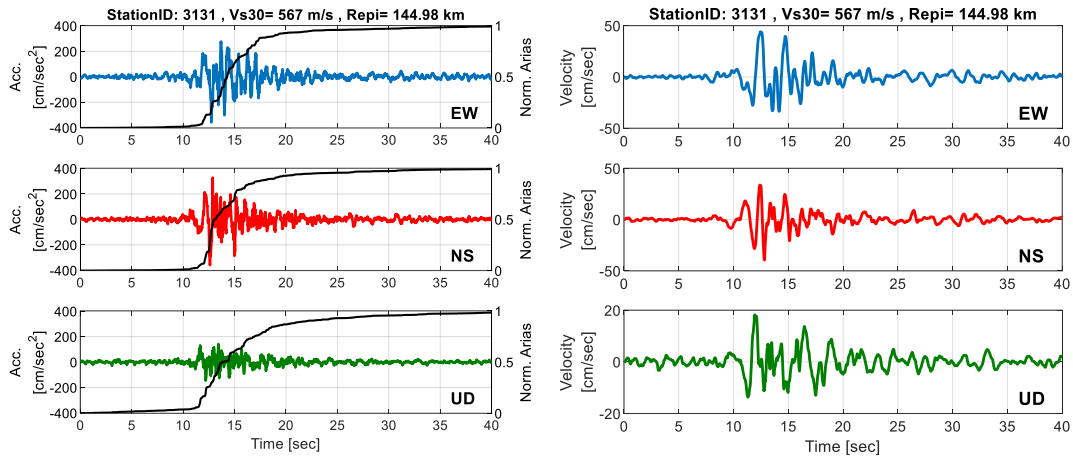


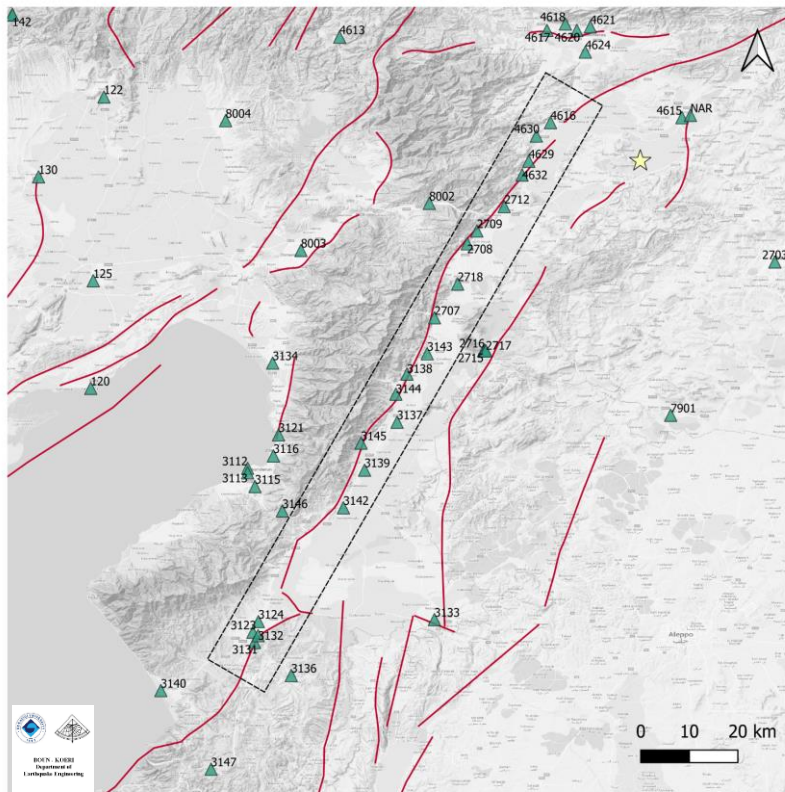
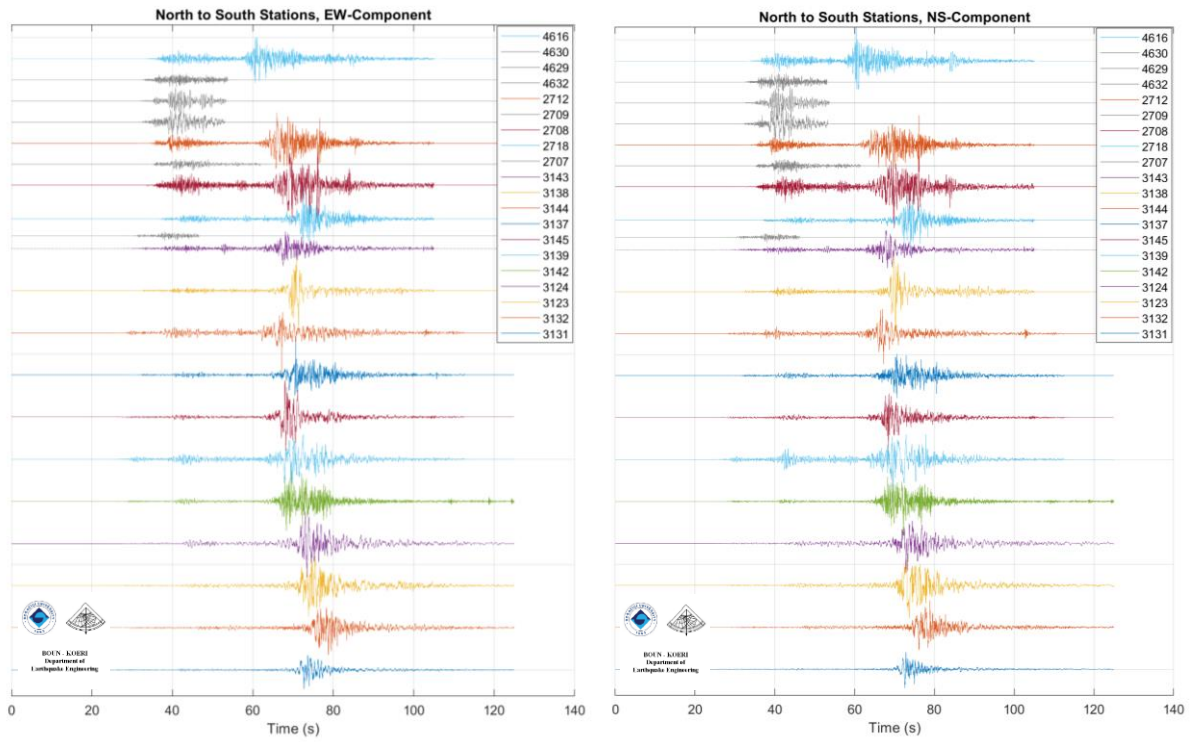










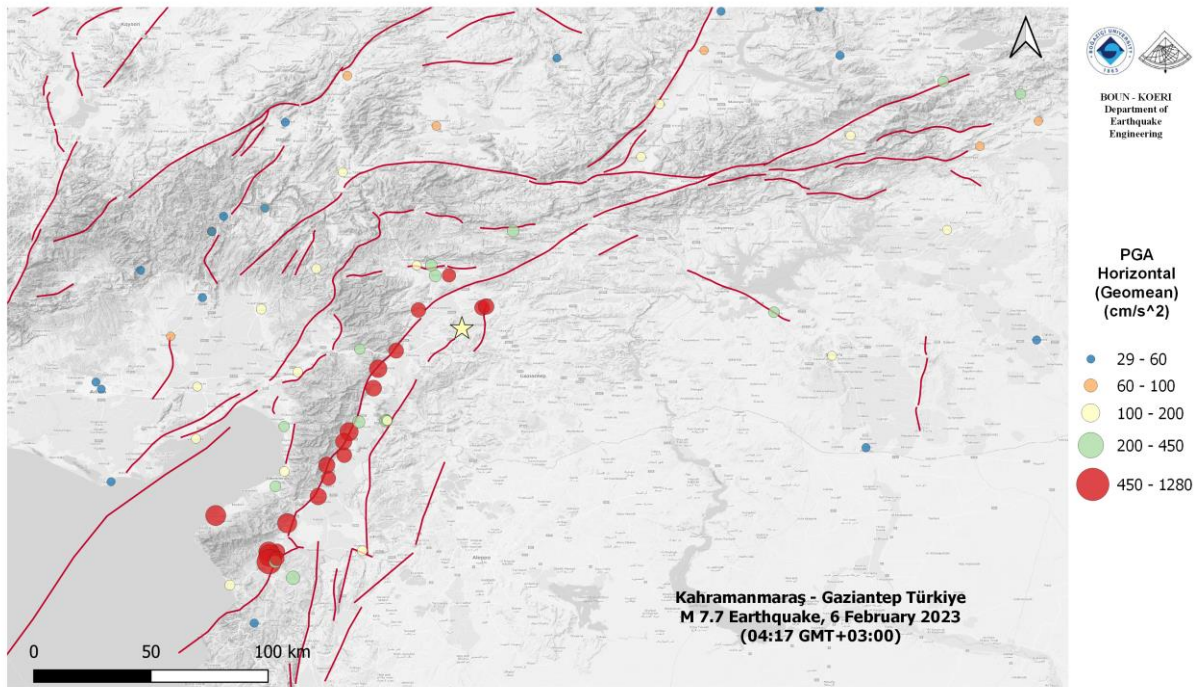


Acceleration records of the stations on the Amanos segment (within dashed rectangle) from NE to SW. Red lines represent the faults compiled from Active Fault Maps of Turkey, MTA (Mineral Research & Exploration General Directorate).

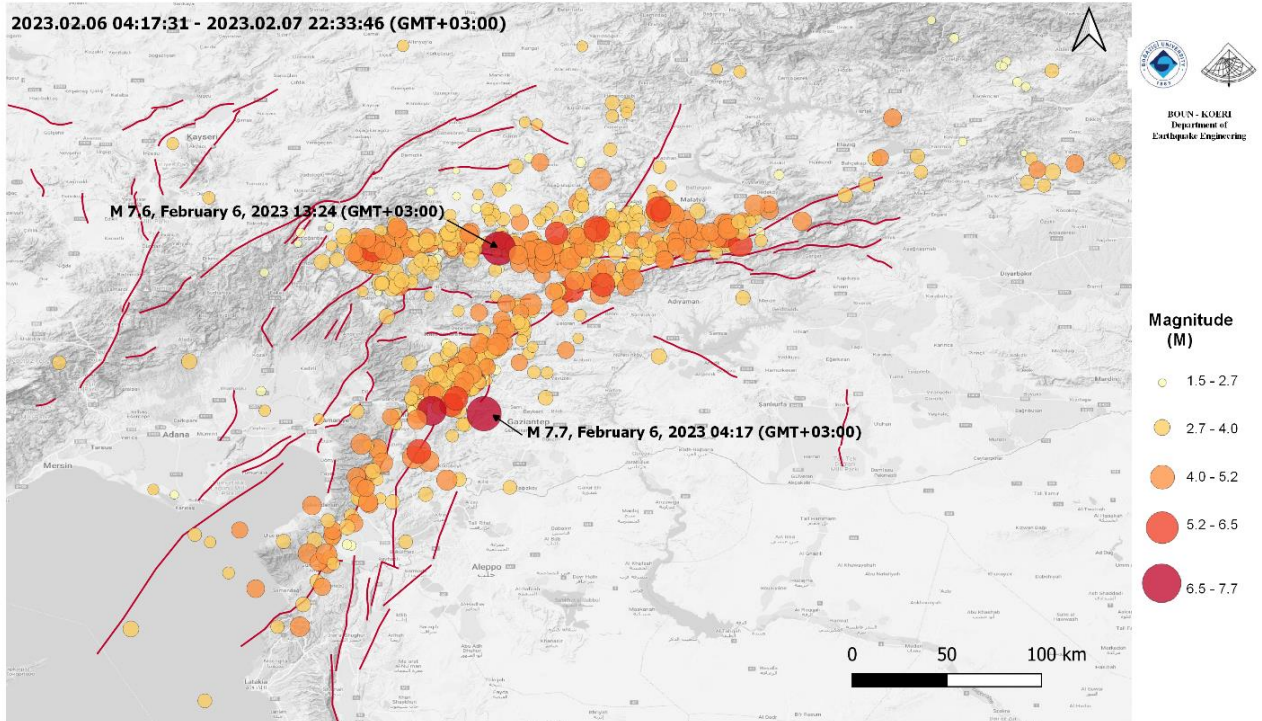
6 February 2023 (04:17) Kahramanmaraş-Türkiye M7.7 Earthquake

Preliminary Report (v6)

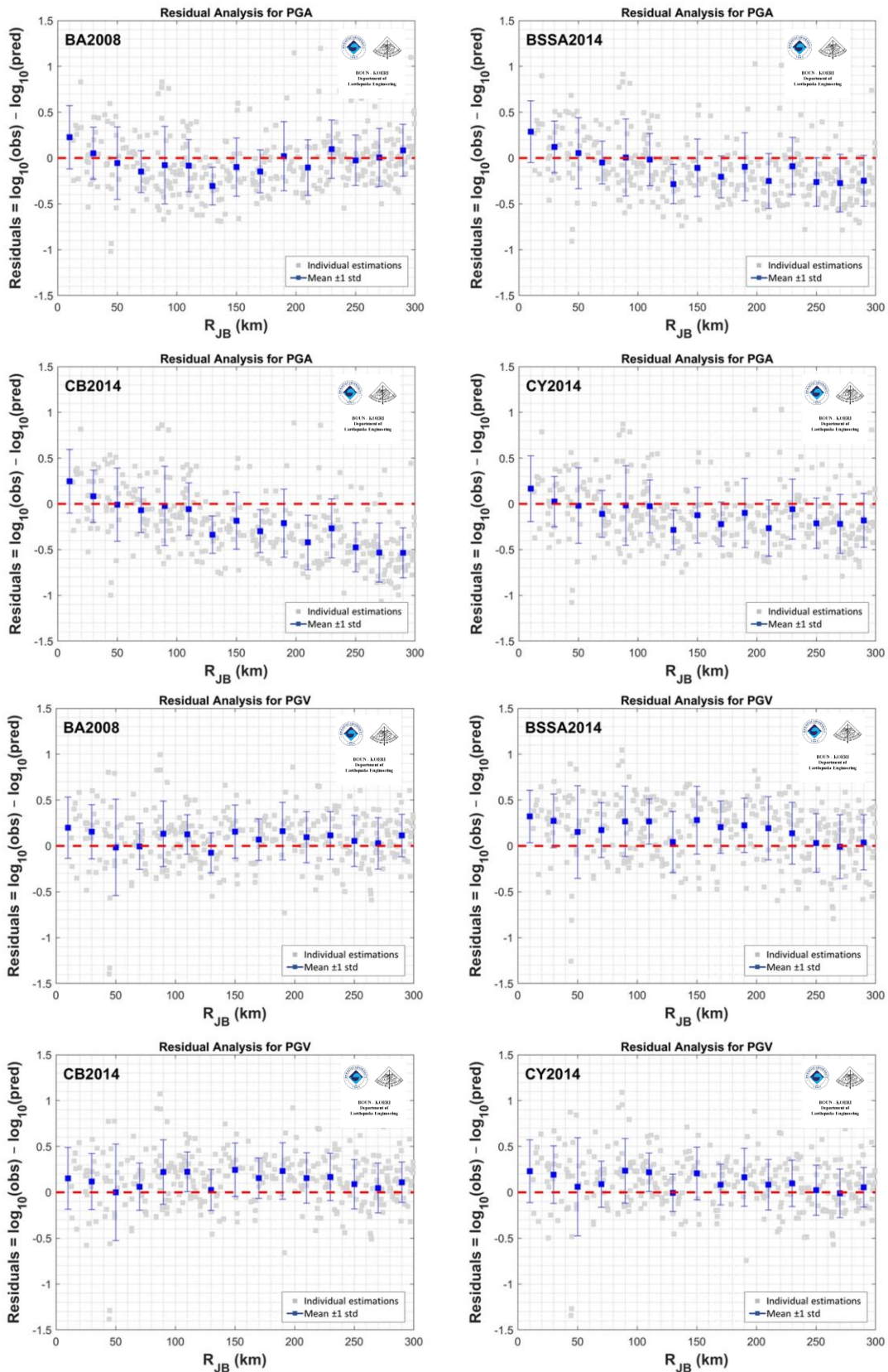




AFAD stations' PGA values from the M 7.7 Kahramanmaraş – Gaziantep Earthquake. Red lines represent the faults compiled from Active Fault Maps of Turkey, MTA (Mineral Research & Exploration General Directorate).



Aftershock activity. Data taken from KOERI (<http://www.koeri.boun.edu.tr/sismo/2/en/>). Red lines represent the faults compiled from Active Fault Maps of Turkey, MTA (Mineral Research & Exploration General Directorate).

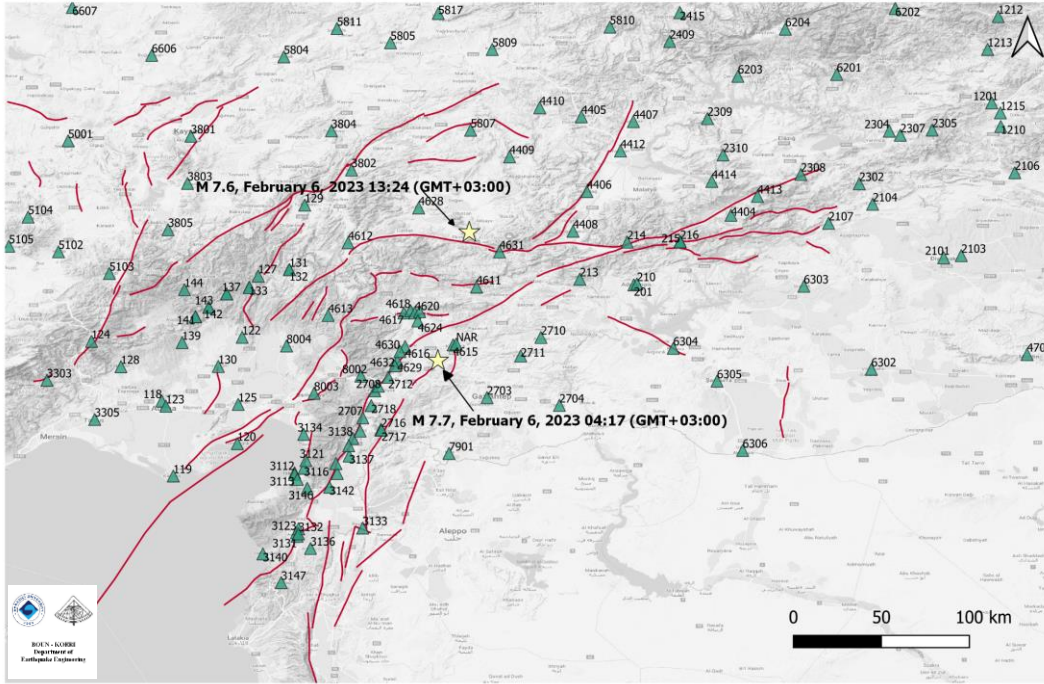


PGA and PGV residual analyses to investigate predictive capacity of four GMPEs for the M7.7, M7.6 and M6.6 (6 Feb 2023) earthquakes.

6 February 2023 (04:17) Kahramanmaraş-Türkiye M7.7 Earthquake

Preliminary Report (v6)





The yellow stars correspond to the epicenters of the M 7.7 Kahramanmaraş – Gaziantep and M 7.6 Ekinözü – Kahramanmaraş Earthquakes occurred on 6 February 2023. AFAD stations are shown with green triangles. Red lines represent the faults compiled from Active Fault Maps of Turkey, MTA (Mineral Research & Exploration General Directorate).



Station ID	Lat.	Lon.	Vs30 (m/s)	Repi (km)	Rjb (km)	Rrup (km)	Comp	PGA (cm/s <sup>2</sup> )	PGV (cm/s)	PGD (cm)	AI (m/s)	Dur 5-95 (s)	CAV (m/s)
118	37.036	35.318	946	155.36	106.18	106.18	E N U	34.97	9.21	3.05	0.07	75.18	4.72
								43.94	8.19	2.89	0.09	58.13	5.09
								20.37	4.89	1.88	0.04	78.65	4.02
119	36.568	35.390	485	167.32	79.39	79.39	E N U	48.64	7.37	2.24	0.08	46.73	4.65
								41.46	5.10	1.96	0.06	56.17	4.27
								24.14	5.04	1.53	0.03	61.86	3.11
120	36.770	35.790	439	125.25	57.04	57.04	E N U	116.59	9.57	2.97	0.39	55.82	9.93
								120.56	12.46	3.67	0.39	56.72	10.10
								94.12	5.91	1.65	0.12	56.31	5.77
122	37.434	35.820	501	109.28	81.09	81.09	E N U	52.90	3.67	1.04	0.15	54.15	6.70
								54.02	4.69	1.24	0.15	52.30	6.66
								34.61	4.26	1.06	0.05	53.32	3.64
123	37.003	35.344	519	153.9	102.76	102.76	E N U	34.30	5.56	2.26	0.08	67.08	5.22
								32.89	6.56	2.83	0.08	65.06	5.16
								14.69	3.34	1.34	0.03	76.70	3.54
125	37.015	35.796	208	114.62	67.40	67.40	E N U	87.47	13.56	5.48	0.47	60.99	12.16
								125.31	23.16	5.06	0.70	60.83	13.73
								36.47	4.35	1.32	0.08	61.41	5.25
127	37.816	35.920	583	115.07	96.89	96.89	E N U	50.72	3.53	0.85	0.15	45.51	6.34
								55.31	5.25	0.85	0.13	41.51	5.48
								39.42	2.71	0.68	0.04	45.69	3.47
129	38.259	36.211	965	130.43	112.08	112.08	E N U	42.44	3.89	1.14	0.09	49.93	5.01
								48.84	3.18	1.11	0.09	50.19	5.23
								30.18	2.78	0.67	0.04	55.73	3.54
130	37.252	35.671	-	121.47	85.35	85.35	E N U	64.19	10.01	2.93	0.20	64.97	7.93
								77.12	10.38	3.47	0.24	58.58	8.44
								31.00	5.03	1.94	0.08	64.93	5.26
131	37.857	36.115	-	103.35	85.23	85.23	E N U	155.35	3.40	0.54	0.72	41.89	13.45
								143.53	3.66	0.86	0.75	42.52	13.75
								47.34	2.09	0.73	0.08	45.35	4.59
132	37.856	36.115	-	103.34	85.22	85.22	E N U	32.36	2.48	0.59	0.05	47.59	3.78
								39.83	3.05	0.91	0.07	45.70	4.29
								28.09	2.51	0.75	0.04	48.72	3.42
133	37.745	35.864	-	115.76	97.21	97.21	E N U	74.98	4.61	0.83	0.17	42.76	6.61
								80.18	3.88	1.59	0.11	43.06	5.14
								37.97	3.83	0.83	0.04	44.59	3.38
134	37.744	35.864	-	115.66	97.10	97.10	E N U	43.70	3.37	0.76	0.07	45.60	4.26
								69.95	4.82	1.46	0.12	41.61	5.50
								36.83	3.45	0.83	0.04	44.73	3.33
140	37.563	35.529	-	137.11	110.48	110.48	E N U	26.38	1.68	0.48	0.04	60.41	3.50
								34.14	1.85	0.42	0.06	56.06	4.30
								17.62	1.74	0.43	0.02	64.94	2.50

Station ID	Lat.	Lon.	Vs30 (m/s)	Repi (km)	Rjb (km)	Rrup (km)	Comp	PGA (cm/s <sup>2</sup> )	PGV (cm/s)	PGD (cm)	AI (m/s)	Dur 5-95 (s)	CAV (m/s)
201*	37.761	38.267	391	120.12	25.75	25.75	E N U	923.97 479.31 306.08	27.52 43.23 11.54	5.61 9.28 1.86	2.99 1.33 0.62	5.57 7.35 12.66	8.92 6.32 5.83
210*	37.767	38.287	-	121.92	25.87	25.87	E N U	53.89 54.18 35.54	1.90 1.54 1.54	0.43 0.24 0.40	0.03 0.04 0.02	7.41 6.75 7.42	1.08 1.24 0.78
213*	37.797	37.930	-	96.48	11.22	11.22	E N U	173.74 242.05 236.24	32.13 52.91 23.27	13.43 21.15 9.31	0.76 0.99 0.52	8.69 6.77 8.73	6.27 6.87 5.01
214*	38.028	38.226	-	132.74	1.72	1.72	E N U	53.28 64.01 66.07	2.61 2.55 3.32	0.55 0.61 0.61	0.02 0.02 0.02	7.97 7.30 7.78	1.02 0.81 0.81
215*	38.030	38.556	-	156.69	8.03	8.03	E N U	105.63 60.15 29.56	2.36 1.93 0.99	0.42 0.18 0.20	0.10 0.03 0.01	10.17 9.87 10.79	2.24 1.08 0.68
1210	38.750	40.559	-	348.26	196.94	196.94	E N U	59.99 73.16 49.14	2.84 2.98 2.53	0.83 1.25 0.55	0.04 0.05 0.03	20.69 20.00 17.58	2.53 2.76 2.09
1212	39.434	40.548	-	387.63	235.42	235.42	E N U	69.47 98.37 36.53	3.90 3.15 1.24	0.54 0.62 0.32	0.03 0.03 0.01	11.37 11.31 20.33	1.94 1.91 1.28
1213	39.231	40.477	-	369.54	216.93	216.93	E N U	330.50 253.91 190.60	21.07 11.77 4.61	3.09 1.70 0.87	0.82 0.46 0.25	4.10 8.21 6.81	6.98 6.00 4.30
1215	38.835	40.557	-	352.42	200.49	200.49	E N U	60.15 63.29 61.70	5.54 5.50 3.61	1.31 0.91 0.66	0.08 0.14 0.05	46.95 42.01 37.67	4.85 6.08 3.51
2101	37.931	40.203	519	287.35	152.08	152.08	E N U	69.60 78.13 34.00	12.18 8.60 4.76	4.28 2.79 1.78	0.23 0.20 0.05	69.67 57.18 82.52	9.32 8.57 4.64
2103	37.944	40.313	-	297.07	161.53	161.53	E N U	42.45 53.27 23.36	14.36 9.38 5.59	4.19 3.20 1.48	0.14 0.13 0.05	68.76 59.90 87.08	7.37 6.83 4.60
2104	38.264	39.759	-	262.22	114.40	114.40	E N U	87.51 63.88 43.37	12.57 7.38 6.34	3.95 2.80 2.05	0.17 0.12 0.07	46.17 61.61 72.24	6.87 6.19 4.99
2106	38.462	40.647	-	342.16	194.67	194.67	E N U	60.42 69.78 34.02	6.25 6.67 3.55	1.65 1.43 1.00	0.06 0.07 0.03	31.57 28.11 40.99	3.65 3.71 2.97
2107	38.146	39.484	-	234.92	88.69	88.69	E N U	112.39 72.12 45.64	16.16 11.16 5.55	4.49 3.23 1.69	0.28 0.24 0.08	43.53 47.92 55.64	8.53 8.20 4.73

Station ID	Lat.	Lon.	Vs30 (m/s)	Repi (km)	Rjb (km)	Rrup (km)	Comp	PGA (cm/s <sup>2</sup> )	PGV (cm/s)	PGD (cm)	AI (m/s)	Dur 5-95 (s)	CAV (m/s)
2302	38.392	39.675	907	261.74	110.99	110.99	E N U	229.11	9.96	1.68	0.27	8.75	5.19
								205.00	7.66	1.16	0.21	10.52	4.88
								115.88	5.04	1.58	0.09	19.90	3.95
2305	38.728	40.131	907	314.34	162.05	162.05	E N U	42.12	3.21	1.01	0.03	33.34	2.75
								52.63	2.63	1.22	0.02	34.50	2.38
								36.00	2.51	1.01	0.02	32.65	2.04
2307	38.696	39.932	329	297.63	145.10	145.10	E N U	37.23	5.17	1.71	0.06	54.64	4.49
								31.01	6.92	2.70	0.04	61.87	3.98
								30.72	3.64	1.72	0.03	71.60	3.18
2308	38.451	39.310	450	237.3	84.61	84.61	E N U	165.62	22.96	5.47	0.35	37.35	8.09
								319.63	26.78	5.51	0.59	20.52	9.11
								389.74	7.55	1.54	0.36	10.92	5.93
2309	38.799	38.727	860	223.57	84.62	84.62	E N U	32.69	4.54	1.06	0.03	33.34	2.79
								34.94	3.88	1.01	0.04	38.54	3.16
								25.66	5.08	1.57	0.02	38.23	2.31
2310	38.573	38.825	-	211.7	64.23	64.23	E N U	48.92	8.28	2.46	0.17	53.14	8.19
								60.22	11.34	3.81	0.20	43.70	8.48
								49.99	6.56	2.18	0.07	50.42	5.22
2408	39.602	39.035	416	310.27	177.71	177.71	E N U	24.59	4.33	0.87	0.02	78.99	2.96
								34.47	7.22	1.61	0.03	68.39	3.20
								13.14	2.89	0.77	0.01	83.44	1.93
2411	39.970	40.021	284	394.74	250.48	250.48	E N U	112.08	8.35	0.87	0.12	7.27	2.94
								88.30	4.52	0.80	0.08	7.26	2.49
								47.80	2.31	0.42	0.02	8.60	1.34
2413	39.808	40.039	435	382.53	236.35	236.35	E N U	63.43	4.18	1.18	0.05	27.18	3.14
								58.96	3.74	0.81	0.04	26.72	2.91
								18.19	1.96	0.52	0.01	57.36	1.88
2703*	37.058	37.350	758	37.34	53.77	53.77	E N U	162.33	10.46	2.80	1.21	53.91	17.23
								151.40	11.74	2.71	1.16	54.33	17.06
								74.70	4.90	1.40	0.29	54.17	8.60
2704*	37.009	37.802	721	74.1	77.01	77.01	E N U	165.26	10.19	2.06	0.93	34.66	12.47
								98.87	7.17	1.94	0.42	34.96	8.53
								62.43	4.16	1.00	0.21	36.43	6.25
2707*	36.931	36.574	558	57.52	0.71	0.71	E N U	90.13	4.18	0.78	0.11	11.06	2.37
								98.14	4.87	0.63	0.12	11.03	2.60
								42.97	2.27	0.45	0.03	13.33	1.41
2708	37.099	36.648	523	40.77	0.72	0.72	E N U	746.54	138.25	38.53	10.90	38.25	38.80
								792.48	80.83	28.41	9.66	39.94	38.88
								623.12	38.60	9.73	3.65	29.52	20.76
2709*	37.129	36.670	555	37.45	0.39	0.39	E N U	125.87	8.14	1.42	0.27	16.94	4.76
								155.17	9.03	1.81	0.41	16.74	5.72
								94.45	7.90	1.71	0.14	21.63	3.41

Station ID	Lat.	Lon.	Vs30 (m/s)	Repi (km)	Rjb (km)	Rrup (km)	Comp	PGA (cm/s <sup>2</sup> )	PGV (cm/s)	PGD (cm)	AI (m/s)	Dur 5-95 (s)	CAV (m/s)
2711*	37.317	37.560	-	45.88	36.59	36.59	E N U	102.22 113.29 63.40	8.69 12.75 6.75	3.08 4.40 2.40	0.72 0.79 0.27	51.98 52.89 51.17	13.61 14.01 8.33
2712	37.184	36.733	-	29.79	0.98	0.98	E N U	577.20 554.01 281.95	93.69 43.21 19.41	20.11 15.19 5.22	7.15 5.90 1.83	33.91 36.88 38.98	29.90 28.67 16.38
2715	36.855	36.686	-	57.62	12.16	12.16	E N U	322.34 411.30 150.49	20.90 21.50 12.50	7.03 8.12 4.09	1.15 1.03 0.28	49.90 48.84 48.29	14.70 13.66 7.29
2716	36.856	36.688	-	57.38	12.36	12.36	E N U	229.76 242.96 165.42	34.21 38.88 14.95	7.91 11.76 4.51	2.32 2.74 1.02	52.03 56.55 54.48	22.58 24.91 15.91
2717	36.855	36.691	-	57.34	12.62	12.62	E N U	144.60 139.69 81.80	24.55 17.80 13.39	7.16 7.78 4.36	0.36 0.30 0.17	48.62 54.05 52.48	8.12 7.57 5.99
2718	37.008	36.627	-	48.3	3.59	3.59	E N U	613.16 669.09 552.20	61.27 58.00 40.71	21.26 10.76 11.23	4.08 4.24 2.13	21.73 13.49 22.60	22.44 21.41 15.69
3112*	36.588	36.148	233	111.31	20.06	20.06	E N U	85.11 163.43 85.87	13.95 24.29 7.87	3.12 7.09 2.41	0.15 0.31 0.09	24.71 23.86 27.92	4.15 5.65 3.09
3115	36.546	36.165	424	113.57	15.94	15.94	E N U	217.99 281.73 217.82	27.48 35.59 17.47	7.55 8.35 3.43	1.76 3.25 1.27	37.19 29.75 29.59	20.10 25.83 16.73
3116	36.616	36.207	870	105.38	16.55	16.55	E N U	174.86 148.53 154.46	16.77 17.21 11.46	5.19 4.63 2.91	0.82 0.77 0.42	35.81 33.29 30.96	12.61 12.76 9.43
3123	36.214	36.160	470	143	12.67	12.67	E N U	584.38 631.04 847.09	82.91 168.25 48.51	20.27 43.60 14.83	7.20 8.97 4.63	16.99 12.86 14.16	31.30 33.61 23.86
3124	36.239	36.172	283	140.11	9.74	9.74	E N U	631.90 560.58 567.23	79.36 107.50 30.06	21.17 36.11 8.81	7.25 5.86 3.09	19.24 21.60 17.04	32.64 30.42 19.28
3125	36.238	36.133	448	142.15	11.92	11.92	E N U	1069.3 4 814.14 862.64	79.24 69.94 50.77	18.52 23.96 10.90	7.18 6.25 6.31	17.37 17.90 11.12	29.75 29.10 24.88
3126	36.220	36.138	350	143.54	13.16	13.16	E N U	1017.6 1 1197.1 1 987.71	63.35 105.51 63.67	17.65 32.00 14.07	11.05 20.65 11.10	25.25 20.18 9.86	41.96 53.74 32.43
3129	36.191	36.134	447	146.39	16.02	16.02	E N U	1196.8 7 1369.7 1 734.47	66.47 164.91 41.00	15.18 29.25 14.23	18.10 24.82 6.38	14.90 10.72 10.39	41.45 47.27 24.54

Station ID	Lat.	Lon.	Vs30 (m/s)	Repi (km)	Rjb (km)	Rrup (km)	Comp	PGA (cm/s <sup>2</sup> )	PGV (cm/s)	PGD (cm)	AI (m/s)	Dur 5-95 (s)	CAV (m/s)
3131	36.191	36.163	567	144.98	14.87	14.87	E N U	358.31	44.10	12.49	1.67	10.74	13.75
								359.43	39.50	6.60	1.31	11.35	11.53
								146.34	18.20	5.38	0.36	19.36	7.30
3132	36.207	36.172	377	143.12	12.99	12.99	E N U	515.10	49.47	10.06	4.28	17.80	23.84
								516.03	67.19	15.40	3.65	13.46	21.80
								337.70	35.96	8.26	1.82	13.68	15.03
3133	36.243	36.574	377	123.47	32.28	32.28	E N U	136.05	17.57	5.05	0.60	52.07	12.31
								224.28	29.99	6.83	0.92	45.05	14.20
								87.19	7.97	2.62	0.27	54.43	8.99
3134	36.828	36.205	374	90.29	25.63	25.63	E N U	197.52	32.49	8.32	1.22	46.57	16.37
								244.86	22.25	7.62	1.38	47.09	17.32
								113.28	11.33	3.30	0.52	45.31	11.10
3135	36.409	35.883	460	142.15	32.24	32.24	E N U	1246.5	68.70	9.38	6.81	22.53	29.01
								2	46.80	13.65	5.49	22.59	26.90
								734.01	35.76	5.88	2.38	25.05	18.85
3136	36.116	36.247	344	148.38	22.27	22.27	E N U	375.18	40.92	7.92	3.54	33.37	26.19
								531.06	49.83	11.28	3.90	27.81	25.98
								213.39	22.15	6.32	1.09	31.27	14.43
3137	36.693	36.489	688	82.48	3.45	3.45	E N U	729.12	45.85	18.57	3.58	16.57	21.76
								431.25	49.25	12.29	3.50	17.19	22.19
								449.04	34.26	9.08	2.25	16.79	17.60
3138	36.803	36.511	618	71.7	0.38	0.38	E N U	787.02	128.82	31.57	5.65	12.65	22.50
								854.11	137.46	30.44	7.82	17.17	26.30
								1143.3	82.15	22.33	3.27	5.59	14.39
3139	36.584	36.414	272	96.19	2.14	2.14	E N U	474.59	95.09	30.28	6.72	29.71	31.99
								558.72	128.48	48.19	8.27	37.20	36.76
								336.70	50.03	14.86	2.92	15.25	20.52
3140	36.082	35.950	210	165.82	35.84	35.84	E N U	188.18	49.52	23.78	1.80	41.93	21.07
								190.19	45.18	16.23	2.15	35.74	22.36
								165.07	22.89	8.77	0.83	36.54	14.10
3141	36.373	36.220	338	125.42	2.10	2.10	E N U	842.23	103.73	25.23	15.12	13.19	43.51
								943.13	62.33	15.30	13.31	16.37	43.78
								612.52	38.88	8.63	6.16	13.98	28.03
3142	36.498	36.366	539	106.49	1.60	1.60	E N U	723.91	48.94	13.22	5.80	12.12	26.02
								642.65	62.62	10.81	5.49	11.66	24.47
								409.57	21.76	4.30	1.98	13.18	15.66
3143	36.849	36.557	444	65.13	1.59	1.59	E N U	327.06	64.47	25.37	2.33	29.10	18.69
								374.42	68.43	21.28	2.59	26.19	18.42
								392.65	28.77	7.32	1.66	19.63	14.81
3144	36.757	36.486	485	77.04	0.67	0.67	E N U	781.13	54.73	28.31	3.55	43.31	26.08
								572.69	59.83	13.60	3.44	35.47	22.50
								466.03	62.43	21.15	1.31	17.44	12.82

Station ID	Lat.	Lon.	Vs30 (m/s)	Repi (km)	Rjb (km)	Rrup (km)	Comp	PGA (cm/s <sup>2</sup> )	PGV (cm/s)	PGD (cm)	AI (m/s)	Dur 5-95 (s)	CAV (m/s)
3145	36.645	36.406	533	91.13	0.39	0.39	E N U	698.17 625.31 602.22	97.72 56.45 58.64	31.24 20.24 17.01	6.25 3.68 3.02	11.33 13.89 10.57	23.05 20.48 16.96
3146*	36.491	36.227	-	114.57	7.61	7.61	E N U	332.50 462.40 289.58	27.68 22.68 15.78	7.22 6.89 4.82	3.17 4.92 1.69	18.13 18.16 18.76	19.23 23.88 14.80
3147	35.902	36.064	-	177.12	48.14	48.14	E N U	44.46 57.12 28.43	8.18 8.73 7.15	2.79 1.92 3.17	0.06 0.07 0.04	50.55 56.63 50.32	3.93 3.93 3.08
3802	38.478	36.504	305	140.55	120.41	120.41	E N U	83.53 97.57 54.67	15.76 13.44 7.99	3.59 3.66 1.54	0.52 0.60 0.19	60.12 56.82 56.59	12.80 13.86 7.79
4404	38.196	38.874	1380	190.02	37.80	37.80	E N U	136.89 132.83 95.21	9.82 10.11 9.79	2.74 2.52 2.37	0.19 0.20 0.09	21.79 21.08 26.27	5.49 5.57 4.10
4405	38.811	37.940	579	186.63	91.20	91.20	E N U	128.00 89.48 66.66	6.63 4.54 4.75	1.48 1.72 1.69	0.16 0.11 0.07	23.07 27.78 28.31	5.01 4.55 3.82
4406	38.344	37.974	815	143.07	43.15	43.15	E N U	129.79 98.55 45.49	13.71 9.64 6.84	5.58 3.29 3.06	0.30 0.22 0.10	41.55 47.00 47.28	7.97 7.35 5.13
4407	38.781	38.264	735	197.44	81.26	81.26	E N U	29.15 39.43 19.23	5.73 9.15 4.59	2.54 3.20 1.23	0.06 0.07 0.02	55.62 51.69 50.62	4.07 4.27 2.65
4408	38.096	37.887	654	116.59	21.08	21.08	E N U	145.60 96.72 93.31	13.55 10.50 16.75	5.92 5.06 3.87	0.41 0.22 0.22	26.04 29.07 26.69	8.04 6.36 6.11
4409	38.561	37.491	-	146.86	81.77	81.77	E N U	27.04 38.35 27.15	2.84 4.27 3.41	0.92 1.57 1.19	0.03 0.04 0.03	54.84 50.41 51.27	3.13 3.48 2.79
4410	38.867	37.679	-	184.16	106.25	106.25	E N U	41.34 32.09 21.58	6.94 7.67 4.05	2.24 1.83 1.39	0.09 0.07 0.03	49.97 45.49 65.00	4.97 4.53 3.23
4412	38.597	38.184	-	176.6	62.15	62.15	E N U	65.92 65.32 44.34	16.59 13.86 12.20	9.49 5.58 6.21	0.24 0.21 0.15	50.98 47.46 60.30	8.28 7.91 7.29
4414*	38.407	38.754	-	195.07	45.23	45.23	E N U	152.30 103.25 48.28	24.49 10.53 6.49	5.77 1.96 1.88	0.39 0.18 0.08	28.85 31.55 28.53	7.57 5.16 3.38
4611	37.747	37.284	731	55.32	16.82	16.82	E N U	314.29 340.25 175.62	34.82 30.04 10.26	7.86 6.77 2.43	2.57 2.74 0.76	44.38 43.22 47.39	23.05 23.49 12.83



Station ID	Lat.	Lon.	Vs30 (m/s)	Repi (km)	Rjb (km)	Rrup (km)	Comp	PGA (cm/s <sup>2</sup> )	PGV (cm/s)	PGD (cm)	AI (m/s)	Dur 5-95 (s)	CAV (m/s)
4612	38.024	36.482	246	95.59	77.11	77.11	E N U	120.18	12.14	2.53	1.25	51.93	18.89
								137.26	11.52	2.98	0.99	52.37	16.99
								52.79	3.77	0.83	0.19	53.60	7.61
4613	37.570	36.357	-	68.19	50.11	50.11	E N U	156.53	7.20	1.69	0.62	40.56	11.74
								144.93	7.30	1.71	0.49	41.58	10.60
								70.82	4.40	1.56	0.19	43.04	6.66
4615	37.387	37.138	484	13.83	13.08	13.08	E N U	562.80	111.68	24.35	5.84	47.10	32.21
								577.19	76.52	22.67	5.49	46.87	31.09
								665.81	46.88	9.68	2.88	36.01	20.51
4616	37.375	36.838	390	20.54	2.55	2.55	E N U	466.26	41.89	9.61	3.74	41.24	25.23
								640.65	70.72	22.64	6.50	41.82	31.91
								402.61	15.88	3.54	2.08	39.34	18.11
4617	37.586	36.830	574	38.04	19.57	19.57	E N U	109.24	17.72	6.76	0.54	44.66	11.03
								147.01	19.34	9.08	0.70	44.43	11.92
								108.62	10.06	2.25	0.45	46.38	10.18
4618*	37.600	36.872	715	37.84	18.98	18.98	E N U	100.89	8.76	2.62	0.19	14.95	3.73
								85.88	6.90	1.52	0.16	15.05	3.36
								72.78	7.13	2.26	0.10	16.45	2.85
4620	37.586	36.898	484	35.48	16.43	16.43	E N U	325.95	23.99	9.22	2.55	44.25	22.19
								296.79	21.21	5.46	2.28	42.20	20.54
								168.98	9.79	2.35	1.10	46.58	15.20
4621*	37.593	36.929	714	35.42	15.85	15.85	E N U	176.47	12.80	3.19	0.32	5.92	3.21
								142.64	14.61	2.88	0.28	6.50	3.24
								86.18	7.21	2.07	0.09	7.57	1.92
4624	37.536	36.918	280	29.73	10.82	10.82	E N U	318.17	44.34	13.82	4.32	46.00	29.49
								339.69	41.30	13.49	3.80	46.31	27.30
								155.03	24.37	4.84	1.09	43.92	15.07
4625	37.539	36.982	346	28.4	8.27	8.27	E N U	483.24	40.15	12.28	4.63	42.09	28.26
								426.34	56.46	20.19	4.24	39.18	27.38
								363.53	24.26	5.61	2.27	33.81	19.89
4628	38.241	36.923	186	106.52	79.09	79.09	E N U	82.48	7.08	1.48	0.57	60.14	13.55
								88.41	6.29	1.64	0.45	57.12	11.98
								55.88	3.13	1.08	0.10	57.95	5.52
4629*	37.287	36.789	382	22.5	1.10	1.10	E N U	248.63	17.56	3.16	1.38	10.57	9.09
								340.40	27.93	4.66	2.06	10.18	10.88
								122.18	6.52	1.74	0.26	12.96	4.22
4630*	37.345	36.806	347	21.89	3.64	3.64	E N U	125.70	5.85	1.45	0.37	14.90	5.28
								175.62	9.99	2.54	0.57	13.79	6.07
								161.29	4.54	0.71	0.36	12.99	4.92
4632*	37.256	36.774	428	24.09	0.25	0.25	E N U	290.66	31.71	7.24	1.52	11.05	9.76
								353.73	43.03	8.10	2.13	9.99	11.02
								192.36	11.88	1.93	0.61	12.31	6.48

Station ID	Lat.	Lon.	Vs30 (m/s)	Repi (km)	Rjb (km)	Rrup (km)	Comp	PGA (cm/s <sup>2</sup> )	PGV (cm/s)	PGD (cm)	AI (m/s)	Dur 5-95 (s)	CAV (m/s)
6202	39.486	39.900	-	348.86	200.60	200.60	E	40.87	3.58	1.07	0.03	68.37	3.27
							N	31.03	2.63	0.98	0.03	65.65	3.25
							U	13.85	2.19	0.85	0.01	77.73	1.99
6302	37.234	39.751	936	239.71	145.34	145.34	E	51.07	6.83	1.71	0.14	63.57	6.80
							N	54.99	6.42	2.10	0.16	54.79	6.77
							U	27.81	4.08	2.05	0.05	79.29	4.54
6303	37.752	39.329	986	208.12	82.52	82.52	E	110.10	21.04	5.75	0.19	33.56	6.46
							N	119.22	12.99	4.89	0.16	39.47	5.86
							U	35.27	5.54	1.99	0.08	69.27	5.37
6304	37.365	38.513	376	130.27	74.82	74.82	E	239.39	12.99	3.11	1.78	46.73	21.85
							N	214.13	20.05	4.08	1.49	45.26	19.57
							U	89.82	6.98	2.49	0.32	54.48	9.92
6305	37.160	38.787	-	155.06	104.16	104.16	E	97.89	15.31	4.79	0.81	89.88	21.11
							N	122.79	23.81	4.29	0.85	90.22	21.23
							U	57.36	7.58	1.84	0.29	112.22	13.54
6306	36.728	38.947	-	180.18	154.33	154.33	E	48.96	9.94	3.79	0.36	122.23	15.78
							N	61.30	11.53	4.78	0.48	124.82	17.52
							U	30.40	4.65	1.60	0.13	134.52	9.72
7901*	36.709	37.112	463	64.7	53.36	53.36	E	15.99	0.42	0.09	0.00	2.15	0.13
							N	52.32	1.13	0.20	0.01	2.95	0.48
							U	47.19	1.32	0.24	0.01	3.24	0.45
8002	37.192	36.562	430	43.91	11.48	11.48	E	196.79	13.52	4.99	1.21	43.74	15.42
							N	235.81	27.47	7.20	2.36	36.42	20.75
							U	304.03	14.06	2.49	1.45	34.12	15.75
8003	37.084	36.269	350	72.18	29.24	29.24	E	181.89	17.55	6.60	1.12	39.39	15.43
							N	143.05	20.86	5.73	0.89	40.55	13.58
							U	134.61	14.33	3.30	0.61	41.58	11.26
8004	37.380	36.098	426	84.2	57.14	57.14	E	180.07	15.80	3.87	0.96	44.22	14.84
							N	168.43	15.02	2.38	0.80	42.07	13.18
							U	67.22	6.34	1.94	0.18	51.68	7.13
NAR	37.392	37.157	-	15.35	13.24	13.24	E	558.07	67.57	23.85	3.28	44.18	23.93
							N	671.13	62.86	18.43	3.60	40.04	24.10
							U	422.80	32.31	11.89	1.89	35.70	17.32

**Notes:**

- 1) \*: Stations with incomplete seismic wave.
- 2) Stations with unknown Vs30 assumed as ZC site class.

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