

SUPPLEMENT TO

UNRAVELING THE RUPTURE PROPERTIES OF FOUR DESTRUCTIVE EARTHQUAKES IN TÜRKİYE (1966-1975)

Murat Utkucu^{1,2}, Şeyma Berzah^{1,2}, Fatih Uzunca^{2,3},
Hatice Durmuş⁴, Süleyman Sami Nalbant⁵

¹ Sakarya University, Engineering Faculty, Department of Geophysics, Sakarya, Türkiye

² Sakarya University, Institute of Natural Sciences, Sakarya, Türkiye

³ The Ministry of Environment, Urbanization and Climate Change, Urban Transformation Presidency, Sakarya, Türkiye

⁴ Kütahya Dumlupınar University, Engineering Faculty, Department of Geological Engineering, Kütahya, Türkiye

⁵ Iğdır University, Faculty of Science and Literature, Geography Department, Iğdır, Türkiye

The supplement includes five additional figures (Figs. S1-S5) and four supplementary tables (Tables S1-S4) with their captions.

Supplementary Figures

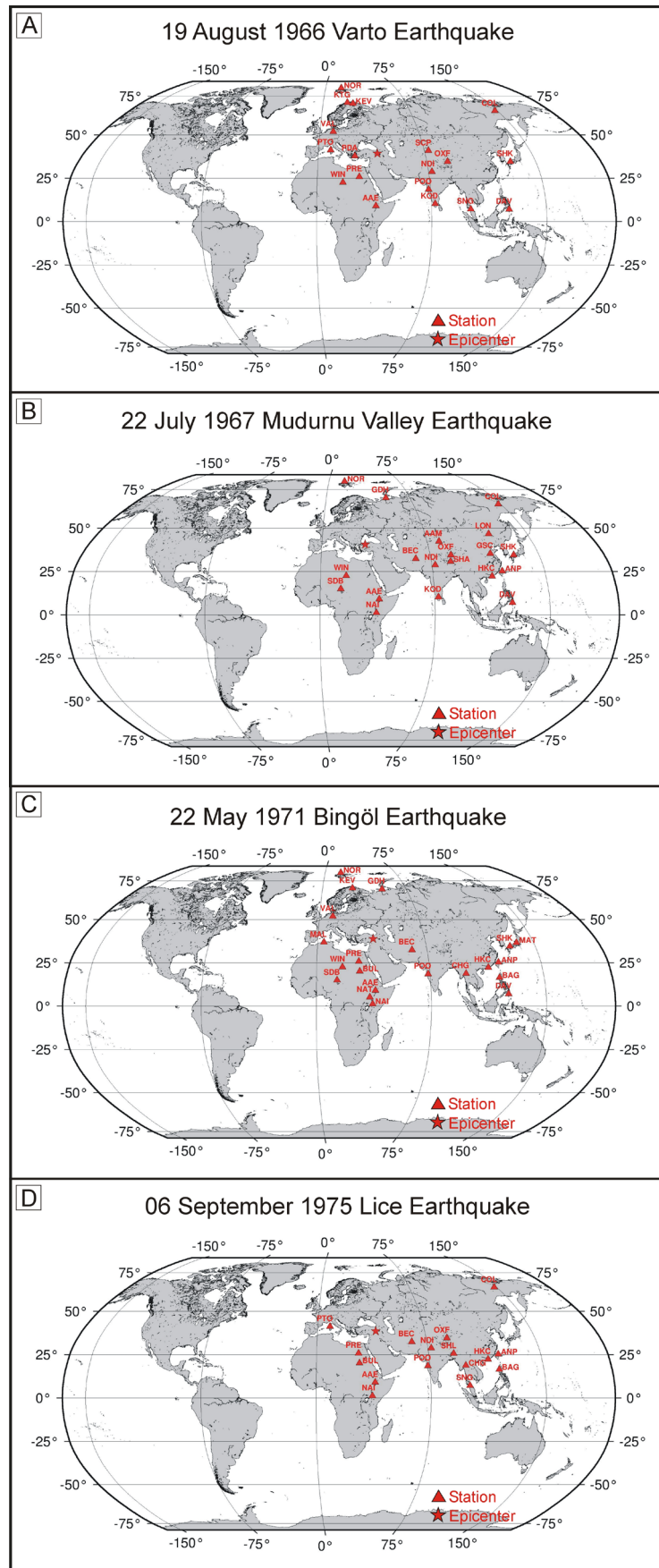


Figure S1. Station names and locations used in the inversion for the studied earthquakes.

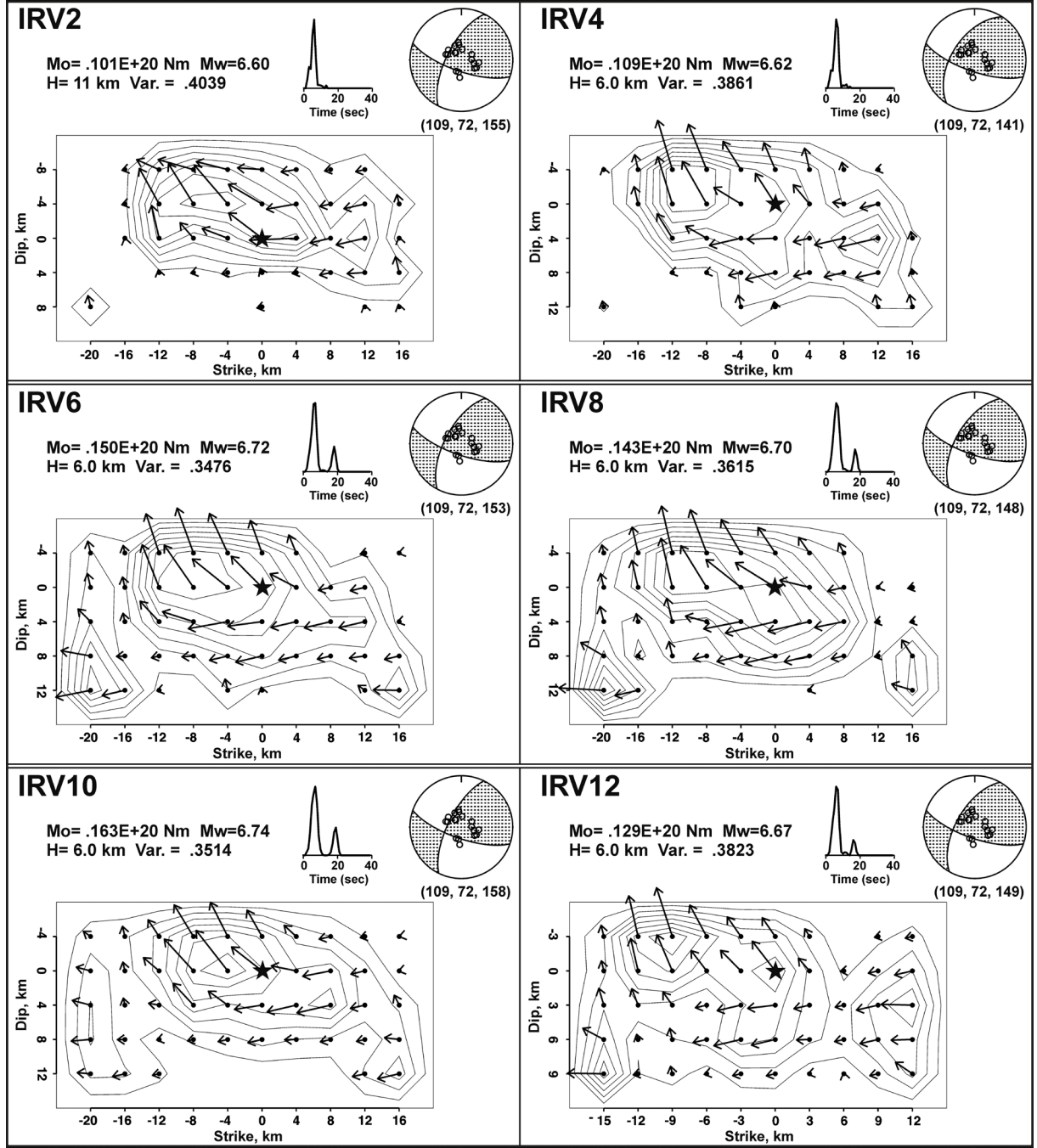


Figure S2. Selected inversion results from numerous inversions performed for the 1966 Varto earthquake. Each panel shows the source-time function, focal mechanism, and slip distributions obtained for the labeled models. See Table S1 for the parameters used in each model.

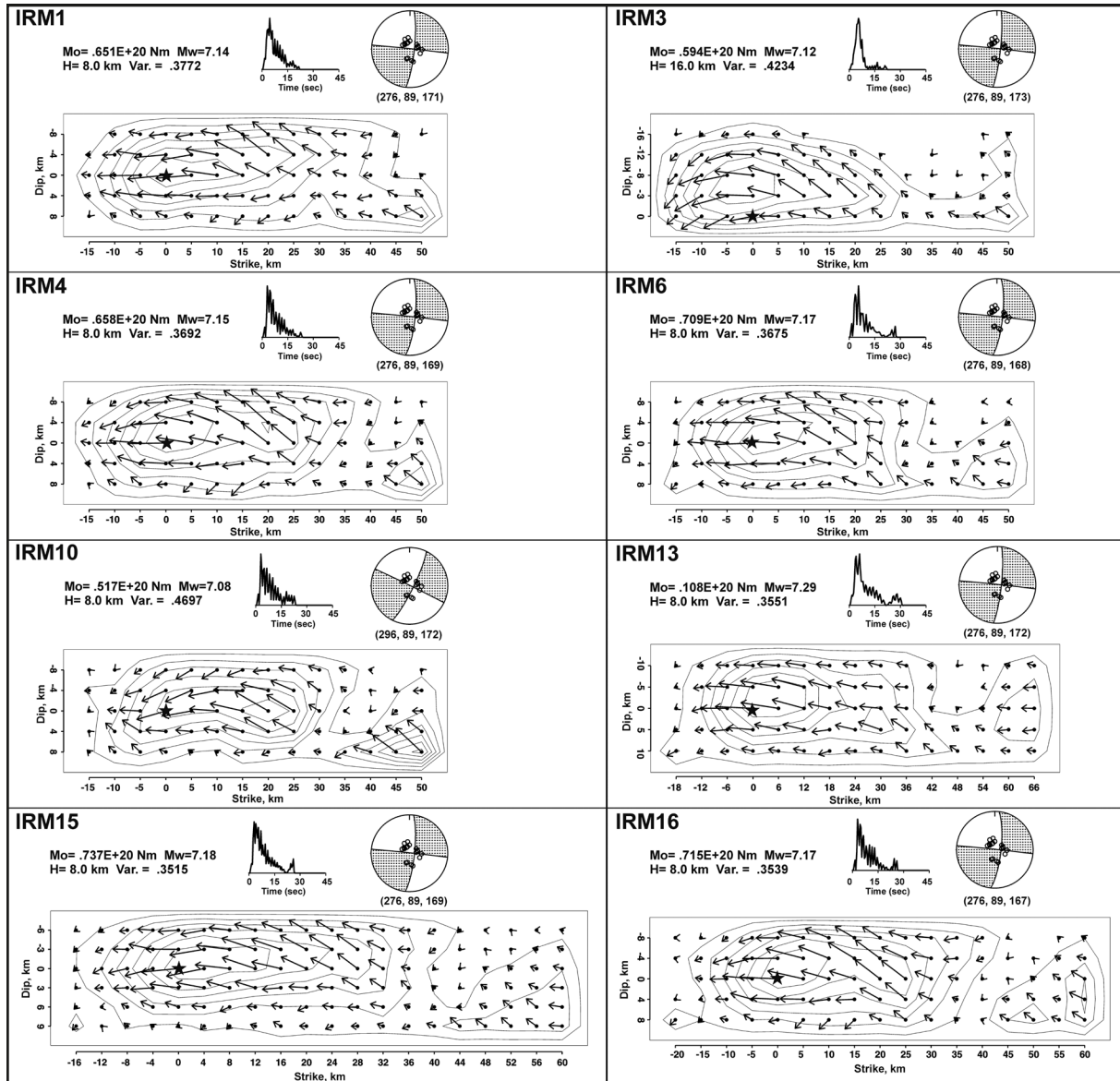


Figure S3. Selected inversion results from numerous inversions performed for the 1967 Mudurnu Valley earthquake. Each panel shows the source-time function, focal mechanism, and slip distributions obtained for the labeled models. See Table S2 for the parameters used in each model.

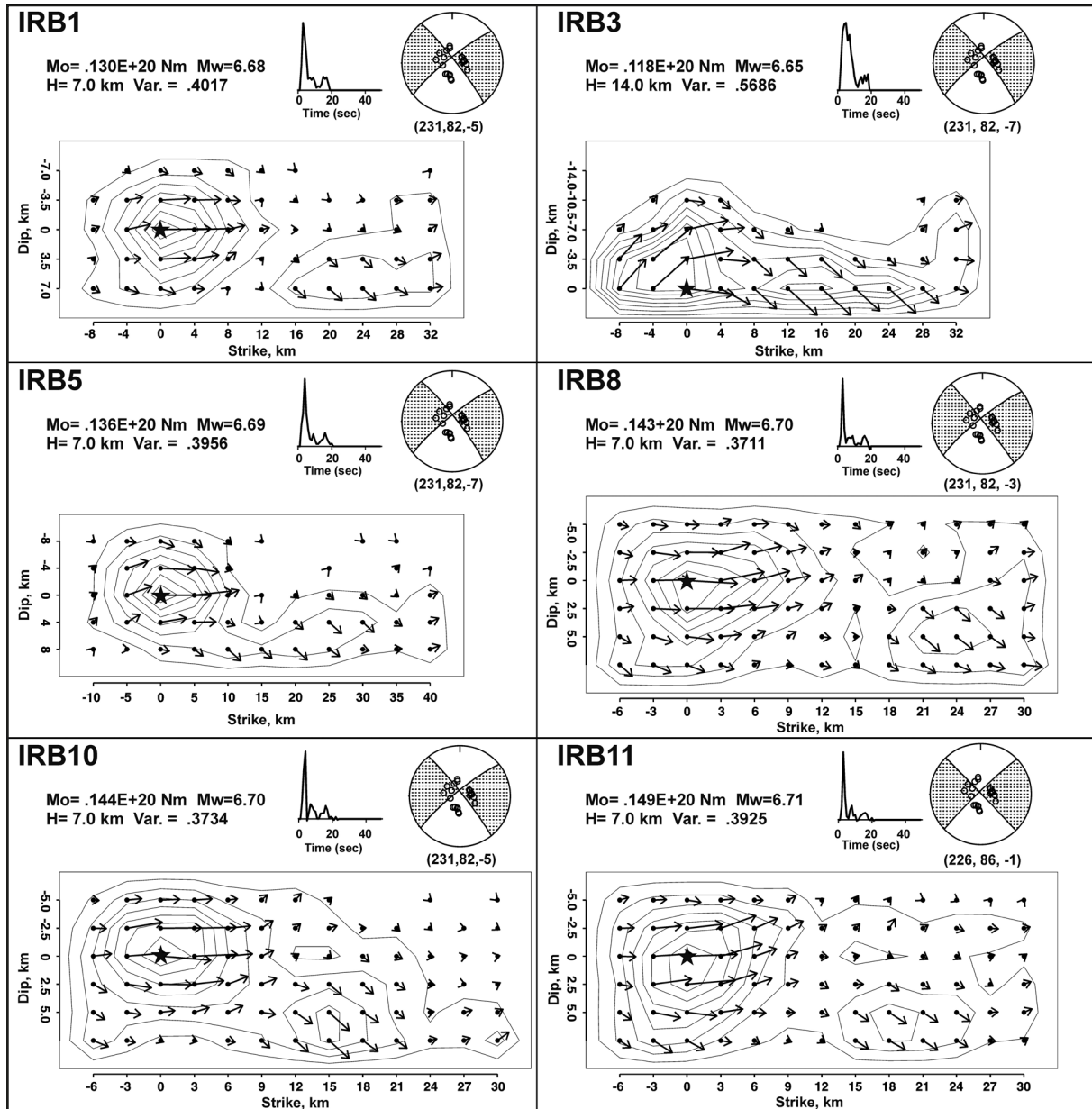


Figure S4. Selected inversion results from numerous inversions performed for the 1971 Bingöl earthquake. Each panel shows the source-time function, focal mechanism, and slip distributions obtained for the labeled models. See Table S3 for the parameters used in each model.

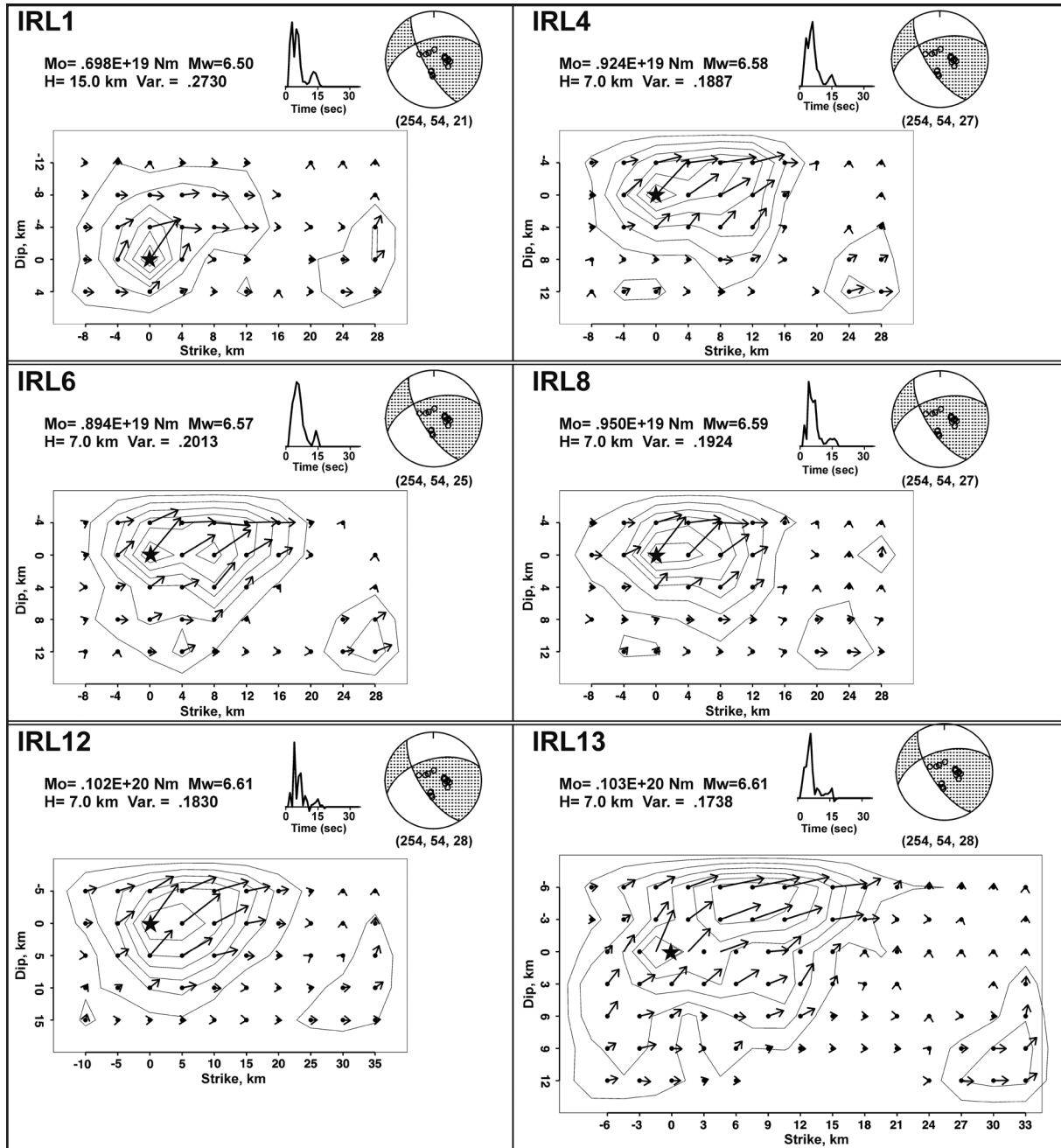


Figure S5. Selected inversion results from numerous inversions performed for the 1975 Lice earthquake. Each panel shows the source-time function, focal mechanism, and slip distributions obtained for the labeled models. See Table S4 for the parameters used in each model.

Supplementary Tables

Table S1. Inversion trials carried out for the August 19, 1966 Varto earthquake. The results are shown for the selected solutions in Fig. S2.

Model	Strike (°)	Dip (°)	Rake (°)	Vr km/s	SRT (s)	TW- Lag	RD (km)	PSG		Var.	Mo 10 ¹⁹ (Nt.m)	Mw	AR (°)	MS (m)
								Along strike	Along depth					
IRV1	298	65	144	3.0	1.0-1.0	5-1.0	11	6/10 4 km	3/5 4 km	0.6801	0.796	6.53	159	2.56
IRV2	109	72	148	3.0	1.0-1.0	5-1.0	11	6/10 4 km	3/5 4 km	0.4039	1.01	6.60	155	1.77
IRV3	109	72	148	3.0	1.0-1.0	5-1.0	16	6/10 4 km	4/5 4 km	0.4620	0.958	6.59	168	2.30
IRV4	109	72	148	3.0	1.0-1.0	5-1.0	6	6/10 4 km	2/5 4 km	0.3861	1.09	6.62	141	1.79
IRV5	109	72	148	3.0	1.5-1.5	5-1.5	6	6/10 4 km	2/5 4 km	0.3778	0.95	6.59	146	1.55
IRV6	109	72	148	3.0	2.0-2.0	5-2.0	6	6/10 4 km	2/5 4 km	0.3476	1.50	6.72	153	1.96
IRV7	109	72	148	3.3	2.0-2.0	5-2.0	6	6/10 4 km	2/5 4 km	0.3663	1.45	6.71	151	1.96
IRV8	109	72	148	3.5	2.0-2.0	5-2.0	6	6/10 4 km	2/5 4 km	0.3615	1.43	6.70	148	1.86
IRV9	109	72	148	2.7	2.0-2.0	5-2.0	6	6/10 4 km	2/5 4 km	0.3504	1.60	6.74	156	2.78
IRV10	109	72	148	2.5	2.0-2.0	5-2.0	6	6/10 4 km	2/5 4 km	0.3514	1.63	6.74	158	2.51
IRV11	109	72	148	3.0	2.0-2.0	5-2.0	6	6/10 5 km	2/5 5 km	0.3458	1.63	6.74	155	1.93
IRV12	109	72	148	3.0	2.0-2.0	5-2.0	6	6/10 3 km	2/5 3 km	0.3823	1.29	6.67	149	3.41
IRV13	109	72	148	3.3	2.0-2.0	5-2.0	6	6/10 5 km	2/5 5 km	0.3485	1.59	6.73	152	1.65
IRV14*	109	72	148	3.0	2.0-2.0	5-2.0	6	6/10 5 km	2/5 5 km	0.3870	1.59	6.73	153	1.88

Vr: Rupture velocity, SRT: Rise-fall durations of slip rise-time function, TW-Lag: number of time window-time lag of the next time window, RD: Reference depth, PSG: reference/number and interval of point sources in point-source grid, Var.: Variance, Mo = Seismic Moment, AR: Calculated average rake angle, MS: maximum slip.
* Same as the Model IRV11 but crustal velocity model is from Zor et al. (2003).

Table S2. Inversion trials carried out for the July 22, 1967 Mudurnu Valley earthquake. The results are shown for the selected solutions in Fig. S3.

Model	Strike (°)	Dip (°)	Rake (°)	Vr km/s	SRT (s)	TW-Lag	RD (km)	PSG		Var.	Mo 10 ¹⁹ (Nt.m)	Mw	AR (°)	MS (m)
								Along strike	Along depth					
IRM1	276	89	-178	3.3	0.8-0.8	4-0.8	8	4/14 5 km	3/5 4 km	0.3772	6.51	7.14	171	4.05
IRM2	276	89	-178	3.3	0.8-0.8	4-0.8	12	4/14 5 km	4/5 4 km	0.3918	6.34	7.13	171	4.64
IRM3	276	89	-178	3.3	0.8-0.8	4-0.8	16	4/14 5 km	5/5 4 km	0.4234	5.94	7.12	173	4.85
IRM4	276	89	-178	3.0	0.8-0.8	4-0.8	8	4/14 5 km	3/5 4 km	0.3692	6.58	7.15	169	4.02
IRM5	276	89	-178	2.7	0.8-0.8	4-0.8	8	4/14 5 km	3/5 4 km	0.3679	6.63	7.15	169	4.78
IRM6	276	89	-178	2.4	0.8-0.8	4-0.8	8	4/14 5 km	3/5 4 km	0.3675	7.09	7.17	168	4.92
IRM7	276	89	-178	3.0	0.8-0.8	4-0.8	8	6/14 5 km	3/5 4 km	0.3805	6.24	7.13	169	4.00
IRM8	276	89	-178	3.0	0.8-0.8	4-0.8	8	8/14 5 km	3/5 4 km	0.3833	6.11	7.12	167	4.09
IRM9	286	89	-178	3.0	0.8-0.8	4-0.8	8	4/14 5 km	3/5 4 km	0.3999	5.78	7.11	167	3.99
IRM10	296	89	-178	3.0	0.8-0.8	4-0.8	8	4/14 5 km	3/5 4 km	0.4697	5.17	7.08	172	3.80
IRM11	276	89	-178	3.0	1.5-1.5	4-1.5	8	4/14 5 km	3/5 4 km	0.3653	5.17	7.08	168	5.52
IRM12	276	89	-178	3.0	1.2-1.2	4-1.2	8	4/14 5 km	3/5 4 km	0.3636	8.98	7.24	167	3.49
IRM13	276	89	-178	3.0	1.2-1.2	4-1.2	8	4/15 6 km	3/5 5 km	0.3551	10.08	7.29	172	4.68
IRM14	276	89	-178	3.0	0.8-0.8	4-0.8	8	5/18 4 km	3/6 3 km	0.3588	6.87	7.16	169	5.38
IRM15	276	89	-178	3.0	0.8-0.8	4-0.8	8	5/20 4 km	3/6 3 km	0.3515	7.37	7.18	169	5.42
IRM16	276	89	-178	3.0	0.8-0.8	4-0.8	8	5/17 5 km	3/5 4 km	0.3539	7.15	7.17	167	4.14
IRM17	276	89	-178	3.0	1.2-1.2	4-1.2	8	5/17 5 km	3/5 4 km	0.3487	10.04	7.28	168	5.99
IRM18	276	89	-178	3.0	0.8-0.8	4-0.8	8	6/17 5 km	3/5 4 km	0.3539	9.79	7.26	168	6.07
IRM19	276	89	-178	3.0	0.8-0.8	4-0.8	8	8/17 5 km	3/5 4 km	0.3676	6.61	7.15	170	4.15
IRM20	276	89	-178	3.0	1.2-1.2	4-1.2	8	5/18 4 km	3/6 3 km	0.3575	9.37	7.25	169	7.34
IRM21	276	89	-178	3.0	1.2-1.2	4-1.2	8	5/17 5 km	3/5 4 km	0.3550	8.98	7.24	167	531

Four Destructive Earthquakes in Türkiye

Model	Strike (°)	Dip (°)	Rake (°)	Vr km/s	SRT (s)	TW-Lag	RD (km)	PSG		Var.	Mo 10 ¹⁹ (Nt.m)	Mw	AR (°)	MS (m)
								Along strike	Along depth					
IRM22*	276	89	-178	3.0	1.2-1.2	4-1.2	8	5/17 5 km	3/5 4 km	0.3630	10.0	7.27	170	5.53
IRM23**	276	89	-178	3.0	1.2-1.2	4-1.2	8	5/17 5 km	3/5 4 km	0.3592	10.01	7.27	165	5.31

Vr: Rupture velocity, SRT: Rise-fall durations of slip rise-time function, TW-Lag: number of time window-time lag of the next time window, RD: Reference depth, PSG: reference/number and interval of point sources in point-source grid, Var.: Variance, Mo = Seismic Moment, AR: Calculated average rake angle, MS: maximum slip.
 * Same as the Model IRM17 but crustal velocity model is from Kahraman et al. (2015). ** Same as the Model IRM17 but crustal velocity model is from Zor et al. (2006).

Table S3. Inversion trials carried out for the May 22, 1971 Bingöl earthquake. The results are shown for the selected solutions in Fig. S4.

Model	Strike (°)	Dip (°)	Rake (°)	Vr km/s	SRT (s)	TW-Lag	RD (km)	PSG		Var.	Mo 10 ¹⁹ (Nt.m)	Mw	AR (°)	MS (m)
								Along strike	Along depth					
IRB1	231	82	3.0	3.0	1.0-1.0	6-1.0	7	3/11 4 km	3/5 3.5 km	0.4017	1.30	6.68	-5	2.95
IRB2	231	82	3.0	3.0	1.0-1.0	6-1.0	10.5	3/11 4 km	4/5 3.5 km	0.4591	1.27	6.67	-6	2.67
IRB3	231	82	3.0	3.0	1.0-1.0	6-1.0	14	3/11 4 km	5/5 3.5 km	0.5686	1.18	6.65	-7	1.90
IRB4	231	82	3.0	3.0	1.0-1.0	6-1.0	7	5/11 4 km	3/5 3.5 km	0.4071	1.19	6.65	-3	2.99
IRB5	231	82	3.0	3.0	1.0-1.0	6-1.0	7	3/11 5 km	3/5 4 km	0.3956	1.36	6.69	-7	2.35
IRB6	231	82	3.0	3.0	0.8-1.5	6-1.5	7	3/13 3 km	3/6 2.5 km	0.3657	1.44	6.71	-5	2.96
IRB7	231	82	3.0	3.3	0.8-1.5	6-1.5	7	3/13 3 km	3/6 2.5 km	0.3716	1.42	6.70	-4	2.84
IRB8	231	82	3.0	3.5	0.8-1.5	6-1.5	7	3/13 3 km	3/6 2.5 km	0.3711	1.43	6.70	-3	2.89
IRB9	231	82	3.0	2.7	0.8-1.5	6-1.5	7	3/13 3 km	3/6 2.5 km	0.3728	1.41	6.70	-6	3.08
IRB10	231	82	3.0	2.5	0.8-1.5	6-1.5	7	3/13 3 km	3/6 2.5 km	0.3734	1.44	6.70	-5	3.32
IRB11	226	86	12.0	3.0	0.8-1.5	6-1.5	7	3/13 3 km	3/6 2.5 km	0.3925	1.49	6.71	-1	3.28
IRB13*	231	82	3.0	3.0	0.8-1.5	6-1.5	7	3/13 3 km	3/6 2.5 km	0.4086	1.36	6.69	-8	3.19

Vr: Rupture velocity, SRT: Rise-fall durations of slip rise-time function, TW-Lag: number of time window-time lag of the next time window, RD: Reference depth, PSG: reference/number and interval of point sources in point-source grid, Var.: Variance, Mo = Seismic Moment, AR: Calculated average rake angle, MS: maximum slip.
 *Same as the Model IRB6 but crustal velocity model is from Zor et al. (2003).

Table S4. Inversion trials carried out for the September 9, 1975 Lice earthquake. The results are shown for the selected solutions in Fig. S5.

Model	Strike (°)	Dip (°)	Rake (°)	Vr km/s	SRT (s)	TW-Lag	RD (km)	PSG		Var.	Mo 10 ¹⁹ (Nt.m)	Mw	AR (°)	MS (m)
								Along strike	Along depth					
IRL1	254	54	40.0	3.0	1.0-1.0	5-1.0	15	3/10 4 km	4/5 4 km	0.2730	0.70	6.50	21	1.02
IRL2	254	54	40.0	3.0	1.0-1.0	5-1.0	12	3/10 4 km	4/5 4 km	0.2220	0.79	6.53	19	0.83
IRL3	254	54	40.0	3.0	1.0-1.0	5-1.0	10	3/10 4 km	3/5 4 km	0.2046	0.89	6.57	21	0.82
IRL4	254	54	40.0	3.0	1.0-1.0	5-1.0	7	3/10 4 km	2/5 4 km	0.1887	0.92	6.58	27	0.90
IRL5	254	54	40.0	3.3	1.0-1.0	5-1.0	7	3/10 4 km	2/5 4 km	0.1904	0.91	6.57	26	0.86
IRL6	254	54	40.0	3.5	1.0-1.0	5-1.0	7	3/10 4 km	2/5 4 km	0.2013	0.89	6.57	25	0.79
IRL7	254	54	40.0	2.7	1.0-1.0	5-1.0	7	3/10 4 km	2/5 4 km	0.1911	0.97	6.59	27	1.00
IRL8	254	54	40.0	2.5	1.0-1.0	5-1.0	7	3/10 4 km	2/5 4 km	0.1924	0.95	6.59	27	1.07
IRL9	254	54	40.0	3.0	0.8-0.8	5-0.8	7	3/10 4 km	2/5 4 km	0.1839	0.90	6.57	30	0.65
IRL10	254	54	40.0	3.0	0.5-0.5	5-0.5	7	3/10 4 km	2/5 4 km	0.1916	0.21	6.15	28	0.23
IRL11	254	54	40.0	3.0	1.5-1.5	5-1.5	7	3/10 4 km	2/5 4 km	0.2072	0.69	6.49	25	0.85
IRL12	254	54	40.0	3.0	0.8-0.8	5-0.8	7	3/10 5 km	2/5 5 km	0.1830	1.02	6.61	28	0.58
IRL13	254	54	40.0	3.0	0.8-0.8	5-0.8	7	3/14 3 km	3/7 3 km	0.1738	1.03	6.61	28	0.78
IRL14	244	54	40.0	3.0	0.8-0.8	5-0.8	7	3/14 3 km	3/7 3 km	0.1684	0.97	6.59	31	0.75
IRL15	242	58	27.0	3.0	0.8-0.8	5-0.8	7	3/14 3 km	3/7 3 km	0.1690	0.94	6.58	27	0.75
IRL16*	244	54	40.0	3.0	0.8-0.8	5	7	3/14 3 km	3/7 3 km	0.1881	1.09	6.62	32	0.83

Vr: Rupture velocity, SRT: Rise-fall durations of slip rise-time function, TW-Lag: number of time window-time lag of the next time window, RD: Reference depth, PSG: reference/number and interval of point sources in point-source grid, Var.: Variance, Mo = Seismic Moment, AR: Calculated average rake angle, MS: maximum slip.
* Same as the Model IRL14 but crustal velocity model is from Zor et al. (2003).