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Supplemental Material

Table S1. Main locations of the Palu rupture zone, where coseismic offset amounts were measured on-site.

Table S2. Field investigation locations of the Palu rupture zone, shown in Figure 2.

Figure S1. UAV images and surface coseismic left-lateral offset distribution. See Figure 3 for the locations of the three photographs.

Figure S2. Mirrored trench and interpretation. A trench was excavated across the coseismic surface rupture, showing that the ground surface during the Palu EQ was vertically displaced by 25–30 cm. The location is shown in Figure 2.

Figure S3. Relations between the surface rupture trace and slip and the architecture of the Palu-Koro Fault and aftershocks as of 3 October 2018. The main fault lines including the northern section mapping (red line) were referenced from previous studies (Bao et al., 2019; Song et al., 2019; Socquet et al., 2019). The surface displacement curve that varies with latitude was obtained by Socquet et al. (2019) according to InSAR data. The 30-km section of the rupture is a supershear type rupture, and south of Palu City (green line) remarkably simple faulting characteristics, which shows a mature, high dip angle and a sharp, straight, pure mode II rupture with a large smoothly varying slip (Socquet et al., 2019). However, the north and south ends of the fault traces are geometrically complex. The obvious feature of the supershear segment of the fault is that significant aftershocks are not directly associated with the segment. The aftershocks were obtained from the USGS, and they occurred within five days of the earthquake in the area ($119^{\circ}30' E$ – $120^{\circ}30' E$, $0^{\circ}0'$ – $2^{\circ}0'S$) around the rupture (data downloaded from USGS). The magnitude of these aftershocks generally ranged from Mw 4.1–5.2. Along the supershear segment, few aftershocks occurred near the fault trace itself. Instead, they were spread at both ends of the rupture, with especially an aftershock cluster located near the termination of the fault. The epicenter is indicated by a yellow star. The focal mechanism is from <https://www.globalcmt.org/>, and of the nine largest aftershocks, it was significantly different from the mainshock. The black faults represent previously mapped faults that did not rupture in the 2018 EQ, while red faults represent all faults that ruptured and were previously not mapped. The previously mapped faults that ruptured are in orange. Dashed lines represent possible fault traces.

REFERENCES CITED

- Bao, H., Ampuero, J., Meng, L., Fielding, E.J., Liang, C., Milliner, C.W.D., Feng, T., and Huang, H., 2019, Early and persistent supershear rupture of the 2018 magnitude 7.5 Palu earthquake: Nature Geoscience, v. 12, no. 3, p. 200–205, <https://doi.org/10.1038/s41561-018-0297-z>.

- Socquet, A., Hollingsworth, J., Pathier, E., and Bouchon, M., 2019, Evidence of supershear during the 2018 magnitude 7.5 Palu earthquake from space geodesy: *Nature Geoscience*, v. 12, no. 3, p. 192–199, <https://doi.org/10.1038/s41561-018-0296-0>.
- Song, X., Zhang, Y., Shan, X., Liu, Y., Gong, W., and Qu, C., 2019, Geodetic observations of the 2018 Mw 7.5 Sulawesi earthquake and its implications for the kinematics of the Palu fault: *Geophysical Research Letters*, v. 46, no. 8, p. 4212–4220, <https://doi.org/10.1029/2019GL082045>.

Table S1

Main locations of the Palu rupture zone, where coseismic offset amounts were measured on-site

No	Latitude ¹	Longitude ¹	Distance/m ²	Min fit/m	Best fit/m	Max fit/m	Markers	Coseismic offset/m	error/m	Type of survey	Date	Figure
Figure 3D												
1	-0.8821	119.8410	236	2.4	2.45	2.5	Road	2.5	0.05	Tape	30-Sep-18	Figure 4C
2	-0.8835	119.8415	405	4.05	4.09	4.54	Road	4.09	0.1	UAV	30-Sep-18	
3	-0.8843	119.8418	498	5.65	5.68	5.72	Wall	5.69	0.11	UAV	30-Sep-18	
4	-0.8845	119.8419	514	4.34	4.38	4.42	Wall	4.38	0.05	UAV	30-Sep-18	
5	-0.8846	119.8419	535	3.71	3.76	3.8	Wall	3.76	0.13	UAV	30-Sep-18	
6	-0.8851	119.8420	586	4.58	4.62	4.68	Road	4.63	0.41	UAV	30-Sep-18	
7	-0.8858	119.8422	668	4.27	4.33	4.38	Road	4.33	0.06	UAV	30-Sep-18	
8	-0.8859	119.8423	682	3.08	3.12	3.16	Road	3.12	0.1	UAV	30-Sep-18	
9	-0.8868	119.8425	774	3.06	3.11	3.17	Road	3.12	0.13	UAV	30-Sep-18	
10	-0.8879	119.8429	915	6.11	6.22	6.32	Road	6.22	0.07	UAV	30-Sep-18	
11	-0.8881	119.8429	937	4.04	4.08	4.12	Road	4.08	0.16	UAV	30-Sep-18	
12	-0.8882	119.8429	942	5.07	5.12	5.18	Road	5.13	0.2	UAV	30-Sep-18	
13	-0.8887	119.8430	1020	2.44	2.49	2.54	Wall	2.49	0.07	UAV	30-Sep-18	
14	-0.8903	119.8434	1190	1.87	1.92	1.96	Wall	1.92	0.05	UAV	30-Sep-18	
15	-0.8913	119.8438	1320	4.28	4.33	4.38	Road	4.33	0.04	UAV	30-Sep-18	
16	-0.8932	119.8443	1500	4.28	4.33	4.38	Grass	4.33	0.07	UAV	30-Sep-18	
17	-0.8940	119.8446	1610	3.78	3.83	3.88	Road	3.83	0.11	UAV	30-Sep-18	
18	-0.8953	119.8449	1750	4.38	4.42	4.46	Wall	4.42	0.1	UAV	30-Sep-18	
19	-0.8955	119.8450	1780	4.42	4.98	5.54	Road	4.98	0.56	UAV	30-Sep-18	

¹ The latitudes and longitudes of the points of type ‘UAV’ were extracted from Google earth and of type ‘Tape’ were observed in field.² The Distance is measured along the fault from the Palu Bay coastline.

20	-0.8959	119.8451	1840	5.82	6	6.09	Road	5.96	0.18	UAV	30-Sep-18	
21	-0.8964	119.8452	1880	5	5.04	5.08	Wall	5.04	0.05	UAV	30-Sep-18	
22	-0.8968	119.8453	1940	5.81	5.87	5.92	Road	5.87	0.06	UAV	30-Sep-18	
23	-0.8970	119.8454	1940	4.94	5	5.06	Road	5	0.06	Tape	30-Sep-18	Figure 4D
24	-0.8975	119.8455	2010	3.9	3.95	4	Road	4.105	0.15	UAV	30-Sep-18	Figure 4A
25	-0.8985	119.8458	2140	4.49	4.54	4.58	Wall	4.535	0.07	UAV	30-Sep-18	
26	-0.8993	119.8459	2220	4.58	4.62	4.66	Road	4.62	0.08	UAV	30-Sep-18	
27	-0.9002	119.8461	2320	5.03	5.31	5.58	Road	5.305	0.28	UAV	30-Sep-18	
28	-0.9006	119.8462	2360	5.44	5.48	5.52	Road	5.48	0.08	UAV	30-Sep-18	
29	-0.9009	119.8463	2400	4.48	4.53	4.58	Road	4.53	0.05	UAV	30-Sep-18	
30	-0.9013	119.8465	2450	4.74	4.79	4.84	Road	4.79	0.05	UAV	30-Sep-18	
31	-0.9018	119.8466	2500	4.58	4.81	5.03	Road	4.805	0.23	UAV	30-Sep-18	
32	-0.9107	119.8487	3500	3.69	3.85	4.01	Grass	3.85	0.16	UAV	30-Sep-18	Figure 4B

Figure S1A

33	-0.9424	119.8569	7142	4.95	5.095	5.24	Road	5.1	0.15	Tape	1-Oct-18	
34	-0.9447	119.8574	7396	4.47	4.605	4.74	Road	4.61	0.14	Tape	1-Oct-18	Figure 6G, H
35	-0.9460	119.8577	7649	0.93	1.045	1.16	Road	1.05	0.12	Tape	1-Oct-18	

Figure S1C

36	-1.0246	119.8625	16195	4.34	4.46	4.58	Road	4.46	0.12	UAV	1-Oct-18
37	-1.0256	119.8626	16295	5.31	5.34	5.37	Cropland	5.34	0.03	UAV	1-Oct-18
38	-1.0258	119.8627	16315	5.47	5.515	5.56	Cropland	5.52	0.05	UAV	1-Oct-18
39	-1.0260	119.8627	16337	5.67	5.725	5.78	Cropland	5.73	0.06	UAV	1-Oct-18
40	-1.0261	119.8627	16349	5.4	5.43	5.46	Cropland	5.43	0.03	UAV	1-Oct-18
41	-1.0263	119.8627	16368	5.39	5.435	5.48	Cropland	5.44	0.05	UAV	1-Oct-18

42	-1.0267	119.8627	16420	5.06	5.155	5.25	Cropland	5.16	0.1	UAV	1-Oct-18	
43	-1.0268	119.8628	16436	5.21	5.25	5.29	Cropland	5.25	0.04	Tape	1-Oct-18	Figure 4H
44	-1.0271	119.8628	16466	4.86	4.865	4.87	Cropland	4.87	0.02	Tape	1-Oct-18	Figure 6A
45	-1.0273	119.8628	16481	5.27	5.285	5.3	Cropland	5.29	0.02	UAV	1-Oct-18	
46	-1.0275	119.8628	16510	4.85	4.87	4.89	Cropland	4.87	0.02	UAV	1-Oct-18	

Figure S1E

47	-1.4296	119.9836	62851	1.66	1.71	1.76	Cropland	1.71	0.05	UAV	2-Oct-18	
48	-1.4305	119.9838	62977	2.06	2.14	2.22	Cropland	2.14	0.08	UAV	2-Oct-18	
49	-1.4310	119.9839	63038	1.69	1.73	1.77	Wall	1.73	0.04	Tape	2-Oct-18	Figure 4F
50	-1.4311	119.9839	63044	2.15	2.29	2.43	Cropland	2.29	0.14	Tape	2-Oct-18	Figure 4G
51	-1.4311	119.9839	63051	2.07	2.155	2.24	Cropland	2.16	0.09	UAV	2-Oct-18	
52	-1.4317	119.9841	63112	1.43	1.535	1.64	Road	1.54	0.11	UAV	2-Oct-18	

Table S2

Field investigation locations of the Palu rupture zone, shown in Figure 2.

No	Latitude ¹	Longitude ¹	Figure	Observation type
Fault F1				
1	-0.8821	119.8410	Figure 4C	left-lateral offset
2	-0.8859	119.8423		left-lateral offset
3	-0.8850	119.8502		left-lateral offset
4	-0.8930	119.8443		left-lateral offset
5	-0.8953	119.8449		left-lateral offset
6	-0.8970	119.8454	Figure 4D	left-lateral offset
7	-0.8965	119.8452	Figure 6F	left-lateral offset; tensional cracks
8	-0.9002	119.8461		left-lateral offset
9	-0.9009	119.8464		left-lateral offset
10	-0.9013	119.8465		left-lateral offset
11	-0.9023	119.8453		left-lateral offset
12	-0.9159	119.8501		left-lateral offset
13	-0.9251	119.8524	Figure 4E	left-lateral offset
14	-0.9416	119.8566		left-lateral offset
15	-0.9424	119.8569		left-lateral offset
16	-0.9447	119.8574	Figure 6G, H	left-lateral offset; tensional cracks; mole tracks
17	-0.9460	119.8577		left-lateral offset
18	-0.9475	119.8582		left-lateral offset
19	-0.9560	119.8599		left-lateral offset
20	-0.9631	119.8602		left-lateral offset
21	-0.9804	119.8611		left-lateral offset
22	-1.0155	119.8647		left-lateral offset
23	-1.0248	119.8625	Figure 7A	left-lateral offset; mole tracks
24	-1.0256	119.8626		left-lateral offset
25	-1.0268	119.8628	Figure 4H	left-lateral offset
26	-1.0271	119.8628	Figure 6A	left-lateral offset; tensional cracks
27	-1.0284	119.8629		left-lateral offset
28	-1.0307	119.8629		left-lateral offset
29	-1.0333	119.8630		left-lateral offset
30	-1.0333	119.8633		left-lateral offset
31	-1.0391	119.8633		left-lateral offset
32	-1.0397	119.8633		left-lateral offset
33	-1.0397	119.8636		left-lateral offset
34	-1.0538	119.8708		left-lateral offset
35	-1.0817	119.8702		left-lateral offset
36	-1.0821	119.8710		left-lateral offset
37	-1.1110	119.8748		left-lateral offset
38	-1.1111	119.8750		left-lateral offset

¹ The latitudes and longitudes of points were observed in field.

39	-1.1120	119.8738	left-lateral offset
40	-1.1270	119.8760	left-lateral offset
41	-1.1441	119.8793	left-lateral offset
42	-1.1572	119.8815	left-lateral offset
43	-1.1700	119.8814	left-lateral offset
44	-1.1804	119.8846	left-lateral offset
45	-1.1805	119.8845	left-lateral offset
46	-1.1816	119.8843	left-lateral offset

Fault F2

1	-0.8580	119.7997	tensional cracks
2	-0.8496	119.8079	tensional cracks
3	-0.9001	119.8340	tensional cracks
4	-1.0008	119.8476	tensional cracks
5	-1.0019	119.8479	tensional cracks
6	-1.0023	119.8481	tensional cracks
7	-1.0029	119.8483	tensional cracks
8	-1.0029	119.8488	tensional cracks
9	-1.0034	119.8484	tensional cracks
10	-1.0130	119.8508	tensional cracks
11	-1.0288	119.8525	tensional cracks
12	-1.0351	119.8540	tensional cracks
13	-1.0415	119.8539	tensional cracks
14	-1.0420	119.8543	tensional cracks
15	-1.0429	119.8544	Figure 6C, D
16	-1.0656	119.8608	tensional cracks
17	-1.0771	119.8616	tensional cracks
19	-1.0813	119.8645	tensional cracks
20	-1.0982	119.8657	tensional cracks
21	-1.1109	119.8691	tensional cracks
22	-1.1422	119.8719	tensional cracks
23	-1.1672	119.8754	tensional cracks
24	-1.1806	119.8796	tensional cracks
25	-1.1872	119.8893	tensional cracks
26	-1.2013	119.9004	tensional cracks
27	-1.2090	119.9113	tensional cracks
28	-1.2157	119.9195	tensional cracks
29	-1.2274	119.9297	tensional cracks

Fault F3

1	-1.2026	119.9463	no surface rupture
2	-1.2146	119.9439	no surface rupture
3	-1.2236	119.9477	no surface rupture
4	-1.2297	119.9457	no surface rupture

5	-1.2309	119.9454		no surface rupture
6	-1.2307	119.9455		no surface rupture
7	-1.2339	119.9445		no surface rupture
8	-1.2377	119.9433		no surface rupture
Southern strand				
1	-1.2396	119.9468		left-lateral offset
2	-1.2508	119.9553		left-lateral offset
3	-1.2648	119.9564		left-lateral offset
4	-1.2648	119.9564		left-lateral offset
5	-1.2763	119.9566		left-lateral offset
6	-1.2962	119.9642		left-lateral offset
7	-1.2978	119.9596		left-lateral offset
8	-1.2981	119.9591		left-lateral offset
9	-1.2992	119.9580		left-lateral offset
10	-1.3369	119.9633		left-lateral offset
11	-1.3597	119.9705		left-lateral offset
12	-1.3908	119.9706		left-lateral offset
13	-1.3913	119.9708		left-lateral offset
14	-1.4121	119.9805		left-lateral offset
15	-1.4124	119.9801		left-lateral offset
16	-1.4142	119.9815		left-lateral offset
17	-1.4147	119.9813		left-lateral offset
18	-1.4150	119.9812		left-lateral offset
19	-1.4204	119.9820		left-lateral offset
20	-1.4219	119.9821	Figure 6B	tensional cracks
21	-1.4251	119.9825	Figure 6E	tensional cracks
22	-1.4281	119.9833		left-lateral offset
23	-1.4286	119.9831		left-lateral offset
24	-1.4292	119.9833		left-lateral offset
25	-1.4296	119.9836		left-lateral offset
26	-1.4305	119.9838		left-lateral offset
27	-1.4310	119.9839	Figure 4F	left-lateral offset
28	-1.4311	119.9839	Figure 4G	left-lateral offset
29	-1.4311	119.9839		left-lateral offset
30	-1.4317	119.9841		left-lateral offset
31	-1.4445	119.9906	Figure S2	left-lateral and vertical offset





