The International Seismological Summary for 1918

(Continued).

FORMERLY THE BULLETIN OF THE BRITISH ASSOCIATION SEISMOLOGY COMMITTEE.

The present number contains the information for July, August, and September, 1918. The practice of presenting three months' records at a time is found to be convenient.

Special attention has been paid to the series of shocks from the Epicentre 46°·5N. 151°·4E. For the first of these (on Sept. 7d. 17h.) the focus was apparently 0·030 radius *above* the usual depth, while for that on Sept. 8d. 5h. it seems to be at normal depth. The essential difference between the two cases is shown by a direct comparison in a note to Sept. 8d. 5h. The repetition on Sept. 8d. 0h., however, seems to agree with Sept. 7d. 17h. For the other repetitions the evidence is generally too slight to decide whether the focus is high or normal, though on Sept. 12d. 13h. there seems to be a return to the high focus of Sept. 7d. 17h. [Another instance of the occurrence of shocks at different depths below the same Epicentre seems to be furnished by the shocks of 1918 Feb. 7d. 5h. and 1918 Sept. 11d. 4h., the latter having normal depth, the former 0·025 below.]

But the series has another point of interest. It is shown that the periodicity of 21min. suggested in another connection has no appreciable influence in determining the sequence. But the suggestion of Dr. Jeans (Proc.R.S. A.Vol. 102, p. 554, 1923) that the shocks recur after times mt_1+nt_2 where $t_1=125{\cdot}8$min. and $t_2=222{\cdot}0$min. was found to be borne out with striking accuracy on one condition, viz., that for the time of the first shock (Sept. 7d. 17h.) the value of m is at least $+2$. Otherwise (*i.e.*, if m and n are zero for the first shock) the first two repetitions cannot be represented with positive values of m and n; though from the third shock onwards this can be done. The representation is, however, so satisfactory if this condition be granted as to support Dr. Jean's suggestion very strongly.

H. H. TURNER.

University Observatory, Oxford,
1923 August 8th.

1918 JULY, AUGUST & SEPTEMBER.

1918. July 1d. 6h. 8m. 18s. Epicentre 9°·5N. 127°·0E.

A = −·594, B = +·788, C = +·165; D = +·799, E = +·602; G = −·099, H = +·132, K = −·986.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Manila	W.	7·8	311	i 2 6	+ 8	—	—	4·0	4·2
Taihoku	O.	16·4	342	4 17	+20	—	—	7·5	10·5
Zi-ka-wei	—	22·3	347	i 5 14	+ 5	9 20	+ 9	i 9·7	15·9
Batavia	W.	25·5	233	5 33	−10	10 2	−11	—	12·7
Kobe	O.	26·2	15	e 5 56	+ 6	(10 25)	− 1	10·4	16·2
Osaka	O.	26·4	16	5 57	+ 5	(10 37)	+ 7	10·6	20·2
Mizusawa E.	O.	32·2	21	6 48	− 2	11 57	−14	—	—
Adelaide	M.	45·8	167	12 59	?	(14 59)	−26	24·0	26·4
Colombo	M.	46·8	271	6 18	?	15 36	− 2	28·4	33·4
Kodaikanal	M.	48·8	275	9 24	+25	—	—	20·2	36·1
Riverview	—	49·0	153	e 9 0	0	e 15 54	−12	e 24·5	26·7
Sydney	—	49·0	153	9 6	+ 6	(16 18)	+12	26·2	31·9
Melbourne	M.	50·2	161	—	—	(16 36)	+15	30·6	32·7
Simla	O.E.	51·0	303	9 0	−13	—	—	—	26·4
Bombay	O.E.	53·2	287	8 51	−36	—	—	—	—
Honolulu	M.	72·7	70	10 54	−40	21 0	+ 2	33·6	35·7
Mauritius N.	M.	74·1	246	18 54	?	—	—	—	31·1
E.	M.	74·1	246	19 48	?	—	—	38·7	41·2
Helwan	M.	90·2	300	13 36	+19	—	—	—	64·8
Lemberg	B.O.	91·0	321	e 19 48	?	e 23 54?	−30	e 55·7	60·3
Budapest	—	94·8	320	—	—	e 24 42	−22	—	—
Victoria	M.	95·6	39	23 42	?S	31 34	?SR_1	45·3	75·4
Vienna Z.	—	96·3	321	i 13 43	− 8	—	—	—	—
Graz	W.	97·2	320	12 42	−73	—	—	—	—
Zagreb	W.	97·4	319	e 12 41	−75	e 24 17	−73	50·7	59·7
Triest	W.	98·9	319	e 15 6?	+61	—	—	—	—
Pola	W.	99·1	318	e 24 39	?S	(e 24 39)	−68	e 55·2	63·8
Berkeley	—	100·0	49	e 34 12	?SR_1	—	—	—	—
Pompeii	—	100·3	315	e 18 24	?PR_1	e 24 14	−105	—	—
Rocca di Papa	Ag.	100·8	316	e 18 6	?PR_1	—	—	e 51·1	68·8
De Bilt N.	—	101·0	328	—	—	—	—	e 54·7	57·4
E.	—	101·0	328	—	—	e 24 6	−119	e 56·7	61·5
Uccle	—	102·1	327	e 17 42	?PR_1	—	—	e 53·7	56·7
Edinburgh	M.	102·8	334	14 12	−12	—	—	—	67·2
Moncalieri	S.	103·0	321	e 14 15?	−10	26 7	−17	43·1	69·0
Eskdalemuir	G.	103·2	333	e 14 12	−14	i 24 57	−89	46·7	57·0
Stonyhurst	M.	103·7	332	19 42	?PR_1	29 12	?	58·7	64·0
Kew	M.	104·1	329	—	—	—	—	—	67·7
Bidston	M.S.	104·2	332	17 42	?PR_1	25 6	−89	—	36·8
Paris	—	104·2	326	e 18 42	?PR_1	e 24 58	−97	53·7	57·7
Barcelona	Ma.	108·2	320	—	—	e 24 22	−170	e 57·2	67·7
Tortosa	—	109·7	320	19 12	?PR_1	25 22	−123	28·7	68·0
Cape Town	M.	110·7	237	55 12	?L	—	—	(55·2)	69·2
Coimbra	—	115·6	324	e 19 59	?PR_1	29 36	+81	57·6	63·6
Rio Tinto	M.	115·9	320	19 42	?PR_1	—	—	(56·7)	81·0
Ottawa	—	121·4	19	i 20 42	?PR_1	30 36	+96	e 60·7?	—
Toronto	M.	121·7	22	—	—	—	—	54·5	—
Accra	M.	125·3	284	—	—	—	—	76·2	89·7
Georgetown	—	126·7	23	e 21 19	?PR_1	—	—	76·7	—
Washington	Mar.	126·7	23	21 24?	?PR_1	27 22?	?	58·7	81·2
La Paz	Bi.	163·7	117	20 18	[+ 7]	33 56	?	75·7	83·7

For Notes see next page.

NOTES TO JULY 1d. 6h. 8m. 18s.

Additional records: Manila gives MN = +4·5m. Zi-ka-wei MN = +17·3m. Batavia gives its records ten minutes early. Kobe MN = +16·1m. Osaka MN = +15·9m. Mizusawa SN = +12m.6s. Adelaide S is given as PR_1, also S = +18m.19s., SR_1 = +20m.4s. Riverview ePR_1 = +11m.7s., eS = +16m.1s., PS = +16m.25s., MN = +25·5m., MZ = +37·3m., T_0 = 6h.8m.36s. Sydney gives S +10m. wrong. Melbourne S is given as PR_1, also S = +22m.6s., SR_1 = +25m.42s., SR_2 = +27m.12s. Simla MN = +31·4m. Zagreb MNW = +63·7m. Pola MN = +65·9m. Rocca di Papa L = +60·1m., +61·1m., and +78·4m. De Bilt gives epicentre 9°·0N. 127°·0E. Moncalieri MN = +71·6m. Eskdalemuir e = +18m.26s. Coimbra MN = +63·3m. Rio Tinto M = +28·7m. Ottawa L = +76·7m. and +88·7m. Toronto L = +69·0m. and +89·9m. Washington L = +34·2m. and +76·7m.

July 1d. 11h. 2m. 0s. Epicentre 34°·5N. 25°·0E.

A = +·747, B = +·348, C = +·566; D = +·423, E = −·906; G = +·513, H = +·239, K = −·824.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Athens		3·6	344	0 59	+ 3	1 41	+ 2	2·0	2·2
Pompeii		10·3	310	i 2 44	+10	e 4 38	+ 1	6·5	—
Rocca di Papa		12·1	310	e 3 12	+12	—	—	—	3·8
Zagreb		13·2	331	e 3 15	− 1	e 7 37?	?L	(e 7·6?)	8·5
Pola		13·4	324	—	—	e 5 59	+ 6	e 8·2	8·9
Triest		14·1	326	e 6 0	?S	(e 6 0)	−10	—	—
Graz		14·5	333	e 3 33	0	5 48	−32	—	—
Lemberg		15·4	359	e 6 33	?S	(e 6 33)	− 8	e 8·2	9·4
Moncalieri		16·9	314	—	—	e 7 33	+17	10·2	12·2
Paris		21·9	318	—	—	i 9 13	+10	13·0	—
Uccle		22·1	324	e 5 0	− 6	e 8 12	−55	e 12·0	—
De Bilt	N.	22·6	327	—	—	e 9 15	− 2	11·5	13·1
	E.	22·6	327	—	—	—	—	12·7	15·5
Bidston		27·4	322	13 42	?L	—	—	(13·7)	17·4
Edinburgh		28·8	327	16 20	?L	—	—	(16·3)	—

Additional records: Athens gives MN = +2·3m. Zagreb e = +4m.15s., MNW = +8·7m.

July 1d. Records also at 5h. (Rio Tinto (2)), 8h. (Rio Tinto and Mizusawa), 10h. (Tokyo), 21h. (Lick).

July 2d. Records at 1h. (San Fernando), 3h. (Batavia), 4h. (Ootomari), 6h. (La Paz), 7h. (Melbourne), 8h. (La Paz and Helwan), 11h. (Helwan and Ann Arbor), 14h. (Taihoku and Rio Tinto), 15h. (Pompeii), 17h. (Manila (2)), 19h. (Manila), 20h. (Taihoku), 23h. (Taihoku, Manila, and San Fernando).

1918. July 3d. 6h. 51m. 55s. Epicentre 3°·5S. 142°·0E.

A = −·787, B = +·615, C = −·061; D = +·616, E = +·788;
G = +·048, H = −·038, K = −·998.

The deduced values of T_0 have rather a wide range. The adopted value is near the mean, and the anticentral stations suggest a normal focal depth. But the observations in Japan and Australia (roughly N. and S.) are both negative, as for a deep focus. The Indian and Apia observations would be improved a little by an epicentre further east.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		° ′	°	M. S.	S.	M. S.	S.	M.	M.
Manila	W.	27·7	312	e 6 5	0	i 10 29	−25	i 12·5	14·3
Riverview	—	31·5	165	i 6 30	−13	e 11 48	−12	e 13·9	19·3
Sydney	M.	31·5	165	6 35	− 8	11 35	−25	14·4	18·9
Adelaide	M.	31·6	185	6 43	0	11 55	− 6	15·8	18·3
Melbourne	M.	34·4	176	9 11	?PR_1	14 35	?SR_1	18·1	20·1
Taihoku	O.	34·9	326	7 6	− 6	12 40	−14	15·8	20·4
Batavia	W.	35·2	264	i 7 16	+ 1	i 8 53	?PR_1	—	18·1
Perth	M.	37·6	218	6 56	−39	—	—	—	—
Kobe	O.	38·7	351	e 7 34	−10	—	—	16·4	16·7
Osaka	O.	38·7	351	7 36	− 8	12 39	−69	15·8	16·2
Tokyo	O.	39·2	357	7 45	− 3	18 6	?L	(18·1)	—
Zi-ka-Wei N.	—	39·9	332	7 52	− 2	e 13 50	−15	e 16·7	22·7
E.	—	39·9	332	—	—	e 13 56	− 9	e 17·0	22·5
Mizusawa E.	O.	42·6	359	8 7	− 8	14 2	−41	—	—
N.	O.	42·6	359	8 3	−12	14 12	−31	—	—
Apia	W.	46·8	106	e 8 25	−21	e 14 45	−53	18·6	28·6
Ootomari	—	50·2	1	8 58	−10	16 22	+ 2	20·1	21·9
Calcutta	O.E.	58·5	299	10 5	+ 3	18 29	+24	—	—
Colombo	M.	62·9	280	10 23	− 8	15 5	?PR_1	23·1	38·1
Honolulu	M.	63·7	64	10 35	− 1	19 17	+ 8	31·5	34·2
Kodaikanal	M.	65·8	283	10 53	+ 3	—	—	16·1	45·8
Simla	O.E.	70·6	305	e 11 5	−16	e 20 23	−10	—	45·1
Bombay	O.E.	71·6	291	11 30	+ 3	21 3	+18	—	45·4
Sitka E.	B.O.	89·0	33	—	—	23 32	−31	—	23·9
N.	B.O.	89·0	33	—	—	23 38	−25	—	37·4
Victoria	M.	95·8	42	13 43	− 5	i 25 33	+19	44·4	55·9
Z.	—	95·8	42	13 35	−13	—	—	44·1	52·7
Berkeley	—	98·6	52	e 17 24	?PR_1	e 26 9	+47	—	48·6
Lick	W.	97·2	53	e 18 5	?PR_1	—	—	—	—
Tucson	B.O.	106·4	57	23 54	?	—	—	47·1	67·1
Lemberg	B.O.	110·4	323	e 19 17	?PR_1	e 28 17	+45	e 57·1	68·3
Athens E.	—	114·2	310	19 50	?PR_1	e 29 43	+99	e 58·1	67·1
N.	—	114·2	310	19 57	?PR_1	—	—	—	73·6
Budapest	—	114·4	322	19 38	?PR_1	24 38	?	—	—
Cape Town	M.	115·0	230	24 47	?	29 35	+85	59·0	66·6
Vienna	—	115·6	323	19 53	?PR_1	—	—	—	—
Graz	W.	116·7	322	e 19 33	?PR_1	—	—	—	—
Zagreb	W.	117·0	321	e 15 14	−15	—	—	60·1	74·1
Triest	W.	118·4	321	19 57	?PR_1	28 27	−10	—	—
Pola	W.	118·7	320	e 20 7	?PR_1	e 30 13	+93	e 44·6	74·1
Dyce	Ma.	119·2	339	19 39	?PR_1	30 53	+127	49·6	66·9
Hohenheim	—	119·5	326	e 18 59	[+ 8]	30 15	+89	—	—
De Bilt E.	—	119·8	331	15 35	− 6	e 28 33	−15	59·1	56·5
N.	—	119·8	331	—	—	e 28 22	−26	53·1	60·4
Pompeii	O.A.	120·0	316	i 19 49	?PR_1	i 29 59	+70	58·5	64·5
Monte Cassino	—	120·2	317	41 46	?L	—	—	(41·8)	41·8
Edinburgh	M.	120·6	338	19 5	[+11]	—	—	—	76·1
Zurich	—	120·6	325	e 19 3	[+ 9]	e 20 36?	?PR_1	—	—
Rocca di Papa	Ag.	120·8	318	e 19 1	[+ 7]	26 15?	?	e 59·4	73·8
Uccle	—	120·8	330	e 18 59	[+ 5]	e 30 17	+82	50·1	63·8
Eskdalemuir	G.	121·1	338	e 15 33	−15	i 28 38	−20	38·1	44·7
St. Louis	W.	121·1	46	—	—	(e 28 5)	−53	58·1	63·1
Milan	—	121·3	323	21 14	?PR_1	—	—	—	25·0
Stonyhurst	M.	121·9	336	21 35	?PR_1	29 41	+38	—	72·0
Besançon	—	122·1	326	—	—	—	—	58·1	—
Bidston	M.S.	122·4	336	16 5	+11	19 59	?PR_1	—	74·2

Continued on next page.

Station and Component.	Machine.	Δ	Azimuth.	P.	O—C.	S.	O—C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Moncalieri	S.	122·5	323	15 45	−10	28 23	−45	37·8	76·6
Kew	M.	122·6	333	20 5	?PR$_1$	—	—	—	76·1
Paris	—	123·0	329	i 20 52	?PR$_1$	e 28 49	−23	51·1	63·1
Shide	—	123·6	333	20 34	?PR$_1$	—	—	51·2	77·2
Ann Arbor E.	W.	123·8	40	19 11	[+ 8]	—	—	59·0	—
E.	B.	123·8	40	18 35	[−28]	30 47	+89	60·1	64·1
N.	B.	123·8	40	19 17	[+14]	29 5?	−13	58·1	—
Marseilles	Ma.	124·7	323	e 21 1?	?PR$_1$	—	—	65·1	78·1
Toronto	M.	125·8	36	22 35?	?	29 59	+27	i 66·6	72·4
Ottawa	—	126·7	32	i 21 5	?PR$_1$	e 28 5	−93	61·1	—
Barcelona	—	127·8	322	e 19 49	?PR$_1$	—	—	e 59·9	63·2
Ithaca E.	B.O.	128·1	36	e 21 21	?PR$_1$	e 31 21	+93	e 56·9	—
N.	B.O.	128·1	36	22 41	?	e 33 3	+195	e 57·6	—
Tortosa	—	129·1	323	19 20	[+ 4]	32 35	+160	39·7	82·0
Northfield	B.O.	129·3	32	18 25	?	25 50	?	e 56·1	—
Cipolletti	M.	129·4	150	26 41	—	—	—	77·6	94·4
Algiers	B.M.	129·7	317	e 19 32	[+15]	30 12	+13	48·1	68·1
Georgetown E.	—	129·9	40	e 19 18	[0]	31 33	+93	e 51·2	—
N.	—	129·9	40	e 19 15	[− 3]	31 35	+95	e 51·2	—
Washington	Mar.	129·9	40	19 15	[− 3]	26 25	?	66·1	—
Cheltenham N.	B.O.	130·1	40	21 36	?PR$_1$	38 26	?SR$_1$	63·8	74·4
E.	B.O.	130·1	40	21 35	?PR$_1$	38 35	?SR$_1$	64·3	87·7
Harvard E.	B.O.	131·3	32	(21 36)	?PR$_1$	31 37	+28	—	—
N.	B.O.	131·3	32	(22 31)	?PR$_1$	31 25	+16	67·4	71·7
Coimbra N.	—	134·6	328	18 59	[−30]	31 29?	+58	59·9	73·7
E.	—	134·6	328	19 37	[+ 8]	31 9?	+38	64·6	70·4
San Fernando	—	135·9	322	18 5	+71	—	—	73·1	86·1
Pilar	M.	137·2	147	20 53	[+79]	—	—	81·6	96·6
Chacarita	M.	137·3	155	24 23	?PR$_1$	—	—	78·9	85·4
Andalgala N.	M.	138·7	141	24 53	?PR$_1$	—	—	80·9	103·4
E.	M.	138·7	141	24 53	?PR$_1$	—	—	74·9	94·2
Accra	M.	142·3	274	32 35	?S	(32 35)	+78	—	46·1
La Quiaca	M.	142·7	135	24 23	?PR$_1$	—	—	—	—
La Paz	Bi.	144·1	125	19 50	[+ 3]	33 53	?	69·0	78·8
Vieques N.	B.O.	149·4	59	20 4	[+ 9]	—	—	—	110·1
E.	B.O.	149·4	59	20 26	[+31]	—	—	101·9	110·3
Rio de Janeiro	B.O.	153·1	171	—	—	e 35 5	?	60·3	—

Additional records: Manila gives T_0 = 6h.52m.28s. Riverview PR_1 = +8m.16s., eS = +11m.37s., MZ = +19·8m. Epicentre 4°·0S. 149°·0E., T_0 = 6h.51m.57s. Adelaide PR_1 = +10m.23s., SR_1 = +13m.23s. Melbourne SR_1 = +16m.5s., SR_2 = +16m.35s. Kobe MN = +23·0m. Should ME be 10m. later? Osaka MN = +19·8m., T_0 = 6h.53m.9s. Zi-ka-wei iE = +14m.10s., iN = +14m.28s., iE = +17m.16s., iN = +17m.18s. Mizusawa T_0 = 6h.52m.25s. Apia eP = +8m.35s. Colombo M = +46·2m. Honolulu T_0 = 6h.51m.48s. Victoria (horizontal Component) S? = +16m.59s., S = +23m.53s. Berkeley T_0 = 6h.58m.34s. Zagreb MNW = +64·1m. Pola MN = +73·1m. De Bilt PR_1 = +20m.32s., eE = +30m.18s. and +49m.35s., eN = +49m.47s. Epicentre 3°·5S. 144°·5E. Uccle PR_1 = +20m.29s., M = +64·2m. Eskdalemuir i = +20m.37s. and +24m.36s., M = +51·8m. St. Louis gives eS as eLN. Moncalieri MN = +76·2. Toronto P = +24m.59s., S or iL = +33m.47s. Ottawa eE = +30m.59s., e = +33m.17s., and several L's. A confused record, probably of several shocks. Ithaca eE = +38m.32s., eN = +38m.29s., and +43m.53s. Northfield LE = +65·1m., +69·1m., and +113·1m. Georgetown PR_1E = +21m.43s., PR_1N = +21m.29s., eE = +22m.40s., eN = +22m.47s. Washington L = +49·6m., +56·1m., and +62·1m. Harvard eE = +22m.38s., eN = +32m.37s., eE = +39m.37s. Coimbra PR_1E = +22m.8s., PR_1N = +21m.57s., SR_1 = +40m.9s. San Fernando MN = +88·1m. Pilar MN = +93·9m. La Paz PR_1 = +23m.31s., SR_1 = +36m.11s., SR_2 = +40m.36s.

July 3d. Records also at 0h. (Lick), 2h. (La Paz), 8h. (Mizusawa and Barcelona), 9h. (Riverview), 14h., 17h., and 19h. (Manila).

July 4d. 11h. 25m. 15s. Epicentre 37°·4N. 30°·5E. (as on 1918 Jan. 16d. 7h.).
A = +·684, B = +·403, C = +·607 ; D = +·508, E = −·862 ;
G = +·523, H = +·308, K = −·794.

The residuals for Triest, Bidston, and Eskdalemuir suggest an earlier shock in addition.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	5·4	278	e 1 31	+ 8	e 2 13	−15	e 2·7	2·8
Helwan	7·6	174	2 45	+50	—	—	—	—
Pompeii	12·8	290	i 3 35	+25	i 7 5	?L	(7·1)	—
Lemberg	13·2	342	—	—	—	—	e 7·2	9·7
Zagreb	13·7	313	e 3 16	− 6	—	—	i 7·7	8·9
Rocca di Papa	14·4	293	i 3 41	+ 9	—	—	e 8·0	9·2
Pola	14·5	306	e 7 21	?S	(e 7 21)	+61	e 8·3	9·4
Graz	14·7	316	e 4 56	+81	—	—	—	—
Vienna	14·9	321	e 5 15	+97	(5 15)	−75	—	—
Triest	15·0	308	e 5 45	+126	—	—	—	—
Moncalieri	18·7	301	4 35	+10	7 49	− 6	10·4	13·0
Zurich	18·9	309	4 32	+ 4	—	—	e 11·7	—
Barcelona	22·2	289	—	—	—	—	—	14·8
Uccle	22·9	314	e 5 9	− 7	—	—	e 11·7	—
De Bilt	23·0	318	e 5 15	− 2	e 9 23	− 2	12·7	15·2
Paris	23·2	308	i 5 17	− 2	e 9 30	+ 1	13·7	14·7
Kew	25·8	313	—	—	—	—	—	10·7
Stonyhurst	27·9	317	—	—	—	—	—	20·0
Bidston	28·1	316	4 27	−102	11 21	+20	—	17·0
Eskdalemuir	28·9	319	4 34	−103	11 25	+10	17·4	—
Edinburgh	29·1	320	10 45?	?S	(10 45)	−34	—	—

Additional records: Zagreb gives i = +7m.57s., and three other records, Pola MN = +9·5m. Moncalieri MN = +13·1m. Barcelona gives e = 11h.25m.38s.

July 4d. Records also at 0h. (San Fernando and Zurich), 6h. (La Paz and Zurich), 7h. (Dehra Dun), 14h. (Taihoku, De Bilt, and Paris), 18h. (Taihoku), 23h. (La Paz and Cipolletti).

July 5d. 15h. 41m. 20s. Epicentre 37°·0N. 20°·5E.
A = +·748, B = +·280, C = +·602 ; D = +·350, E = −·937 ;
G = +·564, H = +·211, K = −·799.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	2·8	69	0 47	+ 3	1 23	+ 6	—	2·0
Pompeii	5·9	311	e 1 45	+14	e 2 47	+ 6	—	—
Rocca di Papa	7·6	311	e 1 27	−28	—	—	—	2·8
Pola	9·2	330	e 1 40	−39	(e 4 8)	0	e 4·1	4·6
Zagreb	9·4	341	e 1 38	−44	i 2 2	?P	—	4·0
Triest	10·0	332	2 42	+12	—	—	—	—
Graz	10·7	342	e 2 16	−24	—	—	—	—
Helwan	11·6	125	13 40	?L	—	—	(13·7)	—
Vienna E.	11·6	346	e 2 40	−13	—	—	—	—
Moncalieri	12·4	314	—	—	e 5 28	− 1	8·1	—
Lemberg	13·1	10	e 5 34	?S	(e 5 34)	−12	—	5·8
Hohenheim	14·3	329	—	—	e 6 34	+19	—	—
De Bilt	18·5	330	—	—	—	—	e 9·2	—

Additional records: Athens gives T_0 = 15h.41m.21s. Pola MN = +4·2m. Zagreb i = +1m.54s. and +3m.36s., MNE = +4·1m., MNW = +4·2m.

July 5d. Records also at 0h. and 16h. (San Fernando), 20h. (La Paz), 23h. (Manila).

July 6d. 20h. 10m. 22s. Epicentre 8°·0S. 146°·5E.
A = −·826, B = +·547, C = −·139 ; D = +·552, E = +·834 ;
G = +·116, H = −·077, K = −·990.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	26·2	171	e 5 50	0	e 10 26	0	16·7	16·7
Melbourne	29·9	183	e 11 38	?S	(e 11 38)	+ 6	18·2	20·0
Manila	34·0	312	e 8 38	?PR_1	—	—	—	—
Honolulu	61·8	61	18 38	?S	(18 38)	− 8	27·1	30·1
Helwan	115·7	299	73 38	?L	—	—	(73·6)	—
De Bilt E.	125·8	332	—	—	e 30 47	+75	66·6	67·6
N.	125·8	332	—	—	e 31 10	+98	65·6	68·5
Eskdalemuir	126·9	339	—	—	—	—	66·6	—
Stonyhurst	127·8	337	e 72 38	?L	e 75 8	?L	(e 72·6)	78·6
Bidston	128·3	337	70 20	?L	—	—	(70·3)	79·1
Paris	129·2	330	—	—	—	—	e 72·6	76·6

Additional records: Riverview gives PS = +10m.59s., MN = +15·4 and T_0 = 20h.10m.24s.

July 6d. Records also at 3h. (Tokyo), 5h. (La Paz), 13h. (Barcelona), 14h. (La Paz, Melbourne, and Manila), 15h. (La Paz), 16h. (Zurich and La Paz), 17h. (Rio Tinto).

July 7d. Records at 0h. (La Paz), 4h. (Colombo), 7h. (Lick), 9h. (Taihoku), 10h. (Accra), 12h. (Manila), 13h. (Manila), 16h. (Rio Tinto), 20h. (Riverview), 23h. (La Paz).

1918. July 8d. 10h. 22m. 7s. Epicentre 26°·5N. 92°·0E.

A = −·031, B = +·894, C = +·449; D = +·999, E = +·035;
G = −·016, H = +·446, K = −·895.

A better Epicentre would probably be 26°·5N. 90°·4E. See Note at end.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	s.	M. S.	s.	M.	M.
Calcutta	O.E.	5·2	221	0 53	−27	—	—	—	—
Dehra Dun	O.	12·8	290	1 53	−77	—	—	—	—
Simla	O.E.	13·8	293	2 47	−36	e 5 17	−46	6·7	—
Bombay	O.E.	19·2	251	4 4	−27	7 22	−44	9·2	—
Kodaikanal	M.	21·2	223	—	—	—	—	4·3	9·4
Colombo	M.	22·8	213	(5 23)	+ 8	—	—	5·4	21·1
Hokoto	O.	25·1	91	5 3	−36	(9 38)	−27	9·6	10·4
Zi-ka-wei	—	26·1	73	5 49	0	9 24	−60	—	16·9
Taihoku	O.	26·6	86	5 50	− 4	10 43	+10	15·4	17·4
Manila	W.	29·5	108	e 6 9	−14	i 11 32	+ 6	14·7	19·1
Batavia	W.	35·7	154	6 47	−32	—	—	—	15·9
Kobe	O.	37·7	67	7 31	− 5	—	—	19·4	23·5
Osaka	O.	38·0	67	7 32	− 6	13 35	− 3	19·5	24·9
Tokyo	O.	41·4	66	8 1	− 5	15 28	+61	22·3	—
Mizusawa E.	O.	42·6	60	8 13	− 2	14 47	+ 4	—	—
N.	O.	42·6	60	8 14	− 1	14 34	− 9	—	—
Ootomari	O.	44·4	49	8 27	− 2	15 12	+ 5	18·8	30·2
Helwan	M.	52·9	289	9 23	− 2	—	—	—	35·3
Lemberg	B.O.	56·1	314	e 9 50	+ 3	i 17 42	+ 7	e 36·8	37·5
Athens	M.	57·6	300	9 53	− 3	17 47	− 7	27·4	41·6
Vienna Z.	—	61·2	313	i 10 20	0	—	—	—	—
Zagreb	W.	61·9	310	e 10 24	0	i 18 51	+ 4	36·9	38·9
Perth	M.	62·7	157	10 25	− 5	18 33	−24	—	—
Pola	W.	63·5	309	e 10 33	− 2	i 19 7	0	e 29·4	44·4
Pompeii	O.A.	64·0	305	i 10 47	+ 9	e 18 11	−62	32·0	45·0
Monte Cassino	—	64·3	308	10 47	+ 7	—	—	—	11·1
Rocca di Papa	Ag.	65·1	306	10 40	− 6	19 51	+25	e 34·4	40·1
Zurich	—	66·5	313	e 10 55	0	19 51	+ 7	—	—
Milan	—	66·6	311	11 13	+18	—	—	—	21·7
De Bilt	—	67·5	318	11 6	+ 5	20 3	+ 7	35·9	36·9
Moncalieri	S.	67·7	310	i 11 5	+ 3	i 19 54	− 4	31·8	44·8
Besançon	—	68·3	313	11 25	+19	20 23	+17	36·9	—
Uccle	—	68·3	317	e 11 7	+ 1	20 12	+ 6	27·9	38·1
Marseilles	—	69·9	309	i 11 28	+12	i 20 28	+ 3	38·9	44·9
Paris	—	70·0	316	i 11 20	+ 3	i 20 23	− 3	32·9	38·9
Dyce N.	Ma.	70·1	325	e 11 41	+23	20 45	+18	29·2	36·9
E.	Ma.	70·1	325	11 29	+11	20 41	+14	29·3	36·8
Kew	M.	70·9	319	20 53	?S	(20 53)	+16	—	42·9
Edinburgh	M.	71·1	324	11 43	+19	20 53	+14	—	52·6
Eskdalemuir	G.	71·3	323	11 33	+ 8	20 47	+ 5	33·9	35·9
Stonyhurst	M.	71·4	322	7 47?	?	i 15 41	?PR$_1$	i 24·7	51·9
West Bromwich	—	71·5	320	11 30	+ 3	20 44	0	—	—
Shide	—	71·7	318	—	—	—	—	—	46·0
Bidston	M.S.	71·8	321	12 29	+61	21 59	+71	—	40·9
Barcelona	—	72·7	308	11 35	+ 1	20 57	− 1	36·1	42·0
Algiers	B.M.	73·7	304	11 36	− 4	21 7	− 3	36·9	42·4
Tortosa	—	74·1	308	11 37	− 6	21 13	− 2	32·0	43·2
Adelaide	M.	75·6	142	11 33	−20	21 3	−30	34·1	46·5
Rio Tinto	M.	80·3	308	7 53	?	—	—	—	87·9
Coimbra	—	80·5	310	12 27	+ 5	i 22 23	− 6	39·9	50·6
San Fernando	—	80·6	306	12 11	−12	22 11	−19	45·4	50·9

Continued on next page.

Station and Component.	Machine.	Δ	Azimuth.	P.	O–C.	S.	O–C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Melbourne	M.	81·3	140	i 12 5	−22	i 22 5	−33	37·7	49·7
Riverview	—	82·4	134	i 12 22	−10	i 22 31	−19	e 35·3	39·4
Sydney	M.	82·4	134	10 53	−99	22 35	−15	48·6	54·9
Sitka N.	B.O.	87·4	24	23 49	?S	(23 49)	+ 4	e 44·1	49·2
E.	B.O.	87·4	24	23 53	?S	(23 53)	+ 8	e 45·8	54·9
Accra	M.	89·4	276	33 53	?L	—	—	(33·9)	36·9
Cape Town	M.	92·2	233	13 35	+ 7	23 23	−74	43·1	52·1
Honolulu	M.	97·1	62	32 5	?SR_1	—	—	—	55·9
Victoria	—	98·7	23	24 7	?S	(24 7)	−96	46·1	64·0
Z.	—	98·7	23	23 0	?	32 6	?SR_1	—	66·6
Apia	W.	101·7	97	e 18 53	?PR_1	26 53	+41	41·9?	48·9
Ottawa	—	107·2	351	i 14 30?	−15	i 25 1?	−122	53·9	—
Northfield	B.O.	107·9	348	—	—	e 24 3	?	e 46·9	—
Berkeley E.	—	108·0	28	e 19 26?	?PR_1	e 28 34	+84	—	—
N.	—	108·0	28	e 19 22?	?PR_1	e 28 26	+76	—	70·6
Z.	—	108·0	28	e 18 26	?PR_1	e 28 26	+76	—	—
Harvard E.	B.O.	109·3	347	12 57	−117	28 10	+48	54·0	—
N.	B.O.	109·3	347	15 20?	+26	27 5?	−17	54·5	62·3
Toronto	M.	109·4	353	15 47?	+52	26 29	−54	i 52·8	73·5
Ithaca N.	—	110·2	351	e 19 10	?PR_1	e 28 45	+75	e 55·5	—
E.	—	110·2	351	e 26 57	?S	(e 26 57)	−33	48·1	—
Ann Arbor E.	B.	111·0	357	—	—	—	—	48·9	60·9
N.	B.	111·0	357	18 17	[− 8]	28 59	+82	—	59·9
E.	W.	111·0	357	17 59	[−26]	—	—	48·9	61·9
N.	W.	111·0	357	17 53	[−32]	30 23	?	—	61·5
Washington	Mar.	113·8	351	10 53	?	25 15	?	51·9	—
Georgetown	—	113·8	351	e 19 48	?PR_1	25 34	?	e 47·3	—
Cheltenham N.	B.O.	113·9	351	19 51	?PR_1	e 30 28	?	e 55·9	71·4
E.	B.O.	113·9	351	19 39	?PR_1	—	—	e 56·2	59·5
St. Louis	W.	114·8	2	e 19 47	?PR_1	28 59?	+51	45·1	—
Tucson	B.O.	117·3	22	21 5	?PR_1	—	—	55·7	64·2
Vieques	B.O.	130·2	331	22 54	?PR_1	—	—	—	—
Balboa Heights	B.O.	143·6	346	19 43	[− 3]	—	—	—	—
Pilar	M.	158·4	250	—	—	—	—	43·9	53·2
La Paz	Bi.	159·0	295	20 2	[− 5]	34 7	—	69·9	71·7
Cipolletti	M.	159·2	228	—	—	—	—	37·7	44·2
Andalgala	M.	160·7	262	—	—	—	—	—	87·1

Additional records: Colombo gives M = +10·0m. Zi-ka-wei PME = +6m.17s., SR_1E = +12m.5s., MN = +16·2m. Manila iE = +8m.28s., iN = +8m.43s., MN = +19·8m. Kobe MN = +23·4m. Osaka MN = +21·9m. Athens mE = +10m.52s., mN = +12m.10s., mN = +18m.14s., mE = +18m.23s., LN = +31·7m., MN = +32·5m., T_0 = 10h.22m.9s. Zagreb eP = +10m.14s., iP = +10m.33s. and +10m.43s., PR_2 = +14m.25s., SR_1NW = +24m.12s., M = +39·9m. Perth PR_2 = +14m.45s. Pola MN = +39·2m., T_0 = 10h.22m.7s. Rocca di Papa L = +43·5m. and +58·8m. De Bilt i = +11m.17s., LN = +31·9m., MN = +37·6m., T_0 = 10h.22m.16s. Moncalieri P = +10m.58s., MN = +46·7m., T_0 = 10h.22m.9s. Paris PR_1 = +14m.14s., PR_2 = +17m.29s., T_0 = 10h.22m.24s. Eskdalemuir PR_1? = +14m.12s., PR_2 = +16m.28s., SR_1 = +26m.9s., M = +36·9m., T_0 = 10h.22m.24s. Barcelona PR_1 = +14m.28s., PR_2 = +16m.20s., SR_1 = +25m.58s., LN = +35·6m., MN = +40·5m., T_0 = 10h.22m.18s. Adelaide PR_1 = +14m.18s., SR_1 = +26m.18s., M = +43·6m. Coimbra MN = +44·0m. San Fernando S = +22m.23s., MN = +50·4m., T_0 = 10h.22m.16s. Melbourne PR_1 = +15m.5s., PR_2 = +17m.17s., SR_1 = +28m.23s., SR_2 = +32m.5s., SR_3 = +33m.23s. Riverview eP = +12m.17s., iP = +12m.41s., PR_1 = +15m.27s., PR_2 = +17m.23s., iS = +22m.26s., PS = +23m.0s., SR_1 = +27m.55s., SR_2 = +31m.5s., SR_3 = +33m.42s., T_0 = 10h.22m.12s. Honolulu gives its P as 5h.54m.12s., which was corrected by +5h. Victoria S = +32m.29s. Apia e = +32m.53s. Ottawa iN = +17m.53s., PR_1? = +18m.59s., i = +34m.23s., eL = +44·9m. Berkeley T_0? = 10h.28m.31s. Harvard PN? = +10m.20s., iN = +18m.53s., iE = +18m.55s., SN? = +24m.52s., eN = +33m.19s., eE = +33m.57s., eLN = +48·9m., LE = +49·3m. Toronto iS = +34m.17s., L = +39·3m., LE = +137·3m. Ithaca eN = +35m.5s., eE = +35m.11s. Washington PR_1? = +19m.41s., L = +56·9m. and +66·9m. St. Louis iE = +20m.47s., eLE = +58·4m. Tucson LN = +60·5m. Vieques PE = +23m.5s. La Paz SR_1 = +38m.13s. Andalgala MN = +105·5m.

This earthquake affords a good example of the difficulties which may attend the determination of precise elements, in spite of a wealth of material, and is accordingly worth special attention, if only to show cause why, in other cases when the material is only scanty, a solution may seem impossible. The fundamental characteristic of the observations is the difference in T_0 assigned by the near and far stations. For Simla and De Bilt the calculation of a correction to T_0 would stand thus :—

	△	P.	S—P	Add ¼	δ T_0
	°	s.	s.	s.	s.
Simla	13·8	−36	−10	−12	−24
De Bilt	67·5	+ 5	+ 2	+ 3	+ 2

[The argument is that since S−P = 0·8P approximately we can infer the proper value (−12s.) of the P residual by adding one quarter of the S−P residual, which is, of course, independent of T_0. The actual P residual −36s. can only be made to agree if we diminish T_0 by 24s.]

We may take these as representative of near and distant stations, and since the difference will be made still clearer presently, we need not dwell on it here, but may proceed to consider and clear out of the way possible corrections to the above solution.

The near stations indicate corrections to T_0, which are consistently negative, and if we include all the stations as far as Lemberg (△ = 56°) we find a mean value −13s. But since the more distant stations do not agree (though this may be due to error of tables) we will adopt a rather smaller value, say −10s. The anticentral residuals will then be [+7s.] and [+5s.], and we may assume a focal depth of −·010 (*i.e.*, ·010 above the standard. See Geop. Sup. to Mon. Not. Vol. I 1).

Station	△	Corr. for −·010	Obsd. δ△ P	Obsd. δ△ S	Az.	C	Final △	Residuals P	Residuals S
	°	°	°	°	°	°	°	s.	s.
Calcutta	5·2	0·0	−1·2	—	221	−0·7	4·5	− 7	—
Simla	13·8	+0·2	−2·1	−1·7	293	−0·9	13·1	−17	−19
Bombay	19·2	+0·4	−1·8	−1·9	251	−0·9	18·5	− 9	−19
Zi-ka-wei	26·1	+0·5	+0·5	—	73	+1·0	27·6	− 5	(−78)
Taihoku	26·6	+0·5	+0·1	+0·5	86	+1·0	28·1	− 9	− 8
Manila	29·5	+0·7	−0·9	+0·3	108	+1·0	31·2	−19	−12
Batavia	35·7	+0·8	−3·4	—	154	+0·4	36·9	−33	—
Kobe	37·7	+0·8	−0·1	—	67	+0·9	39·4	− 9	—
Osaka	38·0	+0·8	−0·3	−0·3	67	+0·9	39·7	−10	−17
Tokyo	41·4	+0·8	−0·2	—	67	+0·9	43·1	− 8	(−49)
Lemberg	56·1	+1·1	+0·9	+0·3	314	−0·7	56·5	+11	+12
Zagreb	61·9	+1·2	+0·2	−0·1	310	−0·8	62·3	+ 7	+ 9
De Bilt	67·5	+1·2	+1·1	+0·2	318	−0·7	68·0	+12	+11
Uccle	68·3	+1·2	+0·5	+0·2	317	−0·7	68·8	+ 7	+10
Paris	70·0	+1·3	+0·7	−0·7	316	−0·7	70·6	+ 9	0
Eskdalemuir	71·3	+1·3	+1·5	0·0	323	−0·6	72·0	+13	+ 7

The column △ is reproduced from the adopted solution. Then follows the correction to this △ for the high focus. Next the P and S residuals, corrected for 10s. error in T_0, are converted into corrections to the new △. (Thus, for Eskdalemuir, the new P and S are +11m.43s. and +20m.57s., corresponding to △ = 74°·1 and 72°·6, which exceed 71°·3 + 1°·3 by +1°·5 and 0°·0.) The Azimuth in the next column is reproduced from above, and on making a solution for x sin Az + y cos Az the values x = +1°·0 y = +0°·0 were found, represented in the column C; equivalent to moving the epicentre nearly 1° further west to 26°·5N. 91°·2E. The column "Final △" is then the sum of columns 2, 3, and 7, and if we now compare the observations of P and S (increased by 10s., as above) with their tabular values corresponding to the "Final △," we get the residuals of columns 9 and 10.

Now the systematic change between Tokyo and Lemberg is very clear. Let us omit from the first group the large −33s. for Batavia and the S residuals bracketed for Zi-ka-wei and Tokyo, which may be 1min. in error; even then the mean P residual is −10s. and S −15s., whereas for the six European stations the means are P = +10s. and S = +8s. There is a clear difference of some 20s. between the two sets. Does this mean that there were two shocks 20sec. apart, the first of which was noted by the near stations, but did not reach the far ones; but that the second shock being stronger was noted by them? There is one scrap of evidence in support of this view in the records hitherto received, but only one. Zi-ka-wei gives P at 10h.27m.56s. and PM at 10h.28m.24s., indicating that a maximum follows the first P at an interval of 28sec. If this represents a second shock the commencement probably precedes this M by a few seconds, and we may take the interval as perhaps 22sec. Let us adopt this hypothesis for trial, adopting

T_0 = 10h.21m.45s. and T_1 = 10h.22m.7s. (as adopted).

The question now arises, which of these is applicable to the anticentral stations? As they are most distant of all, it should be T_1 rather than T_e; in which case the idea of a high focus gets no support from the observations at anticentral stations, since the residuals will be as printed in the main solution, viz., [−3s.] and [−5s.]. On the other hand, if for some reason the first shock at T_e penetrates through the earth to the anticentral stations the residuals will be such large positive quantities [+19s.] and [+16s.] that we should expect a higher focus still, say −·020 instead of −·010. Nevertheless, on trial it was found that no substantial alteration could be made in the solution just found, with an epicentre at 26°·5N. 91°·2E. with focus ·010 *above* normal. It is even unnecessary to give the figures, for they are very similar to those just given, except that as a consequence of the two values for T_e the residuals in the last column down to Tokyo must be increased by 12sec. and those below decreased by 10sec. We thus give as a definite solution:

Epicentre **26°·5N. 91°·2E.**
Focus **·010 above** normal.

Two shocks: the earlier one at **July 8d. 10h. 21m. 45s.** reaches stations within $\Delta = 50°$ only, and possibly those near the anticentre. The second and stronger at **July 8d. 10h. 22m. 7s.** reaches stations outside this radius.

July 8d. Records also at 1h. (La Quiaca, Andalgala, and Cipolletti), 2h. (Taihoku), 4h. (La Paz and Pilar), 7h. (Andalgala), 11h. (Rocca di Papa), 15h. (Pompeii and Manila), 16h. (La Paz), 17h. (Zagreb), 21h. (San Fernando).

July 9d. 1h. 55m. 40s. Epicentre 9°·3N. 129°·3E. (as on 1913 April 24d. 10h.).

$A = -·625$, $B = +·764$, $C = +·162$; $D = +·774$, $E = +·633$;
$G = -·102$, $H = +·125$, $K = -·987$.

An alternative solution would be $T_e = 1h.55m.26s.$, with epicentre 6°·5N.128°·0E. as on 1917 June 6d. and 1918 July 15d. 16h. This suits Batavia better, but Zi-ka-wei not so well.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		9·7	304	e 2 29	+ 3	4 32	+11	5·2	5·4
Zi-ka-wei		23·1	343	e 5 18	0	e 9 22	− 5	—	—
Batavia		27·3	236	e 5 20	−41	—	—	—	10·3
Colombo		49·0	271	29 20	?L	—	—	(29·3)	32·3
Honolulu		70·6	71	22 8	?S	(22 8)	+95	35·3	37·3
Helwan		92·1	301	24 20	?S	(24 20)	−16	—	—
De Bilt	N.	102·3	329	—	—	—	—	e 54·3	56·8
	E.	102·3	329	—	—	—	—	e 55·3	57·2
Eskdalemuir		104·3	334	—	—	—	—	49·3	—
Paris		105·5	327	—	—	—	—	e 57·3	—

Additional record: Manila gives MN = +5·5m., $T_e = 1h.55m.38s.$

July 9d. 14h. 1m. 10s. Epicentre 37°·5N. 19°·7E. (as on 1917 Nov. 28d.).

$A = +·747$, $B = +·267$, $C = +·609$; $D = +·337$, $E = -·941$;
$G = +·573$, $H = +·205$, $K = -·793$.

It seems clear that this shock cannot be from the focus of July 11d. 9h. 48m., since the Athens record is relatively later and the following stations are relatively earlier.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	3·2	81	0 59	+ 9	1 35	+ 7	1·8	2·3
Pompeii	5·2	310	i 1 22	+ 2	e 2 36	+14	—	4·8
Monte Cassino	6·0	312	1 53	+21	—	—	—	—
Rocca di Papa	6·8	311	1 32	−12	—	—	—	4·5
Zagreb	8·8	341	e 1 55	−18	i 3 49	− 9	—	4·4
Triest	9·2	333	e 3 8	+49	4 50	?L	(4·8)	—
Graz	10·0	343	e 2 20	−10	—	—	—	—
Vienna	11·0	348	e 3 20	+36	—	—	—	—
Paris	16·8	318	—	—	—	—	9·8	—
De Bilt	17·8	329	—	—	—	—	8·8	—

Additional records: Athens gives MN = +2·0m., $T_e = 14h.1m.23s.$ Zagreb 1 = +3m.36s., MNW = +4·5m. De Bilt LN = +9·2m.

July 9d. Records also at 3h. (Batavia, Manila, and Zi-ka-wei), 5h. (Andalgala, Cipolletti, and Riverview), 8h. (Taihoku), 9h. (Zi-ka-wei and Taihoku (3)), 12h. (Riverview), 13h. (La Paz and Monte Cassino), 14h. (Budapest and Moncalieri), 20h. (Melbourne and San Fernando).

July 10d. Records at 2h. (Manila), 9h. (Tokyo), 11h. and 13h. (La Paz), 16h. (Uccle), 21h. (Manila), 23h. (San Fernando).

July 11d. 9h. 48m. 5s. Epicentre 38°·0N. 21°·5E.

A = +·733, B = +·289, C = +·616; D = +·366, E = −·930; G = +·573, H = +·226, K = −·788.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	1·8	91	0 29	+ 1	—	—	0·7	0·8
Pompeii	6·1	299	i 1 37	+ 4	i 2 44	− 2	—	4·4
Monte Cassino	6·9	303	1 49	+ 4	—	—	—	4·8
Rocca di Papa	7·7	302	1 56	− 1	3 23	− 6	—	5·4
Zagreb	8·8	334	i 2 14	+ 1	—	—	i 4·5	5·6
Pola	8·9	322	e 2 10	− 5	(e 3 46)	−15	e 3·8	5·6
Budapest	9·6	350	2 21	− 3	—	—	—	—
Graz	10·1	336	e 2 33	+ 2	—	—	—	—
Vienna z.	10·9	341	e 2 25	−18	—	—	—	—
Helwan	11·5	132	5 55	?L	—	—	(5·9)	—
Lemberg	11·9	8	e 5 43	?L	—	—	(5·7)	6·7
Moncalieri	12·4	308	e 3 8	+ 3	5 31	+ 2	7·1	8·8
Zurich	13·3	319	e 3 13	− 4	5 35?	−16	—	—
Hohenheim	13·9	325	i 3 16	− 9	—	—	—	—
Tortosa	16·4	287	4 3	+ 6	6 54	−10	7·6	14·8
Paris	17·4	314	i 4 8	− 2	i 7 29	+ 2	—	—
Uccle	17·6	322	e 4 8	− 4	e 7 25	− 6	—	—
De Bilt	18·1	326	4 17	− 1	7 45	+ 3	8·9	—
Bidston	22·9	320	—	—	8 49	−34	—	16·6
Eskdalemuir	24·0	324	5 14	−14	9 25	−19	11·3	—
Edinburgh	24·3	325	9 55	?S	(9 55)	+ 5	—	—

Additional records: Rocca di Papa gives MN = +5·9m. Zagreb iPNW = +2m.8s., i = +2m.20s., +2m.44s., and +3m.26s. Pola MN = +5·9m. Moncalieri MN = +9·6m., T_0 = 9h.48m.18s. De Bilt i = +8m.6s., T_0 = 9h.48m.4s.

July 11d. Records also at 3h. (La Paz), 4h. (Taihoku), 8h. (La Paz), 14h. (La Paz and Calcutta), 16h. (La Paz), 17h. (Calcutta, Helwan, and Bombay), 21h. (Riverview and Melbourne), 22h. (Honolulu, La Paz, San Fernando, and De Bilt), 23h. (Helwan).

July 12d. Records at 0h. (Lick, Tokyo, and Mizusawa), 1h. (Calcutta), 2h. (Mizusawa), 5h. (La Paz), 15h. (Colombo and De Bilt), 19h. (Rocca di Papa and Apia), 20h. (Helwan), 21h. (Georgetown, Washington, and Ottawa), 23h. (San Fernando and Lick (2)).

July 13d. Records at 12h. (Paris), 13h. (Zagreb and Rocca di Papa), 14h. (Lick), 17h. (Rocca di Papa).

July 14d. Records at 0h. (La Paz, Apia, and Rio Tinto), 1h. (San Fernando), 4h. (Osaka), 7h. (Taihoku), 9h. (Tokyo), 13h. (Zi-ka-wei), 18h. (Tucson, Georgetown, Ottawa, and Harvard), 19h. (Colombo), 22h. (Mizusawa).

1918. July 15d. 0h. 22m. 53s. Epicentre 41°·1N. 126°·6W.

A = −·449, B = −·605, C = +·657 ; D = −·803, E = +·596 ;
G = −·392, H = −·528, K = −·754.

Discussion of the residuals suggests moving the epicentre further east and a little south, say to 40°·7N. 125°·0W., which would reduce the negative residuals in the eastern States.

Station and Component.	Machine.	△	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Berkeley E.	—	4·6	134	i 1 8	− 3	—	—	e 2·1?	4·2
N.	—	4·6	134	i 1 8	− 3	—	—	e 2·1?	3·7
V.	—	4·6	134	i 1 7	− 4	e 2 0	− 6	e 2·2	2·7
Lick	W.	5·3	132	e 1 19	− 3	—	—	e 2·6	4·1
Victoria	M.	7·7	17	2 32	+35	—	—	4·0	6·0
Z.	—	7·7	17	2 7	+10	3 53	+24	5·8	6·3
Tucson N.	B.O.	15·3	120	3 49	+ 6	6 44	+ 5	8·0	9·6
E.	B.O.	15·3	120	3 49	+ 6	6 48	+ 9	7·9	10·3
Sitka N.	B.O.	16·9	343	4 21	+17	—	—	7·7	9·0
E.	B.O.	16·9	343	4 23	+19	—	—	7·9	8·6
Saskatoon	Ma.	18·0	46	i 4 6	−11	i 7 21	−19	e 8·5	—
Lawrence	W.	24·0	85	e 5 21	− 7	9 57	+13	12·6?	13·1
St. Louis N.	W.	27·8	83	i 5 49	−17	i 10 37	−18	e 12·1	16·3
E.	W.	27·8	83	i 5 52	−14	—	—	e 16·2	—
Ann Arbor E.	W.	31·7	73	6 31	−13	—	—	16·8	20·3
N.	W.	31·7	73	6 31	−13	—	—	16·6	19·1
E.	B.	31·7	73	6 13	−31	—	—	17·9	20·1
N.	B.	31·7	73	6 25	−19	13 7	+64	17·1	18·7
Honolulu	M.	33·1	243	7 7	+10	—	—	14·2	17·1
Toronto	M.	34·5	70	—	—	i 12 7	−41	i 18·8	22·0
Ottawa	—	36·7	66	i 7 10	−18	i 12 49	−31	e 16·1	21·1
Washington	Mar.	37·5	76	7 16	−18	12 59?	−32	16·5	20·7
Georgetown N.	—	37·5	76	e 7 21	−13	e 13 17	−14	e 16·8	21·2
E.	—	37·5	76	i 7 18	−16	e 13 10	−21	e 16·8	21·2
Cheltenham N.	B.O.	37·7	77	7 36	0	13 24	−10	e 19·1	21·5
E.	B.O.	37·7	77	7 31	− 5	13 19	−15	18·8	23·6
Northfield	B.O.	39·1	67	7 10?	−37	13 18?	−35	e 20·0	24·6
Harvard E.	B.O.	40·6	69	e 7 22	−38	13 25	−50	—	21·3
N.	B.O.	40·6	69	7 38	−22	13 47	−28	e 19·1	22·1
Edinburgh	M.	71·8	30	20 7	?S	(20 7)	−41	—	40·6
Dyce N.	Ma.	71·8	28	e 11 49	+21	i 20 54	+ 6	34·1	44·5
Eskdalemuir	G.	72·2	30	11 36	+ 5	21 7	+15	33·1	—
Bidston	M.S.	73·7	31	11 37	− 3	20 19	−51	—	45·1
Stonyhurst	M.	73·7	30	22 13	?S	31 49	?	38·5	42·1
Kew	M.	76·3	31	—	—	—	—	—	46·1
Shide	—	76·5	32	21 46	?S	(21 46)	+ 3	33·6	48·6
De Bilt N.	—	77·8	28	12 10	+ 4	22 3	+ 5	33·1	38·5
E.	—	77·8	28	12 12	+ 6	—	—	34·1	36·3
Uccle	—	78·6	29	e 12 7	− 4	e 22 7	0	e 35·1	44·1
La Paz	Bi.	78·9	124	12 17	+ 5	22 15	+ 4	41·6	44·6
Paris	—	79·5	31	e 12 38	+22	i 22 19	+ 1	33·1	39·1
Zurich	—	83·0	29	e 12 34	− 2	—	—	—	—
Rio Tinto	M.	84·0	44	—	—	—	—	—	48·1
Zi-ka-wei	—	84·3	309	—	—	e 23 51	+40	—	—
Moncalieri	S.	84·7	31	12 57	+11	23 16	0	35·5	50·1
Tortosa	—	84·9	37	12 43	− 4	23 7	−11	37·6	46·9
Vienna	—	84·9	24	—	—	—	—	e 37·1	—
Barcelona	—	85·3	36	—	—	e 22 8	−74	33·4	50·2
San Fernando	—	85·5	44	30 7	?SR_1	—	—	43·1	46·1
Lemberg	B.O.	85·5	18	—	—	e 23 19	− 6	e 44·3	49·7
Zagreb	W.	86·9	25	e 13 1	+ 3	e 23 29	−11	46·1	53·1
Pola	W.	87·0	27	—	—	e 24 7	+26	e 40·7	52·8
Rocca di Papa	Ag.	89·3	29	e 13 12	0	e 24 2	− 4	e 47·9	—
Ag.	89·3	29	e 13 7	− 5	e 24 12	+ 6	e 44·3	50·3
Algiers	B.M.	89·5	38	—	—	e 23 33	−36	46·1	48·6
Pompeii	O.A.	90·9	28	i 16 11	?PR_1	i 24 16	− 7	—	—
Cipolletti	M.	96·1	138	51 37	?L	—	—	53·9	61·4
Manila	W.	96·5	296	—	—	23 35	?	—	—
Helwan	M.	106·2	20	28 7	?S	(28 7)	+73	—	—
Melbourne	M.	112·8	239	e 36 37	?SR_1	—	—	—	63·7

For Notes see next page.

NOTES TO JULY 15d. 0h. 22m. 53s.

Additional records: Saskatoon gives T_0 = 0h.22m.56s., Toronto iL = +21·3m. Ottawa T_0 = 0h.22m.55s. Harvard SR_1 = +16m.25s., and SR_2 = +16m.57s., T_0 = 0h.22m.29s. De Bilt T_0 = 0h.23m.8s. La Paz SR_1 = +27m.15s., T_0 = 0h.23m.10s. Moncalieri MN = +47·4m., T_0 = 0h.23m.29s. Barcelona LN = +36·2m., MN = +53·5m. San Fernando MN = +48·6m. Zagreb iP = +13m.21s., MNW = +52·1m. Pola MN = +54·4m.

July 15d. 16h. 18m. 36s. Epicentre 6°·5N. 128°·0E. (as on 1917 June 6d.).

A = −·612, B = +·783, C = +·113; D = +·788, E = +·616; G = −·070, H = +·089, K = −·994.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	10·7	320	e 2 39	− 1	4 45	− 3	5·3	6·4
Zi-ka-wei	25·5	347	—	—	—	—	e 8·3	—
Osaka	29·0	13	6 12	− 6	—	—	—	—
Mizusawa	34·7	17	—	—	—	—	25·3	—
Helwan	92·6	301	33 24	?L	—	—	(33·4)	—
Rocca di Papa	104·0	317	—	—	—	—	e 57·4	—
De Bilt N.	104·0	329	—	—	25 11	−82	47·4	51·9
E.	104·0	329	—	—	—	—	51·4	53·0
Edinburgh	105·8	336	52 24	?L	—	—	(52·4)	—
Moncalieri	105·9	321	—	—	—	—	e 54·4	—
Paris	107·1	327	—	—	—	—	e 58·4	—
Bidston	107·4	332	57 54	?L	—	—	(57·9)	64·8

Additional records: Manila gives MN = +6·2m. Mizusawa gives L = +25·6m.

July 15d. Records also at 0h. (Tokyo (2)), 5h. (Zurich and La Paz), 7h. (Tokyo), 11h. (Algiers), 18h. (La Paz), 19h. (Moncalieri), 20h. (Kodaikanal), 23h. (De Bilt).

July 16d. 11h. 49m. 42s. Epicentre 45·°5N. 15°·0E. (as on 1916 July 14d.).

A = +·677, B = +·181, C = +·713.

	Δ	P.	O−C.	S.	O−C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Zagreb	0·8	e 0 14	+ 2	0 25	+ 3	—	0·4
Triest	0·9	0 14	0	—	—	—	—
Pola	1·0	e 0 25	?S	(e 0 25)	− 3	0·7	0·8
Graz	1·6	0 27	+ 2	—	—	—	—
Vienna E.	2·9	e 0 48	+3	—	—	—	—
Rocca di Papa	4·1	e 1 30	+26	—	—	—	1·9
De Bilt	9·2	—	—	—	—	e 5·0	—

Zagreb gives i = +20s.

1918. July 16d. 20h. 3m. 36s. Epicentre 36°·3N. 26°·3E.

A = +·722, B = +·357, C = +·592; D = +·443, E = −·897; G = +·531, H = +·262, K = −·806.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Athens	—	2·6	311	i 1 0	+19	i 1 29	+15	1·6	1·8
Helwan	M.	7·7	145	1 54	− 3	—	—	—	7·9
Pompeii	O.A.	10·2	299	i 2 4	−29	i 3 49	−46	—	5·8
Monte Cassino	—	11·0	302	2 55	+11	—	—	—	—
Rocca di Papa	Ag.	11·9	302	e 3 1	+ 3	—	—	e 7·7	—
	P.O.	11·9	302	i 3 7	+ 9	5 16	− 1	—	9·1
Zagreb	W.	12·2	324	e 3 7	+ 5	i 5 12	−12	i 6·0	7·0
Pola	W.	12·7	316	e 3 17	+ 8	(e 5 30)	− 7	e 5·5	9·2
Lemberg	B.O.	13·6	354	e 3 21	0	e 6 6	+ 8	—	7·4
Vienna Z.	—	14·0	332	i 3 32	+ 6	—	—	—	—
Milan	—	15·8	311	3 53	+ 4	—	—	—	9·1
Moncalieri	S.	16·5	308	4 2	+ 3	6 44	−23	10·2	13·6
Zurich	—	17·2	316	i 4 10	+ 3	7 24	+ 2	—	—
Marseilles	—	17·5	300	i 4 21	+10	i 7 39	+10	—	—

Continued on next page.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Algiers	B.M.	18·6	278	4 1	−23	7 51	− 2	14·4	22·4
Besançon	—	18·6	312	3 27	−57	6 55	−58	—	—
Barcelona	—	19·4	293	i 4 28	− 6	i 8 11	+ 1	—	—
Tortosa	—	20·6	291	4 47	− 1	8 34	− 2	10·8	16·0
Paris	—	21·4	313	i 4 56	− 2	i 8 50	− 3	11·4	13·4
Uccle	—	21·4	320	i 4 53	− 5	8 50	− 3	—	—
De Bilt	—	21·7	323	i 4 59	− 2	8 56	− 3	10·6	12·6
Kew	M.	24·2	317	—	—	—	—	—	9·4
Shide	—	24·4	315	5 23	− 9	9 52	0	—	—
San Fernando	—	26·1	280	6 54	+65	—	—	11·4	18·4
Stonyhurst	M.	26·5	320	i 6 54	+61	i 12 24	?L	(12·4)	15·9
Bidston	M.S.	26·6	320	5 36	−18	10 18	−15	—	—
Eskdalemuir	G.	27·6	323	5 52	−12	—	—	14·9	—
Edinburgh	M.	27·9	324	5 39	−28	—	—	—	22·4
Dyce N.	—	28·2	327	e 6 56?	+46	e 11 54?	+51	16·7	22·9
E.	—	28·2	327	e 6 52?	+42	11 54	+51	16·7	22·4
Colombo	M.	56·8	108	16 24	?S	(16 24)	−80	—	37·4
Cape Town	M.	70·6	187	36 48	?L	—	—	(36·8)	43·0
Ottawa	—	72·3	314	e 11 30	− 2	(e 20 48?)	− 6	25·5?	—
Toronto	M.	75·5	314	—	—	—	—	44·5	—
Zi-ka-wei	—	75·8	62	e 12 35	+41	—	—	—	—
Washington	Mar.	76·8	309	17 19	?PR_1	21 42?	− 5	—	—
Georgetown	—	76·8	309	e 17 51	?PR_1	(e 21 42?)	− 5	e 21·7?	—
Osaka	O.	83·1	52	12 52	+15	—	—	—	—
Manila	—	85·1	75	—	—	—	—	—	23·0
Batavia	W.	86·1	101	e 22 24	?S	(e 22 24)	−67	—	—
Victoria	M.	91·1	340	—	—	—	—	—	46·9
La Paz	Bi.	103·2	259	16 45	?	—	—	e 43·4	—

Additional records: Athens gives M = +2·2m. Rocca di Papa iL = +3·1m., M = +5·7m. Zagreb i = +3m.21s. and +4m.33s., MNW = +9·6m. Pola MN = +9·3m. Moncalieri MN = +11·3m. Algiers gives its record as at 18d., but the record assigned to it by De Bilt is at 20d., so that it is almost certainly a misprint. Paris M = +15·4m., T_0 = 20h.3m.40s. Uccle i = +4m.55s. and +9m.26s., T_0 = 20h.3m.32s. De Bilt m = +9m.1s., T_0 = 20h.3m.38s. San Fernando MN = +18·9m. Ottawa gives S as eL? and e = +14m.0s. Toronto L = +47·0m. Triest T_0 = 20h.3m.34s. Graz T_0 = 20h.3m.49s.

July 16d. Records also at 1h. (San Fernando), 2h. (Batavia), 4h. (Paris), 10h. (La Paz), 11h. (Rocca di Papa), 15h. (Tokyo), 18h. (Rocca di Papa and Riverview), 19h. (Calcutta), 20h. (Osaka and Rocca di Papa), 21h. (Zi-ka-wei and Tokyo), 22h. (San Fernando and Tokyo), 23h. (La Paz, De Bilt, Riverview, Toronto, Victoria, and Cipolletti).

July 17d. Records at 0h. (Manila, Tokyo, Bidston, Edinburgh, Helwan, and Lick (2)), 13h. (Manila), 14h. (De Bilt), 15h. (Balboa Heights and Apia), 16h. (Manila), 18h. (La Paz).

July 18d. 21h. 5m. 5s. Epicentre 36°·5N. 19°·7E.

A = +·757, B = +·271, C = +·595.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	3·5	66	0 51	− 4	1 27	−10	1·6	1·7
Pompeii	5·9	318	e 1 24	− 7	e 2 44	+ 3	—	—
Rocca di Papa	7·5	317	e 1 38	−16	—	—	—	4·0
Zagreb	9·7	345	e 2 57	+31	—	—	—	4·5
Moncalieri	12·4	317	—	—	—	—	e 5·7	—

July 18d. Records also at 0h. (San Fernando), 2h. (Manila), 6h. (Lick), 10h. (Manila), 12h. (La Paz), 13h. (La Paz), 14h. (Kew and Helwan), 22h. (Manila), 23h. (La Paz).

July 19d. 19h. 1m. 0s. Epicentre 45°·6N.10°·2E.

A = +·689, B = +·124, C = +·715 ; D = +·177, E = −·984 ;
G = +·704, H = +·127, K = −·700.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Moncalieri	1·9	251	0 27	− 2	0 49	− 4	—	—
Zurich	2·1	327	e 0 26	− 7	i 1 2	+ 4	—	1·1
Pola	2·7	108	e 0 46	+ 4	—	—	1·1	1·3
Zagreb	4·0	85	e 0 56	− 6	—	—	1·8	2·2
Rocca di Papa	4·3	153	e 1 11	+ 4	—	—	—	2·2

Additional records : Zagreb gives iP = +0m.59s., MNW = +1·1m. Zurich ePE = +0m.23s., ePV = +0m.29s., MN = +1·2m.

July 19d. Records also at 0h. (San Fernando), 12h. (Apia), 13h. (Edinburgh), 20h. (Mizusawa and La Paz), 21h. (Balboa Heights), 23h. (Lick (2)).

July 20d. Records at 2h. (San Fernando), 6h. (Bidston and Tokyo), 8h. (Kew), 9h. (La Paz), 11h. (La Paz and Batavia), 12h. (Manila), 13h. (Manila and Paris), 14h. (Paris), 15h. Manila) (2)), 17h. (Manila), 18h. (Helwan and Mizusawa), 21h. (De Bilt and Melbourne).

1918. July 21d. 6h. 9m. 25s. Epicentre 7°·0S. 155°·0E.

(as on 1916 Sept. 3d. and 1917 Dec. 20d., etc.)

A = −·900, B = +·420, C = −·122 ; D = +·423, E = +·906 ;
G = +·111, H = −·052, K = −·993.

The T_0 adopted is about the mean of some rather discordant determinations, but the anticentral stations suggest that it should be increased by about 15s., which would accord with Perth, Mizusawa, and Zi-ka-wei if an error of one minute is assumed in the last.

Station and Component.		Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
			°	°	M. S.	S.	M. S.	S.	M.	M.
Riverview		—	27·1	187	e 5 47	−12	i 10 35	+ 8	12·3	15·8
Sydney		—	27·1	187	6 5	+ 6	9 41	−62	10·9	14·9
Adelaide		M.	31·8	206	7 0	+15	11 53	−12	16·0	20·0
Melbourne		M.	32·1	195	2 5	?	8 35	? PR_1	15·5	16·3
Apia		W.	33·4	105	i 6 48	−12	e 12 35	+ 5	e 14·6	15·1
Manila		W.	40·1	303	e 7 58	+ 2	13 4	−64	14·2	15·0
Perth		M.	44·1	230	8 24	− 3	14 54	− 9	22·2	27·2
Tokyo		O.	45·0	344	8 48	+15	—	—	e 22·7	—
Osaka		O.	45·6	337	9 0	+23	—	—	20·2	24·0
Taihoku		O.	45·7	316	8 57	+19	15 31	+ 7	21·2	27·9
Batavia		W.	47·9	267	e 8 35	−18	—	—	—	28·6
Mizusawa	N.	O.	47·9	345	8 59	+ 6	16 2	+ 9	—	—
	E.	O.	47·9	345	9 3	+10	15 58	+ 5	—	—
Zi-ka-wei		—	49·9	322	e 10 24	+78	e 17 34	+76	—	32·8
Honolulu		M.	54·2	57	8 41	−53	16 53	−18	23·6	27·6
Ootomari		O.	54·8	350	16 58	? S	(16 58)	−21	—	—
Colombo		M.	76·3	279	11 29	−28	(21 17)	−24	21·3	30·2
Kodaikanal		M.	79·1	283	20 5	?	—	—	22·6	53·4
Simla		O.E.	83·3	303	—	—	e 23 11	+11	—	23·3
Bombay		O.E.	85·0	290	13 0	+12	—	—	—	—
Sitka	N.	B.O.	85·1	31	—	—	e 29 46	? SR_1	—	—
Berkeley		—	88·6	52	—	—	e 23 35	−24	—	—
Lick		W.	89·0	52	—	—	e 29 35	? SR_1	—	—
Victoria		M.	89·8	41	24 1	? S	(24 1)	−11	42·2	59·9
Tucson	E.	B.O.	97·3	58	17 50	? PR_1	26 25	+56	45·2	51·2
St. Louis		W.	113·7	51	20 5?	? PR_1	—	—	55·8	66·6
Ann Arbor	E.	B.	117·7	45	29 59	? S	40 17	? SR_1	59·3	64·6
	N.	B.	117·7	45	30 17	? S	—	—	60·6	68·6
	E.	W.	117·7	45	30 5	? S	—	—	59·6	54·6
	N.	W.	117·7	45	29 59	? S	—	—	61·6	—

Continued on next page.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Cipolletti	M.	119·1	142	21 23	?PR$_1$	—	—	66·4	97·4
Toronto	M.	120·1	43	21 53?	?PR$_1$	31 5	+135	55·9	73·5
Lemberg	B.O.	120·9	325	20 41	?PR$_1$	—	—	50·6	71·0
Cape Town	M.	121·9	222	30 41	?S	(30 41)	+98	—	72·6
Ottawa	—	121·9	40	20 39?	?PR$_1$	30 31?	+88	53·6	—
Helwan	M.	122·5	301	20 35	?PR$_1$	—	—	—	—
Ithaca E.	B.O.	122·6	43	e 37 13	?SR$_1$	—	—	e 58·0	—
Washington	Mar.	123·4	47	e 17 5	+66	(e 30 55)	+100	55·6	—
Georgetown	—	123·4	47	e 20 50	?PR$_1$	30 50	+95	55·6	—
Cheltenham	B.O.	123·8	48	—	—	—	—	63·4	69·6
Dyce	Ma.	124·1	347	21 7	?PR$_1$	38 41	?	70·6	82·2
Northfield	B.O.	124·5	40	—	—	—	—	e 63·6	—
Budapest E.	—	125·0	325	25 35	?	—	—	—	—
Vienna E.	—	126·0	327	e 19 17	?	—	—	—	—
Harvard	B.O.	126·3	41	(e 21 7)	?PR$_1$	i 30 50	+75	e 58·9	65·3?
Pilar	M.	126·4	138	22 23	?PR$_1$	—	—	69·9	99·9
Andalgala N.	M.	127·2	133	25 23	?	—	—	73·9	88·1
E.	M.	127·2	133	25 53	?	—	—	73·8	79·7
Graz	W.	127·2	326	e.19 34	[+22]	—	—	—	—
Zagreb	W.	127·6	325	e 24 35	?	—	—	63·6	67·6
Chacarita	M.	127·7	145	25 53	?	—	—	66·9	75·4
Edinburgh	M.	128·1	345	21 35	?PR$_1$	—	—	—	92·6
De Bilt E.	—	128·6	337	e 21 46	?PR$_1$	e 22 50	?PR$_1$	e 59·6	61·4
N.	—	128·6	337	—	—	e 22 52	?PR$_1$	e 63·6	66·0
Eskdalemuir	G.	128·7	344	19 28	[+13]	—	—	—	—
Triest	W.	128·9	326	22 45	?PR$_1$	—	—	—	—
Pola	W.	129·3	325	22 51	?PR$_1$	(e 41 35)	?SR$_1$	e 41·6	68·7
Stonyhurst	M.	129·8	343	i 22 29	?PR$_1$	i 38 47	?SR$_1$	i 66·3	82·2
Uccle	—	129·9	336	e 19 5	[−13]	—	—	e 59·6	70·6
Bidston	M.S.	130·3	343	19 47	[+28]	—	—	—	79·5
La Quiaca	M.	130·7	127	26 23	?	—	—	—	—
Zurich	—	130·7	330	e 19 23	[+ 3]	30 15?	+10	—	—
Kew	M.	131·1	340	—	—	—	—	—	95·6
La Paz	Bi.	131·3	119	19 39	[+17]	33 39	?	60·6	69·2
Pompeii	M.	131·3	320	18 33	?	—	—	—	—
Rocca di Papa	Ag.	131·7	322	19 29	[+ 7]	23 0	?PR$_1$	69·0	86·9
Shide	—	132·0	340	23 3	?	—	—	58·7	79·5
Paris	—	132·1	337	i 25 35	?	—	—	66·6	81·6
Moncalieri	S.	132·6	329	19 37	[+13]	33 28	?	63·8	80·9
Barcelona	—	137·9	329	23 18	?PR$_1$	(e 41 52)	?SR$_1$	69·8	85·6
Tortosa	—	139·2	330	18 9	?	23 23	?PR$_1$	—	—
Algiers	B.M.	140·7	323	e 19 37	[− 3]	—	—	47·6	83·6
Coimbra N.	—	143·6	339	17 48?	+23	33 0?	+96	e 52·6	—
E.	—	143·6	339	19 52	[+ 6]	29 8?	−136	62·6	—
Rio Tinto	M.	145·0	334	18 35	+64	—	—	—	111·6
San Fernando	—	145·9	332	—	—	—	—	87·6	113·6

Additional records: Riverview gives iP = +6m.8s., i = +6m.39s., iPR$_1$? = +6m.58s., PS = +10m.56s., MN = +16·8m., MZ = +17·1m. Epicentre 6°·0S. 153°·0E., T° = 6h.9m.10s. Adelaide PR$_1$ = +7m.53s. Melbourne SR$_1$ = +11m.53s., ?S. Apia iP = +6m.43s., M = +18·6m. Manila MN = +15·2m. Perth SR$_1$ = +18m.7s. Tokio gives L one hour early. Osaka MN = +27·1. Colombo M = +57·8m. Victoria S = +31m.14s. (?SR$_1$). St. Louis eLN = +45·6m. Toronto L = +46·3m. and L = +69·2. Ottawa eL = +45·6m., T$_0$ = 6h.18m.10s. Ithaca eN = +37m.12s., eLN = +54·3m. Washington eL = +30·9m. (?S) and +67·6m. Cheltenham LN = +62·3m., MN = +71·6m. Northfield L = +75·6. Zagreb e = +53m.35s., De Bilt epicentre 6°·0S. 153°·0E. Pola MN = +68·9m. Uccle ePR$_1$ = +22m.53s. La Paz PR$_1$ = +23m.1s. Moncalieri MN = +85·5m. Barcelona records SR$_1$ as L. San Fernando MN = +106·6m.

July 21d. 9h. 44m. 25s. Epicentre 7°·0S. 155°·0E. (as at 6h.).

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview		27·1	187	e 5 59	0	(10 45)	+ 2	13·4	16·9
Adelaide		31·8	206	11 38	?S	(11 38)	−27	20·1	22·3
Melbourne		32·1	195	—	—	—	—	16·2	20·4
Manila		40·1	303	e 7 56	0	(14 53)	+45	14·9	—
Perth		44·1	230	9 5	+38	17 4	?	26·2	—
Mizusawa	E.	47·9	345	8 55	+ 2	16 26	+33	—	—
	N.	47·9	345	9 34	+41	16 12	+19	—	—
Batavia		47·9	267	e 8 35	−18	—	—	—	—
Honolulu		54·2	57	16 47	?S	(16 47)	−24	26·1	27·6
Colombo		76·3	279	46 35	?L	—	—	(46·6)	58·1
Victoria		89·8	41	—	—	—	—	—	56·4
Mauritius		94·2	249	31 35	?SR_1	—	—	—	41·2
Toronto		120·1	43	—	—	—	—	—	77·5?
Ottawa		121·9	40	—	—	—	—	e 61·6	—
Zagreb		127·6	325	18 35	[−38]	e 22 35	?PR_1	65·6	—
De Bilt		128·6	337	—	—	—	—	65·6	70·3
Bidston		130·3	343	40 47	?SR_1	—	—	—	74·0
La Paz		131·3	119	22 52	?PR_1	—	—	—	—
Paris		132·1	337	e 24 35	?	—	—	69·6	—
Rio Tinto		145·0	334	85 35	?L	—	—	(85·6)	110·6

Additional records: Riverview gives eS = +10m.13s., SR_1 = +12m.9s., MN = +19·1m. The S in the table is given as PS. Adelaide S = +17m.13s., M = +23·3m. Perth PR_1 = +13m.48s.

July 21d. Records also at 3h. (Osaka, Mizusawa, Tokyo, and La Paz), 4h. (Helwan, Bidston, and De Bilt), 5h. (Tokyo), 7h. (Zagreb), 13h. (La Paz), 14h. (La Paz and Taihoku), 19h. (Mizusawa), 23h. (Manila).

July 22d. Records at 0h. (San Fernando), 4h. (Manila (2)), 5h. (Melbourne, Riverview, and Tokyo (?)), 12h. (Pola, Rocca di Papa, and Zagreb), 13h. (Zagreb), 16h. (Rio Tinto), 23h. (Tokyo).

July 23d. 13h. 22m. 17s. Epicentre 4°·5S. 152°·0E. (as on 1917 Sept. 24d. 20h.).

A = −·880, B = +·468, C = −·079; D = +·470, E = +·883; G = +·069, H = −·037, K = −·997.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview		29·2	182	e 3 49?	−151	10 13	−67	e 15·2	16·9
Sydney		29·2	182	7 31	+71	12 1	+41	15·2	17·2
Melbourne		33·9	190	—	—	12 43	+ 4	—	21·7
Manila		36·2	302	e 13 0	?S	(e 13 0)	−13	—	19·2
Perth		43·5	227	—	—	(14 5)	−50	23·7	—
Zi-ka-wei		46·1	323	e 8 46	+ 5	—	—	—	—
Honolulu		55·3	60	17 7	?S	(17 7)	−18	24·7	29·7
Berkeley		89·4	52	—	—	—	—	e 40·7	—
Victoria		89·9	41	—	—	—	—	45·2	56·0
Mauritius		92·2	250	42 43	?L	—	—	(42·7)	—
Helwan		118·7	302	74 43	?L	—	—	(74·7)	—
Toronto		120·2	40	—	—	—	—	65·1	75·5
Ottawa		121·8	38	—	—	—	—	e 62·7	—
Graz		123·4	326	—	—	—	—	e 67·7	—
Edinburgh		125·0	343	67 43	?L	—	—	(67·7)	—
De Bilt	N.	125·1	336	—	—	e 31 5	+98	e 64·7	72·7
	E.	125·1	336	—	—	—	—	e 66·7	67·0
Eskdalemuir		125·5	343	—	—	—	—	74·9	—
Stonyhurst		126·5	342	—	—	—	—	—	80·3
Rocca di Papa		128·1	322	—	—	—	—	69·1	—
Paris		128·7	335	—	—	—	—	67·7	—
Moncalieri		128·9	329	—	—	—	—	74·8	—

Additional records: Riverview gives PS = +10m.44s. (?S), eSR_1 = +12m.55s., MN = +16·7m., MZ = +17·7m. Manila MN = +19·3m. Perth gives S as PR_1 and S = +17m.16s. Toronto eL = +69·2m.

July 23d. Records also at 0h. (San Fernando and Tokyo), 5h. (Tokyo), 9h. (Tokyo), 21h. (Edinburgh).

1918. July 24d. 10h. 53m. 0s. Epicentre 42°·0S. 178°·0E.

A = −·743, B = +·026, C = −·669; D = +·035, E = +·999; G = +·669, E = −·023, K = −·743.

Very doubtful. If we accept the Sydney P instead of the Riverview P, a T_0 = 24d.10h.51m.20s., and the epicentre 22°·0S. 180°·0W., as on 1917 May 24d.19h.20m.30s., would suit some of the records.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Riverview	—	22·6	282	e 5 12	0	9 17	0	e 11·9	15·5
Sydney	—	22·6	282	4 30	−42	—	—	12·0	14·0
Melbourne	M.	25·5	268	10 6	?S	(10 6)	− 7	15·5	18·0
Apia	W.	29·5	20	e 3 30?	?	—	—	e 7·0?	14.0
Adelaide	M.	31·3	272	12 4	?S	(12 4)	+ 8	19·4	22·2
Perth	M.	49·6	260	27 54	?L	—	—	(35·9)	—
Andalgala	M.	88·6	127	50 18	?L	—	—	(50·3)	—
Berkeley	—	96·5	44	e 37 0	?L	—	—	(e 37·0)	—
Colombo	M.	100·7	270	47 0	?L	—	—	(47·0)	65·0
Victoria	—	104·1	36	—	—	—	—	44·6	58·3
Kodaikanal	M.	104·6	271	—	—	—	—	64·7	68·8
Georgetown	—	124·7	66	e 42 21	?SR_1	—	—	e 53·4	—
Toronto	M.	125·4	60	—	—	—	—	e 63·6	66·7
Ottawa	—	128·5	59	—	—	—	—	63·0	—
Harvard	B.O.	130·3	65	—	—	e 42 46?	?SR_1	65.9	—
Helwan	M.	150·6	256	28 0	?	—	—	—	—
Edinburgh	M.	166·1	3	81 0?	?L	—	?	(81·0?)	108·5
Eskdalemuir	G.	166·6	3	—	—	—	—	85·0	—
Stonyhurst	M.	168·2	1	e 76 36?	?	e 81 42	?	86·2	90·8
Bidston	M.S.	168·5	3	86 6	?L	90 18	?	(86·1)	97·6
De Bilt E.	—	168·8	337	—	—	e 43 11	?SR_1	e 96·0	96·9
N.	—	168·8	337	—	—	—	—	e 88·0	91·1
Rocca di Papa	—	169·1	273	—	—	—	—	e 104·2	113·9
Kew	M.	170·4	353	—	—	—	—	—	98·0
Moncalieri	S.	172·4	296	—	—	—	—	e 92·6	—
Paris	—	172·5	337	—	—	—	—	e 88·0	91·0
San Fernando	—	173·6	148	45 30	?SR_1	—	—	91·0	108·0
								—	

Additional records: Riverview gives PS = +9m.30s., SR_1 = +10m.42s., MN = +13·5m., MZ = +14·3m. Melbourne S = +13m.54s. Apia L = +9·5m. Adelaide S = +16m.4s. Colombo M = +76·0m. Ottawa eLN? = +52·0m. Harvard e = +49m.1s., eLN? = +53·4m., LN = +61·9m.

July 24d. Records also at 5h. (Batavia), 6h. (Sydney), 12h. (Mizusawa), 13h. (Zagreb), 14h. (Melbourne, Riverview, Sydney, and Perth), 15h. (Helwan, Tokyo, and Mizusawa), 19h. (Helwan), 22h. (San Fernando).

July 25d. 20h. 49m. 55s. Epicentre 35°·0N. 143°·0E. (as on 1917 Aug. 10d.).

A = −·654, B = +·493, C = +·574; D = +·602, E = +·799; G = −·458, H = +·345, K = −·819.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Tokyo		2·7	284	0 44	+ 2	1 10	− 4	—	—
Mizusawa		4·4	340	1 9	+ 1	1 57	− 4	—	—
Osaka		6·2	269	2 6	+31	—	—	3·1	3·5
Kobe		6·4	269	1 54	+16	—	—	3·0	3·6
Ootomari		11·6	356	3 18	+25	4 54	−15	6·6	—
Zi-ka-wei		18·4	266	e 4 24	+ 2	e 8 7	+ 18	—	—
Manila		28·5	230	e 7 57	+104	14 14	+186	20·2	23·1
Colombo		64·1	263	39 35	?L	—	—	(39·6)	—
Budapest	E.	83·4	326	—	—	—	—	45·1	—
Edinburgh		84·7	342	23 5	?S	(23 5)	−11	—	52·6
Eskdalemuir		85·1	341	23 12	?S	(23 12)	− 8	42·1	—
De Bilt	N.	85·4	336	—	—	23 13	−10	44·8	45·5
	E.	85·4	336	—	—	—	—	47·8	50·3

Continued on next page.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Zagreb	86·1	326	e 12 51	− 3	23 9	−22	47·1	55·1
Stonyhurst	86·2	340	47 29	?L	51 41	?L	(47·5)	56·4
Uccle	86·7	337	36 5	?	—	—	49·1	54·1
Bidston	86·8	340	30 5	?SR_1	—	—	—	56·2
Triest	87·2	328	—	—	—	—	e 51·1	—
Kew	87·8	338	—	—	—	—	—	57·1
Helwan	88·6	306	24 5	?S	(24 5)	+ 6	—	—
Shide	88·7	340	—	—	—	—	42·1	—
Paris	89·1	335	—	—	e 23 36	−28	52·1	—
Rocca di Papa	90·7	326	16 48	?PR_1	i 24 15	− 6	e 52·3	59·2
Ottawa	92·3	27	—	—	—	—	e 55·1	—
Barcelona	95·5	331	—	—	—	—	e 49·7	57·4
Algiers	99·2	329	—	—	—	—	54·1	64·1
Coimbra	100·2	340	—	—	—	—	e 51·4	—
Rio Tinto	101·9	336	58 5	?L	—	—	(58·1)	67·1
San Fernando	103·0	338	57 5	?L	—	—	62·1	61·6

Additional records: Manila gives MN = +21·3m. Zagreb MNW = +58·1m., T_0 = 20h.50m.26s. San Fernando MN = +65·6m.

July 25d. Records also at 13h. (Helwan), 14h. (Algiers), 22h. (Mizusawa), 23h. (San Fernando).

July 26d. Records at 0h. (Colombo), 1h. (Riverview), 2h. (Helwan), 17h. (Colombo), 19h. (La Paz), 23h. (Manila).

July 27d. Records at 1h. (Taihoku), 2h. (Edinburgh and San Fernando), 3h. (Mizusawa and Tokyo), 11h. and 12h. (La Paz), 14h. (Barcelona), 15h. (Algiers), 16h. (Manila), 17h. (Rocca di Papa, Monte Cassino, and Pompeii), 21h. (San Fernando).

July 28d. Records at 10h. (San Fernando), 16h. (Tokyo and Mizusawa), 20h. (Mizusawa, Tokyo, and Balboa Heights), 21h. (Melbourne, Riverview, Pompeii, and Rocca di Papa), 22h. (Helwan).

July 29d. 11h.16m.39s. Epicentre 18°·0S. 167°·0E. (as on 1917 May 14d. 22h.).

A = −·927, B = +·214, C = −·309; D = +·227, E = +·974; G = +·301, H = −·070, K = −·951.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	21·3	219	4 57	0	e 8 51	+ 1	e 11·4	14·1
Melbourne	27·7	220	—	—	10 39	−15	16·0	19·4
Honolulu	52·2	43	15 27	?S	(15 27)	−79	21·4	28·6
Manila	55·9	303	e 10 21	+36	—	—	—	—
Batavia	59·8	273	e 9 21	−50	—	—	—	—
Victoria	90·7	39	—	—	—	—	44·4	52·0
Kodaikanal	92·8	280	55 21	?L	—	—	(55·4)	—
Ottawa	121·7	48	—	—	—	—	e 64·4	—
Helwan	138·0	295	82 21	?L	—	—	(82·4)	—
Edinburgh	141·4	351	82 21	?L	—	—	(82·4)	—
Bidston	143·8	350	80 33	?L	—	—	(80·6)	90·6
Paris	146·7	341	—	—	—	—	100·4	—
Rocca di Papa	147·7	323	i 18 42	?	—	—	—	—
San Fernando	160·6	343	67 21	?L	—	—	(67·4)	—

Additional records: Riverview gives PS = +9m.9s., MN = +15·6min.

1918. July 29d. 16h. 50m. 16s. Epicentre **1°·3S. 143°·4E.**

A = −·803, B = +·596, C = −·023; D = +·596, E = +·803;
G = +·018, H = −·014, K = −1·000.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Manila	W.	27·3	308	e 5 58	− 3	i 10 50	+ 4	i 13·6	14·8
Riverview	—	33·3	168	e 6 26	−33	e 11 14	−75	e 13·4	17·6
Sydney	M.	33·3	168	9 8	+129	13 44	+75	16·2	17·7
Taihoku	O.	33·8	324	e 7 7	+ 4	—	—	14·8	19·0
Adelaide	M.	33·9	187	11 27	?	(12 52)	+13	16·2	18·3
Melbourne	M.	36·5	178	—	—	12 14	−63	17·8	20·3
Batavia	W.	36·8	261	e 6 44	−44	—	—	—	16·7
Kobe	O.	36·8	348	e 7 18	−10	—	—	16·4	19·2
Osaka	O.	36·8	348	7 26	− 2	13 31	+10	18·5	23·0
Tokyo	O.	37·1	355	7 40	+ 9	—	—	—	—
Zi-ka-wei	—	38·6	330	7 30	−13	13 24	−22	—	19·9
Mizusawa	O.	40·5	358	7 57	− 2	14 7	− 7	—	—
Honolulu	M.	61·5	64	10 26	+ 4	18 44	+ 2	28·7	43·9
Colombo	M.	64·0	279	10 44	+ 6	17 8	−125	23·3	27·1
Victoria	M.	93·2	42	22 20	?	33 57	?	54·6	68·9
Lemberg	B.O.	109·5	323	e 27 38	? S	(e 27 38)	+14	e 62·8	67·7
Helwan	M.	109·8	301	19 20	? PR_1	—	—	—	29·6
Vienna Z.	—	114·7	325	e 19 38	? PR_1	—	—	—	—
Graz	W.	115·8	324	—	—	e 27 44?	−32	—	—
Zagreb N.E.	W.	116·1	322	i 19 41	? PR_1	29 7?	+48	53·7	71·7
N.W.	W.	116·1	322	i 25 33	?	29 32	+73	—	63·7
Cape Town	M.	117·5	231	49 26	?	—	—	65·2	66·4
Triest	—	117·6	323	27 56	? S	(27 56)	−35	—	—
Dyce N.	M.S.	117·8	340	—	—	—	—	66·4	71·3
Pola	W.	117·9	322	e 28 6	? S	(e 28 6)	−27	e 61·0	65·6
De Bilt	—	118·5	332	—	—	30 6	+88	e 58·7	60·1
Edinburgh	M.	119·1	340	24 44	?	—	—	—	74·2
Eskdalemuir	G.	119·6	339	e 20 25	? PR_1	i 30 10	+84	e 56·7	—
Uccle	—	119·6	332	e 18 44	[− 7]	e 30 14	+88	—	61·7
Rocca di Papa	Ag.	120·1	320	e 19 48	? PR_1	—	—	e 64·5	—
Stonyhurst	M.	120·5	337	4 14	?	i 30 50	+117	—	76·8
Bidston	M.S.	121·0	337	20 44	? PR_1	30 32	+95	—	66·7
Moncalieri	S.	121·5	325	i 20 38	? PR_1	37 3	? SR_1	62·2	73·4
Paris	—	121·8	331	e 20 37	? PR_1	e 30 33	+90	59·7	62·7
Shide	—	122·3	334	20 40	? PR_1	30 38	+92	—	76·0
Toronto	M.	123·1	36	—	—	—	—	—	72·8
Ottawa	—	124·1	32	—	—	(e 37 44?)	? SR_1	e 37·7?	—
Barcelona	—	126·9	323	e 14 35	−99	32 41?	+182	e 60·9	70·7
Georgetown	—	127·3	40	—	—	—	—	61·7	—
Washington	Mar.	127·3	40	e 19 14	[+ 2]	—	—	—	—
Tortosa	—	128·2	324	20 5	[+51]	31 44	+116	59·1	82·0
Harvard	B.O.	128·6	32	—	—	—	—	62·4	—
Algiers	B.M.	129·0	318	e 20 53	? PR_1	32 21	?	64·7	80·7
Rio Tinto	M.	134·3	327	22 44	? PR_1	—	—	—	94·7
San Fernando	—	135·0	326	21 14	? PR_1	68 44	? L	79·7	94·2
La Paz	Bi.	144·1	122	19 42	[− 5]	e 32 31	+64	70·5	74·7

Additional records: Manila gives MN = +14·4m. Riverview MN = +19·1m. MZ = +19·6m., T_0 = 16h.50m.36s. Adelaide S is given as PR_1, also S = +14m.22s., SR_1 = +15m.32s. Melbourne SR_1 = +14m.56s. Osaka MN = +20·9m., T_0 = 16h.15m.1s. Zi-ka-wei MN = +20·8m. Mizusawa SN = +14m.11s., T_0 = 16h.50m.26s. Dyce ME = +72·7m. Pola MN = +74·7m. De Bilt PR_1 = +20m.18s., e = +36m.52s. Eskdalemuir i = +27m.22s., LN = +74·7m. Moncalieri MN = +74·5m. Harvard LN = +61·9m., LE = +71·6m. San Fernando MN = +88·2m.

July 29d. Records also at 0h. (Rocca di Papa), 5h. (Helwan), 9h. (Manila), 12h. (Kodaikanal (2)), 15h. (Colombo and Kodaikanal), 16h. (Kodaikanal, Helwan, and Edinburgh), 18h. (Osaka, Tokyo, and Mizusawa), 20h. (La Paz), 22h. (Kodaikanal and Tokyo).

July 30d. Records at 0h. (San Fernando), 6h. (La Paz), 10h. (Perth, Tacubaya, and Taihoku), 11h. (Perth), 14h. and 15h. (La Paz), 16h. (Perth and Ootomari), 22h. (Mizusawa), 23h. (San Fernando).

1918. July 31d. 14h. 36m. 43s. Epicentre 11°·0N. 88°·0W.

A = +·034, B = −·982, C = +·191; D = −·999, E = −·035;
G = +·007, H = −·191, K = −·982.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Balboa Hts. N.	B.O.	8·6	104	2 40	+30	—	—	4·7	5·6
E.	B.O.	8·6	104	2 33	+23	—	—	4·8	6·0
Tacubaya	—	13·7	309	3 56	+34	—	—	—	—
Vieques N.	B.O.	23·0	67	4 55	−22	—	—	—	16·2
E.	B.O.	23·0	67	4 43	−34	9 26	+ 1	11·4	17·4
Cheltenham N.	B.O.	29·4	18	—	—	11 29	+ 5	16·0	19·1
E.	B.O.	29·4	18	—	—	11 25	+ 1	15.8	17·4
Georgetown	—	29·6	17	e 6 18	− 6	11 36	+ 9	e 15·7	—
Washington	Mar.	29·6	17	6 14	−10	11 26	− 1	15·9?	—
Tucson N.	B.O.	29·9	318	—	—	—	—	20·3	23·3
E.	B.O.	29·9	318	—	—	—	—	18·3	33·3
Ann Arbor E.	B.	31·5	6	6 41	− 2	11 29	−31	17·2	18·7
N.	B.	31·5	6	—	—	11 17	−43	18·7	19·6
E.	W.	31·5	6	—	—	11 35	−25	17·3	17·7
N.	W.	31·5	6	5 53	−50	12 11	+11	18·4	18·9
Ithaca N.	B.O.	33·0	17	6 40	−16	e 11 52	−32	17·8	—
E.	B.O.	33·0	17	e 7 54	?PR_1	e 13 40	?SR_1	17·4	—
Toronto	M.	33·5	11	11 53?	?S	(11 53?)	−39	20·5	23·4
La Paz	Bi.	33·8	144	e 7 4	+ 1	12 24	−14	16·8	18·8
Harvard	B.O.	34·7	22	7 44	+33	i 12 6	−45	e 19·1	22·5
Northfield	B.O.	35·7	19	e 8 17	?PR_1	13 2?	− 4	20·0	—
Ottawa	—	35·9	16	7 10	−11	13 9	0	e 17·9	—
Berkeley	—	40·7	317	—	—	e 12 17	?	—	—
Andagala	M.	44·0	152	15 5	?S	(15 5)	+ 3	—	—
Victoria	M.	47·6	330	—	—	25 6?	?L	29·5	39·4
Cipolletti	M.	53·3	161	15 35	?	—	—	28·1	33·1
Chacarita	M.	53·6	149	15 35	?	—	—	—	—
Honolulu	M.	67·6	289	11 47	+45	20 11	+14	32·5	37·1
Rio Tinto	M.	76·6	53	19 17	?	—	—	—	58·3
San Fernando	—	77·0	55	23 47	?	35 17	?	40·8	47·3
Eskdalemuir	G.	78·0	35	7 1	?	—	—	42·3	—
Edinburgh	M.	78·1	34	21 17	?S	(21 17)	−44	—	48·8
Bidston	M.S.	78·2	38	—	—	33 23	?L	(33·4)	45·0
Stonyhurst	M.	78·6	38	15 29?	?PR_1	i 23 29	+82	—	44·2
Shide	—	79·5	40	—	—	—	—	37·8	—
Kew	M.	80·0	39	—	—	—	—	—	50·3
Tortosa	—	81·8	50	12 54	+25	—	—	39·8	38·3
Paris	—	82·2	42	—	—	e 23 17	+29	35·3	—
Barcelona	—	82·9	49	—	—	(e 28 26)	?SR_1	e 28·4	44·3
Uccle	—	83·0	40	—	—	—	—	e 37·3	38·3
De Bilt N.	—	83·3	39	—	—	e 23 55	+55	e 36·3	38·5
E.	—	83·3	39	—	—	e 23 9	+ 9	e 39·3	41·3
Algiers	B.M.	84·3	54	—	—	(22 17)	−54	22·3	45·3
Moncalieri	S.	86·3	46	10 50?	?	23 37?	+ 4	36·2	52·7
Triest	W.	90·3	43	—	—	—	—	e 36·3	—
Pola	W.	90·6	44	e 24 17	?S	(e 24 17)	− 3	e 45·6	54·0
Rocca di Papa	Ag.	90·6	47	—	—	—	—	e 45·0	58·2
Vienna	—	91·2	40	—	—	—	—	e 42·3	—
Zagreb	W.	91·7	43	e 13 53	+28	e 24 5	−27	42·3	55·3
Lemberg	B.O.	95·3	38	—	—	25 17	+ 8	—	—
Helwan	M.	108·9	52	25 17	?S	(25 17)	−121	—	—
Cape Town	M.	109·8	122	58 35	?L	—	—	(58·6)	65·6
Sydney	—	121·6	236	57 47	?L	—	—	(57·8)	63·9
Riverview	—	121·6	236	—	—	—	—	e 58·0?	64·3
Melbourne	M.	125·7	230	—	—	—	—	65·3	69·8
Zi-ka-wei	—	129·2	327	—	—	—	—	e 81·8	—
Manila	W.	141·5	311	e 19 54	[+12]	—	—	—	—
Mauritius	M.	146·0	110	69 17	?L	—	—	(69·3)	81·8
Kodaikanal	M.	154·3	33	92 47	?L	—	—	(92·8)	—
Colombo	M.	158·4	34	—	—	—	—	92·6	102·8

For Notes see next page.

NOTES TO JULY 31d. 14h. 36m. 43s.

Additional records: Georgetown gives eLN = +16·4m., T_0 = 14h.36m.20s. Toronto S = +16m.59s. Harvard eN = +8m.18s., iE = +15m.19s., eLN = +18·6m., T_0? = 14h.27m.4s. Ottawa PR_1 = +8m.23s., SR_1 = +15m.17s., L = +21·3m., T_0 = 14h.36m.20s. San Fernando MN = +45·3m. Eskdalemuir LN = +36·3m. Moncalieri MN = +46·0m. Pola MN = +48·2m. Zagreb MNW = +48·3m. Cape Town L = +62·6m. Riverview MN = +67·1m.

July 31d. 21h.58m.45s. Epicentre 12°·6S. 150°·0E.

A = −·845, B = +·488, C = −·218; D = +·500, E = +·866, G = +·189, H = −·109, K = −·976.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	21·3	177	e 4 57	0	8 51	+ 1	e 11·6	13·6
Sydney	21·3	177	8 57	?S	(8 57)	+ 7	12·4	13·6
Adelaide	24·6	203	—	—	17 30	?L	20·3	22·2
Melbourne	25·6	189	—	—	10 15	+ 1	16·2	16·6
Perth	36·8	232	—	—	19 4	?L	26·6	—
Manila	39·6	314	e 8 45	?PR_1	—	—	—	—
Honolulu	61·3	57	15 15	?	—	—	23·2	29·8
Lick	96·3	53	—	—	—	—	e 96·2	—
Victoria	97·2	42	—	—	—	—	46·3	56·6
Helwan	121·0	298	84 15	?L	—	—	(84·2)	—
Toronto	127·5	43	—	—	—	—	62·0?	70·4
De Bilt E.	131·5	331	—	—	21 33	?PR_1	e 72·2	82·4
N.	131·5	331	—	—	39 45	?SR_1	e 77·2	78·0
Edinburgh	132·0	340	72 15	?L	—	—	(72·2)	—
La Paz	132·4	127	—	—	—	—	63·2	—
Rocca di Papa	132·9	316	e 18 37	?	—	—	—	—
Tortosa	141·1	322	17 53	+38	—	—	80·4	108·3
Rio Tinto	147·3	325	103 15	?L	—	—	(103·2)	108·2
San Fernando	148·0	322	63 45	?L	—	—	(63·8)	—

Additional records: Riverview gives PS = +9m.11s., MN = +14·0m. Adelaide PR_1 = +15m.40s., SR_1 = +19m.0s. Perth PR_1 = +15m.13s.

July 31d. Records also at 4h. and 9h. (Manila), 11h. (Helwan), 13h. (Manila), 15h. (La Paz), 16h. (Tacubaya), 21h. (La Paz), 23h. (Edinburgh).

Aug. 1d. 11h. 42m. 0s. Epicentre 11°·0S. 176°·0W. (as on 1918 Feb. 6d. 3h.).

A = −·979, B = −·068, C = −·191; D = −·070, E = +·997; G = +·190, H = +·013, K = −·982.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Apia	5·0	125	1 19	+ 2	2 2	−15	2·3	3·1
Honolulu	36·9	28	—	—	13 24	+ 2	16·5	17·9
Riverview	37·7	228	e 10 24?	+168	e 15 31?	+117	e 18·1	22·2
Sydney	37·7	228	13 18	?S	(13 18)	−16	21·3	23·0
Edinburgh	134·7	6	—	—	—	—	76·0	—
Eskdalemuir	135·4	6	—	—	—	—	75·0	—
De Bilt	138·9	359	—	—	—	—	78·0	87·0

Additional records: Riverview MN = +19·4m. De Bilt e = +72·0m., eLN = +82·0m., M = +82·6m.

Aug. 1d. Records also at 0h. (La Paz and Balboa Heights), 4h. (La Paz and Honolulu), 6h. (Batavia), 8h. (Monte Cassino), 13h. and 16h. (Helwan), 19h. (Osaka and Tokyo), 21h. (San Fernando).

Aug. 2d. 16h. 35m. Epicentre near La Paz. La Paz iP = 16h.35m.7s., L = 16h.35m.55s., M = 16h.35m.58s. La Quiaca P = 16h.39m.6s.

Aug. 2d. Records also at 2h. (Rocca di Papa), 9h. (Riverview), 21h. (San Fernando).

Aug. 3d. Records at 2h. (La Paz), 5h. (Zi-ka-wei, Tokyo (2), and Taihoku), 8h. (Riverview and Melbourne), 9h. (De Bilt and Helwan), 10h. (Helwan), 13h. (Zagreb (2)), 22h. (Monte Cassino).

Aug. 4d. (I) 1h. 5m. 7s. } Epicentre 44°·0N. 20°·0E.
(II) 5h. 4m. 15s. }

A = +·676, B = +·246, C = +·695.

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
I Zagreb		3·3	e 1 1	+ 9	i 1 46	+15	—	1·8
II Zagreb		3·3	e 1 10	+18	i 1 24	− 7	—	1·4
I Pola		4·4	1 26	+18	—	—	1·6	1·7
II Pola		4·4	e 1 3	− 5	—	—	e 1·3	1·4
I Rocca di Papa		5·8	e 1 34	+ 4	(2 50)	+11	—	3·8
I Zurich	E.	8·6	e 2 45	+35	e 3 51	− 2	—	—
I San Fernando		21·3	8 53	?S	(8 53)	+ 3	—	—

Zagreb I gives also iNE = +1m.32s. and +1m.38s., i = +1m.42s., iNW = +1m.52s., MNW = +1·9m. Zurich eSN = +3m.53s.

Aug. 4d. Records also at 10h. (Riverview and Melbourne), 16h. (Harvard, Georgetown, Washington, Algiers, and Ottawa), 19h. (La Paz), 20h. (Helwan and De Bilt), 21h. (Colombo), 22h. (Riverview and Melbourne), 23h. (De Bilt).

1918. Aug. 5d. 1h. 37m. 10s. Epicentre 30°·2S. 177°·7W.

(as on 1917 June 6d. (2) and Dec. 9d.).

A = −·864, B = −·035, C = −·503; D = −·040, E = +·999;
G = +·503, H = +·020, K = −·864.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Apia		17·2	20	e 4 20?	+13	—	—	8·2	10·8
Riverview		26·6	254	e 5 47	− 7	(e 10 19?)	−14	e 11·7	16·6
Melbourne		31·7	246	12 2	?S	(12 2)	− 1	17·5	20·3
Adelaide		36·9	256	8 55	?PR$_1$	(13 0)	−22	22·0	29·8
Batavia		74·3	272	e 11 50	+ 6	—	—	—	—
Cipolletti		84·8	133	22 8	?S	(22 8)	−69	—	—
Victoria		92·4	33	35 48?	?	42 41	?L	51·8	58·4
Andalgala		92·6	124	—	—	—	—	62·1	70·6
La Paz		97·7	114	e 14 40	+42	24 30	−63	47·9	52·2
Kodaikanal		107·9	272	60 56	?L	—	—	(60·9)	—
Capetown		114·1	195	65 26	?L	—	—	(65·4)	67·9
Toronto		115·9	53	—	—	—	—	64·8	—
Ottawa		118·9	52	—	—	e 28 20	−21	e 52·8?	—
Harvard		121·4	56	—	—	—	—	57·8	—
Edinburgh		154·0	7	58 50	?	—	—	—	101·8
Eskdalemuir		154·6	7	19 50	−12	—	—	—	—
Helwan		154·9	275	30 50	?	—	—	—	—
Stonyhurst		156·0?	7	72 2	?L	—	—	(72·0)	90·8
De Bilt	E.	158·0	353	e 24 56	?PR$_1$	e 32 15	?	—	88·3
	N.	158·0	353	e 24 48	?PR$_1$	e 31 20	?	e 84·8	90·8
Kew		158·6	5	—	—	—	—	—	106·8
Graz		160·3	332	—	—	—	—	e 94·8	—
Zagreb		161·1	329	—	—	—	—	e 111·8	—
Paris		161·4	0	e 24 50	?PR$_1$	—	—	90·8	102·8
Rocca di Papa		165·7	327	e 25 14	?PR$_1$	—	—	e 96·2	114·3
Tortosa		169·3	5	20 14	[0]	31 47	?	—	101·1
San Fernando		170·5	46	92 50	?L	—	—	(92·8)	—

Additional records: Riverview gives e(S?) = +9m.1s., MN = +17·2m., S recorded as SR$_1$. Melbourne S = +16m.8s., Adelaide S = +16m.0s., SR$_1$ = +20m.25s. Ottawa eLN = +62·3m., LE = +78·8m. De Bilt eN = +34m.47s., eE = +44m.32s., eN = +52m.57s. Paris e = +34m.50s. and +44m.50s., MN = +91·8m. Rocca di Papa M$_1$ = +32·2m., M$_2$ = +34·8m.

Aug. 5d. Records also at 0h. (Helwan, Apia, and San Fernando), 1h. (Perth and Bidston), 10h. (Zi-ka-wei), 11h. (Cipolletti), 21h. (Manila).

Aug. 6d. Records at 0h. (San Fernando and La Paz), 4h. (Manila and Riverview), 11h. (Manila), 15h. and 17h. (Mizusawa and Tokyo), 21h. (Apia), 23h. (Eskdalemuir, Stonyhurst, San Fernando, and De Bilt).

Aug. 7d. Records at 6h. (Rio Tinto, Manila, De Bilt, Tokyo, and Mizusawa), 7h. (Manila and La Paz), 9h. (Manila (2)), 14h. (De Bilt), 15h. (Kew), 17h. (Manila), 19h. (Zurich and Chur), 20h. (La Paz).

1918. Aug. 8d. 9h. 47m. 48s. Epicentre 6°·0S. 153°·4E.

(as on 1913 July 8d. 22h.).

A = −·886, B = +·451, C = −·104; D = +·457, E = +·891; G = +·093, H = −·047, K = −·995.

This is a good example of a compromise solution, where the errors of P and S are small but of opposite signs. To make them consistent we should increase T_0 by some 13s., to 9h.48m.1s. say. Then all the stations except Batavia demand smaller △s, which means "deep focus" (say ·015). But the support from anticentral stations is doubtful.

Station and Component.	Machine.	△	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Riverview	—	27·9	183	e 6 4	− 3	i 10 46	−11	e 13·8	14·5
Sydney	M.	27·9	183	6 12	+ 5	11 0	+ 3	13·4	14·7
Melbourne	M.	32·7	192	12 12	?S	(12 12)	− 7	17·1	20·0
Manila	W.	37·9	303	e 7 40	+ 3	13 28	− 9	20·1	20·9
Perth	M.	43·3	228	8 30	+10	14 46	− 6	23·1	—
Osaka	O.	44·0	339	9 46	?PR$_1$	—	—	—	21·1
Batavia	W.	45·9	268	e 9 12	+33	—	—	—	20·2
Zi-ka-wei	—	47·9	325	e 8 57	+ 4	e 15 27	−26	e 19·7	25·2
Honolulu	M.	55·3	59	9 42	+ 1	17 36	+11	26·3	33·2
Colombo	M.	74·1	279	20 12	?S	(20 12)	−63	—	—
Kodaikanal	M.	76·7	282	50 24	?L	—	—	(50·4)	—
Berkeley	—	89·4	52	—	—	e 21 12	?	—	—
Victoria	M.	90·3	41	23 57	?S	(23 57)	−20	32·2	54·0
z.	—	90·3	41	24 6	?S	(24 6)	−11	41·7	46·7
Mauritius	M.	92·6	249	12 54	−36	(22 42)	−119	40·2	51·7
Tucson	B.O.	98·3	58	—	—	—	—	45·6	53·8
Ann Arbor	B.	118·3	45	30 30	?S	(30 30)	+114	50·3	65·2
Helwan	M.	120·4	301	21 12	?PR$_1$	—	—	—	—
Toronto	M.	120·8	42	—	—	(37 36)	?SR$_1$	i 61·3	71·5
Cape Town	M.	121·4	223	32 6	?	—	—	—	75·9
Ottawa	—	122·4	39	20 40	?PR$_1$	30 32	+85	62·2	—
Ithaca	B.O.	123·2	42	—	—	(e 49 42)	?	58·5	—
Vienna	W.	124·0	326	—	—	—	—	e 62·2	—
Washington	Mar.	124·2	46	20 41	?PR$_1$	30 34	+74	59·7	—
Georgetown	—	124·2	46	e 21 20	?PR$_1$	e 30 41	+81	61·8	—
Cheltenham	B.O.	124·4	46	—	—	—	—	61·2	67·2
Northfield	B.O.	124·8	39	—	—	—	—	e 62·2	—
Dyce	Ma.	125·1	344	—	—	—	—	69·2	—
Graz	W.	125·3	326	e 20 12	?PR$_1$	—	—	—	—
Zagreb	W.	125·6	324	e 21 8	?PR$_1$	e 31 6	+96	63·2	77·2
Edinburgh	M.	126·6	344	19 42	?	—	—	—	82·2
Harvard	B.O.	126·7	40	—	—	(e 37 29?)	?SR$_1$	63·2	—
De Bilt	—	126·9	336	(e 21 20)	?PR$_1$	e 22 40	?	e 56·2	60·2
Triest	—	127·0	325	—	—	—	—	e 55·2	—
Eskdalemuir	G.	127·2	343	21 19	?PR$_1$	32 57	+136	55·2	74·8
Hohenheim	—	127·4	331	e 18 47?	[−25]	—	—	—	—
Pola	W.	127·4	324	e 22 24	?PR$_1$	—	—	—	75·9
Balboa Hts.	B.O.	127·8	83	14 56	−81	—	—	15·4	15·5
Uccle	—	128·1	335	e 22 30	?PR$_1$	—	—	e 56·2	70·2
Bidston	M.S.	128·7	342	22 48	?PR$_1$	33 12	?	—	79·9
Kew	M.	129·4	339	—	—	—	—	—	88·2
Rocca di Papa	Ag.	129·8	322	e 20 8	?PR$_1$	—	—	e 65·1	77·5
Shide	—	130·4	339	—	—	—	—	e 57·4	—
Paris	—	130·5	335	e 22 53	?PR$_1$	—	—	54·2	60·2
Moncalieri	S.	130·7	328	e 21 48?	?PR$_1$	36 59?	?SR$_1$	54·7	76·7
La Paz	Bi.	133·5	119	e 19 40	[+13]	32 40	+136	62·8	95·7
Barcelona	—	136·1	328	—	—	—	—	e 63·2	71·4
Tortosa	—	137·4	329	22 36	?PR$_1$	—	—	64·7	90·2
Algiers	B.M.	138·7	323	e 22 47	?PR$_1$	—	—	69·2	79·2
Vieques	B.O.	140·6	68	—	—	—	—	71·2	75·2
Coimbra	—	141·9	337	20 42	[+59]	32 55	+101	67·9	79·0
Rio Tinto	M.	143·2	333	47 12	?	—	—	—	115·2
San Fernando	—	144·1	332	19 12	[−35]	—	—	67·7	96·2

For Notes see next page.

NOTES TO AUGUST 8d. 9h. 47m. 48s.

Additionzl records : Riverview gives i = +6m.19s., PS = 11m.17s., iSR$_1$? = +12m.46s., MZ$_1$ = +15·1m., MN$_2$ = +15·3m., T$_0$ = 9h.47m.57s. Melbourne S = +15m.54s., SR$_1$ = +16m.24s. Perth SR$_1$ = +17m.57s., Osaka MN = +22·5m. Honolulu T$_0$ = 9h.47m.42s. Victoria S = SZ = +29m.51s. Toronto E = +46m.42s., LE = +60·2m., LE = +67·7m. Ottawa SR$_1$N = +37m.16s., eLE = +48·2m., L = 52·2m. and +62·2m., T$_0$ = 9h.56m.34s. Ithaca LN = +59·8m. Washington SRPE = +36m.42s., L? = +46·7m., L = +56·7m. Georgetown ePN = +20m.31s. Cheltenham LN = +60·2m. Zagreb e = +58m.12s., MNW = +72·2m. Harvard Ls at +50·5m., +55·7m., +58·5m., +62·1m., and from +69·0m. to +71·4m. De Bilt Epicentre 7°·0S. 150°·1E. Eskdalemuir SR$_1$ = +39m.34s., SR$_2$ = +44m.24s., MN = +78·3m. Pola MN = +73·5m. La Paz PR$_1$ = +21m.58s., SR$_1$ = +35m.34s., SR$_2$ = +40m.52s. Barcelona eL = +46·0m., MN = +77·3m. Coimbra MN = +78·9m. San Fernando MN = +94·2m.

Aug. 8d. Records also at 0h. (San Fernando), 3h. (Tokyo), 5h. (De Bilt, Helwan, and Colombo), 10h. (Apia), 11h. (Mauritius and Andalgala), 12h. (Manila and Riverview (2), 14h. (Tokyo), 17h. (La Paz).

Aug. 9d. 0h. 38m. 40s. Epicentre 40°·8N., 35°·8E.

A = +·614, B = +·443, C = +·653 ; D = +·585, E = −·811 ; G = +·530, H = +·382, K = −·757.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	E.	9·8	257	2 28	+ 1	4 29	+ 6	5·0	5·9
	N.	9·8	257	2 27	0	4 25	+ 2	4·8	5·3
Helwan		11·5	200	4 44	?S	(4 44)	−23	(6·2)	12·7
Lemberg		12·2	321	i 5 7	?S	(5 7)	−17	7·9	8·1
Zagreb		15·2	296	3 41	− 1	i 6 48	+11	i 8·0	9·2
Pompeii		16·1	277	e 3 48	− 5	e 7 20	+23	—	—
Pola		16·5	291	e 4 3	+ 4	e 7 3	− 4	e 8·8	10·8
Rocca di Papa		17·4	281	e 4 24	+14	7 24	− 3	—	10·2
		17·4	281	e 4 18	+ 8	8 8?	?SR$_1$	e 11·6	—
Milan		19·9	292	5 52	+72	—	—	—	12·1
Zurich		20·5	298	e 4 48	+ 1	—	—	—	—
Moncalieri		20·9	291	4 57	+ 5	8 46	+ 4	11·1	12·3
De Bilt		23·7	309	5 28	+ 3	9 35	− 3	11·2	16·4
Uccle		23·9	305	e 5 25	− 2	e 9 38	− 4	e 12·3	—
Paris		24·7	300	e 5 38	+ 3	i 9 52	− 5	13·3	17·3
Barcelona		25·2	283	5 40	0	10 2?	− 5	e 12·2	16·6
Algiers		25·7	272	e 5 29	−16	9 35	−41	13·3	16·3
Tortosa		26·2	282	5 50	0	10 14	−12	11·9	18·1
Kew		26·8	306	—	—	—	—	—	20·3
Shide		27·4	304	e 9 32	?S	(e 9 32)	−76	(15·4)	—
Stonyhurst		28·6	310	5 20?	−54	i 11 38	+28	—	20·8
Bidston		28·9	309	15 32	?L	—	—	(15·5)	21·3
Eskdalemuir		29·3	313	—	—	11 2	−20	14·3	—
Dyce		29·3	317	—	—	—	—	19·3	—
Edinburgh		29·4	314	10 50	?S	(10 50)	−34	—	21·8
Rio Tinto		32·7	279	—	—	13 20	+61	—	23·3
San Fernando		32·8	276	5 50	−65	(14 20)	?SR$_1$	14·3	18·8
Coimbra		33·3	284	—	—	12 3	−26	18·2	—
Colombo		51·7	119	32 20	?L	—	—	(32·3)	—

Additional records : Helwan records L as S and S as P. Zagreb gives iNW = +3m.47s., eMNW = 8·3m., iMNE = +8·4m. Pola MN = +10·9m., T$_0$ = 0h.39m.1s. De Bilt M = +13·6m., T$_0$ = 0h.38m.59s. Epicentre 38°·7N. 31°·6E. Rio Tinto gives its S as 8d.0h. instead of 9d. San Fernando gives its P record 10 minutes too early. Coimbra LN = +15·8m.

Aug. 9d. Records also at 1h. (Zi-ka-wei), 2h. (San Fernando), 7h. (Coimbra), 14h. (Zi-ka-wei), 15h. (Manila), 19h. (La Paz and Manila), 20h. (La Paz, Helwan, and De Bilt), 21h. (La Paz).

Aug. 10d. 18h. 44m. 32s. Epicentre 42°·5N. 7°·5E.

A = +·731, B = +·096, C = +·676; D = +·130, E = −·991; G = +·669, H = +·088, K = −·737.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Marseilles	1·7	298	i 0 22	− 4	i 0 42	− 6	2·6	—
Moncalieri	2·5	3	0 35	− 4	1 2	− 7	1·2	1·6
Milan	3·2	22	1 19	+29	1 59	+31	—	4·0
Rocca di Papa	3·9	99	e 0 38	−23	—	—	e 2·6	7·5
Barcelona	4·1	256	1 19	+15	—	—	2·1	6·2
Besancon	4·8	348	1 58	+44	3 20	+69	—	—
Zurich	4·9	9	e 1 20	+ 4	i 2 2	−12	—	—
Pola	5·2	61	1 43	+23	—	—	e 3·3	4·3
Triest	5·5	52	e 1 39	+14	—	—	—	—
Pompeii	5·5	106	e 2 23	?S	(2 23)	− 8	—	—
Tortosa	5·5	254	1 9	−16	2 5	−26	2·2	3·9
Hohenheim	6·4	10	e 1 16	−22	—	—	—	—
Algiers	6·6	212	e 1 33	− 8	—	—	—	—
Zagreb	7·0	58	e 1 58	+12	e 4 39	+89	—	5·4
Paris	7·2	333	e 1 42	− 7	e 2 55	−20	3·6	—
Graz	7·3	48	e 2 45	+54	—	—	—	—
Vienna	8·5	44	e 3 46	?S	(e 3 46)	− 4	—	—
Uccle	8·6	347	e 2 46	+36	e 4 10	+17	—	7·3
De Bilt	9·7	351	—	—	—	—	4·8	5·7
Granada	10·0	242	4 30	+120	6 13	+104	—	—
Shide	10·2	327	5 25	?L	—	—	(5·4)	—
Kew	10·4	332	—	—	—	—	—	6·5
Coimbra	12·1	264	3 41	+41	6 33	+72	8·2	10·4
Eskdalemuir	14·6	335	—	—	—	—	7·5	—
Helwan	22·9	116	9 28	?S	(9 28)	+ 5	—	—

Additional records: Moncalieri MN = +2·2m. Rocca di Papa transposes L and M. Zurich ePN = +1m.7s., iN = + 2m.31s., iE = +2m.28s. Pola MN = +4·4m. Algiers gives ? = +3m.43s., LM = +11·0m. De Bilt LN = +5·5m., M = +8·5m. Coimbra eN = +5m.31s., LN = +10·0m.

Aug. 10d. Records also at 2h. (Helwan, Moncalieri, La Paz, and De Bilt), 8h. (Eskdalemuir), 11h. (Kew and San Fernando), 15h. (De Bilt and La Paz), 18h. (Riverview and Manila), 19h. (La Paz).

Aug 11d. 10h. 49m. 57s. Epicentre 16°·0S. 168°·0E. (as on 1917 May 29d., Aug. 16d., Sept. 5d., 9d., 20d., Oct. 20d., Nov. 29d.).

A = −·940, B = +·200, C = −·276; D = +·208, E = +·978, G = +·270, H = −·057, K = −·961.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	23·4	217	(e 5 21)	0	(e 9 33)	0	—	—
Cipolletti	104·0	138	33 51	?SR_1	—	—	—	—
Cape Town	122·2	210	29 3	?S	(29 3)	− 3	—	35·0
La Paz	115·8	118	e 11 28?	—	—	—	44·5	56·3
Algiers	155·3	330	—	—	—	—	67·0	—
Helwan	138·0	297	61 3	?L	—	—	(61·0)	—
De Bilt	141·4	343	e 44 3	?[L]	—	—	e 69·0	76·1
Moncalieri	146·6	334	e 68 34	?L	—	—	(68·6)	—

It is assumed that the times given by Riverview are one hour wrong; they are given as +65m.21s. and +69m.33s. respectively. But the identification is very doubtful and rest chiefly upon the former activity of this epicentre, the Riverview observations, and the values of L. If we omit the Riverview observations as possibly due to a later shock, then an epicentre at 73°·0S. 90°·0E. would fit the other records better. De Bilt gives also MN = +74·8min.

Aug. 11d. 13h. 23m. 25s. Epicentre 45°·0N. 4°·8E.

$A = +\cdot705$, $B = +\cdot059$, $C = +\cdot707$; $D = +\cdot084$, $E = -\cdot996$; $G = +\cdot705$, $H = +\cdot059$, $K = -\cdot707$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Marseilles	1·7	167	i 0 34	+ 8	i 0 54	+ 6	—	2·2
Moncalieri	2·1	89	e 0 37	+ 4	1 10	+12	2·0	2·1
Besancon	2·4	20	1 26	?S	(1 26)	+20	(2·8)	—
Milan	3·1	80	1 29	?S	(1 29)	+ 3	—	4·3
Zurich	3·5	46	e 1 20	+25	i 2 13	+36	1 2·5	—
Barcelona	4·0	206	e 1 1	− 1	1 41?	− 9	e 2·0	6·6
Paris	4·1	339	e 1 48	?S	(e 1 48)	− 5	(i 3·0)	—
Tortosa	5·2	219	1 12	− 8	2 15	− 7	2·3	4·0
Hohenheim	5·4	38	e 0 49	−34	—	—	—	—
Uccle	5·7	357	e 2 11	+43	(e 2 11)	(−25)	e 4·3	7·4
Triest	6·3	81	e 2 44	?S	(e 2 44)	− 8	—	—
Pola	6·5	88	e 1 36	− 3	—	—	e 3·4	4·2
Rocca di Papa	6·6	117	i 0 54	−47	1 51	?P	—	2·7
Shide	6·7	327	—	—	—	—	5·2	7·3
De Bilt E.	7·0	1	—	—	—	—	4·3	6·0
N.	7·0	1	—	—	—	—	5·2	6·8
Graz	7·7	71	1 50	− 7	—	—	—	—
Zagreb	7·9	80	4 44	?L	i 4 59	?L	(5·0)	6·8
Algiers	8·3	186	2 12	+ 6	4 5	+20	—	9·6
Pompeii	8·4	118	e 0 59	−68	e 2 38	−72	4·5	—
Vienna	8·6	63	e 3 53	?S	(e 3 53)	0	—	—
Bidston	9·7	331	3 59	?S	(3 59)	−22	—	9·6
Budapest	10·2	71	—	—	e 4 30	− 5	—	—
Coimbra	10·6	249	—	—	e 4 20	−25	8·5	10·6
Eskdalemuir	11·4	336	—	—	—	—	6·6	—
San Fernando	12·0	228	1 35	−84	—	—	—	—
Dyce	12·8	343	—	—	8 43	?	11·1	12·3
Lemberg	13·9	62	—	—	e 5 35	−31	—	11·2

Additional records: Marseilles MN = +1·6m. Moncalieri gives i = +0m.53s., MN = +2·5m. Zurich ePN = +1m.15s., ePZ = +1m.18s. Paris LE = +3·8m., LN = +3·9m. Uccle iZ = +4m.47s. Pola MN = +4·5m. Rocca di Papa i = +0m.50s., eL = +4·6m., MN = +3·2m. Zagreb iM = +5·5m. Coimbra SN = +5m.53s., SE = +6m.1s., MN = = +11·4m.

Aug. 11d. 14h. 2m. 10s. Epicentre 45°·0N. 4°·8E. (as at 13h.).

$A = +\cdot705$, $B = +\cdot059$, $C = +\cdot707$.

		Δ	P.	O−C.	S.	O−C.
		°	m. s.	s.	m. s.	s.
Moncalieri		2·1	0 28	−5	0 50	− 8
Zurich	E.	3·5	—	—	e 1 40	+ 3
	N.	3·5	—	—	e 1 41	+ 4
	V.	3·5	—	—	e 1 49	+12

Aug. 11d. 18h. 2m. 5s. Epicentre near Pompeii, which gives eP = +13s., eS = +23s. Rocca di Papa gives i = +1m.34s.

Aug. 11d. 23h. 28m. 0s. Epicentre 5°·4N. 125°·2E.

The first of a series of twelve shocks in August from this epicentre or near it. See introductory note.

$A = -\cdot574$, $B = +\cdot813$, $C = +\cdot094$; $D = +\cdot817$, $E = +\cdot576$; $G = -\cdot054$, $H = +\cdot077$, $K = -\cdot996$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		10·1	336	e 2 24	− 7	5 2	+30	6·0	7·3
Batavia		21·7	238	e 5 0	− 1	—	—	—	—
Helwan		90·7	298	25 0	?S	(25 0)	+40	—	—
De Bilt	E.	103·4	327	—	—	—	—	e 56·0	66·4
	N.	103·4	327	—	—	—	—	e 55·0	58·9
Eskdalemuir		105·9	331	—	—	—	—	53·0	—
San Fernando		118·3	317	74 0	?L	—	—	(74·0)	—

Manila gives also MN = +6·6m.

This is the first of a series of shocks from the Epicentre 5°·4N. 125°·2E. As mentioned in the Introductory Note to this number, the discussion of a series at the Epicentre 46°·5N. 151°·4E. (see the full Note following Sept. 7d. 17h.) the repetitions seem to fit in with Dr. Jeans' suggestion of returns to the epicentre of surface waves which complete the circuit of the earth in $t_1 = 125{\cdot}8$min., and $t_2 = 222{\cdot}0$min. respectively. But some difficulties of detail arise in interpretation. This first shock on Aug. 11 was clearly small, and was not followed by any other (recorded) for nearly three days. A far more notable shock was that of Aug. 15.52.50. There is no difficulty in representing the first four shocks (three repetitions) by multiples of t_1 and t_2, as below, but difficulties begin with Nos. 5, 6, and 7.

No.	Dates.	Interval from No. 1	Multiples t_1	Multiples t_2	Resid.
1	1918 Aug. 11·9778	·0000	0	0	·0000
2	14·3868	2·4090	24	2	+·0041
	·3875	2·4097			+·0048
3	15·1097	3·1319	27	5	−·0022
4	(Large) 15·5250	3·5472	30	6	+·0014
5	15·5418	3·5640	39	1	+·0028
6	15·6431	3·6653	19	13	+·0015
7	15·7292	3·7514	20	13	·0000
8	15·7646	3·7868	31	7	−·0006

The first interval is so large that it may not be significant; but No. 3 follows No. 2 by $3t_1 + 3t_2$, and No. 4 (the big shock) follows No. 3 by $3t_1 + t_2$.

We can perhaps see some reason for No. 4 being large; for since $30t_1 = 17t_2$ the combination $30t_1 + 6t_2 = 23t_2$, so that two sets of waves arrive simultaneously at the epicentre. The matters left in doubt are why there was no result after $30t_1$, combined with multiples of t_2 less than 6, and generally why so long an interval as $24t_1 + 2t_2$ elapsed before anything more happened. But on coming to Nos. 5, 6, and 7 we get more serious difficulties. These shocks do not follow No. 4 after intervals of the form $mt_1 + nt_2$. We cannot represent them in this form without recurring to No. 1 as starting point; and it seems odd that, in the case of No. 5 for instance, 38 intervals of t_1 should elapse without noticeable result, and the 39th produce a shock. Of course, we could write $39t_1 + t_2 = 9t_1 + 18t_2$, but this only alters the difficulty in detail.

An explanation may perhaps be suggested as follows: Waves of the first type will converge to the anticentre in time $t_1/2$. If then they can* return to the epicentre as waves of the other type, the whole time of return is $(t_1 + t_2)/2 = {\cdot}1208$day $= m$ say. Now No. 6 follows No. 4 (the big shock) by ·1181 day, which only differs from m by ·0027 day. No. 7 follows No. 6 by t_1, which offers no difficulty; and No. 8 follows No. 4 by $(t_1 + t_2)$. It is perhaps noteworthy that the intervals $(t_1 + t_2)$ and $(t_1 + t_2)/2$ allow of the concurrence of two sets of waves, one set starting as type 1 succeeded by type 2, the other type 2 succeeded by type 1; and this concurrence must increase the effect.

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*At present Dr. Jeans finds theoretical objections to this supposition, which is therefore given very tentatively.

But No. 5 in the list is still unexplained. It clearly cannot follow from No. 4, the interval being too short. But it follows No. 3 at an interval

$$\cdot 4321 = \cdot 1208 + \cdot 3083 + \cdot 0030 = m + 2t_2 + \cdot 0030.$$

We can thus represent the series as below, starting from No. 3 as zero to avoid the big multiples introduced by No. 1.

No.	Date.	Interval from 3	Multiples t_1	t_2	m.	Resid.
3	15·1097	·0000	0	0	0	·0000
4	15·5250	·4153	3	1	0	−·0010
5	15·5418	·4321	0	2	1	+·0030
6	15·6431	·5334	3	1	1	−·0037
7	15·7292	·6195	4	1	1	−·0049
8	15·7646	·6549	4	2	0	−·0029
9	15·8375	·7278	3	3	0	+·0042
10	15·8563	·7466	5	2	0	+·0015
11	15·9465	·8368	6	2	0	+·0043
12	15·9730	·8633	5	2	1	−·0026
13	15·9861	·8764	0	3	0	−·0014
14	16·1426	1·0329	0	4	0	+·0009
15	16·3579	1·2482	9	3	0	−·0006
			2	7	0	−·0057
16	16·3925	1·2828	13	1	0	−·0071
			6	5	0	−·0122
			29	4	0	−·0059
17	18·2540	3·1443	22	8	0	−·0111
			13	13	0	+·0044
			6	17	0	−·0008
18	19·7271	4·6174				
19	19·9986	4·8889				
20	21·0127	5·9030				

It will be seen that as we get later in the series different alternatives present themselves. They are not, however, exclusive—quite the contrary. There seems to be no good reason why they should not reinforce one another. And something of the same kind is true earlier in the series.

Thus No. 12 = No. 3 + $5t_1$ + $2t_2$ + m
= No. 4 + $2t_1$ + t_2 + m
= No. 5 + $5t_1$
= No. 6 + $2t_1$ + t_2
= No. 7 + t_1 + t_2
= No. 8 + t_1 + m
= No. 10 + m

But No. 12 cannot be regarded as partly due to No. 9. On the other hand, No. 13 can only be referred to Nos. 3 and 5.

For 18, 19, 20 the alternatives are so numerous that it seemed unnecessary to specify them.

Aug. 11d. Records also at 1h. (Rocca di Papa), 17h. (Algiers), 20h. (Lick).

Aug. 12d. 4h. 58m. 13s. Epicentre at 8°·0S. 105°·0E.

A = −·256, B = +·956, C = −·139; D = +·966, E = +·259;
G = +·036, H = −·134, K = −·990.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia		2·6	45	i 0 36	− 5	i 1 3	− 9	—	2·1
Manila		27·6	35	e 6 3	− 1	—	—	—	11·2
Colombo		29·2	299	16 17	?L	—	—	(16·3)	—
Kodaikanal		32·9	303	18 35	?L	—	—	(18·6)	—
Sydney		49·7	128	28 59	?	—	—	31·5	33·6
Helwan		80·1	302	44 47	?L	—	—	(44·8)	—
De Bilt	E.	102·3	322	—	—	e 24 19	−119	58·3	63·1
	N.	102·3	322	—	—	—	—	55·3	61·3

Additional record: Manila gives MN = +11·7m.

Aug. 13d. 20h. 0m. 50s. Epicentre at 45°·5N. 15°·0E. (as on 1916 July 14d. 20h.).

A = +·677, B = +·181, C = +·713.

	Δ	P.	O−C.	S.	O−C.	L.	M.
	°	s.	s.	s.	s.	s.	s.
Zagreb	0·8	i 14	+ 2	i 24	+ 2	(i 34)	44
Pola	1·0	e 14	− 1	(e 27)	− 1	e 27	29
Zurich	4·8	e 72	− 2	128	− 3	—	—
Zurich v.	4·8	e 71	− 3	129	− 2	—	—

Additional records: Zagreb gives MNW = +46s. and records L as S. Pola MN = +30s.

Aug. 13d. Records also at 0h. (San Fernando), 1h. (La Paz, Tokyo, and Rocca di Papa), 4h. (San Fernando), 7h. (La Paz), 10h. (San Fernando), 15h. (Zagreb, Athens, and Rocca di Papa), 23h. (Tokyo).

Aug. 14d. 13h. 19m. 28s. Epicentre 36°·0N. 21°·0E.

A = +·755, B = +·290, C = +·588; D = +·358, E = −·934; G = +·549, H = +·211, K = −·809.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	2·9	62	e 0 47	+ 2	1 23	+ 3	1·5	1·5
Pompeii	6·9	315	e 2 18	+33	—	—	—	—
Rocca di Papa	8·6	314	2 2	− 8	—	—	—	3·9
Pola	10·4	330	e 4 44	?S	(e 4 44)	+ 4	e 6·1	7·0
Triest	11·1	333	e 5 2	?S	(e 5 2)	+ 5	—	—
Graz	11·8	341	—	—	—	—	6·5	—
Zurich	14·6	325	e 3 24	−10	—	—	—	—
De Bilt	19·6	330	—	—	—	—	e 11·0	—

Rocca di Papa gives MN = +5·2m.

Aug. 14d. Records also at 2h. (Zi-ka-wei and San Fernando), 3h. (De Bilt), 9h. (Manila (2)), 14h. (Kodaikanal), 17h. (Kodaikanal), 18h. (Kodaikanal, Tokyo, and Harvard), 20h. (Harvard), 21h. (De Bilt).

1918. Aug. 15d. 12h. 17m. 55s. Epicentre 5°·4N. 125°·2E.

(as on 1918 Aug. 11d. 23h.)

A = −·574, B = +·813, C = +·094; D = +·817, E = +·576; G = −·054, H = +·077, K = −·996.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Manila	W.	10·1	336	e 2 33	+ 2	—	—	—	—
Hokoto	O.	18·9	344	e 4 32	+ 4	—	—	6·2	7·0
Taihoku	O.	19·9	350	4 47	+ 7	6 22	−119	9·1	20·4
Batavia	W.	21·7	238	4 58	− 3	6 48	−131	—	9·1
Zi-ka-wei	—	26·0	353	e 5 48	0	e 10 58	+36	—	12·9
Kobe	O.	30·7	16	e 6 24	−11	—	—	14·4	18·9
Osaka	O.	30·8	17	6 33	− 3	12 21	+33	14·6	15·4
Tokyo	O.	33·1	22	e 7 7	+10	e 9 38?	−168	15·6?	—
Mizusawa	O.	36·6	21	7 16	−11	12 56	−22	—	—
Perth	M.	38·4	192	7 50	+ 9	—	—	—	—
Calcutta E.	O.E.	39·5	299	7 29	−22	13 53	− 6	19·9	—
N.	O.E.	39·5	299	7 35	−16	13 47	−12	20·0	32·0
Adelaide	M.	42·3	163	8 25	+12	14 50	+11	21·6	25·6
Ootomari	O.	43·9	17	8 39	+14	(15 39)	+38	15·6	16·8
Colombo	M.	45·2	274	(9 35)	+61	(14 5)	−73	14·1	38·1
Riverview	—	46·3	150	e 8 35	− 7	i 15 43	+11	e 22·5	31·1
Sydney	M.	46·3	150	8 35	− 7	15 29	− 3	22·6	—
Melbourne	M.	46·9	159	(9 17)	+31	(16 17)	+37	16·3	20·1
Kodaikanal	M.	47·5	277	8 5	−46	14 23	−85	14·4	35·1
Dehra Dun	O.	50·8	305	8 5	−67	—	—	—	—
Simla	O.E.	51·8	306	9 17	− 2	16 41	0	—	—
Bombay	O.E.	52·8	290	9 3	−22	16 35	−19	—	—
Apia	W.	65·4	108	11 12	+25	20 14	+44	33·1	34·1

Continued on next page.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Honolulu	M.	75·8	69	12 17	+23	22 23	+48	36·1	45·1
Sitka	B.O.	90·5	31	e 14 20	+61	24 28	+ 9	e 37·2	40·0
Helwan	M.	90·7	298	12 35	−45	—	—	—	64·6?
Lemberg	B.O.	93·0	321	e 13 23	− 9	23 59	−46	44·3	65·5
Athens	—	95·7	309	e 14 40	+53	e 25 0	−13	42·6	62·9
Budapest	—	96·7	319	14 5	+12	26 5	+42	—	—
Vienna	—	98·2	320	13 49	−12	23 5	−153	—	—
Zagreb	W.	99·3	318	e 13 57	−10	i 25 14	−35	53·6	68·1
Victoria	M.	99·9	39	14 23	+13	25 41	−14	37·5	65·5
Z.	—	99·9	39	14 23	+13	26 35	+40	46·6	48·4
Triest	W.	100·8	318	16 5	+111	25 41	−22	—	—
Pola	W.	100·9	318	e 18 17	?PR_1	e 29 25	?	e 49·8	69·5
Pompeii	O.A.	101·9	314	e 14 18	− 2	e 30 18	?	52·3	71·3
Monte Cassino	—	102·1	315	14 45	+24	—	—	—	—
Hohenheim	—	102·5	323	13 35	−48	26 24	+ 4	—	—
Rocca di Papa	Ag.	102·8	315	e 14 23	− 1	22 52?	?	e 52·6	68·9
				e 14 38	+14	20 43?	?	53·9	68·6
De Bilt	—	103·4	327	e 14 21	− 6	e 26 10	−18	e 47·1	69·4
Zurich	—	103·5	321	e 14 31	+ 3	—	—	—	—
Milan	—	103·8	319	15 44	+75	19 28?	?PR_1	51·1	62·1
Berkeley	—	104·0	49	e 14 28	− 2	e 25 24	−69	—	51·5
Dyce	Ma.	104·3	333	18 45	?PR_1	26 45	+ 9	44·8	69·2
Uccle	—	104·4	326	e 14 17	−15	e 25 5	−92	e 49·1	67·9
Lick	W.	104·7	50	e 19 33	?PR_1	—	—	—	68·5
Moncalieri	S.	105·0	320	14 36	+ 2	26 26	−16	36·8	71·4
Besançon	—	105·2	322	19 5	?PR_1	—	—	—	—
Edinburgh	M.	105·6	332	14 35	− 2	—	—	—	68·1
Eskdalemuir	G.	105·9	331	14 35	− 4	—	—	—	—
Stonyhurst	M.	106·4	330	e 12 11	−150	e 15 35	?	i 29·5	66·9
Paris	—	106·5	325	e 14 41	− 1	e 25 12	−105	51·1	54·1
Kew	M.	106·6	328	18 5	?PR_1	—	—	—	73·1
Cape Town	M.	106·9	236	18 47	?PR_1	25 17	−103	28·6	65·3
Bidston	M.S.	107·0	331	18 59	?PR_1	26 23	−38	—	54·1
Marseilles	Ma.	107·2	317	19 5	?PR_1	29 30	+147	53·1	67·7
Shide	—	107·6	326	15 8	+22	26 57	− 9	53·0	69·3
Barcelona	—	110·1	318	e 18 58	?PR_1	35 20?	?SR_1	47·3	68·8
Algiers	B.M.	111·6	313	e 19 15	?PR_1	29 15	+93	—	60·1
Tortosa	—	111·6	318	18 23	?PR_1	27 17	−25	53·1	69·1
Tucson E.	B.O.	114·8	50	20 35	?PR_1	30 28	+140	56·7	68·6
N.	B.O.	114·8	50	21 45	?	30 31	+143	58·4	89·5
Denver	W.	115·5	41	—	—	—	—	55·1	—
Granada	—	116·1	316	e 19 5	?PR_1	e 31 47	?	—	—
Coimbra	—	117·7	322	e 18 34	?PR_1	27 54	−38	40·1	65·8
Rio Tinto	M.	117·8	318	16 5	+32	—	—	—	73·1
San Fernando	—	118·3	317	15 5	−30	29 35	+59	66·1	79·1
Accra	M.	124·4	279	30 25	?S	(30 25)	+63	—	58·1
St. Louis	W.	125·1	34	e 20 53	?PR_1	e 28 11	−76	61·1	64·1
Ann Arbor E.	W.	125·6	26	20 53	?PR_1	—	—	38·7	56·1
N.	W.	125·6	26	19 59	?PR_1	28 11	−79	39·0	56·1
E.	B.	125·6	26	20 53	?PR_1	—	—	40·2	42·1
N.	B.	125·6	26	20 41	?PR_1	28 41	−49	38·2	39·4
Ottawa	—	125·8	18	19 25	[+17]	27 17	−135	38·1	—
Toronto	M.	126·2	22	19 35?	[+27]	i 37 17	?SR_1	40·1	81·7
Northfield	B.O.	127·9	16	e 20 35	?PR_1	—	—	e 38·6	—
Ithaca	B.O.	128·3	20	21 29	?PR_1	29 11	−38	55·2	—
Tacubaya	—	129·7	60	19 18	[0]	—	—	—	63·5
Harvard	B.O.	130·0	16	17 49	?	24 48	?	34·4	40·1
Washington	Mar.	131·1	23	19 32	[+11]	26 30	?	e 32·1	—
Georgetown	—	131·1	23	19 44	[+23]	26 36	?	e 32·5	76·2
Cheltenham	B.O.	131·3	23	19 40	[+18]	—	—	40·1	84·0
Cipolletti	M.	144·3	162	20 23	[+36]	21 41	?	—	99·9
Balboa Heights	B.O.	151·4	60	20 16	[+18]	31 15	−49	72·2	82·4
Pilar	M.	152·4	163	20 23	[+24]	27 35	?	47·4	104·4
Vieques	B.O.	154·2	24	21 8	[+67]	27 45	?	e 64·3	81·3
Andalgala	M.	155·2	155	19 53	[− 9]	21 53	?	—	81·9
Rio de Janeiro	B.O.	159·2	212	e 21 47	[+100]	33 59	?	56·4	96·6
La Quiaca	M.	160·2	149	19 53	[−15]	29 53	?	—	62·9
La Paz	Bi.	162·8	131	20 24	[+14]	34 18	?	66·2	80·2

For Notes see next page.

NOTES TO AUG. 15d. 12h. 17m. 55s.

Additional records: Hokoto gives another shock with L = +9·6m. and M = +9·9m.; it seems probable that these really apply to this shock and the L and M of the text to an earlier one, which may explain the negative residuals for S at Taihoku, Batavia, and Tokyo. Zi-ka-wei PRN = +6m.38s., PRE = +6m.48s., MN = +12·2m. Kobe MN = +19·7m. Osaka MN = +16·2m. Adelaide PR_1 = +10m.5s., SR_1 = +18m.10s., M = +27·5m. Riverview i = +8m.54s., and +9m.5s., iPR_1 = +10m.42s., iPR_2 = +11m.1s., iPS = +16m.18s., iSR_1 = +18m.25s., iSR_2 = +19m.38s., MN = +31·4m. Sydney PR_1 = +10m.53s. Melbourne SR_1 = +12m.35s., SR_2 = +13m.29s. Kodaikanal records its P as at 18h. Apia i_1 = +12m.4s., i_2 = +12m.22s., i = +21m.32s., M = +35·1m. Helwan gives M one hour too early. Lemberg ePR_1? = +17m.29s. Athens MN = +58·7m. Zagreb iPR_1 = +17m.46s., iPR_2 = +20m.43s., iPR_3 = +22m.15s., MNW = +65·1m. Victoria L = +40·4m., SZ = +26m.35s., LZ = +46·6m., MZ = +48·4m. Pola MN = +71·2m. Rocca di Papa L = +59·9m. + 56·5m., and +62·9m. De Bilt eE = +13m.23s., ePR_1 = +18m.50s., eE = +28m.48s., and +31m.0s., eN = +34m.2s., and +42m.18s., MN = +55·9m. Epicentre 5°·5N., 124°·5E. Berkeley MN = +50·8m., MV = +51°·0m., T_0? = +12h.19m.23s. Dyce e = +19m.17s. Uccle e = +18m.5s., $M_{10}Z$ = +68·7m. Lick MN = +51·4m. Moncalieri MN = +70·8m. Stonyhurst M = +78·6m. Paris PR_1 = +19m.29s., i_1 = +26m.1s., i_2 = +27m.22s. Marseilles MN = +86·8m. Shide PR_1 = +19m.21s. Barcelona LN = +46·3m., M = +72·1m. Algiers i = +20m.7s. Coimbra PR_1 = +21m.51s., PR_2E = +23m.32s., PR_2N = +23m.33s., SR_1E = +30m.3s., SR_1N = +30m.9s., LN = +42·6m., MN = +70·0m. San Fernando MN = +81·1m. St. Louis eSE = +28m.17s., eL = +34·2m. Ottawa L = +59·1m., T_0 = 12h.27m.32s. Toronto PE = +21m.53s., i = +27m.47s., and +33m.29s., L = +44·2m., iL = +69·4m., and +77·2m. Ithaca eN = +23m.20s., +24m.29s., +32m.11s., +34m.32s., and +39m.33s., eE = +39m.15s., LN = +57·3m. Harvard i = +20m.1s., and +20m.12s., T_0 = 12h.26m.21s. Washington L = +40·1m. and +65·1m. Georgetown MN = +92·2m. Andalgala MN = +99·5m., ME = +96·9m. Rio de Janeiro LN = +56·5m., MN = +91·1m. La Quiaca M = +93·4m. La Paz PR_1E = +21m.37s., PR_1N = +21m.44s., PR_2N = +27m.19s., PR_2E = +27m.27s., SR_1N = +36m.13s., SR_1E = +36m.15s., SR_2E = +40m.9s., SR_2N = +40m.24s., iE = +46m.9s. and +48m.37s., iN = +48m.53s., LN = +64·6m.

Aug. 15d. 15h. 26m. 0s. Epicentre 5°·4N. 125°·2E. (as at 12h.).

A = −·574, B = +·813, C = +·094; D = +·817, E = +·576;
G = −·054, H = +·077, K = −·996.

		△	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		10·1	336	e 2 40	+ 9	—	—	—	—
Batavia		21·7	238	e 5 0	− 1	—	—	—	9·0
Zi-ka-wei		26·0	353	e 5 51	+ 3	10 26	+ 4	—	—
Kobe		30·7	16	e 7 36	+61	—	—	15·9	16·8
Osaka		30·8	17	7 27	+51	13 10	+82	15·8	21·0
Mizusawa	E.	36·6	21	7 27	0	13 11	− 7	—	—
	N.	36·6	21	7 30	+ 3	13 8	−10	—	—
Adelaide		42·3	163	8 0	−13	—	—	—	19·0
Riverview		46·3	150	e 9 1	+19	e 15 30?	− 2	—	30·0
Zagreb		99·3	318	e 14 0	− 7	—	—	—	—
Rocca di Papa		102·8	315	—	—	—	—	41·8	65·3
De Bilt		103·4	327	—	—	—	—	—	56·2
Uccle		104·4	326	—	—	—	—	e 43·0	59·0
La Paz		162·8	131	19 33	[−37]	33 12	?	83·0	88·9

Osaka gives MN = +17·9m. Riverview MN = +29·4m. De Bilt M = +58·3m.

1918. Aug. 15d. 17h. 30m. 5s. Epicentre 5°·4N. 125°2·E.

A = −·574, B = +·813, C = +·094; D = +·817, E = +·576;
G = −·054, H = +·077, K = −·996.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		10·1	336	e 2 38	+ 7	—	—	—	—
Taihoku		19·9	350	4 38	− 2	(8 23)	+ 2	8·4	13·0
Batavia		21·7	238	i 5 2	+ 1	9 2	+ 3	—	11·9
Zi-ka-wei		26·0	353	5 50	+ 2	e 10 17	− 5	—	16·1
Kobe		30·7	16	e 6 20	−15	—	—	—	—
Osaka		30·8	17	7 4	+28	12 16	+28	14·5	15·3
Tokyo		33·1	22	e 7 3	+ 6	—	—	—	—
Mizusawa	E.	36·6	21	7 8	−19	12 52	−26	—	—
	N.	36·6	21	7 10	−17	12 48	−30	—	—
Perth		38·4	192	10 42	+181	13 37	− 7	16·2	18·0
Calcutta		39·5	299	7 37	−14	13 37	−22	—	—
Adelaide		42·3	163	—	—	13 55	−44	21·9	26·2
Ootomari		43·9	17	8 37	+12	—	—	—	—
Colombo		45·2	274	(8 37)	+ 3	(15 25)	+ 7	15·4	31·4
Riverview		46·3	150	e 8 33	− 9	i 15 25	− 7	e 22·6	29·0
Melbourne		46·9	159	—	—	15 49	+ 9	19·1	19·9
Simla		51·8	306	9 19	0	16 25	−16	—	28·9
Bombay		52·8	290	9 27	+ 2	—	—	—	35·9
Honolulu		75·8	69	12 7	+13	21 31	− 4	35·0	49·9
Lemberg		93·0	321	17 19	?PR_1	24 19	−26	53·9	57·6
Athens		95·7	309	e 17 29	?PR_1	23 59?	−74	e 53·9	—
Budapest		96·7	319	—	—	e 24 55	−28	—	—
Vienna		98·2	320	17 49	?PR_1	26 55	+79	—	—
Zagreb		99·3	318	e 13 49	−18	—	—	52·9	64·9
Victoria		99·9	39	25 49	?S	(25 49)	− 6	47·0	72·5
Pola		100·9	318	e 18 17	?PR_1	e 24 53	−71	e 32·7	63·7
Hohenheim		102·5	323	17 57	?PR_1	25 51	−29	—	—
Rocca di Papa		102·8	315	18 27	?PR_1	e 26 14	− 8	e 56·7	64·9
De Bilt	E.	103·4	327	(e 18 32)	?PR_1	e 24 44	−104	e 49·9	54·1
	N.	103·4	327	(e 18 39)	?PR_1	e 25 50	−38	e 51·9	64·0
Berkeley		104·0	49	—	—	—	—	e 46·9	—
Uccle		104·4	326	e 17 55	?PR_1	—	—	e 50·9	62·9
Moncalieri		105·0	320	e 12 23?	?	i 28 0	+78	40·0	65·2
Eskdalemuir		105·9	331	e 24 55	?	—	—	—	56·2
Paris		106·5	325	e 18 18	?PR_1	i 29 19	?	51·9	56·9
Kew		106·6	328	—	—	—	—	—	61·9
Capetown		106·9	236	25 7	?	31 7	?	—	65·1
Bidston		107·0	331	27 13	?S	(27 13)	+12	—	53·3
Barcelona		110·1	318	18 52	?PR_1	28 50	?	39·7	64·5
Algiers		111·6	313	e 19 25	?PR_1	29 7	?	45·9	69·9
Tortosa		111·6	318	19 8	?PR_1	27 48	+ 6	56·1	67·6
Granada		116·1	316	20 19	?PR_1	e 33 5	?	—	—
Coimbra		117·7	322	19 49	?PR_1	29 57	?	57·4	65·5
San Fernando		118·3	317	29 55	?	—	—	—	82·9
Ottawa		125·8	18	i 21 3	?PR_1	i 37 55	?SR_2	59·9	—
Toronto		126·2	22	(21 49)	?PR_1	—	—	86·9	89·0
Ithaca		128·3	20	—	—	e 37 45	?SR_1	e 53·9	—
Harvard		130·0	16	—	—	40 45?	?SR_1	60·2	69·8?
Washington		131·1	23	e 21 32	?PR_1	22 40	?	40·4	—
Georgetown	E.	131·1	23	e 20 55	?PR_1	23 11	?	e 39·2	—
Georgetown	N.	131·1	23	e 20 55	?PR_1	23 6	?	e 39·1	—
Cheltenham		131·3	23	22 45	?PR_1	—	—	—	—
La Paz		162·8	131	e 20 19	[+ 9]	34 6	?	75·3	81·2

Additional records: Taihoku gives M = +9·1m. Zi-ka-wei ePN = +5m.38s., PMN = +5m.54s., SME = +10m.36s., SMN = +11m.2s. Osaka MN = +20·3m. Adelaide SR_1 = +16m.55s. Colombo gives P as S and S as L. Riverview PR_1 = +10m.26s., eS = +15m.16s., iSR_1 = +18m.29s., MN = +30·0m., MZ = +30·2m. Zagreb iPR_1 = +18m.2s., MNW = +69·9m. Victoria S = +36m.42s. Rocca di Papa L = +72·7m. De Bilt eN = +33m.9s., eE = +33m.18s., eN = +43m.30s. Uccle MN = +61·9m. Moncalieri i = +18m.49s., MN = +70·4m. Eskdalemuir MN = +56·4m. Barcelona MN = +62·2m. Coimbra PR_1N = +22m.46s., MN = +77·0m. San Fernando MN = +79·9m. Ottawa i = +26m.25s., eLE? = +50·9m., L = +69·9m., and +74·9m. Toronto L = +42·9m. Harvard LN = +60·8m., T_0 = 17h.48m.24s?. Cheltenham PN = +22m.48s.

Aug. 15d. Records also at 0h. (San Fernando), 2h. (Manila), 5h. (Dehra Dun), 13h. (Batavia, Hokoto, and Manila), 15h. (La Paz (2)), 18h. (Batavia and Pompeii), 19h. (Manila), 20h. (Batavia (2) ,Manila (2), and Colombo), 21h. (Mizusawa and De Bilt), 22h. (Manila), 23h. (Manila (2) and Lick).

Aug. 16d. 3h. 25m. 23s. Epicentre 5°·4N. 125°·2E. (as on Aug. 15d. 12h. and 15h.)

$A = -\cdot574$, $B = +\cdot813$, $C = +\cdot094$; $D = +\cdot817$, $E = +\cdot576$; $G = -\cdot054$, $H = +\cdot077$, $K = -\cdot996$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	10·1	336	e 2 45	+14	4 25	− 7	5·5	7·4
Taihoku	19·9	350	3 5	−95	(8 0)	−21	8·0	8·7
Batavia	21·7	238	e 5 0	− 1	—	—	—	11·6
Zi-ka-wei	26·0	353	5 42	− 6	e 10 21	− 1	e 12·9	15·9
Kobe	30·7	16	e 6 11	−24	—	—	14·8	21·1
Osaka	30·8	17	6 43	+ 7	12 10	+22	15·2	19·4
Perth	38·4	192	8 1	+20	13 36	− 8	—	—
Adelaide	42·3	163	—	—	14 32	− 7	24·3	26·5
Colombo	45·2	274	15 1	?S	(15 1)	−17	—	38·1
Sydney	46·3	150	15 25	?S	(15 25)	− 7	27·1	29·1
Riverview	46·3	150	e 8 38	− 4	e 15 27	− 5	e 24·7	30·7
Melbourne	46·9	159	—	—	(15 49)	+ 9	15·8	21·9
Kodaikanal	47·5	277	15 49	?S	(15 49)	+ 1	30·1	33·0
Simla	51·8	306	—	—	e 16 49	+ 8	—	—
Helwan	90·7	298	14 37	+87	—	—	—	—
Zagreb	99·3	318	e 17 37	?PR_1	—	—	50·6	—
Triest	100·8	318	—	—	—	—	e 52·6	—
Pompeii	101·9	314	e 25 13	?S	(e 25 13)	−61	—	—
Rocca di Papa	102·8	315	e 19 48	?PR_1	—	—	—	33·3
De Bilt	103·4	327	—	—	e 25 53	−35	e 51·6	56·5
Uccle	104·4	326	—	—	—	—	e 54·6	—
Moncalieri	105·0	320	e 18 30	?PR_1	29 17	?	57·7	—
Edinburgh	105·6	332	31 37	?	—	—	—	73·6
Eskdalemuir	105·9	331	e 23 25	?	—	—	49·6	—
Kew	106·6	328	—	—	—	—	—	66·6
Barcelona	110·1	318	e 25 36	?	—	—	—	—
Algiers	111·6	313	—	—	—	—	74·6	—
Coimbra	117·7	322	—	—	—	—	e 59·6	—
La Paz	162·8	131	21 8	[+58]	—	—	45·0	46·3

Additional records: Manila gives MN = +5·8m. Zi-ka-wei SMN = +10m.50s. Osaka MN = +20·2m. Adeliade SR_1 = +17m.42s. Riverview ePR_1 = +10m.43s., eSR_1 = +18m.49s. and +19m.16s., MZ = +30·8m., MN_1 = +31·0m. Rocca di Papa eP = +18m.12s., i = +66m.19s. De Bilt eE = +21m.32s., eN = 23m.21s., eLN = +53·6m., MN = +63·0m. Edinburgh records P as at 0h. instead of 3h. La Paz M = +49·0m.

Aug. 16d. 7h. 22m. 20s. Epicentre at 9°·0N. 110°·0E.

$A = -\cdot338$, $B = +\cdot928$, $C = +\cdot156$; $D = +\cdot940$, $E = +\cdot342$; $G = -\cdot054$, $H = +\cdot147$, $K = -\cdot988$.

The active epicentre 5°·4N. 125°·2E. does not fit the observations.

	Δ	Az.	P.	O−C.	L.	M.
	°	°	m. s.	s.	m.	m.
Manila	12·1	62	e 3 2	+ 2	5·9	—
Batavia	15·5	192	e 3 40	− 6	—	9·7
Taihoku	19·4	33	e 4 48	+14	—	—
Zi-ka-wei	24·7	24	e 5 35	0	—	—
Osaka	34·7	38	8 41	?PR_1	—	22·9
Helwan	75·8	299	24 40	?	—	—

Osaka gives MN = +20·8m.

1918. Aug. 16d. 8h. 35m. 25s. Epicentre 5°·4N. 125°·2E.

A = −·574, B = +·813, C = +·094; D = +·817, E = +·576;
G = −·054, H = +·077, K = −·996.

There are advantages in keeping the same adopted epicentre as on Aug. 11, 15, &c., but the residuals point to an epicentre further north.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	10·1	336	e 2 52	+21	—	—	4·6	6·8
Taihoku	19·9	350	4 25	−15	8 11	−10	11·0	13·2
Batavia	21·7	238	5 8	+ 7	—	—	—	9·6
Zi-ka-wei	26·0	353	5 44	− 4	i 10 16	− 6	e 14·7	16·2
Kobe	30·7	16	6 51	+16	—	—	16·2	17·4
Osaka	30·8	17	6 39	+ 3	11 42	− 6	14·8	27·6
Perth	38·4	192	13 58	?S	(13 58)	+14	—	—
Colombo	45·2	274	14 35	?S	(14 35)	−43	—	18·6
Riverview	46·3	150	i 8 57	+15	e 16 9	+37	e 23·9	29·8
Sydney	46·3	150	15 53	?S	(15 53)	+21	27·6	30·2
Melbourne	46·9	159	—	—	16 5	+25	19·7	22·3
Kodaikanal	47·5	277	15 59	?S	(15 59)	+11	19·9	36·5
Simla	51·8	306	—	—	e 16 5	−36	—	35·9
Vienna	98·2	320	—	—	—	—	e 61·6	—
Zagreb	99·3	318	e 15 35	+88	—	—	51·6	—
Victoria	99·9	39	—	—	—	—	47·2	63·4
Triest	100·8	318	—	—	—	—	e 55·6	—
Rocca di Papa	102·8	315	e 17 36	?PR_1	—	—	—	19·4
De Bilt	103·4	327	—	—	e 24 52	−96	e 51·6	58·1
Uccle	104·4	326	—	—	—	—	e 53·6	58·6
Moncalieri	105·0	320	e 14 30?	− 4	24 57?	−105	43·4	—
Eskdalemuir	105·9	331	e 26 20	?S	(e 26 20)	−31	52·1	—
Paris	106·5	325	—	—	—	—	e 58·6	68·6
Kew	106·6	328	59 35	?L	—	—	(59·6)	71·6
Capetown	106·9	236	57 23	?L	—	—	(57·4)	64·3
Bidston	107·0	331	60 5	?L	—	—	(60·1)	71·2
Barcelona	110·1	318	—	—	—	—	61·0	71·8
Algiers	111·6	313	—	—	—	—	69·6	—
Coimbra	117·7	322	—	—	—	—	e 63·6	—
San Fernando	118·3	317	45 35	?	—	—	—	77·6
Toronto	126·2	22	—	—	—	—	45·3	—
La Paz	162·8	131	19 46	[−24]	—	—	44·2	92·3

Additional records: Manila gives MN = +6·4m. Zi-ka-wei eSN = +10m.8s. Osaka MN = +17·3m. Riverview eS = +14m.52s., SR_1 = +19m.16s. and +19m.42s., MN_1 = +30·2m., MZ = +31·0m. De Bilt eN = +24m.58s. and +33m.7s., eE = +33m.21s., MN = +58·3m. Paris MN = +63·6m. Barcelona MN = +67·5m. La Paz L = +89·4m.

Aug. 16d. 9h. 25m. 10s. Epicentre 5°·4N. 125°·2N., as at 8h.

A = −·574, B = +·813, C = +·094; D = +·817, E = +·576;
G = −·054, H = +·077, K = −·996.

	Δ	Az.	P.	O−C.	M.
	°	°	m. s.	s.	m.
Manila	10·1	336	e 2 33	+ 2	—
Batavia	21·7	238	i 4 50	−11	9·8
Zi-ka-wei	26·0	353	e 4 34	−74	—
Osaka	30·8	17	7 28	+52	20·6
Riverview	46·3	150	18 32	?SR_1	—
Rocca di Papa	102·8	315	e 33 10	?SR_1	—

Osaka gives MN = +19·3m. Riverview e = +18m.8s.

Aug. 16d. Records also at 0h. (Helwan, Manila, Tokyo, San Fernando, and De Bilt), 1h. (Manila), 2h. (Zagreb and La Paz), 4h. (Zagreb, Batavia, Manila (2), and Rocca di Papa (2)), 5h. (Zagreb), 6h. (Riverview (2)), 8h. (De Bilt, Edinburgh, and San Fernando), 10h. (Zi-ka-wei, Batavia, Manila (2), and De Bilt), 11h. (Manila, Tokyo, and Zi-ka-wei), 15h. (La Paz), 16h. (Batavia, Moncalieri, Manila, Tokyo, Zi-ka-wei, and San Fernando), 17h. (Helwan, Edinburgh, and De Bilt), 20h. (Rocca di Papa and Monte Cassino), 22h. (Manila and Lick).

1918. Aug. 17d. 6h. 53m. 28s. Epicentre 18°·5S. 63°·5W.

A = +·423, B = −·849, C = −·317 ; D = −·895, E = −·446 ;
G = −·142, H = +·284, K = −·948.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
La Quiaca		4·2	209	2 20	?L	6 20	?	—	8·1
La Paz		4·8	294	i 1 15	+ 1	—	—	2·1	2·6
Andalgala	E.	9·5	195	2 20	− 3	2 56	?PR$_1$	—	4·9
	N.	9·5	195	1 56	−27	2 56	?PR$_1$	—	3·5
Pilar	E.	13·2	181	5 44	?	6 50	?L	(6·8)	7·9
	N.	13·2	181	5 50	?	6 56	?L	(6·9)	9·0
Georgetown		58·8	348	e 10 1	−3	18 6	− 3	e 32·0	—
Washington		58·8	348	10 2	− 2	18 6	− 3	e 29·0	—
Ithaca		62·0	349	e 10 27	+ 2	18 47	− 1	34·2	—
Ann Arbor	N.	63·6	343	—	—	18 56	−12	—	—
Toronto		63·8	347	—	—	—	—	38·1	48·2
Ottawa		64·8	351	10 43	− 1	19 27	+ 4	e 31·5	—
San Fernando	N.	77·1	44	44 32	?L	—	—	(44·5)	52·0
	E.	77·1	44	43 32	?L	—	—	(43·5)	51·5
Rio Tinto		77·6	43	17 32	?	—	—	—	49·5
Coimbra		77·9	40	12 27	+21	22 49	+50	40·2	48·6
Algiers		83·6	48	—	—	e 23 6	+ 1	37·5	54·5
Tortosa		83·9	43	12 52	+11	23 40	+32	39·5	48·0
Barcelona		85·2	43	16 33	?PR$_1$	—	—	e 46·4	—
Victoria		85·4	325	—	—	—	—	50·2	52·0
Shide		88·0	34	13 10	+ 5	i 24 1	+ 9	47·7	50·7
Bidston		88·6	31	13 14	+ 6	23 14	−45	—	50·5
Kew		89·0	34	—	—	—	—	—	57·5
Stonyhurst		89·1	31	i 22 50	?	e 32 56	?SR$_1$	—	49·6
Paris		89·2	37	e 18 2	?PR$_1$	i 25 12	+67	46·5	50·5
Eskdalemuir		89·6	30	e 13 19	+ 5	24 12?	+ 2	43·0	—
Edinburgh		90·0	29	23 32	?S	(23 32)	−42	—	—
Moncalieri		90·5	42	e 13 18	− 1	26 5	?	e 41·0	58·1
Uccle		91·1	36	—	—	—	—	e 46·5	—
De Bilt		92·2	35	e 13 41	+13	e 24 13	−24	e 49·1	54·4
Rocca di Papa		92·4	47	e 13 25	− 4	24 12?	−27	—	—
		92·4	47	e 17 31	?PR$_1$	23 12?	−87	e 55·1	68·1
Triest		94·6	43	—	—	—	—	e 49·5	—
Zagreb		96·1	44	e 17 32	?PR$_1$	—	—	53·5	59·5
Vienna		97·3	41	e 18 2	?PR$_1$	—	—	—	—
Honolulu		100·7	289	24 26	?S	(24 26)	−96	44·5	56·0
Helwan		103·2	63	25 50	?S	(25 50)	−36	—	68·7
Melbourne		117·7	205	—	—	—	—	e 54·5	56·5
Riverview		118·1	212	—	—	e 35 49	?	e 51·9	56·4
Kodaikanal		141·4	97	84 32	?L	—	—	(84·5)	—
Simla		142·4	63	58 8	?L	—	—	(58·1)	62·1
Manila		174·2	228	e 20 10	[− 6]	—	—	—	—

Additional records : Georgetown gives L = +34·8m., T_0 = 6h.53m.28s. Washington L = +34·5m., T_0 = 6h.53m.29s. Ithaca LN = +35·5m. Toronto eL = +46·6m. Ottawa L = +36·5m. and +41·5m., T_0 = 6h.53m.27s. San Fernando records PN at 3h. instead of 7h. Coimbra LN = +38·5m., T_0 = 6h.53m.31s. Eskdalemuir SR_1 = +30m.25s., T_0 = 6h.53m.51s. Moncalieri i = +16m.22s., MN = +56·7m. De Bilt ePR_1E = +17m.38s., e = +26m.35s., eLN = +50·1m., MN = +54·5m. Zagreb MNW = +56·5m. Riverview e = +39m.14s., MN = +53·9m.

Aug. 17d. 10h. 25m. 25s. Epicentre 77°·0S. 110°·0E.?

A = −·077, B = +·211, C = −·974.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Melbourne	42·0	40	—	—	20 11	?L	(20·2)	25·1
Riverview	46·9	43	—	—	e 15 43	+ 3	e 22·6	26·4
La Paz	86·5	183	e 12 58	+ 2	23 32	− 4	38·1	43·0
Osaka	112·8	25	17 11	+121	—	—	—	28·6
Helwan	116·6	290	77 35	?L	—	—	(77·6)	—
San Fernando	131·2	250	79 35	?L	—	—	(79·6)	—
Stonyhurst	146·9	260	—	—	—	—	—	88·7
Edinburgh	149·0	263	82 35	?L	—	—	(82·6)	(109·8)

Additional records : Melbourne L = +23·6m. Riverview gives MN = +25·3m. Osaka MN = +30·3m. But the Osaka records may refer to a different shock.

Aug. 17d. Records also at 3h. (La Paz, Denver, and Manila), 4h. (Manila and Helwan), 8h. (Manila), 12h. (Taihoku and Zi-ka-wei), 16h. (La Paz), 18h. (La Paz, Manila, and Barcelona), 21h. (La Paz).

Aug. 18d. 6h. 4m. 50s. Epicentre 5°·4N. 125°·2E. (as on Aug. 16d. 9h., &c.).

A = −·574, B = +·813, C = +·094; D = +·817, E = +·576; G = −·054, H = +·077, K = −·996.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		10·1	336	e 2 54	+23	5 5	+33	5·8	7·3
Batavia		21·7	238	e 4 10	−51	—	—	—	10·2
Zi-ka-wei		26·0	353	5 45	− 3	e 10 22	0	—	16·0
Osaka		30·8	17	6 37	+ 1	—	—	—	20·5
Riverview		46·3	150	e 11 34?	+172	e 18 51	+199	e 28·6	35·5
Melbourne		46·9	159	—	—	(15 40)	0	15·7	32·2
Helwan		90·7	298	16 10	?PR_1	—	—	—	—
Rocca di Papa		102·8	315	—	—	—	—	70·6	—
De Bilt	E.	103·4	327	—	—	—	—	e 52·2	67·2
	N.	103·4	327	—	—	—	—	e 54·2	60·2
Uccle		104·4	326	—	—	—	—	—	55·2
Edinburgh		105·6	332	54 10	?L	—	—	(54·2)	71·7
Eskdalemuir		105·9	331	—	—	—	—	50·2	—
Paris		106·5	325	—	—	—	—	e 59·2	—
Bidston		107·0	331	62 52	?L	—	—	(62·9)	70·3

Additional records: Zi-ka-wei gives SMN = +10m.56s. Riverview eSR_1 = +22m.49s., MN = +30·1m.

Aug. 18d. Records also at 2h. (Mizusawa), 3h. (Manila, Barcelona, and Batavia), 4h. (De Bilt), 8h. (Manila, La Paz, Pilar, Andalgala, and Cipolletti), 9h. (Manila, La Paz, Helwan, and Edinburgh), 13h. (San Fernando), 16h. (Marseilles), 17h. (Zi-ka-wei (2)), 21h. (La Paz), 22h. (Manila).

Aug. 19d. 17h. 27m. 0s. Epicentre 5°·4N. 125°·2E. (as on Aug. 18d. 6h.).

A = −·574, B = +·813, C = +·094; D = +·817, E = +·576; G = −·054, H = +·077, K = −·996.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		10·1	336	e 3 30	+59	—	—	5·1	6·3
Batavia		21·7	238	e 5 0	− 1	—	—	—	12·0
Tokyo		33·1	22	5 39	−78	—	—	—	—
Colombo		45·2	274	30 0	?	—	—	—	—
Riverview		46·3	150	—	—	—	—	e 19·6	31·1
Helwan		90·7	298	25 0	?S	(25 0)	+39	—	—
De Bilt	E.	103·4	327	e 28 28	?	—	—	e 57·0	58·9
	N.	103·4	327	—	—	—	—	e 55·0	59·0
Edinburgh		105·6	332	54 0	?L	—	—	(54·0)	72·0
Eskdalemuir		105·9	331	—	—	—	—	51·0	—
La Paz		162·8	131	19 26	[−44]	—	—	—	—

Additional records: Manila gives MN = +6·5m. Riverview e = +26·6m., MN = +31·7m.

Aug. 19d. 23h. 57m. 55s. At 5°·4N. 125°·2E. (as at 17h.).

A = −·574, B = +·813, C = +·094; D = +·817, E = +·576; G = −·054, H = +·077, K = −·996.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	10·1	336	e 2 35	+ 4	4 21	−11	6·1	6·4
Batavia	21·7	238	e 5 5	+ 4	—	—	—	10·1
Helwan	90·7	298	59 5	?L	—	—	(59·1)	—
De Bilt	103·4	327	—	—	—	—	e 53·1	57·5
Edinburgh	105·6	332	52 5	?L	—	—	(52·1)	—
Eskdalemuir	105·9	331	—	—	—	—	50·1	—
San Fernando	118·3	317	36 5	?SR_1	—	—	—	—

De Bilt gives MN = +57·8m.

Aug. 19d. Records also at 0h. (San Fernando), 1h. (Stonyhurst and Manila), 3h. (La Paz), 4h. (Manila), 7h. (Manila and Rio Tinto), 11h. (Berkeley), 12h. (Riverview), 17h. and 18h. (Manila), 21h. (La Paz), 22h. (Helwan).

Aug. 20d. Records at 2h. (Manila, Tokyo, and Osaka), 3h. (La Paz, Tokyo, and De Bilt), 4h. (Athens), 6h. (Tokyo), 7h. (Manila), 12h. (Manila), 13h. (Batavia), 18h. (Lick and Berkeley), 21h. (La Paz), 22h. (San Fernando).

Aug. 21d. 0h. 18m. 15s. Epicentre 5°·4N. 125°·2E. (as on Aug. 19d. 23h.).

A = −·574, B = +·813, C = +·094.

	Δ	Az.	P.	O−C.	L.	M.
	°	°	m. s.	s.	m.	m.
Manila	10·1	336	e 2 38	+ 7	—	—
Batavia	21·7	238	e 4 45	−16	—	—
Riverview	46·3	150	e 21 9	?L	e 25·8	26·5
Helwan	90·7	298	49 45	?L	(49·8)	—
De Bilt	103·4	327	—	—	55·4	61·0
Paris	106·5	325	—	—	62·8	—
La Paz	162·8	131	20 6	[− 4]	—	—

Riverview gives MN = −29·0m. De Bilt MN = +57·8m.

Aug. 21d. 4h. 12m. 12s. Epicentre 43°·4N. 72°·0W.

A = +·224, B = −·691, C = +·687.

	Δ	P.	O−C.	S.	O−C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Harvard	1·2	0 16	− 2	—	—	—	0·7
Ottawa	3·4	—	—	1 36	+ 2	e 1·8	—
Toronto	5·4	—	—	—	—	2·2	2·4

Harvard gives T_0 = 4h.11m.54s. Ottawa T_0 = 4h.12m.50s.

Aug. 21d. 12h. 19m. 5s., 12h. 44m. 45s., 13h. 13m. 26s., 13h. 43m. 32s., 17h.2m.8s. A series of Tacubaya records, in which P follows these times by 31sec. and M by approximately 78sec., indicate shocks from the same epicentre as on August 22d. 8h.

Aug. 21d. Records also at 7h. (Rio Tinto), 9h. (De Bilt and San Fernando), 11h. (Helwan), 13h. (La Paz), 14h. (Manila), 15h. (Helwan, Lick, and Athens), 17h. and 18h. (Athens), 19h. (La Paz and Athens), 20h. (Batavia), 21h. (Manila and La Paz).

Aug. 22d. 8h. 31m. 0s. At 20°·0N. 99°·0W. (as on 1913 June 14d.).

A = −·147, B = −·928, C = +·342; D = −·988, E = +·156:
G = −·053, H = −·338, K = −·940.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Tacubaya	0·6	202	(0 3)	− 6	—	—	—	(0·8)
Toronto	28·8	30	—	—	(11 18)	+ 5	11·3	—
Ottawa	31·8	32	13 56	?S	(13 56)	+111	—	—
La Paz	47·4	138	8 42	− 8	15 42	− 4	24·3	26·7
Honolulu	54·9	282	—	—	17 48	+28	24·7	29·0

This is one of a series of shocks recorded at Tacubaya on Aug. 21 and 22, in all of which M follows P by about 47sec., and which are probably from the same epicentre close to Tacubaya. But it would seem that there is an error of 2min. in the present case, the actual records giving P = −1m.57s. and M = −0·7m. The other times for T_0 are

Aug. 22d. 9h. 47m. 52s. P = +31s. M = +83s.
9h. 57m. 58s. P = +31s. M = +82s.
11h. 58m. 21s. P = +31s. M = +75s.

but if there is an error of 2min., as above, it may extend to others. The Tacubaya records are given in local time, and the longtitude 6h.36m.47s. has been added in this and other cases. It is assumed that the Toronto L is really S. The Ottawa P may be S (with an error of 2min.) or L. The Honolulu P is assumed to be S.

Aug. 22d. Records also at 1h. (Lick), 15h. (Victoria), 17h. (Zi-ka-wei and Bidston), 19h. (Manila), 20h. (San Fernando and Lick), 22h. (Bidston), 23h. (Manila).

Aug. 23d. 6h. 7m. 30s. Epicentre 10°·0S. 44°·0E.

A = +·708, B = +·684, C = −·174; D = +·695, E = −·719; G = −·125, H = −·121, K = −·985.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mauritius	N.	16·7	129	3 42	−19	—	—	7·4	8·9
	E.	16·7	129	3 24	−37	—	—	7·9	8·9
Cape Town		33·4	220	11 24	?S	(11 24)	−66	18·9	20·2
Kodaikanal		38·9	60	18 6	?L	—	—	(18·1)	—
Colombo		39·5	66	—	—	17 30	?SR$_1$	21·0	53·2
Helwan		41·7	343	13 30	?S	(13 30)	−61	—	—
Simla		52·0	36	e 16 42	?S	e (16 42)	− 2	—	53·0
Rocca di Papa		59·2	333	(e 10 5)	− 1	e 10 5	?P	e 39·3	40·4
Algiers		60·6	323	—	—	—	—	30·5	40·5
Zagreb		61·2	338	—	—	e 25 30	?	36·5	—
Moncalieri		64·0	332	e 19 11	?S	(e 19 11)	− 2	32·7	—
Barcelona		64·2	326	—	—	—	—	31·6	41·4
Tortosa		64·7	325	10 57	+14	—	—	29·5	—
San Fernando		66·2	318	33 30	?L	—	—	37·5	128·0
Rio Tinto		67·2	318	32 30	?L	—	—	(32·5)	142·5
Coimbra		69·8	320	—	—	—	—	e 35·6	45·7
Paris		69·8	332	—	—	—	—	e 36·5	37·5
De Bilt	E.	70·5	336	—	—	—	—	e 38·0	40·0
	N.	70·5	336	—	—	e 20 32	0	e 36·4	43·0
Shide		72·3	332	—	—	—	—	35·9	124·5
Stonyhurst		74·9	334	e 27 0	?SR$_1$	e 40 6	?L	e 42·0	44·0
Eskdalemuir		76·3	335	—	—	—	—	37·5	—

Additional records: Cape Town gives S = +15m.54s. Simla gives M_2 = +87·1m. Rocca di Papa gives eP = 6h.7m.23s.—possibly a T_0. Coimbra MN = +44·2m.

1918. Aug. 23d. 6h. 36m. 33s. Epicentre 11°·0S. 165°·0E.

A = −·948, B = +·254, C = −·191; D = +·259, E = +·966; G = +·184, H = −·049, K = −·982.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Apia		22·8	100	i 5 9	− 6	i 10 13	?SR$_1$	11·4	12·4
Riverview		26·1	207	e 5 41	− 8	i 10 15	− 9	e 11·8	15·9
		26·1	207	i 5 45	− 4	i 10 23	− 1	—	16·8
Melbourne		32·3	210	(7 51)	?PR$_1$	12 15	+ 2	19·2	20·4
Adelaide		33·9	221	6 41	−23	12 11	−28	17·7	20·7
Honolulu		48·7	48	8 57	− 1	15 57	− 5	23·8	30·2
Perth		49·8	237	9 20	+14	16 21	+ 5	24·4	27·9
Manila		50·6	300	e 9 8	− 3	16 32	+ 6	26·0	27·7
Tokyo		52·4	335	9 22	0	—	—	—	—
Osaka		53·6	330	9 25	− 5	16 55	− 9	23·3	27·2
Kobe		53·7	330	i 9 29	− 2	17 2	− 3	24·0	28·0
Mizusawa	E.	54·8	337	9 38	0	17 11	− 8	—	—
	N.	54·8	337	9 39	+ 1	17 10	− 9	—	—
Taihoku		55·9	311	9 36	− 9	17 24	− 9	27·3	29·1
Batavia		57·6	270	9 57	+ 1	—	—	—	14·4
Zi-ka-wei		59·4	317	10 8	0	18 22	+ 6	e 28·2	34·8
Ootomari		61·0	344	10 34	+15	—	—	—	—
Berkeley		83·5	49	—	—	e 21 57	−66	—	—
Lick		83·7	50	—	—	e 22 27	−39	—	—
Victoria		86·5	39	22 58	?S	(22 58)	−38	39·2	50·6
Kodaikanal		89·6	280	22 51	?S	(22 51)	−79	—	—
Tucson		91·0	57	—	—	—	—	42·2	64·3
Mauritius	E.	101·8	246	17 27	?PR$_1$	—	—	52·0	55·8
	N.	101·8	246	20 9	?PR$_1$	—	—	52·6	56·0
Cipolletti		109·8	139	24 15	?	26 45	−41	—	64·8
Toronto		115·9	46	24 39?	?	(i 29 21)	+64	e 59·0	70·8
Pilar		116·7	134	22 15	?	—	—	—	—
Andalgala		117·1	129	22 15	?	27 45	−42	—	65·2
Ottawa		118·1	44	i 19 40	?PR$_1$	e 29 50	+75	e 59·4	—
Ithaca	E.	118·3	48	—	—	29 52	+76	58·4	—
	N.	118·3	48	—	—	30 52	+136	61·6	—

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Georgetown	E.	118·5	51	i 20 15	?PR_1	e 30 4	+86	e 57·0	—
	N.	118·5	51	e 20 15	?PR_1	e 29 48	+70	e 56·8	—
Washington		118·5	51	e 19 54	?PR_1	—	—	e 57·4	—
Cheltenham	E.	118·7	52	—	—	—	—	e 64·4	68·4
	N.	118·7	52	—	—	—	—	e 62·4	76·4
La Paz		120·7	117	e 19 17	?	30 59	?	51·6	60·5
Harvard		122·1	46	e 25 27	?	29 40	+35	60·3	—
Lemberg		129·6	328	e 21 21	?PR_1	—	—	e 65·6	79·4
Vieques		130·8	75	—	—	—	—	67·4	73·4
Vienna	Z.	134·5	331	e 19 36	[+ 7]	—	—	—	—
De Bilt	E.	135·8	342	—	—	(e 40 9)	?SR_1	e 64·4	65·0
	N.	135·8	342	—	—	—	—	e 67·4	67·7
Stonyhurst		136·0	349	—	—	i 41 3	?SR_1	—	82·8
Athens		136·2	315	e 22 9	?PR_1	—	—	—	—
Bidston		136·6	350	10 39	?	21 27	?PR_1	—	80·6
Hohenheim		137·2	337	e 20 6	[+32]	—	—	—	—
Uccle		137·2	342	e 17 27	+28	(22 16)	?PR_1	—	77·4
Triest		137·6	330	e 22 9	?PR_1	—	—	—	—
Kew		137·8	346	72 27	·?L	—	—	(72·4)	101·4
Pola		138·1	329	e 23 15	?PR_1	—	—	e 63·2	88·4
Paris		139·5	342	e 22 33	?PR_1	i 37 19	—	66·4	70·4
Milan		139·8	334	19 4	[−35]	—	—	76·4	86·6
Moncalieri		140·8	334	24 15?	?PR_1	36 26?	?	55·3	87·8
Rocca di Papa		140·9	327	e 19 38	[− 3]	—	—	e 72·9	—
		140·9	327	e 20 56	?	(e 41 10?)	?SR_1	e 41·2	41·4
Barcelona		146·0	337	19 53	[+ 3]	—	—	63·1	93·1
Algiers		149·5	331	20 2	[+ 7]	—	—	64·4	90·0
Coimbra		150·2	350	20 13	[+17]	—	—	e 62·4	89·9

Additional records: Riverview gives PS = +10m.34s. and +11m.23s., MZ = +15·4m., T_o = 6h.36m.21s. Epicentre 10°·0S. 161°·5E. Melbourne SR_1 = +15m.33s. Adelaide PR_1 = +8m.11s., SR_1 = +13m.11s. Manila MN = +27·1m., T_o = 6h.36m.24s. Osaka MN = +27·5m., T_o = 6h.36m.34s. Batavia gives its records an hour late. Zi-ka-wei MN_1 = +31·2m., MN_2 = +34·2m. Victoria S = +28m.53s. Toronto S = +36m.21s., eL = +40·6m., eL = +61·2m. Ottawa e = 25m.48s., i = +36m.21s., L = +67·4m. Ithaca eE = +26m.57s., eN = +27m.26s., eE = +36m.32s. Georgetown L = +63·4m. Records given one hour late. Washington L = +63·4m. La Paz PR_1 = +21m.32s., +24m.12s., and +26m.5s., SR_1 = +32m.37s., +35m.59s., and +37m.58s. Harvard SE = +37m.41s., SN = +38m.26s., LE = +65·4m. and +72·4m., T_o = 6h.48m.47s.? Vieques MN = +75·4m. De Bilt eE = +44m.42s. and +55m.36s., eN = +44m.55s. and +55m.19s. Epicentre 10°·0S. 161·5E. Uccle gives S as PR_1. Kew gives its L, recorded as P, one hour too early. Pola MN = +74·7m. Paris iPN = +22m.38s., SR_1 = +40m.50s., M = +75·4m. Milan gives its M earlier than the L. This may be one hour wrong. Moncalieri MN = +87·9m. Coimbra eLN = +58·4m.

Aug. 23d. 22h. 34m. 30s. Epicentre 15°·0S. 151°·0E. (see 1918 Feb. 26).

A = −·845, B = +·468, C = −·259: D = +·485, E = +·875; G = +·226, H = −·126, K = −·966.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	18·8	180	(e 4 26)	− 1	(e 7 54)	− 4	e 7·9	12·3
Adelaide	22·9	207	13 30	?L	—	—	(13·5)	16·7
Melbourne	23·4	192	—	—	11 36	?L	14·6	16·4
Perth	36·2	236	13 14	?S	(13 14)	+ 1	(18·3)	—
Manila	41·9	314	e 6 14	?	—	—	—	—
Honolulu	61·8	55	13 12	?PR_1	—	—	15·3	15·7
Helwan	122·9	296	37 30	?SR_1	—	—	—	—
De Bilt	134·1	331	e 20 48	?	—	—	e 65·5	74·8
Edinburgh	134·6	340	67 30	?L	—	—	(67·5)	—
Bidston	136·6	338	65 48	?L	73 6	?L	(65·8)	89·0
Tortosa	143·6	321	16 54	−31	—	—	73·5	78·9

Additional records: Riverview gives eP? = 22h.34m.6s., possibly intended to be a T_o, MN = +11·9m. Perth L = +24·4m. De Bilt MN = +67·8m. The Honolulu records do not fit (except the P, which is a very accurate PR_1), and may refer to another shock.

Aug. 23d. Records also at 0h. (Riverview), 7h. (Kodaikanal), 8h. (Edinburgh), 9h. (Riverview and Ann Arbor), 14h. (Tokyo and Mizusawa (2)), 16h. (Sydney), 17h. (Manila and Zi-ka-wei), 21h. (Apia), 22h. (San Fernando).

Aug. 24d. Records at 0h. and 2h. (Athens), 3h. (La Paz), 7h. (Athens), 11h. (Riverview), 13h. (Zagreb), 14h. (Athens), 16h. (De Bilt and La Paz), 17h. (Helwan and La Paz), 18h. (Riverview), 21h. (La Paz and San Fernando), 22h. (Paris).

Aug. 25d. 0h. 15m. 50s. Epicentre 37°·5N. 142°·5E. (as on 1916 Aug. 27d.).

A = −·630, B = +·483, C = +·609; D = +·609, E = +·793; G = −·483, H = +·370, K = −·793.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa	E.	2·0	327	0 34	+ 3	—	—	1·1	—
	N.	2·0	327	0 42	+11	—	—	1·3	—
Tokyo		2·9	231	e 0 53	+ 8	—	—	—	—
Manila		29·8	226	e 15 57	?L	—	—	18·0	18·4
Batavia		54·9	225	—	—	e 17 10	−10	—	22·2
Perth		73·8	203	—	—	—	—	32·1	—

Manila gives MN = +18·3m.

Aug. 25d. Records also at 1h. (De Bilt, Helwan, Eskdalemuir, and Bidston), 2h. (Manila), 5h. (Helwan), 6h. (San Fernando), 10h. (Riverview and Tokyo), 11h. (Melbourne), 12h. (Manila), 21h. (San Fernando), 22h. (La Paz and Paris).

Aug. 26d. 5h. 51m. 28s. Epicentre 30°·2S. 75°·0E.

A = +·224, B = +·835, C = −·503; D = +·966, E = −·259; G = −·130, H = −·486, K = −·864.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mauritius	N.	18·4	299	—	—	7 38	−11	—	11·0
	E.	18·4	299	—	—	8 32	+43	—	11·0
Colombo		37·3	8	13 32	?S	(13 22)	+ 4	—	—
Cape Town		47·4	250	21 32	?L	—	—	(21·5)	28·0
Manila		63·0	51	e 19 1	?S	(e 19 1)	0	—	—
Helwan		73·0	321	16 32	?	—	—	—	—
Rocca di Papa		92·0	319	e 12 32	−55	22 50?	−105	41·4	48·1
Algiers		95·0	310	—	—	—	—	35·5	40·5
Barcelona		98·2	314	—	—	—	—	e 37·2	43·3
Paris		102·0	320	—	—	—	—	e 40·5	48·5
De Bilt		102·3	324	—	—	—	—	e 39·9	42·3
Coimbra		104·5	308	—	—	—	—	e 39·7	—
Bidston		107·3	322	27 8	?S	(27 8)	+ 4	—	54·1
Eskdalemuir		108·2	324	—	—	—	—	41·5	—
Edinburgh		108·3	325	44 32	?L	—	—	(44·5)	—
La Paz		121·3	222	—	—	—	—	55·5	56·8

Additional records: Rocca di Papa e = +33m.26s. Bidston gives S = +34m.44s.

Aug. 26d. Records also at 5h. (Cape Town), 7h. (Tokyo), 8h. (Manila), 11h. (Osaka, Kobe, Tokyo, and Manila), 19h. (Manila), 21h. (Manila and San Fernando), 22h. (Monte Cassino), 23h. (La Paz).

Aug. 27d. Records at 1h. (Rocca di Papa and Manila), 5h. (San Fernando (2) and Lick), 7h. (Rio Tinto and Balboa Heights), 20h. (La Paz, Batavia, Tokyo, and Manila), 21h. (San Fernando).

Aug. 28d. Records at 6h. (Stonyhurst), 7h. (Apia), 12h. (Bidston), 15h. (Zi-ka-wei), 20h. (San Fernando).

Aug. 29d. 6h. 39m. 25s. Epicentre 41°·6N. 35°·7E.

A = +·607, B = +·436, C = +·664; D = +·584, E = −·812; G = +·539, H = +·387, K = −·748.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	E.	9·9	252	2 30	+ 1	4 30	+ 4	1 5·0	6·0
	N.	9·9	252	2 32	+ 3	—	—	—	5·4
Lemberg		11·5	319	e 5 11	?S	(e 5 11)	+ 4	(e 6·3)	12·0
Helwan		12·3	198	5 23	?S	(5 23)	− 3	(6·6)	12·2
Budapest		13·2	302	e 4 41	?	—	—	—	—
Zagreb		14·8	293	e 4 46	?	—	—	—	—
Pompeii		15·9	274	e 3 49	− 2	e 8 39	?L	(e 8·6)	11·6
Pola		16·2	289	e 4 23	+28	—	—	e 8·4	—
Triest		16·3	292	e 4 3	+ 7	—	—	—	10·6
Monte Cassino		16·3	277	4 5	+ 9	—	—	—	—
Rocca di Papa		17·1	278	e 4 10	+ 4	e 7 13	− 7	e 10·2	11·6
Milan		19·5	290	e 3 38	?	5 5?	—	—	10·9
Zurich		20·1	296	e 4 53	+11	—	—	—	—
Moncalieri		20·5	289	4 54	+ 7	1 8 39	+ 5	11·5	—
De Bilt	E.	23·1	307	—	—	—	—	11·5	15·5
	N.	23·1	307	—	—	9 38	+11	10·9	16·3
Uccle		23·3	304	e 5 29	+ 9	e 9 35	+ 4	e 12·6	14·9
Paris		24·2	298	1 6 22	+52	e 9 52	+ 4	13·6	16·1
Barcelona		25·0	281	5 39	+ 1	10 3	0	13·6	14·6
Algiers		25·6	270	e 5 38	− 6	10 7	− 7	13·9	17·0
Tortosa		26·2	280	5 51	+ 1	10 21	− 5	—	17·6
Shide		26·8	302	6 46	+50	—	—	16·4	19·7
Edinburgh		28·8	313	10 35	?S	(10 35)	−38	—	18·1
San Fernando		32·6	275	17 35	?L	—	—	(17·6)	24·1
Coimbra		33·0	283	e 7 52	?PR_1	12 44	+20	18·6	—
									23·9

Additional records: Lemberg gives also a record at +7m.35s. Helwan gives S as P and L as S. Pola MN = +10·1m. Moncalieri MN = +14·9m., T_o = 6h.39m.38s. Paris MN = +17·6m., T_o = 6h.41m.26s.

Aug. 29d. Records also at 2h. (Taihoku), 3h. (Zi-ka-wei), 4h. (De Bilt), 5h. (Bidston, Eskdalemuir, and San Fernando), 9h. (Tokyo), 16h. (Monte Cassino), 17h. (Ootomari), 18h. (De Bilt), 21h. (Riverview and San Fernando), 22h. (Lick), 23h. (Sydney and Lick).

Aug. 30d. Records at 5h. (Perth), 14h. (Pompeii), 23h. (Lick).

Aug. 31d. 21h. 53m. 35s. Epicentre 9°·0S. 111°·0E.

A = −·354, B = +·922, C = −·156; D = +·934, E = +·358; G = +·056, H = −·146, K = −·988.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia		5·0	304	1 1 23	+ 6	1 2 28	+11	—	4·0
Perth		23·4	169	5 44	?PR_1	(9 33)	0	9·6	—
Manila		25·6	23	e 5 34	−10	—	—	—	—
Colombo		34·9	296	12 25	?S	(12 25)	−29	—	32·4
Kodaikanal		38·4	299	21 7	?L	—	—	(21·1)	—
Melbourne		42·0	139	14 31	?S	(14 31)	− 4	23·5	27·1
Riverview		44·4	130	e 8 32	+ 3	e 16 7	+60	e 23·8	30·5
Mauritius	E.	52·4	251	16 37	?S	(16 37)	−12	24·9	26·6
Helwan		85·7	301	23 25	?S	(23 25)	− 2	—	—
De Bilt		106·8	322	—	—	—	—	e 55·4	65·6
Edinburgh		110·8	327	58 25	?L	—	—	(58·4)	—
La Paz		154·5	182	e 20 2	[0]	e 33 40?	?	82·4	83·9

Additional records: Batavia gives T_o = 21h.53m.38s. Colombo M = +16·4m. Riverview e = +10m.17s., eSR_1? = +18m.19s., and +18m.45s., MN = +26·8m., ME = +30·5m. Mauritius P = +18m.13s. De Bilt MN = +63·6m.

Aug. 31d. Records also at 0h. (San Fernando), 1h. (Manila and Batavia), 5h. (Rocca di Papa), 18h. (Algiers), 21h. (San Fernando and Stonyhurst).

Sept. 1d. 6h. 27m. 55s. Epicentre 38°·3N. 20°·0E.

A = +·737, B = +·268, C = +·620; D = +·342, E = −·940; G = +·582, H = +·212, K = −·785.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Athens		3·0	94	—	—	e 1 25	+ 2	i 1·9	2·2
Zagreb		8·0	340	e 2 5	+ 4	—	—	—	5·9
Helwan		12·6	129	3 5	− 2	—	—	—	—
Paris		16·4	316	—	—	—	—	14·1	—
De Bilt	E.	17·2	328	e 6 35	?S	(e 6 35)	−47	e 10·2	13·4
	N.	17·2	328	e 5 59	?S	(e 5 59)	−83	e 9·3	11·2
Shide		19·4	317	—	—	—	—	13·2	—

Sept. 1d. Records also at 11h. (Zagreb and Rocca di Papa), 14h. (Osaka), 16h. (De Bilt), 20h. (Manila, Monte Cassino, and Batavia), 21h. (San Fernando), 22h. (La Paz), 23h. (Helwan).

1918. Sept. 2d. 14h. 15m. 10s. Epicentre 0°. 145°·0E.

(as on 1917 June 1d.).

A = − 819, B = +·574, C = ·000; D = +·574, E = +·819; G = ·000, H = ·000, K = −1·000.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		27·9	303	e 6 8	+ 1	10 50	− 7	13·8	14·9
Taihoku		33·8	320	e 5 22	−101	12 38	0	17·5	19·3
Riverview		34·3	171	e 5 54	−73	(e 13 20?)	+36	15·7	22·1
Sydney		34·3	171	11 8	?S	(11 8)	−96	—	—
Adelaide		35·5	189	—	—	13 4	+ 1	15·8	23·6
Osaka		35·8	347	7 54	+34	13 1	− 6	18·2	20·7
Melbourne		37·8	180	—	—	18 26	?L	(18·4)	21·9
Zi-ka-wei		38·3	327	e 7 33	− 7	e 13 46	+ 4	e 16·2	20·9
Batavia		38·6	260	7 31	−12	7 59	?	—	14·8
Perth		42·2	218	13 34	?S	(13 34)	−64	22·8	—
Honolulu		59·5	65	9 50	−19	17 20	−57	25·8	33·8
Colombo		65·4	277	31 50	?	—	—	—	—
Kodaikanal		67·9	281	39 26	?L	—	—	(39·4)	—
Victoria		91·2	42	42 12?	?L	—	—	(42·2)	52·5
Helwan		110·4	302	30 50	?	—	—	—	—
Zagreb		116·0	323	—	—	—	—	e 57·8	74·8
De Bilt	E.	118·0	333	—	—	—	—	e 59·8	60·8
	N.	118·0	333	—	—	—	—	e 61·8	64·7
Hohenheim		118·2	328	—	—	—	—	52·5	—
Edinburgh		118·5	340	29 50	?S	(29 50)	+72	—	77·3
Eskdalemuir		118·9	340	—	—	—	—	56·8	—
Uccle		119·3	333	—	—	e 38 50	?SR_1	e 64·8	—
Stonyhurst		119·9	338	20 50	?PR_1	—	—	—	76·4
Bidston		120·4	339	29 2	?S	(29 2)	+10	(41·6)	69·3
Kew		120·8	336	—	—	—	—	—	91·8
Toronto		121·1	36	—	—	—	—	64·5	—
Moncalieri		121·3	326	25 33	?	35 20	?SR_1	58·8	75·3
Paris		121·5	332	—	—	e 43 50	?	62·8	72·3
Ottawa		122·1	33	—	—	—	—	64·8	—
Barcelona		126·7	326	—	—	—	—	e 70·1	—
San Fernando	E.	134·8	327	76 50	?L	—	—	84·8	—
	N.	134·8	327	33 50	?	—	—	85·8	—

Additional records: Manila gives MN = +17·1m. Riverview eS = +10m.44s., MN_1 = +17·5m., MZ = +20·2m. Osaka MN = +22·4m. Melbourne SR_1 = +19m.44s., L = +21·2m. Zi-ka-wei MN = +21·9m. Bidston gives S = +41·6m. (taken as L above). Toronto L = +70·9m. Moncalieri MN = +76·8m. Paris MN = +74·8m. Ottawa eLN? = +52·8m.

Sept. 2d. Records also at 2h. (Manila), 10h. (Zi-ka-wei), 16h. (Stonyhurst and Rocca di Papa), 18h., 20h., and 21h. (La Paz), 22h. (San Fernando).

Sept. 3d. Records at 2h. (La Paz), 6h. (Mizusawa), 7h. (Tokyo), 13h. (Capetown) 14h. (Zagreb), 15h. (Batavia and Manila), 23h. (San Fernando).

Sept. 4d. 3h. 11m. 50s. Epicentre 9°·0S., 111°·0E. (as on 1918 Aug. 31d.).

A = −·354, B = +·922, C = −·156; D = +·934, E = +·358; G = +·056, H = −·146, K = −·988.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia		5·0	304	1 16	− 1	2 16	− 1	—	3·2
Colombo		34·9	296	23 10	?L	—	—	(23·2)	—
Melbourne		42·0	139	—	—	—	—	e 25·2	31·2
Mauritius	E.	52·4	251	23 52	?L	—	—	(23·9)	26·0
Helwan		85·7	301	48 10	?L	—	—	(48·2)	—
De Bilt	N.	106·8	322	—	—	—	—	e 61·2	66·2
	E.	106·8	322	—	—	—	—	e 65·2	69·6
Eskdalemuir		111·0	326	—	—	—	—	64·2	—

Batavia gives T_0 = 3h.11m.52s.

Sept. 4d. 19h. 54m. 45s. Epicentre 36°·8N. 114°·3W. (as on 1918 May 6d. 4h.).

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Tucson	N.	5·3	147	1 28	+ 6	(e 2 24)	− 1	e 2·4	3·0
	E.	5·3	147	1 16	− 6	(e 2 4)	−21	e 2·1	3·0
Georgetown		29·2	74	—	—	—	—	e 15·4	—
Ottawa	N.	30·0	61	—	—	—	—	e 16·7	23·7

Sept. 4d. Records also at 1h. (Manila), 2h. (Barcelona and Tortosa), 3h. (Monte Cassino), 8h. (Tacubaya), 11h. (Tokyo), 13h. (Athens and La Paz), 17h. Batavia and Manila), 18h. (De Bilt), 20h. (Ann Arbor), 22h. (La Paz).

1918. Sept. 5d. 7h. 5m. 30s. Epicentre 5°·5N. 124°·5E.

A = −·564, B = +·826, C = +·096; D = +·824, E = +·566; G = −·054, H = +·079, K = −·995.

This epicentre was independently computed, but is probably the same as that of Aug. 21d. 0h. and several previous dates in August, viz., 5°·4N. 125°·2E.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		9·7	339	e 2 27	+ 1	4 19	− 2	6·2	7·6
Taihoku		19·7	352	4 22	−15	7 45	−32	11·3	12·0
Batavia		21·2	236	e 4 58	+ 3	—	—	—	9·5
Zi-ka-wei	N.	25·8	354	5 44	− 2	10 14	− 4	—	—
	E.	25·8	354	5 36	−10	10 22	+ 4	—	—
Osaka		30·9	18	7 31	?PR_1	—	—	—	18·1
Ootomari		44·2	18	7 28	−59	—	—	—	—
Colombo		44·5	274	14 30	?S	(14 30)	−39	—	—
Riverview		46·7	149	e 8 36	− 9	e 15 41	+ 4	e 28·6	36·4
Kodaikanal		46·8	279	25 30	?L	—	—	(25·5)	—
Melbourne		47·3	158	—	—	—	—	19·0	31·0
Mauritius		70·2	246	29 6	?L	—	—	(29·1)	—
Honolulu		76·4	69	e 39 48	?L	—	—	43·7	52·6
Rocca di Papa		102·2	315	e 19 8	?PR_1	—	—	e 33·0?	58·7
De Bilt		102·9	327	e 24 42	?S	(24 42)	−101	e 60·5	—
Uccle		104·0	326	—	—	—	—	—	57·5
Moncalieri		104·4	319	e 18 44?	?PR_1	28 27	+120	56·9	—
Edinburgh		105·2	333	22 30	?	—	—	—	62·2
Eskdalemuir		105·5	332	24 58?	?	—	—	48·5	—
Paris		106·0	325	—	—	—	—	e 60·5	—
Stonyhurst		106·0	331	—	—	—	—	—	63·8
Kew		106·1	328	—	—	—	—	—	70·5
Bidston		106·6	330	42 30	?	52 18	?L	(52·3)	68·1
Shide		106·8	327	—	—	—	—	56·1	—
La Paz		163·4	133	e 20 10	[0]	33 52	?	82·5	94·8

Additional records: Manila gives MN = +6·8m. Zi-ka-wei S = +10m.8s. Osaka MN = +18·5m. Riverview eP = +9m.12s., eSR_1 = +19m.6s., MN = +32·9m.

Sept. 5d. Records also at 0h. (San Fernando), 1h. (Athens), 6h. (La Paz), 7h. (Rocca di Papa), 12h. (Victoria), 13h. and 14h. (La Paz), 16h. (Riverview), 17h. (Melbourne), 19h. (Zi-ka-wei and Taihoku (3)).

Sept. 6d. 3h. 4m. 0s. (I) } Epicentre 35°·0N. 24°·0E. (as on 1913 Sept. 30
12h. 32m. 18s. (II) } and 1915 June 24d.).

A = + 748, B = + ·333, C = + ·574 ; D = + ·407, E = − ·914 ;
G = + ·524, H = + ·233, K = − ·819.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
(II)	Athens	2·9	358	1 35	?S	(1 35)	+15	1·9	2·1
(II)	Helwan	8·1	129	8 42	?	—	—	—	—
(II)	Rocca di Papa	11·1	311	e 2 49?	+ 3	—	—	—	5·7?
(II)	Pola	12·5	325	e 3 20	+14	—	—	e 4·7	6·8
(II)	Zagreb	12·5	332	3 0	− 6	i 5 21	−11	—	6·8
(II)	Graz	13·7	335	e 3 22	0	—	—	—	—
(II)	Moncalieri	15·9	314	—	—	e 6 57	+ 4	9·0	—
(II)	Hohenheim	17·5	326	e 5 12	+61	—	—	—	—
(I)	De Bilt	21·7	327	e 5 24	+23	8 54	− 5	e 17·0	20·4
(II)		21·7	327	—	—	—	—	e 15·3	—
(I)	San Fernando	24·5	282	26 0	?	—	—	—	—
(I)	Stonyhurst	26·3	324	—	—	—	—	—	27·8
(I)	Bidston	26·4	322	10 18	?S	(10 18)	−12	(18·9)	25·8
(II)		26·4	322	8 30	?	—	—	—	16·4
(I)	Eskdalemuir	27·6	326	4 25?	−99	10 0	−52	—	—
(I)	Edinburgh	27·9	327	8 0	+113	—	—	—	—
(II)		27·9	327	8 42	+155	—	—	—	—
(I)	Manila	87·2	74	e 12 57	− 3	—	—	—	—
(I)	La Paz	101·1	258	64 10	?L	—	--	(64·2)	—

Additional records : Athens (II) gives MN = + 2·2m. Pola (II) MN = + 6·7m. Zagreb (II) iNE = + 5·8m., MNE = + 6·2m. Moncalieri (II) S? = + 8m.24s. De Bilt (I) MN = + 19·9m.

Sept. 6d. Records also at 0h. (Zagreb), 2h. (La Paz), 3h. (Rocca di Papa), 8h. (La Paz), 10h. (Monte Cassino), 12h. (Rocca di Papa and Athens (2)), 16h. (La Paz), 21h. (San Fernando), 22h. (La Paz).

Sept. 7d. 7h. 14m. 16s. Epicentre 11°·5N. 114°·0E. (as on 1917 Nov. 13d. 19h.).

A = − ·398, B = + ·895, C = + ·199.

Identification doubtful, as there is no direct S − P for evaluating T_0.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	7·5	65	—	—	e 3 28	+ 4	7·5	9·2
Taihoku	15·3	27	e 2 39	−64	—	—	9·1	—
Batavia	19·1	202	e 4 44	+14	—	—	—	9·7
Zi-ka-wei	20·9	18	—	—	7 12	−90	—	—
Colombo	34·0	266	15 44	?L	—	—	(15·7)	—
Riverview	57·5	143	—	—	e 17 44	− 9	e 26·3	29·5
Melbourne	57·2	151	—	—	18 14	+25	23·8	26·7
Helwan	78·1	298	25 44	?SR_1	—	—	—	—
Honolulu	84·0	70	—	—	—	—	e 36·8	46·5
Rocca di Papa	90·6	313	—	—	(24 12)	− 8	24·2	28·1
De Bilt	92·1	324	—	—	25 11	+35	—	—
Paris	95·0	322	—	—	—	—	e 62·7	—
Eskdalemuir	95·3	329	—	—	25 44	+35	—	—
Kew	95·5	325	—	—	—	—	—	64·7
Bidston	96·1	326	49 2	?L	57 14	?	(49·0)	68·4
Balboa Heights	155·5	34	74 51	?	—	—	75·9	76·2
La Paz	174·6	158	e 18 55	?	28 53	?	—	—

Additional records : Manila gives MN = + 8·3m. Riverview MN = + 29·1m., Mz = + 29·0m. Balboa Heights PN = + 74m.59s., LN = + 76·0m., MN = + 76·1m.

1918. Sept. 7d. 17h. 15m. 51s. Epicentre 46°·5N. 151°·4E.

A = −·604, B = +·330, C = +·725; D = +·479, E = +·878 ;
G = −·637, H = +·347, K = −·688.

The positive residuals of [P] for anticentric stations indicate a very shallow focus. The whole determination favours this as the graph of residuals against azimuth shows positive values for all values of the latter. A height of 0·030 above the normal depth has been assumed for the focus.

Station and Component.	Machine.	Corr. for Focus	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	°	M. S.	S.	M. S.	S.	M.	M.
Ootomari	O.	0·0	5·9	285	2 13	+42	2 54	+13	3·8	5·9
Mizusawa E.	O.	+0·4	10·5	229	2 54	+11	(4 54)	+ 2	4·9	—
N.	O.	+0·4	10·5	229	2 55	+12	—	—	5·2	—
Tokyo	W.	+0·6	13·9	228	3 46	+13	6 27	+ 7	7·6	9·2
Osaka	O.	+0·9	16·8	231	4 32	+19	—	—	8·0	9·1
Kobe	O.	+0·9	17·0	232	4 27	+11	(7 51)	+13	7·8	9·4
Nagasaki	O.	+1·3	21·4	236	5 4	− 9	—	—	8·8	—
Zi-ka-wei	—	+1·8	27·6	247	6 11	−11	11 14	−10	12·7	17·8
Taihoku	O.	+2·1	32·0	238	7 1	− 5	(12 42)	0	12·8	26·2
Hokoto	O.	+2·2	34·4	239	7 7	−20	12 45	−33	—	21·2
Manila	W.	+2·5	40·8	229	e 8 9	−11	14 45	− 7	20·2	32·2
Sitka	B.O.	+2·8	44·2	48	e 8 42	− 5	15 29	−12	22·4	32·4
Honolulu	M.	+3·0	47·9	104	9 9	− 3	16 9	−21	21·0	25·2
Victoria	M.	+3·4	54·6	54	7 47	?	10 11	? P	17·6	37·3
Z.	—	+3·4	54·6	54	7 39	?	10 9	? P	—	26·2
Calcutta	O.E.	+3·4	55·5	267	10 15	+11	18 27	+17	28·0	41·0
Dehra Dun	O.	+3·5	57·5	282	11 9	+50	—	—	—	—
Berkeley E.	—	+3·6	61·3	64	e 10 59	+15	e 20 10	+46	e 26·4	30·7
N.	—	+3·6	61·3	64	e 11 6	+22	e 20 3	+39	e 26·4	29·5
Z.	—	+3·6	61·3	64	e 10 49	+ 5	—	—	—	33·5
Saskatoon	Ma.	+3·6	61·6	41	10 40	− 6	i 19 22	− 5	26·7	—
Lick E.	W.	+3·6	62·3	64	e 11 5	+15	e 19 45	+ 9	e 26·4	33·8
N.	W.	+3·6	62·3	64	—	—	e 19 52	+16	e 26·3	33·7
Batavia	W.	+3·7	65·8	230	11 9	− 5	19 5	−75	e 27·2	42·2
Bombay	O.E.	+3·8	68·7	275	11 18	−15	21 24	+28	35·6	—
Apia	W.	+3·8	68·8	141	e 11 35	+ 1	20 56	− 1	31·2	37·2
Denver	W.	+3·8	70·2	53	21 9	? S	(21 9)	− 5	38·2	49·2
Kodaikanal	M.	+3·8	71·6	265	13 39	?	(21 51)	+21	21·8	51·4
Tucson N.	B.O.	+3·8	72·0	62	12 19	+25	21 25	−10	e 36·2	50·2
E.	B.O.	+3·8	72·0	62	12 21	+27	21 21	−14	e 35·2	56·1
Colombo	M.	+3·8	72·3	261	12 45	+49	(21 15)	−23	21·2	49·8
Lemberg	B.O.	+3·9	73·4	328	e 12 6	+ 3	e 21 27	−25	e 36·6	54·0
Dyce	Ma.	+3·9	74·0	346	i 12 12	+ 6	22 6	+ 7	44·8	53·0
Edinburgh	M.	+3·9	75·4	346	12 39	+24	—	—	—	51·6
Eskdalemuir	G.	+3·9	75·9	345	12 20	+ 2	—	—	—	—
Stonyhurst	M.	+3·9	77·2	344	e 8 45	?	i 14 15	?	i 24·2	—
De Bilt	—	+3·9	77·3	340	12 25	− 1	22 47?	+10	e 33·2	52·4
Bidston	M.S.	+4·0	77·7	345	12 21	− 8	23 27	+44	—	54·4
West Bromwich	—	+4·0	78·4	344	12 31	− 1	22 46	− 4	—	—
Ann Arbor E.	B.	+4·0	78·6	38	12 33	− 1	—	—	—	47·2
N.	B.	+4·0	78·6	38	12 9	−25	—	—	32·2	47·2
E.	W.	+4·0	78·6	38	12 45	+11	—	—	32·2	47·2
N.	W.	+4·0	78·6	38	13 3	−31	—	—	33·2	—
St. Louis	W.	+4·0	78·6	44	e 12 27	− 7	22 33	−20	38·0	41·4
Uccle	—	+4·0	78·9	340	12 33	− 2	22 52	− 4	34·2	55·5
Kew	M.	+4·0	79·0	342	14 9	?	—	—	—	54·2
Ottawa	—	+4·0	79·2	32	12 33	− 4	i 22 59	0	34·2	54·2
Z.	—	+4·0	79·2	32	e 12 54	+17	—	—	e 36·6	—
Toronto	M.	+4·0	79·3	35	12 33?	− 5	i 22 57	− 3	i 37·2	57·8
Zagreb	W.	+4·0	79·7	330	e 12 39	− 1	i 23 5	− 1	46·2	—
Shide	M.S.	+4·0	79·9	343	12 47	+ 6	23 22	+14	34·5	—
	M.B.	+4·0	79·9	343	12 56	+15	23 7	− 1	35·6	55·6
Cork	M.	+4·0	80·1	347	12 29	−14	22 29	−40	—	51·6
Sydney	M.	+4·0	80·3	180	11 9	?	22 51	−20	42·6	51·0
Riverview	—	+4·0	80·3	180	e 12 39	− 5	(23 3)	− 8	e 33·2	34·9
Zurich	—	+4·0	80·7	336	e 12 44	− 2	i 23 18	+ 2	—	—
Paris	—	+4·0	80·9	340	i 12 45	− 2	i 23 16	− 2	35·2	39·1

Continued on next page.

Station and Component.	Machine.	Corr. for Focus	Δ	Azimuth.	P.	O—C.	S.	O—C.	L.	M.
		°	°	°	M. S.	S.	M. S.	S.	M.	M.
Pola	W.	+4·0	81·2	331	e 12 48	− 1	—	—	e 38·0	60·0
Northfield	B.O.	+4·0	81·4	30	12 45	− 5	e 22 11?	−72	44·2	59·2
Besançon	—	+4·0	81·5	337	12 41	−10	23 24	− 1	—	—
Ithaca E.	B.O.	+4·0	81·5	34	e 12 54	+ 3	22 49	−36	33·2	50·0
N.	B.O.	+4·0	81·5	34	e 12 59	+ 8	22 51	−34	—	59·6
Adelaide	M.	+4·0	82·2	191	13 22	+28	22 57	−35	34·4	53·0
Moncalieri	S.	+4·1	83·1	335	12 55	− 5	23 50	+ 7	34·5	47·3
Athens N.	—	+4·1	83·5	321	12 57	− 6	23 39	− 9	32·2	56·2
E.	—	+4·1	83·5	321	13 15	+12	—	—	33·8	56·3
Harvard	B.O.	+4·1	83·5	30	i 13 31	+28	23 36	−12	37·2	48·2
Halifax	—	+4·1	83·8	22	13 21	+17	i 23 57	+ 6	36·2	—
Washington	Mar.	+4·1	84·2	36	e 12 57	−10	e 23 31	−24	47·2	—
Georgetown E.	—	+4·1	84·2	36	e 13 2	− 5	i 23 38	−17	e 34·0?	52·1
N.	—	+4·1	84·2	36	e 13 2	− 5	e 23 35	−20	e 34·0?	57·2
Monte Cassino	Ag.	+4·1	84·3	329	13 2	− 5	—	—	—	85·0
Rocca di Papa	Ag.	+4·1	84·4	330	12 59	− 9	e 21 34	−144	e 29·6	59·1
Cheltenham N.	B.O.	+4·1	84·5	36	13 32	+24	24 9	+10	e 45·6	73·2
E.	B.O.	+4·1	84·5	36	13 32	+24	24 20	+21	e 45·6	68·7
Melbourne	M.	+4·1	84·5	185	13 39	+31	22 57	−62	38·8	—
Perth	M.	+4·1	84·7	210	13 14	+ 5	24 2	+ 1	40·7	79·2
Marseilles	Ma.	+4·1	85·3	336	i 13 9	− 3	i 24 4	− 3	50·2	55·2
Helwan	M.	+4·1	86·4	311	i 13 27	+ 8	—	—	—	58·2
Barcelona	—	+4·2	87·9	337	13 13	−15	24 24	−12	38·2	43·2
Tortosa	—	+4·2	88·9	338	13 26	− 7	24 34	−12	37·3	57·5
Coimbra	—	+4·2	91·5	345	13 45	− 2	25 6	− 7	48·3	68·0
Algiers	B.M.	+4·2	92·0	333	13 39	−11	24 36	−42	43·2	63·7
Rio Tinto	M.	+4·2	93·4	343	13 9	−49	—	—	—	60·6
San Fernando	M.	+4·2	94·7	342	14 9	+ 4	24 39	−66	33·2	64·2
Vieques N.	B.O.	+4·3	107·3	37	e 19 38	?PR_1	—	—	51·8	69·4
E.	B.O.	+4·3	107·3	37	e 19 59	?PR_1	27 23	−19	57·2	76·4
Balboa Heights	B.O.	+4·4	108·4	54	19 13	?PR_1	—	—	47·2	57·6
Accra	M.	—	122·2	325	23 9	?	—	—	—	24·8
La Paz	Bi.	—	135·7	61	19 53	[+22]	31 22	—	57·7	66·8
La Quiaca E.	M.	—	141·5	64	27 21	?	74 15	?L	(74·2)	88·2
N.	M.	—	141·5	64	27 33	?	74 9	?L	(74·2)	—
Cape Town	M.	—	142·5	273	20 51	[+67]	—	—	23·6	24·7
St. Helena	M.	—	144·0	320	20 9	[+22]	—	—	—	—
Andalgala E.	M.	—	144·8	71	25 57	?PR_1	74 45	?L	(74·8)	88·4
N.	M.	—	144·8	71	25 57	?PR_1	75 9	?L	(75·2)	96·4
Pilar	M.	—	149·3	74	20 33	[+38]	85 21	?L	(85·4)	96·5
Cipolletti	M.	—	150·3	90	20 33	[+37]	69 51	?L	(69·8)	84·4
Rio de Janeiro	B.O.	—	153·6	31	e 20 45	[+44]	31 9	—	44·2	89·6
Chacareta	M.	—	154·6	73	22 27	?PR_1	72 45	?L	(72·8)	91·6

Additional records : Ootomari records a second shock, probably from the same epicentre, at T_0 = 20h.26m.5s., with P = +2m.15s., L = +3·7m., MN = +4·4m. Osaka gives MN = +8·6m. Zi-ka-wei SRN = +12m.7s., MN = +14·8m. Sitka ePN = +8m.49s., SN = +15m.28s., MN = +30·8m. Victoria i = +11m.53s. Berkeley T_0 = 17h.15m.24s. Saskatoon gives S = +17m.49s. The S in the table is recorded as i. Batavia PR_1 = +13m.57s., PR_2 = +15m.35s., M = +22·2m. Bombay gives the "maximum by major arc" as 163·9m., as shown by the tilt seismograph. Apia PE = +11m.46s., iS = +21m.5s., iE = +28m.24s., MN = +33·4m. Denver PN = +22m.9s., S? = +32m.9s., LN = +36·2m. Colombo M = +59·0m. De Bilt MN = +53·3m., T_0 = 17h. (15m.52s.)., Az. N29°E. St. Louis MN = +43·6m. Uccle SR_1 = +28m.9s., MN = +53·7m., MZ = +54·1m. Kew M = +58·2m. Ottawa eS = +21m.20s., T_0 = 17h.17m.37s. Toronto e? = +11m.21s., eP = +13m.27s., i = +16m.45s., S = +21m.9s., iL? = +25·0m., etc. Zagreb iP = +12m.37s., and 12m.45s. iPR_1 =, +16m.14s. Another eP = 17h.34m.8s. Sydney SR_1 = +29m.9s., SR_2 = +33m.51s. Riverview i = +13m.11s., PR_1 = +15m.28s., iS = +22m.39s., MN = +38·6m. Pola MN = +59·0m. Northfield eLE = +34·2m., LE = +52·2m. Adelaide PR_1 = +16m.47s., SR_1 = +28m.52s. Moncalieri MN = +53·8m. Athens P = +13m.15s., mN = +24·4m., LN = +32·2m., MN = +56·4m. Harvard M = +24·6m., T_0 = 17h.17m.14s. Halifax gives S = +22m.41s. The S in above table

Notes continued on next page.

is recorded as i. Washington eL = +33·2m., ?SR_1. Rocca di Papa MN = +55·8m., eP = +33m.0s., M = +35·6m. Melbourne SR_1 = +28m.3s., SR_2 = +32m.15s. Perth PR_2 = +20m.25s., SR_1 = +29m.6s., SR_2 = +33m.6s. Barcelona SP = +26m.13s., LN = +30·4m., MN = +53·2m. Coimbra PR_1N = +17m.37s., PR_2N = +20m.18s., SR_2N? = +30m.57s., SR_1E? = +31m.8s., LN = +45·7m., MN = +65·1m. San Fernando MN = +64·2m. and +70·6m., ME = +66·2m. and +88·7m. Balboa Heights PN = +19m.25s., LN = +47·4m., MN = +59·0m. Record given as 8d. La Paz PR_1N = +23m.33s., SN = +31m.38s., SR_1N = +34m.51s., SR_1E = +36m.9s., and many other phases. La Quiaca PE = +49m.21s., PN = +48m.51s., MN = +94·6m. Cape Town M = 86·7m. Andalgala ME = +98·6m., PN = +48m.9s. Pilar PN = +56m.33s. Chacarita P = +39m.27s., M = +102·4m.

This shock was followed by a number of others, most of which were recorded only at Mizusawa and Ootomari, with others probably at Mizusawa alone. But that on Sept. 7d. 20h. 26m. 0s. is confirmed by Zi-ka-wei. P = +6m.8s., M = +26·9m., and Osaka P = +4m.35s., M = +9·3m. The two on September 8 and one on September 14d. 17h. are given separately.

For the others the times for T_0 in Column 1 below are simply those of Mizusawa P less 2m.54s., as it occurs in the record for the main shock at 7d.17h.15m.51s. They are thus affected by the errors of the Mizusawa P. In the second column they have been converted into decimals of a day, and in the third they have been compared with an integral number of multiples (M given in the 4th column) of 21·0014 min. = ·0145843 days from the date of the main shock, as this periodicity has been elsewhere suggested (Geop. Sup. to M.N. R.A.S., I p. 91).

The days in October (Oct. 10 and 14) are numbered 40 and 44, as though they formed part of September, though after so long an interval they may not belong to the series.

T_0 in Sept.				T_0 in days.	Resid.	(M.)	Mizusawa.		Ootomari.		
							P.	S.	P.	L.	M.
d.	h.	m.	s.				m. s.	m. s.	m. s.	m.	m.
7	17	15	51	7·7194	00	0	2 54	4 54	2 13	3·8	5·9
7	20	26	0	7·8514	+ 7	9	2 54	4 58	2 20	3·8	4·5
8	0	9	30	8·0066	−45	20	2 44	4 24	(2 56)	(4·5)	(5·7)
8	5	40	30	8·2365	+66	35	2 31	4 12	1 50	3·9	5·0
8	8	30	42	8·3546	−65	44	2 54	4 38	2 27	—	—
8	10	38	9	8·4431	−55	50	2 54	4 33	2 19	—	—
8	11	35	54	8·4833	+55	52	2 54	4 31	2 11	—	—
8	20	18	37	8·8458	+34	77	2 54	4 32	2 6	—	—
9	11	17	36	9·4701	+ 6	120	2 54	4 29	2 43	—	—
9	14	20	14	9·5972	−36	129	2 54	—	2 6	—	—
11	2	27	6	11·1021	− 9	232	2 54	—	2 51	5·0	—
11	5	57	40	11·2484	− 9	242	2 54	4 32	2 11	4·1	4·4
12	13	15	18	12·5521	+53	331	2 54	4 30	2 11	—	—
13	5	59	22	13·2496	+27	379	2 54	4 26	2 22	3·6	—
14	17	4	45	14·7113			separately computed.				
22	12	58	13	22·5403	+32	1016	2 54	4 42	2 18	—	—
22	13	48	36	22·5754	−54	1019	2 54	4 34	2 15	3·9	4·5
40	17	54	29	40·7458	+75	2264	2 54	4 9	2 23	—	—
44	1	29	55	44·0625	−10	2492	2 54	4 45	1 56	—	—

The residuals of Column 3 do not show any appreciable clustering about zero, or indeed about any other value. These aftershocks are apparently *not* controlled by the 21min. period. But Dr. Jeans has made a suggestion of a different kind in his paper on *the Propagation of Earthquake Waves* (Proc. R.S.A., Vol. 102, 1923, p. 554). He finds in addition to the L waves several other series of surface waves; two important sets of which complete the circuit of the globe in t_1 = 125·8 min. = ·087361 days, and t_2 = 222·0 min. = ·15417 days, and he suggests that the returns of these to the epicentre after a number of multiples, $mt_1 + nt_2$ may cause the repeated shocks. Combinations of early multiples are made in the following table:

t_1 \ t_2	0	1	2	3	4	5
0	·0000	·1542	·3083	·4625	·6167	·7708
1	·0874	·2416	·3957	·5499	·7041	·8582
2	·1747	·3289	·4830	·6372	·7914	·9455
3	·2621	·4163	·5704	·7246	·8788	1·0329
4	·3494	·5036	·6577	·8119	·9661	1·1202
5	·4368	·5910	·7451	·8993	1·0535	1·2076
6	·5242	·6784	·8325	·9867	1·1409	1·2950
7	·6115	·7657	·9198	1·0740	1·2282	1·3823
8	·6989	·8531	1·0072	1·1614	1·3156	1·4697
9	·7862	·9404	1·0945	1·2487	1·4029	1·5570
10	·8736	1·0278	1·1819	1·3381	1·4903	1·6444

The table has been extended perhaps further than necessary in order to make sure that nothing has been overlooked. Now, on subtracting the date of the main shock (which we take to be that of Sept. 7d. 17h., since nothing from the neighbourhood of this epicentre is recorded previously for some days at any rate) from those which follow, we get differences

·1320, ·2872, ·5271, ·6352, ·7237, ·7639, 1·1264.

Of these we have

$$\left.\begin{aligned} ·5271 &= 6t_1 + ·0029 \\ ·6352 &= 2t_1 + 3t_2 - ·0020 \\ ·7237 &= 3t_1 + 3t_2 - ·0009 \\ ·7639 &= 7t_1 + t_2 - ·0018 \\ 1·1264 &= 4t_1 + 5t_2 + ·0062 \end{aligned}\right\} \quad (a)$$

But there is nothing in the table to fit the first two differences ·1320 and ·2872. It is however noteworthy that the *differences* of these from one another and from the next shock do occur in the table, viz. :

$$·2872 - ·1320 = ·1552 = t_2 + ·0010.$$
$$·5271 - ·2872 = ·2399 = t_1 + t_2 - ·0016.$$

Therefore, if we count from the second shock as starting-point, the differences are all expressible as multiples of t_1 and t_2 : and this continues to hold beyond the third shock, since

$$\left.\begin{aligned} ·6352 - ·1320 &= ·5032 = 4t_1 + t_2 - ·0004 \\ ·7237 - ·1320 &= ·5917 = 5t_1 + t_2 + ·0007 \\ ·7639 - ·1320 &= ·6319 = 2t_1 + 3t_2 - ·0053 \end{aligned}\right\} \quad (b)$$

But we have already seen in (a) that

$$·6352 = 2t_1 + 3t_2 - ·0020, \text{ etc.}$$

Substituting this in (b) we see that

$$·1320 = -2t_1 + 2t_2 - ·0016,$$

and hence

$$\begin{aligned} ·2872 &= -2t_1 + 3t_2 - ·0006 \\ ·5271 &= -t_1 + 4t_2 - ·0022 \end{aligned}$$

In other words, if we shifted the origin of time back to a moment $2t_1$ before the first recorded shock, we could express the times of all the following shocks in the form $mt_1 + nt_2$. The new origin would be at

Sept. 7·7194 − ·1747 = Sept. 7·5447 = Sept. 7d. 13h. 4m. 15s.

About this time La Paz records a shock eP = 13h.2m.11s., S? = 13h.6m.38s., i = 13h.8m.37s., i = 13h.9m.12s., L = 13h.10m.0s., M = 13h.11m.0s. La Paz is 136° from the epicentre under discussion. It is conceivable that something happened near the anticentre (44° from La Paz) which ultimately set up the above series of shocks at the epicentre. If so the true S at La Paz must be one or other of the records marked i. They would give

	S − P = 6m. 26s.	△ = 42°·3	T_0 = 12h. 53m. 58s.
or	S − P = 7m. 1s.	△ = 48°·2	T_0 = 12h. 53m. 16s.

But this is not early enough for the effect to reach the present epicentre by 13h.4m.15s. The available interval is only 10min. or 11min., whereas the shortest time of transmission through the earth is 21min. We conclude that nothing is actually on record which would justify us in dating from 13h.4m. rather than from the time of the first recorded shock (17h.15m.); and for the present we must leave unexplained the fact that the first three terms of the series can only be expressed in the form $mt_1 + nt_2$ if we admit values −1 and −2 for m.

Returning now to the later shocks we may arrive quickly at suggestions for their representation by use of the relations

$$2t_1 - t_2 = +·0205, \quad 4t_2 - 7t_1 = +·0051$$

and by studying the differences between consecutive recorded shocks.

Date.	Diff.
8·8458	
9·4701	·6243 = $2t_1 + 3t_2 - ·0129 = 4t_2 + ·0076$.
9·5972	·1271 = $t_2 - ·0271 = 2t_2 - 2t_1 - ·0066$.
11·1021	1·5049 = $10t_1 + 4t_2 + ·0146 = 19t_1 - t_2 - ·0008$.
11·2484	·1463 = $t_2 - ·0079$.
12·5521	1·3047 = $6t_1 + 5t_2 + ·0097 = 22t_1 - 4t_2 - ·0006$.
13·2496	·6975 = $8t_1 - ·0014$.
14·7113	1·4617 = $8t_1 + 5t_2 - ·0080 = 15t_1 + t_2 - ·0029$.

We thus have (adopting the earlier origin),

$$\begin{aligned}
8{\cdot}8458 &= 7{\cdot}5447 + 6t_1 + 5t_2 + {\cdot}0062\\
9{\cdot}4701 &= \,,, + 15t_1 + 4t_2 - {\cdot}0016\\
9{\cdot}5972 &= \,,, + 20t_1 + 2t_2 - {\cdot}0029\\
11{\cdot}1021 &= \,,, + 39t_1 + t_2 - {\cdot}0037\\
11{\cdot}2484 &= \,,, + 23t_1 + 11t_2 - {\cdot}0013\\
12{\cdot}5521 &= \,,, + 45t_1 + 7t_2 - {\cdot}0029\\
13{\cdot}2496 &= \,,, + 60t_1 + 3t_2 + {\cdot}0008\\
14{\cdot}7113 &= \,,, + 75t_1 + 4t_2 - {\cdot}0021
\end{aligned}$$

But the later multiples could be expressed in alternative forms without large residuals. Thus

$$23t_1 + 11t_2 - {\cdot}0018 = 30t_1 + 7t_2 + {\cdot}0033,$$

since we can add $7t_1 - 4t_2 + {\cdot}0051 = 0$ to any of the expressions, and it seems doubtful whether we can identify the correct multiples with our present knowledge. The evidence is, however, distinctly favourable to Dr. Jeans's suggestion.

We may append the times of possible repetitions, recorded at Mizusawa only.

Date. d. h. m. s.	In days.	
Sept. 7 20 48 54	7·8673	$= 7{\cdot}5447 + 2t_1 + t_2 - {\cdot}0063$
,, 7 22 19 58	7·9305	$= \,,, + t_1 + 2t_2 - {\cdot}0099$
,, 8 10 17 50	8·4291	$= \,,, + 3t_1 + 4t_2 + {\cdot}0056$
,, 9 10 6 46	9·4214	$= \,,, + 2t_1 + 11t_2 + {\cdot}0061$
,, 9 11 47 41	9·4914	$= \,,, + 17t_1 + 3t_2 - {\cdot}0009$

We can refer them to the date of the first recorded shock by subtracting $2t_1$, and it is noteworthy that one of the above would then have a coefficient -1 for t_1, though its large residual makes it doubtful whether it belongs to the series. There is, however, another way of representing this term, if we may use the interval $(t_1 + t_2)/2 = m$, as suggested in the note to Aug. 11, viz.:

$$\begin{aligned}
7{\cdot}9305 &= 7{\cdot}5447 + 3t_1 + m + {\cdot}0029\\
&= 7{\cdot}7194 + t_1 + m + {\cdot}0029
\end{aligned}$$

—so that if we use m we need not go behind the first shock. The question arises whether the use of m would obviate this necessity in other cases; but the answer seems to be in the negative, for we have to explain the first difference ·1320, which differs from m ($= {\cdot}1208$) by $+{\cdot}0108$, too large a quantity for an admissible residual. For the present we must be content to leave the difficulties stated. It is perhaps worth remarking that the perplexing difference $·1320 = 3t_1/2$, but it does not seem that this can help us.

Sept. 7d. 20h. 26m. 0s. See note above. Recorded at Mizusawa, Ootomari, Osaka, and Zi-ka-wei.

Sept. 7d. 23h. 31m. 51s. Epicentre 12°·0N. 95°·0E. (as on 1918 Jan. 18).

$A = -{\cdot}085$, $B = +{\cdot}974$, $C = +{\cdot}208$; $D = +{\cdot}996$, $E = +{\cdot}087$; $G = -{\cdot}018$, $H = +{\cdot}207$, $K = -{\cdot}978$.

(The absence of records from Indian and even Japanese stations suggests that this epicentre may be wrongly identified from the scanty material).

	Δ °	Az. °	P. m. s.	O−C. s.	S. m. s.	O−C. s.	L. m.	M. m.
Taihoku	28·2	62	—	—	e 11 28	+25	—	—
Tokyo	46·7	50	e 5 4	−221	—	—	—	—
Vienna	73·5	316	e 12 9	+30	—	—	—	—
Zagreb	73·9	314	e 12 27	+46	—	—	44·1	—
Graz	74·1	314	e 12 9	+26	—	—	—	—
Rocca di Papa	76·3	310	e 12 53	+56	—	—	—	14·2
De Bilt	80·5	320	e 12 17	− 5	e 22 8	−21	e 43·1	45·5
Uccle	81·1	320	e 12 15	−11	—	—	—	49·1
Paris	82·6	318	—	—	e 22 51	− 2	46·1	54·6
Kew	83·8	321	—	—	—	—	—	53·1
Eskdalemuir	84·7	323	—	—	—	—	36·1	—
Bidston	85·1	322	40 51	?L	44 39	?L	(40·8)	90·4

Additional records: De Bilt eLN = +42·1m., MN = +52·8m. Paris MN = +89·1m.

Sept. 7d. Records also at 12h. (Lawrence), 13h. and 14h. (La Paz), 17h. (Rocca di Papa), 18h. (Osaka and Rocca di Papa), 19h. (Osaka, Tokyo, Rocca di Papa (2), and Zagreb), 20h. (Rocca di Papa, Zi-ka-wei, Tokyo (3), Mizusawa, Osaka (2), and Zagreb), 21h. (Zagreb, Rocca di Papa, and Mizusawa (3)), 22h. (Mizusawa), 23h. (Mizusawa (2)).

1918. Sept. 8d. 0h. 9m. 30s. Repetition from the epicentre of 7d. 17h., 46°·5N. 151°·4E.

A = −·604, B = +·330, C = +·725; D = +·479, E = +·878; G = −·637, H = +·347, K = −·688.

Station and Component.	Machine.	Corr. for Focus	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	°	M. S.	s.	M. S.	s.	M.	M.
Ootomari	O.	0·0	5·9	285	2 56	+85	—	—	4·5	5·7
Mizusawa	O.	+0·4	10·5	229	2 43	0	4 24	−28	—	—
Tokyo	O.	+0·6	13·9	228	3 44	+11	6 23	+ 3	—	—
Osaka	O.	+0·9	16·8	231	4 34	+21	—	—	8·1	9·2
Kobe	O.	+0·9	17·0	232	3 44	−32	(7 20)	−18	7·3	12·3
Zi-ka-wei	—	+1·8	27·6	247	e 6 32	+10	e 11 3	−21	—	17·6
Manila	W.	+2·5	40·8	229	—	—	—	—	e 25·5	—
Honolulu	M.	+3·0	47·9	104	16 18	?S	22 54	?	26·6	31·5
Victoria	M.	+3·4	54·6	54	—	—	—	—	—	40·6
Kodaikanal	M.	+3·8	71·6	265	25 36	?SR_1	—	—	—	—
Colombo	M.	+3·8	72·3	261	45 30	?L	—	—	(45·5)	49·5
De Bilt	—	+3·9	77·3	340	12 (30)	+ 4	22 (30)	− 7	e 36·5	47·0
Graz	W.	+4·0	78·8	331	e 12 44	+ 9	22 54	− 1	—	—
Uccle	—	+4·0	78·9	340	e 12 36	+ 1	e 22 54	− 2	e 45·5	51·5
Kew	M.	+4·0	79·0	342	—	—	—	—	—	57·5
Hohenheim	—	+4·0	79·2	336	i 12 42	+ 5	22 58?	− 1	—	—
Toronto	M.	+4·0	79·3	35	—	—	—	—	e 40·3	55·0
Zagreb	W.	+4·0	79·7	330	e 12 48	+ 8	22 30	−36	43·5	—
Moncalieri	S.	+4·1	83·1	335	—	—	10 45	?	20·6	54·6
Harvard	B.O.	+4·1	83·5	30	—	—	36 36	?	e 47·0	52·3
Rocca di Papa	Ag.	+4·1	84·4	330	e 12 43	−25	e 23 8	−50	e 49·4	58·0
Barcelona	—	+4·2	87·9	337	—	—	—	—	e 44·6	60·5
Coimbra	—	+4·2	91·5	345	e 18 30	?PR_1	—	—	e 49·0	—
Algiers	B.M.	+4·2	92·0	333	—	—	—	—	46·5	60·5
San Fernando N.	—	+4·2	94·7	342	57 30	?L	—	—	(57·5)	62·5
E.	—	+4·2	94·7	342	56 30	?L	—	—	(56·5)	65·5
La Paz	Bi.	—	135·7	61	20 10	[+39]	—	—	67·5	68·9

Additional records: Mizusawa PN = +2m.45s. Kobe MN = +10·8m. Zi-ka-wei MN = +15·0m. Victoria gives P or L? = +2m.26s. De Bilt eLN = +37·5m., MN = +50·0m. Toronto iL = +52·4m., L = +67·1m. Moncalieri records eP? at 0h.8m.24s. Rocca di Papa records eP as 0h.12m.13s. and eS as 0h.22m.38s. It has been assumed above that these are mistakes for 22m. and 32m. respectively. La Paz PR_1 = +23m.11s.

1918. Sept. 8d. 5h. 40m. 30s. Epicentre 46°·5N. 151°·4E.
(as at 7d. 17h. and 8d. 0h.).

But this repetition appears to have a focus of roughly the normal depth. See further note at end.

Station and Component.	Machine.	△	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Ootomari	O.	5·9	285	1 50	+19	—	—	3·9	5·0
Mizusawa	O.	10·5	229	2 31	− 6	(4 2)	−41	4·0	—
Tokyo	O.	13·9	228	4 18	+53	7 26	+80	—	—
Osaka	O.	16·8	231	2 16	−106	(6 6)	−67	6·1	8·7
Kobe	O.	17·0	232	4 9	+ 4	—	—	10·3	11·2
Zi-ka-wei	—	27·6	247	e 6 2	− 2	e 10 44	− 8	—	19·5
Manila	W.	40·8	229	e 9 52	?PR_1	—	—	—	—
Honolulu	M.	47·9	104	e 8 30	−23	15 12	−41	24·2	27·0
Victoria	M.	54·6	54	22 30	?SR_1	—	—	34·0	41·0
Kodaikanal	M.	71·6	265	50 30	?L	—	—	(50·5)	—
Edinburgh	M.	75·4	346	22 0	?S	(22 0)	+30	—	61·5
Eskdalemuir	G.	75·9	345	21 56	?S	(21 56)	+20	40·5	—
De Bilt	—	77·3	342	12 (16)	+13	22 12	+20	e 41·5	46·6
Vienna	—	77·3	331	i 12 14	+11	—	—	—	—
Bidston	M.S.	77·7	345	21 18	?S	(21 18)	−39	—	50·2
Uccle	—	78·9	340	e 12 12	0	e 22 12	+ 1	e 44·5	47·5
Kew	M.	79·0	342	—	—	—	—	—	53·5
Hohenheim	—	79·2	336	i 12 26	+12	23 32?	+78	—	—
Ottawa	—	79·2	32	—	—	e 31 0	?	—	—
Toronto	M.	79·3	35	—	—	—	—	33·2	47·6
Zagreb	W.	79·7	330	e 12 30	+13	22 30	+10	43·5	—
Riverview	—	80·3	180	—	—	—	—	e 45·2	51·6
Paris	—	80·9	340	—	—	e 22 50	+16	45·5	49·0
Moncalieri	S.	83·1	335	e 12 39	+ 2	23 6	+ 8	32·6	—
Harvard	B.O.	83·5	30	—	—	—	—	46·1	—
Rocca di Ppapa	Ag.	84·4	330	e 12 24	−20	—	—	—	55·9
Melbourne	M.	84·5	185	e 22 30	?S	(22 30)	−44	—	58·5
Helwan	M.	86·4	311	23 30	?S	(e 23 30)	− 4	—	58·5
Barcelona	—	87·9	337	—	—	—	—	42·2	52·3
Coimbra	—	91·5	345	—	—	e 26 10?	+101	e 49·0	—
Rio Tinto	M.	93·4	343	50 30	?L	—	—	(50·5)	57·5
La Paz	Bi.	135·7	61	e 22 39	?PR_1	35 45?	—	68·6	80·7

Additional records: Ootomari MN = +6·3m. Mizusawa LE = +4·0m. Osaka MN = +11·6m. Kobe MN = +11·3m. Zi-ka-wei MN = +19·3m. De Bilt eLN = +43·5m., MN = 51·8m., T_e = 5h.40m.(48s.). Bidston S = +28·8m. = SR_1? Graz (△ = 78°·8), T_e = 5h.40m.30s. Uccle T_e = 5h.40m.36s. Ottawa eN = +27m.30s. Toronto eL = 45·0m. and 47·4m. Riverview MN = +47·6m. Moncalieri T_e = 5h.40m.40s. Harvard LE = +51·5m.

As above remarked, the epicentre of Sept. 7d. 17h. seems to suit this earthquake, *but without the supposition of a high focus.* The difference between the two cases can be clearly indicated by a direct comparison of the records at such stations as are well represented in both lists. The excess of the residuals (P and S) for September 7d. 17h. over those for Sept. 8d. 5h. are as below, in the 4th and 5th columns.

	△	Az.	P.	S.	δ△ Equiv. P.	δ△ Equiv. S.	Theory.
	°	°	s.	s.	°	°	°
Ootomari	5·9	285	+23	—	+1·5	—	+0·0
Mizusawa	10·5	229	+23	+42	+1·5	+1·6	+0·4
Kobe	17·0	232	+18	—	+1·5	—	+0·9
Zi-ka-wei	27·6	247	+ 9	+30	+0·9	+1·7	+1·8
Honolulu	47·9	104	+39	+57	+5·8	+4·8	+3·0
De Bilt	77·3	342	+ 9	+35	+1·5	+3·1	+3·9
Uccle	78·9	340	+21	+40	+3·6	+3·5	+4·0
Zagreb	79·7	330	+ 9	(−25)	+1·5	(+3·0)	+4·0
Paris	80·9	340	—	+26	—	+2·3	+4·0
Moncalieri	83·1	335	+16	+44	+2·8	+4·1	+4·1
Rocca di Papa	84·4	330	+35	—	+6·1	—	+4·1
Melbourne	84·5	185	—	+27	—	+2·4	—
La Paz	135·7	61	−166	−263	—	—	—
Mean	—	—	—	—	+2·7	+2·9	+2·6

It is clear from inspection of the 5th and 6th columns that the residuals in S are in general larger than those in P, in about the usual ratio 1·8 to 1·0. The S difference −25s. for Zagreb may be taken as +35s., with an error of one minute. The case of La Paz will be referred to presently.

In the 7th and 8th columns the differences in time for P and S are converted into differences of △ by use of the tables for the appropriate △, and it will be seen that, though there are considerable accidental errors, still (a) the S residuals are sensibly equal to the P residuals; (b) both P and S tend to increase with △, though not so markedly as they should according to the theoretical values reproduced in the last column from the Sept. 7 results. As regards La Paz it seems clear that quite different phenomena were recorded on the two occasions on Sept. 7d., probably [P] and [S], on Sept. 8d.5h. perhaps PR_1 and SR_1.

Sept. 8d. 8h. 30m. 42s.
10h. 38m. 9s.
11h. 35m. 54s.
20h. 18m. 37s.
} Repetitions from the epicentre of Sept. 7d.17h.15m., 46°·5N. 151°·4E. See note to that earthquake.

Sept. 8d. Records also at 0h. (Balboa Heights and Mizusawa (2)), 1h. (Zagreb and Mizusawa (2)), 2h. (Manila, De Bilt, and Mizusawa), 3h. (Barcelona and Mizusawa (3)), 4h. (Osaka and Mizusawa), 6h. (Mizusawa (3)), 7h. (Mizusawa and Tokyo), 9h. (Mizusawa), 10h. (Mizusawa (2)), 11h. (Helwan, De Bilt, Mizusawa, and Zi-ka-wei), 12h. (De Bilt, Zagreb, Edinburgh, Rio Tinto, Honolulu, and Mizusawa), 13h. (Manila, Osaka, Mizusawa, and San Fernando), 14h. (La Paz), 17h. (Mizusawa), 18h. (Helwan), 21h. (De Bilt and Helwan), 22h. (Batavia, Victoria, Manila, Zi-ka-wei, and Helwan), 23h. (Eskdalemuir, De Bilt, and Mizusawa).

Sept. 9d. 11h. 17m. 36s.
14h. 20m. 14s.
} Further repetitions from 46°·5N. 151°·4E., the epicentre of Sept. 7d. 17h. See note to that earthquake.

Sept. 9d. Records at 0h. (Victoria), 4h. and 6h. (Mizusawa), 8h. (La Paz), 12h. (Victoria, La Paz, San Fernando, Manila, Helwan, and Riverview), 14h. (Riverview, Manila, and Batavia), 15h. (Helwan), 21h. (Manila and Mizusawa).

Sept. 10d. Records at 0h. (San Fernando), 3h. (Athens and Mizusawa), 10h. (Lick and Berkeley), 13h. (Mizusawa), 14h. (Helwan), 15h. (Mizusawa and Manila), 16h. (La Paz and Monte Cassino), 18h. (Mizusawa), 21h. (Manila), 23h. (Monte Cassino (2)).

Sept. 11d. 2h. 27m. 6s. Repetition from 46°·5N. 151°·4E. See note to Sept. 7d. 17h.

Sept. 11d. 3h. 47m. 9s. Epicentre 36°·8N. 114°·3W. (as on 1918 Sept. 4d.).

A = −·330, B = −·730, C = +·599; D = −·911, E = +·412; G = −·246, H = −·546, K = −·801.

		△	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Tucson		5·3	147	e 1 22	0	(e 2 11)	−14	e 2·2	3·5
Berkeley		6·4	280	—	—	—	—	e 3·9	—
Ann Arbor		24·1	67	—	—	—	—	16·4	—
Georgetown		29·2	74	—	—	—	—	e 17·0	—
Washington		29·2	74	—	—	—	—	e 16·5	—
Cheltenham		29·4	75	16 55	?L	—	—	(16·9)	20·8
Harvard	N.	33·4	68	e 17 19?	?L	—	—	(17·3?)	—
	E.	33·4	68	e 18 50?	?L	—	—	19·9	—
Stonyhurst		72·1	35	—	—	—	—	—	48·8

Additional records: Tucson gives MN = +2·8m. Ann Arbor LE = +16·8m., LN = +15·2m. and +16·6m. Cheltenham PN = +16m.49s. Harvard eE = +18m.50s.? LN? = +19·8m., LE = +19·9m. Ottawa gives 4h.5m. to 4h.17m.

1918. Sept. 11d. 4h. 6m. 5s. Epicentre 6°·5N. 126°·0E.

A = −·584, B = +·804, C = +·113; D = +·809, E = +·588; G = −·066, H = +·092, K = −·994.

On 1918 Feb. 7d. 5h. 20m. an epicentre 6°·5N. 127°·0E. was adopted with focal depth +·025 below normal. Direct comparison of the observations support this hypothesis of difference in focal depth.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Manila	W.	9·5	330	e 2 34	+11	—	—	5·6	6·4
Taihoku	O.	19·0	347	e 4 3	−26	8 7	+ 5	11·4	11·9
Batavia	W.	22·9	237	i 5 14	− 2	i 9 20	− 3	—	9·9
Zi-ka-wei	—	25·0	351	5 39	+ 1	e 9 57	− 6	—	16·0
Misusawa	O.	35·4	21	6 17	−60	—	—	—	—
Perth	M.	39·6	194	10 23	?	13 54	− 6	18·0	—
Adelaide	M.	42·9	166	14 40	?S	(14 40)	− 7	(21·3)	—
Colombo	M.	45·9	273	14 25	?S	(14 25)	−62	—	—
Riverview	—	46·8	151	e 8 46	0	e 15 41	+ 3	e 24·8	29·7
Sydney	M.	46·9	151	19 13	?SR_1	24 55	?L	(24·9)	—
Melbourne	M.	47·7	160	—	—	15 55	+ 5	20·1	30·9
Kodaikanal	M.	48·2	278	18 49	?	—	—	—	—
Bombay	O.E.	53·2	289	9 24	− 3	—	—	—	—
Mauritius	M.	71·9	246	20 49	?S	(20 49)	0	—	—
Honolulu	M.	74·7	69	e 11 43	− 4	21 43	+21	39·9	48·9
Helwan	M.	90·8	300	14 55	+95	—	—	—	—
Zagreb	W.	99·0	318	e 14 1	− 4	(e 17 54)	?PR_1	52·9	64·9
Rocca di Papa	Ag.	102·6	315	e 18 10	?PR_1	—	—	—	18·7
De Bilt E.	—	102·9	327	(e 18 37)	PR_1	—	—	e 53·3	57·7
N.	—	102·9	327	—	—	—	—	e 53·7	54·5
Uccle	—	104·0	326	—	—	—	—	e 52·9	56·9
Moncalieri	S.	104·6	320	e 17 56?	?PR_1	26 21	−17	42·0	60·0
Edinburgh	M.	105·0	333	23 55	?	—	—	—	71·4
Eskdalemuir	G.	105·4	333	e 18 50	?PR_1	e 29 28	?	47·4	60·5
Stonyhurst	M.	105·9	331	—	—	—	—	—	45·1
Kew	M.	106·1	328	—	—	—	—	—	74·9
Bidston	M.S.	106·4	331	29 25	?	38 55	?	—	60·5
Shide	—	107·1	328	—	—	—	—	55·5	71·7
Barcelona	—	109·9	319	—	—	—	—	e 59·1	63·3
Coimbra	—	117·4	322	e 61 40?	?L	—	—	66·4	—
San Fernando E.	—	118·0	318	66 55	?L	—	—	(66·9)	70·9
N.	—	118·0	318	58 55	?L	—	—	(58·9)	71·9
Ottawa	—	124·7	18	—	—	—	—	e 57·9	—
La Paz	Bi.	162·9	127	20 23	[+13]	—	—	—	—

Additional records: Manila gives MN = +6·9m. Zi-ka-wei PMN = +5m.47s., PME = +6m.6s., SME = +10m.14s., SMN = +10m.17s., MN = +17·2m. Adelaide gives P at 3h.20m.45s., S at 3h.27m.20s. It is assumed that P is S and S is L, and both are 1h. wrong. Riverview PR_1 = +10m.43s., PS = +16m.0s., eSR_1 = +19m.9s. and +19m.23s., SR_2 = +20m.21s., M_2 = +31m.49s. Zagreb MNW = +59·9m. Moncalieri MN = +57·7m. Stonyhurst M = +29·9m. Ottawa LE = +70·9m., etc.

Sept. 11d. 5h. 56m. 57s. Repetition from 46°·5N. 151°·4E. See note to Sept. 7d. 17h.

Sept. 11d. Records also at 0h. (Mizusawa), 1h. (Mizusawa (2)), 2h. (Mizusawa), 3h. (Moncalieri, Helwan, Edinburgh, and Adelaide), 5h. (Stonyhurst), 6h. (Ootomari, De Bilt, Manila, and Moncalieri), 10h. (Riverview, Apia, and Uccle), 11h. (Edinburgh and Helwan), 12h. (Helwan), 16h. (Rocca di Papa), 20h. (Rocca di Papa, Helwan, Athens (2), and De Bilt), 21h. (Helwan, Rocca di Papa, De Bilt, and Athens (3)), 22h. (Athens).

Sept. 12d. 9h. 38m. 30s. Epicentre 39°·5N. 72°·0E.

A = +·234, B = +·734, C = +·636 ; D = +·951, E = −·309 ; G = +·197, H = +·605, K = −·772.

		△	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Simla		9·4	152	e 2 24	+ 2	—	—	—	—
Dehra Dun		10·3	150	2 30	− 4	—	—	—	—
Bombay		20·6	178	4 43	− 5	—	—	—	—
Calcutta	E.	21·9	136	5 0	− 4	9 0	− 3	—	—
	N.	21·9	136	5 6	+ 2	9 6	+ 3	—	—
Colombo		33·3	166	12 30	?S	(12 30)	+ 1	—	—
Helwan		34·5	267	9 30	?	—	—	—	—
Vienna		40·1	301	e 9 0	?PR_1	—	—	—	—
Graz		40·9	300	9 3	?PR_1	14 48	+28	—	—
Zagreb		40·9	298	e 8 31	+29	—	—	—	—
Rocca di Papa		44·2	293	e 7 27	−60	(15 24?)	+19	15·4?	—
De Bilt		46·5	309	—	—	i 16 13	+38	i 20·5	—
Moncalieri		46·6	299	15 41	?S	(15 41)	+ 5	20·0	—
Manila		49·4	106	e 16 30	?S	(e 16 30)	+19	—	—
Edinburgh		50·4	315	21 30	?L	—	—	(21·5)	37·2
Eskdalemuir		50·6	315	—	—	i 17 11	+45	—	—
Shide		50·9	308	—	—	—	—	22·0	—
Bidston		51·0	312	8 24	−49	17 18	+47	—	31·1

Rocca di Papa gives maxima between P and S, ME = +9·2m., MN = +11·5m. Moncalieri iS? = +18m.26s. = SR_1?.

1918. Sept. 12d. 13h. 15m. 20s. Epicentre 46°·5N. 151°·4E.

(as on Sept. 7d. 17h.).

A = −·604, B = +·330, C = +·725 ; D = +·479, E = +·878 ; G = −·637, H = +·347, K = −·688.

When a direct comparison is made between the records for this earthquake and those for Sept. 7d. 17h. the agreement is fairly consistent. Hence, though the material is scanty a focal height of 0·030 above the normal has been assumed as for Sept. 7d. 17h.

Station and Component.		Corr. for Focus	△	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	°	M. S.	S.	M. S.	S.	M.	M.
Ootomari		0·0	5·9	285	2 9	+38	—	—	3·3	4·6
Mizusawa	E.	+0·4	10·5	229	2 52	+ 9	—	—	4·5	—
	N.	+0·4	10·5	229	2 58	+15	—	—	4·5	—
Zi-ka-wei		+1·8	27·6	247	—	—	—	—	e 10·4	17·6
Taihoku		+2·1	32·0	238	e 12 45	?S	(12 45)	+ 3	18·7	20·1
Honolulu		+3·0	47·9	104	16 10	?S	(16 10)	−20	26·8	29·3
Victoria		+3·4	54·6	54	—	—	—	—	—	36·2
Colombo		+3·8	72·3	261	42 40	?L	—	—	(42·7)	—
Edinburgh		+3·9	75·4	346	21 40	?S	(21 40)	−35	—	47·7
Eskdalemuir		+3·9	75·9	345	—	—	—	—	40·7	—
Vienna		+3·9	77·3	331	—	—	—	—	e 42·7	—
De Bilt		+3·9	77·3	340	—	—	e 22 (40)	+ 3	e 48·7	—
Bidston		+4·0	77·7	345	23 28	?S	(23 28)	+45	—	51·2
Graz		+4·0	78·8	331	e 12 28	− 7	—	—	—	—
Uccle		+4·0	78·9	340	—	—	—	—	e 44·7	53·7
Kew		+4·0	79·0	342	—	—	—	—	—	59·7
Zagreb		+4·0	79·7	330	e 12 39	− 1	22 52	−14	44·7	50·7
Riverview		+4·0	80·3	180	—	—	—	—	e 40·1	50.8
Paris		+4·0	80·9	340	—	—	—	—	e 46·7	51·2
Moncalieri		+4·1	83·1	335	—	—	e 29 5	?	43·9	50·1
Rocca di Papa		+4·1	84·4	330	—	—	e 32 58	?	47·9	59·4
Melbourne		+4·1	84·5	185	—	—	—	—	42·9	56·0
Helwan		+4·1	86·9	311	24 40	?S	(24 40)	+21	—	—
Barcelona		+4·2	87·9	337	—	—	—	—	e 49·0	54·0
Coimbra		+4·2	91·5	345	55 0	?L	—	—	56·7	—

Additional records : Ootomari MN = +3·6m. Taihoku S = +16m.13s. Bidston S = +28m.58s. = SR_1?. Zagreb eNW = +12m.45s. Paris MN = +48·2m.

Sept. 12d. 18h. 3m. 0s. Epicentre 55°·0N. 160°·0W. (as on 1917 June 22d.).

A = −·539, B = −·196, C = +·819; D = −·342, E = +·940;
G = −·770, H = −·280, K = −·574.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Sitka	N.	13·8	71	e 3 24	+ 1	(5 6)	−57	5·1	6·9
	E.	13·8	71	e 3 30	+ 7	(e 5 4)	−59	e 5·1	6·8
Victoria		23·4	90	5 15	− 6	—	—	7·7	9·2
Honolulu		33·7	177	e 12 42	?S	(12 42)	+ 6	14·4	15·4
St. Louis		48·2	79	—	—	—	—	e 22·5	—
Ottawa	N.	51·4	63	e 22 0	?SR_1	—	—	e 24·3	—
Washington		55·3	70	—	—	e 21 0	?SR_1	26·2	—
Edinburgh		67·5	14	26 0	?SR_1	—	—	—	—

Additional records: St. Louis L = +82·0m. and +99·1m.

Sept. 12d. 18h. 25m. 45s. Epicentre 43°·4N. 72°·0W. (as on 1918 Aug. 21d. 4h.).

A = +·225, B = −·691, C = +·687; D = −·951, E = −·309;
G = +·212, H = −·653, K = −·727.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Ithaca		3·5	255	e 0 51	− 4	—	—	e 2·8	—
Toronto		5·4	275	—	—	(e 2 33)	+ 5	e 2·6	3·0
Cheltenham	N.	5·9	220	—	—	—	—	e 4·0	4·7
	E.	5·9	220	—	—	—	—	e 4·4	5·2
San Fernando		49·6	74	—	—	—	—	24·2	28·2
De Bilt		50·1	51	—	—	(e 19 45)	?SR_1	e 19·8	32·1
Mizusawa		92·2	335	—	—	—	—	57·6	—

Additional records: Ithaca gives eLN = +1·9m. Toronto eL = +0·6m. and eL? = +43·3m. San Fernando PN = 12h.13m.0s. (some error?), MN = +27·2m. De Bilt MN = +20·1m. Mizusawa E/W = +59·1m.

Sept. 12d. Records also at 1h. (San Fernando), 2h. (Athens and Mizusawa), 6h. (Athens), 7h. (Athens and Zagreb), 11h. (Athens), 13h. (Zagreb), 14h. (Ootomari and Mizusawa (2)), 15h. (Athens), 16h. (Zi-ka-wei), 17h. (Athens (2)), 20h. (Helwan), 22h. (De Bilt).

Sept. 13d. 6h. 54m. 12s. I
7h. 7m. 40s. II
7h. 50m. 18s. III
11h. 3m. 15s. IV
} Epicentre 21°·0N. 120°·0E. (as on 1917 Feb. 17 and Aug. 14).

A = −·467, B = +·808, C = +·358; D = +·866, E = +·500;
G = −·179, H = +·310, K = −·934.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I Taihoku	O.	4·3	19	1 14	+ 7	(1 55)	− 3	1·9	—
II	O.	4·3	19	0 57	−10	(1 41)	−17	1·7	—
III	O.	4·3	19	1 12	+ 5	(2 3)	+ 5	2·0	—
IV	O.	4·3	19	1 10	+ 3	(1 59)	+ 1	2·0	—
I Manila	W.	6·4	171	e 1 32	− 6	—	—	3·6	—
II	W.	6·4	171	e 1 50	+12	—	—	—	—
III	W.	6·4	171	e 1 34	− 4	—	—	3·8	5·2
IV	W.	6·4	171	e 1 35	− 3	—	—	3·6	—
I Zi-ka-wei	—	10·3	7	—	—	—	—	e 5·2	—
II	—	10·3	7	—	—	—	—	—	7·6
III	—	10·3	7	—	—	—	—	e 5·6	8·0
IV	—	10·3	7	e 2 47	+13	—	—	—	6·8
I Mizusawa	O.	25·6	40	5 28	−16	—	—	—	—
III	O.	25·6	40	5 24	−20	—	—	—	—
I Batavia	W.	30·1	207	e 6 48	+19	—	—	—	—
III	W.	30·1	207	5 42	−47	—	—	—	—

Continued on next page.

Station and Component.	Machine.	Δ	Azimuth.	P.	O—C.	S.	O—C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
I Colombo	M.	41·4	256	9 20	?PR_1	—	—	—	—
III	M.	41·4	256	25 42	?L	—	—	(25·7)	—
IV	M.	41·4	256	24 45	?L	—	—	(24·8)	—
IV Riverview	—	62·3	151	—	—	—	—	33·0	—
II Mauritius	M.	73·3	240	44 26	?L	—	—	(44·4)	—
II Helwan	M.	78·7	298	30 20	?L	—	—	(30·3)	—
IV	M.	78·7	298	33 45	?L	—	—	(33·8)	—
I De Bilt	—	87·7	326	—	—	e 22 (37)	−72	e 48·3	50·1
II	—	87·7	326	—	—	—	—	e 48·3	49·8
III	—	87·7	326	—	—	—	—	e 48·3	50·0
IV	—	87·7	326	—	—	—	—	e 47·4	50·1
IV Rocca di Papa	Ag.	88·2	315	—	—	—	—	e 56·8	65·6
IV Uccle	—	88·7	325	—	—	—	—	e 48·8	51·8
I Edinburgh	M.	89·5	332	22 48	?S	(22 48)	−81	—	66·3
IV	M.	89·5	332	38 45	?L	—	—	(38·8)	52·8
I Eskdalemuir	G.	89·8	332	—	—	—	—	45·8	—
IV	G.	89·8	332	—	—	—	—	43·8	—
II Stonyhurst	M.	90·4	330	—	—	—	—	—	54·6
III	M.	90·4	330	—	—	—	—	—	54·6
II Kew	M.	90·7	328	56 20	?L	—	—	(56·3)	—
IV Paris	—	90·8	324	—	—	—	—	e 49·8	57·8
I Bidston	M.S.	90·9	330	40 24	?L	—	—	(40·4)	47·8
IV	M.S.	90·9	330	24 57	?S	(24 57)	+34	—	55·0
II Shide	—	91·7	327	—	—	—	—	41·9	—
III	—	91·7	327	—	—	—	—	54·8	—
IV	—	91·7	327	—	—	—	—	47·4	—
II Coimbra	—	102·2	322	—	—	—	—	e 58·1	—

Additional records: Manila III MN = +4·8m. Zi-ka-wei II MN = +9·1m., III MN = +8·8m., IV MN = +6·6m. De Bilt I MN = +50·2m., II MN = +49·9m., III MN = +49·9m. Uccle gives 7h.56m. to 8h.11m. and 8h.39m. to 8h.51m. Paris gives eL from 7h.44m. to 8h.0m.

Sept. 13d. 9h. 7m. 35s. Epicentre 40°·3N. 139°·5E.

A = −·580, B = +·495, C = +·647; D = +·649, E = +·760; G = −·492, H = +·420, K = −·763.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa		1·7	133	0 28	+ 2	0 47	− 1	—	—
Tokyo		4·7	178	0 44	−29	1 13	−56	1·4	1·6
Osaka		6·5	212	1 59	+20	—	—	3·4	4·6
Kobe		6·6	213	1 40	− 1	—	—	3·0	3·4
Ootomari		6·8	19	2 24	+40	—	—	4·0	—
Zi-ka-wei		17·2	244	e 4 7	0	—	—	—	—
De Bilt	E.	79·6	333	—	—	—	—	e 43·4	48·5
	N.	79·6	333	(e 12 14)	− 3	e 12 14	?P	e 44·4	45·2

Additional records: Mizusawa gives SN = +49s. Tokyo MN = +1·5m., M_2E = +3·0m., M_2N = +2·3m., &c. Osaka MN = +4·0m. Kobe MN = +2·6m. Zi-ka-wei PME = +4m.13s.

Sept. 13d. Records also at 0h. (San Fernando and Mizusawa), 1h. (De Bilt), 2h. (Kodaikanal), 3h. (Athens), 4h. (Mizusawa (2)), 6h. (De Bilt), 9h. (Mizusawa), 10h. (Athens), 13h. (Athens and Mizusawa), 15h. (Mizusawa and Tokyo), 16h. (Taihoku (2)), 18h. (Mizusawa), 23h. (San Fernando).

1918. Sept. 14d. 17h. 4m. 45s. Epicentre 45°·0N. 152°·1E.

A = −·625, B = +·331, C = +·707 ; D = +·468, E = +·884 ;
G = −·625, H = +·331, K = −·707.

Direct comparison indicates that this is not a mere repetition of either Sept. 7d. 17h. or Sept. 8d. 5h.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Ootomari	O.	6·7	294	1 58	+16	—	—	3·5	4·3
Mizusawa	O.	10·0	238	2 32	+ 2	4 11	−18	—	—
Tokyo	W.	13·2	236	e 3 42	+26	(e 5 42)	− 7	e 5·7	—
Osaka	O.	16·4	237	3 5	−52	(6 53)	−11	6·9	13·4
Kobe	O.	16·5	237	e 4 0	+ 1	—	—	9·9	12·3
Zi-ka-wei	—	27·6	251	5 54	−10	10 30	−22	—	15·9
Taihoku	O.	31·7	241	—	—	e 11 30	−33	18·3	19·4
Manila	W.	40·2	231	e 8 3	+ 6	13 57	−13	15·2	15·7
Honolulu	M.	47·0	103	e 8 51	+ 4	15 39	− 2	26·2	29·8
Victoria	M.	55·1	54	16 32	?S	(16 32)	−50	32·3	40·1
Batavia	W.	65·2	231	—	—	—	—	—	21·2
Apia	W.	67·3	142	i 20 28	?S	(20 28)	+34	—	21·2
Bombay	O.E.	69·3	276	20 4	?S	(20 4)	−14	—	42·6
Colombo	M.	72·7	262	21 15	?S	(21 15)	+17	—	48·8
Lemberg	B.O.	75·0	328	e 13 51	?	—	—	e 42·6	46·6
Edinburgh	M.	77·0	346	18 15	?	—	—	—	48·8
De Bilt N.	—	78·8	340	12 26	+14	22 12	+ 2	36·3	52·5
E.	—	78·8	340	—	—	22 16	+ 6	—	44·6
Stonyhurst	M.	78·8	345	—	—	—	—	—	51·2
Riverview	—	78·9	181	e 12 33?	+21	e 22 13?	+ 2	e 33·0	41·2
Sydney	M.	78·9	181	21 51	?S	(21 51)	−20	—	—
Bidston	M.S.	79·3	345	15 45	?PR_1	22 21	+ 6	—	53·8
Ann Arbor	B.	79·5	39	10 45	−91	21 33	−45	40·2	—
Ottawa	—	80·2	32	12 23	+ 3	22 27	+ 2	e 36·8	—
Toronto	M.	80·2	35	e 16 39	?PR_1	e 21 21	−64	37·3	51·2
Uccle	—	80·2	340	e 12 21	+ 1	e 22 21	− 4	44·3	45·3
Kew	M.	80·7	343	—	—	—	—	—	50·2
Zagreb	W.	81·2	331	e 12 25	− 1	i 22 33	− 4	(e 43·3)	54·3
Shide	—	81·6	344	22 44	?S	(22 44)	+ 2	42·6	65·4
Ithaca	B.O.	82·5	34	e 17 15	?PR_1	22 32	−20	e 41·1	—
Paris	—	82·5	340	i 12 35	+ 2	i 22 47	− 5	43·2	47·1
Pola	W.	82·8	332	e 23 16	?S	(e 23 16)	+21	e 45·0	47·5
Melbourne	M.	83·0	186	—	—	(23 15)	+18	23·2	23·4
Harvard	B.O.	84·5	31	—	—	e 34 39	?	e 46·8	—
Moncalieri	S.	84·7	336	12 40	− 6	24 1	+45	42·2	49·9
Athens N.	M.	85·0	322	12 43	− 5	23 2	−17	—	53·9
E.	M.	85·0	322	e 12 48	0	—	—	e 37·8	55·4
Washington	Mar.	85·1	36	12 51	+ 2	23 11	− 9	46·2	—
Georgetown	—	85·1	36	e 12 55	+ 6	23 24	+ 4	47·2	—
Rocca di Papa	Ag.	86·0	331	i 12 50	− 3	23 10	−20	e 46·6	56·8
Helwan	M.	87·8	312	14 33	+89	—	—	—	62·8
Barcelona	—	89·5	338	—	—	i 23 58	−11	34·2	48·8
Tortosa	—	90·5	339	23 42	?S	(23 42)	−37	46·2	59·2
Coimbra	—	93·1	345	e 20 5	?	30 55	?SR_2	46·1	55·3
Algiers	B.M.	93·6	334	—	—	e 23 57	−55	51·2	53·7
Rio Tinto	M.	95·0	343	26 15	?S	(26 15)	+69	—	59·2
San Fernando	—	96·3	343	—	—	—	—	52·2	55·2
Mauritius	M.	106·9	258	55 15	?L	—	—	(55·2)	59·4
La Paz	Bi.	135·9	63	19 36	[+ 4]	—	—	65·8	67·6

For Notes see next page.

NOTES TO SEPT. 14d. 17h. 4m. 45s.

Additional records: Ootomari gives MN = +6·4m. Mizusawa PN = +2m.35s. Osaka MN = +10·9m. Kobe MN = +12·4m. Zi-ka-wei MN = +15·9m. Manila MN = +15·3m. Honolulu T_0 = 17h.5m.2s. Victoria S = +20m.58s., probably L. Batavia gives e = 17h.5m. Edinburgh records P as 11h. De Bilt T_0 = 17h.(5m.23s.). Epicentre 44°·7N. 153°·6E. Riverview MN = +40·7m. Ottawa L = +39·2m., +50·2m., &c., T_0 = 17h.5m.1s. Toronto eL = +43·2m., L = +50·2m. Uccle T_0 = 17h.5m.6s. Zagreb iP = +12m.37s. and +12m.45s., eS = +22m.28s., T_0 = 17h.5m.5s. Also eP = 17h.44m.42s. Pola eS = +33·4m., MN = +55·2m. Harvard L = +50·0m., +54·1m., +60·1m., and +65·0m. Moncalieri MN = +54·8m. Athens T_0 = 17h.5m.7s. Georgetown LE = +50·7m. Coimbra PR_1N? = +21m.15s., LN = +49·0m., MN = +61·2m. San Fernando MN = +58·8m. Mauritius PN = +59m.27s. (=ME), MN = +63·4m. La Paz PR_1 = +23m.44s. Andalgala and Cipolletti record P at 18h.23m.36s. and 18h.16m.48s. respectively, which may refer to this earthquake, with an error of 1h. But the fit even then is not good, and these observations have been relegated to the final note.

Sept. 14d. Records also at 1h. (Taihoku), 4h. and 9h. (Mizusawa), 18h. (Cipolletti, Andalgala, and Cape Town), 19h. (Mizusawa), 21h. (Athens), 23h. (Edinburgh).

Sept. 15d. 16h. 41m. 6s. Epicentre 34°·5N. 10°·0W. (as on 1915 July 11d.).

A = +·812, B = −·143, C = +·566; D = −·174, E = −·985;
G = +·558, H = −·098, K = −·824.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
San Fernando	3·7	56	1 6	+ 8	—	—	—	—
Coimbra	5·9	12	1 24	− 7	2 22	−19	—	2·6
De Bilt	20·7	27	—	—	—	—	e 10·5	11·2
Zagreb	22·7	52	e 7 13	?	—	—	—	9·2

Coimbra gives MN = 1s. less than ME, T_0 = 16h.41m.17s. De Bilt MN = +10·8m. San Fernando and De Bilt both suggest epicentre 36°·0N. 11°·0W., which would perhaps give a better result than the old epicentre adopted above.

Sept. 15d. Records also at 0h. (San Fernando), 2h. (Zi-ka-wei), 3h. (Taihoku), 4h. (Edinburgh), 6h. (Manila and Victoria), 7h. (Osaka and Zi-ka-wei), 9h. (Edinburgh and Athens), 10h. (Zagreb), 12h. (Zi-ka-wei (2) and Taihoku), 13h. (La Paz), 18h. (Honolulu, De Bilt, Zi-ka-wei, and Manila), 20h. (Zi-ka-wei).

Sept. 16d. 5h. 55m. 45s. Epicentre 21°·0N. 120°·0E. (as on 1918 Sept. 13d.).

A = −·467, B = +·808, C = +·358; D = +·866, E = +·500;
G = −·179, H = +·310, K = −·934.

		Δ	Az.	P.	O−C.	L.	M.
		°	°	m. s.	s.	m.	m.
Taihoku		4·3	19	1 20	+13	2·1	—
Manila	E.	6·4	171	e 1 31	− 7	3·1	4·9
Colombo		41·4	256	25 15	?L	(25·2)	—
Kodaikanal		42·3	263	27 9	?L	(27·2)	—
De Bilt		87·7	326	—	—	e 48·2	57·3
Edinburgh		89·5	332	51 15	?L	(51·2)	55·8
Bidston		90·9	330	53 27	?L	(53·4)	60·6

Additional records: Manila gives MN = +3·5m. De Bilt gives MN = +57·2m.

Sept. 16d. 13h. 4m. 0s. Epicentre 48°·5S. 162°·5E.

A = −·632, B = +·199, C = −·749; D = +·301, E = +·959; G = +·714, H = −·225, K = −·663.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Melbourne	16·6	304	(3 54)	− 6	3 54	?P	7·3	9·8
Riverview	17·0	326	i 4 5	0	e 7 20	+ 2	e 8·6	9·1
Sydney	17·0	326	3 54?	−11	—	—	—	—
Adelaide	22·3	299	—	—	(9 35)	+24	9·6	12·7
Honolulu	78·2	37	e 22 0	?S	(e 22 0)	− 2	41·7	45·6
La Paz	101·0	131	56 23	?L	—	—	(56·4)	79·2
Victoria	116·1	45	57 49?	?L	—	—	(57·8?)	68·6
Toronto	138·0	74	—	—	—	—	67·2	74·5
Helwan	138·7	260	76 0	?L	—	—	(76·0)	—
Ottawa	141·1	74	—	—	—	— e	69·0	—
Athens	148·6	269	e 76 49	?L	—	— (e	76·8)	77·0
Rocca di Papa	157·8	264	e 50 39	?	—	— e	54·2	—
	157·8	264	—	—	—	— e	96·0	99·5
Moncalieri	162·5	268	—	—	—	— e	101·2	—
De Bilt	165·2	293	—	—	—	— e	87·0	102·9
San Fernando	165·4	219	32 0	?	—	—	(93·0)	—
Paris	166·8	279	—	—	—	— e	98·0	106·5
Eskdalemuir	168·9	313	—	—	—	—	88·0	—
Stonyhurst	169·2	305	e 91 18	?	e 94 30	? e	99·0	104·2
Coimbra	169·5	221	—	—	—	— e	98·0	—
Bidston	169·7	304	86 18	?L	99 12	?	(86·3)	107·6

Additional records: Riverview gives iS = +7m.38s., MN = +9·4m., MZ = +10·2m., T_0 = 13h.3m.55s., Epicentre 47°·5S. 165°·0E. La Paz L = +78·2m. Toronto L = +69·3m., and eL = +72·7m. Ottawa L = +75·0m. and 81·0m. Athens L = +76·9m. De Bilt MN = +90·4m. Epicentre 47°·5S. 165°·0E. San Fernando gives L as the P of another shock.

Sept. 16d. Records also at 0h. (Mizusawa (2) and San Fernando), 2h. (Taihoku and Zi-ka-wei), 4h. (Mizusawa), 5h. and 10h. (Athens), 14h. (Athens and Rocca di Papa), 15h. (Cipolletti), 17h. (La Paz), 20h. (Zi-ka-wei and Zagreb).

Sept. 17d. Records at 0h. (San Fernando), 1h. (Zagreb), 2h. (Zagreb, Rocca di Papa, Uccle, and Zurich), 5h. (Denver), 10h. (Athens and Hokoto), 13h. (Kew and Manila), 14h. (La Paz), 19h. (Batavia), 22h. (Balboa Heights).

Sept. 18d. 22h. 18m. 35s. Epicentre 21°·0N. 120°·0E. (as on 1918 Sept. 16d.).

A = −·467, B = +·810, C = +·358.

	Δ	P.	O−C.	S.	O−C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Taihoku	4·3	1 7	0	(1 52)	− 6	1·8	—
Manila	6·4	e 1 31	− 7	—	—	3·1	3·6
Zi-ka-wei	10·3	2 43	+ 9	—	—	—	—
De Bilt	87·7	—	—	—	— e	48·4	50·0
Edinburgh	89·5	50 25	?L	—	—	(50·4)	—
La Paz	171·1	e 52 31	?	—	—	—	—

Sept. 18d. Records also at 2h. (San Fernando and Rocca di Papa), 7h. (Rocca di Papa), 18h. (Taihoku (2)), 19h. (Helwan), 20h. (Mizusawa).

Sept. 19d. Records at 2h. (San Fernando, Manila (2), Riverview, and Batavia), 19h. (Batavia), 20h. (Riverview, Helwan, and Perth), 22h. (San Fernando and Mizusawa), 23h. (Taihoku).

Sept. 20d. Records at 1h. (Monte Cassino), 2h. (Zi-ka-wei and Monte Cassino), 3h. (Manila), 4h. (Zi-ka-wei, Monte Cassino, and Mizusawa), 22h. (Mizusawa).

Sept. 21d. Records at 0h. (San Fernando), 2h. (Monte Cassino), 13h. (Batavia), 15h. (Tokyo), 18h. (San Fernando).

1918. Sept. 22d. 9h. 54m. 55s. Epicentre 0°·5N. 100°·0E.

(as on 1915 April 3d.).

A = −·174, B = +·985, C = +·009; D = +·985, E = +·174; G = −·002, H = +·009, K = −1·000.

This determination would generally be improved if a slight depth of focus were assumed, say 0·015. But as La Paz near the anticentre gives a positive residual for [P] the evidence is not sufficiently conclusive.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Batavia	W.	9·5	134	i 2 12	−11	4 30?	+14	—	6·1
Colombo	M.	21·2	289	(5 29)	+34	(9 5)	+17	9·1	14·2
Kodaikanal	M.	24·5	295	10 29	?S	(10 29)	+35	14·1	16·1
Calcutta E.	O.E.	24·7	333	5 41	+ 6	10 11	+14	—	—
N.	O.E.	24·7	333	5 47	+12	10 17	+20	—	—
Manila	W.	25·0	55	e 5 41	+ 3	(10 5)	+ 2	10·1	—
Taihoku	O.	32·1	39	8 7	?PR_1	11 54	−16	16·6	19·6
Bombay	O.E.	32·4	306	6 40	−12	—	—	—	—
Perth	M.	35·7	158	11 29	?	—	—	—	—
Zi-ka-wei	—	36·8	31	7 25	− 3	13 21	0	—	23·6
Simla	O.E.	37·5	327	—	—	e 13 29	− 2	—	21·8
Mauritius N.	M.	46·1	240	14 29	?S	(14 29)	−60	21·7	23·5
E.	M.	46·1	240	14 53	?S	(14 53)	−36	20·9	23·4
Osaka	O.	47·5	40	8 45	− 6	—	—	—	11·6
Mizusawa E.	O.	53·8	39	9 36	+ 4	17 14	+ 8	—	—
Melbourne	M.	56·4	140	—	—	17 29	−10	30·5	32·9
Sydney	M.	59·0	131	17 47	?S	(17 47)	−24	—	—
Riverview	—	59·0	131	e 9 53	−12	i 17 51	−20	26·9	34·5
Helwan	M.	71·3	301	11 47	+22	—	—	—	44·5
Lemberg	B.O.	80·6	320	e 8 23	−240	21 59	−31	—	22·8
Cape Town	M.	83·3	236	22 35	?S	(22 35)	−25	(40·1)	45·1
Vienna	—	85·4	319	e 13 5	+15	23 35	+12	—	—
Zagreb	W.	85·5	316	i 12 47	− 4	—	—	—	23·4
Pompeii E.	O.A.	86·3	311	i 12 31	−24	—	—	—	—
Pola	W.	86·9	315	e 22 59	?S	(e 22 59)	−41	e 23·3	23·6
Rocca di Papa	Ag.	87·7	312	i 12 56	− 7	23 35?	−14	—	—
Moncalieri	S.	91·3	315	—	—	i 24 9	−18	50·4	—
De Bilt N.	—	92·6	321	—	—	i 24 (28)	−13	55·1	56·2
E.	—	92·6	321	—	—	—	—	58·1	61·0
Algiers	B.M.	95·3	309	—	—	e 24 2	−67	—	58·6
Edinburgh	M.	97·0	328	65 5	?L	—	—	(65·1)	68·1
Honolulu	M.	100·9	69	24 53	?S	(24 53)	−71	59·1	68·9
San Fernando E.	—	102·6	308	61 5	?L	—	—	(61·1)	83·1
Victoria	M.	119·3	31	63 56	?L	66 54	?	(63·9)	77·2
Ottawa	—	134·9	355	e 18 35	[−55]	e 34 23	?	72·1	—
Toronto	M.	136·9	359	—	—	—	—	e 83·7	84·8
Washington	Mar.	140·5	356	e 19 25	[−15]	22 35?	?PR_1	e 80·1	—
La Paz	Bi.	160·2	215	20 16	[+ 8]	—	—	76·1	79·8

Additional records: Batavia gives T_0 = 9h. 54m.18s. Colombo records P as S and S as L. Zi-ka-wei PMN = +7m.27s., PME = +7m.31s., eS = +13m.15s., MN = +24·1m. Mizusawa SN = +17m.6s., T_0 = 9h.55m.7s. Riverview iS = +17m.54s., MN = +31·6m., T_0 = 9h.54m.54s. Cape Town records S as P and L as S. Victoria L = +72·8m. Ottawa i = +22m.58s. (?PR_1). Toronto L at +39·8m. and +57·9m.

Sept. 22d. 12h. 58m. 13s. } Repetitions from 46°·5N. 151°·4E. See note to
13h. 48m. 36s. } Sept. 7d. 17h. Records at Osaka, Mizusawa, Ootomari, and Zi-ka-wei.

Sept. 22d. Records also at 2h. (San Fernando), 9h. (Manila), 13h. (Mizusawa, Zagreb, and Rocca di Papa), 14h. (Mizusawa, Zagreb, Rocca di Papa, Stonyhurst, Rio Tinto, and De Bilt), 17h. (Mizusawa), 19h. (Colombo), 20h. (Mizusawa).

Sept. 23d. 2h. 13m. 20s. Epicentre 36°·0N. 28°·0E. (as on 1918 Mar. 17d.).

A = +·714, B = +·380, C = +·588; D = +·470, E = −·883;
G = +·519, H = +·276, K = −·809.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	3·9	302	i 1 2	+ 1	—	—	i 1·6	2·0
Helwan	6·7	154	3 34	?L	—	—	(3·6)	—
Pompeii	11·6	298	2 54	+ 1	—	—	—	—
Rocca di Papa	13·2	301	1 10	?	—	—	—	2·1
Zagreb	13·3	321	e 3 20	+ 3	—	—	—	7·7
Pola	13·9	314	e 5 46	?S	(e 5 46)	−20	e 7·0	8·1
Stonyhurst	27·6	320	—	—	—	—	—	18·2

Zagreb eMNW = +7·4m. Rocca seems to record another more local shock.

Sept. 23d. Records also at 1h. (Manila), 3h. (Zagreb), 12h. (La Paz and Mizusawa), 13h. (Helwan), 17h. (Apia), 20h. (Mizusawa), 21h. (Helwan), 22h. (San Fernando).

Sept. 24d. 0h. 3m. 8s. Epicentre 24°·0N. 121°·0E. (as on 1916 Nov. 14d.).

A = −·470, B = +·783, C = +·407; D = +·857, E = +·515;
G = −·210, H = +·349, K = −·914.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Taihoku	1·1	24	0 17	0	—	—	0·7	—
Hokoto	1·5	251	—	—	0 40	− 2	0·9	1·1
Zi-ka-wei	7·2	3	—	—	—	—	e 4·9	—
Manila	9·4	180	—	—	e 4 12	− 1	—	—
De Bilt	85·6	326	—	—	—	—	e 46·9	47·6
Edinburgh	86·8	332	48 22	?L	—	—	(48·4)	50·9
Eskdalemuir	87·5	332	—	—	—	—	45·9	—
Stonyhurst	88·2	330	—	—	—	—	—	52·4

De Bilt gives MN = +47·4m.

Sept. 24d. Records also at 4h. (Tokyo), 6h. (Manila), 8h. and 9h. (Athens), 13h. (Tokyo).

Sept. 25d. 9h. 52m. 20s. Epicentre 16°·0S. 168°·0E. (as on 1917 Nov. 29d.).

A = −·940, B = +·200, C = −·276; D = +·208, E = +·978;
G = +·270, H = −·057, K = −·961.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	23·4	210	e 5 20	− 1	9 26	− 7	e 11·1	16·7
Melbourne	29·8	218	—	—	11 16	−15	14·6	17·7
Honolulu	50·1	43	e 16 40	?S	(e 16 40)	+20	25·7	30·7
San Fernando	158·9	347	63 40	?L	—	—	(63·7)	—

Riverview gives also S = +9m.20s. and MN = +16·2m.

Sept. 25d. Records also at 4h. (San Fernando), 9h. (Mizusawa, Tokyo, and Osaka), 11h. (Helwan), 13h. (Rio Tinto), 17h. (Mizusawa), 20h. (Helwan).

Sept. 26d. 0h. 16m. 25s. Epicentre 46°·0N. 9°·0E. (as on 1917 Dec. 9d.).

A = +·686, B = +·109, C = +·719.

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Milan		0·6	0 52	+43	—	—	—	1·4
Zurich	E.	1·4	i 0 26	+ 5	i 0 42	+ 3	—	0·7
	V.	1·4	0 26	+ 5	0 43	+ 4	—	1·0
Paris		5·2	e 2 20	?S	(e 2 20)	− 2	3·3	—
Uccle		5·7	e 1 23	− 5	—	—	e 2·9	—
Zagreb		5·9	i 1 30	− 1	2 20	−21	—	2·5

Additional records: Zurich gives MN = +0·8m., MV = +1·0m. Neuchatel P = +47s., S = +1m.18s., T_0 = 0h.16m.33s. Paris iS = +3m.5s. Zagreb eP = +1m.24s., MNW = +2·6m.

Sept. 26d. Records also at 11h. (La Paz), 13h. and 17h. (Pompeii), 23h. (La Paz).

Sept. 27d. Records at 0h. (Mizusawa), 1h. (San Fernando), 2h. (Helwan and Edinburgh), 3h. (Lick), 5h. (Nagasaki, Helwan, Cape Town, Algiers, and De Bilt), 9h. (Monte Cassino), 11h. (Taihoku), 12h. (Tortosa), 15h. (De Bilt), 22h. (San Fernando).

Sept. 28d. 10h. 19m. 30s. I } 10h. 35m. 20s. II } At 26°·0S. 80°·0W. (as on 1917 Feb. 15, 16, 21).

A = +·156, B = −·886, C = −·438; D = −·985, E = −·174;
G = −·076, H = +·431, K = −·899.

The South American stations (except La Paz) use Cordoba time, 4h. 16m. 48·22s. W. of Greenwich. If for some reason they have in this case used standard time (4h. 0m. 0s. W.) the two shocks might coalesce into one.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
II Andalgala	12·3	101	3 40	+37	12 52	?	—	16·3
II La Quiaca	13·6	77	—	—	—	—	—	4·5
I La Paz	14·5	52	3 25	− 8	6 21	+ 1	7·9	8·5
II Cipolletti	16·4	145	4 4	+ 7	6 22	−42	—	7·9
I Victoria	83·9	333	37 0	?L	—	—	(37·0)	39·9
I Honolulu	89·2	294	—	—	—	—	37·7	42·0
I Rio Tinto	93·8	49	50 30	?L	—	—	(50·5)	58·0
I Algiers	100·1	54	—	—	—	—	48·5	51·5
I Edinburgh	104·3	34	6 30	?	—	—	—	51·5
I Moncalieri	106·6	48	e 51 1	?	—	—	53·3	—
I Helwan	120·2	68	28 30	?S	(28 30)	−21	—	—

II La Quiaca gives MN = +4·0m.

Sept. 28d. Records also at 4h. (Denver), 11h. (Kodaikanal), 16h. (Moncalieri), 23h. (San Fernando).

1918. Sept. 29d. 12h. 7m. 5s. Epicentre 35°·2N. 34°·7E.

A = +·672, B = +·465, C = +·576 ; D = +·569, E = −·822 ;
G = +·474, H = +·328, K = −·817.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Helwan	M.	6·0	209	1 43	+11	—	—	—	8·1
Athens	M.	9·2	291	2 28	+ 9	4 20	+12	5·0	7·6
Lemberg	B.O.	16·6	335	e 4 7?	+ 7	7 25	+16	—	10·8
Pompeii	O.A.	16·8	295	3 45	−17	e 6 56	−17	10·4	—
Monte Cassino	Ag.	17·5	298	4 11	0	—	—	—	4·8
Zagreb	W.	17·7	312	i 4 22	+ 9	i 7 48	+15	e 8·9	10·6
Rocca di Papa	Ag.	18·4	298	i 4 30	+ 8	i 8 3	+14	e 11·4	15·2
Pola	W.	18·5	308	e 4 16	− 7	e 7 49	− 2	e 9·8	13·7
Milan	Ag.	21·9	306	5 11	+ 7	—	—	—	11·9
Moncalieri	S.	22·7	304	5 16	+ 3	i 9 38	+19	12·9	18·1
Zurich	—	22·9	310	e 5 17	+ 1	9 33	+10	—	—
Marseilles	Ma.	24·0	299	i 5 37	+ 9	i 9 52	+ 8	17·9	—
Algiers	B.M.	25·5	283	5 42	− 1	10 22	+ 9	12·4	23·9
Barcelona	—	26·1	294	5 49	0	10 30	+ 6	—	20·9
De Bilt	—	26·9	318	5 57	0	10 37	− 2	12·9	15·4
Uccle	—	26·9	315	5 53	− 4	10 32	− 7	e 13·9	19·6
Paris	—	27·2	310	e 5 55	− 5	i 10 33	−12	13·9	18·4
Kew	M.	29·7	314	10 55	?S	(10 55)	−34	—	22·9
Shide	—	30·1	310	6 23	− 6	11 53	+17	17·9	21·5
Stonyhurst	M.	31·8	315	7 25	+40	12 49	+44	—	25·5
Bidston	M.S.	32·0	315	6 55	+ 8	12 1	− 7	—	20·4
Eskdalemuir	G.	32·8	320	6 47	− 8	12 5	−16	15·9	18·5
San Fernando	—	32·9	282	6 55	− 1	(11 25)	−57	11·4	31·9
Dyce	M.S.	33·0	323	6 36	−20	11 55	−29	17·8	28·2
Edinburgh	M.	33·0	321	6 45	−11	—	—	—	24·6
Rio Tinto	M.	33·0	288	5 55	−61	—	—	—	30·9
Coimbra E.	—	34·2	292	7 3	− 4	12 36	− 7	20·9	26·6
N.	—	34·2	292	7 19	+12	—	—	15·7	24·6
Cork	—	34·8	312	12 55	?S	(12 55)	+ 3	—	25·4
Simla	O.E.	35·5	85	12 13	?S	(12 13)	−50	18·5	19·1
Bombay	O.E.	37·4	109	7 10	−23	—	—	—	23·4
Kodaikanal	M.	46·2	112	19 49	?SR_1	—	—	28·8	31·6
Colombo	M.	50·1	116	15 25	?S	(15 25)	−55	—	36·2
Mauritius N.	M.	59·5	156	25 43	?L	—	—	(25·7)	33·6
E.	M.	59·5	156	18 13	?S	(18 13)	− 4	—	32·7
Zi-ka-wei	—	70·2	65	e 22 35	?	—	—	—	41·8
Cape Town	M.	70·7	194	28 55	?	36 55	?	39·9	41·9
Ottawa	—	77·8	319	12 12	+ 6	22 8	+10	e 35·9	—
Osaka	O.	78·3	56	10 35	?	22 1	− 3	32·4	43·1
Manila	W.	78·7	80	e 12 31	+20	(22 0)	− 8	22·0	22·4
Batavia	W.	79·2	106	e 11 55	−19	—	—	e 45·9	24·9
Ithaca	B.O.	80·2	317	—	—	—	—	e 39·3	—
Toronto	M.	81·0	320	—	—	23 7?	+32	37·0	50·4
Georgetown E.	—	82·7	314	e 11 54	−40	22 54	0	—	—
N.	—	82·7	314	e 11 54	−40	22 58	+ 4	—	—
Washington	Mar.	82·7	314	(e 12 50)	+16	12 50	?P	e 39·9	—
Ann Arbor N.	W.	84·2	320	12 37	− 6	21 55	−75	34·9?	22·9
E.	W.	84·2	320	12 25	−18	21 55	−75	—	22·8
Victoria	M.	94·2	348	—	—	—	—	e 45·0	59·8
Perth	M.	101·4	122	—	—	—	—	48·9	—
La Paz	Bi.	109·7	265	e 19 2	?PR_1	29 39?	—	55·9	58·7
Melbourne	M.	125·2	116	—	—	—	—	69·4	74·4
Riverview	—	128·6	110	e 57 31?	?	—	—	68·1	74·8
Sydney	M.	128·6	110	—	—	66 7	?L.	(66·1)	—

Additional records: Athens gives MN = +7·4m. Zagreb iS = +7m.52s., M = +13·5m. Pola MN = +11·6m. Moncalieri MN = +15·8m. Zurich i = +5m.33s. De Bilt MN = +15·6m., T_0 = 12h.7m.9s. Uccle SR_1 = +12m.43s. Paris MN = +16·3m. San Fernando MN = +29·4m. Coimbra T_0 = 12h.7m.9s. Simla S = +14m.55s. All these records are given for 13h. Ottawa L = +47·9m., T_0 = 12h.7m.19s. Osaka MN = +42·1m. Manila S = +18m.7s. (?PR_1), MN = +22·1m. Batavia eL = +45·9m., L = +50·9m. Toronto e = +27m.55s., eL = +47·2m., and +49·8m. Washington e? = +11m.55s. Ann Arbor gives, with the Bosch instrument, PE = 12m.13s. Victoria eL = 43·3m., and +50·0m. La Paz adds a note "Probably 5 secs. in error." Riverview MN = +72·4m. MZ = +77·3m.

Sept. 29d. Records also at 0h. (Tokyo, Rocca di Papa, Zagreb, and Athens), 12h. (Taihoku), 14h. (Zurich and La Paz), 23h. (San Fernando).

Sept. 30d. 7h. 28m. 5s. Epicentre 35°·0N. 24°·0E. (as on 1913 Sept. 30d.).

A = +·748, B = +·333, C = +·574; D = +·407, E = −·914; G = +·524, H = +·233, K = −·819.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	2·9	356	i 0 42	− 3	—	—	1·0	1·2
Pompeii	9·4	310	e 2 24	+ 2	e 4 16	+ 3	—	—
Rocca di Papa	11·1	311	e 2 47	+ 1	4 55?	− 2	—	5·6
Zagreb N.W.	12·5	332	e 2 53	−13	i 5 38	+ 6	i 6·5	7·9
N.E.	12·5	332	e 2 58	− 8	—	—	—	7·4
Pola	12·5	325	e 0 55	?	—	—	—	—
Moncalieri	15·9	314	e 4 41?	+50	8 16?	+83	11·1	—
De Bilt	21·7	328	—	—	e 8 55	− 4	e 11·6	12·6

Additional records: Athens gives m = +46s. Rocca di Papa e = +2m.24s.
Zagreb iMNE? = +6m.50s., MNE = +6·9m.

1918. Sept. 30d. 13h. 34m. 20s. Epicentre 51°·0N. 179°·5W.

A = −·629, B = −·005, C = +·777; D = −·009, E = +1·000; G = −·777, H = −·007, K = −·629.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Honolulu	M.	34·1	142	e 7 52	+46	12 16	−26	13·7	14·7
Victoria	M.	35·6	73	(7 13)	− 5	(10 10)	−174	(15·1)	(31·3)
Osaka	O.	36·1	262	7 16	− 7	—	—	—	18·0
Berkeley	—	41·7	86	e 17 40	?	—	—	—	—
Zi-ka-wei	—	47·2	270	9 4	+16	16 10	+26	—	—
Manila	W.	59·7	259	e 17 24	?S	(17 24)	−55	19·7	—
St. Louis	W.	60·6	65	12 40	+144	18 22?	− 9	22·2	33·8
Toronto	M.	62·8	53	10 40?	+ 9	e 19 22	+24	e 27·7	42·2
Ottawa	—	63·4	50	10 30	− 4	18 50	−16	29·2	—
Ithaca N.	B.O.	65·2	52	e 10 30	−16	18 47	−40	34·6	—
Northfield	B.O.	65·8	49	—	—	—	e 38·6	—	—
Washington	Mar.	67·5	56	10 25	−36	19 3	−53	40·7	—
Georgetown	—	67·5	56	—	—	e 33 23	?L	37·3	—
Cheltenham N.	B.O.	67·7	56	e 38 5	?	—	—	40·6	41·6
Harvard	B.O.	67·8	50	(10 39)	−24	—	—	34·0	—
Edinburgh	M.	73·0	3	12 40	+64	—	—	—	—
Eskdalemuir	G.	73·6	3	11 45	+ 5	21 10	+ 1	35·6	—
Bidston	M.S.	75·5	2	11 58	+ 6	20 46	−46	—	30·4
De Bilt	—	76·8	357	11 (59)	− 1	21 (54)	+ 7	e 36·6	40·5
Kew	M.	77·5	0	—	—	—	—	—	55·6
Uccle	—	78·1	358	—	—	e 21 40	−21	e 39·6	50·6
Shide	M.S.	78·3	1	—	—	23 10	+66	39·7	—
Paris	—	80·2	359	—	—	e 22 40	+15	42·6	50·6
Zagreb	W.	82·2	350	e 12 50	+19	e 22 48	0	43·6	49·6
Moncalieri	S.	83·8	355	12 47	+ 6	22 55	−12	35·6	48·3
Batavia	W.	84·6	257	—	—	e 22 40	−35	—	—
Rocca di Papa	Ag.	86·6	351	13 52	+55	23 52	+15	45·5	60·0
Coimbra	—	88·4	7	e 13 12	+ 5	23 30	−26	43·1	—
Riverview	—	88·7	204	e 13 5	− 4	i 23 37	−23	e 43·8	49·2
Algiers	B.M.	92·2	358	—	—	e 23 51	−46	—	26·2
San Fernando	—	92·4	5	40 40	?L	—	—	(40·7)	54·7
Helwan	M.	94·7	334	—	—	24 40	−23	—	—
La Paz	Bi.	116·2	84	19 44	PR_1	—	—	71·6	74·8
Cape Town	M.	158·5	316	84 10	?L	93 40	?L	(84·2)	97·7

For Notes see next page.

NOTES TO SEPT. 30d. 13h. 34m. 20s.

Victoria gives P = 13h.31m.33s., S = 13h.34m.30s., L = 13h.39m.25s., M = 13h.55m.39s., Δ = 1710, which probably refers to an earlier shock, though no other observatory (except possibly Harvard) seems to record it. An attempt is made in the text to reconcile the readings by assuming an error of 10min., but without much success. Osaka gives MN = +18·3m. Toronto L = +56·5m. Ottawa L = +37·6m., &c. Ithaca PE = +8m.50s. Washington L = +35·7m. Georgetown LN = +37·5m. Ann Arbor (Δ = 61°·6) gives 14h. to 14h.30m. Harvard gives P as SE, with SN = +10m.38s., eLN = +31·0m., LE = +34·6m., LE = +39·8m., Δ = 10155, misreading the shock as a very distant one. Eskdalemuir PR_1 = +14m.59s., SR_1 = +26m.0s. De Bilt NSR_1 = +27m.10s., m = +27m.30s., MN = +38·2m., T_0 = 13h.34m.22s., Epicentre 51°·6N. 176°·2W. Moncalieri MN = +46·5m., ME as printed would be +28·3m. Riverview e? = +17m.34s. = PR_1? PS = +24m.8s., MN = +45·1m., T_0 = 13h.34m.51s. San Fernando, the M is given at 19h. instead of 14h.

Sept. 30d. 16h. 8m. 45s. Epicentre 46°·5N. 151°·4E. (as on 1918 Sept. 8d. 5h.).

This seems to be a repetition of Sept. 8d. 5h., with focus at normal depth, rather than of Sept. 7d. 17h., with high focus. Direct comparison of the observations favours this view.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari	5·9	285	1 52	+21	—	—	3·6	—
Mizusawa	10·5	229	2 29	− 8	4 34	− 9	—	—
Osaka	16·8	231	4 13	+11	—	—	—	13·4
Zi-ka-wei	27·6	247	e 5 54	−10	—	—	—	—
Honolulu	47·9	104	15 33	?S	(15 33)	−20	26·0	29·3
Eskdalemuir	75·9	345	—	—	—	—	41·3	—
De Bilt E.	77·3	340	—	—	e 22 1	+ 9	e 43·3	45·3
N.	77·3	340	—	—	—	—	e 42·3	52·6
Hohenheim	79·2	336	i 12 7	− 7	—	—	—	—
Zagreb	79·7	330	e 12 17	0	e 22 16?	− 4	45·3	—
Paris	80·9	340	—	—	—	—	e 45·3	—
Moncalieri	83·1	335	e 41 2	?L	—	—	47·9	—
Rocca di Papa	84·4	330	12 39?	− 5	23 9?	− 3	—	25·7
Cape Town	142·5	273	45 15	?SR_1	—	—	—	—

Additional records: Mizusawa NS = +3m.3s. Osaka MN = +15·0m. Zagreb eNE? = +12m.7s. Rocca di Papa i = +25m.3s., eL = +35·8m., M = +58m., &c.

1918. Sept. 30d. 17h. 51m. 35s. Epicentre 24°·0S. 171°·6E.

A = −·904, B = +·133, C = −·407; D = +·146, E = +·989; G = +·402, H = −·059, K = −·914.

The epicentric residuals suggest an increase of T_0 by about 10sec., in which case the anticentric residuals become distinctly negative and suggest a focus rather deeper than usual.

Station and Component	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Apia	W.	18·7	60	4 26	+ 1	(7 53)	− 2	e 7·9	9·4
Sydney	M.	20·3	236	4 55	+10	8 37	+ 8	10·2	10·9
Riverview	—	20·4	236	i 4 48	+ 2	8 28	− 4	9·8	10·3
Melbourne	M.	26·8	232	6 7	+13	(10 25)	− 8	10·4	15·6
Adelaide	M.	30·7	242	6 22	−13	11 27	−19	15·9	18·4
Perth	M.	49·4	248	8 55	− 8	15 54	−17	26·9	32·5
Honolulu	M.	54·1	36	17 7	?S	(17 7)	− 3	27·5	33·9
Manila	W.	62·8	303	e 10 37	+ 6	(19 3)	+ 5	19·0	19·7
Batavia	W.	64·5	275	10 42	0	19 15?	− 4	e 34·4	36·4
Osaka	O.	68·0	329	11 3	− 1	—	—	—	21·0
Mizusawa E.	O.	69·3	336	11 9	− 4	20 8	−10	—	—
N.	O.	69·3	336	12 13	+60	20 7	−11	—	—
Zi-ka-wei	—	73·2	319	11 39	+ 2	20 56	− 8	—	—
Berkeley	—	87·5	46	—	—	—	—	e 36·2	—

Continued on next page.

Station and Component.	Machine.	Δ	Azimuth.	P.	O−C.	S.	O−C.	L.	M.
		°	°	M. S.	S.	M. S.	S.	M.	M.
Lick	W.	87·6	48	—	—	—	—	e 36·4	—
Victoria	M.	92·8	39	12 57	−34	17 22	?PR$_1$	23·9	55·7
Colombo	M.	94·5	275	23 25	?	—	—	—	—
Cipolletti	M.	95·9	139	—	—	—	—	—	63·8
Mauritius N.	M.	101·9	239	26 43	?S	(26 43)	+29	—	50·2
E.	M.	101·9	239	25 1	?S	(25 1)	−73	—	58·5
Bombay	O.E.	105·3	283	23 37	?	—	—	—	—
La Paz	Bi.	109·0	119	e 18 51	?PR$_1$	28 48	+89	—	—
Toronto	M.	119·7	50	—	—	e 52 25	?	61·2	70·8
Washington	Mar.	120·9	58	—	—	—	—	e 53·4?	—
Georgetown	—	120·9	58	—	—	—	—	65·1	—
Ithaca	B.O.	121·7	51	—	—	—	—	e 63·9	—
Ottawa	—	122·6	48	—	—	—	—	61·4	—
Harvard	B.O.	125·7	51	—	—	—	—	64·7	—
Eskdalemuir	G.	148·5	355	19 55	[+ 1]	30 11	−99	48·4	—
Vienna	—	148·9	328	i 19 54	[0]	—	—	—	—
De Bilt E.	—	150·1	342	—	—	e 30 23	?	e 75·4	110·8
N.	—	150·1	342	—	—	—	—	e 74·4	117·8
Bidston	M.S.	150·3	352	19 49	[− 7]	29 55	?	—	91·9
Zagreb	W.	150·6	323	e 19 51	[− 6]	30 20	?	42·4	—
Uccle	—	151·5	343	e 19 55	[− 3]	e 30 25	?	—	30·4
Hohenheim	—	151·6	335	e 19 47	[−11]	—	—	—	—
Shide	M.S.	152·7	351	—	—	—	—	86·8	—
Zurich	—	153·0	334	e 19 56	[− 4]	—	—	—	—
Paris	—	153·7	344	—	—	30 40	?	79·4	93·4
Rocca di Papa	Ag.	155·1	320	19 36	[−26]	—	—	—	—
	Ag.	155·1	320	e 20 8	[+ 6]	e 37 16?	?	90·6	97·3
Moncalieri	S.	155·3	332	20 5	[+ 3]	—	—	33·3	—
Tortosa	—	161·6	338	20 25	[+16]	31 16	?	92·4	107·6
Coimbra	—	163·8	0	—	—	e 34 25	?	e 50·9	—
Algiers	B.M.	163·9	325	e 20 12	[+ 1]	29 45	?	45·4	107·4

Additional records: Riverview gives eP = +4m.42s., iP = +5m.12s., PS = +8m.47s., MN = +10·9m., MZ = +11·8m., T_0 = 17h.51m.25s. Epicentre 24°·0S., 172°·5E. Melbourne P as S and S as L. Honolulu S = +22m.55s. Manila gives S = 15m.49s. = ?PR$_1$. Batavia M = +20·4m. Osaka MN = +25·0m. Zi-ka-wei SMN = +21m.44s. Toronto eL = +65·0m. Washington L = +68·4m. and +104·4m. Ottawa eLN? = +50·4m., LN = +53·4m. De Bilt gives 24°·0S., 172°·5E., as an estimation of the epicentre. Zagreb gives an alternative to P, iP = +20m.1s. Rocca di Papa eL? = +44·6m.

Sept. 30d. 18h. 37m. 50s. Epicentre 7°·0S. 145°·0E. (as on 1918 June 4d.).

A = −·813, B = +·569, C = −·122; D = +·574, E = +·819;
G = +·100, H = −·070, K = −·993.

We could improve the accordance of Batavia, Honolulu, and Apia (assuming an error of 2min. in this last) by moving the epicentre 5° further east to 7°·0S. 150°·0E., but this would not suit Manila so well.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	27·4	169	e 5 51	−11	i 10 48	0	e 14·0	18·2
Sydney	27·4	169	9 58	?S	(9 58)	−50	15·8	16·7
Adelaide	28·5	191	4 10	−123	8 47?	−141	12·5	21·9
Melbourne	30·7	180	9 28	+173	15 4	+198	18·5	19·6
Manila	32·2	312	e 7 2	+12	12 0	−11	14·8	15·6
Perth	36·9	224	—	—	—	—	24·0	—
Batavia	37·9	269	e 8 20	+43	16 26?	+169	—	—
Osaka	42·7	348	8 23	+ 7	—	—	—	28·2
Apia	43·0	103	5 38?	−160	—	—	16·7	22·2
Zi-ka-wei	44·3	331	8 10?	−18	e 15 1	− 5	—	30·0
Honolulu	62·6	62	17 40	?S	(17 40)	−76	27·5	32·2
Victoria	96·4	42	—	—	—	—	38·0	43·1

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	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Cape Town	114·9	229	—	—	—	—	—	67·7
Zagreb	121·6	321	17 27	?	e 33 10	?	—	46·2
Cipolletti	124·7	147	—	—	—	—	—	78·1
Rocca di Papa	125·4	318	12 40?	?	23 10	?	44·4	54·5
Toronto	126·6	39	—	—	—	—	e 64·8	75·2
Moncalieri	127·0	323	20 17	[+66]	—	—	35·8	50·9
Kew	127·1	332	—	—	32 10	?	—	41·8
Washington	130·5	43	—	—	—	—	58·2	—
Harvard	132·4	36	—	—	—	—	71·3	—
Barcelona	132·4	322	—	—	—	—	e 42·8	55·2
Andalgala	134·3	140	—	—	—	—	—	91·5
La Paz	139·5	126	19 20	[−18]	32 10	?	57·2	63·9
Rio Tinto	139·9	321	44 10	?	—	—	—	71·2

Additional records: Riverview gives PS = +11m.21s., MN and MZ = +15·8m., T_0 = 18h.37m.27s. Sydney gives S = +13m.40s. = L? corrected. Melbourne SR_1 = +16m.28s., SR_2 = +17m.10s. Manila MN = +15·2m. Osaka MN = +32·6m. Zi-ka-wei gives P at 18h.6m.0s. It is assumed that 6m. should be 46m. Kodaikanal (Δ = 70°) gives P at 18h.41m.48s., L at 18h.48m.12s., M at 18h. 54·1m., which probably apply to previous earthquake. Ann Arbor (Δ = 114°·7) gives 19h. to 20h. Toronto eL = +71·2m., iL = +79·2m. Washington L = +22·2m. Andalgala ME = +27·2m., MN = +30·4m., possibly 1h. wrong. Rio Tinto gives M = +79·2m.

Sept. 30d. Records also at 1h. (Harvard and Athens), 3h. (Athens), 4h. (Simla and Athens (2)), 7h. (Athens), 8h. (Athens (2)), 9h. (Athens and Batavia), 10h. (Riverview and Athens), 13h. (Rocca di Papa and Adelaide), 14h. (Batavia), 16h. (Athens), 17h. (Lick), 19h. (Zagreb), 20h. (Zurich), 23h. (Lick).

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