The International Seismological Summary for 1923 January, February, March.

FORMERLY THE BULLETIN OF THE BRITISH ASSOCIATION SEISMOLOGY COMMITTEE.

The present number of the Summary, which opens its sixth year, deals with 84 epicentres, 23 of which are new, and 61 repetitions from old epicentres. The five years already published deal with 595 new epicentres and 930 old, the mean ratio of new to old being thus 0·64; for the present bulletin the ratio is 0·38. It is naturally expected that this ratio will decrease as the number of established epicentres increases, but so far the change has been slower than might have been expected.

There is only one case of assumed abnormal focal depth :—

Date	Epicentre	Depth below normal
Feb. 19d. 6h.	5°·0S. 135°·0E.	0·060

In the five years 1918-1922 there were 73 cases of abnormal focal depth, an average of 14·6 per year or 3·65 per three months.

The earthquake of Jan. 14d. 5h. (at 37°·0N. 138°·5E.) has a tragic interest as being that which led the late Prof. Omori to predict a tranquil time for Tokyo in the future, a prediction which was so rudely falsified before the end of the year. See the note on p. 8.

The earthquake of January 22d. 9h. in California provides a good illustration of the great mass of information which may be available for discussion: and is therefore made the subject of a careful discussion not only of the epicentre but of the phases L and M.

In March there are several occasions when it is found well nigh impossible to reconcile the different observations. Those who find puzzles agreeable may like to try their hand at the earthquake of March 4d. 0h. for instance: or even of March 6d. 21h. or March 13d. 19h. But March 4d. 0h. is perhaps the worst case we have yet encountered, and much time has been spent on it without great success. Effective suggestions for amelioration would be welcome.

There are other notes on Feb. 2, Feb. 12, Feb. 13, Feb. 22, Feb. 24, and Mar. 3.

In the last number of the Summary attention was called to the Gutenberg wave S_cP_cS, which traverses a suggested liquid core of the earth as a longitudinal wave (P), but is a distortional wave (S) both before entering the core and after leaving it. The designation S_cP_cS, though explanatory, is a little elaborate, and inquiry was made of Prof. Gutenberg whether he would approve the use of the alternative [S] for the purposes of this bulletin, and he has given a ready assent. Comparison with the assumed table for this wave can then readily be given in the column O—C which follows the S column in the manner adopted for [P], with which [S] has something in common. The following assumed times for [S] are calculated from the formula

$$S-(\Delta-80°)\times 4{\cdot}6 \text{ sec.}$$

adjusting the seconds here and there so as to make the differences run smoothly.

TABLE FOR GUTENBERG'S S_cP_cS OR [S].

Δ	[S]	Δ	[S]	Δ	[S]
°	m. s.	°	m. s.	°	m. s.
70	21 12	86	23 3	102	24 34
71	19	87	9	103	38
72	27	88	15	104	43
73	34	89	22	105	48
74	42	90	28	106	52
75	49	91	34	107	57
76	56	92	40	108	25 1
77	22 3	93	46	109	6
78	10	94	52	110	10
79	17	95	57	111	14
80	23	96	24 3	112	18
81	30	97	8	113	22
82	37	98	13	114	26
83	43	99	19	115	29
84	50	100	24	116	32
85	56	101	29	117	36

Near $\Delta=80°$ there is considerable difficulty in distinguishing S and [S]. We may take as an example Jan. 23d. 22h. revised solution. The residuals for S and [S] are as follows :—

	Δ	S	[S]		Δ	S	[S]
	°	s.	s.		°	s.	s.
Edinburgh ...	72·3	+ 3	−32	Zurich ...	83·5	+21	+37
Eskdalemuir ...	72·7	+ 4	−30	Toledo ...	83·7	− 3	+14
Stonyhurst ...	74·1	+ 7	−20	Innsbruck ...	84·6	− 6	+15
West Bromwich	75·3	−30	−52	Moncalieri ...	85·1	−13	+10
Oxford ...	76·1	+ 5	−13	San Fernando	85·1	+ 2	+25
Kew ...	76·7	+ 7	− 8	Tortosa ...	85·3	−30	− 6
La Paz ...	76·9	+ 5	− 9	Vienna ...	85·5	+ 6	+31
De Bilt ...	78·4	+ 4	− 3	Barcelona ...	85·5	−59	−34
Hamburg ...	78·9	+25	+20	Granada ...	85·9	+ 5	+32
Uccle ...	79·1	+ 2	− 2	Algiers ...	89·7	−13	+32
Paris ...	79·9	+16	+16	Rocca di Papa	89·9	−21	+35
Coimbra ...	81·2	− 2	+ 4	Belgrade ...	90·0	−20	+26
Strasbourg ...	82·2	0	+10	Pilar ...	90·9	−70	−20
Besançon ...	82·6	0	+12	Athens ...	97·1	−71	+ 8

It seems clear that the first four are observations of S, and the last two of [S]; but it is not easy to be sure about any of the others. Beyond $\Delta=90°$, however, the observations are generally of [S], though not always. Take again the case of Feb. 23d. 5h., omitting irrelevant observations :—

	Δ	Obs.	S	[S]		Δ	Obs.	S	[S]
	°	m. s.	s.	s.		°	m. s.	s.	s.
Konigsberg	96·8	24 2	− 82	− 4	Uccle	107·5	26 27	− 39	+ 88
Vienna	100·8	24 29	− 94	+ 1	Eskdalemuir	109·5	26 41	− 43	+ 93
Innsbruck	104·1	24 44	−110	0	Chicago	130·1	27 50	−132	+ 98
Victoria	105·8	24 44	−126	− 7	Ann Arbor	131·6	28 28	−103	+134
De Bilt N.	106·6	26 18	− 39	+83	Ottawa	131·8	28 18	−114	+124
Moncalieri	107·2	25 30	− 93	+32	Washington	137·2	28 52	−114	+149

Here the first four observations and probably Moncalieri record [S], while De Bilt, Uccle, and Eskdalemuir seen to record S, the tables for which require a negative correction after $\Delta=85°$. But the four American observatories seen to record something else, which is neither S nor [S]. It seems that [S] dies out when Δ exceeds 110° or thereabouts.

On March 2d. 16h. half a dozen observations of [S] from $\Delta=90°$ to 107° give residuals +13s., +14s., +20s., +13s., +22s., +13s., the mean being +16s. It will be seen that the two values of [P] for Andalgala and La Paz are also positive, and the hypothesis of a high focus might suit the case. Such points must be studied in future.

On March 16d. 22h. and 24d. 12h. there are a number of observations of [S], at present shown only by their large S residuals. In future numbers of the Summary the residuals from the [S] will be given.

At the end of the number a table of 2 versin Δ is reprinted for the convenience of those who wish to find Δ by the formula

$$2 \text{ versin } \Delta=(A-a)^2+(B-b)^2+(C-c)^2.$$

H. H. TURNER.

University Observatory, Oxford,
1926 Aug. 8.

1923 JANUARY, FEBRUARY, & MARCH.

Jan. 1d. Readings at 1h., 2h., and 3h. (Nagasaki), 4h. (Batavia), 7h. (Nagasaki), 8h. (Manila and Nagasaki), 11h., 12h., and 16h. (Nagasaki), 17h. (Nagasaki and Ekaterinburg), 19h. (Ekaterinburg and Nagasaki (2)), 20h. (Nagasaki and near Mizusawa), 22h. (La Paz).

Jan. 2d. 22h. 42m. 0s. Epicentre 25°·0N. 121°·5E. (as on 1922 Oct. 14d.).

A = −·472, B = +·773, C = +·423 ; D = +·853, E = +·522 ;
G = −·221, H = +·360, K = −·906.

		Δ	Az.	P.	P−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Taihoku		0·1	22	0 4	+ 2	—	—	0·4	0·4
Hokoto		2·6	231	0 22	−19	—	—	0·9	—
Zi-ka-wei		6·2	359	e 1 29	− 6	e 2 58	+ 9	—	4·1
Hong Kong		7·1	249	3 50	?L	—	—	(3·8)	5·2
Manila		10·4	183	—	—	—	—	e 6·0	—
Nagasaki		10·7	42	3 36	+56	—	—	—	—
Ekaterinburg		53·4	324	10 19	+50	18 31	+90	29·0	42·2
De Bilt		85·0	327	—	—	—	—	e 47·0	—
Uccle		86·1	326	—	—	—	—	e 45·0	—
Victoria		86·6	37	10 3	−174	—	—	11·5	14·4
Berkeley		93·3	45	e 14 22	+48	—	—	—	—
Tortosa	N.	94·3	321	—	—	—	—	e 47·0	54·3
Coimbra		99·8	325	e 22 0	?	31 40	?	38·0	—
Ottawa		107·9	13	e 16 42	+114	—	—	35·0	—
Chicago		108·0	22	15 50	+62	19 40	?PR_1	24·5	—
Toronto		108·7	15	—	—	—	—	i 33·9	35·8
Ann Arbor		108·8	20	e 18 0	?PR_1	—	—	—	—
Cipolletti		163·9	152	65 30	?	—	—	67·9	71·6
La Paz		167·7	49	e 32 43	?S	—	—	72·6	73·2
Pilar		171·9	146	67 0	?	—	—	69·7	70·0

Additional readings: Zi-ka-wei gives also MN = +3·7m. Ekaterinburg SR_1 = +21m.29s., SR_2 = +23m.25s. Victoria MN = +13·2m. Berkeley eP = +6m.8s., e = +16m.8s.?, iZ = +18m.17s. Ottawa eL = +27·5m. Toronto eL = +31·9m. La Paz P = +68m.31s. Pilar LN = +69·8m.

Jan. 2d. Readings also at 0h. (Konigsberg and Ekaterinburg), 2h., 6h., and 7h. (2) (Nagasaki), 8h. (La Paz and Nagasaki), 9h. (2), 16h., 18h. (2), 19h., 21h., and 22h. (2) (Nagasaki), 23h. (Honolulu, La Plata, and near Taihoku).

Jan. 3d. 9h. 41m. 28s. Epicentre 30°·0S. 70°·0W.

A = +·296, B = −·814, C = −·500 ; D = −·940, E = −·342 ;
G = −·171, H = +·470, K = −·866.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Pilar		5·5	109	1 8	−17	—	—	2·9	3·2
Cipolletti		9·1	170	2 30	+12	—	—	3·9	4·4
Chacarita	E.	10·8	118	7 2	?L	—	—	7·5	7·9
	N.	10·8	118	6 50	?L	—	—	7·4	7·6
La Plata	E.	11·3	118	2 45	− 4	4 46	−16	5·6	6·9
	N.	11·3	118	2 57	+ 8	4 57	− 5	5·8	6·4
La Paz		13·6	8	3 24	+ 3	5 55	− 3	7·6	9·8

Additional readings and notes: Pilar gives also LN = +2·8m., MN = +3·4m. Cipolletti readings have been diminished by 3m.

Jan. 3d. Readings at 1h. (La Paz and Nagasaki), 2h. (Nagasaki and Ekaterinburg), 4h., 5h., 7h. (3), and 8h. (Nagasaki), 9h. (near Taihoku), 10h. (La Paz and Nagasaki), 13h., 16h., 17h., and 19h. (Nagasaki), 20h. (Batavia), 21h. and 22h. (Nagasaki), 23h. (Toledo and Upsala).

Jan. 4d. Readings at 1h. (2), 3h., and 7h. (Nagasaki), 8h. (Ekaterinburg, De Bilt, Uccle, and Zi-ka-wei), 12h. (Christchurch), 15h. (La Paz), 16h. (Ekaterinburg), 17h. (La Paz), 18h. (Batavia and Malabar), 20h. and 23h. (Nagasaki).

Jan. 5d. 17h. 50m. 45s. Epicentre 7°·0S. 150°·0E. (as on 1920 Feb. 9d.).

A = −·860, B = +·496, C = −·122 ; D = +·500, E = +·866 ;
G = +·106, H = −·061, K = −·992.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview		26·8	178	e 5 58	+ 2	e 10 36	− 1	e 12·2	17·0
Sydney		26·8	178	8 21	?	—	—	14·4	17·0
Adelaide		29·9	199	—	—	e 11 5	−17	i 15·2	21·0
Melbourne		31·1	186	—	—	e 11 45	− 8	—	19·8
Manila		36·0	309	e 7 35	+13	—	—	—	—
Batavia		42·9	270	e 8 6	−11	—	—	—	—
Hong Kong		45·8	311	9 39	+60	(16 33)	+68	16·6	—
Zi-ka-wei		47·0	326	e 8 47	0	e 15 43	+ 2	—	24·5
Victoria	E.	94·0	41	—	—	—	—	42·6	45·9
La Paz		135·5	123	19 39	[+ 8]	—	—	—	—

Additional readings: Riverview gives also PS = +11m.0s., MN = +15·3m., MZ = +17·9m. Adelaide ePR$_1$ = +4m.39s., eS = +9m.45s., e = +13m.45s. Victoria LN = +38·2m., MN = +40·1m.

Jan. 5d. Readings also at 2h. (Nagasaki), 3h. (near Taihoku and near Victoria), 5h. (Nagasaki), 6h. (Nagasaki and near Mizusawa), 8h. (Ekaterinburg and Nagasaki), 9h., 11h., 14h. (2), 15h., and 16h. (Nagasaki), 18h. (Zi-ka-wei and near Taihoku), 19h. (Nagasaki), 22h. (Ekaterinburg), 23h. (Ekaterinburg and near Malabar).

Jan. 6d. Readings at 1h. (2), 2h. (2), and 6h. (Nagasaki), 7h. (Taihoku), 8h. (Batavia, Malabar, Nagasaki (2), and Manila), 10h. (Ekaterinburg), 11h. (Adelaide), 13h., 14h., 15h., 16h., 18h. (2), 19h., 21h., and 23h. (Nagasaki).

Jan. 7d. 12h. 27m. 15s. (I) } Epicentre 41°·0N. 23°·0E. (as on 1922 Sept. 5d.).
13h. 20m. 6s. (II) }

A = +·695, B = +·295, C = +·656 ; D = +·391, E = −·920 ;
G = +·604, H = +·256, K = −·755.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I	Athens	3·1	170	e 0 57	+ 8	—	—	1·6	2·9
I	Belgrade	4·3	335	i 0 52	−15	1 47	−11	—	2·1
II		4·3	335	e 1 4	− 3	e 2 3	+ 5	—	2·7
I	Mostar	4·5	327	i 0 24	−46	i 1 22	−42	—	1·5
I	Pompeii	6·4	271	e 2 27	+49	e 2 52	− 3	—	—
II		6·4	271	e 3 41	?L	—	—	(e 3·7)	—
I	Rocca di Papa	7·8	279	e 2 3	+ 5	3 18	−13	—	3·8
II		7·8	279	e 1 30	−28	—	—	4·3	5·2
I	Vienna	Z. 8·6	329	e 0 49	−81	i 3 50	− 3	i 4·6	—
II		Z. 8·6	329	4 39	?L	—	—	(4·6)	—
I	Venice	8·9	307	3 1	+46	—	—	—	5·2
I	Florence	9·1	292	2 0	−18	—	—	—	5·2
II	Innsbruck	10·4	311	—	—	e 4 18	−22	—	—
I	Zurich	12·1	307	e 2 35	−25	—	—	—	6·1
I	Strasbourg	13·1	310	—	—	—	—	e 6·0	—
I	De Bilt	16·5	318	—	—	—	—	e 8·8	—
I	Toledo	20·5	275	—	—	—	—	12·8	17·8

Additional readings to shock I: Athens gives also MN = +2·0m., Belgrade iP = +1m.15s. Mostar iP = +0m.58s. Vienna eZ = +1m.38s.

Jan. 7d. Readings also at 3h. (Nagasaki), 7h. (Nagasaki and near Batavia and Malabar), 8h. (near Athens), 9h. (La Paz), 10h., 12h., 15h., 16h., and 23h. (2) (Nagasaki).

Jan. 8d. Readings at 1h. (Riverview), 2h. (2), 3h., and 4h. (2) (Nagasaki), 5h. (Nagasaki and near Zurich and Neuchâtel), 6h. (Nagasaki, Batavia, and Malabar), 8h. (Nagasaki (3)), 10h. (Paris and Nagasaki), 11h. and 12h. (2) (Nagasaki), 13h. (Taihoku, Mostar, and Belgrade (5)), 20h. (La Paz and Taihoku), 22h. (Zi-ka-wei, Victoria, Honolulu, Chicago, Toronto, Ottawa, De Bilt, and Uccle.).

Jan. 9d. Readings at 1h. and 2h. (Nagasaki), 3h. (La Paz), 6h. (Nagasaki), 9h. (Zi-ka-wei, 10h. and 12h. (Nagasaki), 13h. (Nagasaki, Zi-ka-wei, La Paz, Manila, near Mizusawa, and near Taihoku), 14h. (Nagasaki), 15h. (Nagasaki and near La Paz), 20h. (2) and 21h. (2) (Nagasaki), 22h. (near Mizusawa), 23h. (Nagasaki (2) and near Manila).

Jan. 10d. Readings at 0h., 1h. (2), 2h., 4h. (4), 7h., and 9h. (Nagasaki), 11h. (near La Paz), 12h., 13h. (2), 14h., 15h., 16h., and 17h. (Nagasaki), 21h. (Stonyhurst and Nagasaki), 22h. (Nagasaki).

Jan. 11d. 4h. 29m. 0s. Epicentre 41°·8N. 122°·0W.

A = −·395, B = −·632, C = +·667 ; D = −·848, E = +·530 ;
G = −·353, H = −·565, K = −·745.

The epicentre of 1920 Mar. 20d. 17h., viz., 40°·5N. 122°·0W., is definitely too far from Berkeley and Lick).

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Berkeley	E.	3·9	183	e 1 5	+ 4	i 1 59	+12	i 2·7	3·0
	Z.	3·9	183	e 1 0	− 1	2 1	+14	—	3·5
Lick		4·5	176	1 8	− 2	1 47	−17	2·2	—
Victoria	E.	6·6	352	2 7	+26	—	—	3·0	4·0
	N.	6·6	352	1 40	− 1	—	—	3·0	4·1
Tucson		13·0	134	—	—	e 6 18	+34	6·7	6·7
Chicago		25·5	78	9 15	?S	(9 15)	−58	14·6	—
Ottawa	E.	33·2	68	—	—	—	—	e 17·0	19·8
Washington		34·0	80	—	—	—	—	e 16·8	—
Georgetown	N.	34·0	80	(6 44)	−21	—	—	6·7	—

Additional readings : Berkeley gives also iN = +1m.45s., iE = +2m.28s., iLN = +3·2m. Lick readings are given as for 3h. Chicago S = +12m.47s.? Ottawa eLE = +18·5m.

Jan. 11d. 12h. 24m. 30s. Epicentre 31°·5N. 130°·0E. (as on 1922 Dec. 8d.).

A = −·548, B = +·653, C = +·522 ; D = +·766, E = +·643 ;
G = −·336, H = +·400, K = −·853.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Nagasaki	1·3	356	0 17	− 3	—	—	0·7	—
Kobe	5·3	52	1 20	− 2	(2 21)	− 4	2·4	3·7
Osaka	5·6	53	1 29	+ 2	(2 24)	−10	2·4	4·0
Zi-ka-wei	7·3	270	e 2 12	+21	—	—	—	6·2
De Bilt	83·5	330	—	—	—	—	e 45·5	—

Additional readings : Kobe gives also MN = +3·9m. Osaka MN = +4·6m.

Jan. 11d. Readings also at 1h. (2), 2h. (2), 5h. (3), and 6h. (2) (Nagasaki), 7h. (near Malabar and Batavia), 8h. (Nagasaki), 11h. (Zi-ka-wei), 15h. (Osaka and Nagasaki (2)), 16h. (Zi-ka-wei and Nagasaki), 18h. (Nagasaki), 19h. (Kingston), 23h. (Nagasaki (3)).

Jan. 12d. 1h. 54m. 28s. Epicentre 30°·0S. 70°·0W. (as on Jan. 3d.).

$A = +\cdot296$, $B = -\cdot814$, $C = -\cdot500$; $D = -\cdot940$, $E = -\cdot342$; $G = -\cdot171$, $H = +\cdot470$, $K = -\cdot866$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	E.	4·0	55	1 2	0	—	—	2·0	2·9
Pilar		5·5	109	1 56	+31	—	—	3·1	4·7
Cipolletti		9·1	170	2 20	+ 2	—	—	2·7	5·5
Chacarita	E.	10·8	118	4 38	?S	(4 38)	−12	7·5	9·2
	N.	10·8	118	5 32	?S	(5 32)	+42	7·4	9·2
La Plata	E.	11·3	118	i 3 10	+21	5 30	+28	6·4	7·2
	N.	11·3	118	i 3 20	+31	5 39	+37	6·7	7·6
La Paz		13·6	8	e 3 21	0	5 58	0	7·7	8·4
Rio de Janeiro		25·0	80	e 5 38	0	10 2	− 1	13·5	16·6
Coimbra		90·6	42	e 14 22	+63	25 22	+62	47·5	—
Victoria	E.	91·8	329	—	—	—	—	46·1	51·1
	N.	91·8	329	—	—	—	—	47·0	48·9
Oxford		101·4	37	—	—	—	—	54·9	60·5
Kew		101·8	37	—	—	—	—	—	66·5
Stonyhurst		102·1	35	e 49 32	?L	—	—	(e 49·5)	60·5
Eskdalemuir		102·5	32	—	—	—	—	44·5	—
Edinburgh		102·9	32	—	—	—	—	—	62·5
Uccle		103·9	40	—	—	—	—	e 55·5	—
De Bilt		104·9	40	—	—	—	—	e 55·5	56·7
Zi-ka-wei		170·1	280	e 20 15	[0]	—	—	—	80·0

Additional readings and notes: Andalgala readings have been increased by 7m. Pilar gives also MN = +4·6m. Cipolletti readings have been increased by 4m. Coimbra LN = +46·5m. De Bilt MN = +61·3m., MZ = +64·6m.

Jan. 12d. Readings also at 0h., 1h. (2), 2h., 3h., and 5h. (Nagasaki), 6h. (Batavia and Nagasaki (2)), 9d. and 10h. (Nagasaki), 13h. (Ekaterinburg and Nagasaki), 15h. (Nagasaki and Kobe), 16h. (Nagasaki and near Granada), 17h. (Nagasaki), 19h. (Ottawa, De Bilt, Zi-ka-wei, Ekateinburg, and Nagasaki), 20h. (Nagasaki), 21h. (Ottawa), 22h. and 23h. (2) (Nagasaki).

Jan. 13d. 9h. 39m. 50s. Epicentre 69°·0S. 10°·0E

$A = +\cdot353$, $B = +\cdot062$, $C = -\cdot934$; $D = +\cdot174$, $E = -\cdot985$; $G = -\cdot920$, $H = -\cdot162$, $K = -\cdot358$

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
La Paz		70·4	274	11 19	0	e 20 29	− 2	35·3	40·8
Riverview		73·3	147	e 21 7	?S	(e 21 7)	+ 1	e 33·0	33·8
Colombo		89·4	69	31 10	?L	—	—	(31·2)	40·2
Helwan		100·1	19	e 21 55	?	—	—	—	46·3
Toledo		109·3	348	—	—	—	—	47·2	62·2
Coimbra	N.	110·0	345	—	—	—	—	e 47·2	—
Moncalieri		114·7	358	—	—	e 33 31	?SR_1	51·1	—
Uccle		119·9	355	—	—	e 27 46	−62	e 48·2	—
Kew		120·7	351	—	—	—	—	—	58·2
De Bilt		121·1	357	—	—	e 26 10	−168	e 50·2	51·2
Eskdalemuir		124·7	350	—	—	—	—	51·2	59·2
Zi-ka-wei	Z.	126·5	97	—	—	—	—	e 55·2	62·7
Ekaterinburg		131·1	34	—	—	—	—	54·2	—
Victoria		149·4	250	—	—	—	—	82·6	98·6

Additional readings: Riverview gives also MN = +38·8m. Uccle e = +32m.28s. De Bilt e = +32m.52s., MN = +51·0m., MZ = +71·0m. Eskdalemuir MN = +58·2m.

Jan. 13d. Readings also at 5h. (Port au Prince), 6h. (Nagasaki), 7h. (La Paz), 9h. (Oxford), 10h. (near Nagasaki), 13h. (Simla), 15h. (near Manila), 16h. (La Paz), 19h., 22h. (3), and 23h. (Nagasaki).

Jan. 14d. 5h. 51m. 35s. Epicentre 37°·0N. 138°·5E. (as on 1922 June 7d.).

A = −·599, B = +·529, C = +·602 ; D = +·663, E = +·749 ; G = −·451, H = +·399, K = −·799.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Nagoya	2·2	214	0 35	+ 1	—	—	—	0·9
Mizusawa	2·9	44	0 47	+ 2	1 24	+ 4	—	—
Osaka	3·5	227	1 15	+20	—	—	2·3	3·1
Kobe	3·6	230	0 59	+ 3	1 22	−17	1·8	2·8
Hakodate	5·1	19	1 39	+20	—	—	2·6	3·5
Sapporo	6·4	20	2 9	+31	—	—	2·9	—
Nagasaki	8·3	242	2 5	− 1	—	—	7·3	—
Zi-ka-wei	15·3	253	i 3 42	− 1	e 6 40	+ 1	—	11·2
Manila	27·3	219	e 7 25	+84	—	—	—	—
De Bilt	82·1	331	—	—	—	e 43·4	—	—
La Paz	148·8	55	19 44	[−10]	—	—	—	—

Additional readings: Nagoya P = 5h.51m.0s. Tokyo (Δ = 1°·6) gives P = 5h.51m.44s. Epicentre 36°4′N. 140°3′E. Mizusawa PN = +46s. Osaka MN = +2·4m. Kobe MN = +2·5m.

This earthquake was the subject of a careful note by the late Prof. Omori, "Tokyo observation of the strong earthquake on Jan. 14, 1923" (Seismol. Notes No. 4: Imp. Earthq. Invest. Ctee.). He compares it with the severe earthquakes of 1855, 1894 June 20, and 1922 April 26, which were each successively the strongest since the preceding, and adventured the forecast—

> (4) Tokyo may be assumed to be free in future from the visitation of a violent earthquake like that of 1855, as the latter shock originated right under the City itself, and as destructive earthquakes do not repeat from one and the same origin, at least not in the course of 1000 or 1500 years.

The terrible falsification of this hopeful prediction before the year 1923 was out is matter of history.

But Omori's investigation is further remarkable for the discrepancy between the position of the epicentre to which he was led by a careful study of the macroseismic information, viz.,

36°4′N. 140°3′E.

and that assigned above from the study of seismograms. It is not easy to see how the two can be reconciled. Omori's information is copious and appears convincing, and yet his epicentre does not suit the above records, especially that of Zi-ka-wei. A solution was originally made with an epicentre within half a degree of Omori's, and may be given for comparison.

Jan. 14d. 5h. 51m. 35s. Epicentre 36°·5N. 140°·5E. (as on 1922 Sept. 23d., and near Omori's).

A = −·620, B = +·511, C = +·595 ; D = +·636, E = +·772 ; G = −·459, H = +·378, K = −·804.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa E.	2·6	10	0 47	+ 6	1 24	+12	—	—
Nagoya	3·2	245	0 35	−15	—	—	—	1·0
Osaka	4·5	248	1 15	+ 5	—	—	2·3	3·1
Kobe	4·7	249	0 59	−14	1 22	−47	1·9	2·8
Hakodate	5·3	2	1 39	+17	—	—	2·6	3·5
Sapporo	6·5	6	2 9	+30	—	—	2·9	—
Nagasaki	9·6	250	2 5	−19	—	—	7·3	—
Zi-ka-wei	16·7	257	i 3 42	−19	e 6 40	−31	—	11·2
Manila	28·0	224	e 7 25	+77	—	—	—	—
De Bilt	83·2	334	—	—	—	—	e 43·4	—
La Paz	147·7	59	19 44	[− 8]	—	—	—	—

It remains to inquire how far the epicentre adopted above suits the information utilised by Omori. He quotes in support of his solution the following stations:—

1923 Jan. 14d. 5h. 51m. 35s.

	N. Lat.	E. Long.	P−T$_e$	Δ Omori	Δ I.S.S.
	°	°	s.	°	°
Tokyo	35·7	139·8	+ 9	0·5	1·6
Tsukuba	36·1	140·1	+ 6	0·0	1·5
Mito	36·4	140·5	+ 9	0·4	1·7
Choshi	35·7	140·9	+10	0·8	2·3
Kmagai	36·2	139·4	+ 9	0·6	3·3
Nagano	36·7	138·2	+21	1·4	0·4

There is no doubt that Omori's epicentre suits this local information very well, and much better than that of the present summary. The sequence of Omori's Δ is the same as that of P−T$_e$, while with the I.S.S. epicentre the largest P−T$_e$ has the smallest Δ. It is a question, however, how far these exact seconds are to be trusted.

Jan. 14d. Readings also at 1h., 3h., 4h. (3), and 7h. (Nagasaki), 10h. (La Paz), 11h. (Nagasaki), 12h. (Nagasaki and Honolulu), 13h. (Ottawa and Victoria), 19h. (Riverview), 20h. (Batavia).

Jan. 15d. Readings at 0h. (Nagasaki), 3h. (La Paz), 4h. (Nagasaki and near Algiers), 5h. (Nagasaki and Colombo), 6h. (Mizusawa), 9h. (Nagasaki and Colombo), 10h. (La Paz), 14h. (Nagasaki), 19h. (Batavia), 21h. (near Nagasaki).

Jan. 16d. Readings at 0h., 1h., and 7h. (Nagasaki), 8h. (Mizusawa and Nagasaki), 12h. (La Paz), 14h. (Algiers), 16h. (near Rocca di Papa), 17h., 19h., 22h. (2), and 23h. (2) (Nagasaki).

Jan. 17d. Readings at 1h. (Nagasaki (2)), 4h. (Nagasaki and Taihoku), 7h. (Nagasaki), 8h. (La Paz (2)), 9h., 11h. (3), and 14h. (Nagasaki), 15h. (La Paz and Rio de Janeiro), 16h., 17h., 20h. (2), and 23h. (Nagasaki).

Jan. 18d. Readings at 4h. (Malabar and near Batavia), 6h., 13h., 15h., 17h., and 22h. (Nagasaki).

Jan. 19d. Readings at 2h., 5h. (3), and 10h. (Nagasaki), 11h. (Nagasaki, Hong Kong, and near Manila), 17h. (Nagasaki (2)), 18h. (Nagasaki and Colombo), 20h. (Nagasaki (2)).

Jan. 20d. 21h. 36m. 27s. Epicentre 30°·0S. 70°·0W. (as on Jan. 12d.).

A = +·296, B = −·814, C = −·500 ; D = −·940, E = −·342 ;
G = −·171, H = +·470, K = −·866.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Andalgala	N.	4·0	55	1 15	+13	—	—	3·0	3·2
Pilar	E.	5·5	109	2 21	+56	—	—	4·0	5·2
	N.	5·5	109	2 15	+50	—	—	4·0	5·0
Chacarita	E.	10·8	118	4 57	?S	(4 57)	+ 7	7·8	9·8
	N.	10·8	118	5 9	?S	(5 9)	+19	8·0	9·0
La Paz		13·6	8	i 3 20	− 1	i 5 56	− 2	7·6	9·7
Rio de Janeiro		25·0	80	e 5 39	+ 1	(10 3)	0	10·0	14·3
Ottawa		75·6	356	—	—	i 21 14	−19	39·6	—
Victoria		91·8	329	25 28	?S	(25 28)	+55	46·0	49·0

Andalgala readings have been increased by 9m. Ottawa gives also eLE = +31·6m.

Jan. 20d. Readings also at 0h. (Colombo), 1h. (Taihoku and La Paz), 2h. (near Algiers), 10h., 12h., and 13h. (Nagasaki), 16h. (Nagasaki and Mostar), 19h. (La Paz and Nagasaki), 20h. and 21h. (2) (Nagasaki).

Jan. 21d. 4h. 13m. 30s. Epicentre 37°·0N. 20°·5E. (as on 1922 Nov. 4d.).

$A = +·748$, $B = +·280$, $C = +·602$; $D = +·350$, $E = -·937$; $G = +·564$, $H = +·211$, $K = -·799$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Zante		1·6	294	1 30	+66	—	—	—	—
Athens		2·8	69	0 43	− 1	1 20	+ 3	i 1·5	2·0
Pompeii		5·9	311	e 1 58	+27	e 2 58	+17	—	3·5
Mostar		6·6	343	i 2 16	+35	—	—	(4·2)	5·0
Sarajevo		7·0	348	e 1 45	− 1	—	—	(4·1)	4·2
Rocca di Papa		7·6	311	e 2 54	+59	e 4 16	+50	—	5·6
Belgrade		7·8	0	e 2 4	+ 6	i 3 37	+ 6	—	4·8
Florence		9·8	317	3 0	+33	—	—	—	8·0
Venice		10·4	327	1 30	−66	—	—	—	3·0
Helwan		11·5	125	e 2 56	+ 4	4 50	−17	—	11·4
Vienna		11·6	346	e 2 58	+ 5	5 10	+ 1	i 6·6	8·2
Innsbruck	N.E.	12·3	330	i 3 23	+20	i 5 49	+23	—	—
Moncalieri		12·4	314	i 2 54	−11	6 35	+66	8·8	10·5
Algiers		13·9	275	e 3 23	− 2	—	—	—	20·0
Besançon		14·8	318	6 13	?S	(6 13)	−14	—	22·5
Strasbourg		14·9	326	3 0	−38	e 6 30	0	e 8·5	9·2
Paris		17·6	318	e 6 16	+124	—	—	e 9·7	—
Uccle		18·0	325	e 4 17	0	7 31	− 9	9·5	—
Hamburg		18·1	340	e 4 19	+ 1	—	—	—	13·9
De Bilt		18·5	330	—	—	i 7 51	0	10·3	11·8
Tiflis		19·2	68	—	—	e 8 0	− 6	14·6	—
Granada		19·2	278	i 4 32	+ 1	9 23	+77	e 13·3	17·8
Toledo		19·4	286	4 32	− 2	8 7	− 3	e 10·9	16·8
Kew		20·6	321	—	—	—	—	—	12·5
Coimbra		22·8	287	4 57	−18	i 9 5	−16	14·0	—
Eskdalemuir		24·3	326	—	—	i 9 36	−14	13·3	—
Ottawa		68·5	311	—	—	i 20 7	− 1	e 41·5	—

Additional readings and notes: Athens iP = +55s., MN = +1·7m., T_o = 4h.13m.20s. Mostar iP = +2m.50s., MN = +4·6m., L given as SR_1. Sarajevo eP = +2m.51s., L given as SR_1. Belgrade eP = +3m.20s., MN = +5·1m. Moncalieri MN = +9·4m. Strasbourg MN = +9·0m. De Bilt MN = +12·8m., MZ = +14·0m. Epicentre 27°·1N. 20·6E. Tiflis e = +11m.24s., all readings diminished by 9m. Granada i = +5m.35s. Coimbra eP? = +3m.5s., T_o = 4h.9m.1s. Ottawa LE = +45·5m. Toledo MNW = +16·2m.

Jan. 21d. 13h. 37m. 42s. Epicentre 20°·0S. 176°·5E. (as on 1920 Mar. 15d.).

$A = -·938$, $B = +·057$, $C = -·342$; $D = +·061$, $E = +·998$; $G = +·341$, $H = -·021$, $K = -·940$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview		26·4	233	e 6 16	+24	i 10 30	0	e 13·0	13·6
Sydney		26·4	233	5 48	− 4	10 36	+ 6	13·6	15·3
Melbourne		32·6	230	6 54	+ 1	12 6	−12	16·1	19·0
Adelaide		36·6	239	—	—	i 13 0	−18	e 18·8	22·8
Zi-ka-wei	Z.	73·6	315	e 11 16	−24	—	—	—	—
Ottawa		116·4	48	—	—	e 29 48	+87	e 54·3	—
De Bilt		147·2	349	—	—	—	—	e 73·3	—

Additional readings: Riverview gives also PS = +10m.40s., MN = +14·8m. Melbourne PR_1 = +7m.54s. Ottawa eS = +32m.0s.

Jan 21d. Readings also at 0h. (Nagasaki), 2h. (Algiers), 7h. (Nagasaki), 9h. (La Paz), 12h. (Nagasaki), 14h. (Nagasaki and near Victoria), 17h. (La Paz), 18h. (Riverview), 20h. (Nagasaki (2)), 21h. (La Paz).

Jan. 22d. 0h. 54m. 45s. Epicentre 20°·0S. 176°·5E. (as on Jan. 21d.).

A = −·938, B = +·057, C = −·342 ; D = +·061, E = +·998 ;
G = +·341, H = −·021, K = −·940.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Christchurch		23·8	187	5 27	+ 1	9 33	− 7	13·2	14·8
Riverview		26·4	233	5 57	+ 5	e 10 39	+ 9	e 11·4	14·2
Sydney		26·4	233	5 45	− 7	11 3	+33	13·6	15·6
Melbourne		32·6	230	6 57	+ 4	12 27	+ 9	17·2	20·8
Adelaide		36·6	239	e 7 15	−12	i 13 15	− 3	e 18·2	22·6
Honolulu	E.	48·2	34	—	—	e 15 49	− 7	—	19·8
Perth		55·2	245	—	—	15 15	?	—	—
Manila		64·7	300	—	—	e 20 15	+54	—	—
Batavia		68·8	273	e 11 21	+11	i 20 44	+32	37·6	—
Zi-ka-wei		73·6	315	12 4	+24	—	—	—	39·7
Hong Kong		74·1	300	21 27	?S	(21 27)	+12	—	22·2
Victoria	E.	86·8	38	12 32	−26	22 52	−47	35·6	42·5
	N.	86·8	38	12 32	−26	22 46	−53	35·7	43·2
Kodaikanal		102·0	277	65 15	?L	—	—	(65·2)	—
Pilar		102·5	130	37 39	?SR_1	—	—	50·8	57·2
Andalgala		102·8	126	—	—	—	—	34·4	36·0
La Paz		106·8	117	13 26	−77	i 23 56	−183	45·2	50·5
Chicago		107·4	51	e 17 50	?	—	—	53·2	—
Ottawa		116·4	48	—	—	e 29 3	+42	59·2	—
Eskdalemuir		144·7	358	—	—	42 15	?SR_1	70·2	—
De Bilt		147·2	349	i 19 50	[− 1]	—	—	e 72·2	87·3
Vienna		147·5	335	19 37	[−15]	—	—	—	25·2
Oxford		148·2	357	—	—	i 42 51	?SR_1	—	—
Kew		148·4	358	—	—	—	—	—	43·2
Uccle		148·6	350	—	—	—	—	e 64·2	—
Innsbruck		150·1	340	e 19 27	[−29]	—	—	—	—
Paris		150·8	352	—	—	—	—	e 84·2	86·2

Additional readings and notes: Riverview gives also PR_1 = +6m.35s., PS = +10m.57s., MN = +12·7m., MZ = +15·0m. Melbourne PR_1 = +8m.3s., SR_1 = +15m.9s. Adelaide ePR_2 = +9m.15s. Batavia LN = +41·2m. Pilar PN = +37m.15s., MN = +54·0m. Andalgala MN = +37·2m. Ottawa e = +23m.15s., +25m.33s., and +27m.15s. De Bilt MN = +89·9m. Vienna iPZ = +19m.56s.

1923. Jan. 22d. 9h. 4m. 8s. Epicentre 41°·1N. 125°·5W.

(given by Berkeley : see revised solution which follows).

A = −·438, B = −·613, C = +·657 ; D = −·814, E = +·581 ;
G = −·382, H = −·535, K = −·754.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Berkeley		4·1	141	i 1 3	− 1	1 59	+ 6	—	—
Lick		4·8	139	1 12	− 2	2 10	− 1	—	—
	Z.	4·8	139	1 10	+ 4	2 9	− 2	—	3·0
Victoria		7·5	12	2 8	+14	—	—	3·6	6·7
Tucson	E.	14·7	122	i 3 30	− 5	6 12	−13	6·6	9·1
Denver		15·7	88	3 22	−26	6 22	−26	8·2	9·9
Sitka	E.	17·2	342	4 19	+12	i 7 54	+32	8·4	12·9
	N.	17·2	342	—	—	—	—	10·5	13·3
Chicago		28·2	76	5 56	−14	10 50	−13	13·9	—
Ann Arbor		30·9	74	6 28	− 9	11 34	−16	13·9	19·9
Mobile	E.	31·7	97	i 11 35	?S	(i 11 35)	−28	17·3	20·7
Toronto		33·7	70	7 34	+32	13 28	+52	19·2	23·6
Honolulu	E.	33·8	244	7 7	+ 4	12 42	+ 4	14·9	17·7
	N.	33·8	244	—	—	—	—	i 14·7	17·0
Ottawa		35·9	67	7 11	−10	12 51	−18	e 16·6	22·6
Ithaca		36·1	71	7 10	−13	i 12 49	−22	—	20·9
Washington		36·7	79	6 54	−34	12 39	−41	17·1	22·9
Georgetown	E.	36·7	79	i 7 19	− 9	i 13 4	−16	e 18·9	23·0
	N.	36·7	79	e 7 19	− 9	i 13 4	−16	e 18·6	20·5
Cheltenham	E.	36·9	79	7 16	−13	13 4	−18	19·8	23·5
	N.	36·9	79	—	—	—	—	18·5	20·9
Fordham	N.	38·4	73	7 32	− 9	13 27	−17	17·9	21·8
Northfield		38·4	68	7 26	−15	13 28	−16	18·5	22·9

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Port au Prince		50·4	100	e 9 10	+ 1	16 23	− 1	25·4	28·6
Porto Rico	E.	55·8	95	—	—	17 56	+25	26·0	30·0
	N.	55·8	95	9 45	0	17 34	+ 3	28·3	36·2
Bergen		70·9	24	—	—	—	—	e 29·9	41·1
Edinburgh		71·5	30	i 12 2	+35	20 57	+13	30·9	40·2
Eskdalemuir		71·9	30	i 11 34	+ 5	i 21 2	+13	31·9	38·4
Azores		72·5	56	22 22	?S	(22 22)	+86	43·9	49·7
Stonyhurst		73·3	31	e 11 52?	+14	21 22?	+16	37·4	39·9
Bidston		73·3	31	22 22	?S	(22 22)	+76	—	41·7
West Bromwich		74·0	32	11 54	+12	20 59	−15	—	—
Upsala		74·6	18	—	—	e 21 45	+24	e 32·9	44·4
Oxford		75·4	33	11 59	+ 8	21 43	+13	32·9	41·9
Kew		75·9	32	21 53	?S	(21 52)	+16	—	41·9
De Bilt		77·5	29	i 12 11	+ 7	22 9	+14	33·9	38·8
Hamburg		77·6	26	e 12 12	+ 7	e 22 36	+40	e 33·9	43·7
Uccle		78·2	30	12 15	+ 7	22 15	+13	32·9	37·6
La Paz		78·3	126	i 12 13	+ 4	i 12 53	−11	35·4	54·8
Paris		79·1	32	i 12 20	+ 6	i 22 38	+25	33·9	42·9
Konigsberg		79·8	20	—	—	—	—	e 35·2	46·9
Coimbra	N.	80·7	44	12 14	− 9	22 35	+ 4	33·7	41·4
	E.	80·7	44	—	—	—	—	35·4	43·4
Strasbourg		81·3	29	12 33	+ 6	e 22 48	+10	36·9	49·6
Puy de Dôme		81·8	34	—	—	—	—	34·9	—
Besançon		81·8	31	12 35?	+ 6	22 53?	+ 9	33·9	—
Zurich	N.	82·6	30	e 12 38	+ 4	e 23 24	+31	—	—
Toledo		83·3	41	12 43	+ 5	23 3	+ 3	e 39·8	45·2
Rio Tinto		83·4	44	12 52	+14	—	—	—	48·9
Innsbruck		83·7	28	i 12 45	+ 5	e 23 9	+ 3	e 36·9	46·4
Moncalieri		84·3	31	12 14	−30	23 7	− 4	36·3	47·6
Vienna		84·5	24	i 12 47	+ 2	23 31	+17	e 41·4	48·4
Tortosa	N.	84·6	39	e 12 52	+ 6	e 22 52	−23	e 39·9	53·4
San Fernando		84·7	45	12 58	+12	23 22?	+ 6	38·9	51·5
Marseilles		84·8	34	—	—	—	—	38·9	—
Barcelona		84·8	37	—	—	22 26	−51	38·8	43·9
Zi-ka-wei		84·9	309	e 12 54	+ 7	e 20 33	−165	—	60·1
Granada		85·4	42	12 55	+ 5	i 23 34	+11	e 40·4	44·6
Florence		86·7	30	11 47	−70	—	—	—	48·5
Andalgala	E.	87·8	131	13 40	+36	—	—	26·8	43·4
	N.	87·8	131	13 46	+42	—	—	26·9	46·9
Belgrade		88·9	22	e 12 39	−31	e 23 54	− 8	e 44·0	—
Rocca di Papa		89·0	29	i 13 46	+36	23 52	−11	e 43·4	56·9
Algiers		89·0	38	e 13 8?	− 2	23 58	− 5	41·9	46·9
Pompeii		90·5	29	—	—	25 20	+ 61	40·9	45·9
Pilar	E.	92·3	133	23 10	?S	(23 10)	−88	48·7	57·4
	N.	92·3	133	23 16	?S	(23 16)	−82	45·7	64·4
Athens		96·1	24	e 13 42	− 8	e 24 16	−61	e 39·9	49·3
Tiflis		96·8	7	—	—	e 27 16	+112	e 42·3	51·6
Manila		97·2	297	—	—	(e 24 52)	−36	e 24·9	—
Rio de Janeiro		99·4	114	e 24 37	?S	(e 24 37)	−73	44·1	54·4
Helwan		105·9	21	e 18 12	?PR_1	—	—	—	49·2
Riverview		107·0	239	e 23 44	?	e 34 12	?SR_1	e 49·4	50·6
Sydney		107·0	239	23 28	?	34 34	?SR_1	49·6	58·2
Accra		111·8	62	—	—	—	—	—	47·9
Melbourne		113·5	239	25 58	?S	(25 58)	−120	52·6	74·5
Colombo		126·7	328	55 52	?L	—	—	(55·9)	92·9
Capetown		150·8	88	—	—	—	—	—	81·5
Johannesburg		153·6	64	—	—	—	—	74·9	80·9

Additional readings and notes: Berkeley gives also PENZ = +1m.14s. and many other i's. Lick SN = +2m.8s. and many other P's. Victoria S or L = +3m.43s., LZ = +4·6m. Tucson LE = +7·6m. and +8·6m., LN = +7·5m., T_0 = 9h.4m.18s. Denver MN = +8·9m. Sitka LE = +12·0m. Ann Arbor PR_2 = +7m.22s., MN = +18·4m., T_0 = 9h.4m.12s. Mobile iPR_1E = +14m.11s., SE = +15m.49s., LE = +17·5m. Toronto i = +15m.52s., L = +20·2m., +36·4m., and eL = +60·1m. Honolulu PR_1 = +8m.20s., eE = +11m.32s., eN = +11m.27s., SR_1E = +14m.27s., T_0 = 9h.4m.12s. Ottawa PR_1 = +8m.22s., SR_1 = +15m.9s., T_0 = 9h.4m.10s. Washington MN = +20·9m. Georgetown SR_1N = +16m.45s. Cheltenham LE = +23·0m., LN = +20·3m., T_0 = 9h.4m.4s. Fordham PR_2N = +8m.59s., SE = +13m.28s., T_0 = 9h.4m.10s. Porto Rico PR_1E = +12m.59s., LE = +28·0m., LN = +32·6m. Eskdalemuir SR_1 = +25m.52s., SR_2 = +28m.52s. Stonyhurst L = +29m.52s. Azores S = +35m.34s.? Bidston S = +26m.58s. Upsala MN = +46·2m.

Continued on next page.

De Bilt $PR_1Z = +15m.14s.$, $MZ = +42{\cdot}5m.$, Hamburg $eL = +39{\cdot}9m.$, $MZ = +45{\cdot}3m.$, $MN = +46{\cdot}5m.$ Uccle $PR_1 = +15m.10s.$, $PR_2 = +17m.4s.$, $PR_3 = +18m.28s.$, $SR_1 = +26m.40s.$, $MN = +45{\cdot}1m.$ Paris $MN = +40{\cdot}9m.$ Strasbourg $MN = +53{\cdot}5m.$ Zurich $eSE = +23m.5s.$ Toledo $SR_1NE = +30m.43s.$, $SR_1NW = +30m.44s.$, $MNW = +45{\cdot}3m.$ Innsbruck $MNW = +45{\cdot}2m.$ Vienna $iZ = +13m.50s.$ San Fernando $MN = +45{\cdot}4m.$ Barcelona $MN = +44{\cdot}2m.$ Moncalieri $MN = +47{\cdot}7m.$ Granada $MN = +46{\cdot}5m.$ Belgrade $LE = +47{\cdot}4m.$, $LN = +49{\cdot}6m.$ Rocca di Papa $PR_1N = +18m.22s.$ Algiers $MN = +48{\cdot}9m.$ Athens $eE = +17m.40s.$, $MN = +58{\cdot}2m.$ Tiflis $MN = +55{\cdot}2m.$ Riverview $MN = +59{\cdot}1m.$ Sydney $L = +132{\cdot}8m.$, $M = +146{\cdot}2m.$ Accra reading given as 9h.2m.0s. Melbourne $PR_1 = +29m.28s.$, $M = +35m.40s.$, $SR_1 = +41m.40s.$ Colombo P has been increased by 4h.

The epicentre adopted above was given by Berkeley. There is so much material that a careful discussion is possible. Groups of observations in different azimuths were formed as follows, equating the correction to Δ shown by the observations to $x \sin Az. + y \sin Az.$

No. of Stations	Mean Azimuth	$\delta\Delta$	Sin Az.	Cos Az.	C	O−C
	°	°			°	°
8	25	+0·55 = +	·42x	+·91y	+1·02	−0·47
10	31	+1·20 = +	·52x	+·86y	+0·89	+0·31
8	41	+0·80 = +	·66x	+·75y	+0·63	+0·17
9	74	−1·43 = +	·96x	+·28y	−0·25	−1·18
4	95	−0·95 = +1	·00x	−·09y	−0·81	−0·14
4	132	−0·15 = +	·74x	−·67y	−1·46	+1·31
1	244	+0·4 = −	·90x	−·44y	−0·0	+0·4
1	309	+1·2 = −	·66x	+·75y	+1·5	−0·3
1	342	+1·2 = −	·31x	+·95y	+1·6	−0·4

The values $x = -0°{\cdot}68$ $y = +1°{\cdot}44$ were found from these equations and the corresponding values of the right hand sides are shown in the Column C. The large residual $-1°{\cdot}18$ is due to the stations in the Eastern States, and the $+1°{\cdot}31$ to Lick, Berkeley, and Tucson. The new epicentre indicated by the values $x = -0°{\cdot}68 y = +1°{\cdot}44$ is at 39°·7N. 124°·6W., which lies in the same direction from Berkeley as that assigned, but is sensibly nearer to it. This is natural if the focus is at some depth below the surface, for the effects will take longer to reach stations close to the epicentre than the tables would assign. It seems worth giving the revised solution in detail as far as $\Delta = 90°$.

1923. Jan. 22d. 9h. 4m. 8s.

Revised Epicentre 39°·7N. 124°·6W.

$A = -{\cdot}437$, $B = -{\cdot}633$, $C = +{\cdot}639$; $D = -{\cdot}823$, $E = +{\cdot}568$; $G = -{\cdot}363$, $H = -{\cdot}526$, $K = -{\cdot}769$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Berkeley		2·5	135	i 1 3	+24	1 59	+50	—	—
Lick		3·3	136	1 12	+20	2 10	+39	—	—
	Z.	3·3	136	1 10	+18	2 9	+38	—	3·0
Victoria		8·7	6	2 8	− 4	—	—	3·6	6·7
Tucson		13·4	120	i 3 30	+12	6 12	+19	6·6	9·1
Denver		15·1	84	3 22	−18	6 22	−12	8·2	9·9
Sitka		18·7	341	4 19	− 6	i 7 54	− 1	8·4	12·9
		18·7	341	—	—	—	—	10·5	13·3
Chicago		27·9	74	5 56	−11	10 50	− 7	13·9	—
Ann Arbor		30·7	71	6 28	− 7	11 34	−12	13·9	19·9
Mobile		30·9	93	i 11 35	?S	(i 11 35)	−15	17·3	20·7
Toronto		33·6	67	7 34	+33	13 28	+54	19·2	23·6
Honolulu	E.	33·9	245	7 7	+ 3	12 42	+ 3	14·9	17·7
	N.	33·9	245	—	—	—	—	14·7	17·0
Ottawa		35·9	64	7 11	−10	12 51	−18	e 16·6	22·6
Ithaca		35·9	70	7 10	−11	i 12 49	−20	—	20·9
Washington		36·3	76	6 54	−30	12 39	−35	17·1	22·9
Georgetown	E.	36·3	76	i 7 19	− 5	i 13 4	−10	e 18·9	23·0
	N.	36·3	76	e 7 19	− 5	i 13 4	−10	e 18·6	20·5

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Cheltenham	E.	36·5	76	7 16	−10	13 4	−13	19·8	23·5
	N.	36·5	76	—	—	—	—	18·5	20·9
Fordham	N.	38·2	71	7 32	− 8	13 27	−14	17·9	21·8
Northfield		38·3	65	7 26	−14	13 28	−14	18·5	22·9
Port au Prince		49·5	99	e 9 10	+ 6	16 23	+10	25·4	28·6
Porto Rico	E.	55·0	94	—	—	17 56	+35	26·0	30·0
	N.	55·0	94	9 45	+ 6	17 34	+13	28·3	36·2
Bergen		71·9	23	—	—	—	—	e 29·9	41·1
Edinburgh		72·3	30	i 12 2	+30	20 57	+ 3	30·9	40·2
Eskdalemuir		72·7	30	i 11 34	0	i 21 2	+ 4	31·9	38·4
Azores		72·8	54	22 22	?S	(22 22)	+82	43·9	49·7
Stonyhurst		74·1	32	e 11 52?	+ 9	21 22?	+ 7	37·4	39·9
Bidston		74·1	32	22 22	?S	(22 22)	+67	—	41·7
West Bromwich		75·3	32	11 54	+ 3	20 59	−30	—	—
Oxford		76·1	32	11 59	+ 3	21 43	+ 5	32·9	41·9
Kew		76·7	31	21 52	?S	(21 52)	+ 7	—	41·9
La Paz		76·9	125	i 12 13	+13	i 21 53	+ 5	35·4	54·8
De Bilt		78·4	28	i 12 11	+ 2	22 9	+ 4	33·9	38·8
Hamburg		78·9	26	e 12 12	0	e 22 36	+25	e 33·9	43·7
Uccle		79·1	29	12 15	+ 1	22 15	+ 2	32·9	37·6
Paris		79·9	32	i 12 20	+ 2	i 22 38	+16	33·9	42·9
Konigsberg		80·8	19	—	—	—	—	e 35·2	46·9
Coimbra	N.	81·2	43	12 14	−12	22 35	− 2	33·7	41·4
	E.	81·2	43	—	—	—	—	35·4	43·4
Strasbourg		82·2	29	12 33	+ 2	22 48	0	36·9	49·6
Puy de Dôme		82·5	34	—	—	—	—	34·9	—
Besançon		82·6	30	12 35?	+ 1	22 53?	0	33·9	—
Zurich		83·5	29	e 12 38	− 1	e 23 24	+21	—	—
Toledo		83·7	41	12 43	+ 3	23 3	− 3	e 39·8	45·2
Rio Tinto		83·9	44	12 52	+11	—	—	—	48·9
Innsbruck		84·6	27	i 12 45	− 1	e 23 9	− 6	e 36·9	46·4
Moncalieri		85·1	31	12 14	−35	23 7	−13	36·3	47·6
San Fernando		85·1	45	12 58	+ 9	23 22	+ 2	38·9	51·5
Tortosa		85·3	38	e 12 52	+ 2	e 22 52	−30	e 39·9	53·4
Vienna		85·5	24	i 12 47	− 4	23 31	+ 6	e 41·4	48·4
Barcelona		85·5	36	—	—	22 26	−59	38·8	43·9
Marseilles		85·5	33	—	—	—	—	38·9	—
Granada		85·9	43	12 55	+ 2	i 23 34	+ 5	e 40·4	44·6
Zi-ka-wei		86·4	309	e 12 54	− 1	e 20 33	−181	—	60·1
Andalgala	E.	86·4	131	13 40	+45	—	—	26·8	43·4
	N.	86·4	131	13 46	+51	—	—	26·9	46·9
Florence		87·6	30	11 47	−76	—	—	—	48·5
Algiers		89·7	38	e 13 8?	− 6	23 58	−13	41·9	46·9
Rocca di Papa		89·9	30	i 13 46	+31	23 52	−21	e 43·4	56·9
Belgrade		90·0	24	e 12 39	−37	e 23 54	−20	e 44·0	—

The Tortosa residual for S would suit an observation of S_cP_cS: the formula $(80° - \Delta) + 4·6$s. gives −25s. at $\Delta = 85°·3$. But it will be seen that other observatories give the true S. Beyond $\Delta = 90°$ the former solution suggests that Pilar and Athens observe S_cP_cS as S, while Rio de Janeiro, Riverview, Sydney, and Melbourne read it as P.

When there is so much material the residuals can be used for the investigation of corrections to the Tables. This work is already in hand, and consistent corrections negative near $\Delta = 35°$ and positive near 0° and 90°, are being deduced.

But we can also discuss formulæ for L and M. They may conveniently be compared, in minutes, with $\Delta/2$ in degrees. The revised Δs of the above solution give :—

Mean Δ	L − Δ/2	No.	C	O−C	M − Δ/2	No.	C	O−C
°	m.		m.	m.	m.		m.	m.
14·9	+0·7	5	+0·3	+0·4	+2·7	5	+2·7	0·0
32·0	−0·7	5	−0·7	0·0	+3·9	4	+3·3	+0·6
36·8	−0·5	6	−1·0	+0·5	+3·8	7	+3·4	+0·4
52·3	+0·1	2	−2·9	+3·0	+4·7	2	+3·9	+0·8
73·4	−4·1	5	−3·2	−0·9	+5·8	6	+4·5	+1·3
78·6	−5·3	5	−3·5	−1·8	+4·1	6	+4·7	−0·6
81·5	−6·0	5	−3·7	−2·3	−0·8	3	+4·8	−5·6
84·0	−5·0	4	−3·8	−1·2	+5·8	5	+4·8	+1·0
85·5	−2·9	5	−3·9	+1·0	+4·8	4	+4·9	−0·1
89·9	−1·8	3	−4·2	+2·4	+7·5	6	+5·0	+2·5

$L - \Delta/2$ is compared with the formula $C = +1·2m. - ·06\Delta$ and $M - \Delta/2$ with the formula $C = +2·3m. + ·03\Delta$. The constants are possibly related to the time taken to reach the surface from a finite depth.

In connection with the position of the epicentre the following Extract from the meteorological log of S.S. "Highland Heather," Captain G. A. Powell, is of interest (See Bull. Volcan: Organe de la Section de Volcanologie de l'un Geod. et Geop. Internat. Nos. 3 and 4, 1925, p. 87).

January 22nd 1923, 12.15 a.m. lat. 40°3′N. Longitude 124°30′W. (approx.), slight shock felt aboard, compass deflected about 6°. 12.33 a.m., severe shock—violent concussions as if passing over submerged obstruction.

The position of the vessel at "12.15 a.m." was close to the revised epicentre: and the true local time of the shock would be 9h.4m. −8h.18m. =0h.46m. We cannot make a closer comparison without knowing the ship's arbitrary time. We must not, however, assign too much importance to closeness to the epicentre since it is recorded (Bull. Seism. Soc. Aur. Vol. 13, p. 76) that the U.S.S. *Texas*, in lat. 44°N. 124°56′W. "experienced heavy vibrations. The *El Segunds* and the *President Hayes* also felt the temblor," but no positions are given.

It seems worth remarking that notes from the locality of the epicentre would be much easier reading if small towns (and even large) had their positions in latitude and longitude added in brackets. To find these positions a large scale map is generally necessary, and may not be accessible to the reader, whereas the writer probably has one by him.

Jan. 22d. Readings also at 0h. and 1h. (Nagasaki), 6h. (Simla), 7h. (Christchurch), 8h. (Nagasaki and near Zurich (2)), 9h. (Nagasaki), 11h. (Batavia), 12h. (Nagasaki), 14h. (Chicago), 15h. (La Paz), 17h. (Nagasaki) 21h. (Vienna), 22h. (Nagasaki).

Jan. 23d. Readings at 2h. (Pompeii, Rocca di Papa, Belgrade, and Nagasaki), 3h. (La Paz), 6h. (near Manila), 9h. and 11h. (Nagasaki), 14h. and 17h. (Nagasaki and La Paz), 18h. (Nagasaki), 22h. (Tortosa), 23h. (Nagasaki).

Jan. 24d. Readings at 0h. (Manila and Batavia), 1h. (Victoria and Berkeley), 3h. (Nagasaki), 4h. (Zante), 9h. and 15h. (Nagasaki and Zante), 18h. (Riverview and Melbourne), 20h. (Manila), 23h. (Nagasaki).

Jan. 25d. Readings at 0h., 3h., and 4h. (Nagasaki), 5h. (near Athens), 8h., 11h., and 12h. (Nagasaki), 15h. (near Athens), 16h. (Colombo and Nagasaki), 19h. (Nagasaki), 23h. (Nagasaki).

Jan. 26d. 3h. 23m. 50s. (I) } Epicentre 19°·5N. 137°·5E.
21h. 27m. 40s. (II) } See note at end.

A = −·695, B = +·637, C = +·334; D = +·676, E = +·737;
G = −·246, H = +·226, K = −·943.

		△	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I	Osaka	15·3	354	4 9	+26	—	—	8·3	8·7
II		15·3	354	3 49	+ 6	—	—	6·9	8·6
I	Kobe	15·6	353	e 6 25	?S	(e 6 25)	−21	8·2	8·3
II	Nagoya	15·7	358	0 22	?	—	—	3·4	3·5
II	Manila	16·6	255	e 7 38	?S	(e 7 38)	+29	9·8	10·3
II	Zi-ka-wei	18·6	312	i 4 52	+28	e 8 22	+29	—	13·9
I	Mizusawa	19·9	8	3 22	−78	3 39	?	—	—
II		19·9	8	4 9	−31	4 29	?P	—	—
II	Hong Kong	22·0	282	—	—	—	—	—	9·7
II	Hakodate	22·4	6	3 51	−79	—	—	—	—
II	Batavia	39·7	233	i 7 34	−18	i 13 29	−33	i 19·2	—
II	Malabar	39·8	231	i 7 41	−12	i 13 28	−35	—	—
II	Victoria E.	81·4	42	20 1	?	—	—	24·2	25·6
II	N.	81·4	42	—	—	—	—	30·2	32·0
II	De Bilt	97·3	333	i 17 17	?PR_1	e 22 38	−171	e 53·3	—
I	Innsbruck	97·6	327	i 11 52	−126	—	—	—	—
II		97·6	327	i 17 24	?PR_1	—	—	—	—
I	Zurich	99·0	328	i 11 55	−130	—	—	—	—
II	Ottawa	108·5	25	e 22 48	?	i 24 20	?	e 32·3	—
I	La Paz	155·5	87	19 6	[−56]	—	—	—	—
II		155·5	87	18 51	[−71]	27 57	?	40·9	44·8

For Notes see next page.

Additional readings: Osaka I gives also MN = +9·1m. Kobe I MN = +8·4m. Manila II MN = +10·6m. Malabar II iS = +13m.54s. Batavia II iE = +7m.39s., +14m.22s., iN = +15m.28s.

The additional readings given in the Notes suggest that there may have been more than one shock in the neighbourhood of the epicentre; and the readings for Victoria and Ottawa clearly belong to a different shock somewhere in North America, which may have been started by a tremor from No. II above. The La Paz readings for [P] suggest a deep focus; but it is possible that there is an error of 1 min; or again that T_0 is not well determined. To diminish T_0 for II by 30sec. would show an error of 1min. in Manila and Zi-ka-wei, and make the residuals for Kobe, Nagoya, Batavia, and Malabar small, but it would still leave [−41s.] for La Paz, and a greater diminution in T_0 would not suit these other three observatories.

Jan. 26d. Readings also at 3h. (near Kobe), 5h. (Nagasaki (2)), 6h. (Nagasaki and near Taihoku), 8h. (Nagasaki (2)), 9h. (La Paz), 10h. (Colombo), 12h. (Nagoya, Osaka, and Mizusawa), 15h. (La Paz), 19h. (Nagasaki), 20h. (La Paz), 22h. and 23h. (Nagasaki).

Jan. 27d. 4h. 12m. 45s. (I) } Epicentre 38°·3N. 141°·0E.
5h. 4m. 0s. (II) } (as on 1920 Dec. 19d.)

A = −·610, B = +·494, C = +·620; D = +·629, E = +·777;
G = −·482, H = +·390, K = −·785.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I Mizusawa	E.	0·8	6	0 0	−12	0 25	+ 3	—	—
I	N.	0·8	6	0 16	+ 4	0 27	+ 5	—	—
II	E.	0·8	6	0 6	− 6	0 29	+ 7	—	—
II	N.	0·8	6	0 7	− 5	0 31	+ 9	—	—
I Hakodate		3·5	357	—	—	1 38	+ 1	—	—
II		3·5	357	0 44	−11	(1 38)	+ 1	1·6	2·4
I Nagoya		4·5	228	0 54	−16	—	—	1·4	1·9
II		4·5	228	1 28	+18	—	—	2·6	3·1
I Osaka		5·8	233	1 17	−13	(2 16)	−23	2·3	3·2
II		5·8	233	1 31	+ 1	(2 43)	+ 4	2·7	3·7
II Kobe		5·9	234	e 1 25	− 6	(2 51)	+10	2·8	3·2
II De Bilt		81·8	334	—	—	—	—	e 51·0	52·4

Additional readings and notes: Hakodate II gives also MN = +2·6m. Nagoya I and II increased respectively by 4m. and 5m. Osaka I MN = +3·1m., II MN = +3·4m. Kobe II eS = +2m.5s., MN = +3·1m.

Jan. 27d. 8h. 4m. 0s. Epicentre 39°·7N. 105°·0W. (Denver).

A = −·199, B = −·743, C = +·639; D = −·966, E = +·259;
G = −·165, H = −·617, K = −·769.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Tucson	E.	8·8	214	1 47	−26	3 12	−46	4·1	4·1
	N.	8·8	214	—	—	—	—	3·5	3·9
Lick		13·2	265	—	—	—	—	4·2	—
Chicago		13·3	76	3 18	+ 1	5 53	+ 2	6·6	—
Victoria	E.	15·8	309	3 30	−19	—	—	7·0	10·4
	N.	15·8	309	3 40	− 9	5 4	−106	6·6	9·8
Ann Arbor		16·2	74	4 12	+17	7 42	+42	9·0	9·8
Toronto		19·4	70	—	—	—	—	i 10·7	10·9
Georgetown		21·5	83	8 41	?S	(e 8 41)	−14	(10·0)	—
Washington		21·5	83	3 13	−106	6 28	−147	—	—

Continued on next page.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Ithaca	21·5	73	—	—	e 9 0	+ 5	10·5	—
Cheltenham	21·7	84	—	—	—	—	e 9·8	11·6
Ottawa	22·2	66	5 41	+34	—	—	e 10·0	12·1
Fordham	23·6	77	—	—	—	—	13·3	—
Northfield	24·3	69	—	—	—	—	e 12·5	—
Honolulu	48·5	266	—	—	15 12	−48	e 14·4	15·5
Edinburgh	63·9	39	—	—	—	—	e 37·0	—
Eskdalemuir	64·2	39	—	—	—	—	30·0	—
Oxford	67·1	42	—	—	—	—	32·8	38·9
Kew	67·8	41	—	—	—	—	—	40·0
Coimbra	69·9	55	—	—	—	—	e 31·0	—
De Bilt	70·0	39	—	—	—	—	e 33·0	43·4
Lisbon	70·2	56	—	—	—	—	e 32·3	—
Uccle	70·5	40	—	—	—	—	e 32·0	—
Paris	70·9	42	—	—	—	—	e 43·0	45·0
Toledo	72·7	53	—	—	—	—	35·0	46·0
Strasbourg	73·6	40	—	—	—	—	e 39·0	—
Besançon	73·7	42	—	—	—	—	40·0	—
Innsbruck	76·3	39	—	—	—	—	e 37·3	—
Rocca di Papa	80·9	42	—	—	—	—	49·1	—

Additional readings and notes: Denver gives a reading at 9h.4m. Tucson readings have been increased by 6m. Lick gives also LN = +4·3m. Ann Arbor SR_1 = +8m.24s., T_e = 8h.4m.0s. Georgetown I. is given as S. Ithaca e = +7m.6s. De Bilt MZ = +42·0m. Paris MN = +48·0m. Innsbruck readings have been diminished by 1h. Fordham readings are given as on 26d. Rocca di Papa L = +55·1m.

Jan. 27d. Readings also at 0h. (Nagasaki (5)), 1h. (Nagasaki (2) and De Bilt), 2h. (Nagasaki (3)), 3h. (Manila and Nagasaki), 4h. (Nagasaki), 6h. (La Paz and Nagasaki (2)), 7h. (Nagasaki), 8h. (Toronto and near Mizusawa), 9h. (La Paz and Denver), 11h. (Nagasaki), 14h. (Colombo), 16h. (Sydney, Riverview, Melbourne, Adelaide, and Nagasaki), 17h. (Tiflis, Chicago, and Nagasaki (2)), 18h. (Adelaide), 20h. (Nagasaki and near Berkeley), 21h. (Nagasaki and near Kobe (2), and near Granada), 23h. (Adelaide and Riverview).

Jan. 28d. Readings at 2h. (Tortosa), 3h. (Nagasaki (4)), 6h. (Nagasaki and Colombo), 9h. (Colombo (2)), 10h. (Nagasaki), 13h. (near Taihoku), 17h. (Nagasaki).

Jan. 29d. Readings at 1h. (La Paz), 2h. (2) and 5h. (Nagasaki), 7h. (Florence), 9h. (Nagasaki (3) and near Hakodate, Mizusawa, and Sapporo), 10h. (La Paz), 12h. (Mizusawa and Hakodate), 17h. (La Paz), 18h. (Zi-ka-wei, Sydney, Riverview, and La Paz), 19h. (Florence), 21h. (Rio Tinto).

Jan. 30d. Readings at 4h. (Nagasaki (2) and La Paz), 6h. (near Algiers), 7h. (Taihoku and Nagasaki), 14h. (Nagasaki), 19h. (near La Paz), 22h. (Nagasaki (2)).

Jan. 31d. Readings at 1h. (Nagasaki (2)), 2h. (Nagasaki (2) and Malabar), 6h. (near Malabar), 7h. (near Taihoku), 12h. (Nagasaki and La Paz), 18h. (Tortosa and La Paz), 20h. (near Mizusawa).

Feb. 1d. 19h. 24m. 54s. Epicentre 21°·5S. 169°·0E.

A = −·913, B = +·178, C = −·367 ; D = +·191, E = +·982 ;
G = +·360, H = −·070, K = −·930.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Apia		19·9	70	e 4 22	−18	—	—	—	—
Riverview		20·0	228	i 4 42	+ 1	8 27	+ 4	e 9·0	13·1
Sydney		20·0	228	4 36	− 5	(8 36)	+13	8·6	9·1
Wellington		20·4	168	4 48	+ 2	i 8 18	−14	i 9·8	11·1
Christchurch		22·2	173	6 0	+53	10 12	+63	12·8	16·0
Melbourne		26·3	227	5 42	− 9	10 30	+ 2	13·5	17·6
Adelaide		29·8	237	—	—	i 11 30	− 1	e 15·8	19·5
Perth		48·1	246	—	—	15 46	− 9	—	—
Honolulu	N.	53·7	39	17 18	?S	(17 18)	+13	24·6	25·0
Manila		59·4	305	e 10 6	− 2	—	—	—	—
Batavia		61·5	275	10 48	+26	i 19 18	+36	29·9	—
Nagasaki		65·9	325	10 40	−10	—	—	—	—
Mizusawa	E.	66·0	338	10 49	− 2	(19 35)	− 2	19·6	—
	N.	66·0	338	10 52	+ 1	(19 27)	−10	19·4	—
Hong Kong		69·1	307	11 6	− 6	—	—	—	20·4
Zi-ka-wei		69·7	320	11 22	+ 7	e 20 32	+10	—	43·3
Colombo		91·7	277	17 24	?PR_1	(24 6)	−26	24·1	25·1
Victoria		92·3	38	23 54	?S	(23 54)	−44	42·2	43·0
Kodaikanal		95·1	280	23 54	?S	(23 54)	−73	60·7	64·3
La Paz		112·3	240	e 18 1	[−28]	i 29 12	+84	49·1	52·5
Chicago		113·9	52	20 6	?PR_1	29 6	+65	53·1	—
Ann Arbor		116·9	51	e 18 6	[−38]	—	—	54·1	—
Toronto		120·1	50	—	—	—	—	61·7	70·0
Ottawa		122·7	49	e 20 44	?PR_1	e 30 44	+94	56·1	—
Upsala		137·4	341	—	—	e 28 52	?	e 61·1	69·1
Konigsberg	E.	139·2	332	i 27 23	?	i 29 15	?	e 61·1	73·1
	N.	139·2	332	—	—	—	—	e 64·1	75·1
Hamburg		144·2	339	i 19 35	[−12]	—	—	e 63·1	71·1
Belgrade		145·2	320	e 19 20	[−28]	e 29 28	?	36·6	—
Vienna		145·4	328	19 39	[−10]	29 56	?	e 70·6	80·6
Eskdalemuir		145·7	351	—	—	—	—	61·1	—
De Bilt		147·0	341	i 19 46	[− 5]	—	—	e 60·1	79·6
Uccle		148·3	341	e 19 46	[− 7]	—	—	e 61·1	81·7
Innsbruck	N.W.	148·5	330	i 19 48	[− 5]	e 30 6	?	—	—
Strasbourg		149·1	336	19 45	[− 9]	—	—	e 66·1	—
Zurich		149·7	333	19 49	[− 6]	e 30 15	?	—	—
Paris		150·6	342	—	—	e 49 6	?	73·1	84·1
Besançon		150·9	336	—	—	—	—	65·1	—
Florence		151·1	325	19 36	[−21]	—	—	—	80·1
Rocca di Papa		151·6	321	i 19 54	[− 4]	23 42	?PR_1	e 75·0	80·7
Moncalieri		151·9	331	20 6	[+ 7]	36 40	?	68·6	—
Tortosa		158·4	336	20 35	[+29]	—	—	e 50·1	87·3
Algiers		160·4	325	20 50	[+42]	—	—	e 52·1	81·6
Toledo		160·7	344	19 42	[−27]	30 14	?	e 78·1	87·6
Coimbra		161·2	354	—	—	e 35 6	?	75·1	—
Granada		163·1	339	e 20 48	[+38]	32 20	?	e 81·1	90·6
Rio Tinto		163·3	348	38 6	?	—	—	(63·1)	114·1
San Fernando		164·5	346	—	—	—	—	—	116·1

Additional readings: Riverview gives also iP = +4m.38s., PR_1 = +5m.25s., S = +8m.54s., MN = +12·8m., T_e = 19h.24m.56s. Melbourne SR_1 = +12m.0s. Adelaide iSR_2 = +14m.24s. Honolulu SN? = +22m.53s. Batavia i = +10m.54s., +14m.36s., and +20m.0s. Victoria SE = +30m.54s., SN = +30m.17s. Ann Arbor LE = +59·1m. and +71·1m. Toronto eL = +67·4m., L = +100·7m. Ottawa eLE = +37·8m. Hamburg MN = +66·1m. Vienna iPZ = +19m.47s., iZ = +20m.6s., PR_1 = +20m.6s.?, eN = +26m.7s. De Bilt MN = +74·5m., MZ = +81·6m. Paris MN = +80·1m. Toledo MNW = +88·1m., Coimbra LN = +51·1m., eLE = +67·1m. Granada S = +21m.0s., i = +21m.20s., and +26m.6s., MN = +93·6m. San Fernando MN = +94·1m.

Feb. 1d. 21h. 34m. 0s. Epicentre 21°·5S. 169°·0E. (as at 19h.).

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	20·0	228	e 4 42	+ 1	i 8 34	+11	—	14·2
Sydney	20·0	228	4 30	−11	(8 42)	+19	8·7	9·3
Wellington	20·4	168	i 4 30	−16	i 8 0	−32	i 9·6	10·5
Hamburg	144·2	339	e 19 34	[−13]	—	—	—	—
Vienna	145·4	328	19 40	[− 9]	—	—	—	—
Innsbruck	148·5	330	e 19 54	[0]	—	—	—	—

Additional readings: Apia (Δ =19°·9) gives 21h.30m. Riverview PS = +8m.49s., MN = +13·2m., T_0 =21h.33m.42s.

Feb. 1d. Readings also at 0h. (near Mizusawa), 4h. (near Mizusawa and Hakodate), 11h. (Nagasaki), 13h. (near Mizusawa), 18h. (Nagasaki), 19h. (Nagasaki and Osaka (2)), 20h. and 23h. (Nagasaki).

1923. Feb. 2d. 1h. 6m. 15s. Epicentre 50°·5N. 164°·0E.

(as on 1915 July 31d.).

A = −·611, B = +·175, C = +·772 ; D = +·276, E = +·961 ;
G = −·742, H = +·213, K = −·636.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa	N.	19·7	244	4 39	+ 2	8 29	+12	11·1	—
Nagoya		24·9	242	5 7	−30	—	—	—	—
Osaka		26·1	244	6 2	+13	10 51	+27	15·4	16·0
Kobe		26·2	244	6 7	+17	10 34	+ 8	14·6	17·0
Zi-ka-wei		36·9	255	6 35	−54	e 13 3	−19	—	21·0
Honolulu	N.	41·6	120	15 38	?S	(15 38)	+69	22·2	25·1
Victoria		45·4	63	9 14	+38	15 28	+ 8	22·8	29·0
Hong Kong		47·7	252	8 47	− 5	15 45	− 5	23·1	28·8
Manila		49·9	240	(e 9 45)	+39	e 9 45	?P	—	—
Simla		64·6	289	—	—	—	—	16·0	18·4
Upsala		66·3	342	e 10 50	− 4	e 19 34	− 7	e 33·8	37·9
Bergen		67·8	349	10 55	− 8	—	—	—	—
Chicago		68·6	50	11 5	− 3	20 5	− 4	e 32·4	—
Ann Arbor		70·0	46	20 33	?S	(20 33)	+ 7	36·2	—
Konigsberg	E.	70·3	339	11 18	− 1	i 20 29	− 1	e 32·8	46·8
	N.	70·3	339	—	—	i 20 9	−21	e 34·8	—
Toronto		70·9	43	—	—	e 22 3	+86	38·8	47·0
Ottawa		71·0	40	20 38	?S	(20 38)	0	35·5	42·8
Edinburgh		73·0	353	—	—	—	—	45·8	52·8
Ithaca		73·1	41	—	—	—	—	36·8	—
Eskdalemuir		73·6	353	—	—	20 59	−10	—	—
Hamburg		73·6	344	i 11 40	0	21 14	+ 5	e 37·8	42·8
Fordham	E.	75·5	41	—	—	—	—	39·8	—
Bidston		75·5	353	40 57	?L	46 48	?	(41·0)	50·8?
Washington		75·7	45	12 5	+12	—	—	37·8	—
De Bilt	E.	75·8	347	—	—	21 38	+ 3	e 35·8	46·9
	N.	75·8	347	—	—	—	—	e 36·8	49·9
	Z.	75·8	347	11 55	+ 1	—	—	—	53·5
Kew		77·1	350	21 45	?S	(21 45)	− 5	—	50·8
Uccle		77·2	348	e 12 4	+ 2	e 21 51	0	e 34·8	47·6
Vienna		77·4	339	12 2?	− 1	21 35	−18	e 36·2	51·2
Strasbourg		78·9	344	11 4	−68	23 3	+52	e 39·8	48·8
Innsbruck		79·4	340	i 12 13	− 2	e 22 57	+41	e 38·8	—
Paris		79·4	348	—	—	e 22 21	+ 5	42·8	51·8
Belgrade		79·6	333	e 11 58	−19	e 22 4	−15	e 44·6	—
Zurich		79·8	343	e 12 16	− 2	e 22 15	− 6	e 40·8	—
Kodaikanal		80·0	274	30 51	?	—	—	49·4	55·4?
Besançon		80·5	345	—	—	—	—	45·8	—
Colombo		81·0	270	28 45	?SR_1	46 21	?	51·2	56·8
Moncalieri		82·3	343	12 3	−29	22 40	− 9	39·8	49·4
Florence		82·7	340	12 25	− 9	—	—	—	46·2
Rocca di Papa		84·0	339	e 12 42	0	i 22 6	−62	e 45·6	57·6
Marseilles		84·4	344	—	—	e 23 13	+ 1	—	—
Barcelona		86·7	346	—	—	e 23 23	−15	e 49·4	52·4

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Tortosa	E.	87·5	348	13 7	+ 5	23 43	− 4	e 44·8	51·2
	N.	87·5	348	12 59	− 3	—	—	e 40·8	58·6
Adelaide		88·4	201	—	—	e 24 15	+19	e 50·2	60·8?
Coimbra	E.	89·0	354	e 13 25	+15	23 51	−12	42·9	55·0
	N.	89·0	354	13 35	+25	—	—	—	53·0
Toledo		89·0	350	13 5	− 5	23 32	−40	e 48·8	59·8
Helwan		89·3	320	e 13 5	− 7	23 42	−24	—	59·0
Lisbon		89·4	355	—	—	—	—	e 41·8	—
Algiers		91·1	345	e 13 19	− 3	23 57	−28	e 45·8	58·8
Rio Tinto		91·3	353	21 45	?	—	—	—	61·8
Granada		91·6	350	13 30	+ 5	24 15	−16	51·2	56·2
San Fernando		92·5	352	—	—	—	—	—	60·2
La Paz		126·4	70	e 20 26	?PR_1	e 33 5	?	63·7	66·2

Additional readings and notes: Mizusawa gives also PE = +4m.38s. Osaka MN = +18·8m. Kobe MN = +16·0m. Zi-ka-wei MZ = +25·0m. Honolulu SN? = +21m.1s. Simla eP = 1h.2m.54s. Ann Arbor S?E = +28m.45s., LN = +45·2m. Toronto L = +29·6m. Ottawa S = +28m.41s., T_0 = 1h.16m.53s. Hamburg MZ = +49·4m. Bombay (Δ = 76°·3), eP = 1h.1m.43s. Uccle MN = +51·0m. Vienna PS = +21m.57s. Strasbourg MN = +47·8m. Paris eSN = +22m.4s. Belgrade LE = +49·7m., LN = +50·5m. Colombo P is given as for 0h. and has been corrected. Moncalieri MN = +55·5m. Florence P = +12m.37s. Adelaide eSR_1 = +30m.45s., eSR_2 = +36m.45s., e = +55m.15s. Toledo MNW = +52·6m. San Fernando MN = +62·2m.

1923. Feb. 2d. 5h. 7m. 15s. Epicentre 50°·5N. 164°·0E.

(as at 1h. See note at end).

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari		14·5	263	2 46	−47	—	—	5·4	6·7
Hakodate		18·3	250	4 44	+23	—	—	—	5·7
Mizusawa	N.	19·7	244	4 56	+19	8 22	+ 5	9·0	—
Nagoya		24·9	242	4 50	−47	9 34	−27	14·6	15·4
Osaka		26·1	244	6 9	+20	11 2	+38	15·6	16·5
Kobe		26·2	244	5 59	+ 9	10 37	+11	13·1	16·0
Nagasaki		30·7	248	6 30	− 5	—	—	14·0	22·0
Sitka	E.	35·2	56	7 24	+ 9	12 52	− 6	20·2	21·7
	N.	35·2	56	e 8 0	+45	—	—	i 20·9	22·2
Zi-ka-wei		36·9	255	i 7 25	− 4	e 13 16	− 6	e 16·7	21·8
Taihoku		41·3	249	8 14	+ 9	14 28	+ 3	23·0	25·1
Honolulu	E.	41·6	120	9 26	+78	15 31	+62	22·1	22·9
	N.	41·6	120	8 53	+45	15 15	+46	20·9	25·5
Hokoto		43·6	250	e 8 14	− 9	—	—	—	—
Victoria		45·4	63	8 48	+12	(15 43)	+23	15·7	24·8
Hong Kong		47·7	252	8 47	− 5	15 45	− 5	—	29·8
Manila		49·9	240	e 9 32	+26	i 18 4	+106	i 29·9	39·2
Berkeley		52·1	74	9 49	+28	17 15	+30	—	—
	Z.	52·1	74	9 40	+19	17 25	+40	28·2	—
Tucson		62·7	72	11 15	+45	19 40	+43	34·4	36·9
Calcutta	E.	63·8	275	10 45	+ 8	19 1	−10	27·4	34·8
	N.	63·8	275	10 49	+12	19 6	− 5	—	39·9
Dehra Dun		64·6	287	11 15	+33	20 0	+40	30·7	37·7
Simla	N.	64·6	289	10 39	− 3	19 9	−11	31·6	40·6
Upsala		66·3	342	10 44	−10	19 18	−23	28·8	37·6
Bergen		67·8	349	11 5	+ 2	19 50	−10	29·8	42·8
Chicago		68·6	50	11 17	+ 9	20 14	+ 5	33·8	—
Ann Arbor		70·0	46	11 39	+22	20 39	+13	34·0	50·8
Konigsberg	E.	70·3	339	i 11 15	− 4	—	—	e 30·8	32·8
	N.	70·3	339	i 11 18	− 1	i 20 13	−17	—	39·8
Toronto		70·9	43	12 21	+59	i 21 9	+32	40·0	43·0
Ottawa		71·0	40	11 48	+25	20 30	− 8	32·8	40·8
Edinburgh		73·0	353	—	—	20 55	− 7	30·8	54·2
Ithaca		73·1	41	11 45	+ 8	e 20 55	− 8	37·8	—
Northfield		73·3	39	—	—	21 5	− 1	41·8	—
Eskdalemuir		73·6	353	11 45	+ 5	i 21 2	− 7	—	—
Hamburg		73·6	344	i 11 38	− 2	20 51	−18	35·8	42·0
Tiflis		73·6	317	e 11 15	−25	e 20 27	−42	33·8	41·6
Lemberg		74·0	334	e 11 33	− 9	e 19 57	−77	e 39·8	40·4

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Stonyhurst		75·0	352	12 3	+14	e 21 27	+ 1	—	48·8
Batavia		75·0	240	12 15	+26	i 21 43	+17	34·3	46·3
Bidston		75·5	353	13 1	+69	22 30	+58	—	54·6
Fordham		75·5	41	12 2	+10	21 31	− 1	37·8	43·6
Georgetown		75·7	45	12 8	+15	e 21 45	+11	40·1	43·9
Washington		75·7	45	12 4	+11	21 36	+ 2	e 36·8	—
De Bilt	E.	75·8	347	11 49	− 5	21 32	− 3	e 34·8	41·6
	N.	75·8	347	—	—	21 25	−10	e 35·8	39·6
Cheltenham	E.	76·0	45	12 30	+35	21 59	+22	39·4	44·3
	N.	76·0	45	12 37	+42	22 7	+30	39·2	—
West Bromwich		76·3	351	12 3	+ 6	21 32	− 9	—	—
Bombay		76·3	282	11 59	+ 2	21 29	−12	35·3	44·3
Mobile	E.	76·9	57	—	—	e 21 45	− 3	—	—
Kew		77·1	350	14 45	+163	—	—	—	53·8
Uccle		77·2	348	e 11 58	− 4	21 35	−16	31·8	42·5
Vienna		77·4	339	e 11 57	− 6	21 48	− 5	e 33·2	51·2
Strasbourg		78·9	344	11 57	−15	22 3	− 8	e 36·8	50·8
Paris	E.	79·4	348	i 12 12	− 3	e 22 9	− 7	32·8	33·8
	N.	79·4	348	—	—	e 22 19	+ 3	—	36·8
Innsbruck		79·4	340	i 12 11	− 4	e 21 58	−18	e 33·8	52·8
Belgrade		79·6	333	i 11 59	−18	e 21 54	−25	e 33·7	44·5
Zurich		79·8	343	e 12 13	− 5	e 22 11	−10	—	—
Le Mans		80·5	350	e 22 45	?S	(e 22 45)	+16	36·8	50·8
Besançon		80·5	345	12 36?	+14	22 22	− 7	—	37·8
Colombo		81·0	270	12 45	+20	23 45	+70	46·0	56·2
Moncalieri		82·3	343	12 30	− 2	22 19	−30	36·2	49·6
Puy de Dôme		82·4	348	e 12 45	+13	e 22 45	− 5	38·8	—
Florence		82·7	340	12 35	+ 1	22 45	− 9	—	45·8
Rocca di Papa		84·0	339	i 12 37	− 5	e 22 39	−29	e 41·6	53·6
Marseilles		84·4	344	12 45	+ 1	22 59	−13	38·8	43·8
Pompeii		84·9	337	13 0	+13	23 0	−18	37·8	50·8
Athens		85·0	330	e 12 36	−12	e 22 48	−31	e 39·7	42·4
		85·0	330	i 12 55	+ 7	i 23 0	−19	—	44·0
Riverview		85·1	191	e 13 39	+50	e 23 38	+18	—	53·6
Sydney		85·1	191	13 45	+56	23 45	+25	49·6?	50·8
Barcelona		86·7	346	e 12 45	−12	23 15	−23	e 38·1	57·1
Tortosa	E.	87·5	348	13 2	0	23 39	− 8	38·9	49·1
	N.	87·5	348	12 55	− 7	23 36	−11	41·2	52·4
Adelaide		88·4	201	—	—	e 17 57	?PR_1	e 37·2	56·6
Coimbra		89·0	354	13 13	+ 3	23 44	−19	38·8	63·1
Toledo		89·0	350	13 2	− 8	23 36	−27	e 41·8	53·8
Helwan		89·3	320	13 3	− 9	23 45	−21	—	60·9
Lisbon		89·4	355	13 13	+ 1	23 55	−12	41·8	50·8
Melbourne		89·9	195	—	—	24 51	+38	42·6	57·2
Algiers		91·1	345	13 9	−13	23 55	−30	42·8	47·8
Rio Tinto		91·3	353	12 45	−38	—	—	—	60·8
Azores		91·3	8	24 45	?S	(24 45)	+18	—	25·8
Granada	E.	91·6	350	13 28	+ 3	e 23 59	+32	e 42·8	48·8
	N.	91·6	350	—	—	i 24 7	−24	—	50·7
Wellington		92·3	172	e 13 20	− 9	i 23 45	−53	i 40·0	49·2
San Fernando		92·5	352	13 35	+ 5	24 27	−13	—	59·8
Perth		92·8	220	—	—	24 2	−41	—	—
Christchurch		94·4	175	—	—	29 9	?	52·4	56·2
La Paz		126·4	70	i 19 40	[+31]	33 20	?	56·2	77·0
Johannesburg		138·6	289	22 45	?PR_1	—	—	64·8	79·8
La Plata	E.	146·0	80	20 11	[+21]	20 25	?	72·6	83·5
	N.	146·0	80	20 13	[+23]	20 28	?	81·5	92·8
Cape Town		150·0	290	20 16	[+20]	—	—	—	85·2

Additional readings and notes: Hakodate gives also MN = +5·4m. Mizusawa LE = +8·9m. Nagoya S_1 = +6m.55s. Kobe MN = +16·7m. Nagasaki readings have been increased by 1h. Sitka eE = +8m.57s., eN = +11m.32s., SR_1E = +15m.10s., SR_1N = +15m.4s., eE = +17m.12s., eN = +17m.37s., LE = +19·2m. T_o = 5h.7m.45s. Zi-ka-wei MN = +22·9m., MZ = +21·8m. Taihoku MN = +29·8m. Honolulu eE = +17m.33s., SR_1N = +18m.7s., SR_2E = +19m.3s., SR_2N = +19m.15s., T_o = 5h.8m.5s. Victoria PR_1 = +11m.28s. Manila MN = +33·6m. Berkeley PR_1N = +11m.7s., PR_2N = +12m.15s., SR_1N = +21m.17s., SR_4N = +22m.29s., SR_3N = +23m.43s., SR_4N = +23m.57s. Tucson eN = +13m.4s., SE = +19m.50s., eE = +23m.57s., LE = 36·5m., T_o = 5h.8m.7s. Calcutta readings are given as for 9h. Upsala MN = +37·9m. Simla readings have been increased by 24m. Bergen iE = +47m.55s. Ann Arbor SR_3 = +28m.45s., L = +38·8m. and +54·2m. T_o = 5h.8m.0s. Konigsberg iN = +16m.8s., eE = +19m.49s., iE = +20m.43s. Readings

Continued on next page.

given as on 3d. Toronto iL = +29m.45s., i = +36m.39s. Ottawa SR_1 = +25m.26s., eL = +28·8m. T_0 = 5h.8m.21s. Ithaca e = +16m.10s., +25m.33s., and +28m.45s. Eskdalemuir SR_1 = +25m.56s., SR_2 = +29m.0s. Hamburg L = +30·8m., MN = +44·4m., MZ = +49·2m. Tiflis eN = +15m.9s., MN = +45·6m. Fordham SN = +21m.34s. T_0 = 5h.7m.43s. Georgetown ePEN = +12m.1s., L = +43·8m., LN = +42·1m. De Bilt P is for Z component. Other phases are as stated. MZ = +52·1m. Cheltenham PR_1E = +15m.28s., ePR_1N = +16m.58s. and +18m.11s., PSN = +22m.56s., SR_1N = +26m.59s. and +30m.51s., LE = +41·8m., LN = +42·6m. T_0 = 5h.8m.15s. Bombay readings are given as for 15h. Uccle iP = +12m.12s., SR_1 = +26m.51s., SR_2 = +29m.45s., MN = +39·9m. Vienna iPZ = +12m.0s., iPEN = +12m.10s., iZ = +12m.12s., +13m.45s., and +14m.24s., PR_1E = +14m.54s., SN = +21m.6s., SR_1E = +27m.33s., MNZ = +47·2m. Strasbourg MN = +49·8m. Innsbruck iNE = 13m.5s., MNW = +43·0m. Belgrade MN = +52·7m. Moncalieri MN = +59·2m. Riverview iPS = +23m.59s., MN = +49·8m. Barcelona MN = +52·3m. Adelaide iSR_1 = +24m.21s., eSR_2 = +29m.9s. Coimbra i = +24m.17s., MN = +61·2m. T_0 = 5h.7m.54s. Toledo PR_1 = +16m.35s., SR_1 = +29m.44s., MNW = +54·0m. Melbourne PR_1 = +17m.51s.?, SR_2 = +35m.3s. Granada i = +13m.49s., SR_1 = +24m.28s., MN = +50·7m. San Fernando MN = +65·2m. Christchurch PR_1 = +18m.45s., SR_1 = 35m.45s., SR_2 = +40m.45s. La Paz i = +31m.12s.

It is always interesting to compare directly the readings for two shocks presumably from the same focus. The following cases are available as between these shocks at 1h. and 5h., taken in the sense 5h. −1h. :—

Station.	Δ	Az.	P.	S.	Station.	Δ	Az.	P.	S.
	°	°	s.	s.		°	°	s.	s.
Mizusawa	19·7	244	+17	− 7	Vienna	77·4	339	− 5	+13
Nagoya	24·9	242	−17	—	Strasbourg	78·9	344	(+53)	(−60)
Osaka	26·1	244	+ 7	+11	Innsbruck	79·4	340	− 2	(−60)
Kobe	26·2	244	− 8	+ 3	Paris	79·4	348	—	−12
Zi-ka-wei	36·9	255	(+50)	+10	Belgrade	79·6	333	+ 1	−10
Honolulu N.	41·6	120	—	−23	Zurich	79·8	343	− 3	− 4
Victoria	45·4	63	−26	+15	Moncalieri	82·3	343	+27	−21
Hong Kong	47·7	252	0	0	Florence	82·7	340	+10	—
Manila	49·9	240	−13	—	Rocca di Papa	84·0	339	− 5	+23
Bergen	67·8	349	+10	—	Marseilles	84·4	344	—	−14
Chicago	68·6	50	+12	+ 9	Barcelona	86·7	346	—	− 8
Ann Arbor	70·0	46	—	+ 6	Tortosa E.	87·5	348	− 5	− 4
Toronto	70·9	43	—	(−54)	N.	87·5	348	− 4	—
Ottawa	71·0	40	—	− 8	Coimbra	89·0	354	−12	− 7
Eskdalemuir	73·6	353	—	+ 3	Toledo	89·0	350	− 3	+13
Hamburg	73·6	344	− 2	−23	Helwan	89·3	320	− 2	+ 3
Washington	75·7	45	− 1	—	Algiers	91·1	345	−10	− 2
De Bilt	75·8	347	− 6	− 6	Granada	91·6	350	− 2	−16
Uccle	77·2	348	− 6	−16					

(In the five cases bracketed it is assumed that there is an error of 1m.) When these are arranged according to azimuth, the mean differences in P and S are

Az.	No. of Differences.		Mean Differences.	
	P.	S.	P.	S.
° °			s.	s.
40 − 63	3	5	−5	+6
240 − 255	7	5	−3	+3
320 − 354	19	20	−1	−4

Now, considering that several of the usual sources of error (*e.g.*, errors of the tables) are entirely eliminated in this direct comparison, these mean differences are larger than might have been hoped. For instance, the first two groups (10 observations in all) assign a difference of T_0 about 15sec. earlier, while the large third group assigns one 3sec. later. But no sensible difference in epicentre is indicated. If, again, we take means of three groups as they stand (in order of Δ) we get

Δ	P.	S.
° °	s.	s.
20 to 70	−3	+3
71 to 80	−3	−6
81 to 90	−1	−4

This arrangement shows that the chief anomaly is in the observation of S at the smaller epicentral distances, and that one or both of the adopted values of T_0 should be altered so as to increase the mean differences by about 5 sec.

We may therefore regard the errors as accidental rather than systematic; but they emphasise the fact that to obtain trustworthy corrections to the adopted tables a large amount of material will be necessary to eliminate such accidental errors.

Feb. 2d. Readings also at 1h. (Zi-ka-wei), 2h. (Hamburg, Innsbruck, Tortosa, Vienna, La Paz), 4h. (Nagasaki and near Sarajevo and Belgrade), 5h. (near Belgrade), 6h. (near Mizusawa), 7h. (Ekaterinburg and Tortosa), 10h. (Florence and Ekaterinburg), 11h. (Malaga and near Granada), 14h. (Colombo), 15h. (near La Paz), 16h. (Batavia, Malabar, and (Colombo), 17h. (Nagasaki and near Mizusawa), 19h. (Ekaterinburg), 23h. (Nagasaki).

1923. Feb. 3d. 16h. 1m. 36s. Epicentre 54°·0N. 161°·0E.

(as on 1919 May 27d.).

$A = -\cdot556$, $B = +\cdot191$, $C = +\cdot809$; $D = +\cdot326$, $E = +\cdot946$; $G = -\cdot765$, $H = +\cdot263$, $K = -\cdot588$.

It will be seen that though this solution fits the majority of stations, some important European observatories (*e.g.* De Bilt, Uccle, Strasbourg, and West Bromwich) record S about 30 sec. late, suggesting some anomaly.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari		13·7	245	2 24	−58	—	—	—	—
Sapporo		16·9	238	4 23	+19	—	—	5·0	—
Hakodate		18·1	236	4 55	+37	—	—	—	9·9
Mizusawa	E.	20·1	230	4 40	− 2	8 42	+17	—	—
	N.	20·1	230	4 41	− 1	8 56	+31	—	—
Nagoya		25·2	231	4 39	−61	10 24	+17	—	11·1
Osaka		26·3	233	5 58	+ 7	(10 55)	+27	10·9	12·8
Kobe		26·5	234	5 45	− 8	(11 3)	+31	11·0	32·9
Nagasaki		30·6	240	6 20	−14	(11 26)	−18	11·4	18·6
Sitka		34·8	60	7 8	− 3	i 12 42	−10	17·5	—
Zi-ka-wei		36·2	248	i 7 9	−15	e 12 49	−24	—	—
Taihoku		41·1	241	8 0	− 4	(14 36)	+14	14·6	—
Hokoto		43·4	242	7 52	−29	(e 15 32)	+38	e 15·5	—
Honolulu		44·9	120	i 8 39	+ 7	i 15 22	+ 8	20·7	—
Victoria	Z.	45·4	66	8 34	− 2	12 33	−167	19·5	24·6
Hong Kong		47·2	247	8 24	−24	—	—	—	24·9
Manila		50·3	234	e 9 12	+ 3	—.	—	24·1	26·8
Ekaterinburg		51·7	318	i 9 18	0	—	—	—	—
Berkeley		52·9	76	9 29	+ 4	17 6	+11	25·4	26·5
Lick	Z.	53·6	76	13 44	+254	21 26	+262	—	29·9
Denver	E.	61·0	62	8 24	−115	15 54	−162	24·4	32·4
	N.	61·0	62	—	—	16 24	−132	25·4	34·4
Calcutta	E.	61·9	272	10 38	+14	20 16	+89	—	—
	N.	61·9	272	10 33	+ 9	19 45	+58	35·2	—
Dehra Dun		61·9	284	10 29	+ 5	18 34	−13	23·9	54·9
Upsala		62·5	340	e 10 43	+ 4	19 4	+ 9	e 30·4	40·1
Tucson		63·4	73	10 50	+16	i 19 35	+29	32·5	38·0
Bergen		64·0	348	i 9 42	−56	19 24	+11	31·1	34·4
Konigsberg		66·4	337	e 10 59	+ 5	e 19 59	+17	e 26·9	—
Chicago		67·7	50	10 57	− 5	20 7	+ 9	—	48·4
Ann Arbor		69·0	47	11 24	+13	20 24	+10	32·4	40·1
Edinburgh		69·4	351	i 11 33	+20	i 20 55	+36	—	47·7
Ottawa		69·5	40	11 21	+ 7	20 22	+ 2	e 32·4	44·1
Toronto		69·6	42	i 11 42	+27	i 20 30	+ 9	i 35·2	—
Hamburg		69·8	342	i 11 20	+ 4	e 20 36	+12	e 33·4	38·8
Eskdalemuir		69·9	351	i 11 22	+ 6	—	—	—	—
Tiflis		69·9	315	e 11 7	− 9	e 20 55	+30	e 35·4	45·8
Lemberg		70·1	332	e 10 36	−42	e 19 54	−33	e 23·4	41·9
Stonyhurst		71·3	350	11 54	+29	20 36	− 6	—	49·4
Apia		71·7	153	11 48	+20	—	—	30·4	37·9
Northfield		71·7	38	11 32	+ 4	20 54	+ 8	33·4	53·4
Ithaca		71·8	42	e 11 32	+ 4	20 50	+ 2	31·9	—
Bidston		71·8	350	12 39	+71	23 18	+150	—	48·9
De Bilt		72·0	346	i 11 33	+ 3	21 26	+36	36·4	51·1
West Bromwich		72·5	350	e 11 38	+ 5	i 21 28	+32	—	—
Uccle		73·4	347	11 39	+ 1	i 21 33	+26	35·4	47·8
Kew		73·4	350	11 24	−14	—	—	—	—
Vienna		73·5	338	e 11 42	+ 3	21 19	+11	30·6	43·4
Budapest		73·5	335	i 11 45	+ 6	i 21 20	+12	—	—
Bombay		73·8	281	11 49	+ 8	22 14	+62	39·2	42·1
Fordham	E.	74·1	41	12 49	+66	22 9	+54	33·4	42·4
	N.	74·1	41	12 51	+68	22 8	+53	38·4	—
Georgetown	E.	74·5	45	e 11 44	− 2	i 21 19	− 1	e 30·3	47·0
	N.	74·5	45	e 11 45	− 1	e 21 19	− 1	e 30·3	47·3

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Washington		74·5	45	11 48	+ 2	21 24	+ 4	32·4	47·4
Cheltenham	E.	74·8	45	12 0	+12	i 21 32	+ 8	36·3	—
	N.	74·8	45	—	—	21 44	+20	38·1	—
Strasbourg		75·0	344	i 11 54	+ 5	22 10	+44	38·4	41·9
Batavia		75·2	238	e 11 48	− 2	i 22 11	+43	e 34·0	50·3
Innsbruck		75·5	340	i 11 54	+ 2	i 21 39	+ 7	e 31·4	46·3
Paris		75·6	347	i 11 56	+ 3	e 22 22	+49	e 32·4	50·4
Belgrade		75·6	332	i 11 58	+ 5	i 22 41	+68	e 31·5	51·4
Malabar		75·8	236	12 2	+ 8	i 21 43	+ 8	e 32·6	45·6
Zurich		76·0	341	e 11 56	+ 1	i 21 43	+ 6	—	—
Mobile		76·5	56	e 12 0	+ 2	e 21 42	− 1	37·4	44·7
Besançon		76·6	344	12 4	+ 5	22 25	+41	—	43·4
Le Mans		76·7	348	e 13 54	+115	e 24 24	+159	34·4?	52·6
Venice		77·0	339	12 24	+23	—	—	—	14·8
Sarajevo		77·1	334	i 11 48	−14	i 21 41	− 9	32·7	47·1
Mostar		77·4	334	e 11 44	−19	e 22 1	+ 8	e 30·8	50·9
Kodaikanal		78·0	272	(12 0)	− 7	—	—	12·0	53·0
Moncalieri		78·4	342	12 8	− 1	i 22 18	+13	38·8	55·8
Puy de Dôme		78·6	346	12 19	+ 8	22 24	+17	38·9	48·7
Florence		78·9	340	12 19	+ 7	22 55	+44	—	49·4
Rocca di Papa	E.	80·5	339	i 12 19	− 3	22 51	+22	e 33·4	47·2
	N.	80·5	339	—	—	22 48	+19	29·0	48·0
Marseilles		80·5	343	12 24	+ 2	i 22 42	+13	39·4	49·4
Pompeii		81·0	335	e 12 24	− 1	e 23 4	+29	32·4	52·4
Athens		81·1	328	12 23	− 3	i 23 26	+50	e 34·4	44·7
Barcelona		82·9	345	12 38	+ 3	23 28	+32	e 40·7	50·3
Tortosa	E.	83·7	347	12 46	+ 6	23 31	+25	40·7	51·3
	N.	83·7	347	12 38	− 2	23 39	+33	40·6	—
Toledo		85·3	350	12 54	+ 4	23 30	+ 8	e 40·4	57·1
Coimbra		85·4	353	12 58	+ 8	23 48	+25	36·1	44·8
Helwan		85·6	319	12 46	− 5	—	—	—	62·2
Lisbon		86·9	352	13 1	+ 3	23 37	− 3	e 35·4	43·4
Algiers		87·3	343	i 12 57	− 4	23 36	− 8	42·4	58·9
Rio Tinto		87·6	350	9 24	?	—	—	—	54·4
Granada		87·9	349	i 13 4	0	i 23 49	− 2	35·9	53·5
Azores		88·1	6	11 54	−72	21 36?	−137	28·9	62·4
Riverview		88·3	189	12 58	− 9	e 23 47	− 8	e 36·1	37·1
		88·3	189	i 13 23	+16	i 24 5	+10	—	42·4
Sydney		88·3	189	13 0	− 7	23 42	−13	38·4	54·4
San Fernando		88·9	350	13 12	+ 2	24 0	− 2	43·2	46·4
Adelaide		91·0	199	i 13 36	+15	i 24 12	−12	i 42·2	54·2
Melbourne		92·8	194	13 24	− 7	24 30	−13	44·9	67·8
Port au Prince		94·3	50	e 13 38	− 2	e 25 20	+21	38·8	53·6
Perth		94·4	219	13 35	− 5	(i 24 43)	−17	28·4	80·6
Wellington		96·0	170	e 14 6	+17	i 24 18	−58	40·8	42·4
		96·0	170	13 42	− 7	23 54	−82	—	49·4
Porto Rico	E.	97·6	45	—	—	—	—	50·6	59·0
Balboa Heights	E.	99·1	62	13 28	−38	25 36	−11	33·3	59·9
	N.	99·1	62	13 40	−26	25 32	−15	33·4	61·2
Christchurch		100·1	172	26 18	?S	(26 18)	+21	48·4	64·2
La Paz		126·7	65	19 10	[0]	32 2	?	55·3	57·4
Johannesburg		135·8	288	22 12	?PR_1	—	—	34·4	81·4
Andalgala		136·7	72	10 0	?	—	—	24·2	53·9
Mendoza		139·5	80	23 42	?PR_1	—	—	70·1	75·5
Cipolletti		143·8	85	18 12	?	—	—	28·5	76·4
Rio de Janeiro		144·0	40	i 19 58	[+11]	31 2	?	47·6	81·5
Chacarita	E.	146·4	71	22 24	?PR_1	—	—	74·0	84·8
	N.	146·4	71	22 42	?PR_1	—	—	73·6	97·7
La Plata	E.	146·9	72	i 19 54	[+ 5]	34 16	?	60·1	83·6
	N.	146·9	72	19 52	[+ 1]	34 11	?	57·9	92·8
Capetown		147·0	293	19 56	[+ 5]	44 2	?SR_1	87·4	88·6

Additional readings and notes: Hakodate gives also MN = +10·2m. Kobe S = +7m.56s. Sitka eE = +9m.43s., eN = +9m.52s., and +11m.43s., SR_1N = +15m.19s., LN = +19·4m., T_o = 16h.1m.42s. Honolulu eN = +14m.24s., LN = +20·6m., T_o = 16h.1m.46s. Victoria PE = +8m.27s., PN = +8m.32s., ME = +22·0m. Berkeley PN = +9m.59s., +10m.3s., +10m.18s., and +10m.23s., PE = +9m.52s., PZ = +9m.57s. and +10m.1s., SZ = +17m.7s. and twenty-five readings of PR, PS, and SR. Lick PZ = +14m.11s. and +14m.19s., PR_1Z = +15m.54s., e = +20m.59s., SZ = +22m.6s. Are the readings 4 min. too large? Upsala iP = +10m.40s. MN = +41·1m. Tucson P = +11m.11s., e = +19m.24s., PSN = +20m.6s., iN = +21m.15s., eE = +22m.55s. and +26m.22s., eN = +24m.8s., SR_2E = +28m.25s., SR_2N = +28m.13s., LN = +33·4m., T_o = 16h.1m.41s. Bergen

Continued on next page.

e = +10m.39s. Konigsberg iPN = +11m.5s., iPE = +11m.7s., iN = +11m.42s., +13m.19s., and +16m.5s. Ann Arbor SR_2 = +28m.36s., MN = +44·5m., T_0 = 16h.2m.0s. Edinburgh i = +21m.50s., SR_1 = +26m.27s. Toronto i = +13m.36s., +16m.12s., +25m.12s., and +29m.54s., also five other L readings. Hamburg SR_1 = +26m.36s., eL = +37·4m., MN = +42·1m., MZ = +44·0m. Tiflis P = +11m.13s., eN = +11m.20s. and +11m.27s., eS = +21m.26s., MN = +105·9m. Ottawa SR_2 = +28m.14s., T_0 = 16h.1m.56s. Stonyhurst T_0 = 16h.1m.36s. All readings given as on 4d. Apia PR_1 = +13m.30s. and +16m.23s., +29m.24s., T_0 = 16h.3m.14s. Ithaca SR_1 = +26m.5s., SR_2 = +29m.4s., also several L readings. De Bilt MN = +53·4m. Uccle iP = 11m.46s., MN = +44·0m., MZ = +43·7m. Vienna iP = +11m.50s., iZ = +12m.10s., iN = +12m.43s., iZ = +12m.29s., PR_2E = +16m.19s., i = 17m.58s., i = +20m.34s., PS = +21m.58s., i = +22m.40s., i = +23m.24s., SR_1 = +27m.4s., i = 31m.32s., MZ = +45·4m. Cheltenham PR_1E = +15m.32s., PSE = +22m.11s., PSN = +22m.3s., SR_1E = +26m.39s., SR_1N = +26m.51s., SR_2N = +29m.57s., eN = +31m.49s., iN = +32m.53s., eN = +34m.49s., LE = +39·5m. Strasbourg PR_1 = +15m.23s., PR_2 = +17m.12s., PR_3 = +18m.41s., SR_1 = +28m.13s., SR_2 = +31m.52s., SR_3 = +34m.11s., MN = +43·5m. Batavia iP = +11m.56s., iE = +12m.45s., and +19m.26s., i = +22m.1s. Innsbruck SR_1NE = +27m.46s., MNW = +45·7m. Paris ePE = +12m.2s., MN = +42·4m. Belgrade PR_1 = +12m.56s., SR_1N = +22m.58s. Malabar iSE = +22m.18s. Zurich iPZ = +12m.2s. Mobile MN = +45·7m., T_0 = 16h.2m.0s. Moncalieri MN = +56·4m. Florence S = +23m.14s. Rocca di Papa iP = +12m.22s., i = +12m.27s., eL = +28·0m. Marseilles SR_1 = +28m.44s. Athens iPE = +12m.26s., iN = +13m.14s., PR_1 = +16m.10s., PR_2 = +19m.24s., SR_1 = +29m.27s., MN = +44·4m., T_0 = 6h.0m.52s. Barcelona PR_1? = +17m.0s., MN = +50·4m. Toledo PR_1 = +16m.39s., PR_2 = +18m.43s., PR_3 = +20m.3s., SR_1 = +29m.35s., SR_2 = +33m.56s., SR_3 = +35m.45s., MNW = +47·2m. Coimbra PR_1E = +16m.11s., iE = +24m.13s., iN = +24m.20s., MN = +52·2m., T_0 = 16h.1m.41s., 51°·4N. 161°·5E. Algiers MN = +50·9m. Granada PR_1 = +15m.24s., SR_1 = +24m.32s., MN = +52·6m. Riverview PS = +24m.29s. and +26m.26s., eSR_1 = +29m.57s. and +31m.3s., eSR_2 = +34m.1s., MN = +42·4m., MZ = +63·0m., T_0 = 16h.1m.34s., 52°·0N. 175°·0W Sydney SR_2 = +33m.54s., PS = +24m.24s. San Fernando MN = +48·4m. Adelaide ePR_1 = +17m.12s., iSR_1 = +30m.54s., i = +33m.30s., iSR_2 = +35m.0s., iSR_3 = +37m.6s., i = +39m.9s. and +46m.24s., iL = +49·6m. Melbourne SR_1 = +30m.42s., SR_2 = +35m.0s. Perth PR_1 = +17m.1s., S = +20m.58s., true S is given as iSR_1. Wellington ePR_1 = +20m.18s. and +20m.0s., SR_1 = +29m.18s., SR_2 = +33m.12s., T_0 = 16h.3m.15s. and 16h.2m.51s. Porto Rico ePR_1E = +18m.17s., SR_2E = +38m.12s., SR_2N = +38m.8s., eE = +40m.29s., eN = +44m.0s., iLN = +49·4m. Balboa Heights LN = +33·3m., LE = +33·4m. Christchurch P_1 = +31m.42s., P_2 = +32m.54s., S? = +39m.6s., SR_1? = +41m.30s. La Paz i = +21m.12s., PR_1 = +23m.17s., PR_2 = +26m.41s., SR_1 = +38m.17s., SR_2 = +42m.7s., LN = +55·0m., MN = +99·8m. Andalgala LN = +24·0m. Mendoza L = +27·5m. La Plata iPN = +19m.58s., E = +30m.32s., N = +34m.17s., E = +38m.12s., N = +38m.5s., E = +39m.20s., N = +38m.57s., SR_1?E = +42m.36s., SR_1N = +43m.0s., N = +45m.30s., E = +46m.48s., T_0 = 16h.1m.12s.

Feb. 3d. 17h. 40m. 50s. Epicentre 54°·0N. 161°·0E. (as at 16h.).

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Osaka		26·3	233	5 54	+ 3	—	—	—	—
Vienna	Z.	73·5	338	i 11 51	+12	—	—	—	—
Georgetown	E.	74·5	45	e 11 2	−44	21 20	0	—	—
	N.	74·5	45	e 11 4	−42	21 15	− 5	—	—
Washington		74·5	45	11 46	0	21 16	− 4	—	—
Innsbruck		75·5	340	e 11 58	+ 6	—	—	e 48·1	—
Moncalieri		78·4	342	1 1	?	11 20	?	—	—
Rocca di Papa	E.	80·5	339	e 12 16	− 6	e 22 53	+24	(e 49·8)	51·5
	N.	80·5	339	i 12 49	+27	i 22 38	+ 9	(e 48·8)	—
Pompeii		81·0	335	—	—	(23 10)	+35	49·2	—
Tortosa	E.	83·7	347	e 12 10	−30	—	—	—	—
Granada		87·9	349	i 13 10	+ 6	23 49	− 2	—	—
La Paz		126·7	65	19 31	[+21]	—	—	57·2	—
La Plata	N.	146·9	72	19 54	[+ 3]	—	—	—	—

Additional readings and notes: Vienna gives also iPZ = +7m.16s. Rocca di Papa gives its L and M as P and M of another shock, also an intermediate shock for which P = +27m.26s. Pompeii, all readings are given as L, also L = +1m.10s. and +31m.10s. Tortosa ePN = +11m.10s. Granada iE = +13m.22s. La Plata PE = +19m.59s.

Feb. 3d. 18h. 42m. 45s. (I) } Epicentre 54°·0N. 161°·0E. (as at 16h. and 17h.).
50m. 30s. (II) }

Some observatories record apparently a third shock.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I	Ootomari	13·7	245	e 3 15	− 7	—	—	6·4	—
I	Hakodate	18·1	236	4 45	+27	—	—	—	—
I	Mizusawa E.	20·1	230	4 41	− 1	8 19	− 6	—	—
I	Nagoya	25·2	231	4 35	−65	8 55	−72	—	—
I	Osaka	26·3	233	5 51	0	10 48	+20	14·0	15·3
I	Kobe	26·5	234	5 48	− 5	10 18	−14	13·1	15·8
I	Zi-ka-wei	36·2	248	e 7 6	−18	e 16 0	?SR_1	—	—
I	Taihoku	41·1	241	—	—	e 17 39	?SR_1	22·8	25·4
I	Manila	50·3	234	e 9 11	+ 2	—	—	—	—
I	Konigsberg	66·4	337	i 11 13	+19	i 19 34	− 8	—	—
I	Hamburg	69·8	342	i 11 31	+15	e 20 41	+17	e 42·8	49·4
I	Lemberg	70·1	332	e 11 33	+15	e 20 57	+30	e 39·0	41·6
I	Uccle	73·4	347	e 11 49	+11	—	—	—	—
II		73·4	347	e 11 51	+13	—	—	—	—
I	Vienna	73·5	338	e 11 49	+10	—	—	i 29·3	49·2
II		73·5	338	i 11 55	+16	i 21 34	+26	—	41·5
I	Fordham E.	74·1	41	—	—	—	—	39·2	50·2
I	Georgetown E.	74·5	45	e 11 55	+ 9	—	—	e 27·8	—
I	N.	74·5	45	e 11 52	+ 6	—	—	e 27·8	—
II	E.	74·5	45	i 11 52	+ 6	—	—	30·5	—
II	N.	74·5	45	i 11 54	+ 8	—	—	30·5	—
I	Washington	74·5	45	11 51	+ 5	—	—	—	—
II		74·5	45	11 46	0	—	—	—	—
I	Strasbourg Z.	75·0	344	i 12 3	+14	i 20 12	−74	—	—
I	Batavia	75·2	238	i 11 51	+ 1	i 21 29	+ 1	—	—
I	Innsbruck	75·5	340	i 12 2	+10	e 21 15	−17	—	—
II		75·5	340	i 12 5	+13	e 12 36	+ 4	e 33·5	44·3
I	Paris	75·6	347	e 12 2	+ 9	—	—	31·2	46·2
I	Belgrade	75·6	332	e 12 2	+ 9	—	—	e 44·3	49·4
II		75·6	332	e 12 6	+13	—	—	—	—
I	Mobile E.	76·5	56	—	—	—	—	39·6	—
I	Moncalieri	78·4	342	12 26	+17	—	—	—	—
II		78·4	342	11 48	−21	—	—	—	—
I	Florence	78·9	340	12 15	+ 3	—	—	—	—
II		78·9	340	12 11	− 1	—	—	—	—
I	Rocca di Papa E.	80·5	339	e 12 29	+ 7	—	—	—	41·6
II		80·5	339	e 12 34	+12	i 22 44	+15	—	—
I	N.	80·5	339	e 12 22	0	—	—	e 39·1	40·8
II		80·5	339	12 42	+20	—	—	—	—
I	Z.	80·5	339	e 12 23	+ 1	—	—	—	—
II		80·5	339	i 12 32	+10	—	—	—	—
I	Pompeii	81·0	335	13 15	+50	—	—	37·2	57·2
II		81·0	335	13 30	+65	—	—	—	—
I	Athens	81·1	328	e 12 25	− 1	30 27	?SR_1	e 46·2	51·0
II		81·1	328	e 12 34	+ 8	—	—	—	—
I	Barcelona	82·9	345	e 13 17	+42	23 21	+25	—	—
I	Tortosa	83·7	347	12 47	+ 7	23 41	+35	—	—
II		83·7	347	12 48	+ 8	23 14	+ 8	—	—
I	Toledo	85·3	350	11 51	−59	—	—	—	—
II		85·3	350	12 53	+ 3	—	—	—	—
I	Granada	87·9	349	12 7	−57	(23 55)	+ 4	—	—
II		87·9	349	13 18	+14	23 52	+ 1	—	—
I	Riverview	88·3	189	—	—	23 57	+ 2	—	—
I	La Paz	126·7	65	19 30	[+20]	—	—	56·5	—
I	La Plata E.	146·9	72	e 20 9	[+18]	—	—	—	83·2
I	N.	146·9	72	20 2	[+11]	—	—	—	95·9

Additional readings and notes to shock I: Mizusawa gives also SN = +8m.27s. Konigsberg iN = +20m.22s. and +21m.26s. Fordham LE = +47·2m. Batavia iN = +22m.5s. Paris MN = +55·2m. Belgrade MN = +52·4m. Mobile LN = +41·2m. Florence P = +20m.15s. Athens MN = +53·6m. Tortosa I PE = +12m.50s. Granada I S is given as PR_1; also i = +23m.15s. (= PR_1 for II shock), SR_1 = +33m.49s. (II shock ?). Riverview eP = +23m.27s., i = +23m.40s. These are about 2 min. late for II shock; too early for PR_1.

Feb. 3d. Readings also at 1h. (Ekaterinburg), 4h. (Ekaterinburg and Zi-ka-wei), 5h. (Zi-ka-wei, Kobe, La Paz, Manila, Riverview, and near Osaka), 8h. (Nagasaki), 14h. (Rio Tinto, Zi-ka-wei, and Ekaterinburg), 15h. (Simla), 16h. (Taihoku, Vienna, Toledo, Manila, La Paz, Granada (2), Tortosa, Moncalieri, Osaka, and Rocca di Papa (2)), 17h. (Rocca di Papa (3), La Paz, La Plata, and Vienna), 18h. (Toledo, Taihoku, Nagasaki, Bidston, Rocca di Papa (2), Vienna (2), and Osaka (2)), 19h. (Rocca di Papa, Konigsberg, and Barcelona), 22h. (Victoria), 23h. (Nagasaki, Uccle, De Bilt).

Feb. 4d. 15h. 46m. 48s. Epicentre 31°·0S. 72°·0W. (as on 1917 July 27d.).

$A = +\cdot265$, $B = -\cdot815$, $C = -\cdot515$; $D = -\cdot951$, $E = -\cdot309$; $G = -\cdot159$, $H = +\cdot490$, $K = -\cdot857$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mendoza		3·6	122	7 6	?	—	—	8·0	8·3
Pilar	E.	7·0	98	—	—	—	—	4·5	4·7
	N.	7·0	98	—	—	—	—	6·6	6·9
Chacarita	E.	11·9	111	8 12	?	—	—	—	9·2
	N.	11·9	111	8 0	?	—	—	—	9·5
La Plata	E.	12·4	111	3 5	0	5 24	− 5	6·4	7·2
	N.	12·4	111	—	—	5 22	− 7	6·4	6·5
La Paz		14·9	15	e 3 33	− 5	i 6 36	+ 6	8·2	10·0

No additional readings.

Feb. 4d. Readings also at 0h. (Manila), 1h. (La Paz, Upsala, Zi-ka-wei, De Bilt, Ootomari, Nagasaki, and near Batavia, and Malabar), 2h. (Toronto, Nagasaki, Victoria, Mizusawa, and Rio Tinto (2)), 3h. (Rio Tinto, Ekaterinburg, and De Bilt), 4h. (Colombo and Zi-ka-wei (2)), 5h. (Manila), 6h. (Zi-ka-wei and Ekaterinburg), 7h. (Ekaterinburg, Colombo, and Zi-ka-wei), 8h. (Zi-ka-wei, Ekaterinburg, and La Paz), 9h. (Zi-ka-wei, La Plata, and La Paz), 10h. (Zi-ka-wei and Mendoza), 11h. (Ottawa, Zi-ka-wei, Ekaterinburg (2), and Bidston), 12h. (Uccle, Zi-ka-wei (2), Victoria, Manila, Ekaterinburg, De Bilt (2), and Ootomari), 13h. (Konigsberg, Hamburg, Bidston, Upsala, Toronto, Eskdalemuir, Florence, Kew, Zi-ka-wei, Colombo, and near Mizusawa), 14h. (Zi-ka-wei and near Batavia, Malabar, and Taihoku), 15h. (Nagasaki and Zi-ka-wei), 16h. (Ekaterinburg, Ottawa, and Colombo), 17h. (Ottawa, Nagasaki, Ekaterinburg, and Zi-ka-wei), 18h. (Ottawa, Zi-ka-wei (2), and Ekaterinburg) 19h. (Zi-ka-wei), 20h. (Zi-ka-wei, Taihoku, and Ekaterinburg), 21h. (Nagasaki).

Feb. 5d. 21h. 27m. 12s. Epicentre 39°·0N. 143°·5E.

$A = -\cdot625$, $B = +\cdot462$, $C = +\cdot629$; $D = +\cdot595$, $E = +\cdot804$; $G = -\cdot506$, $H = +\cdot374$, $K = -\cdot777$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa	E.	1·8	274	0 27	− 1	0 49	− 2	—	—
	N.	1·8	274	0 30	+ 2	0 53	+ 2	—	—
Hakodate		3·5	325	1 0	+ 5	—	—	—	—
Nagoya		6·5	236	0 25	−74	—	—	1·0	1·4
Osaka		7·8	238	2 13	+15	(3 23)	− 8	3·4	4·6
Ekaterinburg		54·5	318	—	—	—	—	13·8	19·8

Osaka gives also MN = +3·7m. Ekaterinburg readings probably refer to a separate shock.

Feb. 5d. 22h. 23m. 10s. (I) } Epicentre 50°·5N. 164°·0E. (as on 2d.).
22h. 58m. 20s. (II) }

$A = -\cdot611$, $B = +\cdot175$, $C = +\cdot772$; $D = +\cdot276$, $E = +\cdot961$; $G = -\cdot742$, $H = +\cdot213$, $K = -\cdot636$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I Ootomari		14·5	263	e 3 43	+10	—	—	9·0	11·7
II		14·5	263	e 3 40	+ 7	—	—	9·4	10·6
I Nagoya		24·9	242	4 57	−40	—	—	—	—
I Osaka		26·1	244	—	—	—	—	7·1	7·4
I Zi-ka-wei		36·9	255	7 37	+ 8	—	—	e 20·1	23·0
II		36·9	255	—	—	—	—	—	24·4
I Taihoku		41·3	248	18 15	?L	—	—	(18·2)	—
I Victoria	E.	45·4	63	15 29	?S	(15 29)	+ 9	24·3	30·2
I	N.	45·4	63	15 19	?S	(15 19)	− 1	24·2	33·6
II	E.	45·4	63	—	—	—	—	23·6	28·7
II	N.	45·4	63	—	—	—	—	24·0	28·8
I Manila		49·9	240	e 9 50	+44	—	—	—	—
II		49·9	240	e 6 40	?	—	—	—	—
I Ekaterinburg		55·5	320	—	—	17 2	−26	26·8	35·3
I Upsala		66·3	342	—	—	—	—	e 36·8	—
II Konigsberg		70·3	339	—	—	—	—	e 36·7	44·7
II Toronto		70·9	43	—	—	—	—	37·4	40·9
I Ottawa		71·0	40	—	—	—	—	e 38·3	—
II		71·0	40	—	—	—	—	27·7	—
I Hamburg		73·6	344	e 11 41	+ 1	—	—	—	—
II		73·6	334	e 11 40	0	—	—	e 38·7	—
I De Bilt		75·8	347	—	—	—	—	e 41·8	—
II		75·8	347	—	—	—	—	e 40·7	50·6
II Kew		77·1	350	—	—	—	—	—	45·7
I Uccle		77·2	348	—	—	—	—	e 37·8	—
II		77·2	348	—	—	—	—	e 40·7	—
I Vienna	Z.	77·4	339	12 1	− 2	—	—	—	—
I Kodaikanal		80·0	274	45 38	?L	—	—	(45·6)	—
II		80·0	274	50 28	?L	—	—	(50·5)	—
I Colombo		81·0	270	23 20	?S	(23 20)	+45	(41·8)	60·3
I Moncalieri		82·3	343	—	—	e 38 1	?	—	—
II		82·3	343	—	—	e 15 23	?	44·9	52·5
I Florence		82·7	340	21 50	?S	(21 50)	−64	—	—
II		82·7	340	—	—	—	—	—	61·7
I Rocca di Papa		84·0	339	e 12 32	−10	i 22 48	−19	e 26·9	29·1
I Tortosa	N.	87·5	348	—	—	—	—	e 48·8	52·6
II	N.	87·5	348	—	—	—	—	e 48·7	57·8
II Toledo		89·0	350	—	—	—	—	e 54·7	59·6
Helwan		89·3	320	i 23 41	?S	(i 23 41)	−25	—	34·7
II Algiers		91·1	345	—	—	e 22 45	?	58·7	—
I Rio Tinto		91·3	353	38 50	?L	—	—	(38·8)	—
II		91·3	353	—	—	—	—	—	52·7

Additional readings: Zi-ka-wei II gives also MN = +28·0m., MZ = +29·9m. Victoria I SE = +19m.9s., SN = +18m.59s. (?SR_1). Toronto II eL = +38·8m. Ottawa I LE = +39·8m. Eskdalemuir (Δ = 73°·6 Az = 353°) gives simply 23h. Rocca di Papa I ePV = +22m.50s., ePE = +23m.2s., eL = +21·9m. Algiers II e = +26m.10s.

Feb. 5d. Readings also at 0h. (La Paz), 1h. (Colombo and Ootomari), 2h. (Colombo), 3h. (Victoria, Manila, Ekaterinburg, Ottawa, and Zi-ka-wei (2)), 4h. (Rio Tinto, Moncalieri, Upsala, Uccle, De Bilt, Hamburg, and Konigsberg), 5h. (Colombo), 6h. (Colombo, Zi-ka-wei (2), and Ekaterinburg), 7h. (Ekaterinburg and Colombo), 8h. (Colombo, Ekaterinburg, Zi-ka-wei, and Ottawa), 9h. (La Paz), 10h. (Ekaterinburg, La Paz, and Colombo), 11h. (Nagasaki, Manila, Colombo, Zi-ka-wei, and Vienna), 12h. (Uccle, Ekaterinburg, Ottawa, Toronto, and Perth), 13h. (Batavia), 14h. (Colombo), 15h. (Nagasaki), 17h. (Nagasaki and Ekaterinburg), 18h. (Florence, Colombo (2), and near Osaka), 19h. (Colombo), 21h. Zi-ka-wei), 22h. (near Taihoku).

Feb. 6d. 15h. 21m. 32s. Epicentre 43°·5N. 17°·0E. (as on 1920 June 20d.).

$A = +\cdot694$, $B = +\cdot212$, $C = +\cdot688$; $D = +\cdot292$, $E = -\cdot956$; $G = +\cdot658$, $H = +\cdot201$, $K = -\cdot725$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Sinj		0·4	313	i 0 18	+12	i 0 26	+15	—	0·5
Travnik		0·5	120	i 0 4	− 4	—	—	—	—
Mostar		0·6	104	− i 0 2	−11	—	—	—	—
Sarajevo		1·1	70	i 0 1	−16	i 0 10	−21	—	—
Belgrade		2·8	62	e 0 42	− 2	i 1 22	+ 5	—	1·6
Pompeii		3·3	220	i 0 58	+ 6	1 33	+ 2	2·0	2·5
Rocca di Papa		3·6	243	i 1 1	+ 5	i 1 39	0	2·2	2·6
Venice		3·8	301	1 34	?S	2 34	?L	(2·6)	3·6
Florence		4·2	275	1 5	0	—	—	—	3·0
Vienna		4·8	355	e 1 12	− 2	2 18	+ 7	2·5	3·4
Innsbruck		5·5	316	i 1 29	+ 4	i 2 30	− 1	—	3·3
Moncalieri		6·8	286	1 53	+ 9	3 22	+17	(3·4)	5·9
Zurich		7·1	307	e 1 48	0	i 3 18	+ 5	—	—
Athens		7·5	135	e 1 55	+ 1	3 47	+23	4·2	4·5
Strasbourg		8·2	312	e 1 58	− 6	e 3 40	− 2	4·5	4·7
Besançon		8·6	300	2 18	+ 8	3 59	+ 6	—	4·5
Puy de Dôme		10·1	287	—	—	e 4 34	+ 2	e 5·9	—
Hamburg		11·1	338	—	—	e 4 28	−29	—	6·5
Paris		11·3	303	e 3 0	+11	—	—	6·5	8·5
Uccle		11·3	305	e 2 52	+ 3	—	—	5·8	—
Konigsberg	Z.	11·6	10	—	—	e 4 55	−14	—	8·0
De Bilt		11·7	321	—	—	—	—	e 6·3	—
Tortosa	N.	12·5	263	—	—	(e 5 28)	− 4	e 5·5	7·5
Algiers		12·5	242	2 20	−46	e 5 56	+24	7·7	8·5
Toledo		16·1	264	—	—	8 42	?L	(8·7)	—
Granada		16·8	255	i 4 8	+ 6	7 35	+22	—	—
Eskdalemuir		17·6	319	—	—	—	—	9·5	—
Tiflis	E.	20·4	86	e 5 7	+21	e 8 0	−32	e 12·5	15·3
Ekaterinburg		30·3	49	—	—	—	—	15·0	—

Additional readings and notes: Rocca di Papa (L) = +4·6m. Vienna iPZ = +1m.15s., PZ = +1m.32s., iZ = +2m.32s., iN = +2m.42s., SZ = +2m.50s., MZ = +2·9m. Moncalieri MN = +6·1m. Athens i = +3m.11s., MN = +4·3m., T_o = 15h.21m.23s., Strasbourg MN = +4·6m. Paris MN = L = +6·5m. Tiflis eN = +7m.22s., MN = +16·1m. All readings are given as for 0h.

Feb. 6d. Readings also at 0h. (Toledo, Rio de Janeiro, and La Paz), 1h. (Colombo and Nagasaki), 2h. (Batavia and Malabar), 3h. (Colombo), 4h. (Azores), 5h. (Ekaterinburg (2), Colombo, and Florence), 7h. (Taihoku and Colombo), 8h. (Colombo), 9h. (Zi-ka-wei, Colombo, and Ekaterinburg), 10h. (Colombo), 11h. (Ekaterinburg and Nagasaki), 12h. (Colombo, Ekaterinburg, Zi-ka-wei, and Ootomari), 13h. (Ottawa, La Paz, and Colombo and Nagoya), 16h. (Colombo and near Mostar and Belgrade), 17h. and 18h. (Colombo), 19h. (Colombo and Nagasaki), 20h. (Colombo, Nagasaki, and near Belgrade), 21h. (Colombo and Ootomari), 22h. (Ottawa, Ekaterinburg, Zi-ka-wei, and near Zurich).

Feb. 7d. Readings at 1h. (2), 2h. (2), 5h., and 6h. (Colombo), 7h. (Ootomari and Colombo), 9h. and 10h. (Colombo), 11h. (Ekaterinburg and Apia), 12h. (Colombo and near Mostar), 13h. and 15h. (Colombo), 17h. (Zi-ka-wei and Hong-Kong), 18h. and 22h. (Nagasaki), 23h. (Capetown).

Feb. 8d. 0h. 33m. 24s. Epicentre 18°·2N. 97°·5W. (as on 1920 Jan. 4d.).

$A = -\cdot124$, $B = -\cdot942$, $C = +\cdot312$; $D = -\cdot991$, $E = +\cdot130$; $G = -\cdot041$, $H = -\cdot309$, $K = -\cdot950$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Tucson		18·5	322	4 16	− 7	—	—	9·4	9·7
Chicago		25·0	18	5 30	− 8	10 8	+ 5	13·1	—
Ann Arbor		26·8	23	6 0	+ 4	11 12	+35	14·4	—
Georgetown	E.	27·3	36	i 6 9	+ 8	e 10 41	− 5	e 16·6	—
Washington		27·3	36	6 4	+ 3	10 42	− 4	—	—

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Lick		28·5	317	—	—	e 9 55	−73	—	—
Berkeley		29·3	317	i 5 49	−32	(10 41)	−42	14·1	—
Toronto		29·7	27	—	—	—	—	e 23·8	25·1
Ithaca		30·1	33	6 12	−17	11 36	0	e 18·6	—
Ottawa		32·7	30	6 51	− 3	12 18	− 1	e 16·6	—
Northfield		33·3	34	—	—	e 18 36	?L	24·6	—
Victoria	E.	36·7	331	7 4	−24	11 29	−111	18·3	20·4
	N.	36·7	331	6 59	−29	11 39	−101	18·3	20·6
La Paz		45·1	140	i 8 36	+ 2	15 21	+ 5	22·5	25·9
Malaga		81·6	54	12 37	+ 9	—	—	—	—
Granada		82·1	53	12 23	− 8	—	—	12·7	13·3
Vienna		91·3	38	13 21	− 2	—	—	—	—
Ekaterinburg		102·8	12	—	—	—	—	45·6	—

Additional readings: Tucson gives also LN = +10·0m., MN = +10·1m. Ann Arbor PS = +9m.42s., L = +19·0m. Georgetown eSN = +12m.35s. Berkeley iZ = +5m.59s., LE = +14·0m. and +14·3m., S is given as LN. Toronto e = +19m.36s., eL = +32·7m. Ithaca e = +22m.0s. La Paz iS = +15m.36s., T_o = 0h.33m.26s. Vienna i = +17m.6s.

Feb. 8d. Readings also at 0h. (Honolulu, Apia, Nagasaki, Adelaide, Melbourne, Riverview, and Ekaterinburg), 2h. (Manila), 3h. (Ottawa, Riverview, and Adelaide), 5h. (Zante), 6h. (Manila), 7h. (Ekaterinburg, Zi-ka-wei, and Ottawa), 8h. (Honolulu, Manila, Zi-ka-wei, Konigsberg, Hong Kong, Kobe, Toronto, Taihoku, Osaka, Chicago, Uccle, Victoria, Colombo, Kodaikanal, Simla, and De Bilt), 11h. (Granada and Nagasaki), 12h. (Nagasaki), 14h. (La Paz, Tucson, Victoria, and Ottawa), 16h. (Nagasaki), 17h. (Algiers), 20h. (Rio Tinto), 22h. (La Paz and La Plata).

Feb. 9d. Readings at 0h. (Zi-ka-wei, Colombo, and Nagasaki), 1h. (La Paz and La Plata), 2h. (Nagasaki), 4h. (La Paz), 6h. (Athens and Nagasaki), 9h. (Ekaterinburg and near Taihoku), 10h. (Nagasaki), 11h. (Ottawa, Victoria, Chicago, and Zi-ka-wei), 12h. (Nagasaki, Nagoya, and near Lick and Berkeley), 15h. (Ekaterinburg), 16h. (Colombo and Ekaterinburg), 18h. (near Balboa Heights), 19h. (La Paz), 21h. (Nagasaki), 22h. (La Plata).

Feb. 10d. Readings at 0h. (Colombo and La Paz), 1h. (near Taihoku), 2h. Colombo, Zi-ka-wei, and Ekaterinburg), 5h. (Colombo), 7h. (Ekaterinburg, Honolulu, Zi-ka-wei, and near Batavia), 8h. (Victoria and La Paz), 9h. (Zi-ka-wei), 11h. (Nagasaki and Colombo), 12h. (Ekaterinburg, Nagasaki (2), and Zi-ka-wei), 13h. (Colombo and Nagasaki), 15h. (Colombo), 17h. (Ekaterinburg), 19h. (near Mizusawa), 20h. (Nagasaki), 23h. (Florence).

Feb. 11d. 18h. 26m. 24s. Epicentre 37°·0N. 141°·0E. (as on 1922 June 3d.).

A = −·621, B = +·503, C = +·602; D = +·629, E = +·777; G = −·468, H = +·379, K = −·799.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa	E.	2·1	2	0 40	+ 7	1 8	+10	—	—
	N.	2·1	2	0 42	+ 9	1 25	+27	—	—
Nagoya		3·8	242	0 35	−24	—	—	—	0·8
Hakodate		4·8	357	2 2	+48	—	—	—	3·7
Osaka		5·1	245	1 30	+11	—	—	2·7	3·2
Kobe		5·3	246	1 22	0	—	—	2·5	2·9
Zi-ka-wei		17·2	256	e 3 56	−11	—	—	—	10·6

Additional readings: Nagoya gives also P = 18h.26m.5s. Hakodate MN = +3·3m. Osaka MN = +3·4m.

1923. Feb. 11d. 22h. 45m. 34s. Epicentre 55°·0N. 162°·5E.

A = −·547, B = +·172, C = +·819 ; D = +·301, E = +·954 ;
G = −·781, H = +·246, K = −·574.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari		14·9	244	(3 43)	+ 5	—	—	3·7	7·1
Mizusawa	E.	21·4	231	5 0	+ 2	8 58	+ 5	11·5	—
	N.	21·4	231	4 57	− 1	8 56	+ 3	—	—
Zi-ka-wei		37·4	249	e 8 15	+42	—	—	—	23·3
Taihoku		42·4	241	27 45	?L	—	—	(27·8)	—
Victoria	E.	44·2	68	8 35	+ 8	15 10	+ 5	22·7	28·1
	N.	44·2	68	8 20	− 7	14 56	− 9	23·7	26·6
Honolulu	E.	44·7	123	—	—	e 14 6	−65	e 18·8	19·3
Hong Kong		48·4	248	18 43	?S	(18 43)	+104	—	31·4
Manila		51·6	235	e 9 46	+29	—	—	—	—
Berkeley	E.	51·7	79	—	—	(16 26)	−14	27·1	—
Lick	N.	52·5	79	—	—	—	—	e 22·1	—
Upsala		61·8	341	—	—	e 19 26	+40	e 35·4	42·0
Simla	N.	62·4	285	e 10 32	+ 4	—	—	—	—
Konigsberg		65·8	338	i 10 56	+ 6	(19 21)	−14	e 37·4	39·4
Chicago		66·4	50	10 53	− 1	19 43	+ 1	33·1	—
Ann Arbor		67·6	48	—	—	e 19 26	−31	38·4	—
Ottawa		68·2	40	20 3	?S	(20 3)	− 1	39·4	—
Toronto		68·2	44	—	—	—	—	37·3	39·9
Edinburgh		68·5	352	—	—	—	—	—	40·4
Eskdalemuir		69·0	352	—	—	(20 18)	+ 4	39·4	—
Hamburg		69·1	344	e 11 11	− 1	—	—	e 37·4	45·5
Tiflis		69·8	315	e 10 54	−22	e 20 27	+ 3	38·4	41·4
Stonyhurst		70·4	351	e 20 26	?S	(e 20 26)	− 5	—	46·4
Bidston		70·9	351	24 26	?	—	—	—	—
De Bilt	E.	71·3	346	—	—	e 20 47	+ 5	e 34·4	43·2
	N.	71·3	346	—	—	—	—	e 36·4	46·3
	Z.	71·3	346	11 26	+ 1	—	—	—	46·3
Oxford		72·4	350	—	—	—	—	41·1	46·2
Uccle		72·6	347	—	—	—	—	e 35·4	—
Kew		72·6	350	—	—	—	—	—	49·4
Vienna		72·9	338	e 11 36	+ 1	21 8	+ 7	40·4	45·4
Georgetown	N.	73·2	44	e 11 15	−22	—	—	e 44·6	—
Washington		73·2	44	—	—	—	—	e 39·4	—
Strasbourg		74·3	344	e 11 42	− 2	—	—	e 49·4	—
Paris		74·8	347	—	—	—	—	e 48·4	—
Belgrade		75·2	333	e 12 1	+11	e 25 36	?SR$_1$	e 43·0	—
Besançon		75·9	345	—	—	—	—	46·4	—
Batavia		76·5	238	e 12 0	+ 2	i 21 40	− 3	—	—
Moncalieri		77·8	342	10 57	−69	24 51	?SR$_1$	41·8	51·1
Kodaikanal		78·8	273	—	—	—	—	44·4	50·6
Rocca di Papa		79·9	338	e 12 14	− 4	20 44	−98	e 44·4	52·9
Barcelona		82·1	346	—	—	—	—	e 38·6	—
Coimbra		84·5	354	44 26	?L	50 26	?	54·9	—
Toledo		84·5	350	12 40	− 5	23 6	− 8	45·4	59·3
Helwan		85·4	319	i 23 13	?S	(i 23 13)	−10	—	59·2
Algiers		86·6	344	e 12 51	− 6	23 26	−11	58·4	—
Rio Tinto		86·7	351	40 26	?L	—	—	(40·4)	53·4
Granada		87·0	350	12 52	− 7	25 5	+84	—	—
San Fernando		88·1	351	—	—	—	—	—	55·4
La Paz		125·5	67	19 16	[+ 9]	e 33 16	?	60·3	75·8
Andalgala	N.	135·6	74	69 50	?L	—	—	76·0	76·3
La Plata	N.	145·8	72	19 52	[+ 2]	—	—	80·5	93·8

Additional readings : Ootomari gives also P = +0m.52s. Zi-ka-wei MN = +22·8m., MZ = +24·5m. Honolulu eN = +18m.56s., MN = +19·7m. Berkeley LE = +27·6m. Lick LN = +22·4m. Upsala MN = +41·7m. Konigsberg S is given as PR$_3$, SR$_3$ = +33m.46s. Ottawa S? = +24m.41s., L = +27·4m. Toronto eL = +38·3m. Eskdalemuir gives S as LE, also eN = +25m.26s. Hamburg MN = +43·9m., MZ = +47·8m. Tiflis eE = +11m.30s. Vienna iL = +41·6m. Georgetown eLE = +41·9m., LEN = +48·6m. Washington L = +44·4m. Belgrade L = +50·6m. Rocca di Papa ePE = +12m.26s., eL = +51·4m. San Fernando MN = +58·0m. La Plata ME = +93·3m.

Feb. 11d. Readings also at 0h. (near Athens), 1h. (Ekaterinburg, Zi-ka-wei, and Ottawa), 4h. (Nagasaki), 7h. and 12h. (Colombo), 17h. (Ootomari, Vienna, Konigsberg, Victoria, Upsala, Moncalieri, Ottawa, Toronto, and Zi-ka-wei), 18h. (Hamburg and De Bilt), 21h. (Hakodate and near Taihoku).

1923. Feb. 12d. 1h. 58m. 36s. Epicentre **55°·0N. 162°·5E.**
(as on Feb. 11d.).

A = −·547, B = +·172, C = +·819 ; D = +·301, E = +·954 ;
G = −·781, H = +·246, K = −·574.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari		14·9	244	3 39	+ 1	—	—	7·1	8·3
Hakodate		19·5	236	4 57	+22	—	—	—	—
Mizusawa	E.	21·4	231	4 45	−13	8 35	−18	11·1	—
	N.	21·4	231	4 47	−11	8 34	−19	11·0	—
Nagoya		26·5	232	4 21	−92	—	—	—	—
Osaka		27·6	234	6 5	+ 1	10 14	−38	14·0	19·2
Kobe		27·8	235	e 5 43	−23	—	—	e 13·2	17·7
Zi-ka-wei		37·4	249	e 8 17	+44	—	—	—	25·0
Victoria	E.	44·2	68	8 18	− 9	(14 37)	−28	14·6	18·8
	N.	44·2	68	8 18	− 9	(14 58)	− 7	15·0	19·2
Honolulu	E.	44·7	123	8 26	− 5	—	—	21·6	24·1
	N.	44·7	123	—	—	15 15	+ 4	21·3	23·0
Hong Kong		48·4	248	—	—	—	—	—	30·2
Manila		51·6	235	e 9 15	− 2	—	—	—	—
Berkeley		51·7	79	e 9 18	0	(16 44)	+ 4	27·4	—
Lick	N.	52·5	79	13 25	?PR_1	—	—	27·2	—
Upsala		61·8	341	10 31	+ 7	e 18 52	+ 6	e 32·4	39·4
Simla	N.	62·4	285	e 9 54	−34	—	—	—	—
Konigsberg		65·8	338	—	—	i 19 18	−17	e 35·4	42·4
Chicago		66·4	50	11 4	+10	19 48	+ 6	35·4	—
Ann Arbor		67·6	48	20 0	?S	(20 0)	+ 3	35·4	—
Ottawa		68·2	40	20 5	?S	(20 5)	+ 1	e 32·4	44·4
Toronto		68·2	44	—	—	28 42	?	36·6	40·4
Edinburgh		68·5	352	—	—	—	—	e 35·4	52·9
Eskdalemuir		69·0	352	—	—	i 20 21	+ 7	32·4	35·4
Hamburg		69·1	344	i 11 14	+ 2	—	—	e 35·4	42·4
Lemberg		69·6	333	—	—	—	—	e 39·3	45·8
Tiflis		69·8	315	e 11 20	+ 4	e 20 21	− 3	39·4	42·2
Northfield		70·4	39	—	—	—	—	44·4	—
Ithaca		70·4	43	—	—	e 25 6	?SR_1	37·4	—
Stonyhurst		70·4	351	e 20 54	?S	(e 20 54)	+23	—	46·9
Bidston		70·9	351	—	—	—	—	—	42·4
De Bilt	E.	71·3	346	—	—	20 50	+ 8	33·4	42·7
	N.	71·3	346	—	—	—	—	35·4	43·7
	Z.	71·3	346	11 28	+ 3	—	—	—	47·2
Oxford		72·4	350	—	—	21 5	+10	32·9	52·8
Kew		72·6	350	—	—	—	—	—	46·4
Uccle		72·6	347	e 11 34	0	21 1	+ 4	33·4	43·4
Fordham	E.	72·8	42	—	—	—	—	40·4	—
Vienna		72·9	338	e 11 34	− 1	21 8	+ 7	e 37·4	52·4
Georgetown		73·2	44	e 11 38	+ 1	e 20 46	−18	e 38·7	—
Washington		73·2	44	11 47	+10	21 7	+ 3	31·0	—
Strasbourg		74·3	344	11 45	+ 1	—	—	e 44·4	—
Bombay		74·4	280	e 16 19	?PR_1	—	—	—	—
Paris		74·8	347	—	—	e 22 6	+42	46·4	53·4
Belgrade		75·2	333	e 11 39	−11	e 21 31	+ 3	43·7	—
Zurich		75·3	342	i 11 51	0	e 21 36	+ 7	e 44·4	—
Besançon		75·9	345	—	—	21 11	−25	—	42·4
Batavia		76·5	238	e 11 51	− 7	i 21 23	−20	—	—
Moncalieri		77·8	342	12 8	+ 2	21 53	− 5	40·2	49·1
Florence		78·2	340	12 9	+ 1	22 4	+ 2	—	53·4
Kodaikanal		78·8	273	43 48	?L	—	—	57·3	60·2
Rocca di Papa		79·9	338	e 12 24	+ 6	22 24	+ 2	—	54·5
Barcelona		82·1	346	—	—	—	—	e 46·8	—
Tortosa	E.	83·0	348	12 27	− 9	—	—	—	—
Lisbon		83·5	354	—	—	—	—	e 48·3	—
Coimbra		84·5	353	12 44	− 1	e 23 24	+10	e 50·4	61·7
Toledo		84·5	350	12 43	− 2	23 3	−11	e 46·4	59·6
Algiers		86·6	344	e 12 50	− 7	23 15	−22	e 41·4	49·9
Rio Tinto		86·7	351	21 24	?	—	—	—	61·4
Granada		87·0	350	i 12 58	− 1	i 23 31	−10	e 46·4	50·7
San Fernando	E.	88·1	351	—	—	—	—	—	56·9
Riverview		89·4	190	—	—	—	—	e 44·3	53·4
Melbourne		94·0	194	e 15 30	+112	e 24 12	−44	—	62·2
La Paz		125·5	67	19 4	[− 3]	e 32 19	?	e 65·3	71·3

For Notes see next page.

NOTES TO FEB. 12d. 1h. 58m. 36s.

Additional readings and notes: Osaka gives also MN = +16·0m. Kobe MN = +16·7m. Victoria SN = +10m.16s., SE = +10m.22s. Honolulu SR_1E = +18m.44s., SR_1N = +18m.52s., T_0 = 1h.58m.26s. Berkeley gives S as L, also LE = +17·1m., LZ = +26·4m., +27·7m., and +30·1m. Upsala MN = +39·9m. Konigsberg iE = +19m.22s., iN = +20m.24s. Ann Arbor S = +27m.48s. Ottawa L = +36·9m., S = +27m.50s. Toronto eL = +37·9m. and +57·1m. Eskdalemuir SR_1? = +25m.1s., MN = +50·4m. Hamburg MZ = +47·4m. Lemberg e = +44m.30s. Tiflis eS = +20m.36s. Northfield e = +41m.24s. Uccle MN = +49·7m. Fordham e = +32m.55s. Vienna iZ = +11m.37s., iE = +13m.4s. Georgetown LE = +45·6m., LN = +46·8m. Strasbourg eP = +11m.46s. Belgrade LNE = +50·5m. Moncalieri MN = +48·6m. Toledo MNW = +59·5m. San Fernando MN = +58·9m. Riverview MN = +52·3m.

Feb. 12d. 12h. 30m. 0s. Epicentre 36°·1N. 137°·3E. (as on 1922 June 18d.).

A = −·594, B = +·548, C = +·589; D = +·678, E = +·735; G = −·433, H = +·400, K = −·808.

There is clearly some error, and the simplest supposition is that of an error in time determination at Mizusawa, either of 1 minute exactly or perhaps rather more, in which case the T_0 should be reduced accordingly.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Nagoya		1·0	196	−0 47	−62	−0 5	−37	—	0·0
Osaka		2·1	218	0 31	− 2	—	—	1·3	2·2
Kobe		2·2	231	0 33	− 1	—	—	1·3	1·4
Mizusawa	E.	4·3	45	1 23	+16	2 29	+31	(2·5)	—
Nagasaki		7·0	244	1 6	−40	—	—	—	—
Zi-ka-wei		14·1	254	e 2 47	−40	—	—	—	—
Ottawa		93·2	22	—	—	—	—	e 48·0	—
La Paz		150·1	56	18 43	[−73]	—	—	—	—

Additional readings: Osaka gives also MN = +1·3m. Mizusawa SN = +2m.30s. Ottawa LE = +52·0m.

Feb. 12d. Readings also at 0h. (La Paz, Pilar, Mendoza, La Plata, Florence, and Cipolletti), 3h. (Toronto), 6h. (Nagasaki), 10h. (near Belgrade), 12h. (Apia, near Sarajevo, and Mostar), 13h. (Zi-ka-wei, Nagasaki, Georgetown, and Hong Kong), 14h. (Zi-ka-wei, La Paz, Riverview, and Sydney), 15h. (Ekaterinburg), 16h. (near Belgrade (2)), 17h. (Ekaterinburg), 18h. (Victoria), 19h. (Rio Tinto), 20h. (Nagasaki, La Plata, and La Paz), 22h. (Nagasaki).

Feb. 13d. 17h. 9m. 25s. Epicentre 37°·5N. 19°·7E. (as on 1922 July 3d.).

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

The (S−P) intervals for Athens and Sarajevo suggest increasing T_0 by about 50 sec.; this change would suggest an epicentre some 3° to the N.W. of that adopted, which would suit all the observations except those of Athens itself.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	3·2	81	e 1 11	+21	i 1 24	− 4	2·2	2·3
Pompeii	5·2	310	e 1 23	+ 3	—	—	—	—
Sarajevo	6·4	352	e 1 38	0	i 2 11	−44	—	—
Rocca di Papa	6·8	311	2 13	+29	—	—	3·8	4·4
Belgrade	7·3	4	e 1 59	+ 8	e 3 22	+ 4	—	3·6
Florence	8·9	317	2 3	−12	—	—	—	—

Additional readings: Athens gives also S = +2m.6s. (O−C = +34s.). Sarajevo iP = +1m.56s.

Feb. 13d. Readings also at 0h. (Batavia and Zi-ka-wei), 1h. (Nagasaki (3)), 4h. (Ekaterinburg), 7h. (Nagasaki), 8h. (Ekaterinburg and Colombo), 10h. (Zi-ka-wei and Ekaterinburg), 11h. (Ekaterinburg), 12h. (near Taihoku), 14h. (Colombo), 16h. (La Paz), 17h. (Innsbruck and near Zurich), 19h. (Nagasaki), 21h. (near Manila), 22h. (Nagasaki).

Feb. 14d. Readings at 1h. (Colombo), 3h. (Manila), 5h. (La Paz (2), La Plata and Colombo), 17h. (Ottawa, Toronto, Vienna, Hong Kong, and Ekaterinburg), 18h. (De Bilt, Konigsberg, Uccle, and Moncalieri).

Feb. 15d. 9h. 42m. 35s. Epicentre 6°·5S. 126°·0E. (as on 1920 May 19d.).

A = −·584, B = +·804, C = −·113 ; D = +·809, E = +·588 ;
G = +·067, H = −·092, K = −·994.

	△	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia	19·0	270	i 4 50	+21	i 9 7	+65	—	—
Manila	21·7	346	e 4 57	− 4	(9 5)	+ 6	9·1	9·2
Perth	27·2	199	—	—	10 43	− 2	e 15·3	—
Hong Kong	31·0	339	11 37	?S	(11 37)	−14	—	15·4
Melbourne	35·7	153	—	—	12 25?	−41	17·7	19·4
Riverview	35·9	143	e 10 44	?	—	—	18·4	19·1
Zi-ka-wei	37·9	355	e 7 32	− 5	—	—	—	—
Colombo	47·9	285	16 25	?S	(16 25)	+32	—	—
Kodaikanal	51·2	289	30 31	?L	—	—	(30·5)	—
Ekaterinburg	82·4	330	—	—	e 22 49	− 1	—	—
La Paz	153·1	149	20 5	[+ 5]	e 29 20	?	45·8	49·6

Additional readings and notes: Batavia gives also i = +5m.38s. Manila MN = +9·6m. Perth readings have been increased by 2h.

Feb. 15d. 22h. 38m. 38s. Epicentre 55°·0N. 162°·5E. (as on Feb. 12d.).

A = −·547, B = +·172, C = +·819 ; D = +·301, E = +·954 ;
G = −·781, H = +·246, K = −·574.

	△	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari	14·9	244	3 40	+ 2	—	—	7·2	8·6
Nagasaki	31·9	240	10 18	?S	(10 18)	−109	—	—
Zi-ka-wei	37·4	249	—	—	—	—	e 19·0	23·6
Hong Kong	48·4	248	22 34	?L	—	—	(22·6)	28·9
Ekaterinburg	51·6	318	—	—	16 37	− 2	27·4	33·9
Manila	51·6	235	e 9 22	+ 5	—	—	—	—
Upsala	61·8	341	—	—	—	—	e 36·4	—
Konigsberg	65·8	338	—	—	—	—	e 38·4	45·4
Ottawa	68·2	40	—	—	—	—	e 35·4	—
Edinburgh	68·5	352	—	—	—	—	e 42·4	—
Hamburg	69·1	344	—	—	—	—	e 37·4	—
De Bilt	71·3	346	—	—	—	—	e 42·4	46·7
Kew	72·6	350	—	—	—	—	—	53·4
Uccle	72·6	347	—	—	—	—	—	42·4
Strasbourg	74·3	344	—	—	—	—	e 43·9	—
Moncalieri	77·8	342	e 17 51	?PR_1	28 35	?SR_1	46·1	—
Rocca di Papa	79·9	338	—	—	—	—	e 46·1	55·4
Rio Tinto	86·7	351	52 22	?L	—	—	(52·4)	59·4

Additional readings and notes: Nagasaki reading has been diminished by 1h. Ekaterinburg gives also ePR_1 = +11m.53s., SR_1 = +20m.51s. Eskdalemuir (△ = 69°·0) gives simply 23h. Rocca di Papa L = +54·6m.

Feb. 15d. Readings also at 3h. (near Taihoku), 4h. (Mendoza and Colombo), 7h. (Strasbourg), 9h. (Colombo), 10h. (Sydney), 12h. (Nagasaki and Ekaterinburg), 14h. (Colombo), 16h. (near Granada), 18h. (La Paz), 19h. (Colombo), 23h. (Tiflis).

Feb. 16d. 6h. 37m. 15s. Epicentre 55°·0N. 162°·5E. (as on Feb. 15d.).
A = −·547, B = +·172, C = +·819; D = +·301, E = +·954; G = −·781, H = +·246, K = −·574.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari		14·9	244	e 4 45	+67	—	—	8·9	—
Zi-ka-wei		37·4	249	e 17 25	?L	—	—	(e 17·4)	24·1
Ekaterinburg		51·6	318	—	—	16 38	− 1	25·2	30·0
Upsala		61·8	341	—	—	—	—	e 34·8	—
Konigsberg		65·8	338	—	—	—	—	e 36·8	37·8
Ottawa		68·2	40	—	—	—	—	38·4	—
Edinburgh		68·5	352	—	—	—	—	e 41·8	—
Eskdalemuir		69·0	352	—	—	—	—	e 25·7	44·8
Hamburg		69·1	344	—	—	—	—	e 39·8	42·8
Tiflis		69·8	315	e 8 33	−163	—	—	e 23·8	28·0
De Bilt	N.	71·3	346	—	—	—	—	e 39·8	45·6
Uccle		72·6	347	—	—	—	—	e 40·8	—
Kew		72·6	350	—	—	—	—	—	45·8
Vienna		72·9	338	—	—	—	—	e 40·8	44·8
Moncalieri		77·8	342	e 22 0	?S	(22 0)	+ 2	43·4	—
Kodaikanal		78·8	273	45 3	?L	—	—	(45·0)	—
Rocca di Papa		79·9	338	—	—	—	—	e 46·2	53·8

Additional readings: Konigsberg gives also MN = +43·8m. Tiflis eN = +3m.3s. De Bilt eLE = +37·8m. Moncalieri S = +33m.53s.

Feb. 16d. 9h. 16m. 10s. Epicentre 48°·8N. 153°·5E.
A = −·589, B = +·294, C = +·752; D = +·446, E = +·895; G = −·673, H = +·336, K = −·659.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari		7·5	257	2 30	+36	—	—	4·2	—
Mizusawa	E.	13·1	227	—	—	5 44	− 2	—	—
Nagoya		18·3	228	7 21	?S	(7 21)	−26	—	—
Osaka		19·4	230	5 3	+29	(8 37)	+27	8·6	8·8
Zi-ka-wei		29·9	246	i 6 24	− 3	e 11 20	−12	—	16·6
Manila		43·4	230	8 33	+12	(14 33)	−21	14·6	—
Honolulu	E.	47·1	108	—	—	—	—	e 19·0	20·4
Victoria	E.	52·1	57	16 28	?S	(16 28)	−17	24·9	25·5
	N.	52·1	57	16 28	?S	(16 28)	−17	24·5	25·1
Ekaterinburg		52·2	317	9 14	− 7	16 50	+ 4	24·8	30·8
Upsala		65·7	337	10 51	+ 2	19 38	+ 5	e 33·8	41·4
Batavia		68·3	231	e 11 6	0	i 20 7	+ 1	—	—
Konigsberg		69·0	333	i 10 47	−24	e 20 32	+18	e 39·3	42·8
Tiflis		70·0	311	e 12 26	+69	e 22 56	+150	39·8	45·3
Hamburg		73·1	339	i 11 40	+ 3	—	—	e 38·8	45·8
Kodaikanal		73·1	268	21 2	?S	(21 2)	− 1	—	—
Edinburgh		73·5	347	—	—	—	—	e 42·8	—
Eskdalemuir		74·0	347	—	—	e 21 13	− 1	35·8	—
Vienna		76·1	332	i 11 58	+ 2	e 21 44	+ 6	e 39·8	50·8
Ottawa		76·5	33	—	—	e 21 26	−17	e 34·3	—
Uccle		76·9	340	e 12 1	+ 1	21 49	+ 1	37·8	40·8
Kew		77·2	345	—	—	—	—	—	55·8
Strasbourg		78·2	338	i 12 8	0	e 22 50	+48	e 42·8	—
Zurich		79·1	337	i 12 13	− 1	22 15	+ 2	—	—
Besançon		79·9	339	12 18	0	—	—	42·8	—
Moncalieri		81·6	337	12 26	− 2	21 25	−17	45·0	—
Rocca di Papa		83·1	331	i 12 35	− 2	i 22 50	− 8	35·3	57·3
Pompeii		83·3	330	e 12 50	+12	—	—	—	—
Toledo		89·1	344	—	—	—	—	44·8	—
Coimbra		89·6	346	—	—	—	—	e 47·8	—
Algiers		90·4	337	e 13 5	−13	e 23 59	−19	43·8	51·8
La Paz		133·3	60	19 25	[− 1]	e 33 55	?	71·8	79·8

Additional readings and notes: Osaka gives also MN = +9·2m. Victoria SEN = +20m.43s. Konigsberg iN = +12m.53s. (assuming a misprint), iNE = +19m.57s. Uccle SR_1 = +27m.29s., SR_2 = +32m.20s.

Feb. 16d. Readings also at 0h. (Nagasaki (2), Tiflis, and La Paz), 2h. (Nagasaki), 8h. (Nagasaki and Colombo), 21h. (La Paz and Manila).

Feb. 17d. Readings at 1h. and 8h. (Ekaterinburg), 20h. (Nagasaki and La Paz), 21h. (Nagasaki, Innsbruck, and Colombo), 22h. (Colombo).

Feb. 18d. 23h. 39m. 20s. Epicentre 55°·0N. 162°·5E (as on Feb. 16d.).

A = −·547, B = +·172, C = +·819; D = +·301, E = +·954; G = −·781, H = +·246, K = −·574.

		△	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Kobe		27·8	235	—	—	—	—	e 15·0	22·9
Zi-ka-wei		37·4	249	e 7 24	− 9	e 13 30	0	—	24·0
Victoria	E.	44·2	68	10 32	+125	15 12	+ 7	25·5	30·9
	N.	44·2	68	8 47	+20	15 12	+ 7	25·4	32·7
Honolulu		44·7	123	—	—	—	—	e 22·7	—
Hong Kong		48·4	248	15 46	?S	(15 46)	−13	(27·5)	29·2
Manila		51·6	235	e 9 40	+23	—	—	—	—
Upsala		61·8	341	—	—	—	—	e 38·7	43·7
Simla		62·4	285	—	—	—	—	e 36·4	—
Konigsberg		65·8	338	—	—	e 19 44	+ 9	e 39·2	51·7
Chicago		66·4	50	—	—	e 24 40	?SR_1	35·7	—
Ottawa		68·2	40	20 29	?S	(20 29)	+25	e 33·2	44·1
Toronto		68·2	44	—	—	—	—	e 38·3	41·2
Hamburg		69·1	344	—	—	—	—	e 40·7	—
Tiflis		69·8	315	—	—	—	—	e 47·4	48·9
Stonyhurst		70·4	351	—	—	—	—	—	40·7
De Bilt		71·3	346	—	—	—	—	e 43·7	46·9
Uccle		72·6	347	—	—	—	—	e 41·7	—
Kew		72·6	350	—	—	—	—	—	52·7
Vienna		72·9	338	11 56	+21	—	—	e 42·7	55·7
Strasbourg		74·3	344	—	—	—	—	e 50·7	—
Moncalieri		77·8	342	—	—	e 34 49	?	45·1	—
Rocca di Papa		79·9	338	—	—	—	—	e 51·9	57·2

Additional readings and notes: Kobe gives also MN = +17·9m. Hong Kong S = +24m.35s. Konigsberg MN = +45·7m. Ottawa S = +27m.59s., L = +37·7m. Toronto eL = +50·6m. Eskdalemuir (△ = 69°·0) gives 0h. to 1h. Tiflis MN = +48·4m.

Feb. 18d. Readings also at 2h. (Nagasaki and La Paz), 8h. (Nagasaki), 9h. (Hakodate), 10h. (Riverview, Manila, and Batavia), 14h. (Colombo), 15h. and 16h. (La Paz), 18h. (Manila), 19h. (Nagasaki and near Manila), 20h. (Sydney).

Feb. 19d. 6h. 17m. 5s. Epicentre 5°·0S. 135°·0E. (as on 1921 Oct. 10d.).

A = −·704, B = +·704, C = −·087; D = +·707, E = +·707; G = +·062, H = −·062, K = −·996.

The depth of focus 0·060 has been retained, as on 1921 Oct. 10d.

		Corr. for Focus	△	Az.	P.	O−C.	S.	O−C.	L.	M.
		•	•	°	m. s.	s.	m. s.	s.	m.	m.
Manila		−3·0	24·0	325	e 4 47	− 6	7 57	−47	8·9	9·1
Malabar		−3·4	27·3	264	e 5 0	−27	i 9 27	−15	—	—
Batavia		−3·5	28·0	266	i 5 10	−23	i 9 50	− 4	—	10·0
Perth		−3·9	32·4	211	—	—	(11 6)	− 2	17·4	—
Riverview		−4·1	33·3	153	e 6 7	−13	e 11 7	−13	e 13·4	19·4
Melbourne		−4·1	34·0	165	—	—	12 13	+41	15·6	19·4
Zi-ka-wei		−4·6	38·4	341	7 2	−1	e 12 36	− 2	—	—
Osaka		−4·7	39·7	1	6 17	−56	(12 52)	− 3	12·9	14·3
Kobe		−4·7	39·7	1	7 15	+ 2	—	—	16·0	19·9
Mizusawa	E.	−5·1	44·5	8	7 50	0	—	—	—	—
Kodaikanal		−6·2	59·3	285	33 25	?L	—	—	(33·4)	—
Tiflis		−7·6	93·6	313	—	—	—	—	e 41·8	—
Victoria		−7·8	101·5	42	26 49	?	—	—	47·3	49·6
De Bilt		—	117·5	327	—	—	—	—	e 59·9	—
Uccle		—	118·6	326	—	—	—	—	e 59·9	—
Ottawa	E.	—	131·6	29	e 22 21	?PR_1	—	—	59·9	—
La Paz		—	148·6	134	19 35	[−19]	—	—	—	—

Additional readings: Malabar gives also i = +5m.19s. Batavia i = +5m.44s., iN = +9m.32s. Perth S is given as PR_1, also S = +14m.50s. Riverview MN = +17·6m. Osaka S = +9m.10s., ME = +12·9m. (same as L). Kobe MN = +17·2m. Mizusawa PN = +7m.52s. Tiflis reading is given as at 16h. Ottawa e = +34m.19s. and +39m.7s., eLE = +52·9m., LE = +79·4m.

Feb. 19d. Readings also at 0h. (Kodaikanal, Simla, Nagasaki, near Athens, and near Belgrade), 2h. (Ekaterinburg), 3h. (Colombo), 8h. (Ekaterinburg), 13h. (Colombo), 16h. (near Algiers (2)), 17h. (Florence).

Feb. 20d. 10h. 6m. 20s. Epicentre 22°·0N. 123°·5E. (as on 1921 Sept. 5d.).

A = −·512, B = +·773, C = +·375.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	7·8	198	1 56	− 2	(3 34)	+ 3	3·6	3·8
Hong Kong	8·6	274	2 10	0	—	—	4·6	6·4
Zi-ka-wei	9·4	348	—	—	e 4 5	− 8	—	—

Manila gives also MN = +3·6m.

Feb. 20d. Readings also at 0h. (Taihoku), 3h. (Ekateringburg and La Paz), 6h. (La Paz), 12h. (Manila), 13h. and 17h. (Nagasaki), 18h. (Mizusawa and Batavia), 19h. (Victoria).

Feb. 21d. 0h. 55m. 18s. (I) } Epicentre 55°·0N. 162°·5E.
3h. 50m. 28s. (II) } (as on Feb. 18d.)

A = −·547, B = +·172, C = +·819; D = +·301, E = +·954;
G = −·781, H = +·246, K = −·574.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I	Zi-ka-wei	37·4	249	e 6 10	−83	—	—	—	24·4
II		37·4	249	—	—	e 14 34	+64	—	27·1
I	Victoria E.	44·2	68	8 10	−17	15 0	− 5	26·8	32·5
I	N.	44·2	68	—	—	14 48	−17	—	31·0
II	E.	44·2	68	—	—	14 52	−13	18·5	23·7
II	N.	44·2	68	—	—	14 55	−10	18·6	22·8
II	Honolulu N.	44·7	123	—	—	—	—	e 20·5	—
I	Hong Kong	48·4	248	—	—	—	—	—	37·0
II	Ekaterinburg	51·6	318	—	—	e 14 32	−127	29·5	—
I	Upsala	61·8	341	—	—	e 18 49	+ 3	e 37·7	—
II		61·8	341	—	—	—	—	e 37·5	—
I	Simla	62·4	285	—	—	—	—	e 35·5	—
I	Konigsberg	65·8	338	—	—	e 19 42	+ 7	—	44·4
II		65·8	338	—	—	—	—	e 34·5	43·5
I	Chicago	66·4	50	9 46	−68	19 22	−20	34·7	—
II		66·4	50	10 20	−34	19 36	− 6	34·6	—
I	Ottawa	68·2	40	—	—	—	—	36·7	—
II		68·2	40	—	—	—	—	34·5	—
I	Toronto	68·2	44	—	—	—	—	e 37·9	41·0
I	Hamburg	69·1	344	e 11 13	+ 1	—	—	e 45·7	48·7
II		69·1	344	—	—	—	—	e 40·5	—
I	Tiflis	69·8	315	—	—	e 20 39	+15	e 45·7	50·7
II		69·8	315	e 16 44	?PR_1	—	—	e 47·3	48·5
I	De Bilt E.	71·3	346	—	—	—	—	e 42·7	—
II	E.	71·3	346	—	—	—	—	e 45·5	—
II	Uccle	72·6	347	e 11 38	+ 4	e 21 50	+53	35·5	—
I	Kew	72·6	350	—	—	—	—	—	46·7
I	Vienna	72·9	338	11 34	− 1	21 1	0	e 44·7	53·7
II		72·9	338	11 34	− 1	21 5	+ 4	e 42·5	52·5
II	Innsbruck	74·8	340	i 11 49	+ 1	—	—	e 45·2	—
II	Moncalieri	77·8	342	—	—	40 47	?L	e 45·5	—
II	Kodaikanal	78·8	273	45 44	?L	—	—	(45·7)	—
I	Rio Tinto	86·7	351	50 42	?L	—	—	(50·7)	56·7
II	La Paz	125·5	67	27 10	?	—	—	—	—

Additional readings and notes: Simla I gives also eN = +39m.30s. Ottawa I eL=1h.1m., L=1h.9m. and 1h.20m., II e=3h.40m., eL=3h.46m., L=4h.0m. and 4h.15m. Eskdalemuir I gives simply 1h. to 2h. Tiflis I e = +19m.32s., MN = +48·2m., II MN = +50·1m. De Bilt I eLN = +45·7m., II eLN = +40·5m.

Feb. 21d. Readings also at 0h. (Moncalieri), 2h. (Nagasaki and Oxford), 3h. (Ekaterinburg), 6h. (near Malabar and Batavia), 9h., 10h., and 12h. (Ekaterinburg), 13h. (Nagasaki and near Malabar and Batavia), 22h. (Nagasaki).

Feb. 22d. Readings at 4h. (near Zurich), 5h. (near Malabar and Batavia), 9h. (Nagoya, Hakodate, and near Mizusawa).

Feb. 23d. 5h. 51m. 50s. Epicentre 0°·0 122°·4E. (as on 1922 Sept. 11d.).

A = −·536, B = +·844, C = ·000 ; D = +·844, E = +·536 ; G = ·000, H = ·000, K = −1·000.

See note at end.

		△	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		14·7	354	e 3 43	+ 8	(6 35)	+10	6·6	8·0
Hong Kong		23·7	341	5 22	− 3	(9 28)	−10	9·5	11·5
Hokoto		23·7	353	5 23	− 2	(e 9 36)	− 2	e 9·6	—
Taihoku		25·0	358	5 40	+ 2	—	—	—	—
Zi-ka-wei		31·2	358	6 23	−17	e 11 37	−17	—	17·9
Perth		32·5	190	(6 35)	−18	13 9	+53	i 16·7	—
Kobe		36·7	20	7 7	−21	(12 33)	−47	12·5	12·6
Osaka		36·8	20	7 14	−14	(12 35)	−46	12·6	15·8
Nagoya		37·7	22	5 58	−98	11 31	−123	—	11·6
Adelaide		38·0	158	—	—	i 12 58	−40	e 20·2	25·2
Calcutta	E.	40·1	309	7 48	− 8	17 41	?SR_1	—	—
	N.	40·1	309	7 50	− 6	17 57	?SR_1	—	—
Mizusawa	N.	42·7	24	7 55	−21	14 2	−42	17·0	—
Colombo		43·0	280	8 10	− 8	—	—	15·5	30·2
Melbourne		43·1	153	—	—	i 14 16	−33	21·9	29·7
Riverview		43·3	143	i 8 1	−19	i 14 18	−34	e 21·4	28·5
Sydney		43·3	143	8 40	+20	14 16	−36	21·7	27·0
Hakodate		44·9	21	8 24	− 8	(14 38)	−36	14·6	15·3
Kodaikanal		45·9	284	15 22	?S	(15 22)	− 5	33·0	35·7
Bombay		52·2	295	9 47	+26	—	—	—	—
Simla	E.	52·9	311	9 46	+21	17 10	+15	31·5	—
	N.	52·9	311	9 40	+15	17 4	+ 9	31·4	—
Honolulu		80·2	70	—	—	e 22 40	+15	43·6	—
Upsala	E.	82·6	331	—	—	e 17 40	?PR_1	54·2	—
Helwan		91·0	300	i 13 15	− 6	—	—	—	65·2
Konigsberg	E.	96·8	325	i 13 39	−14	i 24 9	−75	e 55·2	61·2
	N.	96·8	325	(i 13 36)	−17	i 23 56	−88	e 50·7	52·2
Vienna		100·8	321	i 13 58	−16	24 29	−94	e 40·2	59·2
Bergen		103·0	334	—	—	e 23 10	−194	—	—
Hamburg		103·3	326	e 14 9	−18	—	—	e 52·2	58·2
Innsbruck	N.E.	104·1	320	14 10	−20	i 24 44	−110	—	—
Victoria	E.	105·8	40	e 23 24	?	24 44	−126	27·4	27·6
	N.	105·8	40	e 23 21	?	24 44	−126	27·6	27·7
Strasbourg		106·0	322	—	—	—	—	e 47·2	—
De Bilt	E.	106·6	326	—	—	e 28 21	+84	e 54·2	56·9
	N.	106·6	326	—	—	e 26 18	−39	e 50·2	56·9
Moncalieri		107·2	317	—	—	e 25 30	−93	53·2	—
Uccle		107·5	325	e 18 58	?PR_1	e 26 27	−39	50·2	57·5
Edinburgh		109·2	330	—	—	—	—	57·2	—
Eskdalemuir		109·5	330	26 41	?S	(26 41)	−43	50·2	71·2
Kew		109·7	326	—	—	—	—	—	71·2
Oxford		110·1	325	i 13 58	−60	—	—	44·2	68·9
Toledo		117·1	316	35 54	?SR_1	44 36	?	—	—
Chicago		130·1	29	22 7	?PR_1	27 50	?	—	—
Ann Arbor		131·6	25	21 52	?PR_1	28 28	?	—	—
Ottawa		131·8	15	21 49	?PR_1	28 18	?	61·2	—
Toronto		132·2	20	—	—	—	—	78·2	—
Ithaca		134·3	19	i 22 42	?PR_1	—	—	—	—
Washington		137·2	22	22 47	?PR_1	28 52	?	—	—
Rio de Janeiro		153·2	211	e 20 25	[+25]	—	—	74·8	—
La Paz		160·4	148	i 20 10	[+ 2]	34 28	?	75·2	84·3

Additional readings: Manila gives also MN = +8·2m. Perth P is given as PR_1. Kobe S = +9m.38s. Osaka MN = +13·0m. Mizusawa SE = +14m.1s. Melbourne SR_1 = +17m.34s. Riverview iP = +8m.24s., eSR_1 = +17m.22s. and +17m.43s., MN = +29·4m., T_e = 5h.51m.51s. Hakodate S = +11m.40s., MN = +15·5m. Upsala eLN = +50·2m. Honolulu iE = +21m.56s., eN = +32m.37s. Konigsberg iPZ has been entered in the space in place of PN, which is not recorded. Vienna PR_1Z = +18m.14s., i = +24m.17s., PS = +26m.25s., i = +27m.28s., eSR_1 = +32m.9s. Innsbruck iNE = +18m.41s. De Bilt eZ = +18m.53s. Moncalieri true S is given as e, also S = +35m.7s. Uccle e = +44m.58s. Eskdalemuir eS? = +34m.45s., eSR_1? = +38m.19s. Ottawa i = +22m.33s., eL = +33·7m., L = +39·2m. and +51·2m. Toronto L = +90·9m.

Note to the above shock: The evidence of stations round the epicentre suggests a considerable depth for the focus, or an earlier value of T_e. On the other hand the two stations, La Paz and Rio de Janeiro, indicate the direct opposite. **The T_e adopted is that derived from the P and S of Riverview, and is a few seconds earlier than the mean for different stations.**

Feb. 23d. Readings also at 0h. (La Paz), 6h. (near Coimbra), 8h. (La Paz and Ekaterinburg), 12h. (Colombo), 13h. (La Paz), 14h. (near Taihoku), 19h. (near Manila).

1923. Feb. 24d. 7h. 34m. 30s. Epicentre 55°·0N. 162°·5E.

(as on 1923 Feb. 21d.).

A = −·547, B = +·172, C = +·819; D = +·301, E = +·954; G = −·781, H = +·246, K = −·574.

See note at end.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari		14·9	244	3 54	+16	—	—	7·6	10·0
Sapporo		18·2	238	4 30	+11	—	—	9·2	—
Hakodate		19·5	236	5 4	+29	8 38	+23	11·1	16·8
Nagoya		26·5	232	4 37	−76	10 2	−30	—	19·8
Osaka		27·6	234	5 59	− 5	10 56	+ 4	16·3	16·1
Kobe		27·8	235	e 6 2	− 4	9 1	−114	13·1	20·2
Nagasaki		31·9	240	6 22	−24	—	—	16·9	24·2
Sitka	E.	33·5	62	6 49	−12	12 12	−20	16·1	19·8
	N.	33·5	62	—	—	—	—	16·9	20·4
Zi-ka-wei		37·4	249	e 7 26	− 7	e 12 42	−48	e 17·6	22·7
Taihoku		42·4	241	14 15	?S	(14 15)	−25	23·9	26·2
Victoria	E.	44·2	68	8 22	− 5	14 48	−17	24·0	28·9
	N.	44·2	68	8 22	− 5	14 48	−17	24·4	29·0
Hokoto		44·7	242	—	—	e 13 36	−95	e 23·6	—
Honolulu	E.	44·7	123	8 27	− 4	i 15 14	− 7	20·8	19·1
	N.	44·7	123	—	—	i 15 4	− 7	20·3	21·5
Hong Kong		48·4	248	9 0	+ 4	15 50	− 9	23·4	30·5
Saskatoon		50·6	53	10 58	+107	18 2	+96	e 25·5	31·0
Ekaterinburg		51·6	318	9 10	− 7	i 16 41	+ 2	24·5	45·2
Manila		51·6	235	i 9 25	+ 8	—	—	—	—
Berkeley		51·7	79	9 17	− 1	16 50	+10	25·4	28·9
	Z.	51·7	79	9 17	− 1	16 57	+17	25·0	29·1
Lick	N.	52·5	79	9 25	+ 2	16 58	+ 8	24·7	—
Denver	E.	59·8	65	21 30	?	—	—	39·5	44·5
Upsala		61·8	341	e 10 23	− 1	i 18 57	+11	e 29·5	38·6
Tucson	E.	62·2	76	—	—	17 57	−54	29·8	46·6
	N.	62·2	76	—	—	18 3	−48	36·2	47·2
Simla	E.	62·4	285	10 54	+26	19 18	+25	35·6	38·5
	N.	62·4	285	10 48	+20	19 12	+19	35·6	40·8
Calcutta	E.	62·7	272	10 41	+11	—	—	35·1	39·1
	N.	62·7	272	10 32	+ 2	—	—	35·2	—
Bergen		63·2	350	10 36	+ 3	18 50	−13	28·5	40·6
Konigsberg		65·8	338	i 10 56	+ 6	i 19 51	+16	e 30·0	41·0
Chicago		66·4	50	10 36	−18	19 30	−12	32·8	37·5
Ann Arbor		67·6	48	11 24	+22	20 6	+ 9	32·5	38·5
Ottawa		68·2	40	11 7	+ 2	19 56	− 8	e 30·5	40·0
Toronto		68·2	44	—	—	i 21 36	+92	e 29·0	40·9
Edinburgh		68·5	352	—	—	i 20 23	+15	31·5	53·2
Eskdalemuir		69·0	352	i 11 20	+ 9	i 20 22	+ 8	33·5	—
Hamburg		69·1	344	e 11 9	− 3	i 20 31	+16	e 34·9	43·8
Lemberg		69·6	333	e 18 0	?	e 25 36	?	e 39·5	46·1
Tiflis		69·8	315	e 11 28	+12	e 20 34	+10	e 33·7	46·9
Stonyhurst		70·4	351	e 11 30	+11	i 20 48	+17	—	46·0
Ithaca		70·4	43	e 11 28	+ 9	20 30	− 1	e 33·5	—
Northfield		70·4	39	10 54	−25	(20 34)	+ 3	20·6	42·5
Bidston		70·9	351	12 35	+73	21 35	+58	—	61·4
De Bilt	E.	71·3	346	—	—	20 56	+14	e 30·5	44·9
	N.	71·3	346	11 33	+ 8	e 21 8	+26	—	46·4
	Z.	71·3	346	11 32	+ 7	20 54	+12	—	50·1
West Bromwich	N.	71·7	351	11 38	+10	e 20 51	+ 5	—	—
Apia		72·2	154	—	—	e 21 30	+38	e 37·5	—
Uccle		72·6	347	i 11 41	+ 7	i 21 11	+14	30·5	48·9
Kew		72·6	350	16 30	?PR_1	—	—	—	47·5
Fordham	E.	72·8	42	e 11 39	+ 4	21 18	+18	35·5	42·9
Vienna		72·9	338	e 11 34	− 1	21 12	+11	e 33·8	45·8
Halifax		73·0	34	13 11	+95	22 12	+70	e 29·5	40·5
Georgetown		73·2	44	e 11 42	+ 5	21 3	− 1	e 33·5	44·9
Washington		73·2	44	11 30	− 7	(e 20 30)	−34	29·5	—
Cheltenham	E.	73·4	46	—	—	21 4	− 3	36·4	45·1
	N.	73·4	46	e 11 44	+ 6	20 56	−11	38·6	44·3

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Strasbourg		74·3	344	11 45	+ 1	21 24	+ 6	31·5	45·5
Bombay		74·4	280	11 52	+ 7	21 59	+40	41·7	42·4
Paris		74·8	347	e 11 30	−18	—	—	43·5	51·5
Innsbruck		74·8	340	e 11 43	− 5	i 21 36	+12	e 34·3	48·9
Belgrade		75·2	333	e 11 50	0	e 21 53	+25	30·6	50·4
Mobile	E.	75·2	59	e 21 35	?S	(e 21 35)	+ 7	37·5	41·5
Zurich		75·3	342	e 11 51	0	e 21 39	+10	e 30·5	—
Besançon		75·9	345	12 1	+ 7	21 50	+14	—	30·5
Le Mans		75·9	350	—	—	—	—	e 49·5	53·0
Batavia		76·5	238	11 27	−31	i 21 40	− 3	e 35·5	55·3
Sarajevo		76·5	336	—	—	—	—	e 32·8	44·1
Malabar		77·1	237	e 12 17	+15	i 21 30	−20	e 44·7	—
Puy de Dôme		77·8	348	12 6	0	22 2	+ 4	43·5	—
Moncalieri		77·8	342	i 12 12	+ 6	i 21 59	+ 1	33·8	47·4
Florence		78·2	340	12 35	+26	—	—	—	47·9
Kodaikanal		78·8	273	12 6	− 6	—	—	41·0	52·4
Marseilles		79·8	345	e 12 45	+27	22 30	+ 9	31·5	50·5
Rocca di Papa	E.	79·9	338	e 12 30	+12	22 30	+ 8	e 37·7	49·2
	N.	79·9	338	e 12 24	+ 6	22 12	−10	e 43·2	54·2
Athens		80·7	329	e 12 29	+ 6	22 31	0	e 40·7	49·9
Barcelona		82·1	346	12 34	+ 3	22 53	+ 6	e 36·3	53·1
Tortosa	E.	83·0	348	—	—	i 23 3	+ 6	39·4	53·8
	N.	83·0	348	12 40	+ 4	i 23 4	+ 7	38·5	53·4
Lisbon		83·5	354	e 13 6	+27	23 12	+ 9	e 44·1	—
Toledo		84·5	350	e 12 38	− 7	i 23 13	− 1	e 36·5	55·3
Coimbra		84·5	354	e 12 55	+10	23 5	− 9	36·5	51·7
Helwan		85·4	319	12 42	− 8	23 18	− 5	—	58·2
Algiers		86·6	344	e 12 45	−12	23 35	− 2	40·5	53·5
Rio Tinto		86·7	351	22 30	?S	(22 30)	−68	—	51·5
Granada		87·0	350	i 13 4	+ 5	i 23 52	+11	e 47·2	57·0
Azores		87·0	8	23 30	?S	(23 30)	−11	—	79·6
San Fernando		88·1	351	13 26	+20	23 48	− 5	—	57·0
Sydney		89·4	190	10 48?	?	24 0	− 7	38·5	52·0
Riverview		89·4	190	e 13 11	− 1	e 23 35	−32	e 38·2	55·4
Adelaide		92·2	201	e 13 54	+26	i 24 30	− 7	i 44·1	52·0
Melbourne		94·0	194	—	—	i 24 48	− 8	38·2	56·9
Perth		95·7	220	18 36	?PR_1	—	—	—	—
Porto Rico		96·3	47	—	—	—	—	e 49·8	57·2
Wellington		96·9	172	e 15 30	+96	i 24 48	−37	42·0	51·5
La Paz		125·5	67	19 36	[+29]	33 45	?	65·5	79·3
Andalgala		135·6	74	8 0	?	25 30	?	—	58·1
Mendoza		138·5	80	23 18	?PR_1	—	—	66·2	68·8
Pilar		140·1	75	23 0	?PR_1	—	—	41·3	42·7
Rio de Janeiro		142·6	42	e 20 30	[+46]	—	—	58·9	82·1
La Plata	E.	145·8	72	19 54	[+ 4]	—	—	80·2	82·1
	N.	145·8	72	19 43	[− 7]	—	—	82·1	86·0
Capetown		147·4	297	21 31	?	—	—	—	95·3

Additional readings and notes: Ootomari gives also MN = +9·0m. Sapporo readings diminished by 10m. Hakodate MN = +13·2m. Osaka MN = +16·9m. Kobe MN = +21·3m. Sitka PR_1E = +7m.55s., SR_1N = +14m.16s., LE = +18·2m., LN = +18·5m., T_o = 7h.34m.32s. Zi-ka-wei MN = +23·1m. Taihoku MN = +32·0m. Honolulu PR_1 = +10m.10s., eN = +14m.22s., SR_1E = +18m.30s., SR_1N = +18m.48s., T_o = 7h.34m.36s. Ekaterinburg iP = +9m.23s., i = +11m.17s., +13m.46s., and +14m.26s. Berkeley gives also many additional P and S readings for the E and N components; also SR_1E = +20m.40s., SR_1N = +20m.32s., SR_1Z = +20m.26s., SR_2E = +22m.6s., SR_2N = +22m.9s., SR_2Z = +21m.32s. Lick SN = +17m.13s. and +17m.30s., SR_1N = +22m.29s. All readings have been diminished by 4m. Denver readings have been diminished by 2h. Upsala iP = +10m.34s. Tucson SR_1N = +22m.5s., LE = +36·4m., LN = +40·0m. Konigsberg iN = +20m.12s., MN = +44·5m. Ann Arbor MN = +44·5m., T_o = 7h.34m.54s. Ottawa SR_1 = +25m.2s., SR_2 = +27m.38s. T_o = 7h.34m.48s. Toronto PR_1 = +19m.24s., SR_1 = +22m.54s., eL = +25·8m., i = +36m.6s., and +39m.12s., also several other L's. Eskdalemuir SR_1 = +25m.36s. Hamburg MN = +44·2m., MZ = +46·3m. Tiflis e = +21m.23s., LE = +36·5m., MN = +47·3m. Ithaca e = +25m.0s. and +28m.23s., L = +35·5m. and +39·2m. Northfield S? = +14m.38s. West Bromwich iSE = +21m.0s. Apia e = +44m.30s. Uccle PR_1 = +14m.36s., PR_2 = +17m.18s., SR_1 = +26m.0s., SR_2 = +28m.54s., MN = +59·1m. Fordham ePN = +11m.47s. T_o = 7h.34m.28s. Vienna iPZ = +11m.42s., i = +12m.21s., PR_1Z = +14m.47s., PR_2 = +16m.14s., i = +21m.30s. Georgetown LEN = +38·8m., MN = +44·2m.

Continued on next page.

Washington S = +16m.50s., true S given as eL. Cheltenham SR_2E = +30m.3s., LE = +38·8m. Strasbourg MN = +50·7m. Paris e = +7h.30m. Innsbruck MNW = +46·4m. Belgrade PR_1 = +12m.35s. Batavia i = +13m.14s. and +18m.18s. Malabar i = +15m.52s., eL = +57·5m. The readings for Batavia and Malabar are given for 23d. Moncalieri MN = +52·6m. Florence M has been diminished by 1h. Athens PR_1N = +14m.54s., i = +23m.45s., MN = +45·0m. T_0 = 7h.34m.55s. Barcelona MN = +52·5m. Coimbra iE = +23m.29s., iN = +23m.35s., MN = +58·0m. T_0 = 7h.35m.12s. Toledo PR_1 = +16m.11s., PR_2 = +17m.50s., PR_3 = +20m.55s., SR_1 = +28m.39s., SR_2 = +32m.21s., SR_3 = +34m.51s., MNW = +52·8m. Granada PR_1N = +15m.2s., MN = +57·8m. Algiers MN = +60·0m. San Fernando MN = +63·0m. Riverview PS = +24m.33s., eSR_1 = +29m.3s., MN = +48·4m. T_0 = 7h.35m.1s. Adelaide SR_1 = +30m.30s., SR_2 = +34m.18s., i = +36m.12s. Porto Rico eN = +54·3m., MN = +57·7m. Wellington PR_1 = +19m.0s., SR_1 = +30m.48s., i = +32m.42s., +36m.18s., and +37m.12s.; also a second set of readings for S, L, and M. Andalgala MN = +113·9m. Mendoza L = +41·2m. Pilar MN = +44·3m. La Plata $SR_1?E$ = +41m.43s., $SR_1?N$ = +41m.58s., SR_2E = +47m.2s. and +67m.10s.

NOTE TO 1923 FEB. 24d. 7h.

The above readings present a very curious feature. They are divisible into two groups, for one of which T_0 should be increased by about 22sec., and for the other it should be apparently decreased by about 14sec. The discrepancy is considerable, and it is somewhat remarkable that the only two observations of [P], viz., [+29s.] at La Paz and [−14s.] at Rio de Janeiro should show a similar discordance.

Azimuth has not much influence on this discrepancy. To examine it more thoroughly the two groups were treated separately, applying the above corrections to T_0, as below :—

First Group : Assumed T_0 7h. 34m. 52s.

Azimuths	No. Obs.	Mean Az.	Mean $\delta\triangle$	Focal Depth +0·020
° °		°	°	
40 to 68	7	47	−2·6	−0·1
190 to 249	5	232	−2·7	−0·8
315 to 353	9	340	−1·8	+0·9

Second Group : Assumed T_0 7h. 34m. 15s.

42 to 80	5	66	+1·4	−0·8
234 to 280	3	251	+2·1	0·0
318 to 350	16	340	+2·2	−0·4

In each group there are three well separated azimuths in much the same directions, and the $\delta\triangle$ is consistently negative for the first, positive for the second. Equations were formed in the usual way for an azimuth term (representing a change of epicentre), but, as may be gathered by inspection, no satisfactory values of x and y were to be deduced. A term representing a focal depth of $\pm$·020, positive or below for the first group, and negative or above for the second, will remove the greater part of the discordance in each case; but the hypothesis of two separate shocks at two different depths below the same epicentre does not commend itself without some independent support, for it leaves unexplained why some of the stations in all localities should record one and some the other.

As a further test the mean P and S residuals were formed as follows :—

Group I P = +6s. S = − 5s.
Group II P = 0s. S = +10s.

At present no better explanation suggests itself than an "accidental" origin for these differences.

Feb. 24d. Readings also at 0h. (La Paz (2) and Nagasaki), 2h. (near Taihoku), 6h. (Nagoya), 8h. (La Paz), 14h. (Moncalieri), 18h. (Ottawa), 21h. (Taihoku).

Feb. 25d. 2h. 24m. 42s. Epicentre 29°·5S. 71°·0W.

A = +·283, B = −·823, C = −·492; D = −·946, E = −·326; G = −·160, H = +·466, K = −·870.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mendoza		4·1	147	2 42	?	—	—	3·7	4·3
Andalgala	E.	4·6	66	2 0	?S	(2 0)	− 6	3·1	3·4
	N.	4·6	66	2 18	?S	(2 18)	+12	3·3	3·9
Pilar	E.	6·6	111	2 12	+31	—	—	3·7	4·0
	N.	6·6	111	2 18	+37	—	—	3·4	3·5
La Plata	E.	12·3	119	3 1	− 2	5 27	+ 1	6·3	7·0
La Paz		13·3	12	i 3 19	+ 2	5 50	− 1	8·3	8·5

Additional readings and notes: Andalgala readings have been increased by 15min. La Plata gives also SN = +5m.40s.

Feb. 25d. Readings also at 4h. (La Paz and Ottawa), 6h. (Nagasaki), 7h. (Ekaterinburg), 8h. (La Paz and Johannesburg), 9h. (Manila (3)), 10h. (Manila and Ekaterinburg), 12h. (La Plata), 14h. (Honolulu and La Paz), 15h. (La Paz and Manila), 20h. (Ekaterinburg).

Feb. 26d. Readings at 1h. (Ekaterinburg and Nagasaki), 2h. (Rio de Janeiro and Stonyhurst), 4h. (Nagasaki and Manila), 9h. (Balboa Heights), 12h. (Manila), 13h. (Ekaterinburg (2)), 19h. (Azores), 23h. (Port au Prince).

Feb. 27d. 20h. 37m. 20s. Epicentre 37°·7N. 118°·5W. (as on 1919 Feb. 16d.)

A = −·378, B = −·695, C = +·612; D = −·879, E = +·477; G = −·292, H = −·537, K = −·791.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Lick		2·5	262	—	—	—	—	e 4·2	—
Berkeley	E.	3·0	273	0 39	− 8	(2 0)	+37	—	—
		3·0	273	0 52	+ 5	(1 20)	− 3	—	—
Tucson		8·3	129	(2 21)	+15	2 21	?P	e 3·4	4·0
Victoria	E.	11·2	343	6 55	?L	9 46	?	11·4	16·7
	N.	11·2	343	6 55	?L	9 43	?	11·4	17·2
Chicago		24·0	71	4 54	−34	9 20	−24	—	—
Ann Arbor		26·9	71	5 52	− 5	10 40	+ 1	e 13·1	—
Georgetown	N.	32·3	75	7 2	+11	12 23	+10	—	—
Washington		32·3	75	e 4 40	−131	9 8	−185	—	—
Ottawa		32·5	62	7 34	+41	12 6	−10	16·4	—
Ithaca		32·8	68	6 53	− 2	—	—	14·2	—
Fordham	E.	34·4	72	—	—	e 14 12	SR_1?	e 17·7	—
Honolulu		37·7	257	—	—	—	—	e 17·7	—
Ekaterinburg		85·5	1	—	—	28 8	?SR_1	36·7	—

Additional readings: Berkeley gives also SE = +5m.16s., SN = +5m.30s. Tucson MN = +5·3m. Ithaca eL = +13·5m. Ottawa eL = +14·3m. T_0 = 20h. 39m. 12s.

Feb. 27d. Readings also at 1h. (Nagasaki), 3h. (Ekaterinburg), 5h. (Innsbruck, Vienna, and near Zurich), 8h. and 11h. (Nagasaki), 13h. (Adelaide and Riverview), 14h. (Nagasaki), 15h. (near Belgrade), 19h. (Rio Tinto), 23h. (Nagasaki).

Feb. 28d. 22h. 18m. 30s. Epicentre 44°·0N. 25°·8W.

A = +·648, B = −·313, C = +·695 ; D = −·435, E = −·900 ;
G = +·625, H = −·302, K = −·719.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Azores		6·3	179	1 30	− 6	—	—	—	—
Coimbra		13·4	100	0 0	−198	2 48	−185	7·1	7·8
Rio Tinto		15·7	107	0 30	−198	—	—	—	7·5
Toledo		16·6	97	4 7	+ 7	7 56	+47	—	—
San Fernando		16·7	110	—	—	—	—	—	11·6
Granada		18·1	105	4 11	− 7	7 17	−25	10·3	—
Eskdalemuir		18·3	44	—	—	8 38	+51	10·0	12·5
Kew		18·6	58	—	—	—	—	—	14·5
Edinburgh		18·6	42	—	—	—	—	—	11·5
Tortosa	N.	19·6	93	4 53	+17	(e 8 30)	+15	e 8·5	13·0
Uccle		21·3	61	e 5 0	+ 3	e 9 34	+44	11·3	—
De Bilt		22·0	57	—	—	e 9 55	+50	12·3	15·5
Algiers		23·0	98	e 5 21	+ 4	—	—	12·7	16·0
Strasbourg		23·4	67	—	—	—	—	e 11·5	—
Moncalieri		23·7	76	5 12	−13	—	—	14·0	—
Hamburg		25·1	55	—	—	—	—	e 12·5	16·5
Rocca di Papa		28·1	81	—	—	—	—	18·4	27·9
Ottawa		35·0	290	7 25	+12	11 41	−74	e 15·5	19·5
Chicago		44·3	290	—	—	—	—	20·5	—
Ekaterinburg		52·7	44	—	—	17 16	+24	25·0	32·2
Nagasaki		100·0	21	53 26	?L	—	—	(53·4)	—

Additional readings and notes : The readings at Coimbra and Rio Tinto seem to apply to a shock some 190 seconds earlier, from about the same focus. San Fernando MN = +10·8m. De Bilt MN = +14·1m.

Feb. 28d. Readings also at 4h., 5h., 8h., and 9h. (Nagasaki), 10h. (Zi-ka-wei, near Taihoku, and near La Paz), 14h. (Nagasaki), 18h. (near Kobe).

Mar. 1d. 8h. 26m. 16s. Epicentre 52°·5N. 166°·5W.

A = −·592, B = −·142, C = +·793 ; D = −·233, E = +·972 ;
G = −·771, H = −·185, K = −·609.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Victoria		27·4	81	6 13	+11	9 43	−65	16·6	25·6
Honolulu		31·8	167	—	—	—	—	e 13·8	18·2
Berkeley	N.	33·7	98	—	—	—	—	e 15·0	17·4
Lick	N.	34·5	98	—	—	—	—	e 16·9	25·3
Chicago		52·0	70	8 30	−50	16 17	−27	24·9	—
Ann Arbor		53·8	66	—	—	e 18 44	+98	32·7	—
Zi-ka-wei		55·2	279	9 43	+ 3	17 11	−13	—	29·3
Toronto		55·3	62	—	—	—	—	30·4	37·0
Ottawa		56·0	59	9 44	− 2	17 33	− 1	e 26·7	—
Northfield		58·5	58	—	—	—	—	e 30·7	—
Georgetown		59·8	65	—	—	—	—	e 24·7	—
Washington		59·8	65	—	—	(e 18 44)	+23	e 18·7	—
Ekaterinburg		64·1	335	10 39	0	19 26	+12	29·2	45·2
Upsala		67·6	358	—	—	—	—	e 39·7	50·3
Manila		67·8	265	e 20 17	?S	(e 20 17)	+17	22·4	—
Eskdalemuir	N.	71·3	11	e 11 32	+ 7	—	—	—	—
Hamburg		73·9	3	—	—	—	—	e 42·7	—
De Bilt		75·2	6	—	—	—	—	e 35·7	52·1
Kew		75·4	10	—	—	—	—	—	50·7
Uccle		76·4	7	—	—	—	—	—	36·7
Innsbruck		80·2	2	e 12 14	− 6	—	—	—	—
Coimbra		85·4	17	—	—	39 39	?L	e 51·2	—
Colombo		98·5	294	18 44	?PR_1	—	—	—	76·7

Additional readings : Honolulu gives also MN = +17·3m. Berkeley MEZ = +17·0m. Toronto i? = +22m.14s., eL = +33·2m. Ottawa i = +19m.31s. and +21m.22s., L = +29·7m., T_e = 8h.26m.15s. Georgetown LEN = +36·9m. De Bilt MN = +55·5m., MZ = +58·3m. Coimbra eE = +33m.39s., LN = +47·7m.

Mar. 1d. Readings also at 0h. (Tortosa), 1h. (Nagasaki), 2h. (Nagasaki (3) and Moncalieri), 6h. (La Paz), 8h. (Nagasaki), 9h. (near Granada), 10h. (Zi-ka-wei), 11h. (Nagasaki and near Mizusawa), 12h. (Nagasaki). 14h. (Batavia and near Malabar), 15h. and 17h. (Nagasaki), 18h. (La Paz), 19h. (Batavia, Malabar, Hong Kong, and Manila), 20h. and 21h. (Ekaterinburg).

1923. Mar. 2d. 16h. 48m. 36s. Epicentre 6°·0N. 125°·0E.

(as on 1922 June 27d.).

A = −·571, B = +·815, C = +·104 ; D = +·819, E = +·574 ; G = −·060, H = +·085, K = −·995.

		△	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		9·5	335	i 2 37	+14	—	—	5·1	—
Hokoto		18·3	344	3 57	−24	(e 7 25)	−22	e 7·4	—
Hong Kong		19·4	328	4 42	+ 8	8 14	+ 4	9·7	—
Taihoku		19·4	350	(5 6)	+32	(8 26)	+16	8·4	10·4
Malabar		21·8	233	5 3	0	i 9 2	+ 1	11·2	—
Batavia		22·0	237	i 5 0	− 5	i 9 5	0	e 21·4	—
Zi-ka-wei		25·5	352	i 6 38	+55	9 24	−49	10·4	14·2
Nagasaki		27·2	9	5 58	− 2	(10 50)	+ 5	10·8	—
Kobe		30·2	17	6 27	− 3	11 26	−11	15·4	17·4
Osaka		30·4	17	6 40	+ 8	11 46	+ 5	16·3	17·0
Nagoya		31·2	19	5 30	−70	—	—	—	—
Mizusawa	E.	36·2	21	7 21	− 3	13 4	− 9	16·2	—
	N.	36·2	21	7 20	− 4	13 2	−11	16·7	—
Hakodate		38·4	20	8 11	+30	(13 52)	+ 8	13·9	—
Perth		38·9	193	9 30	+105	15 38	+109	20·6	34·4
Calcutta	E.	39·1	299	7 51	+ 4	13 51	− 2	21·1	27·5
	N.	39·1	299	7 52	+ 5	13 40	−13	20·9	27·5
Sapporo		39·8	20	8 17	+24	(14 9)	+ 6	14·1	—
Adelaide		42·9	163	—	—	i 14 30	−17	e 23·2	29·7
Ootomari		43·5	19	e 8 23	+ 1	(14 56)	+ 1	14·9	24·2
Colombo		45·0	274	8 36	+ 3	15 18	+ 3	29·1	31·4
Riverview		46·9	150	e 8 41	− 5	i 15 33	− 7	e 22·5	26·5
Sydney		46·9	150	8 36	−10	15 42	+ 2	19·0	19·6
Kodaikanal		47·2	278	8 12	−36	—	—	10·5	34·4
Melbourne		47·5	159	e 9 0	+ 9	i 15 48	0	22·1	28·8
Dehra Dun		50·4	306	9 29	+20	16 45	+21	27·2	35·2
Simla	E.	51·3	306	9 42	+27	16 48	+13	e 33·5	36·8
	N.	51·3	306	9 42	+27	16 54	+19	e 37·5	40·6
Bombay		52·4	289	9 31	+ 9	16 53	+ 4	—	38·3
Wellington		65·6	142	—	—	e 19 36	+ 4	e 36·1	39·4
Apia		65·8	109	—	—	—	—	43·4	—
Ekaterinburg		71·2	330	i 11 32	+ 8	i 19 52	−48	27·4	46·4
Honolulu	N.	75·8	70	—	—	—	—	41·6	44·7
Tiflis	E.	78·8	313	—	—	—	—	47·2	54·4
	N.	78·8	313	—	—	—	—	34·7	50·1
Sitka	E.	90·1	34	—	—	e 23 44	−31	42·5	46·1
Helwan		90·2	300	i 13 16	− 1	23 42	−34	—	60·5
Konigsberg		93·3	327	—	—	e 24 2	−46	e 47·4	54·4
Upsala		93·4	331	e 17 25	?PR_1	24 26	−23	e 44·4	57·9
Belgrade		95·9	317	17 19	?PR_1	e 26 38	+83	e 51·5	60·7
Budapest		96·1	320	e 15 24	+94	—	—	—	—
Vienna		97·7	321	e 13 36	−22	23 27	−126	e 49·4	56·4
Bergen		98·7	335	26 24	?S	(26 24)	+41	55·4	62·4
Hamburg		99·5	328	—	—	—	—	e 52·4	61·4
Victoria		99·6	39	17 57	?PR_1	24 42	−70	33·1	48·3
Innsbruck		101·2	321	—	—	—	—	e 32·4	61·6
Rocca di Papa		102·3	315	18 48	?PR_1	—	—	e 52·7	77·0
Florence		102·5	319	16 54	?	—	—	—	52·9
Strasbourg		102·9	324	—	—	e 25 54	−29	e 50·9	58·9
De Bilt		102·9	327	—	—	e 25 57	−26	e 54·4	59·7
Berkeley	E.	103·8	48	—	—	e 24 54	−97	47·9	—
Uccle		103·9	326	—	—	26 5	−27	49·4	58·9
Besançon		104·5	322	25 7?	?S	(25 7?)	−91	—	53·4
Lick	Z.	104·5	49	—	—	—	—	e 53·5	—
Moncalieri		104·5	320	15 1	+29	26 4	−34	35·7	62·8
Edinburgh		105·0	333	—	—	26 10	−32	49·4	60·6
Eskdalemuir		105·4	332	—	—	26 9	−37	48·4	54·1
Stonyhurst		105·7	331	e 19 24	?PR_1	27 54	+65	—	68·4

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Paris		105·9	325	—	—	i 26 22	−29	53·4	62·4
Kew		106·1	328	22 24	?	—	—	—	64·4
Bidston		106·4	331	35 24	?	41 29	?L	(41·5)	74·0
Marseilles		106·6	320	—	—	e 26 38	−19	52·4	—
Capetown		107·1	236	25 11	?S	(25 11)	−111	—	59·4
Puy de Dôme		107·1	323	—	—	e 44 24	?	57·4	—
Barcelona		109·6	318	e 19 34	?PR_1	e 29 57	?	—	66·9
Algiers		111·0	313	e 18 6	?PR_1	28 59	+82	e 49·4	68·4
Tortosa	E.	111·1	318	—	—	e 29 47	+129	e 53·4	67·7
	N.	111·1	318	19 51	?PR_1	e 28 50	+72	47·9	64·0
Toledo		114·5	319	—	—	e 29 46	+100	e 42·4	67·0
Granada		115·6	315	—	—	—	—	e 63·1	65·0
Coimbra	E.	117·2	322	e 17 46	?	27 55	−37	59·4	66·8
	N.	117·2	322	—	—	26 56	−92	—	67·5
Rio Tinto		117·3	318	18 24	?	—	—	—	76·4
San Fernando		117·7	317	19 42	?PR_1	—	—	—	76·2
Chicago		123·7	29	—	—	20 58	?PR_1	63·4	—
Ann Arbor		125·1	25	21 24	?PR_1	32 36	?	53·1	81·4
Ottawa		125·4	18	—	—	e 20 56	?PR_1	54·4	68·4
Toronto		125·7	22	—	—	21 36	?PR_1	i 57·8	82·6
Northfield	E.	127·4	14	—	—	—	—	e 69·4	—
Ithaca		127·8	20	e 22 50	?PR_1	—	—	62·4	—
Washington		130·7	23	—	—	e 21 28	?PR_1	68·4	—
Mendoza		150·3	157	26 48	?	—	—	76·8	79·1
Pilar	E.	153·0	163	24 48	?PR_1	—	—	90·2	100·7
	N.	153·0	163	24 48	?PR_1	—	—	91·8	95·2
Andalgala	N.	155·8	155	20 54	[+51]	—	—	78·2	119·7
La Paz		163·4	131	i 20 34	[+24]	35 3	?	78·4	99·4

Additional readings and notes: Taihoku records P as S and S as L, also P = +15s. and MN = +14·6m. Malabar i = +6m.36s. Batavia i = +6m.30s. Zi-ka-wei MN = +18·5m. Osaka ME = +14·6m. Perth PR_1 = +12m.57s., SR_1 = +17m.46s., L = +25·9m. and +29·4m. Sapporo S = +9m.23s. Adelaide eSR_1 = +17m.54s., eSR_2 = +20m.24s. Riverview PR_1 = +10m.32s., PS = +15m.58s., SR_1 = +18m.37s. and +19m.9s., MN = +30·1m., T_0 = 16h.48m.37s. Wellington i = +30m.12s. and many e readings. Ekaterinburg i = +16m.6s. Honolulu eN = +32m.6s. and +36m.56s. Tiflis eS = +8m.0s. and seven other e readings. Sitka eN = +24m.7s., LE = +44·4m. Konigsberg PR_1 = +17m.33s., e = +24m.28s., PSN? = +24m.37s., N = +30m.59s. Upsala MN = +50·3m. Belgrade PR_1 = +21m.28s., SR_1 = +32m.6s. Vienna iZ = +15m.30s., iPR_2N = +18m.13s., iNEZ = +21m.44s., PSN? = +24m.23s., SR_1 = +29m.24s., eLZ = +54·4m., MZ = +62·4m. Hamburg eZ = +18m.6s., i = +29m.32s. Innsbruck eNE = +13m.54s. Rocca di Papa ePV = +18m.9s. (?PR_1V), L = +32·7m., MN = +71·3m. Strasbourg MN = +59·8m. De Bilt ePR_1 = +18m.41s., eE = +24m.52s., e = +33m.9s., MN = +58·7m., MZ = +74·2m. Berkeley LE = +48·0m., LZ = +48·7m. Uccle PR_1 = +18m.50s., SR_1 = +33m.24s., MN = +60·3m. Lick LZ = +53·9m. and +58·1m. Moncalieri MN = +62·9m. Eskdalemuir SR_1 = +33m.45s., SR_2 = +37m.45s. Paris i = +45m.20s. Toledo MNW = +66·7m. Granada MN = +71·4m. Coimbra PR_1N = +22m.44s., SE = +29m.47s. San Fernando MN = +82·0m. Chicago eL = +52·9m. Ann Arbor SR_1 = +39m.12s., L = +72·7m. Ottawa e = +13m.8s., i = +31m.13s. and +38m.9s. Toronto e = +39m.30s., L = +53·0m., eL = +71·7m. Ithaca e = +31m.24s. and +38m.24s., L = +65·4m. Washington eL = +39·4m. La Paz PR_1 = +25m.19s., SR_1 = +45m.9s.

Mar. 2d. Readings also at 1h. (Manila), 2h. (Nagasaki), 6h. (Manila), 7h. (Nagasaki), 9h. (near Mizusawa), 11h. (Manila), 13h. (Nagasaki), 17h. (Batavia), 18h. (Manila), 19h. (Taihoku), 20h. (Nagasaki).

Mar. 3d. 10h. 24m. 36s. Epicentre 41°·0N. 131°·0E.

$A = -\cdot 495$, $B = +\cdot 570$, $C = +\cdot 656$; $D = +\cdot 755$, $E = +\cdot 656$; $G = -\cdot 430$, $H = +\cdot 495$, $K = -\cdot 755$.

Very rough.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Kobe	7·1	150	1 57	+ 9	(3 28)	+15	3·5	3·6
Osaka	7·2	149	2 0	+11	(3 32)	+17	3·5	4·6
Mizusawa E.	8·0	100	1 53	− 8	3 24	−13	—	—
Sapporo	8·0	71	1 55	− 6	(3 21)	−16	3·4	—
Nagasaki	8·3	187	e 1 57	− 9	(e 3 54)	+ 9	e 3·9	—
Zi-ka-wei	12·4	221	e 2 10	−55	e 4 42	−47	—	—
Manila	27·8	201	—	—	e 10 24	−31	—	—

Additional readings: Kobe gives also MN = +4·6m. Osaka MN = +4·3m. Mizusawa SN = +3m.22s.

Mar. 3d. 21h. 52m. 50s. Epicentre 1°·0S. 100°·5E.

$A = -\cdot 182$, $B = +\cdot 983$, $C = -\cdot 017$; $D = +\cdot 983$, $E = +\cdot 182$; $G = +\cdot 003$, $H = -\cdot 017$, $K = -1\cdot 000$.

Ekaterinburg records a second shock 4m.20s. later.

The Australian observations suggest an epicentre further east, say at 1°·6S., 102°·1E., but on trial this was found to introduce discordances into other observations.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia	8·2	130	1 45	−19	3 45	+ 3	—	4·8
Malabar	9·5	132	i 2 26	+ 3	i 4 19	+ 3	—	—
Colombo	22·0	291	4 52	−13	(9 10)	+ 5	9·2	14·2
Kodaikanal	25·5	297	10 28	?S	(10 28)	+15	13·9	15·7
Manila	25·6	52	e 5 50	+ 6	(10 18)	+ 4	10·3	—
Hong Kong	26·9	29	10 46	?S	(10 46)	+ 7	14·4	—
Perth	34·2	158	—	—	—	—	16·4	—
Zi-ka-wei	37·8	30	i 7 34	− 2	e 13 25	−10	e 17·2	28·4
Adelaide	49·1	139	—	—	e 18 34	?SR_1	25·7	31·4
Melbourne	54·9	139	—	—	17 4	−16	26·5	37·2
Riverview	57·6	132	—	—	e 22 34	?SR_1	e 32·4	37·5
Sydney	57·6	132	17 10	?S	(17 10)	−44	32·8	38·4
Tiflis E.	65·8	317	—	—	e 19 57	+22	—	—
Ekaterinburg	66·0	337	i 13 7	+136	22 3	+146	30·2	46·5
Vienna	86·8	318	e 12 59	+ 1	23 45	+ 6	—	—
Upsala	87·3	330	—	—	e 23 38	− 6	e 57·2	57·2
Rocca di Papa	89·0	311	i 13 37	+27	(e 23 16)	−47	e 23·3	—
Strasbourg	92·6	318	—	—	—	—	e 60·2	—
De Bilt E.	94·0	322	—	—	e 24 16	−40	e 50·2	—
Puy de Dôme	96·0	316	—	—	—	—	e 40·2	—
Kew	97·5	321	—	—	—	—	—	73·2
Edinburgh	98·4	325	—	—	—	—	—	69·2
Eskdalemuir	98·6	325	—	—	e 43 10	?L	60·2	—
Bidston	98·8	323	125 10	?	—	—	—	—
Ottawa	135·5	356	—	—	—	—	e 64·2	—
Toronto	136·9	0	—	—	—	—	43·9	—
La Paz	159·2	212	19 55	[−12]	—	—	—	—

Additional readings: Malabar gives also P = +1m.56s. Adelaide eSR_1 = +22m.10s., eL = +28·1m. Melbourne eSR_1 = +20m.46s. Riverview e? = +27m.10s. Tiflis eN = +20m.55s. Ekaterinburg iP = +17m.20s., S = +26m.21s. Vienna iPZ = +13m.0s. Upsala eLN = +52·2m. De Bilt eLN = +55·2m., epicentre 2°·8S. 99°·7E. Puy de Dôme e = +54m.10s. and 59m.10s. Eskdalemuir eN = +50m.10s. Ottawa i = +40m.28s., e = +49m.10s., L = +72·2m.

Mar. 3d. Readings also at 2h. (Nagasaki (2)), 4h. (Athens), 6h. (La Paz), 10h. (near Sarajevo), 11h. (Hakodate), 16h. (near Mizusawa and near Nagoya), 17h. (Nagasaki), 19h. (Tiflis), 20h. (La Paz), 23h. (Batavia).

Mar. 4d. 0h. 9m. 16s. Epicentre 0°·0 24°·8W.

$A = +\cdot 908$, $B = -\cdot 419$, $C = \cdot 000$; $D = -\cdot 419$, $E = -\cdot 908$; $G = \cdot 000$, $H = \cdot 000$, $K = -1\cdot 000$.

There are serious difficulties in reconciling these observations on the hypothesis of a single shock. See note at end.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
San Fernando	40·3	24	14 2	?S	(14 2)	− 9	—	24·7
Coimbra E.	42·9	20	e 10 34	?PR_1	14 38	− 9	17·9	18·7
N.	42·9	20	—	—	—	—	17·6	20·7
Toledo	44·1	24	—	—	15 4	+ 1	e 27·7	31·0
Algiers	44·9	33	e 13 2	?	e 18 23	?SR_1	22·6	25·2
La Paz	45·8	247	8 39	0	e 17 22	+117	23·7	31·7
Tortosa	46·8	27	—	—	—	—	e 26·7	32·6
Marseilles	51·0	29	—	—	e 16 44	+13	e 26·7	—
Capetown	52·8	135	—	—	—	—	—	30·7
Moncalieri	53·4	29	e 10 59	+90	17 6	+ 5	26·3	34·3
Rocca di Papa	53·7	34	10 38	+67	17 2	− 3	27·9	45·5
Paris	54·2	22	—	—	—	—	e 32·7	42·7
Florence	54·3	32	—	—	—	—	31·2	—
Oxford	55·4	19	—	—	—	—	23·0	35·9
Kew	55·5	20	—	—	—	—	—	37·7
Strasbourg	56·1	26	—	—	e 16 44	−51	e 26·7	—
Uccle	56·5	23	e 11 44	+115	e 17 38	− 2	e 22·7	—
Innsbruck N.W.	56·8	30	—	—	—	—	e 24·6	—
De Bilt	57·8	23	—	—	e 17 56	0	e 24·4	26·0
Eskdalemuir	58·0	15	—	—	e 17 56	− 3	24·7	—
Edinburgh	58·6	15	—	—	—	—	24·7	36·7
Vienna	59·9	30	e 10 10	− 1	—	—	31·7	—
Hamburg	60·8	24	—	—	—	—	e 24·7	34·7
Helwan	61·1	56	e 10 20	0	18 38	+ 1	—	33·8
Ottawa	63·8	324	—	—	(e 19 44)	+33	26·7	—
Upsala	68·2	21	—	—	—	—	e 27·7	—
Ekaterinburg	87·5	34	e 20 20	?	25 29	?	41·7	49·8
Kodaikanal	102·0	80	54 38	?L	—	—	(54·6)	—
Colombo	104·6	85	—	—	—	—	55·3	56·2
Zi-ka-wei	135·3	43	—	—	e 43 31	?SR_1	—	72·9

Additional readings: San Fernando gives also MN = +24·9m. Moncalieri MN = +31·2m. De Bilt MN = +26·3m., MZ = +36·0m. Hamburg MZ = +41·7m. Ottawa readings are both given as L.

1923 MAR. 4d. 0h.

This is a very curious case. If we attempt to find T_0 in the ordinary way from observations of P and S we get

Place	P−0h.	S−P	Δ	T_0−0h.
	m. s.	m. s.	°	m. s.
Coimbra	19 50	4 4	22·5	14 39
Ekaterinburg	29 36	5 9	30·4	23 4
Algiers	22 18	5 21	32·0	16 31
Uccle	21 0	5 54	37·0	13 30
Moncalieri	20 15	6 7	39·4	12 25
Rocca di Papa	19 54	6 24	42·0	11 43
Helwan	19 36	8 18	61·2	9 16
La Paz	17 55	8 43	65·5	7 7

No two values of T_0 agree within reasonable limits, and it is clear that more than one error or more than one shock must be involved. The number of errors implied in the above solution is not unduly large considering the discrepancies in the values of T_0.

Many other alternatives have been tried without finding better success. Perhaps the best of them is that of assuming the La Paz observations correct and the European observations of P to be in many cases PR_1. Even then we must assume some additional mistakes (perhaps of minutes) in the Algiers and Ekaterinburg observations. The results for the observatories recording P and S are as follow:—

1923 Mar. 4d. 0h. 7m. 5s. Epicentre 16°·0S. 1°·0E.

$A = +\cdot961$, $B = +\cdot017$, $C = -\cdot276$.

(Possible alternative solution.)

		Δ	P or.	PR_1	O−C. P.	O−C. PR_1	S.	O−C.	L.
		°	m. s.		s.	s.	m. s.	s.	m.
San Fernando		52·9	16 13		?S	—	(16 13)	−42	—
Algiers		52·9	11 13		—	−32	16 34	−21	20·8
Helwan		54·4	e 12 31		+176	+31	20 49	+215	—
Toledo		56·1	—		—	—	17 15	−20	e 29·9
Coimbra	E.	56·9	e 12 45		—	+20	16 49	−56	20·1
Rocca di Papa		58·1	12 49		—	+12	19 13	+73	30·1
Marseilles		59·5	—		—	—	e 18 55	+38	e 27·9
Moncalieri		61·3	e 13 10		—	+ 1	19 17	+37	28·5
Strasbourg		64·9	—		—	—	e 18 55	−29	28·9
La Paz		65·6	10 50		+ 1	—	19 33	+ 1	25·9
Vienna		65·7	e 12 21		+92	−90	—	—	33·9
Uccle		66·9	e 13 55		—	− 6	e 19 49	0	e 24·9
De Bilt		68·2	—		—	—	e 20 7	+ 3	e 26·6
Eskdalemuir		71·5	—		—	—	e 20 7	−37	26·9
Ekaterinburg		88·0	22 31		—	+339	27 40	+228	43·9
Ottawa		92·4	—		—	—	e 21 55	−164	28·9

The residuals on this supposition are not better than on the other; and in favour of the former is the fact that the record taken at the Cape Observatory, which happens to be at Oxford, shows that the disturbance there was very slight. Algiers readings have been diminished by 4m.

Mar. 4d. 6h. 53m. 8s. Epicentre 17°·0S. 177°·5W. (as on 1920 Mar. 22d.).

$A = -\cdot955$, $B = -\cdot042$, $C = -\cdot292$; $D = -\cdot044$, $E = +\cdot999$; $G = +\cdot292$, $H = +\cdot013$, $K = -\cdot956$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Apia		6·3	61	1 35	− 1	(2 45)	− 7	2·8	4·4
Christchurch		27·8	195	e 8 22	?	12 46	+111	15·4	18·2
Riverview		32·7	232	e 6 45	− 9	e 12 5	−14	e 14·9	19·6
Sydney		32·7	232	—	—	—	—	18·0	18·9
Melbourne		38·9	230	—	—	13 52	+ 1	19·8	22·4
Honolulu		42·8	29	14 34	?S	(14 34)	−11	18·6	19·0
Adelaide		42·9	237	—	—	e 15 22	+35	e. 21·9	25·8
Perth		61·6	242	—	—	—	—	e 36·0	—
Manila		68·4	295	e 10 52	−15	—	—	—	—
Batavia		74·5	269	—	—	i 21 56	+36	i 30·4	—
Zi-ka-wei	Z.	75·9	311	e 11 58	+ 4	—	—	—	—
Victoria	E.	81·2	33	22 35	?S	(22 35)	− 2	35·9	52·3
	N.	81·2	33	22 42	?S	(22 42)	+ 5	35·8	—
La Paz		102·7	112	e 16 17	+113	25 24	−57	48·8	—
Colombo		104·1	271	27 52	?S	(27 52)	+78	—	67·9
Toronto		107·3	49	—	—	—	—	59·4	84·0
Ottawa		110·1	46	—	—	—	—	e 50·9	—
Ekaterinburg		121·4	327	22 35	?PR_1	32 34	?	50·9	65·9
Upsala		135·8	349	—	—	—	—	e 69·9	—
Edinburgh		140·9	6	—	—	—	—	76·9	—
Eskdalemuir		141·4	6	—	—	36 52	?	—	—
Stonyhurst		142·9	5	66 52	?L	—	—	(66·9)	82·4
Hamburg		143·0	353	—	—	—	—	e 71·9	82·9
De Bilt	E.	144·8	357	—	—	—	—	e 71·9	88·7
	N.	144·8	357	—	—	—	—	e 67·9	70·4
	Z.	144·8	357	e 21 52	?PR_1	—	—	—	85·2
Kew		145·5	3	—	—	—	—	—	87·9
Uccle		146·2	358	—	—	—	—	e 67·9	—
Vienna		146·8	343	e 19 52	[+ 1]	—	—	—	—
Moncalieri		151·7	352	—	—	—	—	78·3	—
Coimbra		154·9	21	—	—	e 68 52	?	78·2	—
Toledo		156·4	13	—	—	—	—	76·9	—
San Fernando		159·1	20	—	—	—	—	—	90·4

Additional readings: Apia gives also MZ = +4·9m. Riverview PR_1 = +8m.11s., MN = +18·7m. T_0 = 6h.53m.8s. Sydney P = 6h.52m.0s. Melbourne SR_1 = +16m.46s. Honolulu SE = +17m.25s., SN = +17m.41s., MN = +23·0m. Adelaide eS = +13m.4s., iSR_3 = +19m.58s., eL = +19·4m. Batavia i = +22m.30s., +23m.0s., and +25m.33s. Toronto L = +61·6m. Ottawa L = +53·9m. Ekaterinburg i = +28m.7s. Vienna iPZ = +19m.59s., i = +21m.0s. San Fernando MN = +87·4m.

Mar. 4d. Readings also at 4h. (Nagasaki (2)), 5h. (Nagoya, near Osaka and Kobe, and near Mizusawa), 12h. (La Paz), 14h. (Nagasaki), 15h. (near Athens), 16h. (Denver), 20h. (Toledo).

Mar. 5d. Readings at 0h. (Taihoku), 1h. (Kobe), 2h. (Nagasaki), 5h. and 8h. (Manila), 13h. (Bombay), 14h. and 18h. (2) (Nagasaki).

Mar. 6d. 21h. 6m. 54s. Epicentre 0°·0 70°·0E.

$A = +\cdot342$, $B = +\cdot940$, $C = \cdot000$; $D = +\cdot940$, $E = -\cdot342$; $G = \cdot000$, $H = \cdot000$, $K = -1\cdot000$.

Very doubtful. This solution serve to show the difficulties of reconciling the observations on the hypothesis of a single shock. The readings for L at Hamburg and De Bilt may refer to SR_1; but the Colombo observations should show something nearer T_n. Possibly there was a separate shock near Simla (as indicated by the eN = +14·5m. given in the notes), which is responsible for the Simla, Colombo, and Zi-ka-wei observations, but the Tiflis observations remain outstanding.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Colombo		12·0	55	24 6	?L	—	—	(24·1)	31·1
Simla	E.	31·9	11	—	—	—	—	e 15·2	—
Tiflis		47·5	336	e 8 48	− 3	(e 16 30)	+42	e 16·5	—
Zi-ka-wei	Z.	57·8	53	—	—	—	—	e 29·6	—
Rocca di Papa	Z.	66·3	319	e 11 22	+28	—	—	—	—
Vienna		66·7	326	e 10 57	+ 1	e 19 48	+ 2	34·1	—
Hamburg		72·8	328	e 13 0	+85	—	—	e 25·1	—
De Bilt	N.	74·9	326	—	—	—	—	e 27·1	—
Upsala		81·6	309	—	—	e 22 6	−36	—	30·4

Additional readings: Simla gives also eN = +14·5m. Tiflis e = +2m.31s., +5m.26s., +7m.32s., +8m.48s., +9m.6s., and +12m.18s. Rocca di Papa e = +7m.24s.

Mar. 6d. Readings also at 2h. (Nagasaki), 3h. (Port au Prince), 9h. (Colombo), 10h. (Nagasaki), 11h. (La Paz), 16h. (Apia).

Mar. 7d. Readings at 2h. (Nagasaki), 3h. (Tiflis), 5h. (near Tucson), 8h. (Nagasaki), 10h. (Bombay), 18h. (Zi-ka-wei, Hakodate, Ootomari, and near Mizusawa), 21h. (near Taihoku), 22h. (Zi-ka-wei and near Taihoku).

Mar. 8d. Readings at 0h. and 1h. (Nagasaki), 3h. (Manila), 5h. (near Mizusawa), 7h. and 9h. (Nagasaki), 14h. (Zi-ka-wei and Manila), 15h. (Nagasaki, Hong Kong, and near Mizusawa), 21h. (Vienna, De Bilt, La Paz, and Pilar), 22h. (Colombo, Strasbourg, La Paz, and near Taihoku).

Mar. 9d. 22h. 56m. 12s. Epicentre 29°·0S. 71°·0W. (as on 1922 Dec. 28d.).

$A = +\cdot285$, $B = -\cdot827$, $C = -\cdot485$; $D = -\cdot946$, $E = -\cdot326$; $G = -\cdot158$, $H = +\cdot458$, $K = -\cdot875$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mendoza		4·5	150	5 30	?	—	—	5·8	6·3
Pilar	E.	6·7	115	3 48	?	—	—	4·6	5·1
	N.	6·7	115	3 36	?	—	—	—	4·6
Chacarita	E.	12·0	121	7 36	?L	—	—	(7·6)	9·0
La Plata	E.	12·6	121	3 7	0	5 28	− 6	6·2	7·0
	N.	12·6	121	3 8	+ 1	5 29	− 5	6·3	6·9
La Paz		12·8	13	3 13	+ 3	—	—	6·2	6·6
De Bilt		104·7	39	e 34 33	?SR_1	—	—	e 93·8	—
Riverview		105·5	215	e 22 30	?PR_1	e 26 48	+ 1	e 31·2	32·9
Adelaide		110·2	206	—	—	—	—	e 37·4?	40·3?
Nagasaki		161·8	287	32 32	?SR_1	—	—	—	—

Additional readings: Chacarita gives also PN = +7m.30s., MN = +9·1m. Riverview readings all given as e, MN = +38·1.

Mar. 9d. Readings also at 2h. (Nagasaki), 4h. (near Taihoku), 6h. (Nagasaki (2)), 7h. and 8h. (2) (near Mostar), 10h. (Batavia and Malabar), 17h. (Nagoya and near Mizusawa), 19h. (La Paz).

Mar. 10d. 19h. 48m. 40s. Epicentre 34°·5N. 27°·5E.

$A = +\cdot731$, $B = +\cdot381$, $C = +\cdot566$; $D = +\cdot462$, $E = -\cdot887$; $G = +\cdot502$, $H = +\cdot262$, $K = -\cdot824$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Athens		4·6	320	e 1 12	+ 1	2 9	+ 3	i 2·3	4·1
Helwan		5·6	144	e 1 50	+23	3 3	+29	—	4·8
Belgrade	N.	11·7	335	e 3 2	+ 7	—	—	e 9·1	—
Pompeii		12·1	305	e 2 55	− 5	—	—	—	8·3
Rocca di Papa		13·7	307	3 32	+10	—	—	—	4·1
Tiflis		15·3	57	e 4 1	+18	—	—	e 8·8	11·7
Florence		15·6	311	—	—	—	—	8·8	—
Vienna		16·1	332	e 3 55	+ 2	7 4	+ 7	—	14·3
Innsbruck		17·6	321	i 4 19	+ 7	e 7 38	+ 7	—	—
Moncalieri		18·4	311	3 28	−54	7 39	−10	10·9	13·8
Zurich		19·2	318	e 4 ?3	+ 2	e 8 11	+ 5	—	—
Algiers		20·0	284	e 4 39	− 2	8 29	+ 6	—	13·8
Strasbourg		20·4	320	4 46	0	8 26	− 6	11·3	12·1
Besançon		20·6	315	4 47	− 1	8 39	+ 3	—	10·3
Barcelona		21·1	297	e 4 55	+ 1	—	—	—	—
Tortosa	E.	22·2	295	5 6	− 1	9 8	− 1	—	11·4
	N.	22·2	295	5 13	+ 6	i 9 6	− 3	9·9	10·2
Hamburg		22·8	332	e 5 10	− 5	e 9 20	− 1	—	15·3
Uccle		23·4	321	e 5 19	− 2	9 26	− 7	12·3	—
Paris		23·4	315	e 5 22	+ 1	e 9 31	− 2	13·3	14·3
De Bilt		23·8	325	5 25	− 1	9 36	− 4	12·3	16·0
Granada		25·3	285	i 5 34	− 7	i 10 22	+13	—	—
Toledo		25·6	291	5 33	−11	10 13	− 1	e 12·3	—
Upsala		26·2	351	e 6 7	+17	e 10 17	− 9	—	18·0
San Fernando		27·4	284	6 20	+18	—	—	—	13·3
Bidston		28·7	321	4 14	−121	11 38	+26	—	15·3
Coimbra		29·0	292	e 7 55	−23	12 27	+70	e 17·3	—
Edinburgh		30·0	325	—	—	e 11 20	−14	—	—
Ekaterinburg		31·6	35	6 47	+ 4	11 58	− 3	20·8	22·2
Kodaikanal		51·5	106	33 38	?L	—	—	(33·6)	—
Cape Town		68·9	188	37 16	?L	—	—	(37·3)	—

Additional readings: Athens gives also iP = +1m.26s., MN = +2·8m., T_0 = 19h.48m.52s. Belgrade iPN = +3m.18s., eSR_1 = +5m.52s., iLE = +8·1m. Rocca di Papa PN = +3m.44s. Tiflis e = +4m.45s. and +7m.45s., eL = +10·8m., MN = +11·2m. Vienna iPZ = +4m.15s., SR_1? = +8m.45s. Moncalieri MN = +12·7m. Strasbourg MN = +11·9m. De Bilt MZ = +17·8m. Granada PR_1 = +6m.4s. and +6m.6s. Upsala MN = +18·9m. Ekaterinburg i = +8m.22s., iP_2 = +15m.17s., S_3 = +19m.5s.

Mar. 10d. Readings also at 0h. (Ottawa and Strasbourg), 2h. (Nagasaki), 8h. (Ottawa, Adelaide, Ekaterinburg, Sydney, and Riverview), 9h. (Colombo, and Uccle), 10h. (Ekaterinburg), 11h. (Taihoku), 14h. (Ekaterinburg and near Batavia and Malabar), 17h. (Batavia), 22h. (Mizusawa and Hakodate), 23h. (La Paz).

Mar. 11d. 23h. 6m. 30s. Epicentre 41°·1N. 126°·6W. (as on 1922 Jan. 31d.).

$A = -\cdot449$, $B = -\cdot605$, $C = +\cdot657$; $D = -\cdot803$, $E = +\cdot596$; $G = -\cdot392$, $H = -\cdot528$, $K = -\cdot754$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Berkeley	E.	4·6	134	1 16	+ 5	1 59	− 7	2·2	2·5
	N. or Z.	4·6	134	1 15	+ 4	1 56	−10	2·6	2·8
Lick	E.	5·3	132	1 33	+11	2 21	− 4	2·7	3·3
Victoria	E.	7·7	17	—	—	—	—	4·1	5·7
	N.	7·7	17	—	—	—	—	2·8	6·4
Chicago		29·0	76	—	—	12 30?	+73	15·5?	—
Ann Arbor		31·7	73	e 7 30	+46	—	—	17·1	—

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Toronto		34·5	70	—	—	—	—	20·1	23·3
Ottawa		36·7	66	7 30	+ 2	13 15	− 5	e 18·5	22·5
Ithaca		36·8	71	—	—	—	—	18·5	—
Georgetown	E.	37·5	76	—	—	—	—	e 19·5	—
Washington		37·5	76	—	—	—	—	e 17·5	—
De Bilt		77·8	28	—	—	—	—	e 38·5	—
Uccle		78·6	29	—	—	—	—	e 41·5	—
Strasbourg		81·7	29	—	—	—	—	e 38·5	—
Ekaterinburg		81·8	356	e 21 30	?	e 28 25	?SR_1	38·5	—

Additional readings and notes: Berkeley gives also PEN = +1m.17s. Lick PE = +1m.57s., SE = +2m.27s. and +2m.35s., LE = +2·9m., all readings have been diminished by 4m. Georgetown eN = +19·8m.

Mar. 11d. Readings also at 0h. (La Paz), 10h. (near Nagoya, Osaka, and Mizusawa), 14h. (Zi-ka-wei and near Taihoku), 19h. (La Paz), 20h. (Berkeley), 21h. (near Sapporo), 22h. (Ekaterinburg and Zi-ka-wei).

Mar. 12d. 9h. 42m. 26s. Epicentre 39°·5N. 145°·0E. (as on 1922 April 12d.).

A = −·632, B = +·443, C = +·636; D = +·574, E = +·819; G = −·521, H = +·365, K = −·772.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa	N.	3·0	263	0 40	− 7	1 11	−12	—	—
Hakodate		4·0	307	1 4	+ 2	(1 37)	−13	1·6	1·9
Ootomari		7·4	348	1 54	+ 2	—	—	—	—
Nagoya		7·7	239	1 42	−15	(3 16)	−13	3·3	3·6
Osaka		9·0	241	2 30	+14	(4 14)	+11	4·2	5·2
Kobe		9·2	242	2 19	0	—	—	4·6	4·7
Zi-ka-wei		20·8	254	e 4 41	−10	e 8 23	−17	—	14·5
Manila		32·6	228	e 8 34	?PR_1	—	—	—	—
Ekaterinburg		55·0	318	i 10 33	+54	17 7	−14	26·6	35·3
Uccle		83·3	336	—	—	—	—	—	45·6
Ottawa		87·6	27	—	—	—	—	e 42·6	—
Toronto		87·7	30	(17 16)	?PR_1	—	—	36·6	—

Additional readings: Mizusawa gives also PE = +38s. Hakodate MN = +2·2m. Kobe MN = +5·2m. Ottawa L = +51·6m. Toronto PR_1 is given as L of a previous shock, also L = +69·1m.

Mar. 12d. Readings also at 0h. (Denver), 2h. (Ekaterinburg (2)), 6h. (near Mostar), 7h. (Nagasaki), 9h. (Nagoya), 10h. (Moncalieri, Malaga, near Granada, and near Taihoku), 12h. (Toronto).

Mar. 13d. 19h. 59m. 12s. Epicentre 55°·5N. 152°·0W. (as on 1917 Dec. 28d.).

A = −·500, B = −·266, C = +·824; D = −·469, E = +·883; G = −·728, H = −·387, K = −·566.

Only the stations near the epicentre give satisfactory readings. The Moncalieri readings indicate a shock 24min. later at 20° from Moncalieri, and the readings at other European stations, as well as that at Hong Kong, are also anomalous.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Victoria	E.	18·9	100	4 28	0	8 0	0	12·6	16·2
	N.	18·9	100	4 28	0	7 48	−12	12·1	14·3
Chicago		43·4	80	i 8 25	+ 4	—	—	21·5	—
Toronto		46·3	73	—	—	—	—	28·8	—
Ottawa		47·0	69	i 9 26	+39	—	—	25·3	—
Zi-ka-wei		62·9	285	e 4 31	?	—	—	—	—
Upsala		64·4	6	—	—	—	—	e 25·8	—
Ekaterinburg		64·6	340	e 10 59	+17	—	—	14·3	23·0
Taihoku		67·6	281	—	—	—	—	e 54·8	—
Hamburg		69·9	10	—	—	e 21 48	+83	—	—
Kew		70·5	18	—	—	—	—	—	40·8

Continued on next page.

	Δ °	Az. °	P. m. s.	O−C. s.	S. m. s.	O−C. s.	L. m.	M. m.
De Bilt	70·8	15	—	—	—	—	e 25·8	32·3
Uccle	71·9	16	—	—	—	—	e 26·8	—
Hong Kong	73·9	284	—	—	—	—	16·4	—
Strasbourg	74·6	12	—	—	—	—	e 30·8	—
Moncalieri	78·1	14	e 28 41	?	32 19	?	35·3	—
Toledo	80·8	24	—	—	—	—	40·8	—
Tiflis N.	81·8	347	—	—	(23 12)	+28	23·2	26·5
Rocca di Papa	81·9	10	—	—	—	—	e 33·4	39·9
Simla N.	83·7	319	—	—	—	—	e 27·0	—
Kodaikanal	102·5	310	30 48	?SR_1	—	—	—	—
Colombo	104·4	306	34 48	?	—	—	—	45·8

Additional readings: Chicago gives also L = +26·6m. Ottawa eL = +20·3m. Ekaterinburg P = +25s., e = +6m.8s., i = +17m.41s. Eskdalemuir (Δ = 66°·3, Az. = 19°) gives 20h. to 21h. De Bilt MZ = +37·2m., MN = +37·4m. Tiflis e? = +3m.29s., LN = +19·8m., ME = +34·8m.

Mar. 13d. Readings also at 1h. (Puy de Dôme), 5h. (Manila, Zi-ka-wei, and Ekaterinburg), 6h. (Uccle and De Bilt), 15h. (near Athens), 18h. (near Manila), 23h. (La Paz).

Mar. 14d. 20h. 44m. 8s. Epicentre 5°·6N. 126°·3E. (as on 1921 June 9d.).

A = −·589, B = +·802, C = +·098; D = +·806, E = +·592; G = −·058, H = +·079, K = −·995.

	Δ °	Az. °	P. m. s.	O−C. s.	S. m. s.	O−C. s.	L. m.	M. m.
Manila	10·4	330	i 2 32	− 4	—	—	i 7·3	7·9
Hong Kong	20·4	326	4 34	−12	8 46	+14	9·8	—
Malabar	22·7	236	i 5 10	− 3	i 9 51	+32	—	—
Batavia	22·8	239	i 5 11	− 4	i 9 17	− 4	e 20·9	—
Zi-ka-wei	25·9	350	i 5 26	−21	e 9 40	−40	—	19·4
Kobe	30·2	15	—	—	—	—	—	19·4
Osaka	30·3	15	5 42	−49	—	—	5·9	12·0
Hakodate	38·4	18	7 34	− 7	—	—	—	—
Perth	38·9	193	(6 48)	−57	17 6	?SR_1	20·3	—
Calcutta E.	40·3	300	7 40	−17	—	—	—	—
Adelaide	42·2	165	—	—	e 14 16	−22	e 21·7	26·1
Riverview	45·9	150	e 8 24	−15	i 15 0	−27	e 21·2	28·2
Sydney	45·9	150	8 22	−17	18 40	?SR_1	26·9	31·2
Colombo	46·2	274	3 52	?	—	—	10·7	12·4
Melbourne	46·8	160	—	—	e 15 52	+14	25·4	34·0
Kodaikanal	48·6	279	15 52	?S	(15 52)	− 9	28·5	31·5
Simla E.	52·5	307	e 9 28	+ 5	e 17 28	+38	33·1	—
N.	52·5	307	e 17 10	?S	e 21 46	?SR_1	33·5	—
Ekaterinburg	72·1	329	i 11 24	− 7	i 20 44	− 7	36·9	45·3
Tiflis	79·9	312	—	—	—	—	e 46·3	51·3
Upsala	94·4	331	—	—	e 23 52	−68	e 48·9	65·5
Vienna	98·8	321	e 13 40	−24	24 16	−88	e 43·9	65·9
Victoria E.	99·0	40	24 29	?S	32 17	?SR_1	46·9	47·7
N.	99·0	40	24 27	?S	31 46	?SR_1	40·6	41·1
Hamburg	100·5	327	e 23 52	?S	(23 52)	−129	e 50·9	54·9
Rocca di Papa	103·4	315	e 18 16	?PR_1	—	—	e 52·5	58·8
De Bilt	103·8	327	14 1	−28	e 28 32	+121	e 49·9	57·1
Strasbourg	104·0	324	—	—	—	—	e 55·9	—
Uccle	104·9	327	e 18 4	?PR_1	e 27 58	+77	e 51·9	55·8
Moncalieri	105·5	320	e 14 25	−12	27 54	+67	56·2	69·4
Besançon	105·6	322	—	—	—	—	55·9	—
Edinburgh	105·9	333	—	—	e 28 52	+121	53·9	66·7
Stonyhurst	106·7	331	e 18 52	?PR_1	—	—	—	73·4
Paris	106·9	326	—	—	—	—	e 34·9	38·9
Kew	107·0	330	—	—	—	—	—	70·9
Bidston	107·3	331	45 22	?	51 58	?L	(52·0)	61·9
Oxford	107·4	330	e 23 52	?	—	—	51·8	67·3

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		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Tortosa	N.	112·1	317	—	—	—	—	e 61·1	63·2
Toledo		115·6	319	—	—	—	—	30·9	—
Coimbra		118·1	321	e 19 52	?PR$_1$	e 31 52	?	e 59·9	67·2
Rio Tinto		118·4	317	61 52	?L	—	—	(61·9)	70·9
Lisbon		119·5	321	—	—	—	—	e 68·2	—
Chicago		123·4	30	20 23	?PR$_1$	29 15	0	55·9	—
Ann Arbor		124·9	26	—	—	—	—	e 58·9	—
Ottawa		125·3	17	20 45	?PR$_1$	28 52	?	64·9	70·4
Toronto		125·6	21	—	—	—	—	72·4	—
Pilar	E.	152·0	161	81 40	?	—	—	81·8	90·4
Rio de Janeiro		160·0	210	e 20 10	[+ 2]	—	—	82·4	—
La Paz		162·2	129	20 6	[− 3]	33 38	?	78·6	—

Additional readings and notes: Manila gives also MN = +7·7m. Malabar iE = +4m.51s. Batavia i = +10m.54s. Zi-ka-wei PSZ = +10m.39s. Kobe MN = +18·7m. Osaka MN = +14·8m. Perth P is given as PR$_1$. Adelaide iSR$_1$ = +17m.16s., eSR$_2$ = +18m.52s. Riverview PS = +15m.36s., SR$_2$ = +18m.26s., MN = +29·1m., MZ = +29·6m. T$_0$ = 20h.44m.12s. Melbourne iSR$_1$ = +18m.52s., SR$_2$ = +19m.46s. Ekaterinburg iPS = +20m.56s., SR$_1$ = +23m.44s., SR$_2$ = +25m.31s. Tiflis eN = +13m.46s. and +14m.10s., L = +48·0m. Upsala MN = +65·0m. Vienna PR$_1$? = +17m.46s., e = +27m.46s. Hamburg MZ = +66·9m. De Bilt PR$_1$Z = +18m.21s., MN = +56·2m., MZ = +67·5m. Uccle e = +22m.34s., MN = +57·9m. Moncalieri MN = +63·1m. Eskdalemuir (Δ = 106°·3) gives 21h. to 23h. Paris MN = +43·9m. Tortosa and Toledo readings have been increased by 1h. Toronto L = +82·9m. and +95·5m. Ottawa eL = +37·4m.

Mar. 14d. Readings also at 1h. and 7h. (Nagasaki), 8h. (La Paz and near Mostar), 9h. (Rocca di Papa, near Athens, and near Granada), 10h. (Granada), 18h. (Batavia), 19h. (Florence).

1923. Mar. 15d. 5h. 40m. 20s. Epicentre 43°·5N. 17°·0E.

(as on 1923 Feb. 6d.).

A = +·694, B = +·212, C = +·688; D = +·292, E = −·956; G = +·658, H = +·201, K = −·725.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Sinj		0·4	313	i 0 15	+ 9	—	—	—	—
Travnik		0·5	120	i 0 25	+17	—	—	—	—
Mostar		0·6	104	i 0 12	+ 3	i 0 18	+ 1	—	—
Sarajevo		1·1	70	i 0 22	+ 5	—	—	—	—
Belgrade		2·8	62	i 0 39	− 5	i 1 25	+ 8	—	1·8
Pompeii		3·3	220	i 0 52	0	i 1 34	+ 3	—	3·7
Rocca di Papa		3·6	243	i 0 59	+ 3	1 42	+ 3	2·2	2·6
Venice		3·8	301	e 0 10	−49	0 57	−47	1·2	1·2
Florence		4·2	275	1 7	+ 2	—	—	—	3·2
Budapest		4·3	19	—	—	e 1 42	−16	—	—
Vienna		4·8	355	i 1 14	0	2 11	0	i 2·4	3·1
Innsbruck		5·5	316	i 1 29	+ 4	i 2 46	+15	—	3·4
Moncalieri		6·8	286	1 52	+ 8	3 11	+ 6	4·3	5·8
Zurich		7·1	307	e 1 50	+ 2	—	—	—	—
Athens		7·5	135	1 42	−12	i 2 57	−27	3·2	4·3
Lemberg	E.	8·0	35	e 1 58	− 3	e 3 52	+15	e 4·7	6·0
	N.	8·0	35	e 2 4	+ 3	e 4 4	+27	—	6·0
Strasbourg		8·2	312	2 4	0	3 34	− 8	4·7	5·2
Marseilles		8·4	272	e 2 20	+13	4 0	+13	—	5·1
Besançon		8·6	300	2 16	+ 6	3 50	− 3	—	4·7
Puy de Dôme		10·1	287	1 40	?	—	—	—	—
Barcelona		11·1	264	2 43	− 3	(e 4 40)	−17	e 4·7	8·1
Hamburg		11·1	338	e 2 41	− 5	i 5 0	+ 3	—	8·0
Paris		11·3	303	—	—	e 4 5	−57	4·7	5·7
Uccle		11·3	315	e 2 46	− 3	e 5 0	− 2	e 5·5	—
De Bilt		11·7	321	2 54	− 1	5 13	+ 1	5·7	8·3

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		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Algiers		12·5	242	2 59	− 7	5 47	+15	7·0	8·5
Tortosa	N.	12·5	263	e 3 26	+20	5 42	+10	6·9	8·4
Le Mans		12·5	297	e 7 40	?	e 9 10	?	10·2	11·7
Kew		14·1	310	—	—	—	—	—	9·7
West Bromwich		15·5	312	3 42	− 4	6 55	+11	—	—
Toledo		16·1	264	3 56	+ 3	7 4	+ 7	e 8·7	10·6
Upsala		16·4	2	i 3 47	−10	6 59	− 5	—	9·9
Stonyhurst		16·4	316	i 3 52	− 5	—	—	—	12·4
Bidston		16·5	314	4 55	+56	8 15	?L	(8·2)	10·7
Granada		16·8	255	i 4 11	+ 9	i 7 27	+14	e 9·0	10·0
Eskdalemuir	N.	17·6	319	4 6	− 6	7 30	− 1	8·5	12·3
Helwan		17·8	136	i 4 4	−11	7 13	−23	—	20·7
Edinburgh		17·9	321	4 17	+ 1	7 49	+11	—	13·7
Bergen		18·3	342	4 22	+ 1	7 56	+ 9	9·7	10·7
Rio Tinto		18·7	260	−0 20	?	—	—	—	8·7
San Fernando		19·0	256	4 34	+ 5	8 10	+ 8	10·5	15·7
Coimbra	E.	19·1	269	4 32	+ 2	i 8 8	+ 4	9·7	13·6
	N.	19·1	269	4 28	− 2	i 8 6	+ 2	—	12·5
Lisbon		20·2	265	4 1	−42	7 31	−56	e 9·5	11·4
Tiflis		20·4	86	e 4 37	− 9	e 8 21	−11	12·8	14·8
Ekaterinburg		30·3	49	i 6 33	+ 2	11 6	−33	i 15·8	18·6
Ottawa		62·3	308	10 25	− 2	18 55	+ 3	e 25·2	37·7
Colombo		65·7	104	19 10	?S	(19 10)	−23	—	52·7
Chicago		71·2	310	11 24	0	20 40	0	e 33·7	—
Rio de Janeiro	N.	86·2	233	i 23 4	?S	(i 23 4)	−28	47·0	—

Additional readings and notes: Belgrade gives also iP = +0m.45s., MZ = +2·6m., MN = +3·3m. Rocca di Papa iP = +1m.0s. Venice MNZ = +5·8m. Budapest eP = 5h.41m. Vienna P = +1m.30s., iE = +1m.49s., iN = +1m.50s., i = +1m.58s., iZ = +2m.47s., MZ = +3·7m. Innsbruck MNW = +3·7m. Moncalieri MN = +6·5m. Zurich i = +2m.3s. Athens MN = +5·0m. T_0 = 5h.40m.30s. Barcelona MN = +7·8m. Hamburg iSN = +5m.3s., MN = +6·6m., MZ = +7·7m. Paris e = +2m.1s. and +2m.21s. De Bilt iZ = +2m.56s., MN = +7·4m. Tortosa ME = +15·6m. Toledo SR_1 = +7m.35s., MNW = +11·2m. Upsala MN = +11·3m. Granada PR_1 = +4m.21s. and +4m.31s. Eskdalemuir P = +4m.4s., eN = +7m.25s., iN = +7m.35s. Bergen L and M have been increased by 10m. San Fernando MN = +12·7m. Tiflis eN?? = +4m.21s., MN = +15·2m. Ekaterinburg i = +7m.0s., e = +7m.18s., i = +7m.38s., and +13m.19s.

Mar. 15d. 6h. 2m. 52s. Epicentre 19°·5N. 65°·0W. (as on 1919 Sept. 6d.).

A = +·398, B = −·854, C = +·334; D = −·906, E = −·423: G = +·141, H = −·303, K = −·943.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Porto Rico		1·4	200	i 0 51	+30	—	—	(i 0·8)	1·7
Port au Prince		7·0	264	1 34	−12	(2 29)	−41	2·5	3·4
Georgetown	E.	22·0	334	e 5 19	+14	e 9 18	+13	e 14·5	—
	N.	22·0	334	e 5 14	+ 9	e 9 22	+17	e 13·2	—
Washington		22·0	334	e 5 8	+ 3	e 8 58	− 7	12·5	—
Ithaca		24·9	340	e 5 40	+ 3	e 10 2	+ 1	13·1	—
Toronto		27·0	337	—	—	—	—	e 14·8	21·7
Ann Arbor		27·7	330	e 6 38	+33	i 10 56	+ 2	14·6	—
La Paz		36·1	186	i 7 21	− 2	19 24	?L	(19·4)	28·4
Victoria	E.	54·6	319	0 3	?	—	—	19·9	27·7
	N.	54·6	319	0 5	?	—	—	22·2	27·3
Stonyhurst		58·3	39	—	—	—	—	—	35·1
Uccle		62·0	42	—	—	—	—	e 31·1	—
De Bilt	E.	62·6	40	—	—	—	—	e 31·1	36·2
	N.	62·6	40	—	—	—	—	e 34·1	35·7
Hamburg		65·6	36	e 11 22	+33	—	—	e 38·1	—
Innsbruck		66·7	46	e 11 32	+36	—	—	—	—

Additional readings and notes: Porto Rico gives also MN = +1·6m. Port au Prince P = +1m.44s., MNW = +2·8m. Washington L = +14·6m. Ithaca i = +5m.56s. Toronto eL = +17·1m. La Paz i = +15m.26s.

Mar. 15d. Readings also at 3h. (Manila), 5h. (near Toledo and near Mostar), 6h. (Pilar, Zi-ka-wei, La Paz, near Granada, and near Mostar), 7h. (Rocca di Papa, Zurich, Pompeii, and near Mostar (3)), 8h. (near Mostar), 9h. near Mostar and Sarajevo), 10h. (near Mostar), 11h. (La Paz), 13h. and 14h. (2) (near Mostar), 15h. (Nagasaki and near Mostar), 17h. (near Mostar), 18h. (near Mostar and Sarajevo), 19h. and 20h. (Nagasaki), 21h. (near Mostar), 22h. (La Paz), 23h. (La Paz and Rio de Janeiro).

1923. Mar. 16d. 22h. 1m. 30s. Epicentre 6°·5N. 127°·0E.

(as on 1920 Feb. 25d.).

A = −·598, B = +·793, C = +·113 ; D = +·799, E = +·602 ;
G = −·068, H = +·090, K = −·994.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Manila		10·0	325	e 2 36	+ 6	—	—	6·2	7·5
Taihoku		19·3	345	4 35	+ 2	8 32	+24	10·6	14·1
Hong Kong		20·1	323	4 40	− 2	8 30	+ 5	10·2	11·8
Malabar		23·7	235	5 19	− 6	i 9 46	+ 8	11·5	—
Batavia		23·8	238	5 24	− 2	i 9 40	0	15·0	—
Osaka		29·2	14	6 23	+ 3	11 18	− 2	15·4	17·0
Kobe		29·2	14	e 6 16	− 4	10 52	−28	15·4	19·2
Nagoya		30·1	16	6 6	−23	—	—	—	—
Mizusawa	E.	35·0	19	7 3	−10	12 36	−19	17·3	—
Hakodate		37·3	17	7 54	+22	(13 37)	+ 9	13·6	14·5
Perth		39·9	195	8 2	+ 8	i 13 50	−15	20·7	—
Calcutta		40·6	297	7 56	− 4	—	—	—	—
Ootomari		42·4	15	8 2	−12	(14 15)	−25	14·2	—
Adelaide		42·9	166	e 8 6	−11	i 14 48	+ 1	e 21·2	26·3
Riverview		46·4	152	e 8 38	− 5	e 15 15	−18	e 20·7	30·8
Sydney		46·4	152	5 30	?	14 0	−93	26·8	27·7
Colombo		46·8	273	8 18	−28	15 48	+10	32·7	34·0
Melbourne		47·3	161	—	—	i 18 6	?	—	32·4
Kodaikanal		49·1	278	10 42	+101	(16 24)	+17	16·4	36·2
Simla	E.	52·6	305	10 24	+60	18 0	+69	33·6	34·7
	N.	52·6	305	10 30	+66	17 54	+63	34·2	—
Bombay		54·1	289	9 43	+ 9	—	—	—	—
Wellington		64·7	143	15 54	?	i 23 48	?	i 32·0	—
		64·7	143	e 10 48	+ 5	e 19 18	− 3	i 34·1	37·5
Christchurch		64·8	145	—	—	(19 42)	+19	32·0	45·8
Ekaterinburg		71·8	329	i 11 31	+ 3	20 37	−11	33·5	47·0
Honolulu		73·6	70	—	—	e 21 27	+18	47·7	48·5
Helwan		91·7	300	e 13 16	− 9	23 48	−44	—	64·4
Upsala		93·9	332	e 17 18	?PR_1	—	—	e 44·5	65·7
Belgrade		97·0	318	e 14 2	+ 8	e 24 13	−73	e 44·6	63·8
Budapest		97·1	320	e 47 30	?L	—	—	(e 47·5)	—
Victoria	E.	97·9	39	13 46	−13	24 54	−41	40·8	54·4
	N.	97·9	39	13 57	− 2	25 12	−23	40·7	41·3
Vienna		98·6	323	e 13 52	−11	24 55	− 47	e 47·5	55·5
Bergen		99·2	336	18 30	?PR_1	—	—	—	—
Hamburg		100·2	328	e 14 30	+18	e 24 30	−88	e 49·5	55·7
Berkeley	E.	101·9	49	—	—	24 32	−102	47·0	55·5
	Z.	101·9	49	—	—	24 28	−106	48·3	55·5
Innsbruck		102·0	323	—	—	e 24 40	−95	e 49·5	—
Lick		102·6	50	—	—	—	—	—	65·6
Rocca di Papa		103·3	316	14 18	− 9	26 0	−27	e 51·4	59·0
De Bilt	E.	103·5	328	14 12	−16	e 24 53	−96	e 51·5	57·2
	N.	103·5	328	—	—	—	—	e 50·5	56·4
Florence		103·5	320	12 20	−128	—	—	—	59·0
Strasbourg		103·7	325	14 15	−14	e 27 42?	+72	e 50·0	62·9
Zurich		103·7	323	13 30?	−59	e 24 48	−102	e 51·5	—
Uccle		104·5	327	e 14 18	−14	24 58	−100	e 51·5	55·6
Moncalieri		105·3	320	e 14 13	−23	27 42	+57	48·8	75·8
Besançon		105·4	324	—	—	—	—	51·5	—
Edinburgh		105·4	333	e 18 50	?PR_1	28 47	+121	48·5	66·8
Eskdalemuir		105·8	333	e 14 9	−29	—	—	—	—
Stonyhurst		106·3	332	18 42	?PR_1	19 42	?	55·5	73·5
Paris		106·6	326	—	—	e 25 30	−87	53·5	66·5
Kew		106·6	329	—	—	—	—	—	81·5
West Bromwich		106·9	330	18 44	?PR_1	29 6	+126	—	—
Bidston		106·9	332	20 15	?PR_1	25 38	−62	—	61·0
Oxford		107·0	329	e 18 3	?PR_1	23 23	?	—	57·5

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Marseilles		107·6	320	e 18 30	?PR$_1$	e 28 30	+84	50·5	59·5
Cape Town		109·0	235	25 24	?S	(25 24)	−115	—	59·5
Barcelona		110·5	319	e 19 30	?PR$_1$	e 29 0	+87	e 43·5	62·5
Tortosa	E.	111·9	319	—	—	28 54	+69	—	69·4
	N.	111·9	319	19 17	?PR$_1$	29 6	+81	44·7	61·5
Algiers		112·1	314	e 19 13	?PR$_1$	29 13	+86	e 47·5	71·0
Toledo		115·4	320	—	—	e 29 50	+97	e 41·5	74·4
Granada		116·6	317	e 20 13	?PR$_1$	i 31 15	?	e 63·7	66·5
Coimbra		117·9	323	e 20 13	?PR$_1$	29 55	+82	56·5	74·2
Rio Tinto		118·1	320	16 30	+56	—	—	—	92·5
San Fernando		118·7	318	20 30	?PR$_1$	30 18	?	—	73·5
Lisbon		119·3	322	—	—	—	—	e 58·7	61·7
Chicago		122·3	30	20 40	?PR$_1$	30 25	?	37·5	—
Ann Arbor		123·8	26	e 20 54	?PR$_1$	—	—	73·5	—
Ottawa		124·3	17	20 52	?PR$_1$	28 45	−36	56·5	70·5
Toronto		124·4	23	—	—	—	—	59·6	84·7
Ithaca		126·6	20	—	—	—	—	69·5	—
Georgetown		129·4	22	e 21 41	?PR$_1$	—	—	80·6	—
Washington		129·4	22	e 21 16	?PR$_1$	30 24	?	e 47·8	—
Pilar	E.	152·9	159	26 54	?	—	—	90·0	99·1
	N.	152·9	159	26 0	?	—	—	85·0	131·7
Andalgala	N.	155·4	150	23 42	?PR$_1$	—	—	79·4	84·5
Rio de Janeiro		161·1	209	e 21 6	[+57]	—	—	84·7	—
La Paz		162·1	125	20 19	[+10]	35 8	?	79·5	84·0

Additional readings and notes: Taihoku gives also MN = +15·1m. Batavia eE = +5m.16s., iE = +9m.4s. Osaka MN = +19·3m. Mizusawa SN = +12m.35s. Perth PR$_1$ = +9m.36s. Adelaide ePR$_1$ = +9m.42s., eSR$_1$ = +17m.18s., eSR$_2$ = +19m.12s. Riverview eP = +8m.54s., PS = +15m.45s., eSR$_1$ = +18m.32s. and +18m.45s., MN = +29·6m., MZ = +29·4m., T$_0$ = 22h.1m.48s. Melbourne e = +12m.42s., PR$_1$ = +14m.36s. Wellington (first line) iPR$_1$ = +18m.48s., i = +20m.30s., and several other i and iL readings (second line) e = +13m.6s. and +14m.30s. and several other readings. Christchurch S is recorded as PR$_1$, also S = +23m.54s., SR$_1$ = +29m.30s., L has been increased by 10m. A second set of readings slightly smaller than the above are also given. Ekaterinburg PR$_1$ = +14m.14s., PR$_2$ = +15m.31s., iSR$_1$ = +21m.2s., SR$_1$ = +24m.12s.; all these readings are given as for 23h. Honolulu eN = +25m.50s., eE = +34m.18s., and +43m.12s., MN = +47·6m. Upsala MN = +52·9m. Vienna i = +14m.36s., PR$_1$ = +17m.59s., PR$_2$ = +20m.8s., iE = +24m.30s., PS = +26m.30s., SR$_1$ = +33m.30s., eLZ = +54·5m., MZ = +65·5m. Hamburg MN = +55·3m., MZ = +67·2m. Berkeley PR$_1$E = +16m.36s., PR$_1$Z = +16m.58s., PR$_2$EZ = +21m.28s., SR$_2$E = +36m.32s., SR$_2$Z = +36m.42s. Rocca di Papa P = +14m.42s. and +18m.36s. De Bilt PR$_1$ = +18m.30s., MZ = +67·4m. Strasbourg i = +18m.28s., MN = +57·0m. Uccle PR$_1$ = +18m.36s., MN = +58·0m. Moncalieri MN = +63·2m. Eskdalemuir ePR$_2$Z? = +18m.37s. Bidston S = +30m.0s. Toledo MNW = +70·2m. Granada MN = +66·4m. Coimbra MN = +66·4m. San Fernando MN = +83·5m. Ann Arbor eL = +38·5m., L = +82·5m. Ottawa eL = +37·8m. Toronto L = +68·2m., eL = +79·8m. Georgetown eN = +22m.3s. and two other L readings. La Paz PR$_1$ = +26m.0s., SR$_1$ = +44m.58s.

Mar. 16d. Readings also at 1h. and 5h. (near Mostar), 9h. (near Christchurch and Wellington), 14h. (La Paz and near Mostar and Sarajevo), 15h. and 16h. (near La Paz), 17h. (De Bilt and Strasbourg), 18h. (Ekaterinburg), 19h. (3), 20h., and 22h. (near Mostar).

Mar. 17d. 16h. 1m. 33s. Epicentre 23°·5N. 119°·0E. (as on 1922 April 7d.).

A = −·445, B = +·802, C = +·399; D = +·875, E = +·485; G = −·193, H = +·349, K = −·917.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Hokoto	0·5	86	−0 27	−35	—	—	−0·1	—
Taihoku	2·8	56	0 44	0	(1 2)	−15	1·0	1·1
Zi-ka-wei	8·0	15	e 1 59	− 2	e 3 41	+ 4	—	4·6
Manila	9·1	168	—	—	—	—	e 5·2	—
De Bilt	85·1	326	—	—	—	—	e 47·4	—
Strasbourg	85·5	322	—	—	—	—	e 55·4	—
Edinburgh	86·8	330	—	—	—	—	e 56·4	—

Zi-ka-wei gives also MN = +4·5m.

We could in some ways improve the residuals by subtracting 33sec. from T_0, but this would suggest moving the epicentre further from both Zi-ka-wei and Manila, which are in nearly opposite azimuths.

Mar. 17d. Readings also at 6h. (Manila and Batavia), 7h. (Ekaterinburg), 9h. (near Batavia and Malabar), 10h. (near Mostar (3)), 11h. (Nagasaki), 12h. (near Mostar), 13h. (Manila and near Mostar (2)), 14h. (near Mostar (2)), 16h. (near Taihoku and near Mostar), 17h. (Ekaterinburg and near Mostar), 18h. (Nagasaki), 19h. (near Mostar), 20h. (Simla), 21h. (La Paz and La Plata), 23h. (Nagasaki (2)).

Mar. 18d. 20h. 29m. 30s. Epicentre 33°·6N. 111°·4W. (as on 1921 Mar. 25d.).

A = −·304, B = −·776, C = +·553 ; D = −·931, E = +·365 ; G = −·202, H = −·515, K = −·833.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Tucson		1·4	161	0 24	+ 3	—	—	0·9	1·0
Berkeley	E.	9·8	298	—	—	—	—	e 5·7	—
Victoria		17·3	333	7 25	?S	(7 25)	0	10·2	12·9
Chicago		20·4	59	10 9	?L	11 19	?	11·4	—
Toronto		26·7	58	—	—	—	—	14·7	—
Georgetown		28·0	69	—	—	—	—	e 14·5	—
Ithaca		28·7	62	—	—	—	—	e 14·5	—
Ottawa		29·6	56	—	—	—	—	e 15·8	18·5

Additional readings : Berkeley gives also LE = +5·8m. and +6·8m. Ottawa L = +16·3m.

Mar. 18d. Readings also at 2h. (Nagasaki), 4h. (Lemberg and Vienna), 5h. (Christchurch), 6h. (Riverview), 7h. (Christchurch), 8h. (Wellington), 10h. (Simla), 11h. (Denver), 12h. (Nagasaki), 14h. (Hokoto, Manila, and near Mostar), 15h. (Ann Arbor), 16h. (near Mostar (3) and near Taihoku), 17h. (near Osaka), 22h. (Manila).

Mar. 19d. 11h. 13m. 6s. Epicentre 6°·0N. 84°·0W. (as on 1920 July 16d.).

A = +·104, B = −·989, C = +·104 ; D = −·994, E = −·104 ; G = +·011, H = −·104, K = −·994.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Balboa Hts.	E.	5·3	56	1 38	+16	2 28	+ 3	—	3·3
	N.	5·3	56	1 34	+12	2 24	− 1	—	2·8
La Paz		27·4	145	i 5 57	− 5	i 10 44	− 4	13·9	15·1
Georgetown	E.	33·5	10	—	—	15 8	?	e 17·1	—
Chicago		35·9	356	—	—	—	—	13·9	—
Ann Arbor		36·4	1	—	—	i 14 36	+80	16·9	—
Toronto		37·9	6	—	—	—	—	e 18·3	22·5
Ottawa		40·1	10	—	—	13 26	−42	15·9	21·9
Pilar	E.	42·3	154	15 24	?S	(15 24)	+45	18·0	20·3
	N.	42·3	154	14 48	?S	(14 48)	+ 9	19·7	20·2
La Plata	E.	47·7	150	8 49	− 3	—	—	28·1	29·5
	N.	47·7	150	8 48	− 4	—	—	28·2	33·2
Rio de Janeiro		49·2	127	i 16 2	?S	(i 16 2)	− 7	25·0	27·6
Victoria	E.	54·0	330	17 22	?S	(17 22)	+13	26·1	34·1
	N.	54·0	330	17 14	?S	(17 14)	+ 5	25·3	35·2
Uccle		84·4	40	—	—	—	—	e 37·9	—
De Bilt	E.	84·8	39	—	—	e 23 12	− 5	e 38·9	42·9
	N.	84·8	39	—	—	—	—	e 36·9	45·6
Strasbourg		86·9	42	—	—	—	—	e 39·9	—
Ekaterinburg		110·9	20	—	—	e 34 40	?SR_1	48·9	—

Additional readings and notes : Balboa Heights SE has been diminished by 1min. to agree with SN and M. Georgetown gives also eE = +9m.18s., LE = +17·9m., and LN = +18·4m. Toronto iL = +21·7m. Ottawa e = +9m.54s. La Plata N = +21m.57s. T_0 = 11h.12m.18s. Rio de Janeiro S = +19m.46s. De Bilt MZ = +45·2m.

Mar. 19d. Readings also at 2h. (Nagasaki), 4h. (Nagasaki and near Barcelona and Tortosa), 8h. (near Barcelona and Tortosa), 10h. (near La Paz and La Plata), 11h. (Rocca di Papa and near Sarajevo and Mostar), 15h. (Riverview), 16h. (Ekaterinburg, Nagasaki, Strasbourg, Ottawa, and De Bilt), 17h. (De Bilt), 20h. (Zi-ka-wei), 21h. (Hakodate, De Bilt, Strasbourg, Ottawa, La Plata, Ekaterinburg, and near Mizusawa), 22h. (Uccle).

Mar. 20d. 8h. 48m. 10s. Epicentre 43°·7N. 144°·4E. (as on 1920 Sept. 27d.).

A = −·588, B = +·421, C = +·691.

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Ootomari		3·2	1 0	+10	—	—	1·8	—
Hakodate		3·3	—	—	1 24	− 7	2·4	2·9
Mizusawa	E.	5·2	1 21	+ 1	2 24	+ 2	—	—
	N.	5·2	1 23	+ 3	2 27	+ 5	—	—
Ekaterinburg		51·6	—	—	—	—	18·8	—

Hakodate gives also MN = +2·8m.

Mar. 20d. Readings also at 2h. (Ekaterinburg), 3h. (De Bilt and Strasbourg), 4h. (near Nagasaki), 7h. (Nagasaki and Zi-ka-wei), 8h. (La Paz and La Plata), 13h. (La Paz and near Malabar), 19h. (Nagasaki and Ekaterinburg), 22h. (near Manila).

Mar. 21d. 8h. 28m. 54s. Epicentre 46°·0N. 149°·0E. (as on 1922 April 25d.).

A = −·596, B = +·358, C = +·719; D = +·515, E = +·857; G = −·617, H = +·370, K = −·695.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari		4·4	281	1 26	+18	—	—	2·6	—
Hakodate		7·3	238	2 26	+35	—	—	4·3	4·8
Mizusawa	E.	8·9	223	2 17	+ 2	4 13	+12	—	—
Osaka		15·3	227	3 41	− 2	(6 35)	+ 4	6·6	7·4
Kobe		15·4	228	3 41	− 3	(6 56)	+15	6·9	—
Zi-ka-wei	Z.	25·9	245	5 30	−17	—	—	—	14·7
Ekaterinburg		52·2	316	9 27	+ 6	16 50	+ 4	22·1	—
Hamburg		74·5	337	—	—	—	— e 36·1		—
Strasbourg		79·7	336	—	—	—	— e 39·1		—
Rocca di Papa		84·1	327	e 15 18	?	(22 18)	−51	22·3	23·1

Additional readings and notes: Mizusawa gives also PN = +2m.16s. Osaka MN = +7·7m. Zi-ka-wei readings have been increased by 1h. Ekaterinburg e = +11m.25s., +12m.47s., +13m.50s., +18m.24s., and +19m.12s. Rocca di Papa e = +11m.6s.

Mar. 21d. Readings also at 1h. (near Mizusawa), 2h. (2) and 6h. (Nagasaki), 9h. (Rocca di Papa and near Balboa Heights), 10h. and 14h. (Nagasaki), 19h. (La Paz).

Mar. 22d. 7h. 46m. 30s. Epicentre 19°·0N. 144°·0E. (as on 1919 Aug. 27d.).

A = −·765, B = +·556, C = +·326; D = +·588, E = +·809; G = −·263, H = +·191, K = −·946.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Nagoya		17·3	340	4 20	+11	—	—	—	—
Osaka		17·4	336	4 15	+ 5	—	—	6·5	7·2
Kobe		17·4	336	4 15	+ 5	—	—	—	—
Mizusawa	E.	20·3	354	4 38	− 7	(8 18)	−11	—	—
Manila		22·5	262	e 6 13	+62	—	—	—	—
Hakodate		22·9	354	5 16	0	—	—	—	—
Ekaterinburg		70·6	325	11 23	+ 2	i 20 31	− 2	50·5	—
Uccle		101·7	334	—	—	—	—	e 51·5	—
La Paz		149·3	90	19 51	[− 4]	—	—	—	—

Mizusawa gives also SN = +8m.12s. This and SE are given as P's of another shock.

Mar. 22d. Readings also at 3h. (Simla and Nagasaki (2)), 8h. (Nagoya), 10h. (near Manila), 11h. (Batavia, near La Paz, and near Tortosa), 13h. (near Mostar and near Mizusawa), 14h. (Mizusawa), 17h. (near Mostar and near Tortosa), 18h. (near Victoria), 20h. and 23h. (Nagasaki).

Mar. 23d. Readings at 0h. (Nagasaki), 1h. (near Bergen), 6h. (near Taihoku), 12h. and 13h. (2) (Nagasaki), 15h. (near La Paz and La Plata), 18h. and 23h. (near Taihoku).

1923. Mar. 24d. 12h. 40m. 10s. Epicentre 31°·5N. 100°·5E.

(as on 1919 May 29d.).

A = −·155, B = +·838, C = +·522; D = +·983, E = +·182; G = −·095, H = +·514, K = −·853.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Calcutta		14·0	233	2 29	−57	(6 2)	− 6	6·0	—
Hong Kong		15·2	123	3 27	−15	6 5	−32	6·6	12·8
Zi-ka-wei		17·9	85	i 4 1	−15	7 25	−13	—	—
Hokoto		18·6	111	4 29	+ 5	7 43	−10	10·2	12·7
Taihoku		19·6	104	4 45	+ 9	8 28	+13	10·8	11·7
Simla	E.	19·9	275	5 2	+22	8 44	+23	11·8	16·3
	N.	19·9	275	5 2	+22	8 50	+29	11·6	13·8
Nagasaki		24·8	79	5 15	−21	9 52	− 7	13·9	16·2
Manila		25·2	127	e 5 27	−13	—	—	12·0	13·2
Bombay		27·9	250	5 53	−14	10 46	−11	14·7	16·5
Kobe		29·1	74	6 4	−15	10 58	−21	15·0	17·0
Osaka		29·3	74	6 16	− 5	11 13	− 9	16·0	18·7
Kodaikanal		30·1	230	6 44	+15	(10 50)	−46	10·8	24·7
Nagoya		30·5	72	5 35	−58	10 47	−56	15·5	16·5
Colombo		31·2	224	4 50	?	—	—	25·8	29·8
Hakodate		33·5	63	8 3	+62	—	—	18·4	21·2
Mizusawa	E.	33·7	66	6 48	−14	12 8	−28	17·8	—
	N.	33·7	66	6 47	−15	12 5	−31	16·0	—
Ootomari		35·6	52	7 8	−10	12 44	−20	15·2	19·9
Ekaterinburg		37·3	325	i 7 29	− 3	i 13 8	−20	17·8	24·4
Batavia		38·2	171	7 17	−23	e 13 11	−30	20·4	—
Malabar		39·3	170	i 7 36	−13	i 13 34	−22	16·6	20·8
Tiflis		45·1	300	e 8 35	+ 1	e 15 37	+21	e 21·8	25·8
Lemberg		58·1	312	e 12 14	+134	e 18 32	+32	e 30·6	36·8
Helwan		58·4	289	10 2	+ 1	18 10	+ 6	—	42·0
Upsala		59·7	325	—	—	e 20 14	+115	e 28·8	39·5
Athens		61·6	300	—	—	e 18 47	+ 4	e 29·8	37·8
Belgrade		61·8	310	e 10 34	+10	e 17 33	−73	e 33·5	35·5
Vienna		63·4	314	10 33	− 1	19 11	+ 5	e 30·8	40·1
Perth		65·0	167	19 28	?S	(19 28)	+ 3	34·8	39·4
Bergen		65·4	329	20 30	?S	(20 30)	+60	37·8	—
Hamburg		65·4	320	e 10 51	+ 4	e 19 45	+15	e 31·8	36·2
Innsbruck		66·8	314	e 11 2	+ 5	e 19 56	+ 8	e 30·8	38·4
Rocca di Papa	E.	68·1	309	i 11 12	+ 7	20 20	+17	e 35·4	40·3
	N.	68·1	309	i 11 17	+12	21 2	+59	—	—
Florence		68·3	311	e 20 20	?S	(e 20 20)	+14	—	40·8
Zurich		68·6	314	e 11 11	+ 3	20 45	+36	—	—
Strasbourg		68·6	315	11 5	− 3	20 15	+ 6	32·8	40·5
De Bilt		68·7	320	11 11	+ 2	20 15	+ 5	e 30·8	38·1
Uccle		70·0	319	e 11 15	− 2	20 28	+ 2	30·8	38·0
Moncalieri		70·1	312	11 21	+ 3	20 39	+12	29·0	52·4
Besançon		70·2	315	11 11?	− 7	—	—	—	35·8
Edinburgh		71·3	325	—	—	e 21 26	+44	34·8	46·2
Eskdalemuir		71·6	325	e 11 20	− 7	20 44	− 1	31·8	39·1
Paris		71·6	318	e 9 43	−104	e 19 2	−103	26·8	34·8
Stonyhurst		71·9	322	e 11 32	+ 3	21 50	+ 1	30·5	46·3
Kew		71·9	321	—	—	—	—	—	45·8
Marseilles		72·4	311	—	—	e 20 30	−25	33·8	40·8
West Bromwich		72·4	323	20 50	?S	(20 50)	− 5	—	—
Bidston		72·5	322	13 50	+137	22 5	+69	—	40·8
Puy de Dôme		72·8	315	—	—	e 21 50	+50	33·8	—
Le Mans		73·4	319	—	—	—	—	e 37·8	49·8

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Barcelona		75·3	311	e 12 0	+ 9	e 21 38	+ 9	e 34·4	41·8
Adelaide		75·5	149	—	—	(21 20)	−12	e 44·3	52·0
Tortosa	E.	76·7	312	—	—	21 59	+14	31·0	42·0
	N.	76·7	312	12 6	+ 7	21 50	+ 5	36·2	42·8
Algiers		77·0	308	e 11 14	−47	21 51	+ 2	49·8	52·8
Sitka	E.	79·7	28	—	—	e 36 22	?	39·5	47·5
	N.	79·7	28	—	—	e 38 22	?	39·7	43·9
Toledo		80·2	313	e 12 24	+ 4	e 22 29	+ 4	e 36·8	51·0
Melbourne		80·7	147	—	—	i 22 8	−23	32·1	50·3
Riverview		80·9	140	e 12 47	+23	e 22 18	−16	e 33·2	45·3
Sydney		80·9	140	12 14	−10	22 50	+16	49·0	51·0
Granada		81·3	310	12 20	− 7	i 22 48	+10	e 34·8	41·8
Coimbra	E.	82·8	315	e 13 28	+53	22 54	− 1	35·9	45·5
	N.	82·8	315	—	—	23 0	+ 5	38·3	44·9
Rio Tinto		83·0	311	20 50	?	—	—	—	75·8
San Fernando		83·5	310	12 38	− 1	22 56	− 7	43·1	53·3
Lisbon		84·0	312	—	—	—	—	e 33·5	43·5
Honolulu	E.	88·1	66	13 38	+32	29 12		?SR_1	42·0	46·7
	N.	88·1	66	—	—	29 40		?SR_1	46·0	47·1
Johannesburg		89·9	239	23 50?	?S	(23 50?)	−23	—	49·3
Victoria	E.	91·1	28	13 16	− 6	23 48	−37	40·8	52·3
	N.	91·1	28	13 21	− 1	23 46	−39	41·4	50·8
Azores		94·5	322	52 20	?L	—	—	(52·3)	55·6
Wellington		99·9	133	—	—	e 24 8	−107	e 44·8	47·8
Berkeley		100·0	33	—	—	e 26 37	+41	51·6	58·4
Lick	E.	100·7	33	—	—	—	—	51·7	57·9
Cape Town		101·2	237	29 13	?	—	—	—	59·0
Ottawa		103·1	358	—	—	25 50	−35	44·8	62·3
Northfield		104·1	355	—	—	—	—	e 58·8	—
Toronto		104·9	0	—	—	e 34 14	?	44·1	63·0
Ithaca		106·1	358	—	—	e 25 50	−63	50·8	—
Ann Arbor		106·2	3	—	—	i 27 50	+56	55·8	65·6
Chicago		106·4	7	e 18 58	?PR_1	—	—	50·8	—
Georgetown		109·6	359	e 18 50	?PR_1	26 16	−68	60·8	67·5
Washington		109·6	359	16 2	+67	24 58	−146	e 53·3	—
Cheltenham	E.	109·7	358	—	—	e 59 54	?L	66·0	67·8
	N.	109·7	358	—	—	58 12	?L	65·6	66·7
Rio de Janeiro		146·7	275	e 42 50	?	—	—	63·9	—
La Paz		161·8	323	20 13	[+ 4]	34 28	?	74·8	93·2
La Quiaca	E.	164·6	304	31 44	?	—	—	88·9	117·4
	N.	164·6	304	32 50	?	—	—	97·2	98·7
Pilar	E.	166·7	265	43 50	?	—	—	95·7	104·5
	N.	166·7	265	43 50	?	—	—	94·7	109·2

Additional readings and notes: Zi-ka-wei readings have been increased by 1h. Manila gives also MN = +12·2m. Kobe MN = +16·6m. Osaka MN = +16·5m. Hakodate MN = +18·9m. Colombo readings have been diminished by 2h. Ekaterinburg iPR_1 = +8m.44s. Batavia iE = +9m.5s. and +16m.26s., i = +13m.19s., +20m.0s., and +22m.45s. Malabar i = +9m.10s. Tiflis eP = +8m.53s. Upsala MN = +35·9m. Athens eS = +26m.1s., MN = +37·3m. Belgrade PR_1 = +13m.41s. and +16m.13s., SR_1 = +18m.47s. and +20m.48s., LN = +37·3m., LE = +42·9m. Vienna PR_1 = +12m.47s., PR_2 = +14m.50s., SR_1 = +25m.28s., L = +34·8m. Perth S = +27m.17s., SR_1 = +30m.16s. Hamburg MZ = +40·9m. Rocca di Papa eN = +9m.44s. Strasbourg MN = +37·1m. De Bilt e = +27m.50s., MZ = +43·8m. Uccle SR_1 = +25m.3s., SR_2 = +27m.57s., MN = +38·7m. Moncalieri MN = +42·8m. Eskdalemuir SR_1 = +25m.30s., SR_2 = +28m.50s. Paris MN = +36·8m. West Bromwich S = +29m.28s. Barcelona MN = +42·0m. Adelaide gives S as iSR_1, also many other readings. Sitka LE = +41·9m. Toledo MNW = +45·5m. Melbourne SR_1 = +26m.50s. Riverview i = +22m.23s., PS = +23m.15s., eSR_1 = +27m.7s., MN = +43·6m., MZ = +56·2m. T_0 = 12h.41m.17s. Sydney PS = +34m.26s., SR_2 = +41m.56s. P and S have been diminished by 10m. Granada S = +23m.6s.; true S is recorded as i simply. San Fernando MN = +52·8m. Honolulu LE = +33·5m. and +38·0m.; the reading of P has been diminished by 10m. Wellington gives very many other e readings. Berkeley eN = +24m.37s., LN = +33·0m. Lick eE = +37m.25s., e = +37m.40s., LE = +46·7m. Ottawa eE = +20m.26s., e = +24m.43s., eL = +37·8m. Northfield L = +62·8m. Toronto iL = +61·0m. Ithaca e = +37m.50s., L = +56·8m. Ann Arbor eN? = +20m.50s., eL = +38·8m. Georgetown eLE = +38·2m., eLN = +37·8m. Washington L = +64·7m. La Paz LE = +72·8m.

Mar. 24d. Readings also at 0h. (Batavia), 2h. (Ottawa and near Port au Prince), 3h. (La Paz), 5h. (near Taihoku), 8h. (Ottawa, Toronto, and near Balboa Heights), 14h. (near Algiers), 21h. (La Paz), 23h. (Manila).

Mar. 25d. Readings at 0h. (Batavia), 2h. (Mizusawa and Ekaterinburg), 6h. (Strasbourg), 7h. (La Paz), 16h. (Batavia and near Malabar), 21h. (Zurich, Rocca di Papa, and Vienna).

Mar. 26d. 13h. 43m. 0s. Epicentre 30°·2S. 75°·0E. (as on 1918 Aug. 26d.).

$A = +\cdot224$, $B = +\cdot835$, $C = -\cdot503$; $D = +\cdot966$, $E = -\cdot259$; $G = -\cdot130$, $H = -\cdot486$, $K = -\cdot864$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Colombo	37·3	8	14 0	?S	(14 0)	+32	—	24·0
Batavia	38·4	57	e 8 0	+19	i 13 32	−12	15·6	24·0
Cape Town	47·4	250	—	—	—	—	—	24·0
Melbourne	57·2	118	—	—	15 24	−145	21·0	26·7
Simla N.	61·3	2	—	—	—	—	e 32·0	—
Manila	63·0	51	14 0	?PR_1	—	—	—	—
Riverview	63·2	116	—	—	e 25 45	?SR_1	e 28·6	29·9
Zi-ka-wei	75·6	40	e 11 2	−51	—	—	e 44·2	—
Ekaterinburg	87·9	353	—	—	e 23 34	−17	39·0	51·3
Strasbourg	98·9	323	—	—	—	—	e 61·0	—
Hamburg	100·8	327	—	—	—	—	e 63·0	—
De Bilt	102·3	324	—	—	—	—	e 59·0	73·6
Bidston	107·3	322	—	—	—	—	—	79·0
Edinburgh	108·3	325	—	—	—	—	e 70·0	—
Ottawa	152·6	312	—	—	—	—	e 74·0	—
Victoria	157·0	33	19 47	[−18]	—	—	82·4	84·2
Chicago	161·8	314	—	—	—	—	e 75·3	—

Additional readings, &c.: Simla observation entered as e simply. Riverview MN = +32·0m. Zi-ka-wei P and L entered as e simply. De Bilt eLN = +62·0m., MN = +70·9m., MZ = +73·3m. Eskdalemuir (Δ = 108°·2) gives simply 14h.30m. to 15h.15m. Victoria PN = +19m.46s., LE = +20·8m., LN = +19·9m., ME = +21·6m., MN = +21·2m., LN = +96·5m. Chicago observation entered as e simply, L = +87·3m.

Mar. 26d. Readings also at 1h. (Manila), 4h. (Ekaterinburg and Eskdalemuir), 6h. (Uccle, Innsbruck, Ekaterinburg, Bidston, Eskdalemuir, De Bilt, Hamburg, and near Mizusawa), 8h. (Colombo, Kodaikanal, and Zi-ka-wei), 12h. (Nagasaki), 14h. (Taihoku), 15h. (Algiers, Toronto, and Perth), 16h. (2) and 17h. (2) (Nagasaki), 19h. (Ekaterinburg), 23h. (Nagasaki).

Mar. 27d. Readings at 3h. (Pompeii and Rocca di Papa), 10h. (Nagasaki), 13h. (Nagasaki (2) and Sydney), 18h. (Algiers), 19h. (Nagasaki).

Mar. 28d. 4h. 28m. 20s. Epicentre 7°·0S. 124°·0E.

$A = -\cdot555$, $B = +\cdot823$, $C = -\cdot122$; $D = +\cdot829$, $E = +\cdot559$; $G = +\cdot068$, $H = -\cdot101$, $K = -\cdot993$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Malabar	16·3	268	4 1	+ 5	7 11	+ 9	—	—
Batavia	17·0	272	4 4	− 1	—	—	i 8·2	—
Manila	21·8	352	e 5 16	+13	—	—	9·7	11·2
Perth	26·1	196	—	—	i 9 45	−39	14·8	20·0
Hong Kong	30·9	343	6 33	− 4	11 40	−10	14·8	—
Adelaide	31·0	157	—	—	e 10 40	−71	e 14·0	17·3
	31·0	157	—	—	i 11 28	−23	—	18·2
Melbourne	36·1	150	e 7 58	+35	i 13 28	+17	i 17·7	—
Riverview	36·7	141	i 6 57	−31	i 12 25	−55	—	23·8
Sydney	36·7	141	6 46	−42	12 40	−40	19·5	23·2
Kobe	43·0	14	—	—	(14 41)	− 7	14·7	—
Osaka	43·1	14	9 25	+66	(14 44)	− 5	14·7	16·0
Colombo	46·2	286	—	—	7 58	?	29·7	33·2
Kodaikanal	49·5	290	29 22	?L	—	—	(29·4)	—
Christchurch	56·0	140	—	—	—	—	25·4	28·6
Wellington	56·5	137	e 9 52	+ 3	e 16 52	−48	—	—
Ekaterinburg	81·9	330	i 12 29	− 1	i 22 38	− 7	34·2	54·8
Tiflis	86·7	314	—	—	e 23 2	−36	e 25·4	—
Upsala	104·2	330	—	—	e 27 40	+65	e 58·7	—
Vienna	106·9	319	e 18 45	?PR_1	—	—	—	121·7
Hamburg	109·7	324	e 19 22	?PR_1	—	—	e 60·7	—
Victoria	110·2	39	—	—	—	—	51·7	54·6
Innsbruck	110·4	318	—	—	e 25 10	−142	—	—
Rocca di Papa	110·5	311	i 18 46	?PR_1	—	—	—	—
Strasbourg	112·5	320	e 20 24	?PR_1	—	—	e 63·7	—
De Bilt	113·0	323	e 19 45	?PR_1	e 29 42	+108	e 56·7	63·1
Uccle	113·9	322	e 19 46	?PR_1	e 29 34	+93	e 41·7	—
Bidston	117·0	326	33 10?	?	—	—	—	46·7
Ottawa	138·0	19	e 41 40	?	e 46 40	?	e 52·7	—
La Paz	153·6	153	20 4	[+ 3]	30 59	?	49·7	—

Additional readings and notes: Batavia gives also iP = +4m.9s., i = +5m.28s. Manila MN = +11·0m. Perth L = +19·6m. Readings given as for 6h. Adelaide (first line) eSR_2 = +12m.58s., (second line) eSR_2 = +13m.58s. Melbourne e = +9m.28s. Riverview iPS = +13m.2s., MZ = +19·7m., MN = +19·9m., T_0 = 4h.28m.17s. Osaka MN = +15·0m. Colombo P = 4h.17m.12s. Christchurch SR_1? = +9m.46s., SR_2 = +15m.10s. Wellington +20m.40s., +21m.28s., +24m.58s., +29m.4s., +30m.40s., +31m.4s., and +32m.28s. Ekaterinburg PR_1 = +15m.45s. All readings have been increased by 30m. Tiflis e = +24m.6s., eE = +24m.10s., eN = +24m.28s. Vienna iPZ = +18m.59s. Victoria PN = +33m.41s., LN = +45·3m., MN = +46·0m. Rocca di Papa ePN = +19m.37s., PR_1 = +29m.40s. De Bilt MN = +65·9m., MZ = +72·7m.

Mar. 28d. 20h. 29m. 12s. Epicentre 5°·5S. 130°·0E. (as on 1921 Mar. 24d.).

$A = -\cdot640$, $B = +\cdot763$, $C = -\cdot096$; $D = +\cdot766$, $E = +\cdot643$; $G = +\cdot062$, $H = -\cdot073$, $K = -\cdot995$.

On each previous occasion when this epicentre was adopted a depth of focus was found necessary.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	22·0	336	e 5 6	+ 1	(9 9)	+ 4	9·2	9·3
Batavia	23·0	267	i 5 12	− 5	9 17	− 8	—	—
Adelaide	30·5	166	—	—	—	—	e 15·8	17·0
Riverview	34·5	148	e 6 42	−27	e 11 56	−52	—	17·5
Ekaterinburg	83·6	330	i 15 50	?	i 22 42	−23	—	—
Vienna z.	109·7	320	19 20	?PR_1	—	—	—	—
La Paz	151·6	141	19 52	[− 6]	—	—	—	—

Additional readings: Batavia gives also i = +5m.52s. Adelaide eSR_1 = +10m.48s., e = +12m.0s. Riverview SR_1 = +13m.46s., MN = +17·8m., MZ = +18·2m. T_0 = 20h. 29m. 14s.

Mar. 28d. Readings also at 3h. (Kobe and near Mostar), 4h. (Nagasaki), 5h. (Nagoya and Uccle), 6h. (Ann Arbor), 7h. (Zi-ka-wei), 13h. (near Mostar), 15h. (Christchurch), 16h. (Nagasaki (2)), 18h. (Vienna, Rio Tinto, Batavia, and Ekaterinburg), 21h. (Ekaterinburg), 22h. (Victoria, Lick, and near Berkeley).

Mar. 29d. Readings at 0h. (Zi-ka-wei), 1h., 8h., and 11h. (Nagasaki), 14h. (Sarajevo), 15h. (Nagasaki), 17h. and 20h. (near Mostar), 22h. (Batavia).

Mar. 30d. 10h. 12m. 0s. Epicentre 43°·4N. 19°·2E.

$A = +\cdot686$, $B = +\cdot239$, $C = +\cdot687$.

		Δ	P.	O−C.	S.	O−C.	M.
		°	m. s.	s.	m. s.	s.	m.
Sarajevo		0·7	i 0 11	0	i 0 20	0	—
Mostar		1·0	i 0 15	0	i 0 28	0	0·5
Belgrade		1·7	i 0 22	− 4	i 0 39	− 9	0·7
Rocca di Papa	E.	5·1	e 3 12	?L	—	—	3·5

Rocca di Papa gives also iPN = +3m.4s.

Mar. 30d. Readings also at 13h. (near Mizusawa and Hakodate), 14h. (near La Paz), 23h. (Nagasaki).

Mar. 31d. Readings at 7h. (near Mizusawa and Nagasaki), 11h. (near Batavia and Malabar), 18h. (La Paz), 23h. (Nagasaki, near Batavia and Malabar, and near Athens).

TABLE OF 2 VERSIN Δ.

The epicentral distance Δ is calculated at Oxford by the formula

$$2 \text{ versin } \Delta = (A-a)^2+(B-b)^2+(C-c)^2$$

where A, B, C are the direction cosines of the epicentre, a, b, c those of the observing station. This method is found rapid and convenient. It requires a table of squares for three or four figures, and a table of 2 versin Δ, which was given in the *Monthly Notices R. A. S.* for May 1915, (75, 538). But as this may not be generally accessible it is reprinted here.

TABLE OF 2 VERSIN Δ.

I. In Units of the Sixth Decimal Place.

°	·0.	·1.	·2.	·3.	·4.	·5.	·6.	·7.	·8.	·9.	°
0	0	3	12	27	49	76	110	149	195	247	0
1	305	369	439	515	597	685	780	880	987	1100	1
2	1218	1343	1474	1611	1754	1904	2059	2220	2388	2561	2
3	2741	2927	3118	3316	3520	3730	3947	4169	4397	4631	3
4	4872	5118	5370	5630	5894	6165	6442	6725	7014	7309	4

II. In Ordinary Units.

5	·0076	·0079	·0082	·0086	·0089	·0092	·0096	·0099	·0102	·0106	5
6	·0110	·0113	·0117	·0121	·0125	·0129	·0133	·0137	·0141	·0145	6
7	·0149	·0153	·0158	·0162	·0167	·0171	·0176	·0180	·0185	·0190	7
8	·0195	·0200	·0204	·0209	·0215	·0220	·0225	·0230	·0235	·0241	8
9	·0246	·0252	·0257	·0263	·0269	·0274	·0280	·0286	·0292	·0298	9
10	·0304	·0310	·0316	·0322	·0329	·0335	·0341	·0348	·0354	·0361	10
11	·0368	·0374	·0381	·0388	·0395	·0401	·0409	·0415	·0423	·0430	11
12	·0437	·0444	·0452	·0459	·0467	·0474	·0482	·0489	·0497	·0505	12
13	·0513	·0521	·0528	·0536	·0544	·0553	·0561	·0569	·0577	·0586	13
14	·0594	·0603	·0611	·0620	·0628	·0637	·0646	·0655	·0664	·0672	14
15	·0681	·0691	·0700	·0709	·0718	·0727	·0737	·0746	·0756	·0765	15
16	·0775	·0784	·0794	·0804	·0814	·0824	·0834	·0844	·0854	·0864	16
17	·0874	·0884	·0894	·0905	·0915	·0926	·0936	·0947	·0957	·0968	17
18	·0979	·0990	·1001	·1011	·1022	·1034	·1045	·1056	·1067	·1078	18
19	·1090	·1101	·1112	·1124	·1136	·1147	·1159	·1171	·1182	·1194	19
20	·1206	·1218	·1230	·1242	·1254	·1267	·1279	·1291	·1303	·1316	20
21	·1328	·1341	·1354	·1366	·1379	·1392	·1404	·1417	·1430	·1443	21
22	·1456	·1469	·1483	·1496	·1509	·1522	·1536	·1549	·1563	·1576	22
23	·1590	·1604	·1617	·1631	·1645	·1659	·1673	·1687	·1701	·1715	23
24	·1729	·1743	·1758	·1772	·1786	·1801	·1815	·1830	·1844	·1859	24

TABLE OF 2 VERSIN Δ—*continued.*

°	·0.	·1.	·2.	·3.	·4.	·5.	·6.	·7.	·8.	·9.	°
25	·1874	·1889	·1903	·1918	·1933	·1948	·1963	·1978	·1994	·2009	25
26	·2024	·2039	·2055	·2070	·2086	·2101	·2117	·2133	·2148	·2164	26
27	·2180	·2196	·2212	·2228	·2244	·2260	·2276	·2292	·2308	·2325	27
28	·2341	·2358	·2374	·2390	·2407	·2424	·2440	·2457	·2474	·2491	28
29	·2508	·2525	·2542	·2559	·2576	·2593	·2610	·2627	·2645	·2662	29
30	·2679	·2697	·2715	·2732	·2750	·2768	·2785	·2803	·2821	·2839	30
31	·2857	·2875	·2893	·2911	·2929	·2947	·2965	·2984	·3002	·3020	31
32	·3039	·3058	·3076	·3095	·3114	·3132	·3151	·3170	·3189	·3208	32
33	·3227	·3246	·3265	·3284	·3303	·3322	·3342	·3361	·3380	·3400	33
34	·3419	·3439	·3458	·3478	·3498	·3517	·3537	·3557	·3577	·3597	34
35	·3617	·3637	·3657	·3677	·3697	·3717	·3738	·3758	·3779	·3799	35
36	·3820	·3840	·3861	·3881	·3902	·3923	·3944	·3964	·3985	·4006	36
37	·4027	·4048	·4069	·4091	·4112	·4133	·4154	·4176	·4197	·4218	37
38	·4240	·4261	·4283	·4304	·4326	·4348	·4370	·4391	·4413	·4435	38
39	·4457	·4479	·4501	·4523	·4545	·4567	·4590	·4612	·4634	·4657	39
40	·4679	·4701	·4724	·4747	·4769	·4792	·4815	·4837	·4860	·4883	40
41	·4906	·4929	·4952	·4975	·4998	·5021	·5044	·5067	·5090	·5114	41
42	·5137	·5160	·5184	·5207	·5230	·5254	·5278	·5302	·5325	·5349	42
43	·5373	·5397	·5420	·5444	·5468	·5493	·5517	·5541	·5565	·5589	43
44	·5613	·5637	·5662	·5686	·5710	·5735	·5760	·5784	·5809	·5833	44
45	·5858	·5882	·5907	·5932	·5957	·5982	·6007	·6032	·6057	·6082	45
46	·6107	·6132	·6157	·6182	·6208	·6233	·6258	·6284	·6309	·6335	46
47	·6360	·6386	·6411	·6436	·6462	·6488	·6514	·6540	·6566	·6591	47
48	·6617	·6643	·6669	·6695	·6721	·6748	·6774	·6800	·6826	·6852	48
49	·6879	·6905	·6932	·6958	·6984	·7011	·7038	·7064	·7091	·7118	49
50	·7144	·7171	·7198	·7225	·7252	·7278	·7306	·7332	·7360	·7386	50,
51	·7414	·7441	·7468	·7495	·7522	·7550	·7577	·7604	·7632	·7659	51
52	·7687	·7714	·7742	·7769	·7797	·7825	·7852	·7880	·7908	·7936	52
53	·7964	·7992	·8019	·8047	·8075	·8104	·8132	·8160	·8188	·8216	53
54	·8244	·8273	·8301	·8329	·8357	·8386	·8414	·8443	·8471	·8500	54
55	·8528	·8556	·8586	·8614	·8643	·8672	·8701	·8729	·8758	·8787	55
56	·8816	·8845	·8874	·8903	·8932	·8961	·8990	·9020	·9049	·9078	56
57	·9107	·9137	·9166	·9195	·9225	·9254	·9283	·9313	·9342	·9372	57
58	·9402	·9431	·9461	·9491	·9520	·9550	·9580	·9610	·9639	·9669	58
59	·9699	·9729	·9759	·9789	·9819	·9849	·9879	·9909	·9939	·9969	59
60	1·000	1·003	1·006	1·009	1·012	1·015	1·018	1·021	1·024	1·027	60
61	1·030	1·033	1·036	1·040	1·043	1·046	1·049	1·052	1·055	1·058	61
62	1·061	1·064	1·067	1·070	1·073	1·077	1·080	1·083	1·086	1·089	62
63	1·092	1·095	1·098	1·101	1·104	1·108	1·111	1·114	1·117	1·120	63
64	1·123	1·126	1·130	1·133	1·136	1·139	1·142	1·145	1·148	1·152	64

TABLE OF 2 VERSIN Δ—*continued.*

°	·0.	·1.	·2.	·3.	·4.	·5.	·6.	·7.	·8.	·9.	°
65	1·155	1·158	1·161	1·164	1·167	1·171	1·174	1·177	1·180	1·183	65
66	1·187	1·190	1·193	1·196	1·199	1·203	1·206	1·209	1·212	1·215	66
67	1·219	1·222	1·225	1·228	1·231	1·235	1·238	1·241	1·244	1·248	67
68	1·251	1·254	1·257	1·261	1·264	1·267	1·270	1·273	1·277	1·280	68
69	1·283	1·287	1·290	1·293	1·296	1·300	1·303	1·306	1·309	1·313	69
70	1·316	1·319	1·323	1·326	1·329	1·332	1·336	1·339	1·342	1·346	70
71	1·349	1·352	1·355	1·359	1·362	1·365	1·369	1·372	1·375	1·379	71
72	1·382	1·385	1·389	1·392	1·395	1·399	1·402	1·405	1·409	1·412	72
73	1·415	1·419	1·422	1·425	1·429	1·432	1·435	1·439	1·442	1·445	73
74	1·449	1·452	1·455	1·459	1·462	1·466	1·469	1·472	1·476	1·479	74
75	1·482	1·486	1·489	1·492	1·496	1·499	1·503	1·506	1·509	1·513	75
76	1·516	1·520	1·523	1·526	1·530	1·533	1·537	1·540	1·543	1·547	76
77	1·550	1·553	1·557	1·560	1·564	1·567	1·571	1·574	1·577	1·581	77
78	1·584	1·588	1·591	1·594	1·598	1·601	1·605	1·608	1·612	1·615	78
79	1·618	1·622	1·625	1·629	1·632	1·636	1·639	1·642	1·646	1·649	79
80	1·653	1·656	1·660	1·663	1·666	1·670	1·673	1·677	1·680	1·684	80
81	1·687	1·691	1·694	1·697	1·701	1·704	1·708	1·711	1·715	1·718	81
82	1·722	1·725	1·729	1·732	1·735	1·739	1·742	1·746	1·749	1·753	82
83	1·756	1·760	1·763	1·767	1·770	1·774	1·777	1·781	1·784	1·787	83
84	1·791	1·794	1·798	1·801	1·805	1·808	1·812	1·815	1·819	1·822	84
85	1·826	1·829	1·833	1·836	1·840	1·843	1·847	1·850	1·854	1·857	85
86	1·860	1·864	1·867	1·871	1·874	1·878	1·881	1·885	1·888	1·892	86
87	1·895	1·899	1·902	1·906	1·909	1·913	1·916	1·920	1·923	1·927	87
88	1·930	1·934	1·937	1·941	1·944	1·948	1·951	1·955	1·958	1·962	88
89	1·965	1·969	1·972	1·976	1·979	1·983	1·986	1·990	1·993	1·997	89
90	2·000	2·003	2·007	2·010	2·014	2·017	2·021	2·024	2·028	2·031	90
91	2·035	2·038	2·042	2·045	2·049	2·052	2·056	2·059	2·063	2·066	91
92	2·070	2·073	2·077	2·080	2·084	2·087	2·091	2·094	2·098	2·101	92
93	2·105	2·108	2·112	2·115	2·119	2·122	2·126	2·129	2·133	2·136	93
94	2·140	2·143	2·146	2·150	2·153	2·157	2·160	2·164	2·167	2·171	94
95	2·174	2·178	2·181	2·185	2·188	2·192	2·195	2·199	2·202	2·206	95
96	2·209	2·213	2·216	2·219	2·223	2·226	2·230	2·233	2·237	2·240	96
97	2·244	2·247	2·251	2·254	2·258	2·261	2·265	2·268	2·271	2·275	97
98	2·278	2·282	2·285	2·289	2·292	2·296	2·299	2·303	2·306	2·309	98
99	2·313	2·316	2·320	2·323	2·327	2·330	2·334	2·337	2·340	2·344	99
100	2·347	2·351	2·354	2·358	2·361	2·364	2·368	2·371	2·375	2·378	100
101	2·382	2·385	2·388	2·392	2·395	2·399	2·402	2·406	2·409	2·412	101
102	2·416	2·419	2·423	2·426	2·429	2·433	2·436	2·440	2·443	2·447	102
103	2·450	2·453	2·457	2·460	2·463	2·467	2·470	2·474	2·477	2·480	103
104	2·484	2·487	2·491	2·494	2·497	2·501	2·504	2·508	2·511	2·514	104

TABLE OF 2 VERSIN △—*continued.*

°	·0.	·1.	·2.	·3.	·4.	·5.	·6.	·7.	·8.	·9.	°
105	2·518	2·521	2·524	2·528	2·531	2·534	2·538	2·541	2·545	2·548	105
106	2·551	2·555	2·558	2·561	2·565	2·568	2·571	2·575	2·578	2·581	106
107	2·585	2·588	2·591	2·595	2·598	2·601	2·605	2·608	2·611	2·615	107
108	2·618	2·621	2·625	2·628	2·631	2·635	2·638	2·641	2·645	2·648	108
109	2·651	2·654	2·658	2·661	2·664	2·668	2·671	2·674	2·677	2·681	109
110	2·684	2·687	2·691	2·694	2·697	2·700	2·704	2·707	2·710	2·713	110
111	2·717	2·720	2·723	2·727	2·730	2·733	2·736	2·739	2·743	2·746	111
112	2·749	2·752	2·756	2·759	2·762	2·765	2·769	2·772	2·775	2·778	112
113	2·781	2·785	2·788	2·791	2·794	2·797	2·801	2·804	2·807	2·810	113
114	2·813	2·817	2·820	2·823	2·826	2·829	2·833	2·836	2·839	2·842	114
115	2·845	2·848	2·852	2·855	2·858	2·861	2·864	2·867	2·870	2·874	115
116	2·877	2·880	2·883	2·886	2·889	2·892	2·896	2·899	2·902	2·905	116
117	2·908	2·911	2·914	2·917	2·920	2·923	2·927	2·930	2·933	2·936	117
118	2·939	2·942	2·945	2·948	2·951	2·954	2·957	2·960	2·964	2·967	118
119	2·970	2·973	2·976	2·979	2·982	2·985	2·988	2·991	2·994	2·997	119

The table should not be used near 180°. It is preferable to use the formula $(a+A)^2+(b+B)^2+(c+C)^2$ instead of $(a-A)^2+(b-B)^2+(c-C)^2$. But, of course, values for angles greater than 90° can be obtained by subtracting from 4 values for an angle less than 90°.

TABLE.

Degrees.	P sec.	S sec.	S − P sec.	Degrees.	P sec.	S sec.	S − P sec.	Degrees.	P sec.	S sec.	S − P sec.
1	15	28	13	51	553	991	438	101	855	1565	710
2	31	55	24	52	560	1004	444	102	860	1575	715
3	47	83	36	53	566	1016	450	103	865	1584	719
4	62	110	48	54	573	1029	456	104	870	1593	723
5	77	137	60	55	579	1041	462	105	874	1602	728
6	92	164	72	56	586	1054	468	106	879	1612	733
7	106	190	84	57	592	1066	474	107	884	1621	737
8	121	217	96	58	599	1079	480	108	888	1630	742
9	136	243	107	59	605	1091	486	109	893	1639	746
10	150	269	119	60	612	1103	491	110	897	1648	751
11	164	294	130	61	619	1116	497	111	902	1657	755
12	179	319	140	62	625	1128	503	112	907	1666	759
13	193	344	151	63	632	1141	509	113	911	1674	763
14	206	368	162	64	638	1153	515	114	916	1682	766
15	219	392	173	65	645	1165	520	115	920	1690	770
16	232	415	183	66	651	1177	526	116	925	1698	773
17	245	438	193	67	658	1190	532	117	929	1706	777
18	257	460	203	68	664	1202	538	118	934	1714	780
19	269	482	213	69	671	1214	543	119	938	1722	784
20	281	503	222	70	677	1226	549	120	942	1729	787
21	293	524	231	71	683	1238	555	121	947	1737	790
22	305	545	240	72	690	1250	560	122	952	1744	792
23	317	565	248	73	696	1262	566	123	957	1752	795
24	328	584	256	74	702	1274	572	124	961	1759	798
25	338	603	265	75	709	1286	577	125	966	1766	800
26	348	622	274	76	715	1297	582	126	970	1773	803
27	358	641	283	77	721	1309	588	127	974	1780	806
28	368	659	291	78	727	1320	593	128	978	1787	809
29	378	677	299	79	733	1332	599	129	983	1794	811
30	388	694	306	80	739	1343	604	130	988	1801	813
31	398	711	313	81	745	1355	610	131	992	1807	815
32	407	728	321	82	750	1366	616	132	996	1814	818
33	416	744	328	83	756	1377	621	133	1001	1821	820
34	425	760	335	84	762	1388	626	134	1005	1827	822
35	433	775	342	85	768	1399	631	135	1009	1833	824
36	442	790	348	86	773	1410	637	136	1014	1840	826
37	450	804	354	87	779	1421	642	137	1018	1846	828
38	458	818	360	88	785	1432	647	138	1023	1852	829
39	466	832	366	89	790	1443	653	139	1027	1858	831
40	475	847	372	90	796	1454	658	140	1031	1864	833
41	483	861	378	91	801	1464	663	141	1035	1869	834
42	491	875	384	92	807	1475	668	142	1039	1875	836
43	498	888	390	93	812	1485	673	143	1043	1881	838
44	506	902	396	94	818	1496	678	144	1047	1886	839
45	513	915	402	95	823	1506	683	145	1051	1892	841
46	520	928	408	96	829	1516	687	146	1055	1897	842
47	527	941	414	97	834	1526	692	147	1059	1902	843
48	534	954	420	98	840	1536	696	148	1063	1907	844
49	540	966	426	99	845	1546	701	149	1067	1912	845
50	547	979	432	100	851	1556	705	150	1071	1917	846

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