The International Seismological Summary for 1920 January, February, March.

FORMERLY THE BULLETIN OF THE BRITISH ASSOCIATION SEISMOLOGY COMMITTEE.

The present number opens the third year of the Summary in its new international form. A general discussion on its arrangement has been suggested for the forthcoming international assembly at Madrid in October, 1924, so that it may be convenient to review here the chief points of procedure in forming the Summary, as experience has gradually moulded them.

I.—The Cards.

Information sent from the observing stations is entered on cards. At first all information from a single station for a single day was entered on a single card, but this was found to be inconvenient, and ultimately a separate card was assigned to each clearly independent shock. This is a little extravagant, and possibly a further change in the direction of using a card for information from different stations which all relates clearly to the same shock may be made. But at present this has not been tried. In fact, it has been the general practice to utilize the rest of the card (especially the back) for computing information relating to the station, which has its name printed on the card, as also the constants *a*, *b*, *c* attaching to the station. But two circumstances affected this procedure in practice.

(a) Sometimes after adopting an epicentre the study of the residuals suggests a change, so that the computations on the card no longer apply.

(b) Sometimes an old epicentre is adopted, in which case the computations are not needed.

For these and other reasons computation on the back of the card has fallen into desuetude; so that there is plenty of room on the card for other uses. The precise use of the cards is, however, a practical detail which does not seriously affect the printing of the Bulletin.

II.—Card Compartments.

The cards are then arranged in compartments under each day. There are four upright chests of drawers, each assigned to a year's records. At present 1919 has been printed off, so that the first chest contains the records for 1920, the other three containing 1921, 1922, and 1923. [Records for 1924 are being collected in a set of 12 separate boxes recently made.] If arrears are caught up sufficiently to set free one of these chests, it will be used for one of the earlier years, not yet dealt with in the modern fashion. The most pressing case is that of 1912, in which there are some good records, though the material is so scanty that after some trials the systematic attack on it was abandoned in favour of 1914. This was at a time when the work was quite new to us, and it was desirable to have plenty of good material. But, subsequently, 1913 was partially dealt with (the "Large Earthquakes of 1913") and our greater experience may enable us now to deal with 1912 (and even earlier years) on a modern footing.

In each yearly chest there are 12 drawers, each devoted to one month, and each drawer is divided into 32 compartments (numbered for the days of the month, with one or two to spare) to receive the cards.

III.—Adopted Tables for P and S: Depth of Focus.

This practically collects together all the information referring to each shock. The next step is to deduce the values of T_0 from the observations of P and S by use of the adopted tables. These tables are only a first approximation, and it has long been hoped to propose corrections to them, but after several abortive trials the hope of doing so at an early date was abandoned, when it was discovered that there were serious differences in the depth of focus at which a shock might take place. Evidence at that time available in support of this view was collected in the Geophysical Supplement to the Monthly Notices R. Ast. Soc., Vol. I, No. 1., and a few copies of this paper were distributed at the first seismological gathering in Rome in 1922. Since then much more evidence has been accumulated. It may be convenient to have a list of the dates so far obtained when there was exceptional depth of focus: The great majority of shocks are at a normal depth which we *suspect* (it cannot be called yet more than a suspicion) to be about 0·040 of the earth's radius below the surface. There is, however, a smaller Group I, when the depth is believed to be less than this normal depth (whatever it is) by the following fractions of the earth's radius :—

GROUP I.

Date	Defect	Date	Defect	Date	Defect
1914 June 26	−·010	1918 July 8	−·010	1919 April 30	−·015
1916 Jan. 1	−·009	1918 Sept. 7	−·030	1919 May 6	−·030
1916 Oct. 3	−·021	1918 Sept. 8		1919 May 29	−·020
1916 Oct. 20	−·021	1918 Sept. 12		1919 Oct. 12	−·020

1917 May 1 and June 13 have been omitted on revision.

It will be seen that there are a few cases of defect by ·030; so that if we admit these as approximately correct, the normal depth must exceed 0·030; 0·040 becomes accordingly a reasonable estimate for the great majority (Group II) at normal depth. Below this group comes Group III, as below.

GROUP III.

Date	Excess	Date	Excess	Date	Excess
1913 Nov. 10	+·033	1918 Nov. 18	+·030	1919 Mar. 16	+·015
1914 Feb. 26	+·053	1918 Nov. 23		1919 Mar. 16	
1915 Jan. 5	+·034	1918 Dec. 14	+·030	1919 Apr. 17	+·010
1916 June 21	+·060	1918 Dec. 25	+·070	1919 May 3	+·005
1916 Sept. 3	+·035	1919 Jan. 1	+·030	1919 June 1	+·040
1917 April 21	+·033	1919 Mar 1	+·030	1919 Aug. 18	+·050
1918 Feb. 7	+·025	1919 Mar. 2	+·020	1919 Aug. 18	
1918 April 10	+·070	1919 Mar. 2		1919 Aug. 31	+·015
1918 May 22	+·050	1919 Mar. 9		1919 Oct. 27	+·040
1918 May 25	+·015	1919 Mar. 13	+·070?	1919 Nov. 6	+·010
				1919 Nov. 20	+·040

There are at least two cases in which there is evidence of so great a depth as ·070 below normal, *i.e.*, at least ·100 of the radius below the surface. There are also some cases where the suggested depth below normal is small (·005 for instance), but where the evidence is so good that the hypothesis has been adventured.

It will thus be clear why the attempt to obtain corrections to the adopted tables has been deferred; for the second approximation should involve some reference to the depth of focus, which, though already declared roughly, is still to be obtained with as great precision as possible. The present tables are constructed on the assumption that the focus lies practically close to the surface. On this assumption Prof. C. G. Knott calculated the paths of the rays, and this work has been used in inferring the depth of focus to which we may take ·040 as a first approximation. We can already see how the tables should be modified in consequence in a general way. For instance, denoting the epicentre by E, the focus ·040 below it by F, and an observing station 10° distant from E by X, then the present tables give the time when P is observed at

E as T_0, at X as T_0+150s.

where T_0 is the actual moment of the shock. But suppose the focus were ·040 lower down still (·080 altogether): It was shown

in the paper cited (Geop. Sup. I 1) that the existing tables could be used if we applied a correction to each Δ (distance from epicentre), viz., for E the correction $+1^{\circ}\cdot5$ and for X the correction $-0^{\circ}\cdot5$, making them $+1^{\circ}\cdot5$ and $+9^{\circ}\cdot5$ respectively, and now the times would be given by the existing tables as T_0+23s. and T_0+143s., so that the interval falls from 150s. to 120s. If, on the other hand, we suppose a focus ·040 higher instead of lower, so as to bring it into the surface, then we should reverse these figures. (This is not strictly correct, but will serve for illustration). The effective distances will become $-1^{\circ}\cdot5$ and $+10^{\circ}\cdot5$, and the times

$$T_0-23\text{s. and } T_0+157\text{s.},$$

the interval being now 180s.

We see, in fact, that if we assume that the present tables are really applicable to shocks originating ·040 below the surface, then if we infer from them new tables applicable to surface shocks (such as Professor Knott thought he was dealing with) we must increase the intervals, especially near the epicentre. Applying the above procedure to other distances (and adding 23s. in the fourth line so as to make the epicentre time zero and all the others positive), the figures are :

Δ from Epicentre	0°	5°	10°	15°	20°	30°	60°	90°
Effective Δ	−1·5	+4·9	10·5	16·0	21·6	32·6	64·6	95·4
	s.	s.	s.	s.	s.	s.	s.	s.
P from tables	−23	+76	157	232	300	413	642	825
23sec. added	0	99	180	255	323	436	665	848
Present tables	0	77	150	219	281	388	612	795
Diff.	0	22	30	36	42	48	53	53

It will be seen that a correction of over 53s. is ultimately needed for P near 90°, but that nearly half of this accrues in the first 5°. The surface velocity is, in fact, considerably decreased.

But so far from this making a difficulty, it removes one. The surface velocity deduced from the Oppau explosion was shown by Dr. Jeffreys and Dr. Wrinch to be much smaller than that assumed in the adopted tables. They find, from consideration of distances up to about 3° from the origin (Geop. Sup. M.N.R.A.S. I 2, p. 16) a velocity of 5·4 km/sec. for P instead of 7·1 km/sec. as shown by the present tables, a decrease in the ratio $5\cdot4/7\cdot1=0\cdot76$. The ratio for 5° distance shown above is $77/99=0\cdot78$, clearly a ratio of the right order of magnitude. It may be doubted whether the present tables are sufficiently correct in detail to allow of a more precise comparison. But it is also clear that they require drastic revision to represent times from an origin on the surface; followed by the repetition of Prof. Knott's investigation with the revised figures.

One other notable consequence of the proposed revision is its effect on PR and SR. At present the time for PR_1 for $\Delta=60^o$ is taken as 2 (P for 30^o)$=2\times$6m.28s.$=$12m.56s., following P for 60^o by 2m.44s. But with the revised tables the time for 30^o is increased by 48s., which is doubled in calculating PR_1, while the correction for 60^o only appears singly. Thus (PR_1-P) is increased by 96s.—53s.$=$43s. Here again this removes instead of introducing a difficulty; for the times observed for PR_1 at large distances from the epicentre are persistently much larger than their calculated values. Since the correction to present tables tends to the constant value 53s., the increase in (PR_1-P) tends also to this value. But this is the increase which would apply when the origin is in the surface, and when the PR_1 ray is consequently made up of two exactly equal arcs; when the focus is below the surface the arcs for PR_1 are no longer equal, and a further correction is needed, which, however, we need not consider here.

The situation is thus as follows: The adopted tables are not applicable to earthquakes originating close to the earth's surface, as was supposed, but neither do most earthquakes originate near the surface, as was supposed. The normal depth at which they originate is about ·040 radius, the evidence for which is

(a) That in certain cases the origin is ·030 radius above the normal depth, which must therefore exceed ·030.

(b) that the recognition of this normal depth, and the consequent correction of the tables which were constructed to suit it, immediately removes the difficulty about the surface velocity, which, as deduced from the Oppau explosion, was sensibly less than the tables assigned.

(c) That the correction of the tables also reconciles the observations of PR_1 at great distances, formerly in error.

Consequently tables really applicable to surface shocks would be essentially different from those adopted; but since most shocks are not surface shocks the adopted tables suit them fairly well, and may be retained for the present until we are on firm enough ground to undertake the revision. It is only recently that even a rough estimate of the normal depth (0·040 radius) has been possible.

IV.—Determination of T_0 from P and S.

Using then the Adopted Tables, the next step is to determine T_0 from as many complete observations of P and S as are available. Thus on 1920 Jan. 4d. 4h. we have among others the following observations of P and S (omitting 4h.).

		P.	S.	S−P.	Δ	T_0
		m. s.	m. s.	m. s.	°	m. s.
Mobile		e 26 48	i 29 14	2 26	12·5	23 42
Tucson	E.	25 33	29 3	3 30	18·7	21 8
	N.	25 44	29 14	3 30	18·7	21 19
Lawrence		e 26 48	e 30 13	3 25	18·2	22 29
St. Louis		26 51	30 39	3 48	20·6	22 3
Denver		26 0	30 0	4 0	22·0	20 55
Chicago		27 26	31 44	4 18	24·2	21 56
La Paz		e 30 32	e 37 16	6 44	45·2	21 58
Uccle		e 34 37	45 0	10 23	83·4	21 59
Strasbourg		e 34 50	e 45 27	10 37	86·0	21 57

It will be seen that the last four give closely consistent determinations of T_0, and we may include St. Louis. But the others are discordant, and such discordances are often a source of considerable uncertainty in determining the place of the epicentre.

V.—Determination of Epicentre.

Whenever possible the epicentre is fixed by use of those observations only which give accordant values of T_0. Using the corresponding observing stations (which are permanently marked on a globe) as centres, arcs of circles are drawn with radii indicated by the S−P differences; the intersections indicate the neighbourhood of the epicentre, which is selected by inspection. But if an old epicentre is close to this spot it is usually adopted for use, in the first instance at any rate, since the former calculations of Δ and Azimuth then become available.

VI.—Calculation of Δ and Azimuth.

Such requisite values of Δ as have not been previously calculated are now found from the formula

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

The quantities a, b, c, are given in a list of observing stations, two editions of which have already been circulated; and A, B, C, are given for each epicentre. A table of 2 versin Δ is given in Mon. Not. R.A.S. for May 1915 (**75** p. 530).

At first the Azimuths (Z) were *calculated* also, from the formulæ

$$2 \sin \Delta \sin Z = (a-D)^2+(b-E)^2+c^2-2$$
$$2 \sin \Delta \cos Z = (a-G)^2+(b-H)^2+(c-K)^2-2$$

—but this involved much work, especially when the position of the epicentre was afterwards revised, and as only an approximate value of the Azimuth is usually required, it has recently been deemed sufficient to read it from the globe, by means of a string and a large circumscribing scale. But in most cases the constants D, E, G, H, K, have still been printed, though they may not have been used, except perhaps for azimuths close to the epicentre.

VII.—Depth of Focus.

In most cases the arcs drawn on the globe intersect in a point or small area, with sufficient precision to indicate that the focal depth is normal. This supposition is not abandoned without strong reasons, which will become clear to anyone who will try to solve the cases in the above list on the ordinary lines. The cases of deeper focus than usual might perhaps be solved on the alternative hypothesis that the first shock took place simultaneously over a large area, so that instead of a single epicentre E, we might adopt a ring of epicentres, of which F and G, say, are in azimuths 0° and 180°. Then stations in azimuth 0° would receive their first news from F, and would all be effectively nearer the epicentre; those in azimuth 180° would receive their first news from G, and would again all be nearer the epicentre. This is, in the main, the phenomenon to be explained, *viz.*, that stations in opposite azimuths both call for the epicentre to be moved nearer to them. But this alternative would supply the same shift to all the stations in the same azimuth, whatever their distance away; whereas the hypothesis of abnormal focal depth graduates the shift according to distance, and is found to fit the facts so well that it is difficult to prefer the constant shift. Moreover, this alternative of a wide area for the shock (supposed always close to the surface) entirely fails to supply any explanation of the cases of " high focus " where all stations call for a displacement of the epicentre *away* from themselves. We should have to suppose that the first news in each case was received, not from the nearest point of the disturbed area, but from that farthest away.

Briefly, it is claimed that the hypothesis of a variation in focal depth at present holds the field; it explains the facts so far as they have been tested; and evidence in its favour is steadily accumulating.

VIII.—The Printed Results: Headings.

Explanation has now been given of the methods used for determining the elements printed at the heading of each earthquake; *viz.*, the time T_0 of occurrence (in Greenwich time reckoned from midnight) the position of the epicentre (δ=latitude λ= longitude reckoned E and W from Greenwich), and the depth

of focus, in fractions of the earth's radius measured from the normal or average depth. This last is believed to be about 0·040 below the surface, but as yet no use has been made of this assumption in the calculations. Next follow the constants

$$A=\cos\delta\cos\lambda,\ B=\cos\delta\sin\lambda,\ C=\sin\delta$$

where δ is the north latitude, and λ the E longitude from Greenwich. These are used in calculating the distance Δ of the epicentre from any station by the formula

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

The distance Δ is always given in degrees so that it may be readily used on any artificial globe. There has been an unfortunate practice of measuring Δ in kilometres, which must be converted into arc before use either on a globe or for calculation. It is to be hoped that this superfluous complication will fall into disuse.

The constants D, E; and G, H, K, are for use in finding the azimuth of the *station from the epicentre*, measured from 0° in the N., through E (90°) S. (180°) W. (270°) to N again. These azimuths are, of course, entirely different from those of the *epicentre from the station*, which can be found from the component seismographs, and may be used in determining the epicentre from observations at a single station. The value of such azimuthal specifications for an independent determination of the epicentre by azimuths alone, without any reference to tables of distance, was pointed out by Galitzin and Walker; and this method would be specially valuable in the cases of alleged abnormal focus, for obvious reasons. But as yet such azimuthal determinations have not been generally made. They require a complete equipment of two horizonal components and a vertical. The last is chiefly useful in electing between opposite azimuths, and might be dispensed with when the epicentre is approximately known. But it is high time to inquire whether those stations possessing two similar horizontal components could not give good indications of the azimuth of the epicentre, which might be used to check the determinations made by means of times of arrival of P and S.

To return, however, to the *other* azimuths—those of the *stations from the epicentre*. These are chiefly useful in estimating suitable displacements of the adopted epicentre as shown by the residuals, or rather by the time-residuals when converted into equivalents in Δ. The effect of a displacement of the epicentre, say p^0 in azimuth Z_0 is approximately

$$p\cos(Z-Z_0)=(p\sin Z_0)\sin Z+(p\cos Z_0)\cos Z$$
$$=x\sin Z+y\cos Z\ \text{say.}$$

Hence x and y are readily determined from a number of linear equations. This formula is, however, only correct when p is quite small, so that a second approximation is sometimes necessary.

Another advantage of having the azimuth Z (even when roughly indicated) before the eyes is that it can often be seen by inspection in which direction displacement of the epicentre is called for ; and cases of abnormal focus can often be detected from the incompatible calls in opposite azimuths.

IX.—The Separate Columns.

Coming now to the separate columns, the following points may be noticed :—

(a) When different readings are given by two components, or two machines, they are sometimes printed separately, the component being specified in the first column. Often, however, the agreement is so close that separate printing seems needless. Or the differences may be chiefly in L and M ; in which case *the results for the E component are printed throughout in the text*, those for the N component being added in the Notes at the end.

(b) In the earlier numbers of the Summary (and in the Bulletin which preceded it) a column was devoted to the nature of the seismograph. But it was found difficult to achieve accuracy in this column. The seismograph was often not specified at an observatory where there was known to be more than one, and it was often difficult to recover the date of change, when it was known that a better machine had been substituted. Hence, although there are undoubted differences between the records of different machines (See B.A. Report for 1917 Table III) this column was dropped as involving more work than seemed proportionate to its value. If any question turns on the particular machine used, reference can be made to the information supplied from the observatory.

(c) The columns of Δ (Distance) and Z (Azimuth) have perhaps been sufficiently explained above. Δ is calculated to $0^{o}{\cdot}1$; Z is now generally read from a globe, and may be in error by 1^{o} or 2^{o}.

(d) The columns for P and S represent the excesses of the observed times over T_0, the adopted time of the shock. In the early years the times themselves were printed, as they could more readily be checked with the originals ; but experience showed the great advantage of subtracting T_0 so that the times of transmission may be readily compared with tables, or with those of another

similar earthquake. Comparisons with the adopted tables are given in the columns O—C, and require little comment for $\Delta < 90^\circ$. But when Δ exceeds 90° the records of P and S become ambiguous, and seldom accord with the tables. Two other phenomena are frequently observed instead of P; the most easily recognised is PR_1, the first reflected wave. But (especially near the anticentre) the wave denoted [P], which reaches the anticentre in about 20m.17s., is often observed. The formula given for it is

$$20\text{m.}17\text{s.} - (180 - \Delta)^2 \times 0{\cdot}0235\text{s.}$$

which was deduced from records between $\Delta = 130^\circ$ and $\Delta = 180^\circ$. If it may be carried back to 90° it would be related to PR_1 (assuming the adopted tables correct for a surface shock so that the time for PR_1 at Δ is just double the time for P at $\Delta/2$) as follows :—

Δ	PR_1	[P]	Δ	PR_1	[P]	Δ	PR_1	[P]
°	m. s.	m. s.	°	m. s.	m. s.	°	m. s.	m. s.
90	17 6	17 7	120	20 24	18 52	150	23 38	19 56
100	18 14	17 47	130	21 30	19 18	160	24 38	20 8
110	19 18	18 22	140	22 34	19 39	170	25 36	20 15

whence it will be seen that near $\Delta = 90^\circ$ there are difficulties in separating the two phenomena, which, however, disappear as Δ increases.

There are similarly SR_1 and [S] (though the latter has not yet been definitely reduced to tables), and generally the number of alternatives for S is larger still. Some of them were briefly indicated in the Introduction to the "Large Earthquakes of 1913," p. vii, but a much larger collection can now be made, which it is hoped to undertake shortly.

(e) The columns for L and M are given to 0·1m. only, as they are often very rough. Different trains of waves are undoubtedly represented in this part of the seismogram, to some of which Dr. Jeans and Dr. Jeffreys have already called attention, and it is doubtful whether any precise meaning can be given, even to the first appearance of L; but the rough rule—

$$2\,(\text{L in minutes}) = \Delta \text{ in degrees}$$

—gives fair results. Near the anticentre it seems that L may represent a long wave starting from the anticentre on the receipt of [P], *i.e.* 20m.17s. after T_0, and this has sometimes been noted as [L].

In the neighbourhood of the epicentre an approximate value of T_0 for a small shock can sometimes be inferred from the formula

$$(P - T_0) = 0{\cdot}4\,(M - P)$$

(f) In the notes are given (as above mentioned) additional records from N components which differ sensibly from E records

printed in the text. Such abbreviations as LN or MN, meaning the L or M observation by the N component, scarcely require explanation.

The above is a general summary of the points on which a reminder, or a new comment, may be useful, in reference to the Summary as a whole.

As regards the present number attention may be called to the cases of abnormal focus below :—

	T_0 (1920)				Epicentre		Depth below normal
	d.	h.	m.	s.	°	°	
Jan.	20	1	42	5	8·0S.	127·5E.	+·030?
Feb.	22	17	35	40	46·7N.	145·8E.	+·050
Feb.	26	1	26	0	5·0N.	110·0E.	+·050
Mar.	3	10	43	25	8·0S.	127·5E.	+·030?
Mar.	15	12	5	30	20·0S.	176·5E.	+·030
Mar.	22	20	1	43	17·0S.	177·5W.	+·040

In the last number of the Summary a new and surprising feature of the 21min. period was mentioned. There seems good evidence that it is controlled by the Moon, but the work of verifying this hypothesis in detail is laborious, and is not yet completed.

It is very pleasant to note that the Seismological Service at Pulkovo has been restored. Records have been received for the months 1923 June to 1924 January. We have previously had records from Ekaterinburg.

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University Observatory, Oxford,
1924 July 16.

1920 JANUARY, FEBRUARY, & MARCH.

Jan. 1d. 12h. 7m. 0s. Epicentre 18°·0S. 173°·5E.
A = −·945, B = +·108, C = −·309; D = +·113, E = +·994; G = +·307, H = −·035, K = −·951.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Apia	14·8	76	e 3 44	+ 8	—	—	4·0	—
Riverview	25·5	227	e 5 42	− 1	e 10 10	− 3	e 12·7	18·2
Sydney	25·5	227	5 0	−43	—	—	12·8	16·5
Christchurch	25·6	181	14 18	?L	—	—	17·2	18·1
Melbourne	31·8	227	—	—	12 0	− 5	19·1	21·9
Adelaide	35·3	234	—	—	—	—	15·4	24·4
Honolulu	48·3	39	14 42	?S	(14 42)	−76	27·5	39·7
Manila	61·2	299	e 11 0	+40	—	—	—	—
Batavia	65·9	273	9 30	−80	e 19 44	+ 8	42·2	21·2
Victoria	87·0	37	—	—	—	—	39·1	44·0
Chicago	108·4	51	—	—	—	—	52·0	—
La Paz	110·2	118	e 11 34	?	e 23 4	?PR_1	46·0	54·8
Toronto	114·6	49	—	—	—	—	54·8	63·5
Cape Town	122·9	208	66 24	?L	—	—	(66·4)	82·4
De Bilt	144·7	348	—	—	—	—	81·0	116·0
Helwan E.	144·2	297	31 18	?S	—	—	—	115·7
N.	144·2	297	34 24	?	—	—	—	116·2
Uccle	146·1	349	—	—	—	—	83·0	—
Moncalieri	150·5	340	—	—	—	—	92·4	—
Coimbra	157·7	4	—	—	e 81 0	?L	104·2	106·1
San Fernando	161·2	359	86 24	?L	—	—	(86·4)	116·0

Additional records: Riverview gives also eP = +6m.7s., SR_1 = +11m.54s., MN = +15·5m., MZ = +16·4m. Melbourne PR_2 = +7m.18s., SR_1 = +15m.12s., SR_2 = +16m.6s. Christchurch gives records also at +14m.36s. and +16m.12s. Batavia L = +48·2m. and +52·2m. Chicago L = +61·0m. Toronto eL = +59·4m. and L = +66·5m. De Bilt eN = +83·0m., MN = +112·2m. Coimbra probably records some other shock. Moncalieri e = +36m.33s. Perth gives from 12h.24m. to 14h.32m.30s.

Jan. 1d. Records also at 1h. (La Paz), 2h. (Lick, Point Loma, Berkeley, Tucson, and Victoria), 3h. (Christchurch and Riverview), 8h. (La Paz), 9h. (La Paz and Apia), 15h. (La Paz, Apia, Riverview, Sydney, and Honolulu), 16h. (Adelaide, Toronto, Chicago, and Helwan), 17h. (San Fernando), 18h. (Riverview), 19h. (Helwan), 20h. (Uccle).

Jan. 2d. 13h. 17m. 15s. Epicentre 46°·0N. 130°·0W. (as on 1918 Oct. 15d.).
A = −·447, B = −·532, C = +·719.

		Δ	P.	O−C.	L.	M.
		°	m. s.	s.	m.	m.
Victoria		5·2	3 20	+120	4·8	5·3
	z.	5·2	2 55	+95	4·1	5·7
Berkeley		9·9	e 2 28	− 1	e 4·2	5·9
Lick		10·6	e 2 38	0	e 4·5	—
Honolulu		33·6	—	—	e 16·1	19·9
Ithaca		37·8	—	—	e 20·9	—

Berkeley gives also MN = +7·3m., T_o = 13h.18m.4s.

Jan. 2d. Records also at 8h. and 9h. (Taihoku), 15h. (near La Paz; and San Fernando), 16h. (Batavia), 22h. (La Paz).

Jan. 3d. 0h. 51m. 28s. Epicentre 40°·0N. 141°·5E.
A = −·600, B = +·477, C = +·643.

	Δ	P.	O−C.	S.	O—C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa	0·9	0 14	0	0 25	0	—	—
Tokyo	4·6	2 6	?S	(2 6)	0	3·9	—
Osaka	7·2	1 35	−14	—	—	2·9	4·6
Zi-ka-wei	18·5	3 48	−35	—	—	—	—
La Paz	145·2	19 34	[−14]	—	—	—	—

Osaka gives MN = +4·2m.

Jan. 3d. Records also at 1h. (Tacubaya), 6h. (Harvard and Taihoku), 8h. (Osaka and Mizusawa), 9h. (La Paz), 12h. (Manila), 13h. (San Fernando), 15h. (Mizusawa), 18h. (Algiers), 19h. (Helwan), 22h. (Lick).

Jan. 4d. 4h. 21m. 58s. Epicentre 18°·2N. 97°·5W.

A = −·124, B = −·942, C = +·312; D = −·991, E = +·130;
G = −·041, H = −·309, K = −·950.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Oaxaca		1·3	141	0 29	+ 9	—	—	1·0	1·2
Tacubaya	E.	1·4	307	2 52	?	—	—	3·3	3·6
	N.	1·4	307	2 53	?	—	—	3·3	3·5
	Z.	1·4	307	2 51	?	—	—	3·3	3·4
Mazatlan	E.	9·7	302	2 33	+ 7	—	—	5·1	5·4
Mobile		15·0	32	e 4 50	+71	i 7 16	?L	(i 7·3)	7·3
Tucson	E.	18·5	322	3 35	−48	7 5	−46	9·0	11·3
	N.	18·5	322	3 46	−37	7 16	−35	9·0	11·1
Lawrence		20·9	5	e 4 50	− 2	e 8 15	−27	11·2	16·0
St. Louis		21·4	16	4 53	− 5	8 41	−12	—	15·5
Denver		22·5	345	4 2	−69	8 2	−73	13·0	14·5
Chicago		25·0	18	5 28	−10	9 46	−17	11·9	—
Ann Arbor	E.	26·8	23	5 32	−24	10 14	−23	13·5	18·5
	N.	26·8	23	5 44	−12	10 8	−29	—	18·0
Cheltenham	E.	27·3	37	5 39	−22	10 38	− 8	—	20·9
	N.	27·3	37	5 46	−15	10 25	−21	16·8	20·5
Georgetown	E.	27·3	36	e 5 55	− 6	10 54	+ 8	e 13·3	—
	N.	27·3	36	e 5 55	− 6	10 48	+ 2	—	—
Washington		27·3	36	6 2	+ 1	10 42	− 4	(12·0)	—
Lick		28·5	317	e 7 10	?PR_1	—	—	—	19·0
Berkeley	E.	29·3	317	e 6 24	+ 3	e 11 13	− 9	—	19·9
	N.	29·3	317	e 6 20	− 1	e 11 15	− 7	e 14·1	20·0
Toronto		29·7	27	6 50	+25	11 2	−27	19·9	25·8
Ithaca		30·1	33	6 18	−11	11 11	−25	13·0	—
Vieques	E.	30·4	84	6 34	+ 2	—	—	14·9	—
Ottawa		32·7	30	e 6 41	−13	e 11 54	−25	e 15·7	—
Harvard	E.	33·0	38	e 6 39	−17	11 58	−26	—	24·7
	N.	33·0	38	e 6 42	−14	11 58	−26	e 15·2	—
Northfield		33·3	34	—	—	—	—	e 23·0	—
Victoria		36·7	331	8 31	+63	12 27	−53	18·8	25·7
	Z.	36·7	331	7 27	− 1	12 22	−58	21·5	25·8
La Paz		45·1	140	e 8 34	0	e 15 18	+ 2	22·8	25·7
Honolulu		56·7	284	—	—	17 38	− 4	28·0	32·5
Eskdalemuir		77·5	36	21 48	?S	(21 48)	− 7	38·0	—
Edinburgh		78·1	36	—	—	—	—	—	46·7
Rio Tinto		79·6	126	15 2	?PR_1	—	—	—	66·0
Oxford		79·6	40	—	—	—	—	45·8	—
Kew		80·2	40	—	—	—	—	—	60·0
San Fernando		80·3	55	—	—	—	—	42·8	46·5
Paris		82·8	41	—	—	—	—	e 43·0	54·0
De Bilt		83·2	38	—	—	e 23 7	+ 8	e 42·0	51·8
Uccle		83·2	39	e 12 39	+ 2	23 2	+ 3	e 39·0	—
Hamburg		85·4	35	e 12 51	+ 1	—	—	e 45·0	—
Strasbourg		86·1	40	e 12 52	− 2	e 23 29	− 2	50·0	—
Algiers		87·3	51	—	—	23 31	−13	50·0	57·5
Moncalieri		87·5	43	23 26	?S	(23 26)	−21	43·8	62·1
Helwan		111·2	47	28 2	?S	(28 2)	+23	—	—
Riverview		117·4	241	e 16 3	+32	—	—	e 58·0	63·9
Melbourne		122·6	236	—	—	—	—	e 62·0	68·0

Additional records: Mazatlan gives PZ = +2m.33s., MN = +5·4m., MZ = +6·0m. Denver MN = +13·0. No seconds are recorded for any of these records. Ann Arbor (Wiechert) PN = +5m.44s., SN = +10m.32s. Cheltenham ME is increased by 10m. Washington gives a second set of PSL, P = +12m.2s., S = +17m.7s., eL = 18·0m. Berkeley ePV = +6m.18s., MV = +19·7m. Toronto P = +5m.38s., L = +21·4m., eL = +22·8m., and +29·3m. Ithaca eN = +12m.2s., e = +13m.14s., LN = +19·1m. Vieques PN = +6m.47s. Ottawa L = +23·0m., and +33·0m., T_o = 4h.22m.3s. Harvard iE = +6m.47s., iN = +6m.51s., T_o = 4h.21m.44s. Victoria iL = +23·7m. La Paz iP = +8m.45s., i = +11m.18s., iS = +15m.40s. Honolulu SR_1 = +23m.50s. Helwan gives PN = +29m.2s. Eskdalemuir iN = +30m.36s. De Bilt MN = +47·1m. Riverview ePS? = +30m.8s., MN = +69·4m.

Jan. 4d. Records also at 5h. (2) and 6h. (2) (near Tacubaya), 7h. (Tacubaya and La Paz), 8h. (Tacubaya (2) and La Paz), 9h. (La Paz), 10h. (Tacubaya (2)), 13h. (Tacubaya), 16h. and 17h. (2) (near Athens), 18h. (near Tacubaya, Oaxaca, and Athens), 21h. (La Paz).

Jan. 5d. Records at 3h. (Manila (2) and near Athens), 4h. (near La Paz), 5h. (Riverview), 8h. (near Tokyo), 12h., 14h., 20h., 22h. (San Fernando), 23h. (Athens (2)).

Jan. 6d. 3h. 50m. 32s. Epicentre 40°·0N. 141°·5E. (as on Jan. 3d.).

$A = -\cdot600$, $B = +\cdot477$, $C = +\cdot643$.

	Δ	P.	O−C.	S.	O−C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa	0·9	0 13	− 1	0 26	+ 1	—	—
Tokyo	4·6	1 13	+ 2	—	—	1·8	2·1
Osaka	7·2	1 48	− 1	—	—	2·8	3·8
De Bilt	80·4	—	—	—	—	e 48·5	49·5

Mizusawa gives SN = +27s. De Bilt MN = +52·1m.

Jan. 6d. Records also at 3h. (Manila), 4h. (near Tacubaya), 5h. (Batavia), 10h. (Apia), 11h. (near Mizusawa), 12h. (Tokyo), 13h. and 14h. (Mizusawa), 20h. (San Fernando).

Jan. 7d. Records at 1h. (Mizusawa, San Fernando, and La Paz), 8h. (Rocca di Papa and Helwan), 9h. (La Paz, Victoria, Monte Cassino, and Honolulu), 10h. (Taihoku), 15h. (Tacubaya and La Paz), 16h. (Tokyo and Mizusawa (2)), 17h. (Mizusawa and Tokyo), 20h. (Taihoku and San Fernando), 21h. and 22h. (near La Paz).

Jan. 8d. Records at 0h. (San Fernando), 1h. (La Paz), 2h. (Helwan), 3h. and 6h. (La Paz), 8h. (Helwan), 9h. (Batavia, Colombo, and Kodaikanal).

Jan. 9d. 11h. 58m. 57s. Epicentre 43°·2N. 29°·3E.

$A = +\cdot636$, $B = +\cdot357$, $C = +\cdot684$; $D = +\cdot489$, $E = -\cdot872$; $G = +\cdot597$, $H = +\cdot335$, $K = -\cdot729$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Lemberg	7·6	333	3 57	?L	5 9	?	(4·0)	6·4
Vienna	10·3	304	e 2 36	+ 2	e 4 40	+ 3	e 5·6	—
Pola	11·2	284	e 5 10	?S	(e 5 10)	+11	e 5·6	6·0
Padova	12·7	286	5 31	?S	(5 31)	− 6	—	7·7
Helwan	13·4	172	7 3	?L	—	—	(8·0)	—
Moncalieri	15·6	284	4 29	+42	6 38	− 8	8·6	11·8
Strasbourg	15·9	297	e 1 3	?	—	—	8·0	—
Hamburg	16·4	316	—	—	—	—	e 9·2	—
Besancon	16·8	292	—	—	—	—	9·0	—
De Bilt	18·5	307	—	—	—	—	e 9·4	10·6
Uccle	18·5	304	—	—	—	—	e 9·0	—
Paris	19·3	296	—	—	—	—	9·0	—
Mizusawa	77·2	48	—	—	—	—	57·6	—

Pola gives MN = +5·9m. Moncalieri MN = +11·2m.

Jan. 9d. Records also at 1h. (San Fernando), 2h. (near La Paz), 4h. (Kodaikanal and Mazatlan), 9h. (Lick and Colombo), 10h. (near Athens), 16h. (La Paz and Balboa Heights), 22h. (Apia and Taihoku).

Jan. 10d. Records at 1h. (Batavia), 3h. (San Fernando), 6h. and 9h. (near Mizusawa), 10h. (La Paz), 11h. (Apia), 18h. (Azores and Batavia), 23h. (San Fernando).

Jan. 11d. Records at 0h. (La Paz), 2h. (Riverview and Adelaide), 3h. (Christchurch and Melbourne), 4h. (Helwan), 5h. (La Paz), 10h. (Helwan), 11h. (Mizusawa), 12h. (La Paz), 13h. (Lick and La Paz), 15h. (near Mizusawa, Tokyo (2), and Osaka (2)), 16h. (La Paz), 18h. (Helwan), 23h. (La Paz and near Zurich).

Jan. 12d. 2h. 52m. 20s. Epicentre 18°·0N. 133°·0E. (as on 1919 Sept. 5d.).

A = −·649, B = +·696, C = +·309; D = +·731, E = +·682; G = −·211, H = +·226, K = −·951.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	12·1	256	e 2 47	−13	—	—	3·5	3·9
Batavia	35·4	229	e 7 17	0	e 13 0	− 1	—	14·0
Colombo	52·9	267	29 40	?L	—	—	(29·7)	—
Helwan	90·8	301	59 40	?L	—	—	(59·7)	—
La Paz	159·8	89	22 10	?PR_1	—	—	—	—

Additional records: Manila gives MN = +4·1m. Helwan PN = +60m.40s.

Jan. 12d. 13h. 39m. 52s. Epicentre 22°·3N. 143°·2E.

A = −·741, B = +·554, C = +·380; D = +·599, E = +·801. G = −·304, H = +·227, K = −·925.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Tokyo	13·7	348	6 24	?S	(6 24)	+23	8·7	11·9
Osaka	14·1	333	3 40	+13	—	—	—	12·1
Mizusawa	16·9	355	3 48	−16	—	—	10·4	—
Taihoku	20·0	281	5 12	+31	8 37	+14	11·0	15·3
Zi-ka-wei	21·3	299	e 4 54	− 3	e 8 51	+ 1	—	13·9
Manila	22·5	254	e 5 54	+43	9 57	+42	11·7	12·3
Ootomari	24·3	359	e 4 34	−57	—	—	6·8	9·6
Batavia	45·6	236	8 37	0	i 15 19	− 3	—	19·1
Honolulu	54·2	79	—	—	22 32	?SR_1	26·7	37·8
Riverview	56·7	171	e 9 51	+ 1	e 17 42	0	26·5	31·4
Adelaide	57·5	184	—	—	—	—	—	36·1
Simla	58·8	293	e 17 44	?S	(e 17 44)	−25	—	18·0
Melbourne	60·2	179	—	—	—	—	36·4	37·6
Colombo	62·8	267	21 8	?SR_1	—	—	—	46·6
Kodaikanal	63·9	271	37 32	?L	—	—	(37·5)	—
Victoria	75·7	43	20 58	?S	(20 58)	−36	32·8	38·7
Berkeley	79·8	52	—	—	—	—	e 34·7	—
Hamburg	94·0	334	—	—	—	—	e 51·1	60·1
Helwan	96·4	306	—	—	25 8	−12	—	—
De Bilt	97·0	336	—	—	—	—	e 51·1	65·9
Uccle	98·4	335	—	—	—	—	e 49·1	—
Strasbourg	98·7	330	—	—	—	—	—	61·1
Rocca di Papa	101·3	324	—	—	—	—	e 63·4	65·9
Moncalieri	101·5	330	e 15 44	+86	—	—	52·1	—
Toronto	103·3	30	—	—	—	—	59·2	66·6
Coimbra	112·0	337	—	—	—	—	e 56·6	—
La Paz	149·9	85	46 17	?SR_1	—	—	—	—

Additional records: Osaka gives MN = +11·8m. Manila MN = +12·0m. Ootomari MN = +9·4m. Honolulu PR_1 = +17m.50s. Riverview MN = +30·5m. Victoria S = +26m.23s. (?SR_1). Hamburg MZ = +63·1m., MN = +67·1m. Helwan +26m.8s. Toronto eL = +64·3m.

Jan. 12d. Records also at 3h. (Manila), 4h. (San Fernando), 10h. (Colombo), 12h. (La Paz and Batavia), 13h. (Kobe), 14h. (Pola, Toronto, San Fernando, and Batavia), 15h. (Rio de Janeiro and La Paz), 16h. (Coimbra, Batavia, and Port au Prince), 19h. (La Paz), 23h. (Tucson and near Tokyo).

Jan. 13d. 18h. 30m. 40s. Epicentre 40°·3N. 139°·5E. (as on 1918 Sept. 13d.).

$A = -\cdot580$, $B = +\cdot495$, $C = +\cdot647$; $D = +\cdot649$, $E = +\cdot760$; $G = -\cdot492$, $H = +\cdot420$, $K = -\cdot763$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa	E.	1·7	133	0 36	+10	0 47	− 1	—	—
	N.	1·7	133	0 34	+ 8	0 49	+ 1	—	—
Tokyo		4·7	178	1 41	+28	—	—	2·6	3·5
Osaka		6·5	212	e 1 53	+14	—	—	—	4·5
Kobe		6·6	213	1 51	+10	—	—	3·7	4·5
Ootomari		6·8	19	0 43	−61	—	—	2·9	4·7
Zi-ka-wei		17·2	244	e 3 54	−13	—	—	—	—
Taihoku		21·4	230	—	—	—	—	e 10·3	—
De Bilt		79·6	333	—	—	—	—	e 44·3	49·4
Uccle		80·8	333	—	—	—	—	e 43·3	—
Helwan		83·4	304	52 20	?L	—	—	(52·3)	—
Moncalieri		84·4	328	—	—	—	—	46·7	—
San Fernando	E.	97·1	332	55 50	?L	—	—	(55·8)	59·3
	N.	97·1	332	55 20	?L	—	—	(55·3)	62·3
La Paz		146·2	52	19 49	[− 1]	—	—	—	—

Additional records: Kobe gives MN = +4·3m. Ootomari MN = +6·6m. De Bilt MN = +50·4m. Helwan PN = +54m.20s. Moncalieri e = +35m.15s. San Fernando gives its M as at 12h., not at 19h.

Jan. 13d. 23h. 0m. 28s. Epicentre 9°·5S. 157°·0E.

$A = -\cdot908$, $B = +\cdot385$, $C = -\cdot165$; $D = +\cdot391$, $E = +\cdot920$; $G = +\cdot152$, $H = +\cdot064$, $K = -\cdot986$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	24·9	191	e 5 37	0	i 10 1	0	e 12·8	14·8
Sydney	24·9	191	10 20	?S	(10 20)	+19	14·9	15·7
Melbourne	30·3	199	12 26	?S	(12 26)	+47	16·2	19·1
Adelaide	30·5	210	6 20	−13	11 32	−11	16·0	19·4
Perth	44·2	234	—	—	15 2	− 3	—	—
Taihoku	48·9	317	e 9 12	+13	—	—	—	—
Nagano	49·4	340	e 8 5	−58	—	—	—	—
Batavia	49·7	273	e 9 6	+ 1	i 16 12	− 3	—	20·2
Zi-ka-wei	53·1	322	e 8 56	−31	—	—	—	—
Honolulu	53·8	55	e 9 44	+12	—	—	23·1	34·1
Victoria	90·4	40	23 4	?S	(23 4)	−74	39·8	45·3
Chicago	115·2	48	—	—	—	—	55·5	—
Toronto	120·5	44	27 2	?S	(27 2)	−111	53·5	73·0
Cape Town	121·4	220	65 26	?L	—	—	(65·4)	72·9
Helwan	125·6	299	40 32	?SR_1	—	—	—	—
Harvard	126·7	42	—	—	—	—	67·1	—
La Paz	128·3	121	i 28 28	?S	(i 28 28)	−81	62·6	96·2
De Bilt	131·6	336	—	—	e 22 26	?PR_1	64·5	76·6
Uccle	133·0	336	e 22 32	?PR_1	—	—	e 63·5	73·5
Strasbourg	133·2	331	e 18 32	[−54]	—	—	—	78·5
Rocca di Papa	135·1	321	i 19 3	[−27]	—	—	83·8	—
Paris	135·3	336	—	—	—	—	76·5	81·5
Moncalieri	135·8	329	—	—	—	—	73·3	83·2
Tortosa	142·4	330	19 24	[−20]	—	—	e 71·5	77·2
Algiers	143·9	322	19 16	[−32]	29 39	?	99·0	105·5
San Fernando	149·0	332	19 51	[− 3]	—	—	90·0	118·5

Additional records: Riverview gives i = +6m.7s., PS = +10m.24s. and +10m.53s., MZ = +15·0m. Melbourne S = +15m.20s. Chicago L = +64·5m. Toronto L = +59·6m., +63·8m., eL = +65·7m. and +80·1m. Helwan PN = +35m.32s. Harvard LN = +83·3m. De Bilt MN = +74·2m. Rocca di Papa LN = +89·4m. Paris eLN = +72·5m. Moncalieri e = +46m.23s. San Fernando MN = +98·0m. Uccle and Riverview give their records on 14d.

Jan. 13d. Records also at 4h. (Mizusawa), 6h. (Batavia), 9h. (Perth), 10h. (Riverview and Rocca di Papa), 11h. (Tacubaya), 14h. (Batavia and Colombo), 15h. (Florence and Helwan), 18h. (Tokyo), 20h. (La Paz), 22h. (La Paz and Mizusawa), 23h. (La Paz).

Jan. 14d. 14h. 38m. 20s. Epicentre 7°·2S. 150°·0E.

A = −·859, B = +·496, C = −·125; D = +·500, E = +·866; G = +·108, H = −·063, K = −·992.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	26·7	178	e 5 56	+ 1	e 10 36	+ 1	e 14·5	16·7
Sydney	26·7	178	10 52	?S	(10 52)	+17	16·2	17·1
Adelaide	29·7	199	7 16	+51	11 28	− 1	16·7	20·5
Melbourne	31·0	185	—	—	12 40	+49	16·8	21·7
Perth	40·3	229	—	—	14 15	+ 4	—	—
Taihoku	42·4	322	—	—	e 14 23	−17	—	—
Honolulu	58·4	60	e 10 40	+39	18 4	0	27·6	37·8
Berkeley	92·6	52	—	—	—	—	e 42·6	—
Victoria	93·2	42	24 5	?S	(24 5)	−42	40·8	49·2
Helwan	118·4	300	31 40	?	—	—	(50·7)	—
Chicago	118·6	46	—	—	—	—	e 59·2	—
Hamburg	123·5	333	—	—	—	—	e 63·7	—
Toronto	123·6	40	63 28	?L	—	—	(63·5)	76·4
De Bilt	126·7	334	—	—	—	—	e 64·7	68·7
Eskdalemuir	127·4	340	—	—	—	—	65·7	—
Uccle	128·0	332	—	—	—	—	e 35·7	—
Paris	130·2	332	—	—	—	—	e 69·7	78·7
La Paz	135·5	123	23 11	?PR$_1$	—	—	84·8	90·1
Algiers	137·9	319	—	—	—	—	e 76·7	84·2
Coimbra	141·7	333	—	—	—	—	e 85·0	—
San Fernando E.	143·7	326	89 40	?L	—	—	(89·7)	93·7
N.	143·7	326	74 40	?L	—	—	(74·7)	92·7

Additional records: Riverview gives PS = +11m.2s. and +13m.14s., MZ = +17·0m., MN = +17·2m. Victoria gives its two records as PN and PE. Victoria S = +29m.59s. (?SR$_1$). De Bilt MN = +69·8m. Helwan L = +70·9m., eL = +72·2m. Toronto

Jan. 14d. Records also at 1h. (Toronto), 2h. (Mizusawa (2)), 3h. (Mizusawa), 4h. (Strasbourg), 5h. (Mizusawa), 6h. (Mizusawa and Tokyo), 7h. (Helwan, De Bilt, Zi-ka-wei, La Paz, and Mizusawa), 9h. (Mizusawa), 11h. (Tacubaya), 13h. (Nagasaki), 15h. (Mizusawa (2)), 17h. (Toronto), 18h. (Lick, Moncalieri, and Mizusawa), 19h. (Lick), 20h. (Mizusawa and Manila), 22h. (Rocca di Papa).

Jan. 15d. 11h. 48m. 5s. Epicentre 11°·5N. 144°·0E. (as on 1919 Sept. 11d.).

A = −·793, B = +·576, C = +·199; D = +·588, E = +·809; G = −·161, H = +·118, K = −·980.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	22·7	280	e 5 29	+16	—	—	—	—
Batavia	41·0	247	e 7 52	−11	—	—	—	—
Riverview	45·8	172	e 15 21	?S	(e 15 21)	− 4	e 23·9	26·2
Perth	51·1	211	—	—	16 25	− 7	—	—
Victoria	83·2	42	—	—	—	—	40·0	44·4
Toronto	112·2	32	—	—	—	—	49·5	61·6
La Paz	148·4	103	19 52	[− 1]	—	—	—	—

Additional records: Riverview gives MN = +35·1m. Toronto L = +60·0m.

Jan. 15d. 16h. 25m. 27s. Epicentre 19°·0N. 70°·0W. (as on 1919 Aug. 22d.).

A = +·323, B = −·889, C = +·326.

	Δ	P.	O−C.	S.	O−C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Port au Prince	2·1	e 0 30	− 3	1 2	+ 4	—	1·8
Vieques E.	4·4	1 3	− 5	—	—	1·4	2·1
N.	4·4	1 3	− 5	—	—	1·5	1·9
La Paz	35·6	7 31	+13	—	—	—	—
De Bilt	66·1	—	—	—	—	e 36·6	—

Port au Prince gives SNW = +1m.3s.

Jan. 15d. Records also at 0h. (near Monte Cassino), 1h. (San Fernando and Mizusawa), 2h. (near La Paz), 4h. (near Mizusawa), 5h. (Manila), 9h. (La Paz), 10h. (Florence and Helwan), 12h. (near Mizusawa), 13h. (Denver), 15h. (Nagasaki), 16h. (La Paz).

Jan. 16d. Records at 7h. (Mizusawa, San Fernando, and Zi-ka-wei), 15h. (Zi-ka-wei, Riverview, and Taihoku).

Jan. 17d. 18h. 48m. 15s. Epicentre 40°·3N. 139°·5E. (as on 1920 Jan. 13d.).

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

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa	E.	1·7	133	0 31	+ 5	0 46	− 2	—	—
	N.	1·7	133	0 29	+ 3	0 44	− 4	—	—
Tokyo		4·7	178	1 40	+27	1 51	−18	2·4	3·8
Kobe		6·6	213	2 27	+46	—	—	4·0	5·5
Ootomari		6·8	19	1 37	− 7	(3 5)	0	3·1	4·6
Zi-ka-wei		17·2	244	e 3 43	−24	e 7 5	−17	—	9·9
Taihoku		21·4	230	—	—	e 8 54	+ 1	—	—
Hamburg		77·6	332	—	—	—	—	e 40·8	48·8
De Bilt		79·6	333	—	—	—	—	e 42·8	49·1
Uccle		80·8	333	—	—	—	—	e 39·8	—
Paris		83·1	333	—	—	—	—	45·8	—
Rocca di Papa		84·9	323	—	—	—	—	e 46·4	54·2
San Fernando	E.	97·1	332	56 45	?L	—	—	(56·8)	61·8
	N.	97·1	332	55 15	?L	—	—	(55·2)	62·2
La Paz		146·2	52	19 43	[− 7]	—	—	—	—

De Bilt gives MN = +48·4m.

Jan. 17d. Records also at 0h. (Zi-ka-wei), 3h. (La Paz, Strasbourg, Helwan, and Uccle), 5h. (Helwan (2)), 8h. (close to Manila (2)), 9h. (close to Tokyo and Mizusawa), 12h. and 14h. (Helwan), 16h. (La Paz), 17h. (Tokyo), 18h. (Helwan), 19h. (Moncalieri), 21h. (San Fernando), 22h. (Mizusawa (2)).

Jan. 18d. Records at 9h. (Tokyo and Taihoku), 18h. (Osaka), 20h. (Batavia).

Jan. 19d. Records at 5h. (Adelaide and Riverview), 8h. (La Paz), 20h. (San Fernando), 22h. (Helwan).

Jan. 20d. 1h. 42m. 5s. Epicentre 8°·0S. 127°·5E. (as on 1918 Nov. 23d.).

A = −·603, B = +·786, C = −·139; D = +·793, E = +·609;
G = +·085, H = −·110, K = −·990.

The deep focus (0·030) of 1918 Nov. 23d. is retained.

	Corr. for Focus	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia	−1·2	20·6	274	e 4 37	+ 3	e 8 20	+10	—	9·6
Manila	−1·5	23·5	344	e 5 1	− 4	—	—	6·9	8·9
Melbourne	−2·2	33·7	158	—	—	(12 7)	+ 7	12·1	12·3
Riverview	−2·2	33·8	142	e 8 24	+101	i 11 58	− 3	e 14·3	19·6
Zi-ka-wei	−2·5	39·6	352	e 7 15	−16	e 12 39	−46	—	—
Colombo	−3·1	49·8	286	13 55	?S	(13 55)	−102	—	42·9
Helwan	−4·4	99·4	300	42 55	?L	—	—	(42·9)	—
La Paz	—	151·0	148	19 45	[−12]	—	—	—	—

Riverview gives also MN = +18·2m.

Jan. 21d. Records also at 1h. (San Fernando), 2h. (Tacubaya), 4h. (Manila, Zi-ka-wei, and Taihoku), 8h. (Rio Tinto), 9h. (Tacubaya), 13h. (Taihoku, Denver, and Manila), 17h. (Toronto), 21h. (Apia and Lick), 23h. (San Fernando).

Jan. 21d. 6h. 0m. 50s. Epicentre 5°·0N. 148°·0E.

A = −·845, B = +·529, C = +·087; D = +·530, E = +·848;
G = −·074, H = +·046, K = −·996.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	28·3	292	e 14 21	?L	—	—	(e 14·4)	—
Tokyo	31·9	349	33 11	?	—	—	—	—
Riverview	38·9	176	e 7 46	+ 1	e 13 52	+ 1	e 18·2	24·3
Adelaide	40·9	192	—	—	16 34	?SR_1	23·8	31·4
Batavia	42·6	258	14 43	?S	(14 43)	0	(i 23·4)	—
Melbourne	42·9	183	—	—	—	—	19·2	29·7
Apia	44·2	115	(8 4)	−23	—	—	8·1	—
Honolulu	54·7	69	17 40	?S	(17 40)	+23	20·2	20·9
Victoria	85·4	42	—	—	—	—	—	30·0
Berkeley	86·7	52	—	—	e 24 13	+35	—	—
Helwan	110·2	304	27 10	?S	(27 10)	−20	—	—
La Paz	142·8	110	19 28	[−17]	i 26 49	?	29·3	31·0

Additional records: Riverview gives i = +19m.3s. and +23m.23s., MN = +20·4m. Adelaide SR_1 = +20m.22s. Apia gives P = +6m.16s. and records the true P as L. Helwan P = +35m.10s. ?SR_1.

Jan. 21d. Records also at 0h. (La Paz and Helwan), 2h. (Manila), 5h. (San Fernando), 6h. (Manila and near Mizusawa), 10h. (near Monte Cassino), 17h. and 20h. (La Paz), 21h. (Lick). 22h. (San Fernando), 23h. (Helwan).

Jan. 22d. 21h. 19m. 10s. Epicentre 16°·0S. 168°·0E. (as on 1918 Sept. 25d.).

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

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Apia	19·7	86	4 56	+19	e 8 38	+21	13·8	14·4
Riverview	23·4	210	e 5 15	− 6	9 33	0	e 11·0	21·0
Sydney	23·4	210	5 8	−13	—	—	9·9	14·4
Christchurch	27·8	173	11 14	?S	(11 14)	+19	16·8	21·3
Melbourne	29·8	218	7 50	?PR_1	13 32	+121	16·8	20·9
Perth	49·8	241	12 0	?PR_1	—	—	23·3	—
Honolulu	50·1	43	i 16 14	?S	(i 16 14)	− 6	e 24·5	27·3
Manila	55·6	301	e 9 50	+ 7	—	—	—	—
Batavia	60·6	271	e 12 14	?PR_1	—	—	—	—
Victoria	88·5	38	22 50	?S	(22 50)	−68	36·6	44·2
Chicago	111·2	51	—	—	—	—	e 51·8	—
Toronto	117·2	49	—	—	—	—	e 65·9	71·0
Helwan	138·0	297	23 50	?PR_1	(38 50)	?SR_1	—	—
De Bilt	141·4	343	—	—	—	—	e 65·8	80·7
Uccle	142·8	343	—	—	—	—	e 64·8	—
San Fernando E.	158·9	347	47 50	?L	—	—	(47·8)	116·8
San Fernando N.	158·9	347	53 50	?L	—	—	(53·8)	99·8

Additional records: Riverview gives S = +9m.41s., MN = +12·6m. Christchurch gives records at +13m.38s. and +16m.8s. Honolulu gives S as iP, and records +21m.14s. as S (?SR_1). Victoria gives S as P and records +28m.56s. as S. Chicago L = +55·8m. and +58·8m.

Jan. 22d. 21h. 44m. 30s. Epicentre 25°·5N. 122°·0E.

A = −·478, B = +·765, C = +·430.

	Δ	P.	O−C.	S.	O−C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Taihoku	0·6	0 8	− 1	—	—	0·3	0·3
Hokoto	3·0	0 48	+ 1	(1 14)	− 9	1·2	1·6
Zi-ka-wei	5·7	e 1 27	− 1	e 2 35	− 1	—	3·9
Manila	10·9	e 2 43	0	(4 33)	−19	4·6	5·0
La Paz	167·0	20 4	[+ 9]	—	—	47·2	55·3

Manila gives MN = +6·0m.

Jan. 22d. Records also at 2h. (Nagasaki), 9h. (Oaxaca), 16h. (Kodaikanal and La Paz), 19h. (Strasbourg and La Paz), 21h. (La Paz), 23h. (Toronto).

Jan. 23d. Records at 1h. (near Lick and Berkeley), 4h. (near Oaxaca and Tacubaya), 5h. (Kobe (3) and Osaka), 15h. (Helwan), 17h. (near Tortosa, Coimbra, and Granada), 22h. (La Paz and San Fernando).

Jan. 24d. Records at 4h. (near Tacubaya and Oaxaca), 6h. (La Paz), 7h. (Victoria and Toronto), 11h. (Lick, Ootomari, and Manila), 12h. (Helwan), 15h. (Riverview, Strasbourg, and Manila), 16h. (La Paz), 19h. (Tacubaya), 20h. (Manila), 21h. (Apia), 22h. (San Fernando).

Jan. 25d. 3h. 50m. 50s. Epicentre 25°·5N. 122°·0E. (as on 1920 Jan. 22d.).

A = −·478, B = +·765, C = +·430.

	Δ	P.	O−C.	S.	O−C.	L.	M.
	°	m. s.	s.	m. s.	s.	m.	m.
Taihoku	0·6	1 4	+55	—	—	1·8	1·8
Zi-ka-wei	5·7	i 1 38	+10	—	—	e 2·8	4·1
Nagasaki	10·0	6 7	?L	—	—	(6·1)	—
Manila	10·9	e 2 48	+ 5	(4 56)	+ 4	4·9	5·1
Batavia	34·9	i 7 0	−12	—	—	—	—
Helwan	78·1	21 10	?S	(21 10)	−51	—	—
La Paz	167·0	20 0	[−13]	—	—	—	—

Additional records: Zi-ka-wei gives MN = +4·9m. 10m. has been added to the record of Nagasaki. Helwan gives P = +23m.10s.

Jan. 25d. Records also at 0h. (Taihoku and Tucson), 1h. (La Paz and Apia), 2h. (Helwan and Apia), 3h. (Apia), 4h. (Nagasaki), 5h. (Manila and Riverview), 18h. (Apia), 20h. (Tacubaya, Tucson, and Helwan), 23h. (Athens).

Jan. 26d. 11h. 14m. 50s. Epicentre 2°·1N. 127°·8E. (as on 1919 Oct. 26d.).

A = −·612, B = +·790, C = +·037; D = +·790, E = +·613;
G = −·022, H = +·029, K = −·999.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	14·2	332	e 3 31	+ 2	—	—	—	—
Riverview	42·1	150	e 18 34	?SR_1	—	—	e 21·3	23·2
Sydney	42·1	150	—	—	—	—	21·2	23·6
Melbourne	43·0	160	—	—	—	—	—	28·8
Honolulu	74·5	69	e 20 58	?S	(e 20 58)	−22	e 37·2	40·3
San Fernando	122·4	317	57 10	?L	—	—	(57·2)	—

Riverview gives MN = +23·4m. Melbourne records from 11h.20m. to 12h.20m.

Jan. 26d. 23h. 1m. 40s. Epicentre 19°·0N. 70°·0W. (as on 1920 Jan. 15d.).

A = +·323, B = −·889, C = +·326; D = −·940, E = −·342;
G = +·111, H = −·306, K = −·946.

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Port au Prince		2·1	e 0 7	−26	0 39	−19	1·0	1·8
Vieques	E.	4·4	0 57	−11	—	—	1·4	1·8
	N.	4·4	0 58	−10	—	—	1·4	1·7
Washington		20·8	5 0	+ 9	8 55	+15	—	—
Chicago		27·2	10 20	?S	(10 20)	−25	—	—
La Paz		35·6	7 24	+ 6	15 59	+175	23·9	26·1

Port au Prince MNW = +1·6m.

Jan. 26d. Records also at 1h. (Helwan), 2h. (Taihoku), 3h. (near Tortosa), 5h. and 8h. (Helwan), 9h. (La Paz), 20h. (Batavia), 21h. (Washington, Chicago, La Paz, Vieques, and Port au Prince), 22h. (near Balboa Heights).

Jan. 27d. Records at 5h. (Helwan), 8h. (Rio Tinto), 13h. (Apia), 14h. (Riverview), 15h. (Helwan, Florence, and San Fernando), 18h. (Manila), 22h. (Apia), 23h. (La Paz (2) and close to Harvard).

Jan. 28d. Records at 0h. (near Tokyo), 1h. (Manila), 2h. (Batavia), 3h. (La Paz), 6h. (Manila), 7h. (Taihoku), 9h. (Tokyo), 18h. (San Fernando).

Jan. 29d. 21h. 44m. 47s. Epicentre 18°·0S. 170°·1E, (as on 1919 Mar. 22d.).

$A = -\cdot 937$, $B = +\cdot 164$, $C = -\cdot 309$; $D = +\cdot 172$, $E = +\cdot 985$;
$G = +\cdot 304$, $H = -\cdot 053$, $K = -\cdot 951$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	23·2	223	e 5 19	0	e 9 28	− 1	e 10·8	12·4
Sydney	23·2	223	8 7	?	—	—	—	12·2
Christchurch	25·6	176	(5 37)	− 7	—	—	9·5	13·6
Melbourne	29·6	223	—	—	—	—	8·3	10·6
Adelaide	32·7	233	—	—	—	—	—	11·2
Batavia	62·6	272	—	—	e 18 30	−26	—	—
Helwan	140·7	295	70 13	?L	—	—	(70·2)	—

Additional records: Riverview gives $MN = +11\cdot 8$m. $= +5$m.37s. (?P). Helwan $P = +72$m.13s. Christchurch SR_1?

Jan. 29d. Records also at 13h. (Apia), 19h. (Christchurch and Tokyo), 20h. (San Fernando), 23h. (Lick).

Jan. 30d. 18h. 26m. 45s. Epicentre 4°·5N. 77°·5W.

$A = +\cdot 216$, $B = -\cdot 973$, $C = +\cdot 078$; $D = -\cdot 976$, $E = -\cdot 216$;
$G = +\cdot 017$, $H = -\cdot 077$, $K = -\cdot 997$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Balboa Hts.	E.	5·0	336	1 29	+12	3 1	+44	3·5	3·9
	N.	5·0	336	1 29	+12	3 3	+46	3·5	4·4
Vieques	E.	18·1	40	4 48	+30	8 39	+57	12·8	13·0
La Paz		22·9	156	i 4 50	−26	i 9 7	−16	11·6	13·6
Tacubaya		25·9	307	5 39	− 8	9 58	−22	11·5	16·9
Washington		34·4	2	e 7 0	− 8	(12 30)	−16	18·0	—
Georgetown		34·4	2	e 6 33	−35	12 26	−20	e 16·6	—
Ithaca	N.	38·0	3	—	—	e 13 29	− 9	16·5	—
	E.	38·0	3	—	—	e 13 34	− 4	19·9	—
Ann Arbor	E.	38·2	355	8 51	+71	15 3	+82	18·2	—
	N.	38·2	355	8 57	+77	14 51	+70	18·0	—
Harvard		38·3	9	e 7 32	− 8	13 15?	−27	20·3	—
Chicago		38·4	350	8 5	+24	15 50	+126	20·2	—
Toronto		39·2	359	10 15	?	e 16 33	+159	20·8	23·2
Ottawa		40·9	4	e 8 27	+25	14 4	−16	17·6	—
Lick		52·0	317	—	—	—	—	e 24·4	—
Berkeley		52·7	317	—	—	—	—	e 24·5	—
Victoria		58·7	327	17 38	?S	(17 38)	−29	28·0	45·8
Coimbra		71·2	50	—	—	e 20 45	+ 5	35·8	37·4
San Fernando		72·3	54	22 15	?	—	—	—	—
Eskdalemuir		77·4	35	22 12	?S	(22 12)	+19	31·2	41·2
Stonyhurst		77·6	38	23 15	?S	28 45	?SR_1	38·2	42·8
Oxford		78·0	39	—	—	—	—	41·2	42·0
Kew		78·5	39	—	—	—	—	—	56·2
Paris		80·1	41	—	—	e 22 15	− 9	42·2	43·2
Uccle		81·4	40	e 12 27	0	22 43	+ 4	e 40·2	44·2
De Bilt		81·9	39	—	—	e 22 49	+ 4	e 40·2	44·2
Moncalieri		83·4	45	22 54	?S	(22 54)	− 7	42·7	—
Strasbourg		83·5	43	e 11 15	−84	—	—	—	44·2
Hamburg		84·9	37	—	—	e 23 15	− 3	—	—
Rocca di Papa		87·2	49	e 12 46	−14	16 27	?PR_1	—	—
Helwan		103·9	59	27 15,	?S	(27 15)	+43	—	—
Melbourne		129·0	223	—	—	—	—	e 60·2	66·4
Colombo		154·7	63	—	—	—	—	98·2	107·2

For Notes see next page.

NOTES TO JAN. 30d. 18h. 26m. 45s.

Additional records: Vieques gives PN = +4m.47s. Tacubaya MN = +14·6m. Washington S is given as PR_1, S = +15m.5s. Georgetown LE = +18·0m., LN = +19·6m. Harvard PR_1 = +9m.27s. Ithaca LE = +16·6m. Chicago PR_1 = +13m.5s., L = +30·2m. Ottawa ePR_1? = +9m.23s., L = +21·2m., T_o = 8h.28m.7s. Victoria gives S as P and S = +23m.3s. Eskdalemuir gives S as P, also PR_1 = +23m.13s., S? = +27m.47s. Uccle SR_1 = +28m.50s., SR_2 = +32m.16s. De Bilt eSR_1 = +29m.21s., eSR_2 = +32m.40s., MN = +42·8m. Moncalieri gives S as P and S = +29m.19s. Helwan P = +28m.15s.

Jan. 30d. 19h. 33m. 10s. Epicentre 17°·0S. 177°·5W. (as on 1919 Aug. 18.).

A = −·955, B = −·042, C = −·292; D = −·044, E = +·999; G = +·292, H = +·013, K = −·956.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Apia	6·3	61	e 1 32	+ 4	(2 44)	− 8	2·7	3·8
Riverview	32·7	232	e 6 52	− 2	e 12 14	− 5	e 16·2	18·0
Sydney	32·7	232	—	—	12 20	+ 1	16·4	36·8
Melbourne	38·9	230	—	—	13 50	− 1	22·1	23·0
Honolulu	42·8	29	e 14 2	?S	(e 14 2)	−43	e 19·5	24·3
Adelaide	42·9	237	—	—	14 38	− 9	21·8	25·4
Victoria	81·2	33	—	—	—	—	—	39·8
Toronto	107·3	49	—	—	—	—	56·1	—
Ottawa	110·1	46	—	—	—	—	56·8	—
De Bilt	144·8	357	—	—	—	—	e 76·8	93·0
Uccle	146·2	358	—	—	—	—	e 78·8	—
Rocca di Papa	153·7	343	e 19 44	[−17]	30 20	?	e 95·2	98·3
Coimbra	154·9	21	—	—	e 63 16	?	77·4	—
San Fernando	159·1	20	—	—	—	—	—	89·8

Additional records: Riverview gives MN = +21·4m. Honolulu S = +16m.50s. (?SR_1). Toronto L = +59·0m. De Bilt MN = +85·7m. Rocca di Papa i = +20m.8s.

Jan. 30d. Records also at 2h. (La Paz), 3h. (San Fernando), 7h. (Sydney), 8h. (Tokyo and Helwan), 14h. and 18h. (La Paz), 19h. (Adelaide).

Jan. 31d. Records at 1h. (Riverview and San Fernando), 6h. (Taihoku), 10h. (La Paz and Helwan), 17h. (Mizusawa), 20h. (near Mizusawa and Tokyo), 23h. (Lick).

Feb. 1d. 13h. 24m. 40s. Epicentre 7°·0S. 150°·0E.

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

Riverview and Manila give fairly consistent values of T_o at 13h.26m.34s. and 13h.26m.26s.; but the corresponding Δs are only 19°·8 and 23°·7, which together only make up 43°·5, whereas the stations are 56° apart. There may be some large error, and the expedient has been adopted of assuming the same epicentre as on Feb. 2d.11h. For the alternative supposition of a very deep focus there is scarcely enough support.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	26·8	178	e 6 33	+37	10 13	−24	e 13·4	16·3
Melbourne	31·1	186	—	—	—	—	15·5	22·3
Manila	36·0	309	e 7 11	−11	11 24	−106	15·2	15·4
Batavia	42·9	270	i 8 31	+14	14 14	−33	—	15·9
Osaka	43·9	344	8 14	−11	—	—	—	16·5
Mizusawa	46·9	352	7 38	−68	—	—	—	—
Honolulu	58·3	60	18 8	?S	(18 8)	+ 5	34·8	36·3
Calcutta	67·2	298	11 20	+21	(19 20)	−32	19·3	—
Colombo	71·4	280	—	—	20 50	+ 7	—	—
Pompeii	128·0	317	21 25	?PR_1	—	—	—	—
Rocca di Papa	128·7	320	e 20 24	?PR_1	e 21 23	?PR_1	—	22·4
La Paz	135·5	123	19 46	[+16]	—	—	—	—
Tortosa	136·6	330	22 8	?PR_1	—	—	—	—

Additional records: Riverview gives also MN = +13·7m. Manila MN = +15·5m. Mizusawa P = +6m.26s. La Paz i = +22m.30s. (?PR_1)

Feb. 1d. Records also at 3h. (Manila), 4h. (Helwan, La Paz, and San Fernando), 9h. (Rio Tinto), 11h. (Mauritius), 12h. (Colombo, Helwan, and La Paz), 13h. (Mizusawa), 14h. (La Paz and Riverview), 15h. (Victoria), 17h. (Batavia and Manila), 18h. (Helwan), 19h. (Mizusawa).

1920. Feb. 2d. 11h. 22m. 15s. Epicentre 7°·0S. 150°·0E.

(suggested by Riverview and as on Feb. 1d.).

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 6 6	+10	i 10 47	+10	e 13·8	22·2
Sydney	E.	26·8	178	6 39	−17	11 15	+38	14·4	20·4
Adelaide		29·9	199	6 39	+12	11 27	− 5	14·6	24·0
Melbourne		31·1	186	7 21	+42	12 33	+40	15·0	22·8
Manila		36·0	309	e 6 45	−37	12 45	−25	16·5	17·6
Apia		38·1	102	e 7 13	−26	e 12 45	−54	i 19·2	20·8
Perth		40·4	227	8 29	+31	14 28	+15	(17·2)	—
Hokoto		42·7	317	e 8 46	+30	—	—	—	—
Batavia		42·9	270	8 23	+ 6	15 24	+37	i 19·0	29·2
Tokyo		43·8	349	7 55	−29	8 38	?	10·8	12·9
Osaka		43·9	344	8 49	+24	18 1	?SR_1	26·4	29·6
Kobe	E.	44·0	344	8 31	+ 5	—	—	e 19·2	32·7
	N.	44·0	344	8 31	+ 5	—	—	21·3	29·9
Nagasaki		44·2	335	8 5	−22	(14 56)	− 9	14·9	—
Mizusawa	E.	46·9	352	8 22	−24	15 38	− 2	—	—
	N.	46·9	352	8 18	−28	15 19	−21	—	—
Zi-ka-wei		47·0	326	e 8 31	−16	e 15 21	−20	e 21·4	24·2
Ootomari		54·1	355	9 35	+ 1	17 22	+12	22·2	29·9
Honolulu		58·3	60	9 57	− 4	—	—	22·2	34·2
Calcutta		67·2	298	10 57	− 2	20 45	+53	28·2	45·8
Colombo		71·4	280	10 33	−53	16 9	?	22·6	54·4
Kodaikanal		74·3	283	11 51	+ 7	—	—	23·2	55·2
Bombay		80·3	291	12 14	− 7	—	—	—	42·3
Sitka	E.	87·6	31	e 22 41	?S	(e 22 41)	−67	40·9	45·9
	N.	87·6	31	e 18 11	?PR_1	—	—	41·8	45·2
Mauritius	E.	89·6	250	11 45	−89	21 57	−133	—	57·2
	N.	89·6	250	11 51	−83	22 3	−127	—	53·8
Berkeley	E.	92·5	51	e 13 2	−28	e 24 0	−40	e 42·4	46·3
	N.	92·5	51	e 13 4	−26	e 23 38	−62	—	49·4
	V.	92·5	51	e 12 53	−37	e 24 31	− 9	e 42·3	46·0
Lick		93·0	52	e 13 21	−11	—	—	e 43·4	45·8
Victoria		94·0	41	12 56	−42	23 45	−71	43·4	48·4
	Z.	94·0	41	13 10	−28	23 45	−71	42·5	51·4
Denver		105·9	50	—	—	—	—	49·8	—
Lemberg		118·0	322	e 18 9	[−38]	e 29 33	+59	e 53·2	66·6
Helwan	E.	118·3	300	18 51	[+ 3]	—	—	—	81·6
	N.	118·3	300	20 21	?PR_1	—	—	—	78·8
Chicago		118·5	45	19 58	?PR_1	29 39	+61	e 48·8	67·9
Cape Town		118·6	224	22 45	?	31 3	+144	67·0	68·0
Ann Arbor	E.	121·1	42	18 57	[+ 2]	—	—	69·4	74·2
	N.	121·1	42	19 9	[+14]	—	—	69·6	74·2
Budapest		122·0	323	18 57	[− 1]	—	—	—	—
Athens		122·5	310	e 18 53	[− 7]	e 30 15	+67	—	—
Vienna		123·2	325	i 19 0	[− 1]	30 41	+88	e 50·2	57·8
Hamburg		123·3	332	e 20 45	?PR_1	—	—	e 57·8	69·8
Toronto		123·5	40	18 33	[−29]	e 30 15	+59	i 48·0	75·8
Ottawa		124·9	37	—	—	e 26 1	−204	e 50·8	—
Dyce	N.	125·3	341	—	—	i 31 3	+95	61·8	—
Ithaca		125·9	40	—	—	e 26 37	−175	62·4	—
Pola		126·4	322	22 16	?PR_1	(e 39 8)	?SR_1	39·1	73·1
De Bilt		126·5	333	e 19 9	[0]	—	—	e 58·8	76·0
Edinburgh		126·7	340	—	—	—	—	54·8	79·8
Georgetown	E.	127·0	44	e 17 45	+91	26 30	−190	e 43·0	74·9
	N.	127·0	44	e 17 45	+91	—	—	e 42·4	72·8
Washington		127·0	44	e 23 45	?	29 25	−15	e 68·8	—
Eskdalemuir		127·2	340	21 14	?PR_1	30 1	+20	42·2	—
Cheltenham		127·2	44	—	—	—	—	73·2	—
Padova		127·3	323	19 7	[− 5]	30 4	+22	—	76·2
Northfield		127·5	38	—	—	e 24 45	?	e 66·8	—
Strasbourg		127·7	328	e 19 4	[− 9]	31 2	+77	e 57·8	76·0
Uccle		127·8	333	e 19 11	[− 3]	—	—	e 57·8	77·1

Continued on next page.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Zurich	127·9	323	e 19 7	[− 7]	—	—	—	—
Pompeii	128·0	317	19 30	[+16]	31 10	+83	39·8	60·8
Stonyhurst	128·2	338	15 45	−34	—	—	—	84·8
Milan	128·4	326	23 27	?	—	—	60·8	82·8
Monte Cassino	128·2	319	19 36	[+22]	—	—	—	—
Florence	128·5	321	22 40	?PR_1	39 55	?SR_1	—	57·6
Rocca di Papa N.	128·7	320	e 21 24	?PR_1	e 36 4	?SR_1	e 59·2	87·2
Kew	129·2	337	21 45	?PR_1	—	—	—	83·8
Besancon	129·4	329	19 23	[+ 7]	—	—	38·8	—
Oxford	129·4	337	—	—	20 58	?PR_1	55·8	80·4
Harvard	129·4	39	e 17 11	+46	e 22 36	?PR_1	65·1	76·3
Moncalieri	129·9	326	i 21 34	?PR_1	40 23	?SR_1	—	85·8
Paris	130·0	332	e 19 15	[− 3]	e 25 11	?	38·8	74·8
Puy de Dôme	132·0	329	19 1	[−22]	—	—	—	—
Halifax	132·4	32	—	—	e 27 45	−152	e 53·2	—
Barcelona	135·3	325	e 22 8	?PR_1	i 34 48	?SR_1	40·7	74·8
La Paz	135·5	123	19 35	[+ 4]	—	—	—	—
Tortosa	136·6	330	19 33	[0]	32 9	+85	59·0	91·8
Algiers	137·7	319	e 20 2	[+27]	29 25	−85	41·8	76·8
Granada	141·5	325	i 19 27	[−15]	i 30 59	−13	—	—
Coimbra	141·6	332	e 19 23	[−19]	30 45	−28	53·8	85·2
	141·6	332	19 9	[−33]	31 21	+ 8	49·2	82·2
San Fernando	143·4	327	19 15	[−31]	30 45	−38	—	129·6
Vieques E.	143·7	66	23 24	?PR_1	—	—	76·0	108·7
N.	143·7	66	23 17	?PR_1	—	—	—	120·7
Rio de Janeiro	147·4	158	e 19 39	[−13]	—	—	54·0	—
Azores	149·0	352	26 15	?	—	—	—	32·4
Accra	150·4	269	17 45	− 8	—	—	—	88·8

Additional records: Riverview gives also iP = +6m.18s. and +6m.52s., iPR_1 = +7m.32s., +8m.15s., and +9m.10s., PS = +11m.17s., MN = +17·6m., MZ = +27·4m. Recrudescence MN = +2h.52m.40s., ME = +3h.5m.54s., T_0 = 11h.22m.26s. Epicentre 7°·0S. 150°·0E., as adopted. Melbourne PR_1 = +8m.27s., SR_1 = +13m.21s. Manila MN = +17·0m. Apia e = +10m.9s. and +16m.45s., T_0 = 11h.22m.26s. Epicentre 8°·0S. 152°·0E. Batavia i = +9m.15s. Zi-ka-wei MN = +26·4m. Ootomari MN = +36·8m. Honolulu alleges two shocks, for the second P = +14m.9s., L = +27·0, L rep. = +160·8m. Calcutta LN = +28·4m., MN = +46·4m. Denver LN = +51·8m. Chicago PR_1 = +25m.18s. Ann Arbor, Wiechert record LEN = +69·6m. Toronto e? = +11m.3s., E? = 12m.21s., E = +19m.57s. and +21m.21s., L = +65·4m. Athens e = +35m.45s. Vienna PR_1 = +23m.5s., PR_2 = +25m.43s., PR_3 = +26m.46s., SR_1 = 37m.7s. SR_2 = +42m.3s., SR_3 = +45m.36s. Hamburg i = +25m.16s., +32m.7s., +38m.9s., and 41m.59s., MN = +70·2m. Ottawa PR_1 = +20m.29s. Dyce S is given as i and S = +38m.3s. Ithaca eL?E = +42·2m. De Bilt e = +21m.14s. and +38m.39s., MN = +75·3m. Georgetown LE = +64·8m., LN = +64·1m. Washington eL = +46·2m., +77·8m., and +137·8m. Northfield L = +62·2m. and +121·8m. Strasbourg e = +33m.17s., SR_1 = +38m.32s., MN = +76·6m. Uccle MN = +76·0m., MZ = +77·0m. Oxford e = +39m.13s. Harvard L = +96·4m., M = +79·8m. Moncalieri MN = +80·5m. Paris i = +22m.10s., MN = +39·8m. Halifax PR_1 = +22m.43s. Barcelona i = +23m.5s., +27m.22s., and +37m.46s. Algiers PR_1 = +25m.30s. Pola MN = +81·0m. La Paz i = +23m.25s., L = +88·5m., +90·5m., +95·8m. Coimbra PR_1N = +23m.21s., PR_1E = +23m.23s., PR_2N = +26m.35s., PR_2E = +26m.37s., SN = +29m.55s., SR_1E = +37m.35s., LN = +55·8m., MN = +84·0m. Milne records are given in the second line, also PR_1 = +23m.39s. San Fernando MN = +89·8m.

Feb. 2d. Records also at 10h. (near Tokyo and Mizusawa), 12h. (Denver), 13h. (Denver, Victoria, Toronto, La Paz, and Cheltenham), 15h. (near Balboa Heights; and Batavia), 16h. (Batavia, La Paz, Riverview (2), Melbourne (2), Manila, Perth, and Victoria), 17h. (La Paz and De Bilt), 18h. (Riverview (2) and Batavia), 19h. (La Paz), 20h. (Riverview and De Bilt).

Feb. 3d. 14h. 53m. 0s. Epicentre 7°·0S. 150°·0E. (as on Feb. 2d. 11h.).

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Sydney	26·8	178	9 30	?S	(9 30)	−67	14·3	17·2
Riverview	26·8	178	e 5 52	− 4	e 10 39	+ 2	e 14·5	17·0
Adelaide	29·9	199	8 48	?	13 30	?SR_1	17·3	21·0
Melbourne	31·1	186	—	—	—	—	e 16·8	17·8
Manila	36·0	309	8 0	+38	—	—	—	—
Perth	40·4	227	—	—	14 0	−13	—	—
Batavia	42·9	270	—	—	14 0	−47	—	—
Honolulu	58·3	60	28 0	?L	31 0	?	35·2	40·5
Victoria	94·0	41	44 13	?L	—	—	(44·2)	49·1
Helwan	118·3	300	33 0	?	—	—	(51·0)	—
De Bilt	126·5	333	—	—	—	—	e 64·0	78·7
La Paz	135·5	123	22 40	?PR_1	—	—	—	—
San Fernando	143·4	327	21 0	?	—	—	—	—

Additional records: Riverview gives also eSR_3? = +13m.45s. and +14m.15s., MN = +18·5m., MZ = +18·3m. Helwan gives its records as PE and PN respectively. De Bilt MN = +81·0m.

Feb. 3d. Records also at 0h. (Riverview (2)), 1h. and 2h. (Riverview), 3h. Christchurch), 4h. (Riverview), 5h. (Helwan), 6h. (Adelaide, Melbourne, Manila, Perth, and Riverview (2)), 7h. (Honolulu, Victoria, Toronto, and Chicago), 10h. (Riverview), 11h. (Batavia and Debra Dun), 12h. (Christchurch), 18h. (Batavia and Manila), 19h. (Sydney, Riverview (2), De Bilt, and Helwan), 20h. (Honolulu, Perth, Victoria, Adelaide, and Florence), 21h. (Riverview), 22h. (Florence, Coimbra, and La Paz).

Feb. 4d. Records at 0h. (San Fernando and La Paz), 8h. (Oaxaca and Tacubaya), 10h. (La Paz), 12h. (Batavia, Manila, Tokyo, Lick, and Mizusawa), 13h. (La Paz and De Bilt), 14h. and 15h. (Stonyhurst (3)), 18h. (Helwan), 20h. (La Paz), 21h. (Riverview), 23h. (Tacubaya).

Feb. 5d. Records at 0h. (La Paz and San Fernando), 2h. (Denver), 9h. (Azores and near Lick and Berkeley), 13h. (La Paz (2) and Monte Cassino), 14h. (near Osaka and Kobe), 18h. (Riverview), 21h. (San Fernando).

Feb. 6d. Records at 4h. (Taihoku), 5h. (Batavia), 8h. (Helwan), 9h. (La Paz, Riverview, Manila, and Honolulu), 15h. (Apia), 16h. (La Paz), 17h. (Tokyo), 18h. (near Athens), 20h. (San Fernando), 23h. (Mauritius).

Feb. 7d. 11h. 50m. 30s. Epicentre 56°·8N. 33°·6W.

A = +·456, B = −·303, C = +·837; D = −·553, E = −·833; G = +·697, H = −·463, K = −·548.

(Compare 1917 March 3d. 10h. at 55°·0N. 35°·0W.)

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Edinburgh	16·7	80	i 3 55	− 6	i 7 38	+27	—	11·2
Eskdalemuir	16·9	82	(4 1)	− 3	(7 45)	+29	7·8	14·5
Dyce	17·0	75	—	—	—	—	7·8	9·5
Oxford	19·3	91	4 32	− 1	7 58	−10	9·3	14·8
Kew	20·0	88	—	—	—	—	—	12·5
De Bilt E.	22·7	85	5 13	0	9 24	+ 5	10·9	13·6
N.	22·7	85	—	—	9 26	+ 7	11·5	14·0
Paris	22·9	95	e 5 19	+ 3	e 9 22	− 1	11·5	12·5
Uccle	22·9	89	e 5 9	− 7	e 9 22	− 1	e 11·5	15·5
Coimbra	23·3	125	i 5 20	0	9 4	−27	10·7	13·2
Hamburg	24·7	79	e 5 36	+ 1	i 9 54	− 3	e 13·5	17·4
Besancon	25·8	95	5 34	−12	10 12	− 6	13·5	—
Strasbourg	25·9	91	e 4 30	−77	10 24	+ 4	e 13·3	15·6
Rio Tinto	26·1	125	12 30	?L	—	—	(12·5)	22·5
Tortosa	27·1	111	6 2	+ 3	10 24	−19	12·7	18·3
San Fernando	27·4	126	—	—	—	—	12·5	15·0
Barcelona	27·5	108	e 6 8	+ 5	—	—	e 14·0	17·9
Harvard E.	27·8	255	—	—	10 53	− 2	e 14·8	17·3
N.	27·8	255	—	—	10 51	− 4	15·6	18·1
Granada	27·9	122	6 14	+ 7	—	—	—	—

Continued on next page.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Moncalieri	28·1	97	6 7	− 2	10 34	−27	13·8	17·4
Ottawa	28·3	265	—	—	i 10 58	− 6	e 14·5	—
Ithaca	30·6	260	—	—	—	—	e 17·2	—
Vienna	30·8	82	—	—	—	—	e 15·5	19·1
Toronto	31·4	266	—	—	—	—	e 16·1	18·5
Algiers	31·5	110	6 33	−10	11 47	−13	16·5	21·5
Pola	31·5	90	e 16 26	?L	—	—	(e 16·4)	19·5
Rocca di Papa N.	32·9	95	e 15 29	?L	19 50	?	(15·5)	22·4
Georgetown E.	33·4	257	—	—	—	—	e 19·1	—
Washington	33·4	257	—	—	—	—	e 18·5	—
Ann Arbor E.	34·6	267	—	—	—	—	18·6	19·2
Pompeii	34·6	94	6 27	−43	—	—	—	—
Chicago	37·1	270	8 55	?PR_1	13 20	− 5	e 17·2	—
Victoria	51·1	301	22 54	?	—	—	25·4	30·3
Helwan	51·9	91	16 30	?S	(16 30)	−13	—	—
Berkeley	58·4	291	—	—	—	—	e 33·8	—
La Paz	78·8	213	11 43	−29	—	—	—	—

Additional records and notes: Eskdalemuir gives P as S and S as L, recording for P + 1m.49s. Coimbra iN = +9m.40s., MN = +11·3m. Hamburg MN = +15·9m. San Fernando MN = +16·0m. Toronto iL = +17·5m. Moncalieri MN = +16·8m. Georgetown LN = +19·8m. Ann Arbor LN (Bosch-Omori) and LE (Wiechert) = +18·7m., MN = +19m.5s. Chicago L = +21·5m.

Feb. 7d. 15h. 7m. 10s. Epicentre 40°·3N. 139°·5E. (as on 1920 Jan. 17d.).

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

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Mizusawa	1·7	133	0 24	− 2	0 53	+ 5	—	—
Tokyo	4·7	178	1 11	− 2	2 13	+ 4	2·6	—
Osaka	6·5	212	—	—	2 31	−26	4·3	4·9
Kobe	6·6	213	—	—	2 58	− 2	4·8	5·6
Taihoku	21·4	230	—	—	—	—	e 10·4	—
Manila	30·4	219	—	—	e 11 50	+ 9	—	—
Batavia	55·3	220	e 8 58	−43	e 17 53	+28	e 25·5	—
Honolulu	55·6	90	16 56	?S	(16 56)	−33	43·8	49·2
Victoria	65·1	46	33 17	?L	—	—	41·6	61·8
Perth	75·5	200	—	—	—	—	34·3	—
Hamburg	77·6	332	—	—	—	—	e 42·8	—
Eskdalemuir	79·2	340	—	—	—	—	45·8	—
De Bilt E.	79·6	333	—	—	e 22 2	−17	e 40·8	47·6
N.	79·6	333	—	—	—	—	e 42·8	44·9
Stonyhurst	80·4	338	46 20	?L	—	—	(46·3)	—
Strasbourg	81·5	330	—	—	—	—	e 47·8	—
Kew	81·8	337	—	—	—	—	—	50·8
Paris	83·1	333	—	—	—	—	e 46·8	53·8
Helwan	83·4	304	23 50	?S	(23 50)	+49	—	—
San Fernando E.	97·1	332	55 50	?L	—	—	(55·8)	60·8
N.	97·1	332	46 50	?L	—	—	(46·8)	64·3
La Paz	146·2	52	19 53	[+ 3]	—	—	—	—

Additional records: Osaka gives MN = +5·3m. Kobe MN = +6·0m. Zi-ka-wei (Δ = 17°·2, Az. = 244°·0) records e at 15h. 9m. ±2m. Honolulu S = +32m.50s. Helwan PN = +24m.50s.

Feb. 7d. 15h. 24m. 28s. Epicentre 7°·0S. 150°·0E. (as on 1920 Feb. 3d.).

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	26·8	178	e 6 2	+ 6	i 10 32	− 5	e 14·1	16·4
Adelaide	29·9	199	—	—	12 26	+54	17·6	19·9
Melbourne	31·1	186	12 56	?S	(12 56)	+63	19·2	20·5
Manila	36·0	309	—	—	e 10 17	—	—	—
Batavia	42·9	270	e 8 14	− 3	—	—	e 35·3	—
Chicago	118·5	45	—	—	—	—	e 54·5	—
Toronto	123·5	40	—	—	—	—	60·6	70·4
De Bilt	126·5	333	—	—	—	—	e 66·5	74·4
Pompeii	128·0	317	54 40	?	54 42	?	(54·7)	—
Stonyhurst	128·2	338	69 32	?L	—	—	(69·5)	—
Harvard	129·4	39	—	—	i 62 50	?L	70·6	—
Moncalieri	129·9	326	19 16	[− 2]	25 3	?	29·4	—

Additional records: Riverview gives PS = +10m.54s., MN = +16·2m., MZ = +20·2m. Chicago L = +59·0m. and = +80·5m. Toronto eL = +65·8m. De Bilt MN = +82·1m. Pompeii a local shock?

Feb. 7d. Records also at 3h. (Tacubaya, La Paz, and Helwan), 4h. (La Paz), 11h. (Rocca di Papa), 13h. (La Paz, Harvard, and near Ootomari), 15h. (near Mizusawa and Riverview), 16h. (Toronto, Moncalieri, and Adelaide), 18h. (Tokyo and La Paz), 19h. (La Paz), 21h. (San Fernando), 23h. (near Tacubaya).

Feb. 8d. 5h. 24m. 12s. Epicentre 35°·0S. 111°·0E.

$A = -\cdot294$, $B = +\cdot765$, $C = -\cdot574$; $D = +\cdot934$, $E = +\cdot358$; $G = +\cdot206$, $H = -\cdot535$, $K = -\cdot819$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Perth	5·1	55	2 55	?	—	—	6·7	—
Adelaide	22·5	97	5 36	+25	10 0	+45	13·7	18·2
Melbourne	27·3	106	—	—	11 36	+50	16·4	18·3
Batavia	29·1	351	6 21	+ 2	—	—	e 18·2	—
Riverview	32·9	100	e 6 57	+ 1	e 12 21	− 1	e 16·7	19·9
Sydney	32·9	100	12 30	?S	(12 30)	+ 8	19·0	20·3
Mauritius	48·8	274	10 42	+103	—	—	—	19·5
Manila	50·5	13	e 8 48	−22	—	—	—	—
Colombo	51·2	319	16 0	?S	(16 0)	−34	25·0	29·0
Kodaikanal	55·3	320	25 0	?	—	—	31·2	33·2
Bombay	65·0	321	26 51	?L	—	—	(26·8)	—
Simla	73·4	330	e 35 54	?L	—	—	(e 35·9)	43·8
Helwan	99·2	300	30 48	?SR_1	—	—	—	—
Honolulu	102·8	74	34 48	?SR_1	—	—	56·0	62·2
De Bilt	126·2	312	—	—	e 36 48	?SR_1	e 66·8	78·6
La Paz	128·5	181	e 18 28	[−47]	29 5	−46	57·0	64·8
Kew	129·3	311	—	—	—	—	—	80·8
San Fernando	129·9	290	62 0	?L	—	—	69·6	73·8
Oxford	130·0	311	—	—	—	—	—	80·5
Rio Tinto	130·7	292	72 48	?L	—	—	(72·8)	81·8
Stonyhurst	130·9	311	69 48	?L	—	—	(69·8)	77·8
Eskdalemuir	131·5	316	—	—	—	—	52·8	—
Victoria	138·2	52	68 26	?L	—	—	75·8	78·8
Chicago	163·9	60	—	—	—	—	83·3	—
Toronto	168·2	40	—	—	—	—	e 95·5	97·6
Ottawa	168·4	24	—	—	—	—	89·8	—
Harvard	172·4	12	—	—	—	—	87·4	—

Additional records and notes: Adelaide gives $SR_1 = +11$m.54s. Sydney S = +16m.48s. Riverview eS = +12m.29s., $SR_1 = +15$m.21s., MN = +20·1m., MZ = +20·0m. Mauritius SN = +16m.30s., SE = +17m.48s. De Bilt MN = +77·7m. San Fernando MN = +75·8m. Harvard L = +96·2m., LE = +98·6m.

Feb. 8d. Records also at 2h. (La Paz and Riverview), 5h. (Capetown), 7h. (Batavia, Victoria, and Stonyhurst), 9h. (Zi-ka-wei), 13h. and 17h. (La Paz), 18h. (near Port au Prince (2)), 19h. (San Fernando), 20h. (Riverview), 23h. (San Fernando).

Feb. 9d. 2h. 31m. 18s. Epicentre 7°·0S. 150°·0E. (as on Feb. 7d.).

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	26·8	178	e 5 30	−26	e 10 26	−11	e 13·4	23·3
Adelaide	29·9	199	—	—	12 48	+76	17·4	20·3
Manila	36·0	309	e 10 42	?	—	—	—	—
Perth	40·4	227	—	—	—	—	22·4	—
Batavia	42·9	270	e 8 32	+15	14 10	−37	—	—
Chicago	118·5	45	—	—	—	—	e 63·7	—
De Bilt	126·5	333	—	—	—	—	e 64·7	65·2

Riverview gives also MNZ = +23·0m.

Feb. 9d. 19h. 2m. 20s. Epicentre 1°·2S. 149°·5E. (as on 1918 Oct. 27d.).

A = −·862, B = +·508, C = −·021; D = +·508, E = +·862; G = +·011, H = −·018, K = −·1·000.

This epicentre cannot very well be the same as at 2h.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	32·4	302	—	—	—	—	e 16·7	—
Riverview	32·7	178	e 6 55	+ 1	e 12 15	− 4	e 16·4	22·0
Sydney	32·7	178	16 28	?L	—	—	19·7	21·3
Melbourne	36·8	188	—	—	—	—	23·7	25·2
Batavia	42·9	264	—	—	e 14 48	+ 1	(21·0)	—
Perth	44·2	222	—	—	—	—	27·7	—
Honolulu	55·9	63	33 34	?L	—	—	36·3	40·7
Helwan	114·8	303	83 40	?L	—	—	(83·7)	—
De Bilt	121·0	335	—	—	—	—	e 70·7	—
Rocca di Papa	123·9	321	i 85 46	?L	—	—	(i 85·8)	85·8
San Fernando	138·2	330	57 40	?L	—	—	(57·7)	—

Riverview gives also MN = +32·1m., MZ = +31·9m. Batavia gives L as S.

Feb. 9d. Records also at 0h. (La Paz), 11h. (near Tacubaya (2)), 13h. (Riverview), 15h. (Taihoku), 22h. (Helwan), 23h. (Pompeii, Taihoku, and Calcutta).

Feb. 10d. 9h. 12m. 45s. Epicentre 11°·7S. 162°·5E. (as on 1919 Jan. 8d.).

A = −·934, B = +·294, C = −·203; D = +·301, E = +·954; G = +·193, H = −·061, K = −·979.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	24·4	203	e 5 35	+ 3	e 10 1	+ 9	e 12·0	17·0
Apia	25·1	98	e 4 45	−54	—	—	8·2	11·2
Melbourne	30·5	208	11 33	?S	(11 33)	−10	18·0	19·8
Adelaide	31·8	219	6 45	0	12 3	− 2	15·2	21·4
Christchurch	33·0	166	—	—	11 57	−27	17·4	19·8
Perth	47·4	303	8 35	−15	16 12	+26	27·0	—
Manila	48·9	302	e 9 3	+ 4	—	—	—	—
Honolulu	50·9	49	9 33	+21	i 16 15	−15	e 23·2	31·6
Mizusawa	54·6	340	17 3	?S	(17 3)	−13	—	—
Batavia	55·2	272	e 9 15	−25	—	—	—	19·2
Colombo	84·3	278	22 15	?S	(22 15)	−56	—	56·2
Berkeley	85·8	50	—	—	—	—	e 39·0	—
Kodaikanal	87·3	281	50 45	?L	—	—	53·8	55·8
Victoria	88·5	40	23 19	?S	(23 19)	−39	37·7	45·3
Tucson	93·4	58	—	—	—	—	42·9	—
Mauritius	99·4	247	23 9	?S	(23 9)	−161	57·0	62·4
Chicago	112·5	49	25 3	?S	34 47	?	55·8	—
Toronto	118·3	46	—	—	—	—	59·2	69·0
Ithaca	120·3	47	—	—	—	—	59·7	—
Ottawa	120·4	44	—	—	e 29 35	+43	58·2	—
Washington	120·9	51	—	—	—	—	e 62·2	—
La Paz	122·5	118	e 6 30	?	—	—	58·1	59·8
Harvard	124·4	46	e 29 3	?S	(e 29 3)	−19	60·5	—
De Bilt	135·7	340	e 56 15	?	—	—	e 66·2	67·3
Moncalieri	140·4	332	—	—	—	—	69·1	—
San Fernando	153·3	340	43 15	?SR_1	—	—	—	—

Additional records and notes: Riverview gives PS = +10m.32s., MZ = +18·1m. Melbourne gives S as P and records S = +16m.15s. Adelaide SR_1 = +13m.57s. Christchurch SR_1 = +14m.15s. Mizusawa PE = +19m.3s. Kodaikanal may record another more local shock. Victoria gives S as P and records S = +29m.16s. Toronto L = +35·8m., eL = +63·4m. Ottawa L = +33·5m. Washington L = +67·2m. Harvard e = +37m.39s. Moncalieri e = +56m.1s.

Feb. 10d. 10h. 2m. 40s. Epicentre 11°·7S. 162°·5E. (as at 9h.).

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	24·4	203	e 5 25	− 7	9 53	+ 1	e 12·8	16·4
Apia	25·1	98	e 4 50	−49	(9 50)	−15	9·8	11·8
Melbourne	30·5	208	—	—	—	—	17·8	19·3
Adelaide	31·8	219	—	—	11 50	−15	16·1	19·4
Manila	48·9	302	e 10 7	+68	—	—	—	—
Honolulu	50·9	49	16 38	?S	(16 38)	+ 8	e 25·3	30·4
Batavia	55·2	272	8 20	−80	—	—	—	20·3
Victoria	88·5	40	—	—	—	—	—	44·9
Toronto	118·3	46	—	—	—	—	e 64·1	70·7
Cape Town	123·0	216	18 8	?	—	—	—	29·1
Harvard	124·4	46	—	—	—	—	66·7	—
San Fernando	153·3	340	—	—	—	—	—	70·3

Additional records and notes: Riverview gives MZ = +15·4m., MN = +15·9m. Adelaide gives P the same as S, also SR_1 = +13m.56s. Honolulu gives S as P and records eS = +21m.44s. San Fernando MN = +74·3m.

1920. Feb. 10d. 22h. 7m. 10s. Epicentre 19°·0N. 68°·0W.

(as on 1919 Sept. 11d.).

A = +·354, B = −·877, C = +·326; D = −·927, E = −·375; G = +·122, H = −·302, K = −·946.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Vieques	E.	2·6	107	0 38	− 3	—	—	0·9	—
	N.	4·1	268	i 0 34	−30	i 0 50	−63	1·6	—
Port au Prince		15·1	230	3 38	− 2	6 30	− 4	8·2	6·7
Balboa Hts.	E.	15·1	230	3 44	+ 4	6 34	0	7·8	6·7
	N.	21·2	341	5 46	+51	9 50	+62	13·2	17·2
Cheltenham		21·4	340	i 5 0	+ 2	i 9 5	+12	e 10·3	18·9
Georgetown	E.	21·4	340	i 5 0	+ 2	i 9 5	+12	e 10·2	19·0
	N.	21·4	340	5 0	+ 2	9 6	+13	e 10·2	—
	Z.	21·4	340	4 58	0	8 54	+ 1	10·7	—
Washington		21·7	306	e 5 28	+27	i 9 39	+40	11·8	13·5
Mobile		23·5	354	e 5 23	0	9 33	− 2	—	13·1
Harvard	E.	23·5	354	e 5 22	− 1	9 21	−14	—	13·8
	N.	24·5	345	5 45	+12	10 7	+13	11·8	—
Ithaca		25·5	352	e 5 38	− 5	10 1	−12	12·2	—
Northfield		25·9	7	5 34	−13	9 58	−22	—	—
Halifax		26·4	341	e 6 8	+16	i 10 50	+20	13·2	18·0
Toronto		26·8	334	5 50	− 6	9 56	−41	12·3	21·1
Ann Arbor	E.	26·8	334	5 56	0	10 8	−29	12·2	20·9
	N.	26·8	334	5 50	− 6	10 2	−35	11·9	21·2
	E.	27·2	348	5 59	− 1	10 34	−11	13·2	—
Ottawa		27·4	271	6 7	+ 5	12 8	?	16·0	19·2
Oaxaca		28·2	328	6 8	− 2	10 50	−13	13·0	30·3
Chicago		29·4	276	7 25	+63	14 17	+173	20·4	24·0
Tacubaya	E.	29·4	276	—	—	—	—	20·5	24·3
	N.	35·5	180	i 6 54	−24	12 30	−33	18·5	28·0
La Paz		40·5	298	7 40	−19	13 50	−24	19·7	30·4
Tucson	E.	41·2	54	19 26	?L	—	—	(19·4)	25·0
Azores		49·9	303	—	—	e 16 28	+10	—	—
Lick		50·5	304	e 9 14	+ 4	(e 16 27)	+ 2	—	36·9
Berkeley	E.	50·5	304	e 9 12	+ 2	—	—	e 26·5	32·7
	N.	50·5	304	e 9 10	0	—	—	—	34·2
	V.	53·1	317	8 38	−49	16 6	−51	26·5	33·4
Victoria		54·9	52	i 9 36	− 2	17 16	− 4	24·9	27·1
Coimbra	E.	54·9	52	e 9 48	+10	17 8	−12	23·9	25·7
	N.	56·1	57	13 50	?PR_1	—	—	23·8	—
Rio Tinto		56·4	58	9 50	+ 2	17 26	−13	32·6	48·3
San Fernando		58·5	57	i 10 7	+ 5	i 18 13	+ 8	—	—
Granada		60·2	36	—	—	(17 50)	−36	17·8	—
Eskdalemuir		60·3	36	18 50	?S	(18 50)	+23	(29·0)	36·0
Edinburgh		60·4	38	18 20	?S	(18 20)	− 8	28·3	30·3
Stonyhurst		60·9	40	—	—	—	—	26·6	32·3
Oxford									

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Dyce	E.	61·1	34	e 10 45	+25	18 43	+ 6	29·9	35·7
	N.	61·1	34	e 10 45	+25	18 43	+ 6	34·6	35·9
Kew		61·4	41	23 50	?	—	—	—	41·8
Tortosa		61·7	51	10 28	+ 5	18 39	− 5	25·9	39·6
Sitka		61·9	325	e 15 35	?PR_1	—	—	33·3	36·9
Barcelona		62·9	52	e 15 19	?	19 4	+ 4	26·0	36·3
Paris		63·1	44	e 10 26	− 7	e 19 5	+ 3	25·8	36·8
Puy de Dôme		63·4	48	9 50	−44	—	—	—	—
Algiers		63·9	58	10 37	0	19 13	+ 1	27·3	36·8
Uccle		64·3	40	e 10 44	+ 4	19 16	− 1	e 29·8	36·2
De Bilt	E.	64·8	40	11 5	+21	—	—	30·8	38·4
	N.	64·8	40	—	—	19 30	+ 7	27·8	29·2
Besancon		65·4	45	10 55?	+ 8	—	—	32·8	—
Strasbourg		66·5	43	e 10 44	−11	i 19 50	+ 6	e 30·8	37·7
Moncalieri		66·7	48	11 0	+ 4	19 53	+ 7	27·1	38·8
Zurich		67·2	45	e 11 6	+ 7	—	—	—	—
Accra		67·3	90	25 50	?SR_1	—	—	—	57·3
Hamburg		67·8	39	e 11 18	+15	i 20 6	+ 6	e 33·8	41·8
Florence		69·4	48	10 50	−23	—	—	—	29·8
Padova		69·6	47	10 35	−40	20 1	−20	—	—
Rocca di Papa		70·7	51	11 23	+ 2	20 36	+ 2	e 34·6	41·2
Pola		71·1	47	i 20 25	?S	(i 20 25)	−14	e 44·3	46·1
Monte Cassino		71·6	51	11 31	+ 4	—	—	—	—
Pompeii		72·2	50	11 40	+ 9	20 50	− 2	36·8	—
Vienna		72·3	42	11 32	0	—	—	—	55·3
Honolulu		83·2	290	e 14 2	?	i 23 14	+15	e 46·6	51·5
Capetown		97·7	123	21 38	?	—	—	—	67·6
Simla		119·7	33	e 64 50	?L	—	—	(e 64·8)	65·1
Zi-ka-wei		129·0	350	—	—	—	—	e 65·8	—
Mauritius		129·2	100	59 38	?L	—	—	(59·6)	75·1
Taihoku		135·0	347	—	—	—	—	e 68·8	—
Kodaikanal		135·1	52	63 26	?L	—	—	83·9	86·0
Colombo		139·0	54	42 26	?SR_1	—	—	—	104·8
Riverview		142·2	239	e 20 21	[+38]	e 33 9	?	e 69·8	71·8
Manila		145·2	345	e 19 50	[+ 2]	—	—	—	—
Melbourne		145·7	230	—	—	—	—	e 73·8	82·3
Batavia		166·2	22	e 19 50	[−22]	—	—	e 91·8	97·6

Additional records and notes: Port au Prince gives $SR_1 = +1$m.28s., L = +2·0m., and +3·7m. Cheltenham MN = +20·2m.; other phases the same for both. Georgetown LE = +13·2m., LNZ = +12·0m. Washington L = +22·8m. and +46·5m. Ithaca $PR_1E = +6$m.21s. Northfield L = +14·8m. Ann Arbor, the last line recorded is for the Wiechert readings, also LN = +11·9m. Tucson $PR_1 = +9$m.20s. Azores records for 11d. Berkeley eSE? = +19m.2s., $T_o = 22$h.6m.39s. Victoria MZ = +32·8m. Coimbra iN = +17m.30s. San Fernando MN = +34·3m. Sitka eE = +33m.15s., ME = +42·3m. Paris MN = +25·8m. Uccle i = +26m.47s., MN = +36·8m. De Bilt eN = 20m.46s. and +26m.52s. Strasbourg MN = +44·2m. Moncalieri MN = +44·5m. Hamburg e = +29m.32s., MN = +39·7m. Padova PR_1 = +11m.45s., SR_1 = +25m.25s. Pola gives eS = +30m.19s. ?SR_1, MN = +46·8m. Mauritius PN = +68m.14s. ?LN. Batavia L = +111·8m.

Feb. 10d. Records also at 0h. (Helwan), 2h. (La Paz and near Manila), 3h. (near Tacubaya), 7h. (Zi-ka-wei, La Paz, and near Tacubaya), 9h. (near Taihoku), 10h. (near Mizusawa), 11h. (Taihoku), 13h. (Toronto and near Mizusawa), 14h. (near Mizusawa and Tokyo), 16h. (Riverview and Apia), 17h. (near Tokyo), 20h. (Apia), 21h. (Colombo and Calcutta), 22h. (near Vieques), 23h. (near Padova, Monte Cassino, and Rocca di Papa).

Feb. 11d. Records at 0h. (Vieques), 6h. (La Paz and near Mizusawa and Tokyo), 7h. (Riverview), 8h. (near Vieques and La Paz), 10h. (San Fernando and near Tokyo), 14h. (near Tokyo), 19h. (near La Paz), 20h. and 21h. (near Lick).

Feb. 12d. 0h. 26m. 15s. Epicentre 19°·0N. 68°·0W. (as on 1920 Feb. 10d.).

$A = +\cdot354$, $B = -\cdot877$, $C = +\cdot326$; $D = -\cdot927$, $E = -\cdot375$; $G = +\cdot122$, $H = -\cdot302$, $K = -\cdot946$.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Vieques	E.	2·6	107	0 44	+ 3	—	—	0·9	2·0
	N.	2·6	107	0 43	+ 2	—	—	1·3	2·0
Port au Prince	N.E.	4·1	268	e 0 34	−30	0 48	−65	1·5	2·2
	N.W.	4·1	268	—	—	1 12	−41	—	2·3
Georgetown		21·4	340	e 5 3	+ 5	9 3	+10	13·9	—
Washington		21·4	340	5 3	+ 5	9 3	+10	e 14·2	—
Harvard		23·5	354	5 11	−12	9 36	+ 1	e 12·3	—
Toronto		26·4	341	—	—	—	—	e 15·8	18·0
Ann Arbor	N.	26·8	334	—	—	13 45	?L	18·3	—
Ottawa		27·2	348	—	—	e 8 47	?	e 14·8	—
Chicago		28·2	328	5 47	−23	10 52	−11	16·8	—
La Paz		35·5	180	7 5	−13	15 10	+127	21·5	22·3
San Fernando		56·4	58	27 45	?L	—	—	(27·8)	—

Additional records and notes: Georgetown gives LN = +13·8m. Harvard L = +12·5m., T_0 = 0h.26m.17s. Toronto L = +4·8m. and +6·8m.

Feb. 12d. 17h. 49m. 10s. Epicentre 19°·0N. 68°·0W. (as at 0h.).

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Vieques	E.	2·6	107	0 39	− 2	0 58	−14	—	1·6
	N.	2·6	107	0 42	+ 1	0 58	−14	—	1·3
Port au Prince		4·1	268	e 0 17	−47	—	—	1·2	1·7
Georgetown		21·4	340	e 5 0	+ 2	—	—	17·1	—
Washington		21·4	340	4 48	−10	7 50	−63	—	—
Harvard		23·5	354	—	—	(9 12)	−23	12·4	—
Chicago		28·2	328	3 5	?	8 5	?	13·8	—
La Paz		35·5	180	6 56	−22	—	—	23·3	25·8
De Bilt	E.	64·8	40	—	—	—	—	e 35·8	38·1

Georgetown gives for eN +4m.49s. De Bilt eLN = +37·8m.

Feb. 12d. Records also at 5h. and 7h. (La Paz), 8h. (La Paz (3) and Riverview), 9h. (Christchurch and De Bilt), 10h. (near Batavia and near Algiers), 12h. (near Mizusawa), 13h. (La Paz), 15h. (La Paz, Port au Prince, and Vieques), 17h. (Lick), 19h. (Riverview), 20h. (La Paz), 22h. (Vieques, La Paz, and Port au Prince).

Feb. 13d. Records at 1h. (San Fernando), 8h. and 12h. (2) (Riverview), 15h. (Manila and La Paz), 18h. and 21h. (La Paz), 22h. (Helwan), 23h. (La Paz).

Feb. 14d. Records at 0h. (Manila), 2h. (San Fernando), 7h. (La Paz), 12h. (Batavia), 13h. (Batavia and close to La Paz), 20h. (near Berkeley), 23h. (La Paz).

Feb. 15d. 2h. 36m. 43s.
4h. 56m. 18s.

A shock from an origin about 1°·2 from Padova.

		P.	S.	M.
		m. s.	m. s.	m. s.
I	Padova	0 17	0 32	—
II		0 17	0 31	—
I	Florence	1 17	—	—
II		−0 55	—	−0 38
I	Rocca di Papa	e 0 55	—	1 47
II		e 0 47	—	2 6

Feb. 15d. Records also at 1h. (San Fernando), 3h. (Azores), 5h. and 10h. (La Paz), 13h. (Manila), 15h. (Toronto and Riverview), 16h. (Helwan and Victoria), 21h. (San Fernando), 23h. (Manila (2)).

Feb. 16d. Records at 3h. (La Paz), 4h. (near Taihoku), 6h. (Riverview), 8h. (Algiers), 9h. (Taihoku and Batavia), 13h. (Riverview), 19h. (Apia), 22h. (San Fernando), 23h. (Apia).

Feb. 17d. Records at 4h. (Riverview), 7h. (La Paz (2)), 8h. (Rocca di Papa), 10h. (Taihoku), 11h. (near Athens), 12h. (San Fernando), 14h. (Helwan), 22h. (Manila), 23h. (La Paz).

Feb. 18d. 10h. 31m. 32s. Epicentre 37°·0N. 138°·5E. (as on 1919 Mar. 28d.).

$A = -\cdot 599$, $B = +\cdot 529$, $C = +\cdot 602$.

		Δ	P.	O−C.	L.	ME	MN
		°	s.	s.	s.	s.	s.
Tokyo		1·6	28	+ 4	53	76	—
Mizusawa	E.	2·9	37	− 8	89	—	—
	N.	2·9	28	−17	79	—	—
Osaka		3·5	52	− 3	95	171	159
Kobe		3·6	64	+ 8	109	112	112

Feb. 18d. Records also at 0h. (near Osaka (2) and Tokyo), 1h. (near Tokyo), 5h. (Rocca di Papa and San Fernando), 7h. (La Paz and near Osaka), 14h. (near Athens), 17h. (La Paz), 20h. (Apia), 23h. (Batavia).

Feb. 19d. 4h. 47m. 50s. (I)
4h. 58m. 50s. (II) } Epicentre 37°·0N. 138°·5E. (as on 18d.).

		Δ	P.	O−C.	L.	M.
		°	s.	s.	s.	s.
I	Tokyo	1·6	37	+13	59	68
II		1·6	37	+13	62	68
I	Mizusawa E.	2·9	—	—	82	—
II	E.	2·9	70	?S	101	—
I	Osaka	3·5	50	− 5	94	195
II		3·5	57	+ 2	100	160
II	Kobe	3·6	57	+ 1	—	177

Feb. 19d. 19h. 54m. 0s. Epicentre 48°·5S. 160°·5W.

$A = -\cdot 625$, $B = -\cdot 221$, $C = -\cdot 749$; $D = -\cdot 334$, $E = +\cdot 943$; $G = +\cdot 706$, $H = +\cdot 250$, $K = -\cdot 663$.

This epicentre is very doubtful indeed, but seems to satisfy the chief conditions approximately. But for the Honolulu records it might be put at 16°·0S. 171°·0W., as on 1917 June 26, the Manila P being then PR_1.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	38·4	275	e 7 40	− 1	e 13 43	− 1	17·5	20·4
Sydney	38·4	275	14 0	?S	(14 0)	+16	16·1	19·1
Melbourne	40·3	266	—	—	—	—	e 20·5	23·0
Adelaide	46·2	266	—	—	—	—	20·8	22·6
Honolulu	69·9	2	28 36	?SR_1	—	—	e 35·0	37·0
Manila	93·5	288	e 15 26	+111	—	—	—	—
San Fernando	157·7	113	81 0	?L	—	—	(81·0)	—
Uccle	170·0	71	—	—	—	—	e 68·0	—
De Bilt	170·2	63	—	—	—	—	e 67·0	67·7

Additional records and notes: Riverview gives PS = +14m.13s., SR_1 = +16m.21s., MN = +19·8m. Algiers (Δ = 163°·3) records from 20h. to 21d.12h. De Bilt e = +65m.12s., MN = +75·6m.

Feb. 19d. Records also at 0h. (Lick), 7h. (near Mizusawa), 8h. (Vienna), 12h. (Batavia), 13h. (Colombo), 18h. (near Pompeii, Monte Cassino, and Rocca di Papa), 19h. (near Tacubaya), 20h. (near La Paz), 22h. (Manila).

1920. Feb. 20d. 0h. 1m. 30s. (I)
11h. 44m. 25s. (II) } Epicentre **42°·0N. 46°·0E.**

A = +·516, B = +·535, C = +·669; D = +·719, E = −·695;
G = +·465, H = +·481, K = −·743.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
I	Helwan E.	17·0	229	4 48	+43	—	—	—	11·7
I	N.	17·0	229	5 6	+61	—	—	—	11·9
II	E.	17·0	229	4 11	+ 6	—	—	—	11·6
II	N.	17·0	229	5 23	+78	—	—	—	11·4
II	Athens	17·5	264	i 4 11	0	7 26	− 3	9·7	10·2
I	Vienna	21·7	297	i 5 3	+ 2	—	—	e 15·5	—
II		21·7	297	i 5 5	+ 4	10 59	?L	e 14·1	19·6
I	Rocca di Papa	24·7	281	5 35	0	—	—	e 17·9	—
II		24·7	281	e 5 35	0	10 1	+ 4	—	17·7
II	Padova	24·7	290	5 34	− 1	8 35	?	—	—
I	Hamburg	26·5	308	e 5 52	− 1	e 10 28	− 4	e 14·6	17·9
II		26·5	308	i 5 56	+ 3	i 10 33	+ 1	i 13·5	18·0
II	Zurich	26·9	294	i 5 59	+ 2	e 10 38	− 1	—	—
II	Simla	27·1	103	e 11 23	?S	(11 23)	+40	—	17·6
I	Strasbourg	27·4	297	e 6 30	+28	—	—	e 14·5	—
II		27·4	297	6 2	0	10 51	+ 3	e 12·6	19·0
I	Moncalieri	27·7	289	6 8	+ 3	10 48	− 6	16·3	17·1
II		27·7	289	6 4	− 1	10 44	−10	14·6	17·5
II	Besancon	28·7	294	7 11	+56	—	—	17·6	—
I	De Bilt	29·2	304	e 6 17	− 3	e 11 33	+13	15·5	18·2
II	E.	29·2	304	6 20	0	i 11 38	+18	14·6	18·3
II	N.	29·2	304	—	—	—	—	13·6	17·7
I	Uccle	29·6	302	5 50	−34	—	—	e 14·5	—
II		29·6	302	7 23	+59	e 11 21	− 6	14·1	17·9
II	Paris	30·9	300	—	—	e 9 35	−135	16·6	19·6
I	Kew	32·5	304	—	—	—	—	—	20·5
II		32·5	304	—	—	—	—	—	19·6
I	Oxford	33·2	304	6 20	−38	11 5	−82	—	23·5
II	Dyce	33·8	315	(i 7 11)	+ 8	i 7 11	?P	16·1	21·9
II	Tortosa	33·8	283	—	—	—	—	e 15·6	23·6
II	Stonyhurst	33·8	306	—	—	—	—	—	22·6
I	Edinburgh	34·3	310	—	—	—	—	e 19·5	25·4
II		34·3	310	e 12 53	?S	(e 12 53)	+ 9	19·9	25·4
I	Eskdalemuir	34·3	310	—	—	—	—	17·5	21·5
II		34·3	310	—	—	—	—	16·6	22·2
II	San Fernando	40·2	279	17 5	?SR_1	—	—	24·1	29·1
II	Rio Tinto	40·0	281	20 35	?L	—	—	(20·6)	33·6
I	Coimbra	40·4	285	e 18 15	?	—	—	21·5	—
II	E.	40·4	285	e 7 50	− 8	14 2	−11	23·0	27·1
II	N.	40·4	285	—	—	—	—	21·3	24·8
I	Colombo	46·1	131	30 30	?L	—	—	(30·5)	—
II		46·1	131	30 5	?L	—	—	(30·1)	33·6
II	Zi-ka-wei	59·5	74	—	—	e 19 2	+45	—	—
II	Mauritius N.	63·0	169	30 11	?L	—	—	(30·2)	35·0
II	Manila	69·2	90	—	—	e 21 5	+49	—	—
II	Batavia	73·2	117	e 12 6	+29	21 39	+35	—	23·4
I	Cape Town	80·0	202	—	—	—	—	—	49·8
II		80·0	202	42 29	?L	—	—	(42·5)	49·8
II	Toronto	81·4	324	—	—	—	—	52·8	—
II	Chicago	86·4	329	—	—	23 45	+11	e 35·6	—
II	Victoria	89·1	354	—	—	42 53	? L	49·8	63·5
II	La Paz	118·8	273	20 35	?PR_1	—	—	—	—

Additional records and notes: Hamburg (I) gives MN = +15·8m., MZ = +17·5m. Hamburg (II) iPE = +6m.0s., iN = +14m.59s., MN = +15·8m., MZ = +17·6m. Strasbourg (II) i = +8m.5s. (?PR_1). De Bilt (I) LN = +14·5m., MN = +18·0m. De Bilt (II) eS = +11m.23s. Eskdalemuir (II) MN = +22·0m. San Fernando (II) MN = +25·1m. Mauritius (II) PE = +29m.47s. Chicago (II) L = +44·6m.

Feb. 20d. Records also at 1h. (La Paz), 2h. (Helwan and near Tacubaya), 4h. (Padova), 6h. (Tokyo), 18h. (Florence), 23h. (De Bilt).

Feb. 21d. Records at 0h. (La Paz and Apia), 1h. and 4h. (Helwan), 6h. (La Paz), 13h. (near Port au Prince and Vieques and Manila), 14h. (La Paz, Hamburg, and De Bilt), 15h. (La Paz and Helwan), 16h. (La Paz (2) and Helwan), 17h. (La Paz, Nagasaki, and Helwan), 18h. and 23h. (2) (La Paz). The La Paz records seem to be repetitions from an origin about 21° distant.

1920. Feb. 22d. 17h. 35m. 40s. Epicentre 46°·7N. 145°·8E.

(as on 1918 Dec. 9d.).

A = −·567, B = +·386, C = +·728; D = +·562, E = +·827;
G = −·602, H = +·409, K = −·686.

It is not possible to obtain a determination without allowing a considerable correction for depth of focus, and 0·050 has accordingly been adopted.

For the anticentric evidence see the note to La Paz.

		Corr. for Focus	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	°	m. s.	s.	m. s.	s.	m.	m.
Ootomari		−1·3	2·1	270	1 7	+14	—	—	2·0	2·7
Hakodate		+0·1	6·1	218	1 38	+ 3	—	—	—	—
Mizusawa	E.N.	−0·3	8·3	206	2 13	+12	2 51	−46	—	—
Tokyo		−0·9	11·9	205	2 43	− 1	(4 58)	+ 4	5·0	—
Osaka		−1·2	14·3	217	i 3 29	+15	—	—	6·1	6·8
Kobe		−1·2	14·4	218	3 23	+ 7	—	—	6·1	6·2
Zi-ka-wei		−2·5	24·3	239	e 5 4	+ 1	e 8 58	− 3	—	11·6
Taihoku		−3·1	29·0	230	e 5 52	+ 5	—	—	—	—
Manila		−3·9	38·2	220	e 7 1	− 6	12 35	− 9	16·4	17·2
Honolulu		−4·9	51·7	99	i 15 50	?S	(i 15 50)	+12	21·3	22·3
Simla		−5·1	53·8	280	15 32	?S	(15 32)	−30	—	22·7
Victoria		−5·4	57·5	52	16 32	?S	(16 32)	−13	22·9	23·8
Batavia		−5·6	63·1	225	i 10 5	+ 9	i 18 9	+16	—	21·4
Berkeley	E.	−5·7	64·6	61	e 10 8	+ 4	(e 18 15)	+ 5	e 18·2	18·4
	N.	−5·7	64·6	61	i 10 9	+ 5	(e 18 20)	+10	e 18·3	18·4
Colombo		−5·9	68·6	259	11 20	+50	—	—	—	23·6
Hamburg		−6·0	73·0	335	e 11 2	+ 4	i 20 2	+12	e 30·4	30·7
Edinburgh		−6·0	74·2	343	—	—	20 16	+12	—	—
Eskdalemuir		−6·0	74·7	343	11 21	+12	20 21	+11	—	—
Vienna		−6·0	75·3	329	i 11 16	+ 3	i 20 32	+14	—	—
De Bilt		−6·0	75·6	336	i 11 20	+ 5	i 20 26	+ 5	e 31·1	—
Uccle		−6·1	77·0	337	11 22	0	20 38	+ 1	e 27·3	—
Oxford		−6·1	77·6	340	e 20 26	?S	i 20 55	+11	—	—
Strasbourg		−6·1	78·0	332	e 11 28	− 1	20 51	+ 2	—	—
Zurich		−6·2	78·8	331	e 11 34	0	(e 21 0)	+ 3	e 21·0	—
Paris		−6·2	79·3	338	11 37	0	i 21 8	+ 5	28·3	45·3
Padova		−6·2	79·4	330	11 45	+ 8	21 18	+14	—	—
Chicago		−6·2	79·7	38	11 38	− 1	20 55	−13	32·9	—
Besançon		−6·2	79·8	333	11 40	0	21 12	+ 3	31·3	—
Riverview		−6·2	80·7	175	e 10 52	−54	e 21 17	− 3	e 34·8	37·5
Ottawa		−6·2	81·0	29	i 11 45	− 3	i 21 11	−13	34·3	—
Moncalieri		−6·2	81·2	331	11 47	− 2	i 21 26	0	29·1	—
Toronto		−6·2	81·2	31	—	—	(21 26)	0	21·4	—
Rocca di Papa	N.	−6·3	82·2	326	11 51	− 3	21 36	0	e 33·2	—
Pompeii		−6·3	82·4	324	11 43	−13	21 33	− 5	—	—
Northfield		−6·3	83·0	27	e 16 0	?PR_1	25 16	?SR_1	—	—
Harvard	E.	−6·4	85·1	27	12 6	− 5	21 55	−13	—	—
	N.	−6·4	85·1	27	12 8	− 3	22 9	+ 1	e 38·2	—
Barcelona		−6·4	86·1	333	e 10 56	−81	i 22 30	+10	e 34·2	—
Washington		−6·4	86·2	32	14 40	+142	24 28	+127	—	24·9
Georgetown		−6·4	86·2	32	12 12	− 6	22 1	−20	—	—
Cheltenham		−6·4	86·5	32	22 29	?S	(22 29)	+ 5	—	22·8
Tortosa		−6·4	87·2	335	12 24	0	22 30	− 3	34·3	35·8
Algiers		−6·5	90·1	330	22 26	?S	(22 26)	−39	37·3	—
Granada		−6·5	91·7	337	i 12 36	−13	i 22 39	−42	—	—
Rio Tinto		−6·5	92·0	340	—	—	25 20	+115	—	28·3
San Fernando		−6·6	93·2	339	19 20	?PR_1	—	—	—	27·3
La Paz		—	138·8	54	e 14 27	?	27 37	−200	42·3	—

For Notes see next page.

NOTES TO FEB. 22d. 17h. 35m. 40s.

Additional records and notes: Ootomari gives MN = +2·1m. Osaka MN = +6·7m. Zi-ka-wei gives its readings for 23d. Manila MN = +17·0m. Honolulu gives iS as iP and records iS = +17m.50s. Victoria gives S as P and records S = +19m.27s. Hamburg MN = +30·6m. Edinburgh records also +23m.0s. De Bilt e = +16m.20s. and +18m.5s., iE = +23m.1s., iN = +23m.6s., eE = +27m.39s. Epicentre 42°·5N., 148°·2E. Uccle i = +23m.20s. Oxford i = +23m.30s. Strasbourg e = +23m.25s. Padova PR_1 = +13m.42s. and +15m.44s., SR_1 = +21m.34s. and +21m.36s. Riverview eS = +21m.25s., MN = +40·6m. Ottawa eE = +23m.56s. Moncalieri S = +20m.5s. Toronto L = +18·3m. Harvard SN = +22m.0s., L = +48·4s., T_0 = 17h.35m.40s. Barcelona PS? = +23m.32s. Georgetown iEN = +22m.12s. Cheltenham PE = +22m.30s. Algiers gives S as P and records S = +25m.35s. (?SR_1). San Fernando MN = +29·3m. La Paz i = +18m.53s. (this may be [P], in which case O−C = −45s.), and +21m.52s.

Feb. 22d. Records also at 1h. (near Taihoku), 2h. (near Tacubaya), 3h. (near Hokoto and Taihoku), 4h. (Kingston), 5h. (La Paz), 11h. (Tokyo), 16h. (Helwan), 22h. (Tokyo).

Feb. 23d. Records at 6h. (near Osaka and Kobe), 7h. (Tacubaya), 9h. and 10h. (Rocca di Papa), 11h. and 15h. (La Paz), 17h. (near Athens), 20h. (La Paz), 22h. (Helwan and San Fernando).

Feb. 24d. Records at 8h. (Harvard, Chicago, Helwan, De Bilt, and Uccle), 15h. (La Paz and Helwan), 20h. (Helwan), 23h. (near Mizusawa).

Feb. 25d. 17h. 56m. 18s. Epicentre 35°·0N. 10°·0E.

A = +·807, B = +·142, C = +·574; D = +·174, E = −·985; G = +·565, H = +·100, K = −·819.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Algiers	5·9	290	1 31	0	2 28	−13	4·7	—
Pompeii	6·8	31	2 42	+58	4 32	+87	6·7	8·7
Rocca di Papa N.	7·1	17	1 50	+ 2	e 3 13	0	—	5·0
Barcelona	8·9	318	e 2 12	− 3	—	—	3·6	5·7
Tortosa	9·4	311	2 18	− 4	3 40	−33	4·2	5·6
Moncalieri	10·1	351	e 0 56	−95	3 16	−76	4·8	6·4
Padova	10·5	7	2 41	+ 4	5 35	+52	—	7·7
Besancon	12·6	348	3 5	− 2	—	—	6·7	—
San Fernando	13·2	281	5 42	?S	(5 42)	− 7	—	—
Rio Tinto	13·6	286	9 42	?L	—	—	(9·7)	11·2
Strasbourg	13·7	354	e 3 18	− 4	e 6 8	+ 7	e 6·7	—
Vienna	14·1	18	3 28	+ 1	—	—	—	10·0
Paris	14·9	341	—	—	e 7 10	?L	8·7	10·7
Coimbra	15·5	295	3 39	− 7	7 6	+22	8·2	10·2
Uccle	16·3	347	e 3 36	−20	—	—	e 6·7	9·7
De Bilt	17·4	350	—	—	—	—	e 8·0	10·4
Hamburg	18·6	0	i 4 24	0	i 7 47	− 6	e 11·1	12·5
Oxford	18·6	338	9 58	?L	—	—	(10·0)	13·5
Helwan	18·7	100	8 42	?S	(8 42)	+47	(13·7)	—
Stonyhurst	20·7	339	8 12	?S	(8 12)	−26	(12·2)	8·2
Eskdalemuir	22·2	340	—	—	—	—	11·7	—
Edinburgh	22·7	341	—	—	—	—	11·7	15·2

Additional records: Vienna gives MN = +11·3m. Moncalieri MN = +6·1m. Coimbra MN = +10·0m. De Bilt MN = +11·8m. Hamburg MN = +12·7m. Helwan gives its two records as PE and PN. Stonyhurst gives readings 1h. too early.

Feb. 25d. 22h. 39m. 48s. Epicentre 6°·5N. 127°·0E. (as on 1918 Feb. 7d.).

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

The depth of focus found for 1918 Feb. 7d. has not been retained.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	10·0	325	e 2 26	− 4	4 14	−15	4·6	4·7
Taihoku	19·3	345	8 12	?S	(8 12)	+ 4	—	—
Batavia	23·8	238	i 5 18	− 8	9 33	− 7	e 13·2	—
Zi-ka-wei	25·3	349	e 5 30	−11	—	—	—	—
Perth	39·9	195	—	—	13 12	−53	—	—
Adelaide	42·9	166	—	—	14 30	−17	23·8	32·3
Sydney	46·4	152	15 30	?S	(15 30)	− 3	18·7	29·7
Riverview	46·4	152	e 8 42	− 1	i 15 34	+ 1	e 26·2	28·4
Colombo	46·8	273	15 36	?S	(15 36)	− 2	—	32·0
Simla	52·6	305	19 54	?PR$_1$	—	—	—	—
Honolulu	73·6	70	22 36	?S	(22 36)	+87	e 42·2	e 47·2
Helwan	91·7	300	24 12	?S	(24 12)	−20	—	—
Victoria	97·9	39	36 27	?SR$_1$	40 29	?	45·9	51·8
Hamburg	100·2	328	e 17 12	?	i 24 31	−87	e 50·2	59·0
Rocca di Papa	103·3	316	e 18 18	?PR$_1$	e 24 30	−117	e 54·3	—
De Bilt	103·5	328	—	—	e 24 44	−105	e 49·2	54·2
Uccle	104·5	327	—	—	e 24 48	−110	51·2	57·2
Moncalieri	105·3	320	e 18 45	?PR$_1$	34 53	?SR$_1$	53·8	65·3
Edinburgh	105·4	333	—	—	—	—	50·2	65·7
Eskdalemuir	105·8	333	24 41	?S	(24 41)	−129	47·2	—
Stonyhurst	106·3	332	45 12	?	52 12	?L	56·7	64·2
Kew	106·6	329	—	—	—	—	—	67·2
Paris	106·6	326	—	—	—	—	e 55·2	57·8
Oxford	107·0	329	50 41	?L	—	—	(50·7)	—
Tortosa	111·9	319	—	—	—	—	e 52·2	66·8
Coimbra	117·9	323	e 29 12	?S	(e 29 12)	+39	e 59·7	—
	117·9	323	30 48	?S	(30 48)	+135	e 61·6	66·7
La Paz	162·1	125	20 22	[+13]	—	—	—	—

Additional records: Manila gives also MN = +4·9m. Adelaide SR$_1$ = +17m.42s. Riverview gives its readings as on 26d., also eSR$_1$? = +18m.29s., MN = +28·8m. Hamburg MN = +53·2m. Rocca di Papa L = +58·9m. De Bilt MN = +55·6m. Uccle eL = +37·2m. Moncalieri i = +24m.49s., MN = +62·6m. Eskdalemuir S = +33m.24s. (?SR$_1$). Coimbra gives a Milne record (second line) as well as its usual one and records eS? = +41m.36s.

Feb. 25d. 23h. 32m. 20s. Epicentre 38°·8N. 32°·9E. (as on 1918 Jan. 16d.).

A = +·654, B = +·423, C = +·627; D = +·543, E = −·840; G = +·526, H = +·340, K = −·779.

But the evidence for actual coincidence with the old epicentre is not good. The residuals would be much improved by moving the epicentre about one degree further west.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	7·2	266	1 36	−13	—	—	1·9	2·0
Lemberg	12·7	333	e 4 34	+85	—	—	e 6·3	7·2
Budapest	13·2	316	3 53	+37	—	—	—	—
Pompeii	14·2	283	2 53	−36	4 38	−95	—	—
Vienna	15·2	314	e 3 36	− 6	6 17	−20	e 6·7	8·4
Rocca di Papa	15·6	287	e 3 13	−34	6 22	−24	—	7·1
Padova	16·9	300	5 22	+78	7 10	− 6	9·5	—
Strasbourg	20·5	306	e 4 45	− 2	—	—	9·3	—
Besançon	21·2	302	9 40?	?L	—	—	10·7	—
Hamburg	21·5	321	e 5 4	+ 5	—	—	e 9·9	15·6
De Bilt	23·3	314	—	—	e 9 58	+27	—	—
Uccle	23·3	310	e 10 40	?L	—	—	(e 10·7)	—
Algiers	23·5	275	e 5 3	−20	9 57	+22	23·7	—
Paris	23·9	305	—	—	—	—	e 10·7	13·7
La Paz	108·7	264	e 10 13	?	—	—	56·7	61·0

Additional records: Athens gives MN = +2·3m. Hamburg MN = +12·9m.

Feb. 25d. Records also at 0h. (Florence, Helwan, and La Paz), 8h. (Helwan), 12h. (La Paz (2)), 13h. (La Paz), 17h. (Simla), 19h. (La Paz), 20h. (Colombo and La Paz).

Feb. 26d. 1h. 26m. 0s. Epicentre 5°·0N. 110°·0E.

$A = -·341$, $B = +·936$, $C = +·087$; $D = +·940$, $E = +·342$; $G = -·030$, $H = +·082$, $K = -·996$.

A depth of focus 0·050 is assumed.

	Corr. for Focus	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia	−0·8	11·6	196	i 2 36	− 5	4 40	−10	—	6·1
Manila	−1·3	14·4	48	e 3 14	0	—	—	—	—
Taihoku	−2·3	22·9	28	10 4	?L	—	—	(10·1)	—
Zi-ka-wei	−3·0	28·3	21	e 5 46	+ 5	—	—	—	—
Colombo	−3·2	30·1	275	17 18	?L	—	—	(17·3)	20·7
Perth	−3·7	37·3	170	—	—	12 0	−34	—	—
Melbourne	−5·1	53·7	145	—	—	—	—	e 27·3	31·3
Riverview	−5·2	54·9	139	e 12 36	?PR_1	e 17 56	+101	e 24·8	30·3
Helwan	−6·1	77·0	300	24 0	?SR_1	—	—	—	—
Rocca di Papa	−6·5	92·1	313	—	—	—	—	e 65·6	69·5
De Bilt E.	−6·6	95·1	324	e 26 42	?	—	—	e 54·0	57·4
N.	−6·6	95·1	324	—	—	e 39 6	?	e 53·0	58·2
Uccle	−6·6	95·9	322	—	—	—	—	e 53·0	—
Eskdalemuir	−6·7	98·7	329	—	—	—	—	57·0	—
Stonyhurst	−6·7	98·9	325	28 30	?SR_1	43 0	?L	(43·0)	—
La Paz	—	168·4	189	19 21	[−53]	—	—	—	—

Additional records: Batavia gives $P_2 = +3$m.26s., $eS_2 = +5$m.32s. Helwan gives also 1h.18m.0s., earlier than T_0. Riverview $MN = +28·4$m.

Feb. 26d. 23h. 4m. 3s. Epicentre 38°·8N. 32°·9E. (as on 1920 Feb. 25d.).

$A = +·654$, $B = +·423$, $C = +·627$; $D = +·543$, $E = -·840$; $G = +·526$, $H = +·340$, $K = -·779$.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Athens	7·2	266	1 51	+ 2	—	—	2·2	2·7
Lemberg	12·7	333	—	—	—	—	e 6·8	7·4
Budapest	13·2	316	3 31	+15	5 53	+ 4	—	—
Pompeii	14·2	283	3 24	− 5	6 14	+ 1	—	—
Vienna	15·2	314	6 27	?S	(6 27)	−10	(9·4)	—
Rocca di Papa	15·6	287	e 3 35	−12	—	—	—	6·0
Padova	16·9	300	6 8	?S	(6 8)	−68	—	9·2
Moncalieri	19·6	296	e 4 32	− 4	7 31	−44	9·3	—
De Bilt	23·3	314	—	—	—	—	e 11·4	11·6

Additional records: Vienna gives S and L as P and S respectively.

Feb. 26d. Records also at 3h. (Apia), 7h. (near Athens and Rocca di Papa), 10h. (San Fernando), 15h. (La Paz), 16h. (Helwan), 18h. (Manila, Apia, and Batavia), 20h. (near Athens (2)), 22h. (Riverview and near Tokyo), 23h. (Padova).

Feb. 27d. 3h. 51m. 36s. Epicentre 35°·0N. 69°·0E.

$A = +·294$, $B = +·765$, $C = +·574$; $D = +·934$, $E = -·358$; $G = +·205$, $H = +·536$, $K = -·819$.

This determination is very uncertain; the shock must have been very slight and its phases difficult to distinguish.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Simla	7·9	117	5 54	?	—	—	8·7	9·0
Dehra Dun	8·9	119	—	—	—	—	6·4	—
Calcutta E.N.	21·0	122	4 48	− 5	8 36	− 8	12·6	—
Kodaikanal	25·9	161	5 48	+ 1	—	—	—	—
Colombo	29·8	158	7 24	+58	9 0	−151	17·1	19·9
Helwan	32·0	271	5 0	−107	—	—	—	15·2
Pompeii	42·7	296	7 51	−25	—	—	27·8	—
Rocca di Papa	43·9	296	e 6 26	−119	—	—	e 28·3	—
Hamburg	44·6	314	—	—	e 15 24	+14	e 28·4	35·4
Taihoku	46·1	88	—	—	—	—	e 31·2	—

Continued on next page.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Strasbourg	46·3	307	e 8 42	0	—	—	e 25·4	33·2
Moncalieri	46·8	302	e 9 45	+59	17 14	+96	26·9	33·0
De Bilt	47·6	312	—	—	e 15 18	−31	e 26·4	32·0
Uccle	48·2	310	—	—	e 15 12	−44	—	—
Manila	50·8	100	—	—	—	—	e 34·4	—
Kew	51·0	312	—	—	—	—	—	42·4
Edinburgh	52·1	317	—	—	—	—	—	42·9
Eskdalemuir	52·1	317	—	—	—	—	24·4	—
Algiers	52·3	292	e 6 35	?	—	—	27·4	29·9
Tortosa	53·0	299	—	—	—	—	e 19·4	32·9
Mauritius E.	56·1	192	12 30	?PR_1	—	—	—	16·2
Rio Tinto	59·2	297	30 24	?L	—	—	(30·4)	40·4
San Fernando	59·4	295	12 54	?PR_1	—	—	33·4	35·4
Coimbra	59·6	300	18 22	?S	(18 22)	+ 4	34·4	35·8
La Paz	137·6	284	69 52	?L	—	—	79·9	—

Additional records and notes: Colombo gives L = +18·5m. Helwan P = +8m.54s., MN = 13·9m. Hamburg MN = +37·4m. Strasbourg MN = +30·2m. De Bilt e = +19m.12s., MN = +37·2m. Uccle e = +19m.0s. Mauritius PN = +13m.12s. San Fernando MN = +35·9m. Coimbra gives S as P and S = +26m.2s.

Feb. 27d. 7h. 10m. 54s. Epicentre 18°·0S. 167°·0E. (as on 1918 July 29d.).

A = −·927, B = +·214, C = −·309; D = +·225, E = +·974; G = +·301, H = −·070, K = −·951.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	21·3	219	e 4 21	−36	e 8 49	− 1	e 10·5	12·7
Sydney	21·3	219	4 48	− 9	8 54	+ 4	11·7	12·9
Christchurch	26·0	171	—	—	10 6	−16	14·1	16·5
Melbourne	27·7	220	—	—	11 12	+18	14·4	18·1
Honolulu	52·2	43	16 48	?S	(16 48)	+ 2	25·6	32·5
Victoria	90·7	39	25 0	?S	(25 0)	+39	—	46·1
Chicago	113·2	50	—	—	—	—	53·1	—
Helwan	138·0	295	23 6	?	—	—	—	—
De Bilt E.	143·1	342	—	—	—	—	e 74·1	99·5
N.	143·1	342	—	—	—	—	e 77·1	80·8
Pompeii	147·2	321	19 43	[− 8]	—	—	—	—
Rocca di Papa	147·7	323	e 19 29	[−23]	—	—	—	19·9
San Fernando N.	160·6	343	92 6	?L	—	—	(92·1)	102·1

Additional records: Riverview eS = +8m.58s., MN = +12·0m. Christchurch PR_1 = +5m.36s. Honolulu gives S as P and eS = +22m.12s. Chicago L = +60·1m. Helwan P = +43m.6s. San Fernando PE = +99·1m.

Feb. 27d. 10h. 34m. 56s. Epicentre 18°·0S. 167°·0E. (as at 7h.).

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	21·3	219	e 5 4	+ 7	e 9 3	+13	e 10·7	12·6
Sydney	21·3	219	4 52	− 5	9 10	+20	11·9	13·1
Christchurch	26·0	171	—	—	10 4	−18	14·1	16·5
Melbourne	27·7	220	—	—	10 34	−20	14·2	17·1
Honolulu	52·2	43	17 46	?S	(17 46)	+60	25·1	31·0
Chicago	113·2	50	—	—	—	—	e 59·1	—
Helwan	138·0	295	87 4	?L	—	—	(87·1)	—
Rocca di Papa	147·7	323	e 19 48	[− 4]	—	—	—	20·0

Additional records: Riverview gives eS = +9m.5s., MN = +12·0m. Helwan gives P = +89m.4s.

Feb. 27d. Records also at 2h. and 5h. (near Tokyo), 9h. (Riverview), 10h. (Rocca di Papa and Melbourne), 12h. (La Paz and Manila), 16h. (La Paz (2)), 17h. (Rocca di Papa and near Athens), 18h. (near Tacubaya), 19h. (Apia), 23h. (La Paz).

Feb. 28d. 18h. 41m. 0s. Epicentre 12°·0S. 69°·0W.

A = +·351, B = −·913, C = −·208; D = −·934, E = −·358; G = −·075, H = +·194, K = −·978.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
La Paz	4·6	169	i 1 13	+ 2	(2 14)	+ 8	2·2	2·4
Balboa Heights	23·5	333	5 0	−23	(9 20)	−15	9·3	10·5
Georgetown	51·5	352	9 9	− 8	16 53	+15	e 24·1	—
Washington	51·5	352	9 8	− 9	16 40	+ 2	e 27·3	—
Harvard N.	54·4	358	e 9 44	+ 9	17 28	+14	e 29·5	—
Chicago	56·4	345	9 48	0	17 34	− 5	27·2	—
Toronto	56·5	351	—	—	—	—	e 25·1	—
Ottawa	57·7	355	11 30	?	18 12	+17	e 25·0	—
Berkeley	70·6	320	—	—	—	—	e 34·3	—
San Fernando	76·3	48	12 48	+51	—	—	49·0	54·0
Coimbra E.	76·5	43	12 8	+10	22 22	+39	e 39·7	45·4
N.	76·5	43	—	—	—	—	e 38·0	45·9
	76·5	43	12 0	+ 2	22 30	+47	41·3	45·4
Victoria	77·1	328	21 33	?S	(21 33)	−17	37·8	47·6
Tortosa	82·9	46	11 33	−62	—	—	e 38·0	49·8
Oxford	86·2	35	—	—	23 16	−16	42·5	49·8
Stonyhurst	86·5	34	23 30	?S	(23 30)	− 6	—	—
	86·5	34	30 30	?SR$_1$	40 0	?	45·5	49·5
Kew	86·6	35	46 0	?L	—	—	(46·0)	53·0
Eskdalemuir	86·7	31	—	—	e 23 19	−19	38·8	—
Edinburgh	87·0	31	—	—	23 25	−16	48·0	49·3
Uccle	89·1	39	—	—	e 23 30	−34	—	48·0
Moncalieri	89·3	43	e 23 6	?S	(23 6)	−60	45·0	58·8
De Bilt	90·0	38	23 43	?S	(23 43)	−31	e 47·0	49·6
Strasbourg	90·4	40	13 18	0	—	—	—	51·6
Rocca di Papa	91·9	48	—	—	—	—	e 55·8	—
Hamburg	93·3	36	e 17 22	?PR$_1$	—	—	e 48·7	53·0
Helwan	104·8	62	26 0	?S	(26 0)	−40	—	—
Riverview	121·3	219	e 34 2	?	—	—	e 53·3	55·8
Colombo	148·8	98	93 0	?L	—	—	(93·0)	—

Additional records: La Paz gives T_0 = 18h. 41m. 8s. Balboa Heights records S as L and gives S = +7m. 40s. Georgetown LE = +33·3m., LN = +33·5m. Harvard SE? = +17m. 46s., eE = +28m. 6s., eE = +29m. 46s. Chicago L = +31·0m. Toronto eL = +29·9m. and +35·3m. San Fernando MN = +50·5m. Coimbra gives a set of Milne readings in addition to its usual set. Moncalieri gives S as P and S +34m. 52s., MN = +55·0m. De Bilt e = +25m. 37s., MN = +51·7m. Helwan PN = +28m. 0s. Riverview MN = +55·0m.

Feb. 28d. 19h. 49m. 15s. Epicentre 45°·0N. 11°·5E. (as on 1918 Nov. 10d.).

A = +·693, B = +·141, C = +·707.

	Δ	P.	O−C.	S.	O−C.
	°	m. s.	s.	m. s.	s.
Padova	0·5	0 16	+ 8	0 29	+15
Zurich	3·1	e 0 43?	− 6	i 1 18	− 8
Strasbourg	4·4	—	—	e 1 50	−11
La Paz	94·5	38 26	?L	—	—

No additional records.

Feb. 28d. Records also at 0h. (La Paz), 4h. (near Tacubaya; and Moncalieri), 7h. and 8h. (La Paz), 12h. (Stonyhurst), 15h. (Strasbourg, Balboa Heights, Tacubaya, and La Paz), 16h. (Stonyhurst, La Paz, Toronto, Uccle, and Helwan), 17h. (Granada), 19h. (Stonyhurst), 20h. (Riverview, Paris, and La Paz), 21h. (Taihoku), 22h. (near Mizusawa).

Feb. 29d. Records at 0h. (San Fernando), 5h. (La Paz), 6h. (La Paz, Monte Cassino, and Batavia), 11h. (Helwan and Apia), 13h. (La Paz), 15h. (Port au Prince), 17h. (La Paz (2) and Helwan), 19h. (Helwan), 21h. (Monte Cassino), 22h. (Batavia).

Mar. 1d. Records at 4h. (La Paz), 7h. (near Tokyo), 10h. (near Taihoku, Hokoto, and Helwan), 11h. (La Paz, Chicago, Coimbra, Melbourne, Riverview, and Sydney), 12h. (Helwan), 15h. (Stonyhurst), 17h. (Stonyhurst (2)), 21h. (San Fernando).

Mar. 2d. Records at 1h. (near La Paz), 4h. (La Paz), 10h. (Colombo), 16h. (near Batavia), 20h. (near Tokyo), 21h. (San Fernando), 22h. (near Manila).

Mar. 3d. 1h 43m. 25s. Epicentre 8°·0S. 127°·5E. (as on 1920 Jan. 20d.).

A = −·603, B = +·786, C = −·139; D = +·793, E = +·609;
G = +·085, H = −·110, K = −·990.

The depth cus (0·030) is retained, as on 1920 Jan. 20d.

	Corr. for Focus	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia	−1·2	20·6	274	4 30	− 4	8 20	+10	—	10·0
Manila	−1·5	23·5	344	5 35	+30	8 59	− 6	9·9	10·3
Melbourne	−2·2	33·7	156	—	—	—	—	18·0	19·4
Riverview	−2·2	33·8	142	e 14 0	?SR_1	—	—	18·0	19·3
Helwan	−4·4	99·4	300	61 35	?L	—	—	(61·6)	—

Additional records: Manila gives MN = +10·1m. Riverview e(S?) = +17m., MZ = +18·7m.

Mar. 3d. Records also at 2h. (Mizusawa), 5h. (La Paz), 11h. (near La Paz), 12h. (Riverview), 13h. (near Mizusawa).

Mar. 4d. Records at 4h. (near Manila), 8h. (near Osaka and Kobe), 16h. (La Paz), 21h. (Stonyhurst and Helwan).

Mar. 5d. Records at 1h. (near Batavia), 12h. and 13h. (Apia), 16h. (La Paz), 21h. (near Tacubaya).

Mar. 6d. Records at 8h. (Taihoku), 15h. (Helwan), 17h. (Manila and Riverview), 21h. (Helwan), 23h. (San Fernando).

Mar. 7d. Records at 2h. (near Florence), 4h. (La Paz), 5h. (near Athens), 6h. (La Paz), 8h. (near Tacubaya), 19h. (near Pompeii), 22h. (near La Paz).

Mar. 8d. 1h 14m. 41s. Epicentre 43°·8N. 11°·2E (Florence), (as on 1919 July 8d.).

A = +·708, B = +·140, C = +·692; D = +·194, E = −·981;
G = +·679, H = +·134, K = −·722.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Florence	0·0	—	0 0	0	—	—	—	0·1
Padova	1·7	17	0 32	+ 6	0 51	+ 3	—	1·7
Rocca di Papa	2·3	152	0 23	−13	—	—	—	2·1
Zurich	4·0	332	e 1 3	+ 1	e 1 42	− 8	—	—
Strasburg	5·3	334	e 1 23	+ 1	e 2 23	− 2	—	—

Additional records: Florence gives two other PN's at +1s. and +3s. Zurich eE = +1m.9s., eV = +1m.8s.

Mar. 8d. Records also at 2h. (De Bilt), 3h. (Helwan), 5h. (near La Paz, near Tivo, and Mizusawa), 10h. (Helwan), 12h. (near Taihoku), 15h. (2) and 16h. (Florence), 19h. (near La Paz and near Tokyo), 20h. (San Fernando).

Mar. 9d. 4h. 34m. 20s. Epicentre 17°·0N. 97°·0W. (as on 1919 April 19d. 2h.).

A = −·117, B = −·949, C = +·292; D = −·992, E = +·122; G = −·036, H = −·290, K = −·956.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Tacubaya	3·2	319	0 45	− 5	—	—	2·7	3·0
Chicago	26·1	19	6 7	+18	10 52	+28	12·9	—
Washington	28·0	34	—	—	—	—	e 15·7	—
Toronto	30·5	27	—	—	—	—	17·6	—
Ottawa	33·5	29	—	—	—	—	17·7	—
Victoria	38·0	331	—	—	—	—	—	17·2

Tacubaya gives MN = +3·4m.

Mar. 9d. Records also at 2h. (Algiers), 12h. (near Tokyo), 16h. (Helwan), 17h. (La Paz), 20h. (San Fernando), 23h. (Capetown, Colombo, and Helwan).

Mar. 10d. Records at 3h. (near Tokyo and Mizusawa), 4h. (near Tokyo (2)), 8h. (near Athens), 11h. (Riverview), 16h. (Tacubaya, Chicago, Toronto, Georgetown, and Ottawa), 17h. and 18h. (Batavia).

Mar. 11d. 11h. 46m. 55s. Epicentre 53°·8S. 148°·0E.

A = −·501, B = +·313, C = −·807; D = +·530, E = +·848; G = +·684, H = −·428, K = −·591.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Melbourne	16·1	351	—	—	6 11	−46	6·9	7·3
Adelaide	20·0	337	4 53	+12	8 53	+30	10·2	11·4
Riverview	20·1	8	e 4 43	+ 1	i 8 26	+ 1	e 9·7	11·6
Sydney	20·1	8	4 35	− 7	8 23	− 2	10·0	11·3
Perth	31·7	301	7 25	?PR_1	11 57	− 6	14·2	—
Batavia	58·0	310	—	—	e 18 5	+ 6	—	—
Manila	72·2	334	—	—	—	—	e 81·1	—
Kodaikanal	87·1	291	43 5	?L	—	—	(43·1)	—
Honolulu	88·3	50	e 43 35	?L	—	—	52·1	57·6
Simla	104·6	303	48 23	?L	—	—	(48·4)	—
Victoria	126·4	55	—	—	—	—	—	66·8
Helwan	129·2	270	66 5	?L	—	—	(66·1)	—
Kingston	130·3	120	—	—	—	—	93·1	—
De Bilt	157·8	281	—	—	—	—	e 77·6	101·7

Additional records and notes: Adelaide—These records have all been corrected by +3m. Riverview gives also PS = +8m.38s., MN = +10·8m., MZ = +12·7m. Sydney gives its records as at 1h. Helwan PN = +68m.5s. De Bilt MN = +101·6m.

Mar. 11d. 18h. 32m. 54s. Epicentre 30°·2S. 179°·0W. (as on 1919 April 17d.).

A = −·864, B = −·015, C = −·503; D = −·018, E = +1·000; G = +·503, H = +·009, K = −·864.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview		25·5	254	e 5 52	+ 9	e 10 9	− 4	e 13·1	15·1
Sydney		25·5	254	10 6	?S	(10 6)	− 7	13·7	16·1
Honolulu		55·4	25	29 6	?L	—	—	31·1	37·6
Victoria		93·0	34	—	—	—	—	—	47·9
La Paz		98·7	116	e 18 58	?PR_1	—	—	—	—
De Bilt	E.	157·9	353	—	—	—	—	e 71·1	75·0
	N.	157·9	353	—	—	—	—	e 73·1	74·6
Uccle		159·2	354	—	—	—	—	e 71·1	—

No additional records.

Mar. 11d. Records also at 0h. (San Fernando), 5h. (Melbourne and Riverview), 7h. (La Paz).

Mar. 12d. 15h. 20m. 15s. Epicentre 6°·5N. 128°·0E. (as on 1919 April 16d.).

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

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Manila	10·7	320	—	—	—	—	e 5·3	—
Zi-ka-wei	25·5	346	e 6 41	+58	—	—	—	—
Adelaide	42·6	166	15 21	?S	(15 21)	+38	22·6	24·7
Riverview	45·9	151	—	—	e 18 21	?SR_1	e 24·3	27·4
Melbourne	47·0	161	—	—	—	—	—	38·8
Kodaikanal	50·1	279	39 45	?	—	—	—	—
Honolulu	72·7	70	24 45	?SR_1	—	—	33·5	41·2
Helwan	92·6	301	48 45	?L	—	—	(45·8)	—
Victoria	97·2	40	—	—	—	—	66·7	45·5
Hamburg	100·8	329	—	—	—	—	e 58·8	—
De Bilt	104·0	329	—	—	—	—	e 55·8	70·0
Uccle	105·1	327	—	—	—	—	e 55·8	—
Moncalieri	105·9	321	—	—	—	—	e 59·2	69·9
Coimbra	118·5	323	—	—	—	—	e 73·3	—
San Fernando	119·4	319	33 45	?	—	—	78·8	—
Toronto	124·1	24	—	—	—	—	67·7	—
La Paz	161·3	124	i 20 10	[+ 1]	—	—	77·8	—

Additional records: Manila gives its records 1h. late. Adelaide S = +19m.57s. (?SR_1). Helwan PE = +65m.45s. De Bilt MN = +64·5m.

Mar. 12d. Records also at 2h. (La Paz, Riverview, Manila, and Taihoku), 3h. (San Fernando and Helwan), 13h. (Tacubaya), 15h. (near Rocca di Papa), 17h. (La Paz and Tacubaya), 18h. (Victoria, Moncalieri, Toronto, and Berkeley), 19h. (De Bilt and La Paz), 21h. (near Oaxaca), 22h. (near Tacubaya and La Paz).

Mar. 13d. 3h. 58m. 55s. Epicentre 11°·5N. 144°·0E. (as on 1920 Jan. 15d.).

A = −·793, B = +·576, C = +·199; D = +·588, E = +·809; G = −·161, H = +·118, K = −·980.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	45·8	172	e 8 41	+ 2	e 15 23	− 2	e 22·4	27·4
Sydney	45·8	172	21 41	?	—	—	25·3	27·4
Adelaide	46·7	186	—	—	—	—	—	35·5
Melbourne	49·3	180	—	—	—	—	30·8	34·9
Apia	50·6	118	9 6	− 5	—	—	10·4	—
Honolulu	56·2	72	22 47	?SR_1	i 28 59	?	e 29·1	33·1
Victoria	83·2	42	—	—	—	—	41·8	48·7
Helwan	103·2	304	43 5	?L	—	—	(43·1)	—
Toronto	112·1	32	—	—	—	—	e 65·9	69·0
San Fernando	124·5	331	61 5	?L	—	—	(61·1)	—
La Paz	148·4	103	e 19 46	[− 7]	31 36	?	55·3	64·5

Additional record and notes: Riverview gives MN = +26·5m. Apia e = +9m.31s. Helwan PN = +46m.5s. La Paz i = +20m.36s., T_o = 4h.4m.41s.

Mar. 13d. 10h. 39m. 40s. Epicentre 24°·0N. 123°·0E. (as on 1919 May 16d.).

A = −·498, B = +·766, C = +·407; D = +·839, E = +·545; G = −·224, H = +·341, K = −·913.

	Δ	Az.	P.	O−C.	L.	M.
	°	°	m. s.	s.	m.	m.
Taihoku	1·7	308	0 30	+ 4	0·9	0·9
Hokoto	3·2	262	0 17	−33	0·8	—
Zi-ka-wei	7·3	349	e 1 36	−15	—	—
Manila	9·6	192	e 2 20	− 4	—	—
Tokyo	18·6	47	3 22	−62	4·5	4·6
Batavia	34·1	209	e 7 15	+ 9	—	8·9
Helwan	79·7	298	33 20	?L	(33·3)	—
De Bilt	86·7	327	—	—	e 45·3	48·2
Uccle	87·8	326	—	—	e 45·3	—
Coimbra	101·6	324	—	—	e 56·0	—

Batavia gives its record as at 11h.

Mar. 13d. Records also at 0h. (La Paz and near Mizusawa), 1h. (Helwan), 5h. (Riverview, Colombo, Hamburg, Uccle, and De Bilt), 8h. (Riverview and Melbourne), 10h. (La Paz and Helwan), 11h. (Helwan), 12h. (Denver and near Tokyo), 13h. (Helwan), 14h. (Tokyo), 15h. (Taihoku), 16h. (near Tokyo), 21h. and 22h. (La Paz).

Mar. 14d. Records at 2h. (Azores and La Paz), 3h. and 4h. (Helwan), 5h. (San Fernando), 9h. (Riverview), 11h. (Helwan), 12h. (near Mizusawa), 13h. (La Paz and San Fernando), 18h. (near Tokyo and Mizusawa), 19h. (San Fernando), 20h. (near Tokyo).

1920. Mar. 15d. 12h. 5m. 30s. Epicentre 20·0S. 176·5E.

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

A focal depth 0·030 is assumed.

		Corr. for Focus	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	°	m. s.	s.	m. s.	s.	m.	m.
Apia		−0·6	12·8	63	i 3 0	− 2	—	—	5·6	12·5
Riverview		−1·7	26·4	233	e 5 33	− 2	i 9 52	− 5	e 11·6	13·8
Sydney		−1·7	26·4	233	6 0	+25	(9 42)	−15	9·7	14·1
Melbourne		−2·2	32·6	230	—	—	8 6	?	12·5	15·0
Adelaide		−2·4	36·6	239	6 24	−43	12 42	− 1	17·4	22·0
Honolulu		−3·0	48·2	34	i 15 48	?S	(15 48)	+30	e 25·0	29·3
Perth		−3·4	55·2	245	3 40	?	—	—	—	—
Manila		−3·7	64·7	300	e 10 30	+11	—	—	—	—
Osaka		−3·7	67·2	326	e 11 22	+47	—	—	—	31·8
Batavia		−3·8	68·8	273	e 10 52	+ 7	—	—	—	22·8
Taihoku		−3·8	69·9	310	—	—	19 30	− 8	30·8	—
Zi-ka-wei		−3·9	73·6	315	e 10 54	−21	e 20 24	+ 2	—	—
Berkeley		−4·0	81·5	46	—	—	—	—	e 33·9	—
Lick		−4·0	81·7	47	—	—	—	—	e 36·6	—
Victoria		−4·1	86·8	38	13 55	+81	22 46	− 8	34·1	43·4
Colombo		−4·4	98·6	275	44 30	?L	—	—	(44·5)	55·5
Kodaikanal		−4·4	102·0	277	36 36	?	—	—	—	—
La Paz		−4·5	106·8	117	18 42	?PR_1	e 28 42	+144	45·5	60·0
Chicago		−4·5	107·4	51	26 50	?S	33 50	?SR_1	47·5	—
Mauritius	E.	−4·5	107·7	240	30 24	?	—	—	—	59·0
Toronto		−4·6	113·7	50	19 36	?PR_1	29 12	+112	56·6	66·3
Georgetown		−4·6	114·9	56	—	—	—	—	58·6	—
Washington		−4·6	114·9	56	—	—	—	—	e 57·5	—
Ithaca		−4·6	115·6	51	—	—	—	—	e 58·9	—
Ottawa	E.	−4·6	116·4	48	e 24 8	?	e 35 0	?SR_1	54·5	—
Harvard		−4·7	119·6	51	29 41	?S	31 29	+200	e 57·0	—
Hamburg		—	144·9	346	—	—	—	—	e 60·5	73·5
Helwan		—	147·1	294	41 30	?SR_1	—	—	—	—
De Bilt	E.	—	147·2	349	—	—	e 41 29	?SR_1	e 58·5	72·3
	N.	—	147·2	349	—	—	—	—	e 67·5	81·8
Vienna		—	147·5	335	i 19 25	[−27]	—	—	e 57·5	81·5
Kew		—	148·4	358	—	—	—	—	—	93·5
Uccle		—	148·6	350	e 19 24	[−30]	e 41 42	?	e 58·5	82·5
Strasbourg		—	150·0	343	e 19 27	[−29]	e 31 55	?	82·5	—
Paris		—	150·8	352	e 19 33	[−24]	—	—	80·5	—
Florence		—	153·2	336	—	—	—	—	60·5	64·5
Moncalieri		—	153·4	343	40 11	?SR_1	52 46	?	83·5	84·5
Puy de Dome		—	153·8	350	20 7	[+ 6]	—	—	—	—
Coimbra		—	159·4	11	49 30	?	—	—	—	—
Algiers		—	162·3	343	—	—	—	—	78·5	92·5
San Fernando		—	163·4	8	—	—	—	—	90·3	103·5

Additional records and notes: Apia gives $T_o = 12h.5m.20s.$ Epicentre 18°·0S. 174°·0E., $\Delta = 14°·5$. Riverview gives MN = +11·9m., MZ = +13·4m. Adelaide gives its record apparently 10m. too soon, $PR_1 = +8m.6s.$ Honolulu iS = +19m.12s. and e = +11m.30s. Osaka MN = +32·3m. Zi-ka-wei gives its readings at 11h. Mauritius PN = +30m.12s., MN = +45·3m. Toronto e = +25m.45s., e = +33m.30s., eL = 59·2m. Georgetown LN = +59·6m. Ithaca eLN = +57·9m. Ottawa eE = +30m.12s., $T_o = 12h.16m.43s.$ Harvard eSE = +36m.37s., L = +60·2m., L = +69·6m. Eskdalemuir ($\Delta = +144°·7$) gives 12h. to 13h. Helwan P = +35m,30s. Moncalieri MN = +86·8m.

Mar. 15d. Records also at 1h. (near Tacubaya), 3h. and 7h. (Helwan), 8h. (Tacubaya), 10h. (Kodaikanal), 14h. (Mauritius), 17h. (Sydney, Riverview, and near Tokyo), 19h. (Helwan), 20h. (La Paz).

Mar. 16d. Records at 1h. (Simla), 4h. (near Balboa Heights), 5h. (La Paz), 9h. (Manila), 10h. (Apia), 11h. (Apia, Helwan, and near Taihoku (2)), 12h. (near Athens), 13h. (La Paz and Tokyo), 15h. (Helwan), 19h. (La Paz), 20h. (Helwan).

1920. Mar. 17d. 18h. 36m. 50s. Epicentre **2°·0N. 96°·0E.**

A = −·104, B = +·994, C = +·035; D = +·995, E = +·104; G = −·004, H = +·035, K = −·999.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Batavia		13·6	127	e 3 27	+ 6	7 18	? L	e 19·2	8·7
Colombo		16·9	287	7 52	?S	(7 52)	+36	11·4	13·2
Kodaikanal		20·2	295	8 16	?S	(8 16)	−11	10·8	13·4
Calcutta	E.	21·8	341	4 16	−47	8 16	−45	—	—
	N.	21·8	341	4 10	−53	8 10	−51	—	—
Manila		27·7	62	e 6 10	+ 5	(10 49)	− 5	10·8	11·3
Bombay		28·3	308	6 15	+ 4	—	—	—	21·9
Zi-ka-wei		37·8	38	e 7 39	+ 3	e 13 31	− 4	—	23·6
Perth		38·8	153	—	—	14 10	+21	—	—
Mauritius		41·3	236	9 52	+107	—	—	—	—
Melbourne		60·2	138	—	—	—	—	e 33·2	41·7
Riverview		63·0	131	e 23 26	?SR_1	—	—	e 32·2	34·7
Helwan	E.	67·1	302	20 4	?S	(20 4)	+13	—	43·0
	N.	67·1	302	20 52	?S	(20 52)	+61	—	38·4
Cape Town		78·5	234	46 35	?L	—	—	(46·6)	53·8
Vienna		81·6	320	i 12 30	+ 2	i 22 44	+ 2	—	55·2
Rocca di Papa		83·7	312	12 40	0	—	—	—	12·9
Hamburg		86·0	324	e 12 53	0	—	—	e 47·2	63·2
Moncalieri		87·4	315	23 24	?S	(23 24)	−21	50·3	—
De Bilt	E.	88·9	322	—	—	e 23 37	−25	e 53·2	58·7
	N.	88·9	322	—	—	—	—	e 48·2	61·4
Uccle		89·6	321	e 13 10	− 4	e 24 4	− 6	e 49·2	—
Chicago		136·1	4	i 23 10	?PR_1	35 22	?SR_1	e 69·2	—
La Paz		158·7	226	20 17	[+10]	—	—	73·2	76·0

Additional records and notes: Colombo gives S = +9m.46s. Manila S = +9m.37s., MN = +11·4m. Zi-ka-wei MN = +24·2m. Mauritius PE = +10m.40s. Riverview MN = +37·5m. Hamburg MN = +61·2m. Moncalieri S is given as P and S = +36m.51s. Chicago L = +80·2m.

Mar. 17d. Records also at 1h. (San Fernando), 12h. (near La Paz), 18h. (near Tortosa), 20h. (Batavia and near Tokyo), 22h. (Batavia), 23h. (Manila).

Mar. 18d. Records at 1h. (near Batavia), 3h. (San Fernando), 6h. (La Paz), 7h. (near Batavia), 12h. (San Fernando), 13h. and 14h. (La Paz), 22h. (Apia).

Mar. 19d. Records at 1h. (near Balboa Heights), 2h. (near Mizusawa and Tokyo), 6h. (Apia, La Paz, and Riverview), 8h. (Helwan), 10h. (Kodaikanal), 12h. (La Paz), 14h. (Apia), 17h. (Washington, Georgetown, Chicago, and Ottawa), 18h. (Manila), 20h. (near Tokyo), 21h. (La Paz (2)), 22h. (San Fernando).

Mar. 20d. 17h. 48m. 42s. Epicentre 40°·5N. 122°·0W. (as on 1919 May 20d.).

A = −·403, B = −·645, C = +·649; D = −·848, E = +·530,; G = −·344, H = −·551, K = −·760.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Berkeley	N.	2·6	186	e 0 37	− 4	e 1 4	− 8	1·2	2·2
	Z.	2·6	186	—	—	e 1 5	− 7	1·2	2·6
Lick		3·1	174	e 0 48	− 1	e 1 25	− 1	e 1·6	2·7
Victoria		8·0	354	—	—	—	—	3·3	4·8
Tucson	E.	12·1	130	5 53	?S	(5 53)	+32	(7·9)	—
Denver		13·0	88	—	—	—	—	7·3	8·3
Chicago		25·8	76	10 28	?S	(10 28)	+10	14·4	—

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Toronto		31·4	70	—	—	20 54	?	23·7	—
Ottawa		33·5	65	—	—	e 12 10	−22	e 21·0	—
Ithaca		33·7	71	—	—	—	—	e 15·3	—
Georgetown	E.	34·2	79	e 15 45	?	19 23	?	e 21·6	—
	N.	34·2	79	e 15 23	?	19 23	?	e 21·1	—
Washington		34·2	79	—	—	—	—	e 14·3	—
Cheltenham		34·4	79	8 54	?PR$_1$	19 18	?L	(19·3)	—
Harvard	E.	37·6	70	16 41	?	—	—	23·2	—
	N.	37·6	70	16 33	?	20 8	?	21·5	23·5
Eskdalemuir		71·0	31	—	—	—	—	30·3	—
Kew		75·0	33	—	—	—	—	—	90·3
De Bilt		76·7	30	—	—	e 21 48	+ 3	e 34·3	38·1
Uccle		77·4	30	—	—	—	—	e 34·3	—
Strasbourg		80·5	32	—	—	—	—	e 41·3	—

Additional records and notes: Berkeley gives E records coinciding with N or Z, ME = 2·5m., T_e = 17h.48m.43s. Lick MN = +2·3m., T_e = 17h.48m.43s. Tucson PN = +7m.23s. Chicago S? = +13m.13s. Ottawa e = +18m.48s. Georgetown LE = +22·8m., eLZ = +21·6m., LZ = +25·6m. Harvard iN = +16m.44s., eN = +18m.4s., iE = +20m.40s., LE = +24·1m. De Bilt MN = +38·4m.

1920. Mar. 20d. 18h. 31m. 15s. Epicentre 35°·8S. 109°·4W.

A = −·269, B = −·765, C = −·585; D = −·943, E = +·332; G = +·194, H = +·552, K = −·811.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
La Paz		41·3	74	i 8 5	0	i 14 27	+ 2	17·5	18·4
Balboa Heights	E.	52·9	39	9 23	− 2	17 5	+10	25·0	28·8
	N.	52·9	39	—	—	—	—	24·8	27·0
Oaxaca		54·2	14	9 32	− 2	17 11	0	25·6	26·6
Tacubaya	E.	55·9	11	10 49	+64	18 38	+65	27·4	31·1
	N.	55·9	11	10 47	+62	18 37	+64	27·5	31·2
Christchurch		58·3	237	—	—	—	—	27·8	34·8
Mazatlan		59·1	4	13 41	?PR$_1$	—	—	—	—
Apia		59·7	276	—	—	e 18 9	−10	28·8	—
Tucson	E.	68·1	358	20 6	?S	(20 6)	+ 3	27·8	29·2
Vieques	E.	68·2	45	13 27	?PR$_1$	20 21	+17	32·6	33·6
	N.	68·2	45	11 41	+36	20 23	+19	35·2	38·2
Honolulu		73·4	313	—	—	i 22 3	+56	37·6	41·4
Berkeley		74·6	350	e 11 46	0	—	—	—	—
Riverview		77·6	237	e 12 27	+22	(23 15)	+79	e 33·0	36·6
Sydney	E.	77·6	237	12 3	− 2	22 15	+19	35·8	42·0
Melbourne		79·3	230	19 45	?	27 45	?SR$_1$	38·8	44·8
Chicago		80·1	16	i 12 22	+ 2	22 20	− 4	51·8	—
Georgetown	E.	80·4	25	e 12 18	− 3	e 22 28	0	39·9	—
	N.	80·4	25	e 12 11	−10	i 22 25	− 3	e 40·8	—
	Z.	80·4	25	e 12 3	−18	22 34	+ 6	e 36·0	—
Washington		80·4	25	e 12 15	− 6	22 28	0	35·8	—
Cheltenham	N.	80·4	26	12 37	+16	22 35	+ 7	41·0	44·6
Ann Arbor	E.	81·6	20	14 51	?	23 57	+75	37·6	42·4
	N.	81·6	20	14 57	?	24 21	+99	37·4	38·4
	N.	81·6	20	—	—	23 57	+75	37·6	38·5
Ithaca		83·8	24	e 12 24	−17	22 39	−28	37·2	—
Toronto		84·0	22	11 33	−69	i 23 33	+25	e 46·0	47·4
Victoria		85·1	351	13 52	+63	23 12	− 8	35·0	43·4
Harvard	E.	85·6	27	e 12 47	− 4	23 14	−12	e 35·4	—
	N.	85·6	27	11 46	−65	23 10	−16	41·2	41·8
Northfield		86·6	26	—	—	e 21 45	−112	e 37·8	—
Ottawa		86·7	23	12 49	− 8	23 27	−11	e 37·8	—
Capetown	E.	95·0	140	23 32	?S	25 44	+38	51·9	52·9
Sitka		95·4	346	—	—	—	—	46·5	—
Coimbra		119·7	60	20 26	?PR$_1$	31 34	+167	49·8	60·0
		119·7	60	20 15	?PR$_1$	31 15	+148	48·8	62·8
San Fernando		119·7	65	19 38	?PR$_1$	—	—	57·2	73·8
Rio Tinto		120·0	63	18 45	?PR$_1$	—	—	—	43·8
Granada		122·0	65	20 42	?PR$_1$	i 33 25	?	—	—

Continued on next page.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Mauritius	E.	122·9	166	30 45	?S	(30 45)	+94	—	60·0
	N.	122·9	166	27 57	?S	(27 57)	−74	(54·2)	57·8
Tokyo		125·2	291	20 31	?PR$_1$	i 45 14	?	i 56·3	—
Batavia		126·0	225	e 21 1	?PR$_1$	—	—	60·0	72·2
Tortosa		126·2	62	e 19 21	[+12]	38 11	?SR$_1$	59·6	77·6
Algiers		126·8	67	e 19 36	[+26]	28 1	−98	53·8	67·8
Barcelona		127·6	62	e 21 20	?PR$_1$	33 41	?	e 55·7	66·4
Eskdalemuir		127·6	42	e 18 37	[−36]	i 28 15	−89	38·5	—
Edinburgh		127·7	42	e 22 35	?PR$_1$	32 45	?	—	65·2
Stonyhurst		127·7	46	30 45	?S	(30 45)	+60	58·8	73·8
Oxford		128·0	48	19 5	[− 9]	—	—	—	65·8
Dyce	E.	128·4	40	i 28 30	?S	i 39 20	?SR$_1$	53·0	—
	N.	128·4	40	i 28 14	?S	38 39	?SR$_1$	55·5	64·0
Kew		128·5	48	—	—	—	—	—	74·8
Puy de Dôme		129·4	55	21 58	?PR$_1$	—	—	—	—
Paris	E.	129·8	51	e 22 50	?PR$_1$	e 35 17	?	58·8	61·8
	N.	129·8	51	e 23 21	?PR$_1$	e 35 9	?	—	75·8
Uccle		131·3	49	e 19 27	[+ 6]	—	—	e 58·8	64·3
De Bilt		131·9	47	e 20 8	[+45]	—	—	e 62·8	67·9
Moncalieri		132·5	59	e 19 59	[+35]	33 55	?	49·0	76·4
Strasbourg		133·0	52	e 19 26	[+ 1]	—	—	e 63·8	67·4
		133·0	52	e 19 53	[+28]	—	—	—	73·1
Florence		134·7	60	25 3	?PR$_1$	40 15	?SR$_1$	54·8	65·6
Rocca di Papa	N.	135·3	64	e 19 51	[+21]	39 57	?SR$_1$	e 67·6	81·6
Padova		135·4	59	20 45	[+74]	29 26	?	—	—
Pompeii		136·4	64	22 45	?PR$_1$	—	—	76·8	—
Hamburg		136·9	46	e 19 28	[− 6]	—	—	e 63·8	64·8
Vienna		138·8	52	i 23 33	?PR$_1$	—	—	e 40·8	74·8
Budapest		140·5	55	e 20 39	[+59]	—	—	—	—
Helwan	E.	146·7	88	31 51	?	—	—	—	89·6
	N.	146·7	88	33 57	?	—	—	—	89·8
Colombo		149·9	197	—	—	41 15	?SR$_1$	76·2	95·8
Kodaikanal		153·6	195	53 9	?	—	—	82·4	95·8
Bombay		163·0	187	23 33	?PR$_1$	—	—	—	—
Simla		172·8	231	e 29 33	?	—	—	47·8	86·6

Additional records and notes: La Paz gives PR$_1$ = +9m.37s., T$_e$ = 18h.31m.17s. Oaxaca records have all been increased by 3min. Christchurch SR$_1$? = +19m.3s., SR$_2$? = +21m.57s. Apia i = +25m.9s. Honolulu i = +30m.57s. = SR$_1$?. Riverview PS = +23m.15s. (taken as S), SR$_2$ = +26m.58s., MZ = +43·0m. Melbourne PR$_1$ = +22m.33s. Cheltenham SE = +22m.30s. Washington L = +40·8m. and 42·8m. Ithaca PR$_1$N = +15m.49s., SN = +22m.49s., L? = +34·8m. Toronto L = +36·4m., eL = +60·8m. and +71·8m., L (repetition) = 20h.45m.30s. Epicentre 23°·4S. 163°·0W. (approx.). Victoria L (repetition) = 21h.5m.23s. Harvard iE = +24m.17s., iN = +24m.11s., SR$_1$N = +29m.5s. ME(repetition) = 20h.43m.46s. Ottawa SR$_1$E = +29m.15s., T$_e$ = 18h.31m.23s. Coimbra PR$_1$ = +30m.20s., SR$_1$ = +36m.45s., iE = +37m.14s., LN = +49·8m., MN = +62·8m., T$_e$ = 18h.13m.28s. San Fernando MN = +68·8m. Granada SR$_1$ = +37m.25s. Batavia i = +28m.9s. and many other L's and M's. Barcelona ? = +38m.41s., MN = +69·0m. Eskdalemuir i = +31m.20s. Edinburgh SR$_1$ = +38m.41s., SR$_2$ = +43m.9s. Stonyhurst S = +39m.33s., L = +42·2m. The actual L is recorded as the P of a second shock, to which M also belongs. Dyce iN = +39m.10s. Uccle i = +21m.38s., PR$_1$ = +22m.52s., eSR$_1$ = +37m.45s., MN = +75·2m. De Bilt eE = +21m.41s., e = +22m.54s. and +39m.14s., m = +40m.4s., MN = +78·6m. Moncalieri MN = +74·9m. Strasbourg ePN = +22m.2s. and +23m.45s. Hamburg iE = +22m.37s. and +40m.39s. Colombo L = +93·8m.

Mar. 20d. Records also at 0h. (Toronto, Victoria, La Paz, and near Tokyo), 1h. (near Batavia), 3h. (near Tokyo), 6h. (Perth), 7h. (near Tokyo), 10h. (near Tacubaya), 12h. (Apia), 14h. (Batavia (2)), 16h. (Apia and near Mizusawa), 17h. (La Paz and near Victoria).

Mar. 21d. Records at 0h. (La Paz, Helwan, Moncalieri, and near Granada and Tortosa), 1h. (Uccle and De Bilt), 4h. (San Fernando), 5h. (Taihoku), 10h. (Helwan), 16h. (La Paz), 19h. (Zi-ka-wei), 20h. (Manila), 21h. (Melbourne, San Fernando, and Riverview), 23h. (Riverview).

Mar. 22d. 1h. 38m. 33s. Epicentre 8°·0S. 160°·0E. (as on 1917 Nov. 22d.).
A = −·931, B = +·339, C = −·139; D = +·342, E = +·940;
G = +·131, H = −·048, K = −·990.

	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
	°	°	m. s.	s.	m. s.	s.	m.	m.
Riverview	27·1	196	e 6 1	+ 2	e 10 40	− 3	e 13·8	15·6
Melbourne	32·8	202	—	—	—	—	e 18·0	20·0
Manila	44·8	300	e 9 27	+55	—	—	—	—
Perth	47·4	233	15 47	?S	(15 47)	+ 1	25·2	—
Honolulu	50·5	54	e 17 51	?S	(17 51)	+86	e 24·2	34·4
Victoria	87·3	40	—	—	—	—	—	44·5
Chicago	111·9	48	—	—	—	—	e 54·4	—
Toronto	117·4	45	—	—	—	—	42·0	—
Ottawa	118·4	42	—	—	—	—	63·4	—
De Bilt	131·3	340	—	—	e 40 26	?SR_1	e 70·4	78·4
Uccle	132·6	339	—	—	—	—	e 68·4	88·4
Tortosa	142·4	334	e 19 27	[−17]	—	—	e 79·4	99·8
San Fernando	148·9	338	48 27	?SR_1	—	—	—	—

Additional records and notes: Riverview gives SR_1 = +12m.13s., MN = +19·8m. Honolulu gives S as eP and S = +22m.9s. Toronto L(?SR_1) = +22m.9s., L = +70·6m. and +109·0m. Ottawa L = +71·4m. and +87·4m. De Bilt ePR_1N = +23m.27s., MN = +88·2m.

Mar. 22d. 20h. 1m. 43s. Epicentre 17°·0S. 177°·5W. (as on 1920 Jan. 30d.).
A = −·955, B = −·042, C = −·292; D = −·044, E = +·999;
G = +·292, H = +·013, K = −·959.

On each previous occasion, viz., on 1918 May 22d. and 1919 Aug. 18d. (2), when this epicentre was adopted a considerable depth of focus was found necessary for the determination. In the present instance a depth 0·040 is assumed, both agreeing with precedent and satisfying the present observations.

		Corr. for Focus	Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
			°	°	m. s.	s.	m. s.	s.	m.	m.
Apia		0·0	6·3	61	1 36	0	2 52	0	3·3	4·3
Riverview		−2·8	32·7	232	e 6 12	−15	e 11 23	− 9	e 13·0	17·2
Sydney	E.	−2·8	32·7	232	7 17	?PR_1	11 29	− 3	13·9	17·5
Melbourne		−3·2	38·9	230	(e 8 47)	?PR_1	(13 23)	+17	13·4	22·8
Honolulu		−3·5	42·8	29	i 15 47	?SR_1	i 18 53	?	e 21·3	27·8
Perth		−3·8	61·6	242	18 37	?S	(18 37)	+41	33·7	—
Manila		−4·8	68·4	295	e 10 50	+14	(19 33)	+25	19·6	—
Batavia		−5·0	74·5	289	11 17	+ 3	—	—	e 41·5	—
Berkeley		−5·0	75·4	41	—	—	—	—	e 33·9	—
Victoria		−5·2	81·2	33	20 27	?S	(20 27)	−70	34·7	41·4
Chicago		−5·6	101·1	50	e 20 17	?	—	—	50·3	—
La Paz		−5·7	102·7	112	i 18 23	[+26]	—	—	48·3	50·6
Colombo		−5·7	104·1	271	51 53	?L	—	—	(51·9)	81·1
Kodaikanal		−5·8	107·3	274	61 5	?L	—	—	(61·1)	—
Toronto		−5·8	107·3	49	—	—	40 35	?	56·8	64·0
Georgetown		−5·8	108·5	53	—	—	—	—	56·3	—
Ottawa		—	110·1	46	e 28′ 21	?S	(28 21)	+52	53·3	—
Cape Town		—	126·9	196	69 47	?L	—	—	(69·8)	76·3
Edinburgh		—	140·9	6	—	—	—	—	73·3	103·3
Eskdalemuir		—	141·4	6	e 36 15	?	e 40 49	?SR_1	67·3	—
Hamburg		—	143·0	353	—	—	—	—	e 78·3	—
De Bilt	E.	—	144·8	357	e 41 29	?SR_1	—	—	e 70·3	95·4
	N.	—	144·8	357	e 47 11	?	—	—	e 67·3	68·8
Kew		—	145·5	3	—	—	—	—	—	84·3
Uccle		—	146·2	358	e 19 16	[−34]	—	—	e 59·3	—
Vienna		—	146·8	343	i 19 22	[−29]	—	—	—	20·3
Strasbourg		—	148·1	351	e 19 25	[−28]	—	—	e 72·3	—
Paris		—	148·2	1	i 19 33	[−20]	—	—	90·3	—
Padova		—	150·8	347	19 47	[−10]	—	—	—	—
Helwan		—	150·7	302	32 17	?	(38 17)	?	—	—
Puy de Dôme		—	151·3	359	19 40	[−17]	—	—	—	—
Moncalieri		—	151·7	352	e 20 32	[+34]	40 38	?	74·8	—
Rocca di Papa		—	153·7	343	e 19 39	[−22]	—	—	e 28·7	—
Coimbra	E.	—	154·9	21	45 47	?SR_1	—	—	e 74·3	82·8
	N.	—	154·9	21	45 17	?SR_1	55 7	?	76·0	—
Tortosa		—	156·1	5	e 20 0	[− 3]	—	—	73·9	82·6
San Fernando		—	159·1	20	—	—	—	—	81·3	120·3
Granada		—	159·1	14	e 19 48	[−19]	30 55	?	—	—

For Notes see next page.

NOTES TO MAR. 22d. 20h. 1m. 43s.

Additional records: Apia gives 18°·0S. 178°·0W., T_0 = 20h.1m.30s., △8°·0. Riverview PS = +11m.52s., MN = +14·6m., MZ = +17·6m. Toronto eL = +60·4m. Ottawa L = +57·3m. and +73·3m. Strasbourg L = +82·3m. San Fernando MN = +90·8m. Granada PR_1 = +20m.29s., PS = +22m.51s.

Mar. 22d. Records also at 0h. (Chicago, Hamburg, Victoria, Helwan, Uccle, and De Bilt), 3h. (Helwan and Batavia), 4h. (Batavia), 5h. (near Tokyo), 7h. (Batavia), 10h. (near Calcutta), 13h. (Helwan), 15h. (Mazatlan and Stonyhurst), 16h. (Stonyhurst), 19h. (Taihoku, La Paz, and Harvard).

Mar. 23d. 15h. 21m. 48s. Epicentre 14°·5N. 91°·0W. (as on 1919 July 6d.).

A = −·017, B = −·968, C = +·250; D = −1·000, E = +·018; G = −·004, H = −·250, K = −·968.

		△	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Oaxaca		6·1	296	1 14	−19	—	—	1·7	2·0
Tacubaya		9·3	304	2 37	+17	—	—	4·1	4·4
Tucson	E.	25·4	318	5 1	−41	—	—	11·9	12·7
	N.	25·4	318	5 7	−35	—	—	12·5	12·6
Cheltenham	E.	27·3	25	6 1	0	11 12	+26	15·5	—
	N.	27·3	25	6 24	+23	11 21	+35	15·5	—
Georgetown		27·3	24	6 17	+16	11 19	+33	13·9	—
Washington		27·3	24	e 5 37	−24	10 52	+ 6	—	—
Chicago		27·4	6	i 5 36	−26	10 10	−38	14·7	—
Ann Arbor	E.	28·5	12	—	—	11 42	+34	16·1	—
	N.	28·5	12	6 12	− 1	11 18	+10	16·1	21·9
	E.	28·5	12	6 6	− 7	11 12	+ 4	16·1	—
Ithaca		30·7	23	—	—	e 13 4	+78	17·6	—
Toronto		30·8	17	3 24	?	10 30	−78	14·6	23·8
Harvard		32·8	28	e 6 14	−41	(12) 51	+30	16·7	19·9
Ottawa		33·5	20	i 6 37	−24	i 11 47	−45	14·7	—
Northfield		33·6	25	—	—	e 12 12	−22	—	—
Berkeley		36·2	316	—	—	—	—	e 18·0	—
La Paz		38·3	143	7 46	+ 6	13 41	− 1	16·9	17·8
Victoria		43·1	329	13 28	?S	(13 28)	−81	21·4	24·9
Honolulu		63·7	287	e 11 0	+24	19 42	+33	29·3	31·2
Coimbra		75·2	52	e 21 12	?S	(e 21 12)	−16	38·2	—
		75·2	52	21 42	?S	(21 42)	+14	35·7	40·2
Edinburgh		76·8	35	—	—	i 21 48	+ 1	—	—
Eskdalemuir		76·8	36	11 57	− 3	21 41	− 6	36·9	—
San Fernando		77·3	55	22 12	?S	(22 12)	+20	—	—
Kew		79·2	39	—	—	—	—	—	55·2
Paris		81·4	42	i 12 25	− 2	i 22 35	− 4	40·2	—
Uccle		82·2	40	e 12 23	− 8	22 37	−11	e 39·2	42·6
De Bilt	E.	82·5	38	12 33	0	22 44	− 8	39·2	40·7
	N.	82·5	38	—	—	—	—	42·2	44·1
Algiers		84·6	53	e 12 45	− 1	22 56	−19	46·2	—
Hamburg		84·7	37	e 12 37	− 9	i 22 58	−18	e 45·2	—
Strasbourg		84·9	41	12 38	− 9	e 22 57	−21	e 42·2	—
Padova		88·4	43	13 49	+42	—	—	—	—
Rocca di Papa		90·3	47	e 13 10	− 8	23 36	+19	—	27·1
Pompeii		91·9	47	—	—	23 48	+14	—	—
Helwan		108·9	51	25 12	?S	(29 12)	?	—	—

Additional records: Oaxaca gives its record 4m. early. Tacubaya MN = +4·7m. = MZ. Toronto i = +12m.36s., eL = +19·3m. Harvard S was recorded 10min. less, eLN = +11·5m., L = +12·4m. Coimbra S = +27m.26s. Pompeii gives its records as 14h.

Mar. 23d. Records also at 0h. (San Fernando), 4h. (Helwan), 6h. (Nagasaki), 16h. (Simla), 20h. (Rocca di Papa), 22h. (Mazatlan).

Mar. 24d. Records at 0h. (Apia, La Paz, San Fernando, and near Mizusawa), 1h. near Mizusawa), 6h. (Riverview), 9h. and 15h. (La Paz), 16h. (near Tokyo), 17h. (La Paz), 20h. (San Fernando), 21h. (near Tokyo).

Mar. 25d. Records at 0h. (Taihoku), 1h. (Manila, Helwan, and La Paz), 2h. (La Paz), 7h. (near Mizusawa and Tokyo), 12h. (near Rocca di Papa), 18h. (Helwan), 21h. (Batavia and La Paz), 22h. (San Fernando).

Mar. 26d. Records at 18h. (near Pompeii and Rocca di Papa), 20h. (La Paz and Riverview).

Mar. 27d. Records at 0h. (San Fernando), 10h. (near Mizusawa), 11h. (near Rocca di Papa), 13h. (near La Paz (2)), 19h. (La Paz), 20h. (near Port au Prince), 22h. (San Fernando).

Mar. 28d. Records at 0h. (Batavia), 1h. (Colombo and Helwan), 4h. (La Paz), 5h. (La Paz and near Mizusawa), 6h. (La Paz), 11h. (Riverview), 13h. (Helwan, Harvard, and La Paz), 18h. (Rio Tinto), 23h. (Harvard).

1920. Mar. 29d. 5h. 7m. 40s. Epicentre 50°·5N. 129°·5W.

A = −·405, B = −·491, C = +·772; D = −·772, E = +·636; G = −·491, H = −·595, K = −·636.

		Δ	Az.	P.	O−C.	S.	O−C.	L.	M.
		°	°	m. s.	s.	m. s.	s.	m.	m.
Victoria		4·5	115	1 35	+25	(2 4)	0	2·1	3·6
	Z.	4·5	115	1 24	+14	—	—	2·8	3·3
Sitka	E.	7·4	334	e 2 15	+23	(e 2 55)	−26	e 2·9	3·9
	N.	7·4	334	—	—	e 3 17	− 4	3·8	4·8
Berkeley	N.	13·6	155	e 3 29	+ 8	—	—	e 6·4	9·1
	E.	13·6	155	e 3 35	+14	—	—	e 6·3	9·6
Lick		14·3	154	e 3 44	+14	—	—	e 7·0	10·8
Denver		20·3	113	4 20	−25	8 20	− 9	12·3	14·3
Tucson	E.	22·8	136	5 41	+26	10 7	+46	13·5	15·8
	N.	22·8	136	5 42	+27	—	—	15·6	15·8
Chicago		29·8	91	i 6 28	+ 2	11 28	− 3	14·3	17·3
Ann Arbor	N.	32·1	88	7 8	+20	12 32	+22	17·0	21·2
		32·1	88	—	—	12 26	+16	17·1	20·3
Mazatlan	E.	32·7	140	6 43	−11	—	—	16·7	21·6
	N.	32·7	140	6 40	−14	—	—	16·6	21·5
Toronto		34·1	83	—	—	12 56	+14	e 18·3	19·8
Ottawa		35·5	78	7 15	− 3	12 56	− 7	17·3	19·3
Ithaca		36·6	82	7 22	− 5	13 10	− 8	18·3	—
Northfield		38·1	77	8 45	+66	14 13	+34	20·5	—
Washington		38·2	88	7 20	−20	13 20	−21	—	25·8
Georgetown	E.	38·2	88	e 7 35	− 5	e 13 25	−16	e 16·7	24·2
	N.	38·2	88	e 7 53	+13	—	—	e 16·8	24·3
	Z.	38·2	88	e 7 35	− 5	e 13 47	+ 6	—	23·8
Cheltenham	E.	38·4	88	7 33	− 8	—	—	21·3	24·1
	N.	38·4	88	7 35	−6	16 27	?SR_1	20·7	24·2
Tacubaya	E.	39·3	133	8 36	+47	14 49	+53	23·0	25·1
	N.	39·3	133	8 37	+48	14 53	+57	23·0	26·9
Dyce	E.	64·0	29	—	—	—	—	30·4	37·2
	N.	64·0	29	—	—	i 19 39	+26	31·2	35·4
Edinburgh		64·7	30	—	—	—	—	29·3	40·9
Eskdalemuir		65·2	30	—	—	i 19 29	+ 2	28·6	32·6
Oxford		68·8	32	—	—	—	—	36·1	44·1
Kew		69·4	32	—	—	—	—	—	43·3
De Bilt		70·5	28	—	—	20 37	+ 5	29·3	37·1
Hamburg		70·5	25	e 11 20	0	i 20 36	+ 4	e 34·3	37·3
Uccle		71·3	29	e 11 20	− 5	e 20 44	+ 2	e 30·3	35·2
Paris		72·5	31	—	—	—	—	e 34·3	39·3
Strasbourg		74·4	28	e 11 50	+ 5	e 21 30	+11	e 36·3	45·0
Coimbra	E.	75·8	43	20 15	?S	(20 15)	−80	33·9	42·9
	N.	75·8	43	—	—	i 21 42	+ 7	34·6	41·8
Vienna		77·1	23	—	—	—	—	e 40·3	57·3
Moncalieri		77·6	30	e 12 28	+23	21 57	+ 1	34·0	43·7
Rio Tinto		78·5	43	24 20	?	—	—	42·3	—
Barcelona		78·8	35	—	—	e 21 34	−36	e 33·2	43·3
Tortosa		78·8	38	—	—	—	—	e 32·3	51·2
Florence		79·8	28	33 48	?L	—	—	(33·8)	39·3
San Fernando		79·8	44	—	—	—	—	42·5	44·3
Rocca di Papa		82·1	28	e 12 33	+ 2	e 22 48	+ 1	e 41·8	52·1
Algiers		83·3	37	i 12 40	+ 2	23 14	+14	39·3	46·3
La Paz		85·8	124	12 53	+ 1	i 23 33	+ 5	41·6	52·1
Helwan		97·9	17	24 20	?S	(26 20)	+45	—	—
Riverview		109·4	240	—	—	—	—	e 42·3	55·2
Melbourne		115·8	240	—	—	—	—	e 52·3	67·3

Additional records and notes: Toronto gives iL = +19·0m. and +22·3m. Dyce gives its records at 6h. Eskdalemuir iE = +19m.31s. De Bilt MN = +37·7m. Hamburg MN = +38·3m. Uccle PR_1 = +25m.20s. (?SR_1), MN = 40·8m. Strasbourg MN = +41·6m. Moncalieri MN = +43·2m. San Fernando MN = +48·3m. Riverview MN = +54·6m.

Mar. 29d. Records also at 1h. and 6h. (La Paz), 7h. (Riverview and Moncalieri), 9h. and 11h. (Zurich), 15h. (Colombo), 18h. (La Paz), 21h. (Algiers), 22h. (near Tokyo).

Mar. 30d. 1h. 4m. 15s. Epicentre 46°·0N. 9°·0E. (as on 1918 Sept. 26d.).

$A = +\cdot686$, $B = +\cdot109$, $C = +\cdot719$.

		Δ	P.	O−C.	S.	O−C.	L.	M.
		°	m. s.	s.	m. s.	s.	m.	m.
Coire		1·0	i 0 25	+10	i 0 47	+19	—	—
Zurich	E.	1·4	e 0 21	0	i 0 39	0	—	0·7
	N.	1·4	e 0 20	− 1	i 0 40	+ 1	—	0·7
	V.	1·4	e 0 22	+ 1	i 0 41	+ 2	—	0·7
Neuchatel		1·8	0 12	−16	0 21	−30	—	—
Strasbourg		2·7	0 38	− 4	1 35	+21	(1·6)	—
Paris		5·2	e 1 52	+32	(2 15)	− 7	2·2	—
De Bilt		6·6	—	—	—	—	e 3·6	—

Mar. 30d. Records also at 8h. (Riverview and La Paz), 10h. (near Athens; and Rocca di Papa), 11h. (near Lemberg), 12h. (Taihoku), 16h. (Riverview, Simla, and La Paz), 19h. (San Fernando and Riverview), 23h. (Kodaikanal).

Mar. 31d. Records at 0h. (near Taihoku), 2h. (San Fernando and near Rocca di Papa), 4h. (La Paz), 8h. (Kodaikanal), 12h. (Florence), 15h. (Stonyhurst (2) and La Paz), 16h. (Helwan), 17h. (La Paz), 18h. (Helwan), 23h. (Riverview and near Vieques).

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