M.O. 350
(Richmond)

COPY FOR OFFICIAL USE

Air Ministry

METEOROLOGICAL OFFICE

THE OBSERVATORIES' YEAR BOOK 1931

Comprising the meteorological and geophysical results obtained from autographic records and eye observations at the observatories at Lerwick, Aberdeen, Eskdalemuir, Cahirciveen (Valentia Observatory), and Richmond (Kew Observatory), and the results of soundings of the upper atmosphere by means of registering balloons.

RICHMOND (KEW OBSERVATORY)

Published by the authority of the
METEOROLOGICAL COMMITTEE

LONDON
PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE
1933

RICHMOND (KEW OBSERVATORY).

Latitude	51° 28′ N.
Longitude	0° 19′ W.
G.M.T. of Local Mean Noon	12h. 1m.

Heights in Metres above Sea Level.

Barometer	10·4
Raingauge Site	5·5
Dines Tube Anemograph	28

Heights in Metres above Ground.

Thermometer Bulbs	3·0
Sunshine Recorder	13·3
Dines Tube Anemograph	23
Beckley Raingauge Rim	0·53

INTRODUCTION.

The Observatory was built in 1769 as the private observatory of King George III. Since 1842 it has been devoted to physics and meteorology. The meteorological records are continuous from 1854. The Observatory is in the Old Deer Park, Richmond (Surrey), about 10 miles (16 km.) to the west of the City of London. The Observatory stands on a low artificial mound whose level is about 1½ metres higher than that of the surrounding park. Round the Observatory a golf course has been laid out. The river Thames is distant about 300 metres on the north and west. Kew Gardens, which are extensively wooded, lie to the east-north-east, the nearest point of the Gardens being about 600 metres away. The town of Richmond, to the south-east, is about 1,100 metres distant. On the east side of the Park is the main road from Richmond to Kew; on the south side the railway from Richmond to Twickenham. An open area partly wooded, Syon Park, lies to the north-north-east across the river. Richmond Park is about 1½ miles (2½ km.) to the south-east. General views of the Observatory building and the exposure lawn are to be found in the 1928 volume. The photographs were taken in 1925, but the only changes (before the end of 1931) which need be noted are the substitution of other experimental screens for the small marine screens which were being tested in 1925, the removal in 1929 of the hedge near the North Wall Screen and the erection in place of the Robinson anemometer of the New Dines anemometer with its vane 5·3 metres above the dome. For the early history of the Observatory reference may be made to papers by S. P. Rigaud (The Observatory 1882, p. 279), R. H. Scott (Royal Society's Proceedings, Vol. 39 (1885), pp. 37–86), C. Chree (The Record of the Royal Society, 1897), and R. S. Whipple (Proceedings of the Optical Convention, 1926).

Table 544 gives for each month mean hourly values derived from all the days for which complete records were obtained. There were 355 such days in the year. The highest and lowest of these hourly values are in heavy type.

Table 545 gives diurnal inequalities derived from the data in Table 544 after the application of non-cyclic corrections. The principal reason for computing the diurnal inequalities was to facilitate comparison with the corresponding diurnal variations in barometric pressure and in the potential gradient of atmospheric electricity.

The mean values computed for recent years are given in the following table, together with the means for successive pairs of months. The unit is 1 mg/m³.

	1926	1927	1928	1929	1930	1931
Jan.–Feb. ..	·29	·25	·22	·40	·18	·24
Mar.–Apr. ..	·30	·10	·18	·27	·13	·15
May–June ..	·08	·07	·09	·05	·05	·06
July–Aug. ..	·07	·05	·05	·06	·07	·07
Sept.–Oct. ..	·19	·17	·15	·10	·13	·25
Nov.–Dec. ..	·26	·21	·25	·21	·29	·33
Year ..	·20	·14	·15	·18	·14	·18

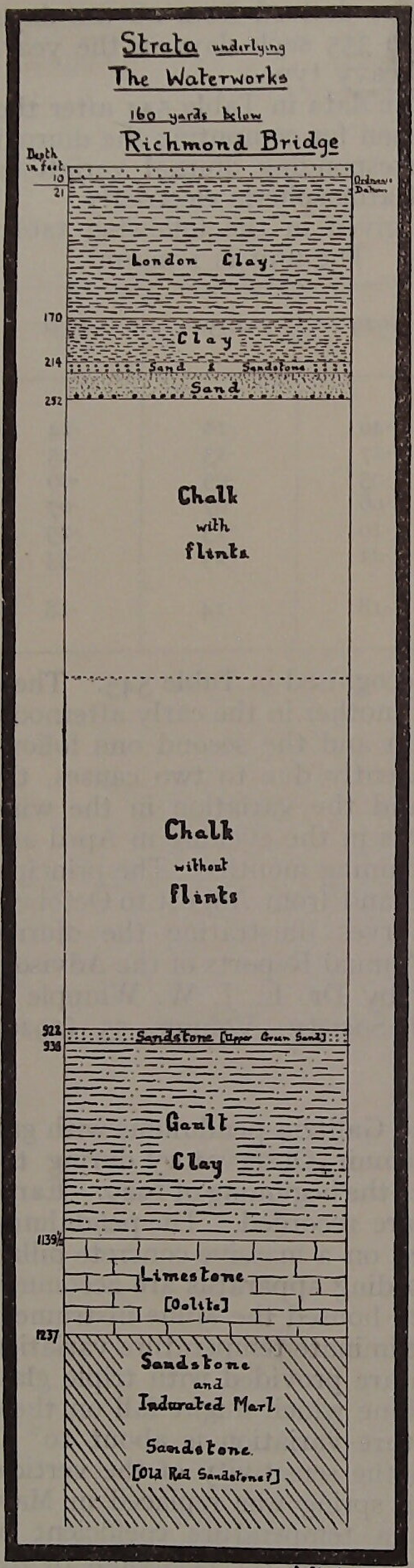
The nature of the diurnal variation is most easily recognised in Table 545. There is always a well defined minimum during the night and another in the early afternoon. The first maximum of the day usually occurs about 9h and the second one follows about 12 hours later. This double oscillation is apparently due to two causes, the variation in human activity in producing pollution and the variation in the wind which disperses it. In 1931 the principal maximum was in the evening in April and from October to December ; in the forenoon in the remaining months. The principal minimum occurred in the afternoon from May to June and from August to October ; in the early morning in the remaining months. Curves illustrating the diurnal variation of atmospheric pollution will be found in the Annual Reports of the Advisory Committee on Atmospheric Pollution and in a paper by Dr. F. J. W. Whipple in the Quarterly Journal of the Royal Meteorological Society, Volume 55 (1929), No. 231.

SEISMOLOGY.

Notes on Instruments.—The seismographs, three Galitzin pendulums with galvanometric registration, were transferred from Eskdalemuir Observatory during the latter part of 1925 and have been in regular operation since the beginning of 1926. Earth movements in the north, east and vertical directions are recorded. The pendulums, which are in the old magnetograph room, are mounted on a massive concrete pillar, separated from the floor. The galvanometers and recording apparatus are accommodated on slate slabs in the old seismograph room, which housed the Milne instrument until it was put out of action on June 17th, 1925. To eliminate temperature variation as far as possible, the windows of the pendulum room are provided with triple glass and also shielded by louvred screens from direct sunshine which might fall on them morning and evening. The annual range of temperature variation is about 10° C. and the mean daily range about 0·2° C. To diminish the sensitivity of the vertical pendulum to temperature changes the steel controlling spring was replaced in May, 1928, by one made of elinvar, an alloy which has a temperature coefficient of elasticity about one-tenth that of steel.* A detailed report on the behaviour of the spring has been published in a paper† by F. J. Scrase. The difficulties usually associated with the operation of the vertical pendulum have been greatly diminished.

* Y. Dammann. "Contribution à l'étude des propriétés élastiques de l'élinvar. Son utilisation dans les séismographes," *Publ. Bur. Cent. Seis. Int., Strasbourg*, Ser. A, Fasc. No. 5, 1927, pp. 122–129.

† *London, Inst. Physics, J. Sci. Instr.*, **6**, 1929, p. 385.



A. Strahan
Prof. Paper No 10, Survey of India.

The concrete pillar rests on gravel. The underlying geological strata are shown in the diagram on this page. The diagram is based on the results obtained* in sinking a well near Richmond Bridge. The Richmond boring terminated at a depth of 440 metres in Old Red Sandstone. At Stonebridge Park, 8 km. to the north, a boring was carried down † to a depth of 600 metres, the last 280 metres being in Old Red Sandstone. There is no information as to deeper strata near Richmond. It may be noted, however, that the sandstone beds dip at about 30° and that a boring at Little Missenden, Bucks, entered Silurian rocks at a depth of 370 metres with no evidence of the presence of Old Red Sandstone.

For detailed description of the Galitzen seismograph and for particulars of interpretation of the records, reference may be made to Fürst B. Galitzin's "Vorlesungen über Seismometrie" (Leipzig, 1914), or to G. W. Walker's "Modern Seismology" (London, 1913).††

Timing is controlled by a half-seconds clock (Morrison 8587) which is rated daily by comparison with the Greenwich wireless time-signal relayed from Daventry. Time breaks are made electro-magnetically every minute and seismometric readings can be determined to the nearest second.

The free periods of the galvanometers (T_1), were determined in November, 1925, and were found to have suffered very little change since the original determinations at Eskdalemuir were made. The lengths of the simple equivalent pendulums (l), are assumed to have remained unaltered.

The values of the other constants which are used for deriving the scale values were determined in September for the vertical pendulum, and in October for the horizontal instruments. In the case of the horizontal instruments it was found that the magnifications agreed closely with those obtained from the previous tests in September 1930. Some adjustments to the vertical pendulum were carred out on September 30th.

The table given below summarises the values of the constants. T is the free period of the pendulum, μ is a damping coefficient which vanishes when the free movement of the pendulum is just aperiodic, A is the length of the beam of light from the galvanometer mirror to the recording drum (usually about 1100 mm), and k is the "transmission" factor. The quantity $\frac{kA}{\pi l}$ may be regarded as a relative measure

* *London. J. Geol. Soc.*, **40**, 1884, **41**, 1885, p. 523.
† Records of London Wells, *Mem. Geol. Surv. Eng., London*, 1913.
†† The graphical method adopted at Kew for determining the constants of the pendulums is explained in a memoir by F. J. Scrase, *Geophysical Memoirs*, No. 49, 1930.

of the nominal magnification. With the instrument properly adjusted $\frac{kAT}{4\pi l}$ is the magnification factor for regular earth movements with a period equal to that of the pendulum.

Component	l	T_1	1931	T	μ^2	$\frac{kA}{\pi l}$	$\frac{kAT}{4\pi l}$
	mm.	sec.		sec.		sec.$^{-1}$	
N	118	24·68	Jan. 1 to Oct. 8	25·2	−0·01	47·3	298
			Oct. 8 to Dec. 31	25·0	+0·01	46·2	289
E	118	24·80	Jan. 1 to Oct. 8	25·2	−0·04	44·2	278
			Oct. 8 to Dec. 31	24·9	+0·02	44·0	274
Z	360	13·04	Jan. 1 to Sept. 30	13·5	+0·12	106	358
			Sept. 30 to Dec. 31	12·6	+0·02	114	359

In windy weather the seismographs, especially the horizontal components, are affected by slow oscillations, which are attributed to the tilting of the ground, the movement being conveyed through the foundations of the Observatory. On occasions the reading of an earthquake record is rendered very difficult, if not impossible, by these irregular disturbances.

Notes on Tables.—The *Seismological Diary*, Table 546, contains the particulars of the earthquakes recorded at the Observatory. The notation employed is as follows :—

P is the normal first phase (longitudinal waves). Special cases of P occur when the waves are reflected from (P_cP) or penetrate (P′) the earth's central core.

PR_1, PR_2 . . . are longitudinal waves reflected once, twice . . . near the earth's surface.

S is the normal second phase (transverse waves). S_cP_cS is a special case of S in which the waves penetrate the central core and pass through it as longitudinal vibrations.

PS and PPS are waves which suffer a change or changes from longitudinal to transverse oscillation or vice versâ, on reflection near the surface.

SR_1, SR_2 . . . are transverse waves reflected once, twice . . . near the surface.

L indicates long waves (surface waves).

i is the sudden commencement of a phase. *e* means a gradual or indistinct commencement. These letters are used as prefixes to the phase symbols, but where the character of the phase is not assignable the letters are used as independent symbols. When the commencement of a phase is moderately clear the prefixes are not used.

The suffixes N, E, Z indicate that the estimates refer to the records from the north-south, east-west and vertical seismographs respectively. The absence of all these suffixes indicates that the estimates refer to all three records.

All times entered against the above phases are the times of arrival of the phases at the station.

m_1, m_2 . . . are successive prominent maxima of sinusoidal waves occurring in the preliminary phases. M_1, M_2 . . . are successive prominent maxima occurring during the principal or surface phase.

The period is the duration of a double oscillation (to and fro movement).

A_N, A_E, A_Z are the amplitudes, in microns (μ=0·001 mm.), of the components of the true displacement of the ground from the position of rest. Displacements to the north, east and upwards are regarded as being positive. When successive positive and negative displacements have the same magnitude the time of occurrence is given for the positive one. When no sign is given the measurement refers to a long group of waves the amplitudes of which are the same.

The following formulæ due to Galitzin are employed for computing the times of the maxima and the amplitudes of sinusoidal waves :—

(1) Lag of the displacement shown by the galvanometer after the maximum displacement of the ground

$$\tau+\tau_1=\frac{T_p}{2\pi}\left[\tan^{-1}\frac{2u\,(1-\mu^2)^{\frac{1}{2}}}{u^2-1}+\tan^{-1}\frac{2u_1}{u_1^2-1}+\frac{\pi}{2}\right]$$

each inverse tangent being taken as between 0 and π.

(2) Magnification of record =

$$\frac{kA\,T_p}{\pi l}\cdot\frac{1}{(1+u^2)(1+u_1^2)\{1-\mu^2 f(u)\}^{\frac{1}{2}}}$$

where T_p is the period of the earth wave considered,

$$u=\frac{T_p}{T},\quad u_1=\frac{T_p}{T_1},\quad \text{and } f(u)=\left[\frac{2u}{1+u^2}\right]^2.$$

Δ is the distance in kilometres of the epicentre measured along the arc of a great circle. For earthquakes located within 10,000 km. of Kew the distance is generally derived from the interval between P. and S. by the tables, due to Zeissig, given in Klotz's "Seismological Tables" (Publication of the Dominion Observatory, Ottowa, Vol. III, No. 2). For greater distances other phases are considered and Δ is obtained from the travel curves given by Gutenbeig.* The azimuth of the epicentre (0° to 360°) is measured from north through east. When an estimation of the azimuth is possible, it is used, together with Δ, for provisional determination of the co-ordinates of the epicentre. The co-ordinates given in the Diary have generally been received at a later date ; the authorities for these determinations are inserted in brackets. Here the letters J.S.A. signify the Jesuit Seismological Association of America, and U.S.C.G.S. the United States Coast and Geodetic Survey.

Brackets enclosing figures or phase symbols indicate that the information is uncertain.

The total number of shocks recorded during the year was 274. The phases being sufficiently well defined, estimates of the epicentral distances were obtained for 53 shocks, whilst in 11 cases the records of the initial impulses were sufficiently sharp to allow of computations of azimuth and so of estimates of the co-ordinates of the epicentres. There were 16 earthquakes which produced a disturbance at the observatory with an amplitude exceeding 0·1 mm. in a horizontal component. These earthquakes originated in Mexico (January 15th), in Northern Burma (January 27th), in the Pacific Ocean north of New Guinea (January 28th), in New Zealand (February 2nd and 13th), in the Balkans (March 8th), in Japan (March 9th, November 2nd), in the Atlantic Ocean between Madeira and Portugal (May 20th), in the North Sea (June 7th), in Mongolia (August 10th and 18th), in Baluchistan (August 24th and 27th), near Sumatra (September 25th), in the Solomon Islands (October 3rd).

The epicentre of the earthquake of June 7th was about 60 miles from the coasts of Yorkshire and Norfolk. The shock was felt in the Channel Islands, in the north of France, in Belgium, Holland and Denmark, and in Germany at places as far away as Hamburg and Brunswick. As far as is known no earthquake has ever been felt over such a large area in the neighbourhood of the British Isles.†

For comparison the statistics for all the years in which the Galitzin seismographs have been in operation at Kew Observatory are given :—

YEAR.	Shocks recorded.	Epicentral distances.	Azimuths. estimated	Shocks exceeding 0·1 mm.
1926	306	55	—	10
1927	314	78	6	9
1928	339	97	19	18
1929	320	74	6	12
1930	301	56	6	8
1931	274	53	11	16

* Handbuch der Geophysik, Berlin, 1929, p. 212.

† Report on Seismological Investigations. British Association, 1931.

Microseisms.—In Table 547 are given the amplitude (A) and period (T_p) of the microseisms shown by the north component seismograph on each day at 0h, 6h, 12h, and 18h. On a few occasions (less than 2 per cent. of the total number) when the north component record was not available measurements of the east component record have been included. The group of waves of greatest amplitude occurring in the 30 minutes centring at the hour in question is selected, and the amplitude tabulated is the mean obtained from the three largest complete waves in that group. The period is derived from a measurement made on the same group*, but the procedure adopted in 1926 and 1927 was slightly modified from January 1st, 1928, in order to diminish the tendency on the part of the tabulator to give preference to certain periods. The total time, to the nearest second, for a number of complete consecutive waves is measured, the number of waves being chosen so that the time is between 23 and 30 seconds. The period is then derived from the following division table :—

Number of Waves.	Time interval in seconds.							
	30	29	28	27	26	25	24	23
3	10	9·7	9·3	9·0	8·7	8·3	8·0	7·7
4	7·5	7·3	7·0	6·7	6·5	6·3		
5	6	5·8	5·6	5·4	5·2			
6	5	4·8	4·7	4·5				
7	4·3	4·1	4·0	3·9				
8	3·7	3·6	3·5					
9	3·3	3·2	3·1					
10	3·0	2·9	2·8					
11	2·7	2·6						
12	2·5							

In computing the mean period occasions of zero amplitude are omitted. The mean values of amplitude and period for each month of 1931 and for the year, together with the corresponding mean values for the period 1926 to 1930, are given below :—

MICROSEISMS—MONTHLY AND ANNUAL MEANS.

1926 to 1930.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Amplitude (μ)	2·4	1·8	1·5	1·0	0·5	0·6	0·4	0·6	0·7	1·2	1·9	2·1	1·2
Period (sec.)	6·6	6·2	5·9	5·4	4·8	4·6	4·3	4·5	4·9	5·3	6·0	6·4	5·4
1931.													
Amplitude (μ)	1·5	1·8	0·9	0·5	0·5	0·4	0·3	0·5	0·3	0·8	1·7	1·9	0·9
Period (sec.)	5·9	6·3	5·3	5·3	4·7	4·3	4·4	4·3	5·2	5·8	6·1	6·5	5·3

The means for the several hours are as follows :—

MICROSEISMS—MEANS AT SPECIFIED HOURS.

1926 to 1930.	0h. (G.M.T.)	6h.	12h.	18h.
Amplitude (μ)	1·25	1·24	1·21	1·24
Period (sec.)	5·43	5·43	5·38	5·42
1931.				
Amplitude (μ)	0·96	0·96	0·87	0·91
Period (sec.)	5·32	5·28	5·35	5·37

These figures indicate that there is no regular diurnal variation in amplitude or period of the microseisms recorded at Kew Observatory.†

* F. J. W. Whipple and F. J. Scrase, " On the Frequency of Microseisms of Different Periods at Eskdalemuir and at Kew," *London, Mon. Not. R. Astr. Soc. Geophys. Supp.* **2**, No. 2, 1928.

† F. J. W. Whipple and A .W. Lee, "Studies in Microseisms," *London, Mon. Not. R. Astr. Soc. Geophys. Supp.* **2**, No. 7, 1931.

International Seismological Centre

SEISMOLOGICAL DIARY.—*continued.*

Galitzin Seismographs, three components.

546. Richmond (Kew Observatory). Lat. 51° 28′ N. Long. 0° 19′ W. Height above M.S.L. 5 metres. **1931.**

Date.	Phase.	Time. G.M.T.	Period	Amplitudes. A_N.	A_E.	A_Z.	△	Remarks.
Sept.		h. m. s.	s.	μ	μ	μ	km.	
23	eL	13 39	...	...	...	...	...	
	F	50	...	...	...	...	...	
25	ePz	6 13 46	...	...	...	...	10890	Near Sumatra.
	ezE	14 5	...	...	...	...	...	4·5° S., 101·5° E.
	ePR_1zE	18 4	...	...	...	...	...	(Strasbourg).
	ePR_2z	20 22	...	...	...	...	...	
	eScPcSNE	24 28	...	...	...	...	...	
	eSN	25 22	...	...	...	...	...	
	iPSEz	27 13	...	...	...	...	...	
	ePPSNz	28 3	...	...	...	...	...	
	iSR_1N	32 45	...	...	...	...	...	
	iSR_1E	33 3	...	...	...	...	...	
	izE	6 33 42	...	...	...	...	...	
	eN	36 17	...	...	...	...	...	
	iSR_2N	37 47	...	...	...	...	...	
	LN	41 59	...	...	...	...	...	
	LE	44 57	...	...	...	...	...	
	Lz	49 55	...	...	...	...	...	
	M_1	51 32	33	+115	...	...	...	
	M_2	57 38	26	−130	...	...	...	
	M_3	57 39	...	...	+89	...	...	
	M_4	7 3 52	22	+120	...	...	...	
	M_5	7 36	20	...	+150	...	...	
	M_6	8 25	22	−130	...	...	...	
	M_7	9 30	21	...	...	>+135†	...	†Negative maxima off chart.
	M_8	9 36	21	...	+150	...	...	
	M_9	15 2	19	...	−80	...	...	
	F	10 20	...	...	...	...	...	
25	e	18 9	...	...	...	...	...	
	F	30	...	...	...	...	...	
25	e	22 5	...	...	...	...	...	
	F	23 0	...	...	...	...	...	
26	ez	20 15 22	...	...	...	...	...	Pacific Ocean off Guatemala.
	eL	33	...	...	...	...	...	
	M_1	46 30	20	...	+12	...	...	12° N., 91° W.
	M_2	46 34	20	...	...	+11	...	(U.S.C.G.S.).
	F	21 40	...	...	...	...	...	No records :—28ᵈ 9ʰ 2ᵐ to 16ʰ 55ᵐ.
28	e	18 21	...	...	...	...	...	
	F	35	...	...	...	...	...	
29	eE	6 10	...	...	...	...	...	No records :—29ᵈ 9ʰ 17ᵐ to 15ʰ 58ᵐ and 30ᵈ 9ʰ 2ᵐ to 16ʰ 10ᵐ, during standardisation, etc.
	eL	18	...	...	...	...	...	
	F	35	...	...	...	...	...	
Oct. 1	eL	12 24	...	...	...	...	...	California.
	M_1	30 9	22	...	+ 8	...	...	29·8° N., 115·2° W.
	M_2	32 33	17	− 8	...	...	...	(J.S.A.).
	F	13 10	...	...	...	...	...	
3	iP^1z	19 32 52	...	...	...	...	(16000)	Confused by microseisms.
	iz	33 44	...	...	...	...	...	
	iPR_1z	35 24	...	...	...	...	...	Solomon Islands.
	ePR_1NE	35 42	...	...	...	...	...	10° S., 161·4° E.(J.S.A.)
	iN	35 51	...	...	...	...	...	Possibly more than one shock.
	iNE	36 43	...	...	...	...	...	
	IN	38 25	...	...	...	...	...	
	eE	42 29	...	...	...	...	...	
	iE	46 7	...	...	...	...	...	
	iz	47 59	...	...	...	...	...	
	i	49 13	...	...	...	...	...	
	i	51 37	...	...	...	...	...	
	izE	53 15	...	...	...	...	...	
	iN	53 59	...	...	...	...	...	
	iE	54 11	...	...	...	...	...	
	L	20 5	...	...	...	...	...	
	M_1	20 0	34	...	−330	...	...	
	M_2	22 35	31	...	−340	...	...	
	M_3	23 8	28	−350	...	...	...	
	M_4	24 38	25	...	+330	...	...	
	M_5	29 46	23	−320†	...	...	...	†Positive maxima off chart.
	M_6	30 50	22	...	...	−260	...	
	M_7	32 58	24	+330†	...	...	...	Overlapped by next shock.
	F	?	...	...	...	...	...	

Date.	Phase.	Time. G.M.T.	Period	Amplitudes. A_N.	A_E.	A_Z.	△	Remarks.
Oct.		h. m. s.	s.	μ	μ	μ	km.	
3	eLNE	23 2	...	...	...	...	...	Repetition of preceding shock.
	eLz	9	...	...	...	...	...	
	M_1	11 35	27	...	−30	...	...	
	M_2	12 53	24	−32	...	...	...	
	F	?	...	...	...	...	...	Overlapped by next shock.
3/4	iz	23 30 3	...	...	...	...	...	Further repetition.
	i	32 45	...	...	...	...	...	
	eNE	33 11	...	...	...	...	...	
	eE	41 41	...	...	...	...	...	
	eNE	44 37	...	...	...	...	...	
	ez	49 53	...	...	...	...	...	
	eL	54	...	...	...	...	...	
	M_1	57 41	27	...	−46	...	...	
	M_2	0 4 30	24	+60	...	...	...	
	M_3	4 35	24	...	...	−61	...	
	M_4	6 52	22	...	+38	...	...	
	M_5	7 33	23	−55	...	...	...	
	F	1 50	...	...	...	...	...	
5	iPz	22 40 12	...	...	...	...	5380	Turkestan (Strasbourg)
	i	40 59	...	...	...	...	...	Possibly more than one shock.
	ezE	42 53	...	...	...	...	...	
	iS	47 15	...	...	...	...	...	
	LNE	48	...	...	...	...	...	
	ez	48 22	...	...	...	...	...	
	eE	48 47	...	...	...	...	...	
	iz	48 51	...	...	...	...	...	
	Lz	52	...	...	...	...	...	
	M_1	52 12	19	...	+13	...	...	
	M_2	52 20	13	...	...	+ 8	...	
	eN	52 28	...	...	...	...	...	
	M_3	23 2 28	19	+12	...	...	...	
	M_4	5 20	15	...	− 8	...	...	
	F	35	...	...	...	...	...	
8	—	— — —	...	...	...	...	...	No records 9ʰ 44ᵐ to 17ʰ 15ᵐ ; standardisation, etc.
9/10	—	— — —	...	...	...	...	...	No records 23ʰ 55ᵐ to 7ʰ 17ᵐ ; lights failed.
10	eL	17 1	...	...	...	...	...	
	M_1	18 49	18	...	+12	...	...	
	M_2	23 15	17	+10	...	...	...	
	M_3	23 46	13	...	...	− 7	...	
	F	18 10	...	...	...	...	...	
12	eLNE	4 6	...	...	...	...	...	
	eLz	18	...	...	...	...	...	
	F	5 15	...	...	...	...	...	
12	eL	14 32	...	...	...	...	...	
	F	15 5	...	...	...	...	...	
13	eL	5 41	...	...	...	...	...	
	F	6 40	...	...	...	...	...	
13	eL	12 42	...	...	...	...	...	Very small.
	F	55	...	...	...	...	...	
14	e	7 35	...	...	...	...	...	Very small.
	F	25	...	...	...	...	...	
18	$e(P^1)$z	0 58 12	...	...	...	...	...	
	e	1 0 58	...	...	...	...	...	
	e	1 44	...	...	...	...	...	
	eLNE	43	...	...	...	...	...	
	eLz	52	...	...	...	...	...	
	M	54 53	23	− 5	...	...	...	
	F	2 55	...	...	...	...	...	
18	$i(P^1)$z	4 49 33	...	...	...	...	...	
	i	49 59	...	...	...	...	...	
	eE	5 12 38	...	...	...	...	...	Probably deep focus.
	eE	13 47	...	...	...	...	...	No surface waves.
	eE	15 47	...	...	...	...	...	
	eE	18 45	...	...	...	...	...	
	F	6 30	...	...	...	...	...	
18	eL	7 47	...	...	...	...	...	
	F	8 5	...	...	...	...	...	

SEISMOLOGICAL DIARY.—*continued.*

Galitzin Seismographs, three components.

546. Richmond (Kew Observatory). Lat. 51° 28′ N. Long. 0° 19′ W. Height above M.S.L. 5 metres. **1931.**

Date.	Phase.	Time. G.M.T.	Period	Amplitudes. A_N.	A_E.	A_Z.	△	Remarks.
Oct.		h. m. s.	s.	μ	μ	μ	km.	
23	$e(P^1)_Z$	20 28 43	...	...	...	...	...	
	eL_{NE}	21 16	...	...	...	...	...	
	eL_Z	21	...	...	...	...	...	
	F	22 20	...	...	...	...	...	
26	eL_{NE}	5 3	...	...	...	...	...	Pacific Ocean off
	M_1	5 47	15	+ 4	...	...	...	Mexico.
	eL_Z	7	...	...	...	...	...	20° N., 107° W.
	M_2	12 31	18	...	...	− 9	...	(U.S.C.G.S.).
	M_3	12 59	18	...	+ 9	...	...	
	F_3	40	...	...	...	...	...	
26	eL	13 1	...	...	...	...	...	
	F	30	...	...	...	...	...	
27	eL	2 20	...	...	...	...	...	
	F	35	...	...	...	...	...	
28	eL_{NE}	6 22	...	...	...	...	...	
	eL_Z	31	...	...	...	...	...	
	M_1	34 31	17	+ 9	...	...	...	
	M_2	34 35	16	...	...	− 9	...	
	F	7 0	...	...	...	...	...	
Nov. 1	eL	13 34	...	...	...	...	...	
	F	45	...	...	...	...	...	
1	eP_{ZN}	19 5 57	...	...	...	...	...	
	$eScPcS_{NE}$	16 18	...	...	...	...	...	
	L_{NE}	35	...	...	...	...	...	
	L_Z	40	...	...	...	...	...	
	M_1	42 22	21	−10	...	...	...	
	M_2	49 54	16	...	+12	...	...	
	M_3	49 49	15	...	...	−13	...	
	F	20 30	...	...	...	...	...	
2	eP_{ZN}	0 44 33	...	...	...	...	8850	Destructive at Oaxaca,
	iS	54 36	...	...	...	...	...	Mexico.
	L_N	1 7	...	...	...	...	...	15·7° N., 96·2° W.
	L_{ZE}	11	...	...	...	...	...	(J.S.A.).
	M_1	14 37	24	−12	...	...	...	
	M_2	16 7	25	...	...	+30	...	
	M_3	16 25	24	...	+27	...	...	
	F	3 15	...	...	...	...	...	
2	iP_Z	10 15 42	...	...	...	...	9400	Compression.
	i	15 47	...	...	...	...	...	Destructive in Japan-
	PR_1	19 0	...	...	...	...	...	ese Islands of Kyushu
	PR_2	21 3	...	...	...	...	...	and Shikoku.
	ez	26 1	...	...	...	...	...	Near 32° N., 132° E.
	iS_{NE}	26 12	...	...	...	...	...	(J.S.A.).
	i_N	27 32	...	...	...	...	...	
	i_E	27 46	...	...	...	...	...	
	SR_{1NE}	31 46	...	...	...	...	...	
	$ePcPPcP_Z$	33 15	...	...	...	...	...	
	i_{NE}	33 21	...	...	...	...	...	
	SR_{2NE}	36 6	...	...	...	...	...	
	L_{NE}	10 37	...	...	...	...	...	
	L_Z	45	...	...	...	...	...	
	M_1	50 56	23	...	−220	...	...	*Positive maxima off
	M_2	52 8	22	−185	...	...	...	chart.
	M_3	54 30	24	...	−210	...	...	
	M_4	58 29	19	+190*	...	...	...	
	M_5	59 34	17	...	−210	...	...	
	M_6	59 38	16	...	...	+240*	...	
	M_7	11 1 58	17	...	...	−185	...	
	M_8	4 55	20	−145	...	...	...	
	M_9	6 46	18	...	−120	...	...	
	F	14 20	...	...	...	...	...	
2	e	15 6	...	...	...	...	...	Very small
	F	10	...	...	...	...	...	

Date.	Phase.	Time. G.M.T.	Period	Amplitudes. A_N.	A_E.	A_Z.	△	Remarks.
Dec.		h. m. s.	s.	μ	μ	μ	km.	
2	ePR_{1Z}	17 24 19	...	...	...	...	...	
	eSR_{1NE}	41 27	...	...	...	...	...	
	eSR_{2E}	46 37	...	...	...	...	...	
	L_N	55 7	...	...	...	...	...	
	L_E	59	...	...	...	...	...	
	M_1	18 9 27	25	...	−14	...	...	
	M_2	9 42	27	−16	...	...	...	
	L_Z	10	...	...	...	...	...	
	M_3	22 52	22	...	...	− 9	...	
	eL_2	55	...	...	...	...	...	Via Antipodes.
	M	19 3 5	18	+ 7	...	...	...	
	F	40	...	...	...	...	...	
3	eL	17 0	...	...	...	...	...	
	F	30	...	...	...	...	...	
4	eL	18 35	...	...	...	...	...	
	F	55	...	...	...	...	...	
5	—	— — —	...	...	...	...	...	No records 9^h 40^m to 15^h 15^m.
18	e_N	4 53	...	...	...	...	...	
	eL	57	...	...	...	...	...	
	F	6 0	...	...	...	...	...	
20	ePR_1	14 38 45	...	...	...	...	...	
	ePcPcS	39 32	...	...	...	...	...	Solomon Islands.
	ePS_{NE}	49 1	...	...	...	...	...	8° S., 161° E. (J.S.A.).
	ePPS	50 38	...	...	...	...	...	
	eSR_{1E}	56 32	...	...	...	...	...	
	L_{NE}	15 13	...	...	...	...	...	
	L_Z	22	...	...	...	...	...	
	M_1	25 44	32	+22	...	...	...	
	M_2	27 56	24	...	+20	...	...	
	M_3	32 13	25	...	−24	...	...	
	M_4	32 33	25	...	...	−33	...	
	M_5	33 19	25	+31	...	...	...	
	F	16 30	...	...	...	...	...	
24	eL	9 41	...	...	...	...	...	
	F	55	...	...	...	...	...	
Dec. 1	eL	4 45	...	...	...	...	...	
	M	55 31	20	+10	...	...	...	
	F	5 20	...	...	...	...	...	
1	e_N	19 12	...	...	...	...	...	
	L_N	28	...	...	...	...	...	
	L_{EZ}	39	...	...	...	...	...	
	M	42 2	23	+ 8	...	...	...	
	F	20 20	...	...	...	...	...	
2	e	21 58	...	...	...	...	...	
	F	22 10	...	...	...	...	...	
6	e	23 37	...	...	...	...	...	
	F	55	...	...	...	...	...	
15	e	3 30	...	...	...	...	...	Felt in Italy.
	F	35	...	...	...	...	...	
18	eL_{NE}	10 47	...	...	...	...	...	
	eL_Z	53	...	...	...	...	...	
	M	58 5	21	...	− 6	...	...	
	F	11 20	...	...	...	...	...	
21	e	12 5	...	...	...	...	...	Very small.
	F	10	...	...	...	...	...	
25	eL	4 29	...	...	...	...	...	
	F	5 0	...	...	...	...	...	
26	e	2 29	...	...	...	...	...	Very small.
	F	45	...	...	...	...	...	
31	e	0 47	...	...	...	...	...	
	F	1 50	...	...	...	...	...	

Derived from readings for the period of thirty minutes centring at the exact hour, Greenwich Mean Time.

547. Richmond (Kew Observatory). **1931.**

Month	January.							
Hour G.M.T.	0 h.		6 h.		12 h.		18 h.	
	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.
Day.	μ	s.	μ	s.	μ	s.	μ	s.
1	3·0	6·0	2·8	6·0	1·9	7·5	2·6	8·3
2	2·3	6·3	1·9	6·7	2·1	5·8	2·2	7·0
3	1·7	6·7	...	...	1·2	6·0	1·0	6·5
4	1·4	6·3	1·2	5·8	1·8	5·2	1·2	5·8
5	1·7	5·6	1·1	5·6	1·5	5·4	0·8	5·6
6	0·9	5·4	1·5	6·7	1·5	6·7	1·4	7·0
7	1·5	6·5	1·1	6·7	0·9	6·7	0·8	6·5
8	0·4	6·3	0·4	6·0	0·2	6·0	0·2	5·4
9	0·2	4·7	0·2	6·0	0·2	5·0	0·2	5·2
10	0·2	5·2	0·2	5·0	0·2	5·6	0·2	5·4
11	0·2	5·2	0·2	5·4	0·2	5·2	0·2	5·0
12	0·3	4·3	0·3	4·1	0·5	4·8	1·5	5·4
13	1·1	5·0	0·9	5·2	1·1	5·0	1·4	5·8
14	1·9	5·6	1·4	5·8	0·6	5·8	0·4	5·4
15	0·2	5·4	0·2	4·7	0·7	4·7	1·1	5·6
16	...	...	1·2	6·0	1·9	6·3	2·2	6·0
17	3·3	7·5	3·8	7·0	3·4	7·0	1·7	7·3
18	2·3	5·8	1·7	6·5	1·8	6·0	1·7	6·3
19	1·9	7·5	2·1	5·8	1·8	6·0	2·3	6·3
20	1·9	6·3	1·5	6·7	1·5	6·7	1·6	5·8
21	1·4	6·0	1·1	5·2	1·0	6·0	0·8	6·3
22	1·1	5·4	0·9	5·4	0·7	4·5	1·5	4·5
23	1·0	5·8	1·8	6·0	2·0	6·0	2·4	6·0
24	2·3	6·3	2·5	5·8	2·3	5·0	2·0	6·7
25	1·9	5·6	2·4	5·4	1·6	6·0	1·8	6·0
26	2·4	5·4	2·3	5·8	1·9	5·6	2·1	5·8
27	1·9	5·8	1·7	5·6	1·5	5·6	1·5	5·6
28	1·7	5·4	2·3	5·6	2·0	6·7	1·9	6·5
29	...	...	2·8	6·0	3·3	6·7	2·4	7·0
30	2·3	6·5	1·7	6·3	1·4	6·0	1·2	4·7
31	0·5	4·8	0·5	4·5	1·9	5·8	2·0	6·0
Mean ...	1·5	5·8	1·5	5·8	1·4	5·9	1·4	6·0
Mean for day ...	A = 1·5μ ; Tp = 5·9s.							

Month	February.							
Hour G.M.T.	0 h.		6 h.		12 h.		18 h.	
	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.
Day.	μ	s.	μ	s.	μ	s.	μ	s.
1	2·9	6·3	3·0	6·0	2·6	5·4	2·2	6·0
2	2·8	6·0	2·1	6·3	1·9	5·8	1·5	5·6
3	...	...	0·9	5·0	0·9	5·0	0·8	6·0
4	0·6	5·6	0·6	5·6	0·6	6·5	0·7	6·7
5	1·3	6·7	2·1	7·5	2·1	7·5	1·8	7·0
6	2·0	6·0	1·9	6·7	1·7	6·3	1·5	6·5
7	1·1	5·2	1·0	5·8	0·9	5·2	1·2	6·0
8	0·8	5·8	0·9	5·0	0·9	5·4	1·1	5·2
9	1·1	5·0	0·8	5·6	1·9	6·7	2·3	7·3
10	2·4	7·5	2·1	7·5	2·2	7·0	1·9	6·5
11	1·9	6·3	2·3	6·3	1·9	6·3	2·2	6·7
12	5·1	7·0	6·4	7·5	4·3	8·3	3·8	8·0
13	2·5	7·0	3·4	4·3	1·9	6·7	1·9	6·7
14	2·0	6·0	1·7	5·4	0·7	5·2	1·1	5·0
15	1·2	6·3	1·2	6·3	1·9	7·7	3·4	7·7
16	3·7	7·7	4·6	7·7	3·5	7·3	3·7	7·3
17	3·6	7·0	2·0	6·7	1·7	6·3	2·1	6·5
18	1·6	6·0	1·3	5·6	1·1	5·4	1·2	5·8
19	0·5	5·0	0·2	4·8	0·5	5·0	0·4	6·0
20	1·5	6·7	...	...	1·7	7·5	2·0	7·7
21	2·9	7·5	2·9	7·5	2·5	6·5	1·6	7·0
22	1·7	6·3	1·9	6·7	1·9	6·5	1·8	7·0
23	1·9	6·7	1·9	6·3	0·8	6·3	0·4	6·3
24	0·8	6·0	0·4	6·5	0·4	5·6	0·4	5·6
25	0·4	5·4	0·9	5·4	0·4	7·0	0·8	5·6
26	0·9	5·0	0·5	4·8	1·1	6·5	1·5	6·7
27	1·6	7·3	1·7	6·7	1·7	6·7	1·7	6·3
28	1·4	5·8	1·4	6·0	1·8	6·0	2·1	6·5
29								
30								
31								
Mean ...	1·9	6·3	1·6	6·1	1·6	6·3	1·7	6·5
Mean for day ...	A = 1·8μ ; Tp = 6·3s.							

Month	March.							
Hour G.M.T.	0 h.		6 h.		12 h.		18 h.	
	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp
Day.	μ	s.	μ	s.	μ	s.	μ	s.
1	1·7	6·7	2·1	5·6	1·5	5·6	2·2	6·7
2	2·6	7·5	1·9	7·5	1·7	6·5	0·7	7·0
3	0·8	6·0	1·1	7·3	0·6	6·0	1·1	6·5
4	1·0	6·0	0·6	5·6	0·7	5·4	0·6	5·8
5	1·1	5·4	0·9	5·0	0·5	4·5	0·5	4·3
6	1·0	4·3	1·9	4·1	2·0	4·5	3·2	5·0
7	3·9	5·4	6·7	5·2	3·8	5·6	2·2	5·2
8	2·0	5·2	2·1	4·8	1·5	4·7	1·7	4·8
9	2·0	5·4	...	...	1·3	5·6	1·9	6·5
10	2·5	5·0	1·9	6·7	0·5	7·0	0·8	6·5
11	0·6	6·5	0·4	6·7	0·6	6·5	0·2	5·2
12	0·2	5·2	0·2	4·7	...	...	0·2	4·8
13	0·3	4·5	0·4	5·2	0·2	5·0	0·2	4·7
14	0·5	5·0	0·4	5·6	0·2	6·0	0·4	5·8
15	1·1	5·4	2·1	5·6	2·3	5·8	1·9	6·5
16	3·6	7·0	2·5	6·3	1·4	6·3	2·0	5·2
17	0·7	5·2	0·7	4·5	0·5	5·0	0·3	3·7
18	0·2	5·0	0·5	4·8	0·2	5·0	0·5	4·8
19	0·2	4·7	0·4	5·4	0·2	5·0	0·3	4·3
20	0·2	4·7	0·5	4·7	0·3	4·5	0·5	4·3
21	0·5	4·8	0·5	4·5	0·2	4·8	0·3	4·3
22	0·3	4·5	0·2	4·8	0·3	4·3	0·3	4·0
23	0·3	4·3	0·3	4·3	0·0	—	0·2	4·7
24	0·0	—	0·2	5·4	0·0	—	0·2	4·7
25	0·2	6·0	0·3	4·3	0·2	4·7	0·2	5·0
26	0·4	5·6	0·4	5·4	0·2	5·6	0·3	4·3
27	0·3	3·7	0·2	5·6	0·2	5·2	0·2	6·0
28	0·6	5·6	0·4	5·8	0·6	6·0	1·8	5·0
29	1·1	5·4	1·6	5·8	1·7	4·7	1·8	4·3
30	1·7	4·5	0·5	4·0	0·3	4·0	0·3	4·0
31	0·3	3·5	0·3	4·0	0·3	4·0	0·5	4·3
Mean ...	1·0	5·3	1·1	5·3	0·8	5·3	0·9	5·1
Mean for day ...	A = 0·9μ ; Tp = 5·3s.							

Month.	April.							
Hour G.M.T.	0 h.		6 h.		12 h.		18 h.	
	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.
Day.	μ	s.	μ	s.	μ	s.	μ	s.
1	0·8	4·3	0·8	4·3	1·3	4·5	2·3	4·5
2	...	...	...	...	0·5	5·0	0·5	4·5
3	0·8	4·3	0·5	4·5	0·5	4·7	0·3	4·5
4	0·4	5·2	0·2	4·8	0·6	6·7	0·2	6·7
5	0·4	5·8	0·2	5·0	0·2	5·6	0·2	5·0
6	0·2	4·8	0·2	4·7	0·2	5·0	0·5	4·8
7	0·5	4·5	0·2	4·7	0·4	5·2	0·7	4·8
8	0·9	5·0	1·1	5·4	1·3	5·4	0·6	6·5
9	1·0	6·3	1·0	6·0	0·6	6·3	1·3	6·5
10	...	...	0·8	5·8	0·5	7·5	1·3	7·0
11	1·2	7·5	1·0	6·3	0·9	7·5	0·7	5·2
12	0·4	5·4	0·4	5·4	0·6	5·6	1·1	5·6
13	1·0	5·8	0·8	5·6	0·6	5·8	0·4	5·2
14	...	...	...	...	0·4	5·6	0·2	5·0
15	0·2	5·2	0·2	5·4	0·3	4·5	0·2	4·8
16	0·7	5·4	0·5	4·7	1·5	6·7	1·4	7·0
17	1·7	7·3	1·7	6·5	1·0	5·8	1·5	4·7
18	0·6	6·0	0·6	5·6	0·4	5·4	1·4	5·0
19	1·5	4·7	0·7	4·8	0·5	5·0	0·5	4·5
20	0·3	4·3	0·2	4·7	0·3	4·0	0·3	3·7
21	0·3	3·7	0·3	4·3	0·0	—	0·0	—
22	0·0	—	0·0	—	0·0	—	0·0	—
23	0·0	—	0·0	—	0·0	—	0·0	—
24	0·0	—	0·0	—	0·3	3·6	...	...
25	0·2	5·0	0·2	4·7	0·5	5·0	0·4	5·4
26	0·7	5·2	0·2	6·3	0·5	5·0	0·2	5·2
27	0·2	4·7	0·5	4·8	0·3	4·5	...	...
28	0·2	4·7	0·3	3·9	0·2	5·6	0·3	4·5
29	0·0	—	0·0	—	0·0	—	0·0	—
30	0·0	—	0·0	—	0·2	5·6	0·2	5·6
31								
Mean ...	0·5	5·2	0·5	5·1	0·5	5·4	0·6	5·3
Mean for day ...	A = 0·5μ ; Tp = 5·3s.							

Month.	May.							
Hour G.M.T.	0 h.		6 h.		12 h.		18 h.	
	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.
Day.	μ	s.	μ	s.	μ	s.	μ	s.
1	0·2	5·4	0·6	5·8	0·5	5·0	0·5	4·7
2	0·2	4·7	0·2	4·7	0·2	4·8	0·2	5·0
3	0·2	4·8	0·3	4·0	0·3	4·3	0·3	4·3
4	0·3	4·1	0·3	4·3	0·3	4·1	0·3	4·0
5	0·3	3·9	0·3	4·5	0·3	4·3	0·2	5·0
6	0·5	4·5	0·7	4·5	1·0	4·5	0·5	4·3
7	0·5	4·8	0·2	4·7	0·3	4·3	0·3	4·5
8	0·3	4·3	0·3	4·0	0·0	—	0·0	—
9	0·2	4·8	0·3	4·5	0·3	4·5	0·2	5·0
10	0·2	5·0	0·5	5·0	0·9	5·4	0·8	6·3
11	1·1	5·2	0·6	5·6	0·4	5·2	0·7	5·2
12	0·4	5·8	0·5	5·0	0·2	5·2	0·2	4·7
13	0·4	5·4	1·1	5·4	2·0	8·0	1·9	7·5
14	1·8	7·0	1·7	7·5	1·3	7·0	1·5	6·5
15	0·6	6·0	0·7	5·4	0·3	4·5	0·3	4·5
16	0·2	4·8	0·3	4·3	0·3	4·0	0·3	4·0
17	0·0	—	0·3	4·3	0·3	4·3	0·2	4·7
18	0·3	4·3	0·3	4·3	0·3	4·3	0·5	4·0
19	0·5	4·3	0·5	5·0	0·5	4·8	0·5	4·3
20	0·7	4·7	1·0	4·7	0·9	5·2	1·7	4·7
21	1·0	4·8	1·1	5·2	0·5	5·0	0·4	5·2
22	0·5	4·7	0·5	4·7	0·5	5·0	0·5	4·5
23	0·5	4·5	0·5	4·7	0·5	5·0	0·3	4·5
24	0·3	4·5	0·2	4·7	0·3	4·3	0·2	5·0
25	0·5	4·3	0·5	4·3	0·3	4·1	0·3	4·0
26	0·3	4·1	0·3	4·3	0·3	4·1	0·3	4·1
27	0·3	4·3	0·3	4·3	0·0	—	0·0	—
28	0·3	4·0	0·3	3·7	0·3	3·7	0·3	3·3
29	0·2	4·7	0·5	4·1	0·3	4·1	0·5	4·3
30	0·7	4·5	0·8	4·3	0·5	4·5	0·3	4·5
31	0·3	4·0	0·3	4·3	0·3	4·1	0·3	4·0
Mean ...	0·5	4·7	0·5	4·7	0·5	4·7	0·5	4·7
Mean for day ...	A = 0·5μ ; Tp = 4·7s.							

Month.	June.							
Hour G.M.T.	0 h.		6 h.		12 h.		18 h.	
	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.
Day.	μ	s.	μ	s.	μ	s.	μ	s.
1	0·3	4·5	0·3	4·5	0·3	4·5	0·3	4·5
2	0·3	4·3	0·2	5·0	0·3	4·3	1·0	4·5
3	1·2	4·7	2·0	4·5	1·5	4·7	1·3	4·5
4	1·5	4·5	1·0	4·7	1·0	4·5	1·1	5·0
5	1·0	4·5	1·0	4·7	0·7	4·5	1·6	4·3
6	0·7	4·5	0·7	4·5	0·5	4·3	0·3	3·1
7	0·3	3·1	0·3	3·6	0·3	3·9	0·3	3·9
8	0·3	3·9	0·3	3·9	0·3	3·9	0·3	3·9
9	0·3	3·7	0·3	3·6	0·3	3·5	0·3	3·7
10	0·3	4·0	0·3	4·1	0·3	4·0	0·5	4·1
11	0·8	4·3	0·5	4·3	0·3	4·1	0·3	4·0
12	0·5	4·3	0·8	4·3	0·3	4·1	0·3	4·3
13	0·3	4·3	0·2	4·8	0·3	4·5	0·2	4·7
14	0·3	4·0	0·3	4·3	0·3	4·0	0·3	4·0
15	0·3	3·5	0·3	3·3	0·3	4·0	0·3	3·9
16	0·5	4·0	0·5	4·3	0·3	4·3	0·5	4·3
17	0·8	4·3	0·7	4·5	0·3	4·3	0·3	4·5
18	0·2	5·0	0·3	4·5	0·3	4·0	0·3	3·9
19	0·3	4·5	0·3	4·3	0·5	4·8	0·5	4·3
20	0·5	4·5	0·3	4·3	0·3	4·5	0·2	4·8
21	0·3	4·3	0·5	4·5	0·3	4·1	0·3	4·3
22	0·2	4·7	0·5	4·8	0·5	5·0	0·5	4·7
23	0·3	4·5	0·3	4·5	0·3	4·5	0·3	4·1
24	0·3	4·3	0·3	4·3	0·0	—	0·3	4·0
25	0·3	4·0	0·0	—	0·0	—	0·0	—
26	0·0	—	0·3	4·5	0·0	—	0·2	4·8
27	0·3	4·0	0·3	4·5	0·2	5·0	0·2	5·0
28	0·2	5·0	0·2	5·0	0·3	4·3	0·3	4·3
29	0·2	4·8	0·2	4·8	0·3	4·5	0·3	4·5
30	0·2	4·7	0·2	4·7	0·2	4·8	0·0	—
31								
Mean ...	0·4	4·3	0·5	4·4	0·4	4·3	0·4	4·3
Mean for day ...	A = 0·4μ ; Tp = 4·3s.							

NOTE.—The symbol ... indicates that microseisms were not measured, either by reason of occurrence of earthquakes or lack of record.

Derived from readings for the period of thirty minutes centring at the exact hour, Greenwich Mean Time.

547. Richmond (Kew Observatory). **1931.**

Month	July.								August.								September.							
Hour. G.M.T.	0 h.		6 h.		12 h.		18 h.		0 h.		6 h.		12 h.		18 h.		0 h.		6 h.		12 h.		18 h.	
	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.
Day.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.
1	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—
2	0·0	—	0·0	—	0·2	4·8	0·4	5·6	0·3	3·3	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—	0·3	4·0	0·3	3·5
3	0·5	4·8	0·2	5·0	0·2	5·0	1·4	6·3	0·3	3·2	0·4	3·0	0·2	4·8	0·3	3·9	0·3	4·0	0·6	3·5	0·3	3·5	0·3	3·3
4	1·1	5·6	0·8	6·0	0·6	5·6	0·8	5·8	0·3	3·6	0·3	3·5	0·3	3·9	0·2	4·7	0·3	4·3	0·3	4·0	0·3	4·5	0·7	5·0
5	0·4	5·4	0·6	5·8	0·5	5·0	0·5	5·0	0·4	5·6	0·2	5·4	0·2	5·4	0·2	5·0	0·2	4·7	0·3	4·5	0·3	4·1	0·3	4·1
6	0·4	5·4	0·2	5·0	0·3	4·0	0·2	5·0	0·2	5·6	0·0	—	0·0	—	0·0	—	0·5	4·7	0·3	3·7	0·3	3·6	0·3	3·5
7	0·2	4·7	0·3	4·0	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—	0·3	3·3	0·3	4·5	0·3	4·5	0·2	4·7
8	0·3	3·7	0·3	3·7	0·0	—	0·0	—	0·4	3·0	0·3	3·3	0·3	3·7	0·3	3·5	0·3	4·5	0·2	4·7	0·2	4·8	0·2	5·0
9	0·3	3·2	0·3	3·3	0·3	3·5	0·3	3·7	1·2	3·5	0·8	4·0	0·4	5·4	0·5	5·0	0·2	5·4	0·2	4·8	0·2	4·7	0·2	4·7
10	0·3	3·7	0·3	3·6	0·3	3·6	0·3	3·5	0·5	4·7	0·5	4·8	0·3	4·3	0·3	4·0	0·2	5·0	0·3	4·5	0·0	—	0·0	—
11	0·3	3·3	0·3	3·3	0·3	3·3	0·0	—	...	...	0·0	—	0·3	4·1	0·3	4·3	0·0	—	0·0	—	0·0	—	0·0	—
12	0·0	—	0·0	—	0·0	—	...	...	0·3	4·1	0·3	4·0	0·0	—	0·3	4·0	0·0	—	0·0	—	0·2	4·8	0·5	5·0
13	0·0	—	0·0	—	0·0	—	0·0	—	0·3	4·3	0·3	4·5	0·3	4·3	0·3	4·3	0·5	5·0	0·2	4·7	0·3	4·3	0·2	4·8
14	0·0	—	0·0	—	0·0	—	0·0	—	0·5	4·8	0·5	4·3	0·5	4·1	0·6	4·0	0·2	5·8	0·2	4·7	0·2	5·6	0·2	4·7
15	0·3	3·2	0·4	3·0	0·0	—	0·3	3·6	0·5	4·5	0·5	5·0	0·5	4·8	1·1	5·0	0·2	5·2	0·2	5·4	0·2	5·2	0·2	5·2
16	0·4	3·0	0·4	3·0	0·0	—	0·0	—	1·4	5·0	0·7	5·0	1·1	4·1	0·7	4·5	0·2	5·4	0·2	5·2	0·2	5·6	0·2	5·2
17	0·0	—	0·0	—	0·0	—	0·3	4·0	0·9	5·0	0·6	3·9	0·8	3·9	0·8	4·1	0·2	5·0	0·2	4·8	0·2	5·0	0·2	4·8
18	0·5	4·3	0·5	4·0	...	...	0·3	3·7	0·5	4·0	0·5	4·1	0·3	4·3	0·3	4·3	0·2	4·7	0·2	5·2	0·2	4·7	0·2	5·0
19	0·3	4·3	0·2	4·8	0·5	5·0	0·5	4·5	0·3	4·3	0·3	4·3	0·3	4·3	0·3	3·9	0·2	6·0	0·6	6·0	0·6	6·3	0·7	6·7
20	0·3	4·0	0·3	4·3	0·3	3·7	0·3	4·3	0·8	4·3	1·7	4·5	1·0	4·5	0·7	4·5	0·7	6·5	0·6	5·8	0·4	6·3	0·2	6·3
21	0·2	4·7	0·3	4·1	0·2	4·8	0·2	4·7	0·8	4·1	1·3	4·3	0·5	4·3	0·5	4·3	0·3	7·5	0·4	5·4	...	...	0·2	5·0
22	0·3	4·3	0·3	4·3	0·3	4·3	0·3	4·5	0·3	3·7	0·3	3·5	0·3	3·6	0·3	4·3	0·2	5·0	0·2	5·6	0·2	4·7	0·2	5·4
23	0·2	4·7	0·7	5·0	0·3	4·5	0·7	5·4	0·3	4·1	0·3	4·0	0·3	4·5	0·3	4·3	0·2	5·2	0·2	5·2	0·2	5·0	0·2	5·0
24	0·6	5·8	0·4	5·4	0·3	4·5	0·3	4·3	0·3	4·0	1·4	4·0	2·5	4·5	4·4	5·0	0·2	5·2	0·2	5·4	0·2	6·0	0·2	6·0
25	0·3	4·1	0·3	4·5	0·3	4·3	0·2	5·0	2·3	5·0	2·4	4·8	2·1	4·8	1·0	4·7	0·2	5·8	0·4	6·3	0·4	5·6	0·7	6·7
26	0·3	4·5	0·3	4·5	0·0	—	0·0	—	0·5	4·3	0·2	4·7	0·2	5·0	0·3	4·3	0·4	5·8	0·4	6·7	0·2	6·0	0·4	6·5
27	0·3	4·5	0·3	4·0	0·3	3·9	0·3	4·0	0·3	4·5	0·5	5·0	0·7	4·7	1·5	4·5	0·4	6·7	0·4	6·0	0·4	6·0	0·2	5·6
28	0·3	4·0	0·3	4·5	0·3	4·5	0·3	4·5	1·7	4·8	1·5	4·5	1·1	4·1	0·8	4·0	0·2	6·0	0·2	6·5	...	...	0·2	6·0
29	0·3	4·0	0·3	3·7	0·3	4·3	0·3	4·5	1·1	4·1	0·5	4·1	0·3	4·1	0·3	3·7	0·2	6·0	0·2	5·0	0·6	6·5	1·1	6·0
30	0·3	4·3	0·3	4·0	0·0	—	0·2	4·7	0·3	3·7	0·3	3·7	0·0	—	0·0	—	1·0	6·7	0·6	6·5	0·4	5·6	0·4	5·2
31	0·2	4·7	0·3	4·3	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—	0·0	—								
Mean ...	0·3	4·3	0·3	4·3	0·2	4·4	0·3	4·6	0·6	4·3	0·5	4·3	0·5	4·4	0·5	4·3	0·3	5·4	0·3	5·2	0·3	5·1	0·3	5·1
Mean for day ...	A = 0·3μ ; Tp = 4·4s.								A = 0·5μ ; Tp = 4·3s.								A = 0·3μ ; Tp = 5·2s.							

Month	October.								November.								December.							
Hour. G.M.T.	0 h.		6 h.		12 h.		18 h.		0 h.		6 h.		12 h.		18 h.		0 h.		6 h.		12 h.		18 h.	
	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.	A.	Tp.
Day.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.	μ	s.
1	0·4	5·2	0·4	5·2	0·4	5·2	...	...	0·2	5·2	0·2	5·0	0·2	5·0	0·2	5·0	1·6	6·3	1·5	7·0	1·2	6·5	1·7	7·0
2	1·3	5·2	1·1	5·6	1·3	5·6	1·6	5·8	0·5	5·0	0·4	5·4	...	...	0·2	5·6	1·3	5·4	1·5	5·8	1·3	5·8	1·4	6·3
3	2·3	7·3	3·5	8·0	2·8	7·5	2·2	7·0	0·2	4·8	0·5	4·3	1·2	5·0	1·2	5·0	1·1	5·8	2·0	6·5	3·7	7·0	3·9	7·0
4	...	...	1·7	7·3	1·4	7·5	1·3	8·3	1·8	4·7	2·2	6·0	2·3	5·6	2·2	5·6	7·4	7·0	8·5	7·0	3·7	6·5	4·8	6·0
5	1·4	8·3	1·2	7·7	1·0	6·5	1·1	6·5	2·2	5·4	1·1	5·2	...	...	1·1	5·8	4·1	7·0	3·9	6·5	2·5	6·5	2·9	6·5
6	0·6	5·6	1·3	5·6	0·6	6·0	1·1	6·5	2·1	5·2	2·1	5·0	1·9	6·0	1·9	5·6	2·5	6·7	2·5	6·5	2·2	6·3	2·2	6·3
7	1·0	6·5	1·4	6·0	1·5	6·5	1·7	6·3	1·9	5·6	1·3	5·8	0·7	5·4	1·3	4·3	2·0	6·3	2·1	6·0	2·1	6·0	2·1	6·0
8	1·9	6·3	1·5	6·7	...	...	0·4	6·3	1·2	3·7	1·5	5·8	0·9	6·7	1·7	7·0	1·9	7·0	1·9	7·0	2·8	7·0	3·4	8·3
9	0·5	5·2	0·5	5·0	0·2	5·0	0·9	5·2	1·8	7·3	1·9	7·0	2·3	5·8	1·7	8·0	4·6	8·3	3·9	8·0	3·4	8·0	1·7	8·0
10	...	...	...	...	0·6	5·8	1·1	5·6	2·7	8·0	3·1	9·0	4·7	9·0	4·6	8·3	1·6	7·7	1·5	6·7	1·3	5·4	1·9	6·7
11	1·6	6·3	1·6	6·3	1·8	6·5	1·5	7·0	3·4	8·3	3·2	6·7	1·8	7·5	1·3	7·0	2·0	6·5	1·6	6·3	1·6	6·3	1·9	7·0
12	1·9	6·7	1·9	6·7	1·4	6·5	0·6	5·6	1·2	5·0	0·6	6·3	0·6	5·8	0·5	5·0	1·4	6·5	1·0	6·3	0·8	6·0	1·1	6·7
13	0·7	5·0	0·2	5·4	0·2	5·0	0·4	6·0	0·7	5·0	0·5	5·0	0·4	5·4	1·6	5·2	1·0	6·5	0·8	6·5	0·4	6·3	0·6	6·3
14	0·2	5·0	0·2	5·0	0·6	5·8	0·4	6·0	1·7	5·6	1·8	7·5	2·5	6·7	1·9	6·7	0·2	5·2	0·2	5·4	0·4	5·4	1·1	5·8
15	0·4	6·3	0·2	5·2	0·4	5·8	0·4	5·6	2·0	6·5	1·7	6·7	1·1	7·3	0·8	6·3	1·9	6·0	1·9	5·8	1·1	5·4	1·1	5·4
16	0·2	5·2	0·4	5·6	0·2	5·6	0·2	5·4	1·2	6·5	0·6	5·8	0·6	6·0	1·4	6·0	1·7	5·8	2·1	6·0	1·9	5·6	2·0	5·4
17	0·2	5·4	0·2	4·8	0·2	5·0	0·2	5·4	1·9	6·7	1·8	7·3	1·3	7·0	1·4	6·5	1·9	5·8	1·9	5·6	1·3	5·4	1·5	5·8
18	0·2	5·2	0·2	4·7	0·0	—	0·0	—	0·8	6·3	1·5	5·8	2·1	5·0	2·1	5·0	1·1	5·8	0·7	5·2	0·6	6·3	1·5	8·3
19	0·0	—	0·0	—	0·2	5·6	0·2	5·0	2·2	5·4	2·1	5·0	1·5	5·6	1·6	5·2	1·8	7·5	1·7	7·7	1·8	7·5	1·8	7·5
20	0·2	5·0	0·6	6·0	1·8	7·3	1·8	7·5	1·6	5·0	1·4	6·3	0·8	6·5	1·2	6·0	1·9	7·5	1·9	7·5	1·8	7·5	1·8	7·5
21	1·6	7·3	1·8	7·3	1·3	6·7	1·4	6·5	1·4	6·3	1·6	6·3	2·8	7·7	3·4	8·7	0·6	7·0	0·8	6·7	0·8	6·0	0·6	6·5
22	0·8	6·0	0·7	5·2	0·8	6·0	0·5	5·2	4·3	8·3	3·7	8·7	2·7	8·0	3·3	7·0	1·5	7·0	1·3	7·0	1·5	6·7	1·4	6·3
23	1·1	5·4	0·5	5·0	0·5	4·7	0·5	5·2	3·1	5·4	3·5	5·6	2·7	6·0	2·8	6·3	2·0	6·5	2·0	6·5	2·0	6·5	1·7	6·7
24	0·5	4·8	1·2	4·8	0·5	4·7	0·5	4·7	2·3	5·2	1·9	5·8	1·8	6·5	1·9	5·8	1·7	6·7	0·8	6·5	2·1	5·2	0·9	5·0
25	0·5	4·8	1·2	4·8	0·7	5·0	0·5	5·0	2·0	5·4	1·5	5·8	1·8	7·3	2·6	7·5	2·0	6·3	2·9	6·7	2·6	7·7	2·6	7·7
26	0·7	5·2	0·6	5·8	0·6	5·6	0·5	4·8	1·6	6·5	1·6	6·3	2·0	4·7	1·6	5·0	2·3	7·5	2·0	7·0	0·8	6·0	1·9	6·0
27	0·7	5·0	0·6	6·0	0·6	5·6	0·8	6·0	1·6	6·3	1·5	5·6	2·1	6·0	1·9	6·0	1·7	6·0	1·1	5·8	2·1	6·0	2·1	6·0
28	0·4	5·6	0·4	6·0	0·5	5·0	0·4	5·8	2·1	5·8	0·9	5·2	0·6	6·7	0·8	5·8	3·0	6·3	3·0	5·8	2·8	6·3	2·9	6·0
29	0·4	6·0	0·7	5·0	1·4	6·0	0·8	6·0	0·4	5·6	1·1	5·6	1·6	6·5	1·1	5·6	2·9	6·0	2·1	6·0	1·7	6·7	1·8	6·5
30	1·7	6·0	0·5	4·7	0·4	5·4	0·7	5·0	1·6	6·3	1·7	7·0	1·5	6·7	1·3	6·7	1·0	6·3	0·2	5·6	0·2	6·0	0·2	6·3
31	0·7	5·4	0·5	5·2	0·3	4·5	0·2	4·8									0·2	6·0	0·2	5·8	0·4	6·3	0·4	6·5
Mean ...	0·8	5·8	0·9	5·7	0·8	5·8	0·8	5·9	1·7	5·9	1·6	6·1	1·7	6·3	1·7	6·1	2·0	6·5	1·9	6·4	1·7	6·3	1·8	6·6
Mean for day ...	A = 0·8μ ; Tp = 5·8s.								A = 1·7μ ; Tp = 6·1s.								A = 1·9μ ; Tp = 6·5s.							

NOTE.—The symbol ... indicates that microseisms were not measured, either by reason of occurrence of earthquakes or lack of record.

Printed under the Authority of HIS MAJESTY'S STATIONERY OFFICE, by C. TINLING & Co., LTD., Liverpool, London and Prescot.

Wt2511/6026 2.33 50 CT&CoLtd. Gp330