On the After-shocks of Earthquakes.

by

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I. General Considerations.

§ 1. A strong earthquake is almost invariably followed by weaker ones and when it is violent and destructive the number of minor shocks following it may amount to hundreds or even thousands. When after-shocks are not reported to have happened it is probably because they were deemed unimportant to record. Or it may be that the seat of origin of the earthquake being very deep or far out under the ocean-bed, the after-shocks did not reach the observer.

Complete records of after-shocks were obtained, I believe, for the first time in the cases of the three recent great earthquakes in Japan; namely, those of Kumamoto in 1889, of Mino and Owari in 1891, and of Kagoshima in 1893. The discussion of these records forms the subject of the present paper.

§ 2. The numbers, daily, monthly, etc., of the after-shocks of these three earthquakes, together with other matters relating thereto are contained in Tables I—XXII at the end of the paper; the shocks being distinguished as "violent," "strong," and "weak" (or "feeble") according to their intensity; the total or aggregate intensity of a number of shocks is obtained by multiplying each shock by one of the coefficients 3, 2, 1, according to its intensity, and taking the sum of the numbers so obtained. The after-shocks of the Mino-Owari earth-

quake were recorded at the Meteorological Stations in Gifu, Nagoya, Tsu, Kyōto, and Ōsaka; those of the Kumamoto earthquake, first at the Prefectural Office, and subsequently at the Meteorological Station in Kumamoto; and those of the Kagoshima earthquake at the Police Station and the District Office in Chiran in Kagoshima Prefecture.

§ 3. The number of after-shocks are found to diminish rapidly with distance from the origin of the initial earthquake,[1] as may be seen from the following list:—

After-shocks of the Mino-Owari Earthquake.

Stations.	Gifu.	Nagoya.	Tsu.	Kyōto.	Ōsaka.	Tōkyō.
Number of shocks during the first two years.	3365[4]	1298[4]	314	125	70	30
Distance in *ri*[2] from the central part of the Neo-Valley.[3]	7	15	25	25	36	68

Of the six cities mentioned in the above table, Gifu, Nagoya, and Tsu are situated nearly along the axis of the depression which extends from the Sea of Isé to the plain of Mino and Owari, while the remaining three, Kyōto, Ōsaka, and Tōkyō are situated in a line roughly perpendicular to this axis. These two sets of places must be regarded as distinct. The decrease with distance in the number of after-shocks is, in the case of the second group, seen to be more rapid than in the inverse ratio.

In the case of the Kumamoto and Kagoshima earthquakes, the

1 The origin of the initial earthquake is not necessarily the same with those of the after shocks, so that in the immediate neighbourbood of the origins the statement in the text is by no means true.

2 1 *ri*=2.44 miles or 3.93 kilometres.

3 The earthquake of October 28th, 1891 was most violent in the Neo-Valley. See Dr. Kotō's excellent paper, "On the Cause of the Great Earthquake in Central Japan, 1891." (Jour. Sci. Coll., vol. V. pt. IV); also § 35 of the present paper.

4 These numbers do not include the shocks within a few hours immediately after the tearhquake, which were not recorded. See Tables XI and XII, and also § 17.

observing stations, Kumamoto and Chiran, may practically be considered as being on the respective epi-centres.

§ 4. Of the 3365 after-shocks recorded at Gifu during the first two years, 10 were "violent," 97 "strong," 1808 "weak," and 1041 "feeble," while in the remaining 409 only sounds were heard without shocks. From Tables IV and V, it will be seen that, in the days immediately succeeding the initial great earthquake, "violent" and "strong" shocks occurred very often, but that these became rarer as time advanced. Of the 10 "violent" shocks, 9 occurred within the first four months and the remaining 1 in September, 1892, twelve months after. The "strong" shocks occurred all within the first thirteen months, and the "weak" shocks all within the first twenty months. It thus seems that at the earthquake-origin great instabilities are removed quicker than small ones. Again, the numbers of "weak" and "strong" shocks at Gifu during the first two years are greater respectively than the total numbers recorded during the same time interval at Nagoya and Ōsaka. Assuming that the after-shocks all originated somewhere near Gifu,[1] it may be concluded that nearly two-thirds of these had radii of propagation less than 10 *ri* and that only one-fiftieth had radii greater than 35 *ri*.

§ 5. The number of after-shocks of the Kumamoto earthquake recorded at Kumamoto up to the end of 1893 is 922, including 1 "violent" shock which happened on August 3rd, 1889, five days after the initial earthquake, 76 "strong" shocks, and 845 "weak" and "feeble" shocks and sounds. These shocks all extended over small areas, only the "violent" one reaching a distance greater than 20 *ri* from the origin.

§ 6. In the cases of the Mino-Owari and Kumamoto earthquakes, all the after-shocks were very much smaller in extent than

1 See § 33.

the initial shocks. In the case of the Kagoshima earthquake, there was a second great shock about four months after the first, but the two had quite different origins.[1]

The frequency or activity[2] of after-shocks at a given distance from the origin is different for different earthquakes, and depends mainly on the magnitude of the initial shock, and at the epicentre, of course on the depth of the focus also. I may here state that the focal depths of the three great earthquakes we are discussing were all comparatively very small, being probably between 2 and 4 *ri.*

§ 7. The table following will serve for making a comparison of the frequency and activity of the after-shocks of the three earthquakes as observed at or near the epi-foci of the latter in the days immediately succeeding the initial shocks :—

COMPARISON OF FREQUENCY AND ACTIVITY OF AFTER-SHOCKS.

(I) MINO-OWARI EQ.			(II) KUMAMOTO EQ.			(III) KAGOSHIMA EQ.			(IV) RATIO $\frac{(I)}{(II)}$		(V) RATIO $\frac{(I)}{(III)}$	
Date.	Freq.	Act.	Date.	Freq.	Act.	Date.	Freq.	Act.	Freq.	Act.	Freq.	Act.
Oct. 29th, 1891	318	333	July 30th, 1889	27	32	Sep. 8th, 1893	45	49	12	10	7.1	7.0
,, 30th, ,,	173	193	,, 31st, ,,	15	16	,, 9th, ,,	44	49	12	12	4.0	4.0
,, 31st, ,,	126	129	Aug. 1st, ,,	11	12	,, 10th, ,,	28	29	12	11	4.5	4.5
Nov. 1st, ,,	99	104	,, 2nd, ,,	8	9	,, 11th, ,,	23	23	12	12	4.3	4.5
						Average.....			12	11	5.	5.

The Kumamoto earthquake took place on July 28th, 1889, at 11h. 49m., p.m.; the Mino-Owari earthquake, on October 28th, 1891, at 6h. 37m., a.m.; and the Kagoshima earthquake on September 7th, 1893, at 2h. 46m., a.m. Though the frequencies and activities of the first three groups, (I), (II), and (III), in the above table, which

1 See § 32.

2 "Frequency" means the number, and "activity" the total *intensity* defined as in § 2, of shocks during any given interval of time.

are put in the same horizontal rows, may not be strictly comparable with each other, yet the ratios in the columns (IV) and (V) are seen to be in each nearly constant. This will show that the law of decrease with time in the frequency or activity of the after-shocks was nearly the same, at least in the days immediately succeeding the initial earthquake, in each of the three cases.

The dependence of the frequency or activity on the magnitude of the initial disturbance is more clearly shown by the following table of total numbers and activities of after-shocks during the first 30 days and the first 2 years :—

Time Interval.	(I) Mino-Owari Eq.		(II) Kumamoto Eq.		(III) Kagoshima Eq.		(IV) Ratio $\frac{(I)}{(II)}$		(V) Ratio $\frac{(I)}{(III)}$	
	Number	Activity	Number	Activity	Number	Activity	Number	Activity	Number	Activity
First 30 days.	1746	1821	340	385	278	292	5.1	4.8	6.2	6 2
,, 2 years.	3365	3482	833	905			4.0	3.8		

Now the total (land and sea) areas of disturbance of the Mino-Owari, Kumamoto, and Kagoshima earthquakes were respectively about 54000, 6500, and 5000 square *ri*. The magnitudes of these earthquakes, therefore, if represented by their areas, are in the ratios of 11 : 1.3 : 1 approximately; i.e., the Mino-Owari earthquake was greater by eight or nine times than the Kumamoto earthquake, and by eleven times than the Kagoshima earthquake. The frequency or activity for the first earthquake is seen from the above table to be greater by four or five times than that for the second, and greater by six times than that for the third. If we compare together the two earthquakes of Kumamoto and Kagoshima, we find that the ratio of the frequencies or activities of their after-shocks for the first 30 days is 1.3, which is equal to the ratio of their areas of disturbance.

Thus the proportionality of the frequency or activity to the area

of disturbance is not strictly verified between these two earthquakes and the Mino-Owari earthquake, and the number of after-shocks for the last as recorded at Gifu seems to be comparatively too small. It may be that the town of Gifu is not sufficiently near to the district which is to be regarded as the proper centre of activity of after-shocks of the Mino-Owari earthquake. The effect that may be due to difference of focal depths must also be kept in mind.

Anyhow the frequency or activity of after-shocks increases with the magnitude of the initial earthquake and therefore can to a certain extent be regarded as a measure of the latter. Thus, for instance, the Kumamoto earthquake of July 28th, 1889, was followed, on August 3rd, five days later, by a second strong shock. According to the above criterion, the first shock was double or treble as great as the second, the numbers of their after-shocks being in the ratio of 90 : 30 approximately.

§ 8. To show the time relation of after-shocks, curves have been drawn, (Figs. 1,5,6,....), whose abscissae are equal intervals of time, and ordinates the numbers or activities of after-shocks during these intervals. The form of the curves drawn, in red, through the ultimate mean positions will be seen to be very like that of a rectangular hyperbola.

§ 9. The time rate of decrease of the frequency or activity of after-shocks is at first very rapid, but afterwards becomes slow and asymptotic. As far as the rate of variation is concerned, the after-shock curve may be regarded as consisting of two nearly straight portions, during the first of which the rate is great, and during the second of which it is small, the turning point occurring sooner with smaller earthquakes. In the case of the after-shocks of the Mino-Owari earthquake this transition took place ten or twelve days after the initial shock.

§ 10. To deduce theoretically the time-relation of the activity (or frequency) of after-shocks, it will be assumed, firstly, that the activity at any moment is proportional to the magnitude of disturbance in the geotechtonic condition then existing at or near the origin of the initial earthquake; and, secondly, that the reduction of this magnitude depends on the corresponding activity of after-shocks; that is, it is assumed that the after-shocks remove so many points of instability or weakness at the origin. It must also be supposed that each of the after-shocks has its own series of secondary after-shocks depending on its magnitude.

Let y=the activity of after-shocks at any instant of time x; m=the corresponding magnitude of disturbance at or near the origin of the initial earthquake, expressed in any arbitrary measure; and k, k' be constants. We then obtain the following two equations:—

$$y=k.\,m\,;$$

$$-dm=k'.y.dx-k''.y.dx,$$

whence, by integration, supposing k'' to be constant,

$$y=a.b^{-x}, \qquad (a)$$

a and b being constants.

The logarithmic time-decrement of the activity of after-shocks seems to be a likely one, when considered from the analogy of certain physical phenomena, but the result obtained by applying equation (a) to the records of after-shocks of the three recent great earthquakes is not very satisfactory.

A formula which gives nearly satisfactory results is the following,—

$$y=\frac{k}{h+x}, \qquad (b)$$

in which y is the frequency (or activity) at time x, k and h being

constants. This equation which represents a rectangular hyperbola may be deduced by taking terms only as far as the first power of x from either of the equations—

$$y=k(h+x)^{-1}+k'(h+x)^{-2}+\ldots\ldots,$$

and

$$y=\frac{1}{p+qx+rx^2+\ldots\ldots}$$

where h, k, k'.....and p, q, r.....are constants.

Equation (b) implies that the frequency varies nearly in an inverse ratio to the time.

§ 11. *The Mino-Owari Earthquake.*

Let us apply equation (b) to the record of after-shocks taken at the Gifu Meteorological Station. As may be seen from Fig. 5, the curve of actual frequency presents a series of maxima and minima, and in deducing the mean values of the constants k and h from observations, the latter must either cover a number of such fluctuations, or be taken to be those at an early epoch when the rate of variation in the frequency is very great and little affected by periods of long duration.

Taking the half-daily numbers of earthquakes during the first five days, from October 29th to November 2nd, 1891,[1] and applying the method of Least Squares, we obtain the equation

$$y=\frac{440.7}{x+2.31}, \qquad (c)$$

in which x denotes successive intervals of 12 hours, beginning with the first half of October 29th, 1891, and y the corresponding numbers of earthquakes. Actual and calculated values of y are tabulated below.

1 See Fig. 6.

x	Date.	y, actual.	y, calculated.
0	1891, 10, 29, 0—12 a.m.	171	190
1	0—12 p.m.	147	133
2	30, 0—12 a.m.	109	102
3	0—12 p.m.	64 } mean,	
4	31, 0—12 a.m.	71 } 68.	76
5	0—12 p.m.	55 } mean,	
6	11, 1, 0—12 a.m.	58 } 57.	56
7	0—12 p.m.	41	
8	2, 0—12 a.m.	46 } mean, 44.	42
9	0—12 p.m.	46	

Now $x=493$ represents the half-day interval which is equally distant from the beginning and end of the year 1892, and $x=1225$ that of the year 1893. The values of y corresponding to these x as calculated from equation (c) are respectively 0.9 and 0.36. In the actual case, there were 867 and 308 shocks at Gifu during the above two years, giving the average half-daily numbers of 1.2 and 0.42.[1]

It is interesting that equation (c), deduced from the observations of only a few days immediately succeeding the initial earthquake, thus represents with tolerable accuracy the frequency of earthquakes a year or two later on.

In the curve represented by equation (b), the point of the maximum curvature occurs at $x=\sqrt{k}-h$. Substituting the values of the constants k and h adopted in equation (c), we find $x=19$, denoting an epoch of time about ten days after the great earthquake (see § 9).

Again, by taking the monthly activities for the successive eighteen

1 Assuming equation (a) and using the same data as in deducing equation (c), we obtain

$$\log y=2.25-x\times 0.106,$$

which gives satisfactory results when x is small, (thus, when $x=0$, $y=175$; when $x=1$, $y=138$; when $x=2$, $y=108$, etc.), but fails when x becomes great.

months, from November, 1891, to April, 1893, we get the follwing equation,—

$$y=\frac{16.9}{x+0.397}, \qquad (d)$$

in which x denotes time in months, the origin being November, 1891, and y the mean daily activity during the month x. Now $x=7.5$ represents the middle of the year 1892, and $x=19.5$ that of the year 1893. The corresponding values of y calculated from the above equation are respectively 2.1 and 0.84, the actual mean daily activities of after-shocks in the two years being respectively 2.4 and 0.84.

If we put $y=\frac{1}{30}$, equation (d) gives $x=510$ months or 42 years; and if we put $y=\frac{1}{60}$, equation (c) gives $x=27000\times\frac{1}{2}$ days or 37 years. The meaning is that the seismic activity or frequency at Gifu due to the residual effect of the great earthquake after about forty years from the initial date may be such that one "weak" or "feeble" shock occurs in each month. Making great allowance for error of calculation and quartering the above figures, we may conclude that at least some ten years will elapse before the disturbed tract about Gifu can practically regain its stability, that is before the activity or frequency of after-shocks at that place reduces to the state of having one small shock per month.

The above conclusion, though only the result of rough approximations, seems a very likely one, when considered in reference to the Kumamoto earthquake of July 28th, 1889, which was far smaller than the Mino-Owari earthquake, and whose after-shocks are still occurring at the present day, about $4\frac{1}{2}$ years after.

§ 12. The variation with time of the frequency or activity of after-shocks of the Mino-Owari earthquake is comparatively simple, and none of these shocks was of a magnitude comparable with that of the initial earthquake itself. A few of the after-shocks, such as those of

January 3rd and September 7th, 1891, were pretty severe and followed by their own (secondary) after-shocks, fifty or more in number. Their residual effects were, however, of very short durations, being sensible only for a month or two. Besides, in deducing equation (*c*), all the after-shocks during the first eighteen months, some of which were due to the severe ones above named, were taken account of, and, therefore, the conclusion stated at the end of the last paragraph will not be materially affected by the occurrence at future times of similar severe after-shocks in the Mino-Owari district.

§ 13. *The Kumamoto Earthquake.*

The district about Kumamoto is steadily settling down to equilibrium, and there has thus far been no new great earthquake.[1] The rate of decrease of the frequency of after-shocks seems in this case to tend finally to be a little quicker than according to equation (*b*). The mean annual frequency at Kumamoto is very well represented by the following equation,—

$$y = \frac{1}{0.0048 + x \times 0.0021 + x^2 \times 0.0043}, \qquad (e)$$

in which x denotes time, in years, 1890 being the origin, and y the corresponding yearly number of earthquakes. The values of y calculated from this equation for the years 1890, 1891, 1892, and 1893 are respectively 208, 89, 38, and 20, agreeing exactly with the actual numbers for these years.

According to equation (*e*), the numbers of earthquakes for the years 1894, 1895, and 1896 would be respectively 12, 8, and 5. Now, before the earthquake of July 28th, 1889, the average yearly number of shocks at Kumamoto had been 3 or 4. We may, therefore, conclude that it would be about seven or eight years from the date of

1 See Fig. 4.

the initial earthquake before the number of shocks in the disturbed tract about Kumamoto can attain its original yearly average, if at all.

§ 14. We have seen (§ 7) that the number of after-shocks of the Mino-Owari earthquake during the first two years is about four times greater than that of the Kumamoto earthquake during the corresponding interval of time. If we now assume that the seismic frequency at Gifu after a given interval of time from the Mino-Owari earthquake is always greater by this ratio than that at Kumamoto after an equal interval from the Kumamoto earthquake, the result inferred from the analogy of the latter is that some nine or ten years will elapse before the yearly number of earthquakes at Gifu is reduced to ten or twelve (compare § 11).

The great earthquake of October 28th, 1891, must have removed the principal geotechtonic instability which had existed beneath the Mino-Owari district, and in this part of the country the present epoch of seismic activity will be followed probably by one of rest. The average yearly number of earthquakes at Gifu before 1891 was about 15.

§ 15. I shall here remark that the space distribution of seismic energy as represented by the relative number of earthquakes during a given interval of time may vary from time to time, and particularly with the occurrence of great earthquakes. In general there is a coïncidence between the distribution of destructive shocks and that of ordinary minor ones, and the latter may be the consequences of the former. In Japan the seismic activity, as far as small earthquakes are concerned, is much greater on the Pacific than on the Japan Sea side, and so is it with destructive shocks, of which 57 % took place on the Pacific side, 28 % on the Japan Sea side, and only the remaining 15 % remote from either. More especially the great shock of the 1st year of Ansei (1854), which affected severely

almost the whole of Japan, might have had some share in making the distribution of seismic energy in this country such as it is at the present day.

§ 16. *Digression on the Seismic Frequency in Tōkyō.*

In connection with this subject, it may be interesting to examine whether there has been in recent years a secular variation in the seismic frequency in Tōkyō.

The systematic instrumental observation of earthquakes at Tōkyō dates from the 8th year of Meiji (1875) and has now been continued for more than eighteen complete years. At first the record was taken by means of Palmieri's seismograph, but since 1887, it has been taken by means of the Gray-Milne seismograph. The numbers of earthquakes during eighteen years (1876–1893) are given in the following table :—

(I) Recorded by Palmieri's Seismograph.

Year.	Total Number of Eqks.	Tremors.[1]	Difference.	
1876	56	38	18	
1877	71	40	31	
1878	50	21	29	
1879	70	30	40	Average of "Difference."
1880	77	32	45	=34.7[2]
1881	66	32	34	
1882	46	19	27	
1883	32	12	20	
1884	68	25	43	
1885	68	38	30	
1886	54	4	50	

1 "Tremors" mean those shocks whose direction of motion was not distinctly shewn by Palmieri's Seismograph.

2 The Central Meteorological Observatory, where the record has been taken, was moved in 1883 from its old position in the southern part of Tōkyō to its present one in the Castle grounds. The observation during that year might be imperfect and is rejected in taking the average number of earthquakes.

(II) Recorded by the Gray-Milne Seismograph.

Year.	Total Number of Eqks.	Tremors.[1]	Difference.	
1887	80	44	36	
1888	101	64	37	
1889	113	75	38	Average of "Difference." =33.3
1890	93	60	33	
1891	97[2]	49[2]	48	
1892	73	52	21	
1893	59	39	20	

As far as the total number of recorded earthquakes is concerned, the frequency appears to be greater in the later epoch, (II), than in the earlier, (I). But, as the record of the number of tremors or very small shocks may have been modified by the change in sensibity with the change of instrument we can safely take only those shocks whose motion was distinctly registered, and then we see that their average yearly number is nearly identical in the two groups (I) and (II).[3]

The Yedo (Tōkyō) earthquake of the 2nd year of Ansei (1855) took place 21 years before 1876, and 38 years before 1893. The above table shews that the residual effect of this earthquake had ceased to be sensible before 1876, and that the *mean* seismic frequency in Tōkyō has remained ever since practically constant. It may here be remarked that the intensity of motion in Tōkyō on the occasion of the earthquake of the 2nd year of Ansei was far less than that in the Neo-Valley and neighbouring tracts on the occasion of the recent Mino-Owari earthquake, the former earthquake being also smaller in extent than the latter.

§ 17. *On the Estimation of the Probable Total Number of After-*

1 "Tremors" here mean those shocks whose motion was too small to be distinctly measured by the Gray-Milne seismograph.

2 See Note to Table XVII.

3 See § 29.

shocks of a Given Earthquake.—If the time relation of the frequency of after-shocks of an earthquake be represented by an equation, we can readily calculate from it their approximate total number. Thus, if $y_0, y_1, y_2 \ldots y_n$ be values of y corresponding to $x=0, 1, 2 \ldots n$, we see that

$$\sum_0^{n-1} y_m > \int_0^n y\,dx > \sum_1^n y_m,$$

from which inequality we can approximately estimate the total number (or activity) of after-shocks, namely, $\sum_0^n y_m$, n being made suitably great. To take an example, we have, from equation (*c*), for the Mino-Owari earthquake,—

$$\sum_0^{1458} y_m > 440.7 \times \log_{10}\left(\frac{1459+2.31}{2.31}\right) \times \log_e 10 > \sum_1^{1459} y_m$$

or

$$\sum_0^{1458} y_m > 2840 > \sum_1^{1459} y_m,$$

in which y_0 denotes the number of shocks at Gifu during twelve hours, from 0 to 12 a.m., on October 29th, 1891, and is equal to 190, the total number of shocks during two complete years, from October 29th, 1891, to October 27th, 1893, being denoted by the sum $\sum_0^{1459} y_m$. The calculated value of the latter thus comes out to be 2900 or 2950. The corresponding actual number is 3257.

Similarly the calculated total number of shocks during ten years, or the sum $\sum_0^{7300} y_m$, is found to be some 3600.

Now the great earthquake of October 28th, 1891, took place at 6.37 a.m., and the record of after-shocks at Gifu was not taken till about 2 p.m. of the same day, the number recorded during the remaining 10 hours, from 2 to 12 p.m., being 101. The total number of shocks during the above initial day was probably not less than 300.

From these considerations I conclude that the entire number

of after-shocks of the Mino-Owari earthquake disturbing the *vicinity of Gifu* is about 4000.[1]

Some of the great earthquakes in the world had areas of disturbance many times bigger than the Mino-Owari earthquake, and we may assume that 10000 is probably the highest possible total number of after-shocks of an earthquake.

The after-shocks of the Kumamoto earthquake are now approaching the end and their total number is 950 or 1000.

§ 18. *The Kagoshima Earthquake.*

The Kagoshima earthquake took place on September 7th, 1893, and is yet only a few months old. Making an estimate from the record already obtained of its after-shocks (see Figs. 15 and 16), we find that, at Chiran, the epi-focal tract, they may continue for three or four years, and that the total number may be some six hundred.

The earthquake took place at about 2.46 a.m. and the record of its after-shocks was not taken till about 9 p.m. of the same day, there being during this interval probably some 100 shocks. Making this addition, the total number of shocks at Chiran during about five months, up to the end of January, 1894, is nearly 480, being less than the number of shocks at Kumamoto during the corresponding interval of time after the earthquake of July 28th, 1889, which may be taken in round numbers as 600.

II. On the Periodicity of the Frequency of After-shocks, etc.

§ 19. What has been said so far about after-shocks relates to the ultimate mean time-relation of their frequency or activity. When

1 It must be remarked that the conclusions regarding the after-shocks of the Mino-Owari earthquake thus far stated are supposed to hold for Gifu, and may not hold necessarily for other places which are not sufficiently near to the principal epi-focal tract.

examined particularly, however, there are to be seen in the variations of the latter various sets of periodic fluctuations (see Figs. 1, 2, 3, 5, etc.).

Earthquakes being isolated or discontinuous events from the nature of their causes, we can from analogy readily conceive why the frequency of those after-shocks which happen in close succession, should present a series of well-marked maxima and minima.

The *fluctuations in the decrease* of the frequency of after-shocks of an earthquake may be of two kinds; namely, those which are proper to the earthquake under consideration, and those whose maxima and minima occur at fixed epochs. The former are of the nature of forced oscillations and may disappear after a time; while the latter are of the nature of free oscillations and may become finally predominant.

The amplitude of the fluctuations would evidently increase with the magnitude of the earthquake.

As far as I can ascertain from the records of after-shocks there are, besides the diurnal and annual fluctuations, six different series of periods in the variation of the frequency, whose lengths range from a few hours to several months.

These various periods have been obtained by drawing curves through the mean positions of points whose abscissae are equal time-intervals of 1 hour, 2 hours, 6 hours, 1 day, 2 days, 5 days, 10 days, or 1 month, and whose ordinates are the numbers of earthquakes during the corresponding intervals. The results given below were obtained by a direct measurement from Figs. 1, 2, 3, 5, etc.

§ 20. *The Kumamoto Earthquake.*

The curves of daily and 2-daily earthquake frequencies (Figs. 2 and 3) respectively indicate periods whose average lengths are 4.6 and 12 days.

The curves of 5-daily and 10-daily earthquake frequencies seem to indicate periods whose average lengths are about 33 days and 3 months respectively.

The curve of monthly earthquake frequency (Fig. 1) indicates distinct fluctuations, of which there are seven between August, 1889, and December, 1893. The dates of maximum and minimum frequencies as given by the curve are as follows :—

Maximum.	Minimum.
October, 1889,	September, 1889, (?)
May, 1890,	February, 1890,
February, 1891,	November, ,,
October, ,,	August, 1891,
May, 1892,	February, 1892,
October, ,,	August, ,,
,, , 1893.	between March and August, 1893.

The successive intervals between the earlier well-defined maxima or minima are from 7 to 9 months.

§ 21. *The Mino-Owari Earthquake.*

The curve of hourly earthquake frequency for Gifu (Fig. 10) indicates a period of 8 or 9 hours, and also a shorter one of about 4 hours. The former is clearly shewn in the curve of 2-hourly earthquake frequency (Fig. 11), which gives an average length of 9 hours.

The curve of hourly earthquake frequency for Nagoya (Fig. 12) indicates regular fluctuations, whose average length is about $4\frac{1}{2}$ hours, and amongst which prominent maxima, marked a, b, c, d, e, f, occur at successive intervals of nearly twenty-four hours, shewing an evident diurnal variation. The curve of 2-hourly earthquake frequency indicates a period of mean length of about 9 hours.

The curves of daily, 2-daily, and 5-daily earthquake frequencies

for Gifu (Figs. 7, 8, and 9) indicate respectively fluctuations, whose average length are $4\frac{1}{2}$, 12.3, and 33 days. Longer periods are not evident.

The curve of monthly earthquake frequency for Gifu (Fig. 5) indicates four maxima and minima between November, 1891 and December, 1893, whose dates are as follows.—

Maximum.		Minimum.	
April,	1892,	June,	1892,
September,	,,	February,	1893,
April,	1893,	June,	,,
September,	,,	December,	,,

The intervals between successive maxima or minima are from 4 to 8 months.

§ 22. *The Kagoshima Earthquake.*

The curves of daily and 2-daily earthquake frequencies for Chiran (Figs. 16 and 17) indicate respectively periods whose average lengths are 4.4 and 12 days. The curve of 5-daily earthquake frequency (Fig. 18) seems to indicate a period whose average length is about 33 days.

The Kagoshima earthquake is not yet sufficiently old to give indications of longer periods. The after-shocks of this and of the Kumamoto earthquake were not numerous enough to enable us to draw curves of hourly frequencies.

§ 23. We have before noted that a few severe after-shocks are likely to be followed by their own after-shocks. It might be supposed that the maxima, which occur in the curves of monthly earthquake frequencies (Figs. 1 and 5) represent merely the effects of such shocks and not the real fluctuations in the residual effect of the initial earthquake itself. But the fact is, on the contrary, that strong shocks

occurred when the frequency was going to reach a maximum, as with the earthquakes of January 10th, 1894, and of September 7th, 1892 (see Figs. 5 and 26). In the case of the latter earthquake, a maximum frequency took place indeed at Gifu, which was quite near the origin, in the same month (September); but, at Mitake, a town about 7 *ri* from the origin, greater numbers of shocks were recorded in the following two months. The three other maxima of frequency for Gifu which took place on April, 1891, and April and September, 1893, were accompanied by no particularly severe shocks. Similarly with the maxima in the monthly earthquake frequency for Kumamoto.

In the case of the Mino-Owari earthquake, some of the after-shocks are doubtless to be regarded as "fore-shocks" of the stronger ones which followed.

§ 24. *The Diurnal Fluctuation of the After-shock Frequency.*

The diurnal and annual fluctuations of the earthquake frequency have been discussed by various European investigators. The results obtained by Perry, Mallet, and others, however, are more or less doubtful, as they were chiefly based on statistics of vulgar records. In the present instance, after-shocks have been recorded at meteorological stations provided with seismographs, and the results here deduced should have therefore far greater weight than those hitherto obtained.

The curves of six-hourly earthquake frequencies for Gifu and Nagoya (Figs. 13 and 14) indicate the daily fluctuation very clearly.

The Mino-Owari earthquake took place on the morning of October 28th, 1891, and during the next thirteen complete days, from October 29th to November 10th, there were 1258 shocks at Gifu and 572 shocks at Nagoya. The distribution of these shocks in the twenty-four hours of the day are shewn in Fig. 19, (1) and (2) (see Tables XIII and XIV).

The curve of the diurnal earthquake fluctuation for Gifu (Fig. 19, (1)) indicates distinctly *three maxima*, which occur respectively between 4 and 5 a.m., between 11 a.m. and noon, and between 6 and 7 p.m., and *three minima* which occur respectively between 9 and 10 a.m., between 3 and 4 p.m., and at 11 p.m. The intervals between successive maxima are 7, 8, and 9 hours, and those between successive minima 6, 8, and 10 hours.

The corresponding curve for Nagoya (Fig. 19, (2)) indicates six more or less distinct oscillations, giving a mean period of 4 hours.

It is evident (see § 21) that both the 4-hour and the 8-hour periods existed together, but that the longer period predominated in the diurnal earthquake frequency for Gifu and the shorter one in that for Nagoya.

The curves drawn in red (Fig. 19, (1) and (2)) seem to indicate a very slight diurnal variation of the *mean* frequency, the minimum occurring between 1 and 2 p.m., and the maximum at about 1 a.m.

The hourly distributions of 148 shocks at Kumamoto during fourteen days, from July 31st to August 13th, 1889, and of 233 shocks as Chiran during an equal time interval, from 8th to 21st, September, 1893, (see Tables III and XVI), are, as shewn in Fig. 20, very similar respectively to those for Gifu and Nagoya.

§ 25. *The Annual Fluctuation of the After-shock Frequency.*

Curves (1), (2), and (3), Fig. 21, shew the annual fluctuation of after-shock frequency at Kumamoto averaged respectively for four years (1890–1893), three years (1891–1893), and two years (1892–1893). The first curve indicates *three* maxima which occur respectively in March, May, and October; and *three* minima which occur respectively in April, between August and September, and in December. The curves drawn in red indicate the annual variation of the *mean* frequency.

The Mino-Owari and the Kagoshima earthquakes are not yet sufficiently old to give positive results respecting the annual fluctuation.

§ 26. We have, in §§ 20, 21, and 22, found various periods of the after-shock frequency whose lengths vary from a few hours to several months. The five periods of about 4 hours, 8 or 9 hours, $4\frac{1}{2}$ days, 12 days, and 33 days, seem to occur constantly in after-shocks of different earthquakes. Besides these, there may exist also a constant period of some three months, (see § 20). But the longest period is different in the cases of the Mino-Owari and the Kumamoto earthquakes, the average length being about 6 months in the former and 8 months in the latter.

To see whether these periods and the diurnal and annual fluctuations stated in §§ 24 and 25 can be identified in the frequency of *ordinary* earthquakes, we shall next consider the seismometrical observations in Tōkyō and over the whole of Japan.

§ 27. *(a) Seismometrical Observations in Tōkyō.*

The hourly distribution of 1168 earthquakes recorded instrumentally at Tōkyō during sixteen years, from 1876 to 1891, (Table XVIII),[1] is shewn in Fig. 19, (4). The diurnal fluctuation presents *three maxima*, which occur respectively between 9 and 10 a.m., between 3 and 4 p.m., and between 8 and 9 p.m.; and the *three minima*, which occur respectively between 2 and 3 a.m., between 11 a.m. and noon, and between 6 and 7 p.m. The intervals between successive maxima are 6, 5, and 13 hours, and those between successive minima 9, 7, and 8 hours. The mean curve, drawn in red, seems to indicate a very slight diurnal variation, of which the maximum occurs in the evening and the minimum in the early morning.

The monthly distribution of 1300[2] earthquakes instrumentally

1 Tables XVIII and XIX are taken, by permission, from the Earthquake Report of the Central Meteorological Observatory.

2 See the note to Table XVII.

recorded at Tōkyō during eighteen years, from 1876 to 1893, (see Table XVII) is shewn in Fig. 21, (4). The curve presents three maxima which occur respectively in March, May, and December; and three minima which occur respectively in January, April, and August or September.[1]

(b) Seismometrical Observations over All Japan.

The hourly distribution of 3842 earthquakes in Japan during six years, from 1885 to 1890, (see Table XIX), is shewn in Fig. 19, (3). The diurnal fluctuation presents again *three maxima*, which occur respectively between 2 and 3 a.m., between 2 and 3 p.m., and between 10 and 11 p.m., the successive intervals being 12, 8, and 4 hours; and *three minima*, which occur respectively between midnight and 1 a.m., between 8 and 9 a.m., and between 5 and 6 p.m., the successive intervals being 8, 9, and 7 hours. The mean curve, drawn in red, seems to indicate a slight variation, having a maximum in the early morning and a minimum in the evening.

Fig. 19, (5) shews the hourly distribution of 5333 earthquakes in Japan, including the after-shocks of the Mino-Owari and the Kagoshima earthquakes, (see Table XX). The character of the curve is very similar to that in Fig. 19, (3) above described.

The monthly distribution of earthquakes during the same six years[2] is shewn in Fig. 21, (5). The annual fluctuation indicates *three maxima*, occurring respectively in February, May, and November; and *three minima*, occurring respectively in April, August, and December.

§ 28. *Conclusions.*

Three distinct maxima and minima occur in the diurnal fluctuation of the frequency of after-shocks as well as in that of ordinary

1 The maximum in March and the minimum in April, which are here very slight, are markedly shewn in the Kumamoto curve, Fig. 21, (1).

2 See Table XIX.

earthquakes. The hours at which these occur seem to be different for different localities and therefore these may not each be shewn, when we mix up earthquake records from distant places of the world together. Whether there are more earthquakes during the night than during the day is not certain, as may be inferred from the mean curves drawn in red.

The 4-hourly and 8-(or 9) hourly periods indicated in the curves of hourly earthquake frequency (Figs. 10, 11, and 12) are evidently due to the above diurnal fluctuation. We have not at present sufficient data to determine whether other three constant periods of $4\frac{1}{2}$, 12, and 33 days occur likewise in the frequency of ordinary earthquakes.

With regard to the annual fluctuation, it is to be noted that all the maxima and minima of the monthly after-shock frequency for Kumamoto (§ 20), with the two exceptions next mentioned, occurred in exactly, or nearly, the same months as the maxima and minima of frequency for all Japan (§ 27, *(b)*). Only the second and third minima at Kumamoto (§ 20) took place respectively in February and November, (1890), which are generally months of maximum earthquake frequency. These may denote fluctuations due to the "proper" period of the Kumamoto after-shocks.

Again, the four maxima of the monthly frequency for Gifu (§ 21) occurred in April and September, which are generally months of minimum earthquake frequency. These may denote the fluctuations due to the "proper" period of the Mino-Owari after-shocks. Of the four corresponding minima, three occurred in months of minimum frequency, and one in a month of maximum.

As already remarked, strong shocks seem to have a tendency to happen when the frequency is going to reach a maximum, and it is interesting to find that of the four severest *after-shocks* (three of the

Mino-Owari, and one of the Kagoshima earthquake) three took place in January and one in September. I believe that periodicity plays a very important part in the frequency of earthquakes, and its attentive study may be of help in the prediction of changes in seismic activity and other events.

I shall here confine myself to merely stating the facts. Theoretical speculations on this interesting branch of the earth's physics are reserved for a future occasion, when more materials respecting after-shocks shall have been obtained.

§ 29. *Again of the Seismic Frequency in Tōkyō, etc.*

As seen above, after-shocks indicate many periods in the variation of the seismic frequency whose lengths range between a few hours and one year. It is of course possible that there should exist periods of still longer duration. We shall here again consider the seismic record taken by instruments in Tōkyō during eighteen years from 1876 to 1893.[1] The curve of monthly earthquake numbers, a portion of which is shewn in Fig. 22, indicates very clearly the existence of the annual period. There seem to exist also fluctuations of a few months' duration, of which, for instance, I can count more or less distinctly—

10 during 39 months between January, 1876, and April, 1879;
15 „ 50 „ „ September, 1882, and November, 1885;
and 15 „ 50 „ „ November, 1885, and January, 1891;

The average length of the period is 3.5 months.

The curve of yearly earthquake numbers at Tōkyō (Fig. 23) shews fluctuations, the maxima of which occurred in the years 1880, 1884–5, and 1889, and the minima in the years 1878, 1883, and 1886, there being besides these a slight maximum in 1891. The average length of the period is 4 years.

1 See Table XVII.

The mean curve (drawn in red), Fig. 23, seems to indicate the existence of a period[1] whose length is some 12 years.

One interesting fact is that the three severest of all the earthquakes recorded at Tōkyō during the eighteen years, namely, those of February 2nd, 1880, of October 15th, 1884, and of February 18th, 1889, happened respectively in the years which mark, exactly or nearly, the epochs of successive maximum frequency. It may likewise be the case that the maxima of the longer (12 years) period may often be marked by great earthquakes.

It may hereby be remarked that the greatest monthly earthquake number, namely 45, was recorded in October, 1891. Of these, 28 happened within four days immediately after the great Mino-Owari earthquake (which took place on the 28th of the same month), and the remaining 17 before the latter, so that the proper number of earthquakes in Tōkyō may be assumed to have been $17 \times \frac{31}{27}$, or 19.[2] Of the other 225 monthly numbers the next greatest namely 18, occurred in April, 1889.

A good example of the occurrence of destructive earthquakes at rather regular intervals is found in the seismic frequency for Kansu, a Department in the north-western corner of China, where the intervals between successive paroxysmal epochs range from 15 to 64 years, giving the mean length of 33 years.[3]

To discover periodicity in seismic frequency we must treat records of earthquakes for different localities separately. By way of example, in Fig. 23, (*A*), (*B*), (*C*) and (*D*), are shewn the curves of yearly seismic activity during 19 years, 1865 to 1883, in Switzerland, the Vesuvian

1 If the sensibilities of the seismographs by which the record of shocks has been made have been different in the earlier and later years, the chief consequence will have been to affect slightly the amplitude.

2 At Gifu only one earthquake had been recorded in October, before the 28th.

3 See the present author's paper, "On Chinese Earthquakes," Seis. Jour. Vol. I.

district, Sicily, and in the Balkan Peninsula and neighbouring Islands.[1] The curves for the Vesuvian district and Sicily shew each a series of periods of about 5 years; and that for Switzerland shews one well-defined of 12 years besides some ill-defined fluctuations of shorter average length. It will be observed that the maxima and minima of seismic activity for the two Italian districts occurred simultaneously, but at quite different epochs from those for Switzerland.

§ 30. To investigate the relations, if any, between earthquakes and the phases of the moon, sun-spots, temperature of the atmosphere, etc., seems not likely to lead to valuable results and would be, as Mallet remarked, a waste of scientific time and labour. With atmospheric changes of pressure it may be different and I shall here, therefore, treat shortly of the possible connection of the barometric height with the frequency of after-shocks.

In Table IV are given the mean barometric heights and the fluctuations during successive days from October 28th, 1891, to April 30th, 1892. It seems that earthquakes happen equally often with low as with high pressures. Thus from an examination of the record of the daily seismic frequency at Gifu, I can count, between the above dates, 55 maxima and 55 minima in the frequency, and the means of the barometric heights corresponding to these two sets are respectively 762.64 and 763.34 mm., which are practically identical.

Again, big barometric falls of 10 or 20 mm. or rises of 5 or 10 mm. were not accompanied by any marked change in the seismic frequency.

A single abrupt change in the atmospheric pressure is not likely to be accompanied by any fluctuation in the frequency of earthquakes. If, however, barometric changes, whether small or great, occur at regular intervals, then the earth's crust may finally assume certain corresponding oscillations. Thus the daily and annual fluctuations in

1 The data are taken from Fuchs' "Statistik der Erdbeben von 1865–1885"; see Table XXI.

the seismic frequency may partly be due to those in the atmospheric pressure. Especially are the curves of the annual barometric and seismic fluctuations very similar to each other.

III. On the Distribution of After-shocks, etc.

§ 31. We shall lastly consider more particularly the magnitude of after-shocks and their distribution.

Earthquakes are produced when strains in the earth's crust reach a certain limit, and, as a very great shock would remove a correspondingly great underground instability, it is probable that such a shock would not, for a long time, be followed by another of a magnitude comparable to its own, in the same or a neighbouring district. When, however, the initial shock is not very great, it may be followed by another like it, and, even in this case, the position of the origin of the second shock would usually be quite distinct from that of the first.

The above statements can well be illustrated by the four recent destructive earthquakes in Japan, namely, those of Mino-Owari, of Noto, of Kumamoto, and of Kagoshima; the three last ones were much smaller than the first, which was indeed very great and violent.

§ 32. The Kumamoto earthquake of July 28th, 1889, was followed five days later, on August 3rd, by a second shock, which was, however, as we have already seen (§ 7) only one-half or one-third as great as the first. All the other after-shocks were much weaker.

The Noto earthquake of December 9th, 1891, was followed, two days later, on the 11th of the same month, by a second severe earthquake. These two had nearly an equal area of disturbance, and the intensity of motion near the epicentres was almost the same. Their origins were, however, different, the epi-centre of the first shock being at a point, latitude 37°4′ N, longitude 136° 40′ E, or in the sea at about

$1\frac{1}{2}$ or 2 *ri* to the SSW of the Togi-mura, Hagui District (Noto province); and that of the second shock at a point about 2 *ri* to the SSE of that of the first, also in the sea and near to the town of Takahama in the same district. All the shocks in Noto which followed these two were small.[1]

The Kagoshima earthquake of September 7th, 1893, was followed, on January 4th, 1894, about four months later, by a second shock whose area of disturbance was a little greater than that of the first. These two shocks again originated from different centres. The epicentre of the first shock was inland and near Chiran-mura in the Kiire District, at about 7 *ri* to the SSW of Kagoshima; while that of the second shock was in the sea at about 2 *ri* to the west of Nomasaki, the distance between the two epi-centres being about 10 *ri*. The damage caused by the first shock was much greater than that by the second. The effect of the second shock on the frequency of earthquakes at Chiran was merely to increase slightly the amplitude of the period of seismic activity during which it occurred (at the epoch marked *a*, Fig. 15).

In the case of the Mino-Owari earthquake, all the subsequent shocks, more than 3000 in number, were far smaller than the initial one itself. It is to be remarked that the three severest of these numerous after-shocks, namely, the earthquakes of January 3rd and September 7th, 1892, and of January 10th, 1894, all originated in the Mino-Owari Plain, and not in the Neo-Valley, wherein indeed no very strong shock has ever occurred since the date of the first great one.

§ 33. *The Mino-Owari Earthquake.*

It thus seems that the Neo-Valley, or the principal epi-focal tract, is steadily settling down to equilibrium, while the Mino-Owari Plain, having probably lines of weakness under it not completely

1 Unfortunately the after-shocks of the Noto earthquake were not carefully recorded.

removed by the earthquake of October 28th, 1891, has been affected by the severe shocks mentioned above. It may be that the latter tract is still to be disturbed in future by a few such shocks, which, however, will then be of only secondary magnitude and not so violent as to destroy houses.

Soon after the great earthquake of October 28th, 1891, temporary seismological observatories were established at Ōgaki and Midori to cooperate with the Meteorological Stations of Gifu and Nagoya. I have myself passed, in the latter part of November and the early part of December, 1891, several days at Midori and Ōkawara, the latter of which is a small village about 5 *ri* to the NNW of the former. Again the town of Gifu is about 7 *ri* to the SSE of Midori, which is in the central part of the Neo-Valley, where remarkable faults have taken place. In the following table are compared the daily numbers of earthquakes I have recorded at Midori and Ōkawara with those observed at Gifu :—

Place. / Date.	Gifu.	Midori.	Ōkawara.
November 22nd, 1891	12	7	...
23rd	23	9	...
...	...	...	...
25th	9	...	5
26th	15	...	15
27th	11	...	10
28th	16	...	7
29th	19	...	6
30th	14	3	...
December, 1st, „	7	2	...
2nd	16	7	...
3rd	17	4	...

Place. / Date.	Gifu.	Midori.	Ōkawara.
December, 4th, 1891	18	11	...
5th	32	3	...
6th	7	6	...
7th	8	5	...
8th	19	4	...
9th	22	6	...
10th	22	8	...
11th	14	5	...
12th	23	12	...
13th	14	2	...
14th	23	11	...

The results contained in the above table are graphically represented in Figs. 24 and 25. Fig. 24 shews that the number of earthquakes at Ōkawara was a little less than that at Gifu, and that the seismic frequencies at the two places did not synchronize in the occurrence of maxima and minima. Fig. 25 shews that the seismic frequency at Gifu synchronized in the occurrence of maxima and minima with that at Midori, but that at the latter place it was generally less than half what it was at the former.

From the above we may conclude that the after-shocks which were felt at Midori were in the main the same as those felt at Gifu, but that the latter place was much nearer to the principal centre of these shocks than the former; also that the shocks which were felt at Ōkawara had mostly proceeded from a centre different from and less active than that of the shocks at Gifu.

Thus it seems that the activity of after-shocks at the principal epi-focal tract was distinctly less than at the regions to its north and south. Again, from what I can infer from information or from my

own experience while travelling in the valleys of the Ibi-kawa and the Mugi-gawa, which are respectively to the west and east of the Neo-Valley, the activity of after-shocks in these two valleys was less than in the latter.

It is difficult to determine the exact position of the most active centre of after-shocks, but it was situated somewhere to the south of the Neo-Valley for some time immediately succeeding the great earthquake of October 28th, 1891, quite near to Gifu and probably in the tract adjoining the town on the west.

Below are tabulated the monthly numbers of earthquakes recorded, from November, 1891, to February, 1894, at various places in the three provinces of Mino, Owari, and Mikawa :—

Year, Month. / Place, District.	1891			1892												
	XI	XII	Sum	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Sum
(Mino.)																
Hachiman, Gujō	139	36	175	18	9	9	3	2	2	3	1	5	3	2	4	61
Kōzuchi, Mugi	304	91	395	21	10	11	7	3	3	5	8	9	10	13	6	106
Takatomi, Yamagata	318	98	411	22	11	18	13	2	3	3	3	7	14	17	7	120
Kitagata, Motosu	154	40	194	17	10	8	4	2	2	2	1	2	4	2	4	60
Ibi, Ōno	152	40	192	13	10	8	4	2	2	2	1	1	3	2	4	52
Tarui, Fuwa	137	48	185	12	10	8	5	2	2	2	1	1	4	2	4	53
Takata, Tagi	232	60	293	16	13	10	7	2	2	2	2	2	5	4	5	70
Takasu, Shimo-Ishizu	266	66	332	16	13	10	7	1	2	2	2	2	5	4	6	70
Ogaki, Ampachi	416	128	544	17	17	12	7	2	2	2	2	2	5	4	6	78
Gifu	1087	416	1503	164	114	87	90	54	30	35	52	107	47	48	39	867
Ōta, Kamo	428	143	571	62	36	22	21	10	8	9	13	17	21	22	13	254
Mitake, Kani	486	166	652	82	55	32	26	17	14	9	17	18	25	24	14	333
Takayama, Toki	310	78	388	38	24	19	11	6	6	3	10	11	11	12	10	161
Nakatsugawa, Ena...	182	31	213	20	11	11	5	1	4	2	5	7	9	4	2	81
(Owari.)																
Ōtajima, Haguri	583	206	789	80	45	25	28	22	9	13	28	33	33	43	30	389
Inazawa, Nakajima	575	204	779	74	45	28	14	9	5	10	15	17	24	24	18	273
Tsushima, Kaito	462	126	588	31	27	16	10	5	4	4	9	11	13	17	11	158
Koori, Niwa	468	217	685	150	52	36	55	53	50	52	46	64	57	69	43	727
Biwajima, Nishi-Kasugai ...	591	215	806	141	51	36	48	44	44	49	42	54	54	55	40	658
Katsukawa, Higashi-Kasugai.	456	178	634	139	49	35	47	44	44	49	42	54	53	55	37	648
Nagoya	416	113	529	43	29	16	11	11	12	4	15	13	8	12	14	188
Atsuta, Aichi	294	72	366	31	29	14	9	8	10	4	15	11	13	18	14	176

Place, District.	1891			1892											
	XI	XII	Sum	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Sum
Handa, Chita	177	42	219	15	15	7	6	4	4	2	5	4	4	5	6	77
(MIKAWA.)																
Chiryū, Aomi	194	47	241	17	13	6	6	3	3	3	5	5	6	6	6	79
Okazaki, Nukada	175	43	218	19	12	8	6	3	4	3	5	5	4	5	5	79
Nishio, Hazu	142	36	178	14	11	7	5	2	4	1	6	5	5	5	4	69
Gou, Hoi	98	26	124	8	6	2	3	...	4	1	2	4	3	2	4	40
Toyohashi, Atsumi...	72	19	91	6	5	1	1	...	3	1	1	1	2	1	3	25
Koromo, Nishi-Kamo	288	75	363	29	24	16	9	4	6	3	11	11	10	15	11	149
Asuke, Higashi-Kamo	287	70	357	37	27	23	11	5	6	3	10	10	8	11	12	163
Shinshiro, Minami-Shidara ...	138	33	171	14	8	3	3	...	4	1	2	5	3	3	4	50
Tomioka, Yana	58	17	75	5	5	1	...	...	3	...	...	2	2	1	3	22
Taguchi, Kita-Shidara... ...	135	32	167	13	9	2	4	2	3	1	2	5	3	3	4	51

Place, District.	1893													1894	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Sum	I	II
(MINO.)															
Hachiman, Gujō	3	2	...	...	1	...	1	...	...	2	1	1	11	4	1
Kozuchi, Mugi...	5	6	1	...	3	1	4	...	1	2	1	...	24	3	...
Takatomi, Yamagata	5	3	5	2	4	2	5	2	7	8	5	10	58	12	6
Kitagata, Motosu	...	...	...	...	...	...	...	...	...	...	...	...	...	12	...
Ibi, Ōno	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Tarui, Fuwa	...	1	1	...	...	1	...	...	...	1	1	...	5	6	...
Takata, Tagi	...	...	...	1	...	...	...	...	...	...	...	...	1	2	...
Takasu, Shimo-Ishizu	...	1	...	...	...	...	...	...	...	...	1	1	3	11	1
Ōgaki, Ampachi	...	1	...	...	...	...	...	...	...	...	2	1	4	5	1
Gifu	31	20	52	59	32	12	18	13	20	19	16	16	308	62	14
Ōta, Kamo	...	...	...	...	...	...	...	...	...	...	...	...	...	28	...
Mitake, Kani	14	11	9	10	13	9	8	7	8	3	8	7	107	57	14
Takayama, Toki	3	3	3	2	3	2	...	...	1	...	3	1	21	8	1
Nakatsugawa, Ena	2	3	5	3	...	1	...	1	...	...	2	3	21	13	...
(OWARI)															
Otajima, Haguri	28	12	19	17	19	4	5	13	4	11	5	13	150	341	49
Inazawa, Nakajima...	11	5	12	4	5	1	1	5	4	3	2	3	56	64	7
Tsushima, Kaito	5	3	1	1	2	1	1	1	...	...	1	2	18	17	3
Koori, Niwa	42	40	48	33	24	20	15	13	23	35	25	32	350	366	95
Biwajima, Nishi-Kasugai	9	6	12	6	7	2	2	6	2	6	3	4	65	39	10
Katsukawa, Higashi-Kasugai. ...	6	5	8	6	3	2	1	2	...	4	3	5	45	62	6
Nagoya	5	5	10	11	14	9	14	14	8	9	4	7	110	89	29
Atsuta, Aichi	4	6	4	3	2	1	...	3	1	2	2	2	30	25	7
Handa, Chita	1	1	2	1	2	1	1	...	1	...	2	1	13	4	3
Maegasu, Kaisai	2	5	2	2	1	1	...	...	...	...	1	1	15	14	2
Toyohama, Chita	...	1	1	...	1	1	...	...	...	...	...	...	4	7	...

Place, District.	1893													1894	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Sum	I	II
(MIKAWA).															
Chiryū, Aomi	1	2	2	3	1	1	1	...	1	...	2	1	15	13	1
Okazaki, Nukada	3	2	1	1	2	2	...	...	1	...	1	2	15	8	1
Sakushima, Hazu	1	2	...	...	...	1	...	...	...	...	...	1	5	5	...
Nishio, Hazu	...	1	1	1	...	1	...	...	1	...	2	2	9	8	2
Horikiri, Atsumi	1	1	...	...	...	...	...	...	...	...	...	...	2	4	...
Gou, Hoi	1	1	1	1	1	2	...	...	1	...	1	...	9	6	...
Toyohashi, Atsumi	...	1	1	1	...	1	...	...	...	...	...	...	4	3	...
Koromo, Nishi-Kamo	6	2	3	5	4	2	...	2	2	1	1	5	32	20	9
Asuke, Higashi-Kamo	8	2	3	2	5	2	1	2	...	...	1	3	29	40	8
Shinshiro, Minami-Shidara... ...	4	1	1	1	4	2	...	...	...	...	1	2	16	13	1
Tomioka, Yana	1	1	1	1	1	1	...	...	...	...	1	...	7	5	...
Taguchi, Kita-Shidara...	...	2	1	...	...	1	1	1	...	...	2	1	9	10	...
Shimoda, Kita-Shidara...	...	1	1	1	1	1	1	...	1	...	...	2	9	16	...

Earthquake reports from District Offices and other stations in the Aichi Prefecture, *i.e.*, in the two provinces of Owari and Mikawa, have been sent in satisfactorily, and the numbers of shocks for these as tabulated above are practically correct. The numbers as recorded at the Gifu Meteorological Station and three District Offices in eastern Mino, namely, those at Mitake, Takayama, and Nakatsugawa, are also accurate; the records at other stations in the province, however, are imperfect and give only the numbers of stronger shocks.

During 1891 and 1892 the greatest number of earthquakes was recorded at Gifu. It is likely indeed that shocks may have been more accurately recorded at a meteorological station than at District Offices, but I believe the number of shocks was actually greatest in the vicinity of Gifu for some time after the great earthquake.

The records during 1892 for the six places in the western part of Mino, namely, Kitagata, Ibi, Tarui, Takata, Takasu, and Ōgaki, were month by month nearly alike, the highest seismic frequency having occurred at Ōgaki and the lowest at Ibi and Tarui. Of the two places in the central part of the province, namely, Takatomi and

Kozuchi, a greater number of shocks was recorded at the former than at the latter. Of the remaining six places, Nakatsugawa, Takayama, Mitake, Ōta, and Hachiman, the greatest number was recorded at Mitake and the least at Hachiman.

The records taken at several stations in Owari shew an evident change with time of localisation of seismic frequency. In 1891, the greatest number of earthquakes was recorded at Biwajima, Ōtajima, and Inazawa, these places being situated in a zone where, it should be remarked, the motion had been very strong on the occasion of the great earthquake of October, 1891. In 1892, the greatest number was recorded at Koori, and the next greatest at Biwajima and Katsukawa. Again, in 1893 the greatest number was recorded still at Koori, but the next greatest at Ōtajima and Nagoya. The least numbers always occurred at Atsuta and the stations in the Chita Peninsula.

The numbers of earthquakes at Nagoya, Atsuta, Handa, and Toyohama indicate an evident decrease of seismic activity with distance as we go southwards.

In Mikawa, the greatest numbers of earthquakes occurred at Koromo and Asuke in the north-western part of the province, the activity there being nearly the same as in the vicinity of Atsuta in Owari.

The seismic activity in the Atsumi Peninsula was less than that in the Chita Peninsula.

§ 34. The distribution of seismic activity in Mino, Owari, and Mikawa during 1892, 1893, and January, 1894, will be clearly seen from Figs. 27, 28, and 29, respectively, in which the curves are loci of places where equal numbers of shocks have been recorded during each of these intervals. In drawing Fig. 28, the numbers of earthquakes during January and September have been omitted as a severe shock

occurred in the beginning of each of these months in the district under consideration, and where consequently the seismic activity in some particular places was greatly increased. The residual effect of these severe secondary-earthquakes, however, as before remarked, soon died away, so that Fig. 28 will fairly represent the distribution of after-shocks in 1892 due wholly to the great earthquake of 1891. On the other hand, Fig. 29 will shew principally the effect of the strong shock which took place on January 10th, 1894.

Fig. 27 shews more or less distinctly four axial lines, which radiate from the vicinity of Koori and along which the seismic activity was greater than in the neighbouring tracts. In Figs. 28 and 29, two of these axial lines, one of which proceeded towards Ibi in the north-western corner of the Mino-Owari Plain, and the other of which proceeded to the basin of the Isé Gulf, became insignificant and we have only two distinct axial lines which extend from the same centre towards ENE and ESE, that is, respectively along the upper valley of the Kiso-gawa and into the mountain districts of the northern Mikawa.

The origin of the severe earthquake of January 10th, 1894, was just at the point of intersection of the above two axial lines, and those of the severe earthquakes of January 3rd and September 7th, 1892, were respectively in the vicinities of Gifu (near to the Kiso-gawa) and of Katsukawa (near to Nagoya), so that all these three shocks had their origins approximately on the same axial line running from WNW towards ESE.

§ 35. *On the Cause of the Great Earthquake of October 28th, 1891.*

The fact that the centre of the greatest activity of after-shocks is, not in the Neo-Valley where the shock had been strongest on the occasion of the earthquake of October, 1891, but in a locality near to it, suggests the idea that there had existed a very extensive

instability under the Echizen, Mino, Owari, and Mikawa provinces, and that the great earthquake was caused by some big fractures produced in this underground strained portion of the earth's crust.

The district adjoining the south-eastern extremity of the Neo-Valley is not yet on the way of steadily settling into equilibrium, and the four axial lines in Fig. 27 probably indicate the positions of four weaker or deeper fractures, the peculiar violence of motion on the occasion of the great earthquake in the zonal tract at the western part of the Owari Plain and in the regions to the south-east of Koori (see Fig. 26) being probably due to the existence of such lines of weakness beneath.[1] The underground fracture along the Neo-Valley was probably sufficiently great and must have removed the chief centre of weakness at that district.

The two axial lines in Fig. 28 seem to indicate the positions of fracture lines which became gradually prominent, and along which the activity of after-shocks is at present greatest.

The centre of activity of after-shocks may in future change its position, but it will very probably recede from, and not approach the Neo-Valley.

The distribution of seismic activity before 1891 is shewn in Fig. 30 (see Table XXII). It indicates no such peculiarity as that seen in Figs. 27, 28, and 29.

§ 36. *Earthquake Sounds.*—I take this opportunity of making some remarks upon earthquake sounds.

Many of the after-shocks of the Mino-Owari earthquake were attended with sounds, which were essentially of two types, being either rushing feeble noises like those caused by winds, or loud rumbling sounds like those caused by the falling of a heavy weight on ground, or by the discharge of a gun.

1 See Fig. 31.

The sounds of the second type, which were sometimes like detonations of thunder, were most frequent and distinct in the Neo-Valley, where, as I believe, their main origin really was. It is remarkable that tremblings of the ground accompanying these sounds were invariably very feeble, and often not to be felt at all, while severe sharp shocks were usually not accompanied by distinctly audible sounds. This peculiar phenomenon was ascertained likewise to have been observed with the after-shocks of the Noto and Kagoshima earthquakes. The following may be one of the possible explanations.

Among numerous depressions of small pieces of ground produced by the great earthquake of 1891, there was one which took place on a high mountain flank near the village of Higashi-Yokoyama, in the Ōno District, Mino, and which was cylindrical in form, being about 9 feet in diameter and 10 feet in depth. The top of the cavity was just shewn on the surface slope as a circular aperture about 4 feet in diameter. From examples like this, we may suppose that some cavities have probably been formed underground which are not shewn on the surface. Especially in the focal region there may exist big vacant spaces, and the falling down into these of superincumbent rock masses would give rise to sounds accompanied by small movements of ground, as muffled sounds are heard when we throw stones into a deep well or hole. On the other hand, shocks may originate by fracturing of strata in districts near the focus which would cause sharp tremblings of the ground, but not be accompanied by loud sounds.

The slight rushing sounds often accompanying earthquakes may, as usually supposed, be caused by quick tremors preceding the principal earthquake motion.

List of Tables, I—XXII.

XIII.—Hourly Numbers of Earthquakes at Gifu, from October 28th to November 10th, 1891.

XIV.—Hourly Numbers of Earthquakes at Nagoya, from October 28th to November 10th, 1891.

XV.—Daily Numbers of Earthquakes at Chiran, from September 7th, 1893, to January 31st, 1894.

XVI.—Hourly Numbers of Earthquakes at Chiran, from September 8th to 21st, 1893.

XVII.—Monthly and Yearly Numbers of Earthquakes recorded instrumentally at Tōkyō, from January, 1876, to December, 1893.

XVIII.—Hourly Distribution of 1168 Earthquakes recorded instrumentally at Tōkyō, from 1876 to 1891.

XIX.—Hourly Distribution of 3842 Earthquakes in Japan from 1885 to 1890.

XX.—Hourly Distribution of 5333 Earthquakes in Japan.

XXI.—Yearly Seismic "Activities" in Switzerland, the Vesuvian District, Sicily, and the Balkan Peninsula and neighbouring Islands.

XXII.—Yearly Numbers of Earthquakes at different places in Owari, Mino, and Mikawa, from 1887 to 1890.

TABLE I.—DAILY NUMBERS OF EARTHQUAKES AT KUMAMOTO, FROM JULY 28th, 1889, TO DECEMBER 31st, 1890.

Day	July, 1889.						August, 1889.					
	violent shocks	strong shocks	weak shocks	feeble shocks or sounds	sum	activity	violent shocks	strong shocks	weak shocks	feeble shocks or sounds	sum	activity
1	...	...	...	...	...	...	...	1	6	4	11	12
2	...	...	...	...	...	...	...	1	...	7	8	9
3	...	...	...	...	...	...	1	3	18	13	35	40
4	...	...	...	...	...	...	...	2	11	9	22	24
5	...	...	...	...	...	...	...	...	5	6	11	11
6	...	...	...	...	...	...	...	1	5	5	11	12
7	...	...	...	...	...	...	...	1	3	...	4	5
8	...	...	...	...	...	...	...	...	5	6	11	11
9	...	...	...	...	...	...	...	...	1	1	2	2
10	...	...	...	...	...	...	...	...	4	2	6	6
11	...	...	...	...	...	...	...	...	4	2	6	6
12	...	...	...	...	...	...	...	...	4	1	5	5
13	...	...	...	...	...	...	...	...	4	5	9	9
14	...	...	...	...	...	...	...	...	1	5	6	6
15	...	...	...	...	...	...	...	1	4	6	11	12
16	...	...	...	...	...	...	...	...	6	7	13	13
17	...	...	...	...	...	...	...	...	3	3	6	6
18	...	...	...	...	...	...	...	...	1	5	6	6
19	...	...	...	...	...	...	...	...	2	1	3	3
20	...	...	...	...	...	...	...	...	2	6	8	8
21	...	...	...	...	...	...	...	...	3	4	7	7
22	...	...	...	...	...	...	...	...	2	1	3	3
23	...	...	...	...	...	...	...	...	2	4	6	6
24	...	...	...	...	...	...	...	2	1	3	6	8
25	...	...	...	...	...	...	...	1	1	2	4	5
26	...	...	...	...	...	...	...	...	1	2	3	3
27	...	...	...	...	...	...	...	...	1	4	5	5
28	1	...	...	...	1	3	...	...	1	5	6	6
29	...	23	14	33	70	93	...	...	2	2	4	4
30	...	5	10	12	27	32	...	...	...	2	2	2
31	...	1	12	2	15	16	...	...	...	3	3	3
Sum	1	29	36	47	113	144	1	13	103	126	243	259

Day	September, 1889.					October, 1889.				
	strong shocks	weak shocks	feeble shocks or sounds	sum	activity	strong shocks	weak shocks	feeble shocks or sounds	sum	activity
1	...	...	...	...	...	1	...	4	5	6
2	...	1	...	1	1	1	2	2	5	6
3	...	1	...	1	1	...	2	1	3	3
4	...	...	1	1	1	...	3	1	4	4
5	1	...	1	2	3	1	3	3	7	8
6	1	1	1	3	4	1	1	1	3	4
7	1	...	1	2	3	...	4	2	6	6
8	...	...	...	...	...	...	1	1	2	2
9	1	...	1	2	3	...	1	1	2	2
10	1	...	2	3	4	...	...	1	1	1
11	...	...	...	...	...	...	...	1	1	1
12	...	1	...	1	1	...	...	...	...	...
13	...	1	...	1	1	...	1	...	1	1
14	1	...	...	1	2	...	2	1	3	3
15	...	2	...	2	2	...	...	1	1	1
16	...	1	...	1	1	1	...	1	2	3
17	...	1	...	1	1	...	...	1	1	1
18	...	...	...	...	...	1	1	2	4	5
19	2	2	...	4	6	...	...	1	1	1
20	...	...	...	...	...	...	3	...	3	3
21	...	2	...	2	2	...	1	...	1	1
22	1	1	...	2	3	1	1	...	2	3
23	2	...	...	2	4	1	1	2	4	5
24	1	...	...	1	2	...	1	2	3	4
25	...	...	1	1	1	...	...	2	2	2
26	2	...	2	4	6	...	...	2	2	2
27	...	...	...	...	...	...	1	1	2	2
28	...	1	...	1	1	...	...	1	1	1
29	...	...	...	...	...	...	1	...	1	1
30	...	1	1	2	2	...	...	2	2	2
31						1	...	1	2	3
Sum	14	16	11	41	55	9	30	38	77	87

Day	November, 1889.					December, 1889.				
	strong shocks	weak shocks	feeble shocks or sounds	sum	activity	strong shocks	weak shocks	feeble shocks or sounds	sum	activity
1	...	...	1	1	1	...	...	1	1	1
2	...	...	1	1	1	...	1	1	2	2
3	1	...	1	2	3	...	...	1	1	1
4	...	1	...	1	1	...	2	1	3	3
5	...	...	1	1	1	...	1	...	1	1
6	...	2	1	3	3	...	...	...	...	...
7	...	1	1	2	2	...	...	...	...	...
8	...	...	...	...	...	1	1	1	3	4
9	...	1	1	2	2	...	...	2	2	2
10	...	1	1	2	2	1	1	2	4	5
11	...	1	2	3	3	...	1	1	2	2
12	...	1	1	2	2	...	...	1	1	1
13	...	2	1	3	3	...	1	1	2	2
14	...	...	1	1	1	...	1	1	2	2
15	...	...	...	...	...	...	1	1	2	2
16	...	1	1	2	2	...	...	2	2	2
17	...	...	...	...	...	...	1	...	1	1
18	1	1	1	3	4	...	1	...	1	1
19	...	1	1	2	2	...	1	...	1	1
20	...	2	...	2	2	...	...	...	...	...
21	...	1	...	1	1	...	1	1	2	2
22	...	1	1	2	2	...	...	1	1	1
23	...	1	1	2	2	...	2	...	2	2
24	...	...	2	2	2	...	...	...	...	...
25	...	1	1	2	2	...	...	1	1	1
26	...	1	...	1	1	...	...	...	...	...
27	...	...	1	1	1	...	1	...	1	1
28	...	...	...	...	...	...	1	...	1	1
29	...	3	2	5	5	...	1	...	1	1
30	1	...	1	2	3	...	...	...	...	...
31						...	1	...	1	1
Sum	3	23	25	51	54	2	20	19	41	43

Day	January, 1890.			February, 1890.			March, 1890.				April, 1890.	May, 1890.			
	weak shocks	feeble shocks or sounds	sum	weak shocks	feeble shocks or sounds	sum	strong shocks	weak shocks	feeble shocks or sounds	sum	feeble shocks or sounds	strong shocks	weak shocks	feeble shocks or sounds	sum
1	...	...	...	...	2	2	...	...	1	1	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	1	1	1	3	5
3	...	1	1	...	...	...	...	...	...	...	...	...	...	3	3
4	...	2	2	...	...	...	...	...	...	...	1	...	1	1	2
5	...	2	2	...	...	...	...	...	1	1	2	...	...	1	1
6	...	...	...	...	...	...	2	...	2	4	2	...	...	...	...
7	1	1	2	...	...	...	...	...	2	2	1	...	...	...	...
8	...	...	...	...	...	...	...	...	2	2	1	...	...	...	...
9	...	...	...	...	1	1	...	...	...	...	1	...	...	...	...
10	...	...	...	...	1	1	...	...	..	...	1	...	...	1	1
11	...	...	...	1	...	1	...	...	1	1	1	...	...	1	1
12	...	...	...	...	...	...	...	...	2	2	...	...	...	1	1
13	...	1	1	...	...	...	...	...	...	...	...	...	...	1	1
14	1	1	2	...	1	1	...	...	2	2	...	...	...	...	...
15	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...
16	...	1	1	...	...	...	...	...	1	1	...	...	...	...	...
17	...	...	...	...	...	...	...	...	2	2	1	...	...	...	...
18	...	...	...	...	...	...	1	...	1	2	1	...	...	4	4
19	...	1	1	...	1	1	...	...	...	...	...	...	...	...	...
20	...	1	1	...	...	...	...	...	1	1	...	...	...	1	1
21	...	...	...	...	...	...	...	...	...	...	1	...	...	2	2
22	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	1	2	3	...	...	...	1	1
24	...	...	...	...	...	...	...	...	2	2	...	...	...	...	...
25	...	...	...	...	...	...	...	..	1	1	2	...	...	1	1
26	...	...	...	...	...	...	...	...	4	4	...	...	...	1	1
27	...	...	...	...	...	...	...	...	...	...	...	...	...	4	4
28	...	1	1	...	...	...	...	...	1	1	...	1	...	...	1
29	...	...	...				...	...	4	4	...	...	1	...	1
30	...	1	1				1	...	3	4	..	...	1	1	2
31	...	...	...				...	...	...	...		...	...	...	...
Sum	2	14	16	1	7	8	4	1	35	40	16	2	4	27	33

Day	June, 1890			July, 1890			Aug., 1890	Sep., 1890	Oct., 1890	Nov., 1890	Dec., 1890
	weak shocks	feeble shocks or sounds	sum	weak shocks	feeble shocks or sounds	sum	feeble shocks or sounds	feeble shocks or sounds	feeble shocks or sounds	feeble shocks or sounds	feeble shocks or sounds
1	...	...	...	...	...	...	2	1	...	...	...
2	1	4	5	...	1	1	2	1	2	1	...
3	1	1	2	...	...	...	2	...	...	...	...
4	1	2	3	...	3	3	...	...	..	...	...
5	...	1	1	...	2	2	...	...	...	...	...
6	...	...	...	...	1	1	2	1	...	...	2
7	...	...	...	...	1	1	...	...	...	...	1
8	...	...	...	1	1	2	...	...	...	...	...
9	...	1	1	...	...	...	...	2	...	...	...
10	...	...	...	...	1	1	...	1	1	...	...
11	...	...	...	...	...	...	2	...	...	...	...
12	...	...	...	...	2	2	...	...	...	...	...
13	...	...	...	...	...	...	...	1	...	...	...
14	...	1	1	...	1	1	1	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...
16	...	1	1	...	...	...	...	...	1	...	...
17	...	1	1	...	...	...	...	1	...	...	...
18	1	1	2	...	...	...	...	1	...	...	...
19	1	1	2	...	...	...	...	...	...	...	...
20	...	2	2	...	...	...	...	1	...	...	...
21	...	...	...	...	...	...	2	...	...	...	...
22	...	3	3	...	1	1	1	3	...	...	...
23	...	...	...	...	...	...	1	...	...	...	...
24	1	...	1	...	...	...	...	...	...	...	...
25	...	...	...	...	1	1	...	...	...	...	...
26	...	1	1	...	...	...	...	...	...	...	...
27	...	1	1	...	...	...	1	1	...	2	...
28	...	...	...	...	1	1	...	...	2	...	...
29	...	...	...	1	...	1	1	...	...	1	...
30	...	...	...	1	1	2	1	...	...	2	...
31				...	...	...	1		...		...
Sum	6	21	27	3	17	20	19	14	6	6	3

TABLE II.—MONTHLY AND YEARLY NUMBERS OF EARTHQUAKES AT KUMAMOTO, FROM 1889 TO 1893.

Month / Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	sum
1889							113[1]	243	41	77	51	41	566
1890	16	8	40	16	33	27	20	19	14	6	6	3	208
1891	8	19	6	9	7	7	2	1	...	12	9	9	89
1892	3	3	3	3	7	3	4	1	2	5	1	3	38
1893	2	1	1	1	...	1	...	...	4	7	3	...	20[2]
Sum	29	31	50	29	47	38	139	264	61	107	70	56	921

TABLE II.[1]—AVERAGE MONTHLY NUMBERS OF EARTHQUAKES AT KUMAMOTO.

Month / Interval	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1890-1893	7.3	7.8	12.5	7.3	12.0	9.3	6.0	5.5	5.0	7.5	4.8	4.0
1891-1893	4.3	7.7	3.3	4.3	4.7	3.7	2.0	0.7	2.0	8.0	4.3	4.0
1892-1893	2.5	2.0	2.0	2.0	3.5	2.0	3.0	0.5	3.0	6.0	2.0	1.5

1. The number for July, 1889, is that for four days, from 28th to 31st of that month.

2. Those shocks at Kumamoto which were evidently due to the Kagoshima earthquake of September 7th, 1893, are not included.

TABLE III.—HOURLY EARTHQUAKE NUMBERS AT KUMAMOTO, FROM JULY 31st TO AUGUST 13th, 1889.[1]

Day / Interval	July, 1889.	August, 1889.													sum
	31	1	2	3	4	5	6	7	8	9	10	11	12	13	
0— 1 a.m.	2	1	...	...	1	...	1	...	...	...	1	1	...	...	7
1— 2	1	1	3	1	...	5	...	...	1	...	...	...	...	1	13
2— 3	3	2	...	6	2	...	1	...	...	...	1	2	...	1	18
3— 4	1	1	...	4	1	...	1	1	1	...	1	...	1	...	12
4— 5	1	1	1	5	...	1	1	...	1	...	...	...	...	...	11
5— 6	1	...	1	4	1	1	1	1	...	...	...	...	...	1	11
6— 7	...	...	1	1	...	...	1	...	...	...	...	...	...	...	3
7— 8	...	2	...	1	...	1	...	...	...	1	...	...	...	1	6
8— 9	...	...	...	1	2	...	...	...	...	...	...	...	...	1	4
9—10	...	1	...	...	1	...	...	...	...	...	...	...	...	...	2
10—11	...	...	...	2	...	...	1	...	...	1	...	...	...	...	4
11—12	...	...	...	1	...	...	...	...	1	...	1	...	...	...	3
0— 1 p.m.	1	...	...	2	2	1	1	...	1	...	1	...	1	1	11
1— 2	1	...	1	...	2	...	1	...	...	...	...	...	...	...	5
2— 3	1	...	...	...	...	...	...	...	1	...	...	...	...	...	2
3— 4	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1
4— 5	1	...	...	...	1	1	1	...	...	...	...	...	...	...	4
5— 6	...	1	...	...	...	...	...	...	...	...	1	...	...	1	3
6— 7	...	...	...	5	1	...	...	...	...	...	...	2	...	...	8
7— 8	...	...	...	1	1	1	...	...	...	...	...	...	1	...	4
8— 9	...	1	...	...	...	...	...	1	1	...	...	...	1	1	5
9—10	1	...	...	...	1	...	...	...	...	...	...	...	...	...	2
10—11	...	...	1	...	...	...	...	...	2	...	...	...	1	...	4
11—12	1	...	...	...	1	...	1	...	1	...	...	...	...	1	5
Sum	15	11	8	34	17	11	11	4	10	2	6	5	5	9	148[2]

During Night, or between 6 p.m. and 6 a.m., 100
„ Day, „ „ 6 a.m. and 6 p.m., 48
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1. The first great earthquake took place on July 28th, 11.48 p.m., and the times of occurrence of subsequent shocks were not noted down till 31st of the same month.

2 The times of occurrence of shocks were lost in a few cases, and therefore this number is slightly less than according to Table I.

TABLE IV—DAILY NUMBERS OF EARTHQUAKES AND BAROMETRIC HEIGHTS AT GIFU, FROM OCTOBER 28th, 1891, TO APRIL 30th, 1892.

Day	OCTOBER, 1891.								
	violent shocks	strong shocks	weak shocks	feeble shocks	sounds	sum	activity	mean[1] bar. ht. in mm.	fluctuation, in mm.
1	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...
28	1	8	94	...	...	103	113	753.7	− 3.5,+ 3.7
29	...	15	303	...	...	318	333	54.9	− 2. ,+ 2.2
30	3	14	147	...	9	173	193	61.3	+ 8.1
31	...	3	116	1	6	126	129	65.1	+ 1.3,− 2.3
Sum	4	40	660	1	15	720	768	...	...

1. The "Mean Barometric Height" was obtained by taking the mean of six observations on each day, at 2, 6, 10, a.m., and 2, 6, 10, p.m. The "Fluctuation" is the difference between these observations, + when rising, and − when falling. For instance, − 3.5, + 3.7 means that the pressure first fell by 3.5 mm. and then rose by 3.7 mm.

Day	NOVEMBER, 1891.								
	violent shocks	strong shocks	weak shocks	feeble shocks	sounds	sum	activity	mean bar. ht. in mm.	fluctuation, in mm.
1	...	5	94	...	...	99	104	762.7	−3. ,+1.2
2	...	4	88	...	...	92	96	63.9	+1.6,−1.6,+2.2
3	...	...	81	...	...	81	81	63.6	−3.
4	...	2	75	1	...	78	80	59.1	−5.
5	...	1	52	...	...	53	54	55.3	+3.7
6	...	4	56	1	6	67	71	59.8	+3.9
7	...	3	42	...	...	45	48	64.2	+4.2
8	...	1	41	...	...	42	43	67.0	+1. ,−2.6
9	...	1	43	...	...	44	45	63.0	−4.3
10	...	...	40	...	...	40	40	58.5	−6.3
11	...	...	37	...	1	38	38	60.5	+7.6
12	...	1	38	1	...	40	41	63.8	−1.7
13	...	1	32	1	1	35	36	62.3	−2. ,+1.6
14	...	...	25	3	1	29	29	64.3	+2.1,−1.4,+2.
15	...	...	23	6	...	29	29	64.4	−3.2
16	...	...	27	1	...	28	28	59.9	−5. ,+2.2
17	...	...	15	1	5	21	21	61.3	+2.5,−1.4,+2.
18	...	...	...	9	9	18	18	61.9	−2.6,+1.6
19	...	...	...	7	10	17	17	62.6	−1.2,+3.
20	...	1	...	18	14	33	34	65.1	−2.7,+2.3
21	1	1	10	5	4	21	24	65.0	−2.1,+1.6
22	...	...	...	9	3	12	12	65.4	+1.8
23	...	2	...	16	5	23	25	61.9	−6.2
24	...	...	...	14	4	18	18	69.1	+4.6
25	...	...	...	6	3	9	9	63.3	+1.2,−1.2,+1.4
26	...	...	3	3	9	15	15	63.8	−2.3,+2.3
27	...	1	4	...	6	11	12	66.6	+5.2
28	1	1	4	...	10	16	19	72.0	−1.4,+1.1
29	...	...	10	3	6	19	19	70.2	−2.2
30	...	...	12	1	1	14	14	66.7	−3.6
Sum	2	29	852	106	98	1087	1120	...	...

Day	DECEMBER, 1891.								
	violent shocks	strong shocks	weak shocks	feeble shocks	sounds	sum	activity	mean bar. ht. in mm.	fluctuation, in mm.
1	...	...	3	3	1	7	7	767.4	+3.8
2	...	...	3	9	4	16	16	70.5	+1.3,−2.1
3	1	1	9	4	2	17	20	61.3	−14.4
4	1	...	4	11	2	18	20	51.6	−1.4,+5.9
5	...	1	17	12	2	32	33	64.0	+10.5
6	...	...	...	6	1	7	7	71.5	+2.3,−2. ,+2.2
7	...	1	...	6	1	8	9	72.4	−2.5
8	...	...	11	5	3	19	19	61.9	−15.4
9	...	2	10	8	2	22	24	57.9	+7.4
10	...	...	17	3	2	22	22	61.7	+1.3,−1.7
11	...	...	10	2	2	14	14	62.6	+3.7
12	...	...	18	2	3	23	23	63.6	+1.2,−4.7
13	...	...	5	1	8	14	14	61.5	+5.5
14	...	...	18	3	2	23	23	66.8	+3.5
15	...	...	...	14	1	15	15	67.3	−3.
16	...	2	17	...	1	20	22	63.7	−2.2,+1.6
17	...	...	10	8	...	18	18	64.7	+1.2,−1.4,+2.3
18	...	...	5	1	1	7	7	68.4	+5.4
19	...	...	...	3	2	5	5	70.8	−2.6,+1.8
20	...	...	5	1	2	8	8	67.3	−5.3
21	...	...	6	2	...	8	8	65.5	+1.8,−3.1
22	...	...	...	3	5	8	8	61.7	−4.2,+2.4
23	...	...	2	1	3	6	6	62.7	+3.2
24	1	1	10	...	3	15	18	66.7	+3.7
25	...	...	...	5	1	6	6	70.6	+2.4,−1.3
26	...	...	...	7	2	9	9	70.4	−2.6
27	...	...	...	2	1	3	3	69.0	+1.2,−2.5
28	...	...	1	6	...	7	7	69.3	+2.1
29	...	1	13	1	1	16	17	70.7	+1.4,−2.5,+1.6
30	...	...	10	2	3	15	15	71.2	−2.7
31	...	...	...	6	2	8	8	63.3	−7.3,+3.4
Sum	3	9	204	137	63	416	431	...	...

Day	JANUARY, 1892.								
	violent shocks	strong shocks	weak shocks	feeble shocks	sounds	sum	activity	mean bar. ht. in mm.	fluctuation, in mm.
1	...	...	4	1	1	6	6	766.3	+1.8,−2.4,+1.6
2	...	...	...	3	2	5	5	65.3	−2.2,+2.7
3	1	1	2	1	2	7	10	68.7	+3.2
4	...	1	6	3	2	12	13	68.0	−2.6
5	...	2	3	1	1	7	9	66.6	−1.3,+2.5
6	...	...	2	2	...	4	4	66.5	−2.7
7	...	...	...	4	5	9	9	63.2	−2.8,+3.
8	...	...	1	3	...	4	4	64.2	−4.5
9	...	...	2	1	...	3	3	60.9	+1.6,−2. ,+1.8
10	...	...	4	3	3	10	10	62.2	+2.6
11	...	...	8	6	...	14	14	62.9	−4.4
12	...	1	2	2	...	5	6	54.1	−6.2,+3.5
13	...	1	5	3	2	11	12	61.4	+10.
14	...	...	...	...	...	...	...	67.3	+2. ,−2.6
15	...	...	...	2	...	2	2	62.8	−5.8
16	...	...	...	3	...	3	3	58.1	−3.3,+1.8
17	...	...	1	1	...	2	2	58.7	+1.3,−1.5,+1.5
18	...	...	...	...	...	...	...	57.3	−2.2
19	...	...	...	4	2	6	6	59.9	+6.9
20	...	...	...	3	1	4	4	62.9	−3. ,+3.5
21	...	...	...	2	...	2	2	66.6	+3.8
22	...	...	...	3	1	4	4	70.6	+2.4,−2.4,+2.2
23	..	...	1	...	2	3	3	71.6	+1.7,−3.2
24	...	...	1	2	3	6	6	69.6	0
25	...	...	1	1	1	3	3	68.3	+1.2,−3.9
26	...	1	...	4	1	6	7	62.7	−5.4
27	...	...	2	3	2	7	7	61.3	+4.5
28	...	1	...	5	1	7	8	65.2	+2.
29	...	...	...	4	1	5	5	63.6	−3.2,+1.2
30	...	...	...	...	2	2	2	65.2	+4.4
31	...	...	...	4	1	5	5	64.2	−5.1
Sum	1	8	45	74	36	164	174	...	...

Day	FEBRUARY, 1892.							
	strong shocks	weak shocks	feeble shocks	sounds	sum	activity	mean bar. ht. in mm.	fluctuation, in mm.
1	...	...	...	...	...	...	763.4	+ 2.1, − 1.5
2	...	...	3	1	4	4	61.5	− 3.1, + 3.4
3	...	...	7	1	8	8	64.9	+ 2.2, − 2.
4	...	...	1	1	2	2	59.3	− 11.2
5	1	1	3	1	5	6	60.7	+ 7.9
6	2	...	1	...	4	6	69.5	+ 3.5
7	...	...	2	2	4	4	71.8	− 3.3
8	...	...	1	2	3	3	56.9	− 18.5, + 5.9
9	...	...	4	...	4	4	60.9	+ 7.
10	...	...	1	1	2	2	66.4	+ 1.8, − 1.7
11	...	...	1	2	3	3	66.9	− 2.1,
12	...	...	2	1	3	3	62.3	− 5.4, + 1.5
13	...	...	1	1	2	2	62.5	+ 1.8, − 1.9
14	...	...	4	2	6	6	55.7	− 11.7, + 4.8
15	...	...	4	1	5	5	57.5	+ 3.6
16	...	...	2	2	4	4	62:7	+ 4.
17	1	1	2	2	6	7	64.1	− 2.8, + 4.4
18	...	...	1	...	1	1	64.5	− 3.4
19	...	...	4	...	4	4	59.4	+ 3.7
20	...	...	2	1	3	3	62.0	− 2.
21	...	...	5	1	6	6	60.3	− 4.2
22	1	...	2	1	4	5	58.5	+ 3.
23	...	1	...	2	3	3	58.5	− 7.5
24	...	1	3	1	5	5	54.1	− 1.5, + 6.9
25	...	...	3	...	3	3	59.5	0
26	...	1	2	...	3	3	56.6	− 4.5, + 1.6
27	...	...	3	...	3	3	59.4	+ 5.1
28	...	...	...	8	8	8	59.4	+ 6.5
29	...	...	3	3	6	6	65.8	− 4.3
Sum	5	5	67	37	114	119	...	...

Day	MARCH, 1892.							
	strong shocks	weak shocks	feeble shocks	sounds	sum	activity	mean bar. ht. in mm.	fluctuation, in mm.
1	...	...	2	3	5	5	760.4	− 4.9,+5
2	...	...	2	1	3	3	63.4	− 1.4
3	...	...	3	4	7	7	60.1	− 2.5
4	...	...	3	2	5	5	58.9	− 2.3
5	...	...	...	...	...	...	58.6	− 1.7,+2.4
6	...	...	...	...	...	...	53.0	−11.3
7	...	...	1	2	3	3	53.1	+ 8.8
8	...	...	3	...	3	3	60.9	+ 5.3
9	...	...	...	1	1	1	67.0	+ 2.9
10	...	...	1	...	1	1	66.0	− 4.4
11	...	1	1	1	3	3	64.2	+ 4.
12	...	...	1	...	1	1	64.8	− 9.
13	...	...	4	1	5	5	51.5	− 5.8,+10.6
14	...	...	5	2	7	7	58.5	+ 4.9
15	...	...	2	...	2	2	63.2	− 1.7,+2.9
16	...	...	2	...	2	2	66.1	+ 1.5,−1.5,+2.7
17	...	...	2	1	3	3	67.4	+ 1.3,−2.6
18	...	...	...	...	...	...	58.0	−10. ,+2.8
19	...	...	...	...	...	...	57.6	+ 4.1
20	...	...	...	...	...	...	62.3	+ 1.6,−1.0,+3.1
21	...	...	...	2	2	2	65.9	+ 2.2,−2.2,+1.5
22	...	...	...	...	...	...	64.8	+ 1.3,−2.4
23	...	...	3	...	3	3	60.8	− 4.6
24	...	...	...	1	1	1	55.9	− 3.1,+5.3
25	...	...	3	...	3	3	63.4	+ 7.5
26	...	...	1	...	1	1	64.9	− 5.8
27	...	...	1	2	3	3	65.2	+ 3.5
28	1	...	2	3	6	7	64.5	− 3.9
29	...	...	3	1	4	4	58.9	− 4.9,+3.6
30	...	3	5	2	10	10	65.2	+ 6.8
31	...	...	2	1	3	3	68.8	− 2.1,+1.3
Sum	1	4	52	30	87	88	...	...

Day	APRIL, 1692.							
	strong shocks	weak shocks	feeble shocks	sounds	sum	activity	mean bar ht. in mm.	fluctuation, in mm.
1	...	...	2	...	2	2	764.4	−12.2
2	...	...	5	...	5	5	53.9	+8.2
3	1	...	1	...	2	2	57.1	−1.8,+7.
4	...	...	2	...	2	2	61.8	+1.3,−3.1
5	...	...	4	1	5	5	59.8	+3.1
6	...	1	...	...	1	1	60.9	−3.1
7	...	...	...	...	...	...	58.9	−2.3
8	...	1	7	1	9	9	57.6	−2.5
9	...	...	2	2	4	4	57.2	−1.3,+4.1
10	...	1	2	...	3	3	64.1	+7.8
11	...	...	...	...	...	...	66.4	−3.4
12	...	...	3	...	3	3	55.9	−12.4
13	...	...	2	...	2	2	55.6	+9.5
14	...	...	2	...	2	2	61.8	+2. ,−3.6
15	...	...	...	2	2	2	59.2	+4.
16	...	...	...	...	...	...	64.8	+3.9
17	...	...	3	...	3	3	63.7	−4.6
18	...	...	4	1	5	5	58.4	−3.2
19	...	...	3	...	3	3	61.6	+6.2
20	...	1	3	1	5	5	65.9	+1.3,−2.2
21	...	...	1	...	1	1	58.8	−7.4
22	...	...	3	...	3	3	61.9	+8.9
23	...	...	2	...	2	2	65.6	−2.5,+1.6
24	1	1	3	...	5	6	59.9	−6.1
25	...	1	...	...	1	1	55.3	−1.4,+1.5
26	...	2	1	...	3	3	60.9	+5.6
27	...	1	...	2	3	3	64.6	+1.4
28	...	...	1	...	1	1	65.2	+1.2
29	...	1	5	...	6	6	69.2	−2.7
30	...	...	4	3	7	7	58.3	−3.3
Sum	2	10	65	13	90	92	...	...

TABLE V.—DAILY NUMBERS OF EARTHQUAKES AT GIFU, FROM MAY, 1892, TO DECEMBER, 1893.

Day	May, 1892.				June, 1892.				
	weak shocks	feeble shocks	sounds	sum	strong shocks	weak shocks	feeble shocks	sounds	sum
1	...	6	...	6	...	...	...	2	2
2	...	3	...	3	...	...	...	1	1
3	...	...	...	...	...	...	...	...	...
4	1	...	...	1	...	...	1	...	1
5	...	1	...	1	...	...	...	...	...
6	...	1	...	1	...	...	...	...	...
7	1	3	...	4	...	...	3	...	3
8	...	...	...	...	...	...	...	...	...
9	...	2	...	2	...	...	2	...	2
10	...	3	...	3	...	...	2	...	2
11	...	4	1	5	...	...	1	1	2
12	1	...	...	1	...	...	1	1	2
13	1	...	...	1	...	...	...	...	...
14	...	1	...	1	...	...	...	...	...
15	1	1	...	2	...	...	1	1	2
16	...	2	...	2	...	...	...	...	...
17	...	...	...	...	...	...	1	...	1
18	...	...	...	...	...	...	1	...	1
19	...	...	...	...	...	...	1	...	1
20	...	...	...	...	1	...	2	1	4
21	...	...	...	...	...	...	...	...	...
22	...	2	...	2	...	...	...	...	...
23	...	2	3	5	...	...	1	1	2
24	...	1	...	1	...	...	...	1	1
25	...	4	...	4	...	...	1	...	1
26	...	2	...	2	...	...	...	...	...
27	...	...	1	1	...	...	1	...	1
28	...	...	...	...	...	...	...	...	...
29	...	1	1	2	...	...	...	...	...
30	...	1	...	1	...	1	...	...	1
31	...	2	1	3					
Sum	5	42	7	54	1	1	19	9	30

Day	July, 1892.				August, 1892.				
	weak shocks	feeble shocks	sounds	sum	strong shocks	weak shocks	feeble shocks	sounds	sum
1	1	...	1	2	...	...	4	...	4
2	...	1	1	2	...	...	1	...	1
3	...	...	1	1	...	...	3	1	4
4	...	2	1	3	...	1	...	..	1
5	...	...	1	1	...	1	...	1	2
6	...	...	...	...	...	...	1	...	1
7	...	1	...	1	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...
9	...	1	1	2	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
11	...	1	...	1	...	...	...	...	...
12	...	...	...	...	...	...	1	...	1
13	1	...	...	1	...	...	...	1	1
14	...	2	...	2	...	...	...	3	3
15	...	...	...	...	...	...	...	1	1
16	...	...	...	...	...	...	...	1	1
17	...	...	...	...	...	...	...	...	...
18	...	1	...	1	...	...	...	...	...
19	...	2	1	3	1	...	1	...	2
20	...	1	...	1	...	1	3	2	6
21	...	1	1	2	...	...	2	1	3
22	...	...	...	...	...	...	1	...	1
23	...	1	...	1	...	...	2	1	3
24	...	...	1	1	...	...	1	...	1
25	...	...	...	...	...	...	...	1	1
26	...	1	1	2	...	...	1	...	1
27	1	3	...	4	...	...	1	2	3
28	...	...	1	1	...	...	2	1	3
29	...	...	...	...	...	...	4	1	5
30	...	1	...	1	...	...	2	...	2
31	...	2	...	2	...	...	1	...	1
Sum	3	21	11	35	1	3	31	17	52

Day	September, 1892.						October, 1892.					November, 1892.			
	violent shocks	strong shocks	weak shocks	feeble shocks	sounds	sum	strong shocks	weak shocks	feeble shocks	sounds	sum	weak shocks	feeble shocks	sounds	sum
1	...	...	...	2	...	2	...	...	...	...	...	...	1	1	2
2	...	...	...	2	...	2	...	...	...	...	...	1	1	...	2
3	...	...	...	2	...	2	...	...	1	3	4	...	4	...	4
4	...	...	...	2	1	3	...	...	2	...	2	...	3	...	3
5	...	...	...	5	...	5	...	...	3	...	3	...	2	...	2
6	...	...	...	5	...	5	1	...	...	...	1	...	1	...	1
7	1	..	1	17	9	28	...	1	1	...	2	...	3	...	3
8	...	...	...	6	2	8	...	1	3	...	4	...	...	...	...
9	...	...	...	6	2	8	...	...	1	...	1	1	3	...	4
10	...	...	...	5	...	5	...	...	...	...	...	...	3	...	3
11	...	...	...	3	...	3	...	...	...	...	...	...	1	...	1
12	...	...	...	2	...	2	...	...	1	...	1	...	2	...	2
13	...	...	1	1	2	4	...	...	1	1	2	...	2	1	3
14	...	...	...	2	1	3	...	...	3	...	3	...	...	...	...
15	...	...	...	...	...	...	...	...	1	...	1	...	6	...	6
16	...	...	...	2	1	3	...	...	2	...	2	...	2	...	2
17	...	...	1	1	1	3	...	...	...	...	...	...	...	...	...
18	...	...	...	4	...	4	...	...	1	...	1	1	...	...	1
19	...	...	...	2	...	2	...	...	2	...	2	...	...	...	...
20	...	...	...	1	1	2	...	...	...	...	...	...	1	1	2
21	...	...	...	...	...	..	...	...	2	...	2	...	...	...	...
22	..	...	...	2	...	2	...	...	2	...	2	...	1	...	1
23	...	...	...	2	1	3	...	. .	2	...	2	...	2	...	2
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	1	...	1	...	...	1	...	1	...	...	...	...
26	...	...	...	2	...	2	...	...	...	...	...	...	1	1	2
27	...	...	...	1	1	2	...	...	5	...	5	...	1	1	2
28	...	...	...	...	1	1	...	...	2	...	2	...	...	...	...
29	...	...	...	...	...	...	...	...	...	3	3	...	...	...	...
30	...	...	...	1	1	2	...	...	...	...	...	...	...	...	...
31							...	...	1	...	1				
Sum	1	...	3	79	24	107	1	2	37	7	47	3	40	5	48

Day	December, 1892.				January, 1893.				February, 1893.			
	weak shocks	feeble shocks	sounds	sum	weak shocks	feeble shocks	sounds	sum	weak shocks	feeble shocks	sounds	sum
1	...	...	1	1	...	...	...	...	...	4	2	6
2	...	...	...	...	...	...	1	1	...	3	...	3
3	...	...	...	...	...	1	1	2	...	...	...	...
4	...	...	...	...	...	...	...	...	...	2	...	2
5	...	...	...	...	...	3	...	3	...	1	...	1
6	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	3	...	3
8	...	...	1	1	...	1	...	1	...	...	...	...
9	1	4	...	5	...	...	...	...	...	1	...	1
10	...	2	...	2	...	...	...	...	...	...	...	...
11	1	2	1	4	...	1	...	1	...	...	...	...
12	...	2	...	2	...	1	...	1	...	...	...	...
13	...	2	...	2	...	1	...	1	...	...	...	...
14	...	2	...	2	...	1	...	1	...	...	1	1
15	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...
18	...	1	...	1	...	1	...	1	...	...	...	...
19	...	5	1	6	...	...	1	1	...	...	...	...
20	...	2	...	2	...	...	...	...	...	...	...	...
21	...	1	...	1	...	...	...	...	1	1	...	2
22	...	1	...	1	...	2	...	2	...	...	...	...
23	...	1	...	1	...	2	1	3	...	...	...	...
24	...	...	1	1	...	3	1	4	...	1	...	1
25	...	...	...	...	...	...	...	...	...	...	...	...
26	...	1	...	1	...	...	...	...	...	...	...	...
27	...	1	...	1	...	1	...	1	...	...	...	...
28	...	1	...	1	...	...	...	...	...	...	...	...
29	...	1	...	1	1	1	2	4				
30	...	...	1	1	...	2	...	2				
31	...	1	1	2	...	2	...	2				
Sum	2	30	7	39	1	23	7	31	1	16	3	20

Day	March, 1893.				April, 1893.			May, 1893.				June, 1893.		
	weak shocks	feeble shocks	sounds	sum	feeble shocks	sounds	sum	weak shocks	feeble shocks	sounds	sum	feeble shocks	sounds	sum
1	...	2	...	2	2	...	2	...	...	...	...	...	...	...
2	...	2	1	3	2	...	2	...	...	...	...	...	...	...
3	...	2	...	2	3	...	3	...	1	...	1	...	...	...
4	...	...	...	...	3	...	3	...	2	2	4	1	...	1
5	...	...	...	...	6	...	6	...	...	...	..	1	...	1
6	...	2	1	3	3	...	3	...	...	...	...	1	...	1
7	...	2	1	3	2	...	2	...	...	1	1	2	...	2
8	...	5	...	5	...	...	...	1	...	...	1	1	...	1
9	...	...	...	...	2	...	2	...	1	...	1	...	...	...
10	...	1	1	2	3		3	1	...	...	1	1	...	1
11	...	1	...	1	...	...	...	...	2	...	2	...	...	...
12	...	...	...	...	2	1	3	1	...	...	1	...	...	...
13	...	...	..	...	2	1	3	...	3	...	3	...	...	...
14	...	1	...	1	8	...	8	...	...	...	...	1	...	1
15	...	4	...	4	2	...	2	...	1	...	1	...	...	...
16	...	2	...	2	2	...	2	...	1	...	1	...	...	...
17	...	2	...	2	...	...	...	...	...	...	...	...	...	...
18	...	1	...	1	2	...	2	...	4	...	4	...	...	...
19	...	1	...	1	1	...	1	...	...	...	...	1	...	1
20	...	1	...	1	...	...	...	...	3	...	3	1	...	1
21	...	4	...	4	2	...	2	..	2	1	3	...	...	...
22	...	2	...	2	2	2	4	...	...	...	...	1	...	1
23	1	1	...	2	1	...	1	..	...	...	...	...	...	...
24	...	5	...	5	1	...	1	...	...	...	...	...	...	...
25	...	3	...	3	2	...	2	...	...	...	...	1	...	1
26	...	1	...	1	...	...	...	..	...	...	...	...	...	...
27	...	...	...	...	1	...	1	...	2	...	2	...	...	...
28	...	1	...	1	...	...	...	...	1	...	1	...	...	...
29	...	1	...	1	...	...	...	...	...	...	..	...	...	...
30	...	...	...	...	...	1	1	...	1	...	1	...	...	...
31	...	...	...	...				...	1	...	1			
Sum	1	47	4	52	54	5	59	3	25	4	32	12	...	12

Day	July, 1893.			August, 1893.			September, 1893.			October, 1893.		
	feeble shocks	sounds	sum	feeble shocks	sounds	sum	feeble shocks	sounds	sum	feeble shocks	sounds	sum
1	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	1	...	1	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	1	...	1
4	...	...	...	...	...	...	...	...	...	...	...	...
5	2	...	2	...	...	...	...	...	...	...	...	...
6	1	...	1	...	...	...	...	...	...	1	...	1
7	...	...	...	1	...	1	...	...	...	1	...	1
8	1	...	1	1	...	1	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	1	...	1
11	...	...	...	...	...	...	...	...	...	...	...	...
12	...	1	1	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	1	...	1	...	...	...
14	...	...	...	...	...	...	2	...	2	...	...	...
15	...	...	...	...	1	1	2	...	2	...	1	1
16	2	...	2	1	...	1	...	...	...	2	...	2
17	...	...	...	...	...	...	2	...	2	1	...	1
18	2	...	2	...	1	1	1	...	1	1	...	1
19	1	...	1	2	...	2	1	...	1	...	...	...
20	...	...	...	...	...	...	1	...	1	1	...	1
21	1	...	1	1	...	1	1	...	1	1	...	1
22	3	...	3	...	...	...	2	...	2	...	...	...
23	2	...	2	...	...	...	1	1	2	...	...	...
24	1	...	1	...	...	...	1	...	1	1	...	1
25	...	...	...	1	...	1	1	...	1	1	...	1
26	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	1	...	1	1	1	2	1	...	1
28	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	3	...	3
30	1	...	1	...	1	1	1	...	1	...	...	...
31	...	...	...	1	...	1				2	...	2
Sum	17	1	18	10	3	13	18	2	20	18	1	19

Day	November, 1893.				December, 1893.			
	weak shocks	feeble shocks	sounds	sum	weak shocks	feeble shocks	sounds	sum
1	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...
4	...	1	...	1	...	...	...	...
5	...	1	...	1	...	...	...	...
6	...	...	...	...	...	1	...	1
7	...	...	...	...	...	1	...	1
8	...	1	...	1	...	...	...	...
9	...	...	...	...	...	...	...	...
10	1	...	...	1	...	...	...	...
11	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	1	1
14	...	2	...	2	...	...	...	...
15	...	...	...	...	...	...	...	...
16	...	1	...	1	...	...	...	...
17	...	...	...	...	...	...	...	...
18	...	2	...	2	...	...	...	...
19	...	1	...	1	...	1	...	1
20	...	...	...	...	...	2	...	2
21	...	...	1	1	...	4	...	4
22	...	1	...	1	...	2	...	2
23	...	1	...	1	...	...	...	...
24	...	...	...	...	...	...	...	...
25	1	...	1	2	1	...	...	1
26	...	...	1	1	...	...	...	...
27	...	...	...	...	...	...	...	...
28	...	...	...	...	...	1	...	1
29	...	...	...	...	...	...	...	...
30	...	...	...	...	1	...	...	1
31					...	...	1	1
Sum	2	11	3	16	2	12	2	16

TABLE VI.—DAILY NUMBERS OF EARTHQUAKES AT NAGOYA, FROM OCTOBER 28th, 1891, TO APRIL 30th, 1892.

Day	October, 1891.				November, 1891.				December, 1891.		
	violent shocks	strong shocks	weak, feeble shocks	sum	violent shocks	strong shocks	we k, feeble shocks	sum	strong shocks	weak, feeble shocks	sum
1	...	...	...	...	...	4	52	56	...	...	...
2	...	...	...	...	...	5	25	30	...	5	5
3	...	...	...	...	...	1	30	31	2	5	7
4	...	...	...	...	...	2	18	20	1	9	10
5	...	...	...	...	...	3	17	20	...	6	6
6	...	...	...	...	...	2	15	17	...	2	2
7	..	...	...	...	...	2	27	29	...	4	4
8	...	...	...	...	...	1	17	18	...	3	3
9	...	...	...	...	...	1	15	16	...	6	6
10	...	..	...	...	...	...	12	12	...	4	4
11	...	...	...	...	...	1	4	5	...	3	3
12	...	...	...	...	...	1	6	7	...	4	4
13	...	...	...	...	...	1	12	13	...	4	4
14	...	...	...	...	...	...	12	12	...	4	4
15	..	..	...	...	...	...	12	12	...	3	3
16	...	...	...	...	...	...	13	13	...	6	6
17	...	...	...	...	...	...	15	15	...	3	3
18	...	...	...	...	...	...	9	9	...	1	1
19	...	...	...	...	...	...	4	4	...	2	2
20	...	...	...	...	...	...	9	9	...	2	2
21	...	...	...	...	...	1	8	9	...	3	3
22	...	...	...	...	...	...	5	5	...	5	5
23	...	...	...	...	...	1	8	9	...	3	3
24	...	...	...	...	...	...	9	9	...	4	4
25	...	...	...	...	...	...	9	9	...	2	2
26	...	...	...	...	...	...	5	5	...	2	2
27	...	...	...	...	...	...	8	8	...	3	3
28	1	4	121	126	1	1	5	7	...	1	1
29	...	7	178	185	...	...	5	5	...	3	3
30	...	4	89	93	...	...	2	2	...	3	3
31	...	3	76	79					...	5	5
Sum	1	18	464	483	1	27	388	416	3	110	113

Day	January, 1892.					February, 1892.			March, 1892.			April, 1892.		
	violent shocks	strong shocks	weak shocks	feeble shocks	sum	weak shocks	feeble shocks	sum	weak shocks	feeble shocks	sum	weak shocks	feeble shocks	sum
1	...	...	...	...	...	...	1	1	...	...	...	...	1	1
2	...	...	...	2	2	1	...	1	...	1	1	...	...	...
3	1	...	...	3	4	...	2	2	.	...	...	1	...	1
4	...	...	2	7	9	...	...	...	...	1	1	...	...	...
5	...	...	2	3	5	1	...	1	...	1	1	...	...	...
6	...	...	...	4	4	1	1	2	...	...	...	1	...	1
7	...	...	...	1	1	...	...	...	...	...	...	...	...	...
8	...	...	...	2	2	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	3	3	...	...	...	...	...	...
10	...	...	...	1	1	...	...	...	...	...	...	...	...	...
11	...	..	...	1	1	...	...	...	...	1	1	...	...	...
12	...	...	...	4	4	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	1	1	...	1	1	...	...	...
14	...	...	...	...	...	...	...	...	...	1	1	...	...	...
15	...	...	...	...	...	...	1	1	...	...	...	...	...	...
16	...	...	...	.	...	...	...	...	...	...	...	...	...	...
17	...	...	...	1	1	...	2	2	...	...	...	1	...	1
18	...	...	...	1	1	...	1	1	...	...	...	...	...	...
19	...	...	...	1	1	...	...	...	...	...	...	.		...
20	...	...	...	...	...	...	1	1	...	...	...	...	...	...
21	...	...	...	...	...	...	1	1	...	...	...	...	...	...
22	...	..	...	1	1	1	4	5	...	...	...	...	...	...
23	...	...	...	...	...	1	...	1	...	2	2	...	...	...
24	...	..	...	...	...	...	...	...	...	...	...	2	...	2
25	...	...	...	...	...	1	1	2	...	1	1	...	1	1
26	...	1	...	1	2	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	2	2	...	...	...	...	1	1
28	...	...	...	1	1	...	2	2	1	1	2	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	1	1	2
30	...	...	..	1	1				1	2	3	...	1	1
31	...	...	...	2	2				1	1	2			
Sum	1	1	4	37	43	6	23	29	3	13	16	6	5	11

TABLE VII.—DAILY NUMBERS OF EARTHQUAKES AT TSU, FROM OCTOBER 28th TO DECEMBER 31st, 1891.

Day	October, 1891.					November, 1891.				December, 1891.		
	violent shocks	strong shocks	weak shocks	feeble shocks	sum	strong shocks	weak shocks	feeble shocks	sum	weak shocks	feeble shocks	sum
1	...	...	...	...	...	...	7	6	13	...	...	...
2	...	...	...	...	...	...	1	3	4	...	1	1
3	...	...	...	...	...	...	...	6	6	...	3	3
4	...	...	...	...	...	...	1	7	8	1	1	2
5	...	...	...	...	...	...	1	4	5	...	1	1
6	...	...	...	...	...	...	2	6	8	...	...	...
7	...	...	...	...	...	...	4	1	5	...	1	1
8	...	...	...	...	...	...	...	3	3	1	...	1
9	...	...	...	...	...	...	...	2	2	1	1	2
10	...	...	...	...	...	...	...	7	7	...	...	...
11	...	...	...	...	...	...	...	3	3	...	2	2
12	...	...	...	...	...	...	...	2	2	...	...	...
13	...	...	...	...	...	...	...	1	1	...	...	...
14	...	...	...	...	...	...	...	2	2	...	2	2
15	...	...	...	...	...	...	...	4	4	...	...	...
16	...	...	...	...	...	...	...	...	...	...	2	2
17	...	...	...	...	...	...	...	3	3	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	1	1	...	...	...
21	...	...	...	...	...	2	...	...	2	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	2	2	...	...	...
24	...	...	...	...	...	...	...	...	...	...	2	2
25	...	...	...	...	...	...	...	...	..	...	...	...
26	...	...	...	...	...	...	...	...	...	...	1	1
27	...	...	...	...	...	...	...	2	2	...	...	...
28	1	12	58	2	73	1	1	...	2	...	1	1
29	...	...	32	7	39	...	...	4	4	...	1	1
30	...	3	5	9	17	...	...	...	..	...	1	1
31	...	...	3	7	10					...	1	1
Sum	1	15	99	25	140	3	17	69	89	3	21	24

TABLE VIII.—DAILY NUMBERS OF EARTHQUAKES AT KYŌTO, FROM OCTOBER 28th TO DECEMBER 31st, 1891.

Day	October, 1891.				November, 1891.			December, 1891.		
	strong shocks	weak shocks	feeble shocks	sum	weak shocks	feeble shocks	sum	weak shocks	feeble shocks	sum
1	...	...	...	...	3	1	4	...	...	...
2	...	...	...	...	1	...	1	...	1	1
3	...	...	...	...	1	...	1	2	1	3
4	...	...	...	...	1	...	1	1	...	1
5	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	1	...	1	...	...	...
7	...	...	...	...	1	...	1	...	...	...
8	...	...	...	...	1	...	1	...	...	...
9	...	...	...	...	1	...	1	...	...	...
10	...	...	...	...	1	...	1	1	...	1
11	...	...	...	...	...	...	...	...	1	1
12	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	1	1
15	...	...	...	...	1	...	1	...	...	...
16	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	1	...	1	...	...	...
18	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	1	1	2	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	1	...	1	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...
28	1	11	26	38	1	2	3	...	...	...
29	...	4	13	17	...	...	...	1	...	1
30	...	5	3	8	...	...	...	1	...	1
31	...	2	4	6				...	...	...
Sum	1	22	46	69	16	4	20	6	4	10

TABLE IX.—DAILY NUMBERS OF EARTHQUAKES AT ŌSAKA, FROM OCTOBER 28th TO DECEMBER 31st, 1891.

Day	October, 1891.					November, 1891.			December, 1891.		
	strong shocks	weak shocks	feeble shocks	feeble shocks	sum	weak shocks	feeble shocks	sum	weak shocks	feeble shocks	sum
1	...	...	...	...	...	2	...	2	...	...	...
2	...	...	...	...	...	1	...	1	...	...	...
3	...	...	...	...	...	...	...	...	...	1	1
4	...	...	...	...	...	...	...	...	1	...	1
5	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	1	...	1	...	...	...
7	...	...	...	...	...	1	...	1	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	1	1	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	1	...	1
25	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...
28	1	2	8	22	33	...	...	...	...	...	...
29	...	...	3	2	5	...	1	1	1	...	1
30	...	1	1	4	6	...	...	...	...	...	...
31	...	...	1	1	2				...	...	...
Sum	1	3	13	29	46	5	2	7	3	1	4

TABLE X.—MONTHLY NUMBERS OF EARTHQUAKES AT GIFU, NAGOYA, TSU, KYŌTO AND ŌSAKA, FROM OCTOBER, 1891, TO DECEMBER, 1983.

Year,	Month	Gifu	Nagoya	Tsu	Kyōto	Ōsaka
1891,	10	720	483	140	69	46
	11	1087	416	89	20	7
	12	416	113	24	10	4
1892,	1	164	43	12	5	2
	2	114	29	10	5	2
	3	87	16	7	1	1
	4	90	11	4	2	...
	5	54	11	1	...	...
	6	30	12	1	3	...
	7	35	4	1	...	...
	8	52	15	7	1	...
	9	107	13	2	1	1
	10	47	8	4	2	...
	11	48	12	...	...	...
	12	39	14	4	2	2
1893,	1	31	5	2	2	...
	2	20	5	2	1	...
	3	52	10	1	...	1
	4	59	11	1	1	...
	5	32	14	1	...	2
	6	12	9	2	...	1
	7	18	14	...	...	...
	8	13	14	...	...	1
	9	20	8	...	...	...
	10	19	9	...	1	1
	11	16	4	...	...	...
	12	16	7	1	...	...
Sum		3398	1310	316	126	71

TABLE XI.—TIMES OF OCCURRENCE OF EARTHQUAKES AT GIFU, FROM OCTOBER 28th, 1 p.m., TO NOVEMBER 10th, 12 p.m., 1891.

Oct. 28th, 1891	4.56 p.m.	8.41 p.m.	0.49 a.m.	3. 5 a.m.
1.55 p.m.	4.58	8.42	0.58	3. 9
2. 3	5.25	8.45	1. 1	3. 9½
2.11	5.30	8.50	1. 5	3.13½
2.12	5.50	8.53	1.10	3.19
2.16	6. 4	9. 3	1.12	3.20
2.27	6.11	9. 7	1.16	3.21
2.32	6.14	9.17	1.17	3.23
2.41	6.15	9.21	1.20	3.24
2.45	6.17	9.22	1.29	3.35
2.50	6.18	9.34	1.31	3.50
2.51	6.26	9.36	1.34	3.59
2.55	6.27	9.40	1.38	4. 0
3. 3	6.28	9.44	1.39	4. 5
3. 6	6.31	9.52	1.43	4. 7
3.10	6.34	9.58	1.44	4. 8
3.22	6.42	10.14	1.50	4.10½
3.32	6.44	10.18	1.53	4.15
3.51	6.47	10.21	1.54	4.18
3.52	6.48	10.21	1.56	4.19
3.53	7. 1	10.30	1.57	4.22
3.55	7. 2	10.40	2. 7	4.23
3.58	7. 8	11. 0	2. 9	4.27
4. 1	7.13	11.10	2.11	4.29
4. 6	7.14	11.14	2.19	4.32
4.13	7.18	11.32	2.28	4.33
4.20	7.26	11.41	2.33	4.35
4.22	7.38	11.49	2.34	4.36
4.24	7.40	11.53	2.36	4.38
4.25	7.50	October, 29th	2.39½	4.40
4.41	7.51	0. 1 a.m.	2.42	4.42
4.43	7.54	0.12	2.49	4.45
4.45	7.57	0.14	2.54	4.47½
4.48	8. 7	0.20	2.56	4.48½
4.51	8.22	0.28	2.57	4.51
4.52	8.23	0.37	2.30	4.52
4.54	8.32	0.46	3. 3	4.55½

October, 29th	8.23 a.m.	11.27 a.m.	0.54 p.m.	4.11 p.m.
5. 6 a.m.	8.24	11.33	0.56	4.17
5. 7	8.26	11.36	0.56½	4.20
5. 8	8.33	11.40	1. 0	4.22
5. 9	8.35½	11.42	1. 2	4.23
5.12	8.37	11.45	1. 2½	4.24
5.14	8.40	11.46	1. 4	4.48
5.18	8.41	11.48	1. 4½	4.51
5.24	8.43	11.49	1. 7	4.52
5.26	8.56	11.49½	1.14	4.58
5.28	9. 6	11.51	1.17	5. 5
5.30	9.13	11.51½	1.19	5. 6
5.31	9.16	11.54	1.21	5.15
5.52	9.21	11.55⅓	1.21⅚	5.23
5.53	9.33½	11.58	1.30⅚	5.29
5.54	9.34½	0. 0 p.m.	1.35	5.34
6.13	9.36	0. 4	1.36	5.41
6.16	9.39	0. 6	1.38	5.45
6.41	9.45	0. 7⅓	1.44⅚	5.51
6.43	10. 1	0. 8	1.51	5.54
7. 4	10.27	0.10	2. 9	5.59
7. 7	10.29	0.13	2.10	6. 2
7.12	10.37	0.14	2.25	6.15
7.13	10.42	0.14½	2.35	6.21
7.14	10.43	0.17½	2.43	6.30
7.15	10.43½	0.18	2.47	6.32
7.23	10.46	0.21	2.51	6.34
7.29	10.48	0.22	2.57	6.41
7.30	10.49	0.23½	3.18	6.42
7.33	10.50½	0.25⅓	3.22	6.44
7.50	10.59	0.26½	3.37	6.46
7.51	11. 0	0.28	3.39	6.47
7.52	11. 5	0.29	3.44	6.50
7.58	11. 7	0.31	3.45	6.53½
8. 1	11.15	0.37	3.47½	6.56
8.11½	11.20	0.46	3.55	6.58
8.13	11.21	0.49	3.57	7. 7
8.22	11.22⅓	0.53	4.10	7.13

October, 29th	10. 7 p.m.	2.14 a.m.	4.29 a.m.	11. 2 a.m.
7.17 p.m.	10.17	2.18	4.30	11.27
7.19	10.21	2.22	4.35	11.32
7.23	10.23	2.36	4.39	11.43
7.25½	10.30	2.42	4.41	11.49
7.26	10.31	3. 2	4.42	11.51
7.27	10.50	3. 8	4.46	11.54
7.30	10.55	3.10½	5. 5	0. 0 p.m.
7.39	11. 0	3.17	5. 8	0.12
7.45	11.10	3.18	5.12	0.26
7.45½	11.15	3.26	5.32	0.43
7.46	October, 30th	3.29	5.39	0.58
7.47	0. 4 a.m.	3.33	5.42	1. 3
7.55	0. 5	3.34	5.47	1.11
7.56	0. 6	3.35	5.57	1.13
8. 4	0.13	3.35½	6.10	1.15
8. 9⅓	0.14	3.39	6.13	1.19
8.13	0.30	3.40	7.26	1.24
8.14½	0.37	3.40¼	7.30	1.27½
8.15	0.41	3.46	7.33	1.40
8.19	0.46	3.47	7.40	1.43
8.35	0.47	3.48	7.43	1.47
8.36	0.48	3.52	8. 0	2.17
8.41	0.53	3.55	8. 4½	2.23
8.42	0.56	3.57	8.10	3. 6
8.49	1.10½	4. 0	8.13	3.50½
8.50	1.14	4. 1	8.14	4. 8½
9. 5	1.17	4. 2	8.15	4.19
9.35	1.18	4. 5	8.21	4.35
9.40	1.22	4. 7	8.30	4.36
9.45	1.32	4. 8	8.50	4.47
9.46	1.37	4.8½	9. 6	4.58
9.47	1.39	4. 9	9.35	5. 8
9.56	1.40	4.19	9.49	5.14
9.57	1.49	4.24	9.57	5.19
9.59	1.50	4.25	10.12	5.23
10. 1	1.54	4.27	10.14	6. 4
10. 4	2. 6	4.27⅓	10.49	6.26

October, 30th	2.40 a.m.	6. 8 a.m.	2.53½ p.m.	10.16 p.m.
6.34 p.m.	2.46	6.14	3. 1	10.29
6.35	2.48	6.28	3. 8	10.34
6.40	2.50	6.35	3.29	10.36
7. 0	2.51	6.48	3.42	10.48
7. 2	2.56	6.57	3.51	10.59
7. 5	2.57	6.59	4. 1	11. 6
7. 7	2.59	7. 7	4.12	11.43
7.25	3. 5	7.13	4.40½	11.52
7.27	3.10	7.22	4.51	Nov., 1st
7.31	3.22	7.24	5.12	0. 7 a.m.
7.42	3.25	7.40	5.45	0. 8
7.43	3.46	7.47	6. 5	0.13
7.49	4. 4	8.18	6.12½	0.18
7.53	4. 8	8.26	6.14	0.19
7.57	4.10	8.38	6.16	0.42
8. 1	4.14	8.51	6.22	0.55
8. 2	4.17	8.53	6.24	1. 2
8. 7	4.19	8.55	6.57	1.23
8.12	4.31	8.57½	7. 8	1.29
8.14	4.37	9.11	7.12	1.30
8.22	4.39	9.27	7.16	1.34
8.28	4.43	9.34	7.17	1.35
8.30	4.49	9.39	7.21	1.44
8.47	4.55	10.23	7.27	1.45
8.50	5. 4	10.30	7.29	1.57
8.53	5. 9	10.35	7.32	2.16
9. 0	5.15	11.14	7.34	2.27
9.17	5.17	11.19	7.35	2.34
9.22	5.21	11.27½	7.55	2.42
9.25	5.25	0. 5 p.m.	8.11	2.44
9.30	5.29	0. 8	8.14	2.47
10.30	5.30	0.36	8.15	2.50
11.47	5.34	1. 2½	8.24	2.54
October, 31st	5.38	1.35	8.35	2.57
0.20 a.m.	5.40	1.48	8.46	3.22
2.20	5.49	2.22	9.14	4.33
2 38	5.58	2.32	9.35	4.40

Nov. 1st	3.10 p.m.	0.33 a.m.	10.45 a.m.	8.19 p.m.
4.50 a.m.	3.47	0.37	10.53	8.44
5. 7	3.51	0.40	11.19	8.52
5.10	4. 6	0.45	11.46	9. 5
5.17	4.55	0.47	11.50	9.26
5.19	5.28	0.55	0.11½ p.m.	9.35
6. 6	5.38	1.15	0.24	9.52
6.29	5.55	2.12	0.47	10.14
6.40	5.58	2.25	0.51	10.17
6.43	6.13	2.36	1. 7	10.37
6.44	6.28	2.58	1.20	10.42
6.47½	6.31	3. 7	1.20½	11.43
6.52	6.45	3.15	1.37	11.57
7.12½	6.49	3.26	2. 9	Nov., 3rd
7.21	6.55	3.29	2.23	0.12 a.m.
7.30	6.59	3.47	2.32	0.34
7.41	7.10	3.50	2.34	1.47
8.31	7.16	3.52	2.38	1.52
8.46	7.45	4. 2	2.45	2. 7
9.17	7.50	4. 5	3. 1	3. 0
9.37	7.57½	4.10	3. 5	3. 3
10. 1	8.20	4.29	4.24	3.13
10.15	8.35	4.29½	4.50	4. 3
10.21	8.38	4.54	4.58	4.15
10.38	9.18	5.46	5.40	4.28
10.43	9.26	5.48	5.50	4.47
10.48	9.27	6. 0	6.29	4.55
11.42	9.30	6.43	6.36	4.58
11.45	9.33	7.11	7. 7	5. 2
11.46	9.35	7.21	7.12	5.32
11.56	9.38	7.32	7.16	5.56
0.46 p.m.	9.58	7.33	7.19	6.48½
1. 5	10.20	8.53	7.29	6.53
1.14	10.21	9.17	7.45	6.56
1.47	Nov., 2nd	9.30	7.48	7. 6
2.43	0. 2 a.m.	9.46	7.50	7. 7
2.55	0.16	9.55	7.52	7.12
3. 0	0.21	10.20	8. 8	7.37

Nov., 3rd	7. 3 p.m.	5. 0 a.m.	5.31 p.m.	6.24 a.m.
7.41 a.m.	7.28	5.29	6.19	6.33
8. 4	7.29	5.34	6.58	7.10
8.20	7.38	5.54	7. 0	7.28
8.32	7.50	6. 8	7.10	7.48
8.53	7.55	6.26	7.16	8. 9
8.55	8.12	6.35	7.19	8.46
9.15	8.15½	6.36	7.45	9.16
9.45	8.40	6.47	8.30	9.18
10.20	8.49	7. 4	8.40	9.58
10.21	8.52	7.47	8.51	10.24
10.32	9.23	8.15	9.24	11.16
11. 2	9.34	8.17	9.35	11.32
11.11	9.35	9.20	9.50	0.15 p.m.
11.30	9.47	9.22	9.54	1.48
11.41	10.14	9.38	10.17½	2.51
0.38 p.m.	10.31	9.55	10.39	3.35
0.44	10.36	9.56	10.41	3.59
0.58	11.43	10.27	10.59	5.10
1. 0	11.50	10.44	11. 0	5.13
1. 8	Nov., 4th	10.48	11.10	5.28
1.16	0.10 a.m.	10.57½	11.17	5.38
2.13½	0.32	11. 4½	11.32	6.48
2.56	0.52	11.38½	Nov., 5th	6.52
3.44	0.57	11.51	0.22 a.m.	6.54
3.54	1. 3	0.34 p.m.	1. 1	7.39
3.58	1.18	0.35	1.14	7.50
4. 7	1.27	0.37	1.52	8. 8
4.47	1.40	1. 0	2. 3	8.16
4.49	1.57	1.17	2.22	8.23
4.50	1.58	1.49	3. 2	8.36
5. 7	2.12	2. 7	3.22	9.10
5.28	2.25	2.19	3.48	9.19
5.34	2.39	2.20	4. 4	9.25
5.42	3. 0	3.15	5. 0	9.28
6.19	3. 1	3.34	5.15	10.24
6.36	4. 5	4. 0	5.22	10.58
6.45	4.20	5. 2	5.24	11.35

Nov., 5th	1.14 p.m.	1.45 a.m.	11.28 p.m.	10.26 p.m.
11.37 p.m.	1.25	3.29	11.30	10.58
Nov., 6th	2.16	4.21	Nov., 8th	11.38
0.10 a.m.	2.17	4.55	0.22 a.m.	11.39
0.12	2.39	5.52	0.53	11.45
1. 4	2.45	6. 7	1. 5	11.48
1.17	3.42	6. 9	1. 7	11.56
2. 7	3.50	6.47	2.32	Nov., 9th
2.47	3.55	6.57	4.15	1.18 a.m.
2.49	5. 7	7.35	4.35	1.27
3.17	5.35	7.47	5.50	1.40
3.26	5.47	8.12	5.55	1.46
3.30	5.57	8.26	6.39	2.47
4. 4	6. 7	8.57	7.26	3.25
4. 8	6.42	9.27½	7.48	3.36
4.20	7. 2	9.49	7.50	4. 0
4.25	7. 6	11.44	8. 3	4.14
4.32	7.11	0.14 p.m.	8.24	4.20
4.39	7.23	2. 0	9.12	4.22
4.56	7.51	2.30	10. 7	4.32½
5. 9	8. 8	2.36	10.41	4.43
5.32	8.10	2.48	10.44	5.25
5.52	8.16	3.49	10.58	5.27
6.18	9 25	4.34	11. 8½	6. 8
6.57	10.10	5.12	11.17	6.20
7. 7	10.30	5.23	11.27½	6.23
9.42	10.50	5.47	11.45½	6.37
9.58	11. 2	6. 6	2.44 p.m.	6.47
10.24	11. 5	7. 8	4. 6	7.24
11. 2	11.32	8. 5	4.15	8. 0
11.15	11.35	8.10	5. 1	9.30½
11.22	11.41	8.43	6.33	10.59
0. 9 p.m.	Nov., 7th	9. 1	6.36½	11.48
0.25	0. 9 a.m.	9.13	7. 2	0.34 p.m.
0.36	0.25	9.40	8.10	2.13
0.39	0.36	9.58	8.14	2.52
0.44	0.48	10.52	8.40	3. 7
0.52	0.58	11. 7	9.44	3.39½

Nov., 9th	10.42½ p.m.	3.35 a.m.	9.39 a.m.	7. 8 p.m.
4. 4½ p.m.	11. 0	5. 0	10.42	7.12
4.40	11. 4	5.39	11. 7	7.21
5. 8	Nov., 10th	6. 8	11.38½	8. 1
5.33	0. 0 a.m.	6.23	0.46½ p.m.	9.13
6. 3	1.24	6.34	3.55	9.59
7.25	1.45	7.32	5.37½	10.10
9. 6	1.57	7.45	5.38½	10.43
9. 5	2.48	7.58	5.40	11.10
9.41½	2.57	8.51	5.51	11.30
10.22	2.58	9.31	6.47	11.33

TABLE XII.—TIMES OF OCCURRENCE OF EARTHQUAKES AT NAGOYA, FROM OCTOBER 28th, 1 p.m., TO NOVEMBER 10th, 12 p.m., 1891.

Oct. 28th, 1891	4.24.30 p.m.	8. 7.40 p.m.	11.13. 0 p.m.	3.30.50 a.m.
1.9.45p.m.	4.24.52	8. 9.35	11.18.31	3.34.30
1.16.5	4.28.10	8.10.46	11.21.26	3.39. 0
1.22.45	4.33.59	8.23.24	11.40.30	3.40.50
1.43.14	4.44.32	8.32. 0	11.44.11	3.41.30
1.54.13	4.51.40	8.32.36	October. 29th,	3.46.55
1.54.32	4.56. 8	8.36. 6	0. 2. 0 a.m.	3.55.35
1.55.00	4.57.10	8.41.49	0.19.45	3.57.28
2. 2.24	5. 0.30	8.46.41	0.22.30	4. 2.10
2. 2.50	5. 4.40	8.52.36	0.34.11	4.13.40
2.10.31	5.15. 2	8.53. 4	0.38.39	4.21. 0
2.19.33	5.17. 1	8.55.15	0.46.29	4.21.40
2.21. 8	5.31.25	8.57.49	0.58.26	4.28.30
2.22.30	5.33. 8	9. 3. 0	1. 1.43	4.35. 0
2.25.46	5.39.55	9. 4. 8	1. 7.38	4.36.30
2.31.40	5.42.15	9. 8.12	1.16. 0	4.39.30
2.35.18	5.45.40	9.21.12	1.20.20	4.44.15
2.29.44	5.51.59	9.24. 9	1.30.29	4.50.30
2.41.37	6. 4.10	9.33.36	1.49.33	4.55. 0
2.48.56	6.14.35	9.41. 3	1.53. 4	5. 3.30
2.50. 2	6.16.39	9.46.10	1.57. 0	5. 7.30
2.56.13	6.19. 5	9.44.13	2.18. 8	5.12.30
3. 2. 5	6.26.25	9.52.40	2.24.25	5.23.50
3.21. 0	6.27.50	10. 7.59	2.29.26	5.28. 0
3.22. 5	6.38.27	10.11.33	2.33.46	5.50. 0
3.23.35	6.47.53	10.17.45	2.35.10	5.53.30
3.24.54	7.12.45	10.30. 0	2.38.21	6. 4.30
3.31.48	7.13.40	10.30.34	2.46.58	6.13.30
3.49.55	7.16.40	10.39.14	2.48.24	6.13.59
3.51.23	7.17.45	10.44.12	3. 0.59	6.43.25
3.52.14	7.19.25	10.47.21	3. 2.57	6.45.20
3.53.12	7.26.30	10.53. 2	3. 7. 0	7. 0. 0
3.55.22	7.29.31	11. 2.12	3. 4.20	7. 3.30
4.13.15	7.34. 5	11. 3.36	3.11.40	7.12. 0
4.15. 8	7.41.14	11. 7.26	3.19.10	7.20.35
4.21.25	7.42. 7	11. 9.32	3.20.55	7.30.45
4.22.16	7.46.30	11.11.21	3.28.50	7.40. 0

7.52.35 a.m.	0.59.22 p.m.	7. 7.30p.m.	0.40. 4 a.m.	11.31.25 a.m.
7.56.10	1.19.39	7.30.20	0.47.12	11.50.25
7.58.32	1.24.12	7.39.10	0.49.29	0.29.32
8. 4.45	1.34. 4	7.45.20	0.51.20	0.43.27 p.m.
8.11.28	1.34.22	7.46.10	1. 7.32	1. 2.30
8.14.30	2. 8.23	7.55.24	1. 9.50	1. 4.19
8.26.10	2. 8.50	8.18.21	1.13.31	1.47.21
8.27.15	2.10.15	8 33.22	1.15.50	2.24.12
8.33.37	2.42.30	8.31.50	1.26.15	3. 6. 5
8.36. 7	2.53. 0	8.41.15	1.28. 0	3.17.28
8.37.53	2.59.40	8.48. 0	1.30. 0	3.59.25
8.41. 1	3. 3.50	8.51.37	1.30.22	4.28.35
8.50.57	3. 5.32	8.58.26	1.39.45	4.39. 5
9. 7.20	3.14.44	9. 1.45	1.51.25	5. 8.29
9.15.56	3.16. 5	9.34.36	1.54.10	5. 9.19
9.21.25	3.22.25	9.43.33	1.56.21	5.10.10
9.24.18	3.33.10	9.51.49	2. 6.20	5.24.15
9.40. 5	3.35. 0	10.29.25	2.27.18	6. 1. 6
9.44. 0	3.44.25	10.44.30	2.36.15	6. 7.32
9.54.40	3.45. 0	10.48.37	3.35.15	6.27.12
10.20.50	4.19.50	10.53.25	3.40. 0	6.36. 2
10.37.40	4.22.20	11. 2. 0	4.16.45	6.42.32
10.44.20	4.37.15	11. 9.16	4.35. 0	7. 7.22
10.46.31	4.43.40	11.14.50	4.53.42	7.17.17
10.49.42	4.49.20	11.32.29	5. 7. 5	7.49.22
11. 7.20	5. 3.10	11.44.19	5.42.17	7.53.10
11.12.30	5.25.50	11.46. 0	5.52.22	8.49.45
11.22.36	5.28.10	October 30th	5.57. 2	9. 6.52
11.27.40	5.30. 0	0. 4.12 a.m.	6.10. 0	9.25.51
11.34.45	5.43.45	0. 5. 0	6.17.31	9.36.32
11.51.50	5.47.25	0. 6.51	7.19.20	10. 4. 7
0. 6.25 p.m.	5.57.27	0.12.35	7.54.26	10.10. 7
0.13.40	6. 4. 0	0.14.40	8.17.20	10.21.32
0.17.15	6.32.12	0.16.10	8.17.20	10.23.22
0.46.37	6.39. 0	0.29. 0	8.30.22	10.27.35
0.47.50	6.45.30	0.29.40	9. 5. 5	10.30.50
0.51. 0	6.51.20	0.32. 0	10. 5.27	10.37.52
0.56.40	7. 4.23	0.37.15	11. 2.40	10.58.35

10.54.54 p.m.	9. 2. 5 a.m.	11.44.15 p.m.	9.41.15 a.m.	3.20. 4 p.m.
11.10. 0	10.33.25	Nov., 1st	10.41. 2	4.58.31
11.10.36	10.44.10	0. 8.27 a.m.	10.52.20	5.30.30
11.16.21	11. 0.36	0.47. 0	11.12.55	8. 9.45
11.28. 5	0.25. 0 p.m.	0.48.46	11.33.31	8.14.25
11.52.38	0.34.10	0.50.40	0.24.50 p.m.	8.19.50
11.53.10	0.37. 0	1.18.55	3. 0.22	9.39.10
11.55.10	0.44.39	1.28.40	4.34.45	9.46.55
October, 31st	1. 4.45	1.36.34	5.18.21	9.48. 5
0. 1.30 a.m.	1.25. 0	1.44.32	5.57.51	10.18.40
0. 6.31	1.56.15	1.46.10	6.30. 8	10.42. 5
0.15.13	2.17.35	1.48.44	7.56.27	11.25. 0
0.29. 7	2.25.41	1.50.44	8.19.52	11.55.30
0.34.28	2.37.25	1.52.56	8.27.10	Nov., 3rd
0.50. 0	2.48. 6	2.13. 0	8.39.38	0. 0.15 a.m.
0.56.50	3. 5.10	2.28.20	9.11.55	0. 2. 5
0.58.12	3.29.59	2.35.13	9.19.21	0.35. 0
0.59.24	3.51.35	2.41.52	9.28.45	0.51.45
1.11. 5	4.18. 8	3. 7.36	9.37.22	0.55. 0
2. 5.52	4.39.20	3.20.24	10.51.40	1.17.35
2.27.32	6.13.28	3.46.17	Nov., 2nd	1.27.30
2.48.50	6.29.25	3.47.58	0. 7.50 a.m.	1.25.10
2.58. 0	7.18. 0	3.52. 0	0.24.20	3. 5.35
3.10.14	7.37. 5	4.24.10	0.34.36	3.24.10
4. 0.55	7.55.52	4.27.15	1.53.10	5.33. 0
4. 9. 5	8.34.25	4.37.40	1.56.45	5.43.42
4.21.30	8.48.20	4.44.25	2. 8. 0	8.16.25
5.16.41	9.12.30	4.51.31	2.27.45	8.22.49
7. 0. 0	9.27.50	5. 9.21	3. 6.15	8.32.56
7.15.25	9.43.14	5.15. 0	4.14.32	8.36.40
7.23.30	9.49.55	5.19.10	5. 0.30	9.16.59
7.49.30	10. 0.20	5.37.25	6.12.59	9.32.34
7.51.27	10. 8.50	6. 2. 0	9.50.40	9.46. 8
8. 4. 2	10.28. 0	7. 7.15	10.52. 0	10. 4.45
8.22.14	10.49. 5	7.12.46	11.52.34	10.23. 2
8.27.58	11.20.35	8. 3.10	1.58.23 p.m.	11. 0.29
8.56.30	11.24.25	8.30.15	2.12.25	11.43.10
8.58.31	11.43. 5	9. 4.40	3. 4.58	11.43.37

0. 1.25 p.m.	Nov., 5th.	11.19.41 a.m.	3. 0. 0 p.m.	4.20.10 a.m.
1.22.30	3. 1.30 a.m.	1.25.15 p.m.	7.39.59	4.34. 2
4.50.40	3.54. 0	3.31.21	9. 3. 4	5. 7.12
4.51.42	4.45.50	7.43.30	11.14.30	5.13.40
7.29.20	6.33.15	7.53. 0	Nov., 8th	6.25. 0
8.51.20	6.34. 5	8.35.15	0.54.40 a.m.	7.17.25
9.54.20	7. 7.35	8.39. 0	1. 0. 5	8.20. 2
Nov., 4th	7.49. 0	9.23.40	1.24.25	0.38.14 p.m.
0.18.29 a.m.	9.58.40	10.11.15	1.52.40	2. 1.10
0.45.25	10.24.25	10.32.25	3. 8.45	7.32.10
1.20.34	11.57.12	10.41.52	3.24.43	7.52.10
1.27.45	0.44.52 p.m.	Nov., 7th	5.23.12	8.55. 0
1.33.46	3.35.13	0. 1.20 a.m.	9. 2.59	Nov., 10th
2. 0. 0	5. 9.56	0. 9.21	11.10.58	2.44.30 a.m.
4. 2.10	5.42.45	0.10. 0	1.28. 5 p.m.	5. 2.50
4.12.21	7.10.21	0.12. 9	1.30. 0	6. 3.45
4.21.50	9.29.56	1. 1. 5	1.47.15	6.24.27
6.37.45	10.16.15	1.46.12	6.37.50	8.34. 0
8.19.15	10.41.18	2.45.30	9.34.20	9.32.35
11.59.30	10.45.38	3.16.40	10.38.50	11.58. 7
2.22.31 p.m.	11.43. 5	4.18.20	11.36.50	5.10.24 p.m.
3.15.18	Nov., 6th	4.18.50	11.46.39	5.41.34
3.56.45	0.50. 0 a.m.	5.47.55	11.58.15	6.14.19
4.18. 8	1. 0.15	5.55. 0	Nov., 9th	7.27. 7
4.39.20	1.19. 7	6.38.50	0.36.25 a.m	8. 4. 0
4.44.35	4.25.40	9.18.15	2.48.47	
7. 1.20	7.26.45	1. 9.22 p.m.	3.25. 0	
8.22. 5	9.59.45	2.48.58	3.37.20	

TABLE XIII.—HOURLY NUMBERS OF EARTHQUAKES AT GIFU, FROM OCTOBER 28th TO NOVEMBER 16th, 1891.

Interval \ Day	October, 1891.				November, 1891.										sum
	28	29	30	31	1	2	3	4	5	6	7	8	9	10	
0— 1 a.m.	...	9	13	1	7	9	2	4	1	2	5	2	...	1	56
1— 2	...	19	12	...	9	1	2	6	3	2	1	2	4	3	64
2— 3	...	15	6	10	9	4	1	3	2	3	...	1	1	3	58
3— 4	...	13	20	5	1	7	3	2	3	3	1	...	2	1	62
4— 5	...	25	20	12	3	6	6	2	1	7	2	2	6	...	92
5— 6	...	15	8	13	4	2	3	4	4	3	1	2	2	2	63
6— 7	...	4	2	7	7	2	3	5	2	2	4	1	5	3	47
7— 8	...	14	5	6	4	4	5	2	3	1	2	3	1	3	53
8— 9	...	14	9	7	2	1	5	2	2	...	3	2	1	1	49
9—10	...	9	4	4	2	4	2	5	3	2	2	1	1	2	41
10—11	...	12	3	3	6	3	3	4	1	1	...	4	1	1	42
11—12	...	22	7	3	4	3	4	3	2	3	1	3	1	2	58
0— 1 p.m.	...	26	5	3	1	4	3	3	1	6	...	...	1	1	54
1— 2	...	17	10	3	3	4	3	3	1	2	1	1	...	...	48
2— 3	11	8	2	3	2	6	2	3	1	4	4	1	2	...	38
3— 4	10	9	2	5	4	2	3	2	2	3	1	...	2	1	36
4— 5	16	11	6	4	2	3	4	1	...	...	1	2	2	...	36
5— 6	3	11	4	2	4	2	4	2	4	4	3	1	2	4	47
6— 7	15	15	5	7	7	2	3	2	3	2	1	2	1	1	51
7— 8	13	16	12	11	5	9	6	5	2	5	1	1	1	3	77
8— 9	9	12	11	6	3	4	5	3	4	3	3	3	...	1	58
9—10	11	9	5	2	8	4	4	4	4	1	4	1	3	2	51
10—11	6	10	1	6	2	4	3	4	2	3	1	2	2	2	42
11—12	7	3	1	3	...	2	2	4	2	5	3	5	2	3	35
Sum	101	318	173	126	99	92	81	78	53	67	45	42	43	40	1258

Note. In forming the hourly "sums," the record for October 28th has not been taken into account.

During Night, or between 6 p.m. and 6 a.m., 709
„ Day, „ „ 6 a.m. and 6 p.m., 549
1258

TABLE XIV.—HOURLY NUMBERS OF EARTHQUAKES OF NAGOYA, FROM OCTOBER 28th TO NOVEMBER 10th, 1891.

Day / Interval	October, 1881				November, 1891										sum
	28	29	30	31	1	2	3	4	5	6	7	8	9	10	
0— 1 a.m.	...	7	14	9	4	3	5	2	...	1	4	1	1	...	51
1— 2	...	8	12	1	8	2	3	3	...	2	2	3	...	...	44
2— 3	...	8	3	4	4	2	...	1	...	...	1	...	1	1	25
3— 4	...	16	2	1	5	1	2	...	2	...	1	2	2	...	34
4— 5	...	11	3	3	5	1	...	3	1	1	2	...	2	...	32
5— 6	...	7	4	1	4	1	2	...	...	...	2	1	2	1	25
6— 7	...	5	2	...	1	1	...	1	2	...	1	...	1	2	16
7— 8	...	9	2	5	2	...	...	...	2	1	...	...	1	...	22
8— 9	...	10	2	5	2	...	4	1	...	...	...	...	1	1	26
9—10	...	7	1	1	2	1	3	...	1	1	1	1	...	1	20
10—11	...	5	1	2	2	1	2	...	1	...	...	...	...	...	14
11—12	...	6	3	1	2	1	3	1	1	1	...	1	...	1	21
0— 1 p.m.	...	8	2	4	1	...	1	...	1	...	...	...	1	...	18
1— 2	7	4	3	3	...	1	1	...	...	1	1	3	...	...	17
2— 3	14	6	1	4	...	1	...	1	...	...	1	...	1	...	15
3— 4	11	9	3	3	1	2	...	2	1	1	1	...	...	...	23
4— 5	12	5	2	2	1	1	2	3	...	...	...	...	...	...	16
5— 6	10	7	4	...	2	1	...	...	2	...	...	...	...	2	18
6— 7	8	5	5	2	1	...	...	...	...	...	...	1	...	1	15
7— 8	11	7	4	3	1	...	1	1	1	2	1	...	2	1	24
8— 9	13	7	1	2	3	3	1	1	...	2	...	...	1	1	22
9—10	10	4	3	4	4	3	1	...	1	1	1	1	...	...	23
10—11	9	4	9	4	1	2	...	...	3	3	...	1	...	...	27
11—12	10	6	7	4	...	2	...	...	1	...	1	3	...	...	24
Sum	115	171	93	68	56	30	31	20	20	17	20	18	16	12	572[1]

Note.—In forming the hourly "sums," the record for October 28th has not been taken into account.

During Night, or between 6 p.m. and 6 a.m., 346
„ Day, „ „ 6 a.m. „ 6 p.m., 226
572

1. The times of earthquake occurrence were lost in a few cases, and therefore this number is slightly less than according to Table VI.

TABLE XV.—DAILY NUMBERS OF EARTHQUAKES AT CHIRAN, FROM SEPTEMBER 7th, 1893, TO JANUARY 31st, 1894. [1]

Day	September, 1893.					October, 1893.				
	strong shocks	weak shocks	feeble shocks or sounds	sum	activity	strong shocks	weak shocks	feeble shocks or sounds	sum	activity
1	...	...	...	...	...	...	...	2	2	2
2	...	...	...	...	...	...	2	...	2	2
3	...	...	...	...	...	...	...	2	2	2
4	...	...	...	...	...	...	...	2	2	2
5	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	1	1	1
8	4	7	34	45	49	...	...	...	...	...
9	5	12	27	44	49	...	...	...	...	...
10	1	4	23	28	29	...	...	...	...	...
11	...	9	14	23	23	...	...	...	...	...
12	...	3	15	18	18	...	1	...	1	1
13	1	1	14	16	17	...	...	...	...	...
14	3	2	16	21	24	...	...	...	...	...
15	...	4	8	12	12	1	1	...	2	3
16	...	...	8	8	8	...	...	1	1	1
17	1	1	3	5	6	...	...	1	1	1
18	...	2	5	7	7	...	...	...	...	...
19	...	...	5	5	5	...	...	...	...	...
20	...	3	3	6	6	...	...	...	...	...
21	...	...	4	4	4	...	...	...	...	...
22	...	...	3	3	3	...	...	...	...	...
23	...	1	3	4	4	...	...	...	...	...
24	...	1	1	2	2	...	1	1	2	2
25	...	1	2	3	3	1	1	1	3	4
26	...	1	3	4	4	...	1	7	8	8
27	...	...	...	...	...	...	...	2	2	2
28	...	...	...	...	...	...	1	2	3	3
29	...	2	1	3	3	...	1	1	2	2
30	...	...	2	2	2	...	...	...	...	...
31						...	...	...	...	...
Sum	15	54	194	263	278	2	9	23	34	36

1. The Kagoshima earthquake took place on September 7th at 2.46 a.m., and the record of after shocks was not taken till about 9 p.m. of the same day. The figures in this Table are the numbers of earthquakes during successive twenty-four hours between 9 p.m. of each day and 9 p.m. of the next.

Day	November, 1893.				December, 1893.				January, 1894.				
	weak shocks	feeble shocks or sounds	sum	activity	weak shocks	feeble shocks or sounds	sum	activity	strong shocks	weak shocks	feeble shocks or sounds	sum	activity
1	...	...	...	...	...	...	...	...	...	...	1	1	1
2	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	1	2	...	3	4
5	...	...	...	...	...	...	...	...	...	1	6	7	7
6	...	1	1	1	...	...	...	...	...	...	3	3	3
7	1	...	1	1	...	...	...	...	...	...	...	...	...
8	...	2	2	2	...	...	...	...	...	...	1	1	1
9	...	...	...	...	...	...	...	...	...	1	3	4	4
10	...	...	...	...	...	...	...	...	...	...	1	1	1
11	...	...	...	...	...	...	...	...	...	...	2	2	2
12	...	...	...	...	...	...	...	...	...	...	1	1	1
13	...	...	...	...	1	1	2	2	...	...	2	2	1
14	2	...	2	2	...	...	...	...	...	...	5	5	5
15	...	...	...	...	...	...	...	...	...	...	2	2	2
16	...	...	...	...	...	...	...	...	...	...	1	1	1
17	...	...	...	...	...	...	...	...	...	...	1	1	1
18	2	2	4	4	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	3	3	3
20	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	1	1	1
22	...	...	...	...	...	2	2	2	...	...	1	1	1
23	...	...	...	...	...	...	...	...	...	...	1	1	1
24	...	...	...	...	...	...	...	...	...	...	1	1	1
25	...	...	..	...	4	1	5	5	...	...	1	1	1
26	...	...	...	...	2	...	2	2	...	...	4	4	4
27	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	2	2	2	1	...	1	1	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	2	2	2
30	2	...	2	2	...	...	...	...	...	2	4	6	6
31					2	...	2	2	...	...	...	...	...
Sum	7	7	14	14	10	4	14	14	1	6	47	54	55

TABLE XVI.—HOURLY NUMBERS OF EARTHQUAKES AT CHIRAN, FROM 8th TO 21st, SEPTEMBER, 1893.

Day / Interval	September. 1893. 8	9	10	11	12	13	14	15	16	17	18	19	20	21	sum
0— 1 a.m.	1	...	...	...	...	...	1	...	...	...	...	1	...	...	3
1— 2	5	1	1	2	1	1	4	...	...	...	...	...	...	...	15
2— 3	5	2	2	2	...	...	...	...	1	...	...	...	...	...	12
3— 4	1	1	1	...	...	1	1	1	...	...	...	...	2	1	9
4— 5	1	1	2	...	1	...	...	...	2	...	1	1	...	...	9
5— 6	...	3	3	4	...	1	2	2	1	...	...	...	...	1	17
6— 7	1	1	2	...	1	1	1	...	1	...	1	...	...	...	9
7— 8	4	2	...	2	1	2	...	...	...	1	...	...	...	...	12
8— 9	2	3	...	...	1	1	...	...	1	...	1	1	...	...	10
9—10	4	7	...	1	2	...	...	...	...	1	...	...	...	...	15
10—11	...	1	1	...	1	...	...	...	...	...	2	...	1	...	6
11—12	3	3	2	...	...	...	1	...	...	1	...	...	1	...	11
0— 1 p.m.	...	...	1	1	1	1	...	...	...	...	...	...	...	...	4
1— 2	...	...	1	2	1	1	5	...	...	...	...	1	...	1	12
2— 3	...	2	3	1	2	1	2	1	...	...	...	1	...	...	13
3— 4	1	3	2	...	...	...	1	...	...	1	...	...	...	...	8
4— 5	3	4	...	1	1	...	...	...	...	...	...	...	...	1	10
5— 6	...	1	1	...	1	1	...	...	...	...	...	...	...	...	4
6— 7	3	2	...	2	...	...	...	1	...	1	1	...	...	...	10
7— 8	3	2	3	1	...	...	...	...	1	...	...	...	1	...	11
8— 9	...	...	1	...	2	...	...	...	...	...	...	...	...	...	3
9—10	2	1	...	...	...	1	2	...	...	1	...	...	1	...	8
10—11	3	1	...	1	1	1	4	1	...	...	...	...	...	...	12
11—12	...	...	4	1	3	1	1	...	...	...	...	...	...	...	10
Sum	42	41	30	21	20	14	25	6	7	6	6	5	6	4	233

During Night, or between 6 p.m. and 6 a.m., 119
„ Day, „ „ 6 a.m. „ 6 p.m., 114
233

TABLE XVII.—MONTHLY AND YEARLY NUMBER OF EARTHQUAKES INSTRUMENTALLY RECORDED IN TOKIO FROM JANUARY, 1876, TO DECEMBER, 1893.

Year \ Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	sum
1876	3	4	6	11	5	3	3	5	3	3	4	6	56
1877	4	5	6	5	8	9	6	4	1	8	6	9	71
1878	3	8	7	2	5	4	4	1	2	4	6	4	50
1879	6	7	14	...	9	4	3	4	1	7	6	9	70
1880	9	9	6	6	2	9	8	4	1	3	10	10	77
1881	13	8	8	8	4	3	3	3	2	3	3	8	66
1882	4	7	15	6	3	2	2	1	1	4	1	...	46
1883	6	...	3	3	6	2	3	1	...	1	3	4	32
1884	5	2	8	2	9	4	1	4	2	8	8	15	68
1885	7	9	8	4	3	6	...	3	8	10	3	7	68
1886	3	3	3	2	8	4	2	8	7	4	2	8	54
1887	10	4	3	8	13	5	6	2	10	...	5	14	80
1888	4	15	7	7	11	9	9	7	11	4	13	4	101
1889	5	16	11	18	13	7	5	8	7	8	9	6	113
1890	5	5	6	15	14	5	12	7	4	8	10	2	93
1891	1	4	6	7	10	7	8	4	4	45	12	15	123
1892	9	9	2	7	8	6	7	2	4	10	4	5	73
1893	6	4	3	7	11	9	4	3	5	3	3	1	59
Sum	103	119	122	118	142	98	86	71	73	133	108	127	1300
Average	5.8	6.6	6.8	6.6	7.9	5.4	4.8	4.0	4.0	7.4	6.0	7.0	72.2

Note.—The greatest monthly earthquake number, namely 45, occurred in October, 1891. Of this however, 28 took place within the last four days of the month, being due to the residual effect of the great Mino-Owari Earthquake. We may take $(45-28)\times\frac{31}{27}\fallingdotseq19$ as the proper number of shocks for October, 1891. Making this modification, the total number for 1891 becomes 97, and the average monthly number for October becomes 6. These latter values have been used in drawing curves, Figs. 18, (4) and 20.

TABLE XVIII.—HOURLY DISTRIBUTION OF 1168 EARTHQUAKES RECORDED INSTRUMENTALLY IN TOKYO FROM 1876 TO 1891.

Interval \ Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	sum
a.m.													
0— 1	4	6	2	3	3	3	3	2	4	3	7	7	47
1— 2	1	1	3	1	4	3	1	1	3	3	4	3	28
2— 3	1	7	3	5	5	2	5	3	4	4	8	2	49
3— 4	1	...	4	2	2	4	3	3	1	6	3	4	33
4— 5	2	2	7	5	4	...	3	4	2	3	3	7	42
5— 6	2	4	4	7	4	2	...	3	6	3	2	9	46
6— 7	3	6	8	2	5	2	2	...	2	7	2	7	46
7— 8	5	4	4	4	4	4	2	4	1	12	...	7	52
8— 9	3	4	2	4	11	6	...	1	6	2	3	2	44
9—10	4	5	4	3	11	6	4	5	1	7	8	6	64
10—11	5	4	2	4	6	5	2	3	4	4	4	2	45
11—12	4	3	4	3	4	3	2	3	1	4	1	6	38
p.m.													
0— 1	2	2	2	4	9	8	4	2	2	1	6	7	49
1— 2	3	5	5	4	4	4	3	4	3	7	9	4	55
2— 3	3	9	6	6	3	4	6	4	1	4	...	4	50
3— 4	7	12	6	8	6	3	6	2	4	4	9	0	67
4— 5	3	1	11	8	3	4	5	3	3	4	5	4	54
5— 6	4	4	4	4	3	2	5	2	3	3	2	3	44
6— 7	4	4	6	2	6	6	1	4	1	5	2	3	44
7— 8	6	3	7	3	2	...	...	2	3	8	5	4	43
8— 9	4	4	4	4	4	...	7	3	4	13	7	11	65
9—10	4	5	5	7	6	5	5	4	1	4	6	6	58
10—11	8	4	7	6	3	2	3	2	1	6	2	9	53
11—12	5	7	7	5	7	5	3	2	1	3	3	4	52
Sum	88	106	117	104	124	83	75	66	63	120	101	121	1168

During Night, or between 6 p.m. and 6 a.m., 560
„ Day, „ „ 5 a.m. „ 6 p.m., 608
1168

ERRATUM AND NOTE.

Page 150, line 7, *for* September 8th to 21st *read* 8th to 21st, September.

NOTE TO TABLE XIX.—The numbers given in this table include those of the after-shocks of the Kumamoto earthquake of July 28th, 1889. When the shocks which happened at Kumamoto during the latter half of 1889 are excluded, the monthly distribution of earthquakes becomes as follows.

Month.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Number of eqkes.	51	57	51	49	65	43	43	42	43	45	57	48

The curve of monthly earthquake frequency [Fig. 21, (5)] has been drawn from the above modified data.

TABLE XIX.—HOURLY DISTRIBUTION OF 3842 EARTHQUAKES IN JAPAN DURING 6 YEARS, FROM 1885 TO 1890.

Month / Interval	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	sum
a.m.													
0— 1	8	13	5	11	11	13	10	11	7	7	28	9	133
1— 2	11	18	6	9	9	10	12	12	16	17	14	19	153
2— 3	17	12	17	14	16	9	26	29	23	13	19	16	211
3— 4	13	11	13	18	22	10	12	29	10	11	12	15	176
4— 5	13	16	7	6	24	8	9	16	11	9	10	10	139
5— 6	13	14	15	11	26	8	15	17	12	16	10	9	166
6— 7	12	16	15	11	16	11	12	12	14	15	9	10	153
7— 8	13	9	10	19	15	18	9	15	12	15	16	11	162
8— 9	12	13	11	9	20	7	9	15	18	8	16	13	151
9—10	12	14	16	7	17	14	11	16	10	14	18	8	157
10—11	16	12	10	11	14	11	7	12	16	11	7	12	139
11—12	10	14	18	12	16	16	10	12	10	8	10	19	155
p.m.													
0— 1	13	9	8	10	14	8	9	15	18	9	25	13	151
1— 2	9	18	12	21	24	16	11	20	11	14	19	11	186
2— 3	13	9	22	22	20	13	17	21	11	10	17	13	188
3— 4	8	24	12	18	13	7	12	22	14	7	16	9	162
4— 5	6	8	12	15	14	6	11	20	13	15	15	9	144
5— 6	17	14	13	11	11	12	10	10	9	10	7	8	132
6— 7	13	10	16	7	12	8	4	15	11	16	12	11	135
7— 8	16	10	17	9	16	10	9	13	10	16	14	16	156
8— 9	13	13	13	12	14	4	9	11	10	15	25	14	153
9—10	15	19	11	8	21	17	18	17	14	11	15	18	184
10—11	14	23	16	12	15	13	7	13	6	24	16	26	185
11—12	16	21	13	10	11	10	11	19	12	16	19	13	171
Sum	303	340	308	293	391	259	270	392	298	307	369	312	3842

During Night, or between 6 p.m. and 6 a.m., 1962
„ Day, „ „ 6 a.m. „ 6 p.m., 1880
3842

TABLE XX.—HOURLY DISTRIBUTION OF 5333 EARTHQUAKES IN JAPAN.

Interval	Gifu.	Chiran	Whole Japan	sum
0— 1 a.m.	56	3	133	192
1— 2	64	15	153	232
2— 3	58	12	211	281
3— 4	62	9	176	247
4— 5	92	9	139	240
5— 6	63	17	166	246
6— 7	47	9	153	209
7— 8	53	12	162	227
8— 9	49	10	151	210
9—10	41	15	157	213
10—11	42	6	139	187
11—12	58	11	155	224
0— 1 p.m.	54	4	151	209
1— 2	48	12	186	246
2— 3	38	13	188	239
3— 4	36	8	162	206
4— 5	36	10	144	190
5— 6	47	4	132	183
6— 7	51	10	135	196
7— 8	77	11	156	244
8— 9	58	3	153	214
9—10	51	8	184	243
10—11	42	12	185	239
11—12	35	10	171	216
Sum	1258	233	3842	5333

1. The data in this table are collected from Tables XIII, XVI, and XIX.

TABLE XXI.—YEARLY SEISMIC "ACTIVITIES" IN SWITZERLAND, THE VESUVIAN DISTRICT, SICILY, AND THE BALKAN PENINSULA AND NEIGHBOURING ISLANDS, FROM 1865 TO 1883.[1]

District / Year	Switzerland	Vesuvian District	Sicily	Balk. Penin.	sum
1865	8	45	21	38	112
1866	7	24	19	104	154
1867	13	26	8	100	147
1868	23	16	8	19	66
1869	14	62	12	28	116
1870	19	51	6	25	101
1871	25	27	6	23	81
1872	1	3	...	9	13
1873	1	...	1	53	55
1874	3	23	16	9	51
1875	3	8	5	5	21
1876	7	55	33	12	107
1877	7	17	6	4	34
1878	9	11	3	6	29
1879	11	8	18	11	48
1880	33	9	26	14	82
1881	65	8	7	17	97
1882	40	...	5	17	62
1883	24	3	21	23	71
Sum	313	396	221	517	1447

1. The data are taken from Fuchs' "Statistik der Erdbeben." It is difficult to count exact numbers of earthquakes from the Catalogue, and the figures in the table, which are intended to represent seismic "activities," are merely the numbers of days in successive years on which one or more shocks have been recorded.

TABLE XXII.—YEARLY NUMBERS OF EARTHQUAKES IN MINO, OWARI, AND MIKAWA, FROM 1887 TO 1890.

PLACE, DISTRICT	1887	1888	1889	1890	sum
(MINO)					
Gifu (Met. Station.)	7	20	19	16	62
Nakatsugawa, Ena	11	11	7	10	39
Mitake, Kani.	8	9	7	13	37
Ōta, Kamo.	6	7	14	16	43
Takayama, Toki.	10	11	12	9	42
Kozuchi, Mugi.	7	4	6	7	24
Kitagata, Motosu.	5	7	7	6	25
Ibi, Ōno.	7	8	7	4	26
Ōgaki, Ampachi.	13	5	8	6	32
Takata, Taghi.	3	2	7	4	16
Takasu, Shimo-Ishizu.	15	3	8	4	30
Hachiman, Gujō.	5	5	6	2	18
Kasamatsu, Haguri	1	3	7	6	17
Takatomi, Yamagata.	2	6	5	6	19
Tarui, Fuwa.	5	3	5	...	13
(OWARI)					
Nagoya (Met. Station)	8	5	9	13	35
Atsuta, Aichi.	3	7	6	8	24
Katsukawa, Higashi-Kasugai.	4	5	9	13	31
Shimo-Otai, Nishi-Kasugai	10	10	8	10	38
Handa, Chita.	12	14	6	15	47
Tsushima, Kaito	8	4	5	7	24
Inazawa, Nakajima.	6	3	8	5	22
Koori, Niwa.	7	8	5	4	24
(MIKAWA)					
Toyohashi, Atsumi.	2	2	3	2	9
Shinshiro, Minami-Shidara	8	5	3	7	23
Okazaki, Nukada.	9	10	12	8	39
Chiryu, Aomi.	5	11	9	8	33
Koromo, Nishi-Kamo.	2	12	9	9	32
Nishio, Hazu.	6	10	3	10	29
Tomioka, Yana.	2	3	3	3	11
Taguchi, Kita-Shidara.	2	3	8	5	18
Asuke, Higashi-Kamo.	5	11	12	14	42
Gou, Hoi.	4	7	7	7	25

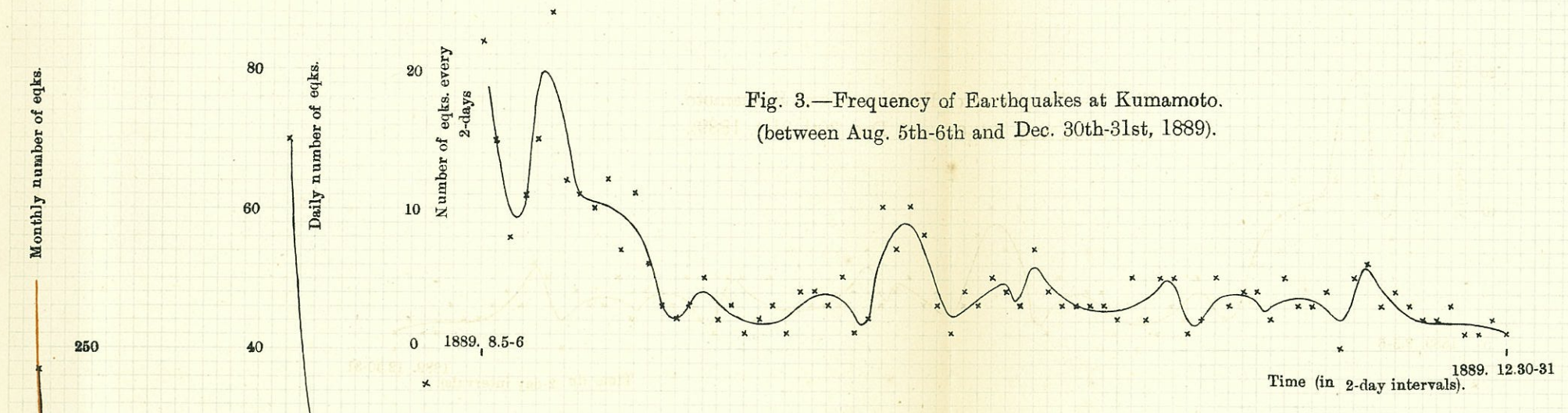


Fig. 3.—Frequency of Earthquakes at Kumamoto.
(between Aug. 5th-6th and Dec. 30th-31st, 1889).

Fig. 2.—Frequency of Earthquakes at Kumamoto,
(between July 29th and Nov. 19th 1889).

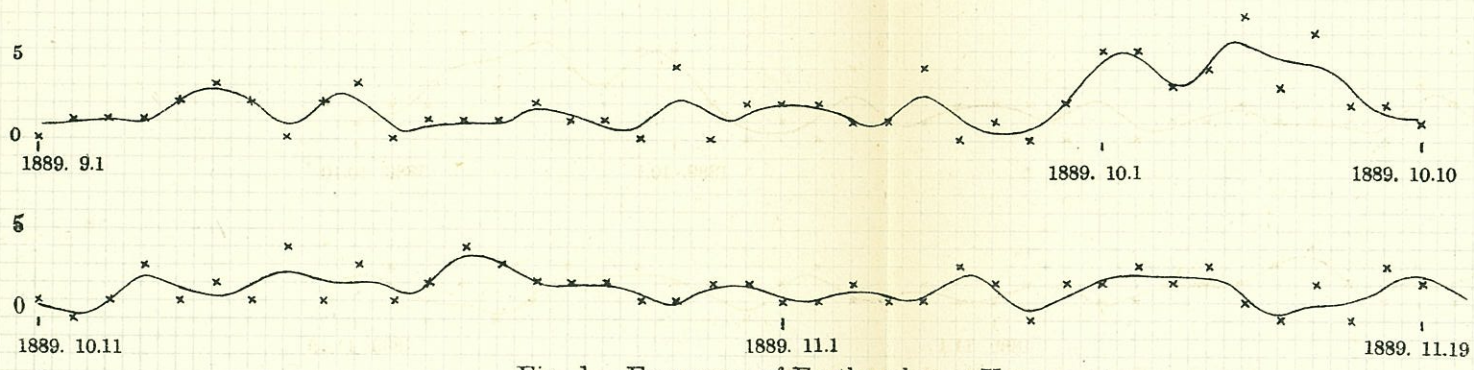


Fig. 1.—Frequency of Earthquakes at Kumamoto,
(between Aug., 1889, and Dec., 1893).

Fig. 6.—Frequency of Earthquakes at Gifu,
(between Oct. 29th and Nov. 5th, 1891).

x = 0 denotes 12 hour interval, 0 – 12 a.m. Oct., 29th, 1891.
x = 1 „ „ , 0 – 12 p.m. „ , „ „ .
x = 2 „ „ , 0 – 12 a.m. „ , 30th, 1891.
x = 3 „ „ , 0 – 12 p.m. „ , „ „ .
etc., etc.

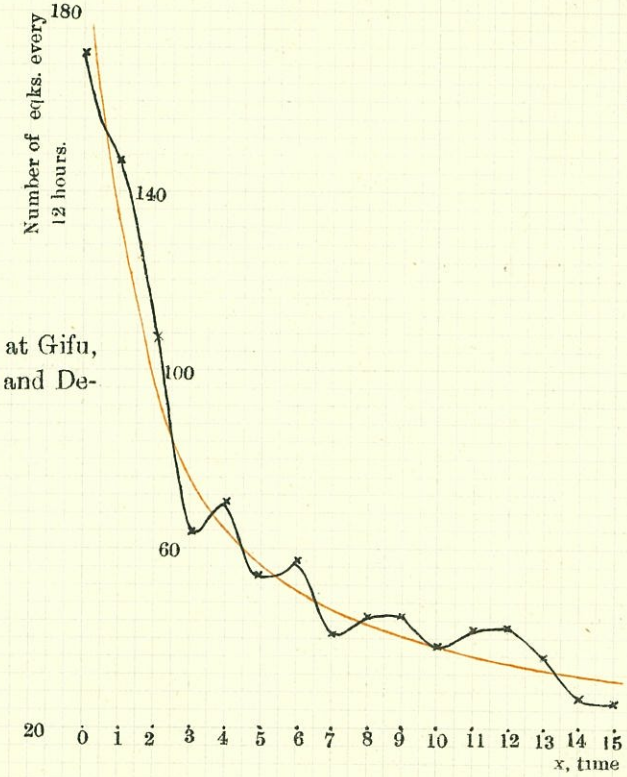
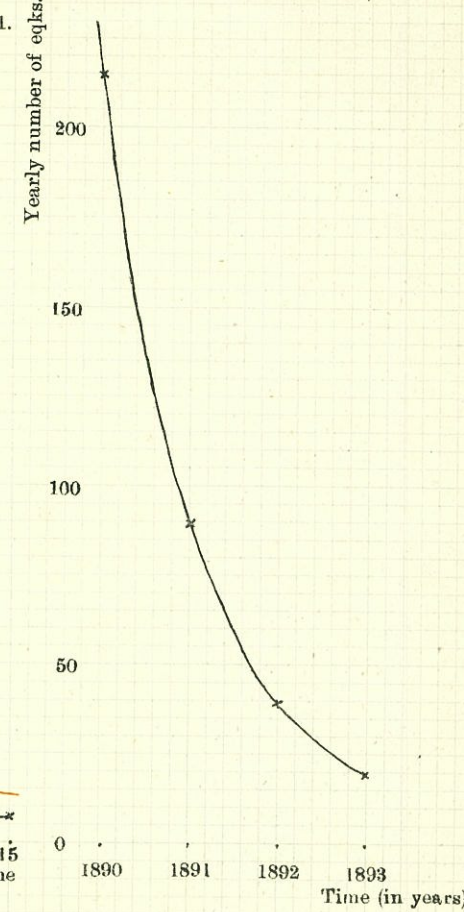


Fig. 5.
Frequency of Earthquakes at Gifu,
(between November, 1891, and December, 1893).

Fig. 4.
Frequency of Earthquakes at Kumamoto,
(between 1890 and 1893).



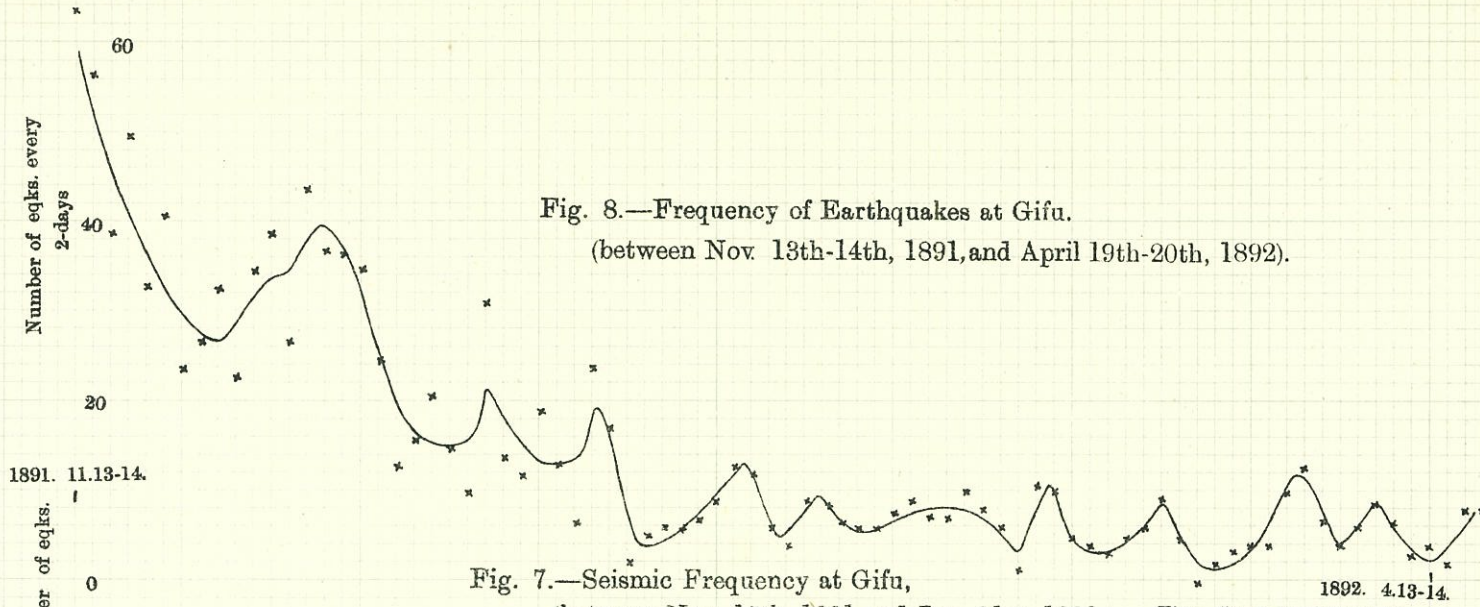


Fig. 8.—Frequency of Earthquakes at Gifu.
(between Nov. 13th-14th, 1891, and April 19th-20th, 1892).

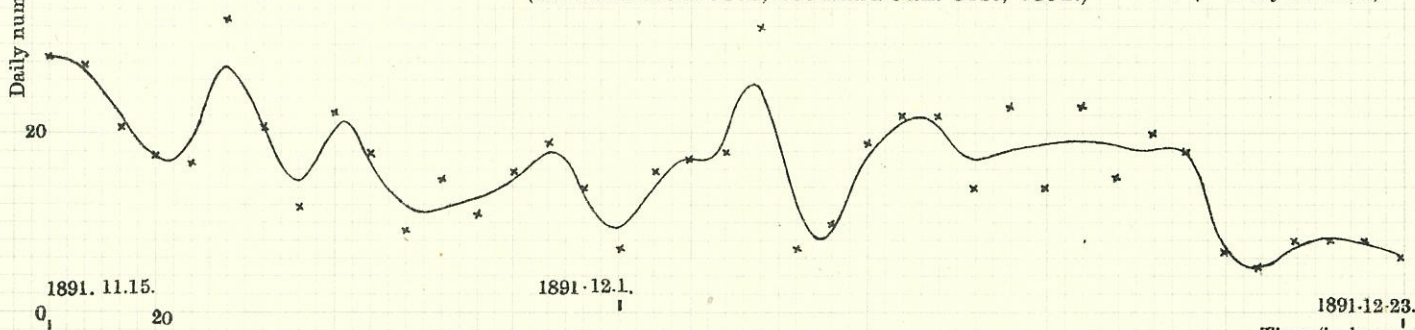
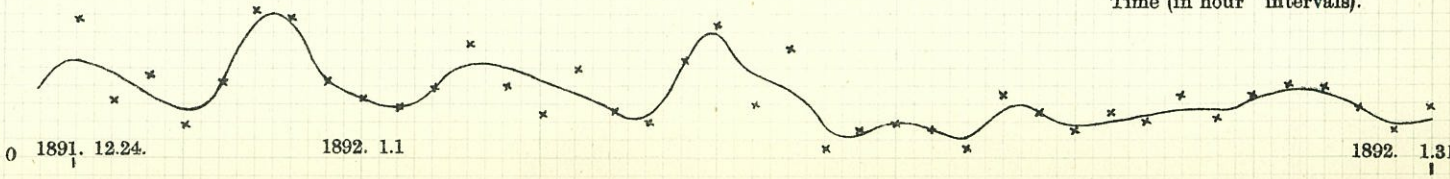


Fig. 7.—Seismic Frequency at Gifu,
(between Nov. 15th, 1891. and Jan. 31st, 1892.)



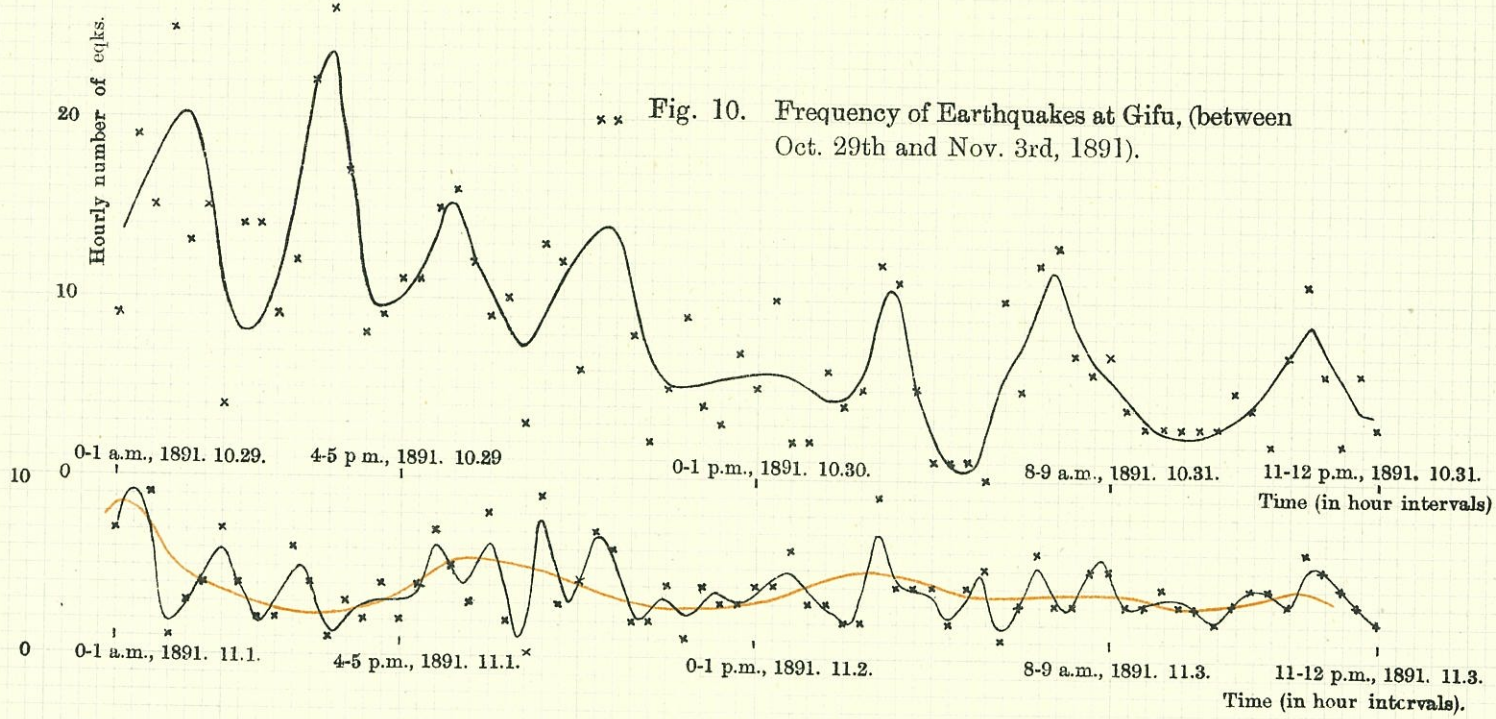


Fig. 10. Frequency of Earthquakes at Gifu, (between Oct. 29th and Nov. 3rd, 1891).

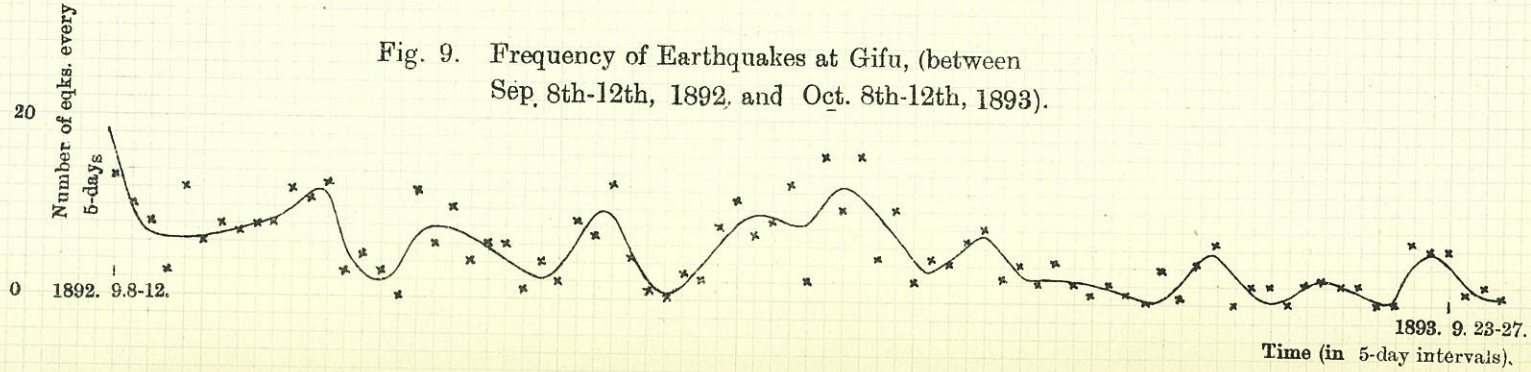


Fig. 9. Frequency of Earthquakes at Gifu, (between Sep. 8th-12th, 1892, and Oct. 8th-12th, 1893).

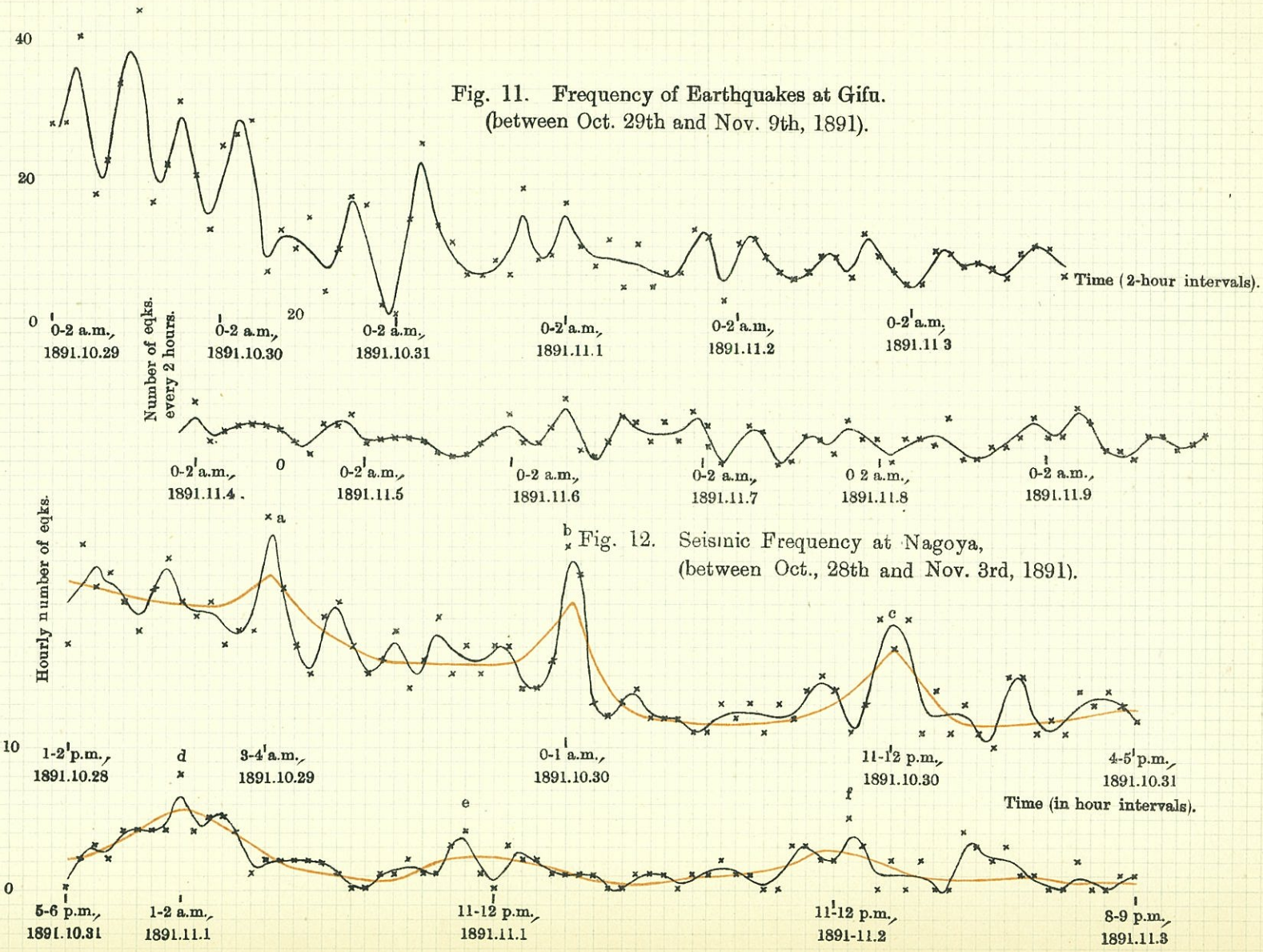


Fig. 11. Frequency of Earthquakes at Gifu.
(between Oct. 29th and Nov. 9th, 1891).

Fig. 12. Seismic Frequency at Nagoya,
(between Oct., 28th and Nov. 3rd, 1891).

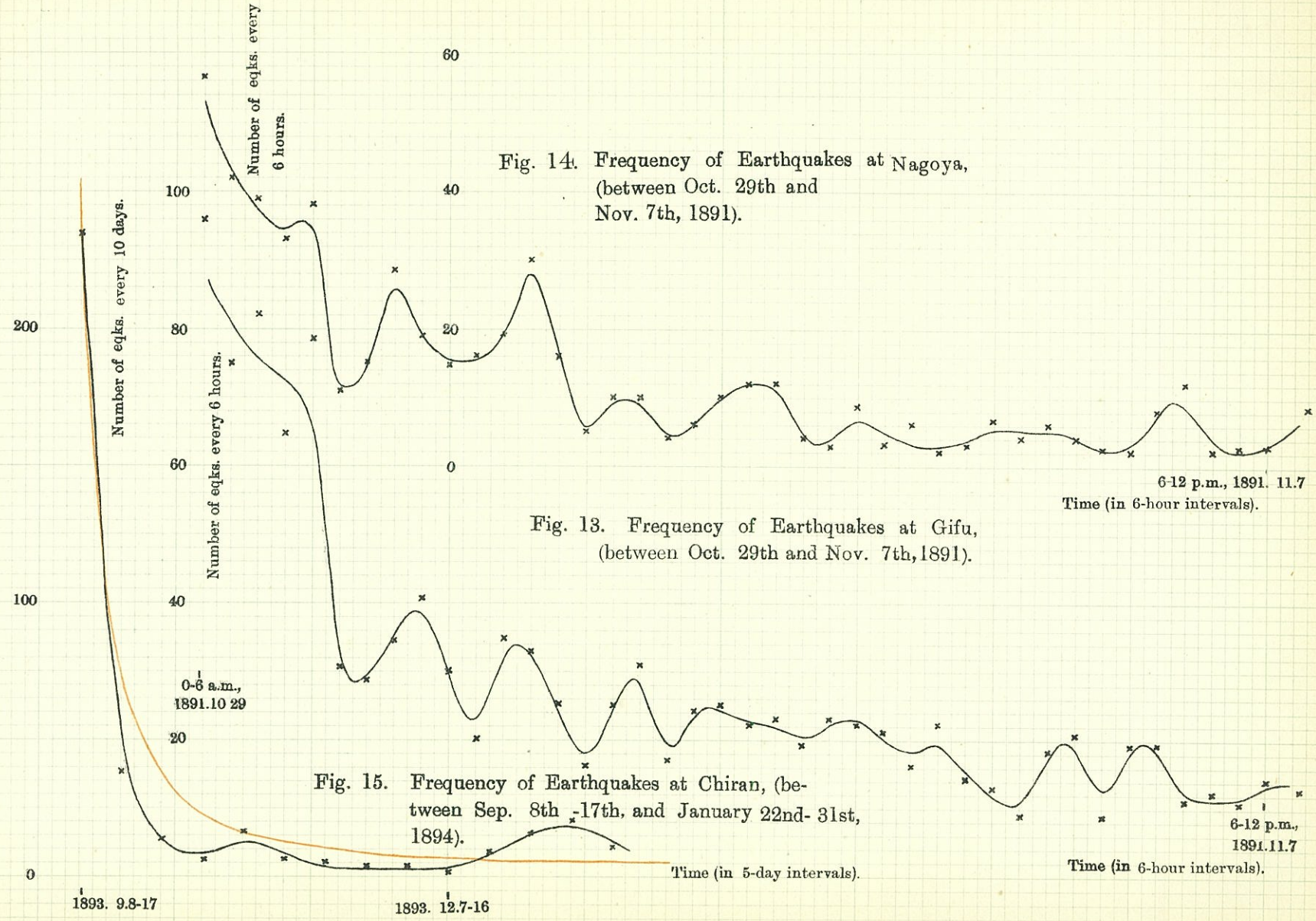


Fig. 14. Frequency of Earthquakes at Nagoya, (between Oct. 29th and Nov. 7th, 1891).

Fig. 13. Frequency of Earthquakes at Gifu, (between Oct. 29th and Nov. 7th, 1891).

Fig. 15. Frequency of Earthquakes at Chiran, (between Sep. 8th -17th, and January 22nd- 31st, 1894).

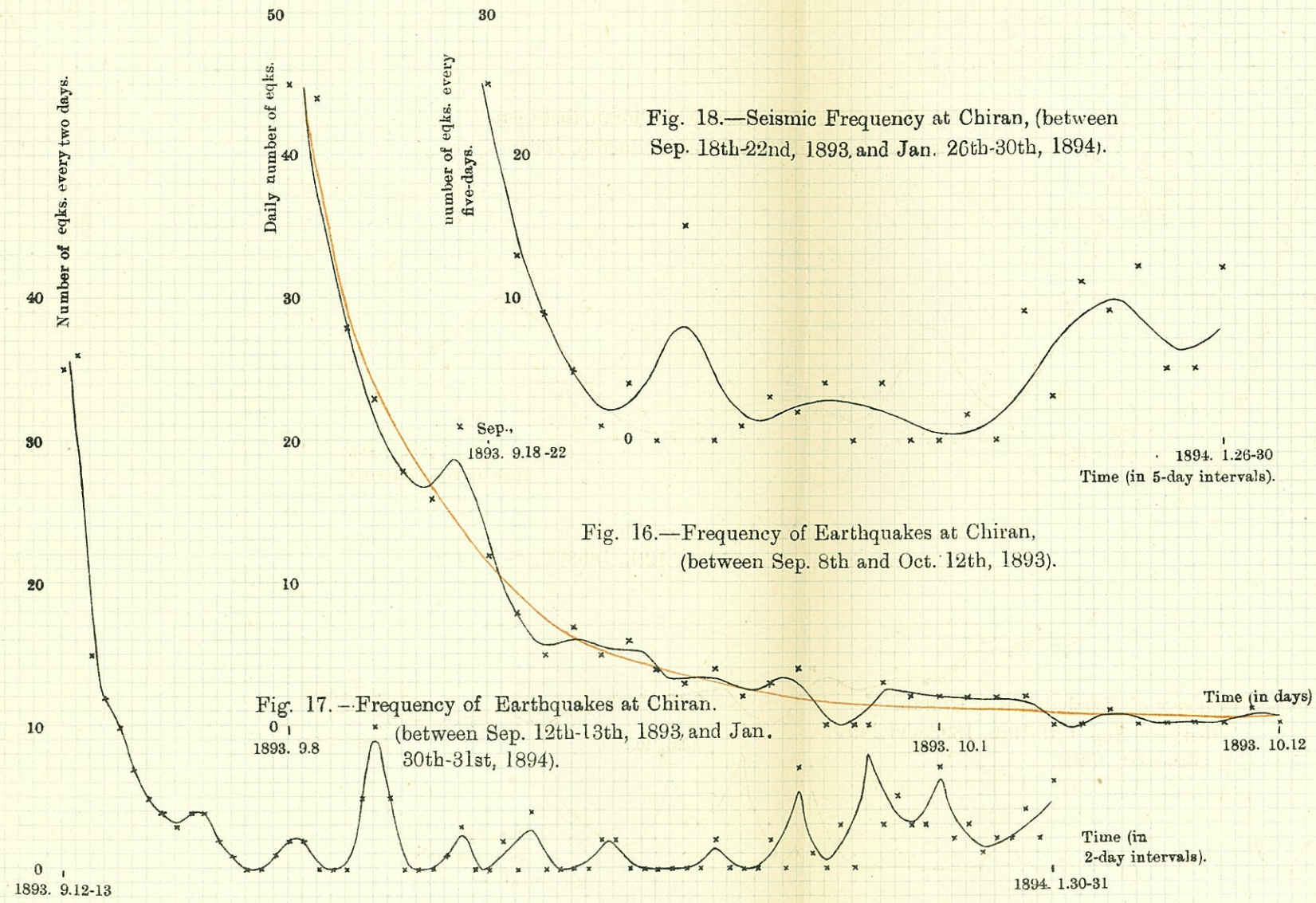


Fig. 18.—Seismic Frequency at Chiran, (between Sep. 18th-22nd, 1893, and Jan. 26th-30th, 1894).

Fig. 16.—Frequency of Earthquakes at Chiran, (between Sep. 8th and Oct. 12th, 1893).

Fig. 17.—Frequency of Earthquakes at Chiran. (between Sep. 12th-13th, 1893, and Jan. 30th-31st, 1894).

Fig. 19.

(1) and (2)–Diurnal Fluctuation of Seismic Frequency at Gifu and Nagoya.

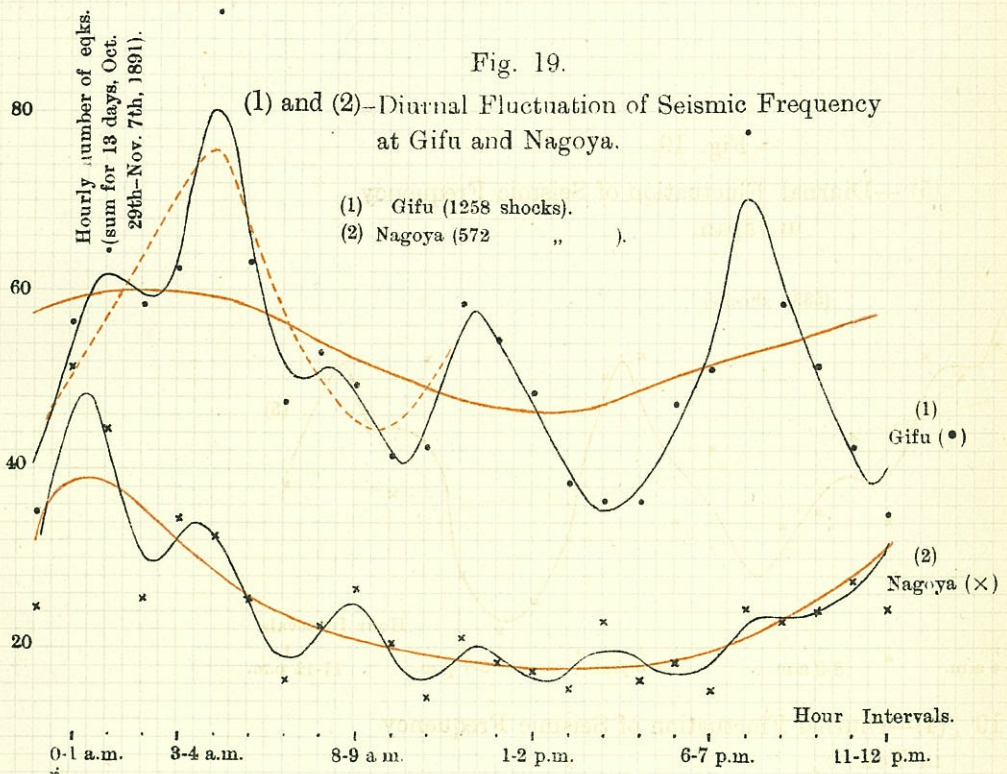


Fig. 19., (3)—Diurnal Fluctuation of Seismic Frequency in Japan.

Fig. 19.

(5) —Diurnal Fluctuation of Seismic Frequency in Japan.

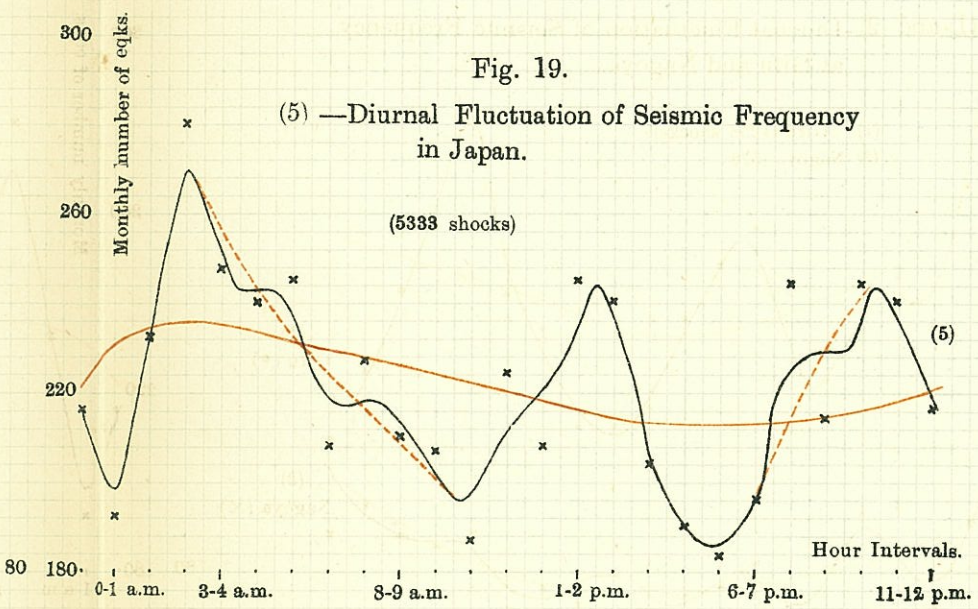


Fig. 19 , (4)—Diurnal Fluctuation of Seismic Frequency in Tokyo.

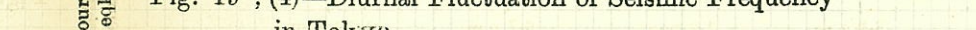


Fig. 21.

(1), (2), (3), and (4)—Annual Fluctuation of Seismic Frequency at Kumamoto and Tōkyō.

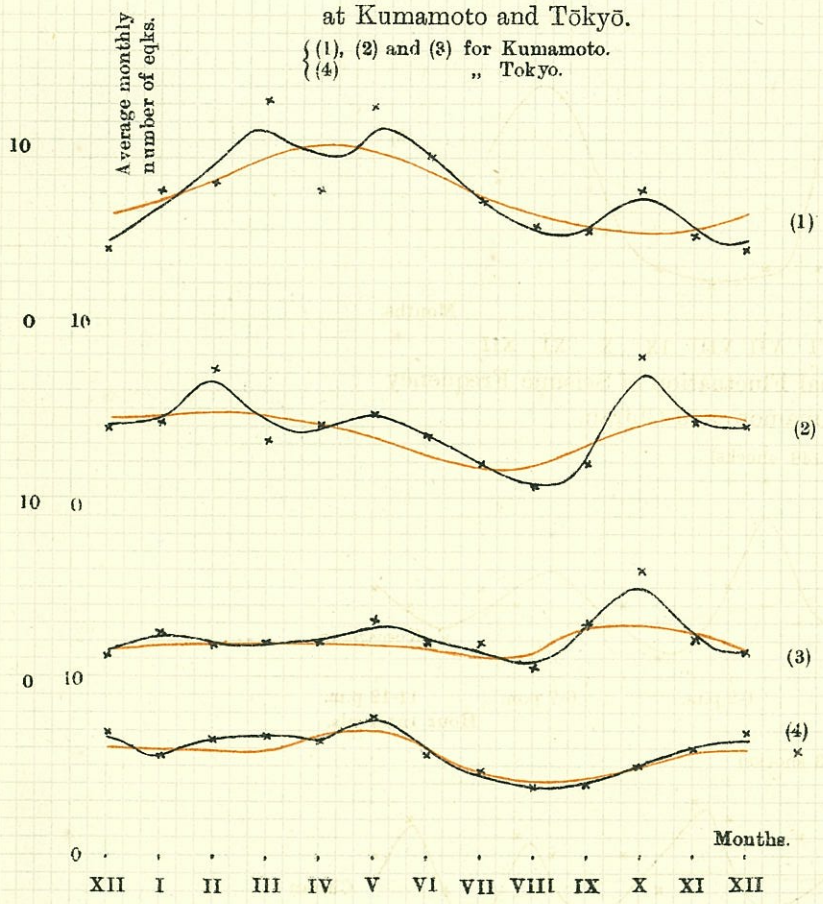


Fig. 21, (5)—Annual Fluctuation of Seismic Frequency in Japan.

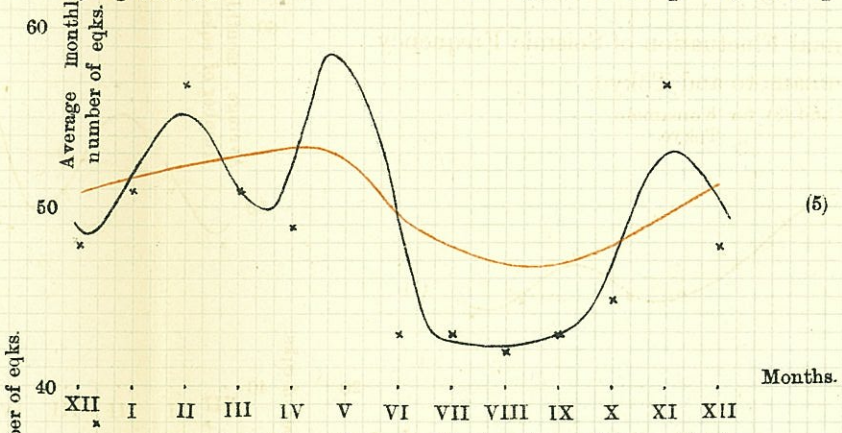


Fig. 20.—Diurnal Fluctuation of Seismic Frequency at Kumamoto and Chiran.

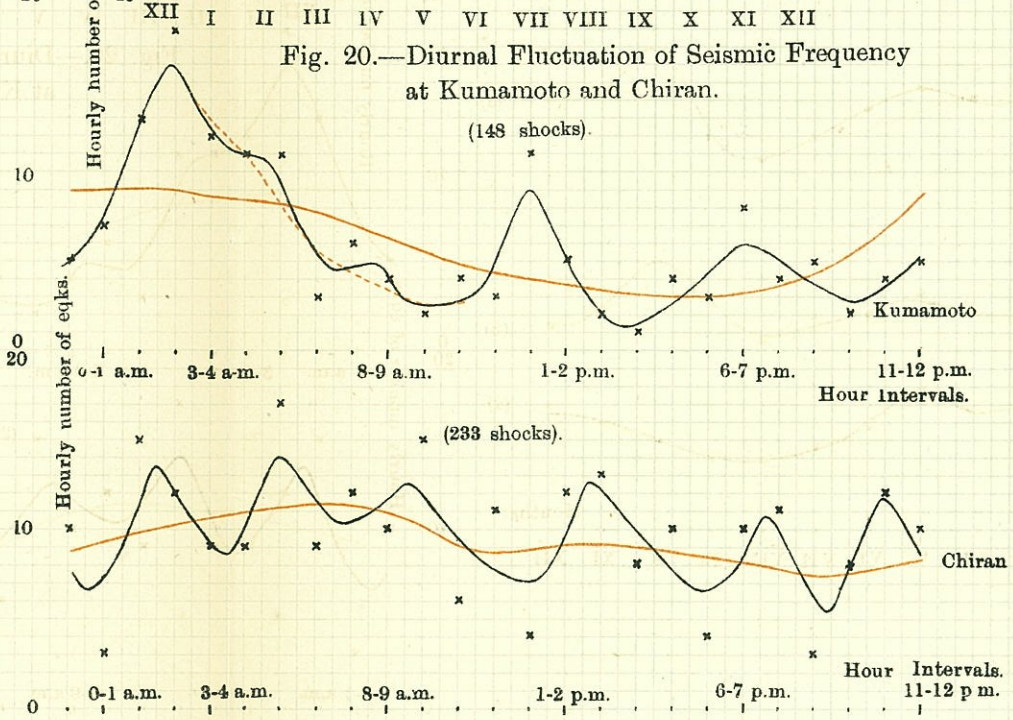


Fig. 24.—Frequency of Earthquakes at Gifu and Ōkawara.

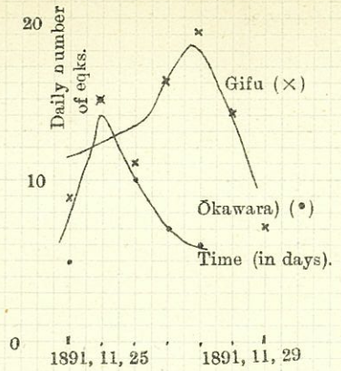


Fig. 25.—Frequency of Earthquakes at Gifu and Midori.

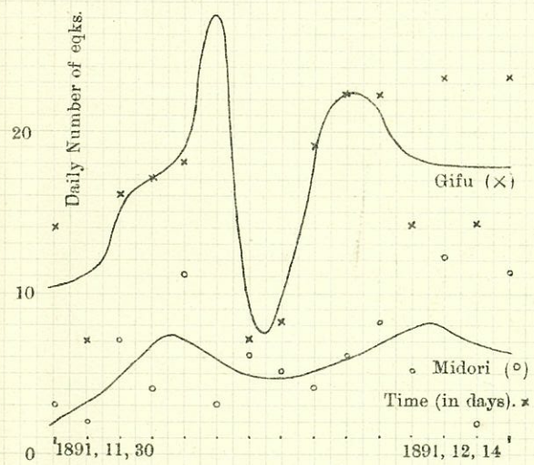


Fig. 23.—(B).
Seismic Intensity for the Vesuvian District, (between 1865 and 1883).

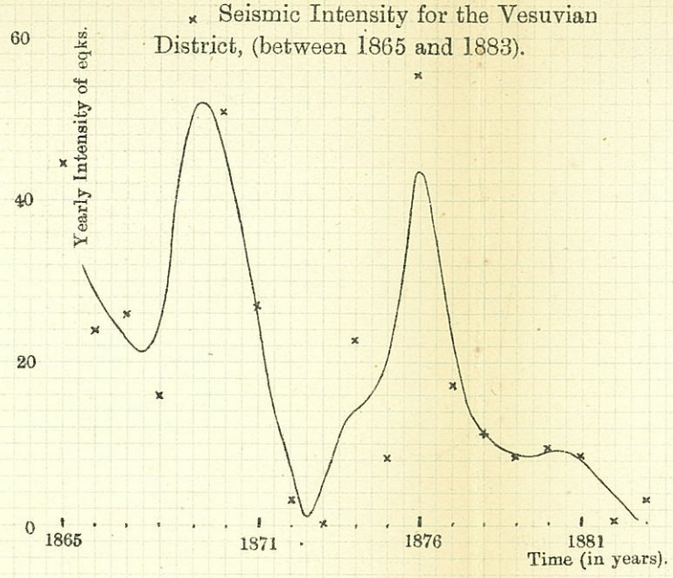


Fig. 23.—(C).
Seismic Intensity for Sicily, (between 1865 and 1883).

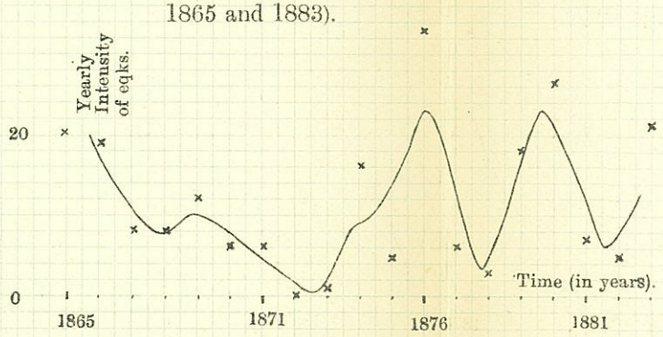


Fig. 23.
Seismic Frequency in Tokyo, (between 1876 and 1893).

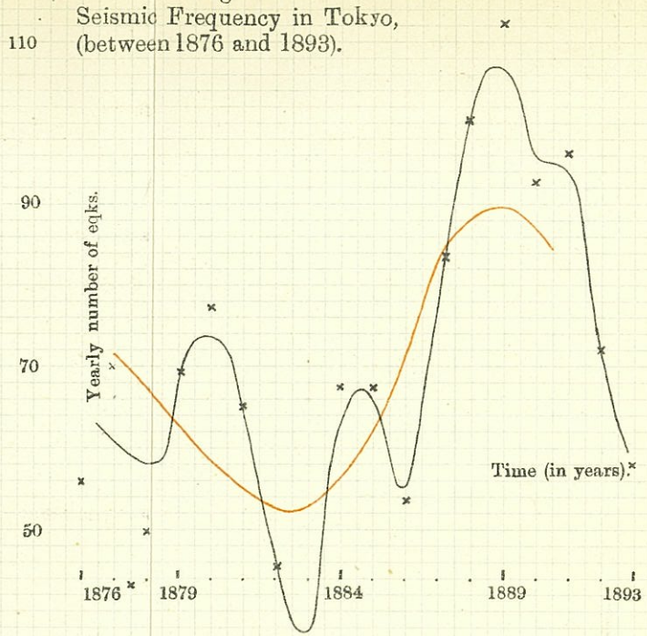


Fig. 23.—(D).
Seismic Intensity for the Balkan Peninsula and the Archipelago. (between 1865 and 1883).

Fig. 22.—Seismic Frequency in Tokyo, (between Jan. 1876 and Dec. 1882).

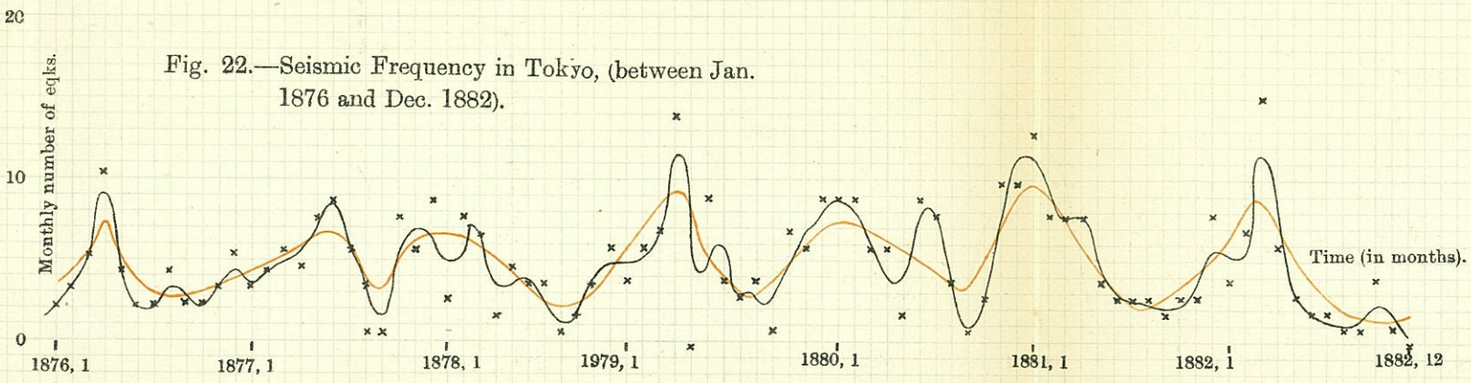
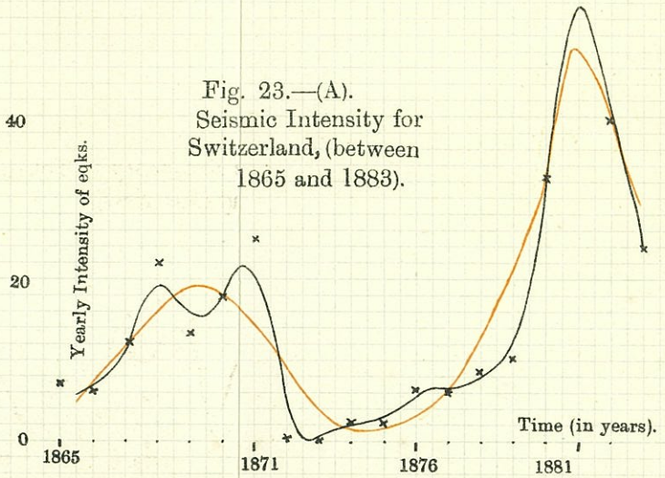


Fig. 23.—(A).
Seismic Intensity for Switzerland, (between 1865 and 1883).



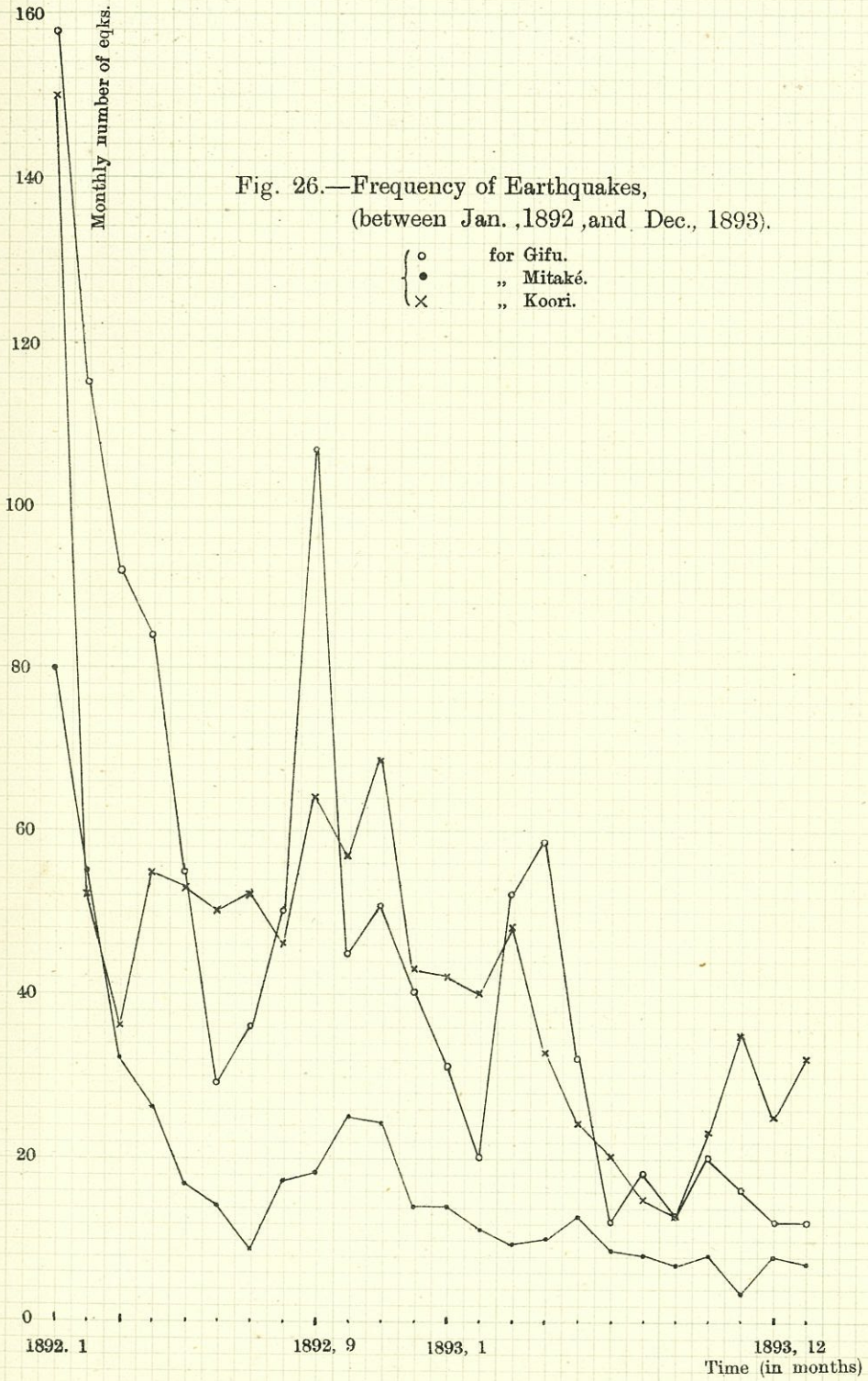
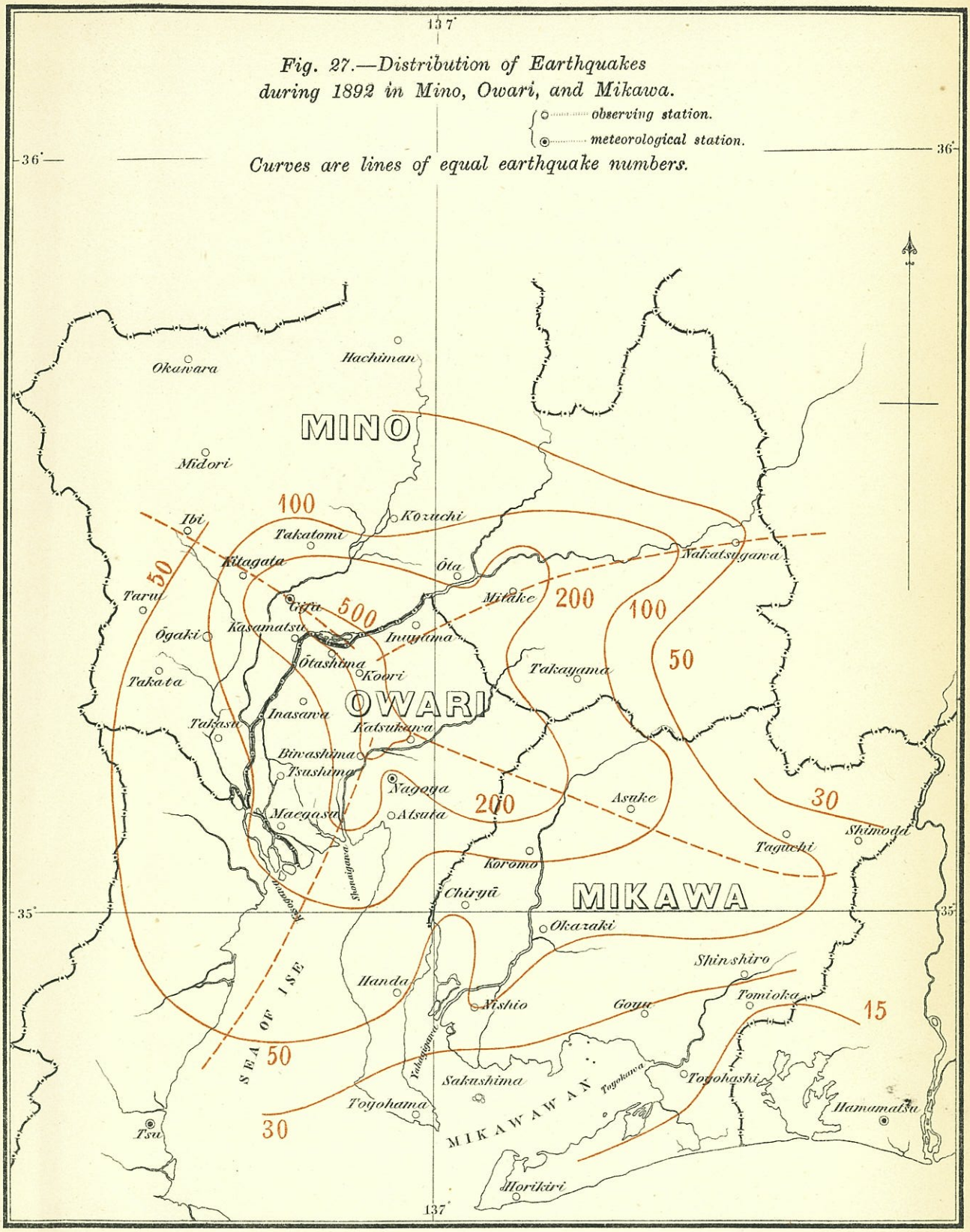


Fig. 26.—Frequency of Earthquakes,
(between Jan. ,1892 ,and Dec., 1893).

Fig. 27.—Distribution of Earthquakes during 1892 in Mino, Owari, and Mikawa.

Curves are lines of equal earthquake numbers.



137°

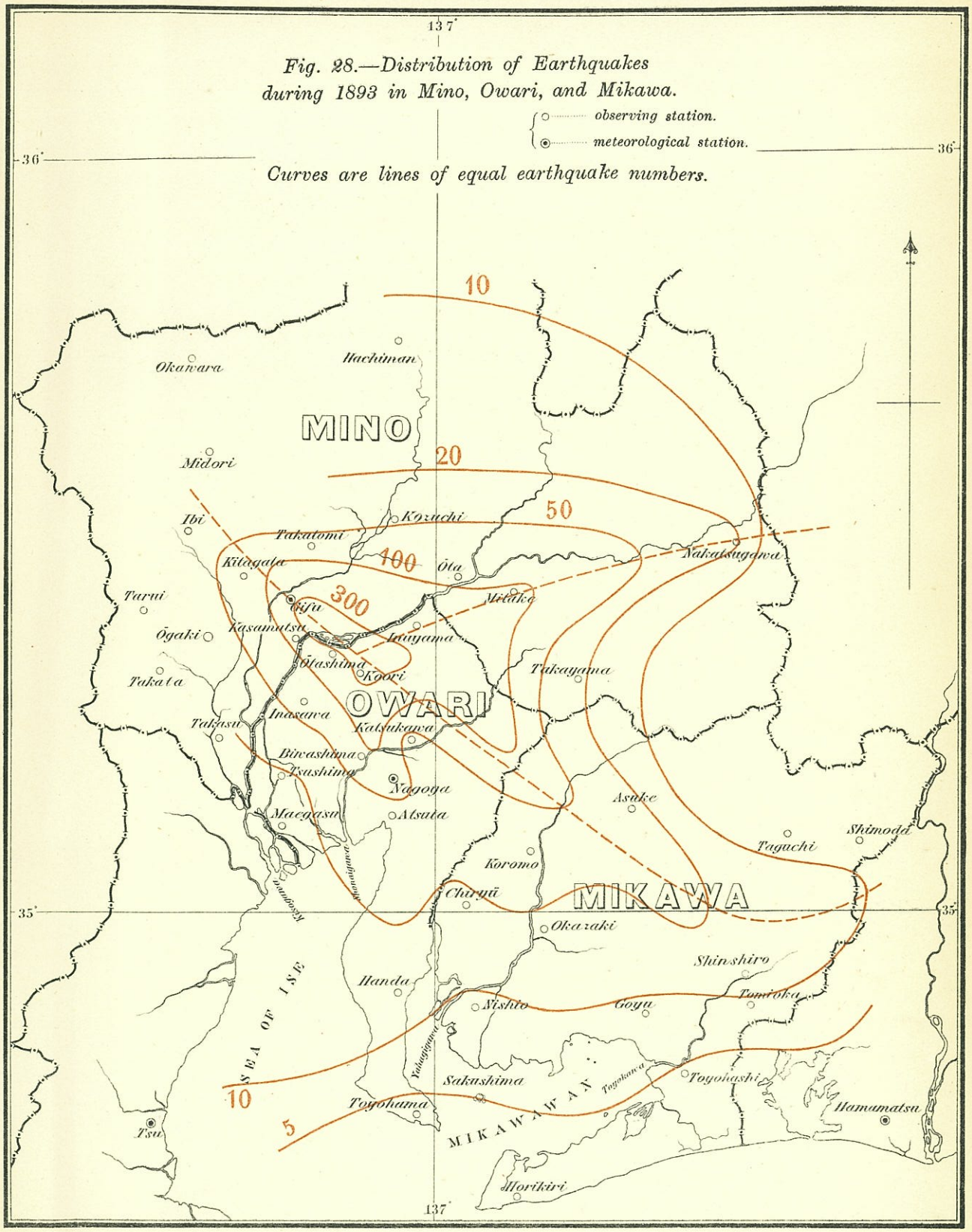
Fig. 28.—Distribution of Earthquakes during 1893 in Mino, Owari, and Mikawa.

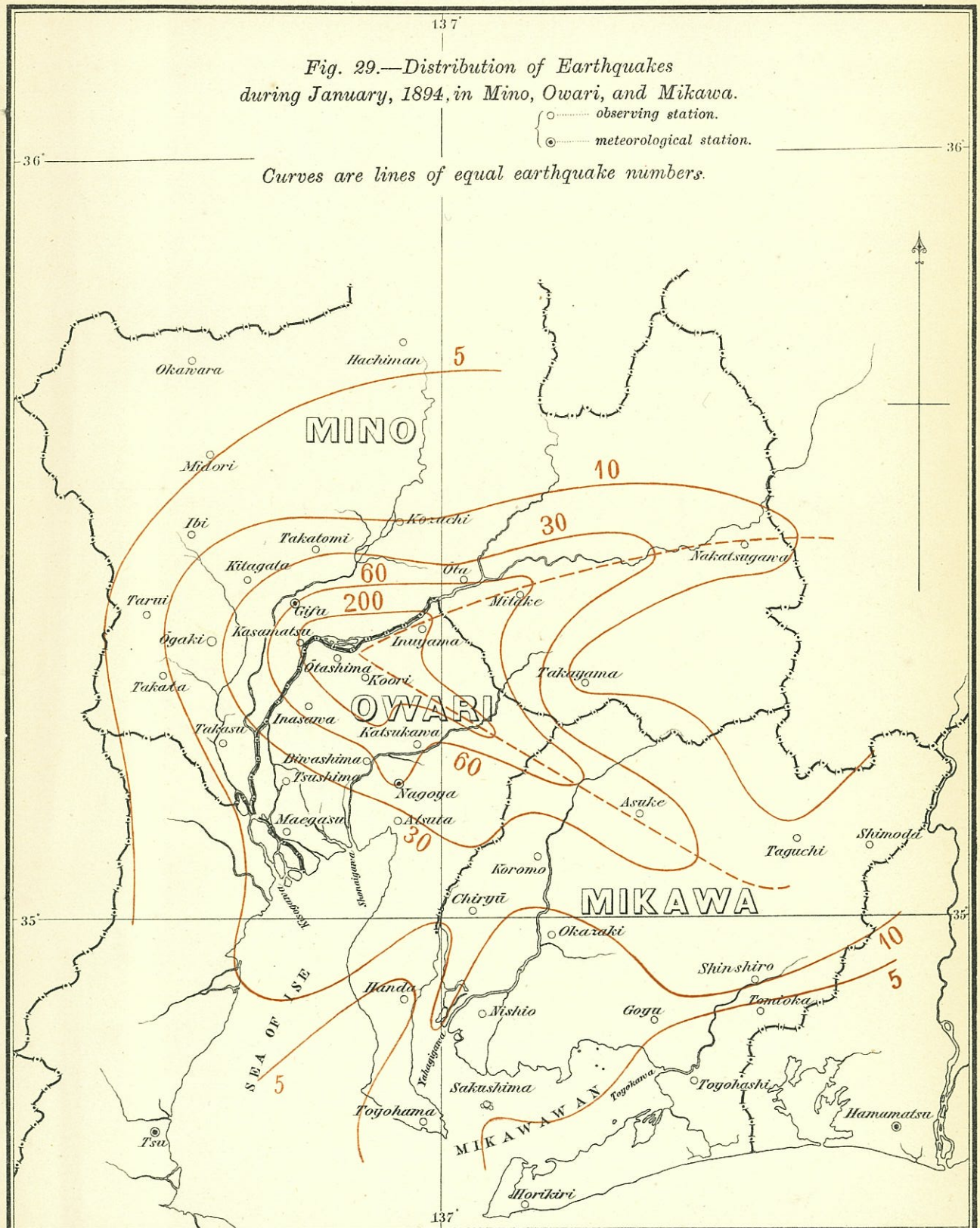
observing station.

meteorological station.

36° 36°

Curves are lines of equal earthquake numbers.




137°
Fig. 29.—Distribution of Earthquakes
during January, 1894, in Mino, Owari, and Mikawa.
observing station.
meteorological station.
36°
Curves are lines of equal earthquake numbers.
Okawara
Hachiman
5
MINO
Midori
10
Ibi
Kozuchi
30
Takatomi
Nakatsugawa
Kitagata
60
Ota
Tarui
200
Gifu
Mitake
Ogaki
Kasamatsu
Inuyama
Otashima
Takayama
Takata
Kodai
OWARI
Inasawa
Takasu
Katsukawa
Biwashima
60
Tsushima
Nagoya
Asuke
Maegasu
Atsuta
30
Shimoda
Taguchi
Koromo
Chiryū
MIKAWA
35°
Okazaki
10
Shinshiro
5
Handa
Nishio
Goyu
Tomioka
SEA OF ISE
5
Sakashima
Toyohashi
Toyohama
MIKAWAWAN
Hamamatsu
Tsu
Horikiri
137°

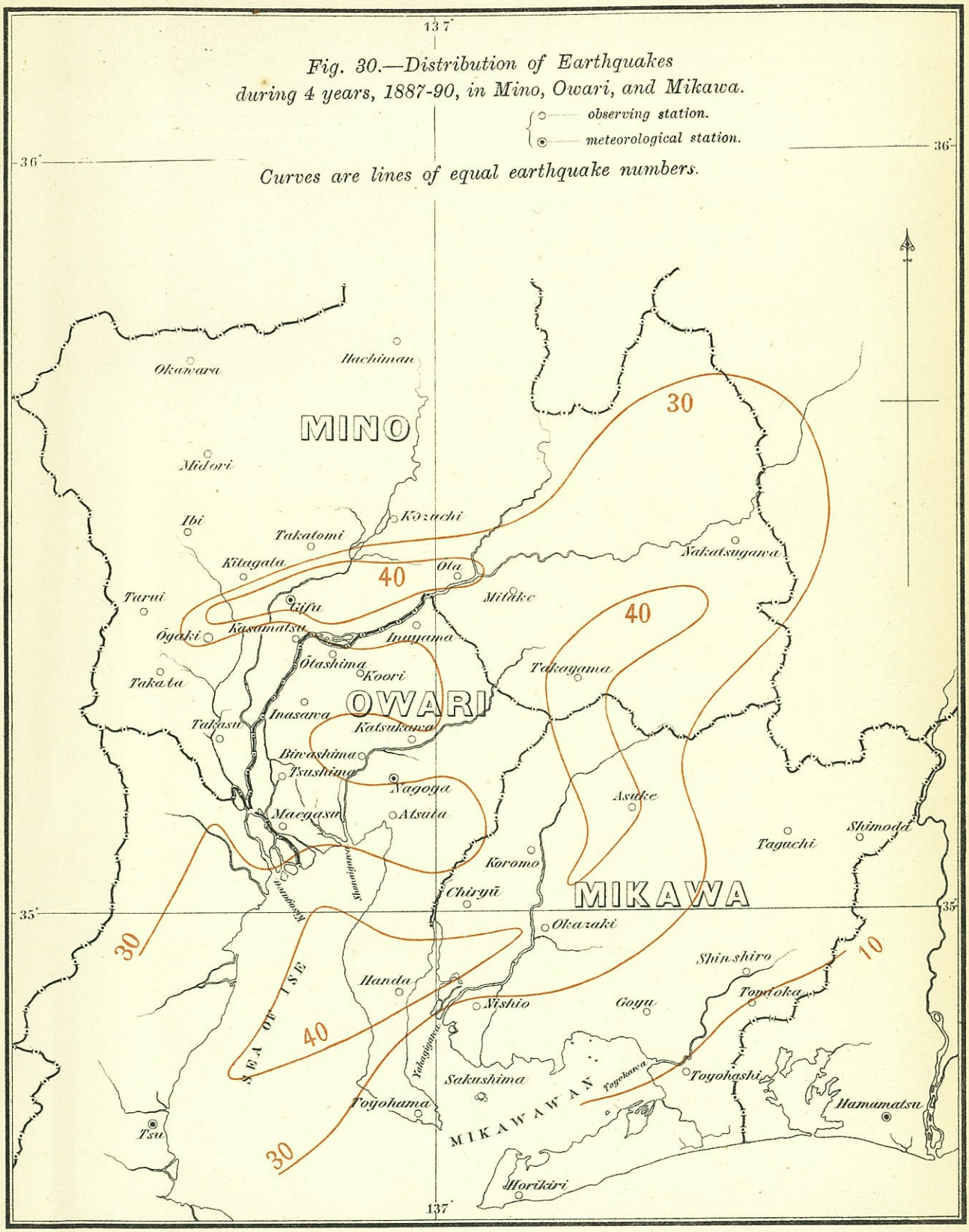


Fig. 30.—Distribution of Earthquakes during 4 years, 1887-90, in Mino, Owari, and Mikawa.

○ observing station.
⊙ meteorological station.

Curves are lines of equal earthquake numbers.

137°

Fig. 31.—The Great Earthquake of Oct. 28th, 1891.

○ observing station.
⊙ meteorological station.

(1) and (2) are isoseismal lines along which the maximum accelerations of earthquake motion were respectively 2000 and 800 mm. per sec. per sec.
The area most strongly shaken is indicated by red shades.

36° 36°

Okawara
Ikuchiman
MINO
Midori
Ibi
Takatomi
Kitagata
Kozuchi
Ota
Nakatsugawa
Tarui
Gifu
Mitake
Ogaki
Kasamatsu
Inuyama
Ōtashima
Koori
Takakuma
Takata
OWARI
Takasu
Inasawa
Katsukawa
Biwashima
Tsushima
Yagoma
Asuke
Maegasu
Atsuta
Shimoda
Taguchi
Koromo
Chiryū
MIKAWA
35° 35°
Okazaki
Shinshiro
Handa
Nishio
Goyu
Tomioka
SEA OF ISE
Yahagigawa
Sakushima
Toyokawa
Toyohashi
Toyohama
Hamamatsu
MIKAWA BAY
Tsu
Horikiri

137°