The mean value of the 2a's for the 22 earthquakes tabulated above is 2.3 mm, the corresponding mean period being 1.2 sec. For the convenience of reference, I collect below the results thus far obtained.

TABLE VI.

| Number of cases. | Period; mean value. | | 2a; mean value. | |
|---|---|---|---|---|
| | sec. sec. | sec. | mm. mm. | mm. |
| 9 | 0.2—0.5 ; | 0.33 | 1.5— 6.1 ; | 2.9 |
| 19 | 0.6—0.8 ; | 0.71 | 1.5— 5.6 ; | 2.8 |
| 22 | 0.9—1.8 ; | 1.20 | 1.5— 5.1 ; | 2.3 |
| 6 | 0.9—2.0 ; | 1.50 | 7.3—76.0 ; | 32.0 |

## 4. Seismographical Observations at the Central Meteorological Observatory, 1885-1897.

The following remarks are based on the earthquake measurement reported by the Central Meteorological Observatory.

### Period.

The Gray-Milne seismograph at the Central Meteorological Observatory, which was first used in Jan. 1885, has recorded during the next 13 years 1404 earthquakes of which 433 gave seismograms large enough to enable us to measure one or more elements of motion distinctly. The results, however, relating to a number of earthquakes, in which the period of the maximum vibration ($T_o$) was long, must be regarded in general as unsatisfactory, because ordinary Gray-Milne seismographs do not record accurately vibrations of periods much above 2 sec. Confining, therefore, our attention to those cases in which the period of the maximum vibration was less than 2 sec., we find 362 earthquakes; the period distribution being as follows :—

## TABLE VII.

| Number of cases. | $T_o$ (sec.). | Number of cases. | $T_o$ (sec.). |
|---|---|---|---|
| 4 | 0.1 | 11 | 1.1 |
| 21 | 0.2 | 20 | 1.2 |
| 25 | 0.3 | 13 | 1.3 |
| 22 | 0.4 | 12 | 1.4 |
| 34 | 0.5 | 12 | 1.5 |
| 29 | 0.6 | 5 | 1.6 |
| 35 | 0.7 | 4 | 1.7 |
| 46 | 0.8 | 10 | 1.8 |
| 21 | 0.9 | 3 | 1.9 |
| 27 | 1.0 | 8 | 2.0 |

The mean value of $T_o$ deduced from all these 362 cases is 0.84 sec.

From the above table it will be seen that the values of $T_o$ most frequently occurring is between 0.5 sec. and 0.8 sec., there being 144 cases corresponding to these periods, which are equivalent to about 40% of the whole number. The periods occurring next frequently are those between 0.2 sec. and 0.4 sec. and between 0.9 sec. and 1.5 sec. On the whole, the number of the cases corresponding to the periods between 0.2 sec. and 1.5 sec. amount to 328, which is equivalent to about 91% of the whole. These results are summarized in the following table :—

## TABLE VIII.

| Period. | Number of cases. | % amount. |
|---|---|---|
| sec.   sec.<br>0.1—0.4 | 72 | 20 |
| 0.5—0.8 | 144 | 40 |
| 0.9—1.2 | 79 | 22 |
| 1.3—1.6 | 42 | 12 |
| 1.7—2.0 | 25 | 7 |

## Maximum Horizontal Motion.

Among the 433 earthquakes instrumentally observed at the Central Meteorological Observatory between 1885 and 1897, there are 366 cases in which the maximum horizontal motion $2a$ was measured; the cases of the vibrations whose periods were greater than 2 sec. being as before excluded. In 8 cases, the $2a$ was great, being respectively 5.6 mm; 6.1 mm; 16.2 mm; 7.3 mm; 22.8 mm; 28.4 mm; 41.0 mm; 76.0 mm. In the remaining 357 cases, the $2a$'s varied between 0.1 mm and 5.1 mm; the number of cases corresponding to the different values of $2a$ being as follows.—

### TABLE IX.

| Number of cases. | 2a (mm). | Number of cases. | 2a (mm). |
|---|---|---|---|
| 74 | 0.2 | 2 | 2.6 |
| 56 | 0.3 | 0 | 2.7 |
| 52 | 0.4 | 1 | 2.8 |
| 34 | 0.5 | 1 | 2.9 |
| 23 | 0.6 | 1 | 3.0 |
| 20 | 0.7 | 1 | 3.1 |
| 14 | 0.8 | 1 | 3.2 |
| 6 | 0.9 | 0 | 3.3 |
| 7 | 1.0 | 1 | 3.4 |
| 5 | 1.1 | 1 | 3.5 |
| 7 | 1.2 | 1 | 3.6 |
| 6 | 1.3 | 1 | 3.7 |
| 3 | 1.4 | 0 | 3.8 |
| 5 | 1.5 | 0 | 3.9 |
| 1 | 1.6 | 1 | 4.0 |
| 9 | 1.7 | 1 | 4.1 |
| 6 | 1.8 | 1 | 4.2 |
| 3 | 1.9 | 1 | 4.3 |
| 1 | 2.0 | 0 | 4.4 |
| 0 | 2.1 | 0 | 4.5 |
| 2 | 2.2 | 0 | 4.6 |
| 1 | 2.3 | 0 | 4.7 |
| 3 | 2.4 | 1 | 4.8 |
| 2 | 2.5 | 0 | 4.9 |
|  |  | 1 | 5.0 |

The above relative frequency of the different 2a's are more shortly given in the following table.—

TABLE X.

| Max. hor. 2a (mm). | Number of cases. | % amount. |
|---|---|---|
| mm. mm. | | |
| 0.2—0.5 | 216 | 59.1 |
| 0.6—1.0 | 70 | 19.2 |
| 1.1—1.5 | 26 | 7.1 |
| 1.6—2.0 | 20 | 5.5 |
| 2.1—2.5 | 8 | 2.2 |
| 2.6—3.0 | 5 | 1.4 |
| 3.1—3.5 | 4 | 1.1 |
| 3.6—4.0 | 3 | 0.5 |
| 4.1—4.5 | 3 | 0.8 |
| 4.6—5.0 | 2 | 0.5 |
| 5.1—5.5 | 1 | 0.3 |
| 5.6—6.0 | 1 | 0.3 |
| 6.1—6.5 | 1 | 0.3 |

As will be seen from the above table, the great majority fall between 0.2 mm and 0.5 mm and between 0.6 mm and 1.0 mm, the number of cases corresponding to these two groups being 216 and 70, which are respectively 59.1% and 19.2% of the whole.
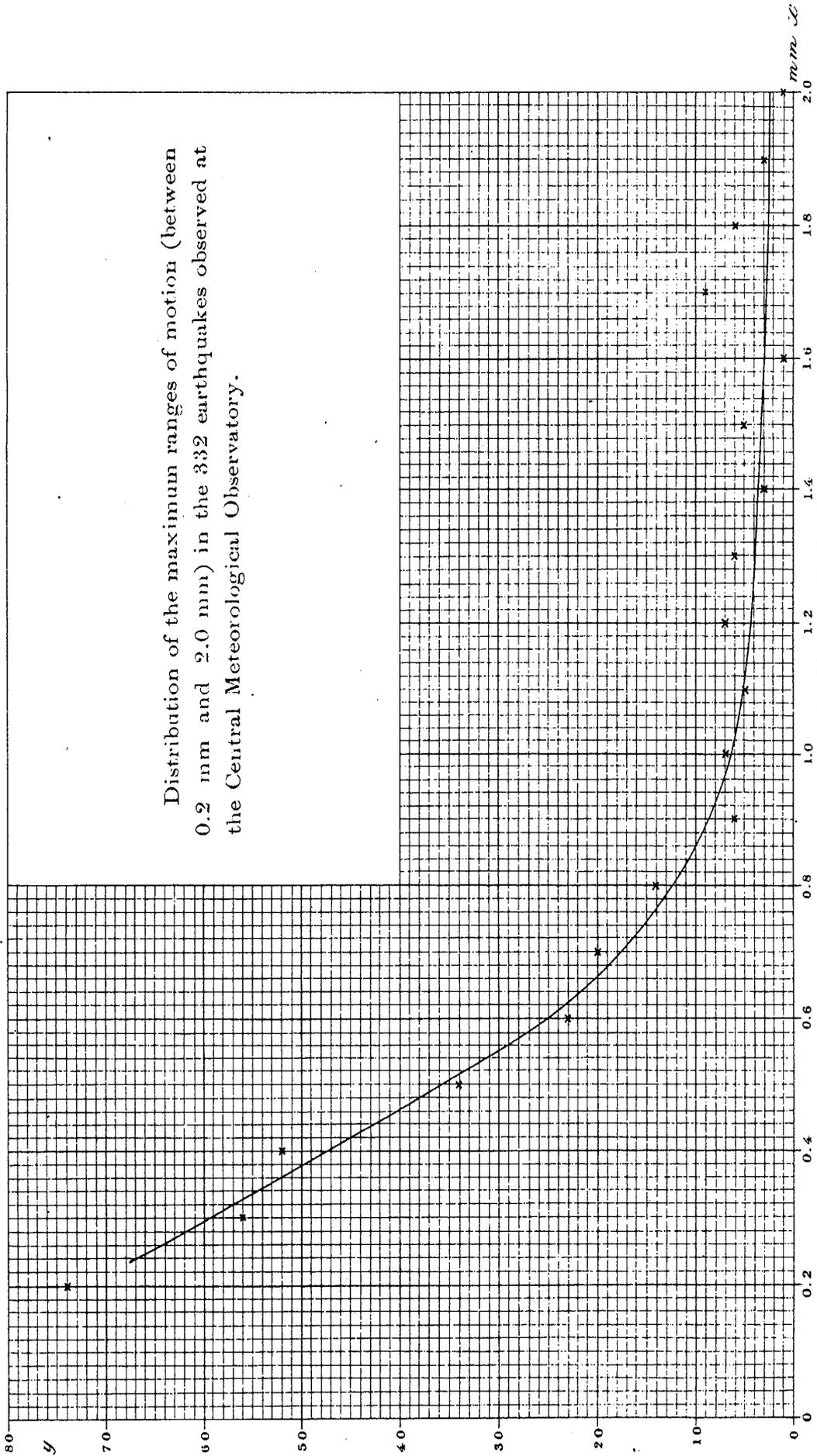
Pl. III and Pl. IV illustrate graphically the results contained in Tables VII and IX respectively.

Distribution of the periods of maximum horizontal motion in the 362 earthquakes

observed at the Central Meteorological Observatory.
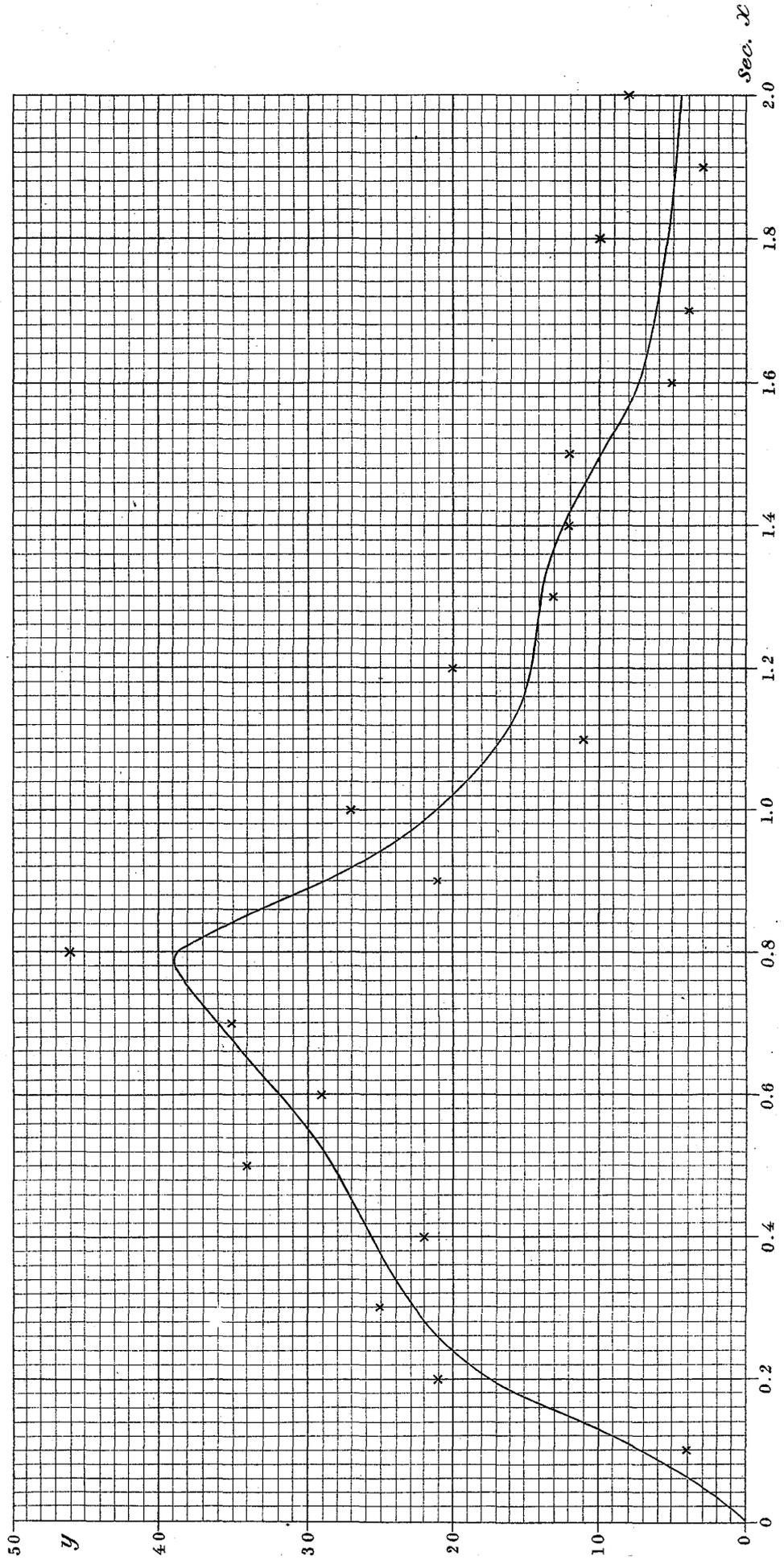


x = Period of maximum horizontal motion (in sec.)

y = Number of earthquakes, whose period of maximum horizontal motion was x.

Distribution of the maximum ranges of motion (between 0.2 mm and 2.0 mm) in the 332 earthquakes observed at the Central Meteorological Observatory.

x = Maximum range of motion, or double amplitude (in mm).

y = Number of earthquakes whose max. range of motion was x.