46. *On the Tilting of the Earth Observed at Tokyo.*

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Some twenty years ago, the late Prof. F. Omori started observations of the earth's tilting with an instrument of his own design, installing it in an underground chamber in the University compound.¹⁾ The instrument still in use is merely a pair of ordinary horizontal pendulums with a record-receiver driven at the rate of 6 mm. per hour. The other instrumental constants are

Mass of the heavy bob=7.5 kg.

Distance of the C.G. from the axis of rotation=73.4 cm.

Height of the pendulum=95 cm.

Free vibration period=25-32 sec.

Statical magnification=15.

These constants give the instrument a sensibility such that a displacement of 1 cm. at the end of the writing index is equivalent to a tilting of 0.''88-0.''54 in a direction perpendicular to the strut. It is not, however, suited for observations through a long period, as it is difficult to keep the zero-point of the index end at the same position in registration because of frictional disturbance, especially, at the joints of its double index.

In examining the registers obtained by the same instrument during the period from Nov. 24, 1925, to Dec. 20, 1926, the writer found that the elimination of the displacements of zero-point due to instrumental defects was of primary importance in working out the correct values of the earth's tiltings. Comparing the results thus obtained during July-Sept. with the registers of an Ishimoto Clinograph, installed at the same place parallel to our instrument, a fair agreement is found to exist between them, especially in the EW component. Therefore, to a certain extent, the results thus corrected, may be regarded as trustworthy. In such registers, we generally notice the presence of two kinds of regular variations of the earth's tiltings—one diurnal and the other annual.

1) Change of the room temperature does not exceed one degree in a week.

1) Diurnal variation.

Firstly, the variation of daily mean was eliminated from each component tilting and the resultant vector then constructed with

Fig. 1.

1cm. displacement = 0.2 tilting.

its end downwards towards the tilting. Fig. 1 shows the locus of the end of the vector corresponding to the two-hourly mean tilting in the different months. As regards the Jan. to Sept. mean, the vector end describes an elliptic curve, counterclockwise, with a major axis of as much as 0.''57 in the direction N 80° W. The rate of change of tilting reaches its maximum values at 3^h, 13^h, and 20^h, and its minimum values at 1^h, 9^h, and 17^h.

2) Annual variation.

Fig. 2.

1cm. displacement = 2 tilting.

Fig. 2 shows the locus of the vector end of the 15-daily mean of the tiltings from Nov. 24, 1925, to Dec. 20, 1926. Undoubtedly, we have here an annual variation, the locus of the vector end being also an elliptic curve with a major axis of as much as 10'' in the direction N 50° E. The length of the minor axis comes out as 3''.

The above-mentioned variations are in fair accord with the corresponding variations of the earth's temperature at a depth of 10 cm.

Fig. 3.

Range of mean diurnal variation
in the different months.

(See also Fig. 3.) On the other hand, however, I was unable to trace any definite relationship between the tiltings and the precipitations, nor the barometric pressures, nor the pressure gradients.

Besides the above-mentioned regular variations, the registers sometimes indicated another one of irregular type, apparently unconnected with any of the agencies just mentioned. Thus, for instance, a remarkable tilting of this type took place just before the Haneda earthquake of Aug. 3, 1926. Such abnormal variations may possibly have intimate connection with earthquake occurrences, as pointed out also by Prof. Ishimoto¹⁾; meanwhile however I should prefer

to reserve the problem for future consideration and study.

1) Ishimoto: Bul. Earthq. Res. Inst., Tokyo Imp. Univ., ii & iv.