# Note on the Annual Variation of the Height of Sea-level at Ayukawa and Misaki.

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With Plate VII.

The present note, which is to be regarded as a supplement to my paper on the annual and diurnal variations of seismic frequency in Japan,[1] treats of the comparison of the amount of fluctuation of the height of sea-level with that of the barometric pressure, at Ayukawa and Misaki. These two places are both situated on the Pacific coast of the Main Island; Ayukawa, in the province of Rikuzen, having been selected on account of its proximity to the origins of the submarine earthquakes so often disturbing the north-eastern part of the Island, while Misaki, in the province of Sagami, has been taken for the sake of comparison.

The following table, which has been deduced from the tide-gauge observations during the year 1902 at Ayukawa and Misaki, gives the mean monthly values of the distance between the sea surface and the datum line in the mareogram at each of the two places.

1) See the *Publications*, No. 8.

| Month. | Distance between sea surface and datum line in the mareogram.[1] | |
|---|---|---|
| | Ayukawa. | Misaki. |
| | metre. | metre. |
| January. | 3.545 | 3.703 |
| February. | 3.666 | 3.832 |
| March. | 3.643 | 3.763 |
| April. | 3.621 | 3.729 |
| May. | 3.570 | 3.644 |
| June. | 3.495 | 3.661 |
| July. | 3.469 | 3.657 |
| August. | 3.482 | 3.606 |
| September. | 3.447 | 3.556 |
| October. | 3.494 | 3.584 |
| November. | 3.539 | 3.668 |
| December. | 3.509 | 3.575 |

The results contained in the above table are illustrated in fig. 1, which shows that the variation of the height of the sea level at Ayukawa was nearly similar to that at Misaki.

The following table gives the mean monthly relative heights of the sea-level at Ayukawa and Misaki, deduced from the preceding together with the mean monthly barometric pressures during the same year deduced from the mean of the observations at the meteorological observatories of Ishinomaki and Yokosuka; the two latter places being respectively near to Ayukawa and Misaki.

| Month. | Mean height of sea-level. | | | Mean barometric pressure (reduced to sea-level and 0°C.) |
|---|---|---|---|---|
| | Misaki. | Ayukawa. | Mean | |
| | mm | mm | mm | mm mm |
| January. | 129 | 121 | 125 | 700 + 61.3 |
| February. | 0 | 0 | 0 | 64.5 |
| March. | 69 | 23 | 46 | 62.2 |
| April. | 103 | 45 | 74 | 60.2 |

1) The figures in the table were furnished by the Survey Department of the General Staff.

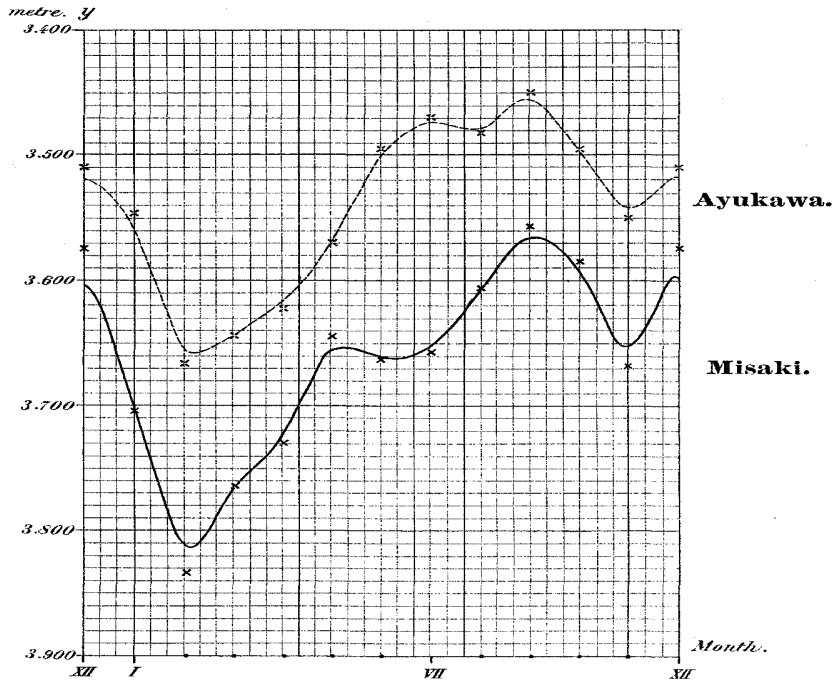
| Month. | Mean height of sea-level. | | | Mean barometric pressure (reduced to sea-level and 0°C.) |
|---|---|---|---|---|
| | Misaki. | Ayukawa. | Mean. | |
| | mm | mm | mm | mm mm |
| May. | 188 | 96 | 142 | 700+59.4 |
| June. | 171 | 171 | 171 | 56.4 |
| July. | 175 | 197 | 186 | 56.2 |
| August. | 226 | 184 | 205 | 58.8 |
| September. | 276 | 219 | 248 | 58.7 |
| October. | 248 | 172 | 210 | 64.1 |
| November. | 164 | 117 | 141 | 65.5 |
| December. | 257 | 157 | 207 | 61.0 |

From fig. 2, which graphically illustrates the results contained in the above table, it will be seen that the curve of the annual variation of the barometric pressure is nearly opposite to that of the height of sea-level. Further, the annual fluctuation of the mean monthly barometric pressure was 9.3 mm, which corresponds to $9.3 \times 13.6 = 126$ mm height of water. On the other hand, the annual fluctuations of the height of sea-level were 276 and 219 mm at Misaki and Ayukawa respectively. At these places, therefore, the fluctuation of the height of sea-level is opposite to, and nearly double, that of the atmospheric pressure. In other words, the sea bottom is subjected to a greater *total* pressure in the summer months than in Feb., March, and April, the difference between the maximum and minimum total pressure being nearly equal to that of the annual amount of fluctuation of the monthly mean barometric height. Such is probably true of the whole Pacific coasts of the Japanese islands.

The increase in the height of sea-level in summer months as above described is to be explained partly by the fall in summer of the atmospheric pressure over Japan and the neighbouring seas, and partly by the presence of a high pressure area on the northern Pacific in the vicinity of the Aleutian islands; the surface of the ocean being consequently thrown into a curve form, such that the surface of the water is depressed beneath the high pressure centre and elevated along

the coasts of the Japanese islands. Similarly the decrease of the height of sea-level in winter months is to be explained by the rise of the atmospheric pressure over Japan and the presence of a low pressure area on the northern Pacific. This probably explains the occurrence in summer and in winter respectively of the maximum and minimum seismic frequencies at those places which are shaken principally by earthquakes of sub-oceanic origin.

**Fig. 1.**




$y$ = Mean monthly height above the sea water of the datum line in the Mareogram.

**Fig. 2.**