10. *On Earth-tiltings observed at Mt. Tukuba.*

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(Read Oct. 20, 1931.-Received Dec. 20, 1931.)

1. Introduction. The previously published note[1] under the same title as that of this paper contained results of observations made by a pair of Ishimoto all-silica tiltmeters in a room of fairly uniform temperature and continued for about two years and a half since the beginning on December 23, 1927 to June 10th, 1930.

The present note which is a continuation of the previous one, deals with observatons made during the three years and nine months since the beginning to September 30th, 1931.

2. Method of procedure. In his previous note the author tried to study the general features of the variations in the earth-tilts by smoothing out the minute irregularities, because, at times, for several days running, the photographs would receive no impression whatsoever, while, at other times, the records obtained would be hopelessly confused by the presence of short period fluctuations in the earth-tiltings.

This time, the variations in the earth-tiltings have been separated into two parts, one being fluctuations in a period of about one or two weeks and the other being those of longer periods. The separation is made as follows; first, the means ($\bar{n}_3$) of three consecutive values of the daily means of the earth-tiltings are taken, then the means ($\bar{n}_{13}$) of thirteen consecutive values of the terms of $\bar{n}_3$, and finally, eath term of $\bar{n}_{13}$ is subtracted from the corresponding term $\bar{n}_3$. The values obtained by this substruction represent the short period fluctuations in the earth-tiltings; $\bar{n}_{13}$ represents variations in the earth-tiltings of the longer periods.

The variations in the air temperature at Mt. Tukuba are also separated into two parts, the short period and the long period, the process of analysis of which is the same as in the case of variations in the earth-tiltings above-stated.

Owing however to the fact that fluctuations of the air temperature

1) W. INOUYE and T. SUGIYAMA, *Bull. Earthq. Research Inst.*, 8 (1930), 346.

are much more active than those of earth-tiltings, the author adopted a somewhat different method of analysis, as follows: First, the means ($\bar{n}_5$) of five consecutive values of the daily means of the air temperature are taken, next the means ($\bar{n}_{19}$) of nineteen consecutive values of the terms of $\bar{n}_5$, and finaly, each term of $\bar{n}_{19}$ is subtracted from the corresponding term of $\bar{n}_5$. The value of $\bar{n}_5 - \bar{n}_{19}$ represents the fluctuations of the air temperature during a few weeks, while $\bar{n}_{19}$ represents those during a longer period.

3. Short period fluctuations. The two components of the short period fluctuations in the earth-tiltings and short period fluctuations in the air temperature for year 1928 are shown in Fig. 1.

As seen in the figure, the fluctuations of each component of the earth-tilting fairly resembles those of the air temperature.

The fluctuations in the NW-SE component of the earth-tiltings in particular, are practically correlated with those of the air temperature, except in the period between April 19th and May 10th, when the relation is inverted. This component of the earth-tilting represents that one along the mountain slope at the station. The mountain slopes down S. E.-wards here, so that increase of the air temperature causes decrease of the inclination of the mountain slope. As will be shown presently, the daily variations of the earth-tiltings take place practically in this component only. Moreover, the relation between the senses of the daily variations in the earth-tilts and those of the air temperature is the same as in the case above-stated; that is, the inclination of the mountain slope decreases as the air temperature increases. At all events

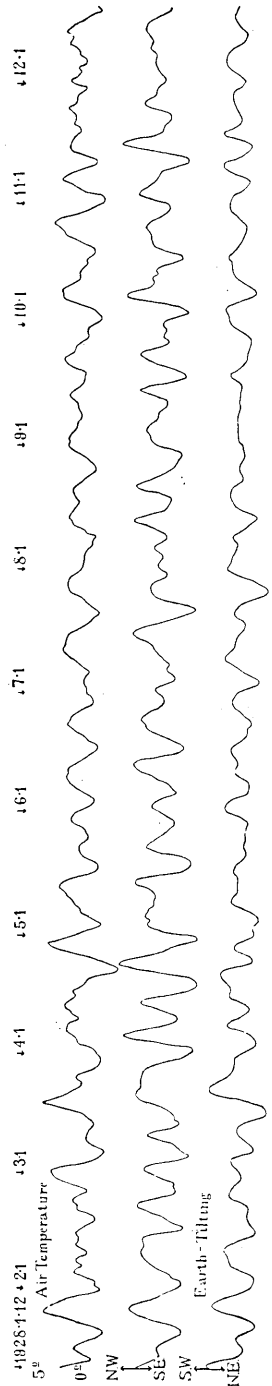

Fig. 1

the short period fluctuation in the earth-tiltings are caused by thermal strains set up in the ground by the sun's heat.

4. Secular and seasonal variations. The slow variations in the earth-tiltings expressed in two components and those in the air temperature are shown in Fig. 2. Taking the resultant of the two component

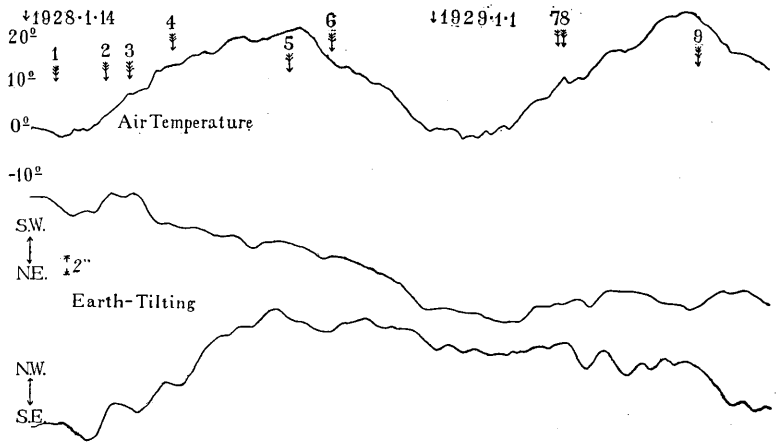

Fig. 2a.

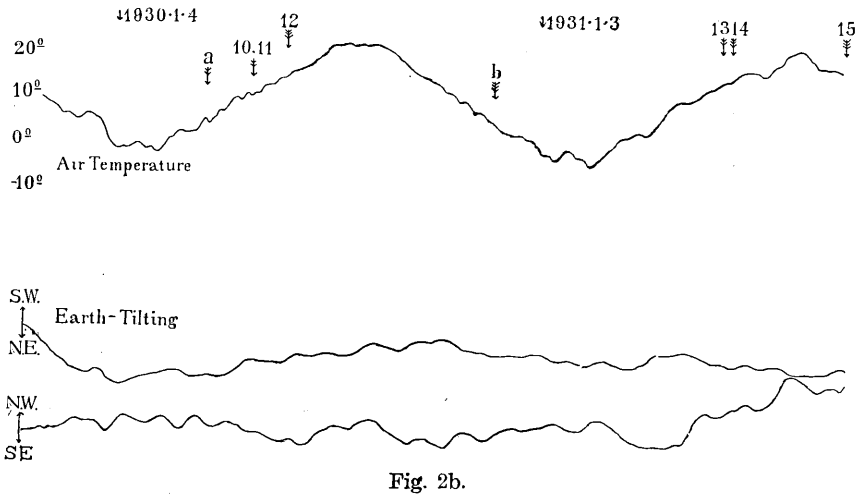

Fig. 2b.

earth-tiltings, a vector diagram was obtained as illustrated in Fig. 3. As will be seen from those figures, the earth-tiltings exhibit secular and seasonal variations, both of which were disturbed several times by stormy perturbations.

The secular variation amounted to 18 second N. N. E.-wards. It

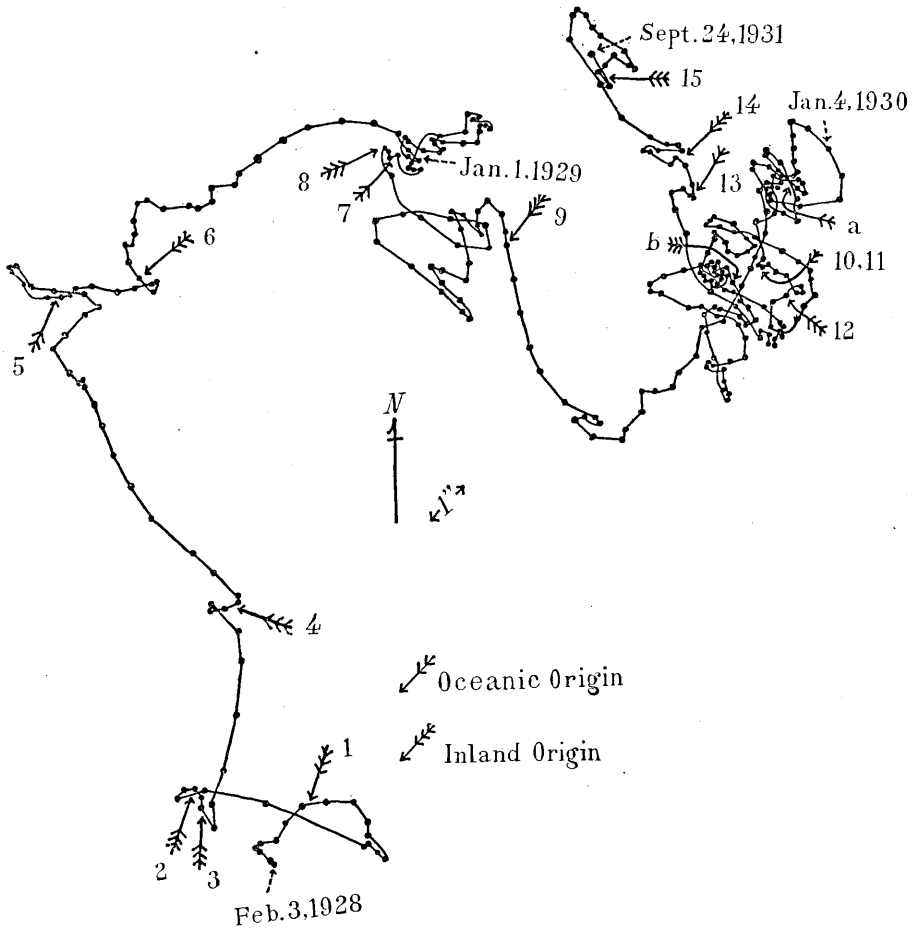

Fig. 3.

may be mentioned that, according to the comparisons of the old and new levellings in the Kwantô district by Messrs. Katuhiko Mutô and Keiryô Atumi[2] of the Millitary Land Survey, the region about Mt. Tukuba has tilted a little short of 1 sec. N. E.-ward during the interval between the two surveys. The variations in the earth-tiltings at Mt. Tukuba is confined to a small area at the station, whereas the secular tilting of the earth's crust about Mt. Tukuba, on the contrary, affects an extensive area of not less than fifty Kms. square. Nevertheless, it is significant that the senses of the earth-tiltings in both cases are fairly alike. The seasonal variations in the earth-tiltings in each of the com-

2) K. Mutô and K. Atumi, *Bull. Earthq. Research Inst.*, **7** (1929), 495.

ponents are rather irregular. The SW-NE component tilts S. W.-ward, and N. E.-ward, whereas the NE-SE component has a tendency to tilt N. W.-ward and S. E.-ward, in both cases according as the air temperature increases or decreases, so that inclination of the mountain slope at the station decreases in the warm season and increases in the cold.

5. Tilt-storms and earthquakes. The author tried to find some possible relation between the earth-tilts and the earthquakes that originate in the vicinity. For this purpose, the author selected fifteen moderate earthquakes that were reported by the Central Meteological Observatory as having originated within a radius of about 90Km. from Mt. Tukuba. The dates, times of occurrence, and the positions of epicentre of these earthquakes are tabulated in Table I, and the latter plotted in Fig. 4. For the purpose of reference, two notable earthquakes are also introduced, one (*a* in Table I) being the most powerful among the swarm of earthquakes that occured off Ito, Izu Peninsula, and the other (*b* in Table I) being the destructive earthquake that was experienced at the neck of the Izu Peninsula.

Table I.

No.	Date	Time of occurrence	Epicentre	
			λ	φ
1	1928 II 12	6h 10m	140°·0	36°·1
2	„ III 23	10 21	139·8	36·0
3	„ IV 13	1 36	140·1	36·2
4	„ V 21	1 29	140·1	35·6
5	„ VIII 27	3 11	141·1	36·4
6	„ X 5	15 58	139·6	36·1
7	1929 IV 18	3 33	140·9	36·3
8	„ IV 23	23 16	140·0	36·1
9	„ VIII 16	22 21	140·2	36·5
a	1930 III 22	17 50	139·1	35·0
10	„ V 1	9 58	140·8	35·7
11	„ V 1	13 20	140·8	35·7
12	„ VI 1	2 58	140·4	36·4
b	„ XI 26	4 03	139·0	35·1
13	1931 VI 9	14 07	140·9	36·5
14	„ VI 17	21 09	139·4	35·6
15	„ IX 21	11 20	139·3	36·0

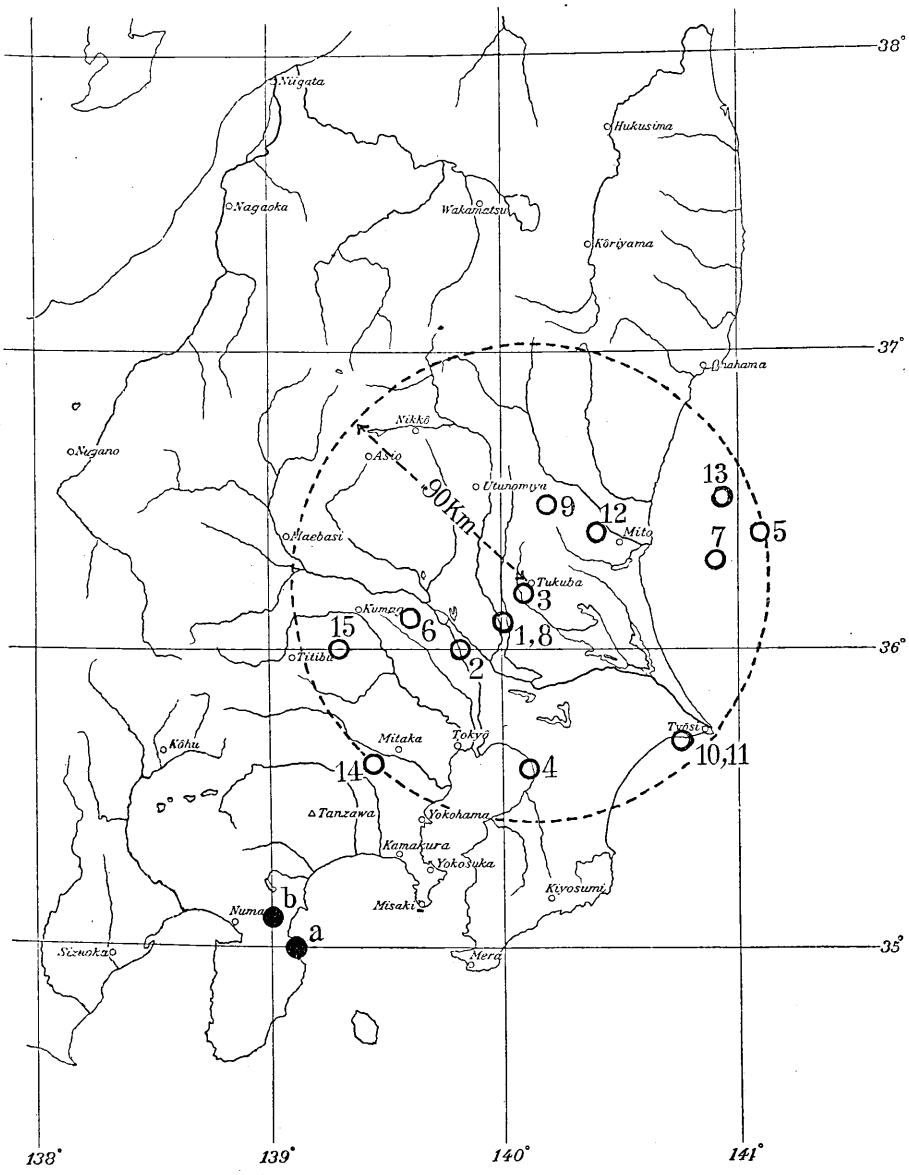

Fig. 4.

As will been seen from Fig. 3, the earthquakes generally occurred when the secular change in earth-tiltings were undergoing irregular fluctuations of comparatively short period. The irregular fluctuations in the earth-tiltings may be called "tilt-storm" just as irregular fluc-

tuations in the elements of terrestrial magnetism are called "magnetic storm". The earthquakes also had a tendency to occur when the sense of the earth-tiltings were changing. Moreover, earthquakes of oceanic origin occurred at an earlier stage of the tilt-storms, while earthquakes of inland origin mostly occurred at a latter stage or almost simultaneously with the cessation of these tilt-storms.

At all events, the earthquakes seem to occure when the secular changes in the earth-tiltings are disturbed by some resisting agencies.

6. Daily variation. The daily variation in the earth-tiltings take place in almost only one component that along the mountain slope at the station. The monthly means of the amounts of deviation, read every three hours, from the daily means during the year 1930 are tabulated in Table II, and shown in vector diagram in Fig. 5. As seen in Fig. 5,

Table II.

The unit is one second in degree.

	Month		Hour							
			0	3	6	9	12	15	18	21
1930	I	SE-NW	+0·18	+0·24	+0·30	+0·06	−0·38	−0·29	−0·11	−0·01
		NE-SW	−0·00	−0·02	−0·03	+0·00	+0·03	+0·02	+0·00	−0·05
	II	SE-NW	+0·14	+0·24	+0·28	−0·01	−0·47	−0·32	−0·05	+0·14
		NE-SW	+0·02	0·00	−0·02	−0·00	−0·00	+0·02	+0·01	−0·00
	III	SE-NW	+0·20	+0·30	+0·29	+0·02	−0·40	−0·34	−0·14	+0·05
		NE-SW	−0·04	−0·04	−0·04	−0·02	+0·04	+0·02	−0·00	−0·01
	IV	SE-NW	+0·21	+0·31	+0·34	−0·03	−0·52	−0·40	−0·13	+0·07
		NE-SW	+0·04	+0·01	+0·00	−0·01	+0·01	−0·00	−0·03	−0·03
	V	SE-NW	+0·33	+0·54	+0·31	−0·10	−0·54	−0·47	−0·16	+0·07
		NE-SW	−0·03	−0·05	−0·05	−0·01	+0·01	+0·04	+0·02	+0·00
	VI	SE-NW	+0·31	+0·34	+0·12	−0·31	−0·41	−0·25	+0·03	+0·25
		NE-SW	+0·01	−0·02	−0·00	−0·00	−0·01	+0·01	+0·00	−0·01
	VII	SE-NW	+0·38	+0·28	−0·09	−0·35	−0·38	−0·20	+0·03	+0·24
		NE-SW	+0·01	−0·00	−0·00	−0·00	+0·00	+0·00	−0·01	+0·01
	VIII	SE-NW	+0·30	+0·41	+0·29	−0·09	−0·52	−0·45	−0·14	+0·12
		NE-SW	−0·00	−0·02	−0·03	−0·00	−0·00	+0·02	+0·02	+0·02
	IX	SE-NW	+0·31	+0·46	+0·40	−0·17	−0·65	−0·40	−0·08	+0·18
		NE-SW	+0·01	+0·01	−0·00	−0·01	+0·00	+0·01	+0·01	+0·00
	X	SE-NW	+0·23	+0·33	+0·34	−0·09	−0·47	−0·37	−0·13	+0·06
		NE-SW	−0·02	−0·04	−0·02	−0·00	+0·02	+0·01	+0·01	−0·00
	XI	SE-NW	+0·14	+0·26	+0·33	+0·13	−0·29	−0·39	−0·20	+0·00
		NE-SW	−0·02	−0·06	−0·04	−0·01	+0·04	+0·03	+0·03	+0·03
	XII	SE-NW	+0·09	+0·15	+0·20	+0·08	−0·20	−0·25	−0·15	−0·01
		NE-SW	−0·02	+0·01	−0·01	+0·00	+0·02	+0·01	0·00	−0·00

the ground tilts N. W.-ward and S. E.-ward as the air temperature increases or dicreases, so that the inclination of the mountain slope is lessened in the daytime by the thermal strain of the ground. Further, the range of the variations is greatre in the warm season than in the cold season, except however during the rainy season in June and July.

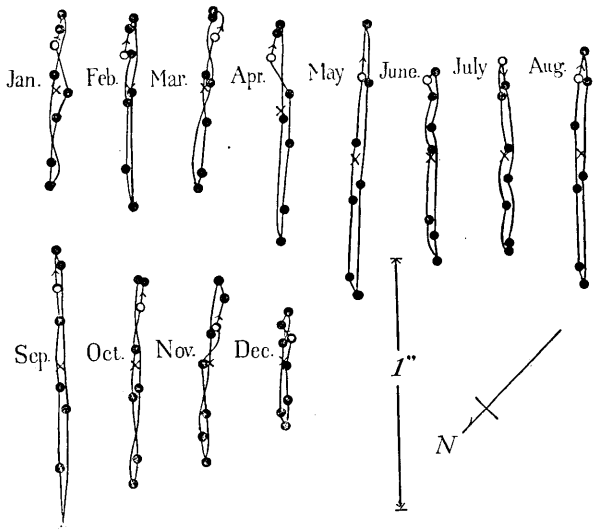

Fig. 5. The daily variation in the earth-tiltings. The white circles represent the earth-tilts at 0 o'clock.

7. Conclusion.

1. The results of the observations of the earth-tilts during three years and nine months are divided into short and long period fluctuations.

2. The short period fluctuations of earth-tilts is shown to be caused by thermal strains of the ground from the sun's heat. Moreover, the daily and the seasonal variations in the earth-tilts are also caused by the same reason. Confining our attention to the component of the earth-tilts along the mountain slope, we notice that the ground at the station tilts always in such a way as to lesson the slope of the mountain as the air temperature increases and vice versa.

3. Slow variations in the earth-tilts consist of secular and seasonal variations, both of which are of frequently disturbed by tilt-storms when an earthquake of near origin occurs. Further, earthquakes of oceanic origin and inland origin occur respectively in the ealier and later stages of the tilt-storms. The earthquakes, at any rate, seem to occur when the secular change in earth-tiltings is disturbed by some resisting agency.

Table III_1. The Values of the Earth-tilts.
The unit is 0·1 second in degree.

NE-SW. (N. E.-ward is taken positive.)

Day \ Month	1928 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	17	30	43	27	55	57	72	76	81	91	105	128
2	23	32	43	29	56	57	75	77		92	105	128
3	22	34	42	30	57	58	76	77		91	109	128
4	25	35	41	30	60	61	73	76		90	110	128
5	27	36	40	29	61	62	70	77		91	111	129
6	31	33	42	28	59	63	70	77		95	112	130
7	33	32	47	23	55	63	68	76	83	99	110	133
8	34	32		22	54	63	66	76	84	100	108	135
9	33	34		26	53	61	66	76	85	100	108	138
10	32	35		26	54	60	67	79	86	98	108	142
11	27	35		26	55	61	68	80	87	96	111	143
12	19	36	43	26	54	62	69	81	87	96	114	147
13	18	40	42	26	54	62	70	82	88	96	116	147
14	20	42	42	20	55	62	71	81	89	95	118	148
15	26	49	44	20	55	62	73	76	91	96	118	148
16	27		45	21	55	61	76	75	91	96	115	148
17	28		43	22	55	65	78	75	89	96	111	150
18	27		40	22	57	67	78	75	89	95	113	151
19	26		37	22	59	70	78	74	93	99	117	152
20	25		32	23	61	69	79	74	95	101	119	153
21	28		23	24	61	70	80	76	97	101	119	
22	30		19	26	61	72	83	78	97	103	119	
23	31	48	17	36	62	72	86	78		103	119	
24	29	42	18	40	62	71	89	78	98	104	120	
25	26	42	19	41	63	70	91	78	99	106	120	
26	23	42	20	40	62	69	91	78	99	105	122	
27	21	42	19	41	62	68	89	80	98	105	121	154
28	19	42	21	44	63	69	87	81	96	104	123	153
29	21	42	22	51	64	69	84	81	93	103	125	152
30	24		22	55	60	70	79	81	92	103	128	149
31	27		24		57		79	81		105		147

Table III_2. NE-SW.

Day \ Month	1929 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	145	156	169	152	139	136	139	155	137	140	170	194
2	148	157	165	152	138	134	139	156	139	140	170	194
3	152	157	164	152	137	134	139	155	139	142	172	194
4	154	155	167		137	135	142	155	138	144	176	194
5	155	156	167		143	135	142	155	138	147	177	196

(*to be continued.*)

Table III_2. NE-SW. (*continued.*)

Day \ Month	1929 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
6	154	156	167		151	137	142	155	136	148	178	203
7	153	157	167	153	152	137	143	155		148	177	207
8	154	158	167	146	151	134	145	157		147	177	
9	153	159	166	166	151	134	146	158	138	146	178	
10	152	160	165	149	152	136	145	158	134	147	179	
11	151	161	165	149	152	137	144	158	132	149	181	
12	151	163	166	149	153	137	145	156	141	149	186	204
13	151	165	165	147	154	137	149	154	144	149	186	201
14	153	166	165	148	153	137	150	153	144	152	189	197
15	153	166	169	148	153	137	150	152	144	154	189	193
16	153	165	170	149	153	137	153	152	143	155	185	192
17		165	170	149	153	137	155	151	141	153	184	191
18		164	169	147	151	136	153	151	138	153	185	191
19	157	164	165	145	149	135	152	152	137	153	187	187
20	157	165	162	146	148	136	150	151	134	154	189	190
21	156	166	159	148	143	136	149	150	131	152	192	198
22	156	166	156	151	134	137	145	149	132	154	193	202
23	157	167	154	151	127	138	146	149	133	157	194	206
24	157	167	153	151	131	138	147	145	135	158	197	207
25	157	166	151	151	134	138	148	142		161	200	
26	158	166	148	150	135	137	149	140		161	200	
27	157	168	147	147	135	137	149	140		162	200	
28	156	169	148	146	137	138	151	141		164	200	
29	157		148	144	135	137	152	140		163	200	
30	157		149	140	136	138	153	140		162	198	
31	156		151		136		155	138		165		

Table III_3. NE-SW.

Day \ Month	1930 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	214	205	202	200	182	190	179	175	175	165	172	178
2	214	205	203	206	185	181	178	172	175	163	171	178
3	213	205	202	210	188		177	171	175	162	173	178
4	213	205	201	211	189	178	178	174	174	164	174	178
5	210	204	200	212	185	177	176	175	173	167	175	179
6	212	200	201	210	185	177	176	176	172	166	176	179
7		199	203	205	188	180	170	169	174	165	176	179
8	215	199	202	203	188	181	170	169	174	163	176	178
9	215	198	205	202	189	178	170	167	173	160	173	178
10	214	198	207	201	188	178	171	166	172	159	171	177
11	213	199	208	200	188	177	179	166	172	159	170	176
12	212	203	208	198	186	178	180	165	172	160	171	175

(*to be continued.*)

Table III_3. NE-SW. (*continued.*)

Day \ Month	1930 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
13	211	203	207	196	186	178	180	164	171	160	173	174
14	210	203	205	197	187	178	180	164	170	160	178	175
15	209	202	202	197	188	177	182	164	166	161	178	177
16		201	203	198	187	175	180	164	164	162	177	180
17		199	202	199	188	178	181	165	163	162	177	180
18		198	202	197	189	183	180	166	162	161	177	178
19	206	197	202	196	189	184	179	167	163	162	177	178
20	208	197	201	195	187	185	179	169		161	177	177
21	208	197	202	191	187	184	178	168	164	163	176	176
22	208	196	206	190	187	181	179	170	164	165	175	176
23	207	195	207	188	187	180	180	171	163	167	175	178
24	206	195	207	185	188	180	180	170	164	168	177	179
25	205	196	201	185	187	177	180		164	168	178	179
26	205	195	200	185	188	177	179		164	167	178	179
27	205	192	200		189	177	178	170	165	170	180	178
28	204	195	200	187	188	176	178	170	165	170	181	178
29	203		199	184	190	177	179	171	166	169	181	176
30	204		199	181	190	178	178	173	166	169	180	175
31	205		198		191		177	175		171		

Table III_4. NE-SW.

Day \ Month	1931 I	II	III	IV	V	VI	VII	VIII	IX
1	178	183	184	188		186	186	192	199
2	177	183	184	188	177	186	188	194	196
3	177	183	183	189	179	185	189	194	196
4	177	185	185	189	178	184	188	194	196
5	177	185	185	187	174	185	188	194	196
6	176	186	185	180	175	186	187	195	196
7	175	187	186	180	173	185	187	195	195
8	176	191	188	181	171	185	187	196	196
9	178	191	189	182	170	185	188	198	196
10	179	192	189	181	170	186	189	199	197
11	180	192	189	180	173	189	191	199	197
12	181	191	190	180	176	189	192	199	195
13	184	190	191	180	178	193	192	197	192
14	187	188	192		181	193	194	198	186
15	188	185	192	179	183	192	194	199	185
16	188	183	192	175	182	190	195	198	187
17	187	184	192	175	184	189	194	197	189
18	185	185	191	175	181	190	193	197	191
19	183	188	191	176	178	191	191	196	190
20	183	188	192	177	178	193	185	196	191

(*to be continued.*)

Table III$_4$. NE-SW. (*continued.*)

Day \ Month	1931 I	II	III	IV	V	VI	VII	VIII	IX
21	182	186	193	177	179	193	183	198	192
22	183	186	194	177	178	192	184	198	193
23	183	186	194	178	181	189	185	197	190
24	183	186	192	177	183	187	188	197	190
25	183	186	191		185	183	191	195	192
26	183	186	190		185	183	190	196	192
27	183	185	190		185	184	188	197	198
28	183	184	190		188	184	187	199	199
29	185		191		188	185	187	199	197
30	186		192		188	185	190	200	197
31	185		191		187		193	200	

Table III$_5$. SE-NW. (S. E.-ward is taken positive.)

Day \ Month	1928 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	7	24	35	11	6	−32	−73	− 90	−87	−73		
2	14	31	43	12	− 7	−32	−74	− 92	−89	−76		−73
3	17	29	34	8	−16	−38	−71	− 90	−88	−73	−98	−76
4	20	25	40		−13	−37	−64	− 91	−88	−69	−88	−77
5	21	25	49		−16	−36	−69	− 93	−90	−70	−87	−75
6	25	27	48	− 2	−18	−38	−74	− 96	−90	−78	−85	−77
7	30	15	45	− 1	−22	−39	−71	−100	−85	−81	−81	−76
8	32	22	42		−21	−46	−73	− 95	−85	−92	−81	−76
9	34	18	43		−23	−47	−75	− 96	−87	−94	−82	−76
10	27	14	39	12	−21	−54	−77	− 99	−83	−86	−77	−81
11	16	20	28	10	−23	−55	−82	− 98	−81	−84	−72	−75
12	19	19	29	11	−21		−82	−105	−79	−88	−71	−75
13	22	19	35	9	−22	−63	−83	−105	−80	−85	−73	−75
14	24	20	33	6	−26	−63	−85	−108	−82	−88		−74
15	25	24	27	5	−27	−58	−88	−100	−83	−82		−72
16	26	34	24	13	−20	−54	−90	− 97	−84	−87	−91	−73
17	24	32	23	21	−13	−53	−87	− 96	−72	− 82	−86	− 68
18	26	31	16	17	− 8	− 60	−84	− 99	−69	−74	−77	−65
19	28	30	12	15	−11	− 60	−80	− 93	−70	−80	−76	−62
20	29	32	5	20	− 8	− 64	−76	− 93	−72	−86	−81	−56
21	31	28	0	11	−10	−70	−73	−101	−74	−85	−77	−60
22	29	28	0	7	−20	−70	−71	−102		−90	−75	−59
23	27	25	− 1			−72	−72	− 95		−88	−74	−61
24		33	− 1	−12		−73	−78		−78	−89	−75	−60
25	18	41	− 3	− 7		−76	−83	− 89	−80	−90	−79	−58
26	16	40	− 3	− 3		−74	−83	− 84	−70	−91	−81	−56
27	14	39	0	− 1	−21	−71	−83	− 86	−73	−92	−79	−57
28	14	42	− 2	0	−21	−72	−88	− 84	−73	−88		−56
29	20	43	3	− 3	−21	−71	−87	− 81	−74	− 90		−56
30	21		7	3	−23	−71	−84	− 80	−70	−84		−52
31	24		9		−26		−85	− 82				−52

Table III$_6$. SE-NW.

Day \ Month	1929 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	−53	−52	−54	−55	−49	−32	−33		− 9	21	16	− 2
2	−46	−51	−46	−49	−49	−40	−31		− 9	28	22	− 5
3	− 43	−53	−41		−33	−40	−26		− 8	31	16	− 3
4	−50	−54	−46		−25	− 4[0]	−30	−44	− 4	23	15	− 2
5	− 56	−59	− 47		− 25	−38	− 31	−35	− 6	12	9	4
6	− 60	−57	−51		− 26	− 32	− 25	−36		12	12	8
7	− 57	−54	−52	−55	− 22	− 22	−19	−26		11	11	11
8	−56	−57	−55	−54	− 28	−13	−17	−32		13	13	8
9	−59	−56	− 58	−57	− 33	−18	−22	−32			15	10
10	· 62	−49	−59	−60	−30	−26	−22	− 35			20	11
11	− 65	−45	−56	−48	−32	−32	− 29	−32			21	10
12	−66	−39	−54	− 47	− 33	−29	· 43	−31	21		13	6
13	−64	−40	−51	−59	−34	−22	− 53	−30	24		12	0
14	− 65	−40	−41	− 57	− 31	−18	−56	− 29	17		9	− 4
15	−61	−41	−41	− 59	−35	−16	− 56	− 26	12		4	− 3
16	−53	−46		−66	−35	−16	−56	−25	9		6	0
17	− 50	−48		−68	−40	−25	−46	− 30	8	14	7	− 3
18	− 50	· 48	−52	− 62	−41	− 22	−40	−30	5	10	9	− 6
19	− 48	− 50	− 55	− 57	−42	−32	−40	−27	− 2	16	11	4
20	−47	−51	− 54	−55	−51	− 36	−37	−28	− 4	19	13	11
21	−46	−52	− 49	− 61	− 48	−32	−27	− 31	3	18	10	
22	−43	−58	− 51	−55	−48	− 41	− 23	−30	4	23	11	
23	−48	− 58	−55	− 56	− 47	−35	−29	−18	6	25	12	15
24	−51	− 52	−57	−56	−55	−31		−13	9	18	15	15
25	− 53	−46	−57	−59	−60	−33		− 9	10	22	9	
26	−55	−42	−53	−62	−58	−39		− 6	16	15	6	
27	−57	−42	−56	−64	− 59	−40	−31	−11	12	0	0	
28	−53	−42	−64	−64	−58	− 39	−31	−10	13	10	− 2	
29	−55		−60	−55	−52	− 40	−39	−12	13	14	− 1	
30	−52		−57	−55	−46	− 39	− 41	−11	18	14	− 2	
31	−52		−53		− 36			− 7		11		

Table III$_7$. SE-NW.

Day \ Month	1930 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	17	7	12		20	10	12	2	15	21	15	10
2	16	8	11		18	15	10	2	13	21	9	16
3	11	5	11	12	5		2		11	24	11	12
4	3	8	9	− 1	5		− 5		13	23	11	14
5	− 5	5	12	− 6	7	28	− 2		14	21	14	15
6	− 3	3	13	− 3	12	22	9	5	20	24	13	9
7	0	0	10	− 4	14	19	12	− 7	26	29	11	2
8		2	3	5	13	21	13	− 3	28	23	10	4

(to be continued.)

Table III$_7$. SE-NW. (*continued.*)

Day \ Month	1930 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
9		3	− 2	2	14	26	17	6	27	24	14	2
10	0	− 1	− 4	3	10	24	20	1	23	26	9	2
11	− 4		− 4	− 3	11	29	15	− 2	21	27	11	4
12	− 2		− 6	9	21	22	9	− 2	22	25	14	− 1
13	− 2		− 10	8	21	22	6	− 2	23	24	18	2
14	− 2		−15	5	21	28	− 5	− 3	25	24	26	10
15	− 6	− 8	− 8	7	18	31	− 7	− 2	26	30	24	10
16		− 7	− 5	4	18	36	− 10	− 3	23	31	23	11
17		− 6	− 2	2	19	31	− 5	0	20	31	24	11
18		− 1	− 4	− 2	14	23	− 1	3	21	30	25	8
19		2	3	− 6	21	25	3	3	26	25	30	6
20	2	− 2	5	2	19	17	10	1		27	26	5
21	3	4	5	8	22		17	6		26	11	8
22	5	7	5	8	23		21	2	22	24	12	12
23	3	8	3	12	20		18	2	12	19	14	13
24	1	5	2	15	29		15	3	17	19	15	11
25	4	5	7	11	32		14		15	14	17	7
26	5	16	7	9	25	21	8		19	10	18	7
27	6	22	7	6	30	25	4		22	4	11	6
28	7	22	8	10	29	2[illegible]	1	18	19	8	11	5
29	5		5	21	20	22	1	20	17	9	13	8
30	2		11	20	19	10	5	15	19	12	12	10
31	3		18		13		5	13		17		8

Table III$_8$. SE-NW.

Day \ Month	1931 I	II	III	IV	V	VI	VII	VIII	IX
1		9	1	26	28	−11	−27	−44	− 31
2	8	3	1	22	27	−12	− 27	−48	−30
3	5	7	− 2	26	25	− 8	−30	−47	− 31
4	2	9	3	24	24	− 3	−27	−45	−33
5	0		− 1	27	22	− 7	−24	−49	−41
6	6		1	27	10	− 7	−19	−56	−36
7	6	11	− 4	30	8	− 4	− 17	−56	−36
8	8	13	3	27	20	− 2	−16	−56	−40
9	8	9	3	24	30	− 3	−11	−60	−37
10	4	12	8	22	30	0	− 8	−54	−45
11	5	10	7	25	28	− 6	− 6	−52	−47
12	5	12	8	30	30	2	−10	−50	−45
13	2	13	12	28	13	−22	−12	−42	−45
14	− 1	5	13	22	5	−24	−11	−45	−37
15	0	− 2	14	24	6	−21	−17	−46	−32

(*to be continued.*)

Table III$_8$. SE-NW. (*continued.*)

Day \ Month	1931 I	II	III	IV	V	VI	VII	VIII	IX
16	1	− 1	14	19	1	−10	−21	−47	−33
17	− 1	− 2	13	19	−13	−13	− 21	−47	−36
18	− 1	1	17	29	− 8	−12	− 22	−45	−34
19	− 2	0	23	29	− 3	−12	− 28	− 50	−38
20	0	− 6	20	32		−14	−22	− 52	− 40
21	3	0	18	30		−16	−19	−51	−35
22	3	1	17	26		−15	− 18	−49	−36
23	3	− 2	13	26		− 15	−19	− 47	−38
24	3	− 1	22	31		− 14	−21	−42	−37
25	9	− 3	23	25		−13	− 23	− 31	−38
26	8	− 2	20	20		−13	− 24	−36	− 35
27	10	− 7	23	23		− 17	− 24	−38	− 55
28	7	3	26	22	−11	− 17	−30	− 43	− 60
29	6		25	25	− 16	−19	−36	−38	−61
30	5		23	19	− 18	−21	− 48	−30	
31	11		24		−17		− 46	−26	

10. 筑波山に於ける傾斜變化觀測報告

地震研究所 井 上 宇 胤

1. 筑波山に於ける三年九ケ月に亙る傾斜變化觀測の結果を二週間程の短週期の部分と長週期の部分に分解しました。

2. 此の短週期の變化は太陽の輻射熱に依つて起される地表面の熱變形の爲に起るものであります。尙傾斜變化の日々變化及び季節變化も共に同樣な原因に依るものであります。今此等の變化の內觀測所に於ける山の傾斜の方向の成分のみに就いて考へますと、いずれの場合も外界の氣溫の上昇に伴つて山の傾斜の度を減ずる如く傾斜變化が起つて居ります。

3. 長週期の變化は、しばしば傾斜嵐に依つて亂されて居ります。此の傾斜嵐の際に筑波山附近の地震が發生して居ります。尙其の內、海底地震は傾斜嵐の初期に於て、內陸地震は終期に於て發生して居ります。

4. 兎に角、傾斜變化の積年變化が何物かにさまたげられる期間に此の附近の地震が發生して居るものと解釋されるかも知れません。