Seismology in Japan in 1939-1947.

By

Hirosi KAWASUMI.

Earthquake Research Institute, Tokyo University.

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In the latter half of this period the seismology in Japan was so much affected by the war that retrogressions in the instrumental seismology became very remarkable. Much regretted three leading seismologists, professors Ishimoto, Sezawa and Imamura died in this period. But the seismic activities in this well-known land of earthquakes were not less active than usual as will be seen in the annexed table of destructive earthquakes, Seismologists in this country are now endevouring to restore its former prosperity in this bitter circumstance.

Organisations engaged in seismological investigations.

The Central Meteorological Observatory and its sub-stations are charged with the routine observations of earthquakes together with the seismological investigations. The Earthquake Research Institute, of the Tokyo University, which is the successor of the former Imperial Earthquake Investigation Committee, is charged with the investigations of earthquakes and related phenomena as well as means for mitigation of earthquake disasters. The Seismological Institute in the Faculty of Science of the same university was enlarged in 1941 into the Geophysical Institute and special students are being educated. Similar Institutes are also attouched to the faculties of Science in Kyoto and Tohoku Universities. In most of the other national universities seismologists are also working.

Seismological Observatories and instuments employed inthese organizations are shown in the annexed tables. It is to be noted that to 131 stations under the Central Meteorological Observatory at the beginning 17 stations were added in this period, while 7 stations at Hamamatu, Hukui, Kohu, Miyazu, Okayama and Tyosi were burnt in the war, and 28 stations became outside of our country after the war. Owing to the economical and instumental conditions 26 stations are suspending their seismographic observations, and remaining 87 stations are working at present under the Central Meteorological Observatory.

Since the removal of its site, the observing room of the Geophysical Institute of the Tokyo University is not yet established. The observations at the Mukaiyama Observatory of the Tohoku University in Sendai are suspended at present.

Besides these organisations which directly engaged in research works of earthquakes, there are two important government agencies which in case of emergency co-operate with the above mensioned organisations in the study of earthquakes, that is the Japanese Geographical Survay Bureau (the former Land Survay Department) and the Hydrographic Survay Bureau (the former Hydrographic Department). These agencies execute survays of topographic changes accompanying important earthquakes by means of geodetic works and soundings respectively.

International co-operations of research works have been carried out by the Division of Geophysics of the National Research Counsil, which will be succeeded by the National Council of Science and Technology shortly. Besides, there was in the same council a commission on the Mitigation of Earthquake Disasters, and recently another important commission for the Liaison of the Organisations on the Research for Earthquake Forecasting has been added. Both of these commissions do not carry out research works by themselves, except mutual co-operations and exchange of the results of investigations in the organisa-

tion to which the member of the commission belongs.

The results of the seismographical observations at the meteorological stations are summarized in the "Kisyō Yōran " (monthly weather review) published from the Central Meteorological Observatory, though some stations have had their own bulletins. Annual English summary of these data is printed in "The Seismological Bulletin of the Central Meteorological Observatory". The observations in the stations under the Earthquake Research Institute has been published in the " Seismometrical Report " of the Institute. No regular report of the other agencies is published.

The Seismological Papers.

The results of the seismological investigations in these organisations are published in respective organ magazines, most important ones of which are the "Geophysical Magazine" (in European language): the "Kensin Zihō " (the Seismometrical Journal in Japanese language) both from the Central Meteorological Observatory: The "Bulletin of the Earthquake Research Institute:": the "Tikyū Buturi" (the Bulletin on Geophysics in Japanese) published from the Geophysical Institute of the Kyoto University. The "Zisin" (the Journal of the Seismological Society of Japan) has been published. Some seismological papers have also appeared in the "Kisyō Syūsi" (the Journal of the Meteorological Society of Japan). It is also to be noted that the "Japanese Journal of Astronomy and Geophysics" published from the National Research Council and the "Proceedings of the Imperial Academy" also contained seismological papers of importance. But recently owing to the economical difficulties almost all of these publications have lost their regular functions. And many papers are published recently in limited numbers in mimeographic printing from a number of agencies.

In the annexed Bibliographies, those papers which were read but not yet printed are also included.

Important items of Seismological Investigations in This Period.

Owing to the too little time afforded, only important items will be mensioned.

1. Detailed investigtions by almost all the seismologists in this country of the most important earthquakes which took place in this period and shown in the annexed table .
2. Theoretical studies on the elastic surface waves by K. Sezawa, K. Kanai, S. Homma and Y. Satō.
3. Theoretical studies on elastic waves in heterogeneous medius by R. Yosiyama.
4. Achievements of new seismometers by M. Ishimoto, K. Iida, K. Sassa,
5. S. Haeno and T. Hagiwara and an acurate recording drum by C. Tsuboi abd others.
5. Application of torsion pendulum as a wave filter on the study of seismic waves and discovery of surface waves in near earthquakes by C. Tsuboi, S. Miyamura and T. Akima.
6. The study of inherent ground motions from observations of after-shocks by T. Minakami, S. Sakuma and others.
7. A discovery of energy law of earthquake occurrence by M. Ishimoto, K. Iida, T. Matuzawa and H. Kawasumi.
8. Statistical studies on intensities and magnitudes of earthquakes determination of magnitudes of Japanese earthquakes, new definition of seismicity in ergs per sq. km. per year and comparison of seismicities in Japan, Philippine Islands, East Indies and in U. S.A. by H. Kawasumi.

9. Studies on intensity distributions of earthquakes by means of post card method and actual inspections, and derivation of local anomaly due to underground structure throughout this country by H. Kawasumi Y. Satō and S. Miyamura.

10. Study on the microseisms by F. Kishinouye.

11. Study on the periods of coda waves by S. Omote.

12. Determination of elastic moduli of rocks, soils, etc. by K. Iida.

13. Theory, experiments and practical observations of vibrations, strains and damages of buildings by K. Sezawa, K. Kanai, T. Saita, S. Miyamura and others.

14. Studies of the mechanisms of earthquake occurrence from observations of initial motions of an earthquake throughout the world by H. Kawasumi and R. Yosiyama and statistical studies on the mechanisms of earthquakes throughout this country by H. Honda and others.

15. Regional and historical studies of large earthquakes all over the country by A. Imamura.

The last mensioned item is the results of the late Prof. Imamura's life long studies on this subject. The study was not finished but almost completed before his much lamented death on Jan. 1. 1948. These posthumous works will shortly published with the title" General View of Large Earthquakes in Japan", and it should be a monumental work in the regional and historical seismology which must make the foundation of the earthquake forecasting, an inevitable task of Japanese Seismology.

Destructive and Semi-destructive Earthquakes in Japan and Vicinity During the period 1939-1947.

(Origin time in S.M.T. of 135° E, Longitude and Latitude of Epicentre, Magnitude in Kawasumi scale and Remarks

1939, III 20, 12h 22m. 131°.8 E. 32°.4 N. M=V.=10^{23}ergs.
Epicentre in the northern part of Hyūga-nada. Felt throughtut Sikoku, Kyūsyū and Tyūgoku and partly in Kinki distrct. Some damages in Miyazaki and Ooita Prefectures.

1939, VII,14h 58m. 139°.49' E. 39°.57' N. M=VI.=10^{24}ergs.
Oga Peninsula, Akita pref. Felt throughout Tōhoku district and Ooita prefectures. Southern half of Hokkaidō and some part of Tyūbu district. The intensity was strong in Akita prefecture, wounded while 958 house (of which 479 were dwelling houses) were collapsed and 1014 (including 858 dwelling houses) were half destroyed. Land slides, faults and cracks of roads appeared, and railway embankments and dridges were damaged, A small tunami of 27cm. double amplitude was experienced at Tutizaki harbout.

1941, IV, 3, 03h 05m. 131°.65 E. 34°.6 N. M=V.=10^{23}ergs.
Epicentre in the vicinity of Susa, Abu-gōri, Yamaguti prefecture. Felt in most part of Tyūgoku and Sikoku and some parts of Kyūsyū and Kinki districts. In the epicentral region it was felt strong, with small damages.

1941, VII 15, 23h 45m. 138°.16' E. 36°.42' N. M=IV.=10^{22}ergs.
Epicentre in the Vicinity of Nagano. Felt in most part of Tyūbu and Kwantō and a part of Tohoku and Kinki districts. The magnitube was not so big, but the epicentre was so shallow that high intensities are experienced in a very limited area. Villages to the north east of the city of Nagano, Naganuma, Hurusato, Kamisato, Wakatuki and Asakawa were severely shaken with 5 deaths and 3 severely wounded, and 78 houses (including 48 godowns etc.) were colapsed and 237 houses half destroyed. Small aftershocks were numerous.

1941, XI, 19, 01h 49m. 132°.4 E. 32°.3 N. M=VI.=10^{24}ergs.
Epicentre in the Hyūga-nada. Felt throughout the Kyūsyū and Sikoku, and most part of Tyūgoku and some part of Kinki districts. The magnitude was very large. 2 men were dead and 27 houses were destroyed. Small tunami of 1m. double amplitude was notised at eastern coast of Kyūsyū and southern coast of Sikoku.

1941, XII 17, 04h 22m. 120°.6 E. 23°.4 N. M=V=10^{23}ergs.
Epicentre near Kagi, Formosa. A very large earthquake with considerable damage at the cieies of Kagi and northern part of Sinei district.

1943, III, 4, 19h 13m. 134°.2 E. 35°.6 N. M=IV.=10^{22}ergs.
Epicentre in the vicinity of Karo, Tottori prefecture. Felt throughout Tyūgoku, Sikoku and Kinki and partly at Kyūsyū, Tyūbu and Kwanto districts, in the epicentral region it was strong, causing considerable damages.

1943, III, 5, 04h 50m. 134°.2 E. 35°.6 N. M=IV.=10^{22}ergs.
Epicentre off the of Hamamura, Tottori prefecture. Areas felt of this earthquake was the same as above. Intensity at the epicentral region was almost the same. The damages wrought by these two earthquakes were as follows. II persons wounded, 69 houses were collapsed and 594 houses half destroyed.

1943, VIII 12, 13h 50m. 139°.8 E. 37°.3 N. M=IV.=10^{22}ergs.
Epicentre in the Vicinity of Tazima, Fukusima Prefecture. Felt in the southern half of Tōhoku, district. At the epicentral region it was strong, and some land slides were occurred, and small damage was wrought reachint to falling of plaster of walls,

1943, Ix, 10, 17h 39m. 134°.2 E. 35°.5 N. M=VI.=10^{24}ergs.
Epicentre in the mid-stream of Saka-gawa, Ketaka-Gōri, Tottori prefecture. Felt in the wide area extending from Maebase, and Niigata in the east to Kumamoto in the west. The city of Tottori and its suburbs were badly shaken with many collapsed houses and casualties. Conspicuous faults appeared near Yosioka and Sikano, to eat nothing with many ground fissures. The losses amounted to 1005 deaths, 7527 totally destroyed houses and 254 totally burned.

1943, X, 13, 14h 43m. 138°.2 E. 36°.8 N. M=IV.=10^{22}ergs.
Epicentre in the Vicinity of the Lake Noziri, Nagano prefecture. Felt throughout Tyūbu and partly in Tōhoku district. A few villages in the vicinity of the epicentre were damaged. With 1 death, 14 wounded, and 34 totally destroyed and 116 half destroyed houses.

1943, XII.

1943, Xii, 2, 14h 09m. 121°.6 E. 22°.9 N.
Epicentre off the east coast of Sinko. Damages wrought at Kasyo Island, 3 deaths, 11 wounded and 139 collapsed and 197 half destroyed houses, some landslides.

1944, XII, 7, 13h 36m. 136°.2 E. 33°.7 N. M=VII.=10^{25}ergs.
Epicentre in the Kumano-nada (the Tōnankai earthquake) Felt in the wide area extending from Sendai and Akita in the north to Kumamoto and Mitazaki in the west. Innuverable losses were caused in the meizoseismal area of Kinki, and southern part of Tyūbu district. 988 persons were dead and 2135 wounded. 26130 dwelling houses totally destroyed and 46950 half destroyed and 11 totally burned. Very big tunamis accompanied in the Pacific coast from Tyōsi in the east to Tosa,Simizu in the west. It reached as high as 6 metres at the eastern coast of the Kii peninsula. Total damage of this tunami was very heavy and 3059 houses were washed away.

1945, I, 13, 13h 38m. 137°.0 E. 34°.7 N. M=IV,=10^{22}ergs.
Epicentre on the northern of the Atumi-Bay, Kikawa province. Felt to the distance as Hukusima and Niigata prefecture in the north to Simane and Ehime prefectures in the west. Severe damages were wrought in Aiti and Gihu prefectures, amounting to 1961 deaths, 896 wounded, and 5539 dwelling houses and 6603 godowns etc. were collapsed while 11706 dwellings and 9976 godwns etc. were half destroyed. Fault appeared. Many aftershocks were observed after these earthquakes.

1946, XII, 21 04h 19m. 135°.6 E. 33°.0 N. M=VII.=10^{25} ergs.
The Nankaidō earthquake. It was felt in the very wide area extending from the southern part of the Tōhoku district in the north to Kyūshū district in the West. The magnitude was very big. the area with damage or fissures in the ground or landdslides were so wide as to extend from Kyūshū, Tyūgoku Sikoku, Kinki and Tyūbu districts. The places where damages were wrought by tunami were also widely distributed in the whole Pacific coast from. Kwantō to Kyūshū districts. The severest part of this tunami were the coast of Kii, peninsula and east and south coasts of Sikoku, where they rose as high as 5 to 6 meters. Land spheaval and subsidences were very conspicuous and more than 10 square km. of paddy fields including part of cities submerged in Sikoku. Damages of earthquake on the roads, rail-ways, embankments and bridges were numerous. 1362 persons were dead. 102 missing and 2632 wounded and 11506 houses were collapsed, 21927 half destroyed, 2602 totally burned, 2109 washed away, and 3306 houses were flooded. Innumerable damages on vessels and other properties.

1947, IX, 27, 01h 04m. 124°.0 E. 24°.0 N.
Epicentre near Isigaki Island. Felt strongly at the Island, with small fissures in the roads and fall of week stone walls.

Status of the Seismological Organisations in Japan.

I. Stations connected with the Central Meteorological Observatory.

No.	Name of Station	North Latitude	East Longitude	Instrument					
				WH	WZ	L	T	Pther	Other
1	Abasiri	44° 01'	144° 17'	a	a		a		
2	Akikawa	38 01	138 15	a	a				
3	Akita	39 43	140 06	a	b	b	c	ac	
4	Aomori	40 49	140 47	a	a	a	b		
5	Asahikawa	43 47	142 22				c		
6	Gihu	35 24	136 46	a	a	a	a		c
7	Hakodate	41 47	140 43			a	ac	bb	bc
8	Hamada	34 54	132 04	a	a	a	b	aa	
9	Hatinohe	40 32	141 32	a	a	b			
10	Hatizyōzima	33 06	139 50				a		
11	Hikone	35 16	136 15	a	a	a	b		
12	Hirosima	34 22	132 26	a	a		b		
13	Hukuoka	33 35	130 23	a	a	a			aa
14	Hukusima	37 45	140 28	a	a	a	a		
15	Hunatu	35 30	138 46	a	a				
16	Ibukiyama	35 23	136 23			a			
17	Iida	35 31	137 50				aa		
18	Itō	34 58	139 07				a		
19	Ituhara	34 12	129 17			a	a		
20	Iizuka	33 39	130 42	a	a				
21	Kagosima	31 34	130 33	a	a	a	a	c	
22	Kakioka	36 14	140 11	a	a	a	a	c c	
23	Kameyama	34 51	136 28	a	a	a			
24	Kanazawa	36 32	136 39				a		
25	Karuizawa	36 20	138 36				aa		
26	Kōbe	34 41	135 11	a	a	a	b	cb	
27	Kōti	33 33	133 32	a	a	a		a	
28	Kumagaya	36 09	139 23	a	a	a			
29	Kumamoto	32 49	130 42	a	a	a	a		
30	Kusiro	42 59	144 24			b	b		
31	Kyōto	35 01	135 44	a	a	a	a		a
32	Maebasi	36	139 0	a	a	a	a		
33	Matue	35 27	133 04			a	a		
34	Matumoto	36 15	137 58	a	a	a	a a		
35	Matuyama	33 50	132 45	a	a	a	a	b	
36	Misima	35 07	138 57	a	a	a			
37	Mito	36 23	140 28	a	a	a b		c	
38	Miyako	39 39	141 58	a	a	a			
39	Miyazaki	31 55	131 26	a	a	a	c	a a	
40	Muzusawa	39 08	141 08					a	a

No.	Name of Station	North Latitude	East Longitude	Instrument					
				WH	WZ	L	P	T	Other
41	Mori	42° 06'	140° 34'	a	a	a			
42	Morioka	39 42	141 10	a	a		a	b b	
43	Muroran	42 20	140 58			a			
44	Muroto	33 15	134 11	a	a	a	a		
45	Nagano	36 40	138 12	a	a	a	a	a a	
46	Nagoya	35 10	136 58	a	a	a	b b	c	
47	Nemuro	43 20	145 35	a	c	c	c	c c	
48	Niigata	37 56	139 03			a	a		(Milne)c
49	Ommaezaki	34 36	138 13	a	b	a			
50	Onahama	36 56	140 54	a	a	c			
51	Ōsaka	34 39	135 32	a	a	a	b	c	
52	Oosima	34 46	139 23	a	a	a		c	
53	Owase	34 04	136 12	a	a	a			
54	Saigō	36 12	133 20				a		
55	Sakata	38 53	139 50				a		
56	Sapporo	43 04	141 21	a	a	a	b		
57	Sendai	38 16	140 54	a	a	a	c	a a	
58	Simonoseki	33 57	130 56				a		
59	Sionomisaki	33 27	135 46	a	a	a	a		
60	Sirokawa	37 07	140 13				a		
61	Sizuoka	34 58	138 24	a	a	b	b b b	a a	
62	Sumoto	34 21	134 54	a	a	a	c	c	
63	Suttu	42 48	140 13				a		
64	Takamatu	34 19	134 03				a		
65	Takada	37 06	138 15			a	a		
66	Takayama	36 09	137 15				a		
67	Titibu	35 59	139 05				a		
68	Tokusima	34 04	134 35			a	a		
69	Tōkyō	35 41	139 46	a	a	a	a	a	(Mainka)a
70	Tottori	35 30	134 14			a	a		
71	Tomie	32 37	128 46	a	a				
72	Tomisaki	34 55	139 50	a	a	a	b	b	
73	Toyama	36 41	137 12	a	a	c	c		
74	Toyooka	35 32	134 49	a	a	a	c		
75	Tu	34 44	136 31			b	a		
76	Tukubasan	36 13	140 06	a	a	a	a		
77	Turuga	35 39	136 04			a	a		
78	Unzendake	32 44	130 15		a	a	a	a a	
79	Urakawa	42 09	142 47				c		
80	Utunomiya	36 33	139 52	a	a	a	a		
81	Uwazima	33 14	132. 33	a	a	a	a		
82	Wakkanai	45 25	141 41			c		c c	
83	Wazima	37 23	136 54	a	a	a			
84	Kasiwara	34 30	135 48				a		
85	Yamagata	38 15	139 39			c c	a a		
86	Yokohama	35 26	139 39	a	a	a	b		
87	Yonago	35 26	133 21			a	a	a a	

Abreviations.

WH : Wiechert horizontal seismograph
WZ : Wiechert vertical seismograph
L : Seismograph of low magnification
P : Portable seismometer
T : Ōmori tromometer.

a; seismograph now working,
b: seismograph stopping owing to the instrumental defect,
c: seismograph stopping from deficiency of necessary materials.

Instrumental Constants at Representative Stations.

Station	Seismo-graph	Compo-nent	Magnific-cation	Period T_o	Friction constant r/T_o^2	Damping ratio	Date of calibration
Sapporo	W	N	104	4.4	0.025	4.8	
		E	98	4.6	0.023	4.6	1947 X 2
		Z	72	4.1	0.021	4.4	
	L	N	2	2.4	0.034	1.1	
		E	2	2.7	0.036	1.2	1943 III 1
		Z	3	2.52	0.037	1.2	
Sendai	W	N	76	5.1	0.004	5.5	
		E	78	5.5	0.002	6.1	1947 XII 21
		Z	57	4.3	0.007	4.3	
	L	N	2	4.2	0.003	6.1	
		E	2	4.0	0.007	5.5	1947 XI 12
		Z	2	4.0	0.007	7.6	
Yokohama	W	N	88	3.7	0.019	4.3	
		E	87	3.6	0.014	4.6	1947 XII 1
Nagoya	W	N	81	4.0	0.01	6.3	
		E	82	4.2	0.01	4.6	1947 XII 1
		Z	42	4.0	0.01	4.2	
	L	N	2	3.5	0.04	2	
		E	2	3.5	0.04	2	1947 III 1
		Z	3	5.0	0.03	2	
Ōsaka	W	N	84	5.3	0.01	6	
		E	84	5.3	0.01	5	1947 XII 5
		Z	74	5.1	0.01	6	
	L	N	2	4.7	0.003	5	
		E	2	4.3	0.001	5	1947 XII 5
		Z	2	4.3	0.006	5	
Kōbe	W	N	94	5.4	0.04	2.0	
		E	109	5.6	0.03	3.3	1947 XII 11
		Z	60	6.0	0.01	6.6	
Hukuoka	W	N	88	3.6	0.012	3.8	
		E	93	3.9	0.007	4.6	1947 XII 1
		Z	71	3.6	0.024	4.3	
	M	N	95	8.3	0.004	6.1	
		E	71	9.6	0.006	8.2	1947 XII 11

Station	Seismo-graph	Compo-nent	Magnific cation	Period T_o	Friction constant r/T_o^2	Damping ratio	Date of calibration
Tōkyō	W	N	74	5.2	0.023	4.0	1948 I 22
		E	93	4.0	0.015	2.5	
		Z	59	2.4	0.016	1.8	
	M	N	92	8.4	0.004	4.9	1948 I 28
		E	98	8.8	0.006		

List of seismometers for loutine observations at the Earthquake research Institute and its substations.

Stations	Seismometer	Component	Magnifidation or Sensitivity	Natural Period T_o	Damping ratio v	Remark
Hongō 35°42'40"N. 139°45'59"E.	O	EW	15	63	4.5	
		NS	20	53	3.0	
		Z	20	12	1.6	
	IP	EW	25	7	1.5	
		NS	25	7	1.5	
		Z	20	7	1.5	
	IL	EW	2	9.3	1.5	
		NS	2	9.3	1.5	
		Z	2	2.2	1.3	
	ISA	EW	1mm.=1.7gal.	0.1		Critical d
		NS	"	0.1		"
		Z	1mm.=4gal.	0.1		"
Mitaka 35°40' N. 139°33' E.	N	EW				
		NS	80	1.4	2.5	
	N	EW	80	1.4	2.5	
Kamakura 35°19' N. 139°33' E.	IP	NS	50	5	1.3	
		EW	50	5	1.3	
	IL	NS	2			
		EW	2			
		Z	2			
		NS				
		EW				
Kiyosumi 35°09' N. 140°02' E.	IP	NS	50	6	3.7	
		EW	50	6	1.3	
		Z	28	6	1.1	
Tōgane 35°34' N. 140°23' E.	IP	NS	50	5	1.4	
		EW	50	5	1.4	
	IP	NS	2	5.3	2.2	
		EW	2	5.3	2.2	
		Z	2	1.3	1.3	
Titibu 35°59' N. 139°05' E.	IP	NS	50	6	1.8	
		EW	50	6	1.8	

stations	Seismometer	Component	Magnifidation or Sensitivity	Natural Period T_o	Damping ratio v	Remark
Tukuba	H	NS	30	5		Critical d.
		EW	30	5		"
	IsA	NS	1mm.=1.7gal.	0.1		"
36°13' N.		EW	"	0.1		"
140°07' E.		Z	1mm.=4.1gal.	0.08		"
Asama	ISH		350	1.0	10.1	
36°24' N.						
138 34' E.						
Susaki	O	NS	25	30		
		EW	25	30		
	IP	NS	50	6		
34°40' N.		EW	50	6		
138 59' E.				0.11		Critical d.
	ISA	NS		0.11		
		EW		0.11		
		Z		0.11		
	H		50	6		

Mitui Geophysical Institute.

Abreviations
- O: Ōmori Seismograph.
- IP: Imamura Portable Seismograph.
- IL: Imamura Low Magnification or Strong Motion Seismograph.
- ISA: Ishimoto Accelleration Seismograph.
- ISH: Ishimoto Horizontal Seismograph.
- N: Nasu Inverted pendulum Seismograph.
- H: Hagiwara Seismograph.

List of seismographs for routine observations at stations connected with the Geophysical Institute, Kyōto University.

Stations

Name	Latitude	Longitude	Height	Abreviation
Abuyama	34° 52' N.	135° 34' E.	h=200 m.	Ab.
Aso	32 53	131 00	540	As.
Kamigamo	35 02	135 42	190	Ka.
Kyōto				Ky.
Ōsakayama				Os.
Beppu	33 17	131 29	75	Be.
Ikomayama				Ik.
Kazan				Kz.

Seismo-graph	Compo-nent	Pendulum Period in sec	Damping ratio	Magnifi-cation	Galvanometer Period in sec	Damping ratio	Max. magn.	Stations
W	H	12	5	200				Ab,Ka,As,Be.
W	Z	4	5	180				Ab,Ka,As,Be.
G	N, E.	20		2000				Ab.
G	Z	10		2000				Ab.
GB	N, E.	8			8		5000	Os.
GB	Z	8			4		5000	Os.
SL	N, E.	36	5	1.1				Ab.
L	N, E.	5	5	5				Ab.
OT	N, E.	8		50				Ka.
SP	N, E.	4		50				Ky.
S20000	N, E.	0.55			0.55		19000	Ka,Ik,Kz.
S20000	Z	0.55			0.55		17000	Ka.Ik,Kz.
S50000	N, E.	0.6			0.60		50000	Ab.

Abreviations

W: Wiechert Seismograph.
G: Galitzin Seismograph.
GB: Sassa-Galizin Seismograph.
SL: Sassa low magnification seismograph.
L: Low magnification seismograph.
OT: Ōmori Tromometer.
SP: Sassa portable seismometer.
S20000: Short period Seismograph with magnification of 20000.
S50000: Short period Seismograph with magnification of 50000.

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