

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND COMMERCE



WEATHER BUREAU

MANILA CENTRAL OBSERVATORY

SEISMOLOGICAL BULLETIN FOR 1933 JANUARY-JUNE

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MANILA
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INTRODUCTION

SEISMIC STATIONS

The following is the list of official seismic stations. Moreover, all the meteorological stations, official and coöperative, have instructions to report all perceptible earthquakes.

Name	Province	North latitude	East longitude	Elevation	Equipment
Manila	Manila	14 35	120 59	2.5	Galitzin-Wilip seismographs, 3 components. Wiechert inverted pendulum, mass 1,000 kg. Two horizontal pendulums, mass 118 kg. each. Vicentini seismograph, 3 components. Wiechert inverted pendulum, mass 200 kg. Vicentini seismograph, 3 components. Wiechert inverted pendulum, mass 200 kg. Do.
Baguio	Mountain	16 25	120 35	1,512.0	
Ambulong	Batangas	14 05	121 03	10.5	
Butuan	Agusan	8 56	125 32	2.0	
Agaña	Guam	13 24	144 38	5.0	

NOTE.—The subsoil of Manila is alluvium.

The time of occurrence is that indicated by the seismographs at the Central Observatory, Manila, whenever the disturbance has been recorded by them. This fact is denoted by an asterisk(*). Otherwise the time is that noted by the meteorological observers who report them. All time indications are in Greenwich Mean Time, insular time being added in brackets for the convenience of Philippine readers.

The intensity of macroseisms is given according to the Rossi-Forel scale.

The instrumental record is that obtained from the seismographs in the Manila Observatory. It is that of the Galitzin-Wilip instruments except where noted otherwise.

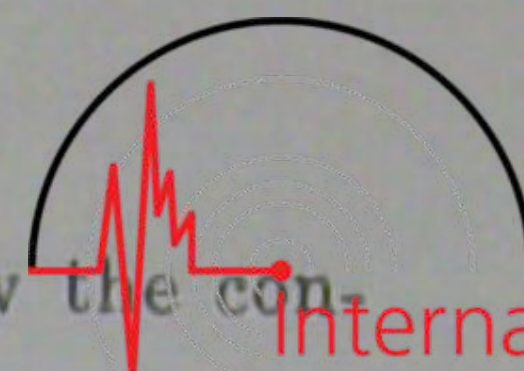
SPANISH TRANSLATION

Beginning with the Seismological Bulletin for 1933 the Spanish translation of the macroseismic records will be omitted.

ROSSI-FOREL SCALE

- I. *Microseismic shock*: recorded by a single seismograph or by seismographs of the same model but not by several seismographs of different kinds; the shock felt by an experienced observer.
- II. *Extremely feeble shock*: recorded by several seismographs of different kinds; felt by small number of persons at rest.
- III. *Very feeble shock*: felt by several persons at rest; strong enough for the direction or duration to be appreciable.
- IV. *Feeble shock*: felt by persons in motion; disturbances of movable objects, doors, windows; creaking of ceilings.
- V. *Shock of moderate intensity*: felt generally by everyone; disturbance of furnitures, beds, etc., ringing of swinging bells.
- VI. *Fairly strong shock*: general awakening of those asleep; general ringing of house bells; oscillation of chandeliers; stopping of pendulum clocks; visible agitation of trees and shrubs; some startled persons leave their dwellings.
- VII. *Strong shock*: overthrow of movable objects; fall of plaster; ringing of church bells; general panic, without damage to buildings.
- VIII. *Very strong shock*: fall of chimneys, cracks in walls of buildings.
- IX. *Extremely strong shock*: partial or total destruction of some buildings.
- X. *Shock of extreme intensity*: great disaster, buildings ruined, disturbance of the strata, fissures in the ground, rock-fall from mountains.

SYMBOLS AND ABBREVIATIONS



P	Normal first preliminary tremors; longitudinal waves which have passed below the continental layer.
\overline{P}	Upper first preliminary tremors whose path lies wholly in the continental layer.
P'	Longitudinal waves that have traversed the earth's core.
PRn	Longitudinal waves reflected "n" times at the earth's surface.
PcP	Longitudinal waves reflected from the outer surface of the earth's core.
S	Normal second preliminary tremors; transverse waves that have passed below the continental layer.
\overline{S}	Second preliminary tremors whose path lies entirely in the continental layer.
PS	Waves transformed from longitudinal to transverse oscillations or vice versa through one reflection at the earth's crust.
SRn	Normal transverse waves reflected "n" times at the earth's surface.
ScS	Normal transverse waves reflected from the outer surface of the earth's core.
ScPcP	Waves which start with transverse vibrations but on refraction into the core are changed to longitudinal, or starting as longitudinal are refracted out as transverse.
L	Long waves of irregular form at the beginning of the surface or main phase.
M	Shorter and more regular waves of large amplitude in the surface group which travel more slowly than the L waves.
Mn	Individual waves of relatively large amplitude in the surface phase and usually in the M group.
F	Finis. End of discernible movement.
i	Impetus. Impulsive and sharply defined beginning of a phase.
e	Emersio. Poorly defined emergency of a phase.
m	Maximum wave in any phase.
A	Amplitude of earth motion measured in microns from position of equilibrium. One micron equals .001 mm.
μ	Micron.
A_E	E-W component of A.
A_N	N-S component of A.
A_Z	Vertical component of A.
T	Period of waves.
O	Time of earthquake at the epicenter.
Δ	Arcual distance from station to epicenter.
T_0	Free or undamped period of the seismograph.
V	Static magnification.
ϵ	Ratio of successive damped amplitudes.
r	Friction constant.
J. S. A.	Jesuit Seismological Association. Central Office at St. Louis University, St. Louis, Missouri, U. S. A.
U. S. C. G. S.	United States Coast and Geodetic Survey, Washington, D. C., U. S. A.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM



Date	N-S component.				E-W component.			
	T_0	V	ϵ	$\frac{r}{T_0^2}$	T_0	V	ϵ	$\frac{r}{T_0^2}$
1933								
January.....	4.4	194	2.4	0.029	4.8	208	2.6	0.029
February.....	4.5	192	2.4	0.027	4.7	200	2.6	0.033
March.....	4.4	194	2.4	0.028	4.8	201	2.5	0.039
April.....	4.4	194	2.4	0.021	4.8	203	2.6	0.027
May.....	4.5	191	2.4	0.023	4.8	203	2.6	0.029
June.....	4.4	199	2.4	0.024	4.9	203	2.7	0.034

CONSTANTS OF THE GALITZIN-WILIP INSTRUMENTS

PERMANENT CONSTANTS			
	N-S	E-W	Z
Galvanometer periods.....	12.3s.....	11.8s.....	11.0s.
Galvanometers to drums.....	100.5 cm.....	100.5 cm.....	100.5 cm.
Telescope to seismographs.....	500 cm.....	492 cm.....	450 cm.
Reduced pendulum lengths.....	11.52 cm.....	11.40 cm.....	14.82 cm.
TEMPORARY CONSTANTS			
Seismograph period, T^1	12.59	11.90	9.0
Coefficient of damping.....	-----	-----	-----
Transmission factor, k.....	-----	-----	-----

SEISMOLOGICAL BULLETIN FOR 1933

JANUARY, 1933

MACROSEISMIC RECORD

3, 13^h 19^m [3, 9:19 P. M.] **Cotabato, Cotabato.** Light earthquake felt at the town of Cotabato and at Lebak.

6, 5^h 33^m [6, 1:33 P. M.] **Cape Bojeador, Ilocos Norte.** Light earthquake of intensity III and five seconds duration.

6, 15^h 00^m [6, 11:00 P. M.] **Impalutao, Bukidnon.** Slight earthquake.

14, 5^h 10^m [14, 1:10 P. M.] **Cape Bojeador, Ilocos Norte.** Earthquake of intensity II and two seconds duration.

14, 20^h 14^m [15, 4:14 A. M.] **Boac, Marinduque.** Light earthquake of four seconds duration.

19, 6^h 47^m 57^{s*} [19, 2:47:57 P. M.] **Jolo.** Very feeble earthquake of two seconds duration. Epicenter probably in the Celebes Sea.

19, 15^h 30^m [19, 11:30 P. M.] **Cantilan, Surigao.** Slight earthquake.

20, 14^h 49^m 33^{s*} [20, 10:49:33 P. M.] **E Mindanao.** Earthquake felt lightly in the Agusan Valley and along the east coast of Mindanao.

21, 3^h 08^m 58^{s*} [21, 11:08:58 A. M.] **Luzon.** Light earthquake felt in Manila and Ambulong.

24, 10^h 40^m 53^{s*} [24, 6:40:53 P. M.] **Basco, Batan Island.** Light earthquake, probably originating in or near Formosa.

25, 2^h 35^m 01^{s*} [25, 10:35:01 A. M.] **Manila.** Light earthquake originating in the China Sea at 13° 55' N; 119° 45' E, a little to the west of Lubang Island.

28, 14^h 13^m [28, 10:13 P. M.] **Talacogon, Agusan.** Light earthquake.

28, 23^h 30^m 47^s [29, 9:30:47 A. M.] **Guam, Mariana Islands.** Light earthquake recorded and felt at Agaña.

31, 12^h 28^m [31, 8:28 P. M.] **NE Mindanao.** Very feeble earthquake felt at Butuan and Talacogon in the Agusan Valley.


31, 18^h 24^m 31^s [Feb. 1, 4:24:31 A. M.] **Guam, Mariana Islands.** Earthquake recorded and felt at Agaña.

INSTRUMENTAL RECORD

International
Seismological
Centre

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
2	1	PNEZ	8	58	00	6,080	14° S; 166° E by Wellington. 15° S; 167° 30' E by Manila, Chiufeng, Batavia, Hong Kong, Amboina, Zikawei, Riverview, Wellington. Phases after P from the Wiechert.
		SNE	9	05	38		
		LNE	15	ca			
		F	51				
3	2	$\overline{\text{PNE}}$	14	42	58	125	From the Wiechert. Strong microseisms.
		$\overline{\text{SNE}}$	43	14			
		F					
4	3	PNEZ?	13	14	05		Disturbed by strong microseisms.
		SNE?	16	36			
5	3	PNEZ	15	34	45	2,745	40° 24' N; 144° E according to Cent. Meteor. Office, Japan.
		SNE	39	00			
		LNE	41	30			
6	4	ePNEZ	1	30	04	2,745	Phases after P from the Wiechert. 25° N; 144° E by Zikawei, Koti, Manila, Batavia, Riverview, Zinsen, Nanking. 25° 48' N; 145° E according to C. M. O., Japan.
		SNE	34	19			
		ie	35	08			
		in	35	10			
		ine	37	42			
		F	2	38			
10	5	PNEZ	18	06	01	1,050	Felt in central and southern Formosa. 121° 12' E; 23° 12' N according to Taihoku.
		SNE	07	52			
		F	25				
14	7	PNEZ	4	13	16	3,735	40° 18' N; 144° E by C. M. O., Japan.
		SNE	18	35			
		MNE	26	18			
		F	6	56			
15	8	eNEZ	6	35	26	4,055?	41° 12' N; 142° 54' E according to Zinsen.
		SNE	41	06			
		F	7	29			
16	9	iPNEZ	2	10	17	5,180	Compression from NW. 40° N; 67° 30' E by Strasbourg.
		SNE	17	03			
		SR ₁ [⊕]	20	34			
		LNE	24	13			
		MN	30	05			
		ME	32	24			
		F	3	45			
19	13	$\overline{\text{PNEZ}}$	12	56	42	175	After P from the Wiechert. Microseisms.
		$\overline{\text{SNE}}$	57	04			
20	13	$\overline{\text{PNE}}$	13	02	34	180	From the Wiechert.
		$\overline{\text{SNE}}$	02	57			
		F	10				
22	15	$\overline{\text{PNE}}$	0	24	05	145	From the Wiechert. Microseisms.
		$\overline{\text{SNE}}$	24	23			
		F	27				
35	19	PNEZ	6	47	57	1,510	Felt at Jolo with intensity II.
		SNEZ	50	34			
		F	7	01			
42	20	PNEZ	14	49	33	770	Compression. Felt in Agusan Valley and east coast of Mindanao.
		SNE	50	57			
		mN	52	36			
		mE	52	47			
		F	15	29			
43	20	$\overline{\text{PNZ}}$	22	19	11	165	
		$\overline{\text{SNEZ}}$	19	32			
		F	24				
45	21	$\overline{\text{PNEZ}}$	3	06	56	160	
		$\overline{\text{SNEZ}}$	07	16			
46	21	$\overline{\text{PNE}}$	3	08	58	160	From the Wiechert. Felt slightly in Manila and Ambulong.
		$\overline{\text{SNE}}$	09	18			
		F	37				
48	21	iPNEZ	19	33	05	8,780	Dilatation. Phases after P from the Wiechert. 37° S; 59° E by U. S. C. G. S. 41° S; 59° E by J. S. A. 34° S; 53° 30' E by Strasbourg.
		in	34	03			
		PR ₁ NE	36	21			
		SNE	43	12			
		PSNE	43	55			
		LE	59	09			
		MNE	20	05	23		
		F	23	17			
49	21	$\overline{\text{PNE}}$	23	55	48	90	From the Wiechert.
		$\overline{\text{SNE}}$	56	00			
		F	59				

INSTRUMENTAL RECORD—Continued



No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
56	24	PNEZ	10	40	53	1,070	Felt at Basco, Batan Islands, with intensity II.
		SNEZ		42	46		
		mN		43	43		
		mE		45	49		
		F		58			
60	25	\bar{P} NEZ	2	15	05	150	Dilatation.
		\bar{S} NEZ		15	28		
		F		20			
61	25	\bar{i} Pz	2	35	01	150	Compression from SW. Felt slightly in Manila. 13° 55' N: 119° 45' E by Manila and Baguio.
		e \bar{P} NE		35	01		
		\bar{S} NE		35	20		
		F	3	11			
62	25	\bar{P} NEZ	7	20	01	150	
		\bar{S} NEZ		20	20		
		F		24			
63	25	PNZ	16	58	13	470	Baguio, 280 km.
		SNE		59	11		
		\bar{S} N		59	19		
		F	17	19			
65	27	iPz	22	48	08	8,345	Dilatation. Felt in Samoa Islands. 10° S: 162° E by Wellington. 14° S: 171° E by U. S. C. G. S.
		e \bar{P} NE		48	08		
		SNE		57	54		
	LNE	23	12	27			
	F	0	38				
67	29	PNEZ	18	07	31	2,435	
		SNE		11	24		
		LNE		13	38		
		F		43			
70	31	\bar{P} NEZ	14	32	44	160	Dilatation.
		\bar{S} NEZ		33	04		
		F		41			
71	31	\bar{P} NEZ	15	15	21	160	
		\bar{S} NEZ		15	41		
		F		24			

In addition to the above there were forty-three insignificant or undecipherable disturbances on the following days of January; 1st, 4th(2), 5th, 6th(3), 9th, 10th, 14th, 15th, 17th(5), 18th(6), 19th(5), 20th, 21st(2), 22nd, 23rd(5), 24th(3), 27th, 29th, and 30th(2).

FEBRUARY, 1933

MACROSEISMIC RECORD

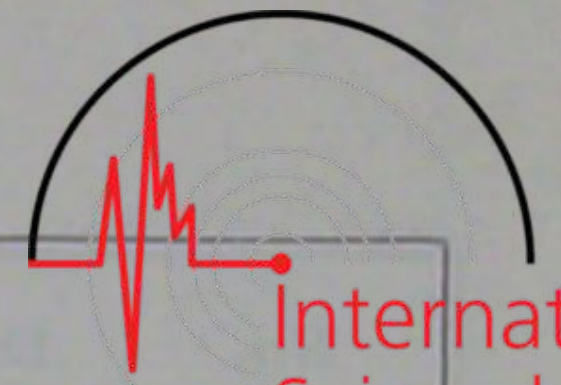
- 1, 3^h 47^m 42^{s*} [1, 11:47:42 A. M.] **Mindanao**. Light earthquake felt in the Agusan Valley and at Hinatuan. Epicenter in the Philippine Deep.
- 1, 15^h 09^m 50^{s*} [1, 11:09:50 P. M.] **SE Luzon**. Earthquake of intensity III felt at Naga and Bacacay.
- 5, 15^h 17^m [5, 11:17 P. M.] **Samar**. Light earthquake of short duration felt at Calbayog.
- 5, 17^h 50^m [6, 1:50 A. M.] **Mt. Province**. Light earthquake at Lubuagan.
- 5, 18^h 20^m 26^{s*} [6, 2:20:26 A. M.] **Ilocos Norte**. Earthquake of intensity IV felt at Cape Bojeador. Aftershock at 2:22 a. m.
- 9, 15^h 00^m [9, 11:00 P. M.] **Masbate**. Earthquake of intensity II
- 10, 17^h 23^m [11, 1:23 A. M.] **Davao**. Earthquake of intensity II.
- 10, 20^h 50^m [11, 4:50 A. M.] **Marinduque**. Light earthquake of three seconds duration felt at Boac.
- 11, 3^h 48^m [11, 11:48 A. M.] **Mindanao**. Light earthquake felt at Cateel and Talacogon. Aftershock felt at 8:39 p. m. in the same places.
- 15, 10^h 00^m [15, 8:00 P. M.] **Guam, Mariana Islands**. Light earthquake felt at Sumay.
- 19, 4^h 01^m [19, 12:01 P. M.] **Benguet**. Light earthquake felt at Baguio by a few persons.
- 19, 4^h 36^m 01^{s*} [19, 12:36:01 P. M.] **SE Luzon**. Earthquake felt over all of SE Luzon, Marinduque, Catanduanes, and Romblon. Center in Camarines Norte at 14° 10' N; 120° 40' E. Intensity VIII at Daet, with duration of twenty-five seconds. Accompanied by subterranean noises. The church of San Vicente suffered about ₱1,000 damage and the walls of the municipal building at Indan were cracked. Aftershocks of varying degrees of intensity IV to VI occurred at the following times during the afternoon and evening of the 19th: 12:34, 12:51, 2:16, 2:21, 6:00, 6:28, 6:40, 9:27, and 10:39. In the morning of the 20th there were aftershocks at 0:54, 2:03, 3:28, and 11:15.
- 21, 1^h 30^m [21, 9:30 A. M.] **Occidental Negros**. Light shock felt at Maa Sugar Central, Bago, at this time and aftershocks at 10:50 A. M., 12:30 P. M. and 1:55 P. M. The shock at 12:30 P. M. was also felt at La Carlota.
- 26, 10^h 20^m 06^{s*} [26, 6:20:06 P. M.] **SE Luzon**. Earthquake felt with intensity VII at Daet and intensity III at Naga.

INSTRUMENTAL RECORD

International
Seismological
Centre

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
72	1	PNEZ SNE F	3 4	47 02	42 37	1,090	Felt in the Agusan Valley and at Hinatuan, Mindanao.
73	1	PNEZ SNE F	15	09 10 21	50 30	280	Felt at Naga, southeast Luzon, with intensity III.
78	2	PNEZ SNE F	22	07 07 22	39 58	150	Compression.
79	3	iPz PR ₂ NE SNE SR ₃ NE LNE MNE F	22	19 22 26 32 34 38 55	29 26 42 32 ca ca	5,490	46° N: 151° E by J. S. A.
81	5	PNE SNE F	18	20 21 26	26 17	415	Felt at Cape Bojeador, north Luzon, with intensity IV. Data from the Wiechert. Galitzin records defective.
82	6	PNEZ SNEZ F	5	15 16 21	53 09	125	
83	9	PNEZ? SNE F	4	02 05 31	26 49	2,020?	31° 42' N: 138° 48' E by Jinsen.
84	9	PEZ SNE LNE ME F	15 17	41 46 49 52 10	06 07 40ca 30ca	3,445	
86	13	PNEZ SNE LNE MNE F	2 3 4	57 03 08 12 20	00 07 45 ca	4,510	Central Asia?
88	14	PEZ iE iz SNE F	4 5	29 29 29 34 04	37 54 58 00	2,865	Netherlands East Indies.
92	15	Pz PNE SNE LNE MN F	9	03 03 07 10 12 58	51 52 50 21 12	2,520	Netherlands East Indies?
94	16	PEZ SNE F	4 5	57 59 37	05 44	1,535	Felt at Menado, N. E. I. Butuan, 6.4°
95	16	PNEZ S?NE LNE F	9 10	11 14 15 34	24 17 40	1,680?	Celebes, N. E. I. Butuan, 8.6°
100	19	PNE SNE LNE	4	28 30 32	35 30 20	1,110	Off Yonakunizima according to Taihoku. 24° 30' N: 122° 48' E.
101	19	PNE SNE	4	36 36	01 26	195	14° 10' N: 122° 40' E by Manila and Baguio. Data from the Wiechert. Felt in southeastern Luzon; at Daet with intensity VIII.
102	19	P _N S _N	4	51 51	23 47	195	Aftershock of No. 101. From the Wiechert.
103	19	P _N S _N	5	10 11	43 07	195	Do.
104	19	PNE SNE F	6	16 17 26	48 12	195	Felt at Daet with intensity VI. Aftershock of No. 101.
105	19	PNE SNE F	6	47 47 53	35 59	195	Aftershock of No. 101.
106	19	PNE SNE F	8	20 20 24	31 55	195	Do.

INSTRUMENTAL RECORD—Continued



International
Seismological
Centre

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
108	19	PNE	9	51	13	195	Aftershock of No. 101.
		SNE		51	38		
		F		54			
109	19	PNE	10	00	06	205	Aftershock of No. 101. 8 more aftershocks until No. 118.
		SNE		00	32		
118	19	PNE	18	03	42	205	Aftershock of No. 101. 5 more aftershocks until No. 124.
		SNE		04	08		
		F		22			
124	20	PNEZ	8	03	11	200	Aftershock of No. 101.
		SNEZ		03	37		
125	20	PNEZ	8	07	20	195	Do.
		SNEZ		07	44		
		F		14			
133	22	ePNEZ	3	48	26	1,020?	Butuan, 3.7°
		S?NE		50	40		
		F	5	20			
137	23	PNE	6	00	30	1,835	
		SNE		03	37		
		ME		07	16		
		F		20			
138	23	ePNEZ	8	29	20		Felt in Iquique, Chile. 19° S: 69° W, by U. S. C. G. S. 18° S: 72° W, by Strasbourg. 19° 30' S: 71° W by J. S. A.
		F	11	28			
140	25	PNEZ	1	18	48	2,555	Guam, 180 km.
		SNE		22	51		
		L?NE		25	17		
		F	2	14			
144	26	PNEZ	10	20	06	195	Aftershock of No. 101.
		SNEZ		20	31		
		F		31			
145	27	P?NEZ	16	23	42	5,735?	Padang, Sumatra, according to Strasbourg.
		iN		26	29		
		SNE		31	00		
		LNE		39	ca		
		F	17	30			

In addition to the above there were forty-seven insignificant or undecipherable disturbances on the following days of February; 2nd(4), 4th, 10th, 13th, 14th(3), 16th(2), 18th(2), 19th(13), 20th(4), 21st(3), 22nd(5), 24th, 25th, 26th(2), 27th, and 28th(3).

MARCH, 1933

MACROSEISMIC RECORD

2, 2^h 21^m [2, 10:21 A. M.] **Laguna.** Light earthquake of intensity III and seven seconds duration felt at Santa Cruz.

3, 2^h 20^m 00^{s*} [3, 10:20:00 A. M.] **Western Luzon.** Earthquake felt through western Luzon from Vigan to the north to Ambulong to the south. Center in Zambales Mountain, western Luzon. Intensity IV at Dagupan was the greatest reported intensity.

12, 20^h 15^m 03^{s*} [13, 4:15:03 A. M.] **Benguet.** Light earthquake felt at Baguio and Kapangan.

13, 19^h 25^m [14, 3:25 A. M.] **Camarines Norte.** Very light earthquake of three seconds duration felt at Daet.

15, 0^h 36^m [15, 8:36 A. M.] **Agusan.** Earthquake of intensity II felt at Butuan.

17, 19^h 34^m 56^{s*} [18, 3:34:56 A. M.] **Eastern Mindanao.** Earthquake felt throughout eastern Mindanao from Butuan to Davao. Epicenter in the Pacific about 200 kilometers from the east coast of Mindanao.

18, 1^h 10^m [18, 9:10 A. M.] **Mindanao.** Light shock felt at Butuan and Hinatuan.

20, 4^h 00^m [20, Noon] **Catanduanes.** Light earthquake at Pandan.

22, 7^h 45^m [22, 5:45 P. M.] **Guam, Mariana Islands.** Light earthquake at Sumay.

22, 11^h 42^m 12^{s*} [22, 7:42:12 P. M.] **Camarines Norte.** Earthquake of intensity IV and three seconds duration felt at Daet.

22, 17^h 49^m [23, 1:49 A. M.] **Zamboanga.** Earthquake of intensity III and eighteen seconds duration felt in the town of Zamboanga.

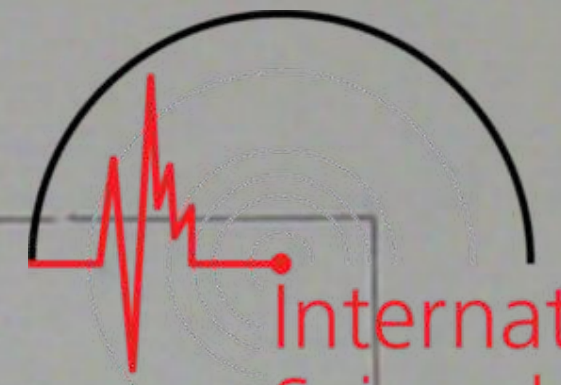
24, 7^h 50^m [24, 3:50 P. M.] **Catanduanes.** Light earthquake felt at Pandan.

25, 17^h 25^m 26^{s*} [26, 1:25:26 A. M.] **NW Luzon.** Light earthquake felt in the Provinces of Abra, Ilocos Sur, and Benguet. Epicenter probably in the mountains north of Baguio.

26, 22^h 38^m 48^s [27, 8:38:48 A. M.] **Guam, Mariana Islands.** Earthquake recorded and felt at Agaña.

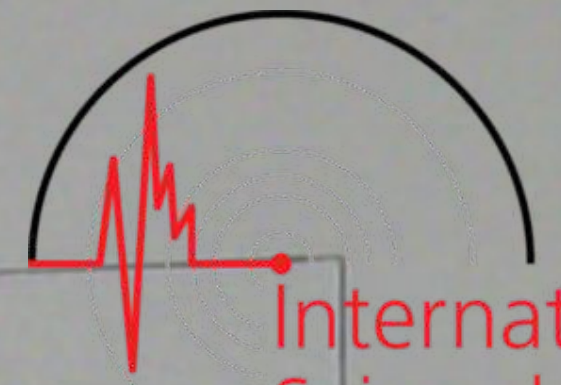
28, 22^h 11^m 24^{s*} [29, 6:11:24 A. M.] **Mountain Province.** Strong earthquake felt at Labuagan.

INSTRUMENTAL RECORD

International
Seismological
Centre

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
152	2	PNEZ SNE F	4	11	02 15 20 29	2,880	
153	2	PeZ SNE LE F	8	15	05 19 08 22 10 12	2,580	Dilatation. Felt in Guam. 145 km. Compression from NE. L from the Wiechert.
154	2	PNEZ SNE F	11	17	14 17 50 21	255	
156	2	PNEZ SNE LNE MNE F	17	37	26 42 30 47 05 50 ca 22 30	3,490	Dilatation. Phases after P from the Wiechert. Sanrokuoki earthquake, Japan. 39° 12' N: 144° 36' E by the C. M. O., Japan.
157	3	iPz ePNE SNE F	2	20	00 20 00 20 15 3 24	120	Dilatation. S from the Omori. Compression at Baguio. Epicenter in the Zambales Mountains, in western Luzon. Felt in Manila with IV. Also felt throughout western Luzon.
159	3	PNEZ SNEZ LNE F	9	19	13 24 32 30 35 11 24	3,730	In region of 39° N and 150° E by Zikawei, Manila, and Hong Kong.
167	5	PNEZ SNEZ F	0	03	18 03 34 06	125	
168	5	iPNEZ SNE MN F	8	24	01 27 17 30 45 10 10	1,935	Compression. Netherlands, East Indies.
171	6	iPNEZ SNEZ F	0	58	48 59 22 1 04	250	Compression.
172	6	iPz ePNE SNE MNE F	13	11	51 11 51 17 08 25 ca 46	3,700	Dilatation. In region of Himalayas by Hong Kong, Manila, Chiufeng.
177	11	eNEZ ScPcS LNE MNE F	2	15	29 19 16 44 ca 52 ca 4 06	11,770	Long Beach Earthquake. 33° 40' N: 118° 02' W by U. S. C. G. S. 32° 48' N: 118° 30' W by J. S. A.
180	11	PNEZ SNE F	19	37	00 40 26 20 50	2,070	Compression. Phases after P from the Wiechert. In region of 24° N and 138° E by Manila, Guam, Butuan, Phu Lien, Hong Kong, Batavia.
190	15	PNE SNE LNE MN F	17	12	31 17 43 21 46 24 40 18 10	3,610	Disturbed by microseisms.
195	17	PNEZ SN F	0	10	37 14 48 36	2,700	N. E. I.
196	17	PNEZ SNEZ LNE MNE F	16	04	48 11 59 21 ca 25 ca 18 02	5,960	55° 24' N: 162° E by U. S. C. G. S. 56° N: 160° E by J. S. A.
197	17	PNEZ SNE LNE MNE F	19	34	56 37 01 38 07 39 20 21 30	1,200	Compression. Phases after P from the Wiechert. Felt in eastern Mindanao. In region of 6° 30' N: 128° E.
200	18	PNEZ SNE LN F	15	57	14 16 01 48 04 48 36	3,035	South of Hatizyo Island.
204	18	eNE F	23	29	02 46		14° 18' N: 87° 48' W by J. S. A.
205	19	PNEZ SNE F	1	16	09 19 26 2 25	1,945	

INSTRUMENTAL RECORD—Continued

International
Seismological
Centre

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
206	19	PNEZ	3	50	20	610	
		SNE		51	29		
		F	4	10			
212	20	PNEZ	15	15	48	2,165	
		SNE		19	22		
		F	16	38			
214	20	PE	19	42	53	3,105	
		SNE		47	32		
		F	20	12			
215	21	PNEZ	19	10	54	200	Compression.
		SNEZ		11	20		
		F		26			
216	21	PNEZ	19	35	22	200	
		SNE		35	47		
		F		41			
217	21	PNEZ	21	14	32	160	
		SNE		14	56		
		F		19			
219	22	PNEZ	11	30	32	200	
		SNEZ		30	57		
		F		38			
220	22	PNEZ	11	42	12	290	Felt in Daet, southeastern Luzon with intensity VI.
		SNE		42	54		
		F		54			
223	23	PNEZ	17	46	33	3,435?	China. P doubtful. Z component defective.
		SNE		51	33		
		LNE		55	10		
		MNE		58	ca		
		F	19	12			
226	25	PNEZ	17	25	26	255	Compression. Felt in northwest Luzon, and at Vigan with intensity III.
		SNE		26	02		
		F		40			
227	26	PNEZ	9	26	50	1,520	Disturbed by microseisms.
		SNE		29	27		
		MNE		32	18ca		
		F		50			
230	27	PNE	23	29	55	260	Z component defective.
		SNE		30	32		
		F		42			
231	28	PNEZ	15	36	48	220	
		SNE		37	18		
		F		47			
232	28	PNE	22	11	12	300	Felt in Lubuagan, Mountain Province.
		SNE		11	52		
		F		17			
233	31	PNE	22	11	59	2,255	
		SN		15	40		
		LNE		17	35ca		
		MNE		19	35		
		F		46			

In addition to the above there were fifty insignificant or undecipherable disturbances on the following days of March; 1st(2), 2nd, 3rd(6), 4th(2), 5th(2), 7th, 8th, 9th(2), 12th(4), 13th, 15th(5), 16th(3), 18th(5), 19th(3), 20th(3), 22nd, 23rd(2), 24th, 25th, and 26th(2).

APRIL, 1933

MACROSEISMIC RECORD

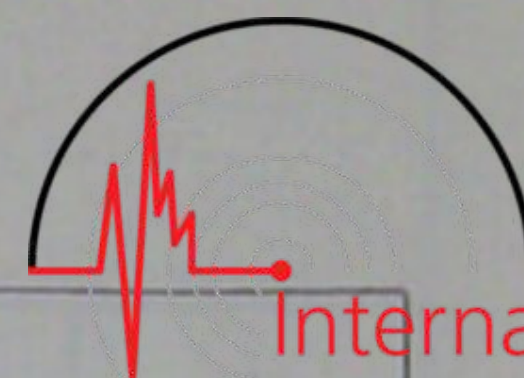
- 1, 8^h 10^m 10^{s*} [1, 4:10:10 P. M.] **Davao**. Earthquake felt at Davao with intensity II. Epicenter in the Philippine Deep.
- 6, 12^h 58^m 20^{s*} [6, 8:58:20 P. M.] **Ilocos Sur**. Earthquake felt at Vigan with intensity III and five seconds duration.
- 9, 2^h 08^m [9, 10:08 A. M.] **Camiguin Island**. Earthquake felt at Mambajao with intensity IV.
- 10, 15^h 25^m 23^{s*} [10, 11:25:23 P. M.] **Luzon**. Earthquake felt at Nasugbu, Batangas with intensity V and at Manila with intensity II. Epicenter probably in China Sea.
- 11, 5^h 20^m [11, 1:20 P. M.] **Surigao**. Earthquake felt at Hinatuan.
- 11, 15^h 06^m 03^s [12, 1:06:03 A. M.] **Guam, Mariana Islands**. Earthquake recorded and felt at Agaña.
- 13, 13^h 00^m [13, 9:00 P. M.] **Surigao**. Earthquake felt at Hinatuan.
- 19, 4^h 55^m [19, 12:55 P. M.] **Camiguin Island**. Earthquake felt at Mambajao with intensity V.
- 21, 22^h 38^m 22^s [22, 8:38:22 A. M.] **Guam, Mariana Islands**. Earthquake recorded and felt at Agaña.
- 27, 15^h 35^m [27, 11:35 P. M.] **Oriental Negros**. Earthquake felt at Dumaguete with intensity III and two seconds duration.
- 27, 17^h 45^m [28, 1:45 A. M.] **Mountain Province**. Earthquake felt at Lubuagan.
- 29, 18^h 35^m [30, 2:35 A. M.] **Jolo**. Very feeble earthquake of four seconds duration.
- 30, 5^h 44^m 06^{s*} [30, 1:44:06 P. M.] **Jolo**. Earthquake of intensity III and twelve seconds duration. Felt also in Basilan Island.

INSTRUMENTAL RECORD



No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
235	1	PNEZ SNE F	8	10	10	1,200	Felt at Davao, southeast Mindanao, with intensity II. 5° 30' N: 127° E by Manila, Pelew, and Batavia.
236	1	PNE SNE LNE MNE F	16	05	20	3,760	From the northeast.
				10	41		
				14	50ca		
				17	30ca		
			17	16			
244	9	iPNEZ SNE F	2	53	06	3,665	Dilatation. 39° 30' N: 143° E by J. S. A.
				58	21		
			6	10			
245	9	PNEZ SNE LNE ME F	10	36	54	3,510	Japan.
				41	50		
				46	ca		
				48	30ca		
			11	39			
247	9	PNEZ SNE F	17	11	36	260	
				12	13		
				18			
249	10	iPNEZ SNE F	15	25	23	135	Compression. Felt at Nasugbu, Batangas, with intensity V and at Manila with intensity II.
				25	40		
			16	11			
253	12	PNEZ iZ iE SNE LNE MNE F	6	01	08	3,580	
				01	24		
				01	37		
				06	17		
				10	27		
				13	30		
				44			
254	13	PNEZ SN F	16	23	28	585	
				25	00		
				39			
257	14	PNE SNE F	7	57	10	365	From the Wiechert. Galitzin records defective. Baguio, 175 km.
				58	05		
			8	25			
263	16	PNEZ SNE F	6	11	49	8,210	
				21	28		
			8	00			
264	16	PNEZ SNE F	11	09	12	215	Baguio, 75 km.
				09	40		
				14			
267	16	iPNEZ iE iN SNE LNE F	19	22	00	3,745	Compression from southeast.
				22	12		
				22	17		
				27	20		
				30	00		
			21	04			
274	19	PNZ SN MN F	3	02	04	3,490	From the NE. Galitzin E-W component defective.
				07	08		
				13	48		
				45			
275	19	PNEZ SNE LNE F	6	47	00	1,090	Phases after P from the Wiechert. Felt widely in Formosa. 24° 20' N: 121° 50' E by Manila, Taihoku, Hong Kong, Zikawei, Koti, Chiu-feng, Pelew.
				48	55		
				49	00		
			8	50			
277	20	PNEZ SNE F	9	30	25	610	
				31	34		
				39			
278	20	PNE SNE F	20	53	16	850	
				54	48		
			21	08			
279	20	PNEZ SNE F	22	18	45	550	
				20	11		
				27			

INSTRUMENTAL RECORD—Continued

International
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No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
281	21	PNEZ	16	39	49	290	
		SNE		40	28		
		F		53			
283	22	$\overline{\text{PNE}}$	16	02	26	160	
		SNE		02	46		
		F		08			
284	22	$\overline{\text{PNEZ}}$	19	05	20	125	
		SNE		05	36		
		F		09			
285	23	iPz	6	10	08		37° N: 27° E by U. S. C. G. S.
		ePNE		10	08		
		iN		10	10		
		MNE		49	40		
288	25	PNE	10	16	39	1,695	Disturbed by microseisms.
		SNE		19	34		
		LN		21	09		
		F		37			
289	27	iPNEZ	2	48	03	8,210	Phases after P from the Wiechert. Anchorage, Alaska. 61° N: 150° W by U. S. C. G. S.
		SNE		57	42		
		PSNE		58	13		
		LNE	3	12	23		
		F		40			

In addition to the above there were thirty-nine insignificant or undecipherable disturbances on the following days of April; 1st(2), 2nd(3), 6th(2), 8th, 9th(2), 11th(3), 13th(2), 15th(5), 16th(2), 17th(5), 19th(2), 21st(2), 23rd(2), 27th(3), 29th, 30th(2).

MAY, 1933

MACROSEISMIC RECORD

1, 5^h 41^m 44^{s*} [1, 1:41:44 P. M.] **Luzon.** Earthquake felt in northern Luzon. Strongest intensity perceived at Pilar, Abra. Epicenter in the mountain north of Baguio.

2, 13^h 45^m [2, 9:45 P. M.] **Mindanao.** Earthquake of intensity III and four seconds duration felt in the town of Surigao. Felt slightly at Butuan.

8, 16^h 47^m 45^{s*} [9, 0:47:45 A. M.] **Agusan.** Earthquake felt at Butuan with intensity III. Aftershock at 1:02 A. M. A pendulum clock was stopped by each of these shocks.

8, 17^h 07^m 13^{s*} [9, 1:07:13 A. M.] **Davao.** Light earthquake felt in the town of Davao.

9, 17^h 30^m [10, 1:30 A. M.] **Cebu.** Light earthquake in the city of Cebu.

11, 18^h 10^m [12, 2:10 A. M.] **Masbate.** Earthquake felt with intensity IV and a duration of forty-five seconds.

16, 10^h 15^m 10^s [16, 8:15:10 P. M.] **Guam, Mariana Islands.** Light earthquake recorded and felt at Agaña.

19, 12^h 17^m 47^{s*} [19, 8:17:47 P. M.] **Mindanao.** Earthquake in the Philippine Deep. Felt in the Provinces of Surigao and Agusan.

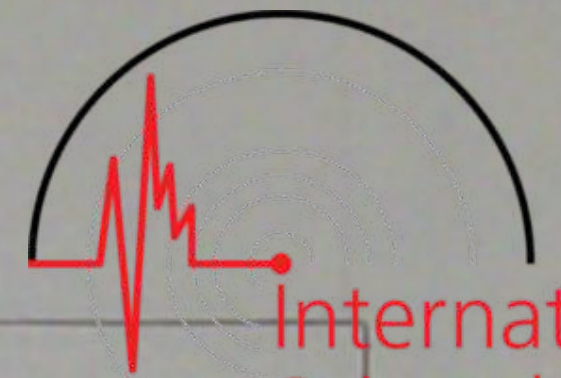
25, 4^h 10^m [25, 12:10 P. M.] **Leyte.** Light earthquake of about thirty-five seconds duration felt at Ormoc.

27, 4^h 43^m 18^{s*} [27, 12:43:18 P. M.] **Samar and Leyte.** Earthquake in the Philippine Deep. Felt with intensity VI at Borongan and intensity V at Tacloban. Bell tower of the church at Borongan was damaged.

27, 13^h 59^m 10^{s*} [27, 9:59:10 P. M.] **Luzon.** Earthquake felt throughout northern Luzon. Epicenter appears to have been in the Mountain Province.

30, 2^h 53^m 58^s [30, 12:53:58 P. M.] **Guam, Mariana Islands.** Strong earthquake recorded and felt at Agaña. Another shock of light intensity at 4:33 A. M. on the 31st.

INSTRUMENTAL RECORD

International
Seismological
Centre

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
297	1	iPz	5	41	44	280?	Felt in northern Luzon. Epicenter in the Mountain Province.
		ePNE		41	46		
		iSNE?		42	22		
		F	6	03			
298	1	PNEZ	18	37	41	5,085	From the NE.
		SNE		44	22		
		MNE		55	ca		
299	1	PNEZ	19	58	33	5,190	No. 298 still recording.
		SNE	20	05	20		
		LNE		12	ca		
		MNE		15	45		
		F	21	46			
308	3	PNEZ	23	33	02	1,025	Felt in greater part of Formosa. 23° 40' N: 122° 30' E by Taihoku, Zikawei, Nanking, Manila, Chiufeng.
		SNE		34	48		
		LNE		35	55		
		F	24	26			
310	6	iP'z	5	53	24	16,600	5° N: 84° W by U. S. C. G. S. 6° N: 82° 30' W by J. S. A.
		eP' NE		53	24		
		S _c P _c P		56	30		
		LNE	6	43	30		
		F	8	00			
315	8	eP'NE	10	53	00	14,300	17° N: 100° W by U. S. C. G. S. 16° 18' N: 101° 12' W by J. S. A.
		PR ₁		55	00		
		PSNE	11	04	50		
		SPS		12	30		
		LNE		34	30		
316	8	PNEZ	16	47	45	840	Felt at Butuan, Mindanao, with intensity II.
		SNEZ		49	16		
		PNEZ	17	07	13		
		F	18	25			
317	8	PNEZ	17	07	13	900	No. 316 still recording. Compression at Butuan. Felt at Davao, with intensity II.
		SNEZ		08	50		
		F	18	25			
319	10	PNE	4	55	45	450	
		SNEZ		56	54		
		F	5	06			
321	10	PNEZ	14	13	28	290	
		SNEZ		14	07		
		F		18			
324	11	iPz	19	22	29	9,185	40° N: 23° E by Kew. 40° N: 24° E by Strasbourg.
		ePNE		22	33		
		iE		32	12		
		SNE		32	53		
		MNE		56	20		
		F	20	47			
325	12	PNEZ	16	16	08	2,645	25° N: 100° E. Upper Yangste Valley according to Taihoku.
		SNEZ		20	16		
		LN		22	36		
		MNE		25	00		
		F	17	03			
326	12	PNEZ	22	03	03	160	
		SNE		03	23		
		F		05			
327	13	PNEZ	23	27	04	190	
		SNE		27	28		
		F		32			
329	14	PNE	1	26	06	350	
		SNE		26	58		
		F		33			
330	14	PNEZ	4	54	49	390	
		SNE		55	48		
		F	5	08			
332	16	iPEZ	1	17	54	2,855	North Sumatra according to Batavia.
		ePN		17	54		
		iSNE		22	16		
		LNE		25	08		
		MNE		27	25		
		F	2	55			
335	16	iPz	16	45	14	1,965	Central Celebes, according to Batavia. 3° S: 123° E by Manila and Batavia as on April 15th 1930.
		PNE		45	14		
		SNE		48	32		
		LNE		50	24		
		F	17	43			

INSTRUMENTAL RECORD—Continued

International
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No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
337	17	PFZ	5	50	50	700	
		SNE		52	08		
		F	6	13			
343	19	PNEZ	12	17	47	795	Felt at Surigao, Butuan, and Hinatuan. 10° 05' N: 126° 30' E by Manila and Butuan.
		SNE		19	14		
		F	13	31			
354	21	PNEZ	11	56	20	2,465	N. E. I.
		SNE	12	00	15		
		F	13	13			
355	21	iPNEZ	21	28	45	2,520	Kisar Island, south Moluccas, according to Batavia.
		SNEZ		32	44		
		iE		32	49		
		iN		32	53		
359	23	PNEZ	6	21	14	180	
		SNE		21	24		
		F		24			
371	27	iPEZ	4	43	18	630	Felt at Borongan (E. Samar) with intensity VI and at Tacloban (Leyte) with intensity V.
		ePN		43	18		
		iSNE		44	29		
		F	5	57			
372	27	iPz	13	59	10	415	Felt in northern Luzon. Epicenter in the Mountain Province.
		ePNE		59	10		
		SNE	14	00	01		
		F		20			
373	27	iPz	16	40	10	160	
		ePNE		40	11		
		SNE		40	30		
		F	17	00			
374	27	iPNEZ	22	41	43	160	Dilatation from the NW. 15° 05' N: 119° 35' E by Manila and Baguio.
		SNE		42	03		
		F	23	40			
378	30	PNEZ	13	57	17	1,720	24° 12' N: 122° 30' E by Taihoku. Felt in Formosa.
		SNE	14	00	15		
		F		21			
379	30	PNEZ	15	41	01	740	Disturbed by microseisms.
		SNE		46	23		
		F		58			

In addition to the above there were fifty-five insignificant or undecipherable disturbances on the following days of May: 1st, 2nd(3), 3rd(5), 5th, 6th(2), 7th(2), 10th(2), 11th(2), 13th, 14th(2), 16th(3), 17th(2), 18th(3), 19th(3), 20th(3), 21st(5), 22nd(2), 23rd(3), 24th(4), 25th(2), 26th(2), 28th, and 29th(2).

JUNE, 1933

MACROSEISMIC RECORD

6, 2^h 28^m 54^{s*} [6, 10:28:54 A. M.] **Luzon.** Strong earthquake having its center in the eastern Cordillera near the southeast end of Laguna de Bay. The towns along the south shore of the lake, Ambulong on Lake Taal, and Nasugbu on the China Sea coast were strongly shaken. Considerable damage to brick work was suffered at the Central in Nasugbu. The earthquake was felt with much less intensity in the towns of southern Batangas, Tayabas, Bulacan, and in Manila. It was also felt in Mindoro, Culion, Cuyo, and Romblon. The E-W fault through the Taal region and the south shore of Laguna de Bay was probably responsible for the strong effects perceived in that section.

7, 0^h 44^m 10^{s*} [7, 8:44:10 A. M.] **Camarines Norte.** Earthquake of intensity IV felt at Daet.

9, 17^h 40^m 30^{s*} [10, 1:40:30 A. M.] **Occidental Negros.** Earthquake felt at Pontevedra, Bacolod, Maa Sugar Central, and La Carlota. The epicenter was in the neighborhood of Canlaon volcano. Aftershocks were felt at La Carlota at 2:22 A. M. and 4:20 A. M.

10, 7^h 48^m [10, 3:48 P. M.] **Surigao.** Slight earthquake at Hinatuan.

12, 8^h 21^m 05^{s*} [12, 4:21:05 P. M.] **Albay.** Earthquake felt at Legaspi with intensity II.

14, 17^h 48^m [15, 1:48 A. M.] **Jolo.** Earthquake felt with intensity III.

15, 3^h 48^m [15, 11:48 A. M.] **Surigao.** Slight earthquake felt at Hinatuan.

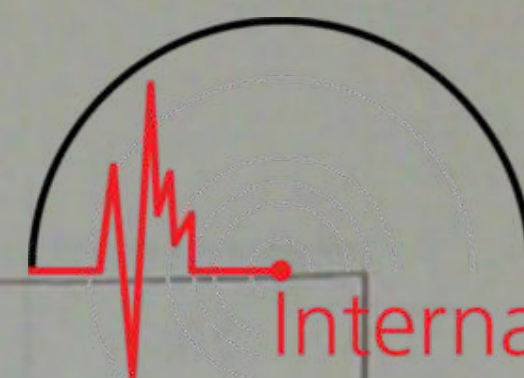
15, 16^h 06^m 07^{s*} [16, 0:06:07 A. M.] **SE Luzon.** Light earthquake felt at Naga and Daet.

17, 13^h 49^m [17, 9:49 P. M.] **Agusan.** Light earthquake of fifteen seconds duration felt at Butuan.

20, 7^h 13^m 12^{s*} [20, 3:13:12 P. M.] **Agusan.** Extremely feeble earthquake felt at Butuan.

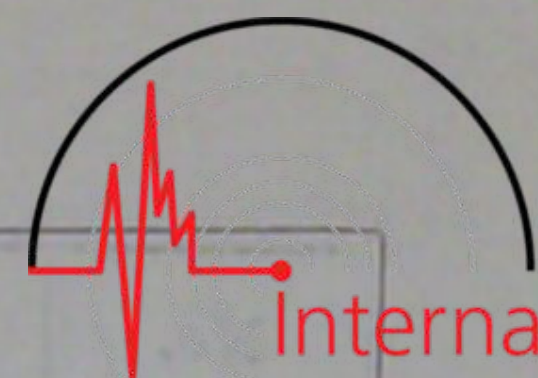
27, 6^h 10^m [27, 2:10 P. M.] **Cotabato.** Light earthquake felt in the towns of Cotabato and Awang.

INSTRUMENTAL RECORD

International
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No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
380	1	PNEZ SNE F	3	22	07	620	Butuan, 240 km.
			4	12			
382	2	iPNEZ SNE F	7	43	10	2,105	Compression from NE. $31^{\circ} 36' N$: $131^{\circ} 06' E$ by Taihoku.
			9	05			
383	2	iPEZ ePN iSNE LNE MN F	12	25	41	2,340	Compression from SE.
				25	41		
				29	28		
				31	30		
				33	50		
			13	27			
384	3	iPz ePNE iSNE SNE F	7	11	25	580	
				11	25		
				12	31		
				12	54		
				32			
385	3	iPNEZ iSNE iLNE MNE F	17	13	00	1,835	$28^{\circ} 30' N$: $129^{\circ} 30' E$ according to Taihoku. Confirmed by Taihoku, Batavia, Nanking, Pelew, Manila, Koti, Hong Kong, Chiufeng.
				16	07		
				17	40		
				19	22		
			19	15			
386	4	iPz PNE SNE? F	13	46	36	2,560?	Dilatation from SE.
				46	36		
				50	38		
			14	38			
388	6	iPNEZ F	2	28	54	80?	Compression from SE. Wiechert pens disjoined at 2:28:58. Epicenter probably in eastern cordillera at $14^{\circ} 20' N$: $121^{\circ} 35' E$. Felt in provinces of central and southern Luzon.
			4	20			
389	6	PNEZ SE	3	16	25	90	No. 388 still recording. Aftershock.
				16	37		
391	6	PNEZ SNE F	6	49	57	2,990	From the NE.
				54	28		
			7	31			
395	7	PNEZ SNE F	0	44	10	210	Felt at Daet, southeast Luzon, with intensity IV.
				44	37		
				49			
397	7	PNEZ iNEZ F	5	57	46		From the SE.
			6	07	38		
				55			
398	7	iPNEZ SNE LNE MN F	11	51	20	2,420	$25^{\circ} 12' N$: $101^{\circ} 54' E$ according to Chiufeng. Phases after P from the Wiechert.
				55	12		
				57	30		
				59	30		
			13	30			
405	8	PNEZ SNEZ F	5	25	20	200	
				25	31		
				30			
406	8	PNEZ SNE LNE MNE F	18	17	18	3,790	$40^{\circ} 12' N$: $144^{\circ} E$ according to Taihoku. Dilatation.
				22	41		
				27	00		
				30	30		
			19	40			
407	9	PNZ SN iN F	17	40	30	510	E-W recording drum not operating. Felt in northwest Negros. Epicenter in neighborhood of Canlaon volcano by Manila and Butuan.
				41	30		
				42	04		
			18	30			
408	10	PNEZ SNE LNE MNE F	2	44	48	1,445	Butuan, 610 km.
				47	18		
				48	00		
				50	ca		
			3	30			
416	11	PEZ SE F	20	20	04	1,435	
				22	33		
				43			
418	12	PE SNE F	8	21	05	250	Felt at Legaspi, southeast Luzon.
				21	40		
				32			
420	12	PNEZ SNZ MNE F	16	23	33	300	
				24	14		
				26	ca		
				40			

INSTRUMENTAL RECORD—Continued

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No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
422	12	PNEZ SNE F	21	14	37 19 33 43	3,370	Japan.
423	13	PNEZ SN LE F	2	07	16 09 18 10 38 55	1,170	4° 45' N: 125° E by Manila, Pelew, Batavia, with Macelwane's Tables of 1933.
427	13	iPz ePNE SNE LNE MNE F	20	40	11 40 12 45 25 49 22 52 10 22 20	3,655	Off mouth of Mabuti river, Aomori prefecture, Japan, according to Taihoku.
428	13	PNEZ SNE F	22	31	06 41 ca 23 40		61° N: 151° W by U. S. C. G. S. 61° N: 149° W by J. S. A.
433	15	PNEZ SNEZ F	16	06	07 06 33 10	200	Felt at Naga and Daet, southeast Luzon, with intensity II.
435	16	PNEZ SNE F	2	44	07 44 42 50	250	
440	18	iPz ePNE SNE LNE ME F	4	05	19 05 19 13 06 23 11 28 ca 5 36	6,235	Felt in Apia, Samoa.
441	18	iPz ePNE SNE LNE MNE F	13	16	26 16 26 21 45 26 10 29 ca 14 40	3,730	38° 30' N: 142° 48' E by Taihoku.
443	18	iPNEZ SNE LNE MN F	21	43	46 48 39 52 ca 55 19 24 25	3,320	Compression from the NE. Phases after P from the Wiechert. Guam, 2,935 km. 38° N: 143° E by J. S. A. 38° N: 142° E by U. S. C. G. S. 43° N: 142° E by Strasbourg.
444	19	iPz ePNE SNE F	6	38	43 38 43 42 16 7 20	2,155	Compression.
446	19	PNEZ SNEZ F	20	27	43 28 02 41	150	
447	20	PNEZ SNE? F	7	13	12 14 26 8 03	830?	Butuan, 100 km.
450	21	PEZ SNE LN ME F	13	46	46 51 15 54 03 56 01 14 35	2,955	South Sumatra, according to Batavia.
453	24	PNZ SNE LNE F	13	58	03 14 00 27 01 40 15 12	1,390	
454	24	PNEZ PR ₂ NE iSNE LNE MNE F	22	00	17 01 07 05 49 07 30 10 ca 1 49	3,000	Benkoelan, Sumatra, according to Batavia. 5° S: 104° 12' E. Phases after P from the Weichert and Omori.
457	25	PNEZ SNE ME F	5	48	52 53 35 59 06 6 40	3,160	
459	25	iPz ePNE SNE F	9	45	22 45 22 50 10 10 30	3,245	

In addition to the above there were forty-eight insignificant or undecipherable disturbances on the following days of June: 1st, 5th, 6th(4), 7th(7), 10th, 11th(6), 12th(3), 13th(3), 14th(2), 15th(2), 16th, 17th(2), 18th(2), 19th, 20th(2), 21st, 22nd, 25th(3), 27th(2), 28th(2), and 30th.

SEISMOLOGICAL BULLETIN FOR 1933
JULY-DECEMBER

INTRODUCTION

SEISMIC STATIONS

The following is the list of official seismic stations. Moreover, all the meteorological stations, official and coöperative, have instructions to report all perceptible earthquakes.

Name	Province	North latitude	East longitude	Elevation	Equipment
Manila	Manila	14 35	120 59	m. 2.5	Galitzin-Wilip seismographs, 3 components. Wiechert inverted pendulum, mass 1,000 kg. Two horizontal pendulums, mass 118 kg. each. Vicentini seismograph, 3 components. Wiechert inverted pendulum, mass 200 kg. Vicentini seismograph, 3 components. Wiechert inverted pendulum, mass 200 kg. Do.
Baguio	Mountain	16 25	120 35	1,512.0	
Ambulong	Batangas	14 05	121 03	10.5	
Butuan	Agusan	8 56	125 32	2.0	
Agaña	Guam	13 28	144 45	5.0	

NOTE.—The subsoil of Manila is alluvium.

The time of occurrence is that indicated by the seismographs at the Central Observatory, Manila, whenever the disturbance has been recorded by them. This fact is denoted by an asterisk(*). Otherwise the time is that noted by the meteorological observers who report them. All time indications are in Greenwich Mean Time, insular time being added in brackets for the convenience of Philippine readers.

The intensity of macroseisms is given according to the Rossi-Forel scale.

The instrumental record is that obtained from the seismographs in the Manila Observatory. It is that of the Galitzin-Wilip instruments except where noted otherwise.

ROSSI-FOREL SCALE

- I. *Microseismic shock*: recorded by a single seismograph or by seismographs of the same model but not by several seismographs of different kinds; the shock felt by an experienced observer.
- II. *Extremely feeble shock*: recorded by several seismographs of different kinds; felt by small number of persons at rest.
- III. *Very feeble shock*: felt by several persons at rest; strong enough for the direction or duration to be appreciable.
- IV. *Feeble shock*: felt by persons in motion; disturbances of movable objects, doors, windows; creaking of ceilings.
- V. *Shock of moderate intensity*: felt generally by everyone; disturbance of furnitures, beds, etc., ringing of swinging bells.
- VI. *Fairly strong shock*: general awakening of those asleep; general ringing of house bells; oscillation of chandeliers; stopping of pendulum clocks; visible agitation of trees and shrubs; some startled persons leave their dwellings.
- VII. *Strong shock*: overthrow of movable objects; fall of plaster; ringing of church bells; general panic, without damage to buildings.
- VIII. *Very strong shock*: fall of chimneys, cracks in walls of buildings.
- IX. *Extremely strong shock*: partial or total destruction of some buildings.
- X. *Shock of extreme intensity*: great disaster, buildings ruined, disturbance of the strata, fissures in the ground, rock-fall from mountains.

SYMBOLS AND ABBREVIATIONS

P	Normal first preliminary tremors; longitudinal waves which have passed below the continental layer.
\overline{P}	Upper first preliminary tremors whose path lies wholly in the continental layer.
P'	Longitudinal waves that have traversed the earth's core.
PR _n	Longitudinal waves reflected "n" times at the earth's surface.
PcP	Longitudinal waves reflected from the outer surface of the earth's core.
S	Normal second preliminary tremors; transverse waves that have passed below the continental layer.
\overline{S}	Second preliminary tremors whose path lies entirely in the continental layer.
PS	Waves transformed from longitudinal to transverse oscillations or vice versa through one reflection at the earth's crust.
SR _n	Normal transverse waves reflected "n" times at the earth's surface.
\overline{ScS}	Normal transverse waves reflected from the outer surface of the earth's core.
\overline{ScPcP}	Waves which start with transverse vibrations but on refraction into the core are changed to longitudinal, or starting as longitudinal are refracted out as transverse.
L	Long waves of irregular form at the beginning of the surface or main phase.
M	Shorter and more regular waves of large amplitude in the surface group which travel more slowly than the L waves.
Mn	Individual waves of relatively large amplitude in the surface phase and usually in the M group.
F	Finis. End of discernible movement.
i	Impetus. Impulsive and sharply defined beginning of a phase.
e	Emersio. Poorly defined emergency of a phase.
m	Maximum wave in any phase.
A	Amplitude of earth motion measured in microns from position of equilibrium. One micron equals .001 mm.
μ	Micron.
A _E	E-W component of A.
A _N	N-S component of A.
A _Z	Vertical component of A.
T	Period of waves.
O	Time of earthquake at the epicenter.
Δ	Arcual distance from station to epicenter.
T _O	Free or undamped period of the seismograph.
V	Static magnification.
ϵ	Ratio of successive damped amplitudes.
r	Friction constant.
J. S. A.	Jesuit Seismological Association. Central Office at St. Louis University, St. Louis, Missouri, U. S. A.
U. S. C. G. S.	United States Coast and Geodetic Survey, Washington, D. C., U. S. A.
C. M. O.	Central Meteorological Observatory, Tokyo, Japan.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM

Date	N-S component.				E-W component.			
	T_0	V	ϵ	$\frac{r}{T_0^2}$	T_0	V	ϵ	$\frac{r}{T_0^2}$
1933								
July	4.4	203	2.5	0.023	4.8	204	2.7	0.029
August	4.4	197	2.4	0.030	4.9	199	2.7	0.034
September	4.5	187	2.5	0.026	4.8	206	2.7	0.029
October	4.5	187	2.4	0.032	4.9	199	2.7	0.030
November	4.5	194	2.4	0.046	4.8	206	2.6	0.041
December	4.4	193	2.3	0.032	4.8	204	2.7	0.034

CONSTANTS OF THE GALITZIN-WILIP INSTRUMENTS

PERMANENT CONSTANTS			
	N-S	E-W	Z
Galvanometer periods	12.3s.....	11.8s.....	11.0s.
Galvanometers to drums	100.5 cm...	100.5 cm...	100.5 cm.
Telescope to seismographs	500 cm.....	492 cm.....	450 cm.
Reduced pendulum lengths.....	11.52 cm...	11.40 cm...	14.82 cm.
TEMPORARY CONSTANTS			
Seismograph period, T^1	12.59	11.90	9.0
Coefficient of damping
Transmission factor, k

SEISMOLOGICAL BULLETIN FOR 1933

JULY, 1933

MACROSEISMIC RECORD

- 1, 17^h 04^m [2, 1:04 A. M.] **Compostela, Davao.** Feeble earthquake.
 2, 17^h 13^m 43^{s*} [3, 1:13:43 A. M.] **NE Mindanao.** Earthquake felt at Butuan, Mambajao, Hinatuan, and Impalutao. Epicenter in the Philippine Deep.
 3, 4^h 31^m [31, 12:31 P. M.] **Cotabato, Mindanao.** Earthquake felt in the Province of Cotabato. Two strong shocks at Upi Agricultural School, Awang.
 6, 10^h 42^m [6, 8:42 P. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña.
 26, 19^h 43^m 51^{s*} [27, 3:43:51 A. M.] **SE Luzon.** Light earthquake of a few seconds duration felt at Naga and Daet.
 30, 12^h 35^m [30, 10:35 P. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			Δ Km.	Remarks	
			h.	m.	s.			
467	2	iPEZ	17	13	43	870	Dilatation. Dilatation from E at Butuan. Felt at Butuan with intensity III-IV. 10° N: 127° 30' E by Manila, Batavia, Nanking.	
		ePN		13	44			
		iSN		15	31			
		iLNE F	18	30				
469	3	PNEZ	15	14	10	2,910		
		SNE		18	36			
		LN		21	13			
		MNE		23	35			
		F	16	24				
482	7	PNEZ	15	21	17	100		
		SNE		21	30			
		F		25				
483	9	PNE	1	37	27	4,345	Light of Z component defective. 45° N; 150° E by U. S. C. G. S. 44° 30' N: 152° 18' E by J. S. A. 43° N: 149° 30' E by Taihoku.	
		SNE		43	24			
		LNE		48	52			
		F	3	40				
485	9	PNE	9	35	40	3,935	45° N: 150° E by U. S. C. G. S. 45° 18' N: 153° 12' E by J. S. A.	
		SNE		41	11			
		LNE		45	41			
		MNE		48	41			
486	9	PNE	11	29	17	4,165	No. 485 still recording.	
		SNE		35	03			
		F	12	30				
487	9	PNE	12	38	07	4,320	Phases after P from the Wiechert. 45° N: 150° E by U. S. C. G. S. 44° 30' N: 152° 18' E by J. S. A. 42° 30' N: 149° E by C. M. O. Japan.	
		SNE		44	03			
		LN		49	26			
		MNE		53	ca			
488	9	PNE	16	14	50	4,090	No. 487 still recording. East coast of Nosyapu-Zaki according to Nagasaki.	
		SNE		20	32			
		LNE		25	31			
		F	17	35				
489	9	PNE	17	59	03	4,310	Same epicenter as No. 488 according to Nagasaki.	
		SNE		18	04			58
		F		19	02			
491	9	PNE	22	22	26	4,290	38° 54' N: 144° 48' E by Taihoku.	
		SNE		28	20			
		F	23	22				
492	10	iPEZ	0	28	11	3,810	Dilatation. Off east coast of Komaisi according to Nagasaki.	
		SNE		33	35			
		LNE		37	30ca			
		F	1	15				
494	10	iPNEZ	10	38	30	2,780	Dilatation. Netherlands East Indies.	
		iSNE		42	47			
		LN		45	30ca			
		F	12	10				
497	11	PNE	0	14	38	115		
		SNE		14	53			
		F		17				

INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
504	13	PNEZ	8	04	26	3,245	From the NE.
		SNE		09	14		
		LE		13	37		
		MNE		16	20ca		
		F		50			
505	13	PNZ	14	29	00	3,600	West Java, according to Batavia.
		SNE		34	11		
		ME		40	25		
		F	15	10			
507	14	PNEZ	1	48	11	6,100	From the SE.
		SNE		55	50		
		F	2	20			
508	14	PNEZ	16	10	35	1,555	From the NE.
		SNE		13	17		
		F		32			
512	15	PNEZ	13	51	00	1,290	
		SNEZ		53	14		
		F	14	05			
514	16	$\overline{\text{PNEZ}}$	4	40	02	190	
		$\overline{\text{SNE}}$		40	26		
		F		54			
517	18	PNEZ	11	28	45	1,735	Disturbed by microseisms. Yokoatari Island, Kagoshima, Japan.
		SNE		31	44		
		LNE		33	ca		
		F		53			
521	18	iPEZ	19	09	33	2,600	Dilatation. $8^{\circ} 15' N$; $143^{\circ} 45' E$ by Guam, Manila, Hong Kong, Nagasaki, Zikawei. Phases after P from the Wiechert.
		ePN		09	34		
		SE		13	38		
		LNE		16	00ca		
		F	20	50			
523	19	$\overline{\text{PNEZ}}$	0	56	28	165	$16^{\circ} 05' N$; $120^{\circ} 55' E$ by Manila and Baguio. Caraballo Mountains.
		$\overline{\text{SNE}}$		56	49		
		F	1	06			
527	19	iPz	15	10	23		$51^{\circ} N$; $174^{\circ} W$ by U. S. C. G. S. $50^{\circ} N$; $170^{\circ} W$ by J. S. A. (Tentative).
		ePNE		10	26		
		SNE(?)		19	00ca		
		F	16	20			
530	20	PNEZ	23	20	28	3,745	Off east coast of Kinkwazan according to Nagasaki.
		SNE		25	48		
		LNE		29	ca		
		ME		31	30		
		F		55			
532	21	iPz	20	26	10	14,970	In region of $48^{\circ} S$; $22^{\circ} W$ according to Strasbourg.
		iP'N		29	17		
		iN		29	28		
		eN		30	06		
		iE		30	29		
		iN		33	45		
		F	22	48			
533	22	iPz	21	06	04	7,120	Compression. $52^{\circ} N$; $169^{\circ} W$ by U. S. C. G. S. $51^{\circ} 54' N$; $166^{\circ} 12' W$ by J. S. A.
		ePNE		04	04		
		iSNE		14	44		
		LNE		26	22		
		MNE		31	30		
		F	23	57			
535	26	iPEZ	19	43	51	225	Compression from SE. Felt at Naga with intensity III.
		ePN		43	51		
		iSNE		44	21		
		F	20	04			
536	27	iPz	21	33	27	2,300	Disturbed by microseisms.
		ePNE		33	29		
		iSNE		37	11		
		iLNE		39	07		
		MNE		41	04		
		F	22	17			
538	28	PNEZ	11	36	25	210	
		$\overline{\text{SNE}}$		36	52		
		F		40			
539	30	PNEZ	17	23	32	2,610	East Java, Bali, Lombok, N. E. I. according to Batavia.
		S?NE		27	37		
		L?NE		30	00		
		MNE		32	15		
		F	18	12			

In addition to the above there were forty five insignificant or undecipherable disturbances on the following days of July: 1st(2), 3rd, 4th(3), 5th(4), 7th(5), 9th(2), 10th(3), 12th(2), 13th(2), 14th(2), 15th(2), 17th(2), 18th(4), 19th(4), 20th, 21st, 24th, and 28th.

AUGUST, 1933

MACROSEISMIC RECORD

3, 8^h 35^m [3, 6:35 P. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña.

3, 14^h 50^m [3, 10:50 P. M.] **Cotabato, Mindanao.** Slight earthquake felt at Cotabato and Awang.

4, 6^h 05^m 35^{s*} [4, 2:05:35 P. M.] **Aparri, Cagayan.** Earthquake of fifteen seconds' duration and intensity III.

6, 13^h 08^m [6, 9:08 P. M.] **Compostela, Davao.** Light earthquake.

7, 12^h 36^m 31^{s*} [7, 8:36:31 P. M.] **NE Mindanao.** Very light earthquake, whose center was in the Philippine Deep, felt at Butuan and Surigao.

7, 18^h 02^m [8, 2:02 A. M.] **Compostela, Davao.** Light earthquake with a repetition at 7:03 P. M. on the 11th.

11, 17^h 21^m 46^{s*} [12, 1:21:46 A. M.] **Virac, Catanduanes.** Earthquake of four seconds' duration and intensity III.

15, 15^h 00^m [16, 1:00 A. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña.

20, 11^h 46^m 12^{s*} [20, 7:46:12 P. M.] **Luzon and Samar.** Earthquake felt over all of southeastern and southern Luzon as far as Manila and throughout northern Samar. Intensity VI in Virac, where it was perceptible for a minute and twenty seconds. The center was in the Pacific about 45 kilometers east of Catanduanes.

Repetitions of the earthquake occurred at 8:07:20 P. M.; 8:28:24 P. M. and 11:00:47 P. M. all of which were recorded in Manila.

21, 11^h 45^m 16^{s*} [21, 7:45:16 P. M.] **NE Mindanao.** Earthquake felt at Surigao with intensity IV and at Butuan with intensity III. Epicenter in Dinagat Sound. A repetition was felt at Virac at 10:02 P. M.

22, 13^h 14^m 02^{s*} [22, 9:14:02 P. M.] **SE Luzon and Samar.** Another earthquake from the same location as that of the 20th. Felt with intensity IV at Virac for a duration of thirty seconds.

26, 3^h 07^m 51^{s*} [26, 11:07:51 A. M.] **Basco, Batan Island.** Earthquake of intensity III and short duration.

26, 21^h 46^m [27, 5:46 A. M.] **Butuan, Agusan.** Very feeble earthquake of short duration.

31, 17^h 28^m [Sept. 1, 1:28 A. M.] **N. Luzon.** Light earthquake felt at Baguio and Kapanagan, Mountain Province.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
540	4	PNEZ SNE F	6	05	35 06 29 15	440	Felt at Aparri, N. Luzon, with intensity III.
541	4	PNEZ SNE F	16	53	42 54 30 17 06	390	
542	4	PNEZ SNE LN F	17	37	52 42 20 45 10 18 20	2,935	
543	5	iPNEZ SNE LNE MNE F	0	52	16 58 40 1 06 00 09 25 2 20	4,790	Solomon Islands by Manila, Koti, Hong Kong, Riverview.
547	7	PNEZ SNE mN F	12	36	31 37 58 40 40 13 42	795	Felt at Surigao and Butuan, NE Mindanao, with intensity III. Epicenter in the Philippine Deep.
549	9	PNEZ SNE LE F	21	04	53 07 50 09 17 33	1,710	
550	10	PNEZ SNE F	0	41	36 42 02 1 04	200	Baguio, $\Delta=120$ km. \bar{S} from the Wiechert and Horizontals.
555	11	PNEZ SNE mNE F	2	37	47 39 04 40 28 3 14	690	Butuan, $\Delta=155$ km.
556	11	iPZ ePNE iNE iSNE iLNE ME F	8	59	17 59 18 59 20 9 03 46 06 40 10 10ca 10 45	2,965	Dilatation. In region of 27° N: 97° E by Chiufeng, Hong Kong, Taihoku, Batavia.
559	11	ePNEZ SNE SNE F	17	21	46 22 51 23 16 35	570	Felt at Virac, Catanduanes Island.
561	12	iPZ ePNE SNE iLN MNE F	7	34	16 34 16 38 48 42 28 45 20ca 8 15	3,010	
566	13	iPZ iPNE iSNE iLN MNE F	9	39	58 40 01 49 45 10 04 12 10 ca 11 22	8,365	Dilatation. SW Indian Ocean.
571	15	PNEZ iZ iNE iSNE LNE MNE F	3	03	20 03 25 03 32 07 46 10 30 12 50 4 15	2,910	29° $12'$ N: 144° E according to Taihoku.
573	15	PNEZ SNE iN F	10	38	50 39 40 39 54 11 35	400	18° N: 122° E by Manila and Baguio.
578	18	ePNEZ SNE LNE F	8	23	48 27 01 28 40 50	1,905	
581	20	PNEZ SNE F	4	18	26 18 54 29	210	

INSTRUMENTAL RECORD—Continued

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No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
582	20	iPNEZ	11	46	12	430	Compression. Felt in SE Luzon with intensity VI. Phases after P from the Wiechert and Horizontals. $13^{\circ} 37' N$: $124^{\circ} 50' E$ by Manila Baguio and Butuan.
		iSNE		47	04		
		iSNE		47	18		
583	20	PNE	12	07	20	435	No. 582 still recording. From the Wiechert. Aftershock of No. 582.
		SNE		08	13		
584	20	PNE	12	28	24	435	Aftershock of No. 582. From the Wiechert.
		SNE		29	17		
589	21	PNEZ	11	45	16	720	Felt at Surigao with intensity IV. Epicenter in Dinagat Sound.
		SNEZ		46	36		
		mNE F	12	47	05ca		
595	22	PNE	3	04	18	2,375	
		SNE		08	08		
		LNE		10	03		
		MNE		12	ca		
		F		37			
597	22	iPNEZ	13	14	02	435	Compression. Same epicenter as No. 582. Phases after P from the Wiechert. Felt in SE Luzon.
		iSNE		14	55		
		mNE		15	26		
598	22	PNE	14	02	44	435	Aftershock of No. 582.
		SNE		03	37		
601	23	PNEZ	12	15	34	435	Do.
		SNE		16	27		
		F		28			
618	25	iPZ	7	55	42	2,710	Compression. Phases after P from the Wiechert. $31^{\circ} N$: $101^{\circ} E$ by U. S. C. G. S. $30^{\circ} 54' N$: $103^{\circ} 12' E$ by J. S. A. $30^{\circ} 30' N$: $103^{\circ} 30' E$ by Chiufeng.
		iPNE		55	44		
		iSNE		59	54		
		iLNE	8	02	27		
		MNE F	11	05 55	ca		
622	26	iPNZ	3	07	51	640	Dilatation. Felt at Basco, Batan Is. Approx. $20^{\circ} 30' N$: $121^{\circ} E$ by Manila, Taihoku, Hong Kong.
		ePE		07	51		
		iSNZ		09	03		
		iN		09	33		
		iNE		10	03		
		F		30			
626	28	PNEZ	0	54	50	175	
		SNE		55	12		
		F		59			
629	28	PNEZ	22	36	12	14,350	$60^{\circ} S$: $28^{\circ} W$ according to Strasbourg.
		iP'NEZ		39	07		
	F	29	2	00			
631	29	iPNZ	15	11	34	11,445	Dilatation. $8^{\circ} 24' S$: $70^{\circ} 36' W$ according to J. S. A.
		iPE		11	36		
		iN		12	16		
		iE		13	03		
		iNE		16	36		
		iN		20	14		
		F	16	20			
633	31	PNE	19	37	07	200	
		SNE		37	33		
				41			

In addition to the above there were sixty-four insignificant or undecipherable disturbances on the following days of August; 5th(3), 9th, 10th(3), 11th(4), 12th(2), 13th(4), 14th(2), 15th, 17th(4), 18th, 19th, 20th(2), 21st(7), 22nd(2), 23rd(10), 24th(7), 25th(2), 26th(4), 28th(2), 29th, and 31st.

SEPTEMBER, 1933

MACROSEISMIC RECORD

2, 11^h 32^m 41^{s*} [2, 7:32:41 P. M.] **Legaspi, Albay.** Light earthquake of intensity III and six seconds' duration.

7, 17^h 55^m 50^{s*} [8, 1:55:50 A. M.] **Mindanao.** Earthquake in the Philippine Deep felt throughout eastern Mindanao but only lightly.

10, 11^h 18^m [10, 7:18 P. M.] **Butuan, Agusan.** Very feeble earthquake of short duration.

10, 12^h 24^m [10, 8:24 P. M.] **Basco, Batan Island.** Very light earthquake of short duration.

12, **Cotabato, Mindanao.** Two shocks felt in the early morning. Time not reported.

12, 8^h 01^m 01^{s*} [12, 4:01:01 P. M.] **Baguio, Mountain.** Very light earthquake.

12, 18^h 15^m [13, 2:15 A. M.] **Basco, Batan Island.** Earthquake of intensity III and two seconds duration.

15, 12^h 40 [15, 8:40 P. M.] **Cotabato, Mindanao.** Another double shocks felt at Cotabato and Awang.

18, 14^h 50^m [18, 10:50 P. M.] **Hinatuan, Surigao.** Slight earthquake.

19, 22^h 05^m [20, 6:05 A. M.] **Baco, Mindoro.** Moderately strong shock felt at the Halcon Rubber Station.

20, 23^h 34^m 07^{s*} [21, 7:34:07 A. M.] **Southern Luzon and Marinduque.** Earthquake felt over all of southern Luzon from Manila to Atimonan with uniform intensity of III-IV. The center was between Mindoro and Marinduque.

22, 3^h 28^m [22, 11:28 A. M.] **Ormoc, Leyte.** Earthquake of intensity IV and forty seconds' duration.

23, 4^h 13^m [23, 2:13 P. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña.

27, 5^h 34^m 26^{s*} [27, 1:34:26 P. M.] **Legaspi, Albay.** Earthquake of intensity III and five seconds' duration.

28, 18^h 57^m 48^{s*} [29, 2:57:48 A. M.] **Southern Luzon.** Earthquake felt in Manila with intensity III and twenty seconds' duration. Also felt in Lucban, Tayabas and Limay, Bataan.

30, 18^h 50^m 39^{s*} [Oct. 1, 2:50:39 A. M.] **Virac, Catanduanes.** Earthquake of intensity III and ten seconds' duration.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
634	1	P?NEZ S?NE F	23	07	12 10 06 38		Disturbed by microseisms. Guam, Δ=6°.
636	2	PNE SE SNE F	11	32	41 33 30 33 41 42	400	Felt at Legaspi, SE Luzon.
637	2	PNE SNE F	16	45	42 49 28 18 00	2,325	Dilatation. From the Wiechert. Guam. Dilatation. S-P, =3m. 30° 42' N: 139° 36' E by Koti.
638	3	iPNZ iSN iLN MN F	3	49	12 51 20 52 30ca 53 44ca 4 50	1,210	Compression. 5° N: 126° E by Manila and Pelew.
640	5	iPz ePNE SNE LN MN F	18	02	01 02 01 05 57 08 ca 10 14 37	2,480	Compression.
641	6	iPNE iSNE F	1	18	20 18 37 20	135	
645	6	iPz iPNE SNE F	22	18	38 18 39 26 57 0 15	6,765	Dilatation from SE. Between Kermadec and Tonga according to Wellington.
647	7	iPNEZ iSNZ MN F	17	55	50 57 48 58 06 19 30	1,135	Dilatation from the SE. 5° 30' N: 126° 30' E by Manila, Hong Kong and Batavia.
649	8	PNE SE F	16	00	08 02 30 20	1,365	
651	9	ePNEZ iSNEZ SR ₂ E LN ME F	5	08	05 12 33 14 11 15 17 17 34 45	2,935	Very sharp S. 44° N: 131° E according to Taihoku.
635	9	iPz iPE ePN iSNEZ L F	21	29	08 29 09 29 09 36 14 44 ca 23 20	5,545	Compression. 14° 30' S; 162° E by Manila, Honolulu, Hong Kong.
656	12	iPNEZ iSNE F	8	01	01 01 24 20	180	Dilatation from NE. Data after P from the Wiechert. Felt at Baguio.
657	13	PNEZ SNE F	0	25	00 25 19 30	150	
658	14	PNE SE F	13	38	40 38 50 40	75	
660	15	PNE SNE F	4	02	42 03 15 07	240	From the Wiechert.
662	16	PNE SNE F	17	52	25 52 41 56	125	Do.
665	20	iPNZ ePE SNE F	21	44	20 44 20 44 40 22 14	160	Dilatation. S from the Wiechert.
666	20	iPNEZ iSNE F	23	34	07 34 27 1 15	160	Compression from SE. Epicenter between Marinduque and Mindoro. Felt throughout southeast Luzon. S from the Horizontals.

INSTRUMENTAL RECORD—Continued

International
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No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
667	21	PNEZ	3	20	01	2,855	37° 06' N: 137° E by Kotl.
		SNE		24	23		
		LNE		27	ca		
		ME		29	31		
		F	4	45			
663	21	iPz	9	54	17	3,245	Compression. 39° 18' N: 143° E by Taihoku.
		ePNE		54	17		
		SNE		59	05		
		LNE	10	02	33		
		MN		05	ca		
F	11	35					
670	21	iPNEZ	13	49	43	3,065	From the NE.
		SN		54	19		
		LNE		57	45		
		F	14	30			
671	22	iPz	11	47	53	3,020?	Disturbed by microseisms.
		ePNE		47	53		
		S?NE		52	26		
		L?NE		55	25		
		F	13	05			
675	23	PN	0	35	05	2,920	Z recording under adjustment. No time eclipses on E-W. Probably 20° 30' N: 146° E by Guam and Manila.
		SN		39	30		
		LN		40	09		
		F	1	15			
681	23	iPN	18	28	08	180	
		SNZ		28	31		
		F		32			
682	24	PNZ	8	07	28	200	
		SNZ		07	54		
		F		11			
683	24	iPNZ	15	29	55	7,165	Compression. 51° N: 177° W by U. S. C. G. S. 51° 54' N: 174° 24' E by J. S. A.
		SN		38	37		
		L?N		48	30ca		
		F	18	30			
685	25	ePNZ	13	04	08	140	
		SNZ		04	26		
		F		09			
686	25	iPNEZ	13	48	19	3,335	Compression from SE. Data after P from the Wiechert.
		SNE		53	12		
		LNE		56	33		
		MNE		59	20ca		
		F	15	53			
687	25	PNEZ	18	58	43	4,310	Dilatation. 43° N: 93° E according to Taihoku.
		SNEZ	19	04	44		
		LE		10	26		
		ME		13	31		
		F	21	55			
695	27	ePNE	5	34	26	420	Felt at Legaspi, SE Luzon.
		SE		35	30		
		F		41			
696	27	iPz	21	48	28	3,720	Dilatation.
		ePNE		48	29		
		iSNEZ		53	47		
		LNEZ		57	45		
		MN	22	01	10		
F		50					
697	28	iPEZ	0	30	24	1,100	Compression. 6° N: 126° E by Manila, Batavia, and Amboina.
		ePN		30	24		
		iSNE		32	21		
		F	1	35			
699	28	iPNZ	18	57	48	150	Dilatation. Felt in Manila. Data after P from the Horizontals.
		SNZ		58	07		
		F	19	30			
700	29	ePNE	13	14	22	145	From the Wiechert.
		iSNE		14	40		
		F		18			
701	30	ePNE	14	26	24	2,825	From the Wiechert. 0°; 143° E according to Taihoku.
		PR ₁ N		26	59		
		SNE		30	44		
		LNE		33	17		
		F	15	24			
702	30	PNE	18	50	39	305	Felt at Virac, Catanduanes Island. From the Wiechert.
		SNE		51	20		
		F		54			

In addition to the above there were thirty-three insignificant or undecipherable disturbances on the following days of September; 2nd, 4th, 6th(3), 7th(2), 8th, 9th, 11th(2), 14th, 15th, 16th, 17th, 21st(3), 22nd, 23rd(5), 25th, 26th(5), 27th(2), and 28th.

OCTOBER, 1933

MACROSEISMIC RECORD

10, 16^h 49^m [11, 2:49 A. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña.

10, 20^h 40^m 02^s* [11, 4:40:02 A. M.] **Baguio, Mountain.** Earthquake of intensity II felt by a few persons.

16, 4^h 55^m [16, 12:55 P. M.] **Cebu, Cebu.** Earthquake of intensity III and short duration.

19, 14^h 15^m [19, 10:15 P. M.] **Masbate, Masbate.** Earthquake of intensity III and five seconds' duration.

20, 23^h 27^m 42^s* [21, 7:27:42 A. M.] **Baguio, Mountain.** Earthquake of intensity II.

23, 20^h 29^m [24, 6:29 A. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña. Another earthquake at 7:23 P. M. on the 26th.

INSTRUMENTAL RECORD

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No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
706	2	ePNEZ	14	08	09	4,335?	Disturbed by microseisms.
		S?NE		14	06		
		LNE		19	40		
		MN		24	20ca		
		F	15	40			
707	2	iPz	15	49	21	11,955?	Compression. PS from the Wiechert, doubtful. St. Elena Peninsula. Ecuador.
		ePNE		49	23		
		PS?E	16	02	58		
708	3	ePNEZ	10	41	06	2,490	
		SNE		45	03		
		F	11	20			
709	3	ePNEZ	16	11	20	220	
		SNEZ		11	50		
		F		16			
712	3	PNEZ	18	44	42	3,065	Niigata Prefecture, Japan, according to Koti.
		PR ₁ NE		45	26		
		SN		49	18		
		LNE		52	18		
		F	19	40			
714	4	ePNEZ	14	47	41	195	
		SNE		48	06		
		F	15	01			
715	4	PNEZ	17	28	32	2,680	
		iSNE		32	42		
		F	18	15			
716	5	ePNEZ	13	40	00	6,700	
		iSN		48	14		
		eSEZ		48	14		
		LNE		59	07		
		MN	14	03	ca		
F	15	35					
720	10	PNEZ	20	40	02	160	Felt at Baguio. Data after \bar{P} from the Wiechert.
		SNE		40	22		
		F		48			
725	16	PNE	18	02	47	720	From the Wiechert. Microseisms.
		S?NE		04	07		
		F		22			
731	22	PNZ	12	02	06	5,035	No time eclipse on E-W.
		SN		08	44		
		LN		15	ca		
		MN		19	ca		
		F	13	30			
732	22	PNZ	18	49	33		
		SN		50	24		
		F		53			
736	24	PNEZ	16	11	47	510	S from the Wiechert. Microseisms.
		SNE		12	47		
		F		33			
737	25	PNEZ	0	52	17	570	Disturbed by microseisms.
		S?NE		53	23		
		F	1	11			
738	25	P'NEZ	23	48	18	18,745?	22° S: 67° W by U. S. C. G. S. 22° S: 68° W by J. S. A. Disturbed by microseisms.
		PR ₁ ?NE		53	31		
		F	2	04			
740	27	PNE	5	44	43	1,365	
		SNE		47	05		
		LE		48	20ca		
		MNE		49	30ca		
		F	6	04			
745	30	P?NEZ	7	08	57		In region of 16° S: 165° E according to Wellington.
		SNE		16	25		
		LNE		28	30ca		
		MN		33	ca		
		F	8	30			

In addition to the above there were twenty-seven insignificant or undecipherable disturbances on the following days of October; 1st(2), 2nd, 3rd(2), 4th, 7th(3), 12th, 14th(3), 16th, 17th, 20th, 21st(2), 23rd(3), 26th, 28th(2), 29th(2), and 31st.

NOVEMBER, 1933

MACROSEISMIC RECORD

6, 20^h 30^m [7, 4:30 A. M.] **Butuan, Agusan.** Very feeble earthquake of short duration.

8, 15^h 30^m [9, 1:30 A. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña.

9, 7^h 34^m 08^{s*} [9, 3:34:08 P. M.] **Davao, Mindanao.** Light earthquake at Lais and Davao.

13, 1^h 35^m 33^{s*} [13, 9:35:33 A. M.] **Luzon.** Earthquake in Central Luzon. Felt at Manila with intensity III, at Baguio, Bamban, and Olongapo.

14, 2^h 55^m [14, 10:55 A. M.] **Masbate, Masbate.** Earthquake of intensity III.

16, 6^h 48^m [16, 4:48 P. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña. Aftershocks at 6:06 P. M.; 6:14 P. M. and 7:40 P. M.

26, 22^h 51^m 23^{s*} [27, 6:51:23 A. M.] **Luzon.** Earthquake felt in southern and Central Luzon. The center was in Lamon Bay, east of Luzon.

28, 1^h 05^m [28, 11:05 A. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
747	2	iPNZ	12	37	19	7,145	52° N: 176° W according to U. S. C. G. S. 45° N: 168° W according to J. S. A.
		ePE		37	19		
		SNE		46	04		
		LNE		59	00		
		F	14	06			
748	5	iPN	20	32	30	2,980	26° N: 97° E by Manila and Chiufeng according to Taihoku.
		ePEZ		32	30		
		SNE		37	00		
		LNE		39	16		
		MNE		41	ca		
		F	21	44			
749	7	PNE	6	45	04	2,390	
		SNE		48	54		
		LNE		51	20ca		
		MN		53	ca		
		F	7	45			
750	9	PNEZ	7	34	08	1,145	Felt at Davao with intensity II.
		SNEZ		36	07		
		F		52			
752	13	iPNEZ	1	35	23	160	Compression from the NW. Felt in Manila with intensity III. S from the Wiechert and Horizontals.
		SNE		35	53		
		F		45			
753	16	ePNEZ	16	48	11	850	
		SNE		49	43		
		F	17	04			
754	17	PNEZ	9	48	51	1,500	
		SN		51	26		
		F	10	08			
755	18	eP?NEZ	2	23	46	1,610?	
		SNE		26	33		
		LNE		28	00ca		
		MNE		29	30ca		
		F	3	05			
756	18	iPz	4	01	29	4,420	Dilatation. 7° 40' S; 153° 40' E by Riverview, Manila, Chiufeng. Christchurch, Nanking.
		ePNE		01	29		
		SNE		07	31		
		LE		13	05		
		F	5	04			

INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
758	18	iPN	16	46	14	2,490	
		SNE		50	11		
		F	17	50	00		
759	18	iPNEZ	22	03	59	135	Dilatation.
		SNEZ		04	16		
		F		08			
760	19	iPEZ	3	20	56	6,055	Compression. In region of 15° S; 165° E by Riverview, Sydney, Manila 17° S: 165° E by Wellington.
		ePN		20	56		
		SNE		28	32		
		LNE		37	20ca		
		MNE		42	35ca		
		F	5	13			
761	19	PNEZ	8	04	04	140	Dilatation.
		SNEZ		04	22		
		F		10			
762	19	PNEZ	9	13	55	2,980	25° N: 97° E by Manila and Chiufeng, according to Taihoku.
		SNE		18	25		
		LNE		21	20ca		
		F		50			
766	20	PNEZ	23	34	43	10,260	Compression from the north. Data after P from the Wiechert. The Wiechert N-S record accidentally spoiled. 73° N: 67° W by U. S. C. G. S. 72° N: 70° W by J. S. A.
		PR ₁ E		38	25		
		ie		40	46		
	ie		46	35			
	21	PSE	0	47	ca		
F		1	30				
770	22	iPN	12	49	20	3,755	Data after P from the Wiechert, in region of 7° S: 149° E.
		ePEZ		49	20		
		SNE		54	41		
		LNE		58	51		
		MNE	13	01	50ca		
		F	14	40			
772	22	PNEZ	22	35	40	1,810	Amosima, Ryukyo according to Taihoku. 28° 18' N: 129° 24' E.
		SNE		38	45		
		LE		40	20ca		
		F	23	30			
782	26	iPNEZ	22	51	23	150	Dilatation. Felt in Manila with intensity III. Data after P from the Horizontals. 14° 22' N: 122° 20' E by Manila and Baguio.
		SNE		51	42		
		F	23	18			
786	28	iPZ	11	19	36	6,965	
		ePE		19	36		
		ie		20	52		
		iSNE		28	05		
		LNE		39	30ca		
		MNE		44	40ca		
		F	13	15			

In addition to the above there were twenty-one insignificant or undecipherable disturbances on the following days of November: 10th, 18th, 19th(3), 21st, 22nd(3), 23rd(3), 25th(4), 26th(2), and 27th(3).

INSTRUMENTAL RECORD



No.	Date	Time	Place	Intensity	Duration	Remarks
177	12-2-33	8:44:36 P. M.	Basco, Batan Island	VII	15	Earthquake felt with intensity VII and duration of fifteen seconds. Objects overthrown; people badly frightened. The epicenter was fifteen kilometers from Basco near Sabtang Island.
178	12-3-33	2:08 A. M.	Guam, Marianas Islands			Earthquake recorded and felt at Agaña.
179	12-9-33	5:35 P. M.	Naga, Camarines Sur	III		Earthquake of intensity III.
180	12-17-33	7:25 P. M.	Butuan, Agusan			Feeble earthquake of short duration.
181	12-17-33	9:11 P. M.	Compostela, Davao			Light earthquake.
182	12-18-33	3:06 P. M.	Butuan, Agusan		15	Very feeble earthquake of fifteen seconds' duration.
183	12-24-33	5:42 A. M.	Guam, Marianas Islands			Earthquake recorded and felt at Agaña.

DECEMBER, 1933

MACROSEISMIC RECORD

- 2, 8^h 44^m 36^s* [2, 4:44:36 P. M.] **Basco, Batan Island.** Earthquake felt with intensity VII and duration of fifteen seconds. Objects overthrown; people badly frightened. The epicenter was fifteen kilometers from Basco near Sabtang Island.
- 3, 16^h 08^m [4, 2:08 A. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña.
- 9, 9^h 35^m [9, 5:35 P. M.] **Naga, Camarines Sur.** Earthquake of intensity III.
- 17, 11^h 25^m [17, 7:25 P. M.] **Butuan, Agusan.** Feeble earthquake of short duration.
- 17, 13^h 11^m [17, 9:11 P. M.] **Compostela, Davao.** Light earthquake.
- 18, 7^h 06^m [18, 3:06 P. M.] **Butuan, Agusan.** Very feeble earthquake of fifteen seconds' duration.
- 24, 19^h 42^m [25, 5:42 A. M.] **Guam, Marianas Islands.** Earthquake recorded and felt at Agaña.

In addition to the above there were considerable instrumental or macroseismic disturbances on the following days: 12-10-33, 12-11-33, 12-12-33, 12-13-33, 12-14-33, 12-15-33, 12-16-33, 12-18-33, 12-19-33, 12-20-33, 12-21-33, 12-22-33, 12-23-33, 12-25-33, 12-26-33, 12-27-33, 12-28-33, 12-29-33, 12-30-33.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
787	1	PNEZ SN F	10	36	32 44 56	5,910	Deep focus according to Riverview.
788	2	iPNZ ePe iSNEZ MNE F	5	28	57 57 38 40 39 ca 7 00	8,270	Dilatation.
789	2	iPNEZ iSNE F	8	44	36 45 45 9 40	610	Compression. Data after P from the Wiechert. Felt at Basco, Batan Island, with intensity VII. 20° 20' N; 121° 55' E by Taihoku, Hong Kong, Manila, Zikawei, Chiufeng, Nanking.
790	2	P'NEZ F	20	24	00ca 23 00		Long distance earthquake. Other phases doubtful.
794	4	iPNEZ iSNEZ iLNE F	19	40	39 46 01 50 00ca 21 10	3,765	Dilatation. La Perouse Strait according to Chiufeng. 46° 36' N: 144° E according to Koti.
802	8	PNEZ SNE LNE MNE F	17	03	07 05 07 06 11 07 10ca 15	1,155	
808	12	iPz ePNE S?NE MNE F	14	18	23 18 23 23 05 27 40ca 16 10	3,145?	Dilatation. 5° S: 153° E by Riverview, Manila, Chiufeng, Adelaide, Perth, Nanking as on Jan. 18th, 1930. Data after P from the Wiechert.
809	13	eE PR ₁ PSE LE F	21	42	46 44 26 54 35 22 22 ca 23 55	13,880	Interpretation by Macelwane's new tables. 18° 30' N: 103° 30' W by J. S. A.
813	17	PNEZ SNE F	18	21	05 22 19 42	660	
814	18	PNE S?NE F	20	41	32 43 14 21 11	960?	Disturbed by microseisms.
816	19	PE SN F	14	28	48 30 17 48	800	Probably near 10° N; 126° 30' E by Butuan and Mazila.
819	22	PNE SNE F	17	57	20 58 07 18 12	370	
820	22	PNEZ SNE F	19	42	37 43 26 54	395	
822	24	ePNEZ PR ₂ N iE SNE LE F	10	52	20 53 48 55 15 57 45 11 02 15ca 12 20	3,820	
825	27	PNEZ SNEZ F	10	51	03 52 37 11 15	880	9° N: 126° 40' E by Butuan and Manila.
829	27	ePNEZ SNE F	16	40	10 41 54 17 00	980	
830	29	ePNEZ SNEZ F	9	50	57 51 30 10 01	240	
831	30	ePNEZ SNE LNE F	5	31	02 34 28 36 30 6 13	2,070	
832	30	ePNEZ SNE MNE F	8	48	13 50 44 53 00ca 9 22	1,455	

In addition to the above there were twenty-eight insignificant or undecipherable disturbances on the following days of December: 3rd(2), 4th, 5th 6th(2), 7th, 8th(3), 9th(2), 10th(2), 11th, 14th(2), 19th, 21st(2), 23rd, 26th(2), 27th(3), and 30th.

NUMBER OF EARTHQUAKES FELT IN THE PHILIPPINES, FROM 1903 TO 1933

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1903	12	5	8	8	15	13	9	24	10	12	17	8	141
1904	22	10	10	9	6	8	11	5	11	15	4	6	117
1905	14	8	12	11	10	8	12	10	11	16	8	12	132
1906	13	6	5	12	6	11	9	9	9	11	5	7	103
1907	13	7	10	14	22	17	14	16	5	5	15	7	145
1908	17	6	11	6	13	9	5	11	8	10	15	11	122
1909	11	8	9	13	12	5	12	12	14	10	5	9	120
1910	13	13	14	12	23	18	22	8	12	21	23	17	196
1911	12	14	21	13	17	15	13	27	29	19	16	18	214
1912	14	21	28	16	15	18	22	15	15	14	12	12	202
1913	9	18	25	5	15	15	12	13	11	7	8	10	148
1914	15	17	12	10	5	11	14	12	13	10	13	14	146
1915	11	14	12	11	14	15	18	12	12	14	12	14	159
1916	13	15	12	7	8	8	15	18	20	15	7	5	143
1917	6	11	13	12	11	11	7	12	12	17	21	13	146
1918	12	17	8	12	19	11	16	14	11	13	20	14	167
1919	12	11	16	8	8	16	17	15	13	11	11	13	151
1920	19	11	12	7	15	10	8	18	8	18	12	9	147
1921	9	7	10	7	20	16	16	13	17	19	15	15	164
1922	15	12	16	13	21	15	13	14	11	14	17	11	172
1923	6	9	20	17	10	6	18	10	19	16	25	14	170
1924	11	12	15	14	15	8	13	14	15	13	7	12	149
1925	17	18	15	18	15	20	13	10	18	24	18	18	204
1926	23	16	11	13	13	4	13	12	7	18	10	18	158
1927	16	14	7	14	11	22	12	8	10	9	20	10	153
1928	11	14	11	15	7	15	6	9	5	5	7	9	114
1929	18	12	12	18	18	9	25	11	14	12	23	15	187
1930	10	13	11	9	10	8	10	15	17	14	9	7	133
1931	18	16	24	20	22	17	22	13	12	19	11	19	213
1932	17	17	18	19	19	16	8	37	16	15	12	20	214
1933	15	32	15	13	13	13	6	19	16	7	11	8	168

The number of violent and destructive earthquakes (VII to X) during these years was 69. In 1913, there were 6; 1907, 5; 1915, 1919, 1923 and 1925, 4; 1910, 1917, 1918, 1920, 1921, 1922, 1928 and 1933, 3; 1904, 1905, 1912, 1924, 1929 and 1931, 2; 1903, 1909, 1911, 1916, 1926 and 1932, 1. Their monthly distribution is the following: January 4, February 3, March 6, April 7, May 6, June 4, July 4, August 5, September 7, October 4, November 10, and December 9.

NUMBER OF SEISMIC DISTURBANCES RECORDED AT MANILA, FROM 1903 TO 1933

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1903	21	20	13	15	16	6	16	16	8	13	9	14	167
1904	15	19	11	19	17	35	25	18	16	26	18	18	237
1905	30	23	18	22	22	29	28	9	24	26	14	19	274
1906	30	17	22	27	13	35	11	14	14	86	21	26	316
1907	16	12	21	32	35	17	19	15	21	14	43	14	259
1908	16	14	23	15	20	12	14	15	9	108	25	24	295
1909	21	24	24	22	25	14	26	15	20	6	13	7	217
1910	20	17	20	17	17	21	19	11	12	18	15	29	216
1911	16	19	30	22	24	30	31	35	30	28	28	22	315
1912	27	16	30	24	23	35	27	35	20	20	31	34	322
1913	44	20	37	61	42	25	22	41	36	24	13	6	371
1914	22	35	30	48	25	23	24	20	22	26	32	22	329
1915	27	19	21	32	38	33	28	28	30	24	27	31	338
1916	37	46	43	38	37	28	31	28	31	39	22	17	397
1917	31	27	27	35	47	34	39	33	27	43	38	25	406
1918	62	35	32	44	47	45	42	23	48	20	24	17	420
1919	37	31	42	44	47	45	42	23	48	20	24	17	420
1920	30	35	17	25	48	40	30	34	32	47	15	19	372
1921	19	23	37	20	80	35	42	25	40	19	24	27	391
1922	41	25	20	41	50	33	33	46	39	32	24	37	421
1923	16	42	34	31	49	20	38	35	46	30	53	22	416
1924	24	31	27	48	74	26	33	30	59	24	20	23	419
1925	36	27	34	28	77	43	26	22	35	38	97	35	498
1926	30	20	32	23	29	41	27	52	34	38	29	22	377
1927	27	28	24	36	39	36	36	32	16	33	32	13	352
1928	24	25	31	27	29	97	18	34	33	22	33	35	408
1929	67	41	46	35	39	74	51	43	32	28	45	47	548
1930	32	39	61	54	93	58	29	48	67	85	39	39	644
1931	77	74	86	63	76	70	97	37	62	65	51	49	807
1932	49	56	44	71	55	66	60	61	109	93	52	60	776
1933	71	78	84	63	83	85	75	94	69	44	40	48	834

- 1903. Installation of Vicentini Seismograph.
- 1907. Installation of Horizontal Pendulums.
- 1911. Installation of Weichert 1000 Kg. Inverted Pendulum.
- 1930. Installation of Galitzin-Wilip Seismographs. 3 components.

A VERY DEEP EARTHQUAKE IN THE PHILIPPINES

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The general interest now shown by seismologists in deep earthquakes prompted the writer to investigate their occurrence in the Philippine Islands. An examination was made of all seismograms on file in the Manila Observatory subsequent to 1911, the date of installation of the Wiechert Inverted Pendulum.

Among those found which had the appearance of considerable depth, that of April 8th 1929 was selected for investigation because the International Summary gave an epicenter and the depth of focus, and the data seemed to be fairly copious.

MATERIAL. Thirty observatories responded to the request for seismograms and three sent information that their records did not show sufficient amplitude to be of any value. It is believed that helpful data have been lost to the investigation by the failure of some observatories to transmit their records or copies. In addition to the above seismograms there were available at Manila the records of the Wiechert, Vicentini and Horizontal Pendulums of Manila and the Wiechert record of Butuan.

MACROSEISMIC DATA. This was very sparse. The earthquake was reported as having been felt slightly at Lais, southeastern Mindanao, and moderately in Butuan, northeastern Mindanao. It is not believed that the perception was actually confined to these places only. The epicenter is in a mountainous Moro district from which little information is obtained.

THE EPICENTER. The International Summary placed the epicenter at $7^{\circ} 48'$ North and $124^{\circ} 36'$ East and the time at origin $10^{\text{h}} 16^{\text{m}} 48^{\text{s}}$, G.M.T. This is a location which has not been known as an earthquake area and the writer was skeptical about the accuracy of the determination.

A misinterpretation of the Butuan seismogram led to the location of an epicenter in Butuan Bay and distances to all observatories were calculated. A reëxamination of the Butuan seismogram showed that the first motion was in a general NE-SW azimuth, and the fact that the first motion at Manila was a compression led to the adoption of the epicenter given by the International Summary.

The calculations based on the Butuan Bay position were not valueless. After the P-curve had been drawn as of the International Summary position, a slight shift of the distances to suit the Butuan Bay position showed that they were less satisfactory, especially in the early parts of the curve.

FOCUS. The International Summary gives the focal depth as $0.09R$, which is 573 km, and the time at focus as $10^{\text{h}} 16^{\text{m}} 48^{\text{s}}$. The present investigation gives a focal depth of 585 km and the time at focus at $10^{\text{h}} 16^{\text{m}} 53^{\text{s}}$. The details are to be found in the subsequent sections of this paper.

THE TRAVEL TIME CURVES. The epicentral distances and the time at focus were taken from the International Summary. The times of P as given by the Summary agreed very well with the values read by the writer from the original records or contact copies. Where these were not available the times were taken from the Summary.

Other phases not given in the Summary were read from the records. The plotting of the times of S and other observed phases showed that in some cases there were mis-

interpretations of S, as was to be expected where the observers had only their own records at hand.

The curves for P and S are the most satisfactory. PR and $S_cP_cS_c$ are also quite good. A series of points beyond 85° probably represents SP. A very important section of pP was obtained. Portions of sP and sPP also appear. A lack of material prevented us from establishing reliable curves for other impulses that appeared on the records.

TIME AT FOCUS. Following Scrase (Phil. Trans. Roy. Soc. London, Vol. 231) the values of S-P were plotted as ordinates against P-arrival times as abscissae. This gave a very good graph, especially under 30° epicentral distance, and indicated the time at focus as $10^h 16^m 53^s$. The horizontal axis of the travel times curves was moved up to coincide with this time. (See Figure 1.)

DEPTH OF FOCUS. A comparison was made between the P-H values obtained by Stechschulte for a focal depth of 410 km (Bull. Seis. Soc. Amer., Vol. 22, No. 2) and those obtained in the present earthquake. The smaller travel times in the present earthquake indicate a focal depth appreciably greater than 410 km.

The difference is of the order of twenty seconds for epicentral distances greater than 50° . The writer has access to a set of travel time curves for different focal depths, constructed by Brunner of St. Louis, but not yet published. These curves show that a difference of about ten seconds in travel time at distances beyond 50° indicates a difference of 100 km in focal depth. It follows that the earthquake of April 8th 1929 had a focal depth approaching 600 km, to be conservative.

Comparing our P-H intervals with those of Scrase (Proc. Roy. Soc. Vol. 132, 1931) for $h=.09$ and distances greater than 50° we obtain;

Distance	Travel time in seconds		Difference
	Scrase	Repetti	
$^\circ$	s.	s.	s.
54.4	516	516	0
62.3	565	568	2
70.8	621	621	0
88.9	728	715	13
110.2	835	813	22

These residuals show that beyond 70° the P-curve of the Mindanao earthquake slopes down below Scrase's curve, another indication of greater depth.

Helwan, Pulkovo and Zagreb gave points on the pP curve that were very important. They fixed the pP curve, in the region of 90° , at a time interval of 2m 5s from the P curve. Comparing this value with those given by Scrase (Phil. Trans. Roy. Soc. London, Vol. 231) and interpolating we find a depth of focus of 585 km.

In the deep earthquake of February 20th 1931 Scrase calls attention to a conspicuous change in slope of the S curve at 86° , and mentions that Miss Lehmann found a similar change at 89° in the case of a normal earthquake. In our case the change in slope occurs at about 81° or 82° .

The L and M waves were so insignificant, and in many cases lacking, that no attempt was made to plot their curves.

Table I gives the phases which were observed, either in the original records or contact copies.

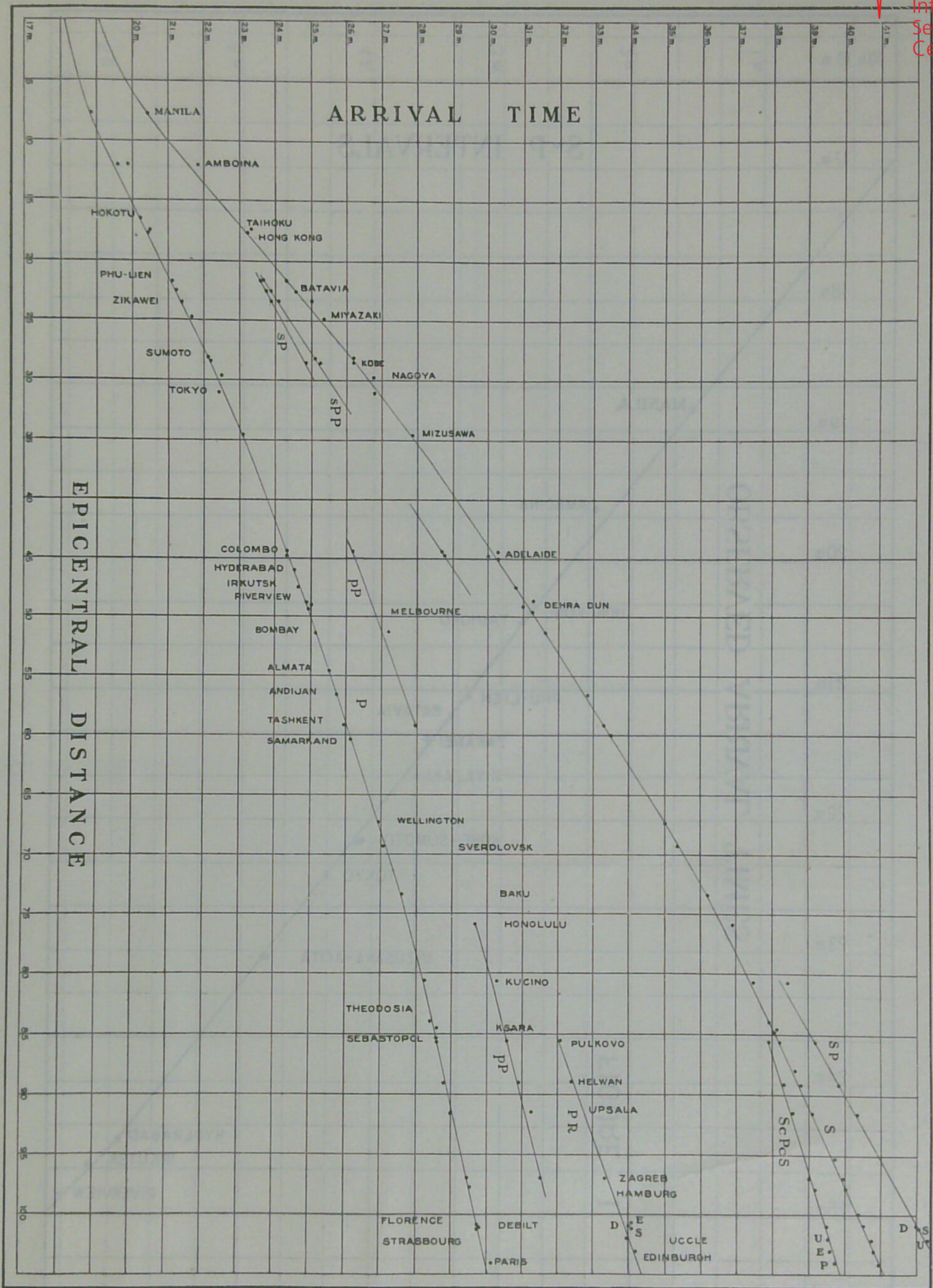


Plate I

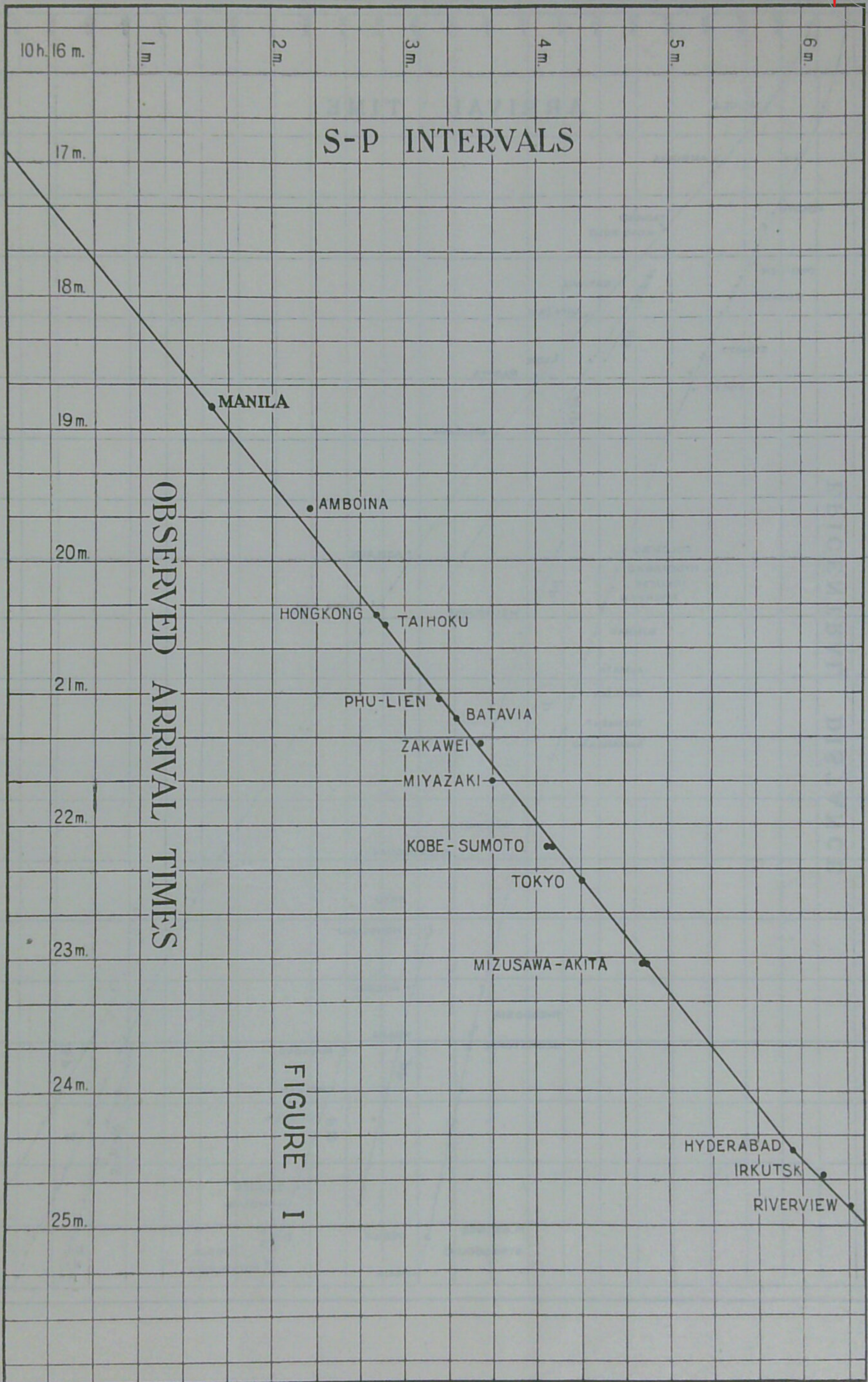


FIGURE I

TABLE I

Observatory	Δ	P	sP	sPP	pP	PR	S	S _c P _c S	SP
		10h +	10h +	10h +	10h +	10h +	10h +	10h +	10h +
	$^{\circ}$	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.
Manila	7.7	18 50					20 25		
Amboina	12.0	19 36					21 53		
Taihoku	17.5	20 29					23 19		
Hong Kong	17.7	20 24	22 46	22 46			23 13		
Phu-Lien	21.7	21 04	23 35	23 40			24 20		
Batavia	22.6	21 12	23 44	23 51			24 35		
Zikawei	23.5	21 23	23 54	24 05			25 00		
Sumoto	28.2	22 07		25 06			26 12		
Kobe	28.6	22 10	24 51	25 12			26 12		
Colombo	44.4	24 09		28 40	26 12		gap		
Adelaide	44.8	24 20		28 46					
Riverview	48.7	24 54					31 15		
Dehra Dun	49.0	25 00					31 00		
Melbourne	49.4	24 58		29 35			31 19		
Bombay	51.4	25 06			27 12		31 35		
Tashkent	59.2	25 58			27 56		33 17		
Wellington	67.3	26 57					35 01		
Honolulu	75.7				29 42		36 56		
Kucino	81.7	28 13			30 19		37 31		38 27
Pulkovo	85.5	28 32			39 34	32 01	38 13	37 57	39 13
Helwan	89.0	28 46			30 54	32 22	38 46	38 19	39 52
Upsala	91.6	29 01			31 14		39 40	38 34	40 21
Zagreb	97.0	29 29			31 29	33 18	39 56	39 00	
DeBilt	101.0	29 47				33 44	40 32	39 26	42 00
Strasbourg	101.2	29 47				34 05	40 32	39 36	42 03
Uccle	102.1					33 57	40 40	39 36	42 13
Edinburgh	103.1					34 09	40 45	39 29	
Paris	104.1	30 05					40 58	39 33	
Kew	104.3							39 42	42 35
		P'							
Florissant	123.2								
Ottawa	123.7							41 00	
Georgetown	129.1	35 03				37 22			

At Butuan the pen levers were thrown out of contact 13 seconds after the arrival of the P waves.

The phases pP at Bombay and S at Honolulu are doubtful.

At Kucino, at about 10^h 37^m 30^s, a phase enters on the N-S component 2 or 3 seconds earlier than on the E-W component. The earlier phase may S_cP_cS and the later phase may be S, for the travel time curves indicate that these phases should very close together at this distance.

Table II gives the travel times of P and S, and also the S-P intervals, for every degree of epicentral distance up to 102°.



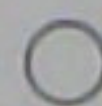
TABLE II

Δ				Δ							
S-P		P-H		S-H		S-P		P-H		S-H	
m. s.		m. s.		m. s.		m. s.		m. s.		m. s.	
1		1	17			52	6 36	8	20	14	56
2		1	23			53	6 42	8	27	15	09
3		1	29			54	6 49	8	33	15	22
4		1	35			55	6 55	8	39	15	34
5		1	41			56	7 01	8	46	15	47
6		1	48			57	7 06	8	53	15	59
7	1 25	1	55	3	20	58	7 12	9	00	16	12
8	1 37	2	00	3	37	59	7 18	9	06	16	24
9	1 43	2	10	3	53	60	7 24	9	13	16	37
10	1 50	2	19	4	09	61	7 30	9	19	16	49
11	1 57	2	28	4	25	62	7 36	9	26	17	02
12	2 04	2	37	4	41	63	7 41	9	33	17	14
13	2 12	2	46	4	58	64	7 47	9	39	17	26
14	2 20	2	55	5	15	65	7 54	9	45	17	39
15	2 27	3	05	5	32	66	7 59	9	52	17	51
16	2 33	3	15	5	48	67	8 06	9	58	18	04
17	2 41	3	24	6	05	68	8 12	10	04	18	16
18	2 50	3	33	6	23	69	8 17	10	11	18	28
19	2 57	3	43	6	40	70	8 23	10	17	18	40
20	3 04	3	53	6	57	71	8 29	10	23	18	52
21	3 12	4	03	7	15	72	8 35	10	29	19	04
22	3 19	4	13	7	32	73	8 41	10	34	19	15
23	3 26	4	23	7	49	74	8 46	10	40	19	26
24	3 34	4	33	8	07	75	8 52	10	45	19	37
25	3 41	4	43	8	24	76	8 57	10	51	19	48
26	3 49	4	52	8	41	77	9 02	10	57	19	59
27	3 55	5	02	8	57	78	9 07	11	02	20	09
28	4 01	5	11	9	12	79	9 12	11	07	20	19
29	4 08	5	20	9	28	80	9 17	11	12	20	29
30	4 16	5	28	9	44	81	9 22	11	17	20	39
31	4 24	5	36	10	00	82	9 26	11	22	20	48
32	4 31	5	45	10	16	83	9 30	11	27	20	57
33	4 37	5	54	10	31	84	9 35	11	32	21	07
34	4 44	6	02	10	46	85	9 40	11	37	21	16
35	4 52	6	10	11	02	86	9 43	11	42	21	25
36	4 58	6	19	11	17	87	9 47	11	47	21	34
37	5 04	6	27	11	31	88	9 52	11	51	21	43
38	5 11	6	35	11	46	89	9 55	11	56	21	51
39	5 17	6	44	12	01	90	9 59	12	01	22	00
40	5 25	6	51	12	16	91	10 04	12	05	22	09
41	5 31	6	59	12	30	92	10 07	12	11	22	18
42	5 38	7	07	12	45	93	10 11	12	15	22	26
43	5 43	7	15	12	58	94	10 15	12	20	22	35
44	5 50	7	22	13	12	95	10 19	12	25	22	44
45	5 56	7	29	13	25	96	10 22	12	30	22	52
46	6 02	7	37	13	39	97	10 27	12	34	23	01
47	6 07	7	45	13	52	98	10 31	12	39	23	10
48	6 13	7	52	14	05	99	10 35	12	44	23	19
49	6 19	7	59	14	18	100	10 39	12	49	23	28
50	6 24	8	06	14	30	101	10 45	12	52	23	37
51	6 30	8	13	14	43	102	10 48	12	58	23	46

We have introduced Table II because convenient travel time curves for deep earthquakes are still uncommon, and because it is evident that a set of travel times that will apply universally to all earthquakes can not be found.

Plate I shows the curves and sections of curves that were established from the seismograms furnished by cooperating observatories. We wish to take this opportunity to express our appreciation of their kindness which has made this investigation possible.

In a future paper we hope to issue the data of other deep earthquakes in the Philippine Islands.



No. 1.

January, 1933.



M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

$\phi = 14^{\circ} 34' 42''$ N. $\lambda = 120^{\circ} 58' 41''$ E. $h = 2.40$ m. Alluvium.

GALITZIN-WILIP

WIECHERT. M=1000 Kg.
January 1, 1933

	T_0	D	T_1	λ	γ^2	K
N-S	12.43	100.5	12.59	11.52	0.017	97
E-W	11.80	100.5	11.91	11.40	-0.075	80
Z	11.60	100.5	9.00	14.82	1.250	200

	T_0	V	ϵ	$\frac{r}{T_0^2}$
N-S	4.4	194	2.4	0.029
E-W	4.8	208	2.6	0.029

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933				
January				
No. 2 1st	PNEZ	8 58 00	6080	After P from the Wiechert. Disturbed by microseisms. 15°S: 167° 30'E by Manila, Batavia, Hong Kong, Amboina, Zikawei, River-view.
	SNE	9 05 38		
	LNE	9 15 ca		
	F	9 51		
No. 3 2nd	PNE	14 42 58	125	From the Wiechert. Galitzin records Disturbed by strong microseisms.
	SNE	14 43 14		
	F	14 49		
No. 4 3rd	P?NEZ	13 14 05	1455?	Disturbed by strong microseisms.
	S?NE	13 16 36		
	F	13 34		
No. 5 3rd	PNEZ	15 34 45	2745	Disturbed by strong microseisms.
	SNE	15 39 00		
	LNE	15 41 30		
No. 6 4th	ePNEZ	1 30 04	2745	After P from the Wiechert. Disturbed by microseisms. 25°N: 144°E by Zikawei, Koti, Manila, Batavia, Riverview.
	SNE	1 34 19		
	1E	1 35 08		
	1N	1 35 10		
	1NE	1 37 42		
	F	2 38		
No. 10 5th	PNEZ	18 06 01	1300	Disturbed by microseisms.
	SNE	18 08 16		
	F	18 25		
No. 14 7th	PNEZ	4 13 16	3735	Northern Japan by Koti, Manila, Hong Kong.
	SNE	4 18 35		
	MNE	4 26 18		
	F	6 56		
No. 15 8th	eNEZ	6 35 26	4055?	Disturbed by microseisms.
	SNE	6 41 06		
	ME	6 49 ca		
	F	7 29		

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY
Continued.

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
1933						
January						
No. 16 9th	$\bar{1}$ PNEZ	2	10	17	5180	0=2:01:37 Compression from NW. In region of 31° N: 72° 30' E by Hong Kong, Manila, Batavia, Amboina. Disturbed by microseisms.
	SNE	2	17	03		
	SR ₁ E	2	20	34		
	LNE	2	24	13		
	MN	2	30	05		
	ME	2	32	24		
	F	3	45			
No. 19 13th	\bar{P} NEZ	12	56	42	175	After P from the Wiechert. Galitzin records disturbed by microseisms.
	\bar{S} NE	12	57	04		
No. 20 13th	\bar{P} NE	13	02	34	180	From the Wiechert.
	\bar{S} NE	13	02	57		
	F	13	10			
No. 22 15th	\bar{P} NE	0	24	05	145	From the Wiechert. Disturbed by microseisms.
	\bar{S} NE	0	24	23		
	F	0	27			
No. 35 19th	PNEZ	6	47	57	1510	Felt at Jolo, intensity II.
	SNEZ	6	50	34		
	F	7	01			
No. 42 20th	PNEZ	14	49	33	770	Compression. Felt at Butuan, Mindanao, Intensity IV.
	SNE	14	50	57		
	mN	14	52	36		
	mE	14	52	47		
	F	15	29			
No. 43 20th	\bar{P} NZ	22	19	11	165	
	\bar{S} NEZ	22	19	32		
	F	22	24			
No. 45 21st	e \bar{P} NEZ	3	06	56	160	
	\bar{S} NEZ	3	07	16		
No. 46 21st	\bar{F} NE	3	08	58	160	From the Wiechert. Felt slightly in Manila and Ambulong.
	\bar{S} NE	3	09	18		
	F	3	37			
No. 47 21st	P?NE	16	38	55	1775?	
	S?N	16	41	57		
	MNE	16	49	ca		
	F	17	12			
No. 48 21st	$\bar{1}$ PNEZ	19	33	05	8780	0=19:21:11 Dilatation. After P from the Wiechert. 37° S: 59° E, 0=19:20:47 by U.S.C.G.S.
	iN	19	34	03		
	PR ₁ NE	19	36	21		
	SNE	19	43	12		
	PSE	19	43	55		
	LE	19	59	09		
	MNE	20	05	23		
	F	23	17			

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
1933						
January						
No. 49	$\overline{\text{PNE}}$	23	55	48	90	From the Wiechert.
21st	$\overline{\text{SNE}}$	23	56	00		
	F	23	59			
No. 56	PNEZ	10	40	53	1070	Felt at Basco, Batan Islands.
24th	SNEZ	10	42	46		
	mN	10	43	43		
	mE	10	45	49		
	F	10	58			
No. 60	$\overline{\text{PNEZ}}$	2	15	09	150	Dilatation.
25th	$\overline{\text{SNE}}$	2	15	28		
	F	2	20			
No. 61	$\overline{\text{iPZ}}$	2	35	01	150	Compression from SW.
25th	$\overline{\text{ePNE}}$	2	35	01		Felt slightly in Manila.
	$\overline{\text{SNE}}$	2	35	20		13° 55' N: 119° 45' E by Manila and
	F	3	11			and Baguio.
No. 62	$\overline{\text{PNEZ}}$	7	20	01	150	
25th	$\overline{\text{SNEZ}}$	7	20	20		
	F	7	24			
No. 63	PNZ	16	58	13	470	Baguio 280 Km.
25th	SNE	16	59	11		
	$\overline{\text{SN}}$	16	59	19		
	F	17	19			
No. 65	iPZ	22	48	08	8345	Dilatation, 0=22:36:29
27th	ePNE	22	48	08		Disturbed by microseisms.
	SNE	22	57	54		74°N: 174°W, 0=22:36:42 by U.S.C.G.S.
	LNE	23	12	27		
28th	F	0	38			
No. 67	$\overline{\text{PNEZ}}$	18	07	31	2435	
29th	SNE	18	11	24		
	LNE	18	13	38		
	F	18	43			
No. 70	$\overline{\text{PNEZ}}$	14	32	44	160	Dilatation.
31st	$\overline{\text{SNE}}$	14	33	04		
	F	14	41			
No. 71	PNEZ	15	15	21	160	
31st	SNE	15	15	41		
	F	15	24			

Forty-two insignificant or undecipherable disturbances on the following days of January: 1st, 4th(2), 5th, 6th(3), 9th, 10th, 14th, 15th, 17th(5), 18th(6), 19th(5), 20th, 21st, 22nd, 23rd(5), 24th(3), 27th, 29th and 30th(2).

No. 3(b).

January, 1933.



M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

CORRECTION TO No. 671, NOVEMBER 3, 1932.

S at Manila 19:52:03, Distance 2665 Km.
Epicenter: 20°N : $145^{\circ} 30'\text{E}$ by Manila, Hong Kong,
Chiufeng.

ADDITION TO No. 709, NOVEMBER 27, 1932.

29°N : 147°E by Zikawei, Chiufeng, Manila.

CORRECTION TO No. 736, December 15, 1932

P=19:35.15
S=19:36.29 Distance 670 Km. $20^{\circ} 30'\text{N}$:
 120°E by Manila, Hong Kong, Zikawei.

CORRECTION TO No. 740, DECEMBER 20, 1932.

P=15:17:34
S=15:19:38 Distance 1200 Km. 5°N : 126°
E by Manila, Batavia, Amboina.

CORRECTION TO No. 742, DECEMBER 21, 1932.

P'NEZ=6:28:26
PSNE =6:37:31 Distance 11500 Km.

No. 747, DECEMBER 24, 1932.

6°S : 145°E , O=6:30:09 by Guam, Manila, Hong Kong, Zikawei, Chiufeng.

No. 749, DECEMBER 25, 1932.

39°N : 95°E , O=2:04:07 by Manila, Chiufeng, Hong Kong, Phu-Lien, Zikawei.

No. 761, DECEMBER 26, 1932.

Approx. $26^{\circ} 15'\text{N}$: $122^{\circ} 30'\text{E}$ by Zikawei, Manila, Chiufeng

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

$\phi=14^{\circ} 34' 32''$ N.

$\lambda=120^{\circ} 58' 41''$ E.

$h=2.40$ m.

Alluvium.

GALITZIN-WILIP

WIECHERT, M=1000 Kg.

February 2nd, 1933.

	T_0	D	T_1	λ	μ^2	K
N-S	12.43	100.5	12.59	11.52	0.017	97
E-W	11.80	100.5	11.91	11.40	-0.075	80
Z	11.60	100.5	9.00	14.82	1.250	200

	T_0	V	ϵ	$\frac{r}{T_0^2}$
N-S	4.5	192	2.4	0.027
E-W	4.7	200	2.6	0.033

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 February				
No. 72 1st	PNEZ SNE F	3 47 42 3 49 37 4 02	1090	Felt at Butuan, Mindanao, with intensity IV.
No. 73 1st	PNEZ SNE F	15 09 50 15 10 30 15 21	280	Felt at Naga with intensity III.
No. 78 2nd	iPZ ePNE SNE F	22 07 39 22 07 39 22 07 58 22 22	150	Compression.
No. 79 3rd	iPZ PR ₂ NE SNE SR ₃ NE LNE MNE F	22 19 29 22 22 26 22 26 42 22 32 32 22 34 08ca 22 38 ca 23 55	5490	O=22:10:39
No. 81 5th	PNE SNE F	18 20 26 18 21 17 18 26	415	Felt at Cape Bojeador, N Luzon, with intensity III-IV. From the Wiechert, Galitzin records defective.
No. 82 6th	PNEZ SNEZ F	5 15 53 5 16 09 5 21	125	
No. 83 9th	P?NEZ SNE F	4 02 26 4 05 49 4 31	2020?	
No. 84 9th	PEZ SNE LNE ME F	15 41 06 15 46 07 15 49 40ca 15 52 30ca 17 10	3445	

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
1933 February						
No. 86 13th	PNEZ	2	57	00	4510	
	SNE	3	03	07		
	LNE	3	08	45		
	MNE	3	12	ca		
	F	4	20			
No. 88 14th	ePEZ	4	29	37	2865	Netherlands East Indies.
	SE	4	29	54		
	IZ	4	29	58		
	SNE	4	34	00		
	MIN	4	34	06		
	ME	4	35	41		
	F	5	04			
No. 92 15th	PZ	9	03	51	2520	
	PNE	9	03	52		
	SNE	9	07	50		
	LNE	9	10	21		
	ME	9	12	12		
	F	9	58			
No. 94 16th	PEZ	4	57	05	1535	Manado, N Celebes, N.E. I.
	SNE	4	59	44		Butuan $\Delta=6.4^{\circ}$.
	F	5	37			
No. 95 16th	PNEZ	9	11	24	1680?	Celebes, N.E.I.
	SNE	9	14	17		Butuan $\Delta=8.6^{\circ}$.
	LNE	9	15	40		
	F	10	34			
No. 100 19th	PNE	4	28	35	1110	
	SNE	4	30	30		
	LNE	4	32	20		
No. 101 19th	PNE	4	36	01	195	14° 10' N; 122° 40' E by Manila and Baguio.
	SNE	4	36	26		Felt in southeastern Luzon. At Daet with intensity VIII. From the Wiechert.
No. 102 19th	P̄N	4	51	23	195	Aftershock of No. 101. From the Wiechert. E-W component off.
	S̄N	4	51	47		
No. 103 19th	P̄N	5	10	43	195	Aftershock of No. 101. From the Wiechert. E-W component off.
	S̄N	5	11	07		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 February				
No. 104 19th	$\overline{\text{PNE}}$ $\overline{\text{SNE}}$ F	6 16 48 6 17 12 6 26	195	Aftershock of No. 101. Daet, intensity VI.
No. 105 19th	$\overline{\text{PNE}}$ $\overline{\text{SNE}}$ F	6 47 35 6 47 59 6 53	195	Aftershock of No. 101.
No. 106 19th	$\overline{\text{PNE}}$ $\overline{\text{SNE}}$ F	8 20 31 8 20 55 8 24	195	Aftershock of No. 101.
No. 107 19th	eNE S?NE LNE F	8 43 04 8 50 28 8 55 ca 9 44		
No. 108 19th	$\overline{\text{PNE}}$ $\overline{\text{SNE}}$ F	9 51 13 9 51 38 9 54	195	Aftershock of No. 101.
No. 109 19th	$\overline{\text{PNE}}$ $\overline{\text{SNE}}$	10 00 06 10 00 32	205	Aftershock of No. 101. 8 aftershocks until No. 118,
No. 118 19th	$\overline{\text{PNE}}$ $\overline{\text{SNE}}$ F	18 03 42 18 04 08 18 22	205	Aftershock of No. 101. 5 aftershocks until No. 124.
No. 124 20th	$\overline{\text{PNEZ}}$ $\overline{\text{SNEZ}}$	8 03 11 8 03 37	200	Aftershock of No. 101.
No. 125 20th	$\overline{\text{PNEZ}}$ $\overline{\text{SNEZ}}$ F	8 07 20 8 07 44 8 14	190	Aftershock of No. 101.
No. 133 22nd	ePNEZ S?NE mE mN F	3 48 26 3 50 40 3 54 20 3 54 39 5 20	1020?	Butuan $\Delta = 3.7^\circ$.
No. 137 23rd	$\overline{\text{PNE}}$ $\overline{\text{SNE}}$ ME F	6 00 30 6 03 37 6 07 16 6 20	1835	



M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
1933						
February						
No. 138	ePNEZ	8	29	20		19°S; 68°W, 0=8:09:25 by U.S.C.G.S.
23rd	F	11	28			
No. 140	PNEZ	1	18	48	2555	Guam, $\Delta=180$ Km.
25th	SNE	1	22	51		
	L?NE	1	25	17		
	F	2	14			
No. 144	\bar{P} NEZ	10	20	06	195	Aftershock of No. 101.
26th	\bar{S} NEZ	10	20	31		
	F	10	31			
No. 145	P?NEZ	16	23	42	5735?	
27th	iN	16	26	29		
	SNE	16	31	00		
	LNE	16	39	ca		
	F	17	30			

Forty-six insignificant or undecipherable disturbances on the following days of February: 2nd(4), 4th, 10th, 13th, 14th(3), 16th(2), 18th(2), 19th(12), 20th(4), 21st(3), 22nd(5), 24th, 25th, 26th(2), 27th, and 28th(3).



MANILA, P. I.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

$\phi=14^{\circ} 34' 42''$ N.

$\lambda=120^{\circ} 58' 41''$ E.

$h=2.40$ m.

Alluvium.

GALITZIN-WILIP

WIECHERT. $M=1000$ Kg.

March 2, 1933

	T_0	D	T_1	l	μ^2	K
N-S	12.43	100.5	12.59	11.52	0.017	97
E-W	11.80	100.5	11.91	11.40	-0.075	80
Z	11.60	100.5	9.00	14.82	1.250	200

	T_0	V	ϵ	$\frac{r}{T_0^2}$
N-S	4.4	194	2.4	0.028
E-W	4.8	201	2.5	0.039

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1933 March				
No. 152 2nd	PNEZ SNE F	4 11 02 4 15 26 4 29	2880	
No. 153 2nd	PEZ SNE LE F	8 15 05 8 19 08 8 22 10ca 9 12	2580	Dilatation. Felt in Guam, $\Delta=145$ Km. Compression from NE. Phase after S from the Wiechert.
No. 154 2nd	ePNEZ SNE F	11 17 14 11 17 50 11 21	255	
No. 156 2nd	PNEZ SNE LNE MNE F	17 37 26 17 42 30 17 47 05 17 50 ca 22 30	3490	Dilatation. Japan. Phases after P from the Wiechert. 39.5° N; 143.5° E; $0=17:31:00$ by U.S.C. G.S. 40° N; 145° E Chiufeng.
No. 157 3rd	1PZ ePNE SNE F	2 20 00 2 20 00 2 20 15 3 24	120	Dilatation. Epicenter in Zambales Mtn. Felt in Manila with intensity IV. Also felt throughout western Luzon. S from the Omori. Compression at Baguio.
No. 159 3rd	PNEZ SNEZ LNE F	9 19 13 9 24 32 9 30 35 11 24	3730	In region of 39° N; 150° E by Manila, Zikawei, Hong Kong.
No. 161 3rd	P?NE S?NE LNE F	15 14 40 15 20 04 15 24 ca 16 57	3810?	
No. 164 3rd	eNE F	20 30 30 21 01		

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
1933						
March						
No. 167 5th	ePNEZ	0	03	18	125	
	SNEZ	0	03	34		
	F	0	06			
No. 168 5th	iPNEZ	8	24	01	1935	Compression. N.E.I.
	SNE	8	27	17		
	MN	8	30	47ca		
	F	10	10			
No. 171 6th	iPNEZ	0	58	48	250	Compression.
	SNEZ	0	59	22		
	F	1	04			
No. 172 6th	iPZ	13	11	51	3700	Dilatation. In region of Himalayas by Hong- Kong, Manila, Chiufeng.
	ePNE	13	11	51		
	SNE	13	17	08		
	MNE	13	25	ca		
	F	13	46			
No. 177 11th	eNEZ	2	15	29	11770	Disturbed by microseisms. 33°40'N; 118°02'W; O=1:54:12 by U.S.C.G.S.
	S _c P _c SNE	2	19	16		
	LNE	2	44	00ca		
	MNE	2	52	00ca		
	F	4	06			
No. 180 11th	PNEZ	19	37	00	2070	Compression. In region of 24°N; 138°E by Manila, Guam, Butuan, Phu- Lien, Hong Kong, Batavia. Disturbed by microseisms. Phases after P from the Wiechert.
	SNE	19	40	26		
	F	20	50			
No. 190 15th	PNE	17	12	31	3610	Disturbed by microseisms.
	SNE	17	17	43		
	LNE	17	21	46		
	MN	17	24	42ca		
	F	18	10			
No. 195 17th	ePNEZ	0	10	37	2700	Disturbed by microseisms.
	iSE	0	14	18		
	eSN	0	14	48		
	F	0	36			
No. 196 17th	ePZ	16	04	28	5960	55°4N; 162°E; O=15:55.5 by U.S.C.G.S.
	ePNE	16	04	29		
	SNEZ	16	11	59		
	LNE	16	21	00ca		
	MNE	16	25	20ca		
	F	18	02			

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1935 March				
No. 197 17th	PNEZ SNE LNE MNE F	19 34 56 19 37 01 19 38 07 19 39 20ca 21 30	1200	Compression. In region of 6° 30' N; 128° E. Felt in eastern Mindanao. At Davao with intensity IV. Phases after P from the Wiechert.
No. 198 18th	P?NEZ S?N F	3 26 45 3 32 53 5 0.	4520?	Disturbed by microseisms.
No. 200 18th	PNEZ SNE LN F	15 57 14 16 01 48 16 04 48 16 36	3035	
No. 203 18th	eNE SNE F	18 56 04 19 02 42 19 45	3090?	
No. 204 18th	eNE F	23 29 02 23 46		
No. 205 19th	ePNEZ SNE mN mE F	1 16 09 1 19 26 1 21 06 1 21 36 2 25	1945	
No. 206 19th	PNEZ SNE mN F	3 50 20 3 51 29 3 52 42 4 10	610	
No. 212 20th	PNEZ SNE mN mN F	15 15 48 15 19 22 15 21 27 15 22 15 16 38	2165	
No. 214 20th	PE SNE F	19 42 53 19 47 32 20 12	3105	
No. 215 21st	PNEZ SNEZ F	19 10 54 19 11 20 19 26	200	Compression.
No. 216 21st	PNEZ SNE F	19 35 22 19 35 47 19 41	200	
No. 217 21st	PNEZ SNE F	21 14 36 21 14 56 21 19	160	



SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 March				
No. 219 22nd	PNEZ SNEZ F	11 30 32 11 30 57 11 38	200	
No. 220 22nd	PNEZ SNE mE mN F	11 42 12 11 42 54 11 43 33 11 43 43 11 54	290	Felt in Daet, southeast Luzon, with with intensity VI.
No. 223 23rd	P?NE SNE LNE MNE F	17 46 33 17 51 33 17 55 10ca 17 58 00ca 19 12	3435?	China. P is doubtful. Z component defective.
No. 226 25th	PNEZ SNE mN mE F	17 25 26 17 26 02 17 28 26 17 28 39 17 40	255	Felt in Vigan with intensity III. Compression.
No. 227 26th	ePNEZ SNE MNE F	9 26 50 9 29 27 9 32 18ca 9 50	1520	Disturbed by microseisms.
No. 230 27th	PNE SNE F	23 29 51 23 30 32 23 42	260	Z component defective.
No. 231 28th	ePNEZ SNE F	15 36 48 15 37 18 15 47	220	
No. 232 28th	PNEZ SNE F	22 11 24 22 11 49 22 17	190	
No. 233 31st	PNE SN LNE MNE F	22 11 59 22 15 40 22 17 36ca 22 19 37ca 22 46	2355	

Forty-six insignificant or undecipherable disturbances on the following days of March: 1st(2), 2nd, 3rd(4), 4th(2), 5th(2), 7th, 8th, 9th(2), 12th(4), 13th, 15th(5), 16th(3), 18th(3), 19th(3), 20th(3), 22nd, 23rd(2), 24th, 25th, and 26th(2).



MANILA, P. I.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

$\phi = 14^{\circ} 34' 42''$ N. $\lambda = 120^{\circ} 58' 41''$ E. $h = 2.40$ m. Allivium.

GALITZIN-WILIP

WIECHERT. $M = 1000$ Km.
April 1st, 1933.

	T_0	D	T_1	λ	μ^2	K
N-S	12.43	100.5	12.59	11.52	0.017	97
E-W	11.80	100.5	11.91	11.40	-0.475	80
Z	11.60	100.5	9.00	14.82	1.250	200

	T_0	V	ϵ	$\frac{r}{T_0^2}$
N-S	4.4	194	2.4	0.021
E-W	4.8	203	2.6	0.027

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 April				
No. 235 1st	PNEZ SNE MNE F	8 10 10 8 12 15 8 15 10ca 9 03	1200	Felt at Davao, SE Mindanao, with intensity II.
No. 236 1st	PNE SNE LNE MNE F	16 05 20 16 10 41 16 14 50ca 16 17 30ca 17 16	3760	
No. 244 9th	iPZ PNE SNEZ LNE MNE MN ME F	2 53 06 2 53 07 2 58 21 3 02 30ca 3 05 20ca 3 11 00 3 12 23 6 10	3665	Dilatation.
No. 245 9th	PNEZ SNE LNE ME F	10 36 54 10 41 59 10 46 ca 10 48 50ca 11 39	3570	
No. 247 9th	ePNEZ SNE F	17 11 36 17 12 13 17 18	260	Baguio, $\Delta = 60$ Km.
No. 249 10th	iPNEZ SNE F	15 25 23 15 25 40 16 11	135	Felt at Nasugbu, Batangas, and Manila with intensity IV-V and II respectively. Compression.
No. 253 12th	ePNEZ iZ iE SNE LNE MNE F	6 01 08 6 01 24 6 01 37 6 06 17 6 10 27 6 13 28 6 44	3580	



SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1933 April				
No. 254 13th	PNEZ SN F	16 23 28 16 25 00 16 39	585	
No. 257 14th	PNE SNE F	7 57 10 7 58 05 8 25	365	From the Wiechert. Galitzin records defective. Baguio, $\Delta=175$ Km.
No. 263 16th	PNEZ SNE F	6 11 49 6 21 28 8 00	8210	
No. 264 16th	PNEZ SNE F	11 09 12 11 09 40 11 14	215	Baguio, $\Delta=75$ Km.
No. 267 16th	1PNEZ 1E 1N SNE LNE F	19 22 00 19 22 12 19 22 17 19 27 20 19 30 00ca 21 04	3745	Compression from SE.
No. 274 19th	PNZ SN MN F	3 02 04 3 07 08 3 13 48 3 45	3490	Galitzin E-W component defective.
No. 275 19th	PNEZ SNE LNE MNE F	6 47 00 6 52 08 6 56 ca 6 58 30ca 8 50	3560	Phases after P from the Wiechert.
No. 277 20th	PNEZ SNE F	9 30 25 9 31 34 9 39	610	
No. 278 20th	PNE SNE mNE F	20 53 16 20 54 48 20 56 24ca 21 08	850	
No. 279 20th	PNEZ SNE F	22 18 45 22 20 11 22 27	550	
No. 281 21st	PNEZ SNE mN mE F	16 39 49 16 40 28 16 41 44 16 42 03 16 53	290	

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 April				
No. 283 22nd	$\overline{\text{PNE}}$ $\overline{\text{SNE}}$ F	16 02 26 16 02 46 16 08	160	
No. 284 22nd	$\overline{\text{PNEZ}}$ $\overline{\text{SNE}}$ F	19 05 20 19 05 36 19 09	125	
No. 285 23rd	iPZ ePNE iNE iS?NE L?NE MNE	6 10 03 6 10 08 6 10 10 6 22 07 6 42 10ca 6 49 40ca	11520?	37°N; 27°E; O=5:57.6 by U.S.C.G.S.
No. 288 25th	PNE SNE LN F	10 16 39 10 19 34 10 21 09 10 37	1695	Disturbed by microseisms specially in Z component.
No. 289 27th	iPNEZ SNE PSNE LNE F	2 48 03 2 57 42 2 58 13 3 12 23 5 40	8210	Anchorage, Alaska. Disturbed by microseisms. Phases after P from the Wiechert.
No. 296 30th	eNE MNE F	5 44 06 5 44 16ca 5 59		Felt at Jolo with intensity III. Disturbed by microseisms.

Thirty-eight insignificant or undecipherable disturbances on the following days of April: 1st(2), 2nd(3), 6th(2), 8th, 9th(2), 11th(3), 13th(2), 15th(5), 16th(2), 17th(5), 19th(2), 21st(2), 23rd(2), 27th(3), 29th and 30th.

M A Y , 1 9 3 3

We thankfully acknowledge the receipt of the following
bulletins and reports.

S T A T I O N S

B U L L E T I N S

Batavia-----	March 17 to 31, 1933.
Sydney-----	March 1 to 18, 1933.
Perth-----	Preliminary report of earthquake of Japan, March 2, 1933.
Adelaide-----	March, 1933.
Zikawei-----	No. 4; March 2 to 3, 1933.
Tananarive-----	September, 1932.
Chu-Lien-----	August, September, October, Novem- ber and December, 1932.
Batavia-----	April 1 to 19, 1933.
Chiufeng-----	March, 1933.
Georgetown-----	February, 1933.
Koti-----	February 2 to March 25, 1933.
STRASBOURG:	
L'Institut-----	February, 1933.
Bureau Central-----	February, 1933.
Union International-----	February, 1933.
Parc Saint Maur-----	February, 1933.
Hong Kong-----	March, 1933.
La Paz, Bolivia-----	April 22 to August 21, 1932.

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M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

$\phi=14^{\circ} 34' 42''$ N. $\lambda=120^{\circ} 38' 41''$ E. $h=2.40$ m. Alluvium.

GALITZIN-WILIP

WIECHERT. $M=1000$ Kg.
May 3, 1933.

	T_0	D	T_1	λ	μ^2	K
N-S	12.43	100.5	12.59	11.52	0.017	97
E-W	11.80	100.5	11.91	11.40	-0.075	80
Z	11.60	100.5	9.00	14.82	1.250	200

	T_0	V	ϵ	$\frac{F}{T_0^2}$
N-S	4.5	191	2.4	0.023
E-W	4.8	203	2.6	0.029

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1933 May				
No. 297 1st	iPZ ePNE iSNE mN mE F	5 41 44 5 41 46 5 42 45 5 43 45 5 44 00 6 03	400	Felt at Vigan with intensity II and I at Tuguegarao and Baguio.
No. 298 1st	PNEZ SNE MNE	18 37 41 18 44 22 18 55 10ca	5085	
No. 299 1st	PNEZ SNE LNE MNE F	19 58 33 20 05 20 20 12 05ca 20 15 45ca 21 46	5190	No. 298 still recording.
No. 300 1st	P?NEZ iZ S?NE iE iN F	23 21 28 23 21 59 23 27 03 23 28 25 23 38 02 24 10	3980?	
No. 301 2nd	PZ iZ SNE LNE F	6 39 13 6 40 32 6 42 06 6 43 32 7 08	1675	
No. 308 3rd	PNEZ SNE MNE F	23 33 02 23 35 54 23 38 50 24 26	1660	
No. 310 6th	iP'Z eP'NE LNE F	5 53 24 5 53 24 6 44 ca 8 00	16600	5° N; 84° W; $023; 33.3$ by U.S.G.C.S.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
1933 May						
No. 311 6th	ePNEZ	14	06	02	620?	
	SNEZ	14	07	40		
	mN	14	11	04		
	F	14	25			
No. 315 8th	iPZ	10	54	57	6310	
	iPN	10	55	01		
	ePE	10	55	01		
	SNE	11	02	48		
	IE	11	12	40ca		
	F	13	21			
No. 316 8th	PNEZ	16	47	45	840	Felt at Butuan with intensity II.
	SNEZ	16	49	16		
No. 317 8th	PNEZ	17	07	13	900	No. 316 still recording.
	SNEZ	17	08	50		Felt at Davao with intensity II.
	mN	17	11	58		
	mE	17	12	22		
	F	18	25			
No. 319 10th	ePNE	4	55	45	450	
	SNEZ	4	56	54		
	F	5	06			
No. 321 10th	PNEZ	14	13	28	290	
	SNEZ	14	14	07		
	F	14	18			
No. 324 11th	iPZ	19	22	29	9185	
	ePNE	19	22	33		
	iE	19	32	12		
	SNE	19	32	53		
	iN	19	33	03		
	iN	19	33	39		
	iE	19	36	19		
	MNE	19	56	20ca		
	F	20	47			
No. 325 12th	ePNEZ	16	16	03	2645	
	eSNEZ	16	20	16		
	LN	16	22	36		
	MNE	16	25	00		
	F	17	03			
No. 326 12th	ePNEZ	22	03	03	160	
	iSNE	22	03	23		
	F	22	05			
No. 327 13th	PNEZ	23	27	04	190	
	SNE	23	27	28		
	F	23	32			

No. 17.

May, 1955.

MANILA, I.

International
Seismological
Centre

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks
		h.	m.	s.		
1933 May						
No. 328 14th	PNE	1	23	07	350	
	SE	1	23	59		
No. 329 14th	PNE	1	26	06	350	No. 328 still recording.
	SNE	1	26	58		
	F	1	33			
No. 330 14th	PNEZ	4	54	49	390	
	SNE	4	55	48		
	mN	4	56	34		
	mE	4	57	08		
No. 331 14th	PNE	5	02	33	380	No. 330 still recording.
	SNE	5	03	30		
	F	5	08			
No. 332 16th	iPEZ	1	17	54	2855	
	ePN	1	17	54		
	iSNE	1	22	16		
	LNE	1	25	08		
	MNE	1	27	25		
	F	2	55			
No. 333 16th	PNE	8	51	41	310	
	SNE	8	52	26		
	F	8	58			
No. 335 16th	iPZ	16	45	14	1965	
	ePN	16	45	14		
	ePE	16	45	23		
	SNE	16	48	32		
	LNE	16	50	24		
	F	17	43			
No. 337 17th	ePEZ	5	50	50	390	
	SNE	5	51	38		
	F	6	13			
No. 338 17th	PNEZ	7	40	07	625	
	SNE	7	41	47		
	F	7	59			
No. 341 18th	PNEZ	13	00	46	85	
	SNEZ	13	00	57		
	F	13	03			
No. 343 19th	ePN	12	17	47	660	Felt at Surigao and Butuan with in- tensity III.
	iPEZ	12	17	47		
	iSNE	12	19	01		
	mN	12	20	30		
	mE	12	22	12		
	F	13	31			

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued,



No. and Date	Phase	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 May				
No. 354 21st	PNEZ	11 56 20	2465	
	SNE	12 00 15		
	mN	12 01 24		
	mE	12 01 41		
	F	13 13		
No. 356 21st	iPNEZ	21 28 45	2520	
	SNEZ	21 32 44		
	iE	21 32 49		
	iN	21 32 53		
No. 358 22nd	\bar{P} NEZ	12 43 07	150	
	\bar{S} NE	12 43 26		
	F	12 48		
No. 359 23rd	\bar{P} NEZ	6 21 01	180	
	\bar{S} NE	6 21 24		
	F	6 24		
No. 371 27th	iPEZ	4 43 18	500	Felt at Borongan (E Samar) and Tacloban (NE Leyte) with intensity VI and V respectively.
	ePN	4 43 18		
	iSNE	4 44 17		
	mN	4 45 34		
	mE	4 45 43		
	F	5 57		
No. 372 27th	iPZ	13 59 10	415	Felt in northern Luzon with intensity III.
	ePNE	13 59 10		
	SNE	14 00 01		
	F	14 20		
No. 373 27th	i \bar{P} Z	16 40 10	160	
	e \bar{P} NE	16 40 11		
	\bar{S} NE	16 40 30		
	F	17 00		
No. 374 27th	i \bar{P} NEZ	22 41 43	160	
	\bar{S} N	22 42 03		
	F	23 40		
No. 378 30th	PNEZ	13 57 17	1720	Disturbed by microseisms.
	SNE	14 00 15		
	F	14 21		
No. 379 30th	PNEZ	15 45 01	740	Disturbed by microseisms.
	SNE	15 45 23		
	F	15 58		

Forty-seven insignificant or undecipherable disturbances on the following days of May: 2nd(2), 3rd(5), 5th, 6th, 7th(2), 10th(2), 11th(2), 13th, 16th(2), 17th, 18th(2), 19th(3), 20th(3), 21st(5), 22nd, 23rd(3), 24th(4), 25th(2), 26th(2), 28th and 29th(2).



MANILA, P. I.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

$\phi=14^{\circ} 34' 42''$ N.

$\lambda=120^{\circ} 58' 41''$ E.

$h=2.40$ m.

Alluvium

WIECHERT. $M=1000$ Kg.

June 2, 1933

GALITZIN-WILIP

	T_0	V	T_1	λ	μ^2	K
N-S	12.43	100.5	12.59	11.52	0.017	97
E-W	11.80	100.5	11.91	11.40	-0.075	80
Z	11.60	100.5	9.00	14.32	1.250	200

	T_0	V	ϵ	$\frac{r}{T_0^2}$
N-S	4.4	199	2.4	0.024
E-W	4.9	203	2.7	0.034

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks
		h.	m.	s.		
1933 June No. 380 1st	PNEZ SNE mN F	3	22	07	620	Disturbed by microseisms. Butuan, $\Delta=240$ Km.
No. 382 2nd	iPNEZ SNE F	7	43	10	2355	Compression from NE. S from the Wiechert,
No. 383 2nd	iPEZ ePN iSNE LNE MN F	12	25	41	2340	Compression from south.
No. 384 3rd	iPZ ePNE iSNE SNE F	7	11	25	580	
No. 385 3rd	iPNEZ iSNE iLNE MNE F	17	13	00	1835	P in minute gap. In region of 29° N; $129^{\circ} 30'$ E by Hong Kong, Chiufeng, Koti and Manila.
No. 386 4th	iPZ PNE SNE? LNE? F	13	46	33	530?	Disturbed by microseisms. Dilatation from southeast.
No. 388 6th	iPNEZ off F	2	28	54		Compression from southeast. From the Wiechert, pens disjointed. Felt in Provinces of Rizal, Laguna, Batangas, Bulacan, Cavite, Tayabas. Epicenter probably in E cordillera about $14^{\circ} 20'$ N; $121^{\circ} 35'$ E. Felt in Manila with intensity IV. Some damage to brick work in sugar central at Nasugbu, Batangas. Baguio. $\Delta=250$ Km.

MANILA, P. I.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY,--Continued.

No. and Date	Phase	Greenwich Time h. m. s.	Dist. Km.	Remarks
1933 June				
No. 389 6th	$\overline{\text{PNEZ}}$ $\overline{\text{SE}}$	3 16 25 3 16 37	90	No. 388 still recording. Probably aftershock of the No. 388.
No. 391 6th	PNEZ SNE F	6 49 57 6 54 28 7 31	2990	Disturbed by microseisms.
No. 395 7th	$\overline{\text{PNEZ}}$ $\overline{\text{SNEZ}}$ F	0 44 10 0 44 37 0 49	210	Felt at Daet, SE Luzon, with intensity IV. Disturbed by microseisms.
No. 397 7th	PNEZ $\overline{\text{INEZ}}$ F	5 57 46 6 07 38 6 55		
No. 398 7th	$\overline{\text{PNEZ}}$ SNE LNE MN F	11 51 20 11 55 12 11 57 50 11 59 31 13 30	2420	25° 12'N; 101° 54'E according to Chiufeng. Phases after P from the Wiechert. Disturbed by microseisms.
No. 405 8th	e $\overline{\text{PNEZ}}$ $\overline{\text{SNEZ}}$ F	5 25 20 5 25 51 5 30	200	
No. 406 8th	PNEZ SNE LNE MNE F	18 17 18 18 22 41 18 27 00ca 18 30 30ca 19 40	3790	Dilatation. Japan.
No. 407 9th	PNZ SN LN F	17 40 30 17 41 30 17 42 04 18 30	510	E-W cylinder stopped at 12:17. Wiechert E-W component off at 6:12. Felt at La Carlota and Maa, Negros. Butuan, $\Delta=315$ Km.
No. 408 10th	PNEZ SNE LNE MNE F	2 44 48 2 47 18 2 48 30ca 2 50 ca 3 38	1445	Butuan, $\Delta=610$ Km.
No. 416 11th	EEZ SE F	20 20 04 20 22 33 20 43	1435	
No. 418 12th	eEE SNE F	8 21 05 8 21 40 8 32	250	Felt at Legaspi, SE Luzon, with intensity II.
No. 420 12th	e $\overline{\text{PNEZ}}$ SNZ mNE F	16 23 33 16 24 14 16 26 ca 16 40	300	

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1933 June				
No. 422 12th	PNEZ SNE F	21 14 37 21 19 33 21 43	3370	Japan.
No. 423 13th	PNEZ SN LE F	2 07 16 2 09 18 2 10 38 2 55	1135	Butuan, $\Delta=440$ Km.
No. 427 13th	iPZ ePNE SNE LNE MNE F	20 40 11 20 40 12 20 45 25 20 49 22 20 52 10ca 22 20	3655	Japan.
No. 428 13th	PNEZ SNE F	22 31 06 22 41 ca 23 40		$61^{\circ}N$; $151^{\circ}W$ by U.S.C.G.S.
No. 430 14th	ePNEZ iNE F	20 50 11 20 51 06 21 50		
No. 432 15th	PNEZ SNE F	10 26 11 10 26 38 10 40	210	
No. 433 15th	PNEZ SNEZ F	16 06 07 16 06 33 16 10	200	Felt at Naga, SE Luzon, with intensity II.
No. 435 16th	PNEZ SNE F	2 44 07 2 44 42 2 50	250	
No. 440 18th	iPZ ePNE SNE LNE ME F	4 05 10 4 05 19 4 13 06 4 23 11 4 28 ca 5 36	6235	Felt in Apia, Samoa. Disturbed by microseisms.
No. 441 18th	iPZ ePNE SNE LNE MNE F	13 16 26 13 16 26 13 21 45 13 26 10 13 29 ca 14 40	3730	Disturbed by microseisms.
No. 443 18th	iPNEZ SNE LNE MN F	21 43 46 21 48 39 21 52 ca 21 55 19 24 25	3320	Compression from NE. Phases after P from the Wiechert. Disturbed by microseisms. $38^{\circ}N$; $142^{\circ}E$; $O=21:37.6$ by U.S.C.G.S. Guam $21:43:10$, $\Delta=2935$ Km.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.---Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1933 June				
No. 444 19th	iPZ ePNE SNE F	6 38 43 6 38 43 6 42 16 7 20	2155	Compression. Disturbed by microseisms.
No. 446 19th	\bar{P} NEZ SNEZ mNE F	20 27 43 20 28 02 20 28 39 20 41	150	Disturbed by microseisms.
No. 447 20th	PNEZ S?NE F	7 13 12 7 14 26 8 03	830?	Butuan, $\Delta=100$ Km. Disturbed by microseisms.
No. 450 21st	PEZ SNE LN ME F	13 46 46 13 51 15 13 54 03 13 58 01 14 35	2955	Disturbed by microseisms.
No. 453 24th	ePNZ SNE LNE F	13 58 03 14 00 27 14 05 40 15 12	1390	
No. 454 24th	PNEZ P ₂ NE iSNE LNE MNE F	22 00 17 22 01 07 22 03 49 22 07 30ca 22 10 ca 1 49	3000	Benkoelen, 5°S; 104°2E. 60000 Sumatra accord- ing to Batavia. Phases after P from the Wiechert and Onori.
No. 457 25th	ePNEZ SNE ME F	5 48 50 5 53 35 5 59 06 6 40	3100	Disturbed by microseisms.
No. 459 25th	iPZ ePNE SNE F	9 45 22 9 45 22 9 50 10 10 30	3245	Disturbed by microseisms.

Forty-seven insignificant or undecipherable disturbances on the following days of June: 1st 5⁺, 3th(4), 7th(7), 10th, 11th(6), 12th(3), 13th(3), 14th, 15th(2), 16th, 17th(2), 18th(2), 19th, 20th(2), 21st, 22nd, 25th(3), 27th(2), 28th(2) and 30th.

JUNE, 1933



We thankfully acknowledge the receipt of the following bulletins and reports.

S T A T I O N S

B U L L E T I N S

Adelaide-----April 13 to 27, 1933.
Riverview, College Oby-----April 2 to 27, 1933.
San Fernando, Spain-----March and April, 1933.
STRASBOURG:
L'Institut-----March and April, 1933.
Bureau Central-----March and April, 1933.
Union International-----March and April, 1933.
Parc Saint Maur-----March and April, 1933.
Zikawei-----No. 5: March 11 to 17, 1933.
Hong Kong-----April, 1933 and Principal earthquakes
of May, 1933.
Wellington-----April, 1933.
Taihoku-----February and March, 1933.
Zinsen-----January, February and March, 1933.
Osaka-----January 21 to April 27, 1933.
Zikawei-----No. 6: March 18 to April 16, 1933.
U.S.C.G.S.-----Seismographic Report: July, August
and September, 1932.
Ottawa-----April, 1933.
Batavia-----April 23 to May 14, 1933.
Chiufeng-----May 1 to June 3, 1933.
Tananarive-----October, November and December, 1932.
Firenze-----January 1 to March 31, 1933.
Hong Kong-----May, 1933.
Taihoku-----April, 1933 and Principal earthquakes
of May, 1933.
Georgetown, Wash.-----April, 1933.
Granada-----August and September, 1932.

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No. 23.

July, 1933.



M A N I L A , P . I .

$\phi=14^{\circ} 34' 42''$ N.

$\lambda=120^{\circ} 58' 41''$ E.

$h=2.40$ m.

Alluvium.

GALITZIN-WILIP

WIECHERT. $M=1000$ Kg.
July 2, 1933

	T_0	D	T_1	λ	μ^2	K
N-S	12.43	100.5	12.59	11.52	0.017	97
E-W	11.80	100.5	11.91	11.40	-0.075	80
Z	11.60	100.5	9.00	14.82	1.250	200

	T_0	V	ϵ	$\frac{r}{T_0^2}$
N-S	4.4	203	2.5	0.023
E-W	4.8	204	2.7	0.029

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
July 1933				
No. 467 2nd	iPEZ ePN iSN iLNE F	17 13 43 17 13 44 17 15 16 17 15 57 18 30	860	Dilatation. Dilatation from E at Butuan. Felt at Butuan with intensity III-IV.
No. 469 3rd	PNEZ SNE LN MNE F	15 14 10 15 18 36 15 21 13 15 23 35 16 24	2910	
No. 482 7th	\bar{P} NEZ \bar{S} NE F	15 21 17 15 21 30 15 25	100	
No. 483 9th	PNE SNE LNE F	1 37 27 1 43 24 1 48 52 3 40	4345	Light of Z component defective during the day. 45° N; 150° E; $O=1:30:12$ by U.S.C.G.S.
No. 485 9th	PNE SNE LNE MNE	9 35 40 9 41 11 9 45 41 9 48 41	3935	45° N; 150° E; $O=9:28:06$ by U.S.C.G.S.
No. 486 9th	PNE SNE F	11 29 17 11 35 03 12 30	4165	No. 485 still recording.
No. 487 9th	PNE SNE LN MNE	12 38 07 12 44 03 12 49 26 12 53 ca	4320	Phases after P from the Wiechert. 45° N; 150° E; $O=12:30:30$ by U.S.C.G.S.
No. 488 9th	PNE SNE LNE F	16 14 50 16 20 32 16 25 31 17 35	4090	No. 487 still recording.
No. 489 9th	PNE SNE F	17 59 03 18 04 58 19 02	4310	

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY. Continued.

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks
		h.	m.	s.		
1933 July No. 491 9th	PNE SNE F	22	22	26 20 22	4290	
No. 492 10th	iPEZ SNE LNE F	0	28	11 35 30ca 15	3810	Dilatation. Netherlands East Indies.
No. 494 10th	iPNEZ iSNE LN F	10	38	30 47 30ca 12	2780	Dilatation from E.
No. 497 11th	\bar{P} NE \bar{S} NE F	0	14	38 53 17	115	
No. 504 13th	PNEZ SNE LE MNE F	8	04	26 14 37 20ca 50	3245	
No. 505 13th	PNZ SNE ME F	14	28	52 11 25 10	3733	West Java, according to Batavia.
No. 507 14th	PNEZ SNE F	1	48	11 50 20	6100	
No. 508 14th	PNEZ SNE F	16	10	35 17 32	1555	
No. 512 15th	PNEZ SNEZ F	13	51	00 14 05	1290	
No. 514 16th	\bar{P} NEZ \bar{S} NE F	4	40	02 26 54	190	
No. 517 18th	PNEZ SNE LNE F	11	28	45 44 ca 53	1735	Disturbed by microseisms.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase..	Greenwich Time			Dist. Km.	Remarks
		h.	m.	s.		
1953 July						
No. 521 18th	iPEZ	19	09	33	2600	Dilatation. $8^{\circ} 15' N$; $143^{\circ} 45' E$ by Guam, Manila, Hong Kong. Phases after P from the Wiechert. Disturbed by microseisms.
	ePN	19	09	34		
	SE	19	13	38		
	LNE	19	16	00ca		
	F	20	50			
No. 523 19th	\bar{P} NEZ	0	56	28	165	$16^{\circ} 05' N$; $120^{\circ} 55' E$ by Manila and Baguio. Caraballo Mountains.
	\bar{S} NE	0	56	49		
	F	1	06			
No. 527 19th	iPZ	15	10	23	51 $^{\circ} N$; 174 $^{\circ} W$; $O=14:59.9$ by U.S.C.G.S. Disturbed by microseisms.	
	ePNE	15	10	26		
	SNE(?)	15	19	00ca		
	F	16	20			
No. 528 19th	P?NEZ	20	53	34	3000?	Disturbed by microseisms.
	S?E	20	58	06		
	MNE	21	03	48		
	F	21	27			
No. 530 20th	PNEZ	23	20	28	3745	Disturbed by microseisms.
	SNE	23	25	48		
	LNE	23	29	ca		
	ME	23	31	30		
	F	23	25			
No. 532 21st	iPZ	20	26	10		Disturbed by microseisms.
	iENZ	20	28	44		
	iN	20	29	17		
	iN	20	29	28		
	eN	20	30	06		
	iE	20	30	29		
	iN	20	33	45		
	F	22	48			
No. 533 22nd	iPZ	21	06	04	7120	Compression. $52^{\circ} N$; $169^{\circ} W$; $O=20:55.3$ by U.S.C.G.S.
	ePNE	21	06	04		
	iSNE	21	14	44		
	LNE	21	26	22		
	MNE	21	31	30		
	F	23	57			
No. 535 26th	iPEZ	19	43	51	225	Compression from SE. Felt at Naga with intensity III.
	ePN	19	43	51		
	iSNE	19	44	21		
	F	20	04			

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 July				
No. 536 27th	iPZ	21 33 27	2300	Disturbed by microseisms.
	⊙PNE	21 33 29		
	iSNE	21 37 11		
	iLNE	21 39 07		
	MNE	21 41 04		
	F	22 17		
No. 538 28th	PNEZ	11 36 25	210	Disturbed by microseisms.
	SNE	11 36 52		
	F	11 40		
No. 539 30th	PNEZ	17 23 32	2610	Disturbed by microseisms. East Java, Bali, Lombok.
	S?NE	17 27 37		
	L?NE	17 30 00		
	MNE	17 32 15		
	F	18 12		

Forty-four insignificant or undecipherable disturbances on the following days of July: 1st(2), 3rd, 4th(3), 5th(4), 7th(5), 9th(2), 10th(3), 11th(3), 12th(2), 13th(2), 14th(2), 15th(2), 17th(2), 18th(4), 19th(3), 20th, 21st, 24th and 28th.



M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

$\phi=14^{\circ} 34' 42''$ N.

$\lambda=120^{\circ} 58' 41''$ E.

$h=2.40$ m.

Alluvium.

WIECHERT. $M=1000$ Kg.

August 1, 1933.

GALITZIN-WILIP

	T_0	D	T_1	t	μ^2	K
N-S	12.43	100.5	12.59	11.52	0.017	97
E-W	11.80	100.5	11.91	11.40	-0.075	80
Z	11.60	100.5	9.00	14.82	1.250	200

	T_0	V	ϵ	$\frac{r}{T_0^2}$
N-S	4.4	197	2.4	0.030
E-W	4.9	199	2.7	0.034

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1933 August				
No. 540 4th	PNEZ SNE F	6 05 35 6 06 29 6 15	440	Felt at Aparri, N Luzon, with intensity III. Disturbed by microseisms.
No. 541 4th	PNEZ SNE F	16 53 42 16 54 30 17 06	390	Disturbed by microseisms.
No. 542 4th	PNEZ SNE LN F	17 37 52 17 42 20 17 45 10 18 20	2935	Disturbed by microseisms.
No. 543 5th	1PNEZ SNE LNE MNE F	0 52 16 0 58 40 1 06 00 1 09 25 2 20	4790	$O=0:44:02$ Probably in Netherlands East Indies. Disturbed by microseisms.
No. 547 7th	PNEZ SNE mN F	12 36 31 12 37 58 12 40 40 13 42	795	Felt at Surigao and Butuan, NE Mindanao, with intensity III. Epicenter in the Philippine Deep.
No. 549 9th	PNEZ SNE LE F	21 04 53 21 07 50 21 09 17 21 33	1710	Disturbed by microseisms.
No. 550 10th	PNEZ SNE F	0 41 36 0 42 02 1 04	200	Baguio, $\Delta=120$ Km. S from the Wiechert and Omori.
No. 555 11th	PNEZ SNE mNE F	2 37 47 2 39 04 2 40 28 3 14	690	Butuan, $\Delta=155$ Km.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 August				
No. 556 11th	iPZ ePNE iNE iSNE iLE ME F	8 59 17 8 59 18 8 59 20 9 03 46 9 06 40 9 10 10ca 10 45	2965	Dilatation. Asia. In region of 27°N: 97°E by Chiufeng, Hong Kong, Taihoku, Batavia.
No. 557 11th	PNEZ S?NE F	11 22 38 11 26 04 11 55	2065?	
No. 559 11th	ePNEZ SNE SNE F	17 21 46 17 22 51 17 23 16 17 35	570	Felt at Virac, Catanduanes Island, with intensity III.
No. 561 12th	iPZ ePNE SNE iLN MNE F	7 34 16 7 34 16 7 38 48 7 42 28 7 45 20ca 8 15	3010	
No. 566 13th	iPZ iPNE iSNEZ iLN MNE F	9 39 58 9 40 01 9 49 45 10 04 12 10 10 00ca 11 22	8365	SW Indian Ocean. Dilatation.
No. 570 14th	PNEZ S?NE F	22 29 00 22 34 24 23 05	3810?	
No. 571 15th	PNEZ iZ iNE iSNE LNE MNE F	3 03 20 3 03 25 3 03 32 3 07 46 3 10 30 3 12 50 4 15	2910	In region of 28°N: 143° 30'E by Manila, Koti, Hong Kong, Taihoku.
No. 573 15th	PNEZ SNE iN F	10 38 50 10 39 40 10 39 54 11 35	400	18°N: 122°E by Manila and Baguio.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY, Continued.

No. and Date	Phase	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
1933						
August						
No. 578 18th	ePNEZ	8	23	48	1905	
	SNE	8	27	01		
	LNE	8	28	40		
	F	8	50			
No. 581 20th	PNEZ	4	18	26	210	
	SNE	4	18	54		
	F	4	29			
No. 582 20th	1PNEZ	11	46	12	430	Compression. $13^{\circ} 37' N$; $124^{\circ} 50' E$ by Manila, Butuan, Baguio. Felt in southeastern part of Luzon with intensity VI. After P phases from the Wiechert and Omori.
	1SNE	11	47	04		
	1SNE	11	47	18		
No. 583 20th	PNE	12	07	20	435	Felt in southeastern part of Luzon with intensity IV. Aftershock of the No. 582. From Omori. No. 582 still recording.
	SNE	12	08	13		
No. 584 20th	PNE	12	28	24	455	Aftershock of the No. 582 and still recording. From the Wiechert.
	SNE	12	29	17		
No. 589 21st	PNEZ	11	45	16	720	Epicenter in Dinagat Sound, Mindanao. Felt at Surigao, NE Mindanao, with intensity IV. Butuan, $\Delta=115$ Km.
	SNEZ	11	46	36		
	mNE	11	47	05ca		
	F	12	04			
No. 595 22nd	PNE	3	04	18	2370	
	SNE	3	08	08		
	LNE	3	10	03		
	MNE	3	12	ca		
	F	3	37			
No. 597 22nd	1PNEZ	13	14	02	435	Compression. Same epicenter as No. 582. Felt in southeastern part of Luzon with intensity IV. After P. phases from the Wiechert.
	1SNE	13	14	55		
	mNE	13	15	26		
No. 598 22nd	PNE	14	02	44	455	Aftershock of the No. 582 and still recording.
	SNE	14	03	37		
No. 601 23rd	PNEZ	12	15	34	435	Aftershock of the No. 582.
	SNE	12	16	27		
	SNE	12	16	41		
	F	12	28			

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International
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Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1933 August No. 618 25th	iPZ iPNE iSNE iLNE MNE F	7 55 42 7 55 44 7 59 54 8 02 27 8 05 ca 11 55	2710	Compression. Western Szechuan Prov. China. 30°5'N: 103°5'E by Chiufeng. After P, data from the Wiechert. Baguio, $\Delta=25^{\circ}6$. 31°N: 101°E: $\Delta=7:50.3$ by U.S.C.G.S.
No. 622 26th	iPNZ ePE iSNZ iSN iNE F	3 07 51 3 07 51 3 09 03 3 09 33 3 10 03 3 30	640	Dilatation. Approx. 20° 30'N: 121°E by Manila and Taihoku. Felt at Basco, Batan Island, with intensity III.
No. 626 28th	PNEZ SNE F	0 54 50 0 55 12 0 59	175	
No. 629 28th 29th	PNEZ iNZ iE F	22 36 12 22 38 50 22 38 55 2 00		
No. 631 29th	iPNZ iPE iN iE iSNE LN F	15 11 34 15 11 36 15 12 16 15 13 03 15 16 36 15 20 14 16 20	3425	Dilatation. Disturbed by microseisms.
No. 632 31st	P?NE SNE F	12 36 38 12 40 46 13 14	2645?	Disturbed by microseisms.
No. 633 31st	PNE SNE F	19 37 07 19 37 33 19 41	200	Disturbed by microseisms.

Sixty-one insignificant or undecipherable disturbances on the following days of August: 5th(3), 9th, 10th(3), 11th(3), 12th(2), 13th(4), 14th, 15th, 17th(4), 18th, 19th, 20th(2), 21st(7), 22nd(2), 23rd(10), 24th(7), 25th(2), 26th(4), 28th(2), and 29th.

CORRECTION TO NO. 492, JULY 10, 1933.

Epicenter "Netherlands East Indies" should be assigned to No. 494 at 10h 38m.

July 20, 1933. No. 530. In region of northern Honshu, Japan, by Manila, Koti, Chiufeng.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

$\phi=14^{\circ} 34' 42''$ N.

$\lambda=120^{\circ} 58' 41''$ E.

h=2.40 m.

Alluvium.

GALITZIN-WILIP.

WIECHERT. M=1000 Kg.

September 2, 1933

	T_0	D	T_1		μ^2	K
N-S	12.43	100.5	12.59	11.52	0.017	97
E-W	11.80	100.5	11.91	11.40	-0.075	80
Z	11.60	100.5	9.00	14.82	1.250	200

	T_0	V	ϵ	$\frac{r}{T_0^2}$
N-S	4.5	187	2.5	0.026
E-W	4.8	206	2.7	0.029

No. and Date	Phase	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 September No. 634 1st	P?NEZ S?NE MN F	23 07 12 23 10 06 23 13 10 23 38		Disturbed by microseisms. Guam, $\Delta = 6^{\circ}$
No. 636 2nd	PNE SE SNE F	11 32 41 11 33 30 11 33 41 11 42	400	Disturbed by microseisms. Felt at Legaspi, SE Luzon, with intensity II.
No. 637 2nd	PNE SNE F	16 45 42 16 49 28 18 00	2325	Dilatation. From the Wiechert. Disturbed by microseisms. 30.7°N: 139.6°E by Koti. Deep focus. Baguio S-P= 3m 32s. Butuan S-P= 3m 14s. Guam S-P= 3m. Dilatation at Guam.
No. 638 3rd	iPNZ iSN iLN MN F	3 49 12 3 51 20 3 52 30ca 3 53 44ca 4 51	1210	Compression. Disturbed by microseisms.
No. 640 5th	iPZ ePNE SNE LN MN F	18 02 01 18 02 01 18 05 57 18 08 ca 18 10 14 18 37	2480	Compression.
No. 641 6th	iPNE iSNE F	1 18 20 1 18 37 1 20	135	

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933				
September				
No. 645	iPZ	22 18 38	6765	Dilatation from SE. In region of New Hebrides by Manila, Guam, Butuan. L and M not definite. Distur. by mic. 19°S: 179°W by U.S.C.G.S.
6th	iPNE	22 18 39		
7th	SNE F	22 26 57 0 15		
No. 647	iPNEZ	17 55 50	1135	Dilatation from SE.
7th	iSNZ	17 57 48		
	mN	17 58 06		
	F	19 30		
No. 649	PNE	16 00 08	1365	
8th	SE	16 02 30		
	mN	16 04 24		
	F	16 20		
No. 651	ePNEZ	5 08 05	2935	Very sharp S. From the North.
9th	iSNEZ	5 12 33		
	SR ₂ E	5 14 11		
	LN	5 15 17		
	ME	5 17 34		
	F	5 45		
No. 653	iPZ	21 29 08	5390	Compression. Interpretation according to Macell-wanes New Tables, 1933.
9th	iPE	21 29 09		
	ePN	21 29 09		
	iSNEZ	21 36 14		
	SR ₂ E	21 41 00		
	L	21 43 50		
	F	23 20		
No. 656	iPNEZ	8 01 01	180	Dilatation from NE. Felt at Baguio with intensity I. Data after P from the Wiechert. Baguio Δ =152 Km.
12th	iSNE	8 01 24		
	mN	8 02 44		
	F	8 20		
No. 657	PNEZ	0 25 00	150	Disturbed by microseisms.
13th	SNE	0 25 19		
	F	0 30		
No. 658	PNE	13 38 40	75	Disturbed by microseisms.
14th	SE	13 38 50		
	F	13 40		
No. 659	P?NE	18 11 11	4645?	Disturbed by microseisms.
14th	S?NE	18 17 26		
	F	19 04		

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 September				
No. 660 15th	PNE SNE F	4 02 42 4 03 15 4 07	240	From the Wiechert. Disturbed by microseisms.
No. 662 16th	PNE SNE F	17 52 25 17 52 41 17 56	125	From the Wiechert. Disturbed by microseisms.
No. 665 20th	iPNZ ePE SNE F	21 44 20 21 44 20 21 44 40 22 14	160	Dilatation. S from the Wiechert.
No. 666 20th 21st	iPNEZ iSNE F	23 34 07 23 34 27 1 15	160	Compression from SE. Epicenter between Mindoro and Marinduque. Felt at Boac and Atimonan with intensity III, Batangas and Manila II, Baguio I. S from Omeri. Baguio $\Delta \approx 360$ Km.
No. 667 21st	PNEZ SNE LNE ME F	3 20 01 3 24 23 3 27 ca 3 29 31 4 45	2855	Japan. Disturbed by microseisms.
No. 669 21st	iPZ ePNE SNE LNE MN F	9 54 17 9 54 17 9 59 05 10 02 33 10 05 ca 11 35	3245	Compression from N or NE. Disturbed by microseisms.
No. 670 21st	iPNEZ SN LNE F	13 49 43 13 54 19 13 57 45 14 30	3065	From NE. Disturbed by microseisms.
No. 674 22nd	iPZ ePNE S?NE L?NE F	11 47 53 11 47 53 11 52 26 11 55 25 13 05	3020?	Disturbed by microseisms.
No. 675 23rd	P?N SN LN F	0 35 05 0 38 03 0 40 09 1 15	1720	Z recorder under adjustment. No time eclipses in E-W component on 23rd and 24th.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 September				
No. 681 23rd	iPN SNZ F	18 28 08 18 28 31 18 32	180	
No. 682 24th	PNZ SNZ F	8 07 28 8 07 54 8 11	200	
No. 683 24th	iPNZ SN L?Nca F	15 29 55 15 33 37 15 48 30 18 30	7165	Compression. 51°N: 177°W: O=15:19.6 by U.S.C.G.S.
No. 685 25th	ePNZ SNEZ F	13 04 03 13 04 26 13 09	140	
No. 686 25th	iPNEZ SNE LNE MNE F	13 48 19 13 53 12 13 56 33 13 59 20ca 15 53	3335	Compression from SE. Data after P from the Wiechert.
No. 687 25th	PNEZ SNEZ LE ME F	18 58 43 19 04 44 19 10 26 19 13 31 21 55	4310	Dilatation.
No. 693 27th	ePNZ SNE? F	0 16 10 0 16 20 0 34	150?	
No. 695 27th	ePNE SE mN F	5 34 26 5 35 30 5 35 41 5 41	420	Felt at Legaspi, SE Luzon, with intensity II.
No. 696 27th	iPZ ePNE iSNEZ LNEZ MN F	21 48 23 21 48 29 21 53 47 21 57 45 22 01 10 22 50	3720	Dilatation.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933				
September				
No. 697	iPZE	0 30 24	1100	Compression.
28th	ePN	0 30 24		Butuan $\Delta=265$ Km.
	iSNE	0 32 21		
	F	1 35		
No. 699	iPNEZ	18 57 48	150	Dilatation.
28th	SNE	18 58 07		Felt in Manila and Ambulong with intensity III.
	F	19 30		Data after P from Omori.
No. 700	ePNE	13 14 22	145	From the Wiechert.
29th	iSNE	13 14 40		
	F	13 18		
No. 701	ePNE	14 26 24	2825	From the Wiechert. Disturbed by
30th	PR ₁ N	14 26 59		microseisms.
	SNE	14 30 44		
	LNE	14 33 17		
	F	15 24		
No. 702	PNE	18 50 39	305	Felt at Virac, with intensity III.
30th	SNE	18 51 20		From the Wiechert. Disturbed by
	F	18 54		microseisms.

Thirty-one insignificant or undecipherable disturbances on the following Days of September: 2nd, 4th, 6th(3), 7th(2), 8th, 9th, 11th(2), 15th, 16th, 17th, 21st(3), 22nd, 23rd(5), 25th, 26th(5), 27th, and 28th.

CORRECTION TO MAY 3, 1933.

P=23:33:02

S=23:34:48

23° 40' N: 122° 30' E by Taihoku, Zikawei, Nanking, Manila, Chiufeng.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

$\phi=14^{\circ} 34' 42''$ N.

$\lambda=120^{\circ} 58' 41''$ E.

h=2.40 m.

Alluvium.

GALITZIN-WILIP

WIECHERT. M=1000 Kg.

October 5, 1933.

	T_0	D	T_1	λ	μ^2	K
N-S	12.43	100.5	12.59	11.52	0.017	97
E-W	11.80	100.5	11.91	11.40	-0.075	80
Z	11.60	100.5	9.00	14.82	1.250	200

	T_0	V	ϵ	$\frac{r}{T_0^2}$
N-S	4.5	187	2.4	0.032
E-W	4.9	199	2.7	0.030

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 October No. 706 2nd	ePNEZ S?NE LNE MN F	14 08 09 14 14 06 14 19 40 14 24 20ca 15 40	4335?	Disturbed by microseisms.
No. 707 2nd	1PZ ePNE PS?E F?	15 49 21 15 49 23 16 02 58 18 00	11955?	Compression. PS and F from the Wiechert, but very doubtful. Disturbed by microseisms. 3 ^A S: 80 ^W : 0=15:29:20 by U.S.C.G.S.
No. 708 3rd	ePNEZ SNE F	10 41 06 10 45 03 11 20	2490	Disturbed by microseisms.
No. 709 3rd	ePNEZ SNEZ F	16 11 20 16 11 50 16 16	220	Disturbed by microseisms.
No. 712 3rd	P?NEZ S?N LNE MN F	18 44 42 18 48 48 18 51 08 18 53 27 19 40	2620?	Disturbed by microseisms.
No. 714 4th	ePNEZ SNE F	14 47 41 14 48 06 15 01	195	
No. 715 4th	PNEZ SNE F	17 28 32 17 32 42 18 15	2680	

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
1933 October No. 716 5th	ePNEZ	13	40	00	6700	
	iSN	13	48	14		
	eSEZ	13	48	14		
	LNE	13	59	07		
	MN	14	03	15ca		
	F	15	35			
No. 720 10th	\bar{P} NEZ	20	40	02	160	Felt at Baguio with intensity II. Data after \bar{P} from the Wiechert.
	\bar{S} NE	20	40	22		
	F	20	48			
No. 725 16th	PNE	18	02	47	720	From the Wiechert. Disturbed by microseisms.
	S?NE	18	04	07		
	F	18	22			
No. 729 21st	P?NE	2	50	04	1790?	Disturbed by microseisms.
	S?NE	2	53	07		
	F	3	42			
No. 731 22nd	PNZ	12	02	06	5035	No time mark in E-W component on October 22nd.
	SN	12	08	44		
	LN	12	15	30ca		
	MN	12	19	40ca		
	F	13	30			
No. 732 22nd	PNZ	18	49	33		
	\bar{S} N	18	50	24		
	F	18	53			
No. 735 23rd	P?NE	13	44	51	3680?	Disturbed by microseisms.
	iN	13	45	48		
	iE	13	48	19		
	S?NE	13	50	07		
	F	14	23			
No. 736 24th	PNEZ	16	11	47	510	S from the Wiechert. Disturbed by microseisms.
	SNE	16	12	47		
	F	16	33			
No. 737 25th	PNEZ	0	52	17	570	Disturbed by microseisms.
	S?NE	0	53	23		
	F	1	11			

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 October				
No. 738 25th	PNEZ	23 48 09		Disturbed by microseisms.
	S?NE	23 53 31		
	LNE	23 57 42		
26th	F	2 04		
No. 739 26th	eNE	12 27 27		Disturbed by microseisms.
	iE	12 29 10		
	iN	12 31 00		
	iE	12 31 23		
	F	15 10		
No. 740 27th	PNE	5 44 43	1365	Disturbed by microseisms.
	SNE	5 47 05		
	LE	5 48 20ca		
	MNE	5 49 30ca		
	F	6 04		
No. 744 29th	eP?NE	3 54 14	480?	No. 743 still recording. Disturbed by microseisms.
	SE	3 55 11		
	F	4 10		
No. 745 30th	P?NEZ	7 08 57	6755?	Disturbed by strong microseisms.
	S?NE	7 17 15		
	LNE	7 28 33ca		
	MN	7 33 00ca		
	F?	8 30		

Twenty-three insignificant or undecipherable disturbances in the following days of October: 1st(2), 2nd, 3rd(2), 4th, 7th(3), 12th, 14th(3), 16th, 17th, 20th, 21st, 23rd(2), 28th(2), 29th, and 31st.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

$\phi=14^{\circ} 34' 42''$ N.

$\lambda=120^{\circ} 58' 41''$ E.

h=2.40 m.

Alluvium.

GALITZIN-WILIP

WIECHERT. M=1000 Kg.

November 1, 1933.

	T_0	D	T_1	L	μ^2	K
N-S	12.43	100.5	12.59	11.52	0.017	97
E-W	11.80	100.5	11.91	11.40	-0.075	30
Z	11.60	100.5	9.00	14.82	1.250	200

	T_0	V	ϵ	$\frac{r}{T_0^2}$
N-S	4.5	194	2.4	0.046
E-W	4.8	206	2.6	0.041

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1933 November				
No. 747 2nd	iPNZ ePE SNE LNE F	12 37 19 12 37 19 12 46 04 12 59 00 14 06	7145	Disturbed by microseisms. 52°N: 176°W: O=12:27:00 by U. S. C. G. S.

November 4th the Wiechert was stopped from 17:37 to 24:00 G.M.T.

November 4th no records from Galitzin due to strong microseisms.

No. 748 5th	iPN ePEZ SNE LNE MNE F	20 32 30 20 32 30 20 37 00 20 39 16 20 41 ca 21 44	2980	
No. 749 7th	PNE SNE LNE MN F	6 45 04 6 48 54 6 51 20ca 6 53 ca 7 45	2390	Disturbed by microseisms.
No. 750 9th	PNEZ SNEZ F	7 34 08 7 36 07 7 52	1145	Felt at Davao with intensity II. Butuan. $\Delta=360$ Km.
No. 751 10th	P?NEZ S?NE LE F	5 44 57 5 49 21 5 52 ca 6 35	2830?	Disturbed by microseisms.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 November				
No. 752 13th	iPNEZ SNE F	1 35 33 1 35 53 1 45	160	Compression from NW. Felt in Manila with intensity III and in Baguio, II. S from Wiechert and Omori.
No. 753 16th	ePNEZ SNE F	16 48 11 16 49 43 17 04	850	Disturbed by microseisms.
No. 754 17th	PNEZ SN F	9 48 51 9 51 26 10 08	1500	Disturbed by microseisms.
No. 755 18th	eP?NEZ SNE LNE MNE F	2 23 46 2 26 33 2 28 00ca 2 29 30ca 3 05	1610?	Disturbed by microseisms.
No. 756 18th	iPZ ePNE SNE LE F	4 01 29 4 01 29 4 07 31 4 13 05 5 04	4420	Dilatation. In region of Bougainville Island by Riverview, Manila, Chuifeng. Disturbed by microseisms.
No. 758 18th	iPN SNE mN F	16 46 14 16 50 11 16 53 00 17 50	2490	Disturbed by microseisms.
No. 759 18th	iPNEZ SNEZ F	22 03 59 22 04 16 22 08	135	Dilatation. Disturbed by microseisms.
No. 760 19th	iPEZ ePN SNE LNE MNE F	3 20 56 3 20 56 3 28 32 3 37 20ca 3 42 35ca 5 13	6055	Compression. In region of 15°S: 165°E by Riverview, Sydney, Manila.
No. 761 19th	PNEZ SNEZ F	8 04 04 8 04 22 8 10	140	Dilatation.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 November No. 762 19th	PNEZ SNE LNE F	9 13 55 9 18 25 9 21 20ca 9 50	2980	
No. 766 20th	PNEZ PR ₁ E 1E 1E PSE	23 34 43 23 38 25 23 40 46 23 46 35 24 47 ca		Compression from north. Data after P from the Wiechert. The Wiechert N-S sheet accidentally spoiled.
21st	F	1 30		73°N: 67°W: O=23:21.6 by U. S. C. G. S.
No. 770 22nd	iPN ePEZ SNE LNE MNE F	12 49 20 12 49 20 12 54 41 12 58 51 13 01 50ca 14 40	3755	In region of Torres Strait by Man- ila, Hong Kong, Chiufeng, Osaka, Disturbed by microseisms. Riverview Data after P from the Wiechert.
No. 772 22nd	PNEZ SNE LE F	22 35 40 22 38 45 22 40 20ca 23 30	1810	Disturbed by microseisms.
No. 782 26th	1PNEZ SNE F	22 51 23 22 51 42 23 18	150	Dilatation. 14° 22'N: 122° 20'E by Manila and Baguio. Felt in Manila with intensity III and Ambulong. After P, data from Omori.
No. 786 28th	1PZ ePE 1E 1SNE LNE MNE F	11 19 36 11 19 36 11 20 52 11 28 05 11 39 30ca 11 44 40ca 13 15	6965	O=11:09:10

Twenty insignificant or undecipherable disturbances on the following days of November: 18th, 19th(3), 21st, 22nd(3), 23rd(3), 25th(4), 26th(2), and 27th(3).

A D D I T I O N A L D A T A OF NO. 770

7°N: 147°E by Riverview, Adelaide, Manila, Hong Kong, Osaka, Chiufeng.

No. 42.

December, 1933.



M A N I L A , P . I .

$\phi=14^{\circ} 34' 42''$ N.

$\lambda=120^{\circ} 58' 41''$ E.

$h=2.40$ m.

Alluvium.

Galitzin-Wilip.

Wiechert. $M=1000$ Kg.

December 1, 1933.

	T_0	D	T_1		μ^2	K
N-S	12.4	100.5	12.6	11.5	0.017	97
E-W	11.8	100.5	11.9	11.4	-0.075	80
Z	11.6	100.5	9.0	14.8	1.250	200

	T_0	V	ξ	$\frac{r}{T_0^2}$
N-S	4.4	193	2.3	0.032
E-W	4.8	204	2.7	0.034

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933 December				
No. 787 1st	PNEZ SN F	10 36 32 10 44 00 10 56	5910	Deep focus according to Riverview.
No. 788 2nd	iPNZ ePE iSNEZ MNE F	5 28 57 5 28 57 5 38 40 5 59 ca 7 00	8270	Dilatation.
No. 789 2nd	iPNEZ iSNE F	8 44 36 8 45 45 9 40	610	Compression. Felt at Basco, Batan Is. With intensity VII. After P data from the Wiechert. $20^{\circ} 20' N$; $121^{\circ} 55' E$ by Taihoku, Hong Kong, Manila, Osaka.
No. 790 2nd	P'NEZ F	20 24 00ca 23 00		Long distance. Other phases very difficult.
No. 794 4th	iPNEZ iSNEZ iLNE F	19 40 39 19 46 01 19 50 00ca 21 10	3765	Dilatation. Probably from NE. La Perouse Strait, according to Chiufeng.
No. 802 8th	PNEZ SNE LNE MNE F	17 03 07 17 05 07 17 06 11 17 07 10ca 17 15	1155	
No. 807 11th	eNEZ F	11 20 02 11 35		



SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

M A N I L A , P . I .

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1933				
December				
No. 808 12th	iPZ	14 18 23	3145?	Dilatation. 5°S; 153°E by Riverview, Manila, Chiufeng, Adelaide, Perth, as on January 18, 1930. Data after P from the Wiechert.
	ePNE	14 18 23		
	S?NE	14 23 05		
	MNE	14 27 40ca		
	F	16 10		
No. 809 13th	eE	21 42 46	13880	Interpretation by Macelwane's New Tables. Disturbed by microseisms.
	PR ₁	21 44 26		
	PSE	21 54 35		
	LE	22 22 ca		
	F	23 55		
No. 811 14th	eNE	19 02 21		Disturbed by microseisms.
	F	19 22		
No. 812 14th	P?NE	19 27 45	1935?	Disturbed by microseisms.
	S?NE	19 31 01		
	F	19 49		
No. 813 17th	PNEZ	18 21 05	660	Disturbed by microseisms.
	SNE	18 22 19		
	F	18 42		
No. 814 18th	PNE	20 41 32	960?	Disturbed by Microseisms. Butuan, 225 Km.
	S?NE	20 43 14		
	F	21 11		
No. 816 19th	PE	14 28 48	800	Disturbed by microseisms. Probably near 10°N; 126° 30'E by Butuan and Manila.
	SN	14 30 17		
	F	14 48		
No. 819 22nd	PNE	17 57 20	370	Disturbed by microseisms.
	SNE	17 58 07		
	F	18 12		
No. 820 22nd	PNEZ	19 42 37	395	Disturbed by microseisms.
	SNE	19 43 26		
	F	19 54		
No. 822 24th	ePNEZ	10 52 20	3820	
	PR ₂ N	10 53 48		
	iE	10 55 15		
	SNE	10 57 45		
	LE	11 02 15ca		
	F	12 20		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1933				
December				
No. 825 27th	PNEZ	10 51 03	880	9°N; 126° 40'E by Butuan and Manila.
	SNEZ	10 52 37		
	F	11 15		
No. 829 27th	ePNEZ	16 40 10	980	
	SNE	16 41 54		
	mN	16 43 ca		
	F	17 00		
No. 830 29th	ePNEZ	9 50 57	240	
	SNEZ	9 51 30		
	F	10 01		
No. 831 30th	ePNEZ	5 31 02	2070	
	SNE	5 34 28		
	LNE	5 36 30		
	F	6 13		
No. 832 30th	ePNEZ	8 48 13	1455	
	SNE	8 50 44		
	MNE	8 53 00ca		
	F	9 22		

Twenty-five insignificant or undecipherable disturbances on the following days of December: 3rd(2), 4th, 5th, 6th(2), 7th, 8th(3), 9th(2), 10th(2), 14th, 19th, 21st(2), 23rd, 26th(2), 27th(3), and 30th.