

COMMONWEALTH OF THE PHILIPPINES  
DEPARTMENT OF AGRICULTURE AND COMMERCE



# WEATHER BUREAU

MANILA CENTRAL OBSERVATORY

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## SEISMOLOGICAL BULLETIN FOR 1938 JANUARY-JUNE

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MANILA  
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1938



# INTRODUCTION



## SEISMIC STATIONS

The following is the list and data of stations equipped with seismographs.

Name	Islands	North latitude	East longitude	Elevation	Equipment	Substructure
Manila	Luzon	14 35	120 59	3.0	Galitzin-Wilip, 3 components. Wiechert inverted pendulums, mass 955 kg. Two horizontal pendulums, mass 118 kg. each.	Alluvium and pyroclastics to unknown depth.
Baguio	do	16 25	120 35	1,512	Vicentini, 3 components. Wiechert inverted pendulum, mass 200 kg.	Limestone.
Ambulong	do	14 05	121 03	10.5	Vicentini, 3 components	Soil underlaid by tuff.
Butuan	Mindanao	8 56	125 32	2.0	Wiechert inverted pendulum, mass 200 kg.	Alluvium.
Agana	Guam	13 28	144 45	5.0	do	Coral.

All meteorological stations, official and coöperative, have instructions to report all perceptible earthquakes.

## SEISMIC RECORDS

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

The time of occurrence given in the macroseismic records is that indicated by the seismographs of the Manila Observatory whenever the disturbance has been recorded by them. This fact is denoted by an asterisk in the macroseismic record. Otherwise the time is that given by the meteorological observer who reports the earthquake. Greenwich mean time is given and insular time is added in brackets.

Intensity is given according to the Rossi-Forel scale as adapted by Rev. W. C. Repetti, S. J., Chief of the Seismic Division, for use in the Philippine Islands.

## ROSSI-FOREL SCALE OF EARTHQUAKE INTENSITIES (Adapted)

- I. *Microseismic shock*.—Felt only by an experienced observer under favorable conditions.
- II. *Extremely feeble shock*.—Felt by a small number of persons at rest.
- III. *Very feeble shock*.—Felt by several persons at rest. Duration and direction may be perceptible. Sometimes dizziness or nausea experienced.
- IV. *Feeble shock*.—Felt generally indoors; outdoors by a few. Hanging objects swing slightly. Creaking of frames of houses.
- V. *Shock of moderate intensity*.—Felt generally by everyone. Hanging objects swing freely. Overturn of tall vases and unstable objects. Light sleepers awakened.
- VI. *Fairly strong shock*.—General awakening of those asleep. Some frightened persons leave their houses. Stopping of pendulum clocks. Oscillation of hanging lamps. Slight damage in very old or poorly built structures.
- VII. *Strong shock*.—Overturn of movable objects. General alarm, all run outdoors. Damage *slight* in well-built houses, *considerable* in old or poorly built structures, old walls, etc. Some landslides from hills and steep banks. Cracks in road surfaces.
- VIII. *Very strong shock*.—People panicky. Trees shaken strongly. Changes in flow of springs and wells. Sand and mud ejected from fissures in soft ground. Small landslides. Slides in river banks.
- IX. *Extremely strong shock*.—Panic general. Partial or total destruction of some buildings. Fissures in ground. Landslides and rock falls.

## SYMBOLS AND ABBREVIATIONS

- P** Normal first preliminary tremors; longitudinal waves which have passed below the continental layer.
- $\bar{P}$**  Upper first preliminary tremors whose path lies wholly in the continental layer.
- $P'$**  Longitudinal waves that have traversed the earth's core.





PPn	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.
$\bar{S}$	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.
SS	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.
SKP	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 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.
T	Period of waves.
O	Time of earthquake at the epicenter.
H	Time of earthquake at focus.
h	Focal depth.
$\Delta$	Arcual distance from station to epicenter.
To	Free or undamped period of the seismograph.
V	Static magnification.
$\epsilon$	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

1938	N-S component				E-W component			
	$T_o$	V	$\epsilon$	$\frac{r}{T_o^2}$	$T_o$	V	$\epsilon$	$\frac{r}{T_o^2}$
January	4.3	209	2.4	0.074	4.4	255	2.7	0.087
February	4.3	211	2.6	0.069	4.3	258	2.9	0.081
March	4.3	211	2.5	0.067	4.4	247	2.6	0.086
April	4.3	217	2.5	0.071	4.4	256	2.5	0.090
May	4.3	212	2.4	0.072	4.3	253	2.6	0.098
June	4.2	213	2.4	0.071	4.3	267	2.9	0.099

#### CONSTANTS OF THE GALITZIN-WILIP SEISMOMETERS

	$T_1$	T	$\mu^2$	$V_s$
N-S	12.6s	12.9s	0	400
E-W	11.9s	11.9s	.08	230
Z	11.6s	9.0s		

Cf. Theoretical Seismology, Schon, S. J.



## SEISMOLOGICAL BULLETIN FOR 1938

JANUARY, 1938

### MACROSEISMIC RECORD

- 2, 6<sup>h</sup> 14<sup>m</sup> 40<sup>s</sup> [2, 4:14:40 P. M.] **Agaña, Guam.** Earthquake recorded and felt.
- 4, 11<sup>h</sup> 09<sup>m</sup> [4, 7:09 P. M.] **Butuan, Agusan.** Extremely feeble earthquake lasting five seconds.
- 5, 18<sup>h</sup> 56<sup>m</sup> [6, 2:56 A. M.] **Dapa, Surigao.** Earthquake of intensity III lasting about nine seconds. The direction seemed to be E-W.
- 12, 2<sup>h</sup> 37<sup>m</sup> 30<sup>s</sup> [12, 12:37:30 P. M.] **Agaña, Guam.** Earthquake recorded and felt.
- 12, 13<sup>h</sup> 39<sup>m</sup> 56<sup>s</sup>\* [12, 9:39:56 P. M.] **Virac, Catanduanes.** Oscillatory earthquake of intensity V and duration twenty-two seconds. There was an aftershock of intensity V which lasted about seven seconds.
- 16, 18<sup>h</sup> 45<sup>m</sup> [17, 2:45 A. M.] **Masbate, Masbate.** Earthquake of intensity III.
- 18, 20<sup>h</sup> 48<sup>m</sup> 37<sup>s</sup>\* [19, 4:48:37 A. M.] **SE Luzon.** At Virac the intensity was IV with a duration of twenty-seven seconds. There were three aftershocks of the same intensity. In Capalonga the intensity was III with a duration of three seconds.
- 20, 14<sup>h</sup> 30<sup>m</sup> [20, 10:30 P. M.] **Basco, Batanes.** Earthquake of intensity III and four seconds duration.
- 22, 18<sup>h</sup> 24<sup>m</sup> 39<sup>s</sup>\* [23, 2:24:39 A. M.] **Basco, Batanes.** Earthquake of intensity II and three seconds duration.
- 24, 8<sup>h</sup> 15<sup>m</sup> [24, 4:15 P. M.] **Calayan, Babuyan Islands.** A very feeble earthquake which began with a subterranean noise.
- 26, 15<sup>h</sup> 55<sup>m</sup> [26, 11:55 P. M.] **Port Lamon, Surigao.** Earthquake of intensity III and duration thirty seconds.



## INSTRUMENTAL RECORD

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No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h	m.	s		
2	1	PNEZ SNE F	7	35	53 44 57	3,290	
4	1	PNEZ SNEZ F	16	16	31 43 50	2,710	Deeper than normal.
5	1	iPEZ SNEZ iZ F	23	33	07 24 28	2,780	Compression.
8	2	PPEZ SKP PPP PS LN F	22	48	47 03 25 56 ca	14,555	15.7°N: 98°W; 0 = 22:27:13 by U. S. C. G. S. 16°.7N: 98.3°W; H = 22:27:17, J. S. A.
11	3	iPEZ iZ SNE F	21	28	42 40 24 07	8,270	Dilatation(?)
12	4	P?NEZ SNE F	2	41	40 46 00	2,620?	
14	5	PNEZ SNE F	2	39	53 07 51	110	
15	6	PNEZ SNEZ F	0	33	53 33 50	1,545	
17	7	PEZ SEZ MNEZ F	15	33	40 56 10ca	3,665	4°S: 151°E by Wellington.
19	10	PNEZ iZ SNEZ F	20	53	34 12 03 31	2,100	
20	11	iPNEZ SNE F	15	17	03 16 02	2,720	
24	16	P?NEZ S?N F	14	12	52 48 08	4,320?	
25	17	PNEZ SNE F	23	35	35 01 56	2,065	
26	18	iPEZ SNE LNE MNE F	4	25	40 13 25ca 40ca 20	3,020	
28	18	ePNEZ iSE iN F	9	37	36 27 54 25	5,255	
29	18	ePNEZ SNE F	20	48	37 30 33	435	Felt at Virac with intensity V and at Capalonga, intensity III.
30	18	PNEZ SNE F	21	47	53 14 55	165	
31	19	ePNZ S?NEZ F	2	46	35 19 16	2,300?	
32	19	ePNEZ SNE F	14	54	13 52 35	2,235	Deeper than normal.
34	22	iPz ePNE SNE F	15	33	16 16 37 06	2,845	Dilatation.
35	22	ePNEZ SNE F	18	24	39 15 40	895	Felt at Basco with intensity II.



INSTRUMENTAL RECORD—Continued



No.	Date	Phase	Time			$\Delta$ Km	Remarks
			h.	m.	s.		
36	23	ePNEZ	8	44	08	9,535?	21.2°N: 156.1°W; 0=8:32.8, U. S. C. G. S. Felt in Hawaii.
		S?N		54	47		
		F	11	15			
38	24	PNEZ	10	51	01	16,230	Probably, 71°S: 47°W; 0=10:31.3, U. S. C. G. S. 60.4°S: 35.6°W; H = 10:31:45, J. S. A.
		SKP		54	36		
		iNE		56	25		
		F	13	15			
40	25	eEZ	17	05	15	8,745	34°S: 175°W by Wellington.
		SNE		15	15		
		F	18	21			
41	25	iPz	21	01	19	190	
		ePNE			21		
		SNE			43		
		F	10				
44	26	PNEZ	5	16	54	1,720	P in minute gap.
		SNE		19	52		
		LN		21	25ca		
		F		46			
47	28	iPz	4	16	51	3,000	
		ePNE			51		
		SNE		21	23		
		LNE		24	ca		
		F		57			
48	29	ePNEZ	4	19	56	4,380	
		SNE		25	55		
		LN		30	35ca		
		MNE		34	50ca		
		F	5	01			
51	30	ePNE	10	09	51	1,030	
		SNE		11	40		
		F		30			
52	30	ePNEZ	17	21	33	8,020	12°S: 171° E by Wellington.
		SN		31	00		
		F	18	47			

Twenty-three insignificant or undecipherable disturbances on the following days of January: 1st(2), 2nd(2), 3rd(2), 4th, 6th, 8th, 12th(2), 13th, 18th, 20th, 23rd, 25th(2), 27th, 29th(2), and 31st.



## FEBRUARY, 1938

### MACROSEISMIC RECORD

- 1, 19<sup>h</sup> 11<sup>m</sup> [2, 3:11 A.M.] **Ambulong, Batangas.** Earthquake of intensity II.
- 5, 9<sup>h</sup> 55<sup>m</sup> 56<sup>s\*</sup> [5, 5:55:56 P.M.] **S Luzon.** The center was in the region of Catanduanes Island. The intensity was VII at Virac where it was felt for about seventeen seconds. A strong vertical motion was felt, an underground noise was heard, windows were broken, and movable objects were displaced to the NW. Old brick structures were slightly damaged. At Mayon Rest House, Tabaco and Polangui the shock was strong. Intensity V in Legaspi where it lasted forty seconds. In Daet, Sorsogon and Atimonan the intensity was IV; in Capalonga and Naga, III; in Ambulong, II.
- 6, 6<sup>h</sup> 45<sup>m</sup> [6, 2:45 P.M.] **Kiamba, Cotabato.** Moderate earthquake.
- 11, 8<sup>h</sup> 02<sup>m</sup> 58<sup>s\*</sup> [11, 4:02:58 P.M.] **Santa Cruz, Marinduque.** Slight earthquake.
- 11, 14<sup>h</sup> 40<sup>m</sup> 30<sup>s\*</sup> [11, 10:40:30 P.M.] **N Luzon.** Epicenter probably in mountains of northern Luzon. Moderately strong in Santo Domingo, Ilocos Sur, and light in Appari and Laoag.
- 16, 20<sup>h</sup> 47<sup>m</sup> 20<sup>s\*</sup> [17, 4:47:20 A.M.] **SE Luzon.** Felt with intensity IV in Masbate where it lasted five seconds. Felt moderately in Legaspi for twenty seconds, and also in Malinao, Tabaco, and Sorsogon.
- 18, 1<sup>h</sup> 10<sup>m</sup> [18, 9:10 A.M.] **Baganga, Davao.** Light earthquake of eight seconds duration.
- 20, 21<sup>h</sup> 17<sup>m</sup> [21, 5:17 A.M.] **NE Mindanao.** Felt with intensity III at Dapa, Surigao, with a duration of twenty seconds. Extremely feeble at Butuan, Agusan.
- 23, 0<sup>h</sup> 55<sup>m</sup> 17<sup>s\*</sup> [23, 8:55:17 A.M.] **Central Luzon.** Epicenter in the Caraballo Mountains. At Umingan, Pangasinan, the motion was chiefly vertical in several distinct shocks. Felt over a radius of about 100 km. in Central Luzon.
- 23, 13<sup>h</sup> 06<sup>m</sup> [23, 9:06 P.M.] **Laoag, Ilocos Norte.** Earthquake of intensity II and four seconds duration.
- 28, 6<sup>h</sup> 34<sup>m</sup> 34<sup>s\*</sup> [28, 2:34:34 P.M.] **S Luzon.** Felt slightly in Alabat, Manila, and Indang.
- 28, 12<sup>h</sup> 52<sup>m</sup> 25<sup>s\*</sup> [28, 8:52:25 P.M.] **Daet, Camarines Norte.** Earthquake of intensity III lasting ten seconds.

### INSTRUMENTAL RECORD

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
54	1	PNEZ	7	49	23	540	
		SNE		50	48		
		F	8	19			
55	1	PNEZ	18	55	02	2,455	
		SNEZ		59	04		
56	1	PNEZ	19	09	12	2,280	5.5° S: 131° E; H = 19:4.4 by J. S. A. 4° S: 133.5° E by U. S. C. G. S. S. from the Wiechert. No. 55 still recording.
		SN		13	00		
57	1	PE	19	43	49	2,260	No. 56 still recording.
		SE		47	30		
		F	0	18			
59	2	PNEZ	9	42	30	2,890	
		SE		46	55		
		ME		52	ca		
		F	10	45			



## INSTRUMENTAL RECORD—Continued



No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
66	3	PN	12	55	49	3,520	
		SNE	13	00	55		
		LNE		04	35ca		
		F		50			
68	4	PNEZ	10	42	28	3,410	
		SNE		47	27		
		F	11	07			
69	4	PNEZ	11	11	12	300	
		SNE			52		
		F		26			
70	5	iPz	2	43	21	17,555	5.1°N; 75.7°W; H=2:23:38 by J. S. A. 4.5°N; 76°W; 0=2:23:34 by U. S. C. G. S. Felt in Panama and Columbia.
		ePNE			21		
		iz		44	45		
		ie		45	46		
		ine		49	16		
		F	5	25			
72	5	iPNEZ	9	56	56	295	Dilatation. Felt in southeastern Luzon. Probably a little deeper than normal.
		SNEZ		56	36		
		F	12	10			
75	5	iPz	20	31	00	295	
		ePNE			00		
		SNE			40		
76	5	P?NEZ	20	38	36	1,110	No. 75 still recording.
		SNE		40	32		
		F	21	08			
81	6	PNE	7	01	48	1,135	Felt in Kiamba, Cotabato.
		SN		03	54		
82	6	iPz	7	14	20	4,490	No. 81 still recording.
		ePNE			20		
		SNE		20	26		
		F	8	50			
84	6	Pz	18	24	00	2,520	
		SNE		27	59		
		F	19	15			
86	7	ePNEZ	3	53	25	3,290	
		SNE		58	16		
		F	4	32			
91	8	PEZ	7	36	02	7,320	
		SNE		44	53		
		F	9	40			
92	8	PNEZ	13	15	17	1,010	
		SNE		17	24		
		F	14	37			
93	8	ePNEZ	14	40	18		
		ie		50	08		
		F	16	50			
99	11	iPz	7	03	30	5,535	Compression.
		in		05	16		
		in		06	23		
		SNE		10	37		
		F	8	13			
101	11	iPNE	14	40	30	400	Compression from NW. Felt in northern Luzon. S and $\bar{S}$ from the Wiechart. and Horizontal. Baguio, 200 Km.
		SN		41	20		
		$\bar{S}$ E			30		
		F	16	20			
102	11	ePNEZ	17	02	21	1,945	
		SN		05	38		
		F		33			
103	11	ePNEZ	19	28	24	460	
		SNE		29	36		
		F		46			
107	13	iPEZ	8	15	33	8,200	Compression. 38°S: 179°W; 0=8:03:44 by U. S. C. G. S. 38°S: 177°W by Wellington.
		ePN			33		
		SNEZ		25	08		
108	13	iPEZ	8	33	35	3,590	No. 107 still recording.
		in		36	55		
		SNE		38	45		
		F	11	20			
111	14	PNEZ	3	04	45	6,890	Compression. Caspian Sea. 40.8°N: 53.5°E (Strasbourg).
		SNE		13	16		
		F	4	10			



## INSTRUMENTAL RECORD—Continued

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No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
114	15	PP	3	49	31	14,800	Dilatation. 18°N: 25°W; 0=3:27.7 by U. S. C. G. S. 19.3° N: 26°W H=3:27:45 by J. S. A.
		SKP		50	15		
		PPP		52	20		
		L	4	36	ca		
		F	5	05			
118	16	PNEZ	20	47	20	430	Felt in SE Luzon and in Masbate.
		SNEZ		48	12		
		F	21	50			
119	17	PNEZ	5	25	00	2,335	Compression. Deep focus.
		SNE		28	47		
		iz			53		
		F	6	00			
120	17	PNEZ	23	15	28	1,510	
		SNE		18	03		
		F		55			
121	18	PNEZ	1	03	39	1,030	
		SNE		05	30		
		LNE		07	ca		
122	18	PNEZ	2	29	44	2,220	No. 121 still recording.
		SNE		33	23		
		F	3	24			
124	18	PNZ	5	51	11	1,136	
		SEZ		53	09		
		F	6	49			
125	18	PNEZ	19	43	53	125	
		SNEZ		44	10		
		F		48			
127	20	PNEZ	7	15	19	2,480	
		SNEZ		19	15		
		F		37			
128	20	PNEZ	21	35	00	2,865	
		SNE		39	34		
		F		55			
132	22	PNEZ	5	44	39	2,545	
		SNE		48	40		
		F	6	09			
133	22	PNEZ	6	12	29	5,265	
		SNE		19	21		
		F	7	30			
135	23	iPNEZ	0	50	17	160	Compression. Felt in Central Luzon. 16.2°N: 121.5°E by Manila and Baguio.
		SNEZ			37		
		F	1	17			
136	23	PNEZ	17	17	44	260	
		SNEZ		18	21		
		F		22			
139	26	PEZ	19	55	54	400	
		SNE		56	44		
		F	20	07			
140	27	PNEZ	1	36	07	4,590	Siberia, approximately 60°N: 145°E (Strasbourg).
		iz			34		
		SNE		42	19		
		F	2	11			
141	27	ePNEZ	11	25	12	4,755	
		SNE		31	34		
		F	12	10			
142	28	PEZ	6	34	34	120	Compression. Felt slightly in Manila, Alabat, and Indang.
		SEZ			49		
		F		45			
145	28	PNEZ	12	52	25	200	Felt at Daet, intensity III.
		SNE			50		
		F	13	00			
146	28	PNEZ	17	35	04	160	
		SNEZ			24		
		F		40			

Forty-eight insignificant or undecipherable disturbances on the following days of February: 2nd(5), 3rd(3), 5th(6), 6th(2), 7th(4), 8th, 9th(4), 10th, 11th, 12th(3), 13th(2), 14th(2), 15th(3), 18th, 19th, 21st(2), 22nd, 26th(2), and 28th(3).



## MARCH, 1938

### MACROSEISMIC RECORD

1, 20<sup>h</sup> 27<sup>m</sup> 37<sup>s\*</sup> [2, 4:27:37 A.M.] **Tacloban, Leyte.** Earthquake of intensity V, lasting about 15 seconds.

7, 4<sup>h</sup> 55<sup>m</sup> [7, 12:55 P.M.] **Surigao, Surigao.** Extremely feeble shock lasting about four seconds.

10, 16<sup>h</sup> 23<sup>m</sup> 23<sup>s\*</sup> [11, 0:23:23 A.M.] **E Mindanao.** Epicenter in southern part of Philippine Deep. Felt strongly at Santa Cruz, Davao, and lightly at Port Lamon and Lingig in Surigao. Felt feebly at Butuan, Agusan.

10, 19<sup>h</sup> 00<sup>m</sup> 25<sup>s</sup> [11, 5:00:25 A.M.] **Agaña, Guam.** Moderate earthquake recorded and perceived.

12, 20<sup>h</sup> 21<sup>m</sup> 49<sup>s\*</sup> [13, 4:21:49 A.M.] **Alabat, Tayabas.** Moderate earthquake.

14, 7<sup>h</sup> 51<sup>m</sup> [14, 3:51 P.M.] **Davao, Davao.** Earthquake of intensity II.

17, ..... [17, 7:38 A.M. or P.M.?] **Iligan, Isabela.** Earthquake of intensity II.

21, 7<sup>h</sup> 32<sup>m</sup> 42<sup>s\*</sup> [21, 3:32:42 P.M.] **S Luzon.** At Santa Cruz, Laguna, vertical motion of intensity III. There was an oscillatory aftershock of intensity II. Felt lightly at Ambulong and Los Baños.

28, 18<sup>h</sup> 00<sup>m</sup> [29, 2:00 A.M.] **Santa Cruz, Davao.** Light earthquake.

29, 9<sup>h</sup> 22<sup>m</sup> 48<sup>s</sup> [29, 7:22:48 P.M.] **Agaña, Guam.** Earthquake recorded and felt.

30, 2<sup>h</sup> 04<sup>m</sup> 44<sup>s\*</sup> [30, 10:04:44 A.M.] **N Luzon.** Felt with intensity II in Laoag and Aparri, duration five or six seconds.

31, 2<sup>h</sup> 58<sup>m</sup> [31, 10:58 A.M.] **Surigao, Surigao.** Earthquake of intensity III, lasting four seconds.

31, 5<sup>h</sup> 46<sup>m</sup> [31, 1:46 P.M.] **Calayan, Babuyan Islands.** Extremely feeble earthquake lasting six seconds.

31, 22<sup>h</sup> 32<sup>m</sup> 35<sup>s\*</sup> April 1, 6:26 A.M.] **Laoag, Ilocos Norte.** Oscillatory earthquake of intensity III and eight seconds duration.



## INSTRUMENTAL RECORD

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No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
148	1	P?EZ LNE F	4	35	39	2,110?	
149	1	$\bar{P}$ NEZ SNEZ F	6	38	19	125	
155	3	PEZ SNEZ F	23	30	42	395	
156	4	PNEZ SNEZ F	1	41	03	2,090	
158	5	iPz ePNE iZ SNE LN MN F	11	36	00	1,935	
159		$\bar{P}$ NEZ SNEZ	17	43	00	135	
160	5	$\bar{P}$ NEZ SNEZ F	17	50	30	210	No. 159 still recording.
162	5	$\bar{i}$ Pz SNE F	23	06	30	160	Dilatation.
163	6	$\bar{P}$ NEZ SNE F	0	07	36	160	
164	6	iPz SNE LNE MN F	2	03	35	5,455	8° S: 165° E by Wellington.
165	6	PNEZ SNE F	12	16	41	240	
166	6	iPz ePE SNE F	17	04	27	6,910	Deep focus.
167	8	iPz iZ S?z F	5	42	30	7,145?	Compression. N and E components defective.
173	9	PNEZ SNE F	2	15	20	8,545	32°S: 175°W by Wellington.
174	10	ePNEZ SNE MN	15	46	35	2,545	
175	10	iPNEZ SNE F	16	23	23	1,110	No. 174 still recording. Felt in E Mindanao. Butuan, 320 Km.
178	13	P?EZ iN SNE LNE F	21	21	21	5,655?	
179	14	PNEZ SNEZ LNE F	0	56	43	4,810	
180	14	iPz ePNE iSNEZ LNE MNE F	5	19	33	2,910	Dilatation. Deeper than normal.



INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
182	17	PNE	8	24	58	115	
		SNEZ		25	13		
		F		30			
188	22	iPz	15	35	10	10,050	Dilatation. 53°N: 131.8°W; 0=15:22:19 by U. S. C. G. S. 52.2°N: 133.1°W; H=15:22:08 by J. S. A.
		iSNEZ		46	07		
		MN	16	12	ca		
		F	18	26			
189	22	P?NEZ	22	42	21	7,700?	
		SNE		51	35		
		F	23	35			
193	25	ePNEZ	16	00	20	7,055	12°S: 177°W by Wellington.
		SNE		08	56		
		LN		20	30ca		
		MNE		25	30ca		
		F	17	55			
199	30	ePNEZ	2	04	44	400	Felt at Laoag and Aparri, intensity II.
		SNEZ		05	34		
		F		24			
201	31	ePNEZ	5	34	53	1,520	
		SNE		37	31		
		F	6	50			
202	31	PNEZ	15	19	17	580	
		SNE		20	23		
		F		42			
203	31	PNEZ	22	32	35	755?	Felt in Laoag. S from the Wlechert.
		S?NE		33	58		
		F	0	30			
		April 1					

Twenty-nine insignificant or undecipherable disturbances on the following days of March: 1st(2), 2nd(2), 3rd, 4th, 5th, 8th(5), 12th, 13th, 14th, 18th(2), 21st(3), 23rd, 25th(2), 27th, 28th(4), and 30th.



## APRIL, 1938

### MACROSEISMIC RECORD

- 2, 17<sup>h</sup> 36<sup>m</sup> [3, 1:36 A. M.] **Aroroy, Masbate.** Light earthquake.
- 3, 19<sup>h</sup> 55<sup>m</sup> [4, 3:55 A. M.] **Baguio, Mountain Province.** Earthquake of intensity II and three seconds duration.
- 4, 4<sup>h</sup> 27<sup>m</sup> 32<sup>s\*</sup> [4, 12:27:32 P. M.] **Boac Marinduque.** Very feeble earthquake followed by another at 12:32:54 P. M.
- 4, 21<sup>h</sup> 30<sup>m</sup> 32<sup>s\*</sup> [5, 5:30:32 A. M.] **S Luzon.** Earthquake of intensity III at Atimonan, Tayabas, and intensity II at Santa Cruz, Laguna.
- 8, 18<sup>h</sup> 49<sup>m</sup> 33<sup>s\*</sup> [9, 2:49:33 A. M.] **Dapa, Surigao.** Earthquake of intensity III apparently from the east, lasting about seventeen seconds.
- 9, 18<sup>h</sup> 10<sup>m</sup> 41<sup>s\*</sup> [10, 2:10:41 A. M.] **Aroroy, Masbate.** Light earthquake.
- 12, 1<sup>h</sup> 56<sup>m</sup> 34<sup>s\*</sup> [12, 9:56:34 A. M.] **N Luzon.** At Laoag, a rotary motion of intensity IV lasting about eight seconds. At Aparri, oscillatory, apparently NW-SE, intensity III, lasting seven seconds.
- 12, 13<sup>h</sup> 28<sup>m</sup> [12, 9:28 P. M.] **Laoag, Ilocos Norte.** Earthquake of intensity II, lasting about three seconds.
- 15, 11<sup>h</sup> 55<sup>m</sup> 11<sup>s\*</sup> [15, 7:55:11 P. M.] **East Mindanao.** Epicenter in the Philippine Deep. At Port Lamon intensity IV, apparently SE-NW, lasting three seconds. Felt moderately at Lingig, Surigao, and lightly at Davao and Kaatoan.
- 17, 4<sup>h</sup> 02<sup>m</sup> [17, 12:02 P. M.] **Ormoc, Leyte.** Light oscillatory earthquake of intensity II and fifteen seconds duration, apparently WSW-ENE.
- 18, 5<sup>h</sup> 34<sup>m</sup> 43<sup>s\*</sup> [18, 1:34:43 P. M.] **Aparri, Cagayan.** Oscillatory earthquake of intensity II and seven seconds duration, apparently NW-SE.
- 21, 5<sup>h</sup> 25<sup>m</sup> 47<sup>s\*</sup> [21, 1:25:47 P. M.] **Zamboanga, Zamboanga.** Extremely feeble earthquake lasting only two seconds.
- 21, 22<sup>h</sup> 41<sup>m</sup> 54<sup>s</sup> [22, 8:41:54 A. M.] **Agaña, Guam.** Earthquake recorded and felt.
- 23, 7<sup>h</sup> 17<sup>m</sup> 10<sup>s\*</sup> [23, 3:17:10 P. M.] **W. Luzon.** Epicenter in China Sea. At Iba the motion was oscillatory, apparently NE-SW, of intensity IV but lasting only three seconds. A slight hissing sound was heard before the earthquake. Felt lightly in San Antonio and Masinloc, Zambales; Capas, Tarlac; Manila and Baguio.
- 30, 3<sup>h</sup> 34<sup>m</sup> 11<sup>s\*</sup> [30, 11:34:11 A. M.] **SE Luzon.** Felt with intensity III in Masbate and lightly at the Mayon Rest House.



INSTRUMENTAL RECORD

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
208	1	PNZ SNE F	21 22	32 40	33 43	620	
212	4	PNEZ SNEZ F	4	27 31	32 50	140	Felt in Marinduque.
213	4	PNEZ SNEZ F	4	32 33 36	54 12	140	Do.
214	4	PNEZ SNE	21	13 16	27 05	2,155	Dilatation.
219	7	P?NEZ SE F	2	22 25 40	53 24	1,455?	
223	7	PNEZ SNE F	16 17	38 40 33	00 25	1,400	
229	9	iPz ePNE SNE F	9 10	20 28 15	08 08 34	6,780	Dilatation. 16° S; 169° E, by Wellington.
232	12	PNEZ SNEZ F	1 2	56 57 17	34 26	430	Felt in N. Luzon. Baguio, 260 Km.
235	13	iPz SNEZ F	2 3 4	59 08 11	36 39	7,510	Deep focus. 39.5° N; 15° E by Strasbourg. 39.4° N; 15° E by J. S. A.
236	13	ePz SE F	11	02 06 20	19 12	2,435	Deep focus.
238	14	iPz ePN iPE SNE LNE F	1 3	22 26 28 16	03 03 04 31 25ca	2,935	Compression. South China by Strasbourg.
239	14	ePNEZ iZ SNE F	15 16	52 55 54	00 30 35	2,180	
242	15	PNEZ SNE F	11 12	55 56 10	11 52	950	Felt in eastern Mindanao.
243	15	PE SNE F	17 18	56 58 12	03 09	1,210	
245	17	iPz iPNE SNE F	9 10	04 10 10	23 24 52	4,880	Compression. 47° S; 142° E, by Wellington.
247	17	iP'z iP'z PPz SKKSNE F	14 15 17	59 00 04 11 05	40 58 45 21		17° S; 68° W by Strasbourg.
248	18	Pz SNE F	5	34 35 47	43 37	440	Felt in Aparri.
253	19	iPz ePNE SNE LNE MNE F	11 13	11 21 40 48 40	27 27 37 18ca ca	8,960	Compression. 39.5° N; 33.5° E; 0=10:59:18 by U. S. C. G. S. 39° N; 33.1° E; H=10:59:23 by J. S. A.
254	19	ePz SNE F	21 22 23	54 03 15	07 27	7,835	
255	20	Pz SN PSNE F	6 8	37 46 50	40 29 49	7,290	22° S; 175° E, by Wellington.
258	20	PNE SNE LNE F	22 23	57 59 01 55	51 56 ca	1,200	



INSTRUMENTAL RECORD—Continued



No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
260	21	PNEZ SNE F	4	22	34 03 33	820	
264	21	PNEZ SNE F	23	02	38 07 26	215	Dilatation.
266	22	ePNEZ SNEZ F	23	23	25 51 57	200	
267	23	iPz ePNE iZ S?NE F	0	31	42 42 51 21 39	4,045?	Dilatation.
268	23	PNEZ SNE	2	16	31 58	210	No. 267 still recording.
270	23	iPz SNE F	7	17	10 27 31	135	Dilatation. Felt in western Luzon.
275	24	ePz SNE LNE F	14	14	03 44 05 55	1,545	
279	25	PNE SNEZ LN F	14	51	05 32 ca 05	4,835	
283	26	iPNEZ iZ SNEZ LE iE F	12	58	33 36 40 05ca 03 20	2,635	Compression from SE.
287	30	PNEZ SNE F	3	34	11 52 47	310	Felt in Masbate.

Fifty-two insignificant or undecipherable disturbances on the following days of April: 1st(5), 2nd, 3rd, 4th, 5th(2), 7th(5), 8th(3), 9th(2), 10th, 12th, 13th(2), 14th, 15th, 17th(2), 18th(3), 19th, 20th(2), 21st(4), 22nd, 23rd(3), 24th, 25th(6), 28th(2), and 29th.



MAY, 1938

MACROSEISMIC RECORD

- 1, 5<sup>h</sup> 37<sup>m</sup> 23<sup>s</sup> [1, 3:37:23 P. M.] **Agaña, Guam.** Earthquake recorded and felt.
- 9, 9<sup>h</sup> 02<sup>m</sup> 51<sup>s\*</sup> [9, 5:02:51 P. M.] **Aparri, Cagayan.** Oscillatory earthquake of intensity II and five seconds duration, apparently NW-SE.
- 10, 12<sup>h</sup> 22<sup>m</sup> [10, 8:22 P. M.] **Ambulong, Batangas.** Earthquake of intensity II.
- 11, 2<sup>h</sup> 58<sup>m</sup> 40<sup>s\*</sup> [11, 10:58:40 A. M.] **Manila.** Light earthquake.
- 12, 8<sup>h</sup> 02<sup>m</sup> [12, 4:02 P. M.] **Cagayan, Misamis Oriental.** Earthquake of intensity V.
- 13, 9<sup>h</sup> 10<sup>m</sup> [13, 5:10 P. M.] **Casiguran, Tayabas.** Earthquake of intensity II.
- 16, 17<sup>h</sup> 30<sup>m</sup> [17, 1:30 A. M.] **Davao, Davao.** Earthquake.
- 19, 17<sup>h</sup> 12<sup>m</sup> 05<sup>s\*</sup> [20, 1:12:05 A. M.] **Jolo, Sulu.** Earthquake of intensity III lasting about twelve seconds. Epicenter in Netherlands East Indies.
- 20, 22<sup>h</sup> 25<sup>m</sup> 49<sup>s</sup> [21, 8:25:49 A. M.] **Agaña, Guam.** Earthquake recorded and felt.
- 22, 17<sup>h</sup> 56<sup>m</sup> 23<sup>s\*</sup> [23, 1:56:23 A. M.] **S Luzon.** At Infanta, Tayabas earthquake of intensity IV lasting about six seconds, apparently SSE-NNW. At Santa Cruz, Laguna, intensity IV lasting three seconds, apparently N-S.
- 23, 8<sup>h</sup> 22<sup>m</sup> 51<sup>s\*</sup> [23, 4:22:51 P. M.] **Luzon.** Epicenter in the China Sea. Felt very strongly in Batac with duration of fifty-six seconds. Laoag, intensity V, duration forty seconds. Vigan, intensity VI, lasting about fifty-five seconds. Slight damage in old buildings. Another shock of intensity IV at 11:10 P. M. Intensity IV in Aparri and Baguio. At Echague, intensity III, lasting about fifty seconds, apparently SE-NW. Felt slightly in Ambulong, 460 kilometers south of the epicenter. Also felt in Hong Kong, 790 kilometers to the northwest.
- 24, 1<sup>h</sup> 23<sup>m</sup> 38<sup>s\*</sup> [24, 9:23:38 A. M.] **Laoag, Ilocos Norte.** Earthquake of intensity II lasting about four seconds. There was another similar shock at 9:39:09 P. M.
- 24, 20<sup>h</sup> 23<sup>m</sup> 31<sup>s</sup> [25, 6:23:21 A. M.] **Agaña, Guam.** Earthquake recorded and felt.
- 28, 7<sup>h</sup> 56<sup>m</sup> 40<sup>s\*</sup> [28, 3:56:40 P. M.] **Ormoc, Leyte.** Earthquake of intensity II lasting fifteen seconds, apparently NW-SE.
- 31, 23<sup>h</sup> 21<sup>m</sup> [June 1, 7:21 A. M.] **Dapa, Surigao.** Extremely feeble shock lasting about four seconds.



## INSTRUMENTAL RECORD

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No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
288	1	PNE	1	39	34	2,720	
		SN		43	47		
		LNE		46	10ca		
		F	2	20			
295	3	PNEZ	19	23	26	4,400	Deep focus.
		iSNE		29	27		
		F	20	07			
296	4	iPz	5	55	09	2,520	Compression (?)
		ePNE			09		
		iSNE		59	17		
		F	6	45			
300	6	ePNE	3	47	44		
		LNE		57	35ca		
		F	4	20			
301	6	Pz	6	01	04	1,320	
		SNEZ		03	21		
		F		30			
302	6	ePNEZ(?)	18	38	49		13° N: 87° W; 0 = 18:17.4 by U. S. C. G. S. 12.6° N: 86.9° W by J. S. A.
		F	20	40			
305	8	iPz	13	58	45	7,145	No. 304 still recording. Compression.
		ePNE			45		
		iSNE	14	07	27		
		SSEZ		12	13		
		LNE		19	ca		
		MNE		24	ca		
307	9	ePNEZ	9	02	51	400	Felt at Aparri.
		SNE		03	41		
		F		23			
308	9	ePNZ	15	45	35	2,255	
		SNEZ		49	16		
		LNE		51	10ca		
		F	16	36			
309	10	iPNZ	12	21	59	190	Compression. S from the Wiechert and horizontal.
		ePe			59		
		SNE		22	23		
		F	13	00			
312	10	iPz	14	21	14	190	Compression. Aftershock of No. 309. S from the Wiechert and horizontal.
		iPNE			15		
		SNE			38		
		F		57			
314	10	PNEZ	15	10	32	190	Aftershock of No. 309.
		SNEZ			56		
		F		22			
316	10	PNEZ	15	55	35	190	Compression. Aftershock of No. 309.
		SNEZ			59		
		F	16	02			
317	10	PNEZ	17	34	51	185	Aftershock of No. 309.
		SNEZ		35	14		
		F		41			
319	10	PNEZ	22	51	03	125	
		SNEZ			19		
		F		59			
322	11	ePz	2	58	40	145	Felt slightly in Manila.
		SNEZ			58		
		F	3	04			
327	11	eP?NEZ	15	05	47		17° N: 101° W; 0 = 14:44:54 by U. S. C. G. S. 16.8° N: 100.7° W by J. S. A.
		F	17	10			
328	11	PNEZ	17	43	47	3,900	
		SNZ		49	17		
		F	18	16			
329	11	PNEZ	22	05	40	180	
		SNEZ		06	03		
		F		13			
333	12	PNEZ	8	34	17	190	
		SNE			41		
		F		45			



## INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
334	12	iPNEZ SNE F	15 20	45 25	38 26	4,190	New Guinea. Compression. $8^{\circ}\text{S}; 147^{\circ}\text{E}$ ; $0 = 15:39:02$ by U. S. C. G. S. $5^{\circ}\text{S}; 147.5^{\circ}\text{E}$ by J. S. A. S from the Wiechert and horizontal.
336	12	Pz SNE F	21 22	31 48	12 57	2,310	
337	12	$\bar{\text{P}}\text{NEZ}$ $\bar{\text{S}}\text{NEZ}$ F	21	50	27 48	165	No. 336 still recording.
341	13	ePNEZ SN LN F	12	00	07 50 ca 30	3,150	
342	13	iPNEZ SNE LN F	15	10	20 24 10 15	3,490	Compression. Data after P from the Wiechert.
344	14	iPNEZ SNEZ F	12 13	08 42	35 14	2,220	Dilatation.
345	15	PNEZ SNEZ F	0	03	27 03 55	1,510	
348	15	PNE SNE F	13 14	33 22	07 33	2,910	
350	16	PNEZ SNE F	7	10	23 47 10	2,880	Deep focus. Dilatation.
351	16	PNEZ iZ PPNE? iE F	15	34	34 54 57 51 40		Long distance.
357	18	$\bar{\text{P}}\text{NEZ}$ $\bar{\text{S}}\text{NZ}$ F	19	22	36 55 50	150	
364	19	iPNEZ SNE F	17	12	05 06 20	1,720	Compression. Felt in Jolo, intensity III. $0.5^{\circ}\text{N}; 119^{\circ}\text{E}$ , approximately by U. S. C. G. S. $1^{\circ}\text{N}; 118.9^{\circ}\text{E}$ by J. S. A. Data after P from the Wiechert. Destructive in Celebes.
369	20	PNEZ SN F	10 11	46 30	47 29	2,980	
374	22	ePNEZ SN	7 8	55 04	51 01	6,665	$20^{\circ}\text{S}; 170^{\circ}\text{E}$ by Riverview and Manila.
375	22	eP?EZ SEZ F	8	26	07 11 15	4,455?	No. 374 still recording.
376	22	ePNEZ iEZ F	11	32	16 53 00		Long distance.
377	22	$\bar{\text{i}}\text{PNEZ}$ $\bar{\text{S}}\text{NE}$ F	17	56	23 36	100	Dilatation. Felt at Infanta, intensity IV.
379	23	iPNEZ SNE	7	24	25 40	3,665	Compression. Japan. $36.9^{\circ}\text{N}; 141.1^{\circ}\text{E}$ by J. S. A. $36^{\circ}\text{N}; 141^{\circ}\text{E}$ ; $0 = 7:18:50$ by U. S. C. G. S. S from the Wiechert.
380	23	iPNEZ SNE	8	22	51 43	430	Compression from NW. Felt in Luzon and also in Hong Kong. $18^{\circ} 15'\text{N}; 119^{\circ} 45'\text{E}$ by Manila, Hong Kong and Phu-lien. No. 379 still recording.
382	23	iPNZ SNZ F	15 16	09 05	43 35	430	Compression. Felt in Vigan with intensity IV. E component defective.
386	24	$\bar{\text{P}}\text{NEZ}$ $\bar{\text{S}}\text{NEZ}$ F	7	20	47 08 30	170	
386	24	$\bar{\text{P}}\text{NEZ}$ $\bar{\text{S}}\text{NEZ}$ F	7	20	46 08 30	170	



## INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
388	24	PNE	8	37	29	60	
		SNE			37		
		F		43			
391	24	PNEZ	18	54	17	1,910?	
		S?N		57	30		
		F	19	30			
392	24	PNEZ	21	39	09	400	Felt in Laoag, intensity II.
		SNE			59		
		F		49			
397	26	ePNEZ	11	16	19	5,260	
		SNE		23	11		
		F	12	45			
403	27	PEZ	3	41	09	2,135	
		SN		44	41		
		LN		46	40ca		
		F	4	20			
405	27	Pz	13	04	48	1,380	
		SNE		07	11		
		F		30			
407	28	PNEZ	7	56	40	480	
		SNE		57	37		
		F	8	17			
408	28	P?NE	10	27	47	10,745	43°N: 125°W; 0 = 10:14:13 by U. S. C. G. S. 43.3°N: 125°W by J. S. A.
		eNE		40	20		
		F	12	40			
409	28	iPz	16	48	57	4,010	Compression. 43°N: 144°E (Strasbourg).
		ePNE			57		
		iz		49	02		
		SNE		54	34		
		LNE	17	00	ca		
411	30	iPNEZ	14	39	46	6,390	Compression from SE. 20°S: 169°E by U. S. C. G. S. 20.4°S: 169.4°E by J. S. A.
		SE		47	49		
		iz		50	37		
		LNEZ		57	30ca		
		MNEZ	15	02	30ca		
		F	18	30			

Seventy-eight insignificant or undecipherable disturbances on the following days of May: 1st(2), 2nd, 3rd(3), 4th(2), 5th, 7th, 8th(2), 10th(5), 11th(7), 12th(5), 13th, 14th, 15th(2), 16th(2), 17th(2), 18th(4), 19th(6), 20th(5), 21st, 23rd(4), 24th(4), 25th(3), 26th(6), 27th(2), 30th(3), and 31st(3).



## JUNE, 1938

### MACROSEISMIC RECORD

2, 3<sup>h</sup> 18<sup>m</sup> 11<sup>s\*</sup> [2, 11:18:11 A. M.] **N Luzon.** Felt lightly at Aparri, Laoag, Calayan, Piddig, and Batac.

3, 0<sup>h</sup> 49<sup>m</sup> 30<sup>s\*</sup> [3, 8:49:30 A. M.] **Legaspi, Albay.** Vertical shock of intensity II lasting about five seconds.

5, 3<sup>h</sup> 13<sup>m</sup> 55<sup>s</sup> [5, 1:13:55 P. M.] **Agaña, Guam.** Earthquake recorded and felt. Another shock at 8:56:23 P. M.

7, 10<sup>h</sup> 55<sup>m</sup> [7, 6:55 P. M.] **Butuan, Agusan.** Very feeble earthquake lasting about fifteen seconds.

7, 11<sup>h</sup> 37<sup>m</sup> 35<sup>s</sup> [7, 9:37:35 P. M.] **Agaña, Guam.** Earthquake recorded and felt. Another shock at 8:53:19 P. M. Still another on the 9th at 0:47:42 A. M.

9, 12<sup>h</sup> 08<sup>m</sup> [9, 8:08 P. M.] **Iligan, Isabela.** Earthquake of intensity II, apparently N-S.

9, 19<sup>h</sup> 19<sup>m</sup> 23<sup>s\*</sup> [10, 3:19:23 A. M.] **NE Mindanao.** Felt lightly at Dapa and Surigao in Surigao, and Butuan, Agusan. Epicenter in Netherlands East Indies.

11, 0<sup>h</sup> 16<sup>m</sup> [11, 8:16 A. M.] **Dapa, Surigao.** Very feeble earthquake lasting about four seconds.

13, 14<sup>h</sup> 02<sup>m</sup> 35<sup>s</sup> [14, 0:02:35 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

15, 1<sup>h</sup> 39<sup>m</sup> 34<sup>s</sup> [15, 11:39:34 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

15, 2<sup>h</sup> 54<sup>m</sup> 08<sup>s\*</sup> [15, 10:54:08 A. M.] **NW Luzon.** Epicenter in China Sea. Felt lightly in Laoag, Piddig and Batac, all in Ilocos Norte.

16, 20<sup>h</sup> 57<sup>m</sup> 08<sup>s\*</sup> [17, 4:57:08 A. M.] **Ormoc, Leyte.** Earthquake of intensity III lasting twenty-five seconds, apparently W-E.

19, 12<sup>h</sup> 24<sup>m</sup> [19, 8:24 P. M.] **Zamboanga, Zamboanga.** Earthquake of intensity II, apparently E-W.

19, 21<sup>h</sup> 38<sup>m</sup> [20, 5:38 A. M.] **Laoag, Ilocos Norte.** Earthquake on intensity III lasting five seconds, apparently W-E.

21, 6<sup>h</sup> 45<sup>m</sup> 20<sup>s\*</sup> [21, 2:45:20 P. M.] **Basco, Batanes.** Earthquake of intensity III.

24, 22<sup>h</sup> 50<sup>m</sup> 15<sup>s</sup> [25, 8:50:15 A. M.] **Agaña, Guam.** Earthquake recorded and felt. Another shock at 12:25:26 P. M.

26, 11<sup>h</sup> 16<sup>m</sup> 45<sup>s\*</sup> [26, 7:16:45 P. M.] **Calayan, Babuyan Islands.** Extremely feeble earthquake lasting about eight seconds.

26, 20<sup>h</sup> 35<sup>m</sup> 06<sup>s</sup> [27, 4:35:06 A. M.] **Samar.** At Calbayog the intensity was V and the duration fifteen seconds. The direction was apparently SE-NW. There was an after-shock of intensity III at 5:08 A. M. Felt lightly in Catbalogan and Laoang.

27, 18<sup>h</sup> 11<sup>m</sup> [28, 2:11 A. M.] **Dapa, Surigao.** Earthquake of intensity III lasting about four seconds.



## INSTRUMENTAL RECORD

International  
Seismological  
Centre

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
418	2	ePNEZ iz SNE F	3	18	11 23 08 47	480	Felt in northern Luzon.
419	2	ePNEZ pPz? iSNE F	10	30	08 15 24 11 10	2,780	Deeper than normal.
420	3	Pz SNE F	0	28	45 29 11 44	200	
421	3	PNEZ SNE F	0	49	30 50 03 1 03	240	Felt at Legaspi.
422	3	PNEZ SNEZ F	14	23	37 24 00 46	185	Compression.
427	5	ePNEZ SNE SR <sub>2</sub> E LNE F	16	37	42 43 11 46 06 47 40 <sub>ca</sub> 17 16	3,890	
431	7	ePNEZ SNE F	14	21	09 30 27	165	
434	8	ePz ePNE iz iSNE F	8	18	10 11 16 22 30 45	2,820	Deep focus.
437	9	iPNEZ SNE F	19	19	23 22 45 23 00	1,960	Compression from SE. Felt in Surigao and Dapa. 1°S: 132°E by Manila, Zikawei, Riverview. S from the Wiechert. 2°S: 128°E by U. S. C. G. S. 3.1°S: 125.7°E by J. S. A.
439	9	PNEZ SNE F	23	41	09 42 12 58		
440	10	iPNZ SNE F	9	56	26 58 29 14 20	1,165	Dilatation from north. 25°N: 125°E by U. S. C. G. S. S from the Wiechert.
445	12	PNEZ SE F	2	36	11 39 09 4 30	1,720	
449	13	PeZ ie SNE LN MN F	3	29	19 31 35 36 41 45 15 <sub>ca</sub> 49 ca 4 40	5,810	
450	13	iPz ePNE SN LN F	6	59	03 03 7 02 35 04 25 <sub>ca</sub> 54	2,135	Dilatation.
454	14	ePNEZ SNE F	9	05	49 06 06 21	135	
457	15	PNEZ SNEZ F	2	54	08 55 01 3 48	435	Felt in NW Luzon.
459	15	PNEZ SE F	5	15	09 16 28 6 20	710	
464	15	PNZ SN F	12	50	53 59 03 14 27	6,620	
465	15	Pz SN F	20	23	42 31 55 21 45	6,680	



## INSTRUMENTAL RECORD—Continued



No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
467	16	iPNEZ	2	18	53	1,570	Dilatation from NNE. 26.5°N: 127.5°E by Zikawei, Manila, Phulien. 29°N: 128°E by U. S. C. G. S. 29.2°N: 127.7°E by J. S. A. No. 466 still recording.
		SNE		21	36		
		F	6	00			
470	16	ePNE	22	52	47	1,445	
		SNE		55	17		
		F	23	58			
474	18	PNEZ	0	47	51	2,135	
		SNEZ		51	23		
		MNEZ		55	10ca		
		F	1	20			
476	18	iPz	18	15	17	3,060	
		ePNE			17		
		SNE		19	53		
		MNE		26	ca		
		F	19	16			
478	19	PNE	12	20	17	2,320	
		SNE		24	03		
		F		45			
480	20	iPz	23	59	16	5,410	Dilatation?
		iPe			18		
	21	iSNE	0	06	15		
		LNE		14	ca		
		MNE		18	ca		
		F	2	17			
483	21	iPNZ	6	45	20	770	Compression from NE. Felt at Basco.
		SNEZ		46	44		
		F	8	30			
484	21	PNEZ	19	17	52	250	
		SNEZ		18	27		
		F		28			
486	22	ePNEZ	1	46	35	160	
		SNE			55		
487	22	PNE	1	57	23	160	No. 486 still recording.
		SNE			43		
		F	2	07			
488	22	ePNEZ	23	14	39	3,425	
		SNE		19	39		
		LNE		23	ca		
	23	F	0	20			
490	23	ePNEZ	11	58	10	2,480	
		SNE	12	02	06		
		F		30			
491	23	iPEZ	13	05	23	6,590	Compression. Deeper than normal. 20° S: 169° E; 0 = 12:55:25 by U. S. C. G. S. 19.1° S: 168.9° E; H = 12:55:33 by J. S. A.
		iSNE		13	31		
		MNE		28	50		
		F	16	40			
492	23	PNEZ	17	25	03	2,500	
		SNE		29	01		
		F		50			
502	29	iPz	9	43	01	1,370	Compression from SE.
		ePNE			01		
		SNEZ		45	29		
		LNE		47	15ca		
		MNE		48	50ca		
		F	10	50			
505	30	iPz	16	54	37	6,620	24° S: 167° E by U. S. C. G. S.
		SNE	17	02	47		
		F	18	08			

Fifty-six insignificant or undecipherable disturbances on the following days of June: 1st, 4th(2), 5th(2), 6th(2), 7th(2), 8th(2), 9th(2), 10th(3), 11th, 12th(2), 13th(4), 14th(2), 15th(5), 16th(3), 17th(3), 18th, 19th, 20th, 21st(2), 22nd, 23rd(3), 24th(3), 26th(3), 28th, 29th(2), and 30th(2).



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SEISMOLOGICAL BULLETIN FOR 1938  
JULY-DECEMBER

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## INTRODUCTION

### SEISMIC STATIONS

The following is the list and data of stations equipped with seismographs.

Name	Islands	North latitude	East longitude	Elevation	Equipment	Substructure
Manila	Luzon	14° 35'	120° 59'	3.0 m.	Galitzin-Wilip, 3 components. Wiechert inverted pendulums, mass 955 kg. Two horizontal pendulums, mass 118 kg. each.	Alluvium and pyroclastics to unknown depth.
Baguio	do.	16° 25'	120° 35'	1,512	Vicentini, 3 components. Wiechert inverted pendulum, mass 200 kg.	Limestone.
Ambulong	do.	14° 05'	121° 03'	10.5	Vicentini, 3 components.	Soil underlaid by tuff.
Butuan	Mindanao	8° 56'	125° 32'	2.0	Wiechert inverted pendulum, mass 200 kg.	Alluvium.
Agaña	Guam	13° 28'	144° 45'	5.0	do.	Coral.

All meteorological stations, official and coöperative, have instructions to report all perceptible earthquakes.

### SEISMIC RECORDS

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

The time of occurrence given in the macroseismic records is that indicated by the seismographs of the Manila Observatory whenever the disturbance has been recorded by them. This fact is denoted by an asterisk in the macroseismic record. Otherwise the time is that given by the meteorological observer who reports the earthquake. Greenwich Mean time is given and insular time is added in brackets.

Intensity is given according to the Rossi-Forel scale as adapted by Rev. W. C. Repetti, S. J., Chief of the Seismic Division, for use in the Philippine Islands.

### ROSSI-FOREL SCALE OF EARTHQUAKE INTENSITIES (Adapted)

- I. *Microseismic shock*.—Felt only by an experienced observer under favorable conditions.
- II. *Extremely feeble shock*.—Felt by a small number of persons at rest.
- III. *Very feeble shock*.—Felt by several persons at rest. Duration and direction may be perceptible. Sometimes dizziness or nausea experienced.
- IV. *Feeble shock*.—Felt generally indoors; outdoors by a few. Hanging objects swing slightly. Creaking of frames of houses.
- V. *Shock of moderate intensity*.—Felt generally by everyone. Hanging objects swing freely. Overturn of tall vases and unstable objects. Light sleepers awakened.
- VI. *Fairly strong shock*.—General awakening of those asleep. Some frightened persons leave their houses. Stopping of pendulum clocks. Oscillation of hanging lamps. Slight damage in very old or poorly built structures.
- VII. *Strong shock*.—Overturn of movable objects. General alarm, all run outdoors. Damage *slight* in well-built houses, *considerable* in old or poorly built structures, old walls, etc. Some landslides from hills and steep banks. Cracks in road surfaces.
- VIII. *Very strong shock*.—People panicky. Trees shaken strongly. Changes in flow of springs and wells. Sand and mud ejected from fissures in soft ground. Small landslides. Slides in river banks.
- IX. *Extremely strong shock*.—Panic general. Partial or total destruction of some buildings. Fissures in ground. Landslides and rock falls.



## SYMBOLS AND ABBREVIATIONS

- P Normal first preliminary tremors; longitudinal waves which have passed below the continental layer.
- $\bar{P}$  Upper first preliminary tremors whose path lies wholly in the continental layer.
- P' Longitudinal waves that have traversed the earth's core.
- PPn 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.
- $\bar{S}$  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.
- SS 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.
- SKP 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 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.
- T Period of waves.
- O Time of earthquake at the epicenter.
- H Time of earthquake at focus.
- h Focal depth.
- $\Delta$  Arcual distance from station to epicenter.
- To Free or undamped period of the seismograph.
- V Static magnification.
- $\epsilon$  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

1938	N-S component				E-W component			
	$T_0$	V	$\epsilon$	$\frac{r}{T_0^2}$	$T_0$	v	$\epsilon$	$\frac{r}{T_0^2}$
July	4.2	207	2.4	0.088	4.3	257	2.8	0.105
August	4.0	235	2.4	0.087	4.3	251	2.7	0.086
September	4.1	215	2.4	0.083	4.3	258	2.7	0.095
October	4.2	213	2.5	0.088	4.2	282	2.9	0.088
November	4.2	215	2.4	0.087	4.3	272	2.9	0.091
December	4.2	216	2.7	0.105	4.2	277	2.5	0.081



CONSTANTS OF THE GALITZIN-WILIP SEISMOMETERS

PERMANENT CONSTANTS			
	N-S	E-W	Z
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			
Seismometer periods.....	12.9s.....	11.9s.....	9.0s
Galvanometer periods.....	12.6s.....	11.8s.....	11.6s
$\mu^2$ .....	0.0.....	0.08.....	
$V_s$ .....	400.....	230.....	



## SEISMOLOGICAL BULLETIN FOR 1938

JULY, 1938

### MACROSEISMIC RECORD

- 2, 16<sup>h</sup> 48<sup>m</sup> [3, 0:48 A. M.] **Butuan, Agusan.** Perceptible, oscillatory earthquake from N to S; 10 seconds duration.
- 3, 9<sup>h</sup> 29<sup>m</sup> 13<sup>s\*</sup> [3, 5:29:13 P. M.] **Legaspi Albay.** Oscillatory earthquake, NE-SW. Intensity II, duration five seconds.
- 3, 11<sup>h</sup> 15<sup>m</sup> [3, 7:15 P. M.] **Luzon, and Samar.** Earthquake of intensity V in Legaspi, with duration of ten seconds. Intensity I and duration five seconds in Calbayog.
- 3, 17<sup>h</sup> 00<sup>m</sup> [4, 1:00 A. M.] **Ilagan, Isabela.** Earthquake of intensity III and five seconds duration.
- 3, 20<sup>h</sup> 30<sup>m</sup> [4, 4:30 A. M.] **Kaatoan, Bukidnon.** Earthquake.
- 3, 21<sup>h</sup> 31<sup>m</sup> 12<sup>s\*</sup> [4, 5:31:12 A. M.] **NE Mindanao.** Earthquake of intensity IV and seventeen seconds duration at Dapa. Creaking of houses and lamps swing. Very feeble at Butuan but the motion was of such a character as to stop a pendulum clock. At Surigao it was extremely feeble and was felt for only five seconds.
- 4, 1<sup>h</sup> 24<sup>m</sup> 01<sup>s\*</sup> [4, 9:24:01 A. M.] **Luzon.** Earthquake of intensity III and fifteen seconds duration at Capalonga. Intensity II and four seconds duration at Legaspi.
- 4, 17<sup>h</sup> 00<sup>m</sup> [5, 1:00 A. M.] **Pilar, Abra.** Slight earthquake.
- 4, 19<sup>h</sup> 00<sup>m</sup> [5, 3:00 A. M.] **Dapa, Surigao.** Earthquake of intensity IV.
- 6, 16<sup>h</sup> 57<sup>m</sup> 07<sup>s</sup> [7, 2:57:07 A. M.] **Agaña, Guam.** Earthquake recorded and felt.
- 7, 14<sup>h</sup> 02<sup>m</sup> 33<sup>s\*</sup> [7, 10:02:33 P. M.] **Jolo, Sulu.** Earthquake of intensity III and twelve seconds duration.
- 7, 17<sup>h</sup> 00<sup>m</sup> [8, 1:00 A. M.] **Tacloban, Leyte.** Earthquake of intensity III and four seconds duration.
- 11, 11<sup>h</sup> 28<sup>m</sup> 44<sup>s\*</sup> [11, 7:28:44 P. M.] **N. Luzon.** Short earthquake of intensity II felt by a few persons in Baguio. Reported also from Lepanto.
- 12, 16<sup>h</sup> 40<sup>m</sup> [13, 0:40 A. M.] **Santa Cruz, Laguna.** Earthquake of intensity III and two seconds duration.
- 13, 0<sup>h</sup> 42<sup>m</sup> [13, 8:42 A. M.] **Dapa, Surigao.** A sudden shock of intensity II and about three seconds duration.
- 18, 9<sup>h</sup> 27<sup>m</sup> 55<sup>s</sup> [18, 7:27:55 P. M.] **Agaña, Guam.** Earthquake recorded and felt. Three more shocks within the next fifteen minutes.
- 18, 11<sup>h</sup> 55<sup>m</sup> 37<sup>s\*</sup> [18, 7:55:37 P. M.] **Davao, Davao.** Earthquake of intensity II.
- 19, 4<sup>h</sup> 54<sup>m</sup> [19, 12:54 P. M.] **Basco, Batanes.** Earthquake of intensity II, and three seconds duration. A subterranean noise was heard.
- 19, 8<sup>h</sup> 05<sup>m</sup> [19, 4:05 P. M.] **Vigan, Ilocos Sur.** Earthquake of intensity I.
- 19, 11<sup>h</sup> 47<sup>m</sup> 43<sup>s\*</sup> [19, 7:47:43 P. M.] **S Luzon.** Earthquake felt slightly in Manila. Intensity II in Ambulong.
- 20, 7<sup>h</sup> 49<sup>m</sup> 03<sup>s\*</sup> [20, 5:49:03 P. M.] **Agaña, Guam.** Earthquake recorded and felt. Another shock at 6:59 A. M., on the 21st.
- 23, 12<sup>h</sup> 25<sup>m</sup> [23, 8:25 P. M.] **Corregidor Island, Manila Bay.** Light earthquake of three seconds duration.



25, 9<sup>h</sup> 42<sup>m</sup> 31<sup>s\*</sup> [25, 5:42:31 P. M.] Luzon and Samar. Earthquake of intensity VII and ten seconds duration at Calbayog. Intensity IV in Bulan, Legaspi, Sorsogon and Tabaco. Intensity III at Daet and slight at Mayon Rest House.

27, 8<sup>h</sup> 45<sup>m</sup> 28<sup>s\*</sup> [27, 4:45:28 P. M.] Corregidor Island, Manila Bay. Very light earthquake of seven seconds duration.

28, 19<sup>h</sup> 00<sup>m</sup> [29, 3:00 A. M.] Hinatuan, Surigao. Light earthquake

29, 4<sup>h</sup> 34<sup>m</sup> 42<sup>s\*</sup> [29, 12:34:42 P. M.] S Luzon. Earthquake of intensity II and three seconds duration at Batangas. Very light and of sixteen seconds duration at Corregidor.

29, 6<sup>h</sup> 15<sup>m</sup> [29, 2:15 P. M.] Halcon Rubber Station, Mindoro. Earthquake reported as violent.

### INSTRUMENTAL RECORD

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
511	3	ePNEZ SNE F	9	29	13 30 52	395	Felt at Legaspi.
512	3	PEZ SNE F	11	23	04 24 02	690	
513	3	PEZ SE F	21	31	12 32 10	715	E Component stopped at 21:04. Felt in NE Mindanao. Butuan, 80 Km.
514	4	PNEZ SNEZ F	1	24	01 21 34	160	Dilatation. Felt in SE Luzon.
518	4	PNEZ SNE F	17	06	48 07 40	280	
519	4	ePNEZ SNE IE F	21	22	39 30 50 31 39 22 41	6,645	20°S: 170°E by Wellington.
521	5	ePNEZ SN LNE MNE F	2	13	43 20 42 28 40ca 32 30ca 4 40	5,410	21.7°S: 169.4°E by Samoa.
524	5	iPz iPNE SNEZ LNE ME F	22	17	31 32 26 03 37 30ca 42 45ca 23 59	6,990	Region 24°S: 173°E by U. S. C. G. S. 21.5°S: 171°E by Samoa.
526	6	iPNEZ SNE LN F	1	34	44 42 56 53 ca 3 45	6,665	Compression from SE. 21°S: 169°E by Wellington.
527	6	iPz SNEZ F	9	49	51 58 21 11 10	6,860	22°S: 171°E by Wellington.
533	7	P?NL SNE F	14	02	33 05 32 15 01	1,700?	Felt in Jolo, Sulu.
534	7	iPz iZ PP? F	17	32	53 35 26 37 03 19 35		Compression (?)
537	8	ePNEZ iSNEZ F	14	02	03 04 45 15 15	1,555	
539	9	P?NE SNE F	1	02	15 03 44 27	820?	



## INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
540	9	PEZ S?N F	2	03	53 06 25 34	1,465?	
542	11	PNEZ SNEZ F	11	28	44 29 20 45	260	Felt at Baguio.
543	11	ePNEZ SNE LE MNE F	15	58	58 16 01 40 03 ca 04 30ca 37	1,555	
546	12	iPz SNE F	12	47	05 55 37 14 20	6,900	Compression. 22°S: 170°E by Wellington.
557	14	PEZ SNE F	23	42	07 50 33 0 57	6,900	17°S: 175°E by Wellington.
562	17	ePNZ iz iSN F	13	19	28 52 23 31 14 50	2,580	
564	18	PNZ SNEZ LN F	11	55	37 57 55 59 10ca 12 30	1,335	Felt at Davao.
566	19	P?NEZ SNEZ F	9	01	47 04 39 22	1,660?	
567	19	PNEZ SNE F	11	15	07 16 39 36	850	
568	19	iPNEZ SNEZ F	11	47	43 59 12 02	125	Dilatation. Felt very slightly in Manila.
569	19	eP?NEZ SN F	21	37	35 44 15 22 30	5,065?	
571	20	ePNEZ iSNE F	11	54	35 59 23 13 05	3,245	
574	22	eP'NEZ SS L F	8	07	33 25 15 45 ca 10 15	15,565	Long distance. 18.9°N: 107°W; 0=7:48:08 by U. S. C. G. S. 18.9°N: 106.6°W by J. S. A.
576	23	PNEZ SNEZ F	12	23	11 58 27	370	
577	23	ePNEZ SN F	20	10	54 15 53 21 10	3,410	
578	23	iPz ePNE SNE LN F	23	06	41 47 11 51 15 45ca 0 25	3,590	Dilatation.
579	24	ePNEZ SNE F	13	23	13 32 07 15 10	7,445	Compression. 53°N: 167°W by U. S. C. G. S. 33°N: 164°W by JSA.
581	25	PNEZ SEZ F	9	42	31 43 18 11 10	375	Dilatation. Felt in southeastern Luzon.
586	27	iPNEZ SNEZ F	8	45	28 46 58	140	Compression.
589	27	ePNEZ SNE F	16	58	28 17 00 54 19 00	1,350	





INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
594	28	PEZ	12	59	39	2,620	
		SN	13	03	45		
		F		22			
595	28	PNEZ	21	09	31	4,780	
		SNE		16	03		
		F		40			
596	29	iPNEZ	4	34	42	125	Dilatation. Felt in Batangas.
		iSNEZ			58		
		F	5	20			
597	29	iPNEZ	13	12	15	3,100	Compression from southwest. 4.2° S: 100.5° E by J. S. A.
		PPz		13	27		
		iSNE		17	06		
		MNE		29	ca		
		F	14	25			
598	30	PNEZ	7	36	09	530	
		SN		37	11		
		F	8	00			
599	30	PNE	15	59	30	360	
		SNE	16	00	16		
		F		10			
601	31	PNEZ	22	01	12	2,180	Deeper than normal.
		SNE		04	47		
		F		25			

Fifty-three insignificant or undecipherable disturbances on the following days of July: 2nd(3), 4th(3), 5th(3), 6th(4), 7th(3), 8th(2), 10th, 11th, 12th(4), 13th, 14th(6), 15th, 16th(2), 17th(2), 19th, 20th(3), 22nd, 25th(2), 26th(2), 27th(5), 28th(2), and 31st.



## AUGUST, 1938

### MACROSEISMIC RECORD

1, 8<sup>h</sup> 03<sup>m</sup> 55<sup>s\*</sup> [1, 4:03:55 P. M.] **SE Luzon.** Earthquake of intensity III and fifteen seconds duration at Sorsogon. Same intensity but thirty seconds duration at Legaspi.

5, 18<sup>h</sup> 29<sup>m</sup> 27<sup>s\*</sup> [6, 2:29:27 A. M.] **Vigan, Ilocos Sur.** Earthquake of intensity II lasting about fifteen seconds. An aftershock of the same intensity and ten seconds duration occurred six minutes later.

6, 2<sup>h</sup> 53<sup>m</sup> 47<sup>s\*</sup> [6, 10:53:47 A. M.] **Central Luzon.** Intensity III and twenty seconds duration at Baguio. Light at Itogon and Carranglan.

6, 13<sup>h</sup> 08<sup>m</sup> 43<sup>s\*</sup> [6, 9:08:43 P. M.] **Baguio, Mountain.** Earthquake of intensity IV and twelve seconds duration.

8, 5<sup>h</sup> 30<sup>m</sup> [8, 1:30 P. M.] **Davao, Davao.** Earthquake of intensity II.

8, 17<sup>h</sup> 31<sup>s</sup> [9, 1:31 A. M.] **Ambulong, Batangas.** Earthquake of intensity II.

11, 18<sup>h</sup> 33<sup>m</sup> [12, 2:33 A. M.] **Butuan, Agusan.** A very feeble earthquake of two seconds duration.

14, 14<sup>h</sup> 50<sup>m</sup> [14, 10:50 P. M.] **Santa Cruz, Laguna.** Earthquake of intensity III and twenty-five seconds duration. There was an aftershock of intensity II.

27, 8<sup>h</sup> 04<sup>m</sup> [27, 4:04 P. M.] **Corregidor, Manila Bay.** Oscillatory earthquake W-E, intensity II and duration four seconds.

29, 15<sup>h</sup> 23<sup>m</sup> 19<sup>s\*</sup> [29, 11:23:19 P. M.] **SE Luzon and Visayan Islands.** A very strong earthquake having its epicenter in the Samar Sea near the south end of the island of Masbate. Intensity VIII in the town of Cataingan, about 10-15 km. from the epicenter. The municipal building shifted five inches on its foundation and tilted several degrees to the west. Strong posts were broken. The post-office was almost demolished and the safe, weighing 400 kilograms, moved several meters. Ten houses collapsed. Hanging objects swing from west to east; dishes were broken; furniture was overturned, and the populace became panicky. Damages were estimated at about ₱7,000. In a nearby bridge a crack appeared with a length of several kilometers and varying in width from 10 to 45 cms. Stones were dislodged from neighboring hills.

Aftershocks occurred at short intervals until 5 A. M. the next morning and frequent light shocks still being felt up to September 20th. Other occasional shocks from this epicenter were felt during the remainder of the year.

A strong earthquake occurred at the same point on September 22, 1937.

The earthquake of August 29th was felt with intensity VII in Calbayog, Samar with a duration of fifty seconds, and with intensity V-VI in Legaspi where it was felt for about twenty-five seconds. It was felt throughout SE Luzon, northern and western Samar, northern Leyte, Bohol, Cebu, and Panay. The radius of this area is from 200 to 250 kilometers.





INSTRUMENTAL RECORD

No.	Date	Phase	Time			Δ Km.	Remarks
			h.	m.	s.		
602	1	PNEZ	1	47	11	2,020	
		SE		50	34		
		F	2	08			
604	1	PNEZ	8	03	55	320	Felt in SE Luzon.
		SNEZ		04	37		
		F		16			
610	4	iP <sub>1</sub> Z	9	14	40	18,755	Dilatation. 24° S: 65.4° W; 0=8:54.8 by U. S. C. G. S; h=200 Km. 26° S: 68° W by La Plata. 25.1° S: 65.7° W by J. S. A.
		ePNE			40		
		P <sub>2</sub> Z		15	49		
		PPz		19	37		
		F	11	47			
611	5	PNEZ	18	29	27	240	Compression. Felt at Vigan.
		SNEZ		30	00		
		F		50			
613	6	PNEZ	2	53	47	175	Felt at Baguio.
		SNE		54	08		
		F	3	00			
614	6	PNEZ	13	08	43	215	Do.
		SNE		09	11		
		F		17			
617	8	iPz	17	30	35	135	Compression.
		ePNE			35		
		SNE			52		
		F		45			
618	10	PNEZ	12	11	47	1,935?	
		iS?E		15	03		
		F		38			
621	12	ePNEZ	4	16	11		Disturbed by microseisms. Near 20° S: 175° E (Strasbourg).
		S?N		26	45		
		F	5	20			
622	12	ePNEZ	22	01	20	135	
		SNEZ			37		
		F		12			
625	16	iPNEZ	4	33	32	3,355	Dilatation from NW. Data after P from the Wiechert. 24° N: 95° E by U. S. C. G. S.
		SNE		38	38		
		ME		50	40ca		
		F	8	20			
627	16	PNEZ	22	41	44	3,500	
		SNE		46	48		
		F	23	25			
629	18	iPEZ	9	35	32	2,790	Compression. Near 40° S: 104° E (Strasbourg).
		ePN			32		
		SNE		40	00		
		L		42	20ca		
		F	11	25			
630	18	iPNEZ	19	10	06	1,655	Compression. Near 28° N: 130° E (Strasbourg).
		SNE		13	00		
		F	21	05			
631	18	ePNEZ	22	20	17	3,420	
		SN		25	17		
	19	F	0	10			
633	20	ePEZ	5	10	24	2,620	Near 2° S: 104° E (Strasbourg).
		iSNE		14	30		
		LN		17	ca		
		F	7	44			
634	20	iPz	8	37	38	3,710	Dilatation. Bismarck Archipelago by Riverview and Manila. 4° S: 146° E by Wellington.
		ePE			42		
		iSNE		42	56		
		L?NE		45	ca		
		MN		50	ca		
		F	10	40			
650	22	iPz	21	44	30	3,080	Near 7° N: 82° E (Strasbourg).
		ePNE			38		
		iE		47	43		
		SNE		49	25		
		LNE		52	20ca		
		MNE		54	30ca		
		F	23	15			





INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
652	23	PNEZ	8	25	56	3,590?	Disturbed by microseisms.
		S?N		31	07		
		F	9	15			
654	24	ePNEZ	4	23	08	135	
		SNE			25		
		F		32			
656	24	iPEZ	15	49	05	2,745	Compression.
		ePN			07		
		SN		53	30		
		LE		55	55ca		
		MNE		58	15ca		
		F	17	05			
657	25	iPNEZ	1	33	56	3,255	Compression from SW. Near 5° S: 100° E (Strasbourg).
		iSNE		38	44		
		F	3	45			
663	25	iPz	22	11	44	125	Dilatation.
		SNE		12	00		
		F		25			
665	28	ePNEZ	0	36	10	500	
		SNEZ		37	09		
		F		53			
670	29	iPz	15	23	19	430	Dilatation from SE. 12° 05' N: 124° 05' E as on September 22, 1937. H=15:22:19. S from the Wiechert. Destructive in Masbate. Felt in SE Luzon and north Visayas.
		SNE		24	11		
		F	18	30			
674	30	PNEZ	11	55	36	3,255	Compression from southern Azimuth. 5.7° S: 143.3° E by Samoa. 3° S: 144° E by Wellington.
		SNE	12	00	37		
		F	14	20			
675	30	iPNEZ	17	13	13	2,190	Compression from SE.
		SN		16	54		
		F	18	35			
676	31	iPNEZ	17	51	42	4,255	Dilatation from SE. Focal depth about 450 km. (Riverview). 5° S: 146° E by Wellington.
		F	19	31			

Forty-seven insignificant or undecipherable disturbances on the following days of August: 1st(4), 2nd(2), 5th, 8th(2), 10th, 11th, 13th, 15th, 16th, 17th, 19th, 20th(8), 21st(6), 22nd, 23rd(2), 24th, 25th(5), 27th, 28th, 29th(5), and 30th.



## SEPTEMBER, 1938

### MACROSEISMIC RECORD

1, 1<sup>h</sup> 02<sup>m</sup> 04<sup>s\*</sup> [1, 9:02:04 A. M.] **Infanta, Tayabas.** Earthquake of intensity IV and three seconds duration. Window frames and doors of the municipal building creaked. A noise like wind was heard just before the shock occurred. There was a light aftershock nine minutes later.

2, 1<sup>h</sup> 12<sup>m</sup> 22<sup>s\*</sup> [2, 11:12:22 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

2, 21<sup>h</sup> 00<sup>m</sup> [3, 5:00 A. M.] **Palanas, Masbate.** Earthquake.

3, 19<sup>h</sup> 21<sup>m</sup> [4, 3:21 A. M.] **Lian, Batangas.** Light earthquake.

3, 22<sup>h</sup> 00<sup>m</sup> [4, 6:00 A. M.] **Carmen, Bohol.** Violent earthquake. Probably the collapse of a limestone cavity beneath the town.

4, 11<sup>h</sup> 00<sup>m</sup> [4, 7:00 P. M.] **Masbate and Leyte.** Light earthquake at Palanas, Masbate, and Carigara, Leyte. Probably an aftershock of the earthquake of August 29th. An aftershock at Palanas at 8:10 P. M.

4, 19<sup>h</sup> 22<sup>m</sup> 09<sup>s\*</sup> [5, 3:22:09 A. M.] **S Luzon, Mindoro, Marinduque, and Culion.** Epicenter in or near Mindoro. Felt with intensity IV for twenty seconds in Culion and Batangas. Intensity III in Atimonan, Santa Cruz and Manila.

5, 5<sup>h</sup> 27<sup>m</sup> 12<sup>s\*</sup> [5, 1:27:12 P. M.] **Baguio, Mountain.** Earthquake of intensity II.

5, 19<sup>h</sup> 00<sup>m</sup> [6, 3:00 A. M.] **Palanas, Masbate.** Light earthquake.

7, 4<sup>h</sup> 25<sup>m</sup> [7, 12:25 P. M.] **Baguio, Mountain.** Earthquake of intensity II.

7, 11<sup>h</sup> 16<sup>m</sup> 19<sup>s\*</sup> [7, 7:16:19 P. M.] **Luzon and Samar.** Earthquake of intensity II and forty seconds duration in Legaspi. Intensity IV and thirty seconds duration in Calbayog.

10, 7<sup>h</sup> 00<sup>m</sup> [10, 3:00 P. M.] **Palanas, Masbate.** Light earthquake. Another shock at 4:10 A. M. on the 11th.

13, 4<sup>h</sup> 00<sup>m</sup> [13, Noon] **Bongabon, Nueva Ecija.** Light earthquake.

15, 22<sup>h</sup> 05<sup>m</sup> 49<sup>s\*</sup> [16, 6:05:49 A. M.] **Luzon.** Epicenter in the China Sea. Intensity III and six seconds duration at Laoag. Light at Vigan, Bangui, and Cape Bojeador.

19, 7<sup>h</sup> 00<sup>m</sup> [19, 3:00 P. M.] **Palanas, Masbate.** Slight earthquake. Another light shock at 11 P. M. on the 20th.

20, 18<sup>h</sup> 31<sup>m</sup> 55<sup>s\*</sup> [21, 2:31:55 A. M.] **Virac, Catanduanes.** Earthquake of intensity III and seven seconds duration.

22, 0<sup>h</sup> 32<sup>m</sup> 24<sup>s</sup> [22, 10:32:24 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

29, 6<sup>h</sup> 20<sup>m</sup> [29, 2:20 P. M.] **Culion, Palawan.** Oscillatory earthquake of intensity II.



## INSTRUMENTAL RECORD



No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
678	1	PNEZ	2	56	32	1,710	Felt at Taihoku, Formosa.
		SNEZ		59	29		
		LNE	3	01	00ca		
		MNE		02	35ca		
		F	4	20			
681	1	ePNEZ	23	07	42	15,420	13.1° N: 89.4° W by U. S. C. G. S. 13° N: 89.4° W by J. S. A.
		PPN		10	42		
		SKP		11	52		
		F	0	23			
685	3	iPz	7	56	46	110	Compression.
		ePNE			46		
		SNEZ		57	00		
		F	8	12			
686	3	PEZ	11	43	30	555	
		SN		44	57		
		F	12	05			
689	4	iPNEZ	19	22	09	210	Compression from SSE. Felt at Batangas, Culion, Boac and Manila. S from the Horizontal.
		SNE			36		
690	4	iPz	20	19	51	190	No. 689 still recording. Compression.
		PNE			52		
		SNE		20	15		
		F	21	07			
692	5	PNEZ	8	59	49	210	Compression.
		SNE	9	00	16		
		F		18			
694	5	iE	14	53	22		Disturbed by microseisms. Near 35° S: 175° W by Strasbourg.
		iNE	15	07	09		
		iNE		15	20		
		F	16	29			
698	6	PEZ	20	53	09	4,245	Near 47° N: 147° E by Strasbourg.
		SNE		59	00		
		LNE	21	04	08ca		
		F	22	15			
699	7	iPEZ	1	57	21	1,150	Compression from SE. S from the Wiechert. N-S not recording.
		SE		59	20		
		F	3	50			
700	7	iPz	4	05	35	1,505	Dilatation. S from the Wiechert. N-S not recording. 24.1° N: 121.4° E by Taihoku. Felt in all Formosa.
		ePE			37		
		SNE		08	10		
		F	6	50			
701	7	PNZ	11	16	19	410	Felt at Calbayog and Legaspi.
		SNZ		17	21		
		F	12	10			
702	7	iPNEZ	13	05	39	4,055	Dilatation from SE. Near 70° S: 150° E by Riverview and Manila. 7° S: 156° E by Wellington.
		SNE		11	30		
		F	14	30			
707	10	PNEZ	22	31	52	4,655	
		SE		38	08		
		F	23	18			
708	11	ePNEZ	17	24	36	5,420	
		SE		31	36		
		MNE		41	45ca		
		F	18	07			
709	11	PNE	19	48	29	4,300	
		SE		54	24		
		MNE	20	03	ca		
		F		32			
711	12	PNEZ	12	30	25	200	
		SNEZ			51		
		F		42			
712	14	ePEZ	8	53	08	1,590	Felt at Taihoku, Formosa.
		SNEZ		55	54		
		MNE		58	45ca		
		F	9	50			
716	15	PNEZ	22	05	49	400	Felt in northwestern Luzon.
		SNE		06	39		
		SNE			49		
		F		14			



## INSTRUMENTAL RECORD—Continued

International  
Seismological  
Centre

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
717	15	PNEZ	23	18	09	260	
		SNEZ			45		
		F		24			
720	18	ePNEZ	1	37	28	3,940	
		SN		43	00		
		F	2	20			
724	18	PNEZ	13	43	57	1,910	
		SNEZ		47	11		
		LN		48	55ca		
		F	14	30			
726	20	ePNEZ	13	06	40	1,660	
		SN		09	32		
		F	15	03			
727	20	ePNEZ	15	37	52	1,060	
		iSEZ		39	43		
		F	17	10			
728	20	ePNEZ	18	31	55	570	Felt in Virac.
		SEZ		33	00		
		F	19	10			
730	21	iPz	11	40	46	1,090	
		SNEZ		42	41		
		F	12	25			
731	21	iPEZ	18	57	49	4,445	Compression. 31° N: 140° E by Strasbourg.
		iSNEZ	19	04	04		
		LN		11	ca		
		MN		13	50ca		
		F	21	22			
737	27	iPz	10	22	50	4,045	Disturbed by microseisms. 6° S: 151° E by Wellington.
		ePNE			51		
		SN		28	29		
		LNE		33	05ca		
		F	11	25			
738	28	PNEZ	18	22	27		Disturbed by microseisms. Near 11° S: 164° E (Strasbourg).
		iz		24	25		
		F	19	30			
739	29	PNEZ	6	35	18	280	Felt at Cullion.
		SNEZ			56		
		F		47			

Thirty-three insignificant or undecipherable disturbances on the following days of September: 1st(3), 2nd(3), 3rd, 4th, 5th(5), 7th, 8th, 9th, 10th, 12th, 14th(3), 16th, 17th, 18th(3), 19th, 20th, 21st, 23rd(2), 25th, and 27th.



## OCTOBER, 1938

### MACROSEISMIC RECORD

- 4, 13<sup>h</sup> 40<sup>m</sup> 36<sup>s</sup> [4, 11:40:36 P. M.] Agaña, Guam. Earthquake recorded and felt.  
 4, 14<sup>r</sup> 07<sup>m</sup> [4, 10:07 P. M.] Dapa, Surigao. Earthquake of intensity I.  
 7, 21<sup>h</sup> 04<sup>m</sup> [8, 5:04 A. M.] Port Lamon, Surigao. Earthquake of intensity II.  
 13, 19<sup>h</sup> 00<sup>m</sup> [14, 3:00 A. M.] Masbate. Light earthquake felt in the towns of Masbate, Aroroy, and San Fernando.  
 20, 2<sup>h</sup> 28<sup>m</sup> [20, 10:28 A. M.] Ambulong, Batangas. Earthquake of intensity II.  
 23, 21<sup>h</sup> 07<sup>m</sup> [24, 5:07 A. M.] Laoag, Ilocos Norte. Earthquake of intensity II and two seconds duration.  
 25, 7<sup>h</sup> 47<sup>m</sup> [25, 3:47 P. M.] Butuan, Agusan. Feeble earthquake of ten seconds duration.  
 26, 17<sup>h</sup> 00<sup>m</sup> [27, 1:00 A. M.] Masbate. Light earthquake at Palanas and Dimasalang.  
 31, 1<sup>h</sup> 15<sup>m</sup> [31, 9:15 A. M.] Bangui, Ilocos Norte. Light earthquake.  
 31, 20<sup>h</sup> 00<sup>m</sup> [Nov. 1, 4:00 A. M.] Palanas, Masbate. Light quake.

### INSTRUMENTAL RECORD

No.	Date	Phase	Time			$\Delta$ Km	Remarks
			h	m	s		
742	4	iPEZ	8	32	19	4,045	
		SNE		37	58		
		LNE		42	40ca		
		MNE		45	45ca		
		F	9	25			
744	7	iPEZ	0	55	13	480	
		ePN			13		
		iSNE		56	10		
		F	1	57			
745	7	ePNZ	6	17	11	4,155	
		SN		22	57		
		MNE		31	ca		
		F	7	25			
747	7	iPZ	16	29	28	3,155	
		iPE			30		
		iSNE		34	11		
		F	17	40			
749	9	PNEZ	16	48	57	8,890	
		iSNE		59	09		
		LNE	17	15	30ca		
		MNE		21	05		
		F	18	23			
750	9	PNEZ	20	44	50	4,100	
		SNE		50	33		
		LNE		54	30ca		
		F	21	40			
751	10	iPNEZ	20	51	20	1,545	S from the Wiechert. Dilatation from SE. 1°N: 125°E by U. S. C. G. C. and J. S. A.
	11	iSE		54	04		
	11	F	0	04			
752	11	iPZ	0	11	10	1,555	Dilatation. Near 27°N: 142°E (Strasbourg).
		SNE		13	56		
		F	2	05			
753	12	PNZ	0	40	05	6,235	Compression.
		SNE		47	50		
		LNE		57	25ca		
		F	3	10			
757	13	PNEZ	15	28	34	1,135	Felt in all of Formosa.
		SNE		30	40		
		F	17	35			
758	13	PNEZ	18	41	32	1,400	
		SNE		43	57		
		F	19	20			



## INSTRUMENTAL RECORD—Continued



No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
763	20	iPNEZ	2	24	34	2,653	Compression. S from the Wiechert. (Felt in Timor, N. E. I.). 10°S: 123°E by U. S. C. G. S. 9°S: 123°E by Manila and Riverview.
		iSNE		28	54		
		F	4	15			
764	21	iPz	20	33	48	3,030	Conspicuous group of about 17 seconds period waves on E component from 20:55 to 20:59. Near 5°N: 70°E (Strasbourg).
		SN		38	22		
		F	21	21			
768	23	PNEZ	15	13	46	5,820?	
		S?NE		21	10		
		F	16	35			
771	25	ePNEZ	21	28	30	1,050	
		SNE		30	21		
		F		48			
772	26	PNEZ	3	32	28	2,535	
		SNE		36	28		
		MNE		40	30ca		
		F	4	20			
773	26	PNEZ	16	55	14	1,510	
		SNEZ		57	50		
		MNE	17	00	45ca		
		F	18	13			
778	29	ePNEZ	13	14	11	4,680	Near 34°N: 142°E (Strasbourg).
		iSNEZ		20	29		
		LNE		26	ca		
		MNE		30	ca		
		F	15	00			
779	29	iPz	22	58	07	3,255	Dilatation.
		iPNE			08		
	iSE	23	02	56			
	F	0	10				
781	30	ePNEZ	8	23	46	3,210	
		SN		28	32		
		F		47			

Twenty-five insignificant or undecipherable disturbances on the following days of October: 1st(2), 6th, 7th, 8th, 12th(2), 13th(2), 17th(2), 19th, 22nd, 23rd(2), 25th(2), 27th(3), 28th, 30th(2), 31st(2).



NOVEMBER, 1938

MACROSEISMIC RECORD

2, 5<sup>h</sup> 38<sup>m</sup> [2, 1:38 P. M.] **Dumaguete, Negros Oriental.** Earthquake of intensity III and five seconds duration. A hissing sound was heard for three seconds.

4, 21<sup>h</sup> 20<sup>m</sup> [5, 5:20 A. M.] **Pamplona, Negros Oriental.** Slight earthquake.

5, 15<sup>h</sup> 35<sup>m</sup> [5, 11:35 P. M.] **Port Lamon, Surigao.** Earthquake of intensity II and two seconds duration.

7, 15<sup>h</sup> 26<sup>m</sup> 25<sup>s</sup> [8, 1:26:25 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

13, 4<sup>h</sup> 54<sup>m</sup> 56<sup>s</sup>\* [13, 12:54:56 P. M.] **Mindanao, Samar, and Leyte.** Epicenter in the Philippine Deep. Intensity VI with twenty seconds duration at Dapa. This preceded and followed by lighter vibrations; the total duration being one minute. Another shock of intensity II at 12:57 P. M.

In Butuan the intensity was VI; the church bell rang once, clocks were stopped, hanging objects swung from N to S and people ran into the streets. The shock lasted one minute. Felt strongly in Hinatuan and Guiuan. Also felt in Surigao, Port Lamon, Maasin, and Ormoc.

16, 1<sup>h</sup> 00<sup>m</sup> [16, 9:00 A. M.] **Claveria, Misamis Oriental.** Light earthquake.

16, 3<sup>h</sup> 43<sup>m</sup> [16, 11:43 A. M.] **Ormoc, Leyte.** Earthquake of intensity II and ten seconds duration.

17, 5<sup>h</sup> 35<sup>m</sup> [17, 1:35 P. M.] **Badajoz, Romblon.** Moderate earthquake.

18, 15<sup>h</sup> 32<sup>m</sup> 08<sup>s</sup>\* [18, 11:32:08 P. M.] **W Luzon.** Earthquake of intensity III and twenty-five seconds duration at Corregidor. Felt lightly at Manila and Iba, and a hissing sound was heard at the latter place just before the earthquake.

27, 12<sup>h</sup> 00<sup>m</sup> [27, 8:00 P. M.] **Palanas, Masbate.** Earthquake.

30, 13<sup>h</sup> 04<sup>m</sup> [30, 9:04 P. M.] **Libmanan, Camarines Sur.** Extremely feeble earthquake.



## INSTRUMENTAL RECORD

No.	Date	Phase	Time			Km.	Remarks
			h.	m.	s.		
785	1	$\overline{IPNEZ}$ $\overline{SNE}$ F	14	07	09 25	125	Dilatation from SW.
786	5	$\overline{PNEZ}$ $\overline{SNEZ}$ F	3	50	16 29	100	
787	5	ePNZ SNE F	8	49	18 54	3,245	S from the Wiechert. Japan. 36.8° N: 139.6° E by J. S. A. 38° N: 141° E by U. S. C. G. S.
788	5	Pz SNE LNE F	10 11	56 00	05 52 04 10ca	3,245	Sand L from the Horizontal. Japan. 36.7° N: 141° E by U. S. C. G. S. No. 787 still recording.
789	5	PN SN F	21	19	07 49 35	320	Disturbed by microseisms.
790	6	iPNEZ iSNE LNE MN F	8 9	59 05	58 03 08 50ca 11 40ca	3,510	Compression. 36° N: 144° E by U. S. C. G. S.
793	6	PNEZ SNE MNE F	21	44	46 41 56 35ca	3,355	Same as No. 790 by U. S. C. G. S.
795	7	PEZ SNE LNE MN F	1	44	27 31 53 10ca 55 40ca	3,490	
796	7	eP?Z SNE	4	21	45 29	3,945	
797	7	$\overline{PEZ}$ $\overline{SNZ}$ F	5	22	55 18 29	180	No. 796 still recording.
801	9	PNEZ SNE F	9	21	52 19 50	5,745	
804	10	PNZ SNE LNE F	10	52	07 40 59 40ca	3,020	
806	10	iPz ePNE SNE LN MNE F	20	30	09 09 52 54 ca 21 00 30ca	8,290	Data after P from the Wiechert. 56° N: 159° W by U. S. C. G. S. 55.6° N: 157.7° W by J. S. A.
807	11	PNEZ SNEZ F	1	09	13 39 35	7,950	Compression (?).
808	11	ePNEZ SNE LNE MNE F	3	02	45 24 10 15ca 12 25ca	2,935	
809	11	ePNEZ S?ca F	4	41	53 00 40	4,520?	
811	11	iPz SNE F	14	11	14 14 45	4,390	
812	12	ePNZ SNE F	6	12	11 47 33	3,065	
813	13	iPz SNE F	4	54	56 30 5 23	880	Felt in northeastern Mindanao, Samar and Leyte. Data after P from the Wiechert and Horizontal. Epicenter, Philippine Deep.
814	13	PNE SNE F	13	21	02 22 45	4,720	From the Wiechert and Horizontal. 46° N: 149.4° E by J. S. A.



## INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
815	13	iPz	22	37	36	5,065	Compression (?).
		SNE		44	15		
	14	F	0	46			
817	14	iPEZ	12	12	53	2,500	
		SNE		16	51		
		LNE		19	20ca		
		F	13	05			
819	15	ePz	15	28	43	2,780	
		SN		33	00		
		LNE		33	40ca		
		F	16	02			
820	15	ePNEZ	21	06	23	3,290	
		SN		11	14		
		LNE		14	40ca		
		MN		17	10ca		
		F	22	35			
822	16	ePNEZ	11	14	09	5,080	
		SNE		20	50		
		LN		27	50ca		
		F	12	15			
823	17	PNEZ	4	06	07	8,010	Compression. 55° N: 158° W by U. S. C. G. S.
		SNEZ		15	37		
		LNE		29	20ca		
		ME		36	ca		
		F	7	15			
824	18	PNEZ	14	21	26	5,555	
		SNE		28	34		
		F	15	15			
825	18	iPNEZ	15	32	08	160	Compression. Felt W Luzon and in Manila slightly. Deeper than normal.
		SN			28		
		F	16	15			
828	19	ePNEZ	5	47	41	5,035	
		SNE		54	19		
		F	6	55			
829	20	ePNEZ	17	58	58	850	
		iSNEZ	18	00	30		
		F	19	05			
830	21	ePNEZ	1	17	24	3,600	
		SNE		22	35		
		LNE		26	ca		
		MNE		29	25ca		
		F	2	40			
831	21	PNEZ	7	01	22	1,025	Felt strongly at Taihoku.
		SNE		03	10		
		F		49			
832	22	iPz	1	20	03	3,345	Dilatation. S from the Wiechert. 37° N: 142° E by U. S. C. G. S. 36.3° N: 141.6° E by J. S. A.
		SNE		24	57		
		F	4	15			
835	29	PNE	13	45	31	4,845	
		SNE		52	07		
		L		58	ca		
		F	15	20			
836	30	iPNEZ	2	35	47	3,300	Compression. L from the Wiechert. 37° N: 142° E by U. S. C. G. S. 37.5° N: 141.3° E by J. S. A.
		SNE		40	50		
		LNE		48	ca		
		F	4	00			

Eighteen insignificant or undecipherable disturbances on the following days of November: 6th(2), 7th(3), 9th(2), 10th(2), 11th, 14th, 15th, 16th, 18th, 19th, 25th, 27th, and 30th.



DECEMBER, 1938

MACROSEISMIC RECORD

3, 13<sup>h</sup> 15<sup>m</sup> [3, 9:15 P. M.] **NE Mindanao.** Strong in Butuan with a duration of thirty seconds. Windows and doors strongly shaken; pendulum clock stopped. Felt moderately in Tagoloan and Balingasag, Oriental Misamis. Felt lightly in the province of Surigao and southern Agusan.

4, 12<sup>h</sup> 54<sup>m</sup> [4, 8:54 P. M.] **Claveria, Misamis Oriental.** Vertical earthquake of intensity III.

6, 11<sup>h</sup> 29<sup>m</sup> 52<sup>s\*</sup> [6, 7:29:52 P. M.] **Iba, Zambales.** Feeble earthquake of vertical motion and two seconds duration. After a few seconds there was a second shock of the same character.

7, 7<sup>h</sup> 10<sup>m</sup> [7, 3:10 P. M.] **Dumaguete, Negros Oriental.** Earthquake of intensity II and five seconds duration.

8, 23<sup>h</sup> 20<sup>m</sup> [9, 7:20 A. M.] **Bangui, Ilocos Norte.** Slight earthquake.

10, 7<sup>h</sup> 25<sup>m</sup> [10, 3:25 P. M.] **Santa Cruz, Laguna.** Earthquake of intensity III and five seconds duration. At 4:51 P. M. there was another shock of intensity II and two seconds duration.

12, 15<sup>h</sup> 14<sup>m</sup> [12, 11:14 P. M.] **Claveria, Misamis Oriental.** Earthquake of intensity II.

14, 15<sup>h</sup> 53<sup>m</sup> [14, 11:53 P. M.] **N Mindanao.** Earthquake of intensity IV at Cagayan and intensity II at Claveria.

19, 4<sup>h</sup> 54<sup>m</sup> 19<sup>s\*</sup> [19, 12:54:19 P. M.] **N Luzon.** Earthquake of intensity III and seven seconds duration at Laoag. Intensity III at Baguio. Felt lightly through the provinces of north Luzon, and very lightly in Manila.

23, 7<sup>h</sup> 50<sup>m</sup> [23, 3:50 P. M.] **NE Mindanao.** Earthquake of intensity IV and about ten seconds duration in Dapa. Felt slightly in Cantilan and Butuan.

26, 14<sup>h</sup> 30<sup>m</sup> [26, 10:30 P. M.] **Cataingan, Masbate.** Slight earthquake. A strong shock at 11 P. M. and another of moderate intensity at 4 A. M. on the 27th. Some light damage in stores.

27, 14<sup>h</sup> 10<sup>m</sup> [27, 10:10 P. M.] **Calbayog, Samar.** Earthquake of vertical movement, intensity III.

27, 20<sup>h</sup> 56<sup>m</sup> 20<sup>s\*</sup> [28, 4:56:20 A. M.] **SE Luzon.** Earthquake of intensity II at Legaspi; moderately strong at Malinao.

28, 16<sup>h</sup> 12<sup>m</sup> [29, 0:12 A. M.] **Cantilan, Surigao.** Slight earthquake.

29, 11<sup>h</sup> 12<sup>m</sup> [29, 7:12 P. M.] **Masbate, Masbate.** Earthquake of intensity II.



## INSTRUMENTAL RECORD

No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
838	1	iPEZ iN SEZ L M F	2	17	41 56 22 23 25 ca 28 ca 4 20	2,980	Compression.
839	2	ePNEZ SNE F	12	10	58 11 18 16	160	
841	3	iPNZ SNEZ F	12	17	38 25 07 13 00	5,930	
842	3	PNE SNE F	22	21	32 26 07 23 00	2,880	
844	4	iPz iz iz iNE F	16	21	11 23 09 32 07 49 24 17 30		
845	5	iPz S F	17	50	52 55 24 18 30	2,845	
846	6	$\overline{P}$ NE SNE F	11	29	52 30 10 31	145	From the Wiechert. Felt at Iba, Zambales.
847	6	ePNE iNE F	23	02	52 05 17 0 35		P from the Galitzin-Wilip. Other phases from the Wiechert. Very strong microseisms. Felt lightly in Taihoku, Formosa.
849	7	iPz SNE LNE F	13	31	19 37 17 41 ca 13 35	4,165	
850	7	ePNE SNE F	15	03	25 07 23 30	2,400	From the Wiechert.
851	9	PNEZ SNE F	5	05	36 07 41 35	1,120	
860	12	iPNZ SNEZ F	0	25	37 29 19 45	2,200	Dilatation.
863	13	ePNEZ iSNEZ F	2	18	58 22 50 46	2,320	
864	13	iPNEZ iSNEZ L F	17	31	50 37 05 40 30ca 18 30	3,490	
869	15	PEZ SNE	9	23	10 29 37	4,680	
873	16	iPNEZ SNEZ L F	17	32	50 42 14 55 ca 19 30	7,965	Compression. In region of 48° S; 160° E by Riverview and Manila.
875	16	ePNEZ SNEZ L F	23	26	20 35 43 48 ca 1 00	7,945	
876	17	PNEZ SNE LNE F	16	43	12 52 34 56 15 17 40	7,935	
879	18	ePNEZ SNE F	21	52	00 56 27 22 48	2,780	
880	19	iPz ePNE SNEZ F	4	54	19 20 55 07 5 40	390	Dilatation. Deeper than normal. Felt NW Luzon with intensity III, and in Manila with intensity II.



## INSTRUMENTAL RECORD—Continued



No.	Date	Phase	Time			$\Delta$ Km.	Remarks
			h.	m.	s.		
882	19	iPz	18	30	55	4,180	Compression.
		ePNE			55		
		SNE		36	42		
		LN		41	45ca		
		F	20	20			
884	21	iPNEZ	12	32	01	2,865	Compression from SE.
		iSNEZ		36	35		
		LNE		40	05ca		
		MNE		42	15ca		
		F	14	25			
887	22	ePNEZ	3	24	04	1,255	
		SNE		26	14		
		F	4	23			
888	22	PNEZ	16	59	04	1,835	Dilatation. Felt slightly at Taihoku, Formosa.
		SNEZ	17	02	15		
		LNE		03	20		
		MNE		05	40ca		
		F	18	25			
889	23	ePNZ	1	57	39	3,810	
		SNE	2	03	03		
		F		35			
892	24	iPEZ	20	08	52	2,535	Compression.
		ePN			52		
		iSNE		12	52		
		F	21	29			
893	26	PNEZ	4	33	22	135	Compression.
		SNEZ			39		
		F		47			
897	28	iPz	5	10	54	215	Dilatation?
		ePNE			54		
		SNE		11	22		
		F		27			
898	28	ePNEZ	23	25	52	685	
		SNE		27	08		
		F		50			

Thirty-two insignificant or undecipherable disturbances on the following days of December: 2nd, 4th, 7th, 9th, 10th(6), 11th, 12th, 13th(2), 14th(3), 16th(4), 18th(2), 19th, 20th, 21st, 22nd, 23rd(2), 26th(2), and 27th.



## NUMBER OF EARTHQUAKES FELT IN THE PHILIPPINES, FROM 1903 TO 1938



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	3	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
1934	12	8	5	16	14	8	14	13	12	18	14	15	149
1935	14	11	11	9	20	11	11	10	26	42	28	18	211
1936	13	11	18	13	4	6	18	16	11	22	16	23	171
1937	14	10	18	15	10	5	17	64	34	10	8	12	217
1938	13	12	13	14	13	15	24	13	20	9	11	19	176

## NUMBER OF SEISMIC DISTURBANCES RECORDED AT MANILA, FROM 1903 TO 1938

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	29	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	30	22	37	64	68	45	34	48	53	530
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
1934	52	93	56	68	78	81	77	78	52	34	93	94	856
1935	71	90	75	80	138	100	82	71	67	93	45	77	989
1936	61	70	63	106	104	73	51	56	65	48	49	60	806
1937	45	56	86	69	145	52	76	212	125	62	65	72	1,065
1938	53	94	56	84	129	91	94	75	63	45	53	61	898

1903. Installation of Vicentini Seismograph.

1907. Installation of Horizontal Pendulums.

1911. Installation of Weighert 1,000 Kg. Inverted pendulum.

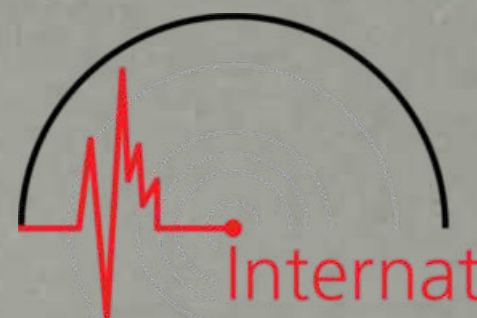
1930. Installation of Galitzin-Wilip Seismograph. Three components.



No. 1.

January, 1938.

MANILA, P. I.  
SEISMOLOGICAL BULLETIN OF THE OBSERVATORY



International  
Seismological  
Centre

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

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

h=3 m.

Alluvium.

CONSTANTS OF THE  
GALITZIN-WILIP

CONSTANTS OF THE WIECHERT  
INVERTED PENDULUM. M=955 Kg.

January 1, 1938.

	$T_1$	T	$\mu^2$	$V_s$
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.00	229
Z	11.6	9.0		

	$T_0$	V	$\epsilon$	$\frac{-I}{T_0^2}$
N-S	4.3	209	2.4	0.074
E-W	4.4	255	2.7	0.087

Cf. Theoretical Seismology.  
Sohn, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Jan. 1938				
#2 1st	PNEZ SNE F	7 35 53 40 44 57	3290	
#4 1st	PNEZ SNEZ F	16 16 31 20 43 50	2710	Deeper than normal.
#5 1st	iPEZ SNEZ iZ	23 33 07 37 24 28	2780	Compression.
2nd	F	1 40		
#8 2nd	PPEZ SKP PPP PS LN	22 48 47 50 03 51 25 58 56 23 27 ca	14555	$15^{\circ} 7' N$ : $98^{\circ} W$ : 022:27:13 by U.S.C.G.S.
3rd	F	0 55		
#11 3rd	iPEZ iZ SNE F	21 28 42 31 40 38 24 23 07	8270	Dilatation (?)
#12 4th	P?NEZ SNE F	2 41 40 45 46 3 00	2620?	
#14 5th	PNEZ SNE F	2 39 53 40 07 51	110	
#15 6th	PNEZ SNEZ F	0 53 53 53 53 50	1545	
#17 7th	PEZ SEZ MNEZ F	15 33 40 38 56 45 10ca 16 21	3665	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.
Jan. 1938				
#19 10th	PNEZ iZ SNEZ F	20 53 34 21 01 12 02 03 31	2100	Disturbed by microseisms.
#20 11th	iPNEZ SNE F	15 17 03 21 16 16 02	2720	
#24 16th	P?NEZ S?N F	14 12 52 18 48 15 03	4320?	Disturbed by microseisms.
#25 17th	PNZ SNE F	23 35 35 39 01 56	2065	Disturbed by microseisms.
#26 18th	iPEZ SNE LNE MNE F	4 25 40 30 13 33 25ca 35 40ca 5 20	3020	
#28 18th	●PNEZ iSE iN F	9 37 36 44 27 45 54 10 25	5255	
#29 18th	ePNEZ SNE F	20 48 37 49 30 21 33	435	Felt at Virac with intensity V and at Capalonga, intensity III.
#30 18th	PNEZ SNEZ F	21 47 53 48 14 55	165	
#31 19th	ePNZ S?NEZ F	2 46 35 50 19 3 16	2300?	
#32 19th	ePNEZ SNE F	14 54 13 57 52 15 35	2235	Deeper than normal.
#34 22nd	iPZ ePNE SNE F	15 33 16 16 37 37 16 06	2845	Dilatation.
#35 22nd	ePNEZ SNE F	18 24 39 26 15 40	895	Felt at Basco with intensity II.
#36 23rd	ePNEZ S?N F	8 44 08 54 47 11 15	9535?	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.
Jan. 1938				
#30 24th	PNEZ iNE iNE F	10 51 01 54 36 56 25 13 15		
#40 25th	eEZ SNE(?) F	17 05 15 15 00 18 21	8400?	
#41 25th	iPZ ePNE SNE F	21 01 19 21 43 10	190	
#44 26th	PNEZ SNE LN F	5 16 54 19 52 21 25ca 46	1720	P in minute gap.
#47 28th	iPZ ePNE SNE LNE F	4 16 51 51 21 23 24 ca 57	3000	
#48 29th	ePNEZ SNE LN MNE F	4 19 56 25 55 30 35ca 34 50ca 5 01	4380	
#51 30th	ePNE SNE F	10 09 51 11 40 30	1030	
#52 30th	ePNEZ SN F	17 21 33 31 00 18 47	8020	

Twenty-three insignificant or undecipherable disturbances on the following days of January: 1st(2), 2nd(2), 3rd(2), 4th, 6th, 8th, 12th(2), 13th, 18th, 20th, 23rd, 25th(2), 27th, 29th(2), 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=3 m.

Alluvium.



CONSTANTS OF THE GALITZIN-WILIP

	$T_1$	T	$\mu^2$	$V_s$
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg. February 1, 1938.

	$T_0$	V	$\epsilon$	$\frac{I}{T_0^2}$
N-S	4.3	211	2.6	0.069
E-W	4.3	258	2.9	0.081

Cf. Theoretical Seismology. Sohon, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Feb. 1938 #54 1st	PNEZ SNE F	7 49 23 50 48 8 19	540	
#55 1st	PNEZ SNEZ	18 55 02 59 04	2455	
#56 1st	PNEZ SN	19 09 12 13 00	2280	4°S: 133°5E by U.S.C.G.S. 5°S: 131°E by J.S.A. S from the Wiechert. #55 still recording.
#57 1st 2nd	PE SE F	19 43 49 47 30 0 18	2260	#56 still recording.
#59 2nd	PNEZ SE ME F	9 42 30 46 55 52 ca 10 45	2890	Disturbed by microseisms.
#64 3rd	PEZ (S?)NE F	0 37 39 41 25 59	2320?	Disturbed by microseisms.
#66 3rd	PN SNE LNE F	12 55 49 13 00 55 04 35ca 50	3520	
#68 4th	PNEZ SNE F	10 42 28 47 27 11 07	3410	
#69 4th	PNEZ SNE F	11 11 12 52 26	300	





## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Feb. 1938 #70 5th	iPZ ePNE iZ iE iNE F	2 43 21 21 44 45 45 46 49 16 5 25	17555	4°5N: 76°W, 02:23:34 by U.S.C.G.S.
#72 5th	iPNEZ SNEZ F	9 55 56 56 36 12 10	295	Dilatation. Felt in southeastern Luzon. Probably a little deeper than normal.
#75 5th	iPZ ePNE SNE	20 31 00 00 40	295	
#76 5th	P?NEZ SNE F	20 33 36 40 32 21 03	1110	#75 still recording.
#81 6th	PNE SN	7 01 48 03 54	1135	
#82 6th	iPZ ePNE SNE F	7 14 20 20 20 26 8 50	4490	#81 still recording.
#84 6th	PZ SNE F	18 24 00 27 59 19 15	2520	
#85 7th	iPZ S?E iE F	1 25 58 32 12 36 28 3 15	4620?	Compression.
#86 7th	ePNEZ SNE F	3 53 25 58 16 4 32	3290	
#89 7th	PNEZ S?NE F	14 48 31 53 08 16 05	2890?	
#91 8th	PEZ SNE F	7 36 02 44 53 9 40	7320	
#92 8th	PNEZ SNE F	13 15 37 17 24 14 37	1010	





No. and Date	Phase	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Feb. 1938				
#93	ePNEZ iE F	14 40 13 50 08 16 50		
#99 11th	iPZ iN iN SNE F	7 03 30 05 16 08 23 10 37 8 13	5535	Compression.
#101 11th	iPNE SN SE F	14 40 30 41 20 30 16 20	400	Compression from NW. Felt in northern Luzon. S and S from the Wiechert and Horizontal. Baguio, 200 Km.
#102 11th	ePNEZ SN F	17 02 21 05 38 33	1945	
#103 11th	ePNEZ SNE F	19 28 24 29 36 46	460	
#107 13th	iPEZ ePN SNEZ	8 15 33 33 25 03	8200	Compression. 38°S: 179°W: 0=8:03:44 by U.S.C.G.S.
#108 13th	iPEZ iN SNE F	8 33 35 36 55 38 45 11 20	3590	#107 still recording.
#111 14th	PNEZ SNE F	3 04 45 13 16 4 10	6890	Compression.
#114 15th	PP SKP PPP L F	3 49 31 50 15 52 20 4 36 ca 5 05	14800	Dilatation. 18°N: 25°W, 0=3:27.7 by U.S.C.G.S.
#118 16th	PNEZ SNEZ F	20 47 20 43 12 21 50	430	Felt in SE Luzon and in Masbate.
#119 17th	PNEZ SNE iZ F	5 25 00 28 47 53 6 00	2335	Compression. Deep focus.
#120 17th	PNEZ SNE F	23 15 28 18 03 55	1510	



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Feb. 1938				
121 18th	PNEZ SNE LNE	1 03 39 05 30 07 ca	1000	
1222 18th	PNEZ SNE F	2 29 44 33 23 3 24	2220	#121 still recording.
124 18th	PNZ SEZ F	5 51 11 53 09 6 49	1135	
125 18th	$\bar{P}$ NEZ $\bar{S}$ NEZ F	19 43 53 44 10 48	135	
127 20th	PNEZ SNEZ F	7 15 19 19 15 37	2480	
128 20th	PNEZ SNE F	21 35 00 39 34 55	2865	
130 21st	P?NEZ SNE F	15 55 08 16 00 21 28	3625?	Disturbed by microseisms.
131 21st	P?EZ SNE F	16 35 19 42 22 17 27	5465?	Disturbed by microseisms.
132 22nd	PNEZ SNE F	5 <del>44</del> 39 48 40 6 09	2545	
133 22nd	PNEZ SNE F	6 12 29 19 21 7 30	5265	
135 23rd	$i\bar{P}$ NEZ $\bar{S}$ NEZ F	0 50 17 37 1 17	160	Compression. Felt in Central Luzon. 16.2N: 120.5E by Manila and Baguio.
136 23rd	PNEZ $\bar{S}$ NEZ F	17 17 44 18 21 22	260	
139 26th	PEZ SNE F	19 55 54 56 44 20 07	400	



## 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
Feb. 1938				
140	PNEZ	1 36 07	4590	
27th	IZ	34		
	SNE	42 19		
	F	2 11		
141	ePNEZ	11 25 12	4755	
27th	SNE	31 34		
	F	12 10		
142	FEZ	6 34 34	120	Compression from SW.
28th	SEZ	49		Felt slightly in Manila, and Cavite
	F	45		Province.
145	PNEZ	12 52 25	200	Felt at Daet, intensity III.
28th	SNE	50		
	F	13 00		
146	PNEZ	17 35 04	180	
28th	SNEZ	24		
	F	40		

Forty-three insignificant or undecipherable disturbances on the following days of February: 2nd(5), 3rd(2), 5th(6), 6th(2), 7th(2), 8th, 9th(4), 10th, 11th, 12th(3), 13th(2), 14th(2), 15th(3), 18th, 19th, 21st, 22nd, 25th(2), and 28th(3),



SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

Ref. 2836



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

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

h=3 m.

Alluvium.

CONSTANTS OF THE GALITZIN-WILIP

CONSTANTS OF THE WIECHERT  
INVERTED PENDULUM, M 955 Kg.  
March 1, 1938.

	$T_1$	T	$u^2$	$V_s$
N-S	12.8	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

	$T_0$	V	$\epsilon$	$\frac{r}{T_0^2}$
N-S	4.3	211	2.5	0.067
E-W	4.4	247	2.6	0.086

Cf. Theoretical Seismology.  
Sohn, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
March 1938 #148 1st	P?EZ LNE F	4 35 39 41 ca 5 00	2110?	
149 1st	$\bar{P}$ NEZ SNEZ F	6 38 19 35 41	125	
154 3rd	P?NEZ SN F	18 41 47 44 29 19 11	1555?	
155 3rd	PEZ SNEZ F	23 30 42 31 31 46	395	
156 4th	$\bar{P}$ NEZ SNEZ F	1 41 03 44 31 2 20	2090	
158 5th	iPZ ●PNE iZ SNE LN MN F	11 36 00 03 36 37 39 14 40 55ca 42 40ca 13 46	1935	
159 5th	$\bar{P}$ NEZ SNEZ	17 43 00 17	135	
160 5th	$\bar{P}$ NEZ SNEZ F	17 50 30 57 18 10	210	No. 159 still recording.
162 5th	i $\bar{P}$ Z SNE F	23 06 30 50 21	160	Dilatation.



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
March 1938				
163 6th	PNEZ SNE F	0 07 36 56 15	160	
164 6th	iPZ SNE LNE MN F	2 03 35 09 46 16 ca 21 ca 3 05	4390	
165 6th	PNEZ SNE F	12 16 41 17 14 30	240	
166 6th	iPZ ePE SNE F	17 04 27 27 12 54 45	6910	Deep focus.
167 8th	iPZ iZ S?Z F	5 42 30 46 17 51 11 7 15	7145?	Compression. N and E components defective.
173 9th	PNEZ SNE LN F	2 15 20 20 51 25 15ca 3 12	3920	
174 10th	ePNEZ SNE MN	15 46 35 50 36 55 ca	2545	
175 10th	iPNEZ SNE F	16 23 23 25 27 18 15	1110	No. 174 still recording. Felt in Davao. Butuan, 320 Km.
178 13th	P?EZ iN SNE LNE F	21 21 21 24 23 28 35 38 ca 22 10	5655?	
179 14th	PNEZ SNEZ LNE F	0 56 43 1 03 08 09 30 51	4810	
180 14th	iPZ ePNE iSNEZ LNE MNE F	5 19 33 33 23 59 26 50ca 29 ca 6 34	2910	Dilatation. Deeper than normal.



## M A N I L A , P . I .

## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International  
Seismological  
Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
March 1938				
182	$\bar{P}$ NE	8 24 58	115	
17th	SNEZ	25 13		
	F	30		
185	ePZ	1 51 11	3750?	
21st	S?N	36 32		
	LN	40 40ca		
	F	2 25		
188	1PZ	15 35 10	10050	Dilatation.
22nd	1SNEZ	46 07		
	MN	16 12 ca		53°N: 131.0°W; 0=15:22:19 by U.S.C.G.S.
	F	18 26		
189	P?NEZ	22 42 21	7700?	
22nd	SNE	51 35		
	F	23 35		
193	ePNEZ	16 00 20	7055	
25th	SNE	08 56		
	LN	20 30ca		
	MNE	25 30ca		
	F	17 55		
199	ePNEZ	2 04 44	400	Felt at Laoag and Aparri, intensity II.
30th	SNEZ	05 34		
	F	24		
201	ePNEZ	5 34 53	1520	
31st	SNE	37 31		
	F	6 50		
202	PNEZ	15 19 17	580	
31st	SNE	20 23		
	F	42		
203	PNEZ	22 32 35	755?	Felt in Laoag. S from the Wiechert.
31st	S?NE	33 58		
Apr. 1	F	0 30		

Twenty-seven insignificant or undecipherable disturbances on the following days of March: 1st(2), 2nd(2), 4th, 5th, 8th(5), 12th, 13th, 14th, 18th(2), 21st(2), 23rd, 25th(2), 27th, 28th(4), and 30th.



MANILA OBSERVATORY



APRIL, 1938

We thankfully acknowledge the receipt of the following  
 Bulletins and Reports.

STATIONS

BULLETINS

Bucarest-----	February, 1938.
De Bilt-----	Magnetic Character: April to September, 1937.
Göttingen-----	July, August and September, 1937.
Graz-----	March 1, 1937 to March 2, 1938.
Hong Kong-----	Principal earthquakes of March, 1938.
Hukuoka-----	July 1, 1936 to June 30, 1937.
Jena-----	Year, 1936.
Kew-----	February, 1938.
Ksara-----	February, 1938.
Lemberg-----	September 19, 1936 to July 31, 1937.
Ottawa-----	January, 1938.
Palau-----	November 2, 1937 to March 5, 1938.
Paris-----	January, 1938.
Pasadena-----	June, 1937.
Phu-Lien-----	December, 1937 and Principal earth- quakes of March, 1938.
Rathfarnham-----	February, 1938.
San Fernando-----	January and February, 1938.
Strasbourg:	
L'Institut-----	January, 1938.
Bureau Central-----	January, 1938.
Union International-----	January, 1938.
Sydney-----	November 30 to December 28, 1937.
Wellington-----	February, 1938.
Zinsén-----	October, November and December, 1937.

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MANILA, P. I.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

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

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

h=3 m.

Alluvium.

CONSTANTS OF THE  
GALITZIN-WILIF

CONSTANTS OF THE WIECHERT  
INVERTED PENDULUM. M=955 Kg.  
April 1, 1938.

	$T_1$	T	$\mu^2$	$V_s$
N-S	12.6	12.9	0	400
E-W	11.3	11.9	.08	229
Z	11.6	9.0		

	$T_0$	V	$\epsilon$	$\frac{-T}{T_0^2}$
N-S	4.3	217	2.5	0.071
E-W	4.4	256	2.5	0.090

Cf. Theoretical Seismology.  
Sohn, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
April 1938				
204 1st	P?NEZ SNE F	0 45 15 46 47 1 29	850?	Disturbed by microseisms.
208 1st	PNZ SNE F	21 32 33 33 43 22 40	620	No. 207 still recording.
212 4th	PNEZ SNEZ F	4 27 32 50 31	140	Felt in Marinduque.
213 4th	PNEZ SNEZ F	4 32 54 33 12 36	140	Felt in Marinduque.
214 4th	PNEZ SNE	21 13 27 17 05	2155	Dilatation.
219 7th	P?NEZ SE F	2 22 53 25 24 40	1455?	
223 7th	PNEZ SNE F	16 38 00 40 25 17 33	1400	
229 9th	iPZ ePNE SNE F	9 20 08 08 24 15 10 15	2510	Dilatation.



## 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.		
April 1938						
231 10th	ePZ STN F	5	19	51	3300?	Disturbed by microseisms.
			24	43		
			45			
232 12th	PNEZ SNEZ F	1	56	34	450	Felt in N. Luzon. Baguio, 260 Km.
			57	26		
			2	17		
235 13th	iPZ SNEZ F	2	59	36	7510	Deep focus.
			3	08		
			4	11		
236 13th	ePZ SE F	11	02	19	2435	Deep focus.
			06	12		
			20			
238 14th	iPZ ePN iPE SNE LNE F	1	22	03	2935	Compression.
				03		
				04		
			26	31		
			28	25ca		
			3	16		
239 14th	ePNEZ iZ SNE F	15	52	00	2180	
				30		
			55	35		
			16	54		
242 15th	PNEZ SNE F	11	55	11	950	Felt in eastern Mindanao.
			56	52		
			12	10		
243 15th	PE SNE F	17	56	05	1210	
			58	09		
			18	12		
245 17th	iPZ iPNE SNE F	9	04	23	4880	Compression.
				24		
			10	52		
			10	10		
247 17th	iP <sub>1</sub> 'Z iP <sub>2</sub> 'Z PPZ SKK(SNE) F	14	59	40		
			15	00	58	
			04	45		
			11	21		
			17	05		



## M A M I L A , F . I .



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
April 1938				
248 18th	PZ SNE F	5 34 43 35 37 47	440	Felt at Aparri.
253 19th	iPZ ePNE SNE LNE MNE F	11 11 27 27 21 37 40 18ca 48 ca 13 40	8930	Compression. 39°N: 33°E. 0=10:59:18 by U.S.C.G.S.
254 19th	ePZ SNE F	21 54 07 22 03 27 23 15	7335	
255 20th	PZ SN PSNE F	6 37 40 46 29 49 8 50	7290	
258 20th	PNE SNE LNE F	22 57 51 59 56 23 01 ca 55	1200	
260 21st	PNEZ SNE F	4 22 34 24 03 33	820	
264 21st	PNEZ SNE F	23 02 38 03 07 26	215	Dilatation.
266 22nd	ePNEZ SNEZ F	23 23 25 51 57	200	
267 23rd	iPZ ePNE iZ S?NE F	0 31 42 42 51 37 21 2 34	4045?	Dilatation.
268 23rd	PNEZ SNE	2 16 31 58	210	No. 267 still recording.
270 23rd	iPZ SNE F	7 17 10 27 31	135	Dilatation. Felt in western Luzon. Epicenter in China Sea.
271 23rd	PNEZ SNE F	8 54 58 56 32 10 23	875	



## 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.
April 1938				
275 24th	ePZ SNE LNE F	14 14 03 16 44 18 05 55	1545	
279 25th	PNE SNEZ LN F	14 51 05 57 32 15 04 ca 16 05	4835	
283 26th	iPNEZ IZ SNEZ LE iE F	12 58 33 36 13 02 40 05 05ca 06 03 14 20	2635	Compression from SE.
287 30th	PNEZ SNE F	3 34 11 52 47	310	Felt in Masbate. Disturbed by microseisms.

Fifty insignificant or undecipherable disturbances on the following days of April: 1st(4), 2nd, 3rd, 4th, 5th(2), 7th(5), 8th(3), 9th(2), 12th, 13th(2), 14th, 15th, 17th(2), 18th(3), 19th, 20th(2), 21st(4), 22nd, 23rd(3), 24th, 25th(6), 28th(2), and 29th.



M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY. --- May, 1938

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

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

$h=3$  m.

Alluvium.

CONSTANTS OF THE  
GALITZIN-WILIP

CONSTANTS OF THE WIECHERT  
INVERTED PENDULUM.  $M=955$  Kg.  
May 1, 1938

	$T_1$	T	$\mu^2$	$V_s$
N-S	12.6	12.9	0.400	
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

	$T_0$	V	$\epsilon$	$\frac{I}{T_0^2}$
N-S	4.3	212	2.4	0.072
E-W	4.3	253	2.6	0.098

Cf. Theoretical Seismology.  
Sohn, S.J.

No. and Date	Phase	Greenwich Time			Dist. Km.	Remarks
		h.	m.	s.		
May 1938						
288	PNE	1	39	34	2720	
1st	SN		43	47		
	LNE		46	10ca		
	F	2	20			
291	P?N	14	58	43	2655?	Disturbed by microseisms.
2nd	SNE	15	02	52		
	F		32			
295	PNEZ	19	23	26	4400	Deep focus.
3rd	iSNE		29	27		
	F	20	07			
296	iPZ	5	55	09	2520	Compression(?)
4th	ePNE			09		
	iSNE		59	17		
	F	6	45			
300	ePNEZ	5	47	44		
6th	LNE		57	35ca		
	F	4	20			
301	PZ	6	01	04	1320	
6th	SNEZ		03	21		
	F		30			
302	eNEZ(?)	18	38	49		$15^{\circ}$ N: $87^{\circ}$ W. $\phi=18;17.4$ by USCGS.
6th	F	20	40			
305	iPZ	15	58	45	7145	No. 304 still recording.
8th	ePNE			45		Compression.
	iSNE	14	07	27	<del>222</del>	
	SSEZ		12	13		
	LNE		19	ca		
	MNE		24	ca		
	F	16	55			

Ref 2717.





MANILA, P. I.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
May 1938				
306 8th	iPZ iN S?NE LN	14 44 56 48 11 25 50 30ca	2365?	No. 305 still recording.
307 9th	ePNEZ SNE F	9 02 51 03 41 23	400	Felt at Aparri.
308 9th	ePNZ SNEZ LNE F	15 45 35 49 16 51 10ca 16 56	2255	
309 10th	iPNZ ePE SNE F	12 21 59 59 22 23 13 00	190	Compression. S from the Wiechert and Horizontal.
312 10th	iPZ iPNE SNE F	14 21 14 15 58 57	190	Compression. Aftershock of No. 309. S from the Wiechert and Horizontal.
314 10th	PNEZ SNEZ F	15 10 32 56 22	190	Aftershock of No. 309.
316 10th	PNEZ SNEZ F	15 55 35 59 16 02	190	Compression. Aftershock of No. 309.
317 10th	PNEZ SNEZ F	17 34 51 35 14 41	185	Aftershock of No. 309.
319 10th	PNEZ SNEZ F	22 51 03 19 59	125	
322 11th	ePZ SNEZ F	2 58 40 53 3 04	145	Felt slightly in Manila.
327 11th	ePNEZ F	15 05 47 17 10		17°N: 101°W. 0-14:44:54 by USCGS.
328 11th	PNEZ SNZ F	17 43 47 49 17 18 16	3900	
329 11th	PNEZ SNEZ F	22 05 40 06 03 13	180	



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
May 1938				
333 12th	PNEZ SNE F	3 54 17 41 45	190	
334 12th	iPNEZ SNE F	15 45 38 51 26 20 25	4190	New Guinea. Compression. 8°S: 147°E. 0715:59:02 by USCGS. S from the Wiechert and Horizontal.
336 12th	PZ SNE F	21 31 12 34 57 22 48	2310	
337 12th	PNEZ SNEZ F	21 50 27 48 57	165	No. 336 still recording.
341 13th	ePNEZ SN LN F	12 00 07 04 50 08 ca 50	3150	
342 13th	iPNEZ SNE LN F	15 10 20 15 24 19 10 17 15	3490	Compression. Data after P from the Wiechert.
344 14th	iPNEZ SNEZ F	12 08 55 12 14 13 42	2220	Dilatation.
345 15th	PNEZ SNEZ F	0 03 27 06 03 55	1510	
348 15th	PNE SNE F	13 33 07 37 53 14 22	2910	
350 16th	PNEZ SNE F	7 10 23 14 47 8 10	2880	Deep focus. Dilatation.
351 16th	PNEZ iZ PPNE? iE F	15 34 34 54 38 57 42 51 17 40		Long distance.
353 17th	P?NEZ SNE F	3 44 28 48 35 5 00	2610?	
357 13th	PNEZ SNZ F	19 22 36 55 50	150	



## MANILA, P. I.

## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
May 1938 364 19th	iPNEZ SNE F	17 12 05 15 06 21 20	1720	Compression. Felt in Jolo, intensity III. 0°5N: 119°E, approx. by USCGS. Data after P from the Wiechert.
369 20th	PNEZ SN F	10 46 47 51 29 11 50	2980	
374 22nd	ePNEZ SN	7 55 51 8 04 01	6665	20°S: 170°E by Riverview and Manila.
375 22nd	eP?EZ SEZ F	8 26 07 32 11 10 15	4455?	No. 374 still recording.
376 22nd	ePNEZ iEZ F	11 32 16 34 53 14 00		Long distance.
377 22nd	iPNEZ SNE F	17 56 23 36 18 08	100	Dilatation. Felt at Infanta, int. IV.
379 23rd	iPNEZ SNE	7 24 25 29 40	3665	Compression. Japn. 36°N: 141°E. 07: 18:50 by USCGS. S from the Wiechert.
380 23rd	iPNEZ SNE	8 22 51 23 43	430	Compression from NW. Felt in Luzon and also in Hong Kong. 18°15' N: 119° 45' E by Manila, Hong Kong and Phu-Lien. No. 379 still recording.
382 23rd	iPNZ SNZ F	15 09 43 10 35 16 05	430	Compression. Second earthquake or after- shock of No. 380. Felt in Vigan with intensity IV. E component defective.
386 24th	PNEZ SNEZ F	7 20 47 21 08 30	170	
388 24th	PNE SNE F	8 37 29 37 43	60	
391 24th	PNEZ S?N F	18 54 17 57 30 19 30	1910?	
392 24th	PNEZ SNE F	21 39 09 59 49	400	Felt in Lapag, intensity II.
397 26th	ePNEZ SNE F	11 16 19 23 11 12 45	5270	



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY,--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
May 1958 398 26th	P?NE SNE	11 36 ca 42 33	4945?	No. 397 still recording.
403 27th	PEZ SN LN F	3 41 09 44 41 46 40ca 4 20	2135	
405 27th	PZ SNE F	13 04 48 07 11 30	1380	
407 28th	PNEZ SNE F	7 56 40 57 37 8 17	480	
408 28th	P?NE eNE F	10 27 47 40 20 12 40	10745	43°N: 125°W. 0-10:14:13 by USCGS.
409 28th	iPZ ePNE iZ SNE LNE F	16 48 57 57 49 02 54 34 17 00 ca 19 10	4010	Compression.
411 30th	iPNEZ SE iZ LNEZ MNEZ F	14 39 46 47 49 50 37 57 30ca 15 02 30ca 18 30	6390	Compression from SE. 20°S: 169°E by USCGS.

Seventy-four insignificant or undecipherable disturbances on the following days of May: 1st(2), 3rd(3), 4th(2), 5th, 7th, 8th, 10th(5), 11th(7), 12th(5), 13th, 14th, 15th(2), 16th(2), 17th, 18th(4), 19th(6), 20th(5), 21st, 23rd(4), 24th(4), 25th(3), 26th(5), 27th(2), 30th(3), and 31st(3),



o. 21.

June, 1938.

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.

$h=3$  m.

Alluvium.

CONSTANTS OF THE  
GALITZIN-WILIP

CONSTANTS OF THE WIECHERT  
INVERTED PENDULUM.  $M=955$  Kg.  
June 8, 1938.

	$T_1$	T	$\mu^2$	$V_s$
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

	$T_0$	V	$\epsilon$	$\frac{I}{T_0^2}$
N-S	4.2	203	2.4	0.071
E-W	4.3	267	2.9	0.099

Cf. Theoretical Seismology.  
Sohn, S.J.

Date	Phase.	Greenwich Time h. m. s.	Dist.	Remarks.
June 1938				
418 2nd	ePNEZ iZ SNE F	3 18 11 23 19 08 47	480	Felt in northern Luzon.
419 2nd	ePNEZ pPZ iSNE F	10 30 08 15 34 24 11 10	2780	Deeper than normal.
420 3rd	PZ SNE F	0 28 45 29 11 44	200	
421 3rd	PNEZ SNE F	0 49 30 50 03 1 03	240	Felt at Legaspi.
422 3rd	PNEZ SNEZ F	14 23 37 24 00 46	185	Compression.
427 5th	ePNEZ SNE SR <sub>2</sub> E LNE F	16 37 42 43 11 46 06 47 40ca 17 16	3890	
428 6th	PNE S?N F	16 21 16 23 25 34	1245?	
431 7th	ePNEZ SNE F	14 21 09 30 27	165	



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
June 1938				
#434 5th	ePZ ePNE iZ iSNE F	8 18 10 11 16 22 30 45	2820	Deep focus.
437 9th	iPNEZ SNE F	19 19 23 22 45 23 00	1960	Compression from SE. Felt in Surigao and Dapa. $1^{\circ}$ S; $132^{\circ}$ E by Manila, Zika wei, Riverview. S from the Wiechert. $2^{\circ}$ S; $128^{\circ}$ E by USCGS.
439 9th	PNEZ SNE F	23 41 09 42 12 58		
440 10th	iPNZ SNE F	9 56 26 58 29 14 20	1165	Dilatation from north. $25^{\circ}$ N; $125^{\circ}$ E by USCGS. S from the Wiechert.
445 12th	PNEZ SE F	2 36 11 39 09 4 30	1720	
449 13th	PEZ iE SNE LN MN F	3 29 19 31 35 36 41 45 15ca 49 ca 4 40	5810	
450 13th	iPZ ePNE SN LN F	6 59 03 03 7 02 35 04 25ca 54	2135	Dilatation.
454 14th	ePNEZ SNE F	9 05 49 06 06 21	135	
457 15th	PNEZ SNEZ F	2 54 08 55 01 3 48	435	Felt at Laoag.
459 15th	PNEZ SE F	5 15 09 16 28 6 20	710	
464 15th	PNZ SN F	12 50 53 59 03 14 27	6620	
465 15th	PZ SN F	20 23 42 31 55 21 45	6680	



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
June 1938 466 16th	PNEZ S?N	1	52	07 03	2480?	
467 16th	1PNEZ SNE F	2	18	53 21 36 6 00	1570	Dilatation from NNE. 26°5N: 127°5E by Zikawei, Manila, Phu- Lien. 29°N: 128°E by USCGS. No. 466 still recording.
470 16th	ePNE SNE F	22	52	47 55 17 23 58	1445	
472 17th	ePNEZ S?NE F	12	33	39 37 24 13 11	2310?	
474 18th	PNEZ SNEZ MNEZ F	0	47	51 51 23 55 10ca 1 20	2135	
476 18th	1PZ ePNE SNE MNE F	18	15	17 17 19 53 26 ca 19 16	3060	
478 19th	PNE SNE F	12	20	17 24 03 45	2320	
479 20th	eP?EZ SE F	15	18	29 25 41 16 23	5620?	
480 20th 21st	1PZ 1PE 1SNE LNE MNE F	23	59	16 18 0 06 15 14 ca 18 ca 2 17	5410	Dilatation?
483 21st	1PNZ SNEZ F	6	45	20 46 44 8 30	770	Compression from NE. Felt at Basco.
484 21st	PNEZ SNEZ F	19	17	52 18 27 28	250	
486 22nd	ePNEZ SNE	1	46	35 55	160	
487 22nd	PNE SNE F	1	57	23 43 2 07	160	No. 486 still recording.



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
June 1938				
488	ePNEZ	23 14 39	3425	
22nd	SNE	19 39		
	LNE	23 ca		
23rd	F	0 20		
490	ePNEZ	11 58 10	2480	
23rd	SNE	12 02 06		
	F	30		
491	1PEZ	13 05 23	6590	Compression. Deeper than normal.
23rd	1SNE	13 31		
	MNE	28 50		
	F	16 40		20°S: 169°E, 0-12:55:25 by USCGS.
492	PNEZ	17 25 03	2500	
23rd	SNE	29 01		
	F	50		
502	1PZ	9 43 01	1370	compression from SE.
29th	ePNE	01		
	1Z	16		
	1E	51		
	SNEZ	45 29		
	LNE	47 15ca		
	MNE	48 50ca		
	F	10 50		
505	1PZ	16 54 37	6620	24 S: 167 E by USCGS.
30th	SNE	17 02 47		
	F	18 08		

Fifty-two insignificant or undecipherable disturbances on the following days of June: 1st, 4th(2), 5th(2), 6th, 7th(2), 8th(2), 9th(2), 10th(3), 11th, 12th(2), 13th(4), 14th(2), 15th(5), 16th(2), 17th(2), 18th, 19th, 21st(2), 22nd, 23rd(3), 24th(3), 26th(3), 28th, 29th(2), and 30th(2).



MANILA, P. I.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

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

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

h=3 m.



Alluvium

CONSTANTS OF THE GALITZIN-WILIP

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M 955 Kg. July 1, 1938

	T	T	$\mu$	V
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
z	11.6	9.0		

	T	V	E	$\frac{r}{T_0^2}$
N-S	4.2	207	2.4	0.088
E-W	4.3	257	2.8	0.105

Cf. Theoretical Seismology. Sohon, S.J.

No. and Date	Phase	Greenwich Time h. m. s.	Dist. Km.	Remarks
July 1938				
#511 3rd	ePNEZ SNE F	9 29 13 30 02 52	395	Felt at Legaspi.
512 3rd	PEZ SNE F	11 23 04 24 21 12 02	690	
513 3rd	PEZ SE F	21 31 12 32 31 22 10	715	E component stopped at 21:04. Felt at Butuan, Dapa and Surigao. Butuan 80 Km.
514 4th	PNEZ SNEZ F	1 24 01 21 34	160	Dilatation. Felt at Capalonga and Legaspi.
518 4th	PNEZ SNE F	17 06 48 07 25 40	280	
519 4th	ePNEZ SNE iE F	21 22 39 30 50 31 39 22 41	6645	
521 5th	ePNEZ SN LNE MNE F	2 13 43 20 42 28 40ca 32 33ca 4 40	5410	
524 5th	iPZ iPNE SNEZ LNE ME F	22 17 31 32 26 03 37 30ca 42 45ca 23 59	6990	Region $24^{\circ}$ S: $173^{\circ}$ E by USCGS.



## 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
July 1938				
526 6th	iPNEZ SNE LN F	1 34 44 42 56 53 ca 3 45	6665	Compression from SE (?)
527 6th	iPZ SNEZ F	9 49 51 58 21 11 10	6860	
533 7th	P?NZ SNE F	14 02 33 05 32 15 01	1700?	Felt in Jolo, Sulu.
534 7th	iPZ iZ PP? F	17 32 53 35 26 37 03 19 35		Compression (?)
537 8th	ePNEZ iSNEZ F	14 02 03 04 45 15 15	1555	
539 9th	P?NE SNE F	1 02 15 03 44 27	820?	
540 9th	PEZ S?N F	2 03 53 06 25 34	1465?	
542 11th	PNEZ SNEZ F	11 28 44 29 20 45	260	Felt at Baguio.
543 11th	ePNEZ SNE LE MNE F	15 58 58 16 01 40 03 ca 04 30ca 37	1555	
546 12th	iPZ SNE F	12 47 05 55 37 14 20	6900	Compression.
557 14th 15th	PEZ S?NE F	23 42 07 50 33 0 57	6900?	
562 17th	ePNZ iZ iSN F	13 19 28 52 23 31 14 50	2580	
564 18th	PNZ SNEZ LN F	11 55 37 57 55 59 10ca 12 30	1335	Felt at Davao.



## 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
July 1938				
566	P?NEZ	9 01 47	1660?	
19th	SNEZ	04 39		
	F	22		
567	PNEZ	11 15 07	850	
19th	SNE	16 39		
	F	36		
568	1PNEZ	11 47 43	125	Dilatation.
19th	SNEZ	59		Felt very slightly in Manila.
	F	12 02		
569	eP?NEZ	21 57 35	5065?	
19th	SN	44 15		
	F	22 30		
571	ePNEZ	11 54 35	3245	
20th	1SNE	59 23		
	F	13 05		
574	eP'NEZ	8 07 33	13565	Long distance.
22nd	SS	25 15		18°9N: 107W; 07:48:08 by USCGS.
	L	45 ca		
	F	10 15		
576	PNEZ	12 23 11	370	
23rd	SNEZ	58		
	F	27		
577	ePNEZ	20 10 54	3410	
23rd	SN	15 53		
	F	21 10		
578	1PZ	23 06 41	3590	Dilatation.
23rd	ePNE	47		
	SNE	11 51		
	LN	15 45ca		
24th	F	0 25		
579	ePNEZ	13 23 15	7445	Compression. 53°N: 167°W by USCGS.
24th	SNE	32 07		
	F	15 10		
581	PNEZ	9 42 51	375	Dilatation. Felt in southeastern part
25th	SEZ	43 18		of Luzon.
	F	11 10		
586	1PNEZ	8 45 28	140	Compression.
27th	SNEZ	46		
	F	58		
589	ePNEZ	16 58 28	1350	
27th	SNE	17 00 54		
	F	19 00		



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
July 1938				
594	PEZ	12 59 39	2620	
28th	SN	13 03 45		
	F	22		
595	PNEZ	21 09 31	4780	
28th	SNE	16 03		
	F	40		
596	iPNEZ	4 34 42	125	Dilatation. Felt in Batangas.
29th	iSNEZ	58		
	F	5 20		
597	iPNEZ	13 12 15	3100	Compression from southwest.
29th	PPZ	13 27		
	iSNE	17 06		
	MNE	29 ca		
	F	14 25		
598	PNEZ	7 36 09	530	
30th	SN	37 11		
	F	8 00		
599	PNEZ	15 59 30	360	
30th	SNE	16 00 16		
	F	10		
601	PNEZ	22 01 12	2180	Deeper than normal.
31st	SNE	04 47		
	F	25		

Fifty-three insignificant or undecipherable disturbances on the following days of July: 2nd(3), 4th(3), 5th(3), 6th(4), 7th(3), 8th(2), 10th, 11th, 12th(4), 13th, 14th(6), 15th, 16th(2), 17th(2), 19th, 20th(3), 22nd, 25th(2), 26th(2), 27th(5), 28th(2), and 31st.



MANILA, P. I.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

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

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

h=3 m.

Alluvium.



International  
Seismological  
Centre

CONSTANTS OF THE  
GALITZIN-WILIP

CONSTANTS OF THE WIECHERT  
INVERTED PENDULUM. M=955 Kg.  
August 2, 1938.

	$T_1$	T	$\mu^2$	$V_s$
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	230
Z	11.6	9.0		

	$T_0$	v	$\epsilon$	$\frac{I}{T_0^2}$
N-S	4.0	235	2.4	0.087
E-W	4.3	251	2.7	0.086

Cf. Theoretical Seismology,  
Sohn, S.J.

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks
		h.	m.	s.		
Aug. 1938						
#602 1st	PNEZ SE F	1	47	11	2020	
604 1st	PNEZ SNEZ F	8	03	55	320	Felt at Legaspi and Sorsogon.
610 4th	$1P_1Z$ ePNE $P_2Z$ PPZ F	9	14	40	18755	Dilatation. $24^{\circ}S$ : $65.4W$ . $0=8:54.8$ by USCGS.
611 5th	PNEZ SNEZ F	18	29	27	240	Compression. Felt at Vigan.
613 6th	PNEZ SNE F	2	53	47	175	Felt at Baguio.
614 6th	PNEZ SNE F	13	08	43	215	Felt at Baguio.
617 8th	$1PZ$ ePNE SNE F	17	30	35	135	Compression.
618 10th	PNEZ $1S?E$ F	12	11	47	1935?	
621 12th	ePNEZ S?N F	4	16	11		Disturbed by microseisms.



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks
		h.	m.	s.		
Aug. 1938						
#622 12th	ePNEZ SNEZ F	22	01	20 37 12	135	
625 16th	iPNEZ SNE ME F	4	33	32 38 50 20	3355	Dilatation from NW. Data after P from the Wiechert. 24°N: 95°E by USCGS.
627 16th	PNEZ SNE F	22	41	44 46 23 25	3500	
629 18th	iPEZ ePN SNE L F	9	35	32 32 40 42 25	2790	Compression.
630 18th	iPNEZ SNE F	19	10	06 13 21 05	1655	Compression.
631 18th 19th	ePNEZ SN F	22	20	17 25 0 10	3420	
633 20th	ePEZ iSNE LN F	5	10	24 30 17 44	2620	
634 20th	iPZ ePE iSNE L?NE MN F	8	37	38 42 56 ca ca 40	3710	Dilatation.
650 22nd	iPZ ePNE iE SNE iNE MNE F	21	44	30 38 43 25 20ca 30ca 15	3080	
652 23rd	PNEZ S?N F	8	25	56 07 15	3590?	Disturbed by microseisms.
654 24th	ePNEZ SNE F	4	23	08 25 32	135	



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Aug. 1938 #656 24th	iPEZ ePN SN LE MNE F	15 49 05 07 53 30 55 55ca 58 15ca 17 05	2745	Compression.
657 25th	1PNEZ 1SNE F	1 33 56 38 44 3 45	3255	Compression from SW.
663 25th	1PZ SNE F	22 11 44 12 00 25	125	Dilatation.
665 28th	ePNEZ SNEZ F	0 36 10 37 09 53	500	
670 29th	1PZ SNE F	15 23 19 24 11 18 30	430	Dilatation from SE. $12^{\circ} 05' N$ ; $124^{\circ} 05' E$ as on Nov. 22, 1937. Destructive in Masbate. Felt in SE Luzon and north Visayas. S from the Wiechert.
674 30th	PNEZ SNE F	11 55 36 12 00 37 14 20	3255	Compression from southern Azimuth.
675 30th	1PNEZ SN F	17 13 13 16 54 18 35	2190	Compression from SE.
676 31st	1PNEZ SNE F	17 51 42 57 46 19 32	4255	Dilatation, from SE (?).

Forty-seven insignificant or undecipherable disturbances on the following days of August: 1st(4), 2nd(2), 5th, 8th(2), 10th, 11th, 13th, 15th, 16th, 17th, 19th, 20th(8), 21st(6), 22nd, 23rd(2), 24th, 25th(5), 27th, 28th, 29th(5), and 30th.



MANILA, P. I.  
SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

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

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

$h=3$  m.

Alluvium.



CONSTANTS OF THE  
GALITZIN-WILIP

	$T_1$	$T$	$\mu^2$	$V_s$
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	230
Z	11.6	9.0		

Cf. Theoretical Seismology.  
Sohn, S.J.

CONSTANTS OF THE WIECHERT  
INVERTED PENDULUM.  $M=955$  Kg.  
September 1, 1938

	$T_0$	$V$	$\epsilon$	$\frac{F}{T_0^2}$
N-S	4.1	215	2.4	0.083
E-W	4.3	258	2.7	0.095

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks
		h.	m.	s.		
Sept. 1938 #678 1st	PNEZ	2	56	32	1710	
	SNEZ		59	29		
	LNE	3	01	00ca		
	MNE		02	35ca		
	F	4	20			
681 1st	ePNEZ	23	07	42	15420	13.1°N; 89.4°W by USCGS.
	PPN		10	42		
	SKP		11	52		
681 2nd	F	0	23			
685 3rd	iPZ	7	56	46	110	Compression.
	ePNE			46		
	SNEZ		57	00		
	F	8	12			
686 3rd	PEZ	11	43	30	555	
	SN		44	57		
	F	12	05			
689 4th	iPNEZ	19	22	09	210	Compression from SSE. Felt at Batan- gas, Culion, Boac and Manila. S from the Horizontal.
	SNE			36		
690 4th	iPZ	20	19	51	190	No. 688 still recording. Compression.
	PNE			52		
	SNE		20	15		
	F	21	07			
692 5th	PNEZ	8	59	49	210	Compression.
	SNE	9	00	16		
	F		18			
694 5th	1E	14	53	22		Disturbed by microseisms.
	iNE	15	07	09		
	iNE		15	20		
	F	16	29			
698 6th	PEZ	20	53	09	4245	
	SNE		59	00		
	LNE	21	04	08ca		
	F	22	15			



## 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
Sept. 1938				
699 7th	iPEZ SE F	1 57 21 59 20 3 50	1150	Compression from SE. S from the Wiechert. N-S not recording.
700 7th	1PZ ePE SNE F	4 05 35 37 08 10 6 50	1505	Dilatation. 24°N: 121.5°E by USCGS. S from the Wiechert. N-S not recording.
701 7th	PNZ SNZ F	11 16 19 17 21 12 10	410	Felt at Calbayog and Legaspi.
702 7th	iPNEZ SNE F	13 05 39 11 30 14 30	4055	Dilatation from SE. Near 7°S: 150°E by Riverview and Manila.
707 10th	PNEZ SE F	22 31 52 38 08 23 18	4655	
708 11th	ePNEZ SE MNE F	17 24 36 31 36 41 45ca 18 07	5420	
709 11th	PNE SE MNE F	19 48 29 54 24 20 03 ca 32	4300	
711 12th	PNEZ SNEZ F	12 30 25 51 42	200	
712 14th	ePEZ SNEZ MNE F	8 53 08 55 54 58 45ca 9 50	1590	
716 15th	PNEZ SNE SNE F	22 05 49 06 39 49 14	400	Felt in northwestern part of Luzon.
717 15th	PNEZ SNEZ F	23 18 09 45 24	260	
720 18th	ePNEZ SN F	1 37 28 43 00 2 20	3940	
724 18th	PNEZ SNEZ LN F	13 43 57 47 11 48 55ca 14 30	1910	



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Sept. 1938				
726	ePNEZ	13 06 40	1660	
20th	SN	09 32		
	F	15 03		
727	ePNEZ	15 37 52	1060	
20th	iSEZ	39 43		
	F	17 10		
728	ePNEZ	18 31 55	570	Felt in Virac.
20th	SEZ	33 00		
	F	19 10		
730	iPZ	11 40 46	1090	
21st	SNEZ	42 41		
	F	12 25		
731	iPEZ	18 57 49	4445	Compression.
21st	iSNEZ	19 04 04		
	LN	11 ca		
	MN	13 50ca		
	F	21 22		
737	iPZ	10 22 50	4045	Disturbed by microseisms.
27th	ePNE	51		
	SN	28 29		
	LNE	33 05ca		
	F	11 25		
738	PNEZ	18 22 27		Disturbed by microseisms.
28th	iZ	24 25		
	F	19 30		
739	FNEZ	6 35 18	280	Felt at Cullion.
29th	SNEZ	56		
	F	47		

Thirty-three insignificant or undecipherable disturbances on the following days of September: 1st(3), 2nd(3), 3rd, 4th, 5th(5), 7th, 8th, 9th, 10th, 12th, 14th(3), 16th, 17th, 18th(3), 19th, 20th, 21st, 23rd(2), 25th, and 27th.



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=3 m.

Alluvium.

CONSTANTS OF THE  
GALITZIN-WILIP

	$T_1$	T	$\mu^2$	$V_0$
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	230
Z	11.6	9.0		

Cf. Theoretical Seismology,  
Sohn, S.J.CONSTANTS OF THE WIECHERT  
INVERTED PENDULUM. M=955 Kg.

October 1, 1938

	$T_0$	V	$\epsilon$	$\frac{P}{T_0^2}$
N-S	4.2	213	2.5	0.085
E-W	4.2	282	2.9	0.088

No. and Date	Phase	Greenwich Time			Dist. Km.	Remarks
		h	m	s		
Oct. 1938 #742 4th	iPEZ	8	32	19	4045	
	SNE		37	58		
	LNE		42	40ca		
	MNE		45	45ca		
	F	9	25			
744 7th	iPEZ	0	55	13	480	
	ePN			13		
	iSNE		56	10		
	F	1	57			
745 7th	ePNZ	6	17	11	4155	
	SN		22	57		
	MNE		31	ca		
	F	7	25			
747 7th	iPZ	16	29	28	3155	
	iPE			30		
	iSNE		34	11		
	F	17	40			
749 9th	PNEZ	16	48	57	8890	
	iSNE		59	09		
	LNE	17	15	30ca		
	MNE		21	05		
	F	18	23			
750 9th	PNEZ	20	44	50	4100	
	SNE		50	33		
	LNE		54	30ca		
	F	21	40			
751 10th 11th	iPNEZ	20	51	20	1545	S from the Wiechert. Dilatation from SE. 1°N: 125°E by U. S. C. G. S.
	iSE		54	04		
	F	0	04			



SEISMOLOGICAL BULLETIN OF THE OBSERVATORY --Continued



No. and Date	Phase	GREENWICH Time			Dist. Km.	REMARKS
		h.	m.	s.		
Oct. 1938 #752 11th	iPZ SNE F	0	11	10 13 56 2 05	1555	Dilatation.
753 12th	PNZ SNE LNE F	0	40	05 47 50 57 25ca 3 10	6235	Compression.
757 13th	PNEZ SNE F	15	28	34 30 40 17 35	1135	
758 13th	PNEZ SNE F	18	41	32 43 57 19 20	1400	
763 20th	iPNEZ iSNE F	2	24	34 28 54 4 15	2655	Compression. S from the Wiechert. 10°S: 123°E, by. U.S.C.G.S. 90g: 123°E by Manila and Riverview.
764 21st	iPZ SN F	20	33	48 38 22 21 21	3030	Conspicuous group of about 17 seconds period waves on E component from 20:55 to 20:59.
768 23rd	PNEZ S?NE F	15	13	46 21 10 16 35	5820?	
771 25th	ePNEZ SNE F	21	28	30 30 21 48	1050	
772 26th	PNEZ SNE MNE F	3	32	28 36 28 40 30ca 4 20	2535	
773 26th	PNEZ SNEZ MNE F	16	55	14 57 50 17 00 45ca 18 13	1510	
778 29th	ePNEZ iSNEZ LNE MNE F	13	14	11 20 29 26 ca 30 ca 15 00	4680	



M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY --Continued

No. and Date	Phase	Greenwich Time h. m. s.	Dist. DKm.	REMARKS
Oct. 1938 #779 29th	1PZ 1PNE 1SE	22 58 07 08 23 02 56	3255	Dilatation.
30th	F	0 10		
781 30th	ePNEZ SN F	8 23 46 28 32 47	3210	

Twenty-five insignificant or undecipherable disturbances on the following days of October: 1st(2) 6th(1) 7th(1) 8th(1) 12th(2) 13th(2) /17th(2) 19th(1) 22<sup>nd</sup>(1) 23rd(2) 25th(2) 27th(3) 28th(1) 30th(2) 31st(2).



MANILA, P. I.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

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

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

h=3 m.

Alluvium



CONSTANTS OF THE GALITZIN-WILIP

	$T_1$	T	$\mu^2$	$V_s$
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	230
Z	11.6	9.0		

CONSTANTS OF THE WIECHERT INVERTED PENDULUM, M=955 Kg.

November 1, 1938.

	$T_0$	V	$\epsilon$	$\frac{I}{T_0^2}$
N-S	4.2	215	2.4	0.087
E-W	4.3	272	2.9	0.090

Cf. Theoretical Seismology. Schon, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Nov. 1938				
785 1st	1PNEZ SNE F	14 07 09 25 20	125	Dilatation from SW.
786 5th	PNEZ SNEZ F	3 50 16 29 56	100	
787 5th	ePNZ SNE F	3 49 18 54 07	3245	Japan. 38°N: 141°E by USCGS. S from the Wiechert.
788 5th	PZ SNE LNE F	10 56 05 11 00 52 04 10ca 13 10	3245	Japan. 38°N: 141°E by USCGS. S and L from the Horizontal. No. 787 still recording.
789 5th	PN SN F	21 19 07 49 35	320	Disturbed by microseisms.
790 6th	1PNEZ 1SNE LNE MN F	8 59 58 9 05 03 06 50ca 11 40ca 12 30	3510	Compression. 36°N: 144°E by USCGS.
793 6th 7th	PNEZ SNE MNE F	21 44 45 49 41 56 55ca 0 45	3355	Same as No. 790 by USVGS.
795 7th	PEZ SNE LNE MN F	1 44 27 49 31 53 10ca 55 40ca 3 23	3490	



## 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
Nov. 1938				
796 7th	eP?Z SNE	4 21 45 27 29	3945?	
797 7th	<u>P</u> EZ <u>S</u> NZ F	5 22 55 23 18 29	180	No. 796 still recording.
801 9th	PNEZ SNE F	9 21 52 29 19 11 50	5745	
804 10th	PNZ SNE L NE F	10 52 07 56 40 58 40ca 13 15	5020	
806 10th	iPZ ePNE SNE LN MNE F	20 30 09 09 39 52 54 ca 21 00 30ca 0 50	8290	Data after P from the Wiechert. 56°N: 159°W by USCGS.
807 11th	PNEZ SNEZ F	1 09 13 18 39 2 35	7950	Compression (?).
808 11th	ePNEZ SNE LNE MNE F	3 02 45 07 24 10 15ca 12 25ca 4 21	2935	
809 11th	ePNEZ S?ca F	4 41 53 40 00 5 40	4520?	
811 11th	iPZ SNE F	14 11 14 17 14 45	4390	
812 12th	ePNZ SNE F	6 12 11 16 47 33	3065	
813 13th	iPZ SNE F	4 54 56 56 30 5 23	880	Felt in northeastern part of Mindanao. Data after P from the Wiechert and Horizontal.
814 13th	PNE SNE F	13 21 02 27 22 45	4720	From the Wiechert and Horizontal.
815 13th 14th	iPZ SNE F	22 37 35 44 15 0 46	5065	Compression (?).



## 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.
Nov. 1938				
817 14th	iPEZ SNE LNE F	12 12 53 16 51 19 20ca 13 05	2500	
819 15th	ePZ SN LNE F	15 28 43 33 00 35 40ca 16 02	2780	
820 15th	ePNEZ SN LNE MN F	21 06 23 11 14 14 40ca 17 10ca 22 35	3290	
822 16th	ePNEZ SNE LN F	11 14 09 20 50 27 50ca 12 15	5080	
823 17th	PNEZ SNEZ LNE ME F	4 06 07 15 37 29 20ca 36 ca 7 15	8010	Compression. 55°N: 158°W by USCGS.
824 18th	PNEZ SNE F	14 21 26 28 34 15 15	5555	
825 18th	1PNEZ SN F	15 32 08 28 16 15	160	Compression. Felt at Iba and in Manila slightly. Deeper than normal.
828 19th	ePNEZ SNE F	5 47 41 54 19 6 55	5035	
829 20th	ePNEZ 1SNEZ F	17 58 58 18 00 30 19 05	850	
830 21st	ePNEZ SNE LNE MNE F	1 17 24 22 35 26 30ca 29 25ca 2 40	3600	
831 21st	PNEZ SNE F	7 01 22 03 10 49	1025	Formosa.



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
Nov. 1938						
832 22nd	1PZ SNE F	1	20	03 24 57 4 15	3345	Dilatation. S from the Wiechert. 37°N: 142°E by USCGS.
835 29th	PNE SNE L F	13	45	31 52 07 58 ca 15 20	4845	
836 30th	1PNEZ SNE LNE F	2	35	47 40 50 48 ca 4 00	3300	Compression. L from the Wiechert. 37°N: 142°E by USCGS.

Eighteen insignificant or undecipherable disturbances on the following days of November: 6th(2), 7th(3), 9th(2), 10th(2), 11th, 14th, 15th, 16th, 18th, 19th, 25th, 27th, and 30th.



SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

$\phi=14^{\circ} 34' 42''$  N.  $\lambda=120^{\circ} 58' 41''$  E. h=3 m. Alluvium.



CONSTANTS OF THE

GALITZIN-WILIP

	T	T	$\mu^2$	V
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	230
Z	11.6	9.0		

CONSTANTS OF THE WIECHERT  
INVERTED PENDULUM. M 955 Kg.

December 1st, 1938.

	T	V	$\epsilon$	$\frac{-I}{T_0^2}$
N-S	4.2	216	2.7	0.105
E-W	4.2	277	2.3	0.081

Cf. Theoretical Seismology.  
Sohn, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Dec. 1938				
838 1st	iPEZ iN SEZ L M F	2 17 41 56 22 23 25 ca 28 ca 4 20	2980	Compression.
839 2nd	ePNEZ SNE F	12 10 58 11 18 16	160	
841 3rd	iPNZ SNEZ F	12 17 38 25 07 13 00	5930	
842 3rd	PNE SNE F	22 21 32 26 07 23 00	2880	
844 4th	iPZ iZ iZ iNE F	16 21 11 23 09 32 07 49 24 17 30		
845 5th	iPZ S F	17 50 52 55 24 18 30	2845	
846 6th	PNE SNE F	11 29 52 30 10 31	145	From the Wiechert. Felt at Iba, Zam- bales.
847 6th 7th	ePNE iNE F	23 02 52 05 17 0 35		P from Galitzin-Wilip. Other phases from the Wiechert. Very strong microseisms.
849 7th	iPZ SNE LNE F	13 31 19 37 17 41 ca 13 55	4165	



## 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.		
Dec. 1938						
850 7th	ePNE SNE F	15	03	25 07 23 30	2400	From the Wiechert.
851 9th	PNEZ SNE F	5	05	36 07 41 35	1120	
860 12th	1PNZ SNEZ F	0	25	37 29 19 45	2200	Dilatation.
863 13th	ePNEZ iSNEZ F	2	18	58 22 50 46	2520	
864 13th	1PNEZ iSNEZ L F	17	31	50 37 05 40 30ca 18 30	3490	
869 15th	PEZ SNE	9	23	10 29 37	4680	
873 16th	1PNEZ SNEZ L F	17	32	50 42 14 55 ca 19 30	7965	Compression. In region of $48^{\circ}$ S: $160^{\circ}$ E by Riverview and Manila.
875 16th 17th	ePNEZ SNEZ L F	23	26	20 35 43 48 ca 1 00	7945	
876 17th	PNEZ SNE LNE F	16	43	12 52 34 56 15 17 40	7935	
879 18th	ePNEZ SNE F	21	52	00 56 27 22 48	2780	
880 19th	1PZ ePNE SNEZ F	4	54	19 20 55 07 5 40	390	Dilatation. Deeper than normal. Felt at Laoag and Baguio with intensity III, and in Manila with II.
882 19th	1PZ ePNE SNE LN F	18	50	55 55 36 42 41 45ca 20 20	4180	Compression.



## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Decm. 1938				
884 21st	iPNEZ iSNEZ LNE MNE F	12 32 01 36 35 40 05ca 42 15ca 14 25	2865	Compression from SE.
887 22nd	ePNEZ SNE F	3 24 04 26 14 4 23	1255	
888 22nd	PNEZ SNEZ LNE MNE F	16 59 04 17 02 15 03 20 05 40ca 18 25	1835	Dilatation from northerly direction.
889 23rd	ePNZ SNE F	1 57 39 2 03 03 35	3810	
892 24th	iPEZ ePN iSNE F	20 08 52 52 12 52 21 29	2535	Compression.
893 26th	PNEZ SNEZ F	4 35 22 39 47	155	Compression.
897 28th	iPZ ePNE SNE F	5 10 54 54 11 22 27	215	Dilatation?
898 28th	ePNEZ SNE F	23 25 52 27 08 50	685	

Thirty-two insignificant or undecipherable disturbances on the following days of December: 2nd, 4th, 7th, 9th, 10th(6), 11th, 12th, 13th(2), 14th(3), 16th(4), 18th(2), 19th, 20th, 21st, 22nd, 23rd(2), 26th(2), and 27th,