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JAPANESE ANTARCTIC RESEARCH EXPEDITION

JARE DATA REPORTS

NO. 4

(SEISMOLOGY)

SEISMOLOGICAL BULLETIN OF SYOWA STATION, ANTARCTICA
1959-1962 AND 1967-1968

Compiled by

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DEPARTMENT OF POLAR RESEARCH
NATIONAL SCIENCE MUSEUM

UENO PARK, TOKYO

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Seismological Bulletin of Syowa Station, Antarctica
1959 - 1962 and 1966 - 1967

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The seismological observation at Syowa Station was started in 1959 by the 3rd party of Japanese Antarctic Research Expedition using a HES seismograph of Z component. In 1961, added with HES seismographs of two horizontal components, the seismological observation at Syowa Station was made by a three-component seismograph.

Since 1966, the observations have been continued by JARE, using HES seismographs of three components.

In this bulletin the data of the respective seismic events interpreted on the vertical component seismograms are listed in chronological order.

1. Date.
2. Identified phase name with its sharpness indication (e or i) and ground motion direction (+: UP, -: Down). If a phase was identified by horizontal components, the phase is denoted with E (detected by E - W component) or N (detected by N - S component).
3. Arrival time in G. M. T.
4. Period of the phase in seconds.
5. Amplitude in millimeters.

The instrumental constants and magnification curve of HES seismographs are shown in Table 1 and Fig. 1. The seismographs are usually operated with the attenuation factor $\mu=1/5$ in the summer season and $\mu=1/2$ in the winter season.

Table 1. Instrumental constants of HES seismographs.

Component	Z	N - S	E - W
T_1 (s)	1.0	1.0	1.0
S_1 (A/mm)	2.80×10^{-5}	2.03×10^{-5}	2.03×10^{-5}
R_1 (Ω)	940	920	930
Ω_1 (Ω)	820	1160	920
h_1	1.0	1.0	1.0
1966 - 1967			
T_2 (s)	1.06	1.04	1.04
S_2 (A/mm)	1.47×10^{-9}	1.20×10^{-9}	1.34×10^{-9}
R_2 (Ω)	600	650	630
Ω_2 (Ω)	1200	1200	1200
h_2	1.0	1.0	1.0

T_1 : Period of the pendulum.
 T_2 : Period of the galvanometer.
 S_1 : Sensitivity of the transducer.
 S_2 : Sensitivity of the galvanometer.
 R_1 : Resistance of the pendulum coil.

R_2 : Resistance of the galvanometer coil.
 Ω_1 : External damping resistance of the transducer.
 Ω_2 : External damping resistance of the galvanometer.
 h_1 : Damping constant of the pendulum.
 h_2 : Damping constant of the galvanometer.

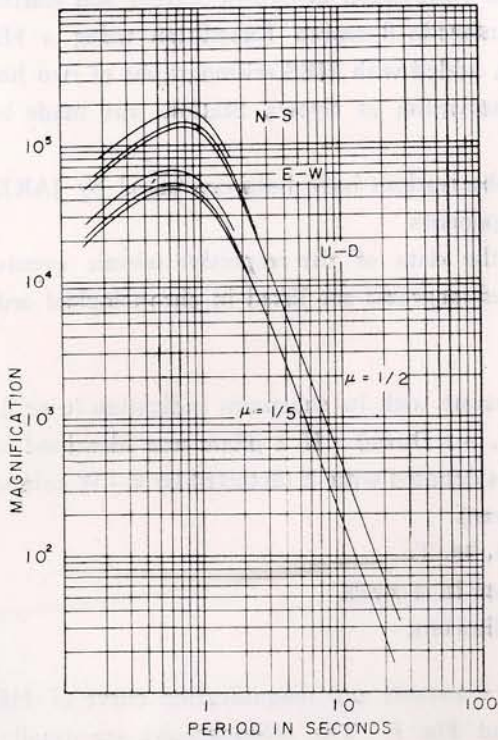


Fig. 1. Magnification curve of HES seismographs.

March 1959			1959			
Observed time	Defect time		Wave length		Phase	Amplitude
		λ_1	λ_2	λ_3		mm
3.40	3.40	1.30	91	25	91.5	65.0
3.45	3.45	1.30	91	25	91.5	65.0
3.50	3.50	1.30	91	25	91.5	65.0
3.55	3.55	1.30	91	25	91.5	65.0
4.00	4.00	1.30	91	25	91.5	65.0
4.05	4.05	1.30	91	25	91.5	65.0
4.10	4.10	1.30	91	25	91.5	65.0
4.15	4.15	1.30	91	25	91.5	65.0
4.20	4.20	1.30	91	25	91.5	65.0
4.25	4.25	1.30	91	25	91.5	65.0
4.30	4.30	1.30	91	25	91.5	65.0
4.35	4.35	1.30	91	25	91.5	65.0
4.40	4.40	1.30	91	25	91.5	65.0
4.45	4.45	1.30	91	25	91.5	65.0
4.50	4.50	1.30	91	25	91.5	65.0
4.55	4.55	1.30	91	25	91.5	65.0
4.60	4.60	1.30	91	25	91.5	65.0
4.65	4.65	1.30	91	25	91.5	65.0
4.70	4.70	1.30	91	25	91.5	65.0
4.75	4.75	1.30	91	25	91.5	65.0
4.80	4.80	1.30	91	25	91.5	65.0
4.85	4.85	1.30	91	25	91.5	65.0
4.90	4.90	1.30	91	25	91.5	65.0
4.95	4.95	1.30	91	25	91.5	65.0
5.00	5.00	1.30	91	25	91.5	65.0
5.05	5.05	1.30	91	25	91.5	65.0
5.10	5.10	1.30	91	25	91.5	65.0
5.15	5.15	1.30	91	25	91.5	65.0
5.20	5.20	1.30	91	25	91.5	65.0
5.25	5.25	1.30	91	25	91.5	65.0
5.30	5.30	1.30	91	25	91.5	65.0
5.35	5.35	1.30	91	25	91.5	65.0
5.40	5.40	1.30	91	25	91.5	65.0
5.45	5.45	1.30	91	25	91.5	65.0
5.50	5.50	1.30	91	25	91.5	65.0
5.55	5.55	1.30	91	25	91.5	65.0
5.60	5.60	1.30	91	25	91.5	65.0
5.65	5.65	1.30	91	25	91.5	65.0
5.70	5.70	1.30	91	25	91.5	65.0
5.75	5.75	1.30	91	25	91.5	65.0
5.80	5.80	1.30	91	25	91.5	65.0
5.85	5.85	1.30	91	25	91.5	65.0
5.90	5.90	1.30	91	25	91.5	65.0
5.95	5.95	1.30	91	25	91.5	65.0
6.00	6.00	1.30	91	25	91.5	65.0
6.05	6.05	1.30	91	25	91.5	65.0
6.10	6.10	1.30	91	25	91.5	65.0
6.15	6.15	1.30	91	25	91.5	65.0
6.20	6.20	1.30	91	25	91.5	65.0
6.25	6.25	1.30	91	25	91.5	65.0
6.30	6.30	1.30	91	25	91.5	65.0
6.35	6.35	1.30	91	25	91.5	65.0
6.40	6.40	1.30	91	25	91.5	65.0
6.45	6.45	1.30	91	25	91.5	65.0
6.50	6.50	1.30	91	25	91.5	65.0
6.55	6.55	1.30	91	25	91.5	65.0
6.60	6.60	1.30	91	25	91.5	65.0
6.65	6.65	1.30	91	25	91.5	65.0
6.70	6.70	1.30	91	25	91.5	65.0
6.75	6.75	1.30	91	25	91.5	65.0
6.80	6.80	1.30	91	25	91.5	65.0
6.85	6.85	1.30	91	25	91.5	65.0
6.90	6.90	1.30	91	25	91.5	65.0
6.95	6.95	1.30	91	25	91.5	65.0
7.00	7.00	1.30	91	25	91.5	65.0
7.05	7.05	1.30	91	25	91.5	65.0
7.10	7.10	1.30	91	25	91.5	65.0
7.15	7.15	1.30	91	25	91.5	65.0
7.20	7.20	1.30	91	25	91.5	65.0
7.25	7.25	1.30	91	25	91.5	65.0
7.30	7.30	1.30	91	25	91.5	65.0
7.35	7.35	1.30	91	25	91.5	65.0
7.40	7.40	1.30	91	25	91.5	65.0
7.45	7.45	1.30	91	25	91.5	65.0
7.50	7.50	1.30	91	25	91.5	65.0
7.55	7.55	1.30	91	25	91.5	65.0
7.60	7.60	1.30	91	25	91.5	65.0
7.65	7.65	1.30	91	25	91.5	65.0
7.70	7.70	1.30	91	25	91.5	65.0
7.75	7.75	1.30	91	25	91.5	65.0
7.80	7.80	1.30	91	25	91.5	65.0
7.85	7.85	1.30	91	25	91.5	65.0
7.90	7.90	1.30	91	25	91.5	65.0
7.95	7.95	1.30	91	25	91.5	65.0
8.00	8.00	1.30	91	25	91.5	65.0
8.05	8.05	1.30	91	25	91.5	65.0
8.10	8.10	1.30	91	25	91.5	65.0
8.15	8.15	1.30	91	25	91.5	65.0
8.20	8.20	1.30	91	25	91.5	65.0
8.25	8.25	1.30	91	25	91.5	65.0
8.30	8.30	1.30	91	25	91.5	65.0
8.35	8.35	1.30	91	25	91.5	65.0
8.40	8.40	1.30	91	25	91.5	65.0
8.45	8.45	1.30	91	25	91.5	65.0
8.50	8.50	1.30	91	25	91.5	65.0
8.55	8.55	1.30	91	25	91.5	65.0
8.60	8.60	1.30	91	25	91.5	65.0
8.65	8.65	1.30	91	25	91.5	65.0
8.70	8.70	1.30	91	25	91.5	65.0
8.75	8.75	1.30	91	25	91.5	65.0
8.80	8.80	1.30	91	25	91.5	65.0
8.85	8.85	1.30	91	25	91.5	65.0
8.90	8.90	1.30	91	25	91.5	65.0
8.95	8.95	1.30	91	25	91.5	65.0
9.00	9.00	1.30	91	25	91.5	65.0
9.05	9.05	1.30	91	25	91.5	65.0
9.10	9.10	1.30	91	25	91.5	65.0
9.15	9.15	1.30	91	25	91.5	65.0
9.20	9.20	1.30	91	25	91.5	65.0
9.25	9.25	1.30	91	25	91.5	65.0
9.30	9.30	1.30	91	25	91.5	65.0
9.35	9.35	1.30	91	25	91.5	65.0
9.40	9.40	1.30	91	25	91.5	65.0
9.45	9.45	1.30	91	25	91.5	65.0
9.50	9.50	1.30	91	25	91.5	65.0
9.55	9.55	1.30	91	25	91.5	65.0
9.60	9.60	1.30	91	25	91.5	65.0
9.65	9.65	1.30	91	25	91.5	65.0
9.70	9.70	1.30	91	25	91.5	65.0
9.75	9.75	1.30	91	25	91.5	65.0
9.80	9.80	1.30	91	25	91.5	65.0
9.85	9.85	1.30	91	25	91.5	65.0
9.90	9.90	1.30	91	25	91.5	65.0
9.95	9.95	1.30	91	25	91.5	65.0
10.00	10.00	1.30	91	25	91.5	65.0

HES seismograph of Z component was set in February and was been operated by Dr. S. MURAUCHI, a member of the 3rd Japanese Antarctic Research Expedition. The seismograph was observed with $\mu=1/5$ from February 13 to July 21 and with $\mu=1/2$ from July 22 to December 26.

Seismograms were read also by Dr. S. MURAUCHI.

February 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
13	-iP	19	16	14.4	1.0	1.2
14	+iP	04	18	21.9	1.5	1.9
16	-iP	11	05	48.5	0.7	0.8
	iS			51.7		
	-iP	18	47	18.0	1.7	2.2
18	+iP	01	20	06.1	1.2	1.5
19	eP	05	25	34.5	1.2	1.5
	eP	06	27	35.5	0.9	1.1
	ePP			05.8		
	eS			55.7		
20	eP	03	41	31.7	1.4	1.7
	eP	06	50	21.7	1.5	1.8
			53	50	0.9	1.1
23	-iP	16	24	25.7	1.3	1.6
	-iP	19	15	06.9	0.6	0.7
25	eP	20	20	42.8	1.4	1.7
	-iP	23	50	07.2	1.7	2.2
27	+iP	05	33	09.2	1.3	1.7
28	eP	11	52	25.8	1.5	1.9
	eP	15	47	39.3	1.7	2.2

March 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
01	-iP	01	20	57.3	1.5	1.8
02	eP	09	26	05.0	1.1	1.3
04	+iP	19	50	57.0	1.1	1.4
	eP	21	54	43.5	1.0	1.2
05	-iP	00	44	56.2	0.9	1.1
	iX		45	11.0		
06	eP	23	07	57.1	1.7	2.1
	-iP	03	46	03.1	0.3	0.5
	iS		15.1			
	iX		55.5			
	eP	04	07	44.4	0.6	0.7
15	eP	12	11	46.1	0.8	1.0
	iS			51.7		
	iX		14	46.8		
21	+iP	04	49	17.9	1.2	1.5
23	eP	07	30	09.6	2.1	2.7
26	eP	03	07	20.5	1.8	2.2
27	+iP	19	58	46.7	1.0	1.2
	iS	20	00	51.9		
	iX		08	14.9		

April 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
07	eP	15	33	50	1.2	1.6
	iX		36	35.8		
08	-iP	08	14	33.8	1.3	1.6
	esP		15	50.1		
	eS			05.0		
10	eP	06	27	54.9	2.5	3.0
11	eP	11	41	51.3	1.0	1.2
	eS		42	02		
15	-iP	19	32	09.3	1.4	1.8
	iX			22.8		
22	-iP	20	38	03.7	1.4	1.8
27	-iP	10	00	39.5	1.9	2.5
	eP	14	00	08.7	1.1	1.4
30	-iP	14	02	01.5	1.2	1.5
	iX			44.9		
	iX		08	23.2		

May 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
07	+iP	20	34	55.0	1.0	1.2
11	iP	16	48	35.3		
	iS			51.5	1.1	1.4
12	ePKP	10	25	22.0	0.9	1.1
14	eP	12	01	51.4	1.0	1.3
	eP	13	32	57.9	1.4	1.7
19	eP	15	47	12.6	1.5	1.5
21	eP	14	08	28.8	1.9	2.4
22	+iP	07	07	46.5	1.0	1.2
	iS		08	01.9		
	eP	16	33	15.2	1.3	1.7

June 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
01	+iP	05	44	11.7	0.8	1.0
	eP	09	14	59.3		
	iP	09	15	00.0	0.7	0.8
	iX		16	05		
	eP	12	44	57.0		
	iP	12	44	57.8	1.4	1.7
	iX		46	30		
02	eP	03	35	35.6		
	-iP	03	35	37.2	1.2	1.5
	-iP	03	44	18.3	1.4	1.8
	-iP	04	04	29.7	1.0	1.2
	-iP	05	52	11.9	1.6	2.0
06	eP	18	16	02.3	1.1	1.4
16	eP	17	04	43.8	1.0	1.3
	eP	19	03	49.6	1.2	1.5
26	eP	15	01	30	0.7	0.9
27	eP	03	47	17.8	1.4	1.8
29	eP	13	15	13	0.7	0.9

July 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
01	eP	10	44	05.3		
	iS			29.4	0.9	1.1
03	+iP	18	38	03.5		
	iS			45.0	1.8	2.3
04	iP	05	06	33.4	1.0	1.3
	eS		07	08.9		
05	eP	23	38			
	iS		39	03.5	0.8	1.0
06	+iP	08	50	23.4	1.0	1.3
07	eP	11	46	32.5	0.8	1.0
	-iP	12	16	58.5	0.6	0.8
	eS		24	21.0		
	eP	16	47	27.6	1.7	2.1
	eS		55	35.5		
09	+iP	16	17	07.9	1.8	2.2
11	eP	05	04	09.9	1.1	1.4
12	-iP	00	06	28.6	1.6	2.0
	iX		07	57.2		
13	eP	12	48	40.7	1.1	1.4
	iX		52	50.5		
14	eP	13	13	09.9	1.3	1.6
18	eP	19	38	38.6	1.4	1.8
19	eP	03	23	15.3	1.2	1.5
	eP	12	15	10.6	0.6	0.7
	+iP	15	18	15.1	0.8	1.0
20	eP	02	20	10.9	0.6	0.7
	iX		21	31.9		
	+iP	02	52	15.1	1.3	1.6
21	eP	01	39	25	1.0	1.2
	iP	07	56	10.1	1.7	2.1
22	+iP	19	42	44.3	0.9	1.1
23	-iP	15	09	06.6	2.0	2.7
24	-iP	01	43	04.6	1.1	1.4
	-iP	23	14	28.7	2.0	2.4
	iX		19	27.3		
28	-iP	11	00	46.7	0.9	1.1
30	-iP	13	05	49.4	0.9	1.2
	iX		14	24.6		
31	+iP	02	03	52.0	0.9	1.1

August 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
01	+iP	10	12	27.3	1.2	1.5
	iX		13	02.5		
	+iP	12	48	34.0	1.0	1.3
	iS			36.9		
	+iP	18	08	20.1	0.4	0.5
	eP	18	38	10.6	1.3	1.6
iX		40	07.5			
02	-iP	02	56	19.5	0.6	0.8
	eP	18	33	07.1	0.7	0.9
	iX		35	01.6		
	eP	20	21	28.7	1.1	1.4
	iX		29	02.5		
eP	21	34	36.5	1.3	1.6	
03	eP	00	33	43.8	0.8	1.0
04	-iP	03	11	02.0	1.4	1.8
	-iP	08	14	00.6	1.4	1.7
	+ipP		16	05.9		
	eP	08	23	31.7		
	iX			43.6		
	-iP	15	54	57.8	0.8	1.0
	iX	16	01	48.4		
	-iP	21	24	18.6	0.9	1.1
iX		33	02.5			
05	eP	10	55	32.1	1.0	1.3
	+iP	14	02	00.9	0.6	0.8
	eP	23	03	53.0	0.8	1.0
08	eP	16	23	09.0	0.8	1.0
	eP	21	11	13.3		
09	eP	00	09	14.2	1.3	1.6
	-iP	02	48	23.0	1.4	1.7
10	-iP	00	45	24.6	2.1	2.6
	eP	02	45	18.5	1.3	1.6
	eP	16	13	36.2	0.9	1.2
11	eP	19	02	30.5	0.8	1.0
	iX			33.4		
	-iP	21	32	47.0	1.3	1.6
12	-iP	01	32	34.0	1.0	1.2
	+eP	04	14	51.5	2.7	3.3

August 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
13	eP	00	25	26.0	0.7	0.9
	iX			29.0		
	-iP	03	08	48.1	1.0	1.2
	iS			51.7		
	iX		10	42.4		
	eP	23	13	47.7	0.7	0.8
14	-iP	01	11	32.2	0.9	1.2
	-iP	04	51	01.8	1.0	1.2
	eP	12	29	24.8	0.9	1.2
15	eP	03	35	53.7	1.2	1.5
	-iP	13	27	09.3	0.6	1.5
17	eP	18	03	59	1.3	3.5
19	eP	01	35	37.5	1.0	2.7
	eP	04	24	02.5	1.7	4.5
	eP	17	25	15.2	1.1	2.8
20	eP	12	27	20.0	1.7	4.4
24	+iP	07	04	27.9	1.0	2.5
	eP	11	52	51.3	1.5	4.0
	eP	15	54	46.8	2.2	6.0
	-iP	12	49	06.0	1.1	3.0
25	eP	06	20	04.2	0.9	2.5
	-iP	12	35	48.5	1.4	3.7
	-iP	13	53	20.1	1.5	4.0
	iX			33.3		
	eP	18	03	10.8	1.1	3.0
27	-iP	08	03	01.7	1.2	3.3
	eS			51.0		
	iX		06	29.3		
	eP	13	46	47.0	1.2	3.2
	eP	19	14	02.9	0.8	2.0
	iX			41.3		
28	+iP	16	04	56.5	1.7	4.5
	eS		16	57.1		
30	-iP	21	52	33.8	0.9	2.5
	ePP		54	04.1		
	iX		57	05.6		
31	-iP	17	33	15.8	0.8	2.0

September 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
01	eP	01	04	54.2	1.0	2.5
02	eP	08	01	52.9	0.7	2.0
03	-iP	16	08	51.3	1.1	3.0
	eS		11	51.6		
04	eP	09	35	43.3	1.5	4.0
	eP	12	41	52.5	1.7	4.5
	+iP	18	38	52.2	0.9	2.3
	-iP	23	32	31.5	0.9	2.5
05	-iP	07	08	19.2		
	iX		09	11.4		
	iX			58.2	2.3	6.0
	eP	15	47	51.4	1.7	4.5
	+iP	23	17	00.5	1.3	3.3
	iX		19	07.3		
06	-iP	00	41	21.4	1.0	2.5
	-iP	19	06	48.1	0.8	2.0
	iX		07	02.9		
07	eP	03	57	45.2	1.4	3.7
	eP	19	18	57.5	1.4	3.7
08	-iP	13	16	14.4	1.5	4.0
	iX		19	12.3		
	+iP	19	27	15.0	1.5	4.0
	iX		30	18.0		
	eP	20	24	36.9	1.7	4.5
09	-iP	02	10	02.2	0.8	2.0
	eP	02	00	05.2	1.3	3.5
	eP	16	32	07.6		
	eS		33	07	0.6	1.6
10	-iP	05	48	19.0	1.4	3.8
	eP	10	47	37.9	1.5	4.0
	iX			46.6		
	eP	09	28	12.1	0.7	1.8
12	+iP	01	52	47.7	0.8	2.2
	iX	02	07	04.1		
13	eP	22	53	42.8	2.0	5.0
	eP	20	07	33.8	1.2	3.2
	iX		08	12.1		
14	eP	04	24	53.8		
	iX		25	11.0	1.2	3.0
	eP	19	48	03.5	1.4	3.6

September 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
17	eP	03	51	30.4	1.2	3.0
	eP	05	40	29.7	0.9	2.5
	-iP	07	22	29.1	1.1	3.0
	-iP	08	51	16.2	1.1	3.0
	eP	11	49	49.8	0.8	2.0
	eP	15	03	49.2	1.5	4.0
	eP	15	20	19.2	1.4	3.7
	iX			27.3		
	eP	17	25	25.8	1.1	3.0
18	eP	03	16	35.7	0.8	2.0
	iX		17	20.0		
	+iP	09	36	52.2	0.8	2.2
	eP	10	55	01.8	0.9	2.5
	-iP	20	18	34.5	0.8	2.2
19	eP	03	26	29.4	0.8	2.0
	eP	10	20	53.1	1.1	3.0
	eP	18	59	21.4	0.7	1.8
20	+iP	23	29	08.3	0.8	2.2
	iS			34.1		
21	eP	02	21	20.0	1.4	3.5
	+iP	13	21	32.9	1.2	3.2
24	eP	19	56	30.1	1.0	2.5
25	-iP	00	26	21.1	1.5	4.0
	eP	01	43	12.3	0.9	2.4
	eP	13	13	03.4	0.8	2.0
26	eP	05	25	07.5	1.0	2.5
	eP	08	40	47.0	1.3	3.5
	iX		41	12.8		
	+iP	10	29	54.5	1.1	3.0
	iX		30	24.8		
27	-iP	10	32	54.8	1.0	2.5
	iX		43	06.8		
29	+iP	13	08	16.7	1.1	2.8
	iX		09	18.2		
	eP	14	43	06.3	1.3	3.5
	-iP	17	19	56.3	1.3	3.8
30	eP	05	08	45.8	1.4	3.6
	iX		15	53.3		
	eP	15	05	31.2	1.3	3.5
	eP	16	42	30.0	1.0	2.6
	-iP	20	38	41.4	1.4	3.8

October 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
01	+cP	17	13	28.0	0.8	2.2
03	eP	21	53	26.8	1.4	3.8
	iP	23	26	23.8	0.9	2.5
	eP	23	33	44.8	0.9	2.5
04	eP	13	23	19.9	0.7	1.8
07	eP	03	39	41.0	1.0	2.5
	iX			43.3		
	eP	07	18	26.6	0.9	2.4
	eP	10	32	30.5	1.1	3.0
08	iP	00	16	07.1	1.8	4.8
	eP	17	01	24.6	0.8	2.0
	eP	22	04	56.6	0.6	1.5
09	iP	22	22	05.2	0.6	1.5
11	eP	02	00	41.0	0.6	1.5
	iX		02	18.5		
	eP	10	09	18.5	0.7	1.8
	eP	18	03	36.9	1.3	3.4
	eP	20	15	34.7	1.1	3.0
12	-iP	03	34	12.0	1.3	3.5
	+iP	03	55	37.7	1.4	3.8
14	eP	13	56	41.7	0.8	2.1
	+iP	15	22	05.7	0.6	1.5
	iP	15	59	30.3	0.8	2.1
	eP	17	49	48.6	1.1	3.0
15	eP	00	01	36.0	0.7	1.8
17	eP	00	41	45.3	0.8	2.0
	eP	01	31	41.1	1.3	3.5
	-iP	10	44	34.5	1.9	5.0
	eP	15	23	51.6	0.9	2.5

October 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
18	eP	12	29	14.1	0.7	1.8
	+iP	17	26	05.7	1.2	3.2
19	eP	00	01	17.7	1.1	2.8
	-iP	01	37	25.4	0.7	1.8
	-iP	02	25	17.0	1.7	4.5
	ipP		26	14.0		
	eP	09	27	32.1	1.2	3.2
	+iP	13	04	16.3	1.0	2.5
	iX		06	26.0		
	eP	17	52	34.3	0.8	2.2
	eP	19	30	15.8	0.7	1.8
	eP	23	27	08.1	0.6	1.5
20	eP	01	04	52.5	0.8	2.0
	eP	03	02	30.9	0.6	1.6
	eP	05	37	44.8	1.0	2.8
	eP	06	28	10.7	1.6	4.2
	eP	10	10	09.1	1.0	2.6
	eP	19	01	11.9	0.8	2.0
	+iP	21	33	58.2	0.7	1.8
	-iP	21	50	26.6	1.3	3.5
	eP	22	30	12.8	1.5	4.0
	eP	23	41	14.3	1.0	2.5
21	eP	01	48	57.5	0.7	1.8
	eP	03	42	15.6	0.4	1.0
	iS			39.1		
	eP	05	27	00.4	0.8	2.0
	eP	06	13	31.0	0.6	1.6
	eP	09	36	35.9	2.1	5.5
	eP	22	22	30		
	iX		23	26.2	0.4	1.2

October 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
22	eP	01	12	46.3	0.7	1.8
	eP	04	57	01.4	1.5	4.0
	eP	05	03	45.8	1.1	3.0
	eP	05	27	23.3	0.8	2.0
	eP	10	31	50.4	0.8	2.2
	eP	10	42	29.4	0.8	2.0
	eP	12	38	51.0	0.7	1.8
	eP	23	00	41.8	0.6	1.5
	eP	23	46	41.8	0.7	1.8
23	+iP	03	56	40.3	1.3	3.5
	eP	06	29	39.0	1.3	3.5
	eP	09	28	14.6	1.3	3.4
	eP	12	54	32.9	0.7	1.6
	eP	18	02	44.5	1.3	3.5
24	eP	03	58	34.0	0.7	1.8
	eP	23	59	11.7		
	iX	24	00	48.3		
25	-iP	01	58	46.8	0.6	1.5
	eP	03	37	10.0	1.4	3.6
	eP	05	17	07.3	0.6	1.5
	+iP	18	44	25.0	0.8	2.0
	eP	20	33	27.4	0.7	1.8
26	eP	12	18	41.3	1.1	3.0
27	eP	06	32	12.0	2.1	5.5
	-iP	09	53	03.8	0.8	2.0
	iS			31.1		
	-iP	14	10	05.7	1.0	2.5
28	eP	17	52	06.7	0.2	0.5

October 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
29	eP	00	26	59.2	1.1	2.8
	eP	03	14	40.4	0.8	2.2
	eP	19	54	12.8	1.1	2.8
	eP	22	10	42.8	1.2	3.2
30	eP	02	13	05.2	0.7	1.8
	eP	04	20	10.9	1.1	3.0
	eP	06	37	01.0	0.8	2.2
	eP	11	23	28.8	1.5	4.0
	eP	11	33	28.8		
	iX			42.0	1.9	5.0
	iSP			57.3		
	iScP		40	17.7		
	-iP	14	10	57.4	1.5	4.0
	epP		11	53.9		
	ePP		14	18.7		
	eP	15	35	35.8	0.5	1.4
	iX		38	36.4		
	+iP	21	49	27.7	1.1	2.8
31	-iP	03	03	23.9	0.7	1.8
	eP	07	55	57.0	0.8	2.0
	+iP	21	24	11.0	0.7	1.8

November 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
01	eP	04	26	40.1	0.6	1.6
	iX		27	06.2		
	eP	15	15	23.4		
02	eP	23	18	38.7	0.7	1.8
	eP	07	50	53.2	1.1	3.0
	eP	08	51	55.7	0.8	2.2
03	-iP	20	16	38.6	1.5	4.0
	iX			49.1		
	ePP		20	47.3		
	iX		28	35.9		
	-iP	22	05	38.4		
04	eP	08	58	48.7	0.7	2.0
	+iP	09	51	38.0	1.1	2.8
	iX	10	01	02.3		
	eP	09	17	31.7	1.0	2.5
05	eP	01	29	09.3	0.8	2.0
	-iP	18	34	53.7	1.0	2.6
	iX		36	42.0		
06	eP	05	58	33.6	0.8	2.2
	eP	11	10	33.9	0.9	2.4
	eP		59	01.3	1.1	2.8
	-iP	12	03	11.8	1.6	4.2
	-iPcP			22.6		
	ePP		06	48.4		
	eP	17	51	17.7	1.8	4.8
	ePP		55	08.1		
	eP	22	06	17.5	0.9	2.4
07	eP	01	20	40.1	1.4	3.8
	ePP		24	44.6		
	+iP	11	55	41.9	1.1	3.0
07	eP	22	28	48.9	1.1	3.0

November 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
08	eP	14	13	46.6	2.4	6.2
	+iPKP	14	14	16.6		
	ePP		16	45.7		
	eSKP		17	39.2		
	eSKSP		26	22.0		
09	eP	14	30	10.0	1.1	3.0
	eP	14	40	28.6	0.8	2.0
	eP	18	16	26.2	1.0	2.5
10	eP	19	59	39.3	1.0	2.8
	iS	05	06	52.5	1.0	2.8
12	eP	05	09	03.6	1.1	2.8
	eP	02	35	47.5	1.1	3.0
	eP	07	18	56.6	1.2	3.2
	eP	08	14	01.1	0.8	2.2
	eP	09	49	44.8	1.0	2.5
13	-iP	10	17	45.0	0.8	2.2
	eP	17	05	23.0	1.1	3.0
	eP	18	20	46.4	0.8	2.2
14	-iP	00	05	00.8	1.3	3.5
	eP	04	35	53.8	0.7	2.0
	eP	15	08	25.8	1.2	3.2
	eP	17	09	43.2	0.8	2.0
	eP	21	59	14.1	1.9	5.0
	eP	04	18	57.3	1.1	3.0
15	eP	07	27	22.2	1.7	4.5
	eP	13	30		0.6	1.5
	eP		23	22.8		
	iX	17	27	31.2	2.3	6.0
	eP					

November 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
16	-iP	01	09	51.9	1.0	2.6
	eP	03	14	33.4	0.8	2.0
	iX		17	26.2		
	eP	08	18	03.1	0.7	2.0
	eP	09	18	21.7	1.0	2.6
	eP	10	33	42.1	2.2	6.0
	eP	23	56	55.0	1.0	2.6
17	eP	01	16	34.9	1.1	3.0
	eP	02	42	46.6	1.0	2.5
18	-iP	20	46	45.0	0.6	1.5
	iX		49	43.5		
19	+iP	05	38	28.8	0.8	2.0
	+iP	11	21	37.5	1.1	3.0
	eS		32	17.4		
	eP	22	32	10.5	1.3	3.5
20	-iP	00	32	33.0	1.1	2.8
	eP	00	13	45.6	0.9	2.5
	eP	15	20	32.1	1.1	2.8
	+iP	15	30	00.0	1.0	2.8
	eP	22	16	46.5	1.1	3.0
	eP	08	22	33.0	0.6	1.6
22	-iP	02	46	10.5	0.8	2.0
	eP	09	21	08.4	0.9	2.4
	eP	13	00	58.2	1.1	2.8
	eP	16	36	16.5	1.2	3.0
	iX		37	24.0		
	+iP	19	46	19.5	0.8	2.0
	iX		48	15.6		
eP	22	55	34.0	1.4	3.8	

November 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
23	eP	16	27		1.5	4.6
	eP	22	07	57.8	1.0	2.6
24	eP	09	36	12.8	2.2	5.8
	eP	21	12	39.8	1.1	2.8
iX	13		18.2			
26	eP	00	54	39.0	1.1	3.0
	eP	05	56	19.5	1.1	2.8
	-iP	06	06	16.0	1.2	3.0
	+iP	07	18	04.0	1.4	3.6
	eP	13	19	23.8	1.1	2.8
	+iP	16	18	43.0	1.2	3.0
27	eP	23	21	09.5	1.3	3.4
	iX		24	33.2		
	-iP	00	03	56.9	1.8	4.6
	eP	03	51	55.4	0.7	2.0
28	-iP	05	21	55.0	0.6	1.8
	iX		22	04.3		
28	eP	00	28	13.3	1.1	2.8
	eP	02	58	29.2	1.5	3.8
	eP	06	44	07.3	1.5	3.8
	iX		45	23.2		
	-iP	12	46	10.3	1.5	4.0
	iX			18.4		
	-iP	22	52	13.3	1.5	4.0
iX	53		25.3			

December 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
01	eP	15	07	29.4	1.3	3.5
	iX			36.9		
	+iP	15	48	47.1	1.0	2.8
	iX			15.6		
02	eP	01	32	30	0.8	2.0
	eP			03		
	-iP	04	38	11.7	0.8	2.0
	-iP			07		
	eP	07	42	35.7	1.8	4.8
	iX			46.7		
	-iP	09	47	50.8	1.3	3.5
	iX			59.0		
03	eP	02	01	20.2	1.2	3.2
	eP			03		
	iP	10	18	30.5	0.7	1.8
	eP			14		
	eP	18	35	35.9	1.0	2.6
	eP			19		
05	eP	00	28	46.1	0.8	2.2
	iX			29		
	eP	08	33	38.5	0.8	2.2
	eP			08		
	eP	13	04	11.8	0.7	1.8
06	eP	04	37	46.8	1.3	3.4
	iX			38		
07	eP	00	46	30.5	0.8	2.0
	iX			59.6		
	eP	08	03	00.0	1.1	3.0
08	iP	04	42	53.5	1.4	3.8
	iPcP			54.8		
	iX		43	01.0		
	eP	20	46	43.7	1.9	5.0

December 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
11	-iP	00	44	23.5	1.5	4.0
	+iPcP			31.9		
	eP	01	51	10.0	1.1	3.0
	ePcP			22.3		
	iX		52	07.0		
	eP	07	15	36.7	1.1	2.8
	eP	10	19	49.6	1.3	3.5
	+iPcP		20	01.6		
	iP	14	56	49.6	0.8	2.0
	iX		57	03.1		
	eP	20	31	23.1	1.1	2.8
	eP	21	10	04.2	1.2	3.0
	eP	22	09	37.5	0.9	2.5
	eP	23	28	20.7	0.6	1.5
12	-iP	17	20	32.5	1.2	3.0
13	eP	12	33	04.5	1.1	3.0
	eP			16		
	iS			17.1		
	eP	17	47	16.2	1.5	4.0
	eP	23	18	07.0	1.1	2.8
14	eP	10	24	05.9	1.1	3.0
	eP			12		
	+iP	18	11	32.9	0.8	2.0
	+iPP		15	12.8		
	iX		17	47.3		
	-iP	22	02	25.7	1.5	3.8
	iX		21	26.0		
	-iP	23	27	52.4	3.2	8.6
	iX		36	09.7		
15	-iP	12	21	45.1	1.8	4.8
	iX			25		
	+iP	15	00	12.2	0.9	2.4
	+iP	19	46	14.5	1.6	4.2
	iX			49		

December 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
16	-iP	03	50	27.7	0.6	1.6
	eP	11	31	39.1	0.9	2.4
	eP	19	27	55.9	1.1	2.8
	iX		30	36.1		
17	eP	02	39	44.5	0.9	2.5
	-iP	03	08	16.6	0.9	2.5
	eP	06	05	34.6	1.1	3.0
	eP	10	11	37.9	0.5	1.2
	eP	12	56	04.0	0.7	1.8
	iX			07.0		
	+iP	17	00	19.0	1.6	4.5
18	eP	16	44	42.1	1.5	4.0
	iX		45	25.0		
20	eP	08	17	20.0	1.0	2.6
21	eP	06	13	52.1	0.7	2.0
	-iP	10	02	46.4	1.1	3.0
	iX		12	48.8		
	-iP	10	26	28.7	1.4	3.8
	-iP	10	31	42.8	1.6	
iX			52.7			
22	eP	00	22	07.2	1.1	3.0
	iX			15.1		
	eP	01	16	21.7	0.7	1.8
	iX			23.8		
	eP	02	58	46.6	1.6	4.5
	eP	14	25	02.9	0.6	1.7
eS			11.9			
23	eP	01	53	06.2	0.8	2.2
	eP	04	09	59.0	1.0	2.6
	eP	04	43	45.0	0.7	2.0
	+iP	14	11	14.4	2.0	5.6
	-iP	18	14	38.8	0.8	2.0

December 1959

Date	Phase	Arrival time			Period s	Amplitude mm
		h	m	s		
24	eP	00	01	36.5	1.3	3.5
	+iP	07	23	35.4	1.4	3.8
	iX		24	39.9		
	eP	09	26	34.3	1.5	4.2
	iX			38.8		
	eP	13	03	15.4	1.3	3.4
25	+iP	15	25	32.5	0.7	1.8
	iX		26	04.9		
	eP	04	01	08.9	1.3	3.5
	iX		02	25.7		
26	-iP	05	19	36.2	0.7	1.8
	iX			57.5		
	+iP	09	30	08.4	1.3	3.5
	iX		57	39.9		
26	-iP	16	07	04.5	1.1	2.8
	iX		10	56.4		
	eP	12	17	51.5	0.7	2.0
	iX			54.5		
	eP	16	27	27.2	1.1	2.8
	iX			29.9		
	eP	16	00	19.7	0.5	1.2
	iX			29.9		
26	-iP	17	08	58.1	1.0	2.8
	eP	18	39	12.7	1.1	3.0
	iX		40	25.6		