DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, DIRECTOR

RESULTS OF OBSERVATIONS MADE AT THE UNITED STATES COAST AND GEODETIC SURVEY MAGNETIC OBSERVATORY NEAR HONOLULU, HAWAII IN 1921 AND 1922

BY

DANIEL L. HAZARD

Assistant Chief, Division of Terrestrial Magnetism



PRICE, 25 CENTS

Sold only by the Superintendent of Documents, Government Printing Office Washington, D. C.

WASHINGTON
GOVERNMENT PRINTING OFFICE
1924

RESULTS OF OBSERVATIONS MADE AT THE UNITED STATES COAST AND GEODETIC SURVEY MAGNETIC OBSERVATORY NEAR HONOLULU, HAWAII, IN 1921 AND 1922

CONTENTS

Introduction
Instruments
Constants of magnetograph
Absolute observations and base-line values
Diurnal variation
Summaries of monthly and annual means
Hourly values of declination, 1921
Hourly values of horizontal intensity, 1921
Hourly values of vertical intensity, 1921
Hourly values of declination, 1922
Hourly values of horizontal intensity, 1922
Hourly values of vertical intensity, 1922
Earthquakes
Magnetic storms
ILLUSTRATIONS

INTRODUCTION

Figs. 1-11. Reproductions of magnetograms showing the principal mag-

netic storms_____facing

[Latitude, 21° 19'.2 N.; longitude, 158° 03'.8 W.; elevation 50 feet (15 meters)]

The Honolulu magnetic observatory is situated on a large coral plain, 12½ miles (21 km.) west of the city of Honolulu, Oahu Island, Hawaii. Its operation began in January, 1902. For a description of the buildings and instruments see the first volume of observatory results. The methods of observing are explained in Directions for Magnetic Measurements, by D. L. Hazard, published in 1911, second edition in 1921.

The division of terrestrial magnetism of the Coast and Geodetic Survey, of which N. H. Heck, hydrographic and geodetic engineer, is chief, includes both office and field work. The work of the Honolulu observatory was carried on during the two years by H. E. McComb, magnetic observer. The office computations and preparation of results for publication were in charge of the writer, assisted by Frank Neumann, O. S. Hill, J. B. Goldsmith, and I. I. Kaplan, computers.

Up to the end of 1914 each hourly value of declination, horizontal intensity or vertical intensity in the monthly tabulations represented the momentary value of the quantity for the specified hour, local mean time. Beginning with 1915 the published hourly values are average values for successive periods of an hour, beginning at midnight of the specified standard meridian time (one hundred and sixty-fifth meridian in the case of Honolulu). Thus a value in a column headed 1 represents the average value for the hour beginning at midnight and ending at 1 a. m., one hundred and sixty-fifth meridian mean time.

100

In April, 1903, a Milne seismograph belonging to the seismological committee of the British Association was transferred from Oahu College to the magnetic observatory. In February, 1921, this instrument was replaced by a Milne-Shaw seismograph. It consists of two horizontal pendulums, one recording east-west motion (E) and the other recording north-south motion (N). Because of the large magnification (150), microseisms are continuously present on the seismograms, with amplitudes ranging from 0.5 mm. to 2.0 mm. and predominant periods of 4 and 8 seconds, the larger amplitudes usually accompanying the longer period. Preliminary phases of small amplitude are difficult to separate from the microseisms. The amplitudes have been computed on the basis of the constants given below. Where the periods of the waves could not be determined, the trace amplitude has been divided by 100. These values are indicated by asterisks.

Period of pendulums, 12 sec. Multiplication, 150.

Damping ratio, about 20:1. Sensitivity, 25 to 30 mm.

Register of earthquakes

				negrsie	r oj eari	nquakes				
No.		Date	Compo- nent	P	8	L	М	С	F	A
1 2 3 4 5	Jan. Jan. Jan. Jan. Feb.	1921 9 14 20 20 27	ZBZBZBZBZBZBZBZBZBZBZBZBZBZBZBZBZBZBZB	h. m. s. 13 20 42 1 37 48 21 24 36 18 31 37	h. m. s.	h. m. s. 13 36 36 19 22 00 1 46 30 21 37 42 18 41 58	h. m. s. 13 43 42 19 27 00 1 53 30 21 43 42 18 42 10	h. m. 13 47 1 56 21 48 19 10	h. m. 15 50 19 30 2 11 22 18 20 14	μ 162
6	Mar.	6	E Z	18 81 31	18 37 25	18 42 40 7 44 53 7 43 32	18 47 13 7 48 50 7 47 52	19 23 7 50 7 53	20 08 8 07 8 14	232 58 54
7	Mar.	10	E			20 31 55 20 27 50	20 34 00 20 33 40	20 41 20 41		*20 *18
8	Mar.	24	E	14 56 52 14 56 52	15 00 36	15 03 00 15 02 51	15 06 37 15 06 28	15 08 15 10	15 13 15 20 8 38	105 88
Ð	Mar.	28	E	8 00 21 8 00 33	8 09 16 8 09 22	8 20 53	8 21 17 8 09 38	8 28 8 27	8 38 8 51	142 *170
10	Mar.	29	E		22 27 12 22 27 12	22 35 47	22 38 12		22 43 22 43	*20 *15
11	Mar.	30	E	15 13 59	15 23 37 15 24 19	22 33 22 15 37 56	15 40 29		16 02 15 39	*17
12	Apr.	1	E	12 16 23 12 16 15	10 24 15	12 20 15 12 20 13	12 25 24 12 24 40	12 28	12 36 12 36	58 42
13 14	Apr. Apr.	3	E E	10 06 28		10 09 32 2 54 47 2 54 55	10 23 26 2 59 04 2 58 28	3 01 2 59	10 31 3 07 3 08	32 24 29
15	Apr.	10	E		13 53 29 13 53 32	13 56 44 13 57 14	13 59 05 14 00 47	14 07 14 05	14 50 14 55	90 74
16	Apr.	12	E			7 45 36 7 46 00	7 52 07 7 51 36	7 55	8 01 7 59	28 14
17	Apr.	22	E			6 46 42 6 51 85	6 49 34		6 57	25 10
18	Apr.	25	E N			17 52 00 17 52 20	17 55 18 17 58 09		7 12 18 23 18 17	27 27
19 20	May May	3	N E		5 55 25	6 02 29 11 00 35	6 04 06	6 10	7 20 11 04	45 10
21	May	4	Ĕ	21 29 10		11 00 20 21 29 20	11 01 53 21 30 18		11 06 21 34	5 14
22	May	12	Ĕ	3 49 45	3 57 18	21 29 40 4 05 49	4 14 24	4 16	21 34 4 48	26 26
23	May	14	E	11 40 56 11 40 56		4 06 04 12 01 53	4 14 51 12 02 05	4 16	4 40 13 11 11 55	14 15
24	May	14	E	20 27 19 20 27 31	20 35 05 20 35 01		20 42 48 20 47 41	20 49	21 35 21 31	18 24
25	Мау	14	E	20 27 31	22 30 32	20 44 13	22 35 00	20 49	22 52	12
26	May	16	E		22 30 40	22 35 35 15 32 42 15 38 04	22 35 53 15 39 27 16 00 43		22 46 16 09 16 09	11 7
27	May	21	Ë	8 53 51	9 03 31 9 03 16	9 17 36	9 27 49 9 13 01		9 56 9 35	18 8
28	May	21	E	22 41 02 22 41 02	22 44 46 22 44 38	22 46 29 22 46 12	22 51 13 22 46 55	22 56 22 59	24 24 24 23	18 8 23 20
29	Мау	28	E N		22 44 33	21 10 30 21 10 23	21 12 25 21 11 40		21 18 21 22	12 10

Register of earthquakes-Continued

				1				1	
No.	Date	Compo- nent	P	s	L	M	C	F	A
30	June 17	E	h.m. s.	h. m. s.	h. m. 8. 8 27 48 8 27 37 2 20 20 2 20 20 14 09 23 5 21 13 5 21 30 14 47 47	h. m. s. 8 30 54 8 28 50 2 22 44 2 23 22	h. m. 8 31 8 31 2 27 2 24	h. m. 8 32 8 33 2 48 2 48 14 48 5 32 5 41	μ 7 8 24 28
31	June 25	E	2 15 52	2 19 29	2 20 20	2 22 44	2 27	2 48	24 28
32 33	June 28 July 3	N			14 09 23	5 22 37		14 48 5 22	
34	July 4	Ň	5 17 10 5 17 10 14 35 16 14 35 16 11 06 00	14 40 11 11 08 20	8 27 48 8 27 37 2 20 20 2 20 20 14 09 23 5 21 13 5 21 30 14 47 47	5 22 37 5 23 46 14 50 07 14 21 26 11 21 05 11 19 09 2 20 10 2 20 14	5 23 5 29	5 41 14 56	14 10 25 25 31 17 14 9
35	July 7	Ň	14 35 16 11 06 00	14 40 11	11 09 20	14 21 26		14 56 14 49 11 55	25 31
36	July 10	N	2 07 55	2 11 22	11 08 50	11 19 09		11 45	17
37		N E	2 07 55 2 07 22	2 11 23 2 10 43	11 09 20 11 08 50 2 15 25 2 16 20 7 04 11 24 13 31 35 13 32 30 18 45 50	2 20 14		2 26 7 18	9
38	July 10 July 13	Ē			11 24			11 37 11 37	
39	July 13	E	13 23 40		13 31 35	18 35 03		13 45 13 41	10
40	July 15	E	18 27 24	18 42 33	18 45 50	18 48 40		18 53 18 50	4
41 42	July 23 July 26	N E	10 52 38		8 57 30 11 01 32	9 00 35 11 02 45 11 01 58 0 47 10 0 47 31 10 16 23 10 15 46 23 48 50 11 03 25 11 03 25 11 03 25 24 02 30 24 02 30 4 30 00 4 30 00 4 30 00 21 06 57	9 04 11 03	11 55 11 45 2 43 2 26 7 18 11 37 13 45 13 41 18 53 18 50 9 30 11 12 11 05	13 44 424 425 37 5 9 9 5 5 114 6 6 8 8 5 5 5 4 4 4 1 2 2 6 6 8 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
43	July 29	N E	10 52 38 10 52 38 0 42 27 0 42 27 10 06 48 10 06 48	0 45 02 0 45 02 10 11 00 10 11 18		11 01 58 0 47 10	0 50 0 54 10 28 10 23 23 50 23 50	11 05 1 01	1 24
44	July 31	N E	0 42 27 10 06 48	0 45 02 10 11 00	0 46 30 0 45 57 10 13 10	0 47 31 10 16 23	0 54 10 28	1 01 1 09 10 52	42 35
45	July 31	N E		10 11 18	0 46 30 0 45 57 10 13 10 10 13 10 23 46 42 23 46 42 11 01 20 11 01 25 24 01 20	10 15 46 23 48 55	10 23 23 50	10 54 24 07	27 5
46	Aug. 9	N E			23 46 42 11 01 20	23 48 50 11 03 25		24 04 11 06	9
47	Aug. 17	N E	23 55 40 23 55 33		11 01 25 24 01 20	11 03 30 24 02 30	24 08	11 07 24 29	5 11
48	Aug. 22	N E	23 55 33		4 29 49 4 29 43	24 02 37 4 30 00	24 08 4 32	24 49 4 57	14 6
49	Aug. 23	N E	20 41 05	20 48 58	i	4 30 00 21 04 19	4 33 21 10	4 50 21 19	6 8
50	Aug. 24	N E	20 41 05	20 48 58	21 00 55 11 13 28	21 06 57	24 06 24 06 4 32 4 33 21 10 21 10	10 54 24 07 24 07 24 08 11 07 24 29 24 49 4 57 4 50 21 19 21 23 11 22 11 17 11 46 11 44	5 5
51	Aug. 24	N E			11 13 28			11 17 11 46	4
52	Aug. 29	N E			11 37 19 19 19			11 46 11 44 19 17 19 16	2
53	Sept. 3	E	9 15 11 9 15 31	9 20 26	9 23 00	9 23 30	9 36 9 37	10 29	8
54	Sept. 4	N E	9 15 31	9 20 26	9 23 00 23 52 40	23 53 31	9 87	23. 58	4
55	Sept. 5	E	20 01 58 20 01 58	20 12 36 20 12 36	20 29 25	20 33 15	20 52	22 47	26
56	Sept. 8	E	20 01 58		19 40 28	19 44 33	19 45	19 52	10
57	Sept. 11	E	4 15 03	4 26 00 4 26 24	4 45 56	9 23 30 9 23 16 23 53 31 23 53 31 20 33 15 20 30 30 19 44 33 19 41 54 4 50 50 4 43 20 3 42 20 3 43 - 4 21 29 23 38 48 23 38 38 19 12 34 2 35 18 2 35 18 2 35 18 3 05	23 54 20 52 20 52 19 45 19 45 5 12 5 28	10 29 10 14 23.58 23 58 22 47 23 02 19 52 19 50 7 35 7 15 4 55	62
3 8	Sept. 13	E	4 15 03 4 15 08 2 58 11	4 20 24	3 38 00	3 42 20		4 55	24
59	Sept. 19	E	4 18 51 4 18 51 23 25 05 23 25 05		4 20 20	4 21 43	4 30 4 29 23 42 23 44 19 13 19 15	6 12	69 46
60	Sept. 19	E	23 25 05	23 31 50 23 31 50	23 35 22	23 38 48	23 42	26 12 26 16	89
61	Sept. 20	E	23 20 03		19 09 42	19 12 34	19 13	19 39	13
62	Sept. 23	E			2 32 21	2 35 18		3 03	1ŏ
63	Sept. 29	E	13 28 43 13 28 48		13 30 42	13 32 57 13 33 05		13 43 13 37	15 13
64 65	Oct. 5 Oct. 10	N			1 57 45	I	2 48	2 01 2 55	21
66	Oct. 15	N E	2 25 45 2 25 45 5 14 11 5 14 11	2 33 02 5 18 25 5 18 50	2 41 30 5 21 05	5 26 35	2 48 5 87	2 53 6 05	21 25 100 96
67	Oct. 18	ezezzezezezezezezezezezezezezezezezeze	5 14 11	5 18 50	21 00 55 11 13 28 11 13 28 11 35 11 13 28 11 35 19 14 19 19 13 40 9 23 00 9 23 00 23 52 31 20 29 25 25 20 20 20 25 20 20 25 20 20 25 20	5 26 35 5 25 10	2 48 2 48 5 37 5 36	6 12 6 34 26 12 26 16 19 39 19 49 3 03 3 05 13 43 13 37 2 01 2 55 6 05 6 05 6 05 9 08 9 23 17 42 17 42	96
68	Nov. 2	N E			9 53 8 37			0 56 9 08	
69	Nov. 6	Ñ E			8 33			9 23 17 42	
70	Nov. 7	N E	16 11 32	16 20 43 16 20 48	17 14 16 34 18	16 34 30	16 49	17 42	81
71	Nov. 11	N E	14 45 43 14 45 46	16 20 48		l	I .	14 58	
••		Ñ	14 45 46	14 48 02	14 48 50 14 48 52	14 49 00 14 49 45	14 51 14 53	14 58 15 07	52

Register of earthquakes-Continued

No.	Date	Compo- nent	Р	S	L	М	С	F	A
	1001		1	1		.	1		
72	Nov. 11	E	h. m. s. 18 47 55	h. m. s. 18 57 22	h.m. s. 19 10 08	h. m. s. 19 22	h. m. 19 45	h.m. 20 27	188
73	Nov. 13	N E	18 47 37	18 57 22 14 07 55		19 19 20	19 55	20 46 14 18	62
74	Nov. 14	N E N	7 08 12	7 11 50	14 12 05 7 13 58	7 16 30	7 21	14 21 7 32	12 29
75	Nov. 15 'Nov. 29	N N	7 08 00 20 54 47	7 11 50 21 04 51	7 14 11 21 21 05	7 16 55 21 22	7 19	7 35 22 11	24 50
76	· 1	N E			21 03 52 21 05 25	21 05 45 21 13 35		21 14 21 20	16 18
77 78	Dec. 2 Dec. 8	N E			21 08 12 55 40	12 58 00		21 18 13 04	11
79	Dec. 18	NENNENENE E	15 41 45		12 54 38	12 58 00		13 02	19
80	Dec. 31	E		15 51 19	0 12 04	15 51 42 0 14 42		16 26 0 18	75 14
	1922	N		20.00.00	0 12 04	0 14 26		0 18	18
81	Jan. 1	E N	19 54 27	20 00 59 20 00 59	20 04 01 20 04 01	20 06 25 20 08 14		21 46 21 51	170 210
82	Jan. 5	ž N			9 25 44 9 25 32			9 31 9 32	
83	Jan. 6	E N		14 34 45 14 35 15	14 52 30 14 53 00	14 54 44 15 36 10		16 27 16 15	48 31
84 85	Jan. 9 Jan. 14	N E			5 52 01 9 14 05	9 19 30		6 18 9 25	21
86	Jan. 17	N E	4 02 25 4 02 35	4 11 65	9 17 05 4 31 55	9 19 40 4 32 50		9 25 6 15	21 22 77
87	Jan. 19	N E	22 18 18	4 12 00 22 25 28 22 25 32	22 31 30	22 33 00		5 53 23 15	80
88	Jan. 22	N E	22 18 08 3 38 08	22 25 32 3 41 10 3 41 17	22 31 18 3 42 08	22 37 30 5 44 15		23 09 5 08	35 147
89	Jan. 22	E .	3 38 08 20 58 50	3 41 17 21 01 46	3 42 14 21 02 40	3 44 20 21 04 02		23 17	819 73
90	Jan. 26	ZE.	20 58 47 9 26 27	*******	21 02 52 9 34 25	9 35 45		22 30	69 26
91 92	Jan. 26 Jan. 31	E .	13 24 10	13 29 38	9 45 20	9 46 44	13 34	11 08 16 45	*850
93	Feb. 2	122	13 24 10		3 28 40		13 35	16 22 3 39	*850 *20
94	Feb. 21	27.		5 30 40	18 25 18 18 25 18	18 26 45 18 26 30		18 35 18 35	45 61
95	Feb. 24	N N		5 32 04	5 35 10 5 33 30	5 35 35 5 34 28		5 40 5 58	12 35
96	Mar. 4	N E	13 15 54 13 15 54	13 22 21 13 22 33	13 28 55 13 29 03	13 22 35 13 27 18		13 56 14 07	12 35 45 40
97	Mar. 10	E N			11 38 22 11 36 27	11 38 18		11 55 11 53	20
98	Mar. 10	N			17 06 27 17 06 27			17 24 17 24	24 28
99	Mar. 12	E N	17 39 17 38 09		17 43 14	17 45		17 55 17 52	21
100	Mar. 26	N E			13 58 16 13 58 16			14 16 14 27	
101	Mar. 28	N E		4 22 58 4 23 34		4 25 30 4 30 25		4 54 5 09	*20 *20
102	Apr. 2	N E	18 52 38		19 29 42 19 29 42	19 33 49 19 35 44		20 50 20 50	*240 144
103	Apr. 5	ezezzezezezezezezzezezezezezezezezezez	 		10 19 16 10 19 16	10 36 10 10 27 30		11 23 11 30	*50 *32
104	Apr. 8	N			21 26 45 21 23 07	21 33 00 21 32 00		. 21 41 21 44	*20 58
105	Apr. 10	Ň			4 12 40 4 10 40			4 28 4 28	
106 107	Apr. 11	N	0 35 02 0 35 02		0 45 10 0 41 56	0 46 26 0 48 20		1 33 1 30	42 24 53
108	Apr. 25	N	1 28 54	21 33 18 1 33 16	21 44 55 1 36 06	21 49 40		22 58 1 42	14
109	Apr. 26	E N	4 14 39 4 14 39	4 20 31 4 20 31	4 25 32	4 29 13 4 20 45		5 54 5 21	19 29
110	May 3	N			4 25 32 4 14 00 4 14 00			4 54 5 14	11 7 *40
111	May 4	N	9 21 20 9 21 20 9 32 17	9 28 08 9 28 08		9 38 16 9 34 58		11 30 11 35	*34
112	May 11	N	9 30 36		9 37 9 37 38	9 52 12 9 50 43		10 29 10 21	11 15
113 114	May 12 May 14	E	18 48 54	18 56 37	16 10 30	19 07 22		20 05 16 16	55
115	May 23	ZEZEZEZEZEZ	3 24 09 3 23 23		16 09 55 3 25 35 3 25 00	3 25 55 3 25 55	3 29	20 05 16 16 16 22 4 05 3 49	121 97
	, '	īń	3 23 23		X 25 00	3 25 55	3 29	3 49	97

$Register\ of\ earth quakes -- Continued$

No.	Date	Compo- nent	P	s	L	М	С	F	A
	1922	 	h. m. s.	h. m. s.	h. m. s.	h. m. s.	h. m.	h. m.	μ
116	May 24	E			8 22 23	!		8 25 8 26	
117	May 26	E	9 07 50		9 08 38			9 11	18 14
1 18	June 2	N	9 07 50 9 07 52 20 23 20 20 23 32 4 57 20	20 34 00	8 22 23 8 22 23 9 08 38 9 08 38 9 08 38 20 51 05	20 54 28		9 11 21 27	14 26
		Ñ	20 23 32	20 34 00 20 33 56 5 02 55				21 29	
119	June 12	E		5 02 55	5 12 07 5 10 08	5 14 30 5 14 11		6 46 6 55	40
120	June 12	E	10 57 57 10 58 10	5 02 50 11 02 40	11 03 50	11 05 45		12 11	40 52 45 55
121	June 12	N	10 58 10	11 02 18	11 04 07 14 14	11 05 10		12 18 14 28	
122	June 16	E	21 06 20		14 14 21 17 38 21 16 28	21 21 34 21 21 02		14 28 21 34 21 28	14
123	June 21	E	21 00 20		13 23 05	21 21 02		13 24	14 14 3
124	June 22	N Tr.			13 23 05 13 23 05 20 25 17 20 25 30 15 03 30	20 26 00		13 29	7
		ที		-11-20-12-	20 25 17 20 25 30 15 03 30	20 26 32 15 15 18		20 59 20 52	7 3 16
125	June 27	N N	14 41 20 14 41 20	14 50 45				15 54 15 25	
126	July 2	E	13 42 45 13 42 34	14 50 45 14 51 45 13 47 55 13 47 55	13 51 01 13 51 01	13 53 47 13 53 47 18 53 23 18 53 23		15 51	175 140
127	July 5	E	13 42 34	13 47 55	18 50 45	18 53 23		15 42 19 06	19 15
128	July 13	N			18 51 00 5 19	18 53 23		19 03 6 01	15
		Ŋ			5 19			6 01	
129	July 29	E			20 24 15		-	20 33 20 30	iô
130	Aug. 3	Й			10 05			10 16	
131	Aug. 5	E N			16 02 00 16 02 00			16 13 16 08	******
132	Aug. 6	E	1 20 09 1 20 01		1 21 15 1 21 01	1 22 28		1 30 1 32	4 7
133	Aug. 7	E	12 40 25 12 40 50	-10.10.10	1 21 01 12 51 35 12 50 31	12 53 22		13 28	14
134	Aug. 11	E	12 40 50	12 46 40 13 52 45 13 52 45	13 55 54	1 22 28 1 22 28 12 53 22 12 53 59 13 57 32 13 57 36		1/1/20	7 14 12 14 14 14
135	Aug. 13	N E		13 52 45	13 55 59	13 57 36		14 38 2 28 2 37 12 07	l
136	Aug. 14	N			1 05	1 23 16		2 37 12 07	21
	_	ğ		70 11 00	1 11 55 40	10 17 01		12 07 12 15 16 24 16 25 5 30 21 25 21 13 12 37	66
137	Aug. 16	N E		16 11 20 16 11 17	16 17 20 16 17 20	16 17 21 16 17 25		16 24 16 25	39
138 139	Aug. 18 Aug. 18	N E			16 17 20 5 27 40 20 58 12 20 58 03 12 06 30 12 07 39 20 25 30 2 44 50 6 47 15			5 30 21 25	
	_	Ĭ Ĭ			20 58 03			21 13	
140	Aug. 25	N N	11 52 40 11 52 40 19 58 35	12 00 00	12 06 30	12 10 20 12 10 24 20 16 55		12 37	8 10 4
141 142	Aug. 25 Aug. 26	N	19 58 35	20 09 40	20 25 30			12 37 12 32 20 27 2 51 7 06 7 23	
143	Aug. 26	E	6 41 15	6 45 35	6 47 15	6 49 58		7 06	12
144	Aug. 29	N E	6 41 24			6 49 58 6 54 29 17 56		7 23	12 9 8
145	_	N	10 49 40		-11 07 40	11 09 00		18 10	3
146	Aug. 30	Ē	10 49 40		11 07 40 23 03 40 23 03 56			11 22 23 08	
147	Sept. 1	N E			23 03 56	23 07 27 19 59 36		23 10 22 08	6 134
	L	Ñ	19 27 34	19 37 12	19 49 56 20 37 13 1 51 05 22 54 0 37 56 0 37 56	19 52 02		23 08 23 10 22 08 21 19 20 40	61
148 149	Sept. 2 Sept. 6	E			1 51 05				
150 151	Sept. 6	E.			22 54		0 40	23 01 0 48	<u>î</u> ī
	Sept, 9	Ŋ			0 37 56	0 39 30 0 39 41	0 41	0 48 13 02	9
152 163	Sept. II	E						13 02 15 28	
154	Sept. 12	Ĕ			15 24 11 52 05	11 56 12		15 28 12 12 12 12	9
155	Sept. 14	N N	19 52 40		11 54 22 20 07 15	20 02 45		20 50	*13
156	Sept. 16	E	23 05 35			23 32 30 23 16 50		23 50 23 43	13
157	Sept. 17	É	7 43 58		7 57 25 7 58 00 10 36 00	8 00 40		20 50 23 50 23 43 8 52 8 28	15
158	Sept. 17	E	23 05 35 23 05 35 7 43 58 7 43 58 10 20 19		10 36 00	11 56 12 11 56 09 20 02 45 23 32 30 23 16 50 8 00 40 8 00 30 10 42 42 10 45 35	10 50	11 14	*13 5 13 15 6 23 8
159	Sept. 18	ZEZBZBZBZBZBZBZBZBZBZBZBZBZBZBZBZBZBZBZ	10 20 19		10 34 15	12 10 18		11 03 12 17 12 17	
160	Sept. 30	N E		8 33 00	12 08 40 8 35 32	1 12 10 30		12 17 9 21	3 23 18
161	Oct. 5	N	8 30 25	8 33 03	5 48	8 38 30 8 38 19		9 21 9 17 6 09	18
101	. 000-	. E			0 40				

Register of earthquakes—Continued

No.	Date	Compo- nent	P	s	ï.	М	C	म	Λ
162 163 164 165 166 167 168 169 170 171 172 173	Oct. 1922 Oct. 24. Oct. 27. Nov. 4. Nov. 7. Nov. 11. Nov. 17. Nov. 21. Nov. 22. Dec. 14. Dec. 19. Dec. 23. Dec. 31.	ZEZEZEZEZEZEZEZEZEZEZEZEZ	23 15 30 18 03 40	23 32 10 4 57 25 4 57 25 11 34 50 11 34 50 23 22 05 23 22 05		15 34 54 15 26 40 21 43 04 3 36 07 3 36 07 3 36 07 3 36 07 23 47 00 23 46 36 5 18 11 49 11 49 11 49 14 00 20 14 00 20 14 00 20 15 04 50		15 04 3 39 3 30 24 50 24 52 8 46 8 49 13 03 14 05 14 05 15 08 15 11	# 21 *32 350

REMARKS

- 1. Beginning indefinite; LR at 14:08.
 3. Phases tabulated as P and S do not fit in with L.
 4. Beginning indefinite. The old Milne saismograph was dismounted on January 27 and the new Milne-Shaw seismograph was started on February 25.
 5. An impetus on both components at 18:37:56.
 8. The phases tabulated as P and S are well defined but do not harmonize with L.

9. SR₂ on N at 8:17:11.

- 10. The phase tabulated as S may be some other phase.

 12. The phase tabulated as P resembles S but no evidence of P could be found among the preceding microseisms.
- microscisms.

 10. E not in operation. The tabulated S, SR₁ at 5:59:24 and SR₂ at 6:00:32 correspond approximately with the location of the epicenter and time at origin derived from other stations.

 21. P_E doubtful; N ill defined.

 22. △=5,900 km.

 23. SR₁ on N at 11:54:23.

 24. SR₂ on E at 20:40:42. △=6,000 km.

24. Sit₄ on E at 20:40:42. Δ=6,000 km.
25. Difficult to interpret; initial phase may be SR₁.
26. 29. No distinct phases.
27. SR₁ on E at 9:08:31. Δ=8,000 km.
30. Phases not well defined. A slight renewal of activity from 10:86 to 10:40 may be from the local shock recorded at Tucson.
31. Lengy comes that a factority.

31. L may come as late as 2:21:44.
32. Phases indistinct. E obscured by overlapping of record.
34. Difficult to interpret. The phase tabulated as P is probably PR₁. There is also an impetus on N at 14:37:12.

t 14:37:12.
30, 39, 40, 41. Phases ill defined.
42. P doubtful. Phase on N at 10:59:21 may be L.
43. P and S not well defined.
44. Distance 2,700 km.
49. SR.E at 20:53:27; O at 20:31:25; distance 6,200 km.
53. O at 6:09:35; distance 3,100 km.
55. PR, on both at 20:05:36; PR_{2N} at 20:07:30; SR₁ at 20:19:03 on E, at 20:18:45 on N. P difficult to dissociate the melacestance. tinguish from microseisms.

7. PR₁, at 4:19:10 on E and at 4:19:18 on N; SR₁ at 4:32:20 on N.

67. Fr.; at 4:18:10 on E and at 4:19:18 on N; Sr.; at 4:32:20 on N.
69. 61. 62. 63. No definite phases.
65. SR_iN at 2:37:07; maximum amplitude at P.
66. Some motion at 5:07:11, but it may not be seismic. The phase tabulated as S may be L.
69. Beginning lost in changing paper from 17:07 to 17:14.
71. 73. Phases ill defined.

- 71, 76. Findes in defined on N at 18:57:30, 133 µ. 72. Actual maximum on N at 18:57:30, 133 µ. 75. E obscured by overlapping. 79. PR₁ on N at 15:45:03. SR₂ at 16:00:20. 81. L doubtful.

83. An emergence on E at 14:41:17.

86. Actual maximum on E at 4:12:35, 307μ and on N at 4:13:13, 113μ. SR₁ on N at 4:17:01.

90. N not operating. F lost in next earthquake.
91. N not operating. Beginning confused with end of 90. Recorded on Z variometer from 9:48 to 9:49.

92. PR₁ at 13:25:11 on E and 13:25:20 on N. SR₁ at 13:32:10 on E and 13:31:40 on N. Spots moving too rapidly to record between 13:32 and 13:34. The greatest amplitude recorded is tabulated. The values given are the trace amplitudes divided by 100.

iven are the trace amplitudes divided by 100.

94. Local shock. Recorded on D variometer from 18:25 to 18:27.

95. No distinct phases.

96. PR, on N at 13:17:29. SR₁ on E at 13:25:30, on N at 13:25:20. SR₂ on E at 13:26:50, on N at 13:26:41.

98. This may not be seismic; most of the record lost while changing paper.

99, 100. No distinct phases.

107. SR₁ on N at 21:40:00. Record of E lost by overlapping of lines.

111. PR₁ at 9:23:23. SR₁ on N at 9:31:30. SR₂ at 9:32:35 on E and at 9:33:05 on N.

112. The first phase on N may not be seismic.

113. E lost by overlapping of lines.

115. P doubtfull. Activity on E at 3:20:17. Recorded on D and H variometers from 3:24 to 3:27.

116. No definite L nor M on N. O at 20:10:38; distance 9,600 km.

117. Pa barely perceptible. SR₁ on N at 5:06:08; possibly SR₂ on E at 5:07:55. O at 4:47:30; distance 5,080 m. km. 122. Emergence of E at 21:16:18

125. O at 14:29:54, distance 8,100 km.
126. SR, at 13:49:49. O at 13:35:47, distance 3,580 km.
127. SR, at 13:49:49. O at 13:35:47, distance 3,580 km.
132. Phases Ill defined.
133. Pa doubtful. PR, on N at 12:42:10. SR, at 12:48:55 on E and at 12:48:38 on N. O at 12:33:28,

133. Ps doubtful. PR; on N at 12:72:10.

distance 4,050 km.

135. Another M on N at 2:23. Nothing definite on E.

137. PR; at 16:06:21. SR; at 16:14:63 on E and at 16:14:43 on N. L₂ at 16:08:04 on E and at 16:08:08 on N.

O at 15:55:58, distance 5,080 km

140. SR; on N at 12:04:22. L₂ on N at 12:10:00. O at 11:43:27, distance 5,700 km.

141. E record lost through overlapping of lines. SR; at 20:16:22. SR₂ at 20:21:30.

143. Nothing definite on N. Emergence on E at 6:43:45.

147. SR; on N at 19:41:50. SR₂ on N at 19:45:20. E record obscured by overlapping of lines. Actual maximum on N at 19:37:10, 92:; O at 19:15:54, distance 8,360 km.

155. E record obscured by overlapping of lines. Another phase on N at 20:01:10.

156. Other pbases at 23:17:25, 23:21:25 and 23:30:02 on E and 23:15:02 on N. Distance may be 5,200 km.
157. L doubtful.
158. SR₁ on N at 10:30:18.
160. P and S very weak. A phase on N at 8:32:30 may be PS.
162. SR₁ at 15:20:40 on E and at 15:20:10 on N. SR₂ at 15:25:20:20 on N.
163. E not operating. PR₁ on N at 21:31:29. O at 21:20:56, distance 5,200 km.
166. PR₁ at 23:23:23 on E and at 23:27:03 on N. Another phase on N at 23:37:25. Interpretation doubtful.
167. PR₁ at 4:50:21. Another impetus at 4:50:40:PR₂ at 4:52:44; PS at 4:59:32; SR₁ at 5:03:45 on E and 5:03:50 on N. SR₂ at 5:10:15 on E and 5:00:25 on N. La at 5:17:22. Liep at 8:12:20 on E at 8:12:10 on N.
169. Che first transpace may be a SR₂ indicating Chila as the criminal property on N. 5:03:30 on N. SR2 at 5:10:16 on E and 5:09:25 on N. La at 5:17:22. L rep. at 5:12:20 on E at 8:12:10 on N. 188. The first two phases may be S and SR₁ indicating Chile as the origin. Ln may be at 11:43:55 or 11:48:09 instead of 11:46:55.

170. Not well defined.

171 PR, on E at 23:17:45.

172 Phases ill-defined.

174. SR₁ at 7:39:42 on E and at 7:39:30 on N. O at 7:19:54, distance, 5.310 km.

MAGNETIC STORMS

Magnetic disturbances of considerable magnitude were recorded at the times tabulated below. When the storm began abruptly, the time is given to the nearest minute.

On the succeeding pages will be found reproductions of the magnetograms showing the principal magnetic storms. A storm selected for reproduction is indicated in the table by an asterisk after the date. An upward motion of the curves corresponds to decreasing east declination, increasing H, and decreasing Z.

UNITED STATES DEPARTMENT OF COMMERCE

R. P. LAMONT, Secretary

COAST AND GEODETIC SURVEY

R. S. PATTON, Director

RESULTS OF OBSERVATIONS MADE AT THE UNITED STATES COAST AND GEODETIC SURVEY MAGNETIC OBSERVATORY NEAR HONOLULU, HAWAII IN 1923 AND 1924

BY

W. N. McFARLAND

Associate Mathematician Division of Terrestrial Magnetism and Seismology



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON: 1929

RESULTS OF OBSERVATIONS MADE AT THE UNITED STATES COAST AND GEO-DETIC SURVEY MAGNETIC OBSERVATORY NEAR HONOLULU, HAWAII, IN 1923 **AND 1924**

CONTENTS Page Constants of magnetograph... Absolute observations and base-line values.... Summaries of monthly and annual means Hourly values of declination, 1923 Hourly values of horizontal intensity, 1923 Hourly values of vertical intensity, 1924 Hourly values of horizontal intensity, 1924 Hourly values of vertical intensity, 1924 Hourly values of vertical intensity, 1924 Earthquakes_____ Magnetic storms 104 ILLUSTRATIONS Figures 1-10. Reproductions of magnetograms showing the principal magnetic storms 106

INTRODUCTION

[Latitude, 21° 19'.2 N.; longitude, 158° 03'.8 W.; elevation 50 feet (15 meters)]

The Honolulu magnetic observatory is situated on a large coral plain, 12½ miles (20 km.) west of the city of Honolulu, Oahu Island, Hawaii. Its operation began in January, 1902. For a description of the buildings and instruments see the first volume of observatory results. The methods of observing are explained in Directions for Magnetic Measurements, by D. L. Hazard, published in 1911, second edition in 1921.

The division of terrestrial magnetism of the Coast and Geodetic Survey, of which N. H. Heck, hydrographic and geodetic engineer, is chief, includes both office and field work. The work of the Honolulu observatory was carried on during the two years by H. E. McComb and W. M. Hill, magnetic observers. H. E. McComb was in charge of the observatory from January 1 to May 31, 1923, when he was relieved by W. M. Hill. Mr. Hill continued in charge until August 14, 1924, when Mr. McComb again took charge, continuing to the end of the year. The office computations and preparation of results for publication were in charge of D. L. Hazard, the assistant chief of the division, and the writer, assisted by O. S. Hill. Appreciate McCorthy, and J. I. Keplen, methometricians, and R. R. Bedde and by O. S. Hill, Augustine McCarthy, and I. I. Kaplan, mathematicians, and R. R. Bodle and Louis P. Sissman, magnetic observers.

Up to the end of 1914 each hourly value of declination, horizontal intensity or vertical intensity in the monthly tabulations represented the momentary value of the quantity for the specified hour, local mean time. Beginning with 1915 the published hourly values are average values for successive periods of an hour, beginning at midnight of the specified standard meridian time (one hundred and sixty-fifth meridian in the case of Honolulu). Thus a value in a column headed 1 represents the average value for the hour beginning at midnight and ending at 1 a. m., one hundred and sixty-fifth meridian mean time.

INSTRUMENTS

VARIATION INSTRUMENTS

The magnetograph is of the Eschenhagen pattern and consists of declination (D), horizontal intensity (H) and vertical intensity (Z) variometers, and a recording apparatus. The variometers are mounted west of the recording apparatus. Upward motion of the curves on the magnetogram corresponds to decreasing east declination, increasing H and decreasing Z. Variations in temperature were determined by means of the photographic

In April, 1903, a Milne seismograph belonging to the seismological committee of the British Association was transferred from Oahu College to the magnetic observatory. In February, 1921, this instrument was replaced by a Milne-Shaw seismograph. It consists of two horizontal pendulums, one recording east-west motion (E) and the other recording north-south motion (N). Because of the large magnification (150), microseisms are continuously present on the seismograms, with amplitudes ranging from 0.5 mm. to 2.0 mm. and predominant periods of 4 and 8 seconds, the larger amplitudes usually accompanying the longer period. Preliminary phases of small amplitude are difficult to separate from the microseisms. The amplitudes have been computed on the basis of the constants given below.

Period of pendulums, 12.0 sec. Multiplication, 150.

Damping ratio, about 20:1. Sensitivity, 25 to 30 mm.

In order to find a place in the table for impulses and emergences which have not been identified with any phase of the seismogram, the times of their appearances have often been included in the column headed P and sometimes in the columns headed S and L.

On January 31, 1925, the President approved an act of Congress which authorized the Coast and Geodetic Survey to make investigations and reports in seismology, and in accordance with the provisions of this act the scope of the work of this bureau in seismology has been enlarged, and its importance has been felt to warrant the issuance of separate publications for the seismological reports. Accordingly, the records of the operation of the Milne-Shaw seismograph at the Honolulu Magnetic Observatory will be published hereafter in the seismological reports, which are issued quarterly, beginning with the first quarter of 1925.

Register of earthquakes

					_						
No.	Date	Compo- nent	:	P		8	L	M	О	F	A
	1923		,	m.		h. m. s.	h, m, s,	h. m. s.	h. m.	h. m.	
٠,١	Jan. 2	N		<i>,,,</i> ,	٠.	16. 116. 0.	22 57 02	24 00 18	16. 110.	24 19	25
1 2	Jan. 8	N N	e 22	09	10		22 01 02	22 11 50		22 16	1 2,000
3	Jan. 14	TE	12	59	40		12 59 50	13 01 40	13 03	13 10	82
٥	Jau. 11	Ñ E E	? 12		18		12 59 55	13 01 45	13 02	13 15	104
4	Jan. 22	E	e 1	10	34			1 14 32		1 22	1 2, 300
ž	do	E	i 9	11	15	9 16 50	9 19 02	9 21 49		11 16	176
0		N E	i 9	11	15		i 9 18 52	9 21 06		11 29	230
в	Jan. 27	E	e 8	19	12					8 23	
۰	VULL AVIII	NNNE	6.8	18	24			8 19 32		8 23	19
7	Feb. 1	N	19	42	12	? 19 47 47	19 49 30 1 28 30	19 49 54		20 01	130
8	Feb. 2	N	1	21	53	? 1 27 16	ì 28 30	1 31 23		1 51	80
9	do	E	5	16	41	5 22 46 5 22 30	5 29 21	5 30 08		6 55	310
•		N	5	16	08	5 22 30	5 29 21 5 28 10	5 32 45		6 55	420
10	Feb. 3	E	i 16	10	15	i 16 16 58	16 22 18			20 53	
		N	i 16	10	15	i 16 16 58	16 22 12	l	l _	20 53 0 23	
11	Feb. 8	E	e0	16			Í		l <i></i>	0 23	
		N	e 0	16						0 23	
12	do	E	e 8	11	10	e 8 14 04	e 8 17 20			8 36	
14		N	68	11	00					8 27	
13	Feb. 10	E	e 7	11	33					8 27 7 13	
10	2 001 202222	N	e 7	12	28					7 13	
14	Feb. 11	E	e 22	59	40		e 23 04 20	23 04 51		23 18	30
**		N					e 23 04 30	23 05 18		23 26 2 49	50
15	Feb. 12	E	? 2	07	02		2 20 11	2 22 41		2 49	60
10		Ñ	? 2	07	02	2 13 51	2 20 11 2 19 55	2 21 37		2 45	80
18	Feb. 16	E	6.9	35	10			9 36 34		9 40	10
10	100/10111111111111111111111111111111111	Ñ	e 9	35						9 40	l
17	Feb. 19	Zezezezezezezezezez	e 0	02						0 08	
^,		N	e 0	02						0 17	
18	Feb. 21	N	e 4	11						4 23	
19	Feb. 23	E	i 6	13	46		6 35 25		.	6 43	
~~		N	e 6	14	30	e 6 24 27				6 34	
20	Feb. 24	E	7	42 42	57	i 7. 49 34	7 55 21	7 53 40		10 37	180
		N	7	42	57	i 7 49 34	7 54 46	7 56 00		10 40	200
21	Feb. 25	E	e 14	58						15 03	
		N	e 14	58					. -	15 03	<u>-</u>
22	Feb. 27	E	e 20	55						21 03	
		EZEZEZEZE	e 20	55						21 03	
23	Mar. 1	E	e 8	40	05			8 44 26		9 41	60
		N	e 8	40	05			8 43 36		9 44	40
24	Mar. 2	N	e 17	20	42	e 17 25 32	17 30 10 7 11 46	17 33 20 7 12 10		18 10	32
25	Mar. 4	\mathbf{E}	7	07	42	7 10 33	7 11 46	7 12 10		7 58	38
		N E N E				7 10 49	7 11 46 22 49 10	7 16 06		7 58	21 50
26	Mar. 16	E	e 22	22	57	e 22 35 48	22 49 10	22 50		23 24	50
- 1		N	e 22	22	57			22 49 09		23 00	40
27	Mar. 24	E	13	03	48	13 09 22 13 09 50	13 13 40 13 15 55	13 26 50 13 27 17		14 24	42
		N E N	13	03	48	13 09 50	13 15 55	13 27 17		14 24	32
28	Apr. 13	E	10	19	17				-	. 19 29	
	•	N	10	19	17				-	19 23	
29	do	N	15	39	30	i 15 46 13	15 52 10	15 53 52		16 22	150
30	Apr. 19	E.	e 3	32	51					4 28	
	•	N E	e 3	32	10					4 17	
31	Apr. 29	E	e 2	46	20			2 48 18		2 56	14
	• •	N N	e 2	45	42			2 47 25		2 55	18
32	May 2	l N	e 16	39	30	l		16 41 54		. 16 49	10
1											

¹ Trace amplitude.

Register of earthquakes—Continued

No,	Date	Compo- nent	P	s	L	М	С	F	A
No, 33 34 35 36 37 38 39 40 41 42 43 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60	Date 1923 May 4 1923 May 5 1923 May 5 1924 May 15 May 12 May 15 May 28 May 28 May 30 1940 May 31 May 28 May 30 May 31 May 30 May 31 May 30 May 3		h. m. s. 16 33 36 16 33 36 16 33 36 16 22 51 45 19 00 15 19 00 15 19 00 15 19 00 15 19 00 16 2 09 40 16 21 48 22 45 29 17 34 08 11 43 52 17 34 08 11 43 52 17 34 08 11 43 52 18 17 00 18 24 07 18 24 07 18 24 03 19 00 00 19 00 00 19 00 00 19 00 00 19 00 00 20 19 00 20 20 19 00 20 20 19 00 20 20 19 00 20 20 19 00 20 20 20 19 00 20 20 20 19 00 20 20 20 20 20 20 20 20 20 20 20 20 20 2	17 41 49 22 51 51 51 51 51 51 51 51 51 51 51 51 51	h. m. s. 16 41 37 16 42 45	h. m. s. 16 44 45 16 45 26 23 39 30 15 20 40 2 13 10	18 03 20 51	h. m. 19 52 24 19 15 27 15 27 15 27 2 19 21 54 22 02 25 26 9 19 9 19 9 03 9 20 18 39 9 20 07 23 07 23 17 24 14 21 54 6 49 18 03 18 10 9 40 9 30 23 51 24 05 8 36 8 36 8 36 8 1 25 21 25 1 21 3 30 23 31 2 23 30 23 35 13 21	151 730 6 14 17 154 134 34 355 10 4 186 47 7 14 184 180 15 12
61 62 63 64 65 66 67 68 69	July 10 July 12 do July 13 July 14 July 16 July 17 July 22 July 23 do	HZ H	7 0 53 24 0 54 24 i 3 23 29 i 3 28 92 i 9 28 02 i 9 28 02 i 11 24 15 11 24 15 e 16 17 20 7 0 07 00 e 13 47 28 13 47 28 13 47 28 13 47 28 14 25 20 i 14 25 18	1 01 00 1 01 10 1 03 30 00 i 3 30 00 i 3 30 00 111 32 44 i 11 32 44 0 15 20 0 15 20 0 15 20 13 54 43 13 54 33	13 04 11 1 08 55 1 14 24 13 33 19 3 33 50 19 32 05 9 32 10 11 41 52 ? 11 40 04 0 25 40 0 24 40 14 00 50 	3 35 30 3 36 30 9 34 00 9 35 30 11 32 46 11 33 01 	14 45 14 45 7 57 7 57	2 20 2 20 5 24 5 34 10 14 10 23 13 18 12 50 0 48 0 40 15 01 14 55 1 27 1 27 28 8 54 8 54	8 10 488 600 14 22 45 24
70 71 72 73 74 75 76 77 78 79 80 81	July 26	ZZEZEZEZEZEZEZEZE	e 9 16 e 9 16 e 3 36 e 3 36 e 7 44 55 e 10 12 57 15 15 16 e 9 40 56 e 10 39 12 e 10 40 40 e 1 29 10 e 1 29 55 e 10 40 00 e 10 36 47 e 10 36 47	e 22 32 04 e 22 33 38 1 17 18	7 48 20 10 16 21 15 24 30 15 24 06	7 52 46 10 20 59 15 27 45 15 33 20 9 44 31 9 43 26 1 32 05 10 42 45 10 41 30		9 32 3 38 3 41 8 21 11 23 17 45 9 50 10 45 1 40 1 40 1 51 9 90 23 30 23 28 2 18	33 22
82 83 84 85 86 87 88 88	Aug. 12	Zezezezezeze	e 1 07 28 e 1 11 49 10 25 39 10 25 39 e 7 03 24 e 7 04 49 e 1 50 31 12 26 57 12 27 04 e 12 42 22 5 33 19 5 33 19 6 8 03 5 e 8 02 57 e 11 50 50	e 10 37 43 e 10 33 50 e 12 34 12 e 12 33 35 5 38 58 5 39 10	12 52 50	1 17 30 10 47 30 10 53 00 7 19 00 7 15 00 12 37 40 12 37 34 12 55 30 5 41 14 5 41 20	5 49 5 47	7 41 7 29 2 05	20 30 22 22 22

$Register\ of\ earth quakes -- Continued$

No.	Date	Compo- nent	P	S	L	M	С	F	A
90	1923 Aug. 28	E	h. m. s. e 23 23 00 23 23 28	h. m. s. 23 29 49	h. m. s. 23 34 35	h. m. s. 23 38 22	h. m.	h. m.	μ 59
	•	Ñ	23 23 28 e 12 35 54	23 30 01	23 34 35 23 33 58	23 38 23 23 40 56 12 48 22	23 52	26 02 13 04	72 4
91	Aug. 31	ZEZEZEZE	e 12 34 12	3 16 22		12 46 25 3 25		13 04 9 15	6 1, 160
92	Sept. 1	N N	3 08 17	3 16 08			4 02	9 22	1,000
93	Sept. 2	N	2 56 20 2 56 24	3 04 00 3 04 06	e 3 14 38 3 13 28	3 13 36	4 02	6 27 6 27	184 120
94	do	N	9 36 30 9 36 30	9 44 12 9 44 12	e 9 54 14 e 9 55 07	9 56 23 9 57 15		11 12 11 13	29 13
95 96	do Sept. 9	N E	e 23 02 22 28 12 22 28 12	22 35 49	e 22 46 51	23 01 50		24 31 24 28	29
97	Sept. 12	N E	22 28 12 6 07 50	22 35 50	e 22 46 40 e 6 11 08	22 49 30 6 13 30		24 30 6 23	63 48
98	Sept. 16	l N I	e 16 54 14		e 6 11 08 e 17 05 33	6 11 30 17 12 14		6 20 17 36	24 32
99	•	E N N	e 16 54 20 e 8 17		e 17 06 15	17 10 16		17 39 8 26	13
100	Sept. 17 Sept. 22	E N	e 15 21 12 e 15 22 01					15 38 15 30	
101	do	E N	e 18 27 52		e 21 41 28 e 21 42 28	21 55 58 22 05 35		22 29 22 24	23 21
102	Sept. 23	E	e 17 44 e 17 44					18 12 18 12	
103	Sept. 26	E N	e 8 38 08	8 41 12 8 41 12	8 48 43 8 48 47	8 50 09 8 51 40		10 01 10 01	24 27
104	Sept. 27	E	7 22 13					8 05 7 52	
105	Sept. 28Sept. 30	N E	e 21 34 22	1 AF 01		2 10 53		21 55	28
106		E N	el 34 17	1 45 31 1 45 38	2 03 30 i 4 06 35	2 10 33 2 10 31 4 09 28	4 24	3 22 5 19	46 170
107	Oct. 7	E N	e 3 41 08 e 3 41 20	1 45 38 13 50 46 3 50 46 ? 7 34 20		4 05 30 8 03 00		5 19 8 09	85 13
108 109	Oct. 10	N E	i 21 17 54				21 51		12
110	Nov. 3	N E	21 18 04 i 16 38 41	21 25 04	21 30 40 16 48 40	16 50 30	21 51	17 39	155 105
111	Nov. 4	N E	e 16 38 35 0 13 52	e 16 46 00 i 0 21 31	16 49 37 0 29 35	16 50 50 0 32 05		17 16	60 225
112	do	N E N	e 0 13 58 e 20 29	i 0 21 31	0 30 20	0 31 28		1 31 20 37	300
113	Nov. 5	E	e 20 34 34 21 47 21					20 37	
114	Nov. 8	N E	21 47 21 e 0 14 49	i 21 54 38		21 59 08 0 17 08		22 46 0 24	95 15
115	Nov. 9	N E	e0 14 43 e3 41 45	e 3 43 56		0 15 52 3 47 20		0 21 3 53 3 53	15 15
116	Nov. 10	N E	e 3 41 10 e 4 23 16			3 43 10		4 28	10
117 118	Nov. 12	N E	e 12 05 00 e 4 31 10]	L	12 06 30 4 32 50 3 12 28		12 10 4 47	25 50
119	Nov. 17	E	e 3 05 15 e 3 05 20	e 3 06 23	3 07 15 3 07 25	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		3 33 3 33	25 65
120 121	Nov. 18 Nov. 19	NEEN	e 22 04 45 e 21 02 18			21 05 30		22 18 21 06	5
		Ñ E	e 21 02 25 e 17 38					21 05 17 48	
122 123	Nov. 25 Dec. 5	E			e 23 10			23 25 16 20	
124	Dec. 7	N E	e 16 13 19 39 00			16 15 20 19 40 20		16 20 19 47	15
125	Dec. 19	E	19 39 00					,	
126	1924 Jan. 7	E	e 10 09 27 e 10 10 33			10 13 45 10 13 45		10 23 10 19	30 45
127	Jan. 12	E N E N	e 14 11 e 14 14					14 22 14 25	
128	Jan. 14	E	e 21 07 25	21 07 58	21 17 08 21 16 15	21 37 17 21 17 14	21 41	22 05 21 59	60 35
129	Jan. 16	N E	21 00 e 21 52 36	21 07 40				22 00 22 00	
130	Jan, 21	N E N	e 21 52 36	2 07 . 28 2 07 28	2 11 18 2 11 30	2 12 40 2 12 46	2 19 2 19	2 36	20 20
131	Jan. 25	E	? 2 02 52 ? 6 14 22 ? 6 14 15	e 6 20 55	6 25 12	6 28 20 6 27 19	6 36	2 34 7 29 7 23	45 45
132	Jan. 26	E	e 3 37 37	e 6 20 15	6 22 18			3 52 3 50	
133	Jan. 29	N E	e 3 38	? 2 21 45	2 39 42	2 41 06		3 21 3 21	40
134	Feb. 16	NEZEZEZE	e 0 37 17		2 40 00	2 40 43		0 45 0 50	30
135	Feb. 21	N E	e 0 36 25 e 13 30					13 35	20
136		N N	e 13 30 00 e 5 58 49		,-::	13 32 03 6 02 15	6 05	13 35 6 16	60
137	Feb. 24 Mar. 4	E N	e 10 28 06	10 28 30 10 29 04	i 10 40 34 e 10 40 00	10 41 45 10 38 14		12 22 12 30	195 85
138	Mar. 11	E N	e 11 14 00 e 11 12 30				 	11 31 11 31	
139 140	Mar. 14 Mar. 15	N E	e 2 50 10 40 52	i 10 48 44	i 10 54 40	10 57 14 10 56 58	 	2 56 12 00	75
141	Mar. 26	N E	e 10 48 42	10 49 00	i 10 54 40 e 20 20 41	20 23 22		11 40 20 46	75 18
142	Mar. 30	N E			e 20 20 41 0 24 09	0 27 29		20 46	45 110
143	Apr. 3	N E			0 24 09 e 1 52	0 28 07		1 30 2 01	60
149	April Outside State Stat	N	e 1 44 40			1 49 30		2 01	65

HONOLULU MAGNETIC OBSERVATORY

Register of earthquakes-Continued

No.	Date	Compo- nent	P	s	L	М	С	F	A
144	Apr. 14	Е	h. m. s. e 9 14	h. m. s.	h. m. s.	h. m. s.	h. m.	h. m. 9 23	μ
145 146	do Apr. 2i	N E E N	e 9 16 48 16 32 13 20 10 32	16 42 18 20 17 52 20 17 55	17 01 05 20 25 20 20 24 00	17 03 21 20 18 35 20 18 49		9 23 19 12 20 45 20 45	390 13 14
147 148	Apr. 29 Apr. 30	ZZEZEZE	e 21 12 13 e 4 26			21 16		21 34 4 34	19
149	do	N E	e 4 26 e 5 25 38					4 34 5 50	
150	May 1	E	e 5 25 38 20 04 27	20 12 45	20 23 00	20 27 17		5 50 21 43	27
151	May 4	N N E	20 04 27 e 16 59 43	20 12 55 17 02 16	20 23 00 20 22 18 17 03 28	20 27 05 17 05 50		21 44 18 24	36 133
152	May 6	N	e 6 38 25 e 6 40 00					6 42	
153	do	ZH	e 10 46 26 e 10 46 20					10 52 10 52	
154	do	E N	e 16 22 11 e 16 22 37	16 31 30 16 31 30	16 45 15 16 45 10	16 54 48 16 54 10	 	17 17 17 14	22 15
155	May 8	E N	e 6 03 15 e 6 02 43					6 07 6 12	
156	May 10	E N	e 3 07 49 e 3 07 49			3 19 3 19		3 30 3 42	7 7
157	May 17	E N	e 4 03 17 e 4 03 08	4 04 18 4 04 23	4 04 59 4 05 05	4 05 50 4 08 27		4 16 4 16	24 11
158	do	E	e 5 37 13 e 5 36 47					6 09 5 54	
159	May 24	E	3 33 17 3 33 17	e 3 38 54	e 3 42 54 e 3 42 39	3 49 24 3 43 15	3 51 3 51	4 13	11 12
160	May 25	E	e 13 54 13 e 13 54 13			3 10 10		$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
161	May 28	E	10 00 31	10 07 13 10 07 13	10 13 25 10 13 37	10 07 27 10 07 34		10 35 10 35	22
162	May 27	E	10 00 37 e 2 54 21	10 07 13	10 13 37	10 07 34		3 01	21
163	May 30	E	е 2 54 21 19 12 31			19 14 11		19 25	82
164	June 7	E	19 12 31 e 19 37 05		19 13 26 19 39 32	19 14 01 19 44 50		19 25 20 00	60 10
165	June 17	N E	e 19 36 50 e 21 19 55	e 21 21 40 e 21 21 32	19 39 24 e 21 23 04 e 21 22 00	19 40 54 21 25 25	2I 32 2I 27	20 00 21 53 21 53	12 10
166	June 22	N E	e 21 19 58 e 13 41 05	e 21 21 32	e 21 22 00	21 24 05	21 27	21 53 14 03	12
167	June 26	N E	e 13 41 15 1 50 14	2 00 55	2 19 04	2 18 55	2 56	14 03 5 51	110
168 169	do June 28	E	e 11 42 7 23 22					11 47 7 50	
170	June 30	ÑE	7 22 55 15 53 09	7 26 40 7 26 17 15 59 05	7 27 25 7 27 13 16 04 53	7 27 33 7 28 13 16 07 57	16 18	7 47	80
171	July 3.	N	15 53 09 5 04 33	15 58 59	16 04 49 5 24 24	16 14 51 5 27 00	16 21	18 27 18 22 6 44	40 42
172	July 5.	N	5 04 33 e 23 06 03		i 5 26 10	5 26 30		6 35 23 20	40
173	July 6	N	e 23 06 10	14 40 50	14 25 15	14 67 40		23 31	
174		N	14 30 58	14 40 50 14 40 50	14 55 15 e 14 57	14 57 46 15 01 43		15 54 16 15	25 6
	July 7	N	e 2 47 50 2 47 22	e 2 53 13 2 52 24	i 2 56 01 2 56 29	2 56 59 2 59 16	3 02 3 00	4 38 5 05	53 34 7
175	July 8.	N	e 11 03 17 e 11 04			11 06 52 11 07 00		11 11	7 8
176 177	do July 9	E E	e 21 03 e 21 03			21 05 40		21 32 21 16	7
178	July 11	N E	e 21 04 20 08 42		_е 20 30 30	21 07 00 20 38 48		21 13 22 20	7 30
179	July 12	N E	20 08 55 e 15 57		i 20 30 50	20 32 01 16 09 30		22 29 16 22	50 9
180	July 13	N E	e 15 59 e 23 27			16 11 00	·	16 22 23 34	10
181	July 16	N E	e 23 28 e 6 05					23 38 6 11	
182	July 20	N E	e 6 06 e 9 39			6 07 48		6 11 9 53	5
183	July 22	Į į	e 9 39 e 4 16 00				.	9 53	
184	do	Z	e 4 26 08					. 4 48	
185	do	N	e 11 16					11 24	
186		N	e 12 06 e 12 02					12 11 12 08	
187	Inly 94	N E	e 14 44 54 e 14 44 54			15 05 00		15 15	8
	July 24.	E N	5 07 32 5 07 32	5 17 49 5 17 49	i 5 37 17 5 39 30 5 57 14	5 37 29 5 40 37 6 05 13		15 10 7 22 7 26	30 40
188	July 29	E N		5 41 42 5 41 38	5 57 14	6 04 28		. 6 25	40 17 5
189	Aug. 6	ZEZEZEZEZEZEZEZEZEZEZEZE	e 0 40 45 e 0 37 53			0 43 50 0 52 00		1 01	5 5 6
190	Aug. 7	E	e 13 44 00 e 13 41 16				-	13 56	
191	do	E	e 16 43 40		16 46 40 16 45 32	16 48 42 16 49 30		17 07 17 07	14 21
192	Aug. 10	E N	6 21 38 6 21 38	6 29 10 6 29 10				7 30 7 30	
193	Aug. 13	N E N	e 13 41 36 e 13 41 36		13 43 30	13 43 57 13 46 21		14 42	20
194	Aug. 14	E NEN	e 0 57 31		. 0 59 04	13 46 21 1 01 21 1 03 12		2 23 27	25 53 48 65 00
	do	174	e 0 57 31 18 12 12		1 00 31	18 31 34		- 27	1 48

Register of earthquakes—Continued

No.	Date	Compo- nent	P		s		L		М		С		F	A
196	1924 Aug. 15	Е	i 23 44	8. 29	h. m. s		h. m. s.	h. 23	m. 54	00	h. m.	h. 24	m. 57	μ 10
197	Aug. 16	N E N	e 2 02	29 00 00				23 2 2	37	29	 	24 3 3	57 25 57	12 12
198	Aug. 21	E	e 15 54 e 15 54			¦						16 16	01 01	
199	do	Ë	e 19 C4	30 58				19 19	06 08	19 59		20 20	23	12
200	Aug. 23	E	10 50	08 08			10 50 40	10 10	51 51	28 18		10 10	56 56	23 23 27
201	Aug. 25	E	14 41		14 48 0 14 48 0		14 53 33 14 53 33	14 14	56 57	05 18		16 16	26 26	10 28 13
202	do	E	23 15		23 26 0		e 23 53 40 23 52 25	23	55 54	00 36		24 24	22 22	13
203	Aug. 30	Ë	i 3 16	37 37	i 3 26 0 i 3 26 0		i 3 38 38 e 3 35 13	23 3 3	40 35	23 38		4	44 59	170 145
204 205	Sept. 3.	NEN	e 0 12 e 20 03	34 31				0 20 20	14 06 07	25 04 53		0 20 20	19 13	6
206 207	Sept. 7	N E	e 13 45 e 10 16	31 05 12				13 10	47 18	00 42		13 10	13 48 28	9 10 7
208 209	Sept. 11	N E E		04 08			3 59 30 e 15 21	10 4 15	17 01 34	16 10 34		10 4 16	28 22 01	33 38
210	Sept. 14	N E N		40 40	e 13 27 5 e 13 27 5		e 15 26 57 13 29 37 13 30 00	15 13 13	37 30 33	00 26 06		17 15 14	12 16 19	38 32 18
211 212	Sept. 19 Oct. 14	N E	e 7 08	15			e 5 43 10	7	13	32		7 5	17 59	20 7 10
213 214	Oct. 17 Oct. 18	E	e 4 39 e 23 38	05 10								$\frac{4}{24}$	46 05	
215	Oct. 20	E	e 20 01	3 i	20 07 4 i 20 07 2		20 13 05 20 14 00		13 13			20 20	$\frac{52}{52}$	37 39
216 217	Oct. 24 Oct. 27	E	e 20 20 e 20 32									20	51	
218	Nov. 5	E N					i 8 49 41 e 8 51 49	8 8		45		8 8	58 58	22 13
219	Nov. 13	E N			8 48 4 8 48 4				56	40		9	30 21	30
220	Nov. 28	E N		43			e 12 53 05 e 12 53 20	$\frac{12}{12}$	53 54	28 16		13 13	05 05	17 16
221	do	E	e 19 16	40 23				19 19	19 20	03 33		19 19	$\frac{22}{34}$	20 32
$\frac{222}{223}$	Dec. 16	N E	e 11 38	$\frac{13}{12}$	i 11 39 J			7 11	10 39	$\frac{57}{12}$		$\frac{7}{12}$	17 03	28 20
224	Dec. 28	N E N	e 11 33		i 11 39 1 i 23 11 1		11 42 58 23 17 57 23 17 54	11 23 23	39 19 19	12 23 14		12 24 24	03 40 40	30 410 230

REMARKS

- 1. E record obscured by overlapping of traces.
 2. E record obscured by overlapping of traces.
 3. Local shock. Felt on all parts of Oahu. Recorded on the magnetograph.
 4. Mere trace of activity on N.
 5. O at 9:04:12, distance 3,800 km.; iPR on both at 9:12:28; e on E at 9:15:40 and on N at 9:15:35; SR on E at 9:18:35; L₂ on N at 9:19:35.

 Recorded on the magnetograph.
 7. E record obscured by overlapping of traces.
 8. E record obscured by overlapping of traces.
 8. E record obscured by overlapping of traces.
 9. O at 5:08:05, distance 4:630 km.; e on E at 5:24:48; SR₁ on N at 5:25:22; SR₂ at 5:26:18 on E and 5:26:30 on N.
 10. O at 16:01:46, distance 5:020 km.; e on N at 16:16:00; L_R on N at 18:57:53; iL_R on N at 19:03:17. Motion after L too rapid to register;
 E visible after 16:29, N after 16:35. Paper changed between 17:08 and 17:19. E record on new sheet obscured by overlapping traces.
 Recorded on the magnetograph.
 11. Very slight. 10. O at 16:01:46, distance 5,020 km.; e on N at 16:16:00; Lg on N at 18:57:33; i.l.g on N at 19:08:17. Motion after L too rapid to register; E visible after 16:29, N after 16:35. Paper changed between 17:08 and 17:19. E record on new sheet obscured by overlapping traces. Recorded on the magnetograph.
 11. Very slight.
 12. e on E at 8:34:20. Activity on E well defined but of small amplitude.
 13. An irregularity in the microseisms.
 15. O at 1:38:26, distance 5,120 km.; SR₁ at 2:17:20 on E and 2:17:28 on N. P merely an irregularity in microseisms. Preliminary phases exceptionally weak.
 18. Mere trace of activity on E.
 19. O at 7:34:36, distance 4,900 km.; PR₁ on both at 7:44:40; e on N at 7:48:52; SR₁ on E at 7:53:00 and SR₂ on N at 7:53:18; M₂ on E at 7:55:50. L doubtful on account of preceding activity. Actual M on E occurs during SR.
 19. Barely perceptible.
 20. Nothing definite.
 21. E record obscured by overlap. Beginning occurred while changing paper.
 22. O at 7:04:10, distance 1,650 km. E record well defined; N indefinite.
 23. E record obscured by overlapping of traces.
 24. E record obscured by overlapping of traces.
 25. O at 12:26:46, distance 3,650 km.; PR₁ on N at 16:34:47; iPR₁ on E at 16:34:53; e on N at 16:36:58; SR₁ at 16:40:55 on E and 16:40:52 on N; SR₂ on N at 16:41:11; La on E at 16:42:30. Paper changed between 17:06:21 and 17:16:21. E record lost after this through overlap.
 26. E record lost through overlap.
 27. O at 2:23:7:28, distance 4,600 km.; PR₁ on N at 16:34:27; iPR₁ on N at 17:47:00; La on N at 17:49:07. Activity continues to next earthquake. E record obscured by overlap.
 28. O at 2:23:7:28, distance 4,600 km.; SR₁ on N at 8:25:28; e on N at 8:27:05; iPS at 8:31:00 on E and 8:31:07 on N; iSR₁ at 8:32:7 on E and 8:32:22 on N. L on E indeterminate.
 29. O at 2:23:44, distance 4:30 km.; PR₁ on N at 8:25:29;

```
57. Beginning lost in coda of preceding earthquake.

59. O at 12:55:18, distance 1,940 km.

60. O at 0:43:53, distance 6,000 km.; L<sub>2</sub> on E at 1:14:00. Interpretation doubtful.

61. O at 3:15:14, distance 4,800 km.; iL<sub>2</sub> on E at 3:34:05; L<sub>2</sub> on N at 3:35:00.

63. O at 11:13:47, distance 7,000 km.; L<sub>2</sub> on E at 11:49:20; M<sub>2</sub> on E at 11:43:40 and M<sub>3</sub> on E at 12:00:00; M<sub>2</sub> on N at 11:47:00.

65. O at 23:35:42, distance 6,820 km. Interpretation doubtful.

66. O at 13:38:18, distance 5,540 km.; SR, at 13:58:25 on E and 13:58:52 on N.

68. O at 14:17:40, distance 4,270 km.; PR<sub>1</sub> on N at 14:26:50; e on N at 14:32:40; L<sub>2</sub> and L<sub>3</sub> on N at 14:35:28 and 14:36:02, respectively; M<sub>2</sub> on E at 14:41:35.

66. O at 13:38:18, distance 5,540 km.; PR no N at 14:38:25 on E and 13:38:52 on N.
68. O at 14:17:40, distance 4,270 km.; PR no N at 14:38:50; eo n N at 14:32:40; L<sub>2</sub> and L<sub>3</sub> on N at 14:35:28 and 14:36:02, respectively; M<sub>2</sub> on E at 14:41:73.
69. SR, on both at 7:46:19; L<sub>2</sub> on N at 7:49:13. Interpretation based on Sitka record.
72. E record obscured by overlapping of traces.
74. O at 15:07:49, distance 4,120 km.; e on N at 15:20:42; L<sub>2</sub> on E at 15:27:00; L<sub>2</sub> on N at 15:25:20.
80. N partly obscured by overlapping of traces.
81. N record partly obscured by overlap. Distance, 5,325 km.
81. N record obscured by overlapping of traces.
82. SR, on E at 12:36:02.
83. SR, on E at 12:36:02.
84. E record obscured by overlapping of traces.
85. SR, on E at 12:36:02.
86. N not recording on account of misplaced drum.
80. O at 23:15:11, distance 4,830 km. E record partly obscured by overlap.
81. O at 23:46:45, distance 6,360 km.; SR<sub>2</sub> at 3:21:23 on E and 3:21:30 on N; M<sub>2</sub> on E at 3:47: M<sub>2</sub> on E is an estimated value as the spot of light went off the paper in one direction. The motion was so rapid as a result of the large amplitude of the swing after S that L could not be picked out.
80. O at 2:36:45, distance 6,100 km.; e on both at 3:09:28; e on E at 3:12:28.
94. O at 9:26:53, distance 6,100 km.; e on both at 3:09:28; e on E at 3:12:28.
95. E record obscured by overlap.
96. O at 2:18:40, distance 6,025 km.
197. O at 3:29:28, distance 8,360 km.; PR<sub>1</sub> at 3:43:32 on E and 3:43:57 on N; PR<sub>2</sub> on N at 3:45:55; iPS on E at 3:51:28; e on E at 3:54:30; SR<sub>2</sub> on N at 3:59:59; e on E at 4:03:20.
198. O at 2:10:53, distance 8,360 km.; PR<sub>2</sub> on E at 0:22:04; SR<sub>3</sub> at 0:27:20 on E and 0:27:00 on N,
198. O at 2:10:35, distance 6,050 km.; PR<sub>2</sub> on E at 0:22:04; SR<sub>3</sub> at 0:27:20 on E and 0:27:00 on N,
199. O at 2:10:35, distance 
  122. Very sign.

128. SR<sub>2</sub> on both at 21:13:36; iL<sub>2</sub> on E at 21:29:22. Exact time of P on N doubtful on account of hour break.

130. L<sub>2</sub> on E at 2:12:34.

131. Heavy microseisms prevailing.

132. E-W component out of order.

133. Heavy microseisms prevailing.

134. E-W component out of order.

137. e on N at 10:31:52; eSR at 10:37:21 on N and 10:38:08 on E; M<sub>2</sub> on N at 10:49:40.

139. E record obscured by overlapping of traces.

140. O at 10:31:04, distance 6,300 km.; e at 10:33:28 on E and 10:54:00 on N.

145. O at 16:20:05, distance 8,900 km.; SR<sub>2</sub> on E at 16:51:52; i on E at 16:55:21. N component not operating.

146. O at 20:01:19, distance 5,700 km.

147. E record obscured by overlapping of traces.

150. O at 19:54:12, distance 6,780 km.; L<sub>2</sub> at 20:25:27 on E and 20:24:27 on N. Preliminary phases difficult to distinguish because of microseisms L<sub>2</sub> is the beginning of regular waves.

151. Light spot on N was off the paper because of tilt. P<sub>E</sub> may have been a few seconds earlier as the 15 seconds time break ended at the recorded time.

152. O at 3:26:12, distance 3,820 km.

153. O at 3:26:12, distance 4,940 km.; PR<sub>2</sub> on both at 10:02:49. Interpretation doubtful. The phases tabulated as S and L are quite similar in character.

161. O at 9:52:10, distance 4,940 km.; PR2 on both at 10:02:49. Interpretation doubtful. The phases tabulated as S and L are quite similar in character.
163. No definite phases. Slight indication of activity on E at 19:11:09. Evidently not far away.
167. O at 1:37:30, distance 9,620 km.; PS on E at 2:01:50; SR on E at 2:06:00. N not operating.
170. O at 1:35:45:09, distance 4,460 km.; e on both at 15:55:22; SR at 16:00:46 on E and 16:00:51 on N.
171. L<sub>2</sub> on E at 5:25:40. Damping ratios near 30:1 during July.
174. O at 2:41:01, distance 3,270 km.; L<sub>2</sub> on N at 2:58:22. Preliminary phases very weak.
176. E traces overlapping.
183. e on N a well-defined phase.
186. e on E at 14:57:50.
187. O at 4:55:13, distance 9,120 km.; PR<sub>2</sub> on E at 5:13:09; e on N at 5:17:04; PS on both at 5:18:40; SR<sub>2</sub> on E at 5:28:40; e on N at 5:30:25 and 5:33:08.

  187. O at 4:35:13, distance 9,120 km.; PR2 on E at 5:13:09; e on N at 5:17:04; PS on both at 5:18:40; SR2 on E at 5:28:40; e on N at 5:30:25 an 5:33:08.

188. e on N at 5:53:30.

189. Damping ratios near 30:1 during August.

192. O at 6:12:12, distance 5,920 km.; SR2 on E at 6:35:08; L2 on N at 6:41:13. No definite maximum.

195. O at 18:02:24, distance, 6,300 km.; SR on N at 18:25:04. Most of E trace obscured by overlap.

201. O at 14:32:38, distance 5,100 km.; L2 on E at 14:54:42

202. e on N at 23:21:51; PS on N at 23:27:55; SR on E at 23:35:30; eSR on N at 23:35:50. Record weak; interpretation doubtful.

203. O at 3:05:05, distance 8,220 km.; PR on E at 3:21:30; PS on N at 3:26:51; SR on E at 3:31:26; eL2 on N at 3:42.

204. E trace obscured by overlap. Damping ratios near 30:1 during September.

206. E record can not be distinguished from microseisms.

207. e on E at 14:29:44; L2 on E at 14:41:20; L2 on E may be major arc wave.

208. N record can not be distinguished from microseisms.

209. e on E at 14:29:44; L2 on E at 14:41:20; L2 on E may be major arc wave.

211. E not recording.

212. Damping ratios during October; E, aperiodic; N, 20:1.

215. e on N at 20:06:10; SR1 at 20:11:00 on E and 20:10:50 on N; SR2 at 20:11:54 on E and 20:11:54 on N; L2 on E at 20:14:24.

216. Long swells continue intermittently for several hours. N-S traces overlap.

219. SR1 on E at 8:64:31; e on E at 8:63:33; SR2 on E at 8:59:43. Interpretation uncertain; microseisms mask all phases on N.

222. E traces overlapping. Damping ratios during December, 20:1.

224. O at 22:54:18, distance 5,930 km.; e on E at 23:12:00; SR<sub>1</sub> at 23:15:40 on E and 23:15:26 on N; reported near Kushiro, Japan, at 22:55.
                                                                                   5:33:08.
```

MAGNETIC STORMS

Magnetic disturbances of considerable magnitude were recorded at the times tabulated below. When the storm began abruptly, the time is given to the nearest minute.

On the succeeding pages will be found reproductions of the magnetograms showing the principal magnetic storms. A storm selected for reproduction is indicated in the table by an asterisk after the date. An upward motion of the curves corresponds to decreasing east declination, increasing H, and decreasing Z.