

DIURNAL AND SEASONAL VARIATIONS IN WHISTLER RECORDS IN JAPAN

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Abstracts—This is a preliminary short report on whistlers observed in Japan for one year in 3rd IGY from 1st July, 1957 to 30th June, 1958. Observations were made at Wakkanai (Geogr. coord. N 45°22', E 141°41'; Geomag. coord. 35.3°, 206.0°) and at Toyokawa (Geogr. coord. N 34°50', E 137°22'; Geomag. coord. 24.5°, 203.5°) at 5~7 min. and 35~37 min. every hour (U.T.).

The total number of whistlers recorded every month at Wakkanai and Toyokawa are tabulated in Table 1, where the number of long whistlers and their percentage to total are indicated in Ab and Ac. In Fig. 1 they are indicated by curves together with K-index of geomagnetic activity observed at Kakioka

TABLE 1 A. Number of Whistlers Observed Every Month

Observatories	Year→ Month↘	1957						1958						Total
		7	8	9	10	11	12	1	2	3	4	5	6	
Wakkanai	<i>a</i>	61	172	1502	1296	636	1597	1401	1999	1193	416	307	32	10612
	<i>b</i>	6	52	102	17	4	1	2	0	1	0	1	12	198
	<i>c</i>	9.8	30.4	6.8	1.3	0.6							3.7	1.9
Toyokawa	<i>a</i>	0	5	107	63	139	264	281	502	156	110	7	2	1636
	<i>b</i>	0	0	12	4	0	2	0	1	0	0	0	0	19
	<i>c</i>			11.2	6.3									1.2
Brisbane	<i>a</i>	191	185	360	136	2	12							
	<i>b</i>						2							
Adelaide	<i>a</i>			1870	748	122	156							
	<i>b</i>													
Hobart	<i>a</i>	1254	473	841	328	281	515							
	<i>b</i>				1									
Macquarie Is.	<i>a</i>	84	57	129	121	48	0							
	<i>b</i>		1	2										

"a" is a total number of whistlers observed.

"b" is a number of long whistlers among "a".

"c" is a percentage of "b" to "a".

TABLE 1 B. Thunderstorm Activities in Every Month
Expressed in Arbitrary Unit

Region↓	Month→	7	8	9	10	11	12	1	2	3	4	5	6
		Within 1,000 km from Wakkanai	32	60	36	32	14	3	2	0	3	4	23
Within 500 km from Wakkanai	14	29	19	19	5	0	0	0	0	1	11	15	
Within 500 km from Darwin	0	0	1	17	28	44	42	31	34	6	1	0	
Within 500 km from Alice Springs	0	1	2	4	4	6	5	3	2	1	1	1	

TABLE 1 C. Number of Occurrence in Each Month that
K Indices Showed 5, 6 or 7 and more than 8

Year→ Month→ K↓	1957						1958					
	7	8	9	10	11	12	1	2	3	4	5	6
5	7	8	26	4	13	5	5	8	11	0	3	10
6 or 7	3	1	21	1	2			5	2		2	7
>8			3					3				

TABLE 1 D. Number of Days in Each Month that K Indices
Showed 5, 6 or 7 and More than 8

Year→ Month→ K↓	1957						1958					
	7	8	9	10	11	12	1	2	3	4	5	6
5	4	6	14	1	6	4	4	4	7	0	2	6
6 or 7	2	1	10	1	2			2	2		1	3
>8			2					1				

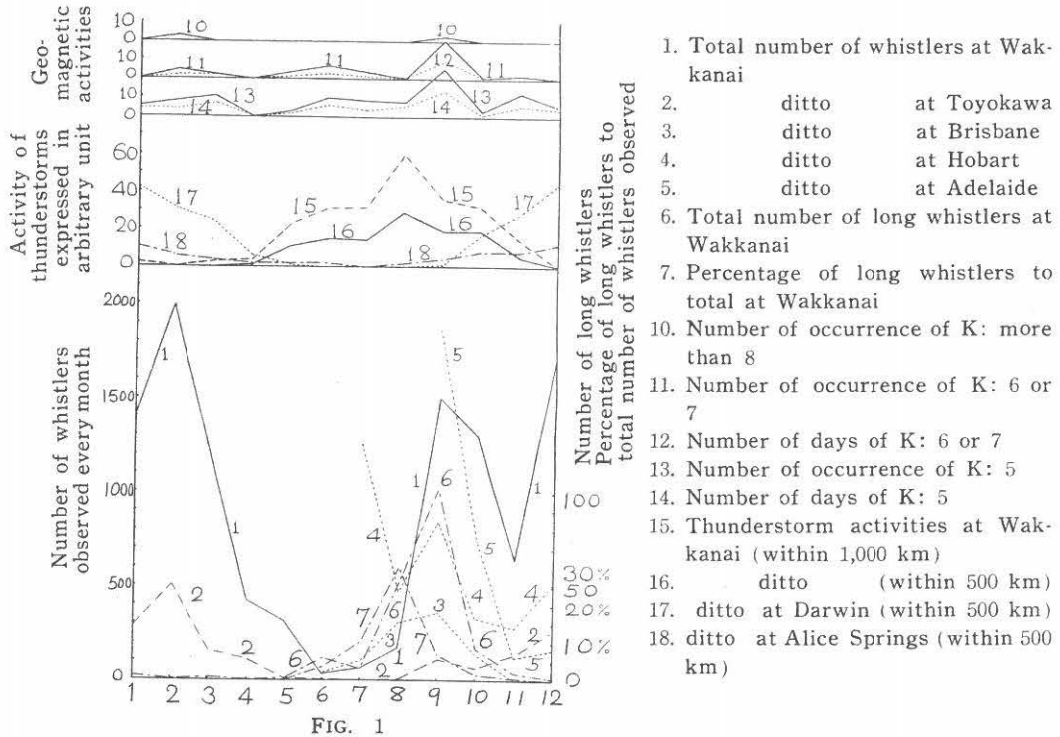
TABLE 1 E. Sunrise and Sunset in the Middle of
Every Month at the Observatories

	Wakkanai (N 45°22' E 141°41')	Toyokawa (N 34°50' E 137°22')	Brisbane (S 27°26' E 153°05')	Adelaide (S 34°57' E 138°32')	Hobart (S 42°50' E 147°28')
Sunrise 1	7 h 10 m	6 h 58 m	5 h 7 m	5 h 48 m	4 h 43 m
2	6 37	6 38	5 30	6 18	5 21
3	5 45	6 2	5 48	6 44	5 57
4	4 49	5 20	6 4	7 8	6 33
5	4 4	4 48	6 21	7 33	7 7
6	3 45	4 36	6 37	7 52	7 32
7	3 58	4 48	6 37	7 51	7 28
8	4 31	5 10	6 19	7 30	7 13
9	5 13	5 33	5 48	6 49	6 9
10	5 52	5 56	5 14	6 6	5 15
11	6 33	6 24	4 48	5 32	4 29
12	7 7	6 51	4 46	5 26	4 18
Sunset 1	16 16	17 1	18 47	20 2	19 40
2	16 59	17 33	18 34	19 42	19 11
3	17 40	17 58	18 5	19 5	18 24
4	18 19	18 22	17 33	18 24	17 33
5	18 57	18 46	17 8	17 52	16 46
6	19 23	19 5	17 0	17 41	16 29
7	19 20	19 5	17 12	17 48	16 50
8	18 44	18 40	17 26	18 13	17 16
9	17 41	17 59	17 40	18 36	17 49
10	16 46	17 17	17 55	18 59	18 23
11	16 3	16 46	18 18	19 31	19 7
12	15 51	16 41	18 39	19 56	19 38

Time in local time at E 135° for stations in Japan and that at E 150° for those in Australia.

Magnetic Observatory, frequency of thunderstorm occurrence observed in the distances less than 500 km and 1,000 km from Wakkanai as well as that observed in the distances less than 500 km from Darwin and Alice Springs, conjugate points of Toyokawa and Wakkanai respectively in Australia.

According to Fig. 1 and Table 1, at Toyokawa whistlers are observed from



the end of autumn to the beginning of spring; they are focussed in winter and scarcely observed in summer. At Wakkanai, which is situated about 10° higher in geomagnetic latitude, whistlers are observed almost all the year round, though they are concentrated in winter. Even in summer they are observed fairly well and long whistlers are observed abundantly in summer. Total number of whistlers observed at Wakkanai is about 9 times that observed at Toyokawa, and as to long whistlers 10 times.

Maximum occurrence of whistlers in one year is found in February both at Wakkanai and at Toyokawa. This fact is probably due to the maximum occurrence of thunderstorms at the conjugate points in Australia, and to low noise levels in Japan in winter. The second maximum is observed in September at Wakkanai and at Toyokawa as well as at 3 observatories in Australia coincidentally. In Japan September is a month situated on the way of increasing tendency of whistler records from summer to autumn, while in Australia September is on the way of decreasing from winter to spring. Therefore the origin of the second maximum in September should be attributed to the world wide phenomena other than thunderstorms. K-index of geomagnetic activity in Kakioka showed maximum in September, 1957 and, on examining in detail, we found 10 heavily disturbed days where k-index showed more than 6, and many other disturbed days. Whistlers are observed frequently after 1-4 days from magnetically disturbed days. Therefore second maximum is very likely due to electrified particles which produce geomagnetic disturbances.

At Wakkanai long whistlers are observed in July, August and September and their percentage of occurrence coincides quite well with the occurrence of thunderstorms in the neighbourhood of Wakkanai as shown in Fig. 1, and accordingly long whistlers in Wakkanai are to be attributed to thunderstorms there.

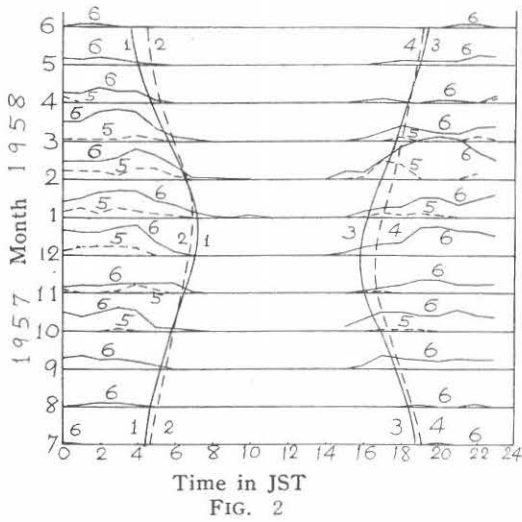
In Table 2 and in Fig. 2 diurnal variations of whistlers observed at Wakkanai and at Toyokawa every month are shown with sunrise and sunset data there. The whistlers were observed mainly at night and we very often found two maxima, the one before sunrise, the other after sunset, both of which were situated at 3 or 4 hours from sunrise or sunset except in February and March where one of the maxima was found almost at sunset. When we began whistler observations in January, 1956, we found frequent occurrences in February at Toyokawa and took their behaviour as showing a general tendency, but, examining the data for one year, we found that they were rather exceptional phenomena in February.

TABLE 2. Diurnal Variation of Whistler Records in Each Month Together with the Number of Long Whistlers in Parenthesis (1957~1958)

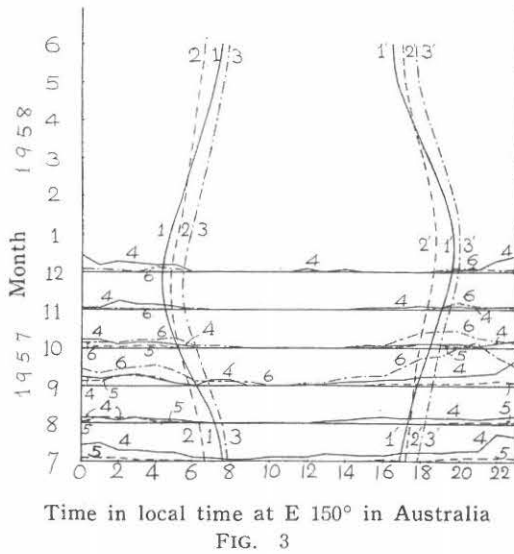
	Month→	7	8	9	10	11	12	1	2	3	4	5	6
	Time in JST↓												
Wakkanai	0	10 (2)	15 (6)	130 (8)	97	32	131	79	89	97	50	30 (1)	1
	1	7	19 (8)	125 (12)	73	34	118	104	95	104	43	26	9 (7)
	2	3 (1)	31 (12)	126 (17)	105	38	123	134	94	152	76	32 (1)	8 (1)
	3	5	27 (13)	111 (6)	119 (2)	35	146	144	107	159	58	28	4
	4	1	13 (2)	80 (4)	107 (2)	46 (1)	157	150 (1)	160	151	54	11 (1)	2
	5	1	7 (2)	69 (1)	35 (7)	47	69 (1)	85 (1)	125	71 (1)	16	7	1
	6	1	5 (1)	9 (1)	29	49	22	71	74	31	3	7	0
	7	0	1	2	11	7	7	27	13	15	1	1	0
	8	0	0	2	2	1	1	8	6	9	0	0	1
	9	0	0	1	0	0	0	1	11	1	0	0	1
	10	0	1	1	0	0	0	2	5	0	0	0	0
	11	0	0	1	0	0	0	13	2	0	0	0	0
	12	0	0	1	1	0	0	7	2	0	1	0	0
	13	0	0	2	5	0	3	6	5	0	2	0	0
	14	0	0	3	10	0	3	2	8	0	0	0	0
	15	0	1	6	21	2	6	1	41	2	3	0	0
	16	0	1	17	59	12	37	29	27	12	9	0	0
	17	2 (2)	2	74 (2)	97	27 (2)	63	42	99	38	20	7	0

TABLE 2. (Continued)

	Month→ Time in JST↓	7	8	9	10	11	12	1	2	3	4	5	6
Wakkanai	18	2	6 (2)	155 (13)	99 (2)	35	66	51	166	79	16	19	0
	19	3	7 (1)	142 (3)	82 (3)	71	142	97	203	59	6	20	1 (1)
	20	7 (1)	3	120 (8)	81	70	156	93	223 (1)	40	13	20	0
	21	5	6	111 (5)	109 (1)	42 (1)	124	58	207	33	12	16	2 (2)
	22	7	14	104 (10)	83	43	121	90	142	68	10	45	2 (1)
	23	7	13	110 (12)	77	45	102	106	95	72	23	38	0
	Total	61 (6)	172 (52)	1502 (102)	1296 (17)	636 (4)	1597 (1)	1401 (2)	1999 (1)	1193 (1)	416	307 (3)	32 (12)
Toyokawa	0	0	0	8	2	19	20	33	34	13	27	0	0
	1	0	0	12 (3)	5	4	44	50	32	15	7	0	0
	2	0	0	13	5 (1)	0	43	19	34 (1)	15	6	0	0
	3	0	5	16 (7)	10 (1)	15	48	40	21	17	6	0	0
	4	0	0	8 (1)	4	40	35	50	58	28	6	0	0
	5	0	0	0	2 (1)	18	4 (2)	19 (1)	53	18	4	0	0
	6	0	0	0	1	0	0	7	22	0	0	0	0
	7	0	0	0	0	0	0	1	7	0	0	0	0
	8	0	0	0	0	0	0	0	3	0	0	0	0
	9	0	0	0	0	1	0	0	5	0	0	0	0
	10	0	0	0	0	0	0	0	0	0	0	0	0
	11	0	0	0	0	0	0	0	0	0	0	0	0
	12	0	0	0	0	0	0	0	0	0	0	0	0
	13	0	0	0	0	0	0	13	0	0	0	0	0
	14	0	0	0	0	0	0	0	0	0	0	0	0
	15	0	0	0	0	0	0	0	1	0	0	0	0
	16	0	0	0	0	11	6	2	11	1	1	0	0
	17	0	0	1	10	13	21	11	92	6	2	0	0
	18	0	0	18	13	1	12	5	68	2	15	5	1
	19	0	0	17	6	2	20	1	15	1	5	0	1
	20	0	0	4	0	2	8	0	5	0	4	0	0
	21	0	0	2	2	4	0	2	6	1	5	0	0
	22	0	0	4	2	3	2	13	5	27	3	1	0
23	0	0	4 (1)	1	6	1	15	30	12	19	1	0	
Total	0	5	107 (12)	63 (4)	139	264 (2)	281 (1)	502 (1)	156	110	7	2	



1. Sunrise at Wakkanaï
2. Sunrise at Toyokawa
3. Sunset at Wakkanaï
4. Sunset at Toyokawa
5. Number of whistlers at Toyokawa
6. Number of whistlers at Wakkanaï



1. Sunrise at Hobart
- 1'. Sunset at Hobart
2. Sunrise at Brisbane
- 2'. Sunset at Brisbane
3. Sunrise at Adelaide
- 3'. Sunset at Adelaide
4. Number of whistlers at Hobart
5. ditto at Brisbane
6. ditto at Adelaide