Abstract

The program of auroral observations carried out by the 8th wintering party of the Japanese Antarctic Research Expedition, 1967–1968, consisted of

1. All-sky camera
2. Visual and photographic observations of aurora
3. Observation of auroral pulsations
4. Auroral photometry along the geomagnetic meridian
5. Observation of the auroral radio noise.

Description of each observation and results obtained are briefly summarized in the following.

1. Space-time variations of aurora and geomagnetic disturbances

A meridian scanning photometer was designed for investigating the time and space variations of auroral luminosity. The meridian time-sequence of auroral luminosity (4278Å) was derived from the data obtained by this photometer. Based on this meridian time-sequence of aurora, the space and time variations of aurora during the auroral substorms and the magnetic field variations associated with the auroral displays are investigated in detail.

2. Auroral pulsations

A special photometer was designed for investigating the detailed characteristics of auroral pulsations and their relationships with geomagnetic pulsations. Auroral pulsations observed at Syowa Station can be classified into the following five types:

A. Irregular fluctuations with large amplitudes observed mostly at the onset of an auroral substorm.
B. Pulse-like auroral pulsations with a period of about 20–40 seconds.
C. Long-lived auroral pulsations with a sinusoidal waveform. Their period and amplitude are about 10 seconds and a few KR, respectively.
D. Rapid fluctuations of auroral luminosity with a period of about 0.5–2.0 seconds.
E. Extremely rapid fluctuations with a frequency of about 20–30 Hz.

Characteristics of each auroral pulsation are investigated and summarized.

1. Introduction

Syowa Station (69°00′S, 39°35′E) is located at lat. 69.6°S and long. 77.1°E in the geomagnetic coordinates. Therefore, Syowa is one of the most suitable stations for the auroral observations.

The auroral observations carried out at Syowa by the 8th wintering party of the Japanese Antarctic Research Expedition, 1967–1968, covered the following items:

1. All-sky camera.
2. Visual and photographical observation of aurora.
3. Observations of auroral pulsations.
4. Auroral photometry along the geomagnetic meridian.
5. Observation of the auroral radio noise.

New instruments for the auroral observation were designed; they are meridian scanning and special zenith photometers. Based on the data obtained by these instruments, the space and time variations of aurora during the auroral substorms and the magnetic field variations associated with these space-time auroral displays were studied first. Secondly, data obtained by the special zenith photometer were analyzed with a characteristic classification of auroral pulsations.

The purpose of this report is to illustrate the preliminary results of such studies in a synthesized form for the sake of convenience of other research workers. Simultaneous data of magnetograms, all-sky camera, meridian time-sequence of auroral luminosity, and serial photographs of aurora, are given in Appendix I, II, III and IV.

2. Outline of Auroral Observations Carried out at Syowa Station in 1967–1968

2.1. Visual, photographic and all-sky camera observations of aurora

The visual observation was carried out from the 6th of March to the 19th of October. The position (lower boundary of aurora) and types of aurora were recorded every 30 minutes on clear nights, according to the code of International Auroral Atlas.

From the end of June, a special emphasis was laid on the photographic observations, especially continuous photographic observations of aurora, for investigating the morphological variations of active auroras. Table 1 shows the duration of continuous photographic observations of aurora. About 2000 sheets of monochrome and color reversal pictures were taken through this season.

All-sky camera was operated every 30 seconds with exposure time of 15 seconds. The details of the durations of all-sky camera are summarized in JARE Data Reports, No. 3 (Aurora).

Table 1. Duration of continuous photographic observations of aurora.

Date	Time (UT)				Number of photograph
	Start		End		
May 1, 1967	21^h	28^m	21^h	30^m	8
	21	46	21	47	3
	22	10			2
	22	11	22	16	17
	22	46			2
	22	50			2
	22	52	23	05	26
2	20	34			14
3					150
12	21	54	21	58	15
27	21	40	21	50	28
28	19	13	19	14	5
	19	15	19	18	18
	22	25			3
30	15	30			1

Date	Time (UT)				Number of photograph
	Start		End		
May 30	15h	31m			1
	15	34			1
	18	31			1
	18	33	18h	37m	20
	18	45			1
	18	48			1
	19	38	19	45	34
	20	00			1
	20	04			1
	20	05	20	06	9
	20	10			2
	20	14			4
June 4	21	55	22	00	21
	22	45	22	47	16
	23	10	23	13	7
	23	14			2
	23	15			3
5	22	55	22	56	6
	23	20	23	25	10
	23	25			1
	23	27	23	28	3
6	20	30	20	31	11
	20	36	20	38	21
	20	40	20	44	4
	21	25	21	26	16
	21	28	21	29	3
	21	31	21	32	10
26	00	26	00	28	14
	00	41	00	42	6
	00	43	00	53	16
	20	36	20	38	25
	20	45			3
27	00	51	00	53	12
28	00	12			3
30	00	03	00	05	19
	00	19	00	20	10
July 5	21	07	21	10	25
	21	40	21	45	25
11	00	38	00	40	16
	00	41	00	45	11
Aug. 7	23	12	23	15	34
27	01	16			1
	22	29	23	08	87
	23	09	23	19	55
Sept. 1	17	28	17	34	21
	17	35	17	39	19
	19	03	19	09	25
	19	11	19	16	19
	19	16	19	30	83
	23	15	23	17	16
2	00	17	00	33	69
	21	57			1
	21	59	22	10	76
	22	15	22	18	11
3	22	43	22	48	16
9	20	34			56
12					41
29	18	25	22	09	270
Oct. 7	21	25			63

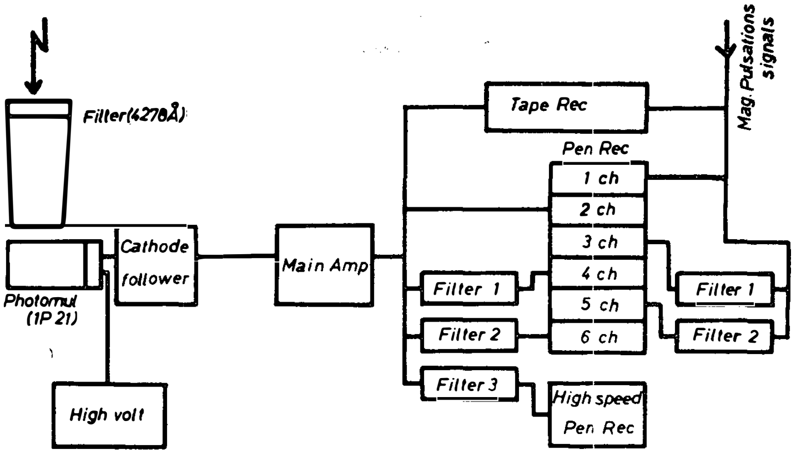

Fig. 1 Block diagram of 5° solid angle zenith photometer.

2.2. Observation of auroral pulsations

A special photometer was designed for investigating detailed characteristics of auroral pulsations and their relationships with geomagnetic pulsations. The photometer (Fig. 1) consists of a single telescope equipped with a band-pass filter (4278Å). The field of view is 5°. The amplified anode current of the RCA 1p21 photomultipliers is fed to three electrical band-pass filters (f_1, 0.01–0.1 Hz; f_2, 0.1–2 Hz; f_3, 2–30 Hz), and recorded by a slow running tape-recorder. The outputs of the band-pass filters are separately registered on multi-channel pen recorders together with the signals of the geomagnetic pulsations. By means of this photometric system, data of more than 300 clear night hours were recorded.

2.3. Auroral photometry along the geomagnetic meridian

A meridian scanning photometer was designed for investigating the time and space variations of the auroral luminosity (4278Å) (Fig. 2). A rotating mirror scans from the north to the south along a geomagnetic meridian. The scanning

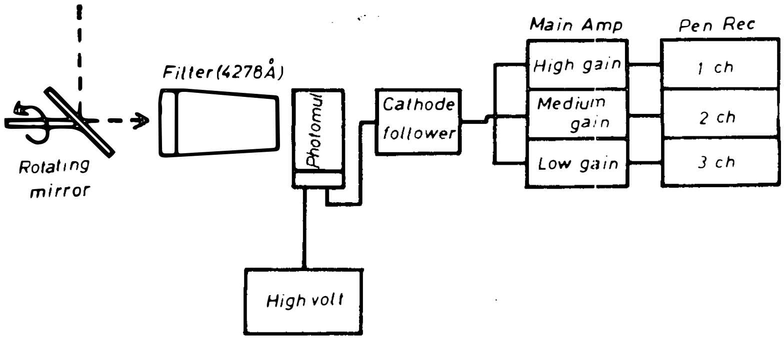

Fig. 2 Block diagram of meridian scanning photometer.

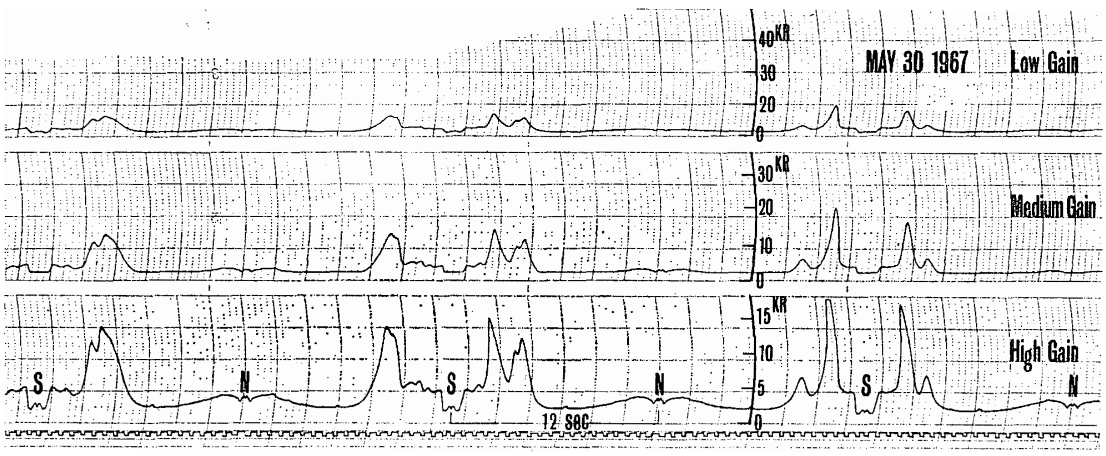

Fig. 3. Chart record obtained by the meridian scanning photometer.

time of this photometer is 12 seconds and the field of view is 5° along the meridian. In the auroral zone, it is desirable to measure the auroral luminosity from 0.1 KR to a few hundreds KR (about 50–60 dB). Therefore, signals of the auroral luminosity are amplified by the high, medium and low gain amplifiers and are separately registered on a 3-channel pen-recorder. Fig. 3 illustrates an example of the chart records.

2.4. Observation of 70MHz auroral radio noise

Observations of 70MHz auroral radio noise (amplifier gain = 140 dB, and band width = 6KHz) have been carried out since February 1966, at Syowa Station. Although we could not identify the natural radio noises which were emitted from the auroras, this instrument was operated perfectly as the standard 70MHz riometer (relative ionospheric opacity meter) for the measurement of wave absorption in the ionosphere.

3. Space-time Variation of Aurora and Geomagnetic Disturbances

3.1. Meridian time-sequence of auroral luminosity (4278 Å)

The meridian time-sequences of auroral luminosity shown, for example, in Figs. 4 or 5, were derived from the chart records of the meridian scanning photometer. These data are taken over a period of 53 days (listed in Table 2) and most of them are given in Appendix III of this report.

3.2. Diurnal appearance of aurora

The diurnal tendency of the auroral appearance in the polar region has been investigated in detail by many research workers. When we observe aurora at a station located at geomagnetic latitude, $\Phi_m = 73° \sim 63°$ (the so-called auroral

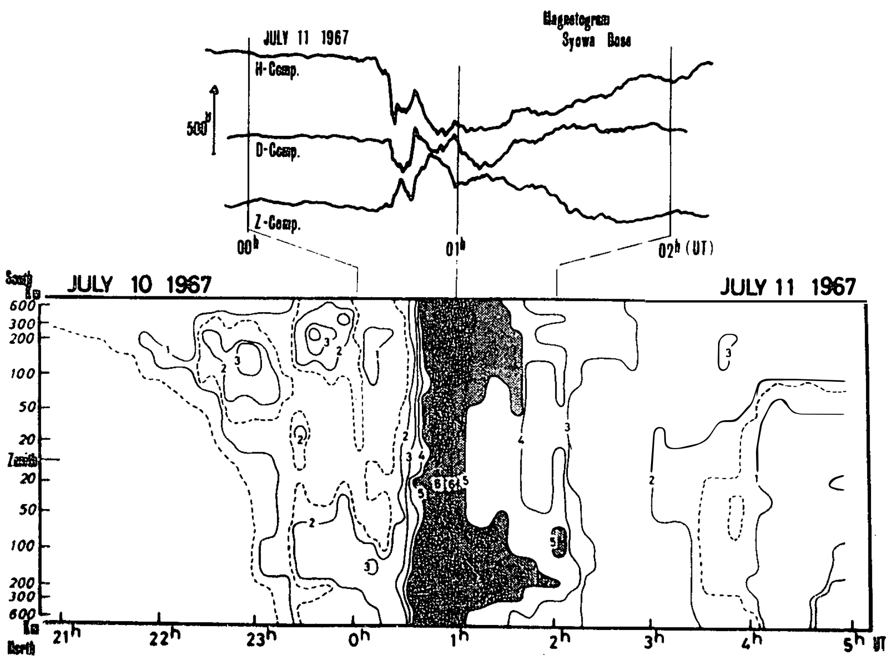

Fig. 4. Meridian time-sequence of auroral luminosity (4278 Å) and the magnetogram on July 10 and 11, 1967.

Table 2. Duration of the auroral observation by meridian scanning photometer.

Date	Time (UT) Start		Time (UT) End		Unit of the contour in the meridian time sequence of auroral luminosity (4278Å) "1" indicates
May 1	22h	00m	23h	10m	about 0.5KR
2	19	50	20	40	0.3KR
25	21	05	21	55	1.0KR
25–26	23	10	01	05	1.0KR
28	18	45	19	20	0.5KR
30–31	15	00	01	10	0.5KR
31–June 1	14	10	00	10	0.3KR
June 2– 3	23	15	00	25	0.3KR
4– 5	16	35	05	10	0.3KR
5– 6	15	15	00	15	0.3KR
6	15	00	23	05	0.3KR
8– 9	14	10	00	10	0.3KR
13	15	00	23	15	
26–27	15	15	05	15	
29–30	19	00	05	10	0.3KR
July 3– 4	19	00	05	20	
5– 6	19	50	05	15	0.3KR
6– 7	15	00	02	05	0.3KR
7– 8	15	06	04	07	
10–11	15	00	05	00	0.3KR
11–12	15	00	05	00	0.3KR
14–15	20	00	00	10	0.3KR
15–16	17	00	05	00	
26	15	00	23	00	
29–30	19	43	04	34	
Aug. 2	18	43	20	43	
7– 8	23	10	01	20	
10–11	18	00	05	00	
11–12	18	43	05	00	
18–19	19	04	00	38	
26–27	18	30	03	05	
27–28	18	00	02	25	0.3KR
Sept. 1– 2	17	50	02	20	0.3KR
2– 3	18	45	01	40	0.3KR
3	21	15	23	30	0.3KR
6– 7	20	08	23	52	
8– 9	19	00	02	00	0.3KR
9–10	18	05	01	45	0.3KR
10–11	18	54	00	30	
11–12	19	09	23	40	
12–13	19	00	22	30	
13–14	17	19	01	27	
15	20	05	21	00	
16	19	17	21	20	
17	18	21	22	48	
18	17	35	22	30	
23	19	00	23	10	
24	18	10	22	10	
29–30	18	15	00	30	0.5KR
30	19	00	23	55	0.3KR
Oct. 8	20	10	21	50	0.3KR

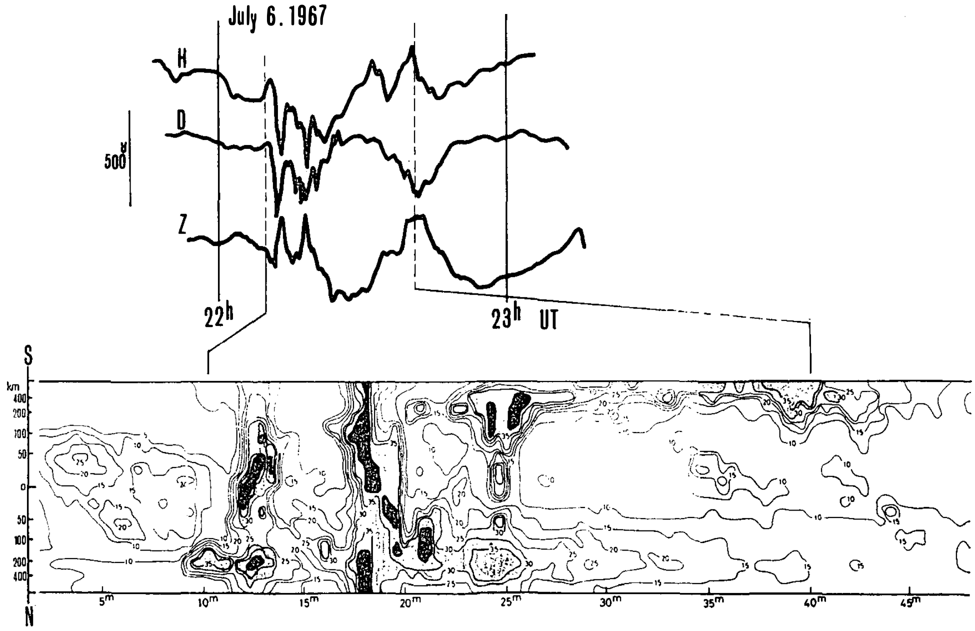

Fig. 5. Meridian time-sequence of auroral luminosity (4278Å) during the auroral substorm on July 6, 1967.

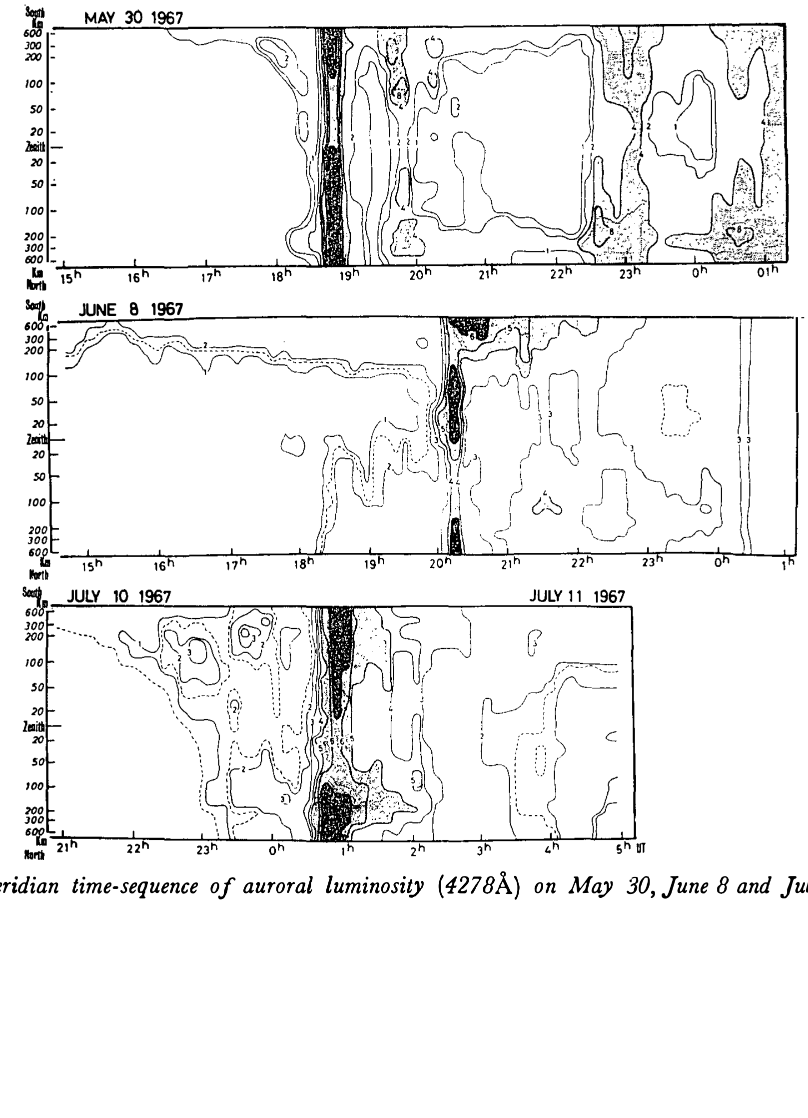

Fig. 6. Meridian time-sequence of auroral luminosity (4278Å) on May 30, June 8 and July 10, 1967.

zone), the auroral glows appear above the poleward horizon of the observing station in the evening hours ($18^h \sim 20^h$LT*). As the night progresses, the auroral glows become the homogeneous arcs or bands. Towards the local midnight, the active region of the aurora shifts to the low-latitudes and various types of the aurora are observable (HEPPNER, 1954).

A similar diurnal tendency is found in the space-time variation of the auroral luminosity obtained at Syowa Station also (Fig. 4). In Fig. 4, faint auroras appear on the poleside of Syowa Station at $20^h \sim 21^h$ UT*. They spread towards the equator, cover the zenith of the observing station at 22:30 UT and reach up to the north horizon at about 23^h UT. After 23^h UT, the auroras are visible from

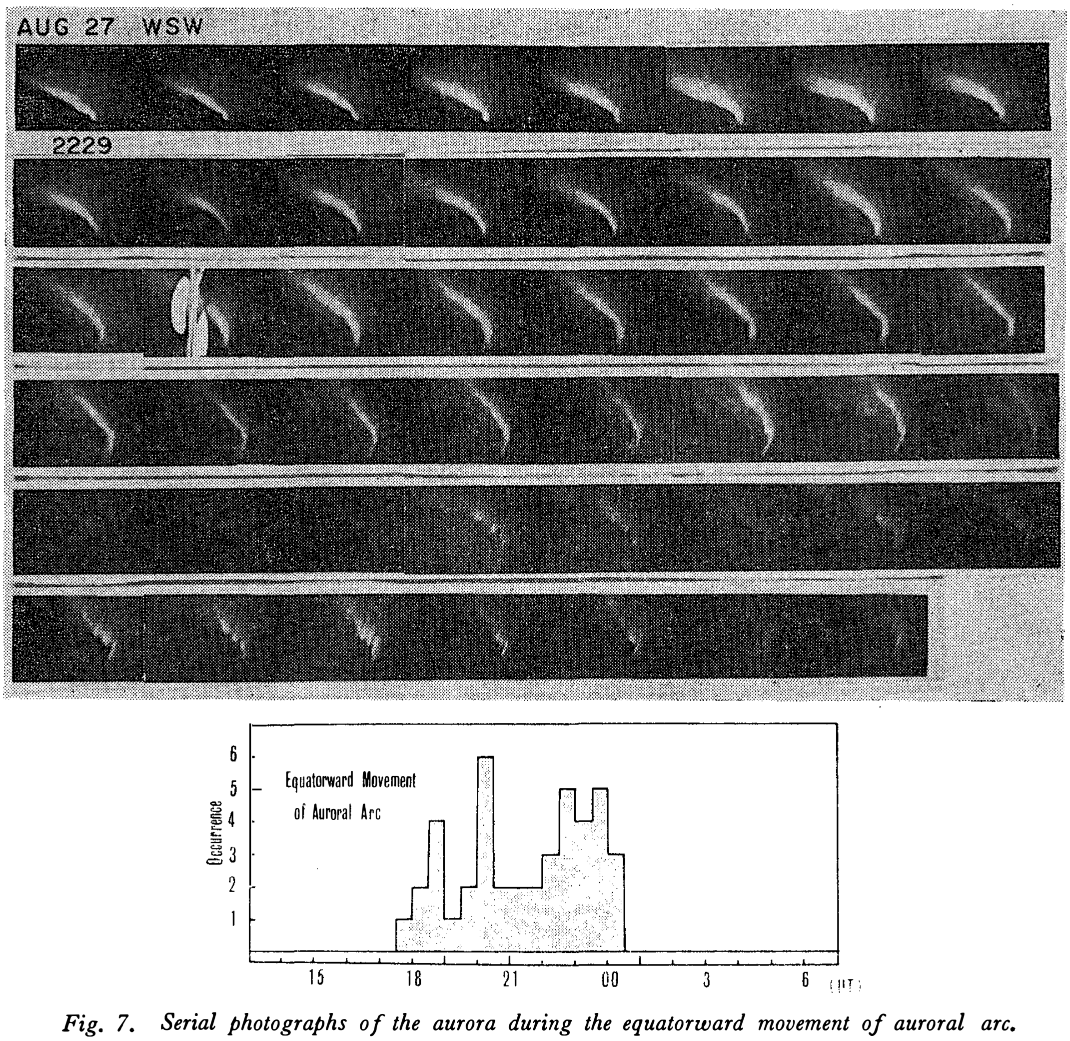

Fig. 7. Serial photographs of the aurora during the equatorward movement of auroral arc. These photographs were taken every 5 to 7 seconds. WSW indicates the geomagnetic direction of the camera.

* The universal time (UT) and the geomagnetic local time (Geomag. LT) are nearly the same at Syowa Station.

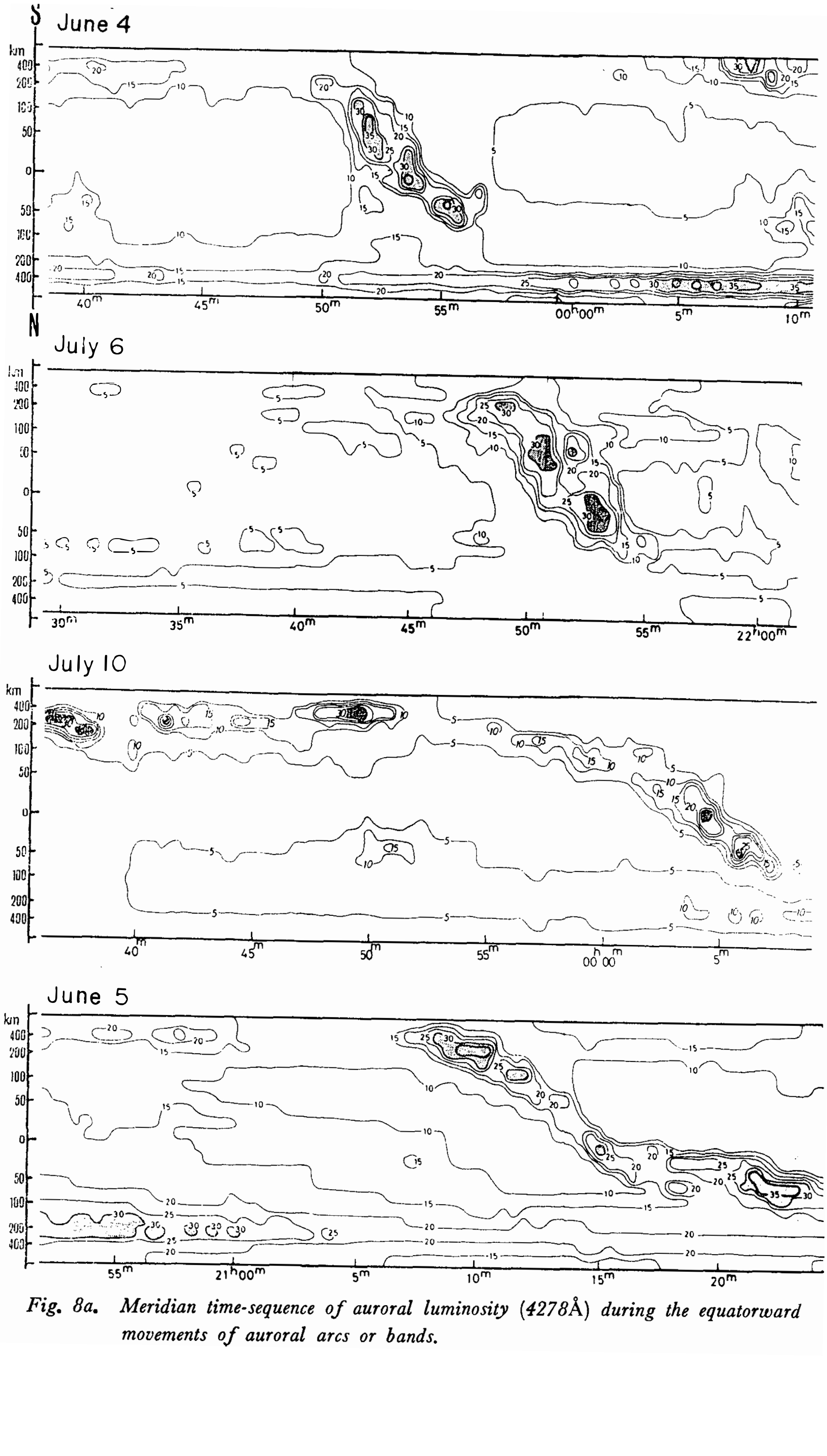

Fig. 8a. Meridian time-sequence of auroral luminosity (4278Å) during the equatorward movements of auroral arcs or bands.

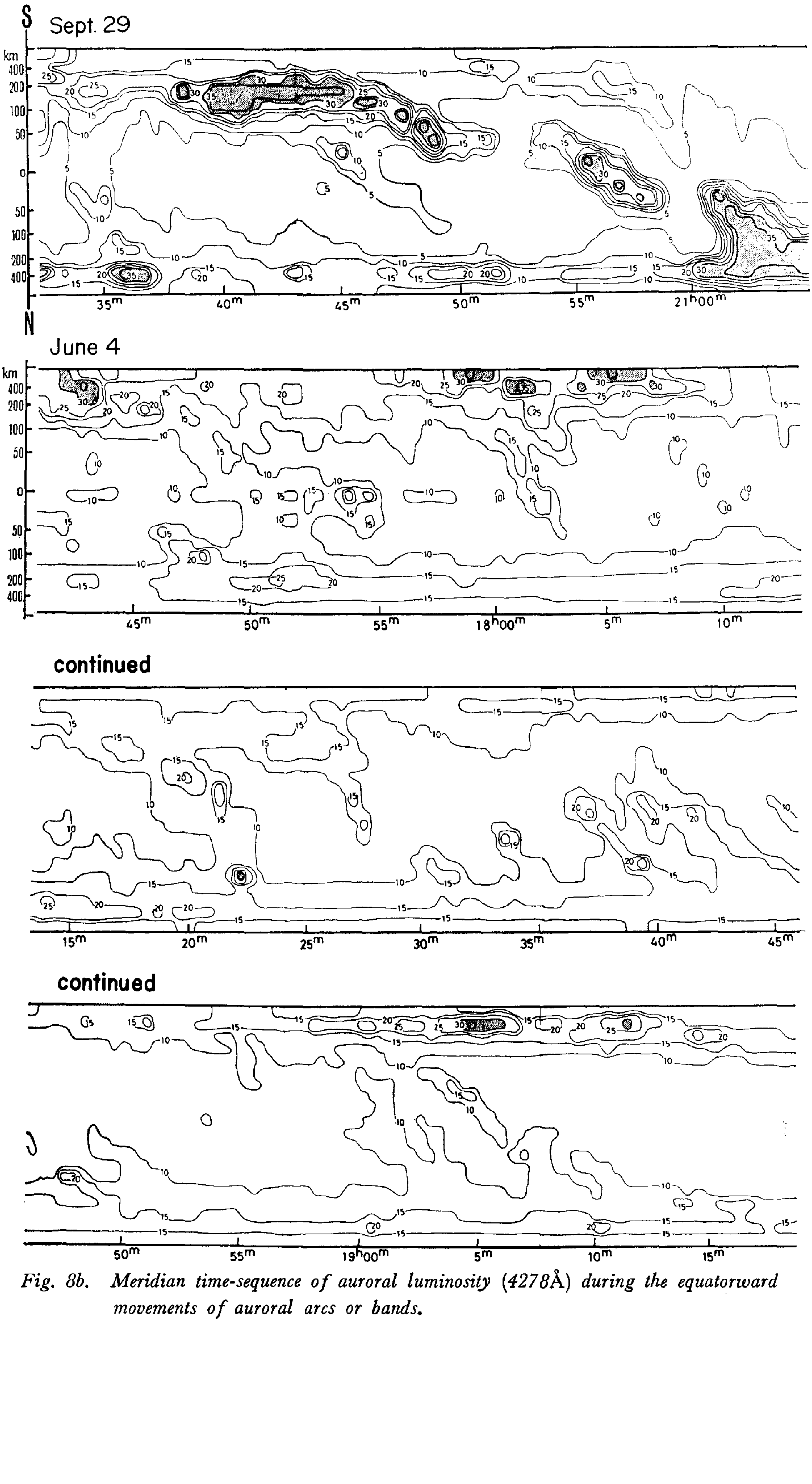

Fig. 8b. Meridian time-sequence of auroral luminosity (4278Å) during the equatorward movements of auroral arcs or bands.

the north to the south of the station. Between 00:40 and 02:00 UT, an auroral substorm occurs. Within several minutes after the onset of a storm, the active auroras with an intense luminosity spread and blanket the sky. Such a diurnal tendency is found also in the data of May 30–31, June 8–9 and July 10–11, 1967 in Fig. 6.

3.3. Equatorward movements of auroral arcs or bands in the evening sector

The serial photographs of the aurora obtained on Aug. 27, 1967 show a definite equatorward movement of the auroral ray arc (Fig. 7). Such movements of the auroras are found in the meridian time sequences also. In the top figure of Fig. 8a, an auroral arc suddenly brightened and began to move towards the equator at 23:50 UT on June 4. This arc passed over the zenith of the observing station with a speed of about 500 m/s, went about 50 km away from the station and suddenly disappeared (see all-sky camera, Appendix II). Some other similar phenomena of the auroral movements are shown in Fig. 8a and b also.

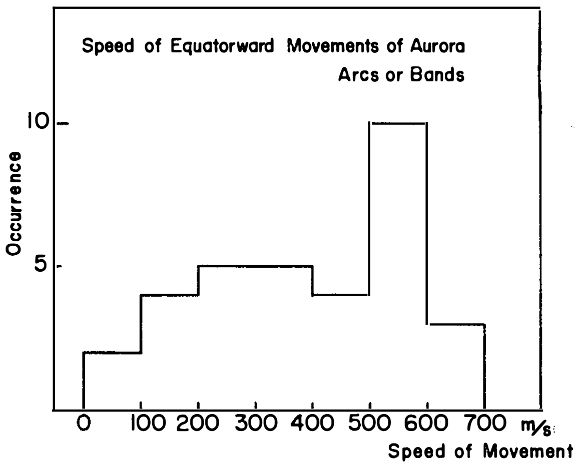

Fig. 9. Histogram of the speed of the equatorward movements of auroral arcs or bands.

Fig. 9 is the histogram of the speed of these auroral equatorward movements. It can be recognized in this figure that these movements have a broad range of speed. Their average speed is about 400 m/s.

At Syowa Station, the equatorward movements of auroral arcs or bands take place mostly in the evening hours, especially in $18^h \sim 00^h$ LT, as shown in the top figure of Fig. 14.

3.4. Auroral and geomagnetic substorms

Detailed morphological studies of auroral and magnetic substorms have been carried out by AKASOFU, using the all-sky camera records obtained at many stations distributed over the polar region. Our present knowledge of the auroral substorms has been greatly advanced by AKASOFU's works.

In this report, we try to investigate the characteristics of the auroral and geomagnetic storms, based on an analysis of the meridian time sequences of auroral luminosity (4278Å). They are obtained by operating the meridian scanning photometer, which was newly designed. From our investigation in detail of the data over a period of 50 days, we have reached a conclusion that the auroral and magnetic substorms observed at Syowa Station are classified into three types of patterns.

3.4.1. Auroral substorm, Type A

As shown in Fig. 10a and b, the clear poleward movements of the aurora

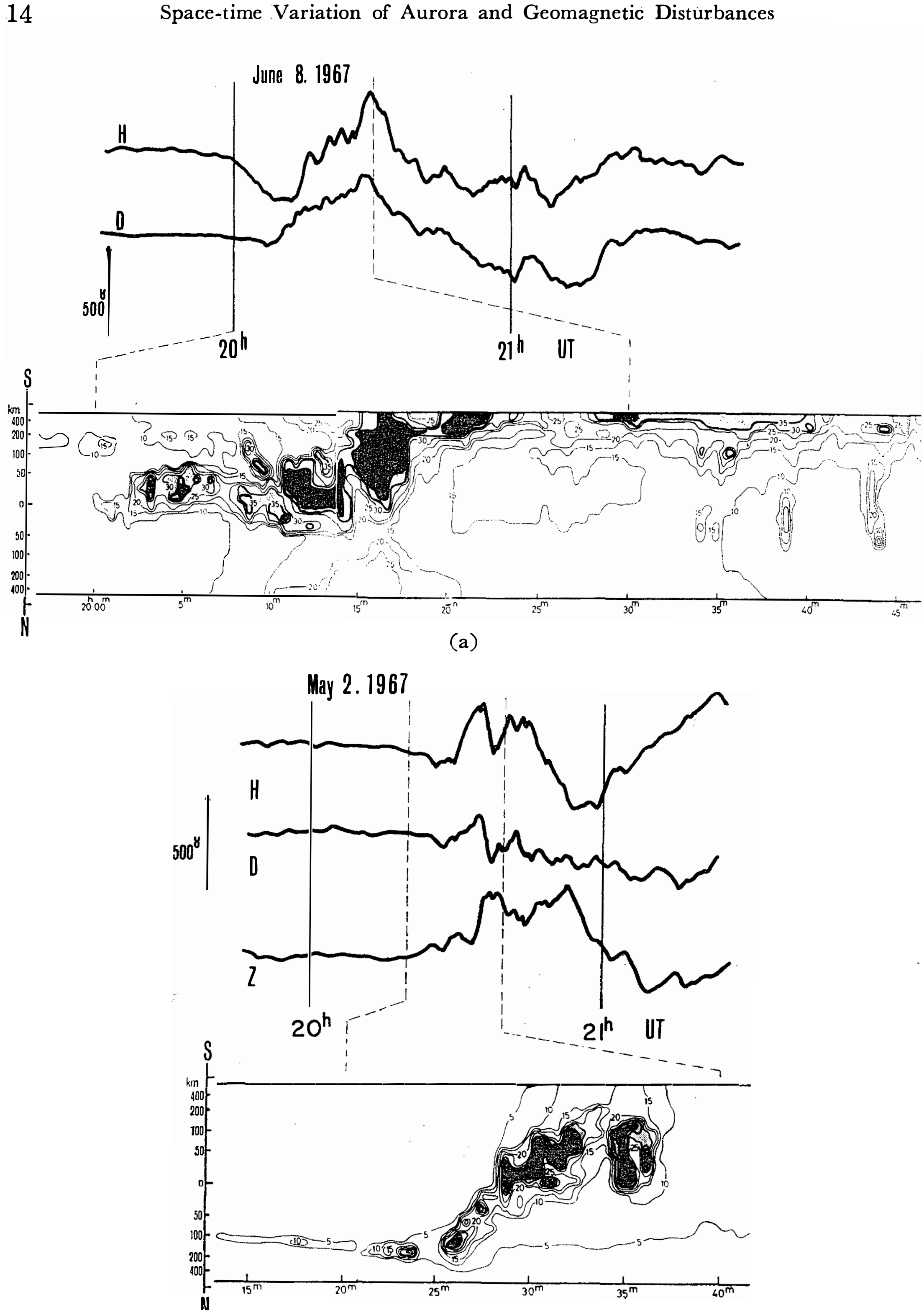

Fig. 10. Meridian time-sequence of auroral luminosity (4278Å) and magnetogram during Type A auroral substorm.

were found. In Fig. 10a, the luminosity of the auroral ray band became suddenly intensified at 20:25 UT on May 2, 1967, and this band began to move rapidly towards the pole at a speed of about 650 m/s. The movement of the aurora was accompanied by an increase of the horizontal field component (H-comp.) (cf. Fig. 18). From the result of examination of the all-sky records of this day (see all-sky camera in Appendix II), we have found that the travelling surge of the aurora (AKASOFU, 1964) appeared in the northeast of Syowa Station at 20:25 UT, and began to travel towards the west. This surge passed over the zenith of the station at about 20:30 UT and went away towards the southwest until 20:40 UT. The auroral storm shown in Fig. 10b has also very similar characteristics. Therefore, it may be concluded that the auroral substorms of this type are observable when the westward travelling surge passes over the vicinity of the observing station.

3.4.2. Auroral substorm, Type B

A typical example of Type B is illustrated by the meridian time sequence of the aurora in Fig. 11. The developing process of the auroral substorm of this type is as follows:

1. About several minutes to half an hour before the onset of the auroral substorm, the quiet arcs which are located on the equatorside of the observing

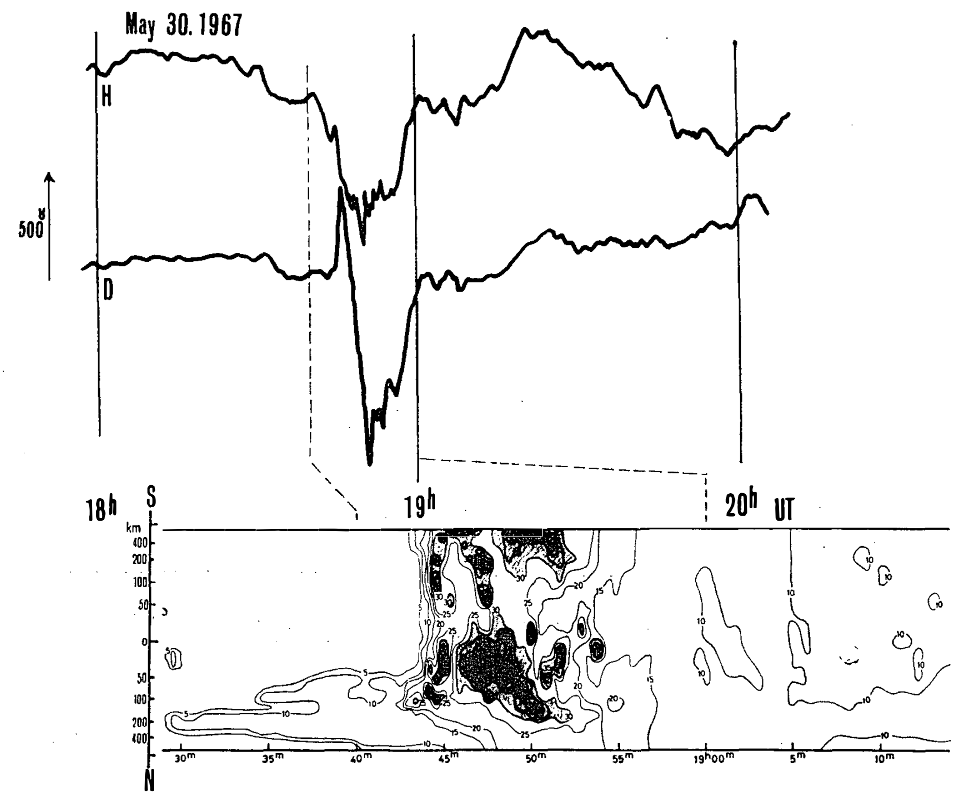

Fig. 11. Meridian time-sequence of auroral luminosity (4278Å) during Type B auroral substorm.

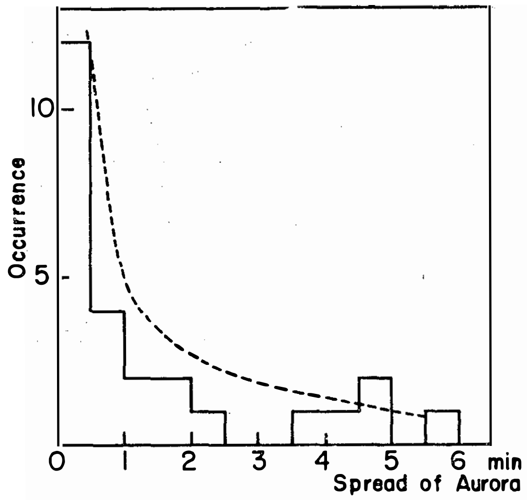

Fig. 12. Spread time of the aurora at the onset of Type B auroral substorm.

station begin to show the brightening.

2. At the onset-time of an auroral substorm, the luminosity of one of these arcs is suddenly intensified.

3. Within a few minutes after the onset of the storm, the aurora spreads and blankets the sky, in which very bright arcs exist, with rapidly fluctuating luminosity. These arcs move towards the pole or the equator at a speed of about 200 ~800 m/s.

4. During the auroral substorm of this type, the horizontal intensity (H) of the geomagnetic field shows a sharp decrease, being associated with the developing process of the storm.

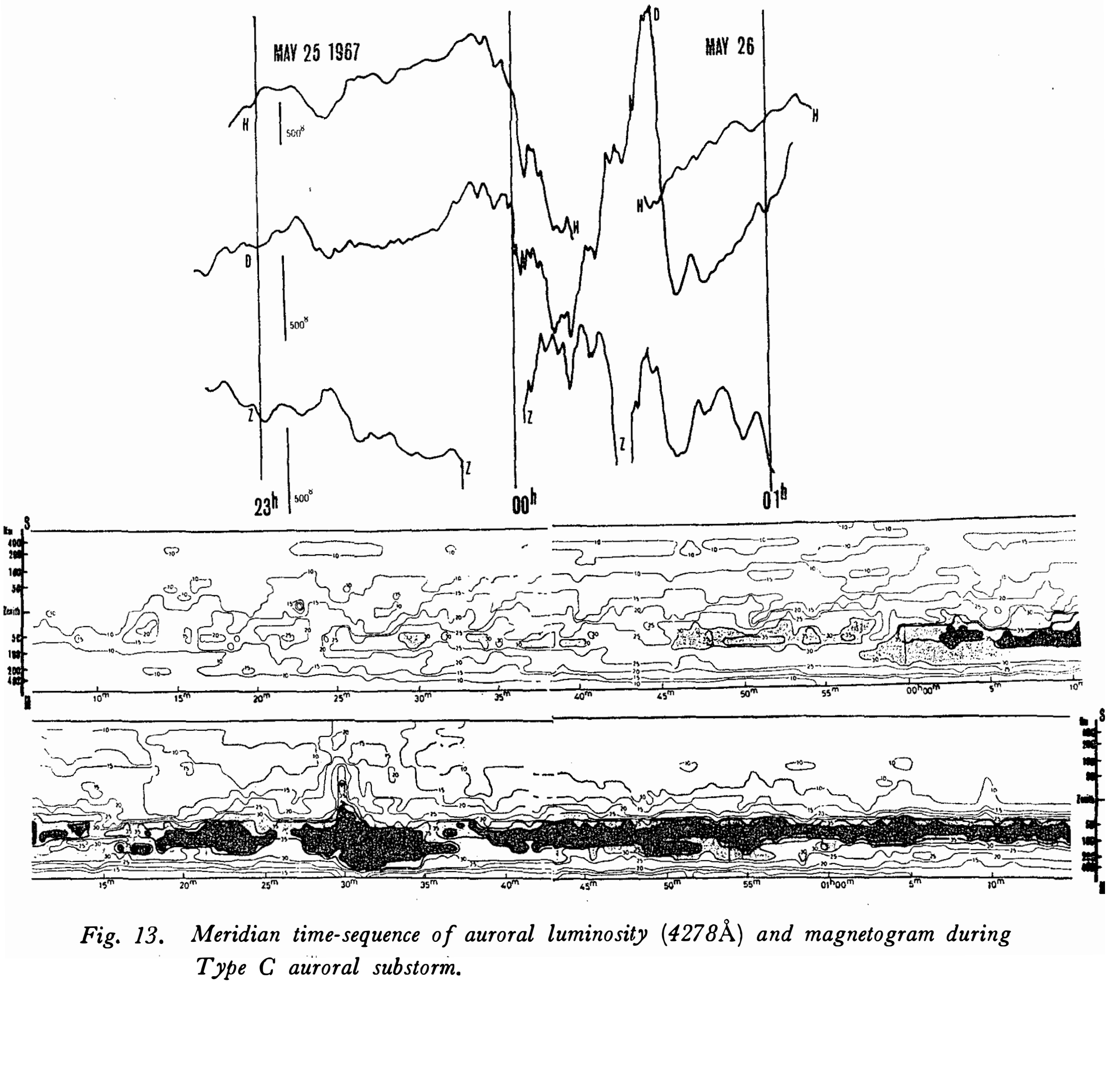

Fig. 13. Meridian time-sequence of auroral luminosity (4278Å) and magnetogram during Type C auroral substorm.

The time, during which the aurora spreads and blankets all over the sky at the onset of the storm, is examined. Fig. 12 shows that the spread time of the aurora is very short, and, in most cases, the aurora blankets the sky within a few minutes after the onset of the Type B auroral substorm.

3.4.3. Auroral substorm, Type C

Fig. 13 shows a typical example of another auroral substorm, Type C. One notices in this figure that the stable and motionless auroras with the latitudinal expansion of about 100 km ~ 400 km existed on the equatorside of the station, lasting for more than an hour. These auroras began to become brighter at 23:45 UT on May 25 and increased both their luminosity and latitudinal expansion. They showed the maximum phase at 00:20~00:35 UT on May 26 and then were gradually restored to the former state. Fig. 13 also illustrates a close relation between the auroral display and the variation of the magnetic horizontal intensity (H); that is, the H-value began to decrease very remarkably at 23 : 50 UT on May 25 and showed the minimum value at about 00:20~00:35 UT on May 26. After the maximum phase of the aurora, H-value recovered gradually.

3.4.4. Occurrence tendency of auroral substorms

The type of auroral substorms may be classified into three groups as mentioned above. The occurrence frequency of each type is shown in Fig. 14. Type A storms take place most frequently in the evening hours (18^h~00^h), while Type B are observable around midnight. Type C storms are concentrated in the early morning hours (00^h~04^h).

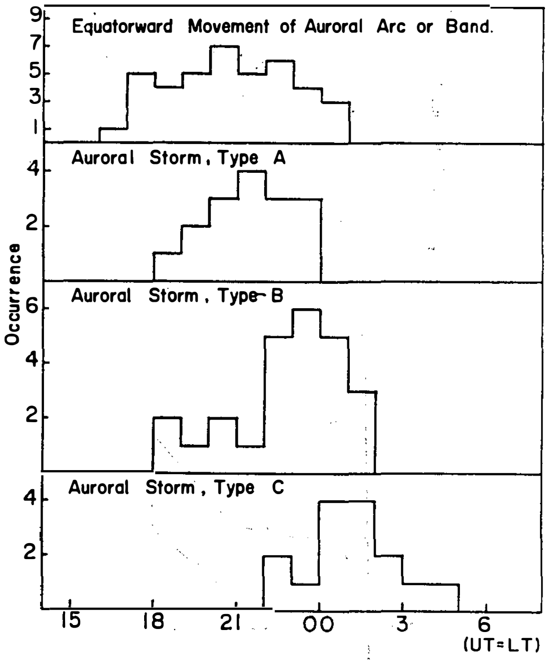

Fig. 14. Occurrence possibilities of the equatorward movement of auroral arcs, Type A, Type B and Type C auroral substorms.

3.5. Simultaneous geomagnetic variation associated with the auroral brightness and movement

Ever since Hally (1716) discovered a correspondence between the aurora and the magnetic disturbance, many research workers have investigated this problem. Oguti (1963), and Nagata and Kaneda (1962) obtained an approximate theoretical relation between the auroral brightness and the magnetic disturbance. Cole (1963) concluded from his investigation of the spatial relations between the aurora and magnetic disturbances that auroras are luminous patches of the ionospheric current system. On the other hand, Kim and Volkman (1963) pointed out that aurora arcs were not always accompanied by

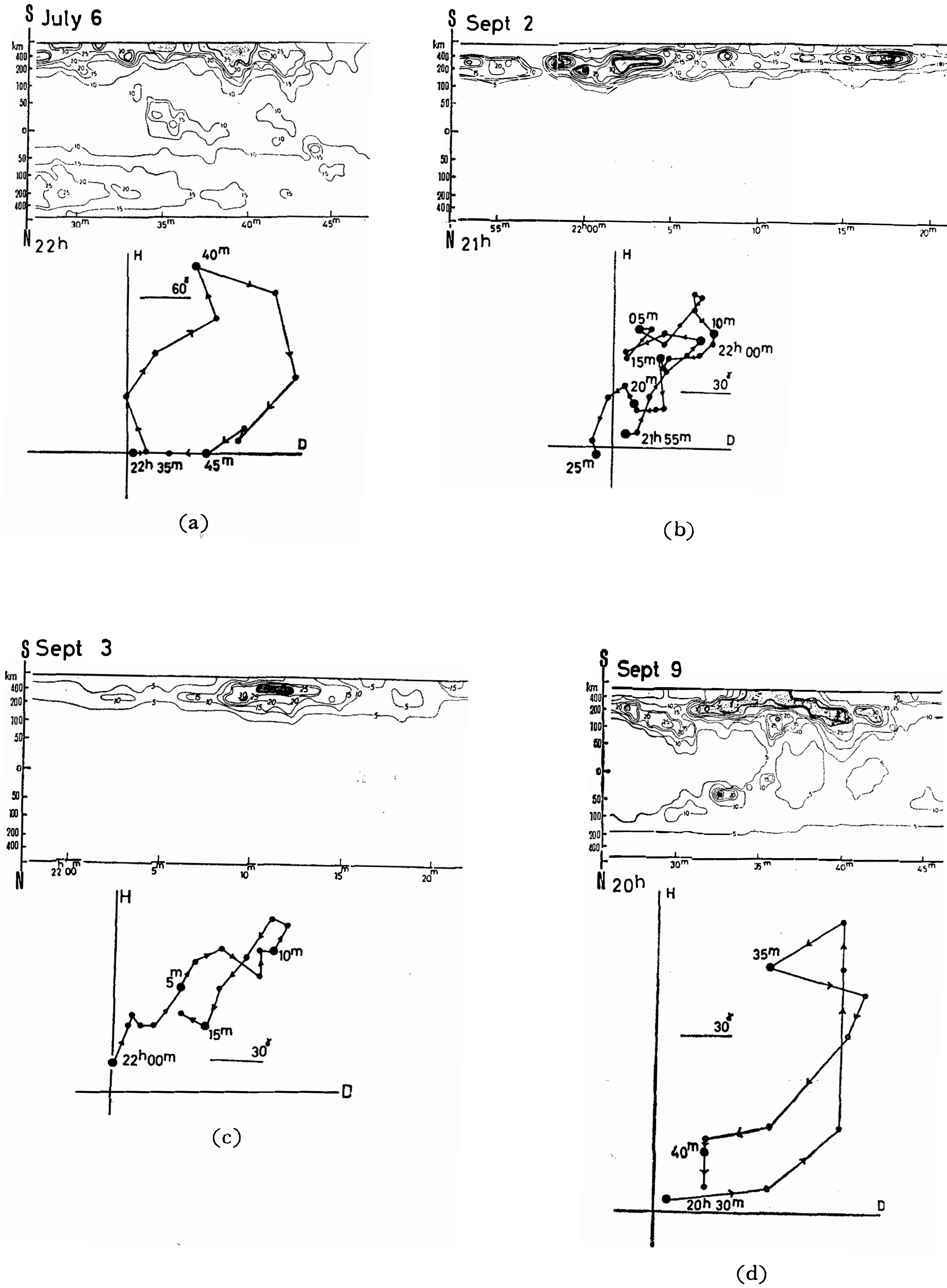

Fig. 15. Geomagnetic field variations associated with the poleward auroral brightening.

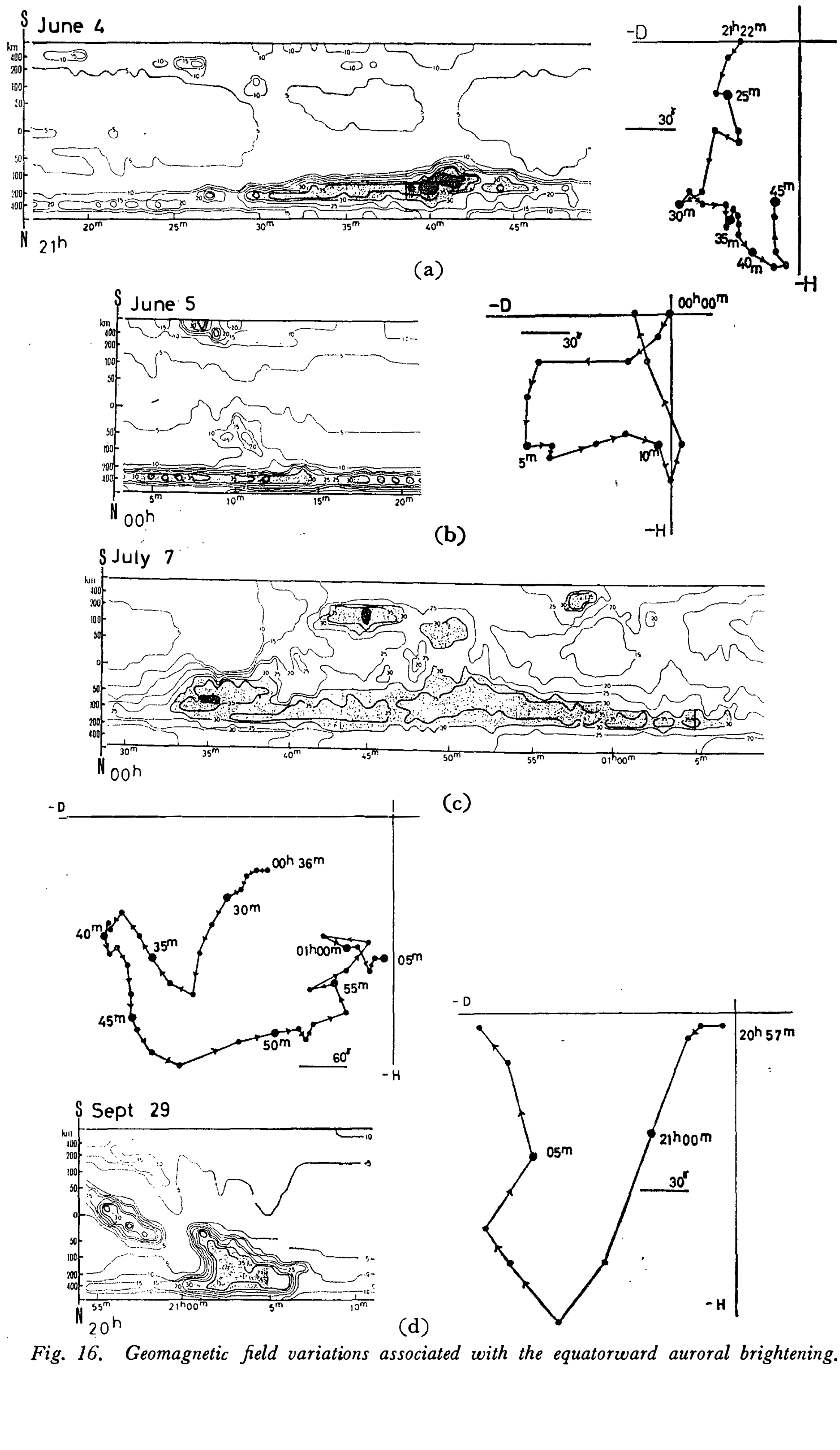

Fig. 16. Geomagnetic field variations associated with the equatorward auroral brightening.

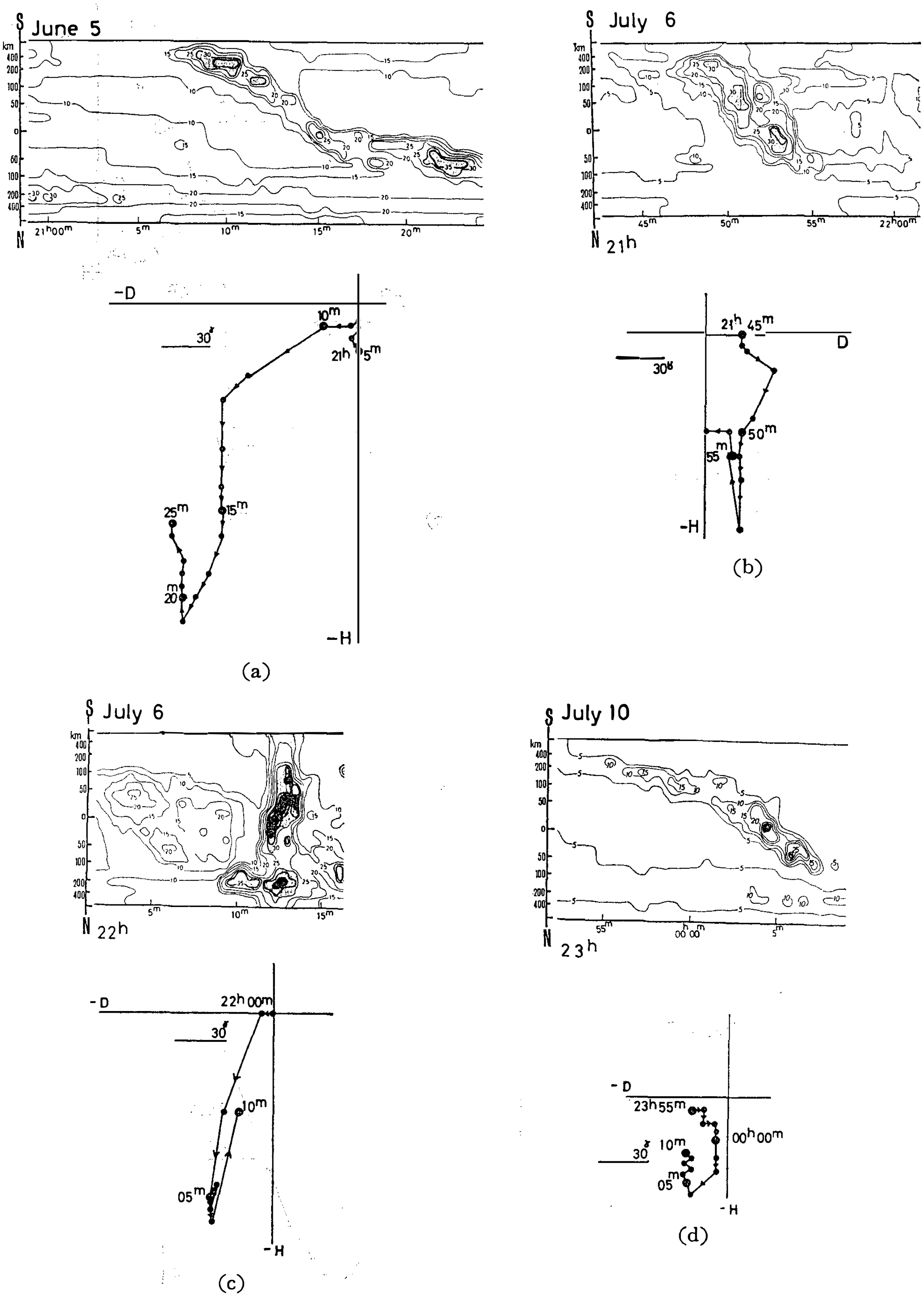

Fig. 17. Geomagnetic field variation associated with the equatorward movements of auroral arcs or bands.

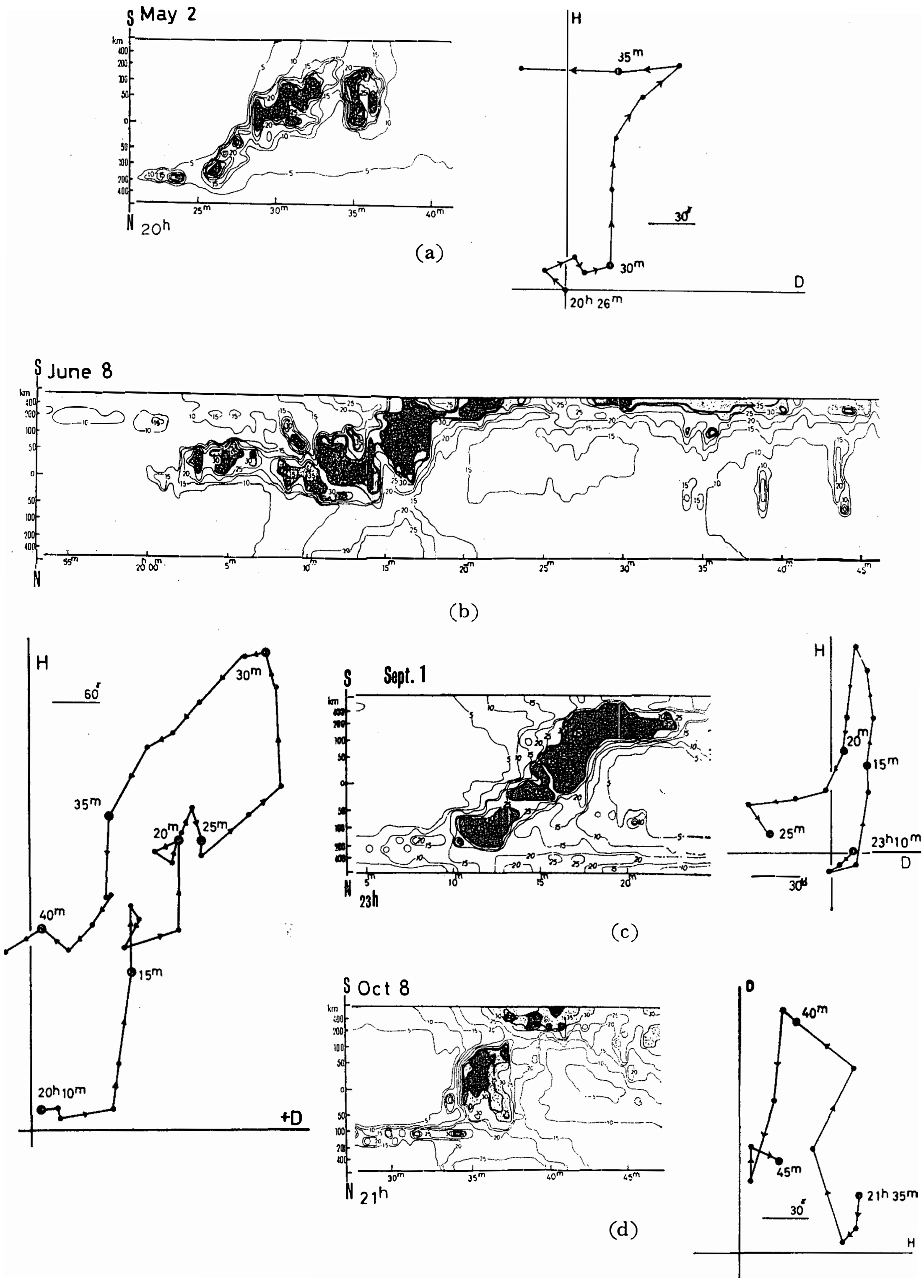

Fig. 18. Geomagnetic field variation associated with the poleward movement of aurora.

appreciable magnetic field changes. It seems therefore a relationship between the two phenomena still remains to be investigated in more detail.

3.5.1. Geomagnetic field variations associated with the poleward auroral brightening

The meridian time sequence of the aurora in Fig. 15a illustrates that auroras were brightening on the poleside of the station and began to increase in both luminosity and latitudinal expansion at 22:35 UT on July 6. They showed the maximum expansion at 22:39 UT and were gradually restored to the former state Associated with this auroral display, the geomagnetic horizontal intensity (H) began to increase at 22:35 UT and attained the maximum value at 22:40 UT. Similar correlations between the aurora and geomagnetic field variations are shown in Fig. 15b, c and d. Therefore, we may conclude that, when the aurora brighten on the polar side of the observing station, H-value increases with a close correlation to the auroral display.

3.5.2. Geomagnetic field variations associated with the equatorward auroral brightening

On the other hand, when the auroras show brightening and latitudinal expansion towards the equatorside of the observing station, the H-value decreases with increasing activation of the aurora, as is illustrated in Fig. 16a, b, c and d.

3.5.3. Geomagnetic field variations associated with the equatorward movements of auroral arcs or bands

As mentioned in the previous section, the equatorward movements of the auroral arcs or bands are frequently observed in the evening sector. During the time of this movement of the aurora, the H-value shows a decrease. One may notice in the Fig. 17b that the auroral arc or band began to move towards the equator at 21:46 UT on July 6, reached a distance about 80 km equatorward from the station at 21:54 UT and disappeared. In association with this movement, the H-value began to decrease at 21:45 UT and showed the smallest value at 21:54 UT. Similar phenomena are given in Fig. 17a, c and d also.

3.5.4. Geomagnetic field variations associated with the poleward movements of aurora

On the contrary, the H-value increases with the poleward movements of aurora, as clearly illustrated in Fig. 18a, b, c and d.

4. Auroral Pulsations

Records of auroral photometers often show a fine structure in the form of quasi-sinusoidal oscillations or trains of pulses, with periods ranging from one second to several minutes. These are called auroral pulsations. They have been recorded at many observatories located in and near the auroral zone for several tens of years, but it is only lately that much attention has been paid to the study of auroral pulsations (STÖRMER, 1942, 1955; VESTINE, 1943; HEPPNER, 1954; OMHOLT, 1957). Some investigators have examined the correlations between auroral and geomagnetic pulsations, and have found that the short period geomagnetic pulsations are frequently associated with auroral pulsations of the same period (CAMPBELL and REES, 1961; OGUTI, 1963; JOHANSEN and OMHOLT, 1966).

4.1. Classification of auroral pulsations in the frequency range of 0.01 to 30Hz

After the investigation of the photometric data of more than 300 clear night hours obtained by the 5° zenith photometer at Syowa Station, we have reached a conclusion that auroral pulsation in the frequency of 0.01 to 30Hz (100 to 0.03s in period) can be classified into the following five types.

Type A. Irregular fluctuations with large amplitudes (several tens of KR) observed mostly at the time of an onset of the auroral substorm (Fig. 19).

Type B. Pulse-like auroral pulsations with a period of about 20–40 seconds, the amplitudes of which are sometimes greater than 10 KR. Pulsations of this type are frequently observed in the early morning hours on magnetically disturbed days (Fig. 20).

Type C. Long-lived auroral pulsations with a sinusoidal waveform. Their period and amplitude are about 10 seconds and a few KR, respectively. This type is dominant in the morning hours (Fig. 21).

Type D. Rapid fluctuations of auroral luminosity with a period of about 0.5–2.0 seconds (Fig. 22).

Type E. Extremely rapid fluctuations with a frequency of about 20–30 Hz (Fig. 23). The auroral pulsations of this type occur most frequently at the time of the equatorial movement of auroral arcs (cf. Fig. 17c and the second figure of

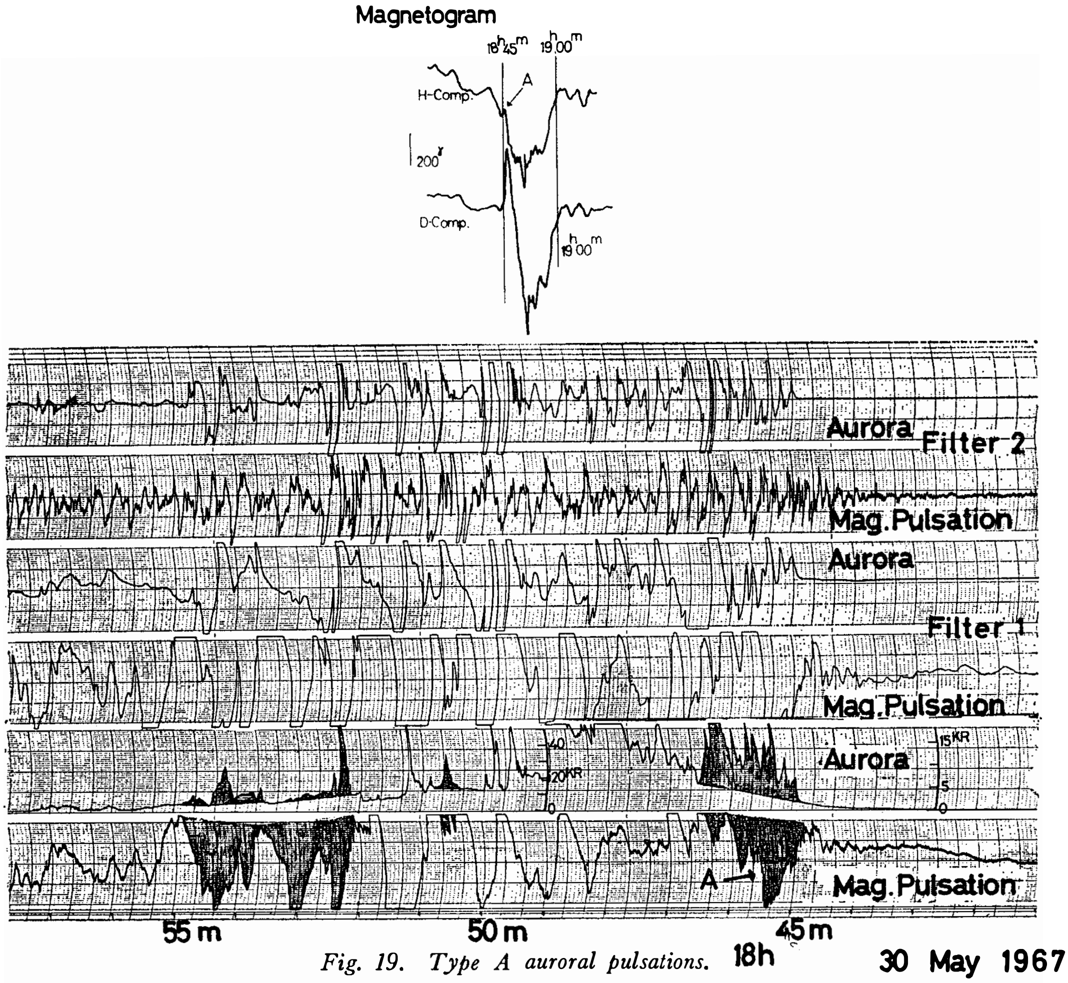

Fig. 19. Type A auroral pulsations.

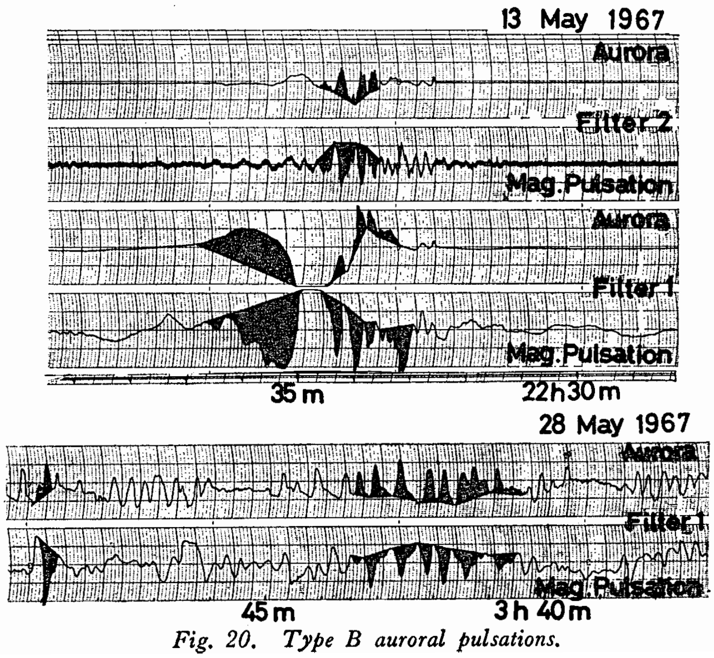

Fig. 20. Type B auroral pulsations.

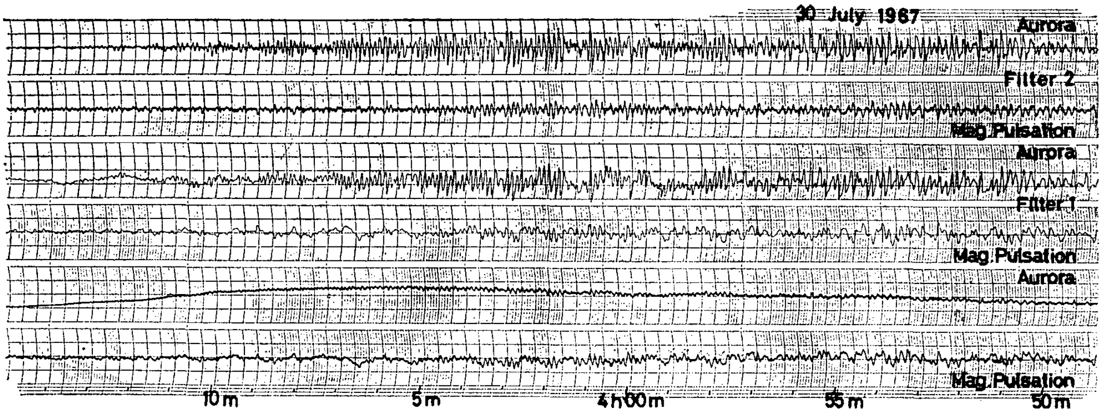

Fig. 21. Type C auroral pulsations.

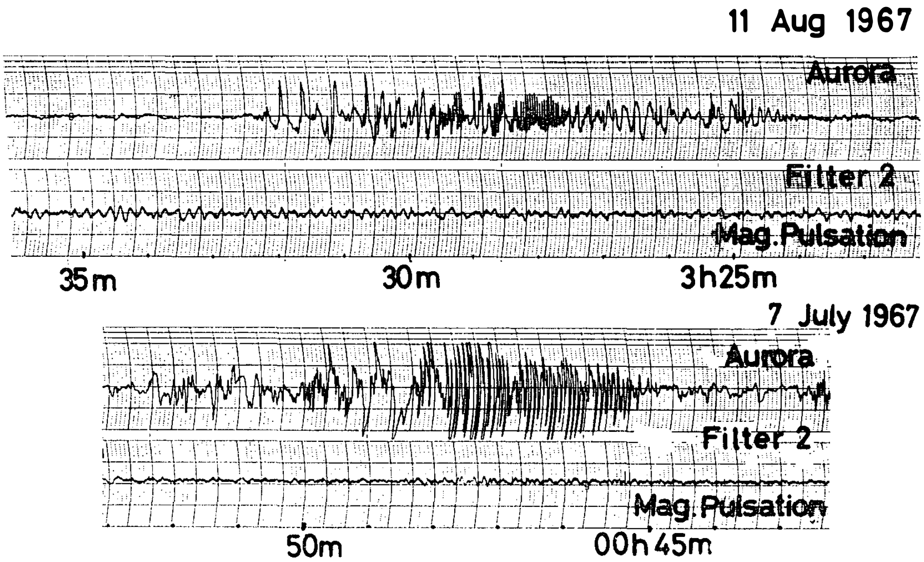

Fig. 22. Type D auroral pulsations.

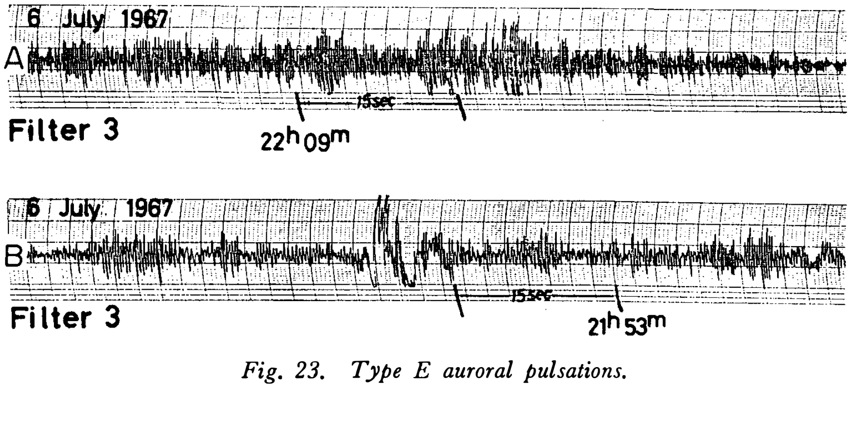

Fig. 23. Type E auroral pulsations.

Fig. 8a).

4.2. Waveform correlation between auroral and geomagnetic pulsations

Waveform correlation between auroral and geomagnetic pulsations depends distinctly on their period. Most of auroral rapid fluctuations of period shorter than 5 seconds are not accompanied by geomagnetic fluctuations. Auroral and geomagnetic pulsations of period longer than 10 seconds have similar waveforms as shown in Figs. 19–21 Fig. 24 shows a correlation between the period of auroral pulsations and the value of $\frac{dxm/dt}{J}$, that is, the ratio of the time derivative of amplitude (Xm) to the luminosity of auroral fluctuations. When we take the ratio $\Delta H/J$, instead of $\frac{dxm/dt}{J}$ (Xm; the amplitude of geomagnetic pulsations), the correlation curve has such a tendency as shown by the solid curve in Fig. 24.

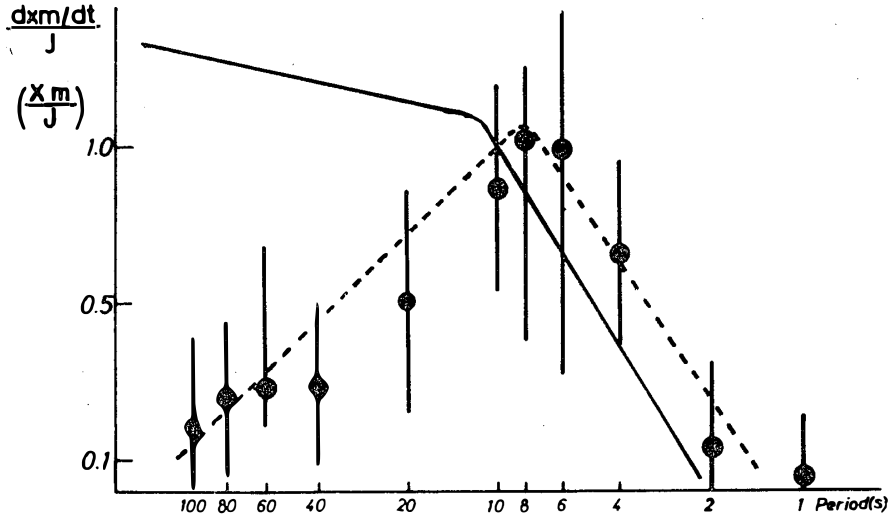

Fig. 24. Correlation between the period of auroral pulsation and $\frac{dxm/dt}{J}$ *or* $\frac{Xm}{J}$.

J: Amplitude of auroral pulsations in luminosity.
Xm: Amplitude of geomagnetic pulsations.
dxm/dt: Time derivative of the amplitude of geomagnetic pulsations.
Dot curve: Correlation between the period of auroral pulsations and $\frac{dxm/dt}{J}$.
Solid curve: Correlation between the period of auroral pulsations and $\frac{Xm}{J}$.

4.3. Summary

The results of the investigation of auroral and geomagnetic pulsations observed simultaneously at Syowa Station, Antarctica, have shown that the auroral pulsations can be classified into five kinds. The typical characteristics of the five kinds are summarized in Table 3.

Table 3. Characteristics of auroral pulsations observed at Syowa Station.

Type	Average period (frequency)	Waveform	Duration	Diurnal variation in: Activity	Diurnal variation in: Period	Correlation with geomagnetic pulsations	Other remarks
A	200∼20s	irregular	5∼30min	most active around midnight (20^h∼24^h LT)		good	usually observed at the onset time of auroral substorms
B	40∼10s	pulse-like	more than an hour	active in the early morning hours (00^h∼06^h LT)	become shorter towards the morning	very good	observed at the recovery phase of auroral substorms
C	15∼05s	sinusoidal	a few hours	active in the morning hours (03^h∼08^h LT)	become shorter towards the morning	very good	observed on the stormy days
D	2∼0.5s	pulse-like or irregular	1∼10min	most active around midnight		none	observed during auroral substorms
E	20∼30Hz	subsinusoidal	a few minutes	active in the evening hours (18^h∼24^h LT)		none	observed most frequently during the equatorward movements of auroral arcs

5. Concluding Remarks

In this report, the items, methods and preliminary results of the auroral observations carried out at Syowa Station in 1967–1968 are summarized. More detailed results will be reported one by one in the near future. We hope that these data are useful for other research workers.

In conclusion, the authors wish to express their most hearty gratitude to all members of the 8th wintering party of Japanese Antarctic Research Expedition for their valuable assistance. They also wish to thank Prof. T. NAGATA for his constant guidance. They are indebted to Prof. N. FUKUSHIMA, Dr. T. OGUTI, Dr. T. TOHMATSU and Dr. S. KOKUBUN for their kind encouragement and advice in planning the instrumentations for the observations.

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