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# The Horizontal Disturbing Vector of Geomagnetic Pulsations, pc

By

K. KURUSU and K. YANAGIHARA


概　要

IGY 期間中に地磁気観測所女満別出張所 ($\varphi$=43°55′ N, $\lambda$=144°12′ E) 及び鹿屋出張所 ($\varphi$=31°25′ N, $\lambda$=130°53′ E) に於て観測した地磁気変化度 (ループ) 早廻記録を使つて, 地磁気 pc 型脈動の水平ベクトルの日変化について調査した. 主なる結果は下記の通りである.

(1) 両地点共, 略同様の結果が得られた.

(2) 水平ベクトルの主方向は, 大部分 (約80%) が北一西の象限にあつた.

(3) 水平ベクトルの描く楕円の短軸と長軸との比は, その大部分 (約80%) が0.50以下であつた.

(4) 水平ベクトルの廻転方向は, その大部分 (約70%) が反時計廻りであつた.


## § 1. Introduction

Geomagnetic micro-pulsations have been arranged tentatively in two groups which are described by the symbols 'pt' and 'pc' after the Meeting of the Committee on Rapid Magnetic Variation and Earth Currents of IAGA, held at Copenhagen in April 1957.

On the diurnal variation of vector direction and the other characteristics of geomagnetic pulsations, excellent investigations have been carried out statistically by T. Terada (1917) and H. Hatakeyama (1938), but in their years pulsations were not classified. Y. Kato et al. (1956) reported the similar studies of psc-pulsations which were regarded as pt. The change of vector direction of magnetic field of pt deduced from earth-currents were also given by one of the present authors.

In this paper, features of vector field of pc pulsations are studied using the induction magnetograms obtained during the IGY (July 1957–1958) at Memambetsu ($\varphi$=43°55′ N, $\lambda$=144°12′ E) and Kanoya ($\varphi$=31°25′ N, $\lambda$=130°53′ E).

The days having relatively long intervals of regular and nearly sinusoidal oscillations are selected from the IGY data. Magnetic storm times are excluded from the selection. As the sample oscillations are regular, the change of their horizontal disturbing vectors can be described practically by the azimuth and ellipticity of the ellipses of locus drawn by the end points of the vectors.

Several representative oscillations of pc pulsations are selected for every one hour of the selected days magnetograms at the two stations. The azimuth and ellipticity of their horizontal disturbing vectors are calculated from amplitudes of east and north components and their phase differences.

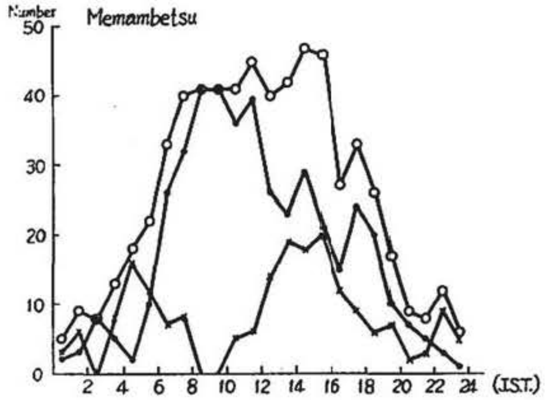
The scale values of north and east components are 0.05–0.07 $\gamma$/sec/mm at both stations, while the speeds of recording paper are 12 mm/min at Memambetsu and 6 mm/min. at Kanoya. The periods of the selected oscillations are almost in the range from 10 to 30 sec., but those of a few cases in night hours are less than 10 sec..

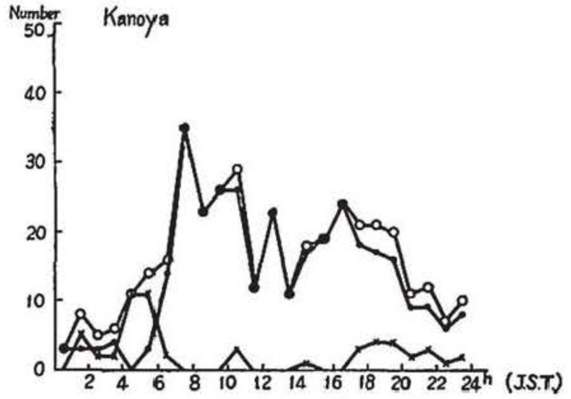
Total numbers of sample-oscillations are 624 at Memambetsu and 385 at Kaonya, respectively.

## § 2. Results of Investigation

1. Azimuth ($\alpha$) of the Horizontal Disturbing Vector.

The local time dependences of the number of pc pulsations whose azimuth $\alpha$ of the long axis of ellipse lie in the quadrant centered at NW, say, N–W quadrant and that in the N–E quadrant are given in Fig. 1 (a), (b). The cases in the N–W quadrant are 69% and 85% of the whole at Memambetsu and Kanoya, respectively. Their maximum hourly occurrences fall at about 8 h L.M.T. at both stations. On the other hand, the occurrence of easterly azimuth reaches maximum at about 5 h L.M.T. for both stations and again show the maximum in the afternoon at about 15 h for Memambetsu and about 19 h L.M.T. for Kanoya, respectively.




•—• number of pc pulsations whose azimuth lie in N-W quadrant
×—× number of pc pulsations whose azimuth lie in N-E quadrant
○—○ total number of pc pulsations

Fig. 1 (a) Local time diurnal variation of number of pc pulsations whose azimuth lie in N-W or N-E quadrant; Memambetsu.

Fig. 1 (b) Local time diurnal variation of number of pc pulsations whose azimuth lie in N-W or N-E quadrant; Kanoya.

Next we divide the directions into eight ranges of 22.5° in width, and count the numbers of the case in each range of directions. Their numbers are shown in Fig. 2 (a), (b) graphically.

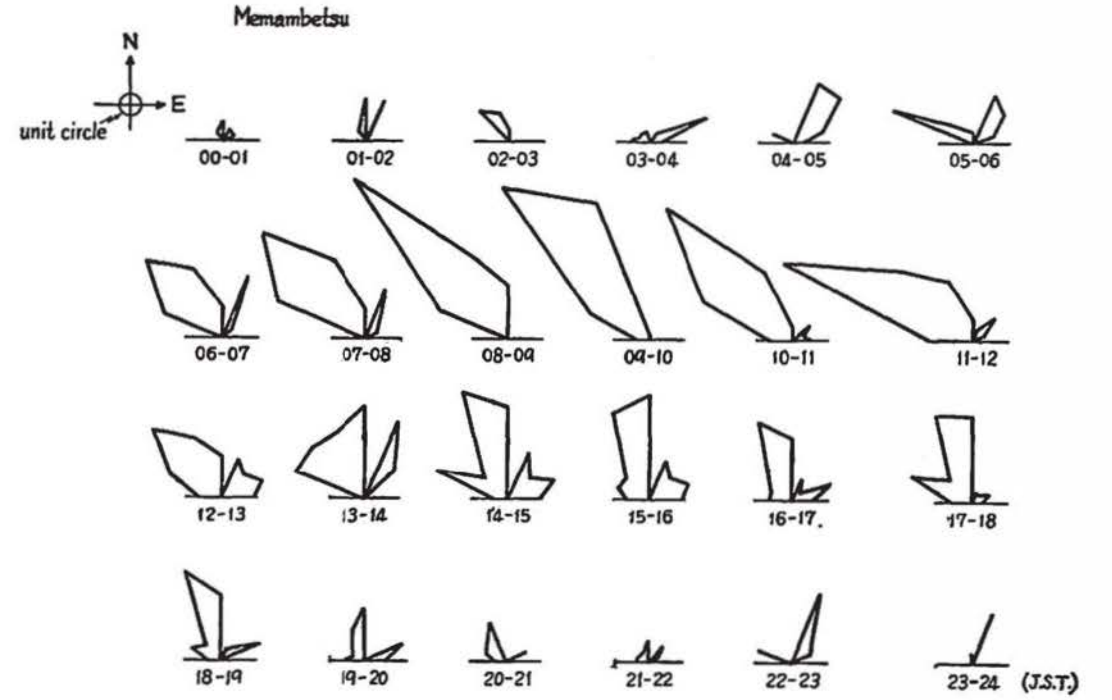



Fig. 2. (a) Hourly distribution of direction of horizontal disturbing vector of pc pulsation. ; Memambetsu.

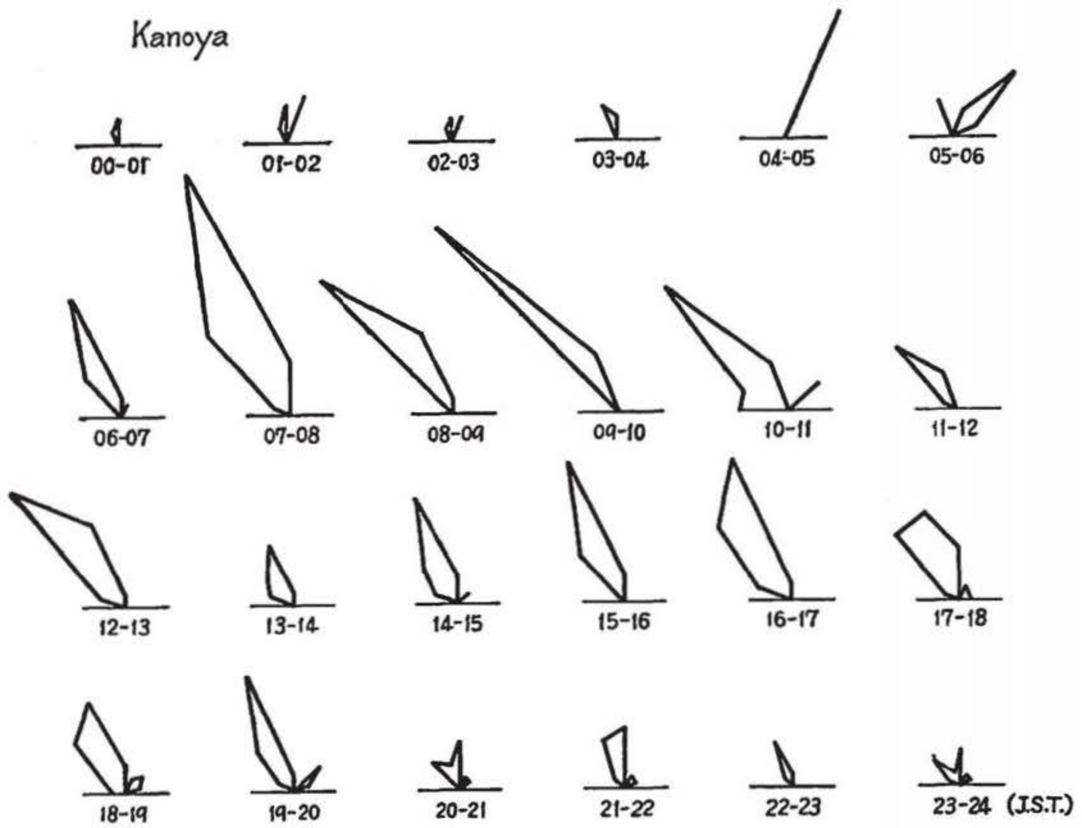



Fig. 2. (b) Hourly distribution of direction of horizontal disturbing vector of pc pulsation. ; Kanoya.

2. Ratio (b/a) of the Length of Minor Axis to Major One of the Ellipse of the Horizontal Vector.

The ratio of minor axis to major one, b/a, is the quantity corresponding to the ellipticity of the supposed ellipse. Numbers of the case of $b/a < 0.50$ anb $b/a \geqq 0.50$ are shown in Fig. 3 (a), (b), for every one hour of local time.

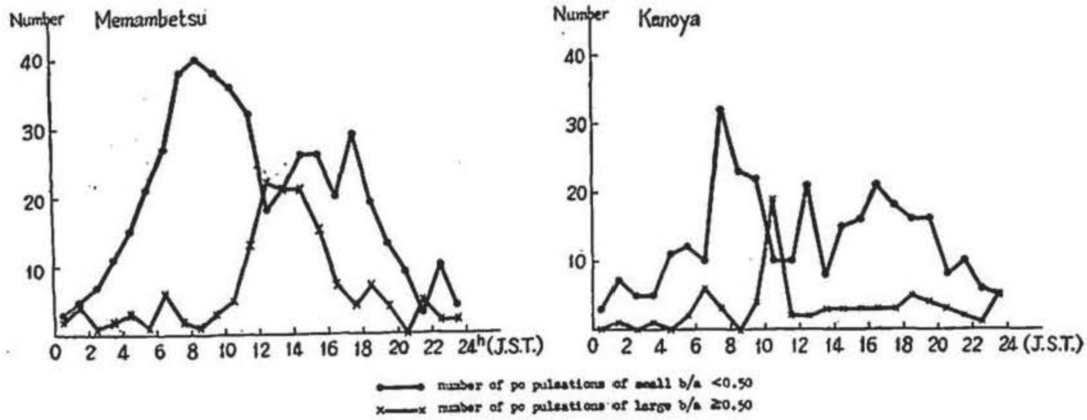



Fig. 3. (a) Local time diurnal variation of ratio b/a of disturbing vector; Memambetsu.

Fig. 3. (b) Local time diurnal variation of ratio b/a of disturbing vector.; Kanoya.

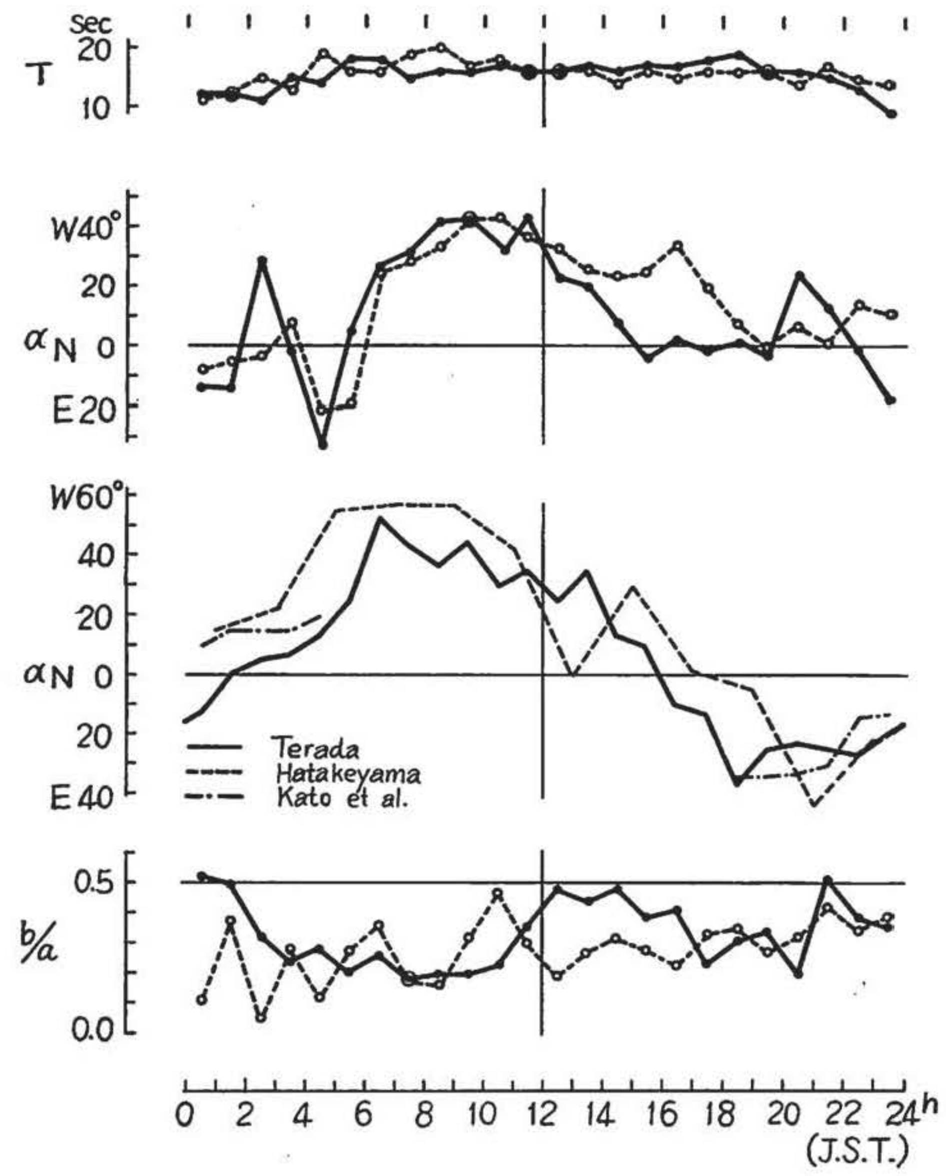
The most part (75% at Memambetsu and 81% at Kanoya) is the case of $b/a < 0.50$. Maximum occurrence of the case, $b/a < 0.50$ appears once before noon (about 8 h L. M. T. at both stations) and again afternoon (about 17 h L. M. T. at both stations). On the other hand most frequent occurrence of the case, $b/a \geqq 0.50$, falls at about 13 h L. M. T. at Memambetsu, and about 10 h L. M. T. at Kanoya.

3. Diurnal Variation of the Azimuth $\alpha$ and the Ratio b/a.

Mean observed values of period, T, azimuth, $\alpha$, and the ratio, b/a of the horizontal disturbing vectors of selected pc pulsations for every one hour are shown in Fig. 4 together with the results of $\alpha$ obtained by T. Terada, H. Hatakeyama, and Y. Kato et al. Azimuth; $\alpha$ is measured counter-clockwise from the geographical north. Comparing b/a with $\alpha$ during daytime, it may be noticed for Memambetsu's data that b/a has the least value when $\alpha$ is most westerly before noon, wheseas b/a reaches the largest value when $\alpha$ is near the north direction afternoon.

Between the present analysis of the distribution of $\alpha$ of pc pulsations and the Terada's (1917) and Hatakeyama's (1938) results on the pulsations, not classified said above, close similarities are found in the daytime behaviour.

The mean values of T, $\alpha$ and b/a for every one hour are listed in Table 1 (a) and (b) together with the corresponding number of samples.




•—• Memambetsu, O—O Kanoya

Fig. 4. Local time diurnal variaton of mean observed values of T, $\alpha$ and b/a. Lower part of $\alpha$'s figure: after T. Terada (1917), H. Hatakeyama (1938) and Y. Kato et al. (1956).

4. Rotational Sense of Disturbing Vector.

In our data, only a few % of the whole show nearly linear oscillations. In the other remaining cases, 95% at Memambetsu and 93% at Kanoya, the disturbing vector describes a rotational figure.

Rotations of the vector can be divided into two cases of the clockwise and counterclockwise sense. The frequency of the case of two sense for each one hour are calculated and shown in Fig. 5 (a), (b). As it is shown in the figures, the most

Table 1 (a) Horizontal uisturbing vector of pulsation pc ; Memambetsu

| J.M.T. | $00^h \sim 01^h$ | | | | $01^h \sim 02^h$ | | | | $02^h \sim 03^h$ | | | | $03^h \sim 04^h$ | | | | $04^h \sim 05^h$ | | | | $05^h$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T |
| | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec |
| 1957 Nov. 14 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Nov. 15 | — | — | — | — | — | — | — | — | — | — | — | — | 5 | 12 | 0.16 | −63 | — | — | — | — | 4 | 21 |
| 1958 Jan. 13 | — | — | — | — | — | — | — | — | — | — | — | — | 4 | 15 | 0.35 | −11 | — | — | — | — | 6 | 20 |
| Apr. 05 | — | — | — | — | — | — | — | — | — | — | — | — | 2 | 17 | 0.32 | −03 | — | — | — | — | 5 | 17 |
| May 27 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| May 28 | 5 | 12 | 0.52 | −14 | 9 | 12 | 0.50 | −14 | 8 | 11 | 0.32 | +29 | 2 | 16 | 0.13 | +72 | 7 | 17 | 0.22 | −39 | 3 | 18 |
| Jul. 25 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 6 | 12 | 0.27 | −38 | 4 | 13 |
| Aug. 13 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Sep. 09 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 5 | 12 | 0.36 | −20 | — | — |
| Mean* | 5 | 12 | 0.52 | −14 | 9 | 12 | 0.50 | −14 | 8 | 11 | 0.32 | +29 | 13 | 15 | 0.24 | − 1 | 18 | 14 | 0.28 | −32 | 22 | 18 |

| J.M.T. | $12^h \sim 13^h$ | | | | $13^h \sim 14^h$ | | | | $14^h \sim 15^h$ | | | | $15^h \sim 16^h$ | | | | $16^h \sim 17^h$ | | | | $17^h$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T |
| | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec |
| 1957 Nov. 14 | 5 | 10 | 0.57 | +46 | 3 | 16 | 0.23 | +60 | 11 | 14 | 0.55 | −20 | 14 | 14 | 0.52 | +13 | 6 | 15 | 0.46 | −21 | 8 | 12 |
| Nov. 15 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1958 Jan. 13 | 2 | 17 | 0.27 | +44 | 3 | 16 | 0.24 | +45 | 5 | 14 | 0.37 | +63 | 3 | 13 | 0.35 | −61 | 5 | 16 | 0.50 | −12 | 1 | 25 |
| Apr. 05 | 2 | 17 | 0.34 | +66 | 5 | 18 | 0.65 | +38 | 2 | 16 | 0.43 | +65 | — | — | — | — | — | — | — | — | — | — |
| May 27 | 7 | 15 | 0.39 | +62 | 6 | 17 | 0.52 | +34 | 7 | 18 | 0.45 | +16 | 8 | 17 | 0.24 | +07 | 9 | 16 | 0.33 | +03 | 8 | 16 |
| May 28 | 9 | 20 | 0.69 | −27 | 9 | 20 | 0.55 | −18 | 10 | 22 | 0.49 | +03 | 2 | 26 | 0.30 | +43 | 4 | 20 | 0.38 | +22 | 10 | 21 |
| Jul. 25 | 5 | 16 | 0.54 | −10 | 5 | 15 | 0.46 | −08 | 3 | 13 | 0.57 | +07 | 3 | 15 | 0.53 | −23 | 3 | 16 | 0.38 | +19 | 3 | 16 |
| Aug. 13 | 5 | 17 | 0.27 | +27 | 7 | 17 | 0.22 | +03 | 5 | 18 | 0.30 | −18 | 6 | 17 | 0.31 | +08 | — | — | — | — | — | — |
| Sep. 09 | 5 | 16 | 0.73 | −26 | 4 | 18 | 0.64 | +09 | 4 | 15 | 0.71 | −53 | 5 | 17 | 0.45 | −18 | — | — | — | — | 3 | 15 |
| Mean* | 40 | 16 | 0.48 | +23 | 42 | 17 | 0.44 | +20 | 47 | 16 | 0.48 | +08 | 41 | 17 | 0.39 | −04 | 27 | 17 | 0.41 | +02 | 33 | 18 |

* For the row "Mean" of this column, "No", the total number of oscillations are listed.

Table 1 (b) Horizontal disturbing vector of pulsation pc ; Kanoya

| J.M.T. | $00^h \sim 01^h$ | | | | $01^h \sim 02^h$ | | | | $02^h \sim 03^h$ | | | | $03^h \sim 04^h$ | | | | $04^h \sim 05^h$ | | | | $05^h$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T |
| | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec |
| 1958 Jan. 13 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Jan. 16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 4 | 20 |
| Mar. 27 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Mar. 28 | — | — | — | — | — | — | — | — | 2 | 19 | 0.05 | −19 | 3 | 16 | 0.28 | −06 | 7 | 21 | 0.16 | −23 | 7 | 14 |
| May 27 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| May 28 | 3 | 11 | 0.11 | −08 | 8 | 12 | 0.37 | −05 | 3 | 10 | 0.05 | +14 | 3 | 09 | 0.28 | +22 | 4 | 16 | 0.07 | −18 | 3 | 13 |
| Mean* | 3 | 11 | 0.11 | −08 | 8 | 12 | 0.37 | −05 | 5 | 15 | 0.05 | −03 | 6 | 13 | 0.28 | +08 | 11 | 19 | 0.12 | −21 | 14 | 16 |

| J.M.T. | $12^h \sim 13^h$ | | | | $13^h \sim 14^h$ | | | | $14^h \sim 15^h$ | | | | $15^h \sim 16^h$ | | | | $16^h \sim 17^h$ | | | | $17^h$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T |
| | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec |
| 1958 Jan. 13 | 6 | 14 | 0.26 | +25 | 3 | 14 | 0.16 | +22 | 5 | 14 | 0.36 | +28 | 7 | 13 | 0.26 | +25 | 6 | 13 | 0.25 | +45 | 5 | 14 |
| Jan. 16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Mar. 27 | 9 | 16 | 0.15 | +46 | 6 | 13 | 0.51 | +45 | 5 | 14 | 0.27 | +43 | 4 | 13 | 0.33 | +12 | 7 | 15 | 0.22 | +27 | 8 | 15 |
| Mar. 28 | 2 | 20 | 0.18 | +26 | 2 | 21 | 0.14 | +12 | 3 | 16 | 0.35 | −04 | 4 | 23 | 0.23 | +22 | 6 | 17 | 0.20 | +25 | 5 | 19 |
| May 27 | 6 | 14 | 0.18 | +36 | — | — | — | — | 5 | 11 | 0.29 | +29 | 4 | 13 | 0.30 | +41 | 5 | 16 | 0.23 | +40 | 3 | 15 |
| May 28 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Mean* | 23 | 16 | 0.19 | +33 | 11 | 16 | 0.27 | +26 | 18 | 14 | 0.32 | +24 | 19 | 16 | 0.28 | +25 | 24 | 15 | 0.23 | +34 | 21 | 16 |

* For the row "Mean" of this column, "No", the total number of oscillations are listed.
The meaning of abbreviations in the heading of the table is as follows;

No : Numbers of sample-oscillations.
T : Period of observed "pc-type" pulsations.
b/a : Ratio of the length of minor axis to major one of the ellipse of the horizontal disturbing vector in the induction field
α : Azimuth of the major axis measured counter-clockwise from the geographical north.

| ~06h | | 06h~07h | | | | 07h~08h | | | | 08h~09h | | | | 09h~10h | | | | 10h~11h | | | | 11h~12h | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α |
| | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° |
| — | — | 4 | 20 | 0. 32 | +61 | — | — | — | — | 5 | 14 | 0. 26 | +53 | 6 | 13 | 0. 41 | +39 | 7 | 13 | 0. 13 | +48 | 6 | 12 | 0. 37 | +66 |
| 0. 14 | +66 | 6 | 19 | 0. 22 | +58 | 4 | 12 | 0. 26 | +27 | 5 | 15 | 0. 18 | +49 | 3 | 16 | 0. 22 | +53 | 6 | 15 | 0. 45 | +15 | 6 | 15 | 0. 30 | +60 |
| 0. 12 | +64 | 4 | 21 | 0. 24 | +60 | 8 | 18 | 0. 14 | +64 | 7 | 18 | 0. 23 | +68 | 5 | 14 | 0. 11 | +54 | 2 | 18 | 0. 10 | +48 | 2 | 19 | 0. 14 | +60 |
| 0. 29 | −41 | 2 | 21 | 0. 41 | −37 | 6 | 16 | 0. 13 | +43 | 5 | 16 | 0. 17 | +46 | 3 | 20 | 0. 17 | +53 | 4 | 18 | 0. 29 | +52 | 4 | 18 | 0. 48 | +49 |
| — | — | — | — | — | — | — | — | — | — | — | — | — | — | 6 | 17 | 0. 19 | +49 | 7 | 18 | 0. 41 | +24 | 4 | 14 | 0. 51 | +35 |
| 0. 13 | −29 | 6 | 19 | 0. 17 | −16 | 8 | 19 | 0. 19 | −10 | 3 | 18 | 0. 13 | +22 | 5 | 18 | 0. 32 | +24 | 3 | 21 | 0. 29 | −15 | 6 | 22 | 0. 56 | +10 |
| 0. 35 | −34 | 9 | 13 | 0. 20 | +25 | 9 | 13 | 0. 21 | +31 | 10 | 15 | 0. 12 | +17 | 5 | 15 | 0. 21 | +39 | 3 | 16 | 0. 07 | +36 | 5 | 15 | 0. 35 | +32 |
| — | — | — | — | — | — | — | — | — | — | — | — | — | — | 4 | 16 | 0. 08 | +23 | 5 | 17 | 0. 15 | +28 | 5 | 16 | 0. 17 | +24 |
| — | — | 2 | 13 | 0. 27 | +40 | 5 | 14 | 0. 17 | +36 | 6 | 14 | 0 32 | +40 | 4 | 15 | 0. 10 | +52 | 4 | 18 | 0. 20 | +54 | 7 | 16 | 0. 35 | +51 |
| 0. 21 | + 5 | 33 | 18 | 0. 26 | +27 | 40 | 15 | 0. 18 | +32 | 41 | 16 | 0. 20 | +42 | 41 | 16 | 0. 20 | +43 | 41 | 17 | 0. 23 | +32 | 45 | 16 | 0. 36 | +43 |

| ~18h | | 18h~19h | | | | 19h~20h | | | | 20h~21h | | | | 21h~22h | | | | 22h~23h | | | | 23h~24h | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α |
| | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° |
| 0. 21 | +54 | 5 | 15 | 0. 20 | +47 | 6 | 15 | 0. 27 | −48 | 3 | 15 | 0. 18 | −18 | 3 | 15 | 0. 53 | +32 | 5 | 13 | 0. 30 | +17 | — | — | — | — |
| — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 0. 13 | −52 | 3 | 21 | 0. 12 | −72 | 3 | 17 | 0. 29 | +24 | 2 | 21 | 0. 29 | +71 | — | — | — | — | — | — | — | — | — | — | — | — |
| — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 0. 31 | +06 | 9 | 16 | 0. 41 | +15 | 8 | 16 | 0. 47 | +14 | 4 | 13 | 0. 14 | +20 | 5 | 15 | 0. 48 | −07 | 7 | 12 | 0. 47 | −18 | 6 | 09 | 0. 35 | −18 |
| 0. 39 | +26 | 9 | 24 | 0. 49 | +14 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 0. 20 | +18 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 0. 11 | −56 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 0. 23 | −01 | 26 | 19 | 0. 31 | +01 | 17 | 16 | 0. 34 | −03 | 9 | 16 | 0. 20 | +24 | 8 | 15 | 0. 51 | +13 | 12 | 13 | 0. 39 | −01 | 6 | 09 | 0. 35 | −18 |

| ~06h | | 06h~07h | | | | 07h~08h | | | | 08h~09h | | | | 09h~10h | | | | 10h~11h | | | | 11h~12h | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α |
| | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° |
| — | — | — | — | — | — | 10 | 18 | 0. 19 | +31 | 10 | 19 | 0. 17 | +41 | 7 | 16 | 0. 23 | +41 | 5 | 18 | 0. 32 | +53 | 3 | 14 | 0. 11 | +30 |
| 0. 37 | −41 | 7 | 16 | 0. 46 | +23 | 9 | 17 | 0. 21 | +34 | 5 | 21 | 0. 20 | +44 | — | — | — | — | — | — | — | — | — | — | — | — |
| — | — | — | — | — | — | — | — | — | — | — | — | — | — | 7 | 19 | 0. 30 | +41 | 9 | 20 | 0. 61 | +67 | 2 | 16 | 0. 62 | +55 |
| 0. 12 | −41 | 5 | 18 | 0. 38 | +35 | 6 | 23 | 0. 20 | +40 | 6 | 21 | 0. 21 | +30 | 4 | 18 | 0. 51 | +43 | 9 | 20 | 0. 59 | +08 | 4 | 18 | 0. 25 | +24 |
| — | — | — | — | — | | — | — | — | — | — | — | — | — | 8 | 14 | 0. 23 | +42 | 6 | 14 | 0. 35 | +44 | 3 | 15 | 0. 21 | +37 |
| 0. 36 | +25 | 4 | 15 | 0. 25 | +16 | 10 | 18 | 0. 12 | +13 | 2 | 18 | 0. 05 | +19 | — | — | — | — | — | — | — | — | — | — | — | — |
| 0. 28 | −19 | 16 | 16 | 0. 36 | +25 | 35 | 19 | 0. 18 | +29 | 23 | 20 | 0. 16 | +34 | 26 | 17 | 0. 32 | +42 | 29 | 18 | 0. 47 | +43 | 12 | 16 | 0. 30 | +37 |

| ~18h | | 18h~19h | | | | 19h~20h | | | | 20h~21h | | | | 21h~22h | | | | 22h~23h | | | | 23h~24h | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α | No. | T | b/a | α |
| | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° | | sec | | ° |
| 0. 57 | +10 | 3 | 17 | 0. 53 | −58 | 2 | 16 | 0. 15 | −60 | 2 | 17 | 0. 35 | −36 | 2 | 19 | 0. 36 | +05 | — | — | — | — | — | — | — | — |
| — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 0. 17 | +34 | 3 | 17 | 0. 23 | +36 | 3 | 16 | 0. 43 | +19 | 4 | 13 | 0. 29 | +47 | 2 | 22 | 0. 75 | −09 | 3 | 19 | 0. 47 | +10 | 7 | 17 | 0. 62 | +13 |
| 0. 29 | +22 | 5 | 18 | 0. 23 | +19 | 7 | 17 | 0. 18 | +29 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 0. 29 | +15 | 10 | 12 | 0. 39 | +34 | 8 | 13 | 0. 31 | +11 | 5 | 12 | 0. 31 | +09 | 8 | 11 | 0. 16 | +08 | 4 | 11 | 0. 21 | +18 | 3 | 10 | 0. 16 | +08 |
| — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 0. 33 | +20 | 21 | 16 | 0. 35 | +08 | 20 | 16 | 0. 27 | 0 | 11 | 14 | 0. 32 | +07 | 12 | 17 | 0. 42 | +01 | 7 | 15 | 0. 34 | +14 | 10 | 14 | 0. 39 | +11 |

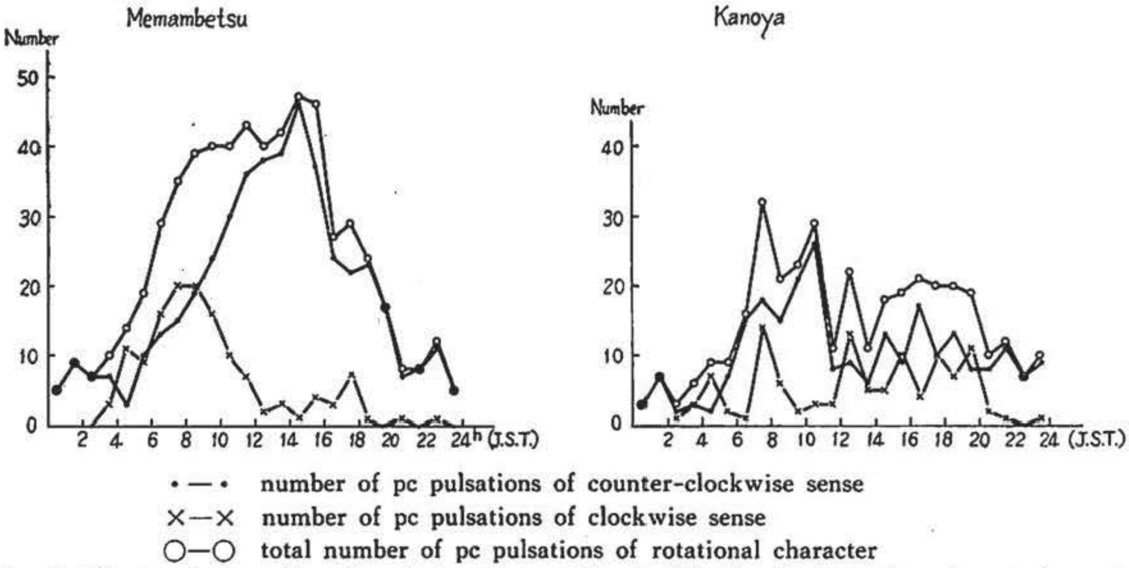



Fig. 5. (a) Local time diurnal variation of rotational sense of disturbing vector.; Memambetsu.

Fig. 5. (b) Local time diurnal variation of rotational sense of disturbing vector.; Kanoya.

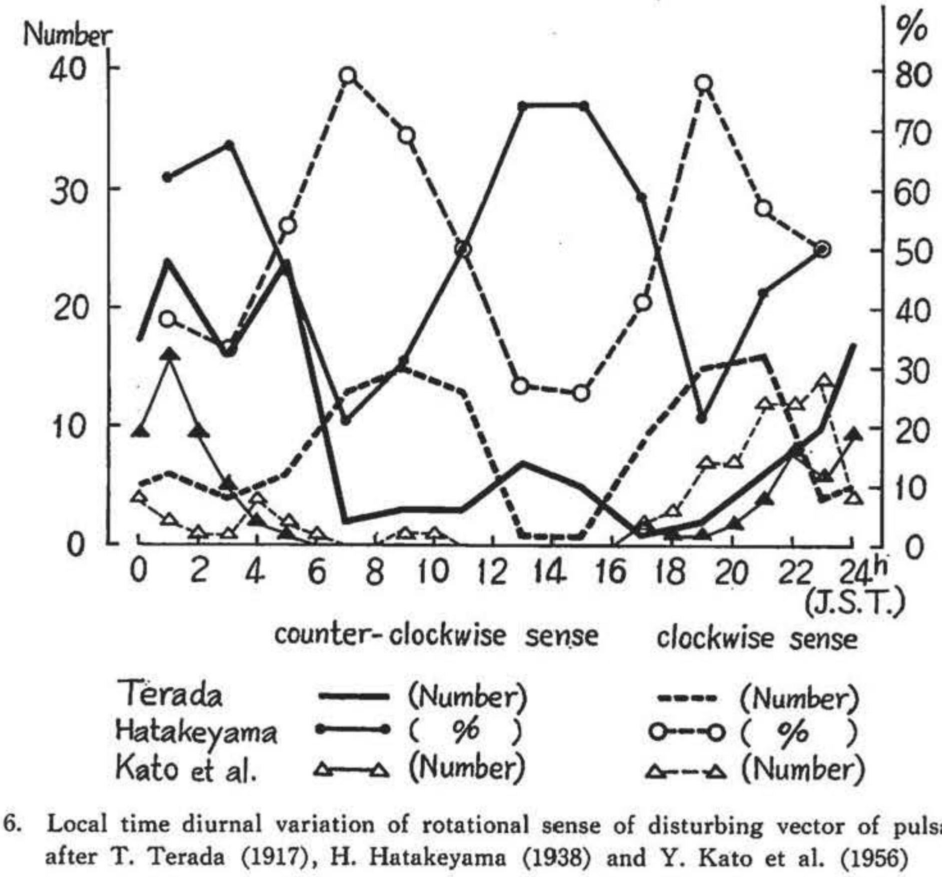



Fig. 6. Local time diurnal variation of rotational sense of disturbing vector of pulsation, after T. Terada (1917), H. Hatakeyama (1938) and Y. Kato et al. (1956)

of all disturbing vectors (77% at Memambetsu and 69% at Kanoya) rotate counter-clockwise. The maximum hourly occurrence frequency of counterclockwise rotation falls at about 14 h L. M. T. at Memambetsu and about 10 h L. M. T. at Kanoya respectively, whereas the clockwise rotation appears most frequently at about 08 h L. M. T. at Memambetsu and doubtful at Kanoya.

Comparing the Fig. 5(a) with Fig. 1(a) and Fig. 3(a) for Memambetsu, it may be noticed that the counterclockwise rotation predominates in those hours when the easterly $\alpha$ and the $b/a \geqq 0.50$, are frequent, while the clockwise rotation predominates in those hours when the westerly $\alpha$ and the $b/a < 0.50$ are frequent.

For the Kanoya's data, we can not find so conspicuous relations on them. Our present results on the change of rotational sense in the daytime are nearly same as those of T. Terada and H. Hatakeyama reproduced here in Fig. 6.

## § 3. Concluding Remarks

At the start of this study we intended to compare in detail the modes of pc-oscillations at Memambetsu and Kanoya each other using the corresponding oscillations. But for simplicity our investigations have been carried out using the oscillations picked up independently for both station. And our present results show no striking difference between the behaviours at two stations.

In near future, we shall attempt to study the same investigation using induction magnetograms in magnetic storm times, and to investigate world wide distribution of disturbing vectors using the simultaneous rapid-run magnetograms.

The authors wish to express their hearty thanks to Dr. T. Yoshimatsu, Director of the Kakioka Magnetic Observatory, and to Mr. M. Hirayama, Chief of the Technical section of the Observatory for their continuous encouragements and valuable advices.

## References

〔1〕 Terada, T. (1917) : On Rapid Periodic Variation of Terrestrial Magnetism. Journal of the College of Science, Imperial University of Tokyo, Vol. XXXVII, Art. 9.

〔2〕 Hatakeyama, H. (1938) : On the Pulsation of the Terrestrial Magnetic Field. Geophys. Mag., Vol. 12, 173.

〔3〕 Kato, Y., J. Ossaka, T. Watanabe, M. Okuda and T. Tamao (1956) : Investigation on the Magnetic Disturbance by the Induction Magnetograph, Pt. V, On the Rapid Pulsation P.S.C. Sci. Rep. Tohoku Univ., Ser. 5, Geophys., 7, 136-146.

〔4〕 Kato, Y. and T. Watanabe (1956) : Studies on P.S.C. Rep. Ionos. Res. in Japan, Vol. 10, 69-80.

〔5〕 Yanagihara, K. (a) (1957) : Earth-Current Pulsations Obrerved at Kakioka Memo. Kakioka Mag. Obs., Vol. 8, 49-59.

[6] Kato, Y. and T. Watanabe (1957) : Studies on Geomagnetic Pulsation, Pc Sci. Rep. Tohoku Univ., Ser. 5, Geophys., Vol. 8, 1-22.

[7] Jacobs, J. A. and K. Sinno (1959) : The Morphology of Geomagnetic Micropulsations, pc., Scientific Report No. 1. Contract No. AF 19 (604)-4068. The Univ. of British Columbia.

[8] Yoshimatsu, T. (1959) : On the Frequency of Geomagnetic Pulsation pc. Journ. Geomag. Geoelec., Vol. 10, 208-213.

[9] Utashiro, S. (1959) : Studies on the Local Character of the Geomagnetic Pulsation Pc. Journ. Geomag. Geoelec., Vol. 10, 214-220.

[10] Kato, Y. and T. Saito (1959) : Preliminary Studies on the Daily Behaviour of Rapid Pulsation. Journ. Geomag. Geoelec., Vol. 10, 221-225.