Equatorial Enhancement of Micropulsation pi-2

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Abstract

Equatorial enhancement of micropulsation pi-2 is found clearly by the use of rapid-run magnetogram during the IGY.

The diurnal variation and latitudinal dependency of the enhancement is similar to those of the other kinds of disturbance.

A possible cause of the enhancement is discussed.

1. Introduction

Many researches have been made so far on the equatorial enhancement of geomagnetic variations, such as Sq, bay, SSC or initial phase of storms. It is a phenomenon of day-side of course, and the high ionospheric conductivity in the equatorial zone is a main cause of the enhancement.

Micropulsations pi-2 occur mainly in the night hemisphere.

Nevertheless, remarkable enhancement of pi-2 at the dayside dip equator is found by the present authors. An occurrence of pi-2 in the night hemisphere is followed by a clear equatorial pi-2 in the opposite meridian, while the corresponding variation in the middle latitude of the same dayside meridian is small or nothing.

Some studies of the enhancement of pi-2 will be reported in this paper.

2. Equatorial pi-2

According to the notation of geomagnetic pulsations revised at the Berkley Assembly of IAGA, pi-2 is used throught this paper instead of pt.

Most of researches of pi-2 show that the occurrence frequency is dependent on local time and has its maximum near 23 h LT.

The period of most frequent occurrence of pi-2 at Fredericksburg (Fr; 49.6°N, 349.9°E) is corresponding to the local noon at Koror (Kr; −3.2°N, 203.4°E) and Guam (Gu; 3.9°N, 212.8°E). Rapid-run magnetograms at Fr, Kr and Gu during the IGY are used to confirm the existence of corresponding equatorial pi-2. Distributions of pi-2 are also studied by the use of rapid-run magnetograms at three other stations, Tucson (Tu; 40.4°N, 312.2°E), Honolulu (Ho; 21.1°N, 266.5°E) and Kakioka (Ka; 26.0°N, 206.0°E).

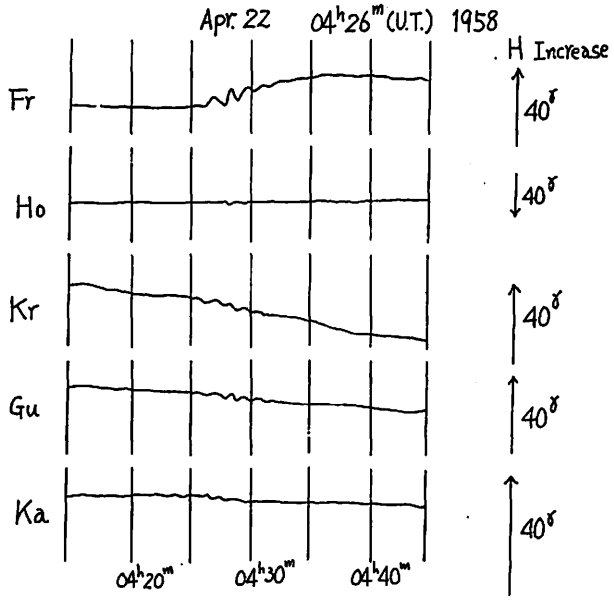

Fig. 1 a Simultaneous occurrence of pi-2 at 04 h 26 m (UT) on Apr. 22, 1958.

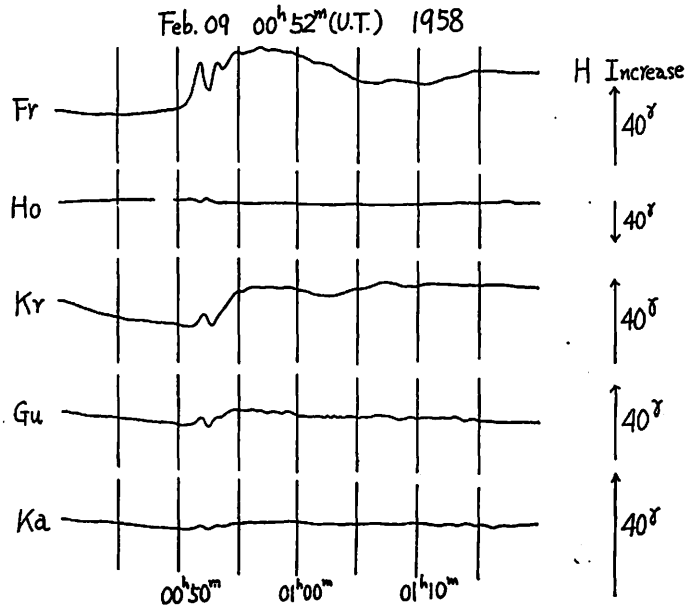

Fig. 1 b Simultaneous occurrence of pi-2 at 00 h 52 m (UT) on Feb. 09, 1958.

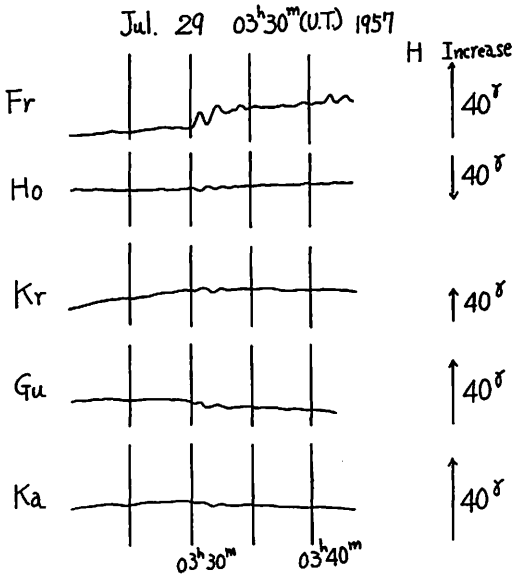

Fig. 1 c Simultaneous occurrence of pi-2 at 03 h 30 m (UT) on Jul. 29, 1957.

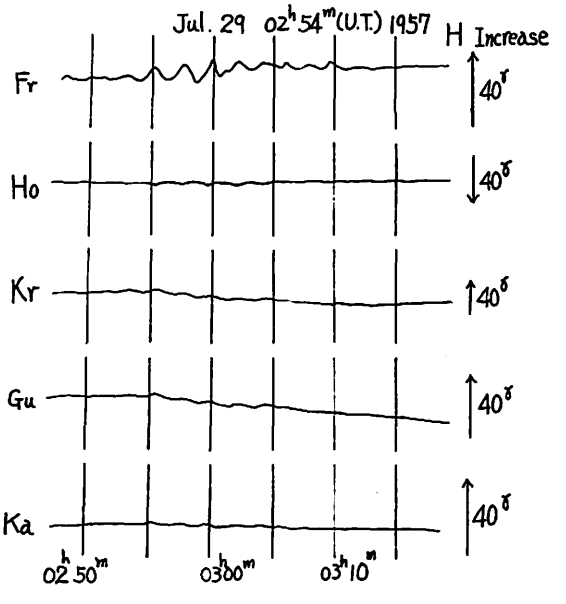

Fig. 1 d Simultaneous occurrence of pi-2 at 02 h 54 m (UT) on Jul. 29, 1957.

It is found that almost all of the pi-2 recorded at American zone stations in night time accompanys similar pulsations at the other stations, especially at Kr_0, and Gu. Some examples are shown in Fig. 1.

Among the 112 pi-2's recorded at Fr in night hours during the IGY, 74 events correspond clearly in occurrence time and phase to those found on the both magnetograms of Kr and Gu.

Doubtful cases are due to the superposition of the other kind of disturbances except the case of very small amplitudes at Fr.

Equatorial enhancement of pi-2 is clearly shown in ratios of Hkr/Hka and Hgu/Hka where Hkr, Hka and Hgu represent the horizontal components of double amplitude of corresponding pi-2 recorded at Kr, Ka and Gu respectively.

The diurnal variation of the ratios is given in Fig. 2.

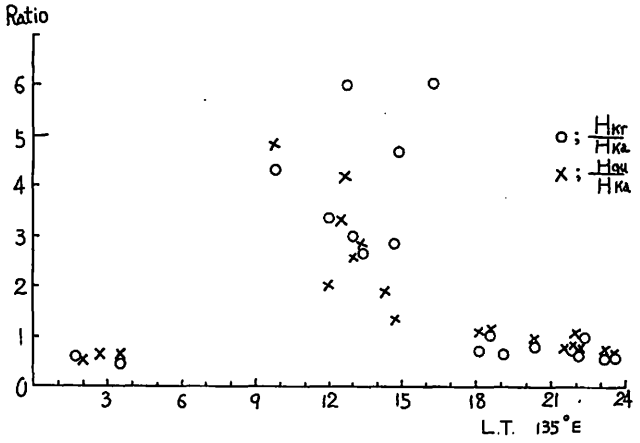

Fig. 2 Diurnal variation of ratios Hkr/Hka and Hgu/Hka.

Only those pulsations corresponding to pi-2 recorded at Fr in phase are used for the daytime data at Kr, Ka and Gu in the figure. To select pi-2's in the nighttime magnetograms of Kr, Ka and Gu, on the other hand, no consideration of correspondency to the American zone data is taken into.

During 4 h-9 h LT no reliable data are available because the corresponding variation at Kr, Ka and Gu are very small or nothing with reference to pi-2's recorded at Chambon-la-Foret where the coresponding local time is 19 h-24 h.

The maximum seems to occur after midday. The variation is larger at Kr than at Gu, and then the equatorial enhancement is similar to that of the other kinds of disturbances.

Latitudinal dependence of the amplitude ratio is roughly shown in Fig. 3. Koror, of which geomagnetic latitude is −3.2°N, is very close to the dip equator.

The enhancement of day time pi-2 seems to be maximum at the dip equator. Night-time pi-2's, on the other hand, have no such equatorial enhancement. The mean amplitude itself is also shown in Fig. 4 to get rough idea of the size of used pi-2. The latitudinal dependence is similar to that of Fig. 3 of course.

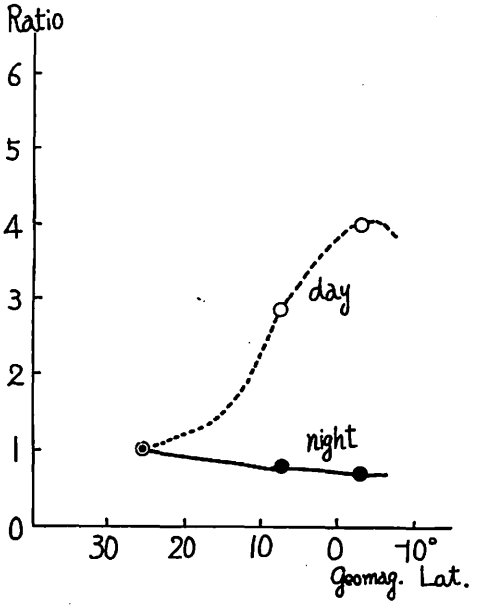

Fig. 3 Latitudinal dependence of amplitude ratio.

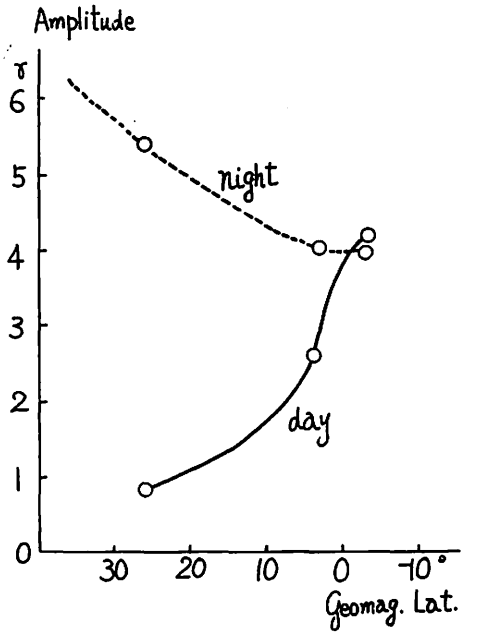

Fig. 4 Latitudinal dependence of mean amplitude.

3. Discussions

Equatorial enhancement of pi-2 is clear as it is shown in the previous section. Nevertheless pi-2 is principally a nighttime event. It is rather difficult to conect these two facts in the present status of knowledge. A possible interpretation may be given by the return current of ionospheric screening effect. Primary cause of hydromagnetic wave in the magnetosphere transfers to the electromagnetic wave when it pass through the ionosphere. At that time modulation of the amplitude occurs and ionospheric currents flow. This situation is called ionospheric screening effect here, though the details of the mechanism is not known enough.

Discussion of this effect is not the purpose of this short paper. If the screen-

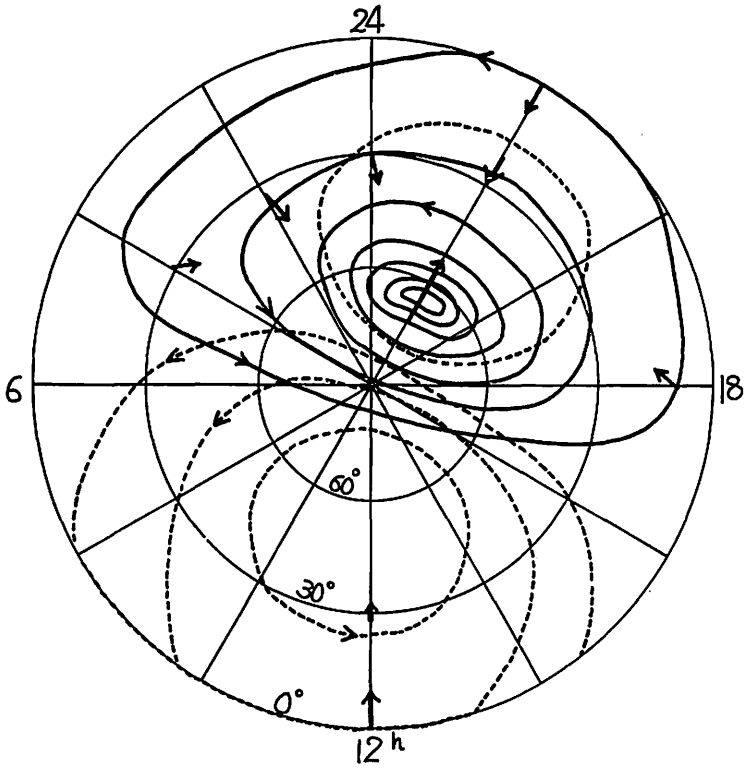

Fig. 5 Schematical schowing of the ionospheric current of pi-2.

ing works effectively, fairly large amount of ionospheric currents flow and a part of the return currents pass through the dayside equator of high conductivity.

This idea is schematically shown in Fig. 5. Full lines of the figure show equivalent currents of pi-2 and dotted lines represent screening currents.

Acknowledgement

The authors wish to express their sincere thanks to Dr. T. Yoshimatsu the director of the observatory for his encouragement.

地磁気 pi-2 脈動の赤道地帯における振幅増大

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概　要

IGY 期間の早回し記録を使って地磁気脈動 pi-2 の赤道地帯における振幅増大を見出した。その日変化振幅比の緯度による変化などの特性は他現象の場合と大体同じようである。この現象をおこす原因について考察した。