

## On diurnal variation of geomagnetic pulsations Pc at M'Bour (West Africa)

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Six years of magnetic quick-run records made at the low-latitude M'Bour Observatory have been analyzed. It was found that the frequency of occurrence of pulsations Pc 3 and 4 presents a marked diurnal variation characterized by two principal maxima, at sunrise and around local noon. The curves of occurrence are compared with the diurnal variation of the critical frequency of the ionospheric  $F_2$  layer at Dakar. The morning maximum of pulsations corresponds to low values of  $f_oF_2$  which contrasts with high values corresponding to the noon maximum. In conclusion the frequency of occurrence of the geomagnetic pulsations Pc does not appear to be directly related to the critical frequency of the  $F_2$  layer.

Six years of magnetic quick-run records made at the low-latitude observatory of M'Bour ( $\varphi = 14^\circ 23.5'N$ ;  $\Phi = 21.3^\circ N$ ), and covering the period 1958 to 1964, have been analyzed for frequency of occurrence of geomagnetic pulsation Pc bands 3 and 4. The pulsations are recorded by Selzer system bars. For the construction of monthly occurrence graphs, successive intervals of 30 minutes have been chosen, for which Pc (either Pc 3 or 4) must be present for at least 15 minutes if this interval is to be considered as an 'occurrence.' Pc 3 or Pc 4 were not separated in order to permit a comparison with the same type of data obtained earlier at other stations, before splitting of Pc in different period bands. Figure 1 shows an example of one of the resulting monthly graphs. Note that local mean time is UT 1 hour 8 minutes, or approximately 1 hour. Figure 2 shows monthly means obtained for the whole period 1958-1964. Small vertical dashes indicate monthly means of sunrise and sunset.

It can be seen from Figure 2 that the frequency of the occurrence shows two principal maxima: the first about sunrise and the second about noon. Frequently the individual monthly graphs show secondary maxima, in particular around sunset.

Figure 3 shows the annual variation of the mean monthly time of these maxima, according to values obtained from Figure 2. Figure 3 also indicates the variation of sunrise over the year by a dashed line; the dotted lines show the monthly median time

(1958-1964) of occurrence for the principal maxima.

It follows from Figures 2 and 3 that the morning maximum follows sunrise in winter months and precedes it in summer. The noon maximum is much broader and peaks between 1100 and 1230 hours LMT, its annual variation being rather irregular. The morning maximum is generally somewhat stronger than the noon maximum, especially during summer.

Concerning secondary maxima, only the evening maximum will be considered. It seems to be most pronounced in October and November. *Romaña* [1962] conjectured a small secondary evening maximum to exist at M'Bour, as observed first by *Hutton* [1959] in Ghana, and later again by *Rivers* [1967] in Sierra Leone.

Seasonal variation is not heavily considered because the existing data concern only half a solar cycle, and seasonal variation is believed to depend on solar activity as put forth by *Saito* [1962] and *Verö* [1965].

Attempts to find some correlations between occurrence of Pc and ionospheric parameters have been made previously. *Verö* [1965] pointed out that in cases of constant electron concentration in the exosphere, the appearance of Pc would be favored by a higher concentration of electrons in the  $F_2$  layer; *Saito* [1962] concludes that maximum occurrence of Pc corresponds to maximum values of  $f_oF_2$ . A similar comparison was made in Figure 4 that concerns a low-latitude observatory (M'Bour), where more than one single maximum of Pc occurrence

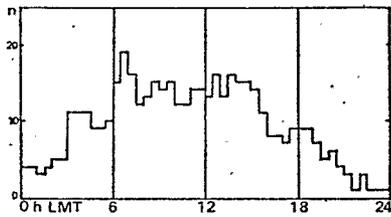


Fig. 1. Example of diurnal variation of Pc occurrence, October 1963. ( $h$  = hour in LMT;  $n$  = number of occurrences per month.)

exists. It can be seen that the morning maximum of Pc occurrence corresponds to lowest  $f_oF_2$ -values, in spite of the secondary evening maximum, which peaks when  $f_oF_2$  also reaches its maximum values. However, as for the noon maximum, it seems that some correlation might exist: during summer, Pc occurrence is lower at noon (see Figure 2) when  $f_oF_2$ -values are likewise comparatively lower; during other months, when  $f_oF_2$  is higher, Pc occurrence is also stronger.

It can be concluded from this that Pc occurrence does not seem to be related to  $f_oF_2$ , but that the monthly Pc occurrence would be related to it.

On the other hand, as it was previously pointed out by Romaña [1962], all low-latitude stations ( $I \leq 30^\circ$ ) present more than one single maximum of

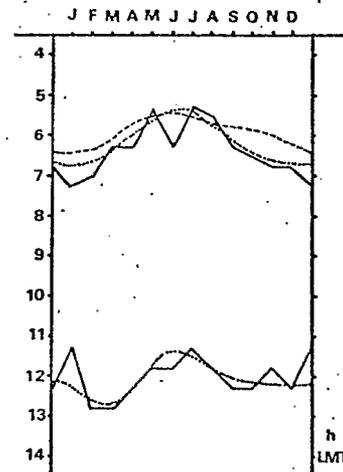


Fig. 3. Annual variation of time of occurrence of principal maxima. (Time, LMT; solid line, monthly mean times of principal maxima according to Figure 2; dashed line, variation of sunrise over the year; dotted line, monthly median time of occurrence of the same maxima, 1958-1964.)

Pc occurrence. It is felt that this behavior might be explained by the particular features of the equatorial ionospheric anomaly, as all field lines corresponding to these stations peak at less than 1000 km of altitude, passing in regions of enhanced electron density which is characteristic of this anomaly. A more detailed study of this question, however, is

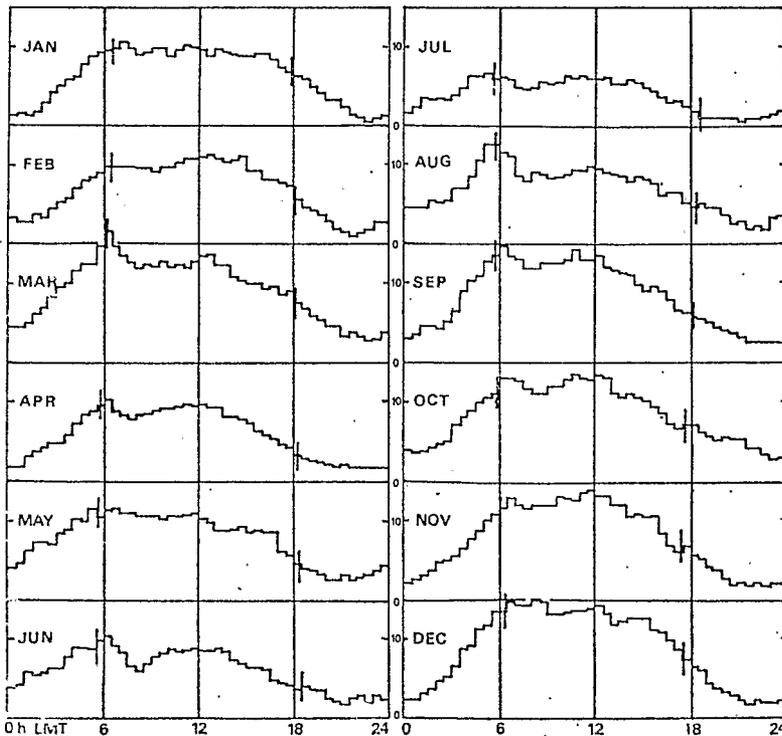


Fig. 2. Monthly means of frequency of occurrence, 1958-1964. (Dashes indicate monthly mean sunrise and sunset.)

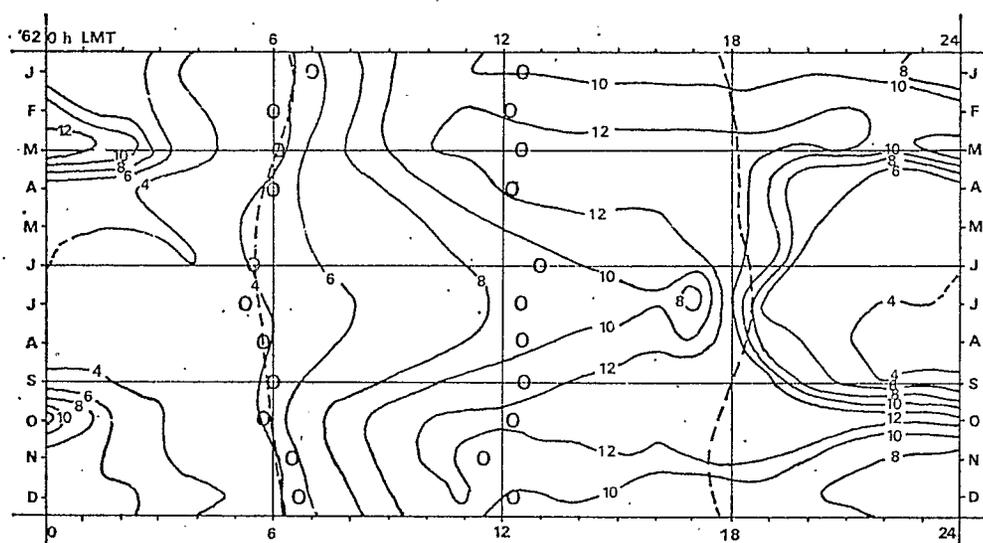


Fig. 4. Diurnal and seasonal variation of  $f_oF_2$ , observed at Dakar (60 km to the northwest of M'Bour) in 1962. (Solid line, lines of equal median values of  $f_oF_2$  in MHz, as observed at Dakar; dashed lines, annual variation of sunrise and sunset at M'Bour; open circles, monthly time of occurrence of principal maxima as observed at M'Bour in 1962.)

necessary and will be accomplished as more low-latitude data become available.

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