Mausam, (1981), **32**, 1, 93-96

550.385.37

Some features of PC_5 pulsations at Nagarampalem (17°43′ N, 83°18′ E)*

M. S. RAO†, A. G. K. MURTHY, T. V. G. K. RAO and B. S. MURTHY

Space Research Laboratory, Andhra University, Waltair

(*Received 16 April 1980*)

ABSTRACT. From an analysis of Telluric current fluctuations recorded at Nagarampalem, a low latitude station close to Waltair, some features of PC_5 pulsations are reported. Occurrence of PC_5 is mostly during daytime, with a maximum around 0800-1000 hr L.T. and also is dependent on magnetic activity. The amplitude of PC_5 pulsations is noticed to increase with the increase of *Kp*. Polarisations of PC_5 pulsations are mostly elliptic with rather low ellipticities. The sense of polarisation is generally clockwise.

1. Introduction

Fluctuations of the geomagnetic field with sinusoidal waveform and in the period range 150-600 sec are classified as PC_5 pulsations (Jacobs *et al.* 1964). Morphological features of these pulsations have been extensively studied and also considerable theoretical advances have been made in the past to explain them. Presently, the accepted view is that PC_5's are generated by Kelvin-Helmholtz instability at the magnetopause (Dungey and Southwood 1970, Samson 1972).

Until recently, most of the studies of these pulsations have been confined to middle latitudes and auroral regions. Only after Campbell (1966); Triotskaya (1967); Saito (1969); and Jacobs (1970) in their views pointed out the lack of information of these pulsations at low latitudes for better understandng of the generation and propagation mechanisms through the magnetosphere and ionosphere, attention has been given for the studies of these pulsations at low and equatorial latitudes.

In the Indian equatorial zone, only a few observations are available on the characterstics of the long period pulsations (Sarma *et al.* 1969, 1974). Recently, Jain and Srinivasacharya (1975) and Jain (1977) have reported the characteristics PC_5 pulsations at Trivandrum and at a few other equatorial stations using quick run magnetograms.

An equipment for recording earth-current fluctuations has been set-up at Nagarampalem, a low latitude station, about 16 km from Waltair, mainly to study the characteristics of al types of pulsations. The details of the experimental set-up have been given elsewhere (Rao and Sitaramam 1978). In this communication, we present the preliminary results of our investigations on the characteristics of long period pulsations, PC_5, using an 8 month data, during the period March-October 1978, covering at least two seasons.

2. Data

Telluric current fluctuations recorded both in the north-south (NS) and east-west (EW) directions at Nagarampalem have been usd in the present analysis. Well developed and nearly sinusoidal PC_5 events are selected from at least one component, namely the EW or NS, for studying the occurrence characteristics. The data is scaled

* Paper presented at the National Space Sciences Symposium held at Banaras Hindu University, Varanasi, during 22-25 January 1980.

† Present Address : Department of Physics, College of Sciences, University of Suleimaniyah, Iraq.

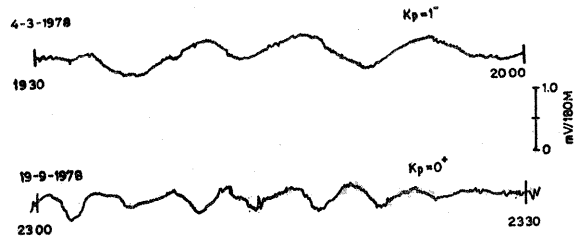

Fig. 1. Tracings of typical PC_5 pulsation records

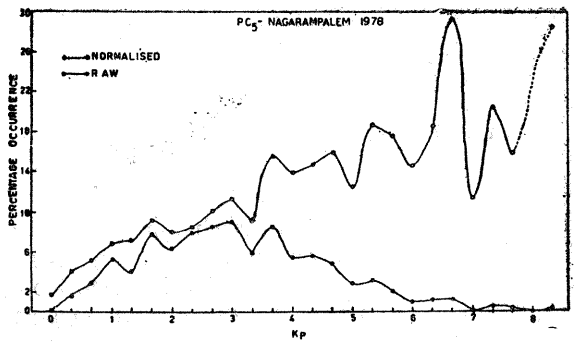

Fig. 2. Percentage of occurrence of PC_5 as function of K_p

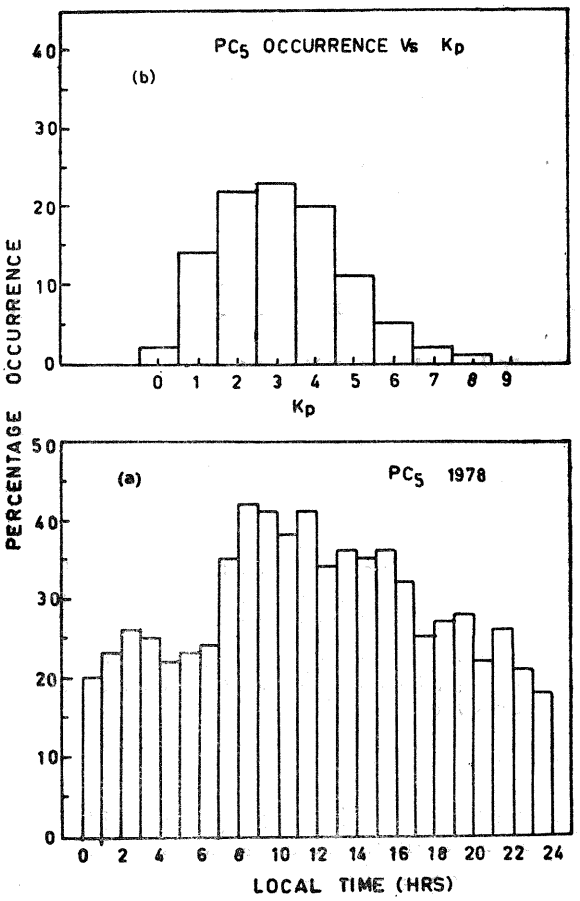

Fig. 3. Histograms of percentage occurrence of PC_5 at Nagarampalem with respect to (a) local time and (b) K_p

from both the components for studying the polarisation characteristics of PC_5 pulsations. The smallest signal that could be resolved and measured at any instant of time is 1 mm on the chart which corresponds to 0.05 mv/180 m. Typcal examples of PC_5 pulsations recorded at Nagarampalem are shown in Fig. 1.

3. Results

(a) *Occurrence characteristics*

Histogram of the percentage occurrence of PC_5 pulsations with respect to the local time is shown in Fig. 3(a). It can be seen from the figure that the percentage occurrence is maximum around 0800-1000 hr L.T. and minimum around midnight hours (0000 hr). No significant change in the time of maximum occurrence of PC_5 with respect to month or season has been noticed. The amplitudes and time periods of PC_5 pulsations are found to be mostly in the ranges of 0.1 to 4.0 mv/180 m, and 200-400 sec resectively. They do not appear to show any dependence on local time.

(b) *Dependence on magnetic activity*

In Fig. 3(b) is shown the histogram of the percentage occurrence of PC_5 with respect to magnetic activity, K_p. It is evident from the figure that the percentage occurrence is maximum for low and moderate magnetic activity (K_p=2-3). However, this can not be taken as a true picture, as there is a bias for the occurrence of the particular values of K_p, namely 2 and 3, in the magnetic data during the 8 month period. So, in order to avoid this bias the data is normalised following the method used by Jain (1977). The normalised percentage occurrence with respect to K_p along with raw percentage occurrence is shown in Fig. 2. The normalised percentage occurrence could be seen from Fig. 2 to be gradually increassing with the increase of magnetic activity, indicating thereby, the occurrence of PC_5 is mostly associated with magnetic activity.

The dependence of amplitude of PC_5 pulsations on magnetic activity is shown in Fig. 4. It can be seen from this figure that the amplitude slowly increases with K_p upto a value K_p=4, and more rapidly from K_p=6. The time period of PC_5 pulsations does not indicate any dependence on magnetic activity.

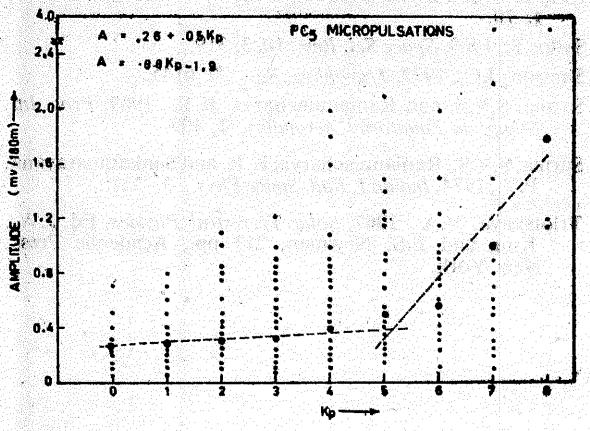

Fig. 4. Variation of amplitude with K_p (Thick dots are the average amplitudes of all the points corresponding to the particular value of K_p)

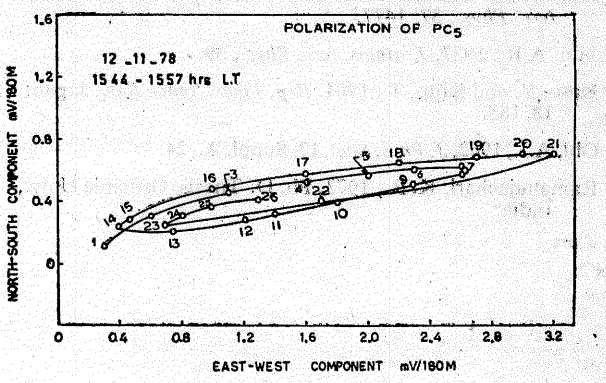

Fig. 5. Typical polarisation diagram of PC_5 Nagarampalem; Ellipticity (Ratio of minor axis to major axis)=0.054, direction of polarisation=9° 20′, Sense of polarisation : Clockwise

(c) *Polarisation characteristics*

For studying the polarisation characteristics, nearly sinusoidal PC_5 events are selected from both the NS and EW components of these pulsations. Starting from the same time NS and EW components are scaled at fixed intervals of time with respect to an arbitrary base line on the chart. These scaled values, after multiplication with their respective scale constants are plotted with NS components as ordinates and EW components as abscissae. The point are numbered and joined in a sequence. The line joining these points represents the movement of terminal point of disturbance vector in the horizontal plane.

Polarisation of PC_5 pulsations are found to be mostly elliptic and the ellipticities and in the range of 0.09 to 0.4. The sense of the polarisation vector is mostly clockwise and is independent of local time.

A typical polarisation diagram, also called the hodograph, of PC_5 as shown in Fig. 5.

(d) *Comparison with earlier work*

The maximum occurrence peak observed in the present investigations in the pre-noon hours (0800-1000 hr) is in conformity with the findings of Jain and Srinivasacharya and Sarma *et al.* at low latitudes and at high and mid latitudes by Ohl (1962), Kato & Saito (1964) and Gupta (1973). Secondary peaks observed around midnight hours by Sarma *et al.* at Hyderabad are not seen by us in the present investigations. The normalised percentage occurrence of PC_5 with magnetic activity noticed by us is also noticed to be similar at Trivandrum. The findings of Gupta (1974) and Jain (1977) for high and low latitudes respectively in respect of the dependence of the amplitude of PC_5 on magnetic activity are in conformity with our results. The observed polarisation characteristics are found to be in agreement with the findings of Srinivasacharya (1973). However there seems to be coastal effect on the polarisation of PC_5 at Nagarampalem, a station very close to the coast of Bay of Bengal, as the ellipticities are comparatively lower than the ones observed by Rangacharya at Choutapal (Hyderabad).

A detailed study with more data is in progress and the results are expected to come out soon.

Acknowledgement

T. V. G. K. Rao and B. S. Murthy wish to thank University Grant Commission for financial assistance.

References

Campbell, W. H., 1966, *Annales Geophys.*, **22**, 492.

Dungey, J. W. and Southwood, D. J., 1970, *Space Rev.*, **10**, 672.

Gupta, J.C., 1973, *J. atmos. terr. Phys.*, **35**, 2217.

Gupta, J.C., 1974, *Radio Sci.*, **9**, 757.

Jacobs, J. A., 1970, *Geomagnetic Micro Pulsations*, Spinger-Verlag, New York.

Jacobs, J.A., Kato, Y., Matsushita, S. and Triotskaya, V.A., 1964, *J. Geophys.*, **69**, 180.

Jain, A.R. and Srinivasacharya, K.G., 1975, *J. atmos. terr. Phys.*, **37**, 1477.

Jain, A.R., 1977, *J. atmos. terr. Phys.*, **39**.

Kato, Y. and Saito, T., 1964, *Rep. Ionos. Space Res.*, Japan, **18**, 183.

Ohl, A.I., 1962, *J. Phys. Soc.*, **17**, Suppl. A., 24.

Ramanujachari, K. R., 1973, Ph. D. Thesis, Osmania Univ., India.

Rao, M.S. and Sitaramam, K., 1978, *Nat. Acad. Sci. Letters*, **1**, 70.

Saito, T., 1969, *Space Sci. Rev.*, **10**, 3, 319.

Samson, J.C., 1972, *J. geophys. Res.*, **77**, 6145.

Sarma, S.V.S. and Ramanujacharya, K.R., 1969, *Proc. Int. Symp. on Equatorial Aeronomy*, **2**, 409.

Sarma, S.V.S., Ramanujacharya, K.R. and Sankaranarayana, P.V., 1974, *Indian J. Rad. Space Phys.*, **3**, 221.

Triotskaya, V.A., 1967, *Solar Terrestral Physics*, Ed. J.W., King and E.S. Newman, 213 pp., Academic Press, New York.