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Radio observations of Quadrantid meteor shower

G. Yellaiah and B. Lokanadham
Centre for Advance Study in Astronomy, Osmania University, Hyderabad 500 007

Abstract. The radio observations of quadrantid meteor shower obtained during the period 1983-88 have been analysed. Diurnal as well as yearly variations in the quadrantid meteor shower activity have been studied.

Key words : radio observations—meteor

1. Introduction

The Quadrantid meteor stream is one of the most intense and active shower at present times. It has been named after an absolute constellation 'Quadrants Murals' (McKinley 1961). This shower was first observed in the year 1830 (Hindley 1972). However, the records of the regular observations of the shower were available from 1860 (Lovell 1954). The systematic observations using radio techniques have been made since 1946 (Lovell 1954). The radiant coordinates of Quadrantid meteor shower are 231°R.A. and 50° Declination. This shower is a short lived annual shower with a sharp maximum occurring over a period of a few hours between January 2nd to 4th. It is a very young meteor stream with high proportion of small particles and very narrow width (McIntosh 1977).

2. Experimental technique

The technique of forward-scatter from the meteor trails is employed in the present studies. The equipment consists of a 100 watts transmitter operating at a frequency of 50 MHz, located in the Osmania University Campus, Hyderabad and receiver which receives the signals after reflection from meteor trails is situated at a field station Japal-Rangapur Observatory about 60 kms away from the University Campus. Two identical six element Yagi antennae are used at the transmitting and receiving ends. The meteor echoes are recorded on a strip chart recorder round the clock during the shower period.

3. Observations and analysis

From the analysis of the meteor echo records obtained during the period of Quadrantid shower (i.e. January 2nd to 4th) of the years 1983-88, it is found that :

1. The curves of mean hourly rates of occurrence of meteoric activity show much narrower peak at the high latitude station, Ottawa, compared to that of the low latitude

station, Hyderabad, with the maximum activity occurring around $\lambda_o = 281.6°$ at both the places (figures 1 and 2).

2. The occurrence of peak activity of the shower is around 0900 hours L.T. with diurnal ratio of about 4.3.

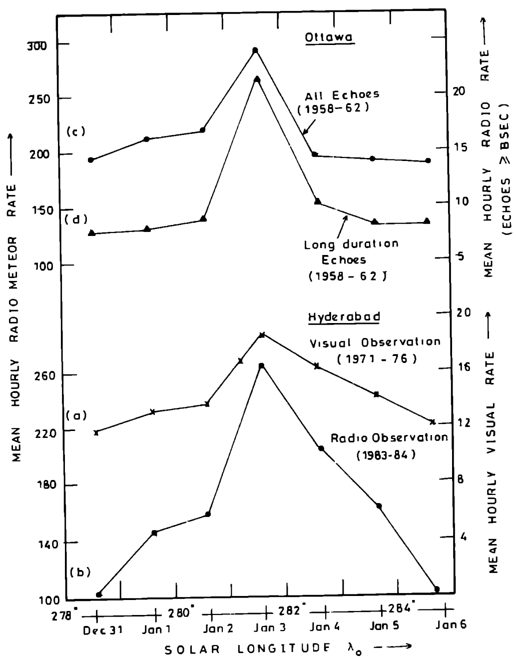

Figure 1. Daily variation in the mean hourly rates of occurrence of meteors during the Quadrantid shower period.

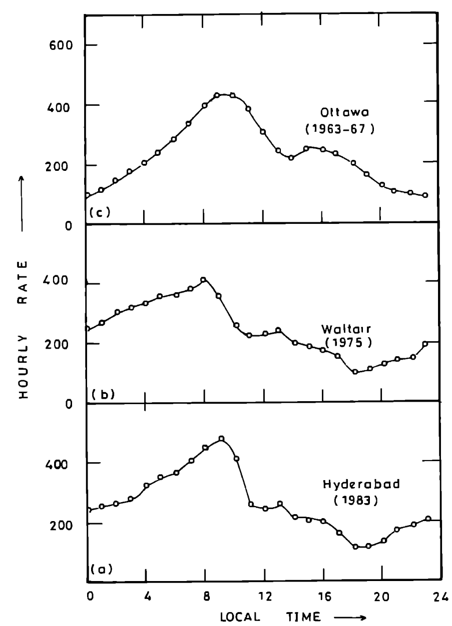

Figure 2. Diurnal variation of the hourly rates of occurrence of meteors on January 3.

3. The curves representing the variation of mean hourly rate of Quadrantid meteor shower as a function of solar longitude, exhibit a sharp maxima with narrow widths (figure 3). The solar longitude, at which the shower maximum occurs, is found to decrease from the period of first half century to the period of recent years. This is due to the retrogression of the nodes caused by Jovian perturbation. From the present observations the retrogress rate is estimated as 5×10^{-3} degrees per year. These perturbations cause the shower spread in the plane of its orbit and tend to increase its eccentricity. These perturbations also often move the orbit slightly to the side causing the earth to miss the main core of the stream and leading to weak return of the shower in some years and strong return in some other years. The strong return of shower can be evidenced from the diurnal variation curves of long duration echoes (figure 4).

4. The curves representing the solar longitude of maximum flux of the Quadrantid meteor (figure 5) shower evidences that the width of he shower is not constant for different years. It was narrower when the activity was maximum. These varying activities of the stream from year to year and its irregular widths confirms the fact that the stream has undergone secular perturbations. The present observations of the shower also indicate that the Quadrantid meteor shower is much younger still suffering from quite strong Jovian perturbations (Hamid & Youssuf 1963).

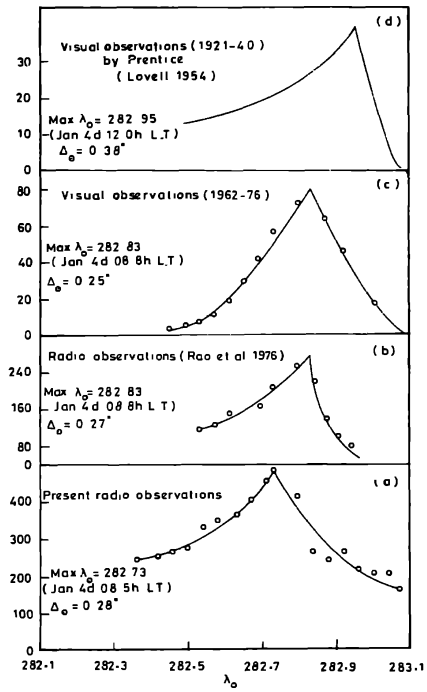

Figure 3. Variation of mean hourly rate of Quadrantid meteor shower as a function of solar longitude.

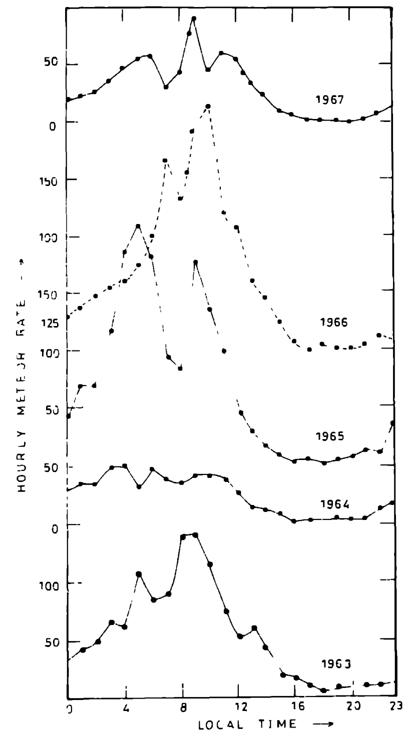

Figure 4. Diurnal variation of Quadrantid meteor shower (long duration echoes).

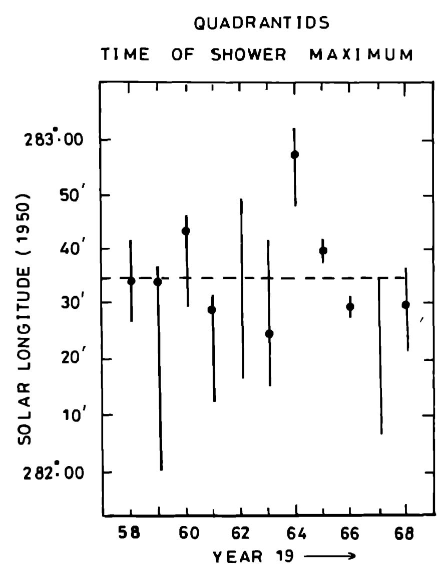

Figure 5. Solar longitude of maximum flux of the Quadrantid meteor shower from eleven years of radar observations.

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