DIURNAL WAVE TRAINS DURING TWO RECENT CONSECUTIVE SOLAR CYCLE

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ABSTRACT

Special type of consecutive days having abnormally high or low diurnal amplitudes in daily variation of cosmic rays have been reported several times earlier with explanation of sources and sinks in antigarden — hose and garden — hose directions. The high diurnal amplitude wave train events (HDW) were categorized when the diurnal amplitude of cosmic rays were higher then 0.4% for atleast there consecutive days and the low diurnal amplitude wave train events (LDW) were categorized when the diurnal amplitude of cosmic rays were less than 0.2% for alteast three consecutive days. The total number of LDW events were much higher than the HDW events during the period of analysis. The events were than categorized on the basis of solar activity phase as well as their association with the geomagnetic disturbance index Ap and other associated parameters. The intercorrelationship between first three harmonics has been also performed. The result and mechanism will be discussed in the light of these observations.

1. INTRODUCTION

The existence of consecutive days having abnormally high & low diurnal amplitude in the daily variation has been reported several times before Jadhav D.K., 1983, Rao U.R., 1972, Tiwari A.K., 1994) with the explanation of source and sinks in anti garden — hose and garden — hose direction; though low amplitude wave trains events were not explainable in terms of corotation. The average daily variation of cosmic ray intensity generally consists of diurnal variation, Semi — diurnal variation & Tri — diurnal variation with significant amplitudes, the amplitude of the diurnal variation (Ist harmonic) at a high / middle latitude station has been found to be of the order of 0.3 to 0.4%, whereas the amplitudes of two higher harmonics is found to be the order of 0.08% and 0.02% respectively (Pomeranz et.al.). The average characteristics have also been found to vary with solar cycle, where the variation is much larger at higher energies. A number of investigators have reported the short term characteristics of the daily variation. Where they have selected continually occurring days of high amplitude and low amplitudes of diurnal variation (Agarwal 1974, Tiwari 1995). These results have pointed out significant departures in the time of maximum as well as there as-

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sociation with higher harmonics. Here, we have selected large number of long duration events.

2. METHOD OF ANALYSIS

To study the characteristic of low amplitude wave Train (LDW) and high amplitude wave Train events (HDW) during solar cycle 22, the LDW and HDW events were selected under strict selection criteria (Tiwari A.K. 1995). For each event and each day the amplitude and phase of first three harmonics have been calculated by harmonic analysis after removing the long term trend.

3. RESULTS AND DISCUSSION

All the events of high diurnal amplitude wave trains (HDW) and low diurnal amplitude wave trains (LDW) have been subjected to harmonic analysis after removing long term trend. The intercorrelation between 1^{st} harmonic and 3^{rd} harmonic amplitude, between 2^{nd} harmonic amplitude and 3^{rd} harmonic amplitude and 3^{rd} harmonic amplitude were plotted for LDW's and HDW's (fig. 1,2) for solar cycle 22. Previously for solar cycle 21 a very peculiar result was obtained when in LDW events 2^{nd} and 3^{rd} harmonic amplitude were also low with 1^{st} harmonic amplitude which was chosen by selection and in HDW events 2^{nd} and 3^{rd} harmonic amplitudes were also high in comparison to normal events, amplitudes with 1^{st} harmonic which was chosen by selection (Tiwari 1995). Here in analysis for solar cycle 22 though LDW's show low value pattern for 1^{st}, 2^{nd} and 3^{rd} harmonic amplitudes, but it is not very significant, but a correlation pattern is observed between 1^{st} and 3^{rd}, 2^{nd} and 3^{rd} harmonic amplitudes, which confirms previous results obtained (Fig. 1,2). Whereas on an average basis there is a scattering in amplitudes of 1^{st} to 3^{rd} and 2^{nd} to 3^{rd} (Fig. 3). The picture which emerges from the observational studies confirms the previous results. Since the observation of daily variation is not a localized phenomenon near the earth and also since the interplanetary medium varies continuously, such a selection provides some confidence to some regularities for a few days. It would also be worthwhile to attempt event by studies to derive the detailed characteristics of the variations by using data from a number of stations.

4. ACKNOWLEDGEMENT

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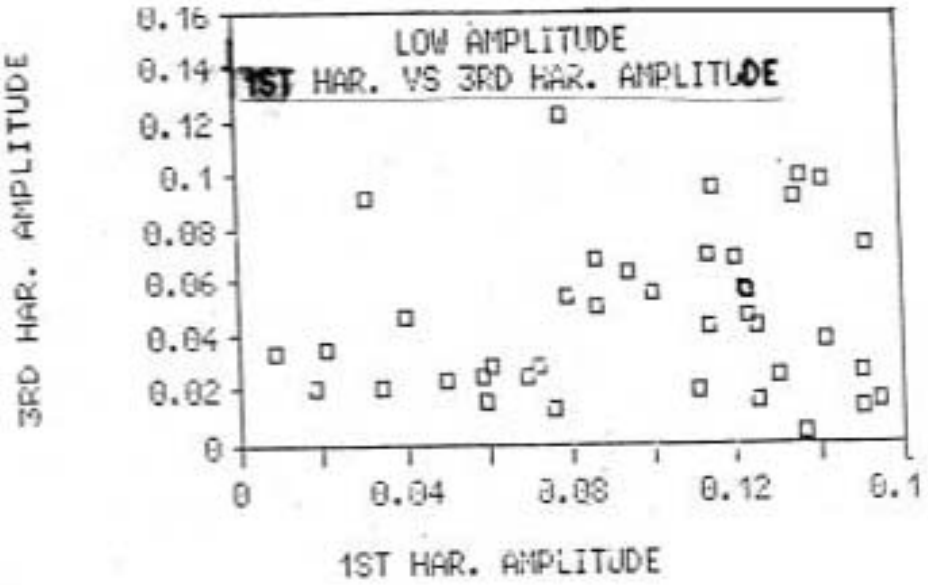

Fig. 1. Shows the scatter plot of the variation of first harmonic amplitude with third harmonic amplitude for Deep River neutron monitor, for 39 low amplitude diurnal wave train events, for 1979–1990.

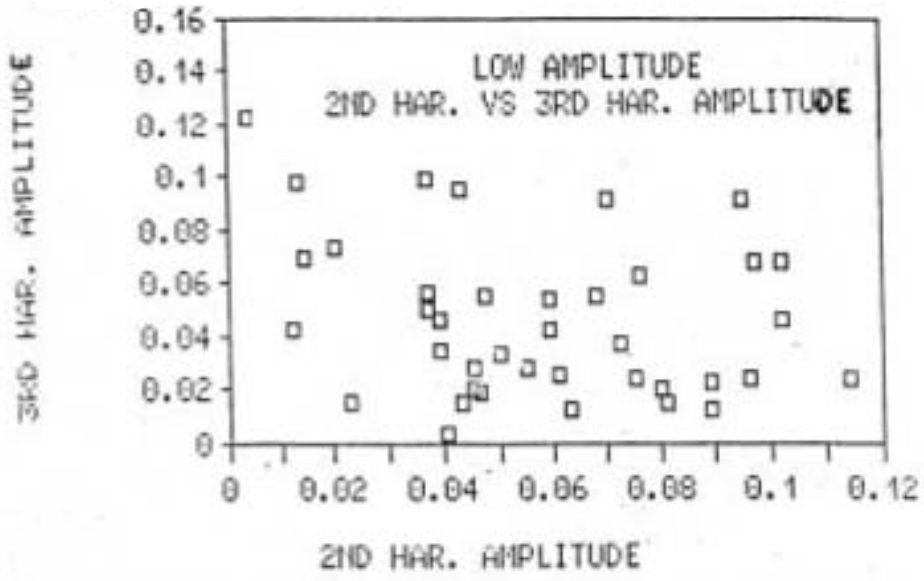

Fig. 2. Shows the scatter plot of the variation of second harmonic amplitude with third harmonic amplitude for Deep River neutron monitor, for 39 low amplitude diurnal wave train events, for 1979–1990.

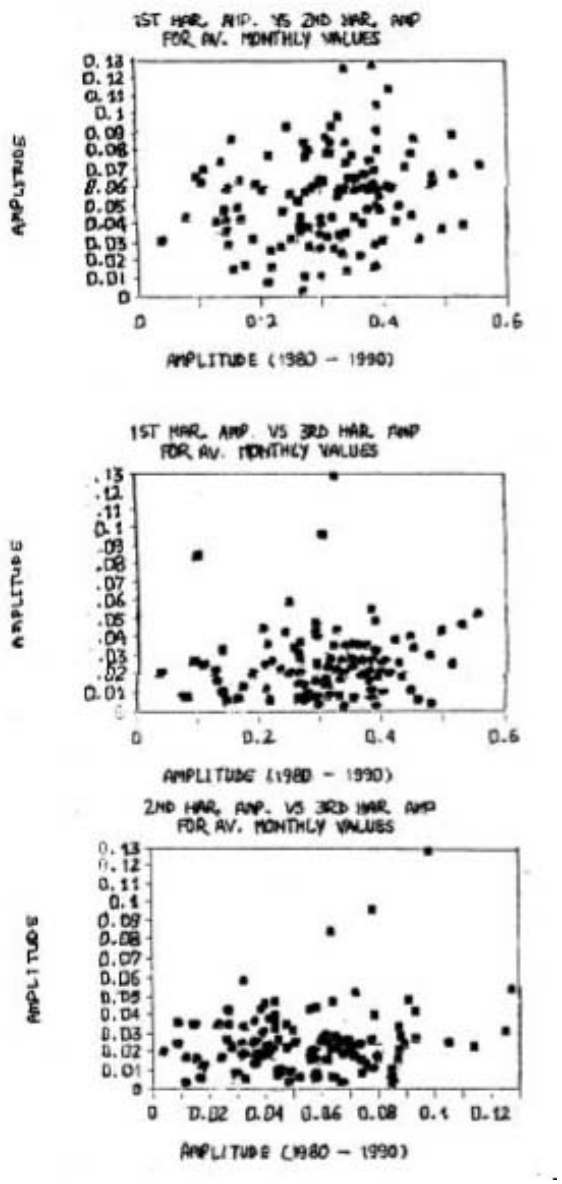

Fig. 3. (a, b, c) — Shows the scatter plot of amplitudes of (a) first and second (b) Deep River neutron monitor. For the interval 1980 to 1991.

5. REFERENCES

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