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The study of cosmic ray intensity distribution near earth

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Abstract. The cosmic ray density distribution near earth is generally investigated by using the yearly excursion in the heliographic latitudinal position of earth. The study has been done for 1978 to 1990 to determine the density distribution on cosmic ray intensity near earth. Results based on this analysis, indicate larger cosmic ray intensity distribution in southern hemisphere in comparison to northern hemisphere during high solar activity period.

Key words : cosmic rays—solar activity—density distribution

1. Introduction

The earth changes its position in heliolatitude by ± 7.25° with solar equatorial plane during the months of September to March each year. Therefore any cosmic ray density gradient perpendicular to solar equatorial plane will be observed as an annual wave in cosmic ray intensity. In earlier studies for the period of declining phase of solar activity (1973-75) during which the semi-diurnal amplitude is higher, no evidence was found for presence of any cosmic ray gradients (Pathak *et al.* 1982). Shrivastava *et al.* (1989, 1993) have found larger cosmic ray density in southern hemisphere for certain intervals, taking corrected cosmic ray intensity values free from the changes due to variation of solar activity.

2. Results and discussion

The average cosmic ray intensity values for each year from 1965 to 1990 along with sunspot number, are plotted in figure 1. The correlation coefficients for each year between cosmic rays sunspot number have been also plotted in the same figure. It again confirms the reverse relationship of cosmic ray intensity with sunspot number. It is also noticed that the correlation is changing from year to year and found significant during the high solar activity period on three year average basis, as depicted by solid lines in figure 1. Such a observed cosmic ray intensity has been cross-plotted with the heliolatitudinal position of earth or the 12-month period. The interval 1978-90, covering the solar cycle 21 and 22, has been divided in four different slots (figure 2). Two 3 year slots 1978-80 and 1988-90, represents the higher solar activity period.

In contrast, we find that the cosmic ray intensity is almost constant from +7.25 to –7.25° or the period 1981-83 and 1985-87. This indicates the absence of cosmic ray density gradients

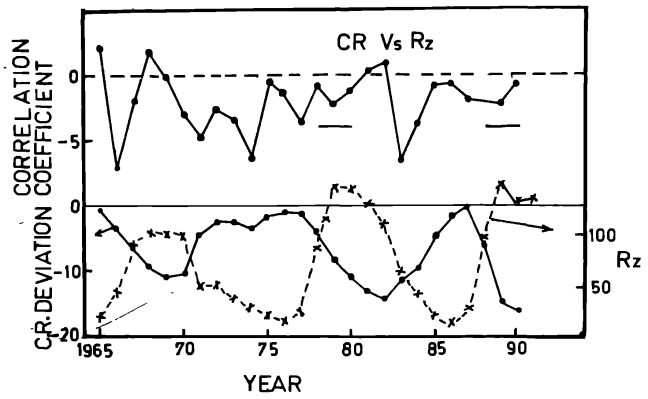

Figure 1. Long term plot of yearly mean values of cosmic ray intensity Rz, and correlation coefficient between CR and Rz.

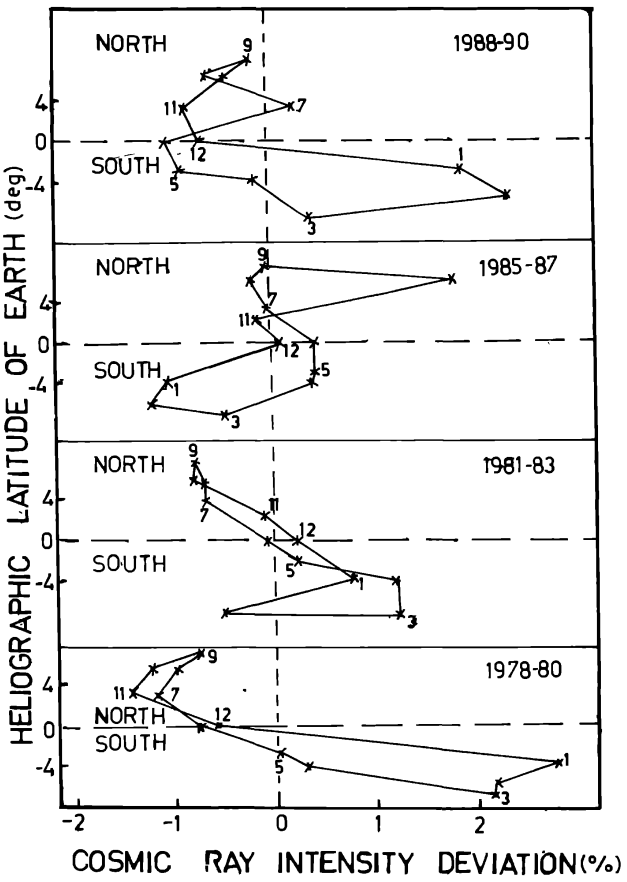

Figure 2. Crossplot between the observed per cent deviation of average intensity and the heliolatitudinal position of earth.

during the low solar activity period. It can be concluded from the analysis that the density of cosmic ray intensity perpendicular to the equatorial plane vary with solar cycle and higher cosmic ray density distribution during the period of high solar activity period. Swinson *et al.* (1991) have used another method to obtain cosmic ray gradient perpendicular to solar equatorial plane, deriving the vector difference between the observed solar diurnal variation for the T and A subsets, is also an indication of the perpendicular gradient relative to earth.

References

Pathak S. P., Agrawal S. P., 1982, Indian J. Radio & Space Physics, 11, 140.

Shrivastava P. K., Pathak S. P., Agrawal S. P., 1989, Proc. Nat. Acad. Sci. India, 59 (A), 171.

Shrivastava P. K., Agrawal S. P., 1993, Indian J. Radio & Space Physics, 22, 26.

Swinson D. F., Humble J. E., Shea M. A, Smart D. F., 1991, J. Geophys. Res., 6, 1757.