International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2014): 5.611

Correlative Study of Cosmic Ray Intensity and Sunspot Number for the Period of Solar Cycles 23 and Ascending Phase of 24

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Abstract: ***Cosmic rays are high energy charged particles. The modulation of cosmic rays intensity (CRI) is related to solar activity. Sunspot number (SSN) are the signature of solar activity.We have done analysis to find the relationship of Cosmic ray intensity with solar activity for solar cycle23 and the ascending face of 24 solar cycle. The correlation coefficient (r) between CRI and SSN are found high and negative (r=-0.78) which varies randomly from one year to another Equally importance, X-rays and UV radiation emitted by solar flares. The frequency of solar flares is directly related to sunspot numbers. Thus the present analysis will help to correlate X Rays classification with cosmic ray intensity and solar activity.***

Keywords: Cosmic ray modulation, SSN, Solar activity, X-ray classification, Solar flares.

1. Introduction

Correlative study between solar activity and modulation of cosmic rays intensity has been extensively studied in the past. Cosmic rays are energetic charged particles that are found in space. Cosmic ray intensity is almost constant outside the heliosphere bus variation happens during their passage through the heliosphere due to the interplanetary magnetic field [8,1,3]. The variation of cosmic rays intensity is mainly due to the outward conversion of solar outputs which are usually associated with sunspots. Sunspots are surface area of sun that appears darker than their surroundings because of low temperature. Over the past 50 years there has been a strong correlation between the sun spot numbers (SSN) and amount of cosmic rays intensity modulation[4,17]. Consequently it has been proposed that the SSN might provide a proxy for the long term changes in the interplanetary magnetic field (IMF) over a longer period of time and thence the cosmic rays intensity. According to Ususking[16] the long term variation in cosmic ray intensity exhibit a strong sensitivity to sun spot numbers during a period of low solar activity and relative invariance at time of higher solar activity. Sreenivasan and Johnson(1968)[15] have observed a negative correlation of 0.4 between daily values of cosmic rays intensity and solar wind speed and this correlation improves to -0.8 for a single forbush decrease available for study during that period. Barichello (1978)[2] has pointed out a significant negative correlation between the two parameters over short period of a few solar rotations. Iucci et al[7] and shukla et al (1979)[14] reveal that the correlation improves for periods of high speed solar wind streams. Pankaj k. shrivastava et al (1996)[11] reported that various solar controlled disturbances in interplanetary medium represented by solar flares, coronal holes, solar wind streams produced significant decrease in cosmic rays intensity as well as enhancement in geomagnetic field. Meera gupta et al (2006)[6] made an attempt to correlated cosmic rays intensity with solar activity parameters SSN and Tilt angle and found time lag between these variations. Pankaj k. shrivastava (2013)[10] predict on the basis of their research work that the consideration of another solar parameter like the polar magnetic field of the sun will be able to explain the long term modulation of cosmic rays intensity.

2. Data and Method of Analysis

In this study and correlative analysis, we have taken data of solar parameter SSN from website of omniweb and cosmic rays intensity data have been used for Moscow NM (latitude 55.47^0 N, longitude 37.37^0E, cut-off rigidity 2.45GV). The available daily pressure corrected nutron moniter data obtained from website fttp://ftp.ngdc.noaa.gov/stp/solardata/cosmicray to derive correlation between solar parameters SSN cosmic rays intensity. observed daily value of parameters used to find monthly and yearly mean values of CRI and SSN. Using the monthly mean values of parameters correlation coefficient have been derived for the period of 1996 to 2013. Which cover the solar cycle 23 and ascending phase of 24.

3. Result and Discussion

The modulation of galactic cosmic rays a complex combination of several mechanisms. It is a function of position, energy and time in the heliosphere and depends upon many facts. Only one solar or interplanetary cannot account for cosmic rays intensity variations but it's a matter of interesting which process and parameter is /are important for the modulation and the variation of heliosphere structure. In this investigation, we have done a detail correlative study to derive the relationship of cosmic rays with SSN for the solar cycle 23 and ascending phase of 24. We plotted the yearly mean values of cosmic rays intensity along with SSN as shown in fig.3 fig.1 & fig 2 shows individually variation of SSN and cosmic ray intensity. Fig 4 shows the correlation

coefficients for each year for pairs of value derived from the corresponding twelve monthly values between cosmic rays and SSN (Rz). In this investigation we found the correlation coefficient(r) between CRI and SSN are found high and negative (r=-0.78) which varies randomly from one year to another.

Graphs for SSN, CRI (MOSCOW) Linear Plot Between SSN & CRI(M) & Correlation Cofficient Variation With Year.

Figure 1

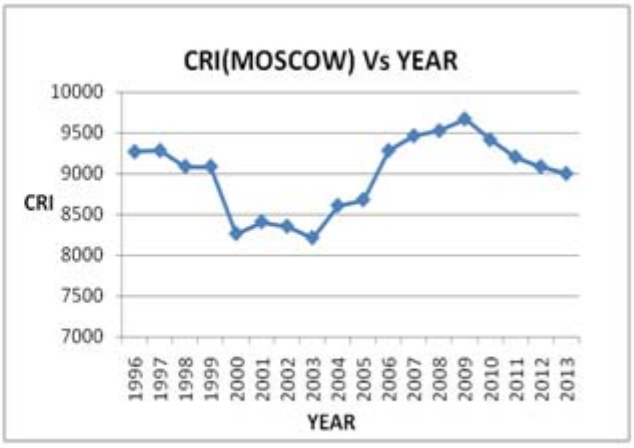

Figure 2

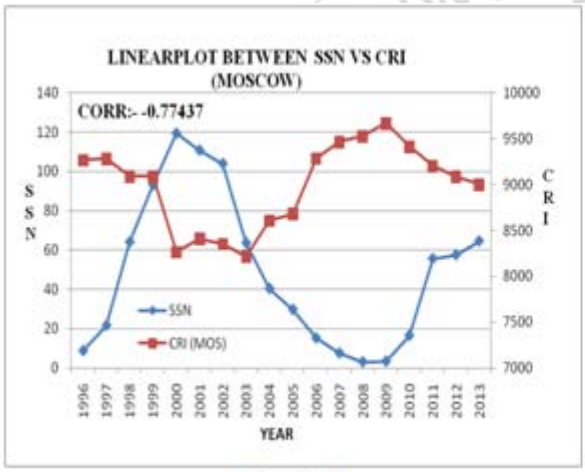

Figure 3

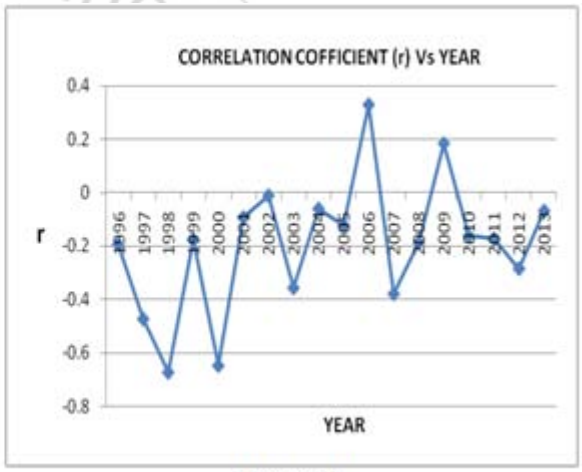

Figure 4

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