



Study on anomalous behavior of cosmic ray intensity during rising phase of solar cycle 24

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Abstract: The solar parameter and cosmic ray intensity for the rising phase of solar cycle 24 have been analyzed. In this analysis we have used the data collected from Moscow (2.42 GV) neutron monitor station and Oulu (2.32 GV) neutron monitor stations for the 1996 to 2012. The cosmic ray intensity increases in the solar cycle 24. The cosmic ray intensity and sunspot number shows negative correlation with each other. As for as normal behavior of cosmic ray intensity is concerned when the cosmic ray intensity is at maximum the sunspot number is at minimum and when the cosmic ray intensity shows minimum the sunspot number shows maximum. However, during solar cycle 24, there are quiet some periods during which both cosmic ray intensity and sunspot number increases or decreases simultaneously. This is not the normal behavior of the cosmic ray intensity but is anomalous behavior of cosmic ray intensity. From this study, it is observed that during the period April, 2003 both the SSN and cosmic ray intensity decreased which shows anomalous behavior of cosmic ray intensity. It is observed that during the period February, 2004 both the SSN and cosmic ray intensity increased which shows anomalous behavior of cosmic ray intensity. It is observed that during the period August, 2005 both the SSN and cosmic ray intensity decreased which shows anomalous behavior of cosmic ray intensity. As we approach towards the solar cycle 24. From the study it is observed that during the period March, 2010, both the SSN and cosmic ray intensity decreased this shows anomalous behavior of cosmic ray intensity. Again it is observed that during the period November, 2011, both the cosmic ray intensity and SSN increased which is again an anomalous behavior of cosmic ray intensity. It is observed that during the period February, 2012, both the cosmic ray intensity and SSN decreased which is again an anomalous behavior of cosmic ray intensity.

Keywords: Cosmic ray, Sun Spot Number.

I. Introduction

Several solar associated phenomenon are continuously occurring on the surface of sun, such as sunspots, solar flares, coronal hole, coronal mass ejection etc. these changes are reported in the form of various indices in the literature from time to time to define the characteristics of solar activity [1]. All the sunspots show one maximum and one minimum during the 11 year period. The sun releases huge amount of energy (in different forms) from its surface in to interplanetary medium, which is ultimately the cause of cosmic ray modulation [2-4]. The interplanetary include solar wind characteristics as well as interplanetary magnetic field, which also vary over the 11 year solar cycle. The solar wind speed is different during solar cycle 23 and 24. During the year 2002 high speed stream are found to occur. Also large number of intense decrease is observed since the year 2003. While as during the Solar Cycle 24, headed for a peak or solar maximum in the year 2013. When it arrives, the peak of the 11-year sunspot cycle will bring more solar flares, CMEs, and geomagnetic storms. That said, most experts predict that this cycle will be exceptionally quiet, producing a lower number of sunspots than the average cycle [5-6]. A quiet Sun usually means weak solar winds, which may allow more galactic cosmic rays into the inner solar system [7-8]. This can pose radiation hazards for astronauts and satellites. During the year 2009, the cosmic intensity is large as compare to other years during solar cycle 24. Which is not expected during approaching solar minima in fact, different phases of sunspot solar cycle and their changing behavior during different epochs produce significantly different effects on cosmic ray intensity. Magnetic polarities of northern and southern hemisphere also play important roles in the long term modulation of cosmic rays.

II. Data and Method

In the present analysis, the data of various solar parameters has been giving us a good comparative study. The other solar activity indices should also be used to obtain the best solar activity parameter for the periods of our investigation (solar cycle 23). In this paper we have collected the data of solar activity parameters for the period

2008–2013 covering the odd and even solar cycles. The daily values of solar parameters have been taken from Solar Geophysical Data Books.

III. Observational Results

To study the anomalous behavior of cosmic ray intensity during solar cycle 23, here we have used the data collected from Moscow (2.42GV) Neutron monitor station neutron monitor station. The figure 1 shows variation of SSN and cosmic ray intensity from Moscow neutron monitor station for the period 2000-2002. The figure 1 shows variation of SSN and cosmic ray intensity from Moscow neutron station for the period 2003-2005. From the figure 1 it is observed that during the period may, 2000 both the SSN and cosmic ray intensity decreased which shows anomalous behavior of cosmic ray intensity. Again from the figure 1 it is observed that during the period April 2001, both the SSN and cosmic ray intensity decreased, this shows the anomalous behavior of cosmic ray intensity. From the figure 2 it is observed that during the period November, 2003, both the SSN and cosmic ray intensity decreased this shows anomalous behavior of cosmic ray intensity. Again from the figure 2 it is observed that during the period October, 2004, both the cosmic ray intensity and SSN increased which is again an anomalous behavior of cosmic ray intensity.

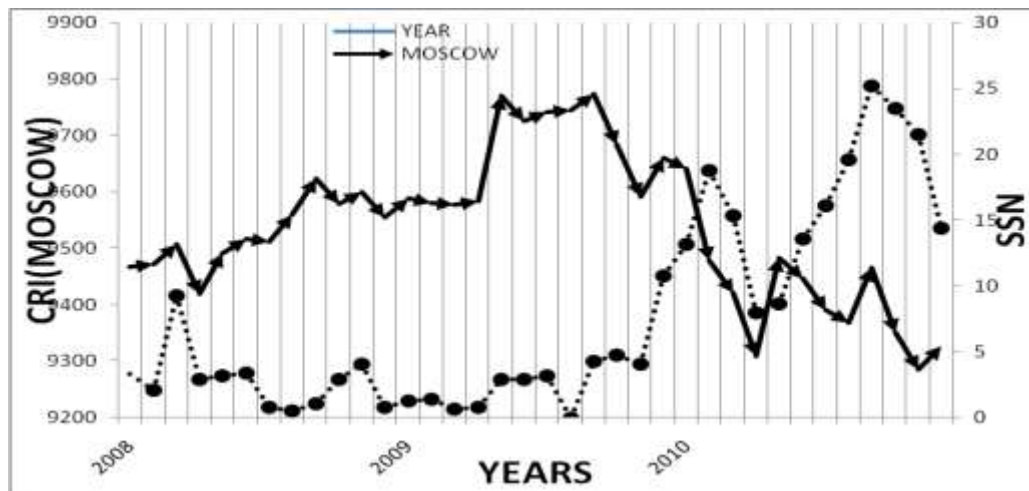


Figure 1: shows variation of SSN and cosmic ray intensity from Moscow neutron monitor stations

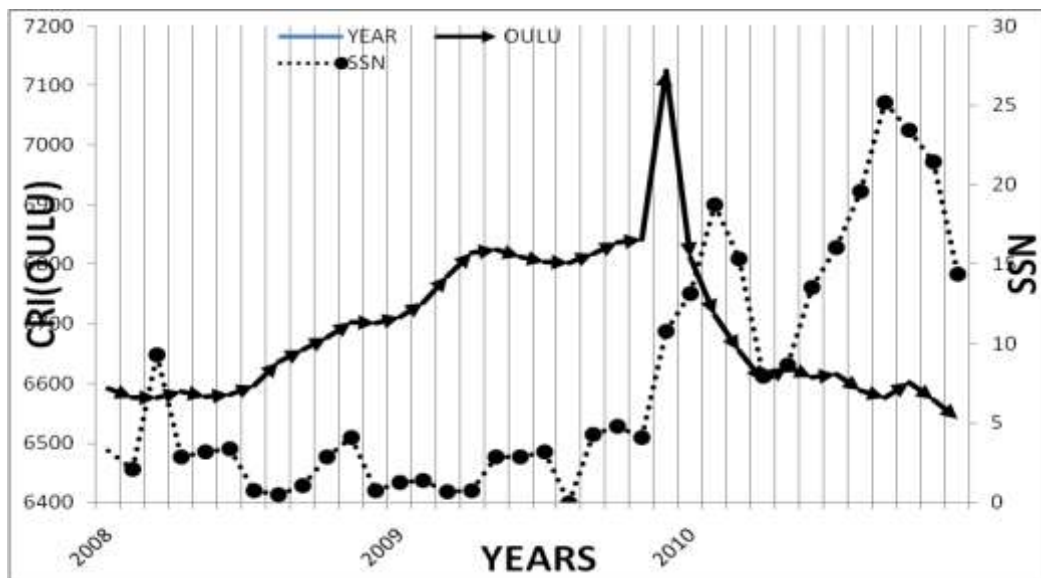


Figure 2: shows variation of SSN and cosmic ray intensity from Oulu neutron monitor stations

IV. Discussion

The cosmic ray decrease is much larger in solar cycle 23 particularly the second decrease. The cosmic ray intensity and sunspot number shows negative correlation with each other. As for as normal behavior of cosmic ray intensity is concerned when the cosmic ray intensity is at maximum the sunspot number is at minimum and when the cosmic ray intensity shows minimum the sunspot number shows maximum. However, during solar

cycle 23 there are quite some periods during which both cosmic ray intensity and sunspot number increases or decreases simultaneously. This is not the normal behavior of cosmic ray intensity but is anomalous behavior of cosmic ray intensity.

V. References

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