



Association of CME events and cosmic ray intensity decreases

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Abstract: We studied the relationship between the projected speed of coronal mass ejections determined from a sequence SOHO/ LASCO images and the hourly averaged magnitude of the cosmic ray intensity decreases (Fds) as measured by the ground based neutron monitor detectors. For CMEs that originate at the central part of the solar disk, we found that the intensity of cosmic ray decreases (Fds) is correlated with the speed of the CME. The relationship is more pronounced for very fast solar wind jump, while slower events display larges scatter. A possible application of the results to space physics is discussed.

Keywords: Cosmic rays, CMEs, Solar wind

I. Introduction

Geomagnetic storms are major disturbances in the earth's magnetosphere that occur when the interplanetary magnetic field turns southward and remains so for a prolonged period of time [1-3]. Shortly after solar coronal mass ejections were discovered [4-5]. It was found that the occurrence of geomagnetic storms is correlated with the occurrence of CMEs [6-7]. Reconnection between the southwardly directed component of the solar wind magnetic field B_z and the northwardly directed geomagnetic field occurs of the day side magnetopause and this reconnection transports energy from the solar wind into the magnetosphere.

II. Data and Method

We used the CME catalog from the center for solar Physics and Space weather of the catholic university of America (http://cdaw:gafe.nasa.gov/cme_list/), which provided us with information on CMEs. The parameters of the solar wind and cosmic ray intensity data are taken from Omni web data centre

III. Result

Cosmic ray intensity decreases (Fds) are associated with interplanetary shocks, coronal mass ejections, solar flare and solar wind disturbances (density and velocity) during the period of 2000 to 2005. From the data analysis of Coronal mass ejections and selected cosmic ray intensity decreases (Fds), we have determined that all the cosmic ray intensity decreases (Fds) are found to be associated with coronal mass ejections. These cosmic ray intensity decreases (Fds) are 100% associated with halo coronal mass ejections. To know the relationship between magnitude of cosmic ray intensity decreases and speed of associated CMEs we have plotted scatter diagram between magnitude of cosmic ray intensity decreases and speed of associated CMEs. The resulting diagram is shown in figure 1 and figure shows positive correlation between these two events. Statistically calculated co-relation co-efficient 0.53 have been found between magnitude of cosmic ray intensity decreases (Fds) and speed of associated coronal mass ejections. From the data analysis it is observed that the total numbers of cosmic ray intensity decreases (Fds) are 16. We have 16 cosmic ray intensity decreases (Fds) in our list, out of which 14 (87.5%) are found to be associated with interplanetary shocks. It is also observed that the related shocks are forward shocks. The onset time of majority of the cosmic ray intensity decreases (Fds) are found at ± 10 hours time lag between onset times of cosmic ray intensity decreases (Fds) and arrival time of interplanetary shocks.

We have plotted a scatter diagram between the magnitude of cosmic ray intensity decreases (Fds) and magnitude of jump in solar wind density (JSWD) events in figure 2. It is clear from the figure that most of the cosmic ray intensity decreases (Fds) which have large magnitude are associated with such jump in solar wind density (JSWD) events which have large magnitude, but the magnitude of these two events do not have any fixed proportion, we have found some cosmic ray intensity decreases (Fds) which have large magnitude but they are associated with such jump in solar wind density (JSWD) events which have small magnitude.

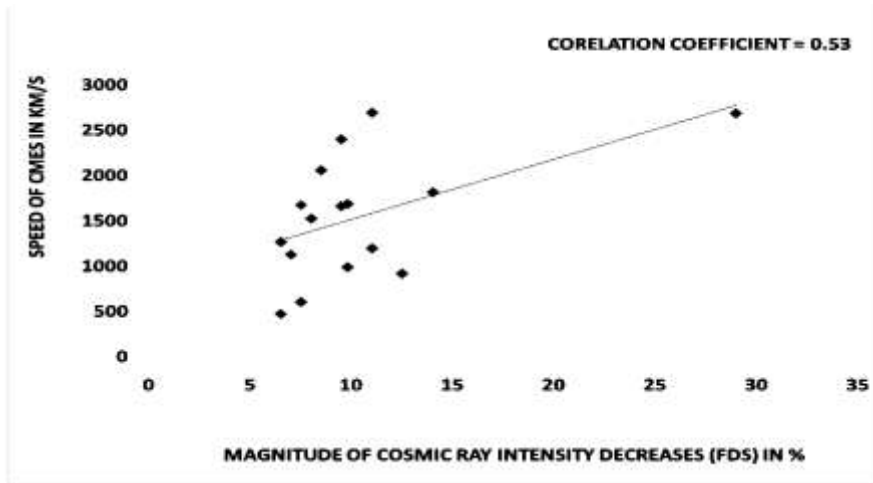


Figure-1 Shows scatter plot between magnitude of cosmic ray intensity decreases (Fds) and speed of associated Coronal Mass Ejections

We have plotted a scatter diagram between the magnitude of cosmic ray intensity decreases (Fds) and magnitude of jump in solar wind velocity (JSWV) events in figure 3. It is clear from the figure that most of the cosmic ray intensity decreases (Fds) which have large magnitude are associated with such jump in solar wind velocity (JSWV) events which have large magnitude, but the magnitude of these two events do not have any fixed proportion, we have found some cosmic ray intensity decreases (Fds) which have large magnitude but they are associated with such jump in solar wind velocity (JSWV) events which have small magnitude.

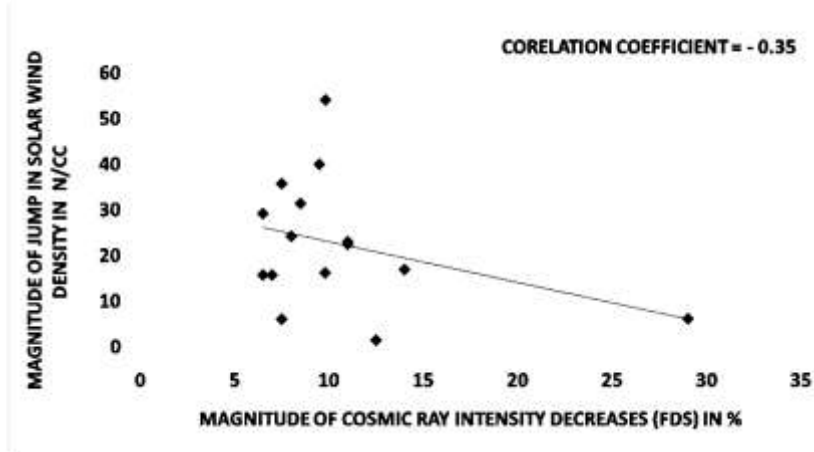


Figure-2 Shows scatter plot between magnitude of cosmic ray intensity decreases (Fds) and magnitude of jump in solar wind density (JSWD)

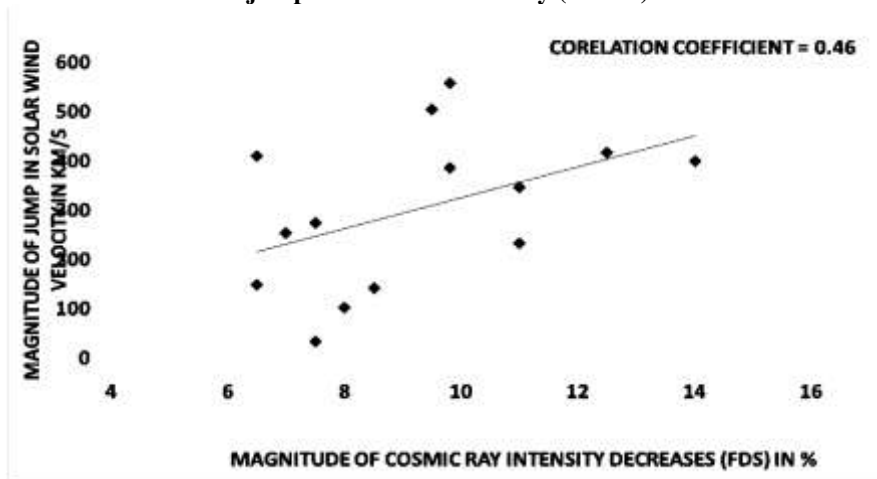


Figure 3 Shows scatter plot between magnitudes of cosmic ray intensity decreases (Fds) and magnitude of Jump in solar wind velocity (JSWV).

V. Discussion

We have analyzed cosmic ray intensity decrease (Fds) and CME associated events. The speed of CME is positively correlated (corre. coeff. 0.53) Correlated with the magnitude of cosmic ray intensity decreases (Fds). Negative co-relation has been found between magnitudes of cosmic ray intensity decreases (Fds) and magnitude of associated of jump in solar wind density (JSWD) events. Statistically calculated correlation coefficient is - 0.35 between these two events. Positive co-relation has been found between magnitudes of cosmic ray intensity decreases (Fds) and magnitude of associated jump in solar wind velocity (JSWV) events. Statistically calculated co-relation co-efficient is 0.46 between these two events.

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