A study of relationship among Coronal Mass Ejections, Geomagnetic activity and cosmic ray modulation

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***Abstract*. Most of large solar variability in the interplanetary medium can be attributed to the large amount of mass ejections from the sun Galactic cosmic rays interact with these types of plasma emissions and magnetic field and their intensity gets modulated. In this work a correlated analysis has been done between cosmic rays (Kiel neutrons) and CME rate for the period of 1996 to 1998. Low latitude comes observed by the LASCO telescope on board SOHO to derive CME rates. To study the short-term cosmic ray intensity variation, Halo CMES and the Interplanetary CMEs have been utilized for the period of 1996 to2002.Chree analysis of superposed epoch methods have been adopted to derive the average influence of Halo CMEs and ICMEs on cosmic ray intensity. It has been investigated that Halo CMEs andICMEs produce short-term decrease in cosmic ray intensity.Resuls of our analysis also suggest that these CMEs produce increase in geomagnetic disturbances.**

***Keywords*: CME Geomagnetic Activity Cosmic Ray Modulation**

I. INTRODUCTION

The fast (¿500 km per second) CMEs coming from the sun into interplanetary medium are the solar/coronal features that contain high magnetic fields. These high magnetic fields are expected to be capable in producing interplanetary disturbances. The complex family of CMEs sometimes with their leading shock waves have been called interplanetary coronal mass ejections during their heliographic propagation.CMEs traveling at different speed tends to merge into what are known as complex ejecta, which are seen in interplanetary medium (Burlaga et al 2001). The increase of the magnetic field during the passage of an ejecta at 1 AU is related to cosmic ray decreases (Cliver et al 2003)

II. DATA ANALYSIS

Observation of CMEs is taken from the LASCO/SOHO, FET/SOHO and GOES satellites. First these satellites are used to identify the front size halo CMEs. Those CMEs which has span angle larger than 100 degree are known as halo CMEs.On the other hand, ICMEs which are observed from the ACE and wind Space craft(Burlaga et al 19810.Here in present analysis Wang et al(2003) ICMEs have been taken. All the 69 events of ICMEs have been selected for the period of 1996 to 2002.

III. RESULT AND DISCUSSION

Cosmic ray in the past research, various investigators reported the flare generated streams as a main cause of transient decrease in cosmic ray intensity (Shrivastava ands Shukla, 1994; Shrivastava, 1997).One of the currently unknown factor in the behavior of ICMEs in inner heliosphere and their relationship with cosmic ray modulation. To observe the average behavior of intensity variation during the period of ICMEs, the chree analysis of super epoch method has been done. The results of chree analysis for days -5 to 10 days have been plotted in figure 1, as a percent deviation of the data from the Kiel neutron monitor station. During each year from 1997 to 2002, significant decreases in cosmic ray intensity are evident. Maximum decreases are observed near zero epoch days9arrival dates of CCME at 1 AU) is seen almost each year starting from 1997 to 2002.Year to year changes in intensity profiles are noticed. Large transient decrease in the year 2001 is generated .It is expected due to occurrence of large number of major solar flares during this particular year. We have also done a correlative analysis between CMEs occurrence rate and cosmic ray for the period of 1996 t0 1998 and observed a negative and good correlation(r=0.41).Further for verification of ICMEs influence on geomagnetic activity, a correlative analysis has been done between the ICMEs speed with corresponding mean Ap values as sho0wn in figure 2.Scattered of points in figure 2 shows significant positive correlation(r 0.58) between these two solar and geomagnetic parameters. It is now inferred from this analysis that the propagation of ICMEs near earth with high speeds produces geomagnetic disturbances. It is expected the shock disturbances in which the ICMEs driving the shock is highly effective in simulating geomagnetic disturbances as well as in cosmic ray decreases. When a CME is accompanied by a shock, the compressed region between the shocks and driving CMEs, which is also known as ahock sheath produces large depression in cosmic ray particles.ICMEs associated with large solar flares usually have large speeds.Infront of such a high speed mass ejection a strong shock wave must develop. It has been suggested that type of waves play unimportant role modulation by acting a barrier in propagating cosmic ray particles.

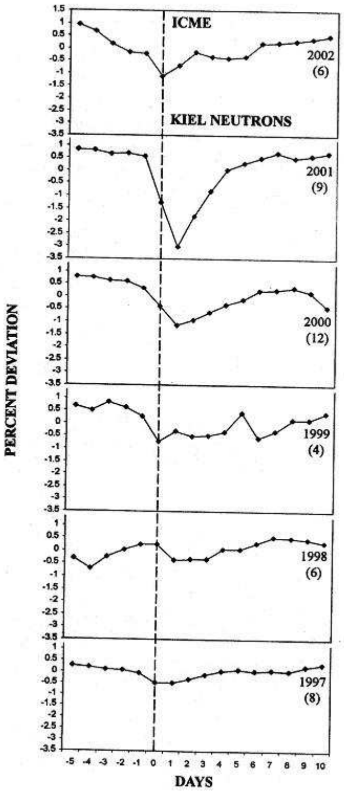

Fig. 1. The results of Chree analysis for -5 to 10 days with respect to zero epoch days. The percent deviation of Kiel cosmic ray intensity for number of events (Noted in parentheses)

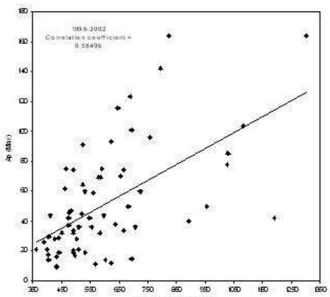

Fig. 2. Cross plot between the Apindex and average ICME speed for the period of 1996 to 2002.

IV. Conclusion

From the above, the following conclusions can be drawn: 1. ICMEs produce significant decreases in cosmic ray intensity. 2. ICMEs produce larger decreases in cosmic ray intensity particulary during high solar activity periods 3. ICMEs are found responsible in geomagnetic disturbances.

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