

Ap* an indicator of CME associated storm Events

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Abstract

We reported the characteristics of coronal mass ejection and the Ap* Index of maximum 24-hour disturbance for storm events. The geoeffective fully backside and fully frontside CMEs are identified and is correlated with the CME speed. It is observed that the occurrence rate of both GE CMEs increases with the CME speed with in limit 400 km/sec. to 1400km/sec. and then the occurrence rate decreases with increase in CME speed. The Ap* values are correlated with Fully front side Halo CMEs, the sunspot number Rz, long wave length type II radio loud burst events RL and also with the amplitude of the I-Harmonic cosmic ray intensity CRI. A positive and significance correlation is observed.

Key words : CME, Geoeffective, Sun Spot Number, Radio Loud CMEs, Ap* Index.

Coronal mass ejections have been recognized as the most energetic phenomenon in the heliosphere driving their energy from the stressed magnetic fields on the sun. CMEs are associated with erupting prominences throughout the solar activity cycle and may act as a solar activity index. The consequences of CMEs in the interplanetary medium have been discussed¹. CMEs appear to surround the occulting disc of the observing white light coronagraph in the sky plane projection and expands rapidly are known as halo CMEs which may be backside or frontside³. The ability of CMEs to cause geomagnetic storm is known as geoeffectiveness, which is measured in terms of geomagnetic index Dst.

Solar radio bursts of type II are indicative of shock propagation in the corona and inner heliosphere. These shocks are associated with coronal mass ejections. The CMEs are classified as radio quiet (RQ) and radio loud (RL). The RQ CMEs are those with no detectable type II radio emission in the metric or deca meter-hectometric (DH) wavelengths. The RL CMEs are those associated with identifiable type II burst at metric or DH wave lengths². Study on the association of CMEs location and geoeffectiveness is also studied by Mishra,⁵ B.K. *et. al.* 2011. The long term relationship between geomagnetic and solar activity parameters is discussed by Tiwari, R.K. *et. al.*,⁶.

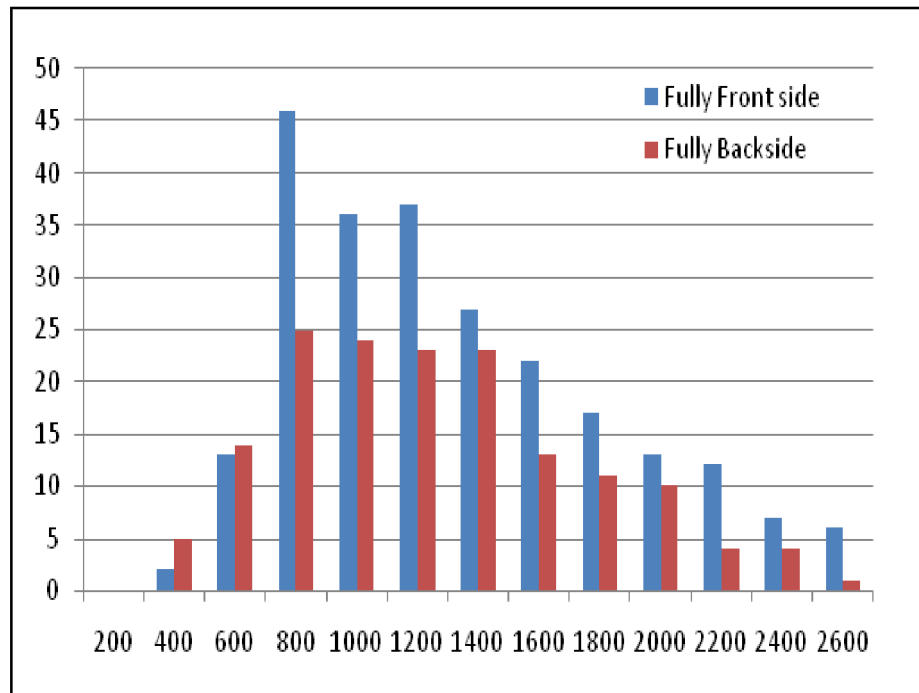


Fig.1 Graph between CME speed and occurrence rate of FF/FB CMEs

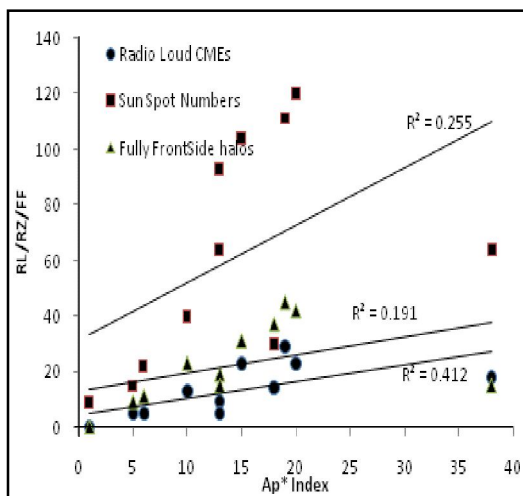


Fig.2 (a) : Correlation plot between Ap* Index and Radio Loud CMEs, Sun Spot Number and Fully Front Side Halos

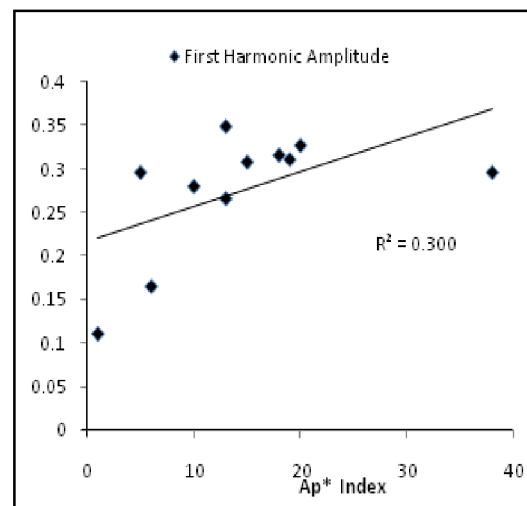


Fig. 2(b) : Correlation plot between Ap* Index and I-Harmonic amplitude

Data and Method of analysis:

In the present study, we exploit the data set on Halo CMEs, RL type II radio burst, the sun spot number Rz, the first harmonic amplitude of CRI and geomagnetic disturbance index Ap* for the period 1996-2006 covering solar cycle 23. The data set are available with SOHO and NGDC. The annual average values of Ap* are taken from the published data at WDC-A for STP. The RL CMEs, GE Fully frontside/backside Halo CMEs are sorted as per the selection criteria^{1,4}. The first harmonic amplitudes of CRI are calculated using Visual Basic program. We have analysed the data statistically.

Result and Discussion

All the geomagnetic activity on earth is driven by the sun and the regularity of its energy output. The solar output may results in magnetic storms or disturbances in earth magnetic field. We have studied the characteristics of coronal mass ejection and the Ap* Index of maximum 24-hour disturbance for storm events. The geoeffective fully back side and fully front side CMEs are identified and is correlated with the CME speed. It is observed that the occurrence rate of fully frontside/backside GE CMEs increases with the CME

speed with in limit 400 km/sec. to 1400km/sec. and then the occurrence rate decreases with increase in CME speed (Fig. 1). The Ap* values are correlated with Fully front side Halo CMEs, the sunspot number Rz, long wave length type II radio loud burst events RL and also with the amplitude of the I-Harmonic cosmic ray intensity CRI. A positive and significant correlation is observed (Fig. 2 a, b). In the present study Ap* index is found to be a good indicator of geomagnetic disturbances, which will be help full to predict the space weather.

References

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