

A Correlative study of Geomagnetic Storms and CRI for solar cycle 22 and 24 during ascending and descending phase

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Abstract: In the present examination we investigate the relationship of geomagnetic storms with the CRI, and Ap index during ascending and descending phase. Our analysis comprises the study of solar cycle 22 and 24. In order to set up the relationship between these parameters we have used the superposed epoch method. During the analysis of both solar cycles we have found a very interesting outcome that the intense value of Dst leads to the intense value of CRI for both phases. We have likewise compared the patterns of Ap index with Dst and CRI and found that the minimum peak of Dst and CRI coincides with the maximum peak of Ap index.

Keywords: Geomagnetic storms, Cosmic ray intensity, Ap index, Dst.

1. INTRODUCTION

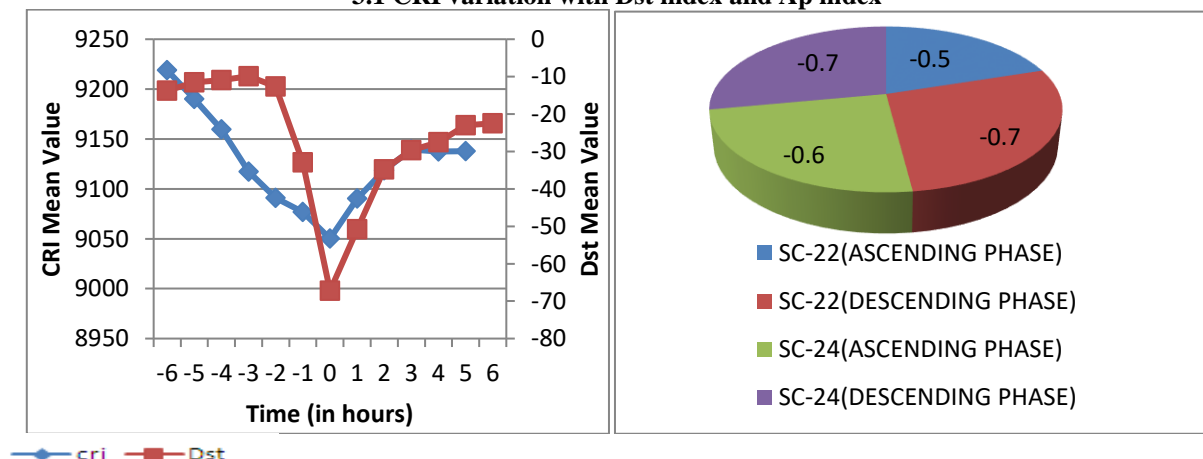
Geomagnetic storms (GS) are fundamentally a kind of perturbation in the magnetic field of Earth caused as a result of coupling of plasma particles catapulted from the Sun and the magnetosphere. These are the phenomenon in which the intensity of geomagnetic field fluctuates in the order of tens to hundred nT. These perturbations are accountable for the various geomagnetic activities. The classifications of GS as intense, strong and weak as well as their manifestations have been examined by various researchers (Tsurutani et al. 1988; Oh and Yi, 2004). Prior findings of various researchers concluded that the occurrence of GS is well associated with the coronal mass ejection (CME), co-rotating interaction regions (CIRs), solar wind speed and the cosmic ray intensity. Hence, we can't state that any single parameter alone is accountable for the production of a GS.

2. METHODOLOGY OF ANALYSIS

In order to establish the association between Dst index, Ap index and CRI we have adopted a technique of Chree analysis by the superposed epoch method. The occurrence day of geomagnetic storms (criteria $Dst \leq -50nT$) is considered as zero epoch day. The daily mean values are taken from the omniweb data center (omniweb.gsfc.nasa.gov/form/dx1.html) for the studied period of solar cycle 22 and 24. Now, by considering $Dst \leq -50nT$ as the zero epoch we have averaged out all the observations in order to plot the graph between these parameters.

3. RESULTS AND DISCUSSION

3.1 CRI variation with Dst index and Ap index



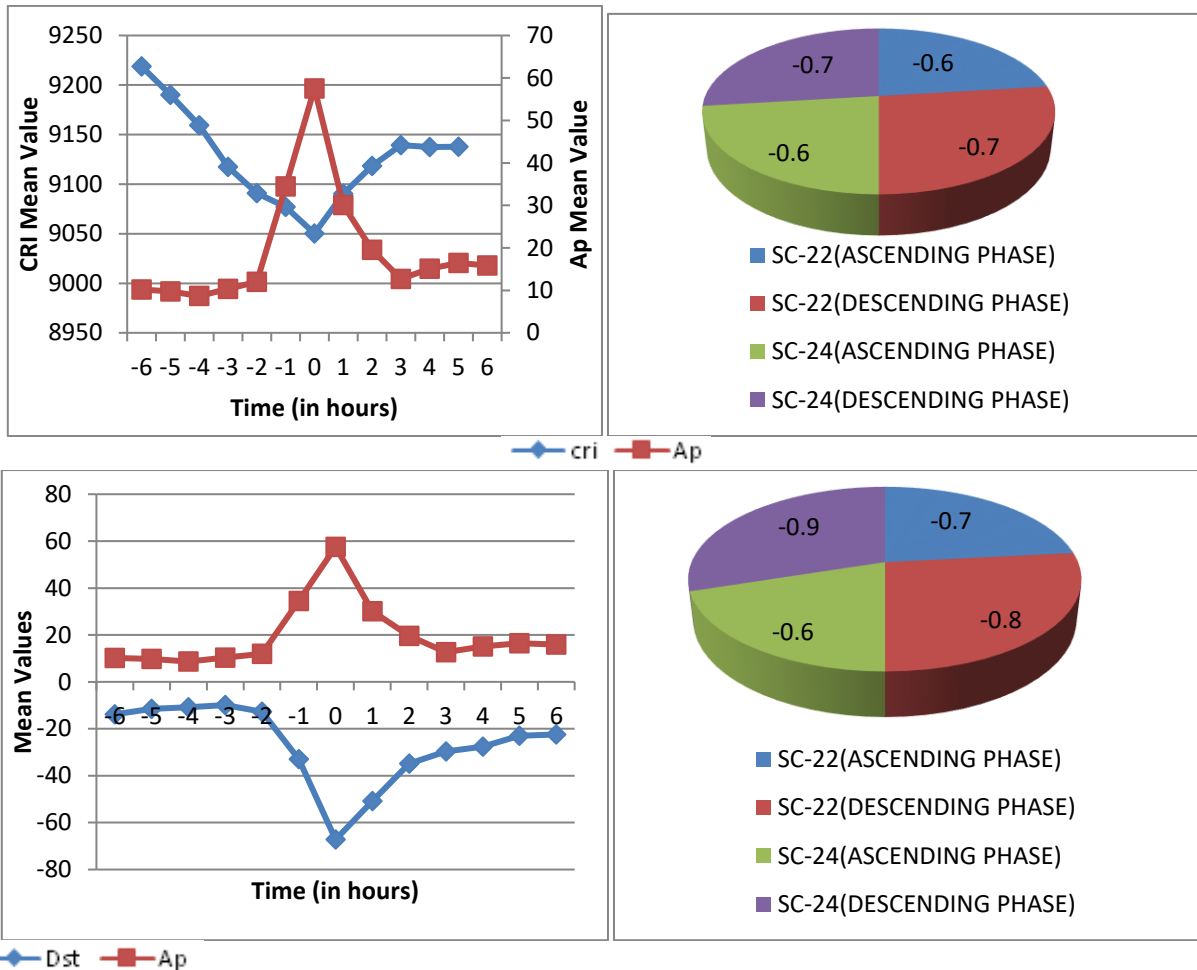


Figure 1(a-c). The result of Chree analysis from -6 day to +6 days with respect to the occurrence day of GS (zero epoch day). In order to study the pattern of Dst with CRI and Ap index the variation of their mean values is plotted for solar cycle 22 and 24.

Fig (1a-1c) are focused on revealing the variation of Dst with CRI and Ap index for solar cycles 22 and 24. In each solar cycle we examine that on the occurrence day of GS (0 day), CRI also shows its strongest decrement and the minimum peak of Dst coincide with maximum peak of Ap index. Further study reveals that CRI and Ap index are negatively correlated with each other i.e. on the occurrence day of CRI, Ap shows its maximum peak value. Moreover, the correlation coefficient between these two parameters is found to be slightly different yet high and positive (**Table 1**) for all studied solar cycles and this clearly reinforce the prior findings of (**Eselevich and Fainshtein, 1993; Gonzalez and Echer, 2005; Kumar and Raizada, 2008**). It is clearly seen from **Table 1** that descending phases showed high correlation value in comparison to ascending one and this clearly signifies that descending phase have more activity in comparison to ascending one.

Table 1: Correlation coefficients between various parameters

Parameters	Solar Cycle-22 (Ascending)	Solar cycle-22 (Descending)	Solar cycle -24 (Ascending)	Solar cycle -24 (Descending)
Dst and CRI	-0.5	-0.7	-0.6	-0.7
Dst and Ap index	-0.7	-0.8	-0.6	-0.9
CRI and Ap index	-0.6	-0.7	-0.6	-0.7

4. CONCLUSIONS

- i. The minimum peak of Dst coincide with the maximum peak of Ap index.
- ii. For both the solar cycles CRI shows its minimum peak on the occurrence day of Dst.
- iii. The minimum peak of CRI coincides with the maximum peak Ap index



iv. The correlation coefficient of Dst with CRI and Ap index is found to be high and negative during ascending phase in comparison to descending one and this signifies that descending phases is dominant in the occurrence of solar activities.

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