Research Paper Physics

Variation Of Geomagnetic Disturbances (Ap) & Plasma Electric Field (V.b) With Sun-Spot Number (Rz) During Stream Time For Solar Cycle 22 & 23.

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ABSTRACT

The present study deals with the associations of geomagnetic disturbances (Ap), Plasma electric field (V.B) with sunspot number (Rz) during stream time for a long time period. It is found that the plasma electric field (V.B) & geomagnetic disturbance index (Ap) vary with 11-year sunspot cycle except at some circumstances. The variation of Ap & V.B. index for solar cycle 22 & 23 show close correspondences with 11-year sunspot cycle. The values of V.B. are higher during solar cycles 22 & 23. Association of Ap with sunspot number for solar cycle 23 shows interesting results. During the minimum phase of solar cycle, Ap indices are higher & show controversial results measured for previous solar cycles.

Keywords :Geomagnetic disturbances index (Ap), Plasma electric field (V.B), Sunspot number (Rz), 11-year solar cycle.

Introduction:-

A geomagnetic storm is a global disturbance in Earth's magnetic field usually occurring due to abnormal conductivity of the interplanetary magnetic field (IMF) & solar wind plasma emissions caused by various solar phenomena. Solar output in terms of solar plasma & magnetic field ejected out into interplanetary medium, as a consequence, create the perturbation in the geomagnetic field. 11-year solar cycle is the best known variability in the Sun. So, we have discussed association of geomagnetic activities & different solar source activities on long-term basis. Earlier studies have shown that large solar wind streams have been responsible for geomagnetic disturbance & plasma electric field (Joselyn & Mc Intosh, 1981). Many recent studies & Skylab observations show that active sunspot regions, CMEs produce large interplanetary & geomagnetic disturbances (Tousey, 1973). The correlation of CMEs & geomagnetic disturbance index have been discussed for different periods by several authors Tsurutani et al (1997), Dubey, (1998), Pandey et al (2008). Gopalswamy et al (2007) have in detail, discussed about single multiple CMEs events & their different associations.

Methods of Analysis:-

For present investigation, we have sorted out geomagnetic disturbance index (Ap) & plasma electric field, during stream time for solar cycle 22 & 23. Data of Ap was taken from International Service of Geomagnetic Indices (ISGI) & National Geophysical Data Centre (NGDC) USA. Then by statistical analysis, we have correlated Ap with Rz & V.B with Rz during stream time for a long-term basis.

Results & Discussion:-

In present analysis, we have established an association of global Ap with annual mean sunspot number Rz during stream time for a period of 1986 to 2009. This is depicted in fig 1.1. This plot indicates that during the minimum phase of solar cycle, global geomagnetic activities are higher. Fig 1.2 is a plot of cross-correlation curve with global indices Ap & sunspot number Rz in which we have found positive correlation coefficient. Similarly we have established an association of plasma electric field (V.B) with annual mean sunspot number (Rz) during stream time for a period of 1986 to 2009, which cover solar cycle 22 & 23 & are depicted in fig 1.3. This plot also indicates that the value of V.B is higher during the minimum phase of solar cycle. Fig 1.4 is a plot of cross-correlation curve with plasma electric field (V.B) & sunspot number (Rz) in which we have found positive & high correlation coefficient. During ascending & maximum phase of solar cycle 22, we observed 45 & 32 solar wind streams, whereas during its descending phase 61 solar wind streams were observed. During ascending phase of solar cycle 23, we observed 57 & 44 solar wind streams whereas during its descending phase, 72 solar wind streams were observed. Fig 1.5 shows the occurrences of solar wind streams during different phases of solar cycle 22 & 23. These results indicate that the solar cycle 23 is remarkable for occurrences of solar wind stream during its descending phase.

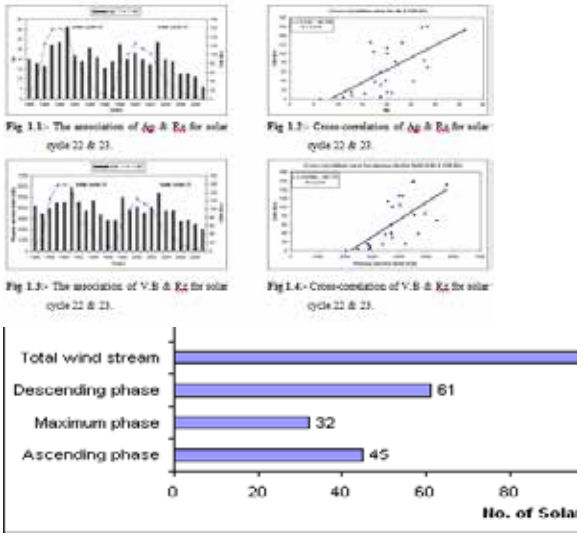

Fig 1.5:- The occurrences of solar wind stream during solar cycle 22 & 23.

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