Study of Solar Interplanetary and Geomagnetic Disturbances in Solar Cycle 23

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Abstract— The most specific of solar cycle 23, sun enters a period of intermediate and weak solar activity in terms of sunspot number. Based on the observation from Omniprobe data centre for solar- interplanetary data, geomagnetic activity and monthly mean count rate of cosmic ray intensity (CRI) variation data taken from neutron monitors during solar activity period 23/24. The phase of minimum solar activity began in May 2005 and lasted for 4.5 years the unprecedented duration of the relative sunspot numbers falls. It is observed that the strength of the interplanetary magnetic field has been falling off to new low levels, and reduces the GCR entering inner- heliosphere and it is also found that SSN positive correlated with Kp and Ap and sunspot number. 10.7 cm solar radio flux, were inverse correlated with monthly mean count rate of cosmic ray intensity.

Keywords: Galactic Cosmic ray (GCR), Interplanetary magnetic field (IMF), Solar activity, sunspot number (SSN)

I. INTRODUCTION

This solar cycle was different other cycle is term of the number of active regions before declining phase and stable (non flare) active regions, which may be weaker circulation in the solar convection zone during this cycle as compared to previous solar cycles (Tiwari,B.K., et al.,2014). Solar cycle 23 have the most specific feature and revealed its properties of evolution, which is entered in the family of the intermediate-magnitude of solar activity, it is farrmall started in May 1996 reached its maximum in term of relative sunspot numbers in April 2000 and maximum 10.7cm solar radio flux observed in Feb 2002 i.e., the maxima of the two main indices were separated in time as in the case of previous solar activity cycle. The complete polarity reversal of solar magnetic field for solar structure at occurred during July-December 2000. The secondary maximum of solar cycle relative to sunspot number was observed in Nov 2001. The total number of active region in 23rd solar cycle still behind previous solar cycle in term of number of optical solar flare and major x-ray flare and the last flare region with high flare appeared in the beginning of December 2006 (after 6.6 years of maximum). The cycle is characterized by abrupt decrease of the fluences (total daily fluxes) before the decrease phase (July 2002), the decrease in the flare activity reconnected in a considerable increase in the number of days with quiet geomagnetic conditions. (Zho et.al. 2011). In the extended solar minimum observed in 2009-2010 counts of highly elevated fluxes of GCRs, this results may be found considering the reduction in the total heliospheric magnetic flux observed by interplanetary spacecrafts, reduction in the magnetic flux comes during a solar minimum, when the heliospheric magnetic field allows better access to the inner heliospheric through gradient and curvature drift of cosmic rays. (Heber et al 2009., Tiwari, et. al.,2014)

In a magnetic epoch like at present, when the larged-scale solar magnetic fields are directed inward in the north, we expect a more peaked time- profile for positive charged GCRs. In contrast we expect a wider peak in the time profile of positive charged GCRs in epochs when the larged-scale solar magnetic field are directed outward is north ( similar as 1970s &1990s). The reduction in heliospheric flux and GCR drift patterns have caused the extended solar minimum to be both elevated in dose rate & prolonged compared to previous solar minimum this provides optional conditions for the measurements of GCR( Schwadron et. al.,2010 )

II. METHOLOGY

Data from three neutron monitor Keil, Moscow and Oulu with cut of rigidity (Rc=2.39GV, Rc=2.42 and Rc=0.80) have been used for analysis together with solar, IMF, solar wind, geomagnetic data from internet sources (http://www.sec.noaa.gov/ace/) and (ftp://ftp.ngdc.noaa.gov/stp/geomagnetic.data/). All results on cosmic ray variation are obtained and analysis based on the original sophisticated method.

Fig.1: linear plot between monthly mean count rate of CRI (Moscow-green ,Oulu-blue)with solar wind velocity (SWV-red) during solar cycle 23/24
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Fig. 2: Linear plot between monthly mean count rate of CRI with (1) proton density (left) and (2) with 10.7 cm solar radio flux (right) during solar cycle 23/24.

Fig. 3: Linear plot between monthly mean count rate of CRI (Keil-red, Moscow-violet, Oulu-Green) with Kp and Ap during solar cycle 23/24.

Fig. 4: Correlation with monthly mean sunspot number with monthly mean (1) of Kp (left) and (2) Ap (right) during solar cycle 23/24.
III. RESULT AND DISCUSSION

The sun is entering a period of intermediate and small solar activity cycles, comparatively about 5 to 6 solar cycle and this solar cycle is characterized by an abrupt decrease of (total daily fluxes) of energetic particles. The decrease in the flare activity resulted in a considerable increase in the number of days with quiet geomagnetic conditions. A decrease in the number of active regions may result in an increase in the number of coronal holes and consequently, in the number of recurrent high velocity solar wind streams, which will cause relative in the number of recurrent minor geomagnetic disturbance in the earth environment. A significant decrease in the number of flare events will result in a decrease in the number of stranger sporadic geomagnetic disturbance conditions. The weaker solar magnetic field will result in the shrinking, galactic cosmic rays modulation 2006 in the interplanetary space & in a significant increased in their intensity thought the entire solar cycle, not only during the epoch of solar minimum.

IV. CONCLUSION

Solar activity were low comparatively about 5 to 6 previous solar cycles. The decrease in the flare activity resulted in a considerable increase in the number of days with quiet geomagnetic conditions, and a decrease in the number of active regions may result in an increase in the number of coronal holes and consequently in the number of recurrent high velocity solar wind streams, which will cause relative in the number of recurrent minor geomagnetic disturbance in the earth environment, and weaker solar magnetic field will result in the shrinking, galactic cosmic rays modulation 2006 in the interplanetary space & in a significant increased in their intensity thought the entire solar cycle.

REFERENCES