STUDY OF LONG -TERM VARIATION OF COSMIC RAY INTENSITY WITH INTERPLANETARY MAGNETIC FIELD (IMF)

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Abstract:

In present work deals the associations of interplanetary magnetic field (B) with annual mean of cosmic ray intensity for the climax (R ≈ 3.00 GV) neutron monitor, in a long period, during 1986 to 2009, which cover solar cycle 22 & 23. It is found that the value of interplanetary magnetic field shows the decreasing trend with cosmic ray intensity (CRI) & also found that, the correlation coefficient is higher during solar cycle 22 comparison to solar cycle 23. During the minimum phase of solar cycle, interplanetary magnetic field is higher & show controversial results for previous solar cycle.

Keywords: Interplanetary magnetic field (IMF), Cosmic Rays Intensity (CRI), 11-year solar cycle

Introduction:

Cosmic ray intensity as observed on the earth surface, exhibit an approximate 11 year variation anti-correlated with solar activity (**Webb** et al 2003). Solar output in terms of solar plasma & interplanetary magnetic field ejected out into interplanetary medium consequently create the perturbation in the interplanetary magnetic field. The 11-year solar cycle is the best known variability in the sun so we have investigated association of interplanetary magnetic

field with cosmic ray intensity on long-term basis. **Joselyn** & **Mc Intosh** (1981) have shown that the solar disappearing filaments have also been linked with large geomagnetic activities & interplanetary magnetic field. The cosmic ray intensity monitored at neutron monitor energies is found varying with an eleven year cycle (**Shrivastava**, et al 1993; **Singh** et al. 1999; **Shrivastava** et al 2003).

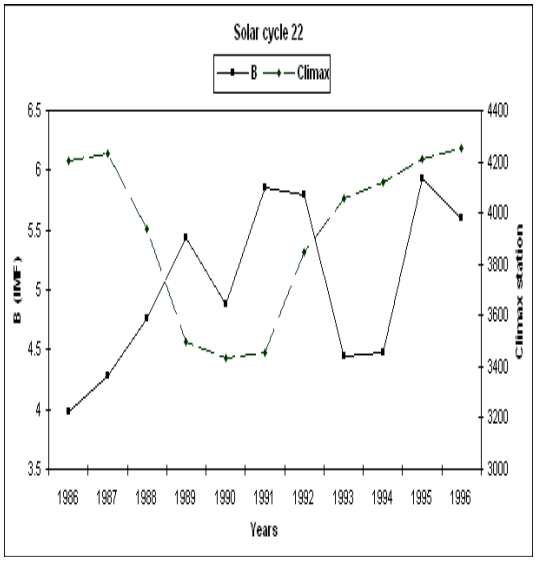
This solar modulation takes place as galactic cosmic ray propagation through the region around the sun. In this work, we have an approach slightly different from that used by earlier worker (**Grade** et al 1983).

Method of Analysis:

For present investigated, we have sorted out interplanetary magnetic field for solar cycle 22 & 23, data of interplanetary magnetic field taken from International Service of Geomagnetic Indices (ISGI). Data of cosmic ray intensity taken by National Geophysical Data Centre (NGDC) at www.ngdc. noaa.gov.website & by U.S. Dept. of commerce. NOAA, Space Environment centre.

Results & Discussion:

To show the long-term cosmic ray intensity & interplanetary magnetic field we plotted the yearly mean values of the cosmic rays intensity for the neutron monitor Climax (R $\approx$ 3 GV) station & geomagnetic parameters for the period of 1986 to 1996 as shown in figure 1.1, which cover the solar cycle 22, whose correlation curve plotted in fig 1.2, which implied Anti-correlation & correlation coefficient found to be negative. Similar curve plotted in fig 1.3 for same indices during the period of 1997 to 2009 which cover solar cycle 23, whose correlation curve plotted in fig 1.4, which gives anti-correlation between interplanetary magnetic field & cosmic ray intensity for the Climax neutron monitor station. The scales for the values of interplanetary magnetic field (B) decreases but cosmic ray intensity increases, these figures clearly demonstrate a good correspondence between cosmic ray intensity & interplanetary magnetic field (IMF) along with some peculiarities. The magnitude of the variation is correlated to earth other for any high & low cut off rigidity stations.



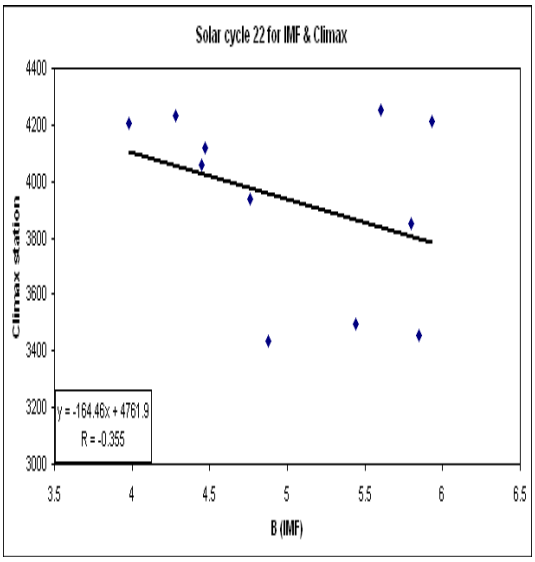
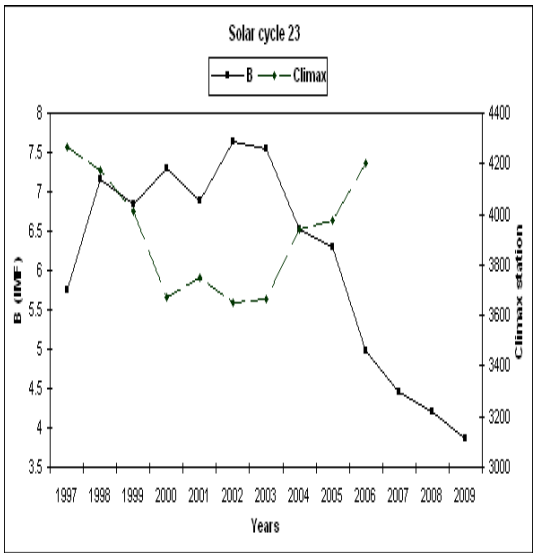


Fig 1.1:- Shows linear correlation curve for IMF & Climax station during 1986 to 1996.

Fig 1.2:- Shows linear cross-correlation curve for IMF & Climax station during 1986 to 1996.



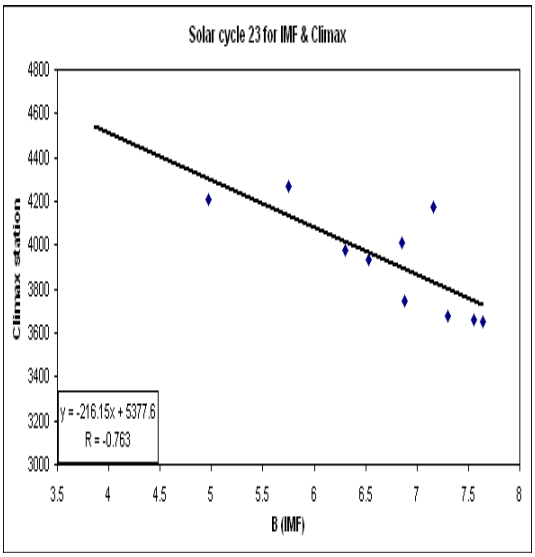


Fig 1.3:- Shows linear correlation curve for IMF & Climax station during 1997 to 2009

Fig 1.4:- Shows linear cross-correlation curve for IMF & Climax station during 1997 to 2009.

References:

Grade, S.K.; Jain A.K.; Pandey P.K. & Shrivastava P.K. (1983) 18th Int. Cos. Ray Conf. **3**. P-278.

Joselyn, J.A; & Mc Intosh, P.S., (1981) J. Geophys Res. **86**, 4555.

Shrivastava P.K. & Agrawal S.P. (1993) Indian Journal of Radio & space physics **22**, 26.

Shrivastava P.K. & Jaiswal, K.L. (2003) Solar Physics, **214**, 195.

Singh M; Nigam, S.K.; Shrivastava, P.K. (1999) Indian Journal of Radio & space physics **28**, 211.

Webb, J (2003) JGR, **105**, 7491.