29th International Cosmic Ray Conference Pune (2005) **00**, 101-104

The study of hysteresis upto recent solar cycles in long term modulation of cosmic rays

Laxmi Tripathi[a], Ambika Singh[a], Anil Kumar Shrivastava[b].
(a) Department of Physics, A.P.S. University, Rewa, MP, 486003, India
(b) Department of Physics, Govt. College, Panna, MP, India
Presenter: Laxmi Tripathi (laxmi.tripathi@rediffmail.com), ind-tripathi-L-abs1-sh34-poster

In this study we have used pressure corrected monthly mean values of cosmic ray intensity of different cut off rigidities for solar cycles 22 and 23. It has been found that hystersis is present between low-low rigidities station as well as low-high rigidities stations.

1. Introduction

The hysteresis in different energy ranges is a common further cosmic ray modulations. Generally a pair of high cut of rigidity station and low cut of rigidity station gives a loop which is commonly known as hysterisis curve. So many authors gives explanation that the solar flares induced propagating to the helisphere are found as responsible factor to produced the hysterisis effect in long term modulation of cosmic ray intensity [1-2].

2. Discussion

We have used here three neutron monitor station data in which two of them are low latitude station of cut off rigidities (Kiel Pc = 2.2, Moscow Pc = 2.4 GeV) and one high latitude neutron monitor station (Huancayo Pc = 12.2 GeV). We have taken into consideration complete solar cycles 22 and 23. The count rates are normalized to the maximum mean value February 1987, which is the minimum solar activity time period.

Hysterisis gives information regarding interplanetary condition. After normalizing the data of all three neutron monitor stations (two low cut off rigidities one high cut off rigidities) [2]. We have plotted correlation diagrams between low-low and low-high rigidity station for solar cycles 22 and 23. (Minimum solar activity expected in 2006).

Figure 1, shows low-low rigidity stations correlation graph between Kiel (Pc=2.2 GeV) and Moscow (Pc=2.4 GeV) for solar cycle 22 (1986 to 1996). From this graph a loop is apparent. Figure 2, shows low-high rigidity stations Kiel (Pc=2.2 GeV) Huancayo (Pc=2.4 GeV) correlation graph in this Figure a loop is apparent having a mini loop. The mini loop seen in the bigger loop is from January 1986 to May 1990. Figure 3 shows low-low rigidity station correlation group between Kiel (Pc=2.2 Gev) and Moscow (Pc=2.4 GeV) for solar cycle 23 (1994 to 2003) running figure 30 loop is observed the reason may be due to minima not yet reached. Similarly Figure 4 shows low-high rigidity correlative graph between Kiel (Pc=2.2 GeV) and Huancayo (Pc=12.9 GeV). From this graph also no loop is observed.

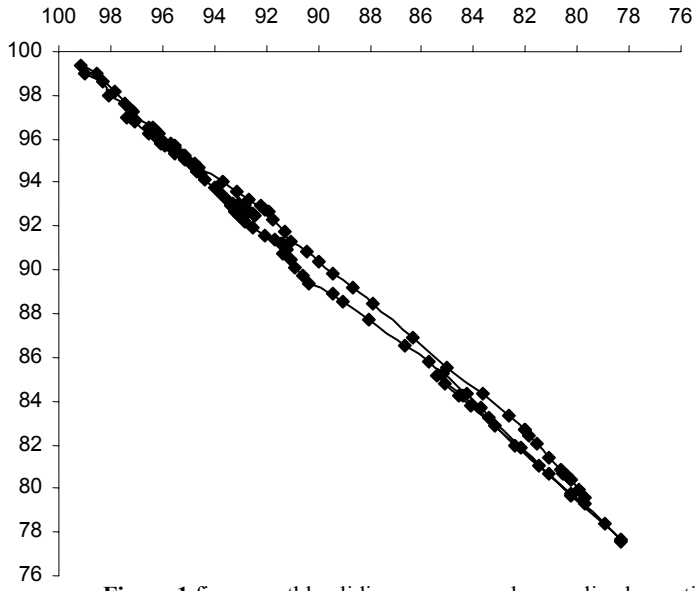


Figure 1.five monthly sliding average and normalized counting rates of neutron moniter at Kiel(2.23GV)plotted against the counting rates of moscow(2.4Gev) from 1986to1996

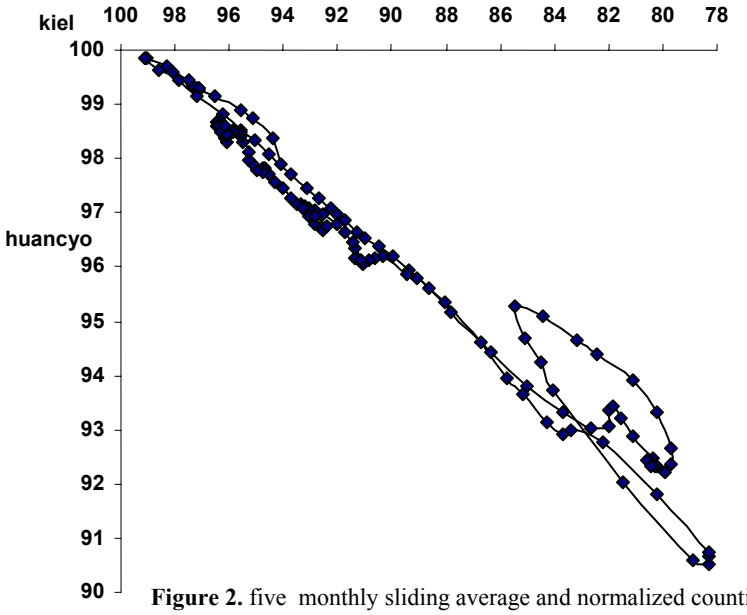
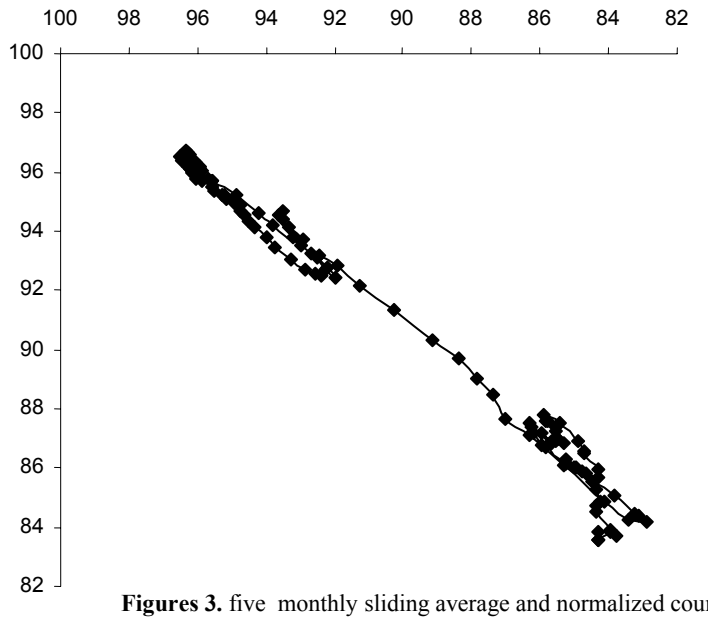


Figure 2. five monthly sliding average and normalized counting rates of neutron moniter at Kiel(2.23GV)plotted against the counting rates of huancyo(12.9Gev) from 1986 to1996



Figures 3. five monthly sliding average and normalized counting rates of neutron moniter at Kiel(2.23GV)plotted against the counting rates of moscow(2.4Gev) from 1994 to2003

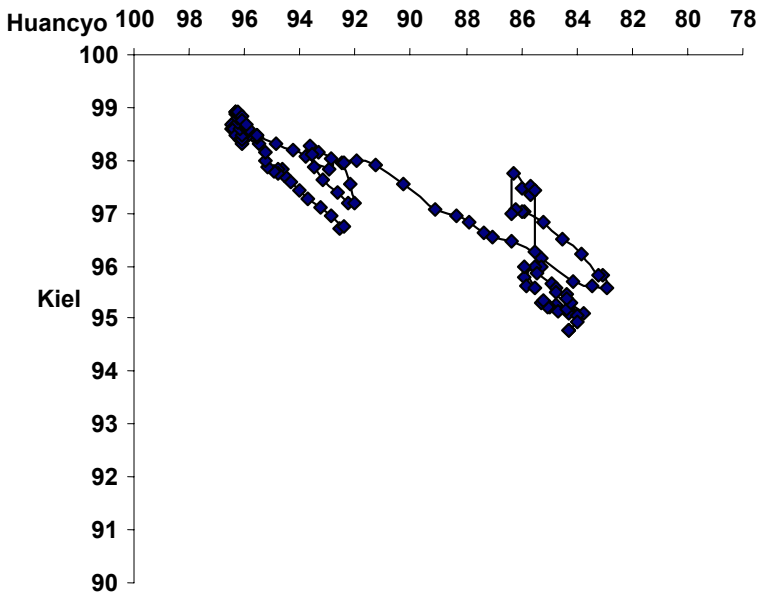


Figure 4. five monthly sliding average and normalized counting rates of neutron moniter at Kiel(2.23GV)plotted against the counting rates of huancyo(12.49ev) from 1994 to 2003

3. Conclusions

It is concluded that in low-low rigidity neutron monitor stations hysterisis is observe for the complete solar cycle 22. Whereas, for low-high rigidity station hysterisis loop is some what wider an a mini loop is also observe which January 1989 to May 1990. For the solar cycle 23 the hysterisis loop is not yet completed because the solar cycle minima is expected in 2006. The anamoly in low-high rigidity cosmic ray neutron monitor for solar cycle 22 is the mini cycle observed in the hysterisis loop which is reported.

4. Acknowledgements

Authors are thankful to World Data Centre, Baurlado, USA for providing the data. Authors are grateful to Dr. Pankaj K. Shrivastava, Asstt. Professor, Govt. Model Science College, Rewa for suggestions.

References

[1] Moraal H. et al., J. Geophys. Res. (USA) 80, 3253.
[2] Stoker P.H. et al., J. Geophys. Res. (USA) 91, 1355.