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CO-RELATIVE STUDY OF SOLAR WIND STREAMS VELOCITY & COSMIC RAY INTENSITY VARIATIONS DURING 2002-2007

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Abstract: A correlative study of solar wind streams velocity & cosmic ray intensity variations during 2002-2007, using the hourly neutron monitor data of Moscow ($R_e = 2.39$ GV) station. High speed plasma streams identified in the solar wind measurement, which can be separated into two categories: Coronal hole associated streams & flare generated solar streams. It is investigated that; the solar wind streams velocity is inversely related with cosmic ray intensity variation on long-term basis.

Keyword: Solar wind velocity (V), Sunspot number (Rz), Plasma Density (D), & Cosmic ray intensity (CRI).

Introduction

The inverse correlation between solar wind stream velocity & cosmic ray intensity in the 11-year variation was first pointed out by **Forbush** (1958) & has been studied in detail by **Rao** (1972), **Pomerantz** & **Duggal** (1974) & **Morral** (1976). According to these studies the time lag between cosmic ray intensity & solar activity varies from several to 12 months, depending on solar cycle & solar activity index (Ap). Solar time anisotropy for cosmic rays with energy above several Gev was explained by Parker (1961) on the basis of the diffusion-convection theory. **Swinson** (1993) reported solar anisotropies due to vector production of density gradient vertical to solar equatorial plane & IMF (Interplanetary magnetic field). While Munakata et al (1993) & Kojima et al (1990) reported anisotropies caused by North-South symmetry & North-South symmetry dependent on IMF.

The first tentative direct observation of the solar wind streams was reported by **Biber**, **Pomerantz** & **Taso** 1983 from the Russian space probe Lunik-2. The data have examined for the long-term variation, either the 11-year solar cycle component (**King** 1979) & in term of quasi

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periodic component such as 1 to 1.3 year oscillators in solar wind velocity (**Wang** & **Sheelay** 1988; **Bolton** 1990, **Gazis** 1996) showed that when long-term averages are considered the correlation between geomagnetic activity & solar wind velocity is indeed very striking. He found significant variation from one cycle to next. The long-term modulations of cosmic ray intensity are significantly correlated with solar wind (**Shrivastava**, 1990; **Bruno**, **Villante** & **Stecca**, in 1994) studied changes in selected solar wind parameters at 1 AU through two solar activity cycles separating the data into two parts corresponding to fast & slow solar wind.

In this work we find the effects of solar velocity on cosmic ray intensity for the period of 2002-2007 & compare the findings with earlier results.

Method of Analysis

In this analysis we have used the annual values of solar wind stream velocity ($\geq$ 450 Km / Sec) & cosmic ray intensity of Moscow neutron monitor for the period of 2002-2007. The basic data are the mean daily values, which are taken from the OMNI website. The gap in the data set & missing values replace by approximately average values. Then we use a statistical technique to correlate them.

Results & Discussion

The sun & its outputs in form of various interplanetary features such as solar plasma, Interplanetary Magnetic Field & solar wind stream velocity are related to the disturbances in earth magnetic field. The average plasma parameters of earths orbit show specific decadal variation & trends, which are of the order of the first tens percent during the last four solar cycles. Earlier a number of investigators have studied & reported significant relationship among solar wind stream & other parameters for the period of solar cycles 22 & 23 (**Mishra** et al, 2000; **Singh** & **Shrivastava** 2002; **Singh** & **Shrivastava** 2003). In the present analysis, we have taken the period of 2002 to 2007 which cover the solar cycle 23. Fig 1.1 shows the correlation between annual average values of solar wind velocity & cosmic ray intensity for Moscow neutron monitor for the period of 2002 to 2007. Fig 1.2 shows the anti correlation between solar wind velocity & cosmic ray intensity for Moscow neutron monitor whose cut off rigidity is 2.39 GV.

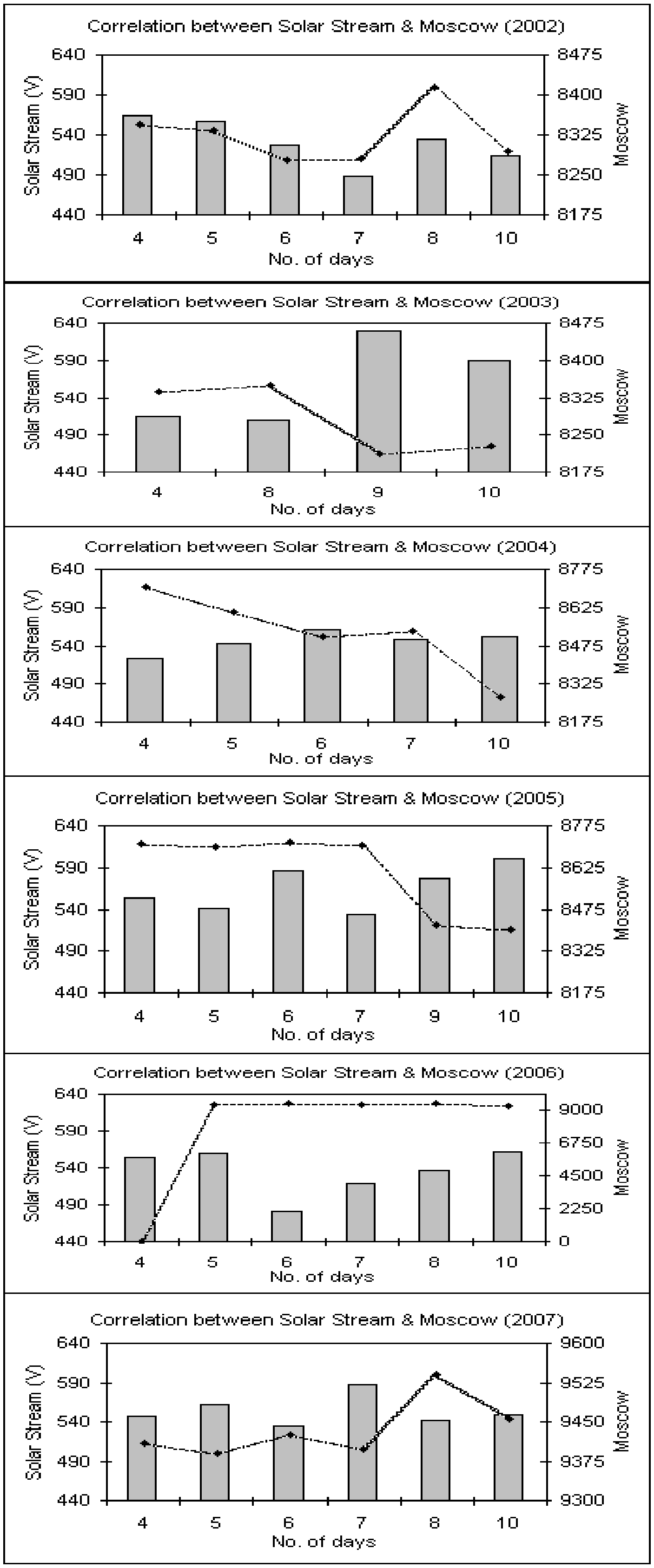

Fig 1.1. Correlation between Solar stream & Moscow (CRI) station from 2002-2007.

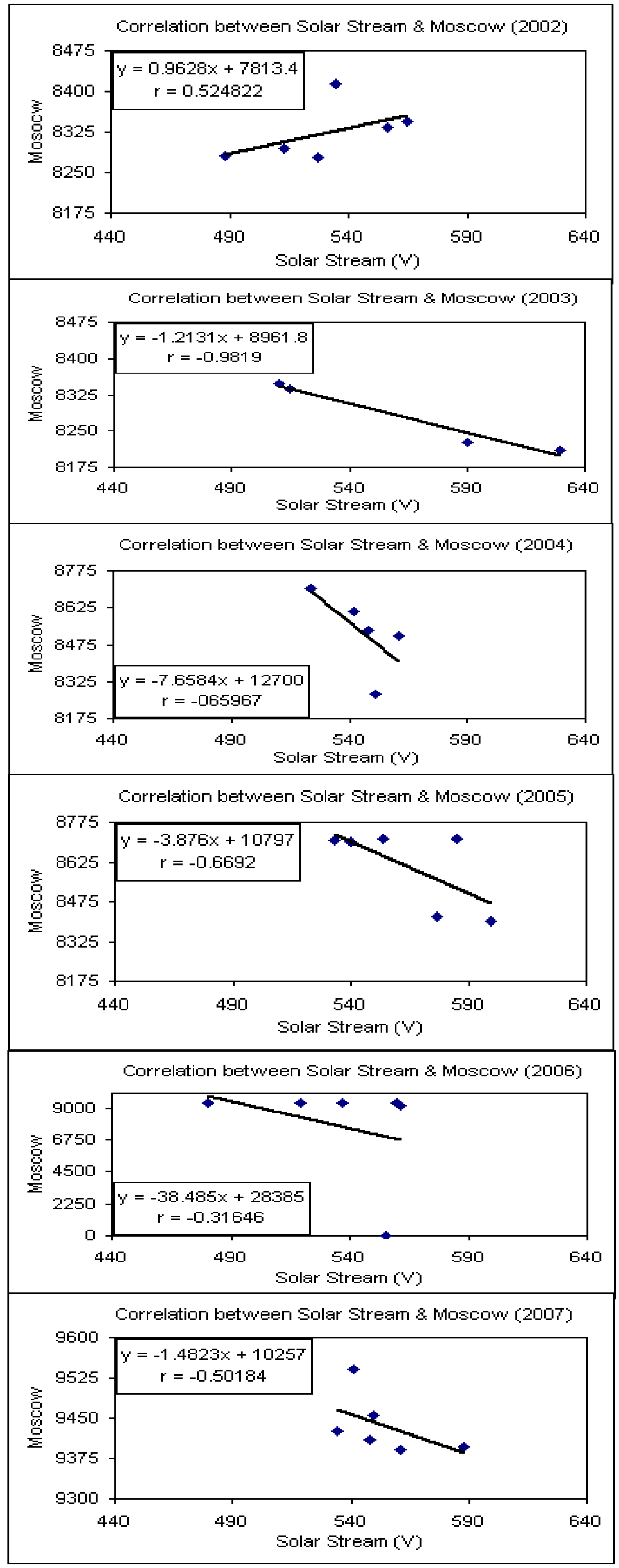

Fig 1.2. Cross-plot between Solar stream & Moscow (CRI) station from 2002-2007.

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References

1. Biber, Pomerantz & Taso, C.M. Proc 18th ICRC (Bangalore), **8**, 289 (1983).
2. Bolton, S.J. J. Geophys, Lett, **17**, 37-40 (1990).
3. Bruno, R.U., Villante & Stecca, A, Ann. Geophys, **12**, 105 (1994).
4. Forbush, S.E.; "Cosmic ray intensity variation during two solar cycles, J.Geophys Res (USA), **63**, 651 (1958).
5. Gazis, P.R. J.Geophys Res, **181**, 415 (1996).
6. King, J.H. J.Geophys Res **84**, 5938 (1979).
7. Kojima, M. & Kakinuma, T. "Solar cycle dependences of global distribution of solar wind speed", Space Sci. Rev. **53**, 173 (1990).
8. Mishra V.K. Tiwari, D.P. & Shrivastava P.K., Asian Journal of physics **9**, 97 (2000).
9. Moraal H; "Observation of the eleven year cosmic ray modulation cycle", Space Sci. Rev (USA), **19**, 845 (1976).
10. Munakata, Y; Mori, S; Swinson, D.B.; Tatwoka, K.; Yasues. 23rd Ind. Cosmic Ray Conf. **3**, 629 (1993).
11. Parker, E.N; Astrophys. J. **133**, 1014 (1961).
12. Pomerantz, M.A. & Duggal, S.P.; "The sun & the cosmic ray", Rev Geophys Space phys (USA) **12**, 343 (1974).
13. Rao, U.R.; "Solar modulation of galactic cosmic ray radiation". Space Sci Rev (USA) **12**, 719 (1972).
14. Singh G.N. & Shrivastava P.K. Earth, Moon & Planet **91**, 1 (2002).
15. Singh G.N. & Shrivastava P.K. J. Curr. Sci 3(1), **233** (2003).
16. Swinson, D.B. J. Geophys, Res **97**, 1947 (1992).
17. Wang & Sheelay. J. Geophys. Res, **93**, 11227 (1988).