Ultra Scientist Vol. 25(1)B, 47-50 (2013).

Sunspot numbers in relation with geomagnetic activity

BALENDRA PRATAP SINGH[1] and ACHYUT PANDEYA[2]

(Acceptance Date 25th January, 2013)

Abstract

We have correlated sunspot number (Rz) with geomagnetic Ap and Kp indices for the period 2006 to 2011, and shown to be positively correlated with coefficient of correlation for sunspot no. vs. geomagnetic disturbance index Ap (r = 0.3528) and for sunspot no. vs. geomagnetic activity index Kp (r = 0.3131), and we have concluded that, if number of sunspots increases then there will be an increase in the value of geomagnetic Ap and Kp indices, i.e. geomagnetic disturbance level will be increased, and If number of sunspots decreases then the value of geomagnetic Ap & Kp indices also decreases, and geomagnetic disturbance level will be decreased.

Key words : Sunspot numbers (Rz), Geomagnetic activity index (Kp), Geomagnetic disturbance index (Ap), Disturbance storm time (Dst).

1. Introduction

We know that the sunspot are the temporary disturbances and most prominent blemishes on the surface of sun. These are the darker region on the solar surface and Ap & Kp both are the geomagnetic indices.

Bartels, the initiator of the widely used Kp and Ap indices of geomagnetic activity, attempted a study of the systematic temporal changes in these indices covering the interval 1932-1961 (Rangarajan and Iyemori)[4].

The name Kp originates from "Planetarische Kennzifer" (Planetary index). K- variations are all irregular disturbances of the geomagnetic field caused by solar particle radiation within the 3-h interval concerned. All other regular and irregular disturbances are non variations. Geomagnetic activity is the occurrence of K-variations (El-Borie *et al.*)[1]. It is known that geomagnetic disturbances index Ap is one of the fundamental parameters which indicates geomagnetic field variations as well as quiet or disturbed condition of interplanetary medium (Srivastava & Shukla)[5]. Although a great deal of work has been done

on the prediction of the sunspot number 1-10 years in advance, very little has been done on the related problem of predicting the level of geomagnetic activity (Feynman & Gu)[2].

The relationship between various indices of geomagnetic activity and interplanetary plasma parameters were studied for the imp-1 period and the partial correlation coefficients showed that Ap, the Dst daily range and the auroral index AE were differently related to different plasma parameters (Kane)[3]. We have investigate the correlative study of different solar and interplanetary parameters with Ap and Kp index for the period 1996-2009 and shows variation of geomagnetic indices with sunspot numbers and reported significant relationship between geomagnetic Kp and Ap index with sunspot number. We have also found that yearly average value of geomagnetic Kp and Ap indices are high during solar activity period (Tripathi *et al.*)[6].

2. Data Analysis :

In the present study we have considered data of geomagnetic Kp and Ap indices with sunspot numbers. Data of sunspot number and geomagnetic Ap and Kp index, daily average value has been taken from Omni web data explorer foe the year 2006 to 2011, then we converted it into yearly average data. We have used statistical methods to correlating and analyzing the data.

3. Result and Discussion :

Fig. 1 & 2, Shows that the line diagram and correlation curve between sunspot number Rz and Ap index respectively for the year 2006 to 2011, whereas figure-3 & 4, shows the line diagram and correlation curve between sunspot number Rz and Kp index respectively for the year 2006 to 2011.

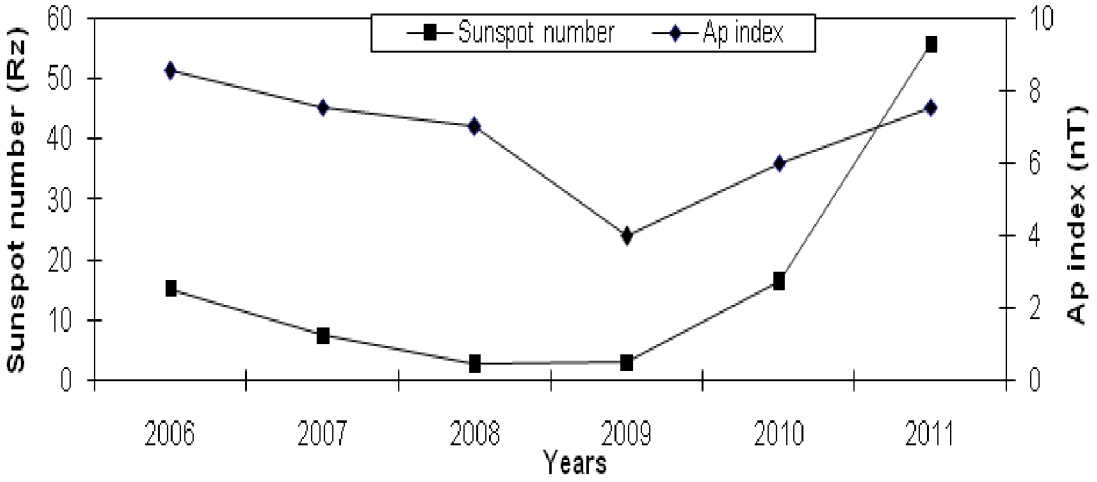

Fig.1. Shows the line diagram between yearly average values of sunspot no. Rz and Geomagnetic disturbances index Ap, for 2006-2011

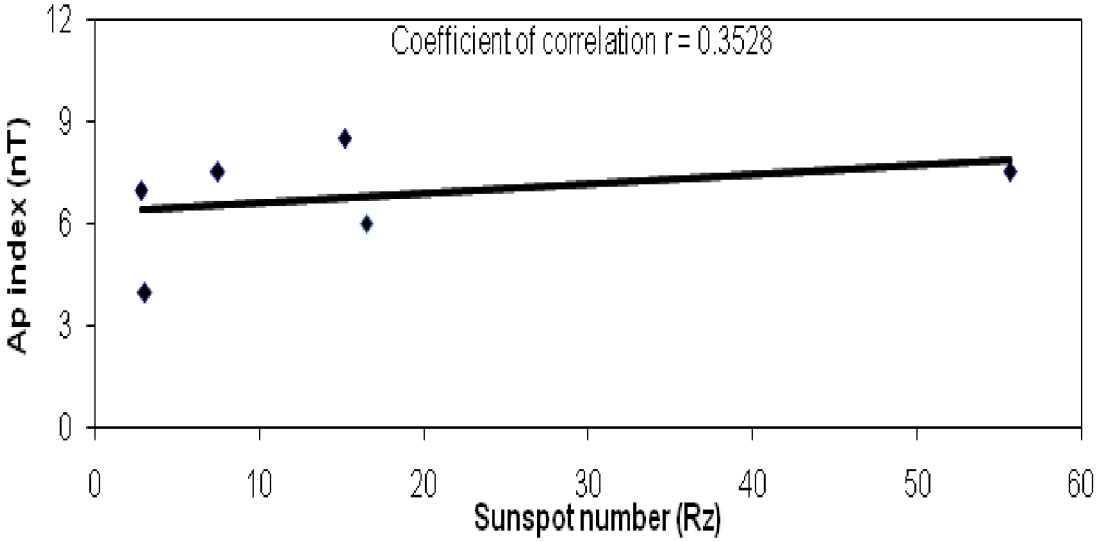

Fig. 2. Shows the cross-plot between yearly average values of sunspot number Rz and Geomagnetic disturbance index Ap, for 2006-2011

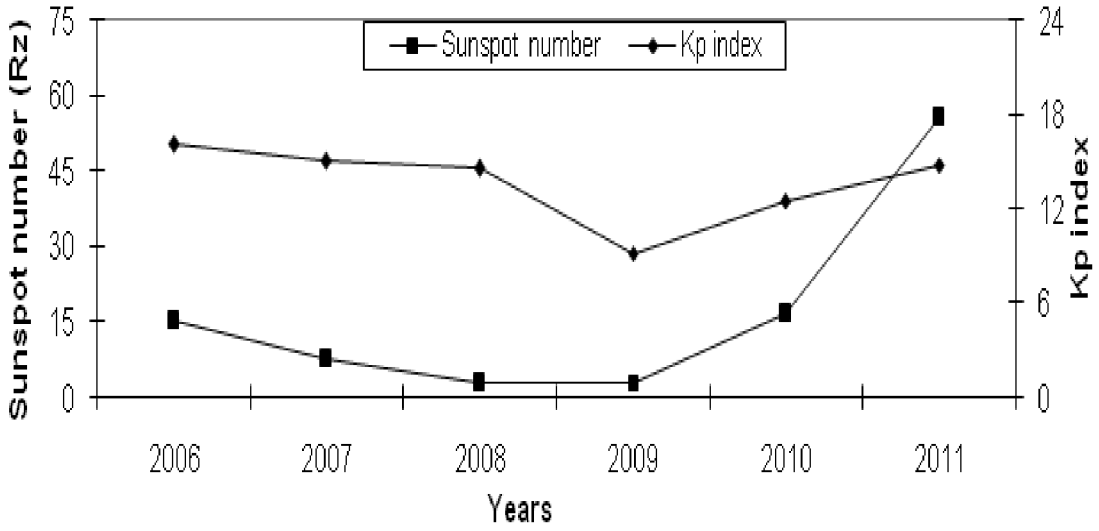

Fig. 3. Shows the line diagram between yearly average values of sunspot number Rz and Geomagnetic activity index Kp, for 2006-2011

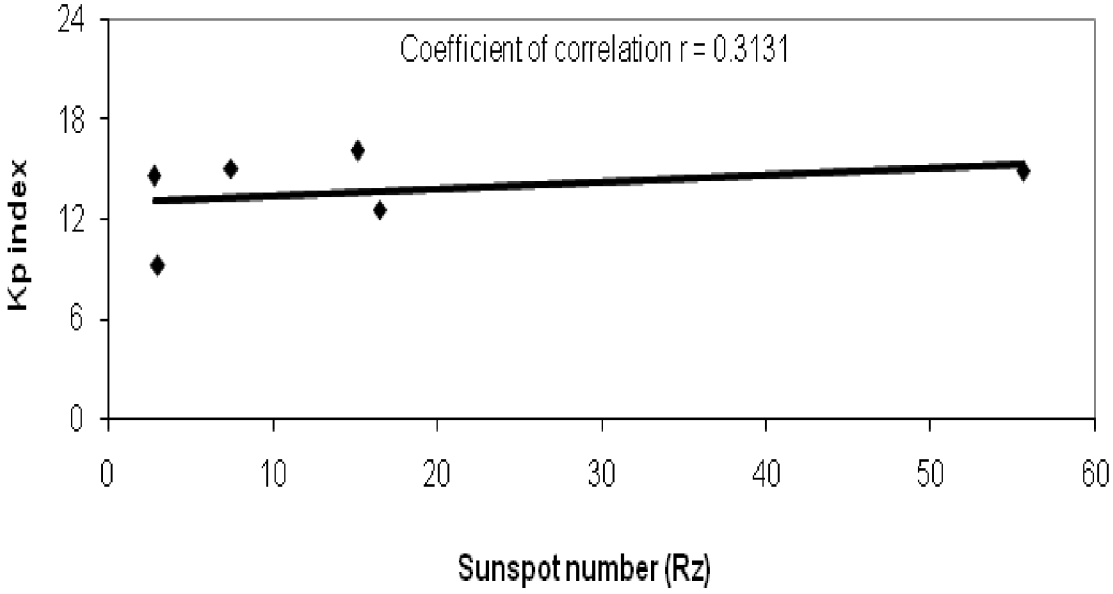

Fig. 4. Shows the cross-plot between yearly average values of sunspot number Rz and Geomagnetic activity index Kp, for 2006-2011.

From figure 1 & 3, we observed that there is a similar variation in **(a)** between sunspot number Rz & geomagnetic Ap index, and **(b)** between sunspot number Rz & geomagnetic Kp index.

From figure 2 & 4, we observed coefficient of correlation in **(a)** between sunspot number Rz & geomagnetic Ap index (r = 0.3528) and **(b)** between sunspot number Rz & geomagnetic Kp index (r = 0.3131).

Acknowledgement

The authors are thankful to omni web data centre for providing the all data for the present study through the web.

Referencess

1. El-Borie M.A., Abd-Elzaher M., Shenawy A. Al, *American Journal of Environmental Engineering, 2(4)*, pp. 81 (2012).
2. Feynman J., Gu X.Y., *Rev. Geophys., 24,* 650 (1986).
3. Kane R.P., *J. Geophys. Res., 79(1),* 64 (1974).
4. Rangarajan G.K., Iyemori T., *Ann. Geophysicae 15*, 1271 (1997).
5. Srivastava P.K., Shukla R.P., *Bull. Astr. Soc. India,* Vol. *24*, pp. 663 (1996).
6. Tripathi M.K., Gupta R.S., Verma P.L. & Khare N., *Indian J. Sci. Res., 3(1),* 153, (2012).