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Physics

CORRELATION BETWEEN THE SUNSPOT NUMBERS AND GEOMAGNETIC PARAMETERS FOR THE SOLAR CYCLE-24

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ABSTRACT In this paper we have studied the correlation between the annual mean values of the sunspot numbers (Rz) and the annual mean values of the geomagnetic disturbance index-Ap and Geomagnetic activity-Kp indices for the selected period of 2007 to 2017, and shown to be positively correlated. The coefficient of correlation for sunspot number Vs geomagnetic disturbance index-Ap is, r =0.355 and for sunspot number Vs geomagnetic activity index-Kp is, r = 0.381, and we have concluded that if number of sunspots increases then geomagnetic disturbance level will be increased, and if number of sunspots decreases then geomagnetic disturbance level will be decreased.

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

INTRODUCTION

As we know that the sunspots are the areas on the photosphere (the visible surface of the sun), which appear darker than the surrounding surface of the sun by virtue of their relatively lower temperature but strong magnetic field. The sunspots usually appear in a pair or a group on sun's surface inside a bipolar magnetic region with strong magnetic field. We know that geomagnetic activity index (K_P) and geomagnetic disturbance index (A_P) both are the geomagnetic indices.

A geomagnetic index was introduced by Davis and Sugiura (1966) [1] to characterize the auroral zone, where the fluctuation of magnetic field is much stronger than at mid and low latitudes during enhanced magnetospheric activity. Bartels, generally used K_P and A_P indices of geomagnetic activity; pursue a study of the systematic temporal changes in these indices covering the interval 1932-1961 [2].

The name K_P originates from "planetarische kennzifer" (planetary index). It available since 1932, represents the general state of planetary geomagnetic activity. K- variations are disturbances of the geomagnetic field produced by solar particle radiation within the 3-h interval concerned. All disturbances are non-variations. Geomagnetic activity is the occurrence of K-variations [3]. It is known that geomagnetic disturbances index A_P is one of the fundamental parameters which express geomagnetic field variations as well as quit or disturbed condition of interplanetary medium [4]. The relation between sunspot number and various indices of geomagnetic activity has been examined by many researchers [5], [6].

In this paper, we show the variation of geomagnetic indices with sunspot numbers for the period 2007 to 2017, and reported significant relationship between geomagnetic K_P and A_P index with sunspot numbers. We have also shown the variation of sunspot numbers in selected period.

DATA ANALYSIS

In this paper we analyzed geomagnetic indices Kp and Ap with sunspot numbers. Data of sunspot numbers and geomagnetic Kp and Ap indices, daily average value has been collected from omni web data explorer (https://omniweb.gsfc.nasa.gov./from/dx1.html), for the year 2007 to 2017. Then we converted the daily data into yearly average data. For analyzing the data and correlation, we used statistical methods.

RESULT AND DISCUSSION

We described the relationship between sunspot numbers (R_Z) and geomagnetic disturbance index (A_P) by using line diagram and correlation curve as shows in Figure 1 & 2, for the selected period 2007 to 2017. The relation between sunspot numbers (R_Z) and geomagnetic activity index (K_P) also described by using line diagram and correlation curve as shows in Figure 3 & 4 for the year 2007 to 2017. And we also plotted the variation of sunspot numbers (R_Z) by using Bar diagram for the selected period in Figure 5.

From Figure-1 & 3, we have found that there is a similar variation in (a) between sunspot numbers (R_Z) & geomagnetic A_P index and (b) between sunspot numbers (R_Z) & geomagnetic K_P index.

From Figure-2 & 4, we have found that coefficient of correlation (a) between sunspot numbers (R_Z) & geomagnetic A_P-index (r=0.355) and (b) between sunspot numbers R_Z & geomagnetic K_P-index (r =0.381), i.e., sunspot numbers are poorly correlated with geomagnetic Ap & Kp indices for the time interval of 2007-2017.

From figure-5, we have found that maximum sunspot numbers are appeared in the year of 2014. In this period, we observed the value of sunspot numbers (R_Z= 113.59).

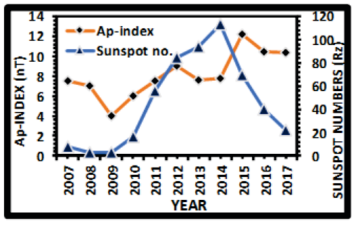

Figure 1. Shows the line diagram between yearly average values of sunspot no. Rz and Geomagnetic disturbances index Ap, for 2007-2017.

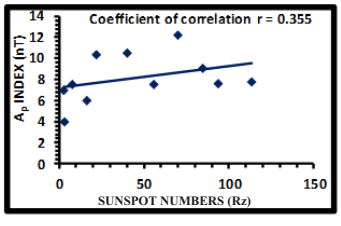

Figure 2. Shows the cross-plot between yearly average values of sunspot number Rz and Geomagnetic disturbance index Ap, for 2007-2017

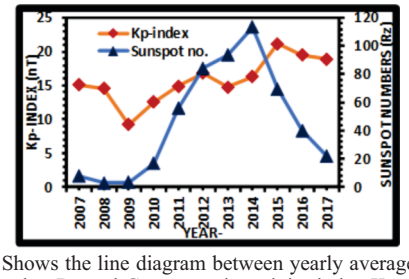

Figure 3. Shows the line diagram between yearly average values of sunspot number Rz and Geomagnetic activity index Kp, for 2007 – 2017.

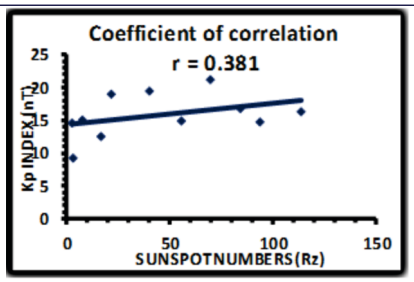

Figure 4. Shows the cross-plot between yearly average values of sunspot number Rz and Geomagnetic activity index Kp, for 2007-2017.

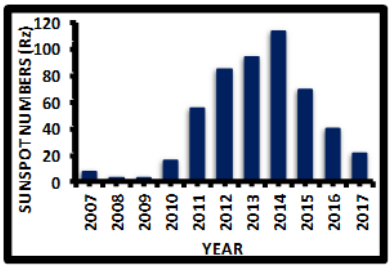

Figure 5. Shows the variation of sunspot numbers (Rz), for 2007-2017.

CONCLUSIONS

From our study of selected parameters, we have concluded that the:

1. As the sunspot cycle progresses the variation of geomagnetic disturbance index-Ap and geomagnetic activity index-Kp are same, in whole study period.
2. Sunspot numbers are poorly correlated with Ap-index.
3. Also, the sunspot numbers are poorly correlated with Kp-index.
4. Sunspot (solar) cycle-24, approaches to its peak value in the year-2014.

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REFERENCES:

[1]. Davis, T.N. and M. Sugiura (1996), "Auroral electrojet activity index AE and its universal time variations," J. Geophy. Res. 71, 785-801.
[2]. Rangarajan G.K., Iyemori T. (1997), Ann. Geophysicae 15, 1271.
[3]. El-Borie M.A., Abd-Elzaher M., Shenawy A. Al (2012), American Journal of Environmental Engineering, 2(4), pp. 81.
[4]. Srivastava P.K., Shukla R.P. (1996), Bull. Astr. Soc. India, Vol. 24, pp. 663.
[5]. Feynman J., Gu X.Y. (1986), Rev. Geophys., 24, 650.
[6]. Kane R.P. (1974), J. Geophys. Res., 79(1), 64.