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Association of Intense Geomagnetic Storms with Solar Wind Speed for Solar Cycle 24

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ABSTRACT
We have studied the association of intense geomagnetic storms (-200 <Dst ≤ -100nT) for the solar cycle 24 with solar wind speed. For our study, we used the Kp index as a sign of geomagnetic storm. In order to find the association of geomagnetic storm (GS) with solar wind speed, we incorporate the analysis technique by superposed-epoch method. The current analysis depict that solar wind speed V is a geo-effective parameter. In addition to this, we also found that Kp index is also a geo effective parameter. Furthermore, the time delay analysis has also been performed by the method of correlation for the introduced parameter.
Keywords *Solar Wind Speed, Geomagnetic Storms, Kp Index.*

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INTRODUCTION

A geomagnetic storm (GS) is a transitory disturbance in the earth's magnetosphere. The main cause of such disturbance is the alternation of solar wind and shock wave with the magnetic field of the earth. This variations in geomagnetic field is known as GS whose durability is measured by Dst or Kp index [3].When a magnetic storm is in progress, it is depicted with the negative sign of Dst index. Solar wind parameters plays a significant role in the initiation of various space weather activities such as geomagnetic storm which on the other hand give rise to auroras [1]. When the charged particles from the sun hit to the upper atmosphere it results to the coloured light in the sky known as auroras [4].

MATERIAL AND METHODS

In order to find the GS variation in relation to solar wind speed, we used a chree analysis by the superposed epoch method. In order to study the variation of solar wind speed, the occurrence hour of GSs are used as a zero days with criteria -200 <Dst ≤ -100nT (intense geomagnetic storms). The hourly mean values of solar wind speed and Kp index are taken from the omniweb data center (omniweb.gsfc.nasa.gov/form/dx1.html) for the studied period 2009-2017 (Solar Cycle 24). We also calculate the correlation coefficient between these parameters.

RESULTS AND DISCUSSION

As a result, we analyse the upshot of various solar wind speed on geomagnetic storm for solar cycle 24. From the following analysis diverse outcomes has been observed which are discussed below-

Kp index and solar wind speed

From figure 1, it is easy to perceive that the strongest increment in solar wind speed does not always occurs on the happening hour of GS. Time delay of few hour is always found between the extreme value of solar wind speed and Kp index. The correlation coefficient between Kp index and solar wind speed is found to be 0.6, which shows that they are moderately and positively correlated with each other. Our

outcome is in good favour with the results of Elliott 2013 [2],who concluded that Kp index and solar wind speed are strongly correlated with each other.

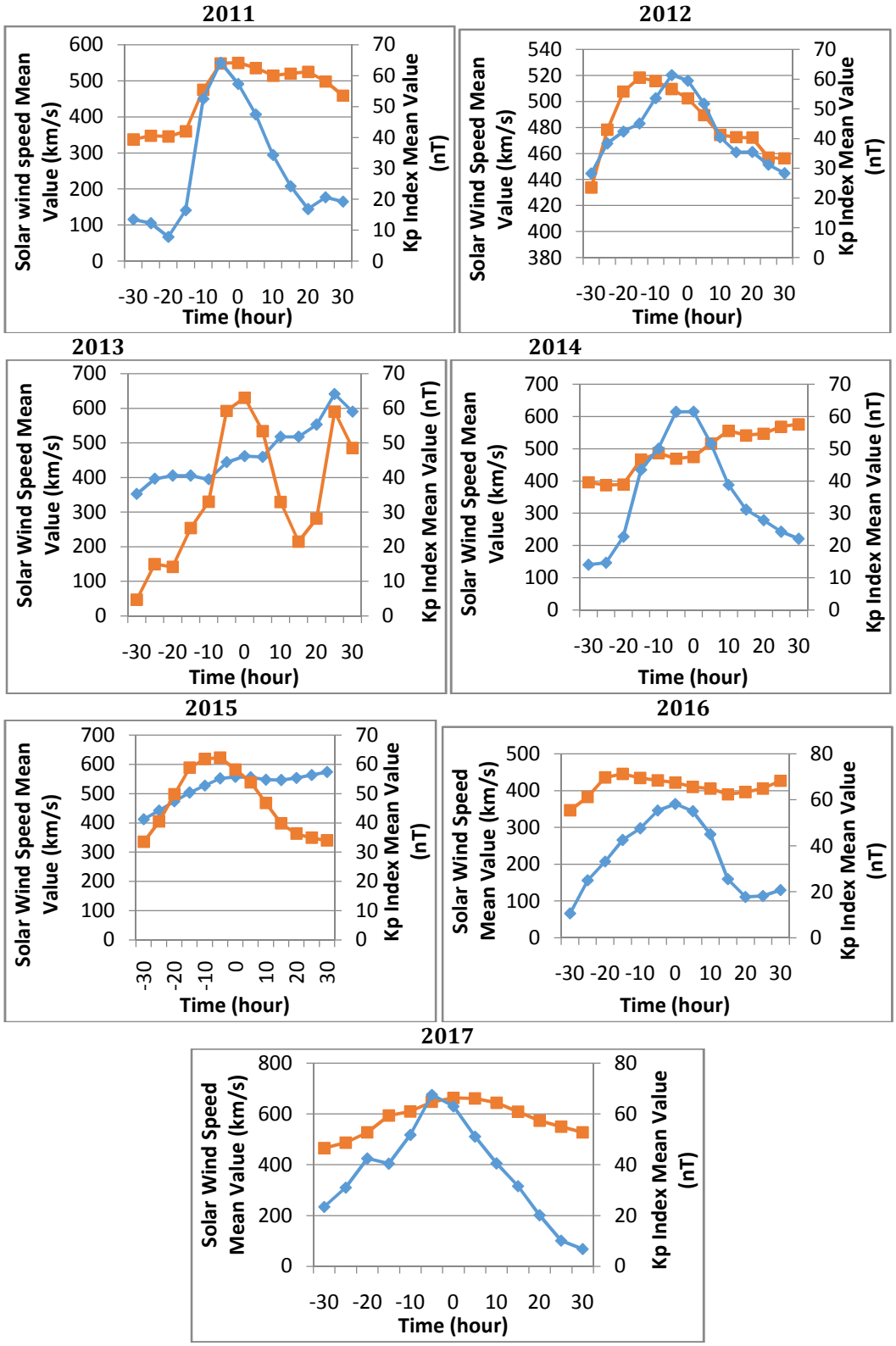

Figure 1 The discrepancy of average values of solar wind speed in blue and Kp index in red is demonstrated for intense geomagnetic storm. No datas are observed in 2009 and 2010 for intense geomagnetic storms.

CONCLUSIONS

After the detailed analysis of our study various conclusions has been observed. During our investigation for the said period, solar wind speed V is found to be a geo-effective parameter . The correlation coefficient between Kp index and solar wind speed is found to be 0.6, which shows that these two parameters are positively and moderately correlated with each other while the correlation coefficient between Kp index and Dst index is found to be -0.8, which shows that these two parameters are highly anti-correlated with each other.

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