Studying the Significance Percentage of Solar Flares during Peak of Solar Cycle 25: Article Review

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Abstract

In this research, the analytical investigation of solar flares significance percentage is studied for maximum of solar cycle 25. The variation of significance percentage of solar flares was achieved statistically analysis for different all days / month of year 2024 depending on dataset of Advance Space-based Solar Observatory. The daily behavior of significance percentage of solar flares values during August and October was clear variations comparing with other months. The significance percentage of solar flares dataset was distributed more in the equatorial latitudes for months (August and October)/ 2024 while there was low allocation during January and April months.

Keywords: solar flare; solar activity; sunspot number

1. **Introduction**

Sun is represented a main sequence G2 spectral class star in the universe and huge activities like sun spots, solar flare and coronal mass ejection. The solar flares phenomenon is a sudden event of energy into solar corona. The solar radiation is emitting energy range in different wavelengths [1]. The discovery of solar flare was observed by R. C. Carrington and R. Hodgman in 1859 [2]. Balfour Stewart [1961] noticed the disturbance of the radio-communication affected by solar charge particles [3] and discovered the existence of electric current that is accrued in the upper Earth's atmosphere in 1899 [4]. Fleming (1936) was found the geomagnetic variation is caused by solar flare events resulting to disruption radio signals [5] and McNish (1937) was made a map of geomagnetic variation during solar flare phenomena [6]. Imamiti (1940) was examined the relationship of geomagnetic effects of solar flares and solar quiet for different observatories [7]. Dieminger & Geisweid (1950) was found the effect of solar flares on ionospheric layer [8]. Greenfield & Venkateswaran (1968) was showed the changing currents that are formed from solar flare leading to temporal variation of ionosphere layer [9].

Sastri & Murthy (1975a) studied the relationship between the characteristics of solar flare with X-rays and microwave that emitted from bursts of the sun [10]. Rastogi et al. (1999) investigated solar flare effects for the Indo-USSR chain of different magnetic observatories ranging from the magnetic latitudes 0º–45º N during strong and normal electrojet periods [11]. Grechnev, V. V. (et. al, 2008) analysized the extreme solar particles of events for 20 Jan 2005 in order to studied the spectral, temporal and spatial properties of main phase of flares [12]. Aschwanden, M. J. (et. al, 2015) used the dataset of global energetic of M- and X-class flares that is measured from Solar Dynamics Observatory [13]. T. Tsiftsi and V. De la Luz (2018) depended on observed data realistic confidence intervals in order to study the maximum X-ray fluxes of flare events [14]. Hayes,

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Laura A. (et. al, 2020) investigated the relationship quasi-periodic pulsations and features of the flaring active region [15]. Maria A. Sergeeva (at. al, 2023) was shown there is impact of solar flares on the lower ionosphere over Mexico during March 2022 [16]. Mingfu Shao (et. al,2025) modified method for prediction the solar flares dataset and investigation the Multimodal Large Models for adjusted solar flare [17]. In this research, an analytical studying of significance percentage has been made for different months and different geographical locations.

2. The Mechanism of Solar Flares

The mechanism of solar flares is principle for understanding their effect on Earth's atmosphere. Solar flares are caused by the release of magnetic energy that is existence in the Suns atmosphere. This process leads to the emission of X-rays and ultraviolet radiation, which aims to study the significance of solar flares within the Sun and their impact for solar activity cycles [18]. The interaction between the emissions with Earth's atmosphere can case to disturbance in the Earth's atmosphere, which may effect of satellite operations and communication systems [19].

3. Test & Results

In this paper, the behavior of solar flares has been made for all months of peak solar activity depending on their significance percentage. The sunspots number has been adopted for different months of peak solar cycle 24 which was measured using solar influence data analysis center (https://www.sidc.be/SILSO/datafiles), as shown in table (1).

Table (1): illustrates the sunspot number.

Month	Sunspots Number
Jan	126.0
Feb	123.0
Mar	103.7
April	137.0
May	172.1
Jun	164.1
Jul	196.8
Aug	216.0
Sep	141.1
Oct	165.8
Nov	154.1
Dec	154.6

The dataset of significance percentage has been collected by Advance Space-based Solar Observatory that is considered one of important observatories for measuring the solar bursts (solar flares and coronal mass ejection) (http://aso-s.pmo.ac.cn/english/data/datapolicy.jsp). The observed values of significance parameter are derived from analysis of solar image disc and Lyman- alpha solar flare. The significance percentage data has been achieved for all days of year 2024. Figure (1) shows analytical investigation of observed significance ratio that is calculated during peak of solar activity.

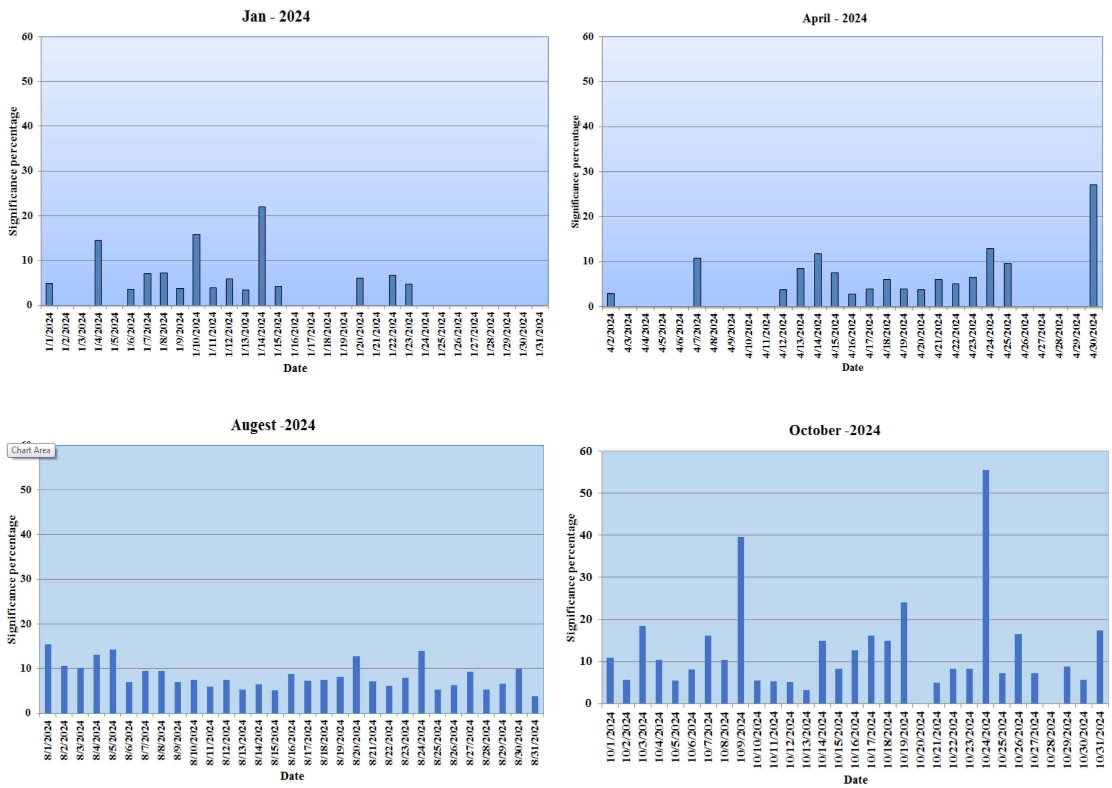
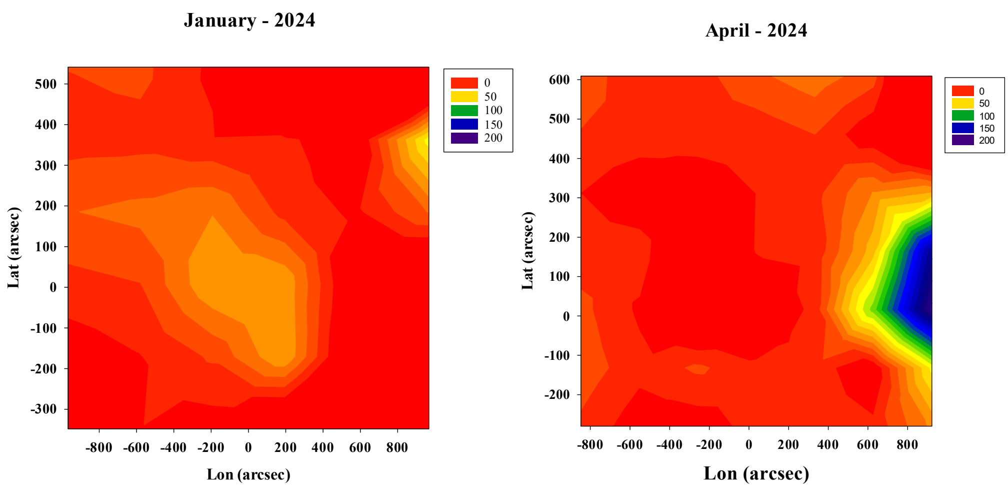


Fig. 1. the behavior of significance percentage of solar flares for year 2024.

Also, the distbusion of signeficance persentage of solar flaers has been studied for different geographical location during peak of solar cycle 25. Figure (2) illusrtate the contour plot samples of signeficance persent of solar flares varation for all days of each month of year 2024.



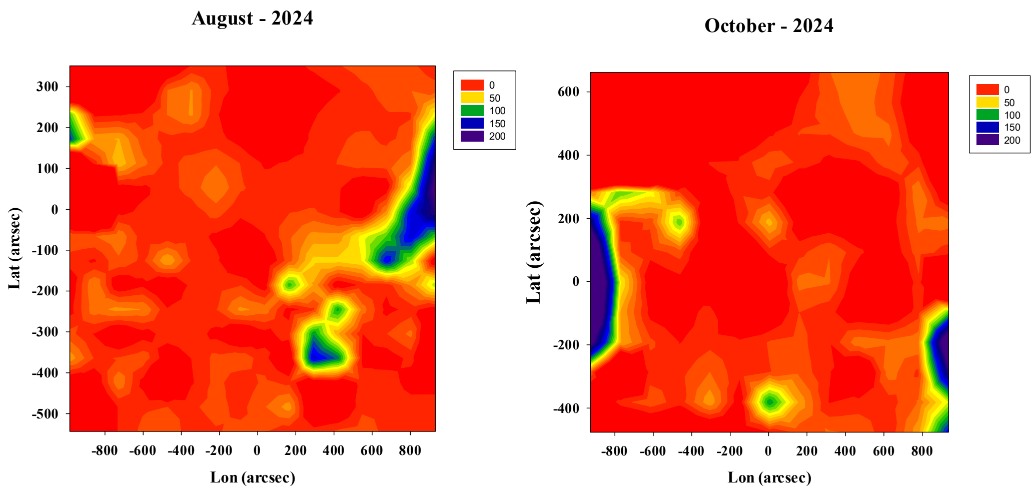


Fig. 2. the significance percentage of solar flares during peck of solar cycle 24.

4. **Discussion and Conclusion**

According to analytical studying of significance ratio of solar flares that have investigated for maximum year of solar activity, the variation of significance percentage of solar flare that is showing in figure (1) during August and October of year 2024 is higher variance than others months (Jan and April) that may be due to the sunspot numbers. In the figure (2), the analytical investigation of significance percentage for solar flares is more focused in the equatorial region of solar surface during August and October of peak solar cycle 25 as comparing with Jan and April months that is resulted from the solar magnetic variation.

From above discussion of the behaviour of significance percentage of solar flares during peak of solar cycle 25, the following points can be concluding:

1. The variation of significance percentage of solar flares is restricted by solar spots that are formed during solar cycle for 11- years.
2. The distribution of solar magnetic activity is playing an important parameter for significance percentage of solar flares.

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