UNIVERSITI TEKNOLOGI MARA

THE SOLAR FLARES FORMATION ANALYSIS BASED ON ACTIVE REGIONS 12192, 11989, 12149, 11967, 12443, 11944, 12017, AND 12565 BY MULTI-WAVELENGTH OBSERVATION

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

The solar flare releases rapid energy by heating and accelerating energetic particles in the solar atmosphere that travel to interplanetary space. Radiation released by solar flares, particularly in waves of electromagnetic radiation ranging from radio waves to gamma rays, releases its energy. The huge solar activities could pose a danger to the power grids on Earth, satellites orbiting the Earth, and aircrews on high altitude spacecraft as examples. By using multi-wavelength observations, this study aims to study solar flares formation based on active regions 12192, 11989, 12149, 11967, 12443, 11944, 12017, and 12565. The first objective is to analyse the active region parameters of sunspot latitude, sunspot sizes, magnetic classification, spot classification and flare duration from 2014 until 2019 in in the solar minimum phase of Solar Cycle 24. The second objective is to study the relationship between active regions and solar flares occurrence through multi-wavelength to avoid any unsatisfactory data at one single band on the analysed results. A methodology that involves the use of statistical techniques, the study of the relationship between active region and solar flares in the multi-wavelength regions, and descriptions of active regions were applied to achieve the goal of studying solar flares. The data were analysed using descriptive analysis to see the patterns for each parameter over six (6) years. In the following analysis, the selected significant data involving the nomination of the active region related to significant solar flares occurrences. The relationship between the active region and solar flares as seen with multi-wavelength methods have been selected since this is the most effective way to study the Sun's layer. During 2014-2019, 1806 processed data sets were used. To determine how these parameters and solar flares occurrence relate, five variables were examined: sunspot coordinate (latitude), sunspot size, magnetic classification (Mount Wilson), spot classification (McIntosh), and flare duration. As a result, the C class flare had a higher production rate than the M and X class flares. According to the location of the active region, the Southern hemisphere produced more flares during the target data (solar cycle 24). AR12192 is the significant active region that possessed almost all the studied parameters. The AR demonstrated that the solar flare was caused by the delta (δ) configuration, owned the large sunspot size that produced stronger magnetic field strength and was classified as an FKC spot. This long-duration event is dominated by AR12565, which had a flaring period of 5 hours 50 minutes and followed by slow and weak coronal mass ejection (CME). The appearance of light bridge, sigmoidal structure of magnetic field, an unstable magnetic field and magnetic reconnection are the trigger points leading to solar flares formation.

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