UNIVERSITI TEKNOLOGI MARA

MORPHOLOGICAL STUDY OF ACTIVE REGION CAUSING CORONAL MASS EJECTION RELATED GEOMAGNETIC STORM AND ITS EFFECTS TO THE GEOMAGNETIC INDUCED CURRENT (GIC)

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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

Geomagnetic storm has been one of greatest events in space weather studies. Apart from the formation of aurora, geomagnetic induced current (GIC) is also induced during the storm when the storm intensity gets severe. The most common source that triggers this phenomenon is coronal mass ejection (CME) and it has been widely proven in past studies. CME is a massive eruption created by the Sun and occurs at active regions (AR) where intense magnetic field is built up. This region is called as AR due to solar activities (flares and CME) taking place at this area. Comprehensive studies on the structure and properties of AR are needed and very important in understanding the formation of CME variation in terms of their speed, angular width and the effects on storms that are triggered afterwards. Thus, this research is aimed to analyze the morphology of AR that initiate geomagnetic storm which include AR parameters (magnetic classification, McIntosh classification of sunspot groups and size of sunspot) and geomagnetic storm properties (Kp- index and CME speed) and to study the relationship between the intensity of geomagnetic storm and geomagnetic induced current (GIC). It focuses on 37 geomagnetic storm events that occurred in 2017. The raw data of AR and geomagnetic storm parameters were obtained from verified databases – Space Weather Live, National Aeronautics and Space Agency (NASA) and National Oceanic and Atmospheric Administration (NOAA). The data was then analyzed by using Principal Component Analysis (PCA) method in studying the morphology of AR, while study on the relationship between storm intensity and GIC was conducted qualitatively by using descriptive approach. The research found that size of sunspot is the most potential AR parameter that determines the formation of fast-moving CME that has caused multiple geomagnetic storms in 2017. Another result from this research deduced that GIC activity is directly proportional to storm intensity, whereby, GIC became more fluctuating as storm was getting more intense. This is believed due to the ionospheric disturbances that modified the magnitudes of magnetic field and thus, electric field was induced on the ground and underneath of it.

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TABLE OF CONTENTS