UNIVERSITI TEKNOLOGI MARA

SOLAR QUIET (*SQ*) CURRENT PROFILES OF THE NORTHERN HEMISPHERE OF ASIA REGION DURING SOLAR CYCLE 24 USING SPHERICAL HARMONIC ANALYSIS

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ABSTRACT

A geomagnetic field recorded in the ground-based magnetometer is a summation of various signal sources. The geomagnetic variation field comprises contributions from external currents in the Earth's ionosphere and magnetosphere and internal currents. Internal currents originate from Earth's dynamo core, rock magnetization field in the crust, and induced currents generated by the external field. There has been a lack of research in monitoring the *Sq* focus vortex of external and internal currents involving the ocean impact, which also relies on regional conductivity due to inadequate information on interior sources. The main objective of this study is to establish the current profile of the external and internal *Sq* current in different phases of solar cycle 24 (SC24) in the Northern Asian Region. The separation current of external and internal fields was determined using spherical harmonic analysis (*SHA*). The analysis was divided into three different regions containing data from a combination of inland stations and oceanic/island stations, mostly inland stations, and merely oceanic/island stations. This is specifically to investigate the induced effect on internal current purposely. The behavior of this current was characterized by monthly, seasonally, and yearly variations. The results revealed that the monthly variation of external and internal current vortex systems is maximum during the pre-noon time near foci current. It was found that external and internal field components contribute to *Sq* current system structures. In the quiet year of 2009, the highest peak current and well-formed current vortex mostly occurred during the summer solstice in all selected regions. However, during peak (2014) and descending (2016) years, the maximum amplitude changes and varies into spring equinox seasons depending on the regional conditions. The strongest current intensity for external and internal fields was detected during the peak year of SC24. The secular variation of external current results exhibited maximum amplitude at mostly inland stations during peak and descending years. Conversely, with internal current results, the highest current intensity was demonstrated at stations with majorly oceanic and island stations during the peak year of SC24. The results could be attributed to the ionospheric conductivity and the electric field at the external field, and the conductive body on the Earth surface that can induce internal currents. This study contributes to geomagnetic field research by providing a quiet baseline for space weather monitoring and influential information parameters from both separate fields.

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