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# Modulation of Terrestrial Lightning Rates by Solar Sector Crossings: Evidence of 14 Day Periodicity of Lightning Rates in the Continental United States

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A small number of studies, principally conducted using lightning data from the UK, have suggested that a connection exists between solar wind magnetic structure and terrestrial weather phenomena. Following these earlier studies, we investigate the hypothesis that there may be a connection between lightning rates and changes in polarity of the heliospheric magnetic field (HMF) by using data from larger and different geographic regions on the Earth. In this study, we use World Wide Lightning Location Network (WWLLN) data spanning the years from 2010-2021. Using Lomb-Scargle periodograms, we demonstrate evidence of a statistically significant 14-day periodicity in lightning activity across the continental United States. A strong 14 day periodicity is also evident in the y component of the HMF. This indicates that there could be a connection between the lightning rates and HMF polarity, and in particular associated with heliospheric current sheet crossings. To further study this phenomenon, we applied a superposed epoch analysis (SEA) to daily averaged rates of lightning. The zero epochs were defined by solar wind sector crossings, defined by state changes in the polarity of the y component of the HMF, such traversals lasting several days. Initial results from this analysis point to the modulation of lightning rates by polarity changes of the HMF, this being validated by the lightning data for the continental United States. Currently, we are analysing other geographic locations including Europe to test if this modulation of lightning rates and periodicity hold in other geographic regions, and how this might be further affected by changes to the number and coherency of heliospheric current sheet crossings at different times and/or phases of the solar cycle.

## Keyword-1

Solar Sector Crossings

## Keyword-2

Lightning

## Keyword-3

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