# DOES TLE FREQUENCY VARY ON THE 11-YEAR SOLAR CYCLE?

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The annual and semiannual areal variations of the world lightning activity deduced from the variations of the diurnal frequency range of Schumann resonances observed at Nagycenk, Hungary exhibit clear 11-year solar cycle modulation. The magnitude of the modulation is about 20 %. The annual areal variation increases with increasing solar activity while the semiannual areal variation shows an opposite behavior on the same time scale, its modulation follows rather the variation of galactic cosmic rays (CR) on the 11-year solar cycle. The opposite modulation of the annual and semi-annual areal variations on the solar cycle can be explained by the north-south asymmetry of the land-covered areas between the two hemispheres. The thunderstorm areas extended up to the 60-65ºN latitude in the Northern Hemisphere summer and practically there is no lightning below 40ºS latitudes in the Southern Hemisphere summer. Lightning activity in high-mid northern latitudes seems to be modulated by the variation of solar activity on the 11-year solar cycle. The semi-annual areal variation originates from lower latitudes. It is attributed to the tropical land surface temperature variations and increased thermal instability in the transition seasons (spring, fall). Areal changes of lightning activity in this lower latitudinal range follow the variations of galactic CR on the 11- year solar cycle. It can be expected that the TLE frequency is highly dependent on galactic CR intensity as the dominant portion of global lightning with energetic lightning strokes candidates for producing TLEs occurs in the tropical belts. The galactic cosmic rays interact with the atmosphere in the whole region where thunderstorms and TLEs occur. The physical chain between the CR particles and lightning triggering /thundercloud - electrification is not well understood, yet. Secondary CR relativistic electrons in the atmospheric electric field can create runaway electron avalanches, which can cause lightning discharges. It is also assumed that EAS (External Atmospheric Showers) generated by primary CR with energy $\geq 10^{14}$ eV can be responsible for lightning ignition.

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