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Areal variations of global lightning on the 11-year solar cycle

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Long-term Schumann resonance frequency records at Nagycenk (NCK), Hungary have been used to determine areal variations of global lightning on the 11-year solar cycle.The daily frequency range (DFR) of Schumann resonances (SR) is the band in which the resonance frequency shifts up and down during a day. The DFR is related to the size of the region where the random lightning discharges are distributed. The wider, the region is, the smaller the DFR becomes, and vice versa. The mean size (diameter) of thunderstorm regions can be obtained from the DFR using a calibration curve characteristic of the SR station at Nagycenk (NCK), Hungary. Monthly means of source diameter were determined from May 1993 up to December 2006. The annual and semiannual areal variations known already exhibit clear 11-year solar cycle modulation. The magnitude of the modulation of the annual areal variation increases with increasing solar activity while the semiannual areal variation shows an opposite behaviour on the same time scale, its modulation follows rather the variation of galactic cosmic rays 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 can be influenced by the variation of solar activity. The semiannual areal variation origins from lower latitudes. It is attributed to the tropical land surface temperature variations and increased thermal instability in the transition seasons (spring, fall). Lightning activity of this lower lati-

tudinal range seems to be modulated by the variations of galactic cosmic rays on the 11- year solar cycle. Contradictory or mixed results based on observations by surface lightning detection systems in country-size regions in different latitudes might be resolved by this explanation. Homogeneous data sets of satellite lightning observations are available only for shorter period than the 11-year solar cycle but they show similar interannual trends as disclosed by Schumann resonances.