



Modulation of UK lightning and the atmospheric electric circuit by heliospheric magnetic field polarity

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Observational studies have reported solar magnetic modulation of terrestrial lightning on a range of time scales, from days to decades. The proposed mechanism is two-step: lightning rates vary with galactic cosmic ray (GCR) flux incident on Earth, either via changes in atmospheric conductivity and/or direct triggering of lightning. GCR flux is, in turn, primarily controlled by the heliospheric magnetic field (HMF) intensity. Consequently, global changes in lightning rates are expected. This study instead considers HMF polarity, which doesn't greatly affect total GCR flux. Opposing HMF polarities are, however, associated with a 40 to 60% difference in observed UK lightning and thunder rates. As HMF polarity skews the terrestrial magnetosphere from its nominal position, this perturbs local ionospheric potential at high latitudes and local exposure to energetic charged particles from the magnetosphere. We speculate as to the mechanism(s) by which this may, in turn, redistribute the global location and/or intensity of thunderstorm activity.