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Low Frequency Electromagnetic Background Radiation From Electron Acceleration Above Thunderclouds

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It was recently proposed that the acceleration of electrons during the growth and branching of streamers above thunderclouds initiated by intense lightning discharges could result in detectable low frequency electromagnetic radiation from several tens of kHz up to several hundreds of kHz (Qin et al., GRL, 2012). The intensity of the predicted radiation scales with the streamer density which is particularly large during spectacular sprite occurrences such as jellyfish sprites and/or dancing sprites. Dancing sprites are up to one second long sequences of consecutive sprites or sprite groups which are typically separated by some hundreds of milliseconds and which tend to follow the spatial development of large scale intracloud lightning discharges. A particularly spectacular series of 10 dancing sprite events over a Mediterranean mesoscale convective system was recorded with a low light video camera in south-eastern France during the early morning hours of August 31, 2012. Each dancing sprite event was composed of $\sim$3-4 consecutive sprites or groups of sprites. All of these sprite occurrences were associated with a sudden enhancement $\sim$2 uV/m/Hz{-1/2} of the low frequency electromagnetic background radiation as measured with a radio receiver in south-west England. It is estimated that $\sim$1000 streamers at a height of $\sim$40 km are necessary to epxlain the observed electric field strengths. These sudden enhancements are superimposed on a more continuous low frequency electromagnetic background radiation which accompanies each dancing sprite event. It is speculated that this low frequency 'radio glow' results from filamentary streamers near the cloud top as a result of the large scale electrostatic charging of the thundercloud and that it may be used as an indicator for sprite occurrences in future studies.