

The Electromagnetic Signatures of Transient Luminous Events

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Abstract

NCKU ISUAL team has routinely carried out ground TLE campaigns in Taiwan and performed a global survey of TLEs using the ISUAL payload onboard the FORMOSAT-2 satellite since 2004. The occurrence of TLEs, including sprite, elve, halo, blue jet and gigantic jet, is known to be closely linked to the electrical discharges in thunderclouds. However, the optical and spectral analyses provide little insight into the characteristics of the electric discharge processes that induce the TLEs. The lightning discharges are known to radiate the bulk of electromagnetic energy at the bands of the ultra low frequency (ULF) and the very low frequency (VLF) bands. An ULF magnetic field and an ELF/VLF magnetic/electric fields recording systems currently are operating at low electromagnetic noise sites in Taiwan. With both systems, we have the capability to monitor the sferics emitted by the electric discharges that produced the observed TLEs and to infer their electromagnetic signatures. The important scientific results obtained from the radio observation in Taiwan, including the TLE activities in a typhoon and sferics associated with blue jets as well as electromagnetic signatures of the TLE-associated discharges, are highlighted in this talk. With a recently installed low frequency (LF) magnetic field recording system, a new algorithm based on Hilbert-Huang transform is developed to analyze the electromagnetic features in this band. The preliminary results on the LF measurements will also be presented.