

## Recent Observations of Western Mediterranean TLE: SAFIR Intracloud Lightning and High-Speed Video Recordings

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During the period July-December of 2008, a low-light camera network registered around 600 TLE (sprites and elves) over the northwestern Mediterranean area. Some of the events occurred over northeastern Spain within the area of detection of a SAFIR lightning detection system. The 2007/2008 upgrade of this interferometric system allows better detection efficiency of sprite-related lightning processes and offers in the best cases reasonably detailed horizontal lightning patterns under the optically determined direction of sprites. Remarkable is that +CG flashes, detected by Morage and LINET systems, are virtually always offset to the side of SAFIR-detected intracloud activity. The detected bursts of intracloud activity occurring between +CG and sprites exhibit speeds of around  $10^7$  m/s, corresponding with that of recoil leaders.

The first high-speed video recordings of sprites and elves have been obtained over the northwestern Mediterranean Sea. Observations were carried out with a Phantom 7.3 monochrome high speed camera attached to an image intensifier. Each frame was time stamped within 1 micro-second resolution provided by a GPS receiver. An additional CCD low light sensitive video camera was attached to the high speed camera in order to have simultaneous images. From three nights of observation during December 2008 and January 2009 a total of 14 sprites and 19 elves were recorded at frame rates from 6688 to 15037 fps. These observations revealed the high amount of elves produced by these storms and also some observations of sprites preceded by elves and haloes. We describe the thunderstorm activity related to the observations and presents the results of the analysis (time delay and currents) of the parent lightning associated to the observed TLEs. We show singularities of our high speed observations of TLEs and a peculiar case in which a sprite tendril appears to bounce back from a previously formed column sprite.

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