

HIGH TIME RESOLUTION ANALYSIS OF THE LIGHTNING-SPRITE RELATIONSHIP

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Through simultaneous measurements of high altitude optical emissions and the magnetic field produced by sprite associated lightning discharge, previous studies have uncovered many aspects of the relationship between these phenomena. However, few data sets have acquired both of these measurements with the millisecond or faster time accuracy and resolution on which many sprite-associated phenomena occur. In this paper, we report results of the coordinated analysis of high and regular speed sprite video and wideband (0.1 Hz to 30 kHz) magnetic field measurements made simultaneously at the Yucca Ridge Field Station and Duke University during the June through August 2005 campaign period. The absolute time accuracy and precision of all instruments has been verified on the order of 10 microseconds, and the intensified high speed video was acquired at rates between 1000 and 10000 frames per second. These data thus enable a close examination with high time resolution of the link between low altitude lightning processes and high altitude sprite processes.

We report results of analysis of the connection between lightning charge transfer and sprite initiation delay and altitude, specifically comparing sprites that initiate rapidly after the lightning return stroke to those that are delayed as long as hundreds of milliseconds. We similarly investigate the relationship of lightning charge transfer characteristics and general sprite morphology and duration. On one observation night (4 July 2005), a large mesoscale convective system produced many sprites that were part of complex TLE sequences that included optical emission elements that appear well after any return stroke and initiate at apparently relatively low altitudes. The connection between these elements and the complex temporal structure of the underlying lightning flash as observed with the magnetic sensors is discussed.

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2. H - Waves in Plasma
3. (a) S-H/G2
4. C - Contributed Paper
5. No special instructions