

Abstract

High Speed Intensified Video Observations of TLEs in Support of PhOCAL

Walter A. Lyons, FMA Research, Inc.

Thomas E. Nelson, FMA Research, Inc.

Steven A. Cummer, Duke University

Timothy Lang, NASA, MSFC

Steven Miller, CIRA, Colorado State University

Nick Beavis, Colorado State University

Jia Yue, Hampton University

Tom A. Warner, ZT Research, Inc.

Tim Samaras, Samaras Technologies

The third observing season of PhOCAL (Physical Origins of Coupling to the upper Atmosphere by Lightning) was conducted over the U.S. High Plains during the late spring and summer of 2013. The goal was to capture using an intensified high-speed camera, a transient luminous event (TLE), especially a sprite, as well as its parent cloud-to-ground (SP+CG) lightning discharge, preferably within the domain of a 3-D lightning mapping array (LMA). The co-capture of sprite and its SP+CG was achieved within useful range of an interferometer operating near Rapid City. Other high-speed sprite video sequences were captured above the West Texas LMA. On several occasions the large mesoscale convective complexes (MCSs) producing the TLE-class lightning were also generating vertically propagating convectively generated gravity waves (CGGWs) at the mesopause which were easily visible using NIR-sensitive color cameras. These were captured concurrent with sprites. These observations were follow-ons to a case on 15 April 2012 in which CGGWs were also imaged by the new Day/Night Band on the Suomi NPP satellite system. The relationship between the CGGW and sprite initiation are being investigated. The past year was notable for a large number of elve+halo+sprite sequences generated by the same parent CG. And on several occasions there appear to be prominent banded modulations of the elves' luminosity imaged at >3000 ips. These stripes appear coincident with the banded CGGW structure, and presumably its density variations. Several elves and a sprite from negative CGs were also noted. New color imaging systems have been tested and found capable of capturing sprites. Two cases of sprites with an aurora as a backdrop were also recorded. High speed imaging was also provided in support of the UPLIGHTS program near Rapid City, SD and the USAFA SPRITES II airborne campaign over the Great Plains.