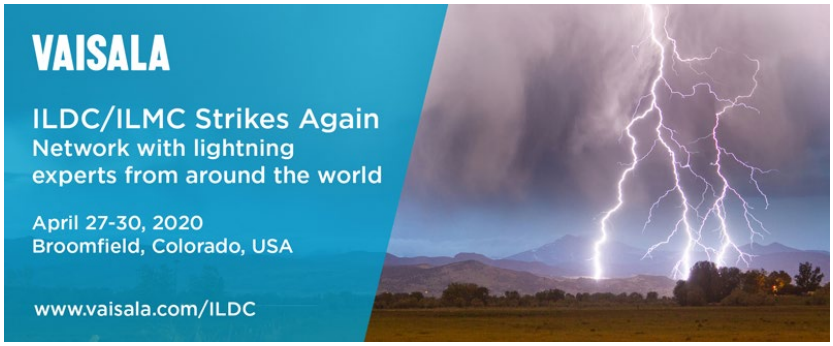

Characteristics of the Parent Lightning of Sprites Observed in and Around Florida

Authors

Mr. Mathieu Plaisir - Florida Institute of Technology

Prof. Amitabh Nag - Florida Institute of Tehcnology

Prof. Ningyu Liu - University of New Hampshire

Mr. Levi Boggs - Florida Institute of Tehcnology

Mr. Jason chiappa - Florida Institute of Tehcnology

Prof. Kenneth L. Cummins - Florida Institute of Technology

Prof. Hamid Rassoul - Florida Institute of Technology

Abstract

Sprites are a class of Transient Luminous Events (TLEs) occurring in the mesosphere that are caused by lightning occurring in the troposphere. Understanding the characteristics of sprite-generating lightning remains an important goal in the field of atmospheric electricity. Between July 2018 and October 2019 we captured 176 sprites using a low-light monochromatic camera, recording at 30 frames per second (fps), located in Melbourne, Florida. Three of these sprites were also recorded using a camera operating at 100 fps. These optical records were GPS time-stamped allowing their correlation with lightning flashes reported by the U. S. National Lightning Detection Network (NLDN). Of the 99 sprites observed in 2018, 93 (94%) were associated with positive return strokes having a median peak current of 77 kA and 6 (6%) were associated with negative return strokes with a median peak current of 102 kA. These strokes occurred at distances ranging from 77-554 km from the camera location. In some sprite-associated flashes, the NLDN reported the occurrences of both positive and negative strokes, indicating that these were perhaps bipolar cloud-to-ground discharges. In 16 of our video-camera records, multiple sprites were captured within the field-of-view of the camera. Four of the sprites in our dataset were also observed using a high-speed video camera operating at 3000-5000 fps. For two sprites, their spectral properties were also recorded at 100 fps using a Volume Phase Holographic Grism (VPHG) and lenses with an effective wavelength band of 550-775 nm. In this study, we will examine in detail the characteristics of the lightning-associated sprites using data from the U. S. NLDN. Additionally, we will examine data from the Geostationary Lightning Mapper (GLM) on-board the GOES-16 satellite to characterize the optical radiance and total cloud-top optical energy associated with the sprite-producing strokes.

Topic Areas

Lightning Interactions with the Upper Atmosphere, Lightning Detection from Space: Performance, Research and Applications

Submission Format

Oral