

Accepted Manuscript

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PII: S1364-6826(17)30089-5

DOI: [10.1016/j.jastp.2018.03.007](https://doi.org/10.1016/j.jastp.2018.03.007)

Reference: ATP 4809

To appear in: *Journal of Atmospheric and Solar-Terrestrial Physics*

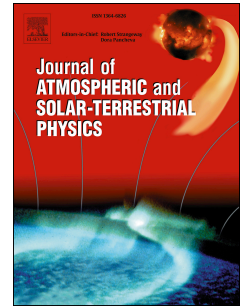
Received Date: 10 February 2017

Revised Date: 11 March 2018

Accepted Date: 12 March 2018

Please cite this article as: Vayanganie, S.P.A., Fernando, M., Sonnadara, U., Cooray, V., Perera, C., Optical observations of electrical activity in cloud discharges, *Journal of Atmospheric and Solar-Terrestrial Physics* (2018), doi: 10.1016/j.jastp.2018.03.007.

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Optical observations of electrical activity in cloud discharges

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1 **Abstract**—Temporal variation of the luminosity of seven natural cloud-to-cloud lightning channels were
2 studied, and results were presented. They were recorded by using a high-speed video camera with the speed of
3 5000 fps (frames per second) and the pixel resolution of 512x512 in three locations in Sri Lanka in the tropics.
4 Luminosity variation of the channel with time was obtained by analyzing the image sequences. Recorded video
5 frames together with the luminosity variation were studied to understand the cloud discharge process. Image
6 analysis techniques also used to understand the characteristics of channels. Cloud flashes show more luminosity
7 variability than ground flashes. Most of the time it starts with a leader which do not have stepping process.
8 Channel width and standard deviation of intensity variation across the channel for each cloud flashes was
9 obtained. Brightness variation across the channel shows a Gaussian distribution. The average time duration of
10 the cloud flashes which start with non stepped leader was 180.83 ms. Identified characteristics are matched with
11 the existing models to understand the process of cloud flashes. The fact that cloud discharges are not confined to
12 a single process have been further confirmed from this study. The observations show that cloud flash is a basic
13 lightning discharge which transfers charge between two charge centers without using one specific mechanism.

14

15 **Keywords-** *Cloud Lightning, High-Speed Photography, Luminosity Variation.*

16 1. Introduction

17 The electrical discharges that take place between the cloud and the ground are called ground lightning
18 flashes. The electrical discharges that occur between clouds or within a cloud are called cloud lightning flashes.
19 Even though most of the lightning flashes taking place in the Earth's atmosphere are cloud flashes, detailed
20 features of their mechanism are still unknown.

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