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► **To cite this version:**

Matthieu Garnung, Sebastien Celestin, Thomas Farges. Estimation of the electric field and the altitude from spectrophotometric observations in limb-viewing geometry. vEGU21, 2021, Online, France. 10.5194/egusphere-egu21-16407 . insu-03559279

HAL Id: insu-03559279

<https://hal-insu.archives-ouvertes.fr/insu-03559279>

Submitted on 7 Feb 2022

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EGU21-16407

<https://doi.org/10.5194/egusphere-egu21-16407>

EGU General Assembly 2021

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Estimation of the electric field and the altitude from spectrophotometric observations in limb-viewing geometry

Matthieu Garnung¹, Sebastien Celestin¹, and Thomas Farges²

¹LPC2E, University of Orleans, CNRS, France

²CEA, DAM, DIF, F-91297, Arpajon, France

Sprites are bright and sudden events occurring above thunderstorms between 40 and 90 km altitude. These phenomena are usually observed using ground-based cameras and from spacecrafts. The Imager of Sprites and Upper Atmospheric Lightning (ISUAL), a payload on the FORMOSAT-2 satellite, recorded several sprite events during its mission. Contrary to JEM-GLIMS (JAXA) or ASIM (ESA), which are space missions dedicated to the observation of TLEs from a nadir-viewing geometry, ISUAL used a limb-viewing geometry. This configuration offers the possibility to directly estimate the altitude of the event from its camera.

The challenge consists in estimating the altitude and the electric field from spectrophotometer measurements. The method of the spectrophotometric ratios consists to use ratios computed from different band systems to estimate the altitude and the electric field. It is the one of the most encouraging to achieve this goal.

In this work, we propose a method to estimate the electric field and the altitude from an observation made by the ISUAL instrument using the following ratios LBH/1PN2, 2PN2/1PN2 and LBH/1NN2+. We show that some spectroscopic ratios are more useful than others and point out some limitations of this approach that will need to be widened to nadir-viewing geometry observations.