

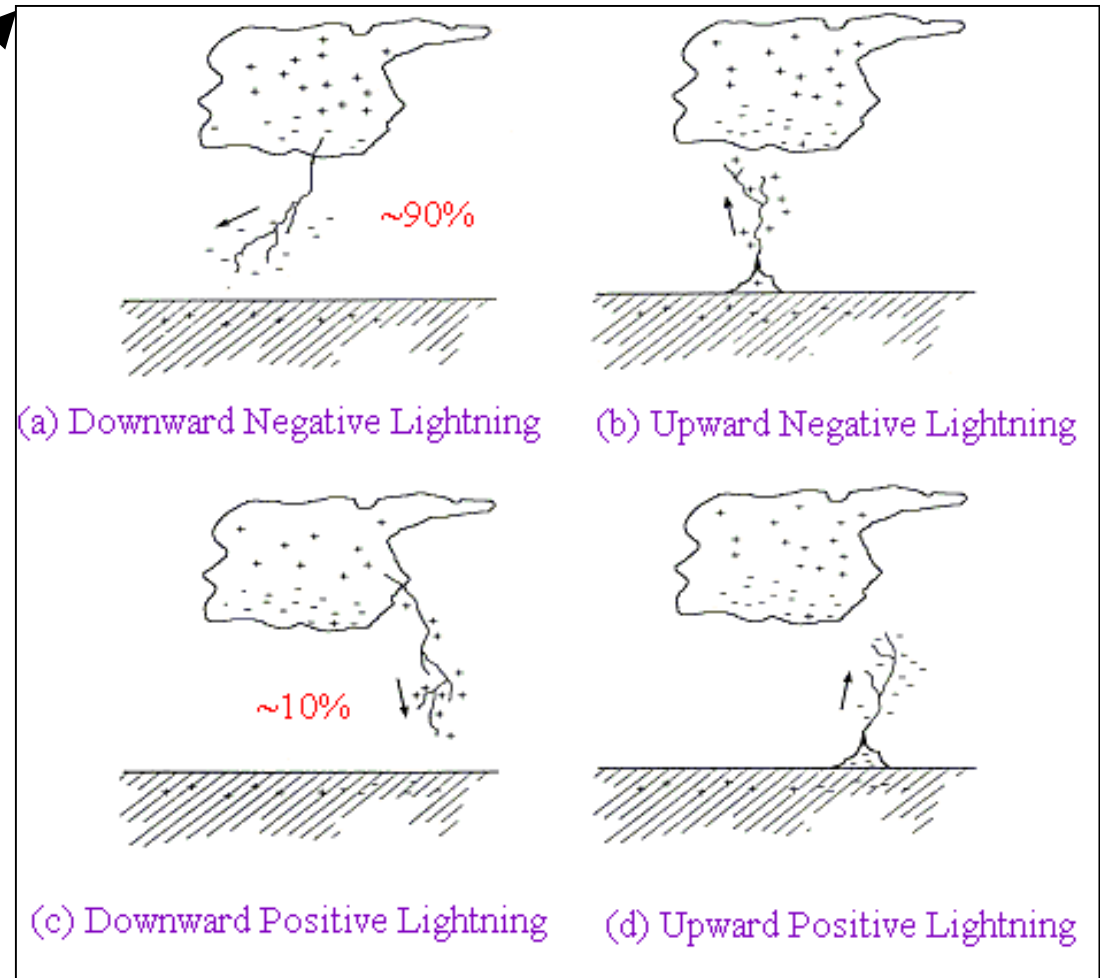
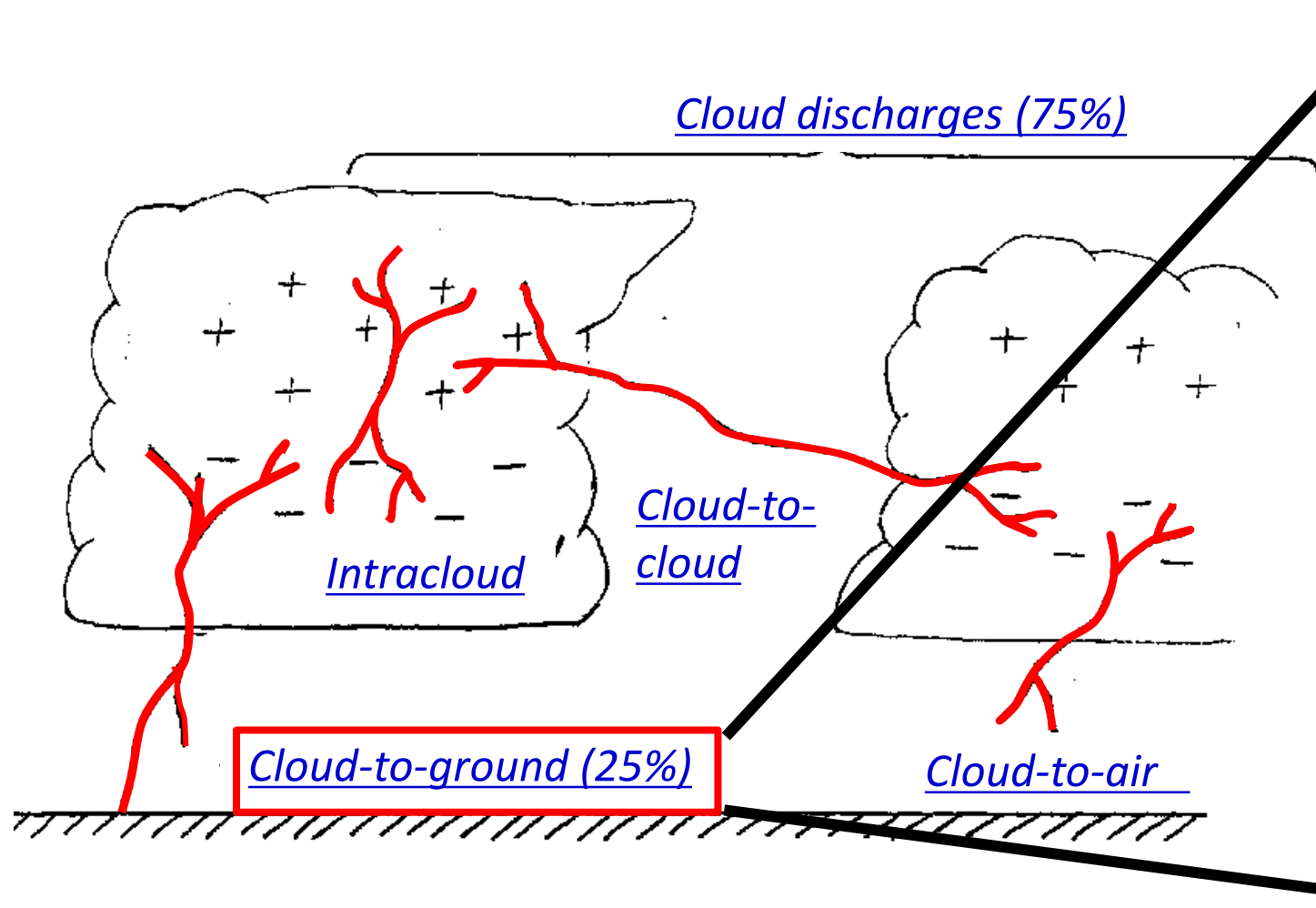
New Mexico Tech Research Colloquium 2024

Simultaneous observations of lightning processes from space and ground

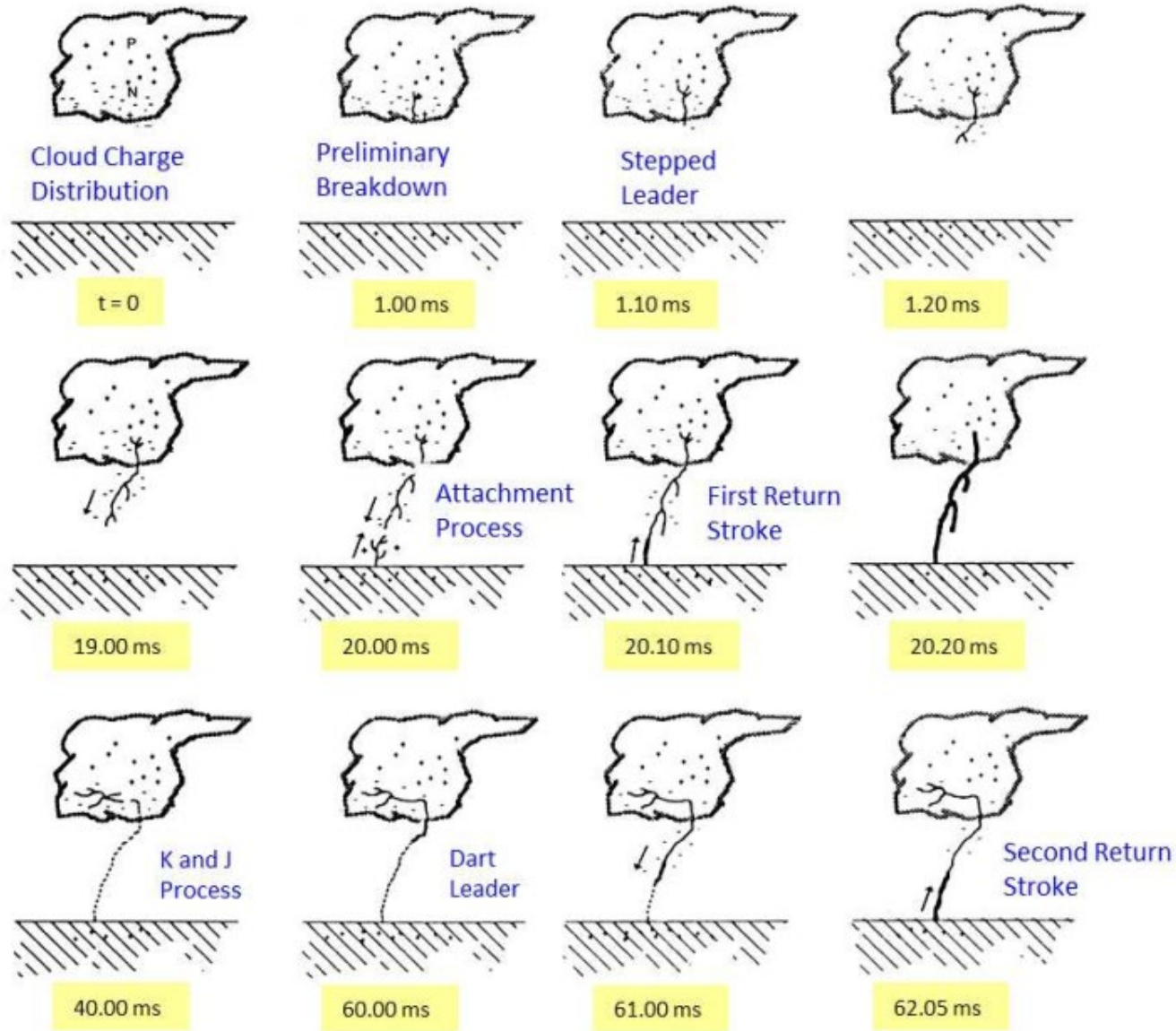
Adonis F.R. Leal

March 1st - 2024

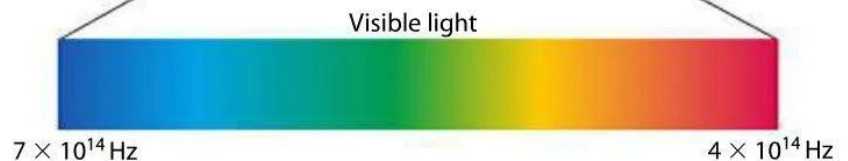
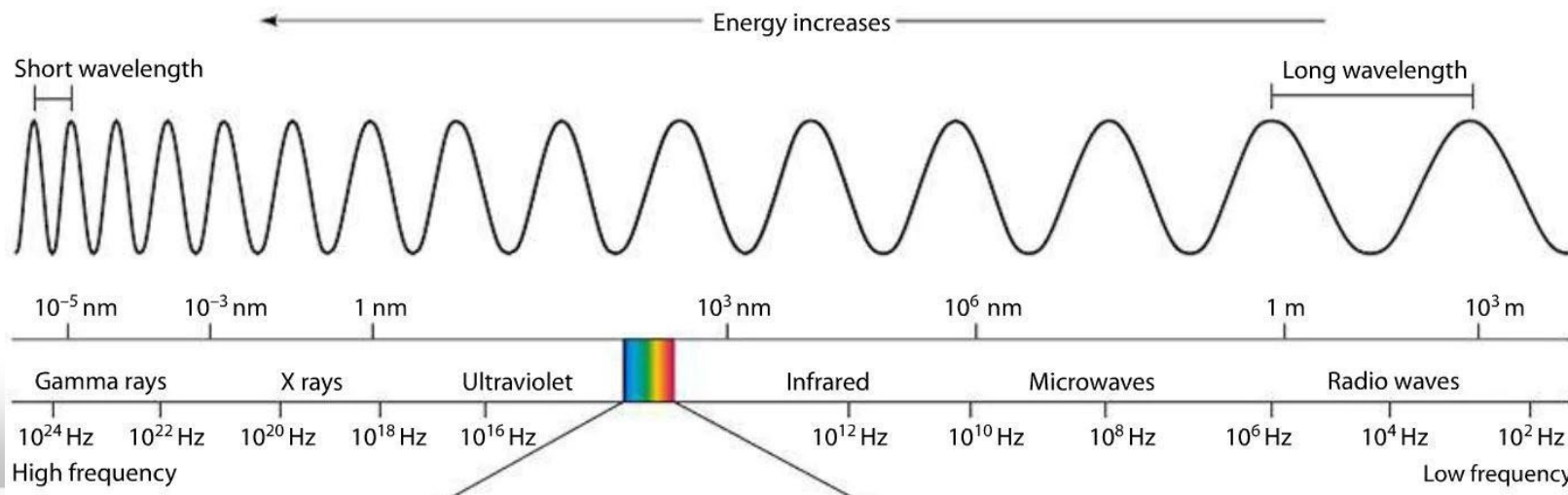
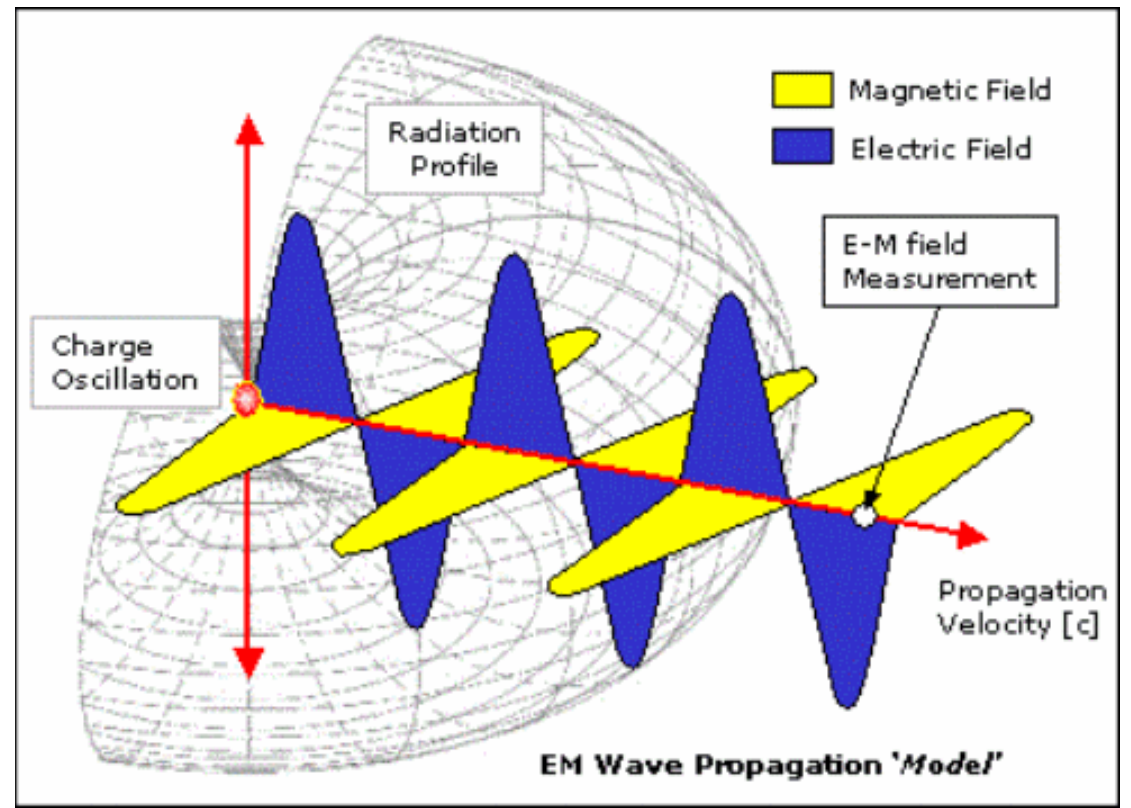
Introduction



Adapted from (RAKOV; UMAN, 2003)

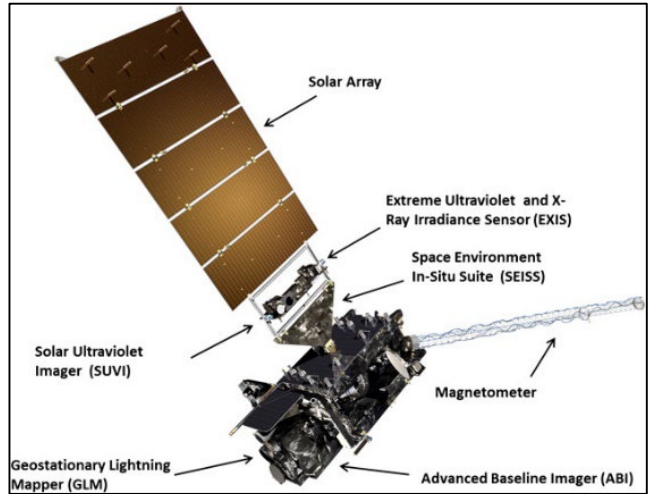


Various processes comprising a negative cloud-to-ground lightning flash.
Adapted from (UMAN, 1987)



Methodology

GLM

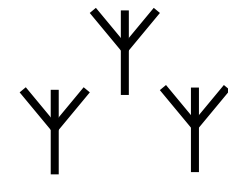


The lightning data recorded at ground level was compared against GLM group data (optical energy in Joules).

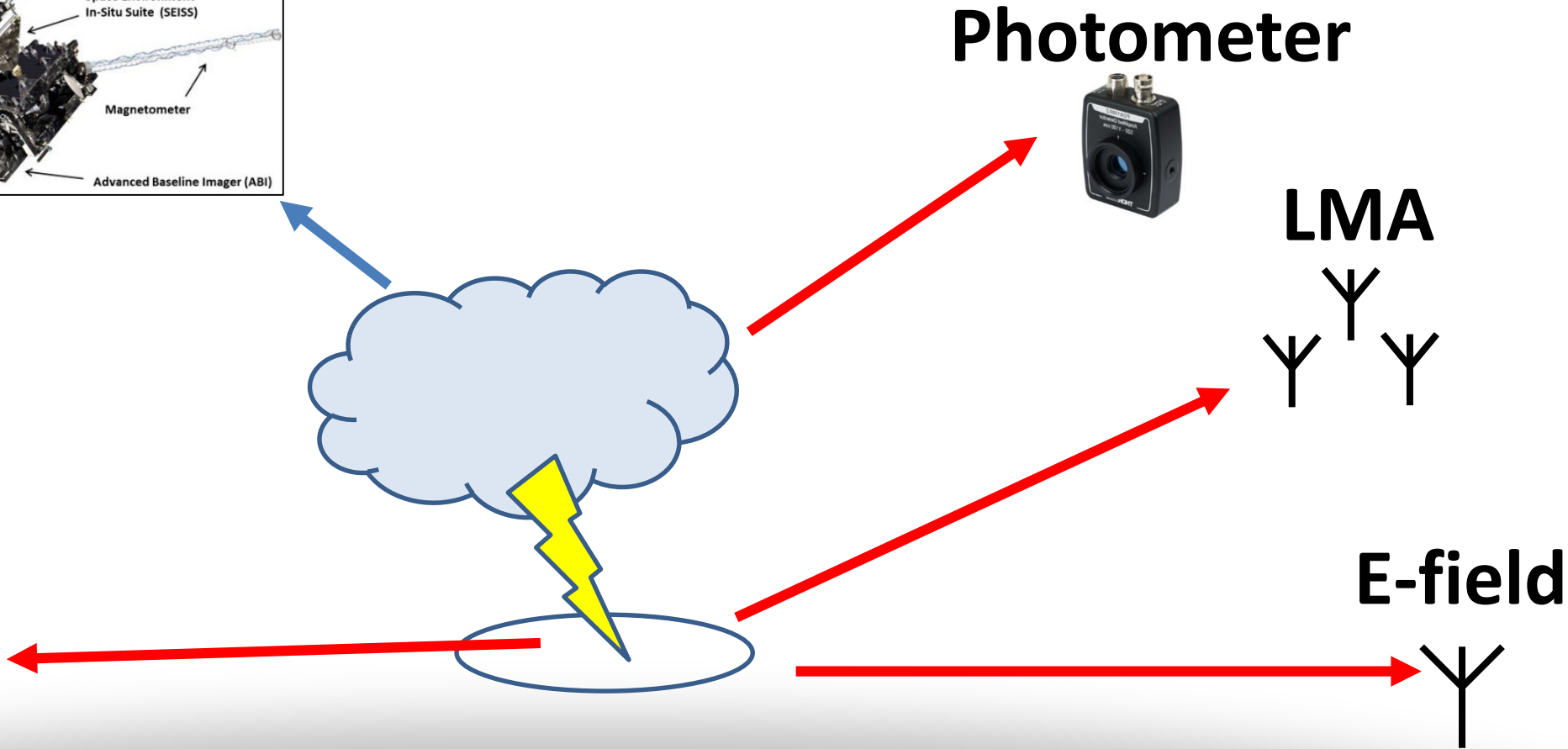
Photometer



LMA



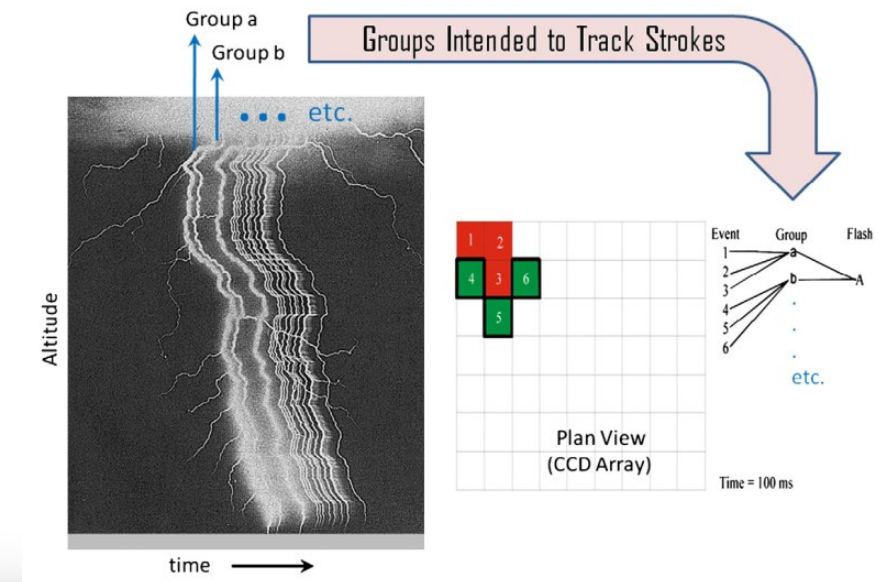
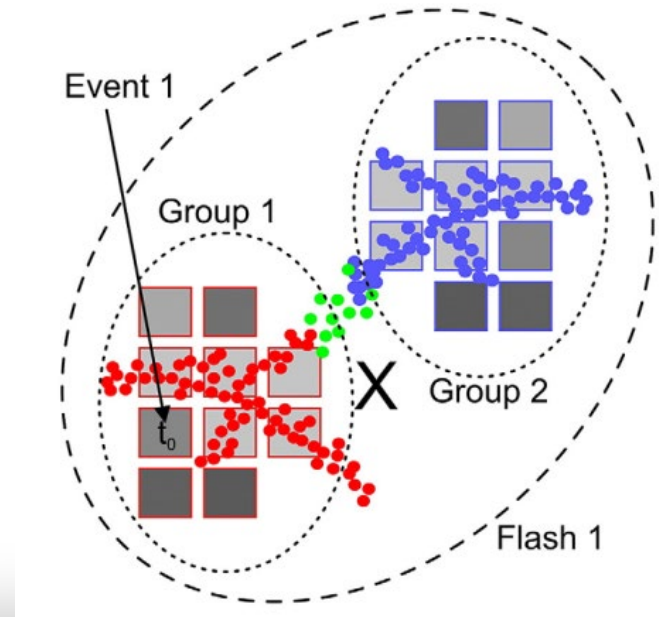
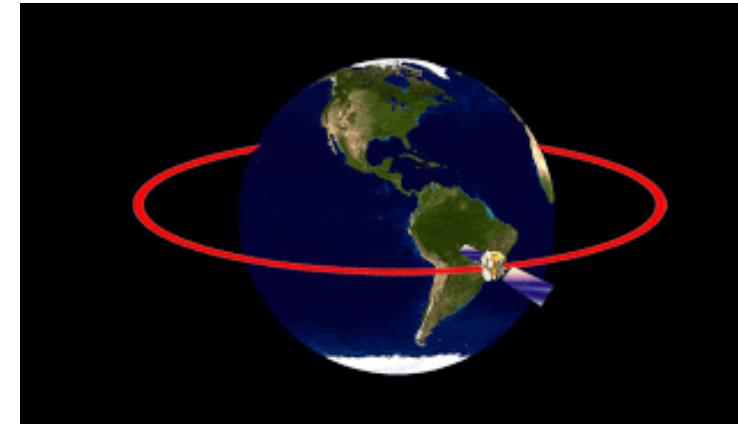
E-field



Geostationary Lightning Mapper (GLM)

Geostationary Lightning Mapper (GLM)

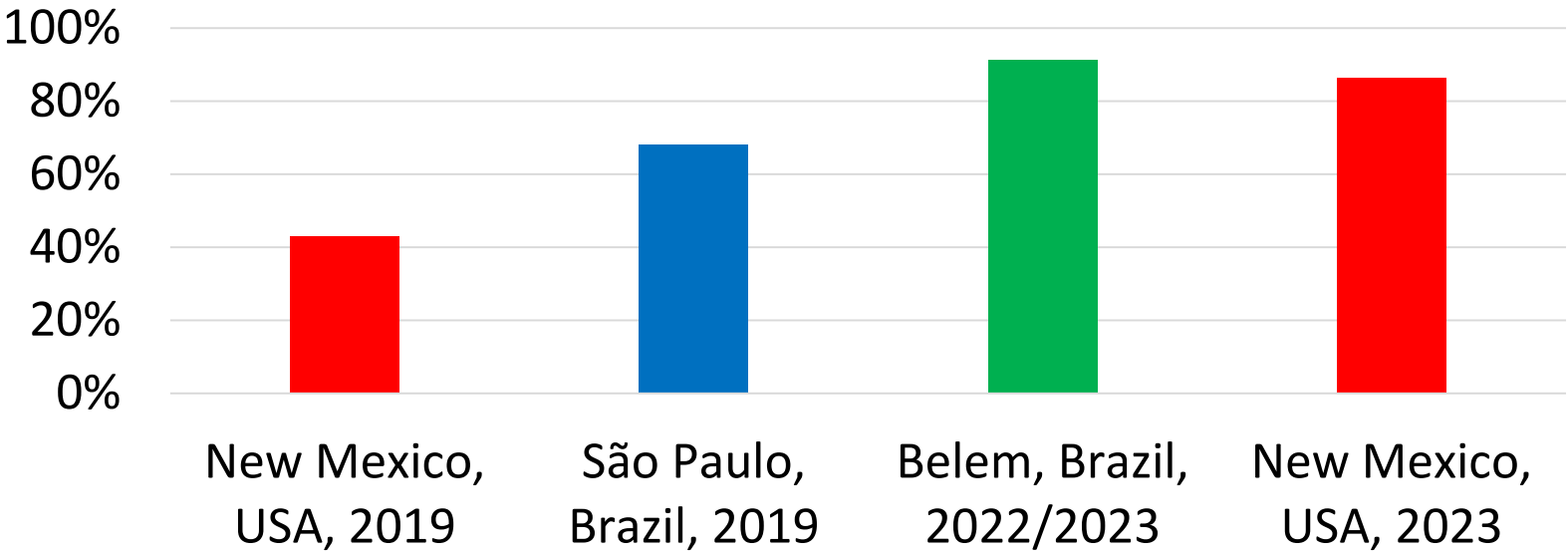
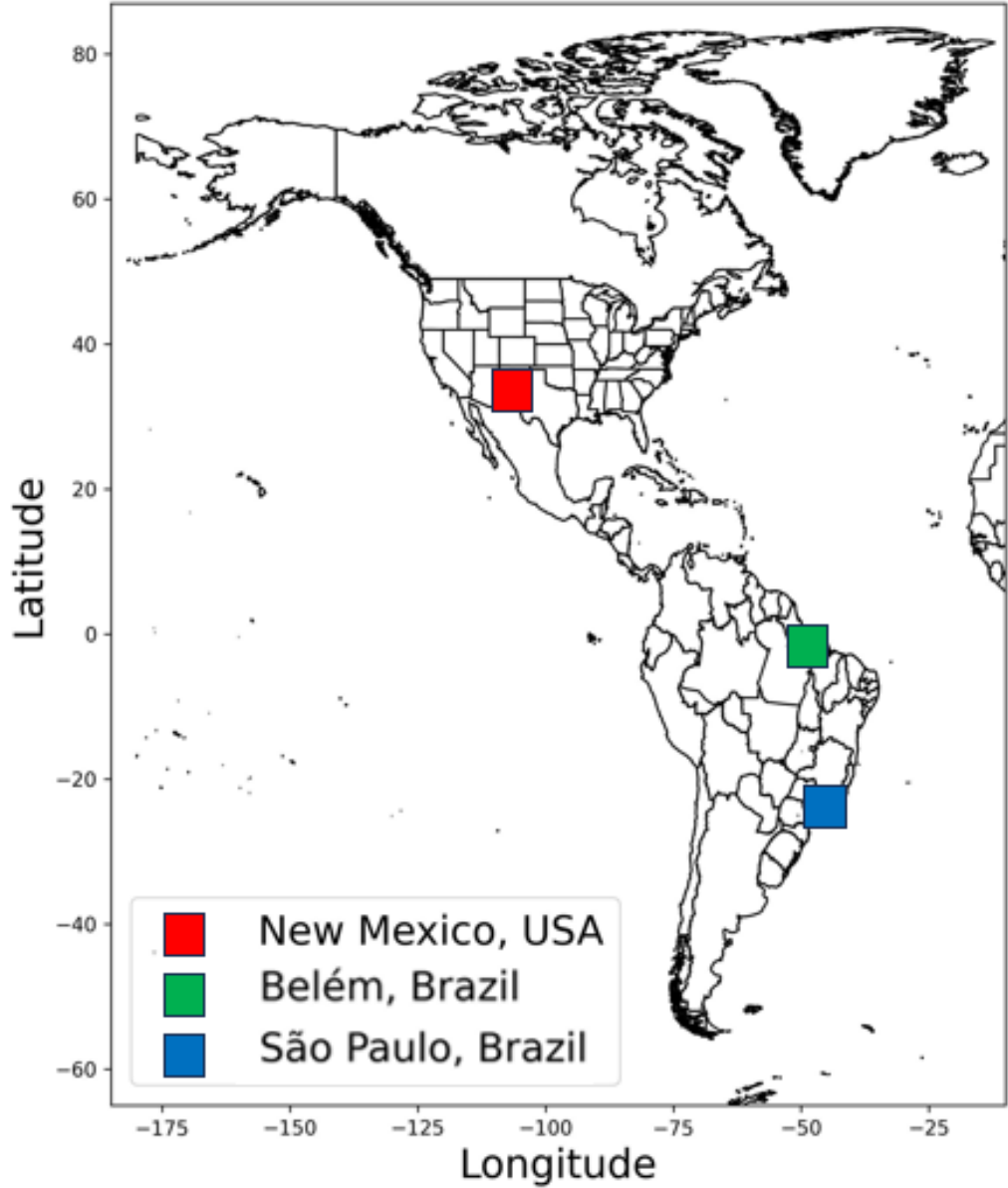
Near uniform spatial resolution 8 km nadir, 14 km edge fov;
70-90% flash detection day and night;
Single band 777.4 nm;
2 ms frame rate;



Results and Discussion

Return stroke GLM detection efficiency

Percentage of return strokes observed by GLM in comparison to ground truth (HSV and/or E-field)



Results and discussion



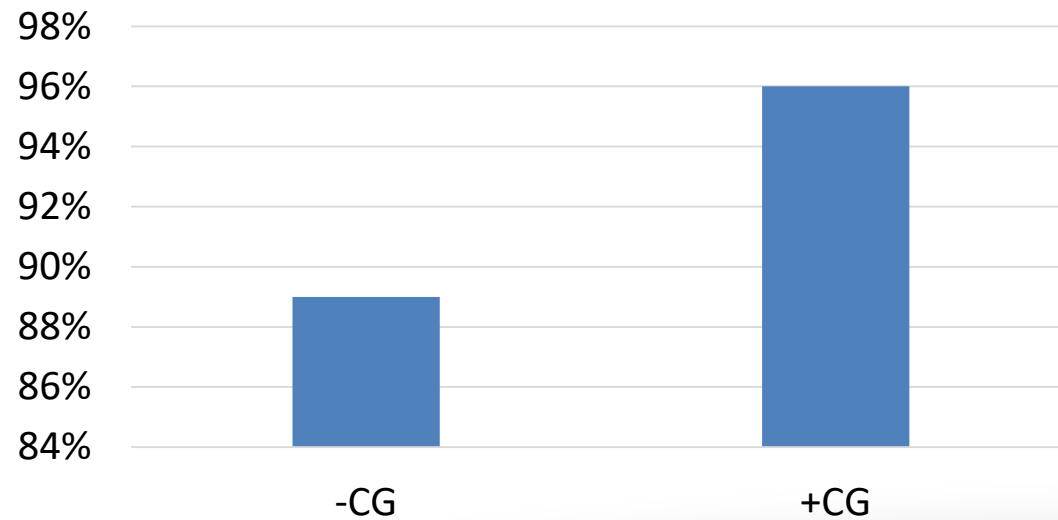
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Electric Power Systems Research

journal homepage: www.elsevier.com/locate/epsr



Detection of return-strokes by the GLM



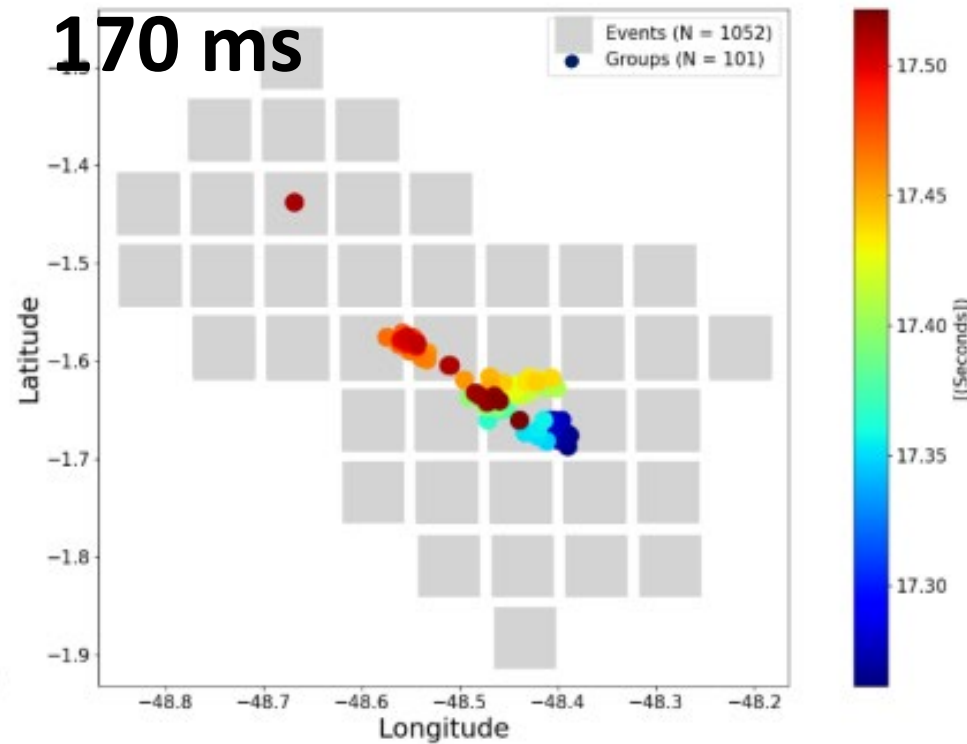
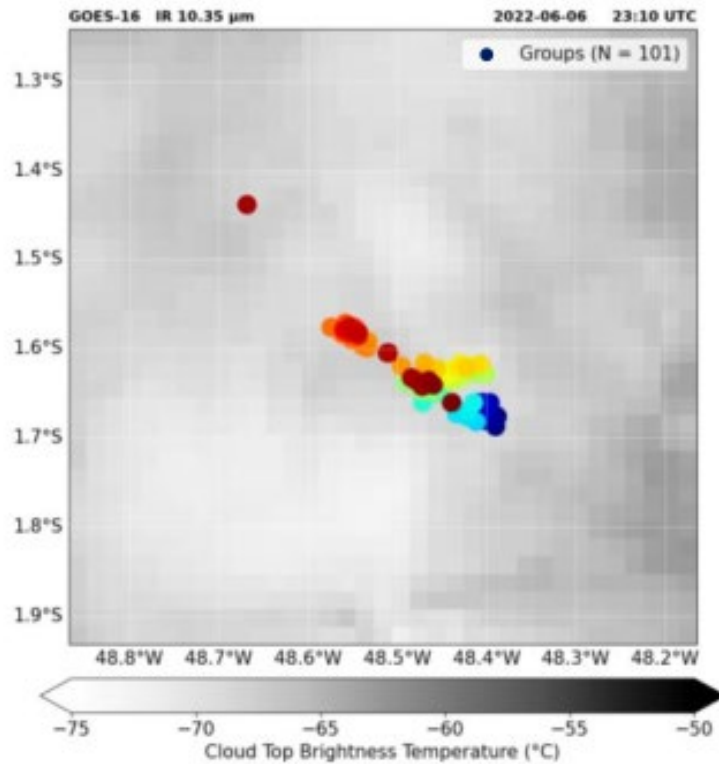
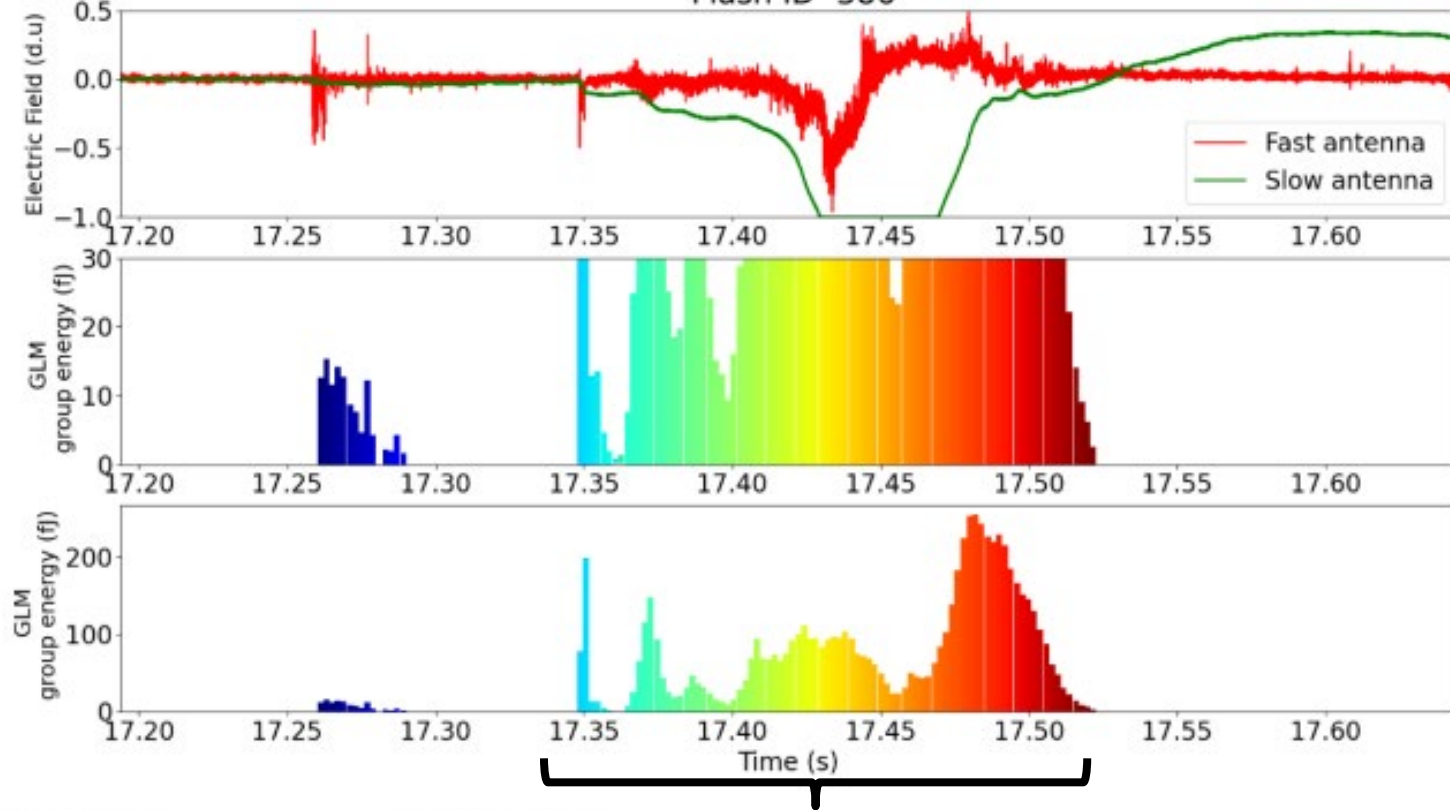
Processes in negative and positive CG lightning flashes detected from space by GLM

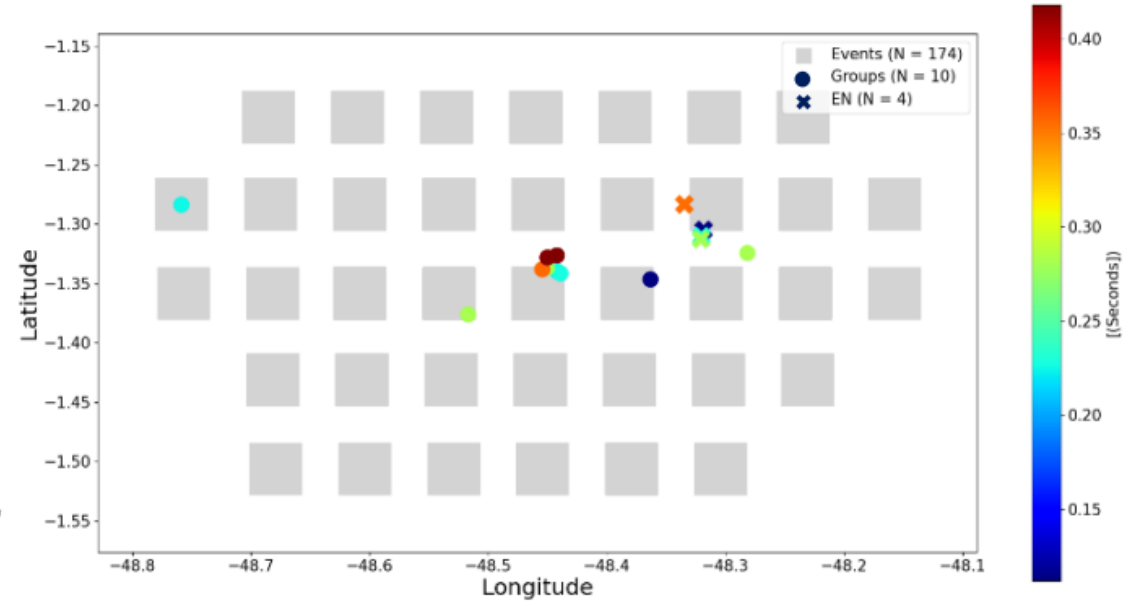
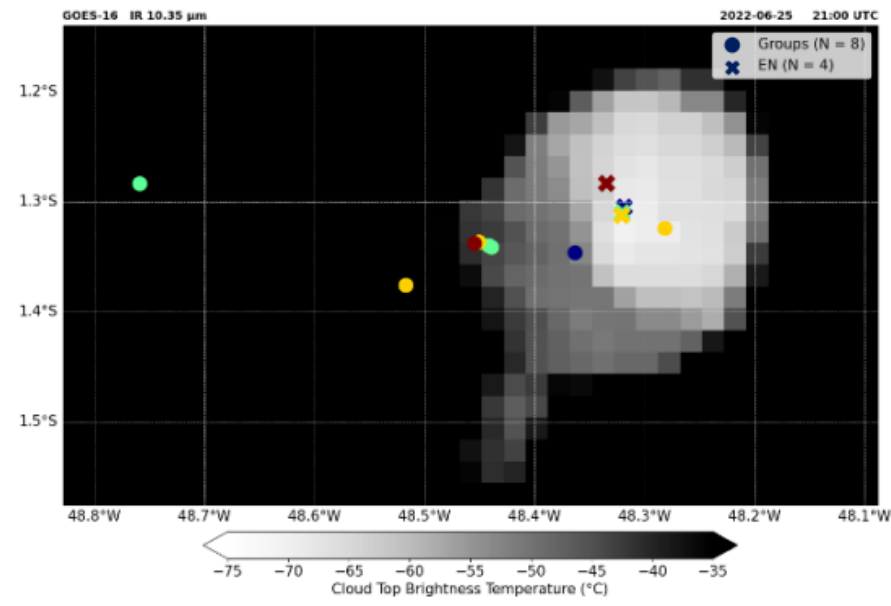
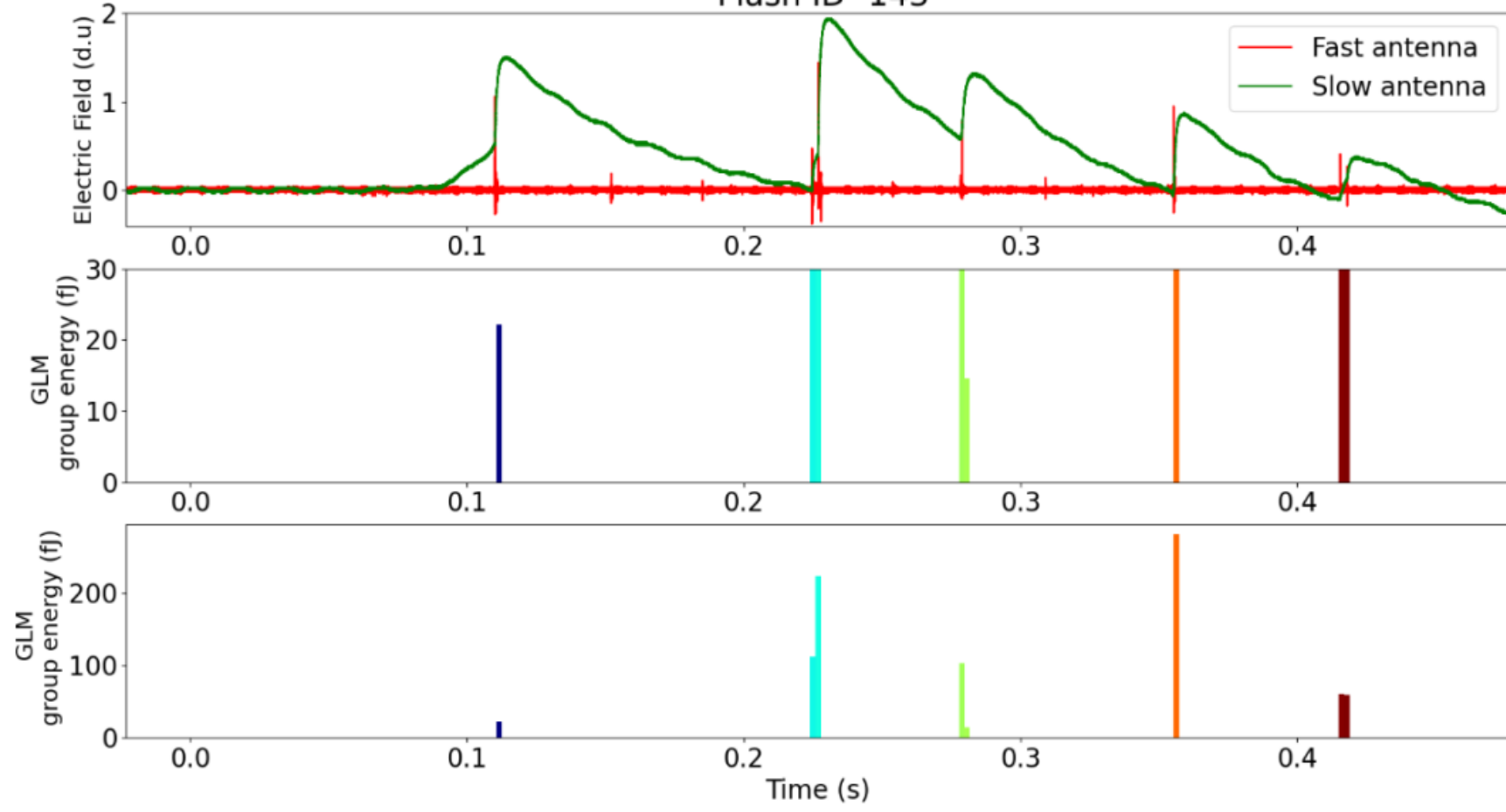
Adonis F.R. Leal^{a,b,*}, Vladimir A. Rakov^c

^a New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro 87801, United States

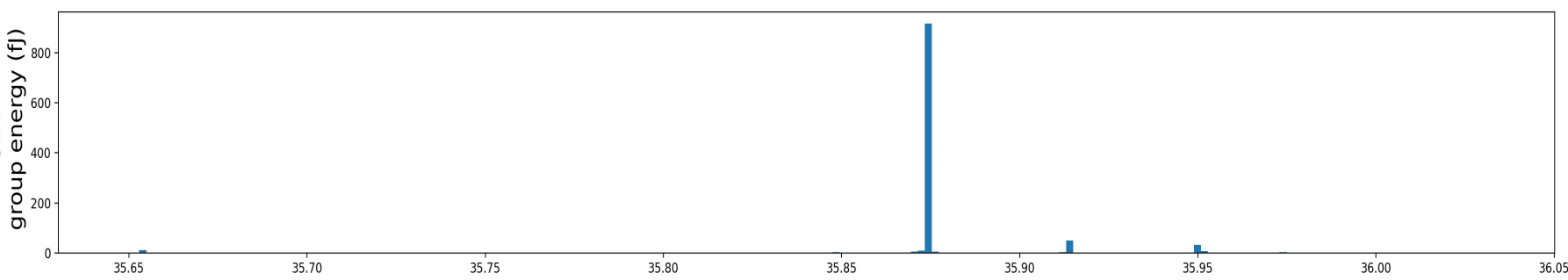
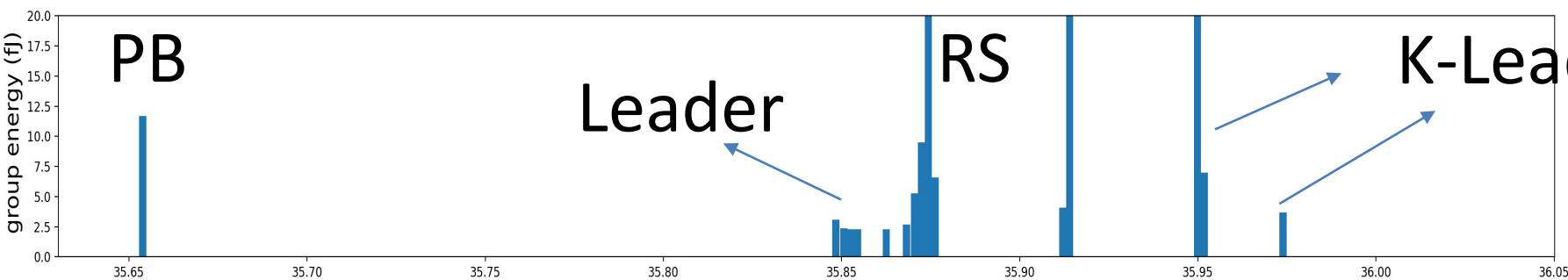
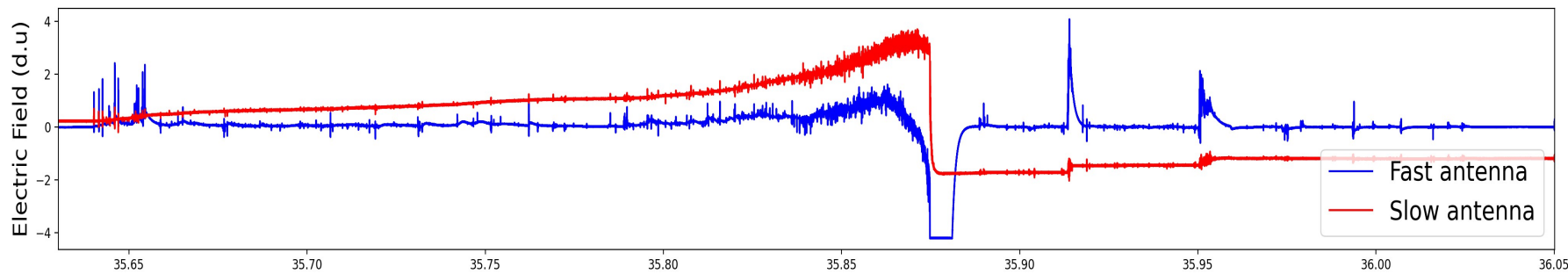
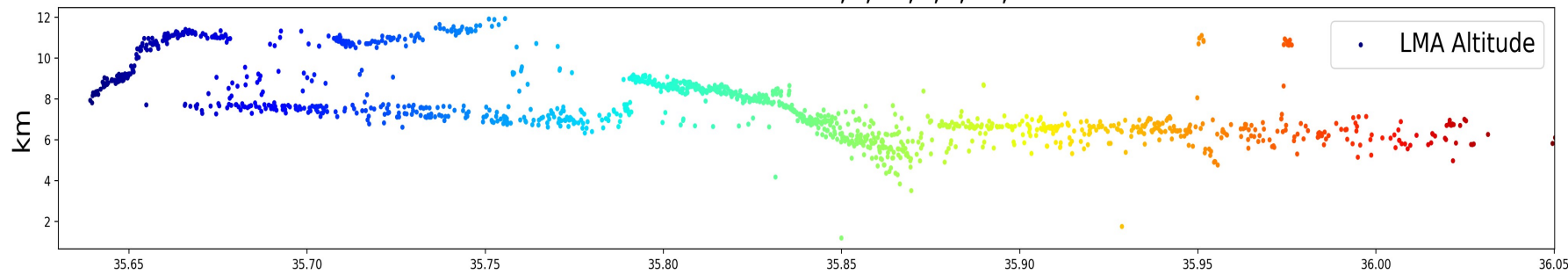
Statistics on the number of GLM groups per return stroke for -CG and +CG flashes.

	Min	Max	Mean	SD
-CG	1	8	1.6	1.2
+CG	1	85	15.8	19





LMA - Efield - GLM 2023,8,22,5,4,35,640160



LMA
E-field
GLM

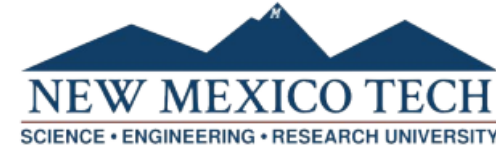
Design of an instrument to perform simultaneous multi-band optical and radio observations of lightning

Jacob Wemhoner¹, A. F. R. Leal¹, J. G. Pantuso¹, C. L. da Silva¹, B. Smith¹, R. G. Sonnenfeld¹, M.G. McHarg², N.Y. Liu³, S. Bandara¹

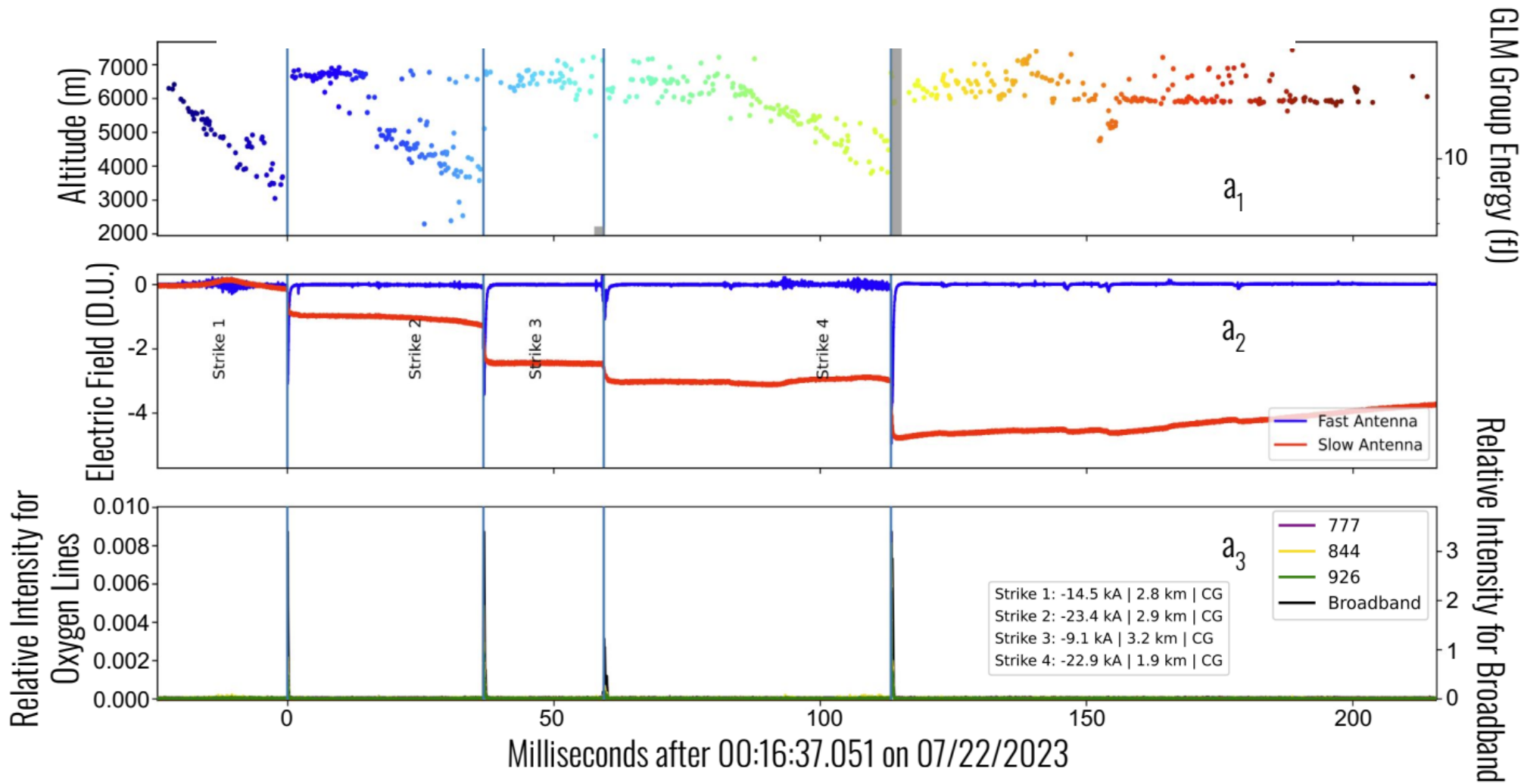
1 – Department of Physics and Langmuir Lab, New Mexico Tech, Socorro, NM

2 – US Air Force Academy, Colorado Springs, CO

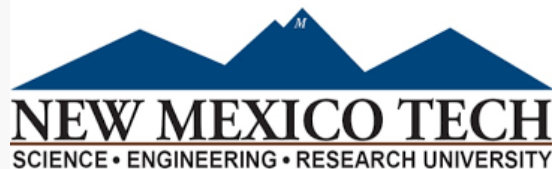
3 – Department of Physics, University of New Hampshire, Durham, NH



Poster #: AE11B-2424



Photometer
E-field
GLM



Design of an instrument to perform simultaneous multi-band optical and radio observations of lightning

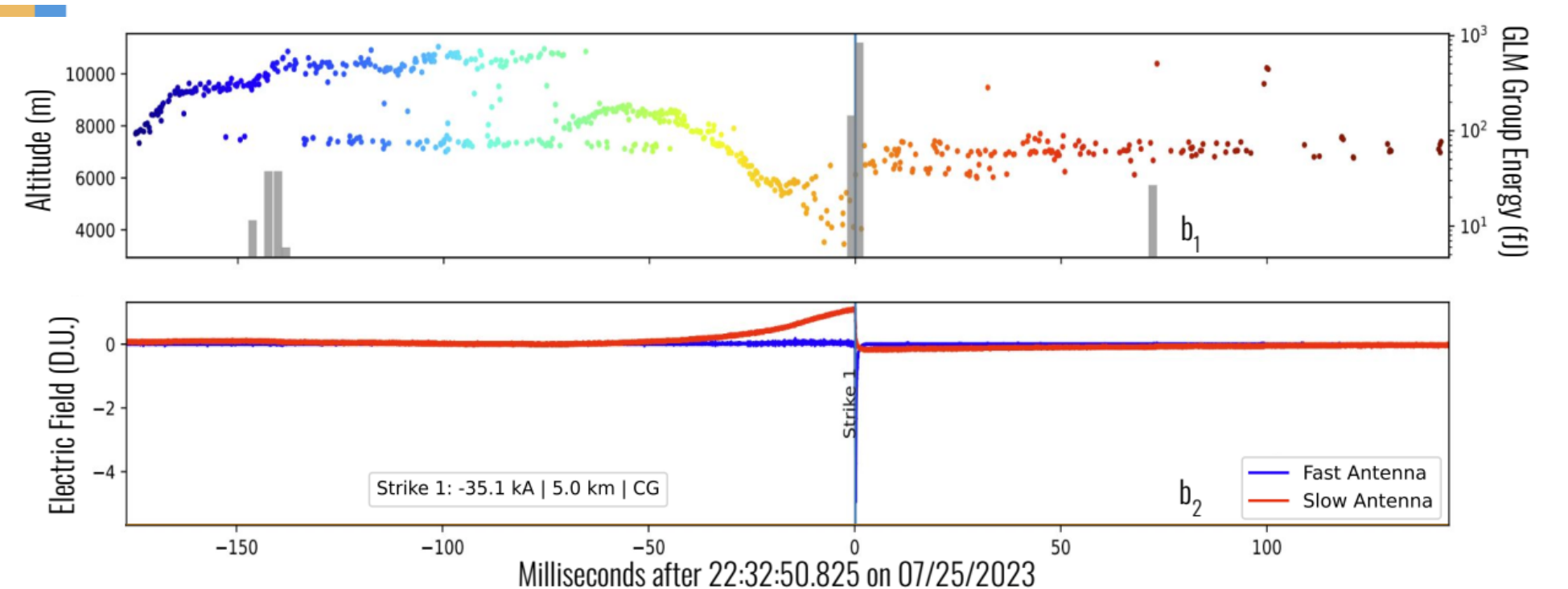
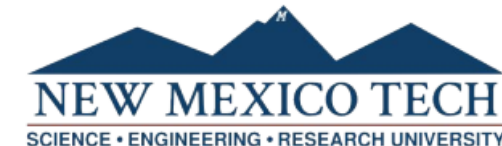
Jacob Wemhoner¹, A. F. R. Leal¹, J. G. Pantuso¹, C. L. da Silva¹, B. Smith¹, R. G. Sonnenfeld¹, M.G. McHarg², N.Y. Liu³, S. Bandara¹

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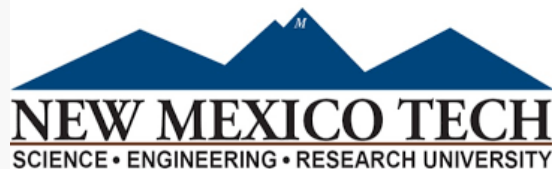
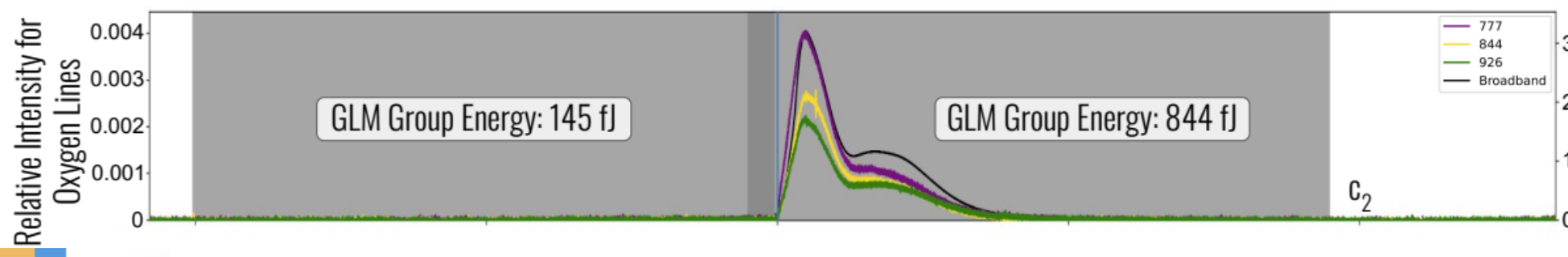
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Poster #:
AE11B-2424



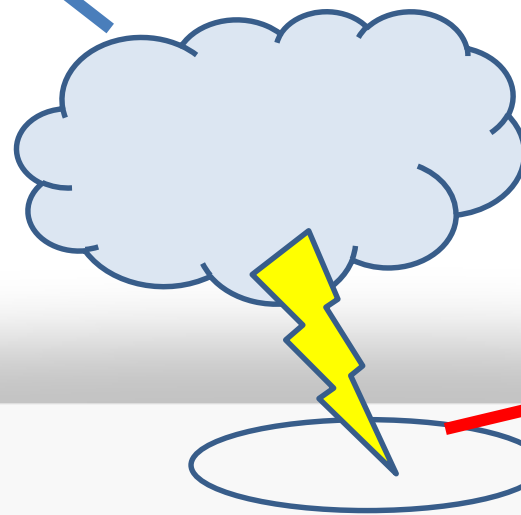
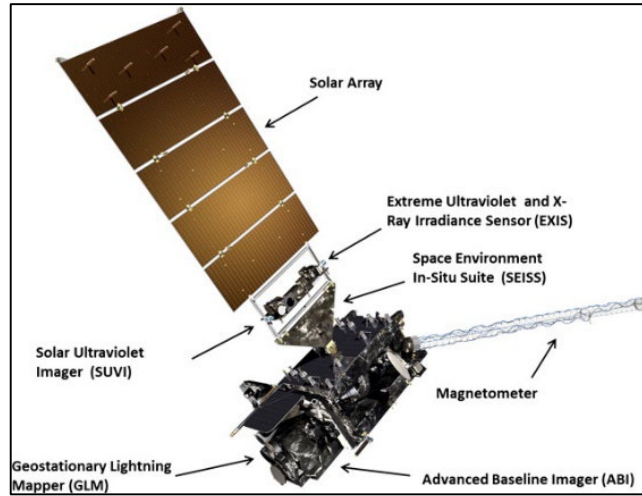
Photometer
E-field
GLM



Future goals

- How the clouds interfere on GLM detection?

GLM



Photometer



Future goals

- How the clouds interfere on GLM detection?
- Is possible to identify different types of lightning from space?



Article

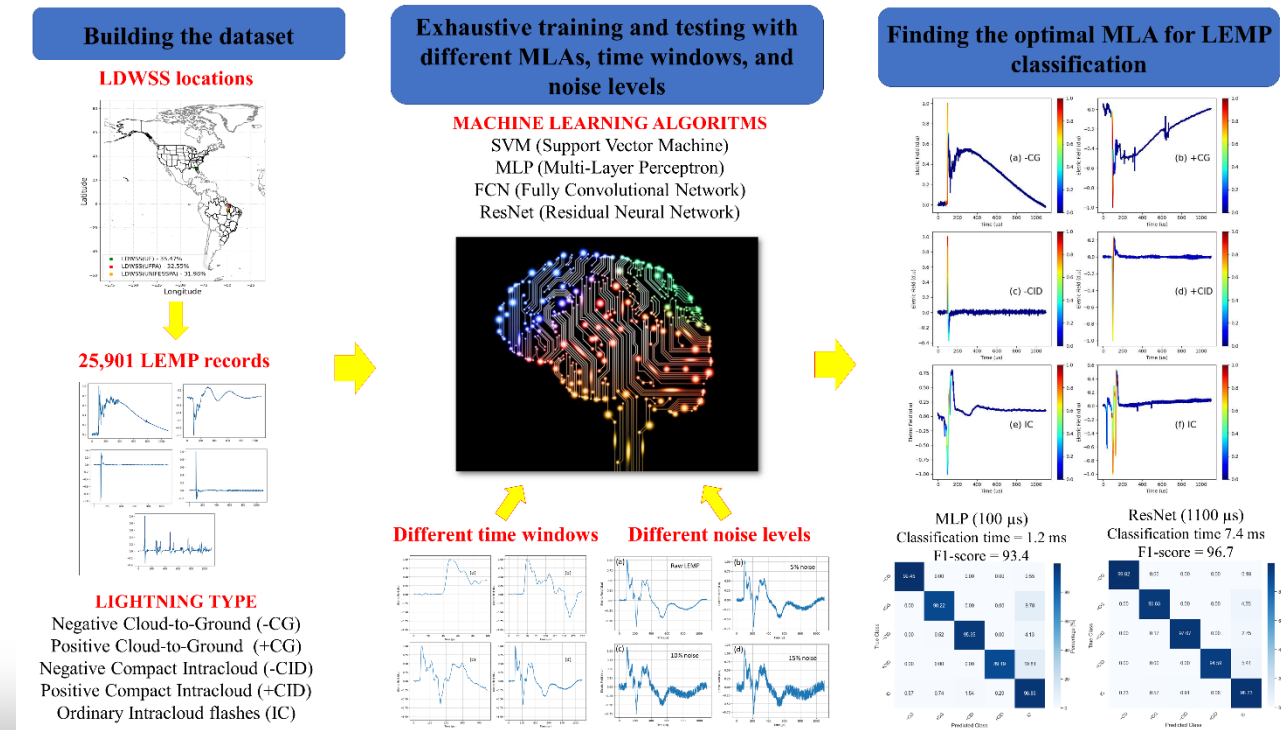
Performance Analysis of Artificial Intelligence Approaches for LEMP Classification

Adonis F. R. Leal ^{1,2,*}, Gabriel A. V. S. Ferreira ² and Wendler L. N. Matos ²

¹ Langmuir Laboratory and Physics Department, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM 87801, USA

² Graduate Program in Electrical Engineering, Federal University of Para, Belem 66075110, Brazil; gabriel.santos.ferreira@itec.ufpa.br (G.A.V.S.F.); wendler.matos@itec.ufpa.br (W.L.N.M.)

* Correspondence: adonis.leal@nmt.edu



Future goals

- How the clouds interfere on GLM detection?
- Is possible to identify different types of lightning from space?
- Is there specific lightning processes that are more likely to be detected from space?

Acknowledgments

- Olivia Cantrell
- Richard Sonnenfeld
- Caitano da Silva
- Jacob Wemhoner
- Gabriel A. V. S. Ferreira
- Wendler L. N. Matos
- Vladimir A Rakov
- Marcelo M Saba

Thank You!

Questions?

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