



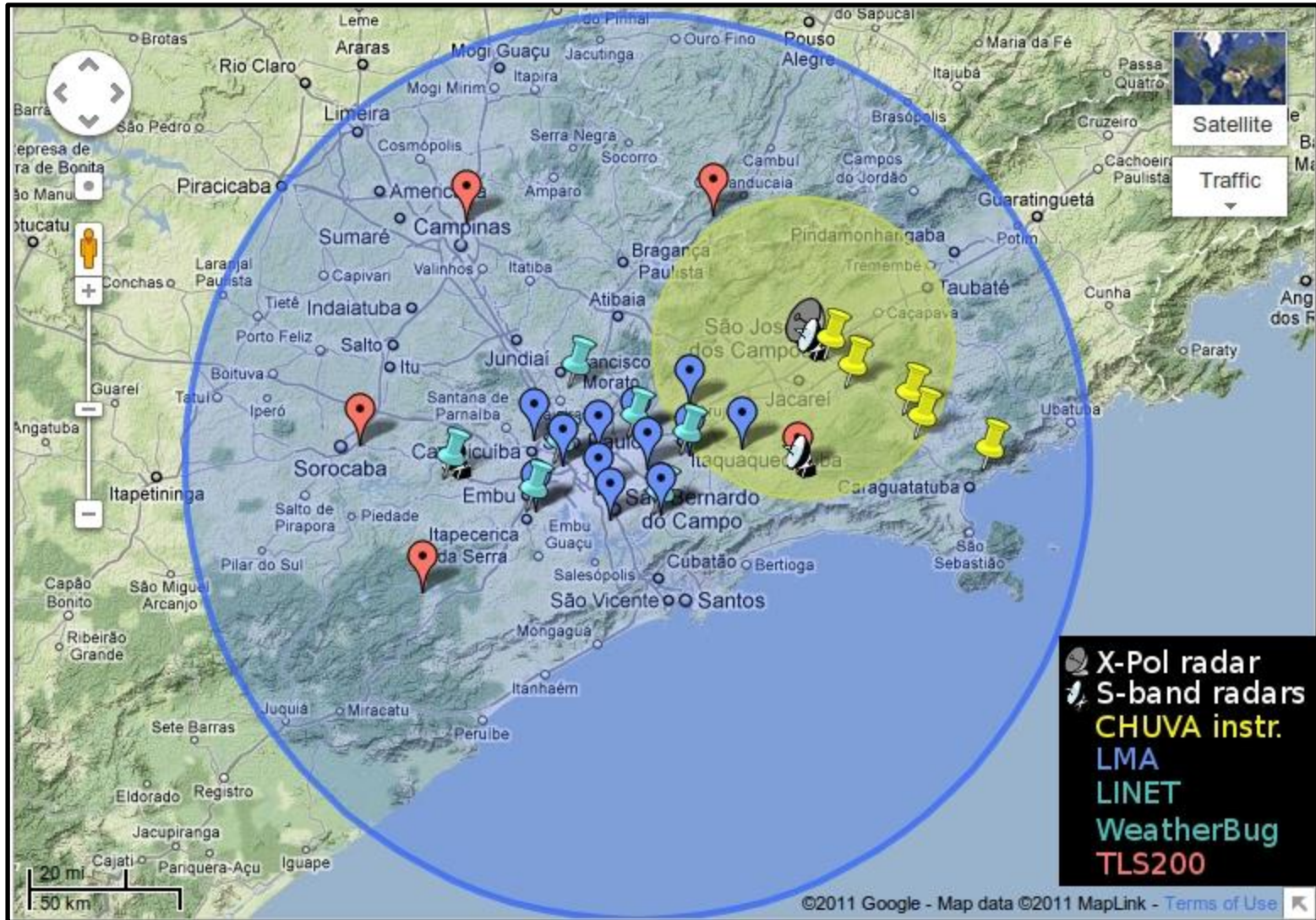
Upward lightning observations from towers in São Paulo and comparison with LLS data



Marcelo Magalhães Fares Saba
Amanda Romão de Paiva
Kleber P. Naccarato
Carina Schumann
Rachel I. Albrecht
Robson Jaques
Marco Antônio Ferro



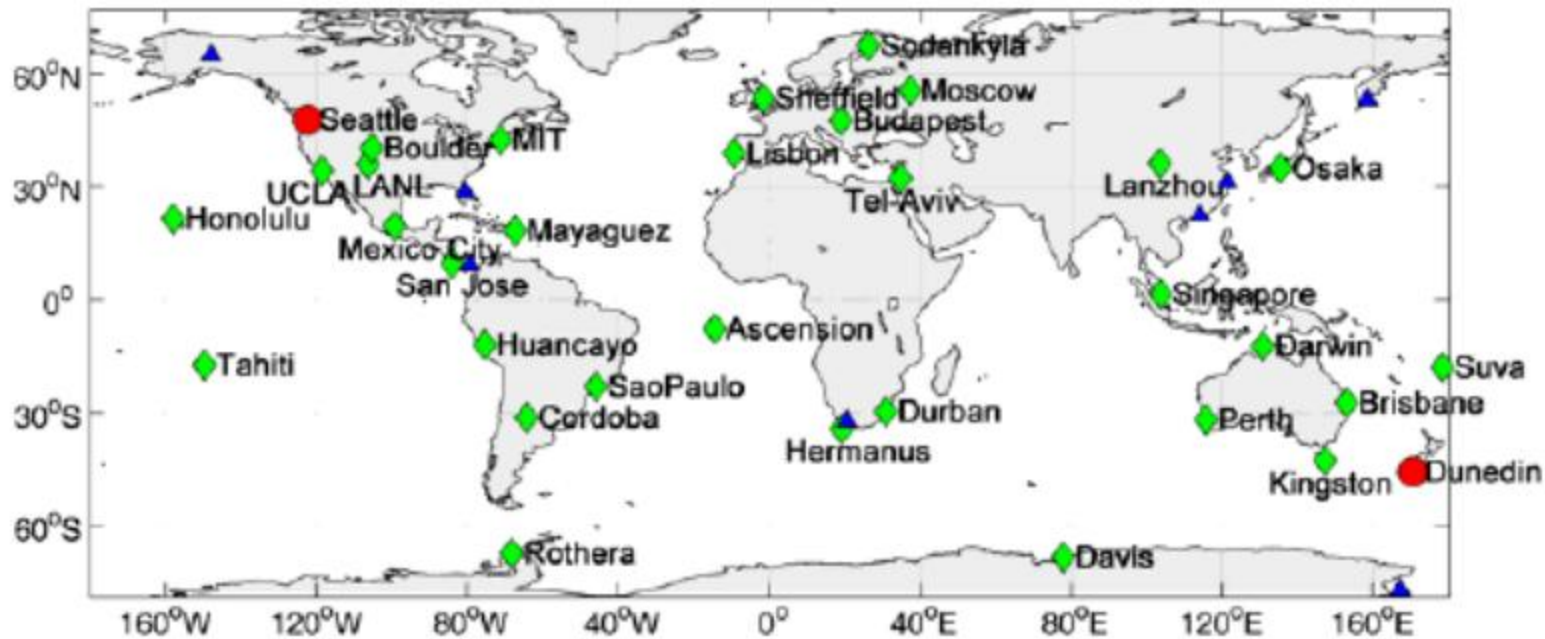
LLSs installed during CHUVA



Data from other
World Wide
LLS

Vaisala GLD 360

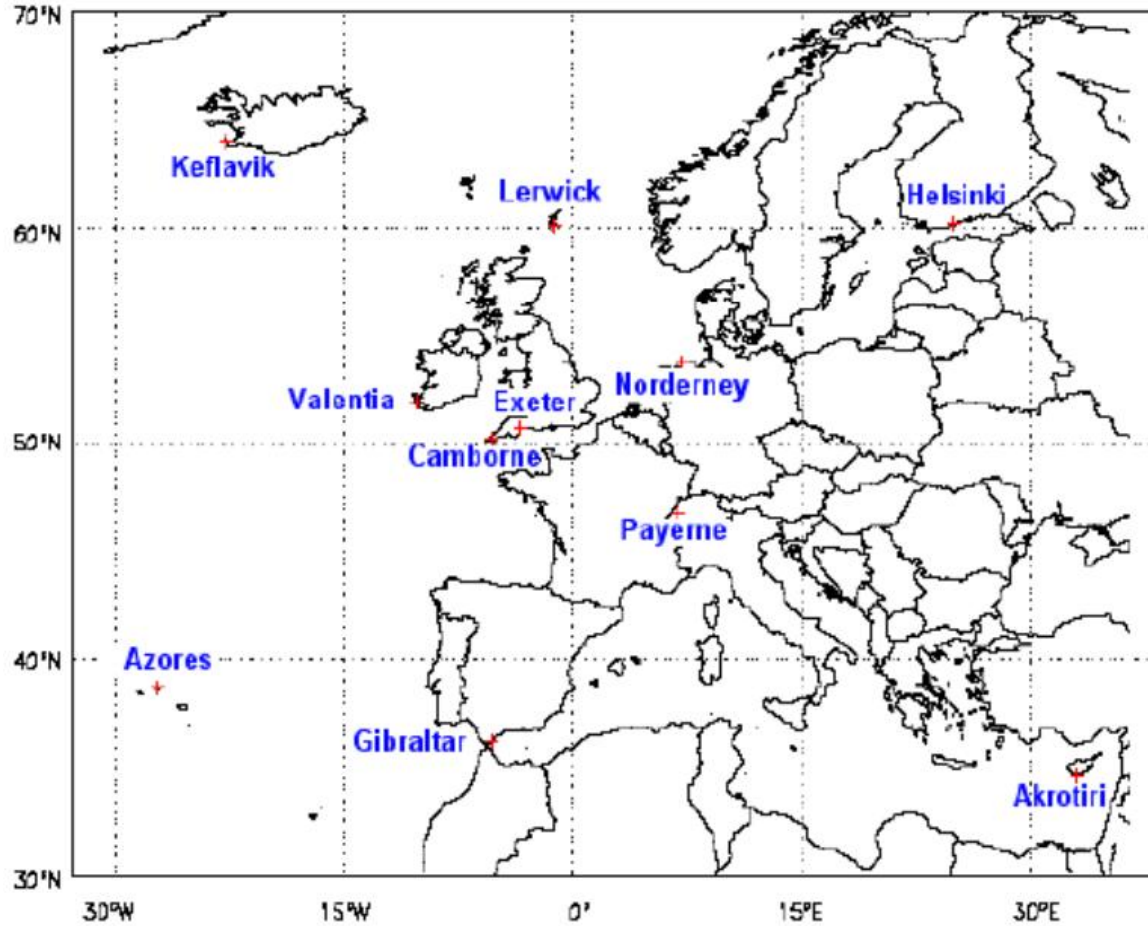
WWLLN (2008)



STARNET (2009)



ATDNET



Detection and Location of:

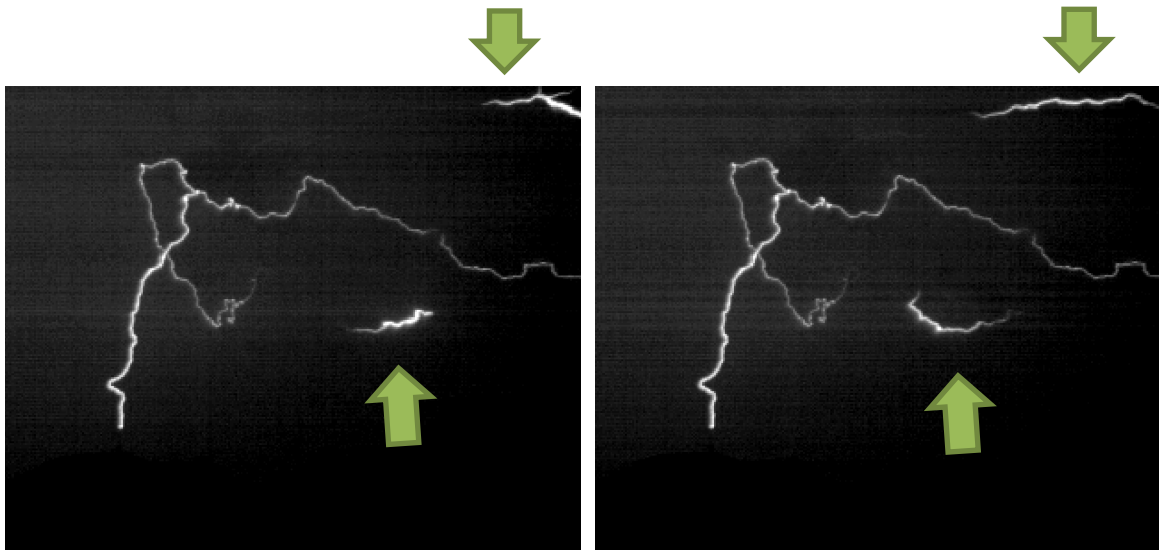
- Leader initiation
- Recoil leaders
- M-component
- Return strokes

Leader initiation



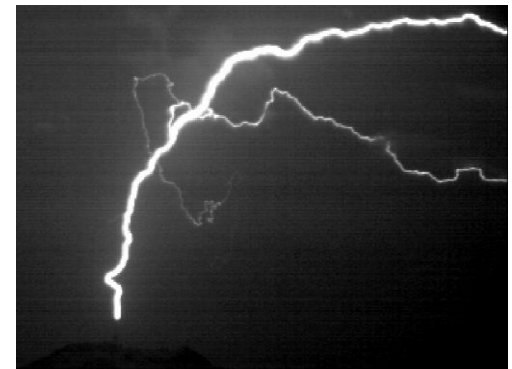
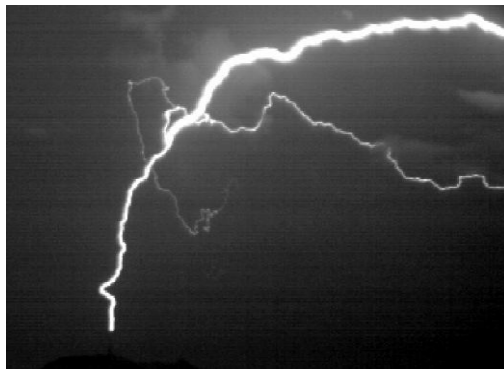
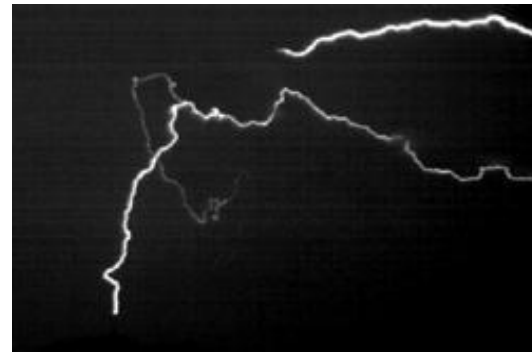
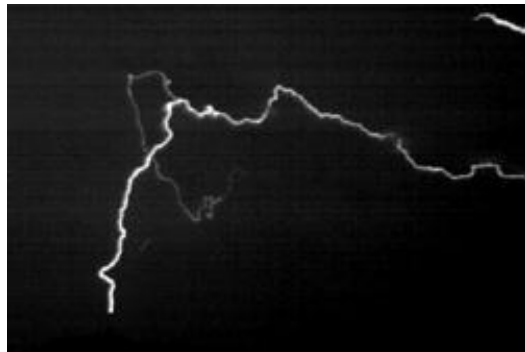
Recoil leaders

Negative leaders retracing portions of + leader path



M-components

During a luminous (current-carrying) channel connected to the tower



Return Strokes

- No luminosity at all



Leader initiation

2 out of 15



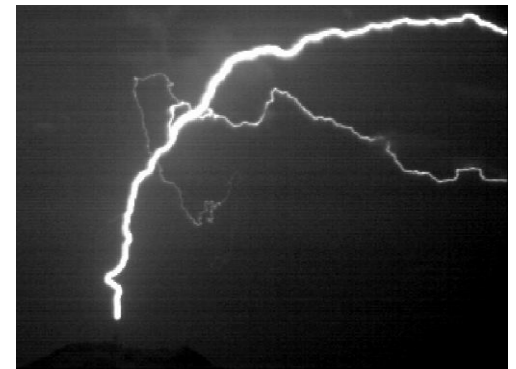
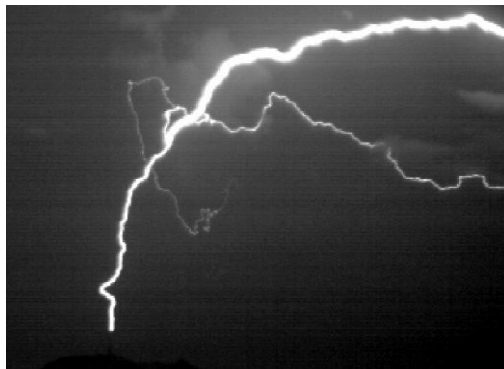
Recoil leaders

none



M-components

11 out of 38



Return Strokes

4 out of 4



2012-03-27 19:42:42.297500 Source: Synch from External Source



2012-03-27 19:42:42.297750 Source: Synch from External Source

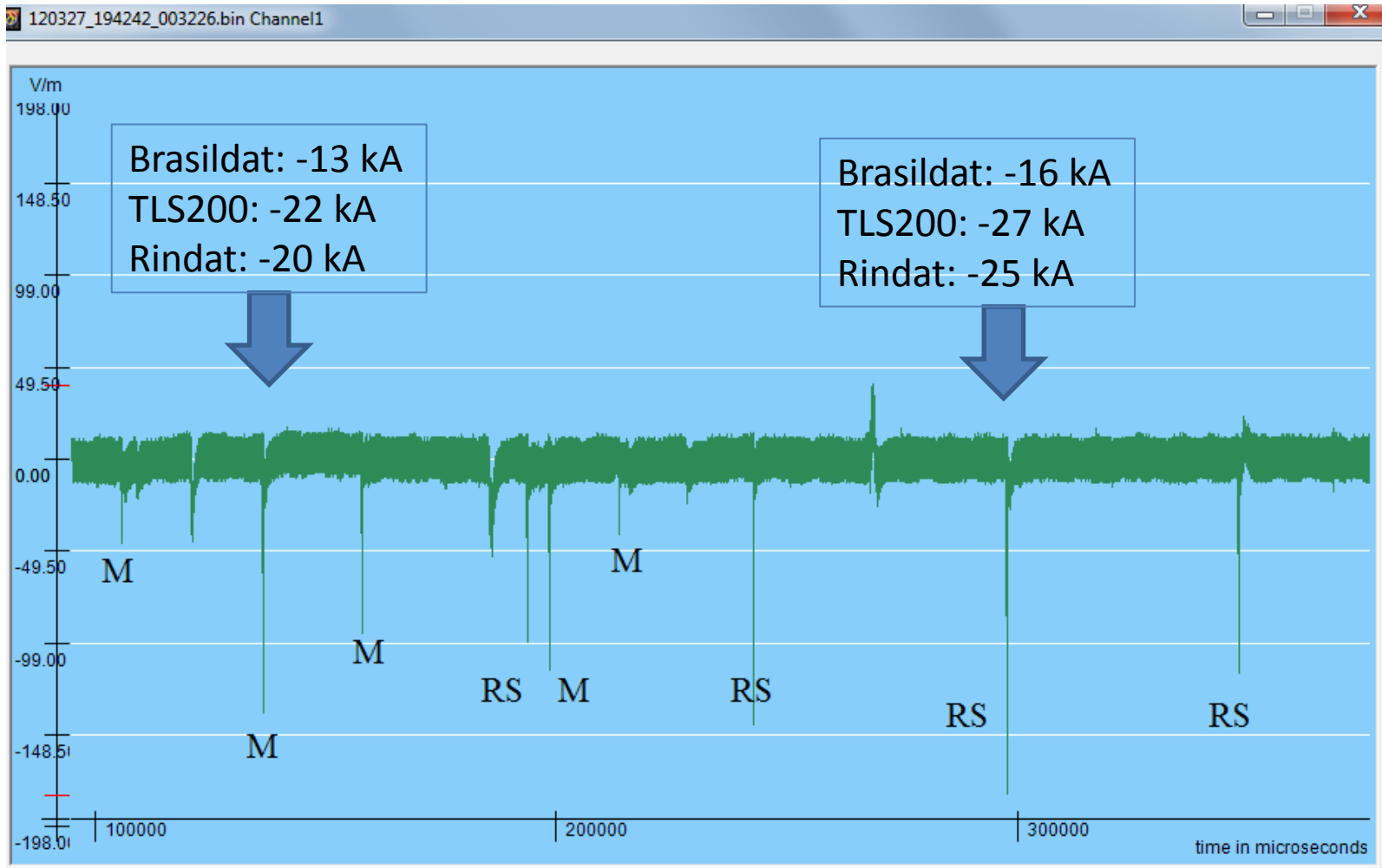


2012-03-27 19:42:42.298000 Source: Synch from External Source

Detected Events

LLS	Leader initiation	M-component	Recoil Leaders	Return Stroke	Total
TLS 200 LF		10		4	14
Rindat – IC					
Rindat - CG		3		3	6
BRASILDAT - IC	2	5			7
BRASILDAT- CG		3		2	5
LINET - IC	1				1
WWLLN					
GLD360					
ATDNET					
STARNET					
HS video	15	38	100s	4	

Why were some M-comp detected?



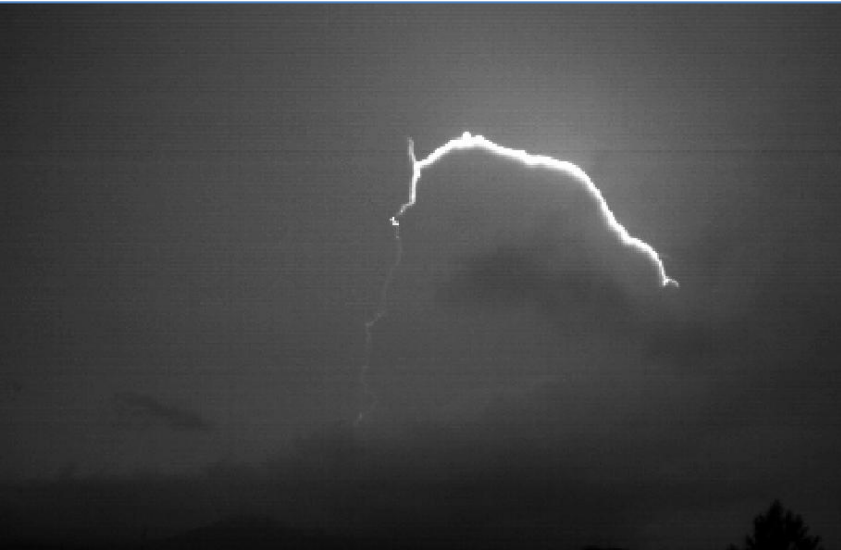
“non-impulsive” M-comp.



2012-03-27 19:42:42.055500 Source: Synch from External Source

2012-03-27 19:42:42.056250 Source: Synch from External Source

“Impulsive” M-comp.

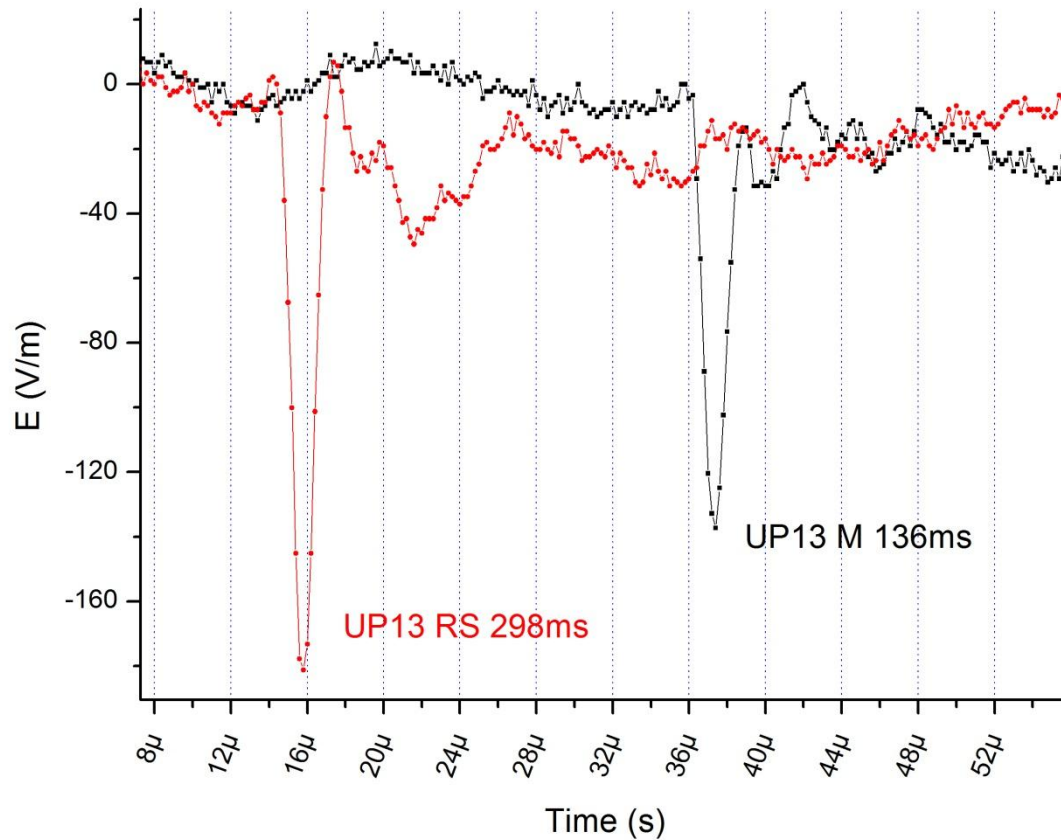


2012-03-27 19:42:42.105500 Source:Synch from External Source



2012-03-27 19:42:42.106250 Source:Synch from External Source

RS and M-comp. waveforms



Location Accuracy (m)

- RINDAT – CG

29,619

172

159

535

339

392

Location Accuracy (m)

- BRASILDAT – IC

3,431
25,156
7,447
430
797
600

Location Accuracy (m)

- BRASILDAT – CG

19,665
343
363
309
354
474

Location Accuracy (m)

- TLS200 – LF

72	0
31	33
20	30
24	8,346
7,469	15
10	10
0	15

Location Accuracy (m)

- LINET – IC 3,835

Summary

- Return stroke is the process most detected in upward flashes. However their presence is scarce in upward flashes (1 flash out of 15).
- Only impulsive M-components are detected. Most are not impulsive.
- Most upward flashes are composed only by the initial continuous current which is not detected.
- Therefore, detection of upward flashes is not trivial.