Thunderstorms and lightning activity in São Paulo metropolitan area during CHUVA-GLM Vale do Paraiba field experiment

CHUVA-Lightning Mapping Campaigns: CHUVA-GLM Vale do Paraíba

- **Goals:**
  - Besides CHUVA main goals (*precipitation measurements*) …
  - Contribute to **GOES-R GLM** and **MTG LI** activities by collecting total lightning data under MSG coverage:

    1) Lightning Location Systems intercomparisons:
    - Understand the differences between ground based LLS in respect to TRMM LIS;
    - Generate GLM and LI proxy data.

    2) Develop multi-sensor and multi-platform algorithms:
    - satellite QPE;
    - nowcasting of severe weather.

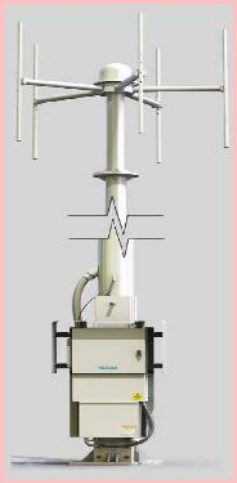
CHUVA-Lightning Mapping Campaigns: CHUVA-GLM Vale do Paraíba

Deployed total lightning networks :

12 LMA sites (VHF)

7 LINET sites (VLF-LF)

5 TLS200 sites (LF-VHF)



7 EN sites (ELF-LF)

Operational networks :

- RINDAT (LF)
- STARNET (VLF)
- WWLLN (VLF)
- GLD360 (VLF)
- ATDnet (VLF)
- BrasilDAT (ELF-LF)

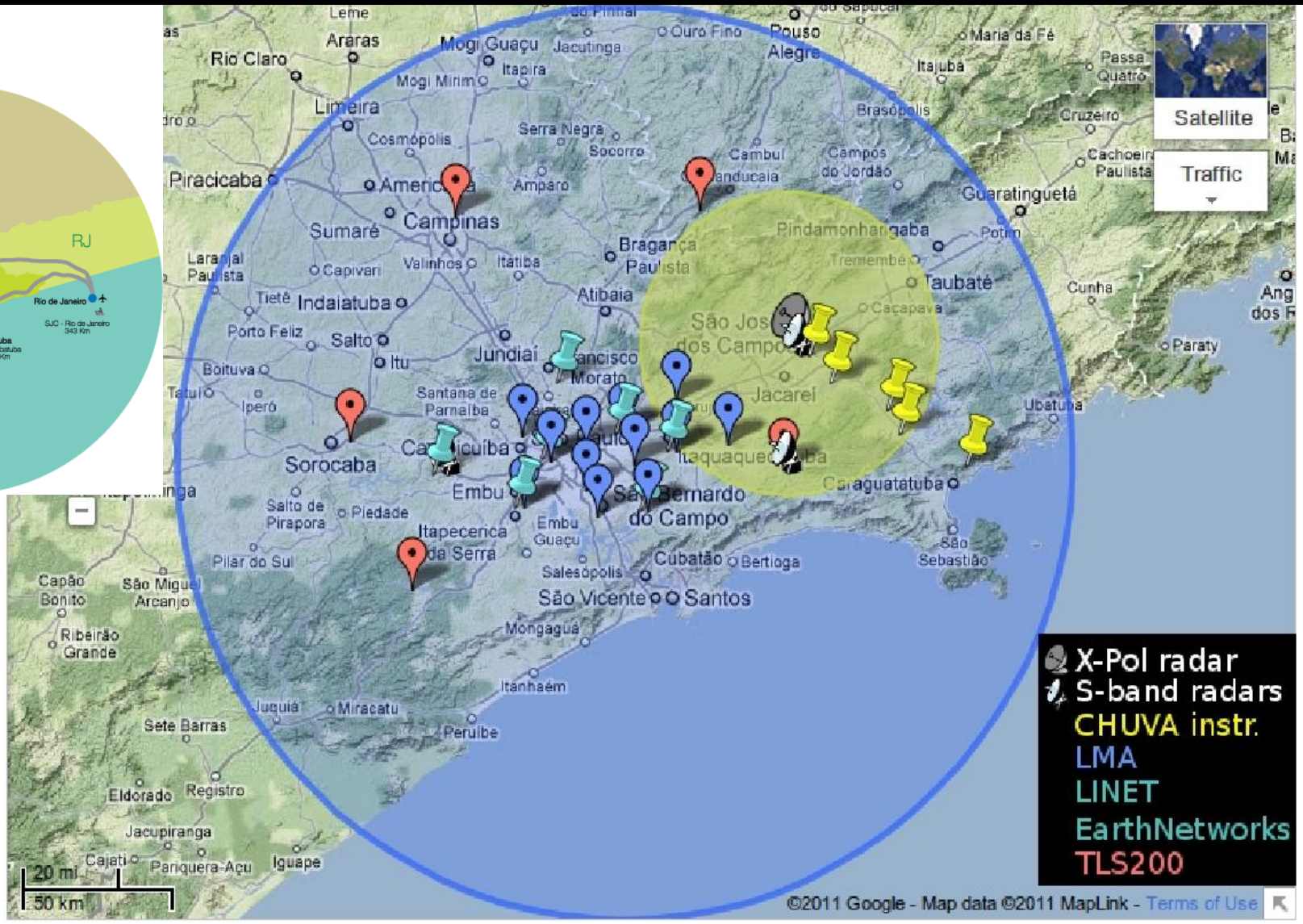
6 High Speed Video Cameras

8 Field-Mills

Satellite Observations :

- GOES-12
- MSG
- TRMM

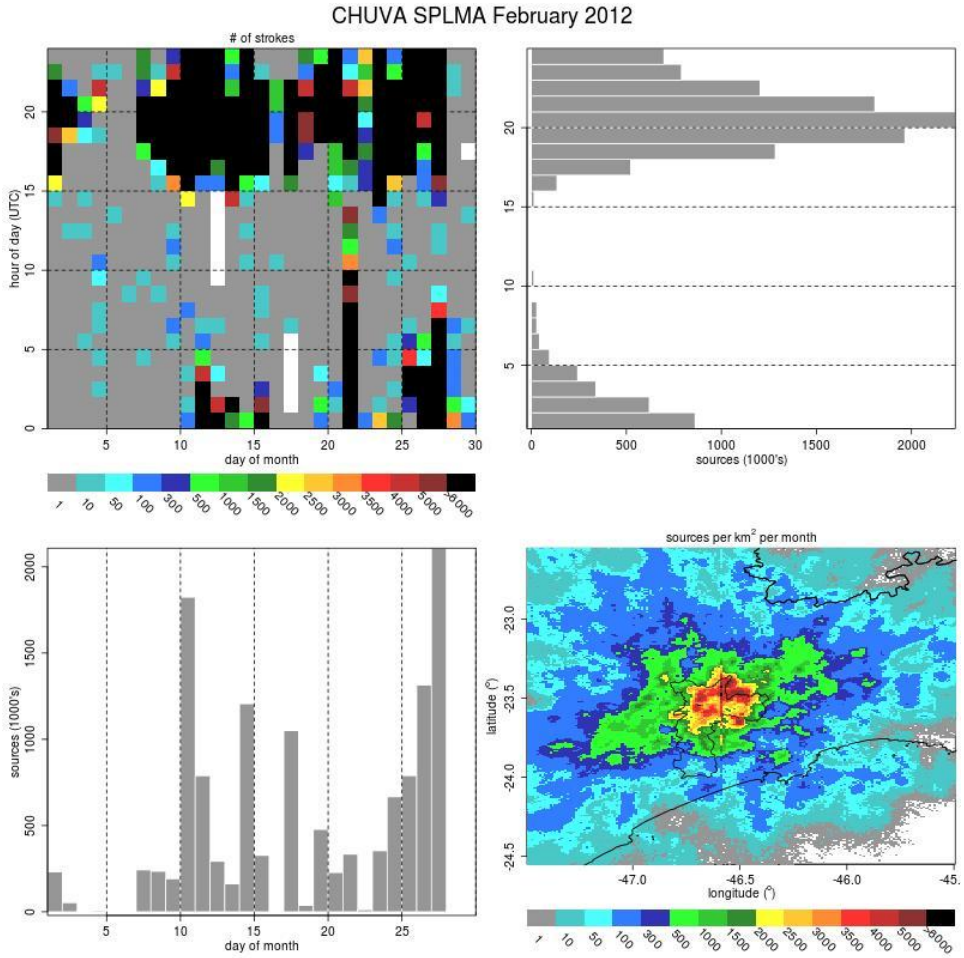
CHUVA-Lightning Mapping Campaigns: CHUVA-GLM Vale do Paraíba

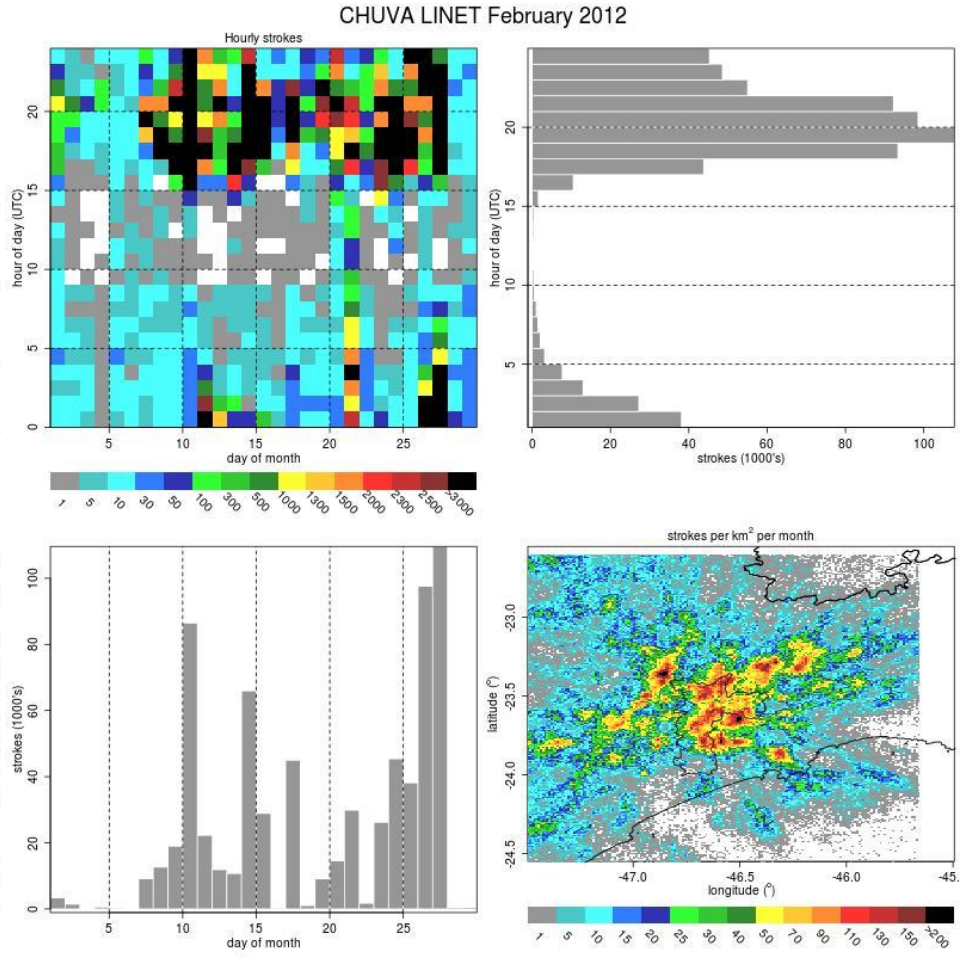


LLS available data

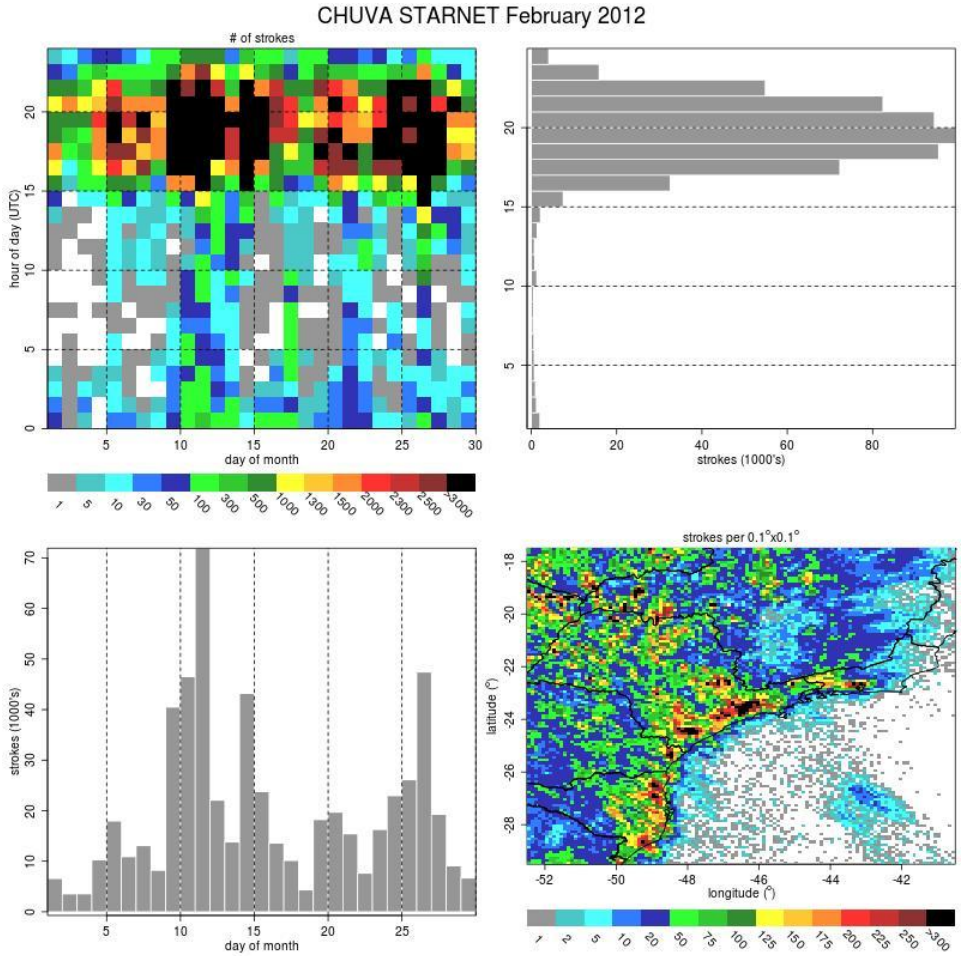
- **Lightning Mapping Array (NASA/UAH/NOAA) [2011-10-24 to 2012-03-31]**
- **LINET (EUMETSAT/DLR) [2011-11-01 to 2012-03-31]**
- **TLS200 (Vaisala) [2012-01-01 to 2012-03-31]**
- **ENTLN (EarthNetworks) [2011-11-01 to 2012-03-31]**
- RINDAT (INPE) [2011-11-01 to 2012-03-31]
- STARNET (USP) [2011-11-01 to 2012-03-31]
- WWLLN (Univ. Washington) [2011-11-01 to 2012-03-31]
- GLD360 (Vaisala) [2011-11-01 to 2012-03-31]
- ATDnet (MetOffice) [2011-11-01 to 2012-03-31]
- TRMM-LIS [2011-11-01 to 2012-03-31]

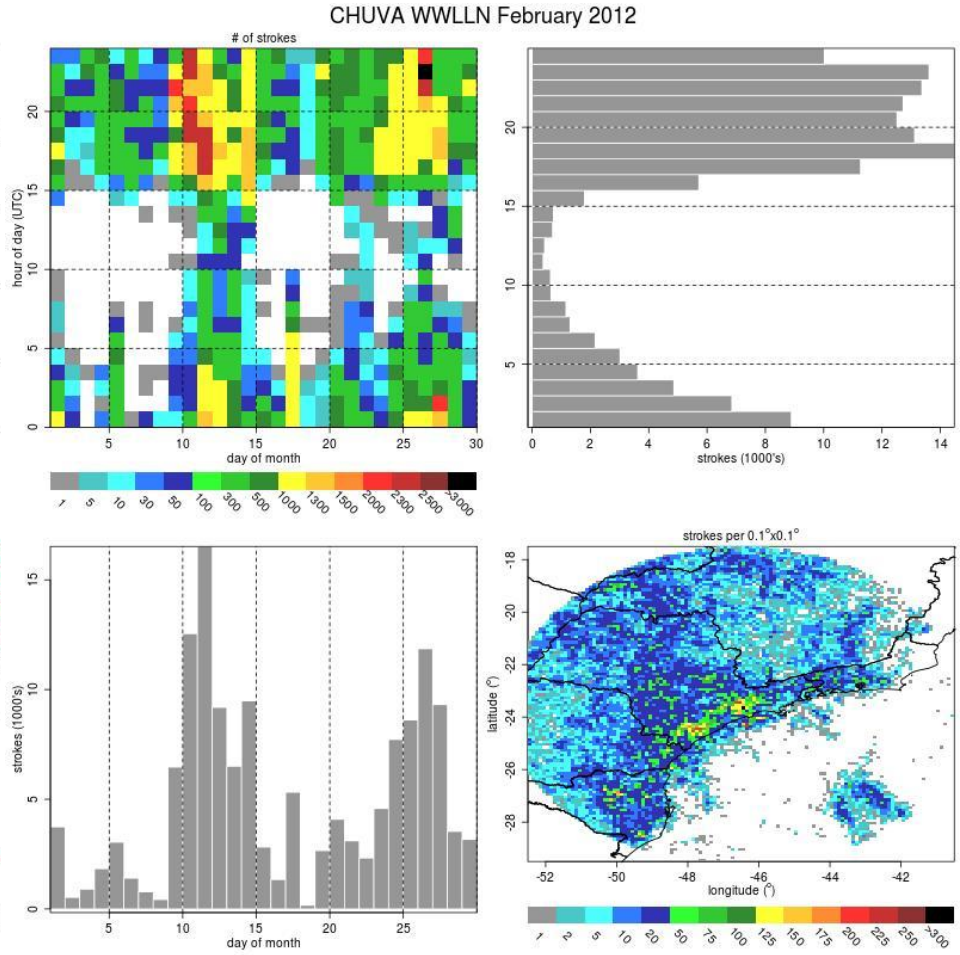
LLS VHF/LF data summary



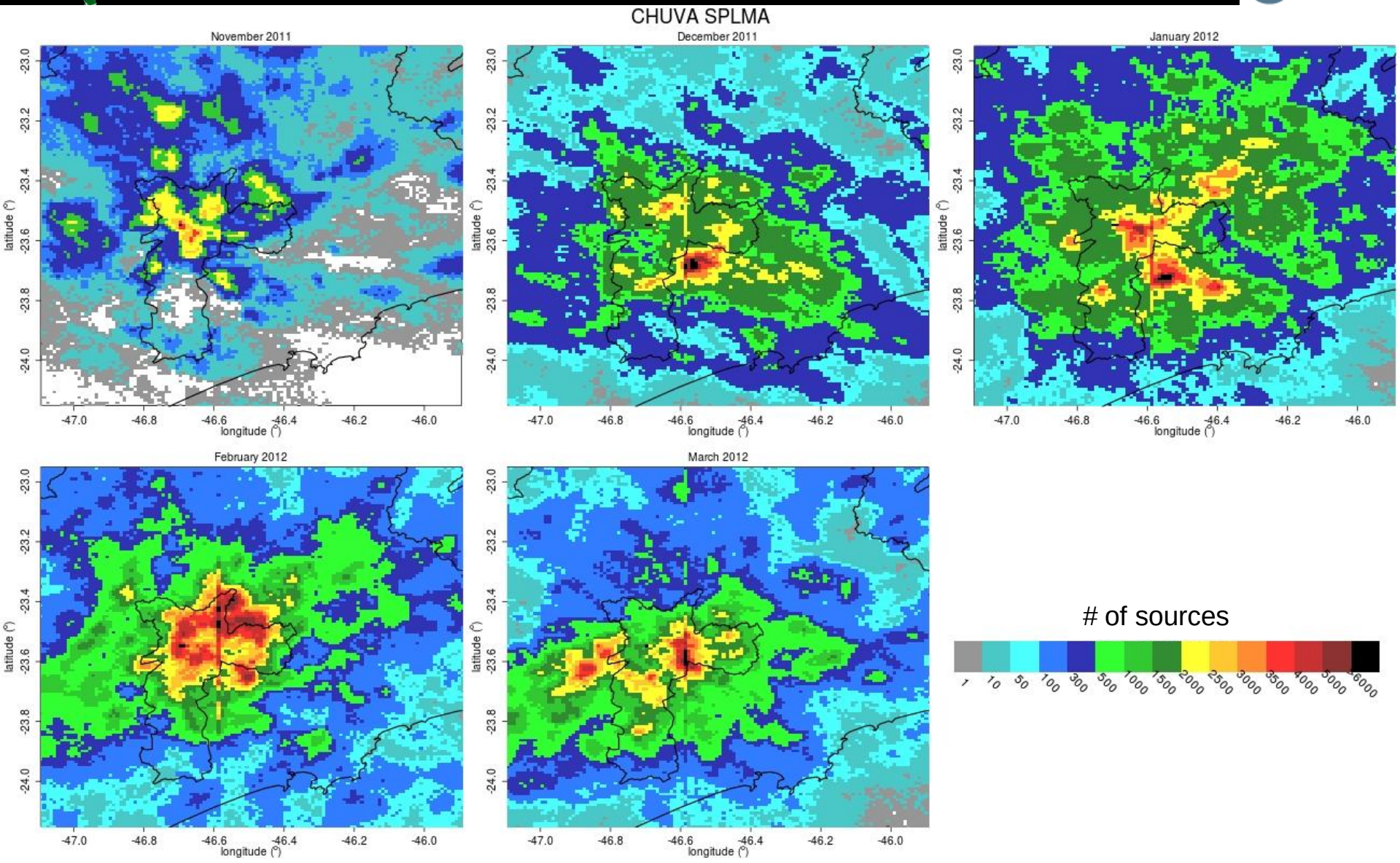


LLS VLF data summary

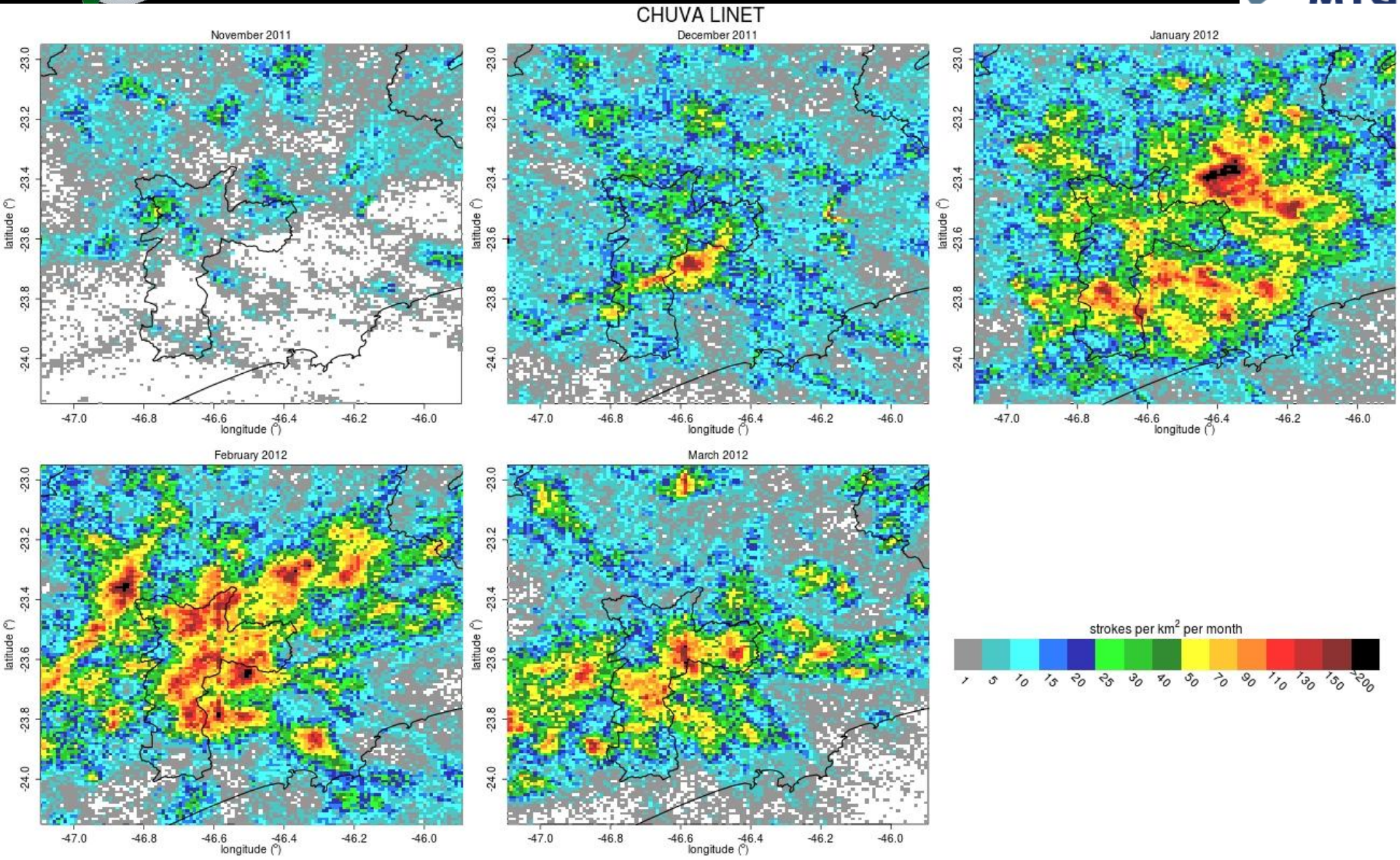




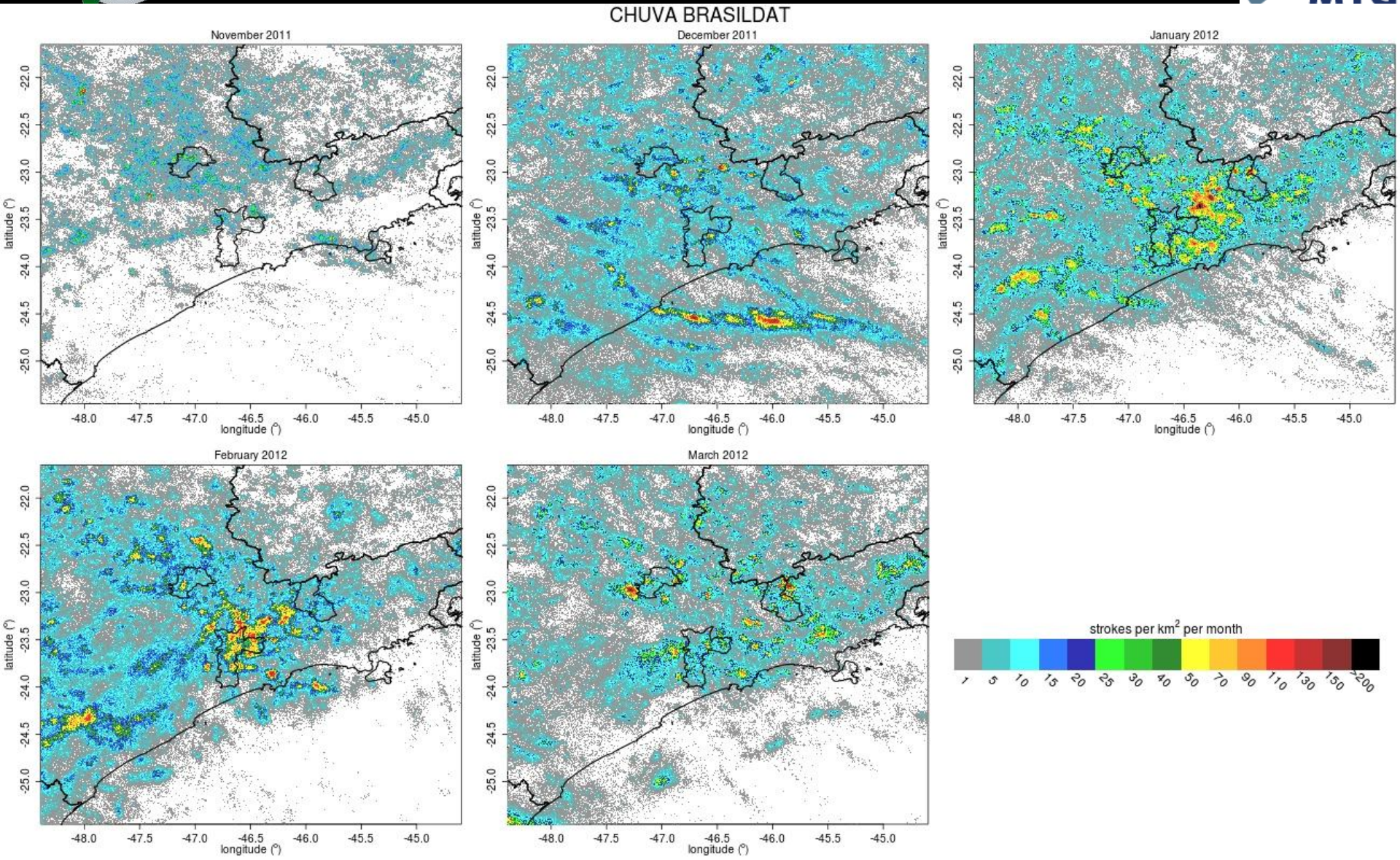
SPLMA sources (VHF) summary (by month)



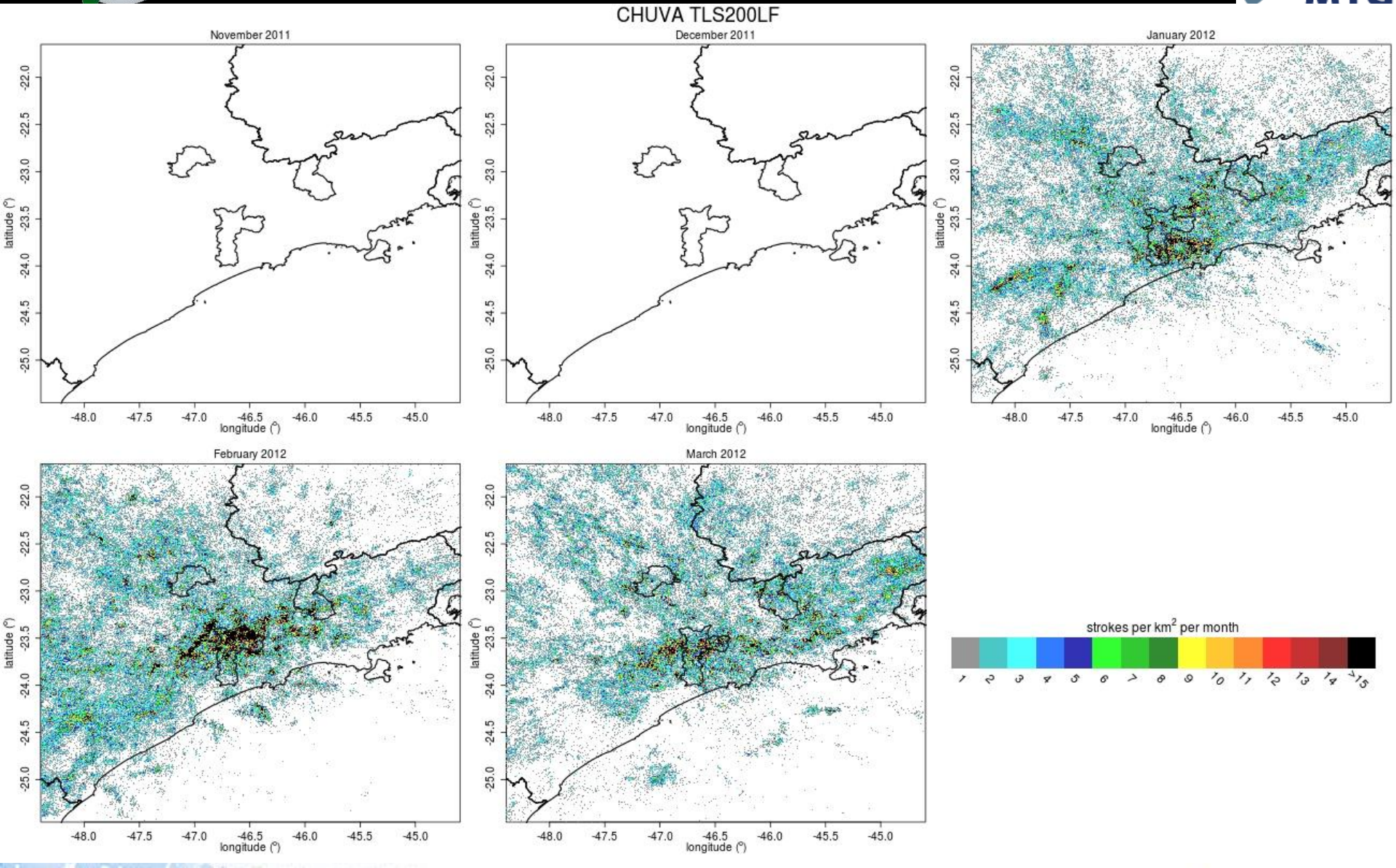
LINET IC+CG (VLF-LF) summary (by month)



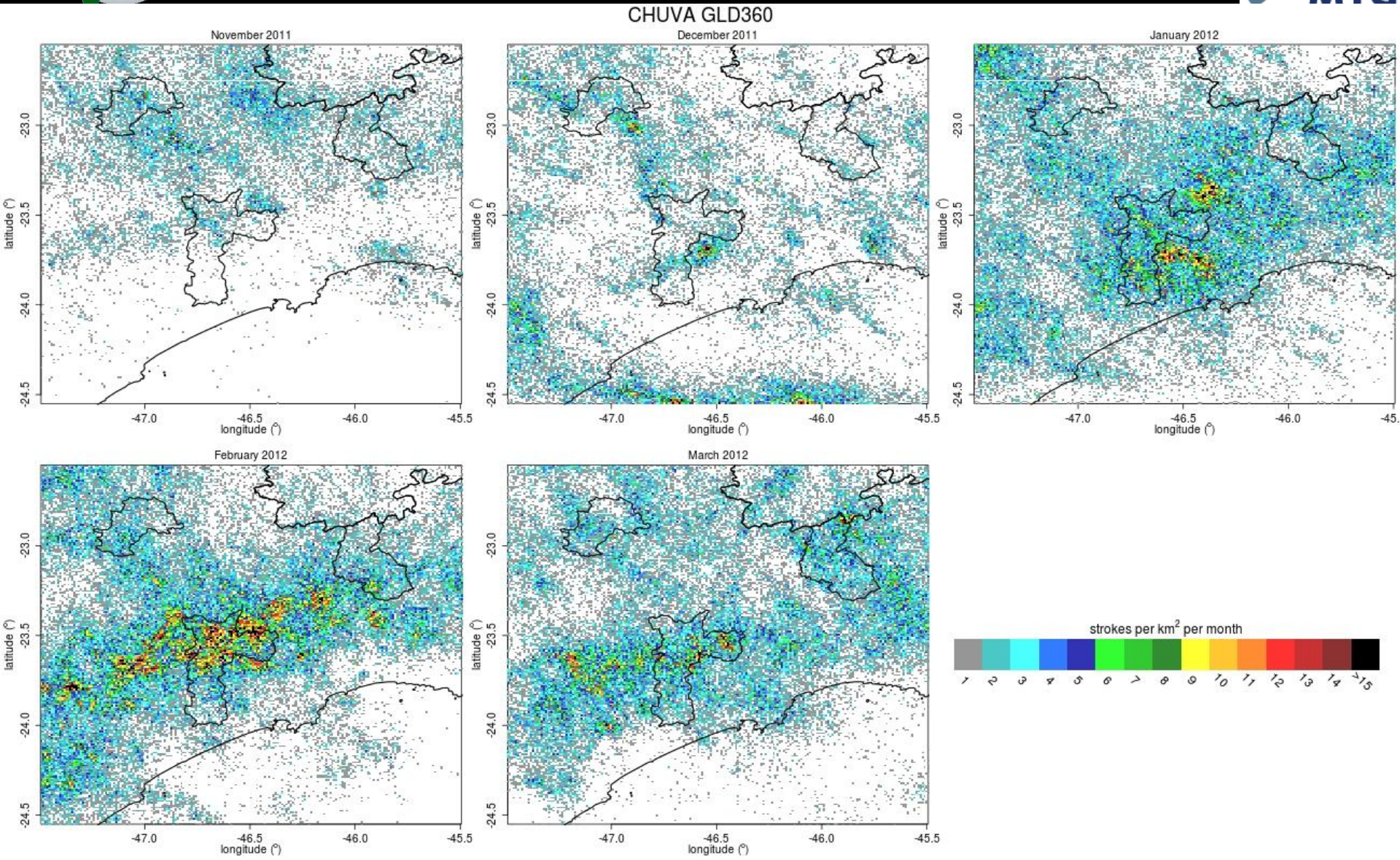
BRASILDAT IC+CG (ELF-LF) summary (by month)



TLS200 CG (LF) summary (by month)



GLD360 CG (VLF) summary (by month)



TRMM LIS overpasses

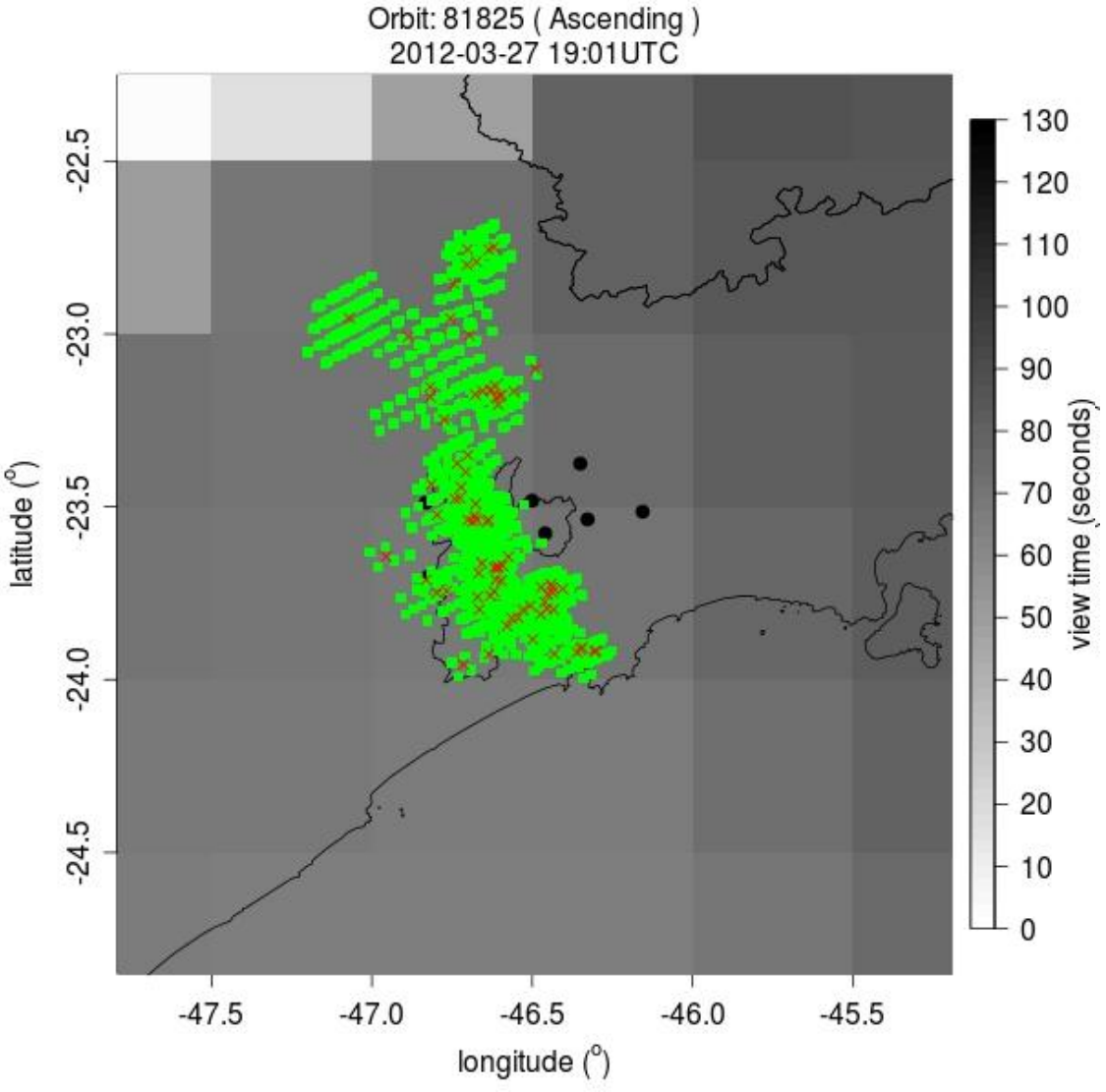
with lighting flashes up to 50km from center of SPLMA

Orbit #	Date	Time (UTC)	Time (LST)
80095	12/7/2011	20:13	17:07
80202	12/14/2011	17:00	13:54
80207	12/14/2011	23:33	20:27
80482	1/1/2012	15:02	11:56
80767	1/19/2012	23:02	19:56
80843	1/24/2012	20:02	16:56
81062*	2/7/2012	20:08	17:02
81077	2/8/2012	19:12	16:06
81108*	2/10/2012	19:00	15:54
81123	2/11/2012	18:04	14:58
81169	2/14/2012	16:55	13:49
81230~	2/18/2012	14:50	11:44
81362	2/27/2012	3:12	0:06
81576	3/11/2012	20:46	17:40
81591*	3/12/2012	19:50	16:44
81825*	3/27/2012	19:01	15:55
* - Good cases			
~ - False LIS flash			

TRMM LIS overpasses

with lighting flashes up to 50km from center of SPLMA

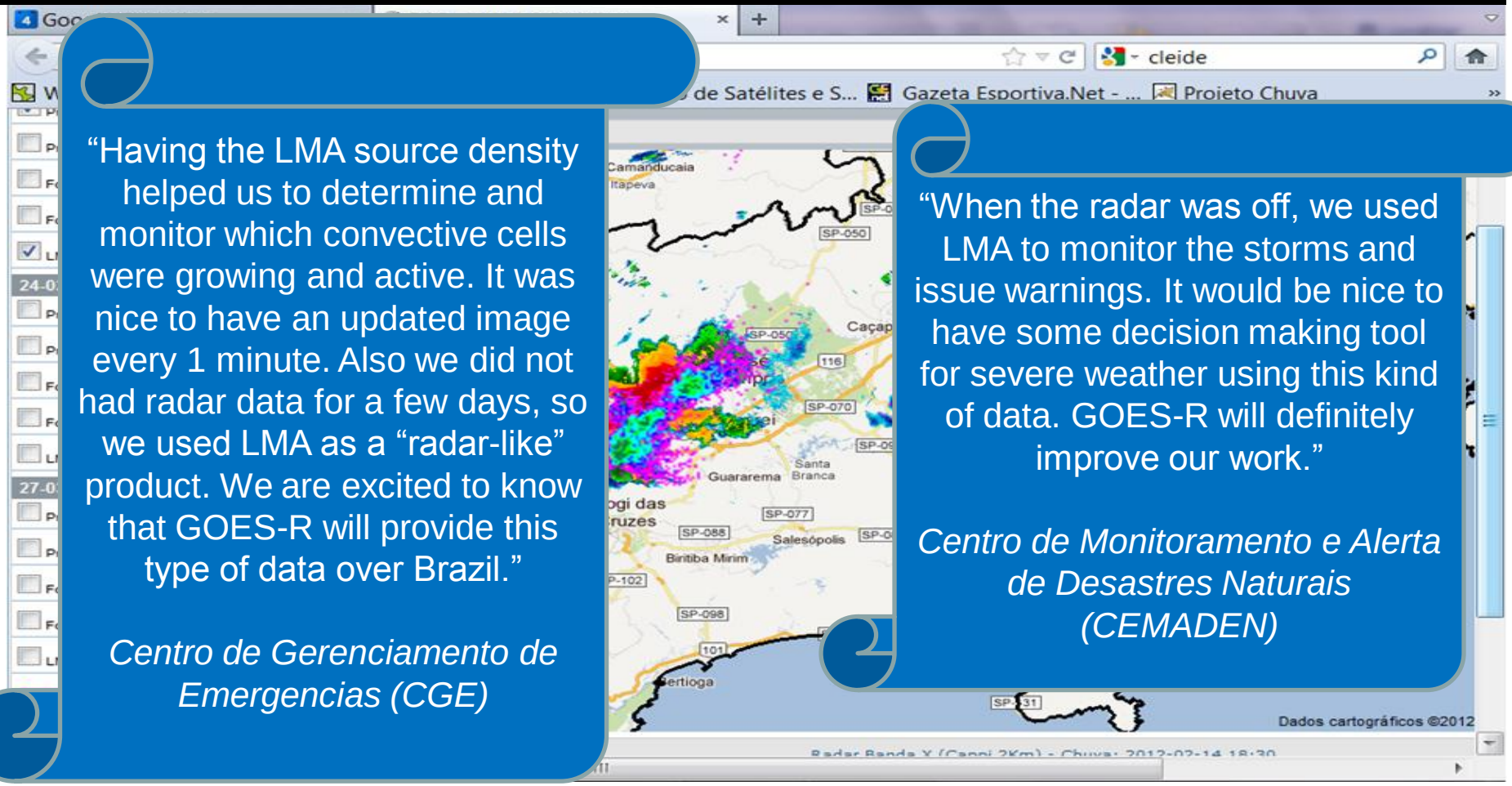
LIS flashes
LIS events



Nowcasting

Interactions with Brazilian Weather Forecast Offices

6-minute LMA source density plots overlapped with radar, satellite and NWP



"Having the LMA source density helped us to determine and monitor which convective cells were growing and active. It was nice to have an updated image every 1 minute. Also we did not had radar data for a few days, so we used LMA as a "radar-like" product. We are excited to know that GOES-R will provide this type of data over Brazil."

Centro de Gerenciamento de Emergencias (CGE)

"When the radar was off, we used LMA to monitor the storms and issue warnings. It would be nice to have some decision making tool for severe weather using this kind of data. GOES-R will definitely improve our work."

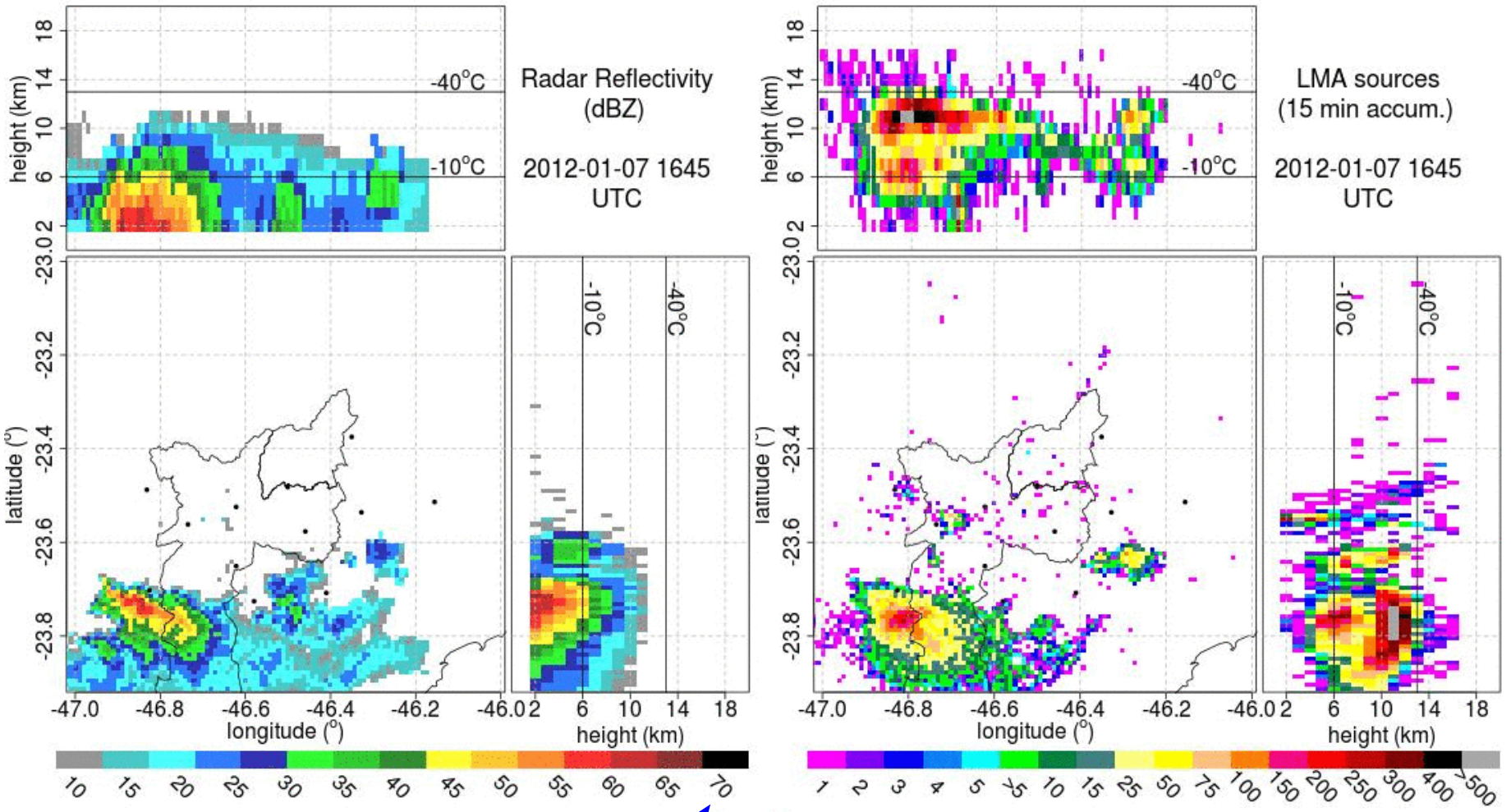
Centro de Monitoramento e Alerta de Desastres Naturais (CEMADEN)

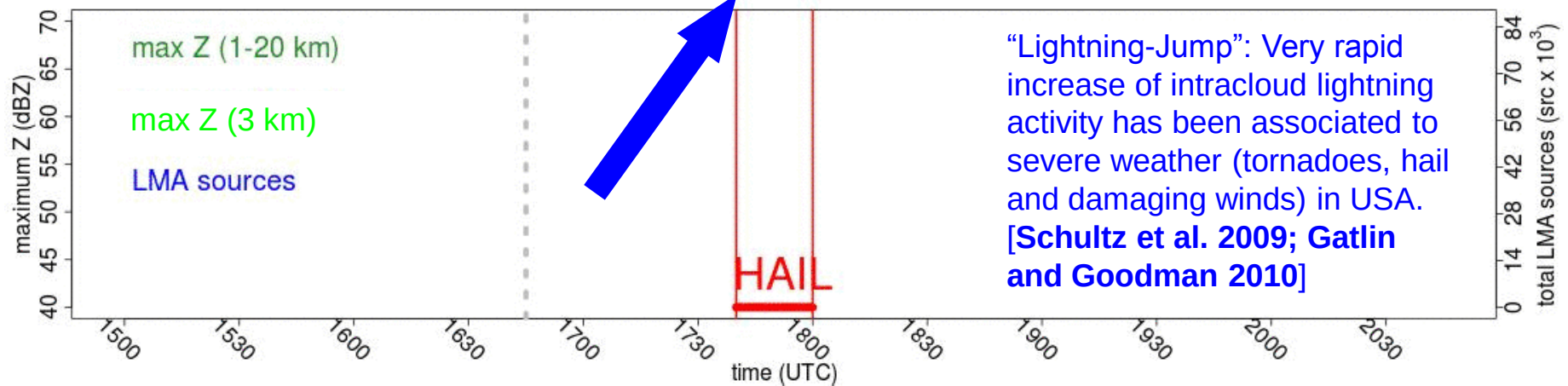
Nowcasting

Interactions with Brazilian Weather Forecast Offices

"Lightning-jump" for tropical severe weather?

- PRELIMINAY RESULTS (20+ cases during CHUVA-GLM Vale do Paraíba):
- 07 January 2012: **hail, damaging winds and flooding** were reported in São Paulo and Guarulhos.





"Lightning-Jump": Very rapid increase of intracloud lightning activity has been associated to severe weather (tornadoes, hail and damaging winds) in USA. [**Schultz et al. 2009; Gatlin and Goodman 2010**]

CHUVA-Lightning Mapping Campaigns: CHUVA-GLM Vale do Paraíba

For all of those that collaborated with us:

THANK YOU SO MUCH!