European NMHSs presentations – The use of LI data at Meteo-France, the improvement of NWCSAF convection products

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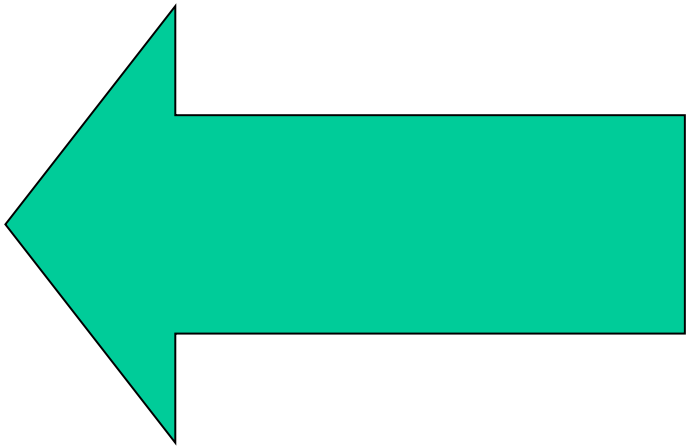
LI short course 05 September 2024 07-11 UTC (9-13 CEST)

PLAN

1. **Flashes, accumulated products: visualization, added value**

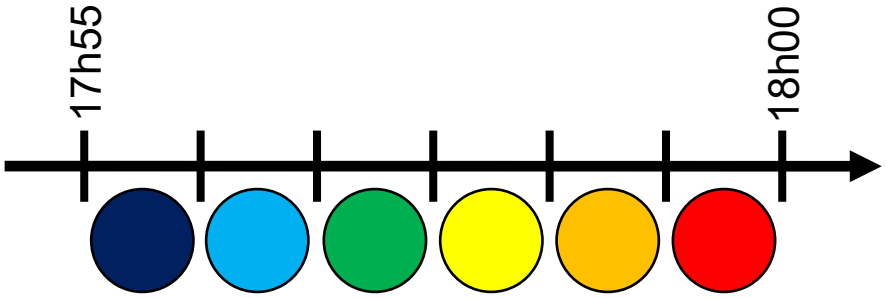


2. Toward NWCSAF Convection products improvement

Lightning data for the forecasters

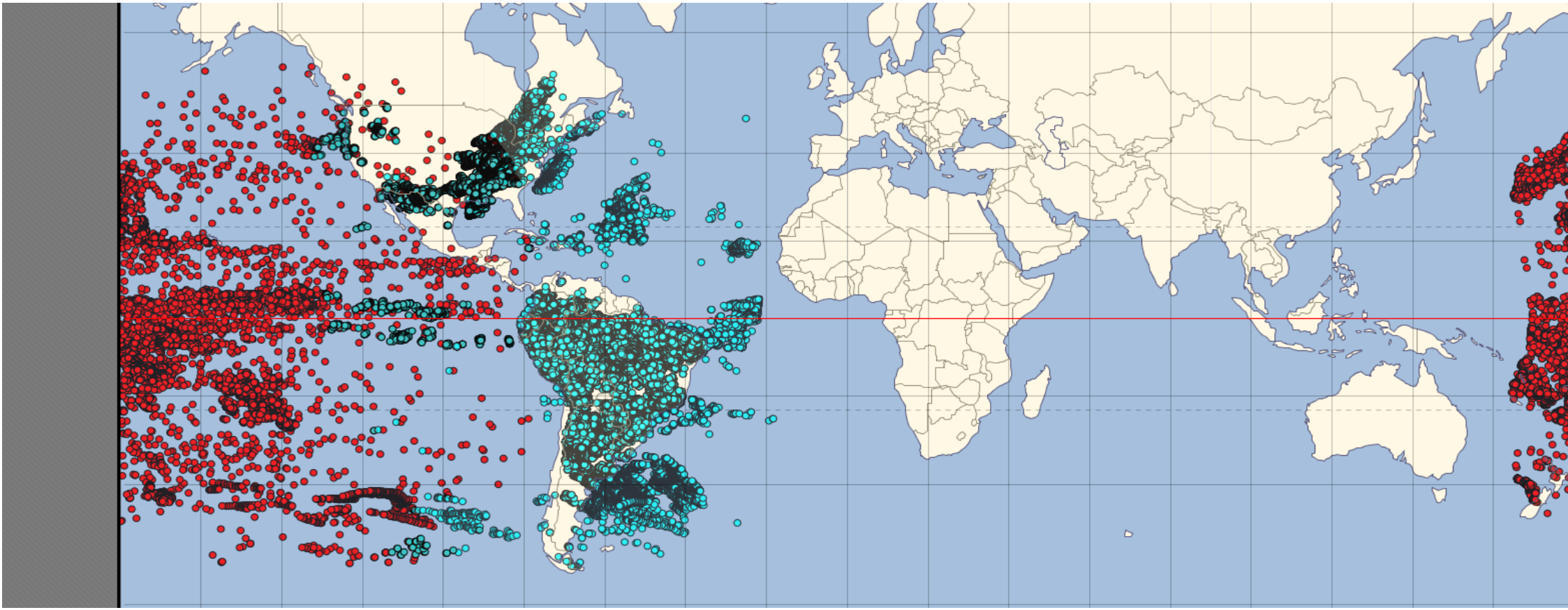
NetCDF (a file every 20 seconds) → GeoJSON (every 5 minutes – only flash information) → Image of 5-min accumulated flashes on Synopsis workstations.

The dots are similar for all flashes but their colour depends on the date:



Flash lat / lon:	02°50'S 77°55'W
	Impacts GOES16
	Processus : GOES16
Image date:	Date de validité : 13/01/2021 18:00
	Période de cumul : [5 Min]
	Qualité satellite : 0
Flash duration:	Durée de l'éclair : 267 ms
Flash energy:	Energie : 2.6e-13 J
Flash area:	Superficie : 322.0 km²
Flash date:	Date de l'impact : 13/01/2021 17:58:25

GLM on Synopsis GOES16 + GOES18 24 hours accumulation



LI not yet on Synopsis forecasters' workstation (version is frrozen up to the end of Olympic and Parlympic PARIS 2024 Games)

GOES16 and GOES18 accumulated products

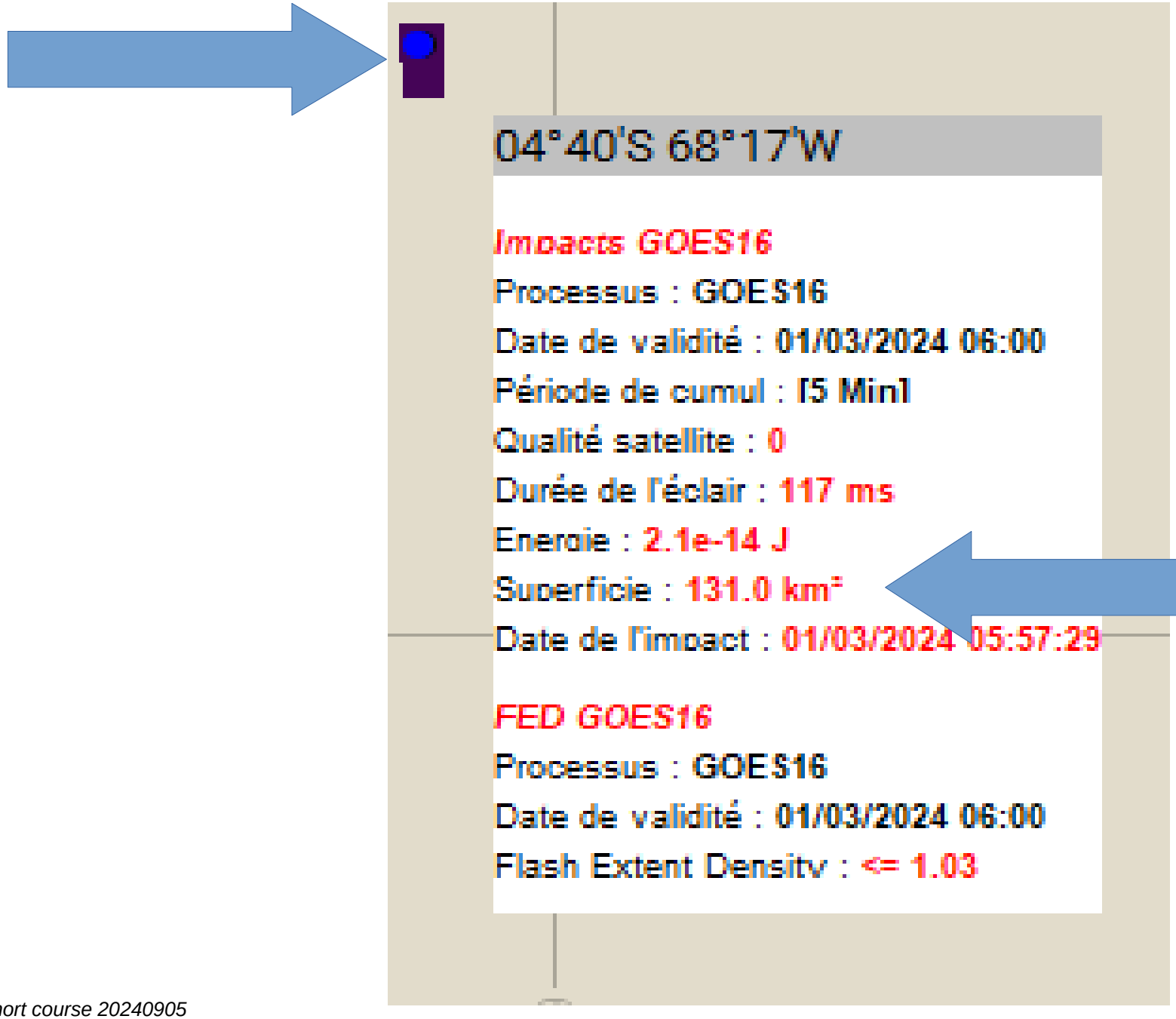
Events, groups and flashes are disseminated

Thanks to E. Bruning program the accumulation products are generated by MF (CMS, Lannion)

5’ / GLM grid (could have been ABI grid)

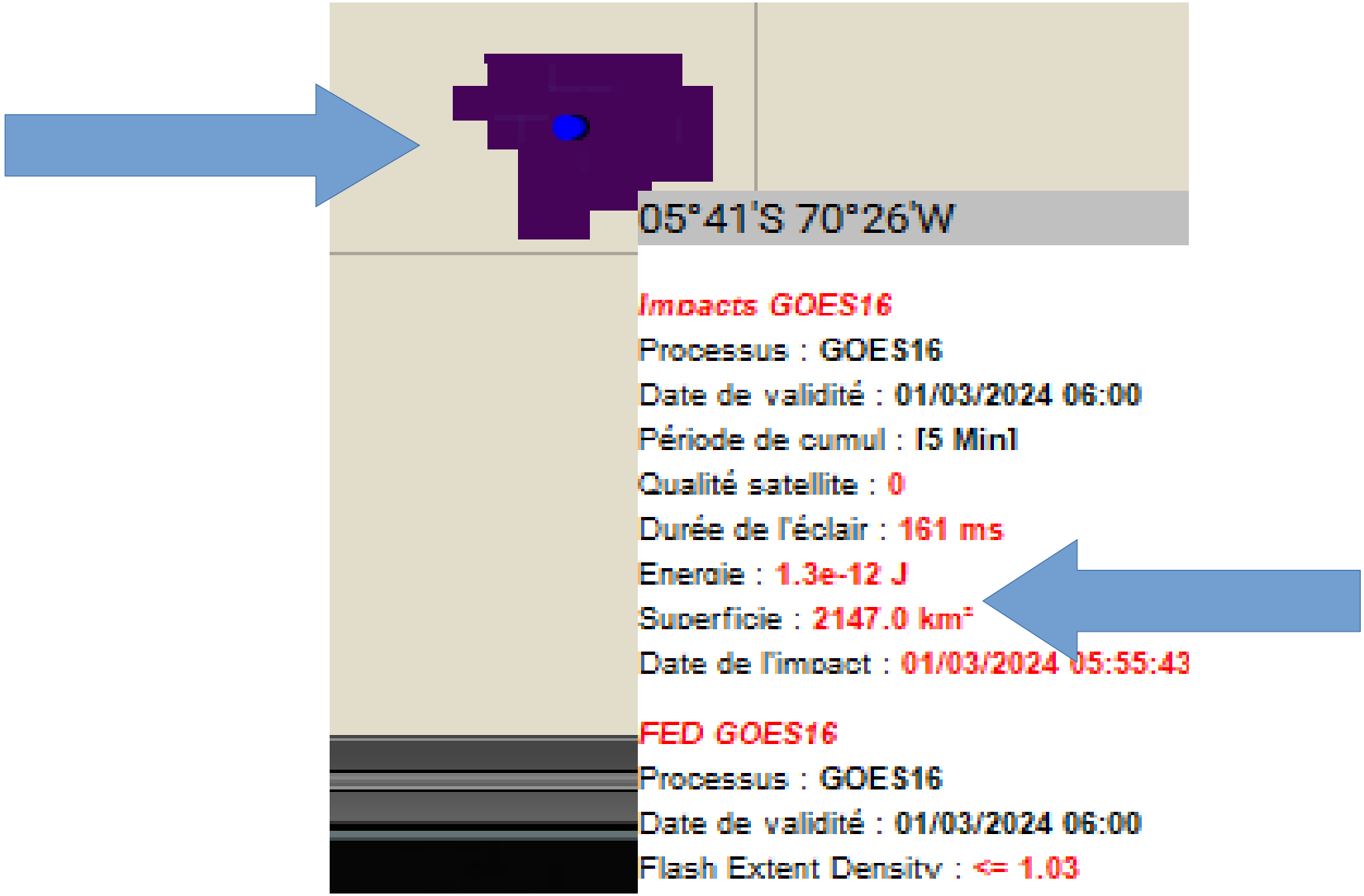
Glmtools : https://github.com/deeplycloudy/glmtools

FED Flash Extent Density (eq AFA): short flash associated to small area of FED

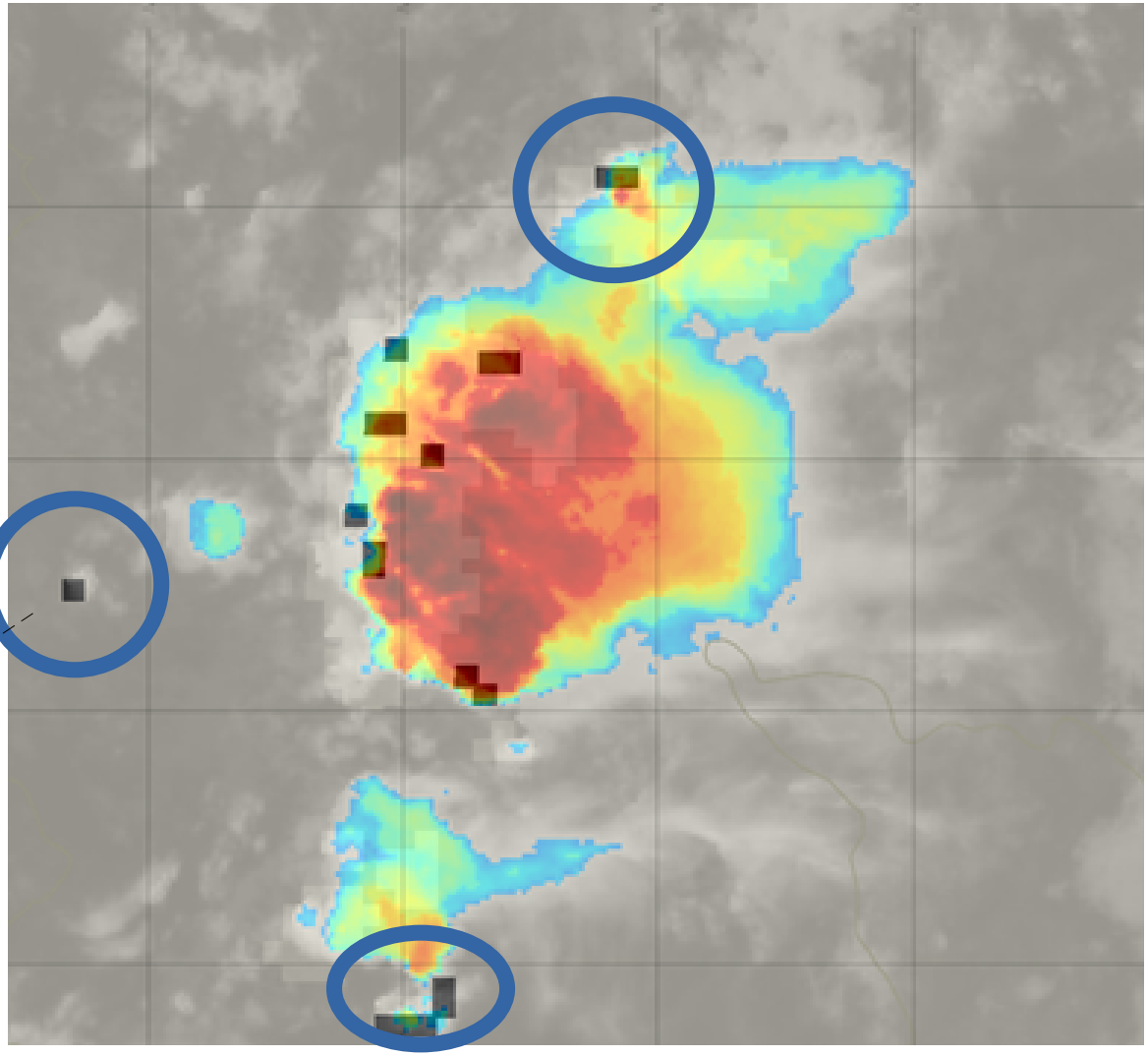


Note :
131 km²
around
2*(8*8)

FED Flash Extent Density (eq AFA): large flash associated to large area of FED



Usefulness of MFA Minimum Flash Area

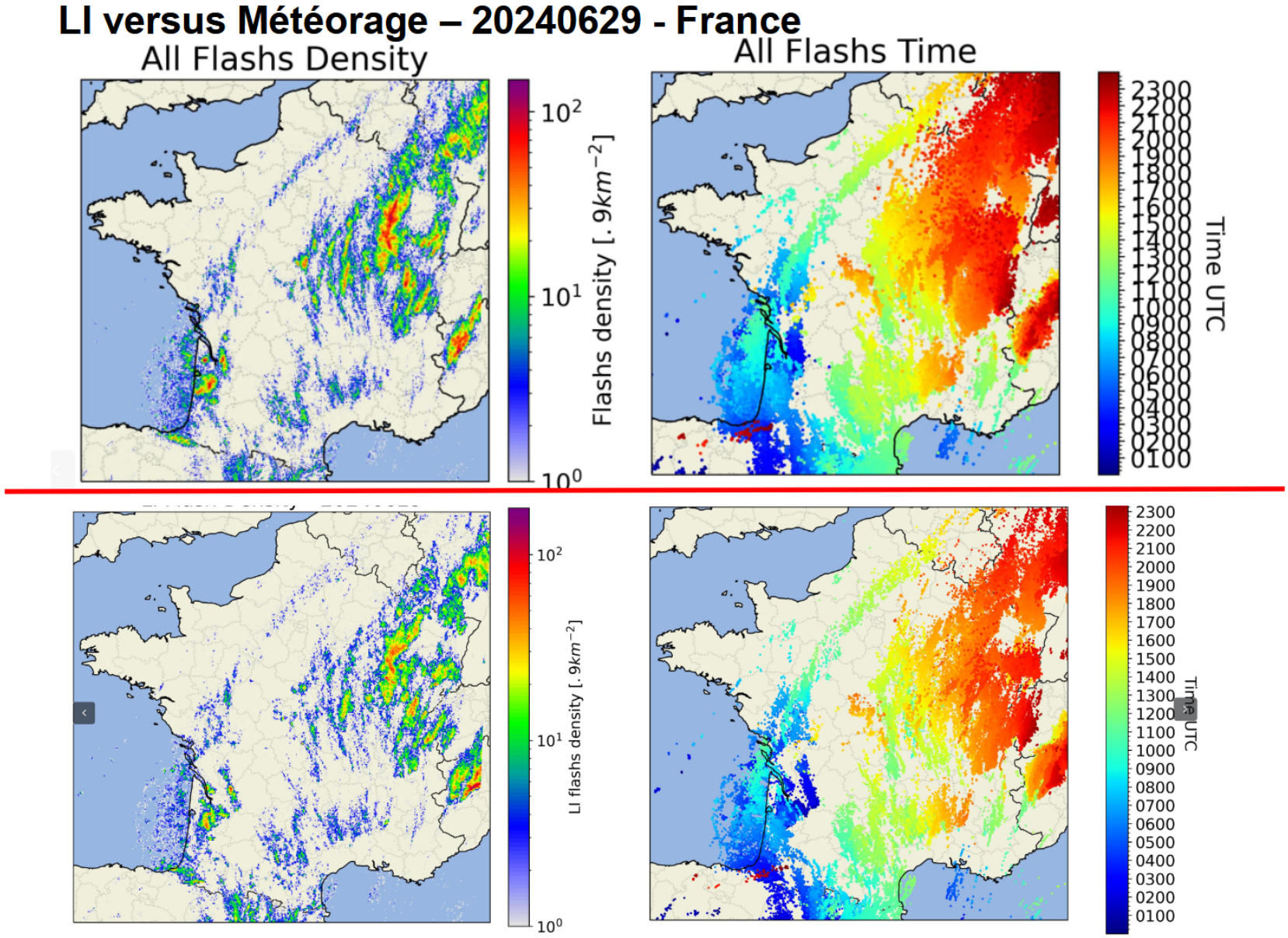


Triggering Warm

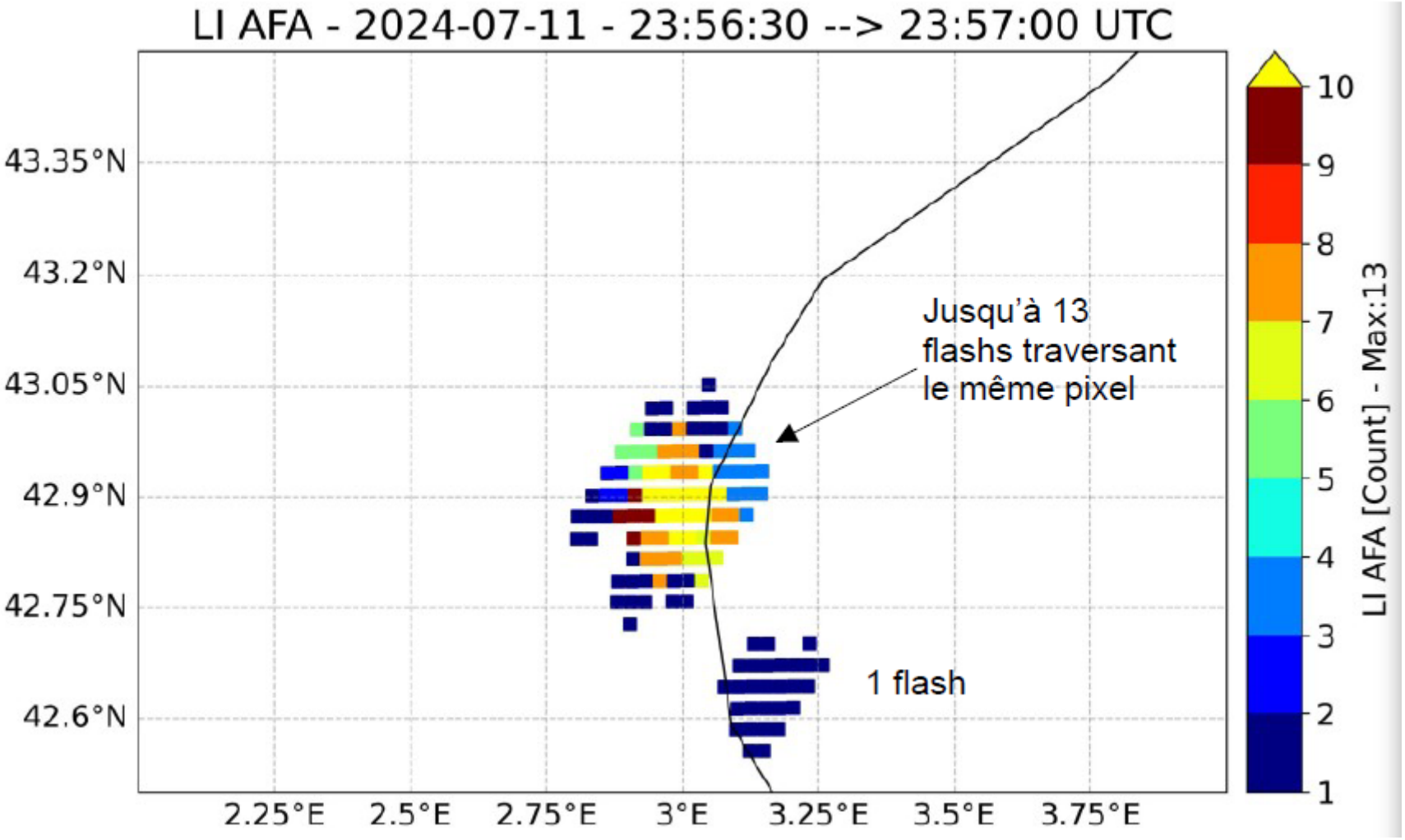
20240205 Brésil – MFA elaborated with GOES16 GLM data thresholded IR 10,5 image (blue = -35,5°C)
MFA thresholded 150km² (you only see low values, in black)

We start to use LI flashes data

Good matching LI/météorage

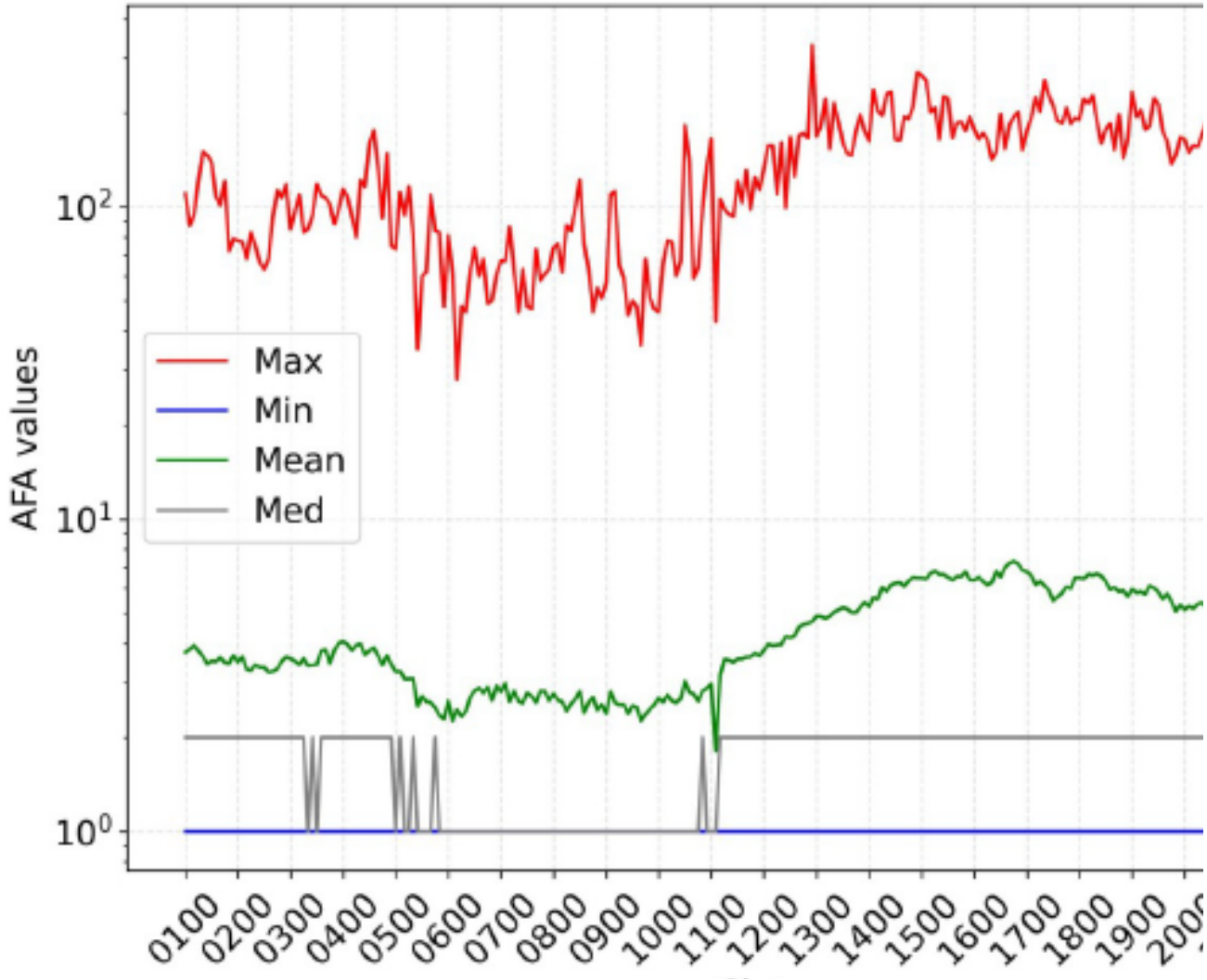


We start to use LI accumulated products, e.g. AFA



We start to use LI accumulated products, e.g. AFA

30 secondes accumulation → 5 minutes accumulation
AFA statistical values evolution 20240711, full FOV
Help to solve the question of colourbar in visualization systems



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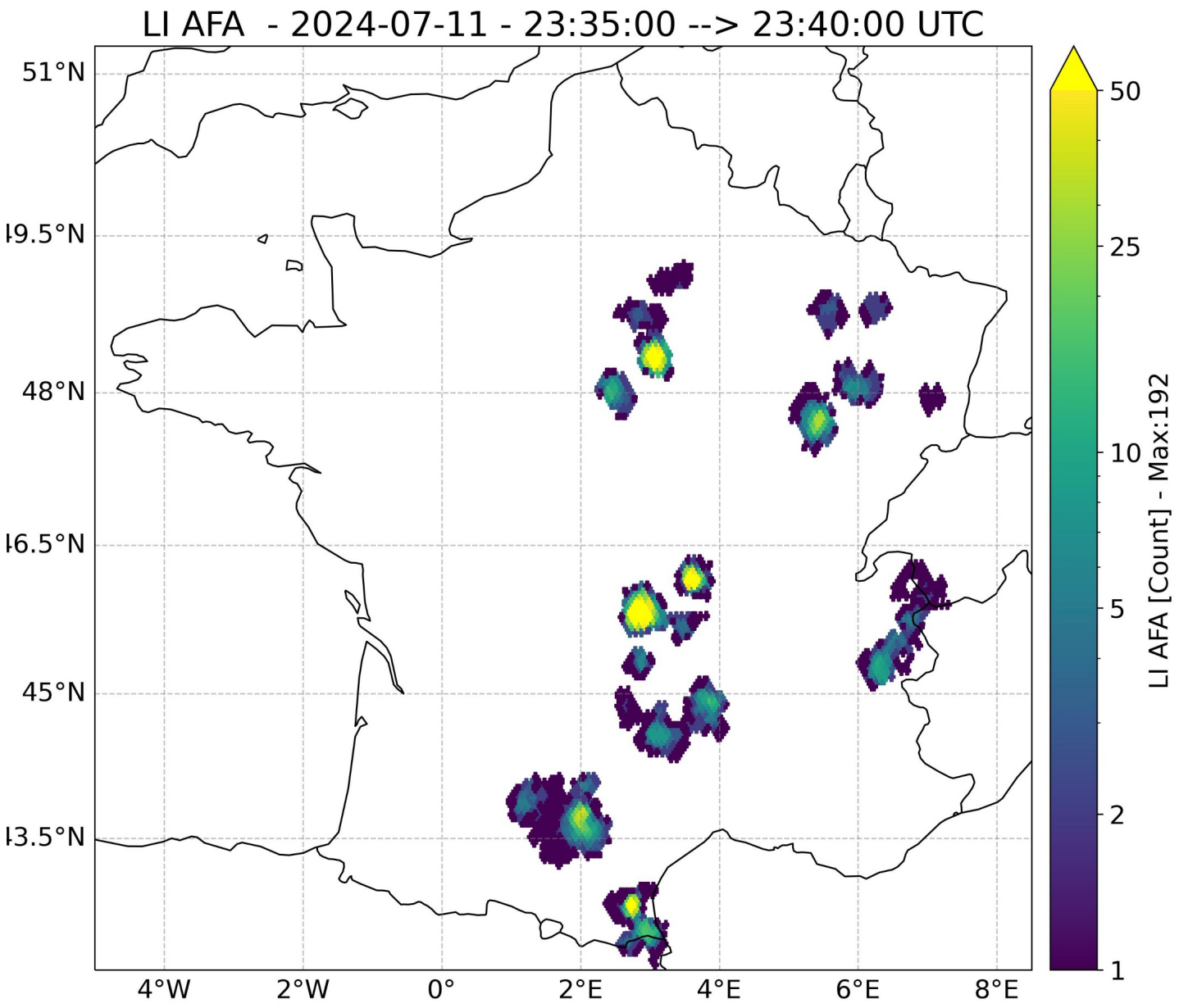
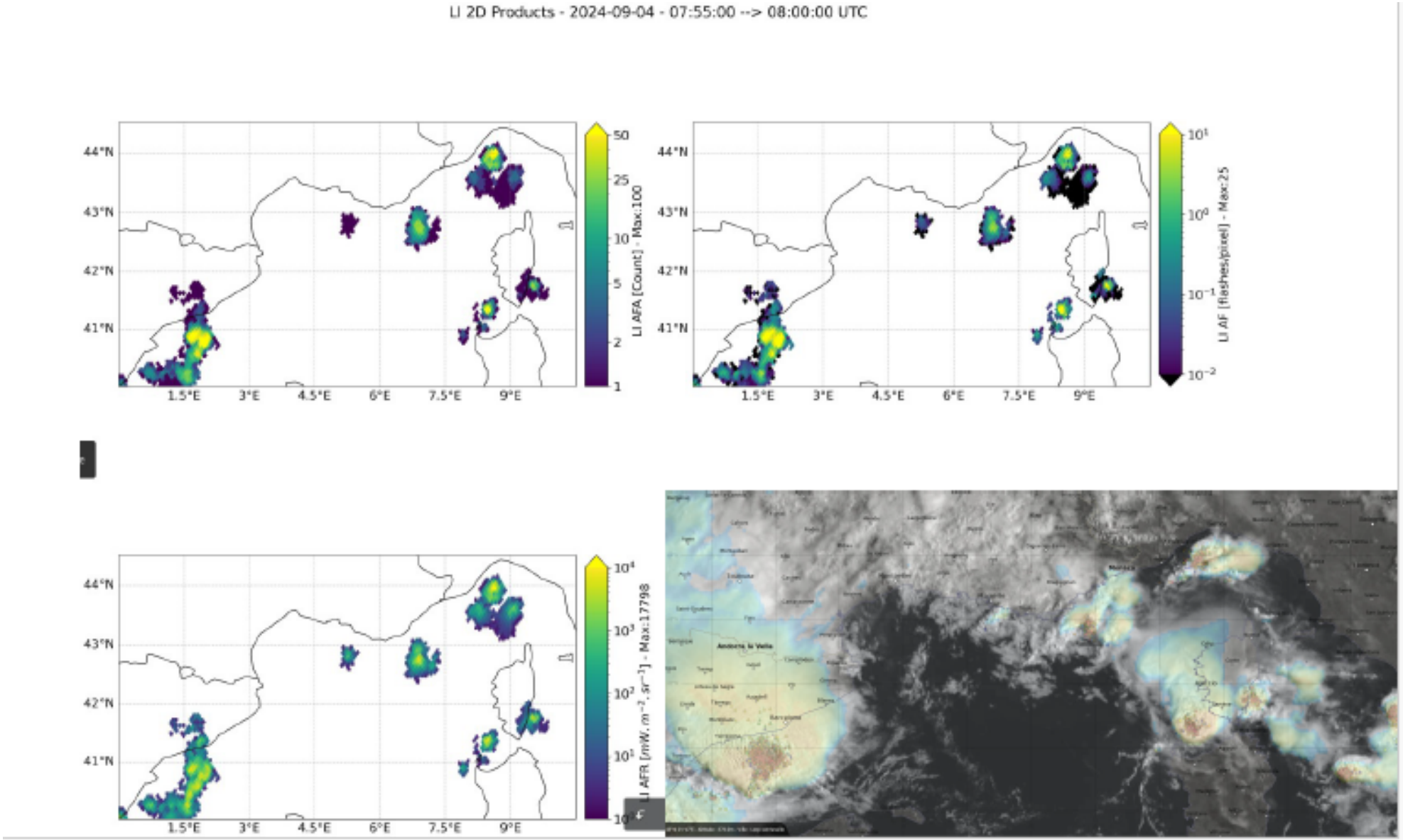


20240904 thunderstorms in the Mediterranean



AF less easy to interpret

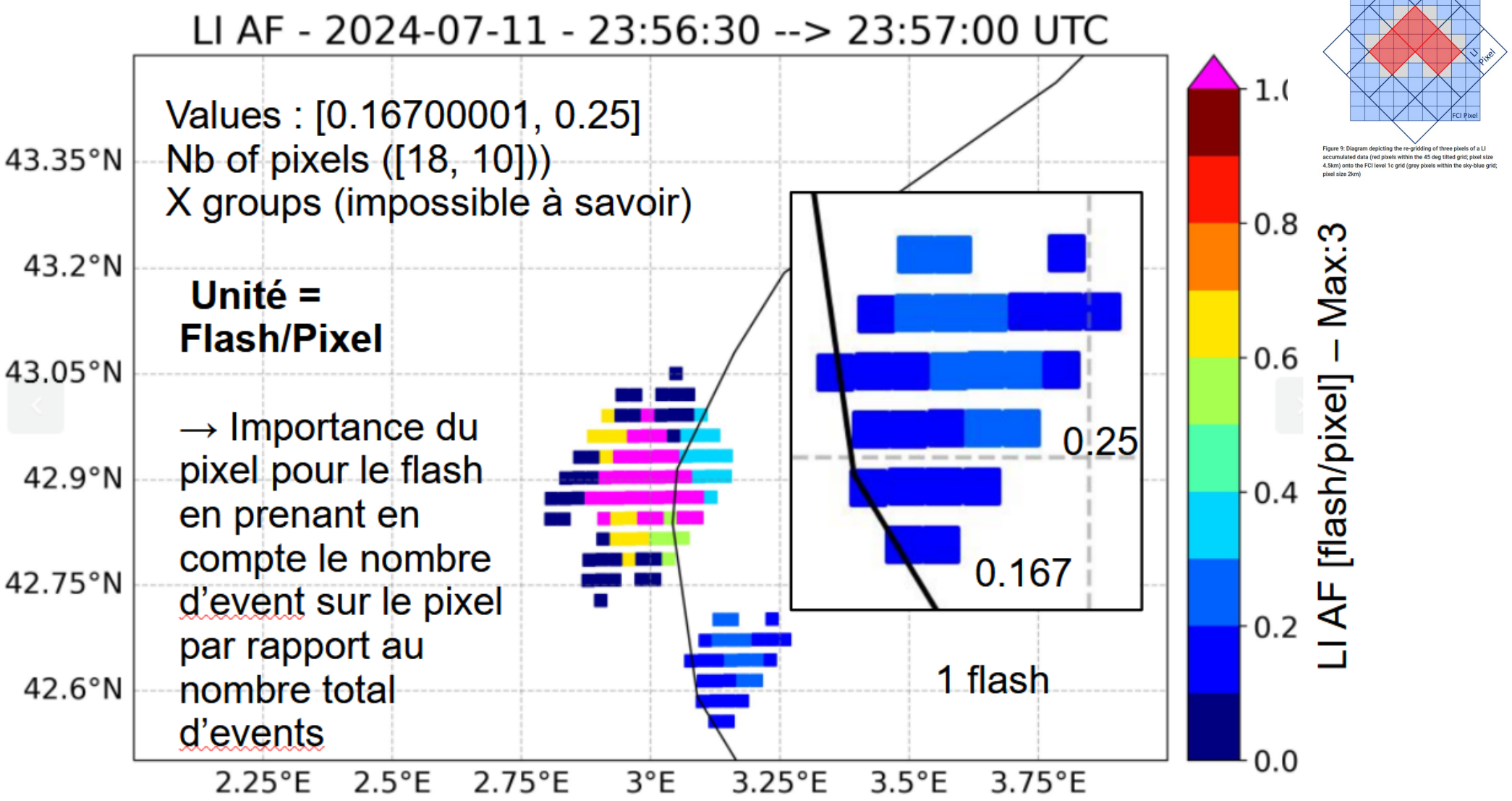


Figure 9: Diagram depicting the re-gridding of three pixels of a LI accumulated data (red pixels within the 45 deg tilted grid; pixel size 4.5km) onto the FCI level 1c grid (grey pixels within the sky-blue grid; pixel size 2km)

Vigilance Points

- Units, especially if we use both GLM data and LI data (e.g. energy vs radiance)

- Name of products, especially if we use both GLM accumulated data and LI accumulated data (e.g. AFA and FED)

- Projection

- Parallax correction: Yes/No ? How ? Especially if you overlay to other images

- FOV : especially if you overlay to other images or if you pair lightning data with other products

- Quality code. Wide used of US quality code

- Colour bar, to define

Training activities inside MF

- Product data sheet for all MF MTG-based products. EUM heritage, but in French and also for our specific production (e.g. RDT)

- Oversea territories: remote training to GLM products: *Antilles/Guyane* (GOES16) and *Polynésie* (GOES18)

- *Métropole*: LI training this Autumn 2024 (TBC), general training FCI+LI in 2025

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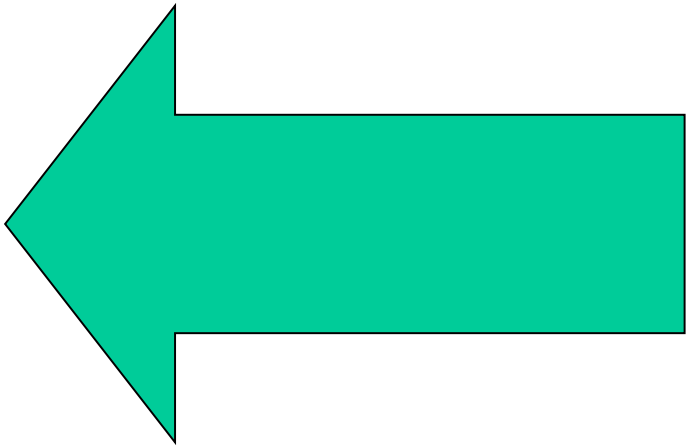


NWCSAF Products: storms monitoring at different development stages. A portfolio for convection

Courtesy NWCSAF LE

Pre-convective environment

iSHAI (imaging Satellite Humidity and Instability)

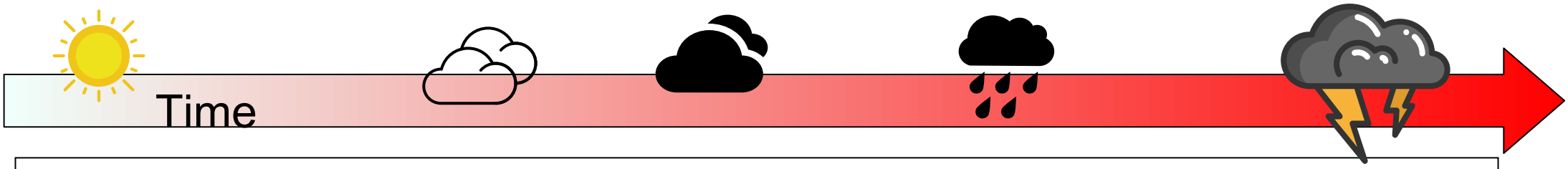
Convection Initiation

CI (convection initiation)

Developing convective storm

RDT-CW (Rapidly Developing Thunderstorm)

Precipitation products



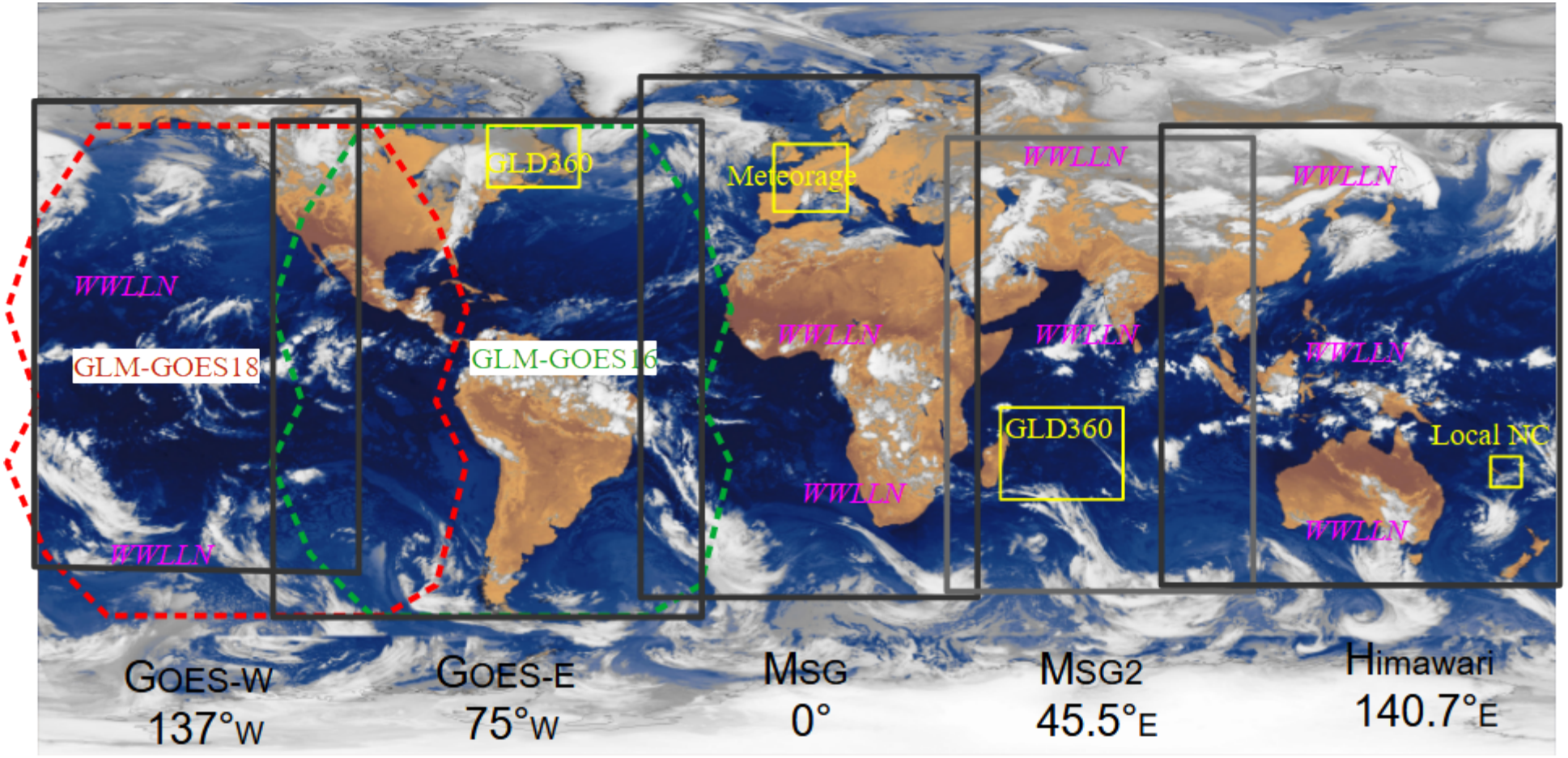
Any time
Cloud products (**CMA**, **CT**, **CTTH**, **CMIC**), High Resolution Winds (**HRW**), ASII

RDT at a glance

- Object-oriented approach, adding value to the satellite image
- A NWCSAF SW
- Current version v2021.3
- Next version v2025 (MTG Day1)

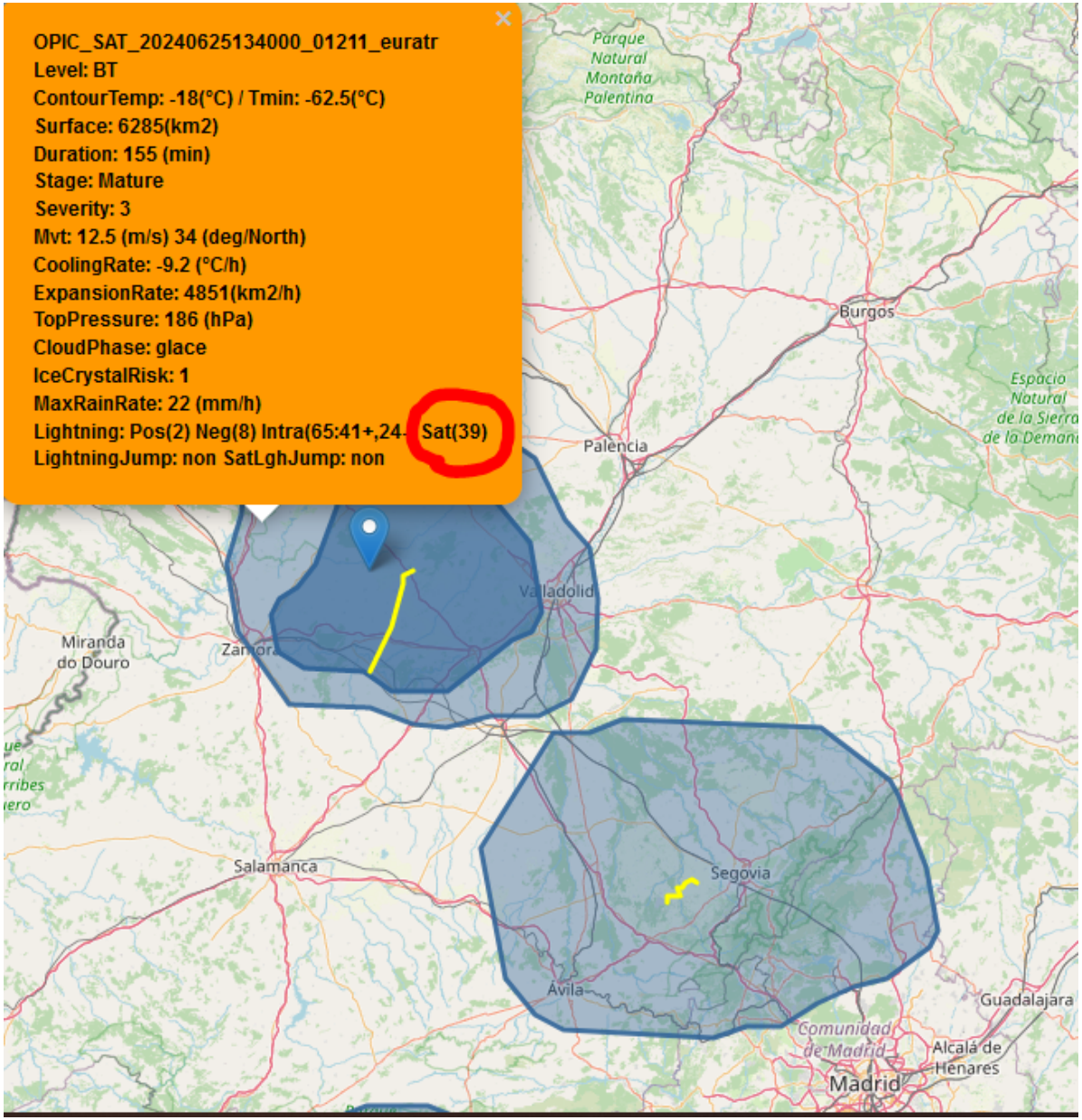
Status (EUM) =Operational

RDT global product in MF, lightning data used



NWCSAF SW allows to use ground-based lightning network and GEO sensor. In RDT-CW we use both. Of course we don't merge, for example we calculate a Lightning Jump for both

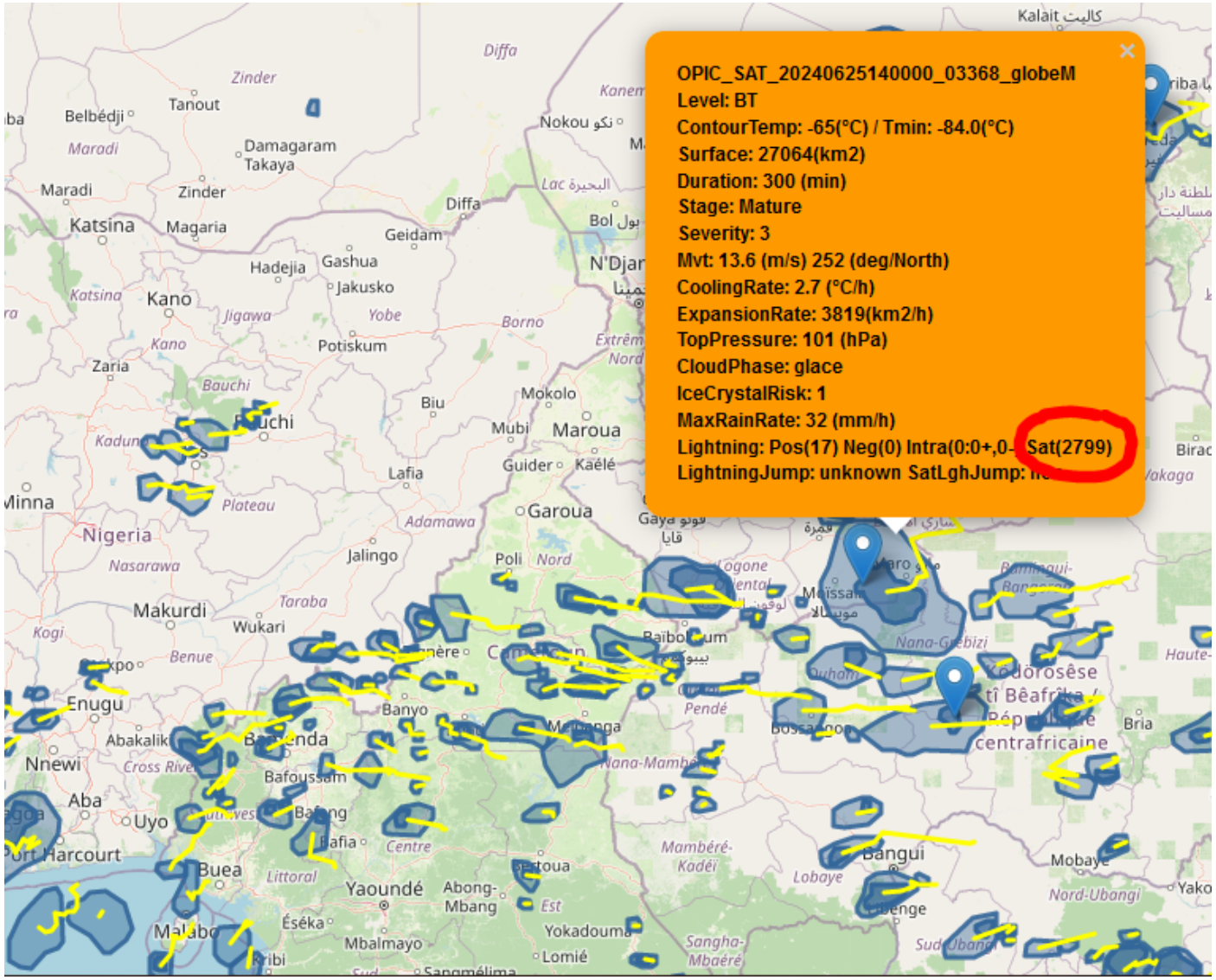
Pairing RDT and lightning data : LI and METEORAGE (over Spain)



RDT, two outlines, OT, trajectory

Lightning data paired: values of the same order

Pairing RDT and lightning data : LI and WWLLN (over Africa)

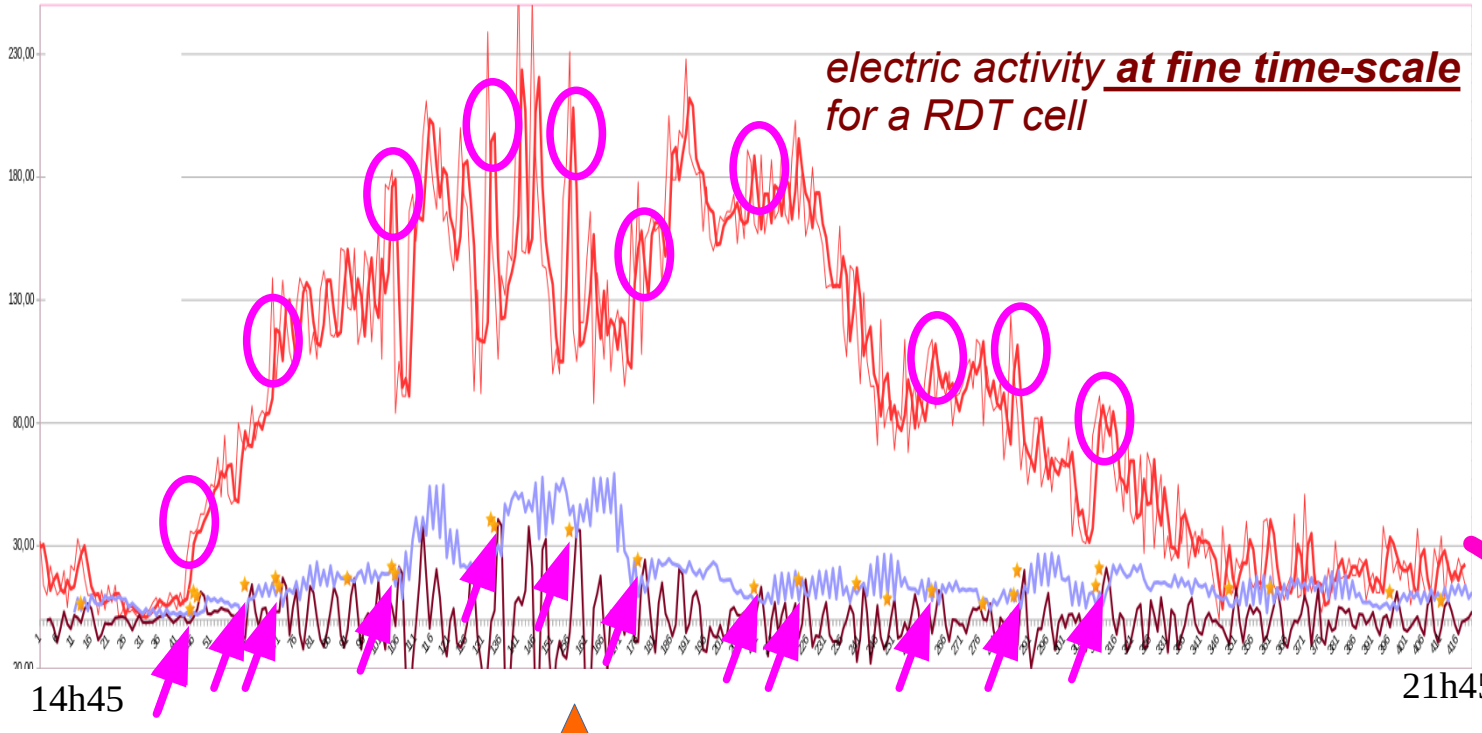


RDT, two outlines, OT, trajectory
High convective activity

Lightning data paired: values not at all of the same magnitude

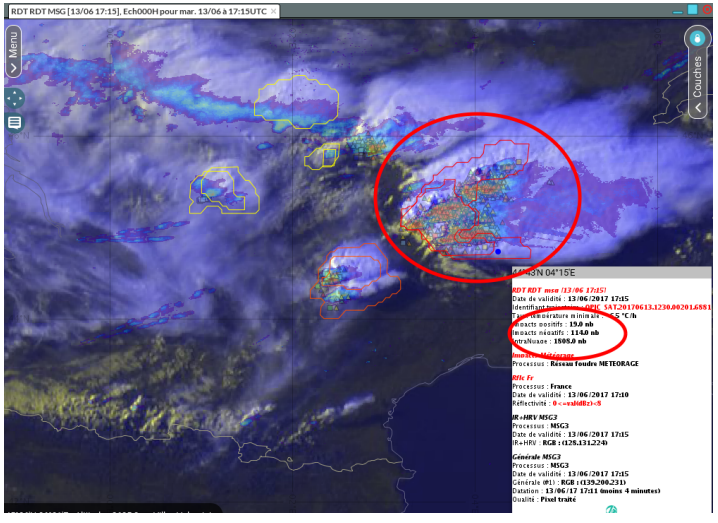
Lightning Jump diagnosis inside RDT

13/6/2017 case study - Extreme Thunderstorm in « Haute Loire » area Intense electric activity / hail event ~ 17h30Z



Lightning Jumps criteria on **amount and acceleration** of electric activity

LJ=Precursor + Proxy FOR HAIL / Severe events



About LJ and LI

Low frequency lightning network, like WWLLN are very useful for RDT.

In some places it’s the only one electric information we have (Africa before the upcoming of MTG/LI, Asia). It helps sometimes to change from « No » to « Yes » the convection diagnosis of RDT

Nevertheless the lack of detection (low POD) and error localization make the pairing RDT/Lightning sometimes hazardous.

The low POD of WWLLN makes that there is no chance to have a LJ detected with this network inside a RDT cell.

It is not the case for LI: **we will have LI-based LJ as we already have GLM-based LJ.**

About NWCSAF SW

Current version v2021.3, GLM flashes compliant

Next improvement v2025 regarding RDT: accumulated products compliance (GLM and LI), LI flashes compliance, FCI compliance, cloud products tuned with FCI.

For RDT we will transpose in Day-1 some tunings from GOES-16/ABI (it works)!. LI will help to mitigate some no-detection in real-time mode.

Once we will have accumulated several months of data we will tune RDT MTG/FCI thanks to LI data. Day-2 approach

What LI will bring to RDT ?

What is done with GLM or ground based network will also be possible with LI

- Better description, in addition to ground-based lightning network. LJ calculation in some place where it wasn’t possible (Day 1)
- Better tuning (Day 2)
- Better real-time mode (Day 1)
- Better validation (Day 1 / Day 2)

A crucial issue will be solved: validation and tuning of RDT over Africa (Day 2)

Conclusion

- LI data usefulness:
  * Available at higher rate of FCI: useful for convection that develops rapidly
  * Clear added value to radiometer for convection: small flashes in triggering systems, large and high flashes in mature systems
  * Clear added value to NWCSAF RDT Convection product
  * Accumulated products useful to resume, especially AFA. LI/MFA would be very interesting

- A certain complexity (partly due to the innovation) : importance of training, documentation

- Not shown : NWCSAF CI validation, improvement of some radar-based products (after blending), validation of some NWP diagnosis and furthermore data assimilation

Thanks for your attention