

# MTG-I1 Lightning Imager NWC SAF Products: overview, algorithm and its applications

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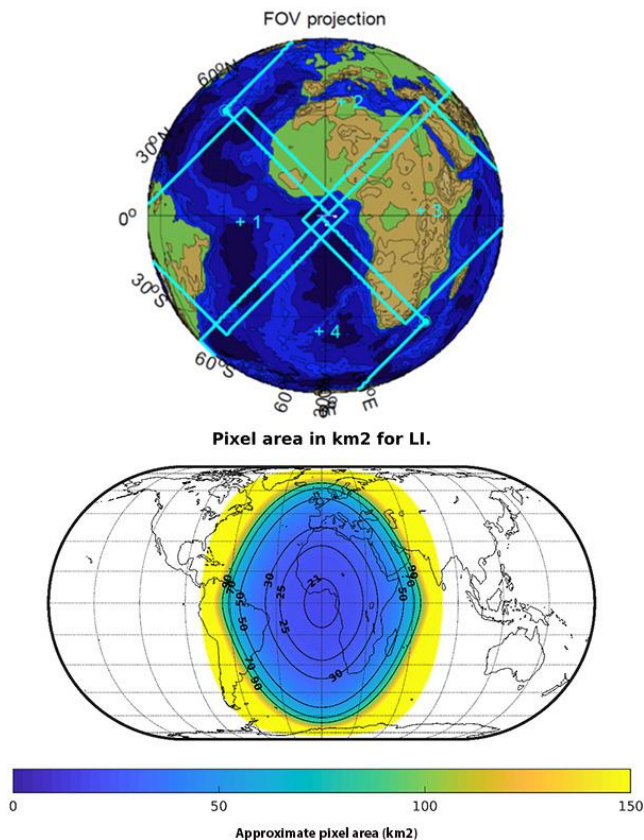


**NWC SAF GEO-LI Software**

**NWC SAF GEO-LI Products Developed**

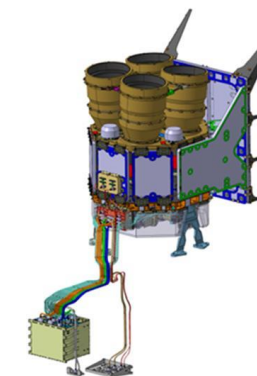
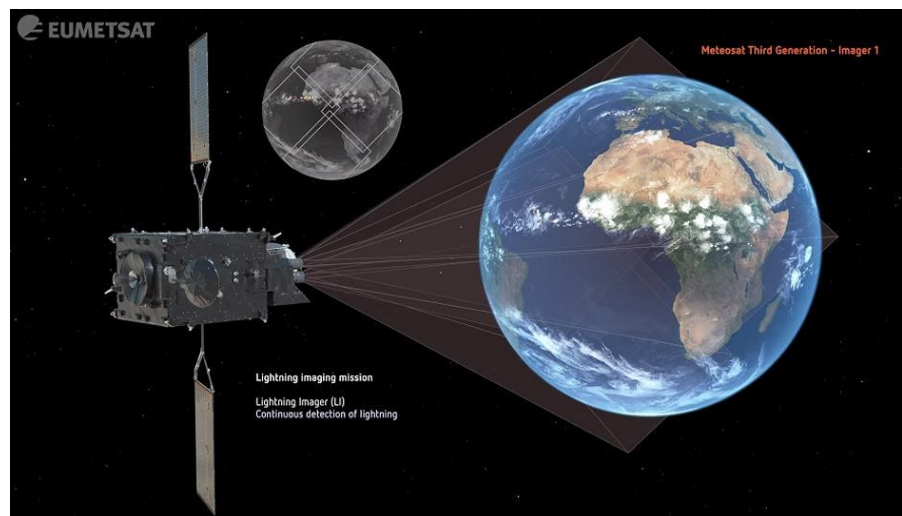
**Conclusion and Future Aspects**

- The GEO-LI package must deal with new satellite data having different spatial, temporal and spectral resolutions than the currently single supported FCI data.
- The new products, LiJump and LiStack, will be part of the new software package, GEO-LI.



*Shows how each optical camera observes a different portion of the Earth disc: the required FOV coverage for the mission is 84% of the Earth disc observable from the 0° longitude geostationary position, and 100% of the territories of all the EUMETSAT member states.*

- ❑ is an imaging filter spectrometer with on-board data processing for detecting lightning by measuring the lightning optical pulse signal from the top of the atmosphere;
- ❑ The so-called LI Optical Head (LOH) includes four identical optical cameras (OC). Each OC is composed of a baffle for stray light, an optical system, a focal plane assembly with a 1000×1170 pixels CMOS detector and front-end electronics, including the real-time pixel processors for the on-board processing;
- ❑ Spectral band: narrowband filter centered over the neutral oxygen triplet at 777.4nm with 1.9nm bandwidth;
- ❑ Spatial sampling: the sampling at sub-satellite point is 4.5km, ie, smaller than typical dimensions of optical pulses expected from lightning activity, while over central Europe it is about 7 km.
- ❑ Temporal sampling: the integration time of 1ms period is comparable to the typical duration of pulses and twice the duration of the 'peak phase' (ie, about 0.5ms).



*A 3D representation of the Lightning Imager Instrument.*



- The LiJump is a future NWC SAF product, developed to detect small, short-duration discharges associated with the most rapid fluctuations in flash rate. It can help identify storms that may produce severe weather (including tornadoes, hail, and straight-line winds) in the short term. LiJump will use EUMETSAT L2 MTG-I LI lightning flashes (LFL) product to track storm “cells” directly from the LI observations and to detect rapid increases in lightning activity (“lightning jumps”), which are often linked to severe weather within the next 60 minutes.
- This new product only relies on LI data. Due to the faster refresh cycle of the LI data with respect to FCI, it is expected that the LiJump will provide a larger lead time to forecasters.
- The workflow is based on quality control and aggregation of flash observations into short, regular time intervals. At each time step, clustering is performed using the DBSCAN algorithm with predefined thresholds, designed to capture both intense storms and weaker storms that may be predisposed to becoming severe. Finally, the identified cells are linked through time to form continuous tracks, and cases exhibiting lightning-jump behavior are flagged.



class Thresholds:

# Strong LJ thresholds ( $\sigma$ -LJ / FRarea-LJ / RIL-LJ)

- s\_sigma: float = 2.0
- s\_activation\_fr: float = 20.0 - **minimum flash rate (FR) for strong LiJump**
- ril\_threshold: float = 1.1 - **relative increase threshold**
- ril\_activation\_fr: float = 20.0 - **minimum flash rate for relative increase level (RIL) LiJump**

# Weak Lightning Jumps

- w\_sigma: float = 1.0
- w\_activation\_fr: float = 10.0 - **minimum flash rate for weak LiJump**

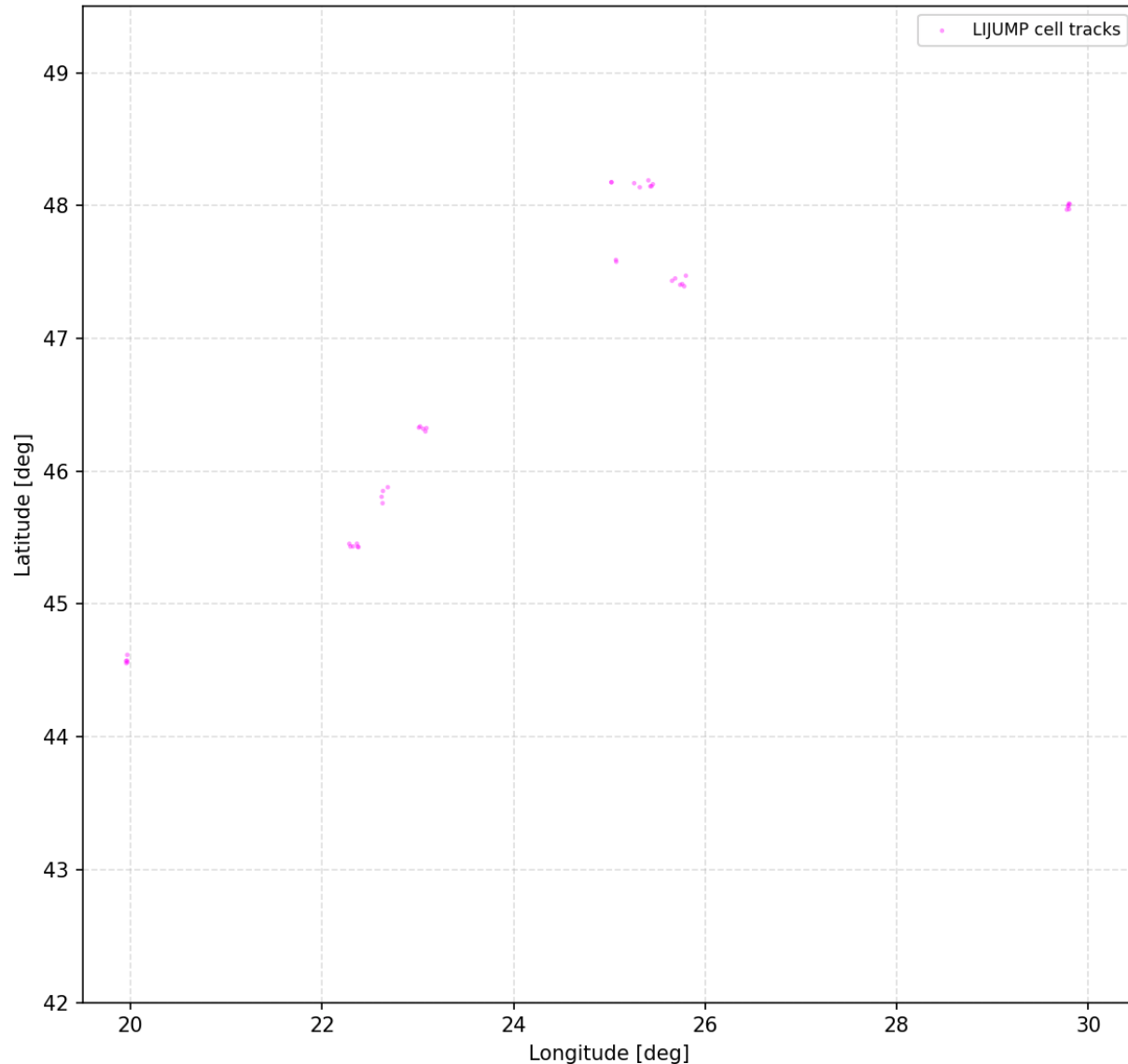
# Minimum lifetime / tracking constraints

- min\_track\_len: int = 4 - **minimum lifetime of a valid tracked cell**
- max\_gap: int = 2 - **maximum allowed temporal gap in the storm track**



- A verification over Romanian territory had been made, having all the data available for the LINET, to make the verification for the 32 study cases happened over the convective season May - September 2025. The data that had been proceeds as the input for the LiJump algorithm, of over 3000 files per month for Lightning flashes (LFL) available on Data Store at every 10 minutes. Need to be mentioned that it is not an accumulation and is the total of all the events happened over a specific time slot.
- Based on MeteoRomania's monthly hail logs for the selected period, hail was reported in 286 locality entries across Romania (these are locality-level observations, not necessarily unique storms). May 2025 with the most hailstorms - 92 reports with frequent hail episodes spanning many regions. Several of the largest hail sizes occurred early in the month in SW Romania, including hail up to 7 cm and multiple cases around 6 cm. June 2025 - 35 reports but includes one of the season's extremes: 8 cm hail on 6 June. July 2025 - 77 reports and features a major outbreak on 27 July, especially in Suceava, where multiple localities recorded very large hail up to 8 cm with several additional cases around 7 cm the same day. August 2025 totals 62 reports, dominated by a widespread event on 22 August affecting many counties. The month's maximum hail size reaches 7 cm. September 2025 was a relatively low-activity month, with 20 hail reports recorded across Romania. Most events occurred during a single widespread outbreak on 8 September.
- It was observed a matching of LiJump results and LINET over 85% .

LIJUMP (strong & weak) vs LINET over Romania  
2025-07-27 13:50 – 2025-07-27 13:55 UTC



Suceava District:  
Approximate center: 47°35' N, 25°46' E.  
Northern boundary: 47°57'31" N.  
Southern boundary: 47°04'33" N.  
Western boundary: 24°57' E.  
Eastern boundary: 26°40' E.

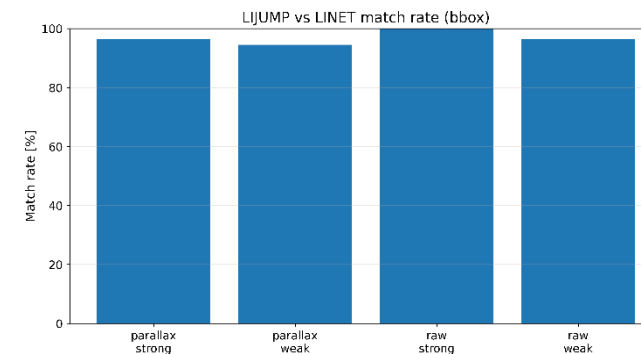
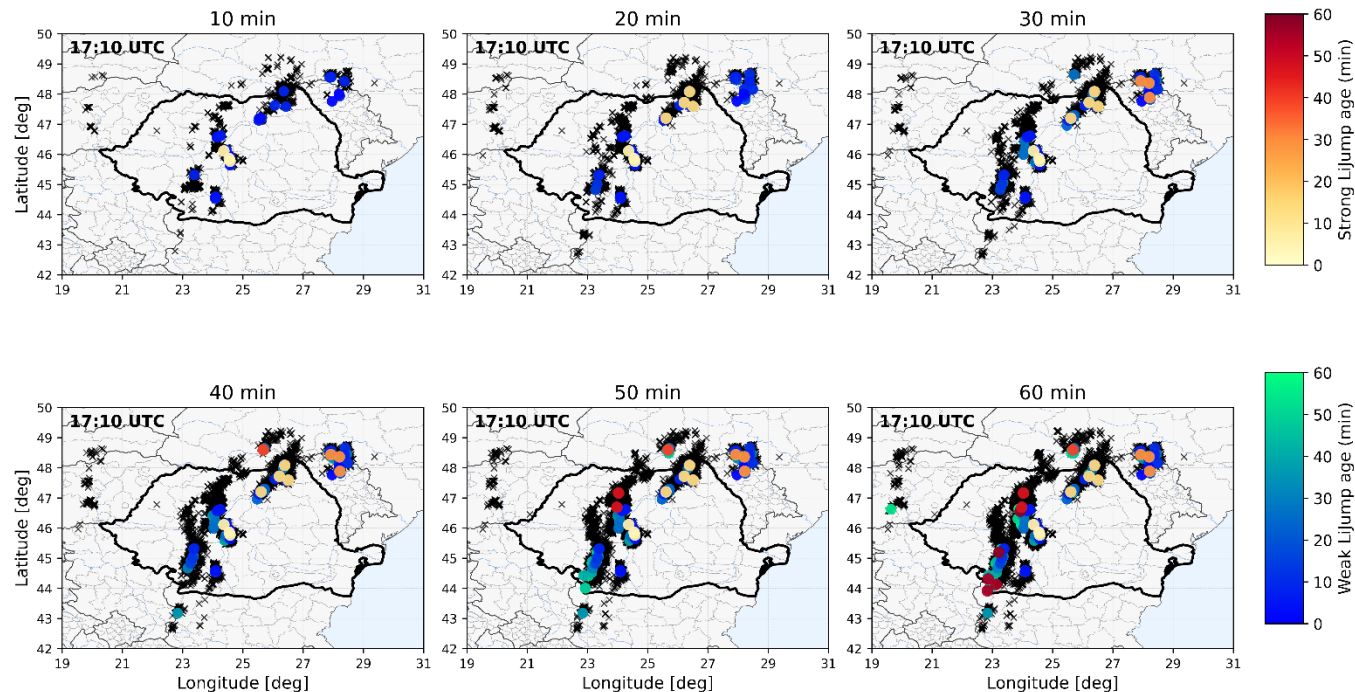
|    |            |                  |              |         |         |         |     |    |                                  |
|----|------------|------------------|--------------|---------|---------|---------|-----|----|----------------------------------|
| 51 | 27.07.2025 | Adâncata         | Adâncata     | Suceava | 47.7350 | 26.2897 | 7.0 | -  | Severe Weather Alert România     |
| 52 | 27.07.2025 | Broșteni         | Broșteni     | Suceava | 47.2378 | 25.6963 | 2.5 | Nu | Furtuni România                  |
| 53 | 27.07.2025 | Bucureasa        | Dănești      | Gorj    | 44.9983 | 23.3146 | 1.0 | Da | Oltenia Weather Alert            |
| 54 | 27.07.2025 | Bumbesti-Jiu     | Bumbesti-Jiu | Gorj    | 45.1778 | 23.3803 | 0.5 | -  | Oltenia Weather Alert            |
| 55 | 27.07.2025 | Calafat          | Calafat      | Dolj    | 43.9849 | 22.9460 | 0.6 | Nu | MeteoRomania                     |
| 56 | 27.07.2025 | Călimani         | Călimani     | Suceava | 47.0979 | 25.2462 | 1.8 | Nu | MeteoRomania                     |
| 57 | 27.07.2025 | Cornești         | Bălești      | Gorj    | 44.9948 | 23.1445 | 0.3 | -  | Oltenia Weather Alert            |
| 58 | 27.07.2025 | Dănești          | Dănești      | Gorj    | 44.9723 | 23.3181 | 1.5 | Da | Oltenia Weather Alert            |
| 59 | 27.07.2025 | Dărmoxa          | Broșteni     | Suceava | 47.1864 | 25.5339 | 5.0 | -  | European Severe Weather Database |
| 60 | 27.07.2025 | Drăgoieni        | Târgu Jiu    | Gorj    | 45.0420 | 23.3389 | 0.7 | -  | Oltenia Weather Alert            |
| 61 | 27.07.2025 | Dumbrăveni       | Dumbrăveni   | Suceava | 47.6594 | 26.4247 | 1.0 | Nu | Meteoplus                        |
| 62 | 27.07.2025 | Frasin           | Frasin       | Suceava | 47.5398 | 25.7906 | 7.0 | -  | European Severe Weather Database |
| 63 | 27.07.2025 | Găinești         | Slatina      | Suceava | 47.4139 | 25.9121 | 1.0 | -  | Meteoplus                        |
| 64 | 27.07.2025 | Luduș            | Luduș        | Mureș   | 46.4744 | 24.0954 | 0.3 | Nu | Furtuni România                  |
| 65 | 27.07.2025 | Neagra           | Broșteni     | Suceava | 47.2221 | 25.6899 | 5.0 | -  | Severe Weather Alert România     |
| 66 | 27.07.2025 | Padeș            | Padeș        | Gorj    | 45.0200 | 22.8561 | 0.8 | Nu | Oltenia Weather Alert            |
| 67 | 27.07.2025 | Ruși-Mănăstioara | Udești       | Suceava | 47.5909 | 26.3782 | 1.0 | Nu | Furtuni România                  |
| 68 | 27.07.2025 | Salcea           | Salcea       | Suceava | 47.6528 | 26.3672 | 3.5 | -  | Severe Weather Alert România     |
| 69 | 27.07.2025 | Șaru Dornei      | Șaru Dornei  | Suceava | 47.2904 | 25.3684 | 4.0 | -  | Severe Weather Alert România     |
| 70 | 27.07.2025 | Stulpicani       | Stulpicani   | Suceava | 47.4575 | 25.7629 | 7.0 | -  | Furtuni România                  |
| 71 | 27.07.2025 | Suceava          | Suceava      | Suceava | 47.6329 | 26.2405 | 0.6 | Nu | MeteoRomania                     |
| 72 | 27.07.2025 | Urdari           | Urdari       | Gorj    | 44.8054 | 23.2899 | 6.0 | Nu | Oltenia Weather Alert            |
| 73 | 27.07.2025 | Vadu Negrișei    | Stulpicani   | Suceava | 47.3866 | 25.8378 | 8.0 | -  | Severe Weather Alert România     |



# 27 July 2025, hailstorm

**Lijump**  
base: 2025-07-27 17:10 UTC

× LINET



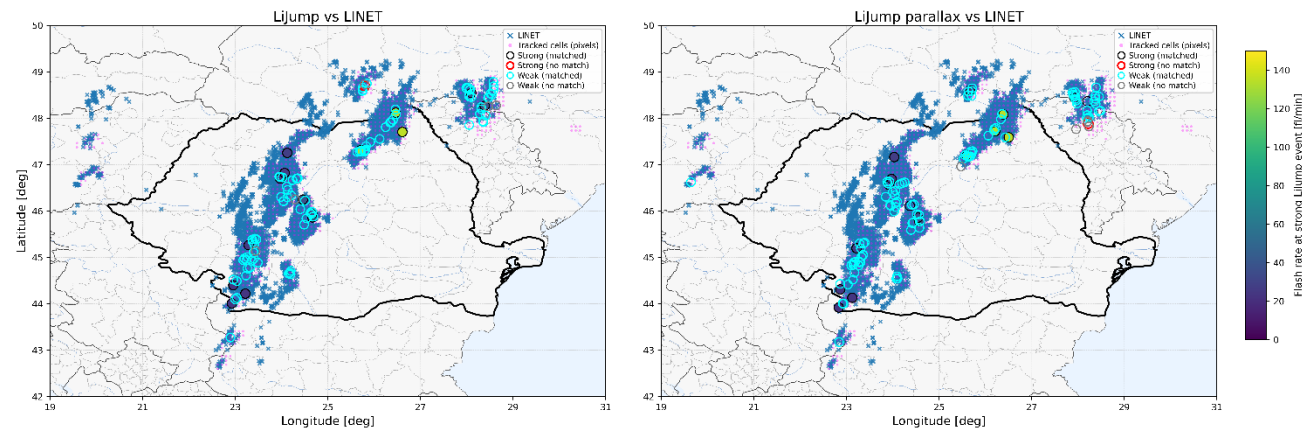
raw - strong: 100.00% (25 / 25)

raw - weak: 96.46% (109 / 113)

parallax - strong: 96.55% (28 / 29)

parallax - weak: 94.50% (103 / 109)

Lijump vs LINET | 2025-07-27 16:10 - 2025-07-27 17:10 UTC | parallax\_applied\_for\_detection=1





# 17 July 2025, Nowcasting Red Alarm over Bucharest

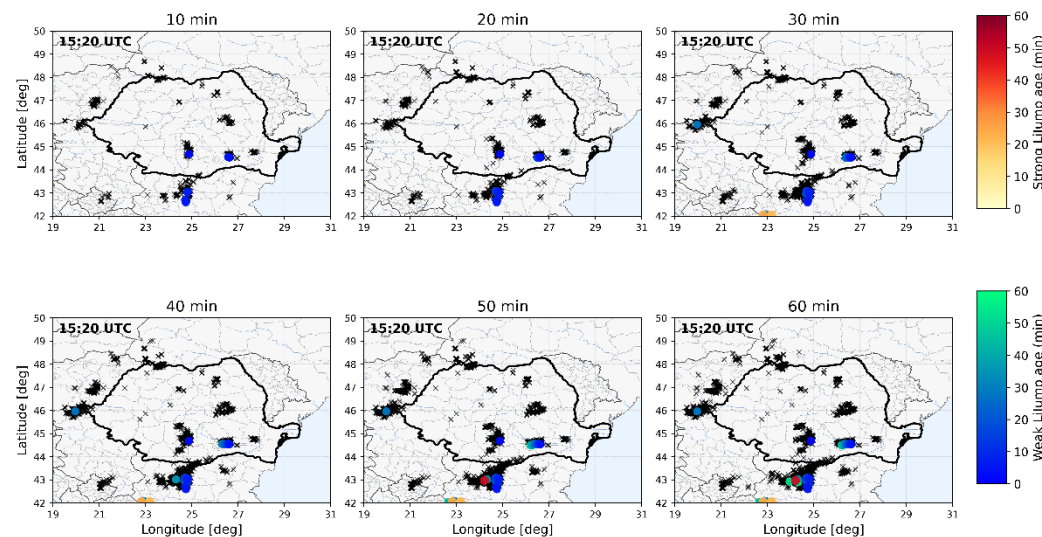
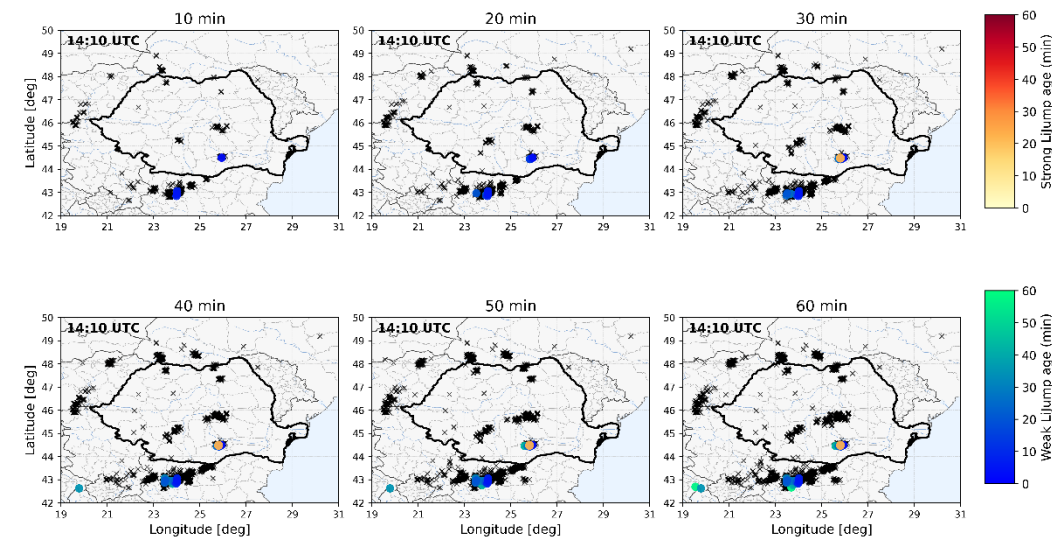


EUMETSAT  
**NWCSAF**

[nwc-saf.eumetsat.int](http://nwc-saf.eumetsat.int)

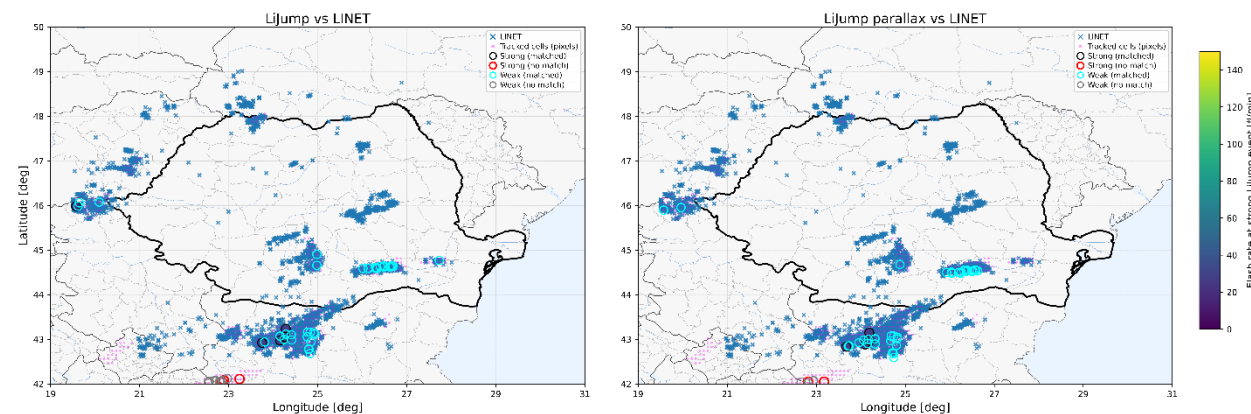
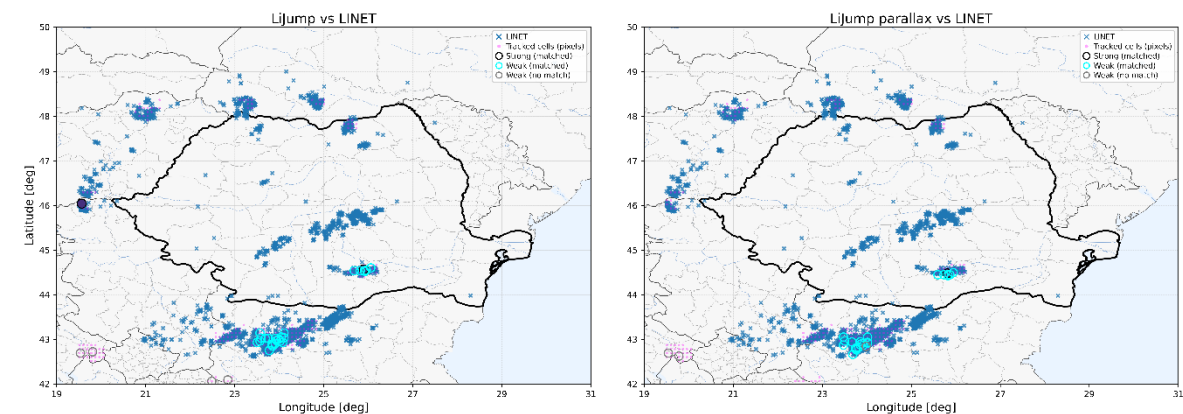
**Lijump**  
base: 2025-07-17 14:10 UTC  
X LINET

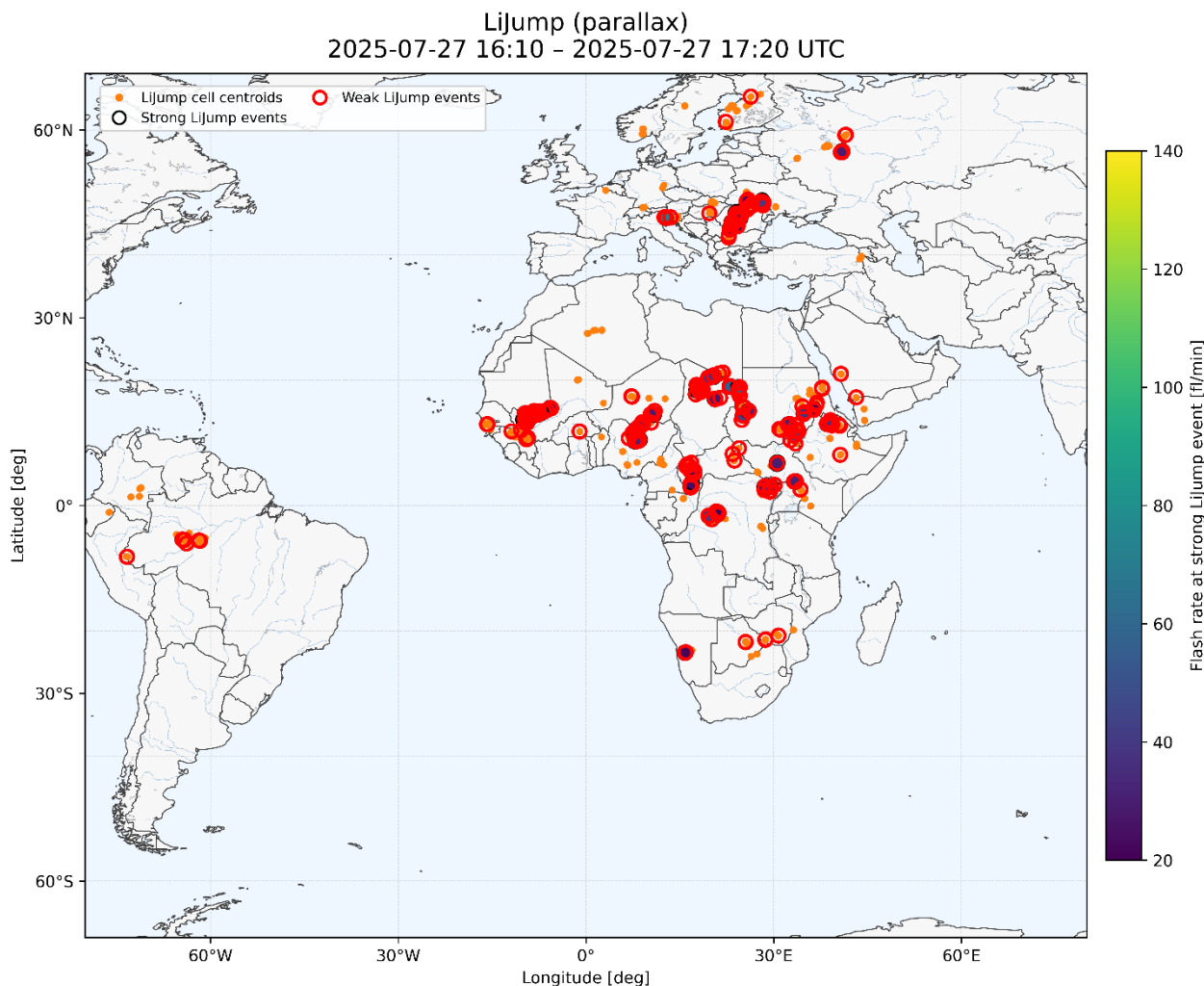
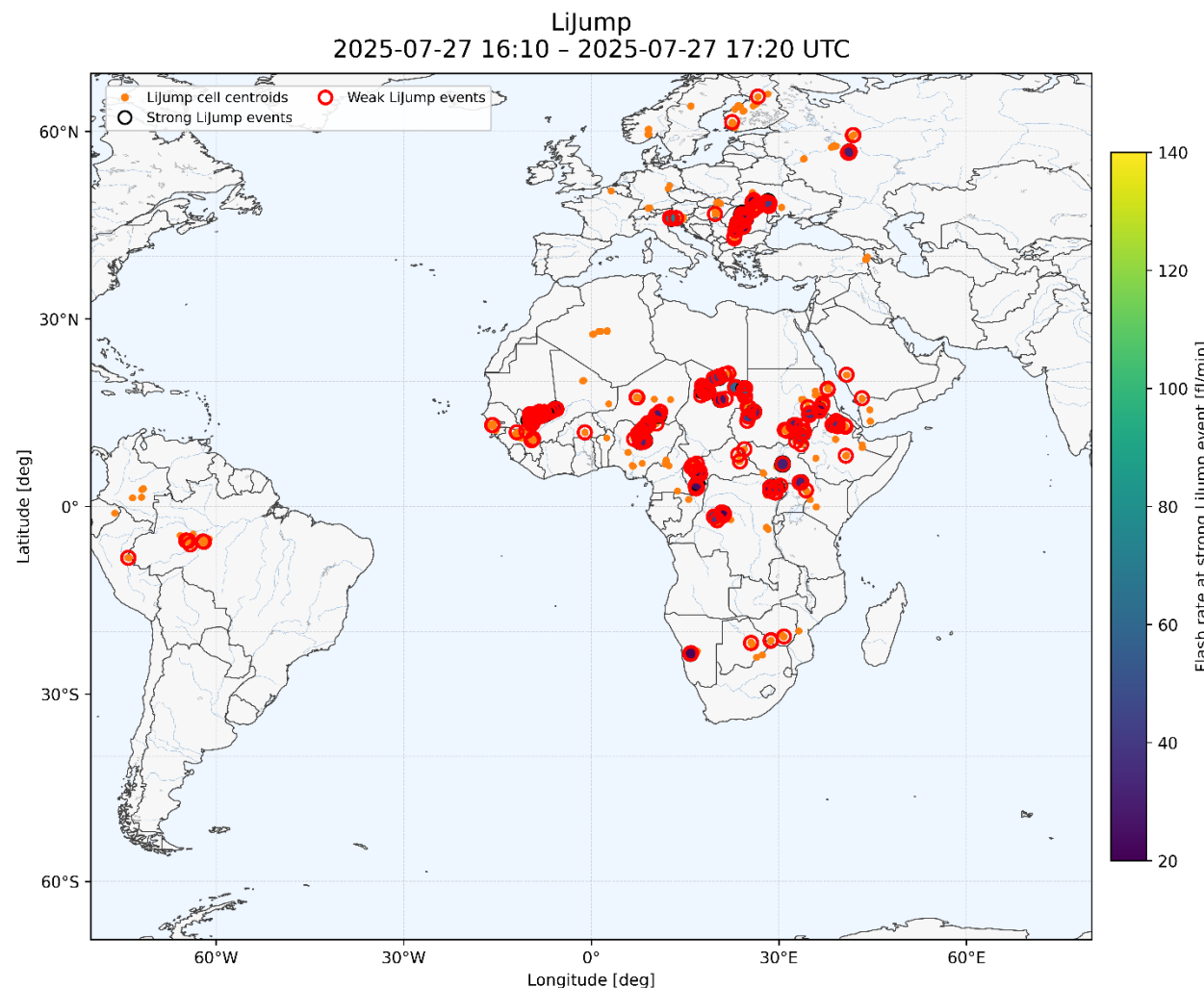
**Lijump**  
base: 2025-07-17 15:20 UTC  
X LINET



Lijump vs LINET | 2025-07-17 12:50 - 2025-07-17 14:10 UTC | parallax\_applied\_for\_detection=1

Lijump vs LINET | 2025-07-17 14:00 - 2025-07-17 15:20 UTC | parallax\_applied\_for\_detection=1





This parallax correction for this product can be applied using a climatology-driven parallax engine using monthly NetCDF look-up tables (LUTs) (e.g., PX\_May\_2005\_2018\_MK\_res1.nc) and improves it with time interpolation, multi-neighbour weighting, and an ice-cloud preference.

- Based on the 2025 season analyzed over Romania territory, May 2025 was the most active hail month (92 locality reports), followed by July (77 reports) and August (62 reports), while June showed fewer cases (35 reports) but included one of the most extreme events of the season (8 cm hail at Leghin, Neamt).
- Study case: July 27 represents a particularly intense situation with multiple 7-8 cm hail reports in Suceava County. August 22 was another extensive episode, affecting several counties with hail sizes reaching 7 cm (Brasov).
- What was observed:
  - Peak flash rates exceeded 80–110 flashes per minute in tracked cells, with pronounced positive  $dFR/dt$  values surpassing the dynamic sigma-based thresholds;
  - Strong LiJump flags were frequently observed 10-30 minutes prior to the peak hail reports.
  - The area-normalized flash-rate metric ( $FR/km^2$ ) also showed abrupt increases during these periods, suggesting robust updraft intensification and vigorous mixed-phase microphysics. For example, during the 27 July 2025 Suceava outbreak (13:50-18:50 UTC), the LiJump algorithm identified multiple tracked cells exhibiting sustained high flash rates (more than 90 fl/min) and significant lightning jumps.

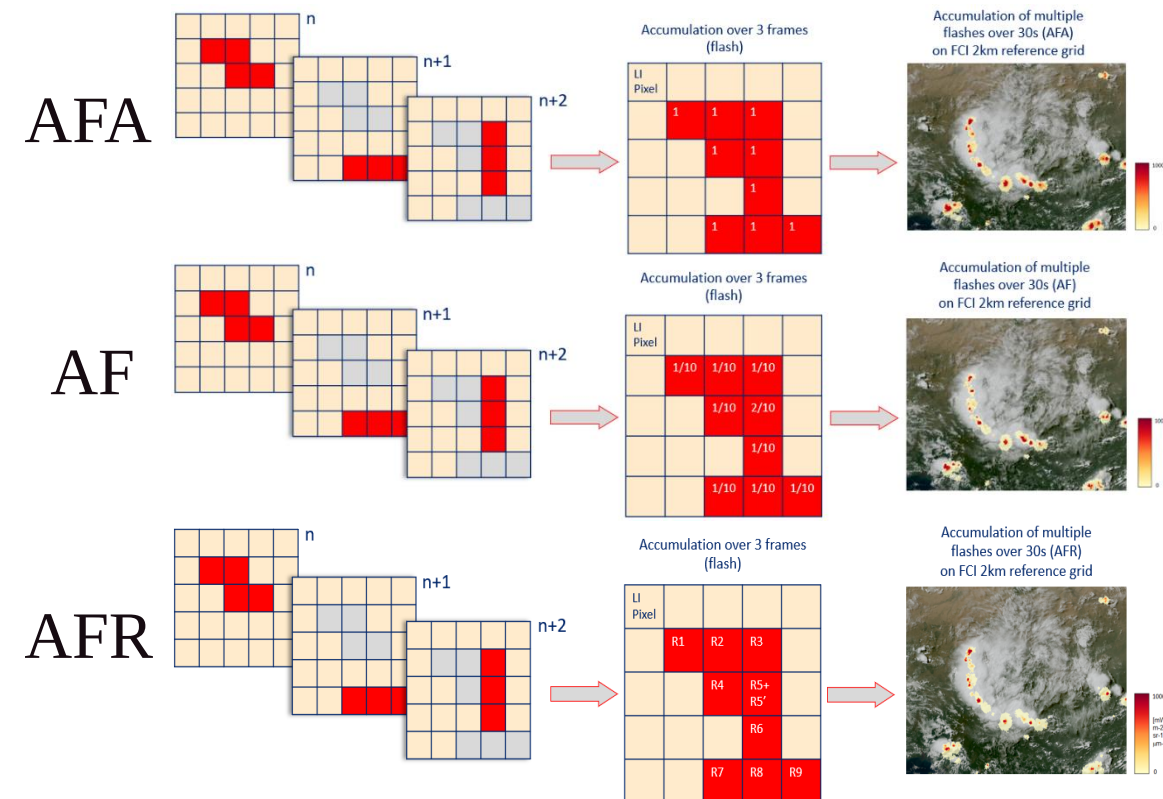


- examining cases associated predominantly with small hail (0.3-1.5 cm). Several study cases (e.g., 3 June 2025, 6 August 2025, and early September localized events) included reports of small hail (0.3-1 cm) without extensive severe impacts. In these events, LiJump signals were often weaker or absent. Flash rates typically remained below 30-40 fl/min, and in some instances the dFR/dt escalation did not exceed the dynamic threshold required for a strong LiJump flag. Weak LJ or moderate RIL signals were sometimes present, but these were less consistent.
- improvement of the algorithm and implementation of a new threshold range for the weak LiJump (can be also called potentially into development strong LiJump) for the flash rate lower than the one for strong LiJump.

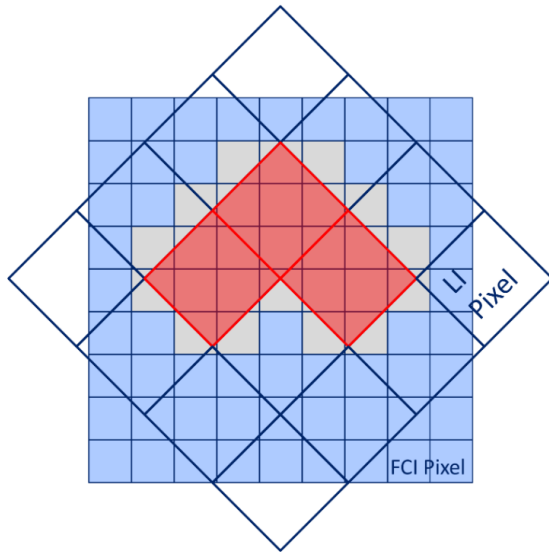


- This product can accumulate lightning data over a user configurable period of time with a longer accumulation period than the original EUMETSAT MTG-I/LI gridded EUMETSAT L2 accumulated products which is 30 seconds, and provide information grouped on the MTG-I/FCI infrared FCI 2km grid for Accumulated flashes (AF), Accumulated Flash Radiance (AFR) and Accumulated Flash Area (AFA).
- The user will be able to configure the software to define the accumulation time period and the time update. At the same time, if the user would like to correlate or to compare the LiStack products with the ground-station data a, a parallax correction will be available and configurable by the user. This correction can be applied using the NWC SAF GEO-I Cloud-Top Temperature and Height (CTTH) product.
- In addition, the configuration file allows the user to select a fixed altitude (a constant value in km) to be used when CTTH files are missing, invalid, or when the user specifically prefers to use this option instead.

- ❑ Lightning flashes-LFL
- ❑ Lightning groups-LGR
- ❑ Accumulated Flash Area (AFA)
  - provides information about the area covered by the optical emission of each lightning strike.
- ❑ Accumulated Flashes (AF)
  - it complements AFA by providing information about the variation in the number of events in an area of interest where lightning activity has been observed.
- ❑ Accumulated Flash Radiance (AFR)
  - it provides information about the pixel-by-pixel variation of accumulated optical emissions over a 30-second period.



Graphical representation of the accumulation of lightning events, contributing to AFA, AF, and AFR. On the left, we have different groups that make up the lightning event and its representative acquisition frame, where the gray shows the accumulated events up to the accumulation degree, and the red indicates the events added to the accumulation at each frame. On the right, we have the final result of the accumulation.



*The diagram illustrates the reprojection of three accumulated LI pixels (red pixels within the grid tilted at 45°; pixel size 4.5 km) onto the FCI level 1c grid (gray pixels within the light blue-colored grid; pixel size 2 km).*

- ☐ Lightning groups (LGR-FD): **61 files per cycle** (60 body chunks and one trail file) – over 10 minutes
- ☐ Lightning Flashes (LFL-FD): **61 files per cycle** (60 body chunks and one trail file) – over 10 minutes
- ☐ Accumulated Flash Radiance (AFR-FD): **21 files per cycle** (20 body chunks and one trail file) - for 10 minutes accumulation
- ☐ Accumulated Flashes (AF-FD): **21 files per cycle** (20 body chunks and one trail file) - for 10 minutes accumulation
- ☐ Accumulated Flash Area (AFA-FD): **21 files per cycle** (20 body chunks and one trail file) - for 10 minutes accumulation
- ☐ The developed code can also be used for all **LI Level 2 to accumulate products for an accumulation time period user configurable**: Accumulated Flash Area (AFA), Accumulated Flashes (AF) and Accumulated Flash Radiance (AFR).
- ☐ Accumulation window in minutes, examples: 5, 10, 20, 60, 1440 (1 day), 10080 (1 week), 43200 (30 days).

### Advantages:

- Ensures increased control over the processed data;
- Allows efficient resource management and optimization of the workflow, which are essential aspects for achieving precise and effective results.

### Disadvantages:

- High complexity, strict requirements, and the need for a meticulous approach, as the programmer must have a deep understanding of both memory allocation and its manipulation.

**Table 1. Main Stages of Program Execution.**

| Nr. | Main Steps                      | Description                                                                                                                                                                                                    |
|-----|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | Reading the configuration files | Reading the necessary information to identify the satellite's position as well as the bands used                                                                                                               |
| 2.  | The initialization of variables | Allocating the necessary memory for matrices to ensure the proper execution of the program                                                                                                                     |
| 3.  | Reading input files             | Reading satellite data over a configurable time period using the variables t_minus and t_plus, which represent the start and end times of the data of interest for processing.                                 |
| 4.  | Data accumulation               | Populating a common matrix set with all the data read in the previous step.                                                                                                                                    |
| 5.  | Parallax Correction             | Based on the CTTH product (ctth_alti) or when CTTH is missing or invalid, the system uses a configurable constant fallback height to maintain continuity of processing and to prevent systematic product gaps. |
| 6.  | Writing output files            | Generating a NetCDF file that contains the final data.                                                                                                                                                         |
| 7.  | Free memory                     | In the C programming language, it is necessary to both allocate and free the used memory at the end of execution.                                                                                              |

## New functions created:

1. ParallaxCorrection
2. WriteLIPProduct

```
Status ParallaxCorrection(Utc *slot,
                          Psing_region *region,
                          Float_32 **ctth_m,
                          Float_32 **lat,
                          Float_32 **lon,
                          Float_32 ***AFA_io,
                          Float_32 ***AF_io,
                          Float_32 ***AFR_io)
```

```
Status WriteLIPProduct(Utc *slot, Psing_region *region, Sat_res res, char **argv, Float_32 **dataAFA, Float_32 **dataAF, Float_32 **dataAFR,
                      Float_32 **dataMFA, Float_32 **dataTOE, Float_32 **dataFED, unsigned char **li_quality, Float_32 **lat, Float_32 **lon,
                      int APPLY_PARALLAX_CORR, Float_32 **sat_zen, Float_32 **ctth)
```

## Parallax Correction Algorithm:

LiStack provides an optional parallax correction stage that can be applied after accumulation.

The correction is geometry-based and relies on satellite viewing angles together with an estimate of the emission height. When available, CTTH information provides a spatially varying height field that improves the storm-top altitudes.

When CTTH is missing or invalid, the system uses a configurable constant fallback height (integer positive value) to maintain continuity of processing.



```
# 1. Identifier of the PGE
# -----
PGE_ID GEO-LIStack

# 2. Satellite bands to be used by the PGE
# -----
#Not used in the LIStack accumulation itself, but can be use for reference/visualization workflow
SAT_BANDS IR38, IR87, IR97, IR105, IR123, IR133

/* ----- */
/* 3a. Accumulation and Parallax options */
/* ----- */
/* APPLY_PARALLAX_CORR:
 * 0 = NO parallax correction:
 *    - output: LI file WITHOUT parallax only
 *
 * 1 = ONLY parallax-corrected LI file:
 *    - LI file WITH parallax only
 *
 * 2 = BOTH files:
 *    - output: one LI file WITHOUT parallax
 *    - output: one LI file WITH parallax
 *In all cases: accumulation window is ACCUM_MINUTES (user configurable)
 */

APPLY_PARALLAX_CORR      2

#Accumulation window in minutes, examples 5, 10, 20, 60, 1440(1 day), 10080(1 week), 43200 (30 days)

ACCUM_MINUTES            20

/* ----- */
/* 3b. Big accumulation (1 week - 1 month) */
/* ----- */
/* If BIG_ACCUM_FORCE_FALLBACK=1 and ACCUM_MINUTES >= BIG_ACCUM_MINUTES:
 * - CTTH files are NOT searched/read
 * - Parallax correction (if enabled by APPLY_PARALLAX_CORR=1 or 2)
 *   uses CTTH_FALLBACK_KM as a constant height
 */

BIG_ACCUM_FORCE_FALLBACK 0

# Threshold in minutes to consider the accumulation "big"
# 10080 = 1 week
BIG_ACCUM_MINUTES        10080

/* ----- */
/* 4. CTTH configuration (used for the parallax correction) */
/* ----- */
/* CTTH_STRICT:
 * 1 = parallax module will look for a CTTH file EXACTLY at the same slot time
 * 0 = use nearest CTTH in the allowed time window directly
 */
CTTH_STRICT              1

# Directory where CTTH products are located
CTTH_DIR                  /home/safnwc/import/Obs_data/Lightning

/* ----- */
/* 5. Parallax User Configurable */
/* ----- */

# CTTH_HEIGHT_PERCENT (Percentage of the CTTH height used to compute the parallax displacement)
# -----
# Examples:
# 10 = very small parallax
# 30 = moderate parallax
# 80 = default
# 100 = full CTTH height

CTTH_HEIGHT_PERCENT      80

# CTTH_FALLBACK_KM
#-----
# The altitude (km) used when CTTH is missing/invalid
# Also used as the constant parallax height when big accumulation fallback is forced

CTTH_FALLBACK_KM         12.0

/* ----- */
/* 4. CTTH configuration (used for the parallax correction) */
/* ----- */
/* CTTH_STRICT:
 * 1 = parallax module will look for a CTTH file EXACTLY at the same slot time
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 */
CTTH_STRICT              1

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# Examples:
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# 80 = default
# 100 = full CTTH height
```

```
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# CTTH_FALLBACK_KM
#-----
# The altitude (km) used when CTTH is missing/invalid
# Also used as the constant parallax height when big accumulation fallback is forced

CTTH_FALLBACK_KM         12.0
```

## Configuration File:

0. A parallax correction will not be applied;
1. Apply a parallax correction;
2. The Software will provide 2 output files; one with parallax correction and a second one without. In all cases: accumulation window is ACCUM\_MINUTES (user configurable).



## **Accumulated Flash Area (AFA)**

- provides information about the area covered by the optical emission of each lightning strike.
- “how large the electrically active cloud-top area is” during the last 30 seconds; shows the spatial footprint of recent lightning-related optical emission.
- look first at AFA, fits well with an overlay with the FCI based products with an accumulation; rolling 5-minute AFA, and in some workflows even 8-10 minutes can be more readable for storm evolution and FCI comparison, based on the MTG-FCI chunk map.

## **Accumulated Flashes (AF)**

- it complements AFA by providing information about the variation in the number of events in an area of interest where lightning activity has been observed.
- “where lightning activity is being mapped”. In practice, treat it as a gridded activity-loading field, not as a clean count of storm objects or a count of flash centroids.
- harder to explain operationally.

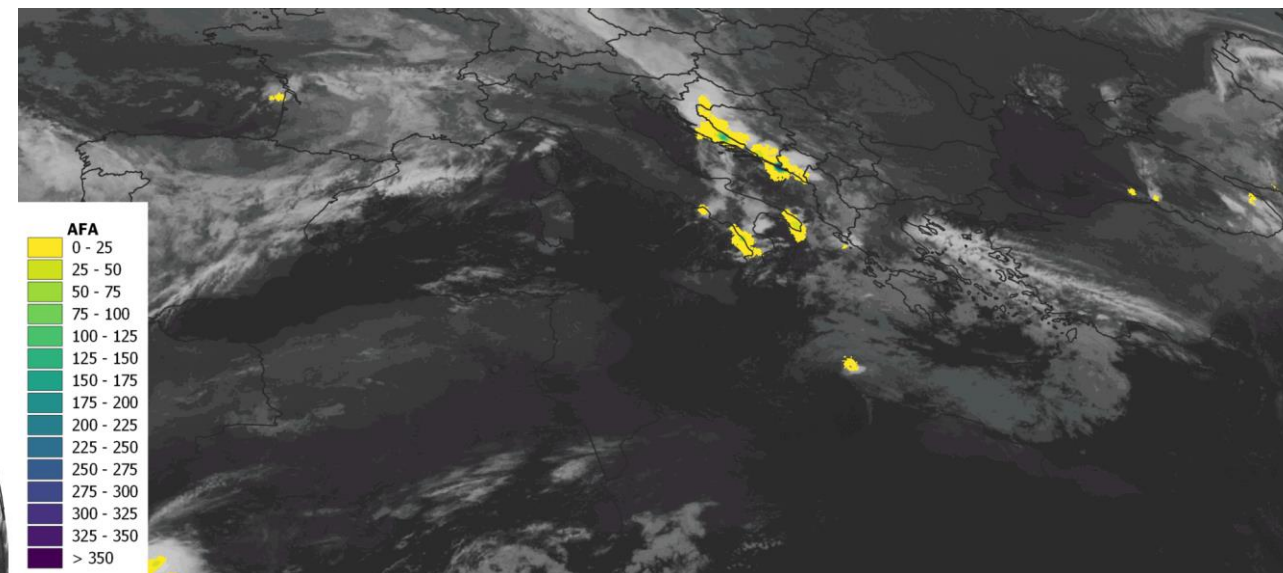
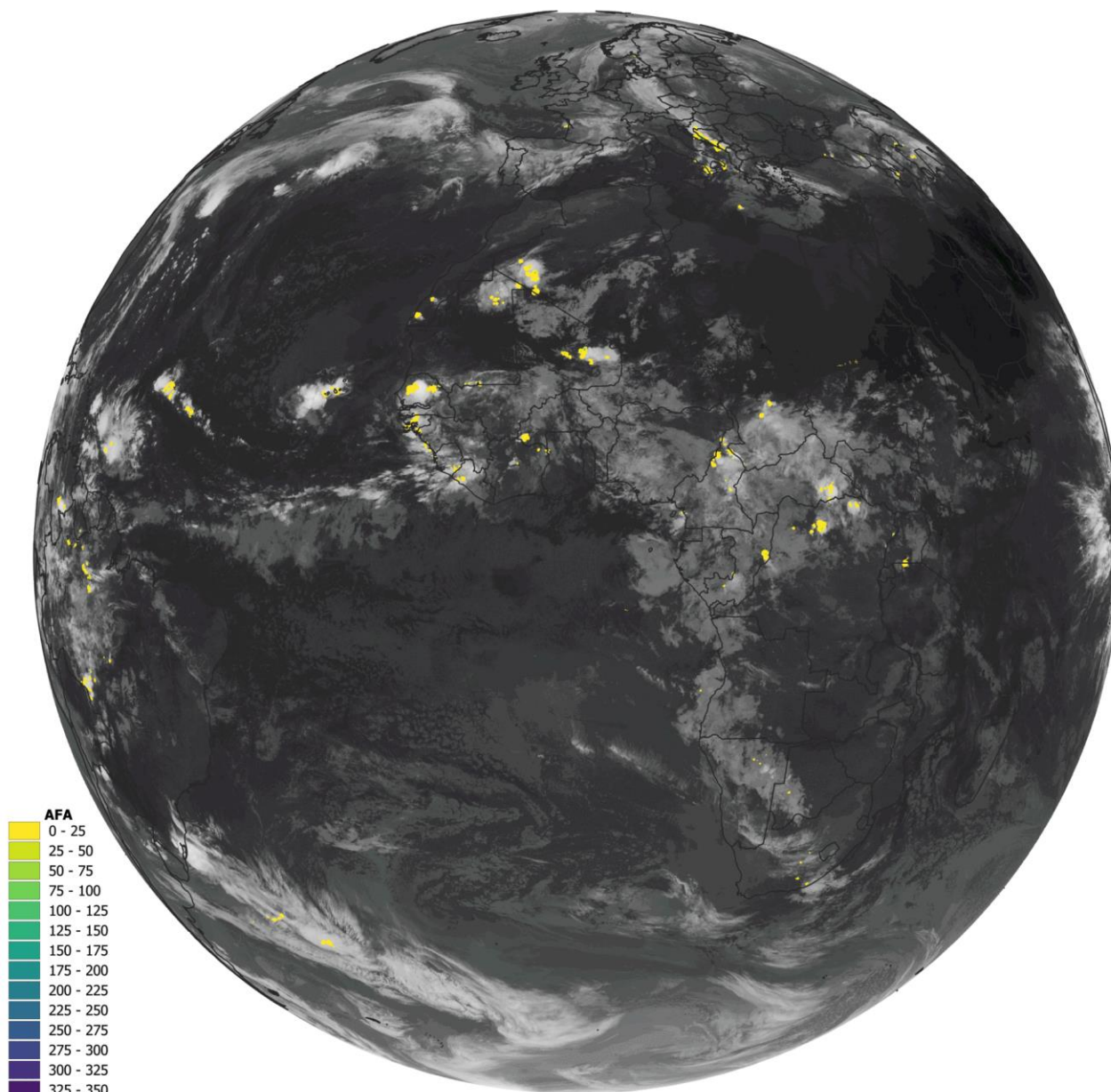
## **Accumulated Flash Radiance (AFR)**

- it provides information about the pixel-by-pixel variation of accumulated optical emissions over a 30-second period.
- “how strong the optical lightning signal is” in each grid pixel during the last 30 seconds. It is useful, but it is not the same thing as flash rate.
- can be used as a second layer

When a comparison of the LI products is performed with radar, rain, or surface impacts, think about parallax, implemented for both LiJump and LiStack products.



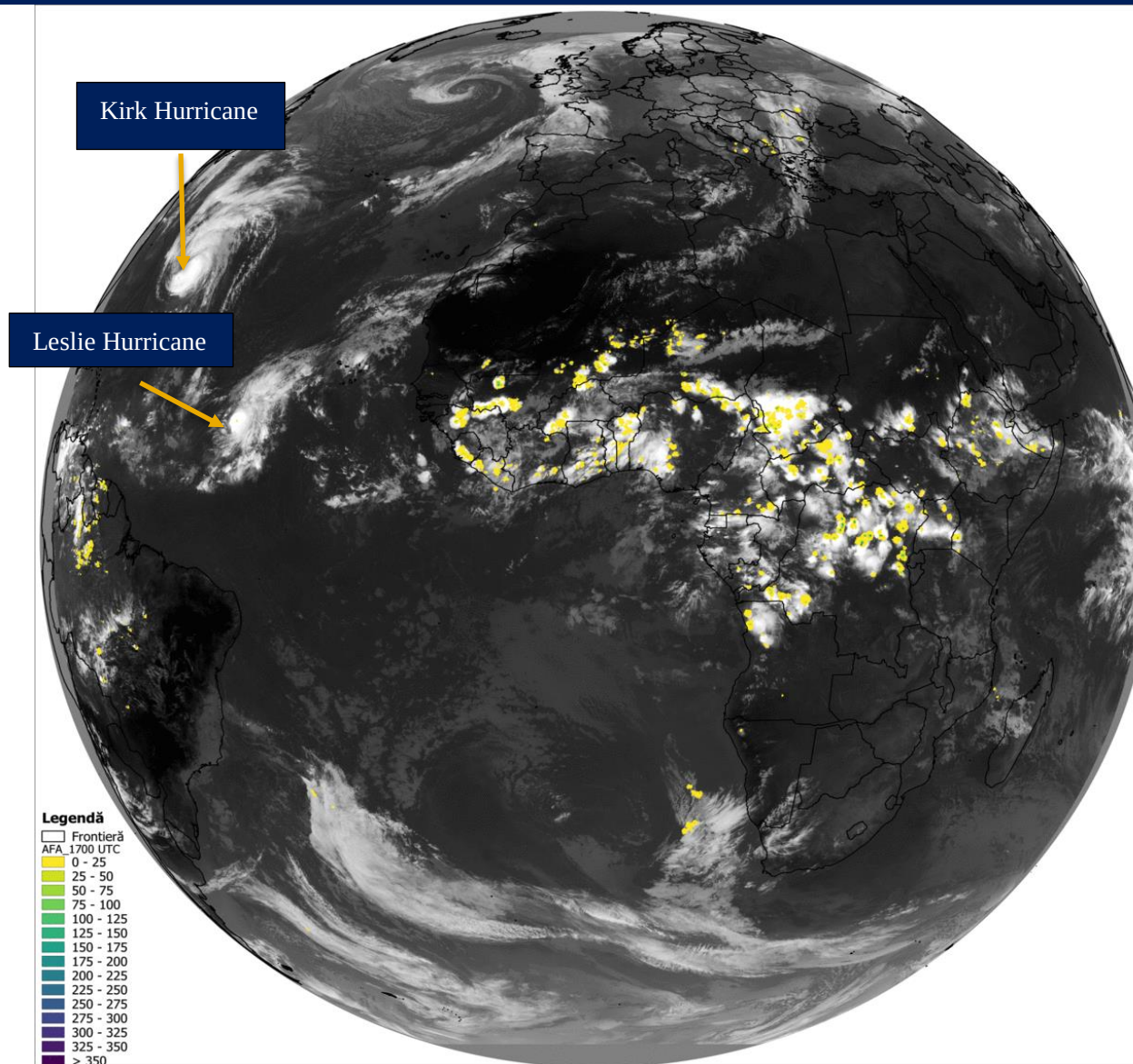
# September 24, 2024, 05:00 - 07:00 UTC

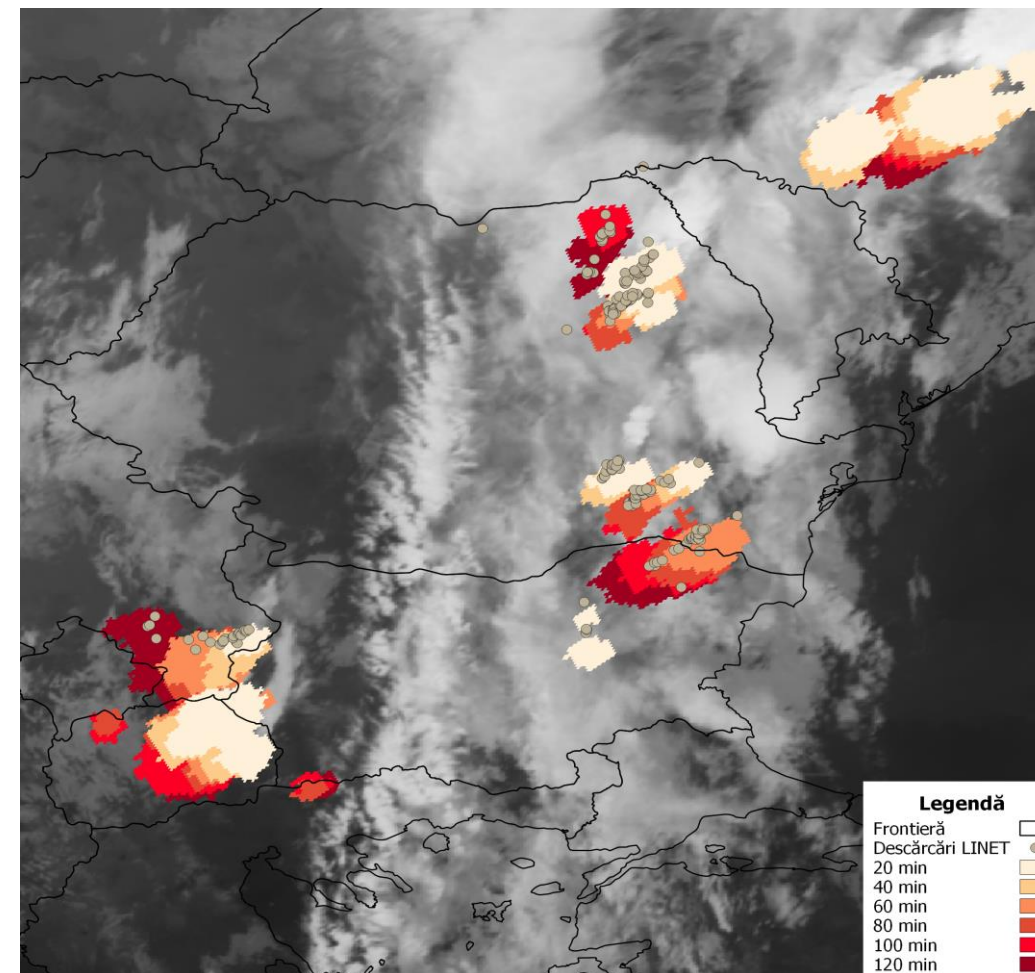
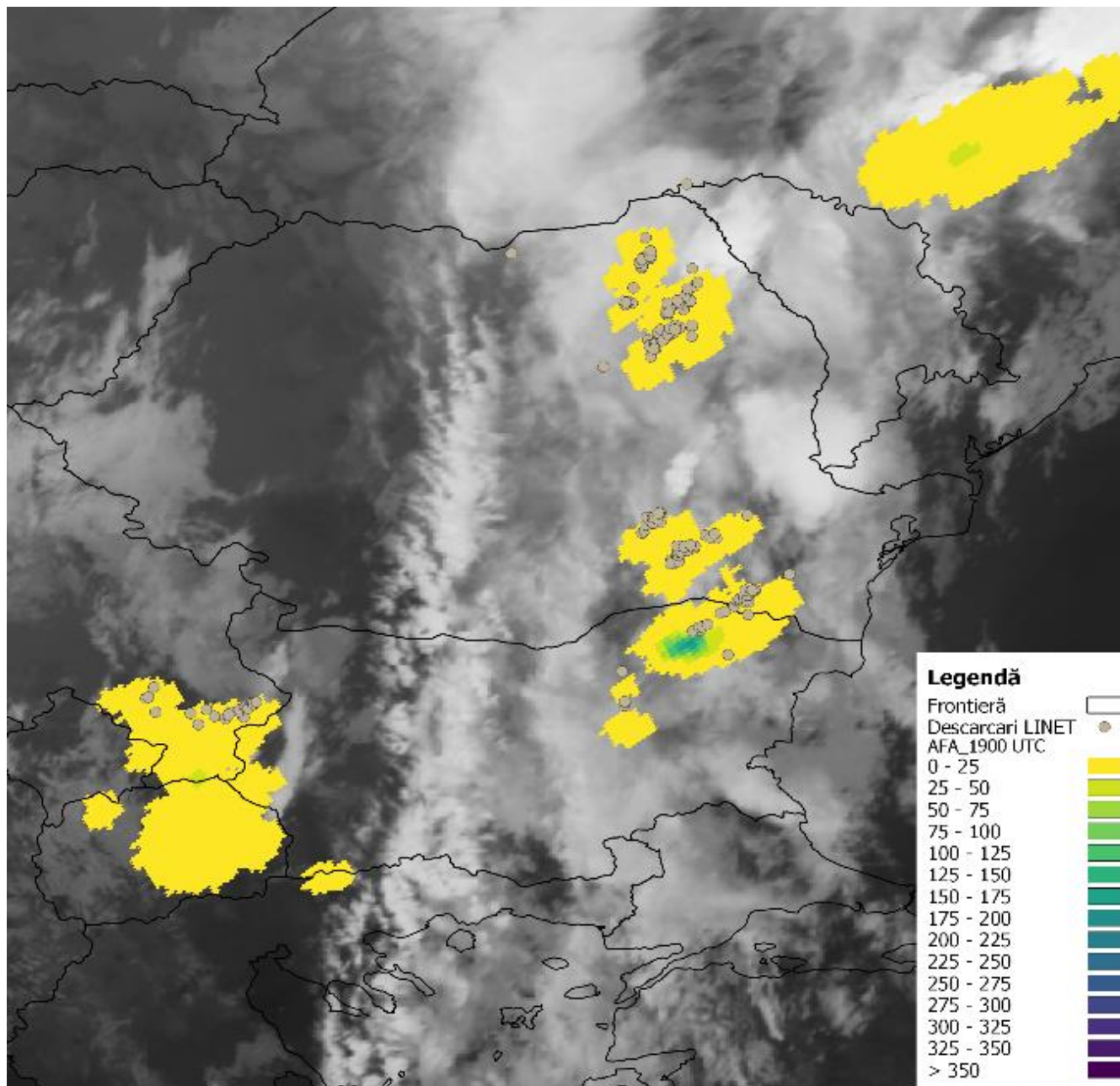


Animation of 10 minutes accumulation of Accumulated Flash Area (AFA) product for September 24, 2024, from 05:00 to 07:00 UTC.

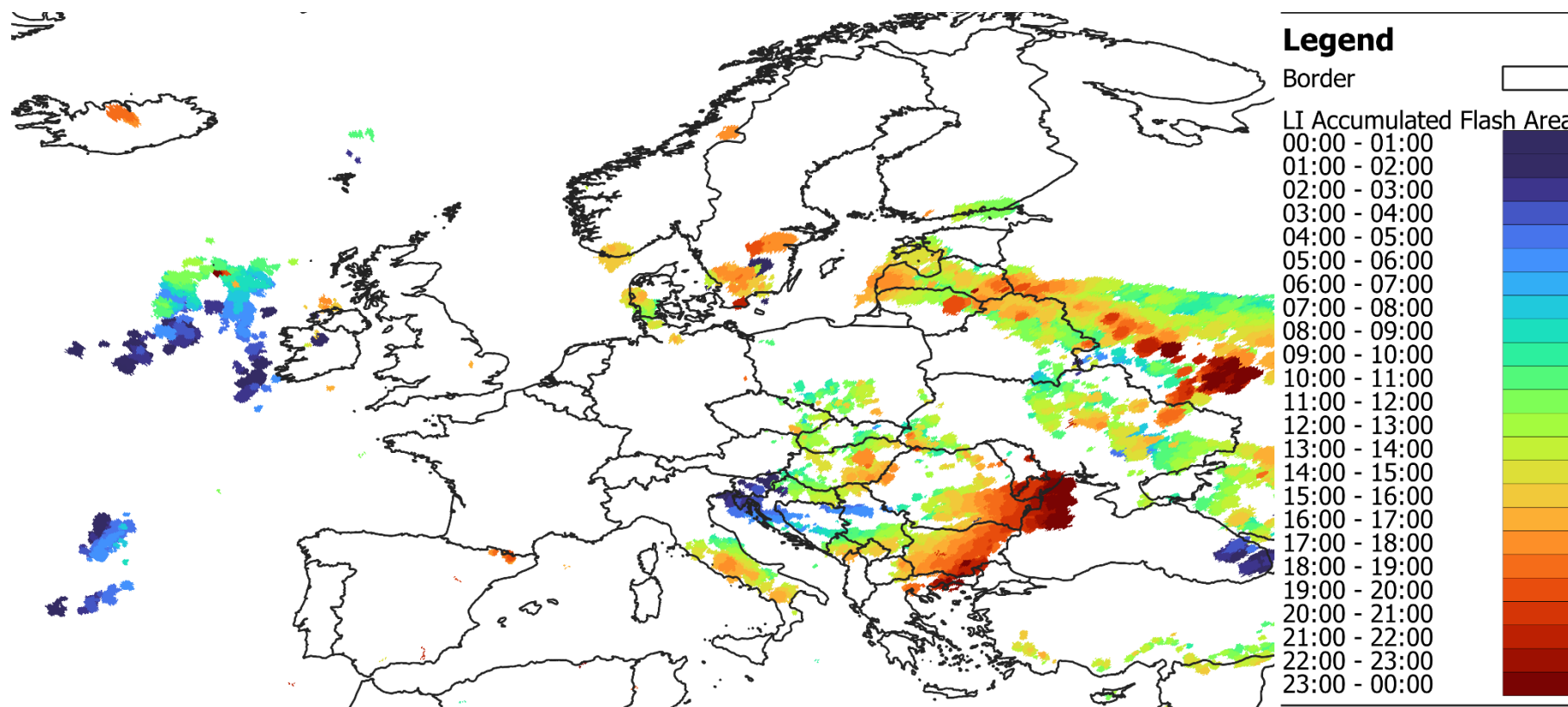


# October 5, 2024, 17:00 - 19:00 UTC

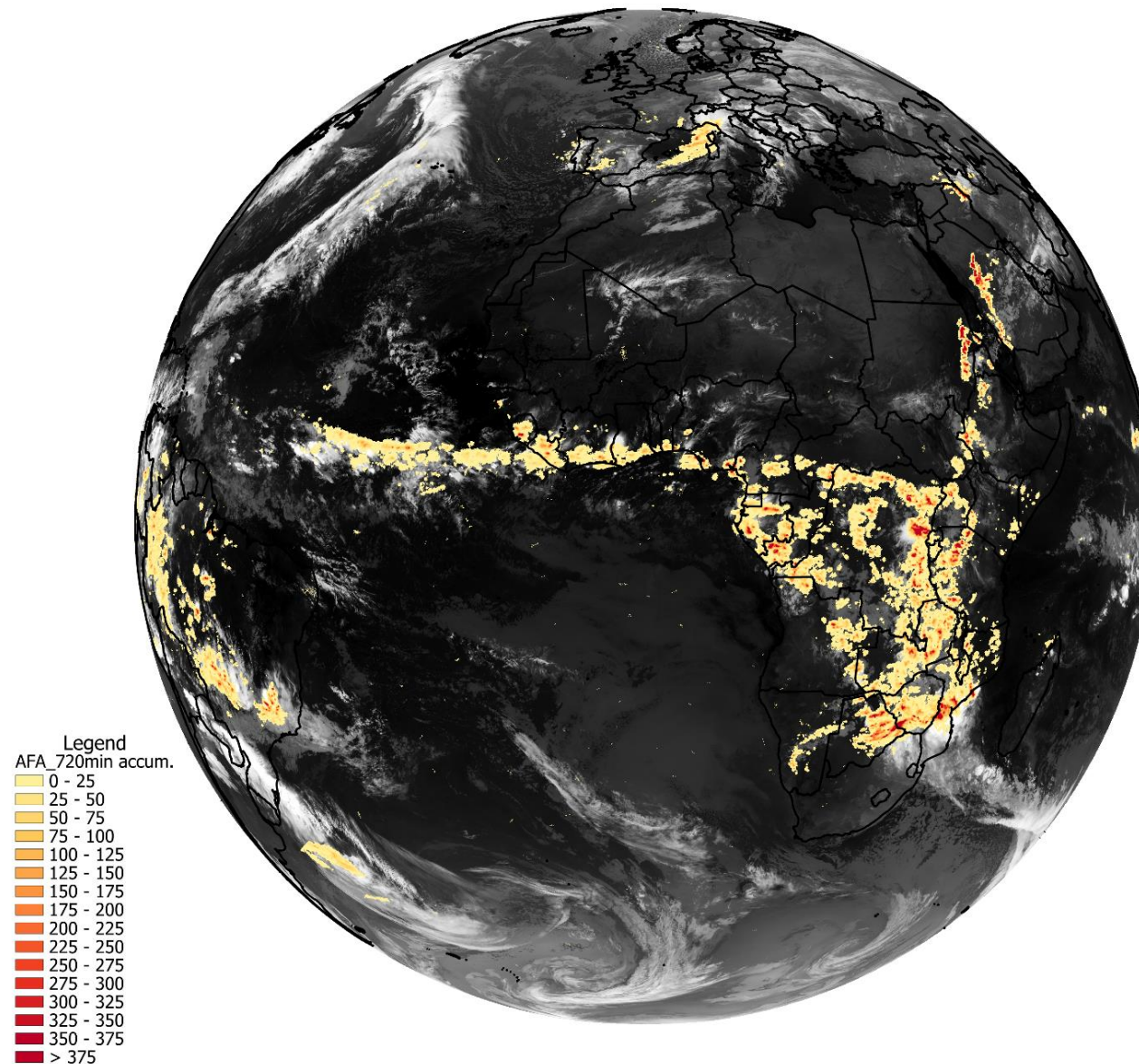




Comparison between the Level 2 Accumulated Flash Area (AFA) and LINET data for October 5, 2024, from 17:00 to 19:00 UTC.



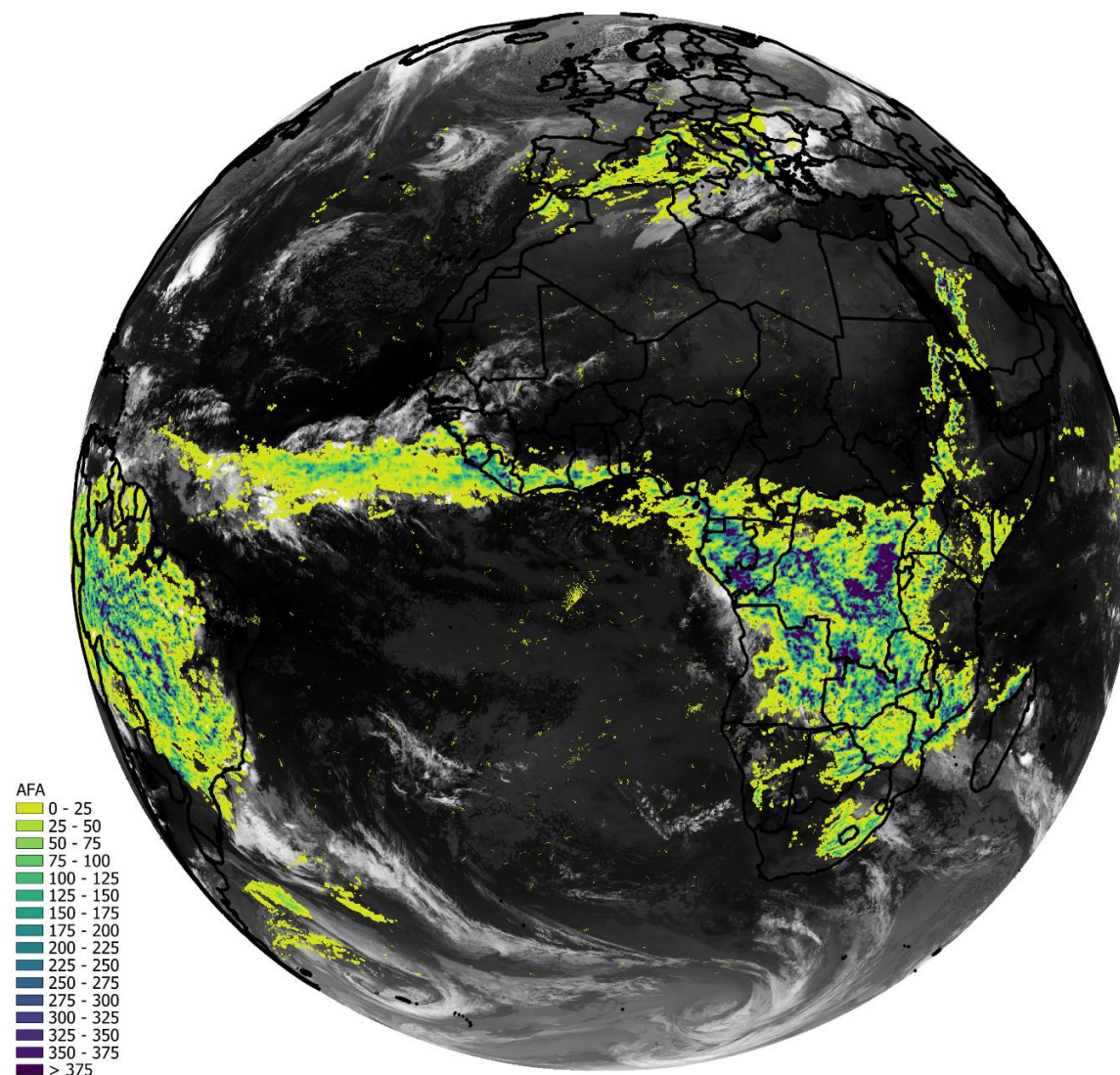
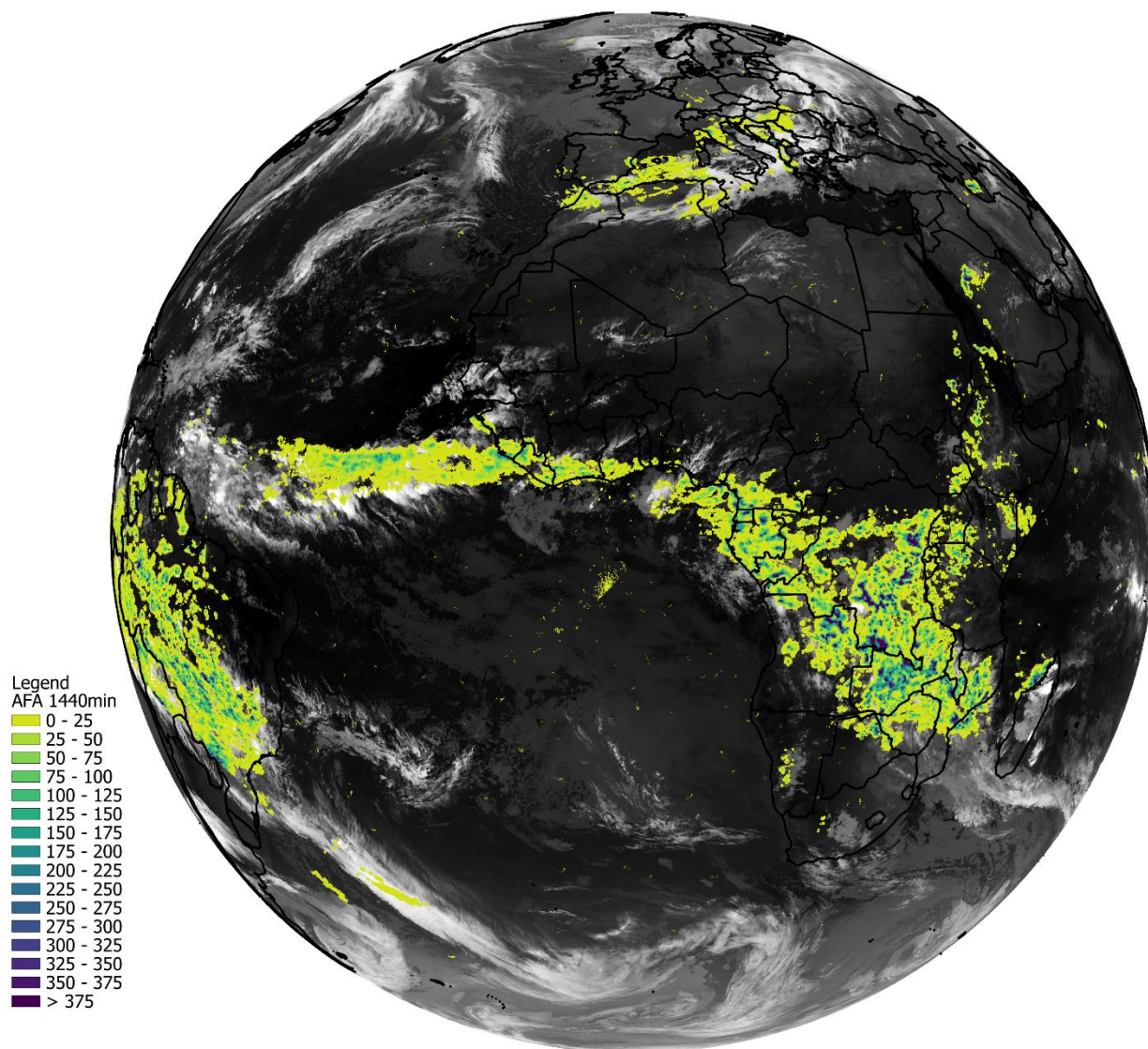
Accumulated Flash Area (AFA) product for July 17, 2025, every 60 minutes accumulation



Accumulated Flash Area (AFA) product for November 16, 2025, **half day accumulation** from 12:00 to 00:00 UTC



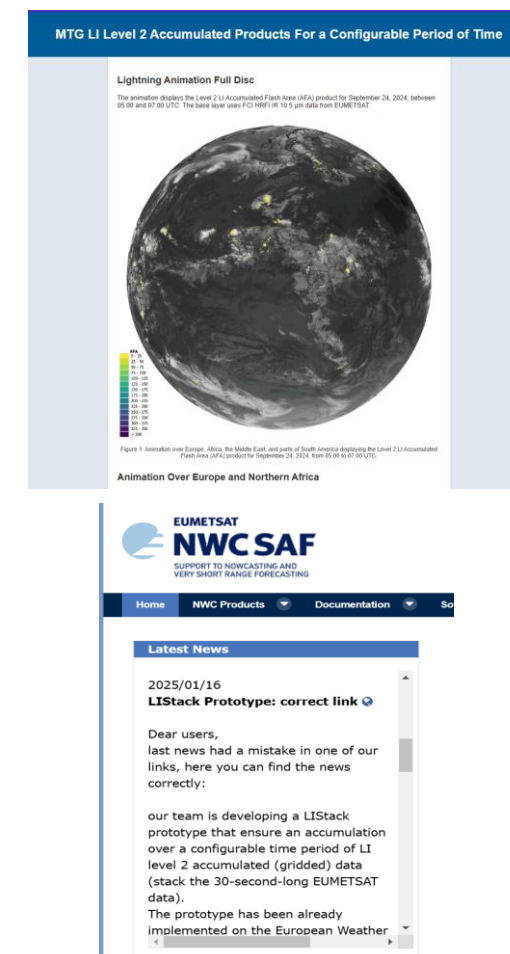
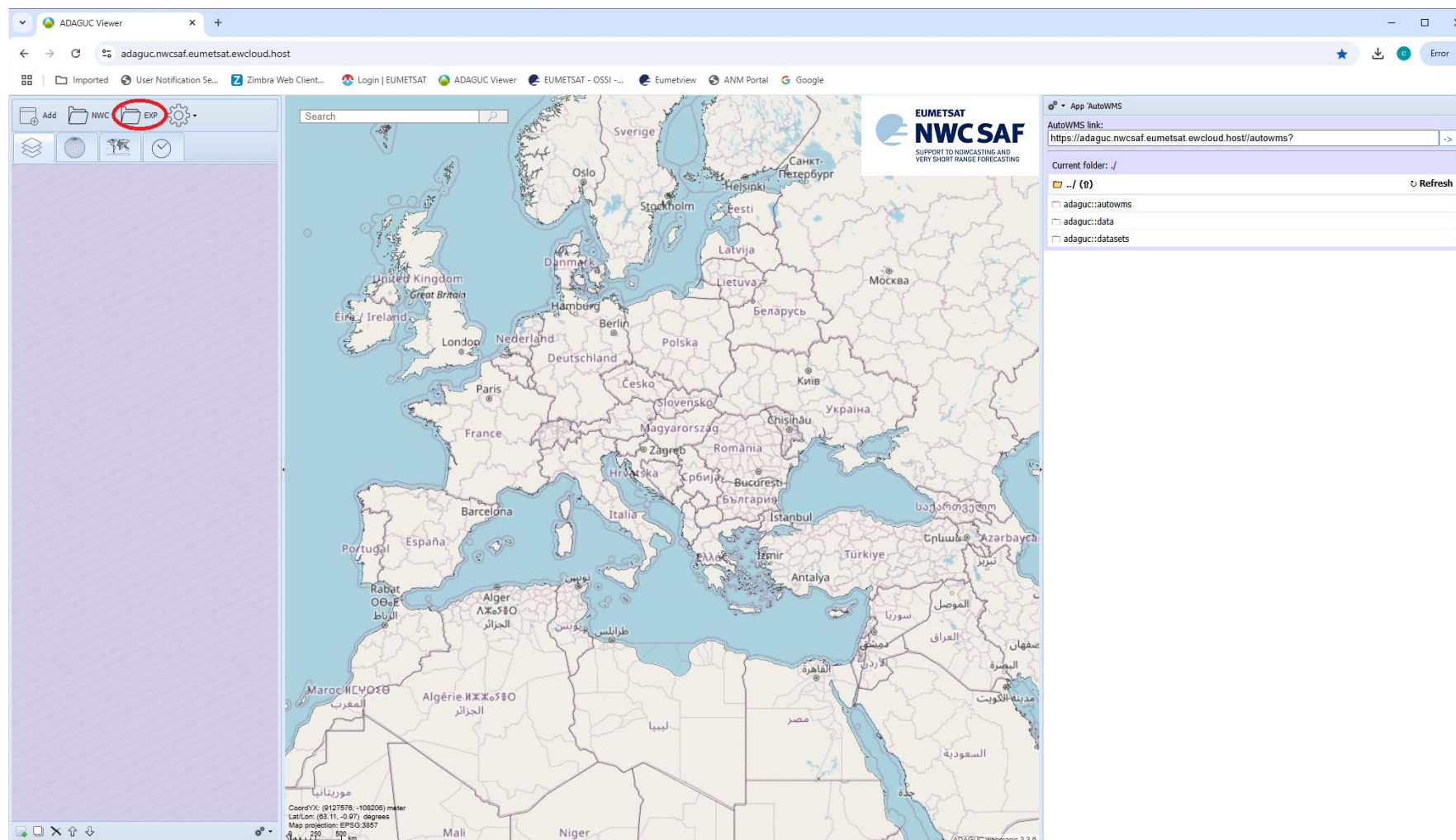
Accumulated Flash Area (AFA) product for **November 17, 2025** - 1440 min (left) and accumulation for 2 days a half - 3600 min (right).





# LiStack Product Visualization in ADAGUC

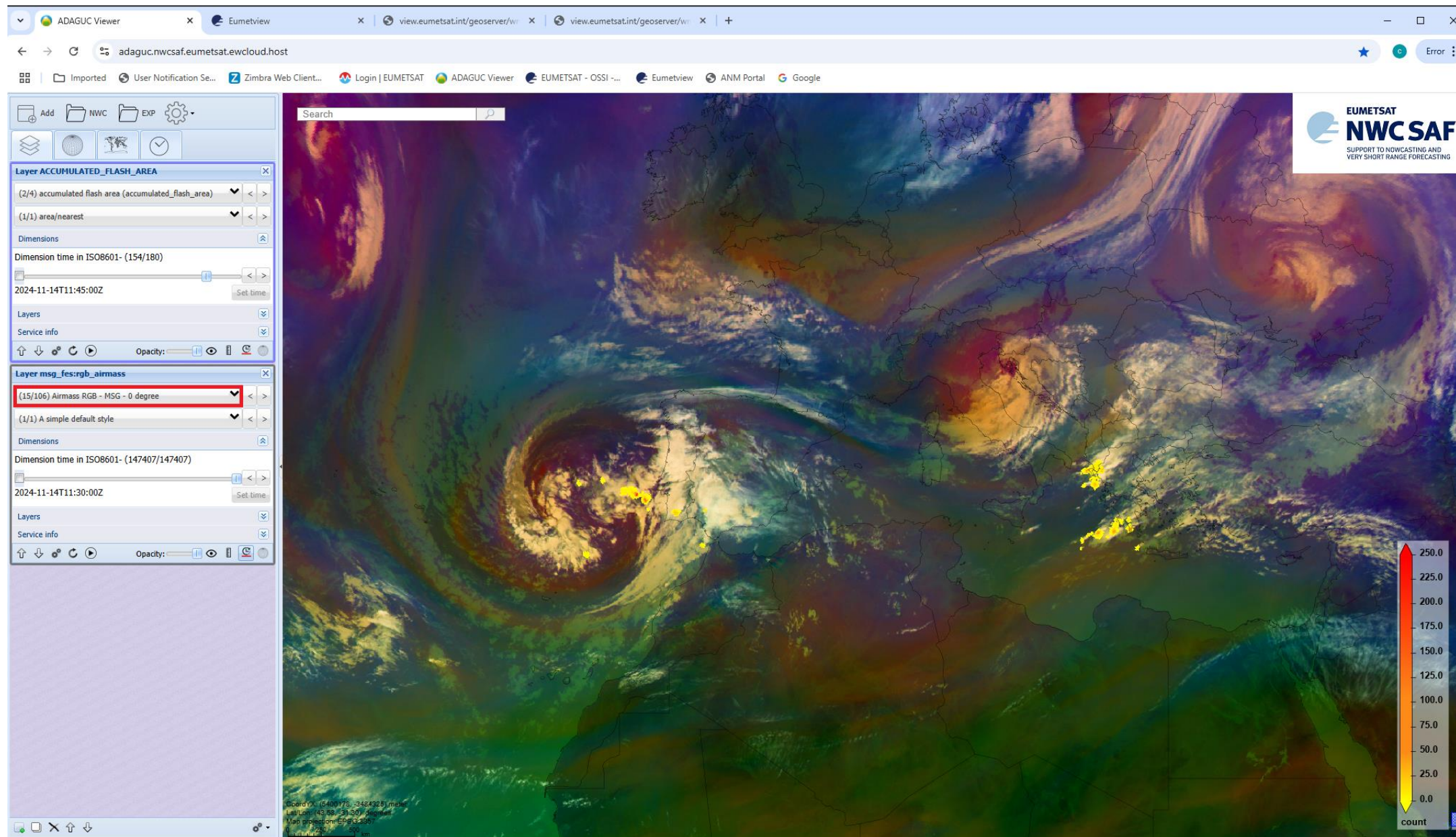
A Python prototype has been already implemented on the European Weather Cloud (EWC) and its results (10 minutes accumulations, 1 minute refresh rate, for the last 4 days) are available by accessing ADAGUC Viewer: <https://adaguc.nwcsaf.eumetsat.ewcloud.host/>



<https://www.nwcsaf.org/web/guest/listack>



# LiStack Visualization in ADAGUC



- MET-12 represents a major innovation, integrating advanced tools for lightning detection and atmospheric monitoring.
- LiStack product can be user configurable.
- LiJUMP first prototype results are very promising after a first season analysis (2025 season over Romania territory).
- Future plans: validation, users feedback and training activities.
- **CDOP-5** new product , LiFcast, to forecast lightning activity in the next minutes.



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- Diamandi, A., Nicola, O. 2019, *Technical Report on the Selection of the MTG LI Prototype Products*. s.l. : Eumetsat NWCSAF.
- MTG FCI level 1c data guide, 2024, <https://user.eumetsat.int/resources/user-guides/mtg-fci-level-1c-data-guide>.
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- Popescu, A.M., A.M., Popa, 2024, *NWC/CDOP3/GEO/NMA/MTG/LI/PROTOTYPE/PRODUCT/DESIGN Issue 1, Rev. 0*. s.l. : Eumetsat NWCSAF.
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**Thank you very much for your attention!**

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