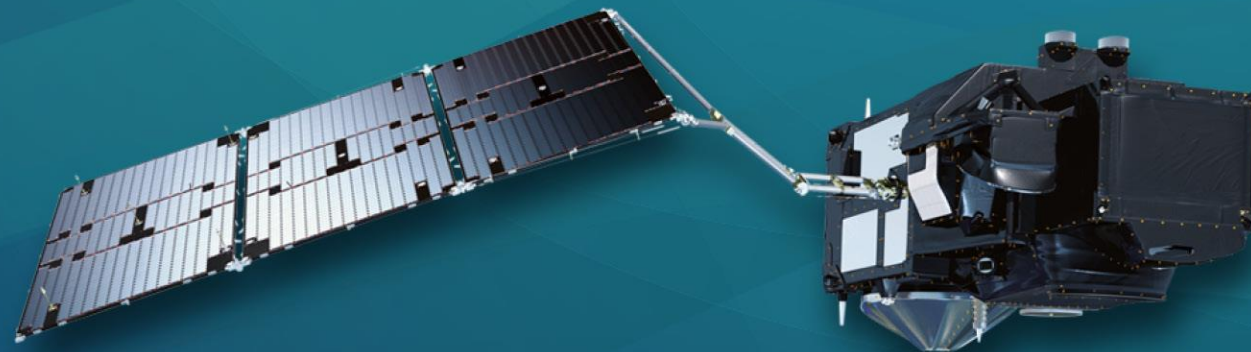




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9th Sentinel-3 Validation Team meeting 2026

30 March–01 April 2026 | ESA–ESRIN | Frascati (Rome), Italy

Copernicus Sentinel-3 NRT Fires product – Upcoming Collection 3.2 and planned evolution

*Edouard MARTINS¹, Julien CHIMOT¹, Andrea MERANER¹, Daria MALIK¹, Martin WOOSTER², Weidong XU²,
Bertrand FOUGNIE¹, Sauli JORO¹, Bojan BOJKOV¹*

1 EUMETSAT (Germany)

2 Kings College London (United Kingdom)

Baseline Collection 3



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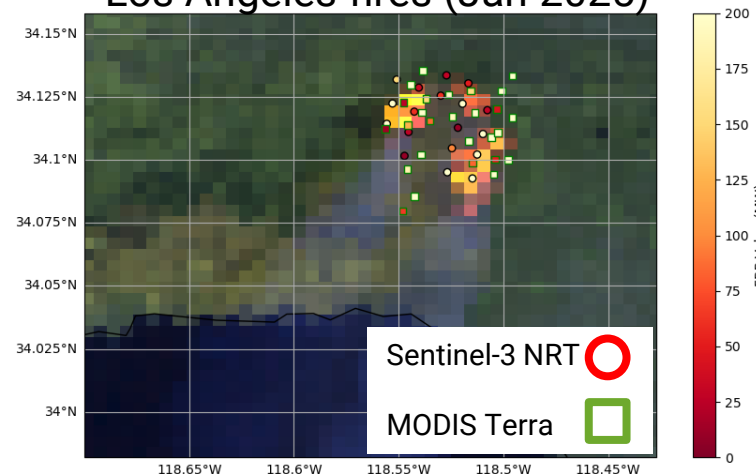
co-funded with



Updates in Coll3.0 (released in July 2024):

- Enhanced F3 BT derivation (S7/F1 replacement for hotspot & surrounding neighbourhood)
- Comprehensive format update for enhanced user-friendliness
 - creation of **csv mini-files**
 - reduction of 80% of product size

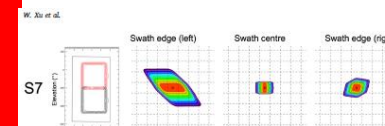
Los Angeles fires (Jan 2025)



```

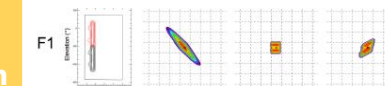
FRP_MWIR1km_standard.csv
1 #title = SLSTR Level 2 Product, Fire Radiative Power (FRP) measurement, Near Real Time (NRT)
2 #description = csv output from the Standard MWIR 1km scheme
3 #product_name = S3R_SL2_FRP_20240227T084621_20240227T084921_20240227T223526_0179_090_121_MAR_0_NRT_02.SEN3
4 #institution = EUMETSAT (Darmstadt, Germany)
5 #source = IFF-SL-2-FRP 04.00
6 #history =
7 #reference1 = EUM/RSP/DOC/20/1169482 - EUMETSAT - SLSTR L2 NRT FRP Product Data Format Specification - 02.00
8 #reference2 = S3IPF PDS 002 - ilr7 - Product Data Format Specification - Product Structures
9 #reference3 = S3MPC ACN FRP 002 - ilr3 - SLSTR L2 FRP Detailed processing model
10 #contact = ops@eumetsat.int
11 #creation_time = Thu Feb 29 22:36:01 2024
12 #absolute_orbit_number = 30423
13 #start_time = 2024-02-27T08:46:20.604788Z
14 #stop_time = 2024-02-27T08:49:20.604788Z
15 #processing_baseline = FRP_NRT_003.00.00
16 #track_offset = 998
17 #start_offset = 193900
18 #number_of_detected_fires = 145
19
20 lat(deg),lon(deg),day,time,D/N,FRP(MW),FRPerr(MW),used_channel,MWIR_confidence(%),MWIR_BT(K),IFOV_area(m2),SZA(deg),VZA(deg),eff_across_track_size(km),eff_along_track_size(km),satellite
21 7.980613,22.448144,2024-02-27,08:46:34,D,9.753106,1.973310,F1,72.324667,305.578182,1401059.000000,33.571027,22.649709,1.137103,1.232130,S3R
22 8.686985,19.016843,2024-02-27,08:46:28,D,18.440159,2.362753,F1,94.642563,317.489375,1178486.000000,36.932390,9.416683,1.078242,1.092970,S3R
23 8.581735,19.228214,2024-02-27,08:46:29,D,36.288936,4.137011,F1,100.000000,315.711250,1166391.250000,36.717019,8.122390,1.074565,1.085454,S3R
24 8.575431,19.217922,2024-02-27,08:46:29,D,19.369689,2.958182,F1,94.915134,316.830000,1166788.625000,36.725632,8.171589,1.074682,1.085706,S3R
25 8.572780,19.226686,2024-02-27,08:46:29,D,12.451393,1.798627,F1,89.564261,315.618125,1166391.250000,36.717019,8.122390,1.074565,1.085454,S3R
26 9.910135,17.317032,2024-02-27,08:46:37,D,18.241573,2.634162,F1,95.912573,322.312500,1394351.375000,38.546415,21.707023,1.138189,1.225061,S3R
27 8.072112,20.226422,2024-02-27,08:46:34,D,15.849183,2.124750,F1,90.577116,312.901250,1155280.375000,35.682609,7.508507,1.072973,1.081345,S3R
28 8.050862,20.280783,2024-02-27,08:46:34,D,14.525965,1.791099,F1,90.408109,314.279375,1161555.125000,35.613374,7.843819,1.072701,1.082832,S3R
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31 7.418186,22.643698,2024-02-27,08:46:44,D,24.593665,3.296859,F1,88.372625,303.809167,1471223.750000,33.263979,25.002467,1.154710,1.274107,S3R
32 7.492392,22.235137,2024-02-27,08:46:42,D,33.969942,3.837055,F1,94.692366,303.245333,1381487.500000,33.666316,21.905686,1.132141,1.220243,S3R
33 7.492031,22.224915,2024-02-27,08:46:42,D,35.132583,3.922914,F1,95.281987,303.362308,1379567.375000,33.674886,21.837915,1.131622,1.219106,S3R
34 7.483793,22.231683,2024-02-27,08:46:42,D,61.711965,6.401387,F1,100.000000,302.861875,1381487.500000,33.666316,21.905686,1.132141,1.220243,S3R
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38 7.956199,21.571283,2024-02-27,08:46:43,D,10.475100,2.378077,F1,76.382641,305.240000,1277892.750000,34.274838,17.219346,1.104815,1.156850,S3R
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41 6.892056,23.541292,2024-02-27,08:46:57,D,31.323384,4.368740,F1,90.969877,307.543448,1768448.500000,32.301893,32.102059,1.223944,1.444859,S3R
42 6.886559,23.518028,2024-02-27,08:46:57,D,70.024975,7.421760,F1,100.000000,309.181000,1760610.250000,32.318942,31.975729,1.222079,1.440668,S3R
    
```

Standard MWIR
Standard SLSTR grid
High co-registration
high distortion across swath

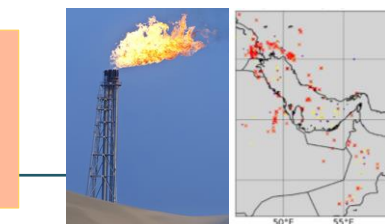


F1 On / Off
(MWIR, Xu et al., 2021)
+ SWIR FRP available

Alternative MWIR
Fire grid
Low distortion across swath
Low co-gistration
Potential radiometry outliers



SWIR
Solar grid
Industrial gas flares



Baseline Collection 3



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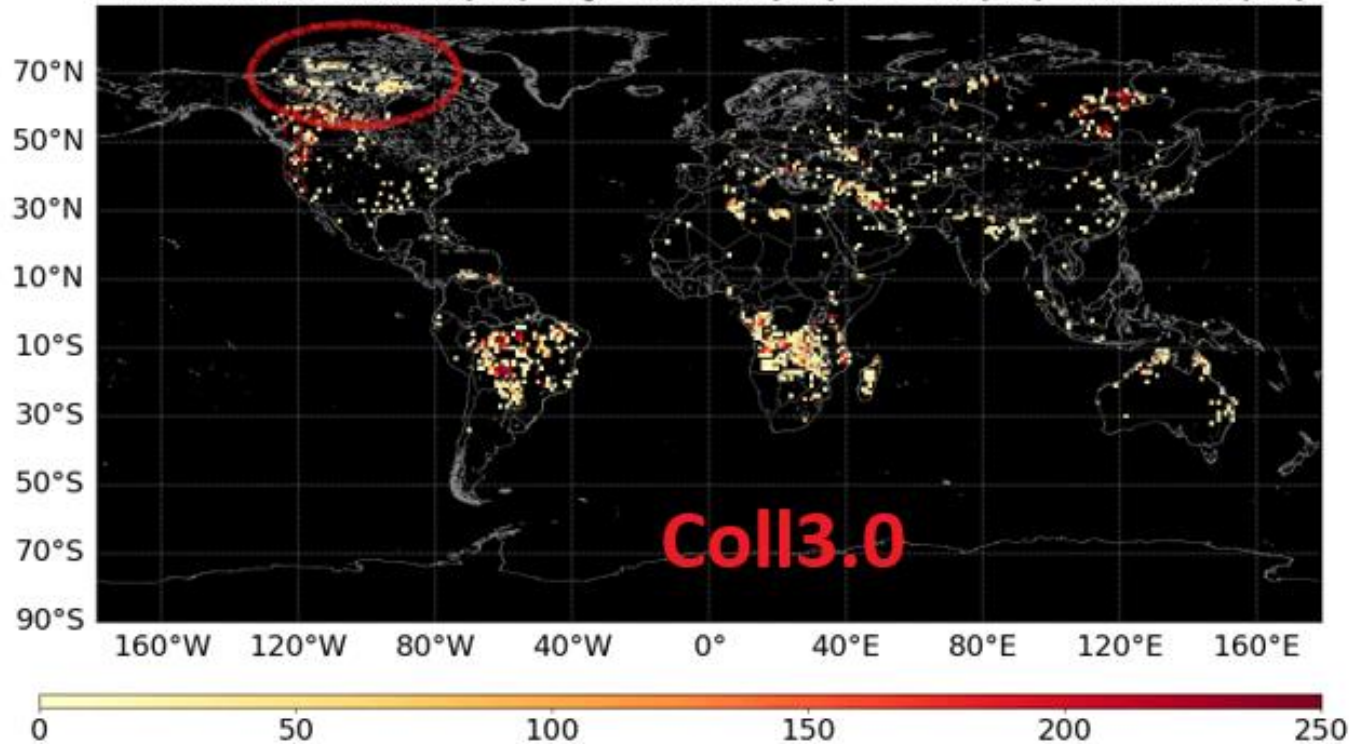


Sentinel-3 A+B SLSTR - Standard FRP MWIR [MW] - Night - 1.0 deg resolution - 21.07.2024

Total number 1 km hot-spots = 12122



FRP 1 km: Total = 228507.5 [MW] - Avg. = 18.9 ± 64.9 [MW] - Min = 0.1 [MW] - Max = 3241.7 [MW]



Updates in Coll3.1 (released in January 2025):

- Fix implemented to correct anomaly in terminator zone (few days around solstice in high latitudes)

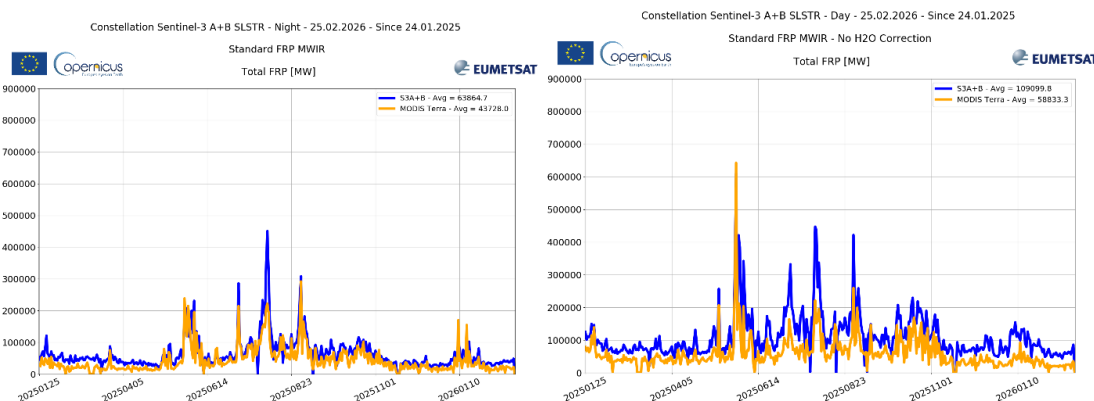
→ Coll3.1 is the current operational version of the product (only for a few more weeks)

Quality monitoring of Coll3.1

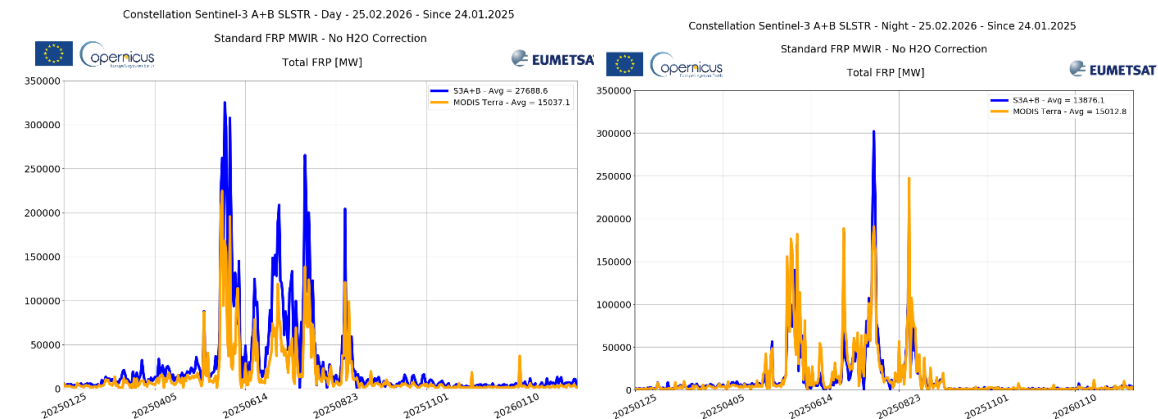
Development of an automatized monitoring NRT FRP system (multi-mission), primarily based on satellite inter-comparison

- LEO/LEO - daily Timeseries: primarily **S3 NRT** vs. **MODIS Terra** (VIIRS + EPS-SG MetImage being added in upcoming evolution, when available)

FRP time series
(Global, Night=left; Day=right)



FRP time series
(North America, Night=left; Day=right)



Quality monitoring of Coll3.1



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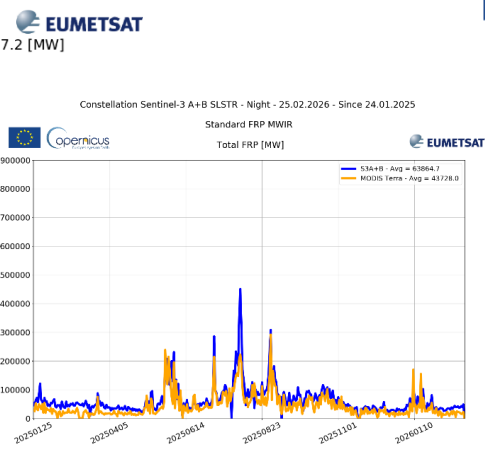
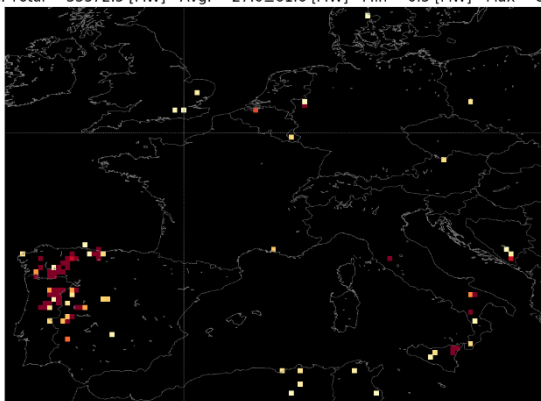
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Portugal/Spain fires - August 2025

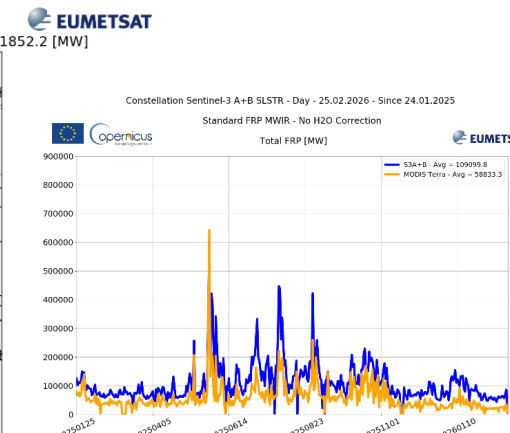
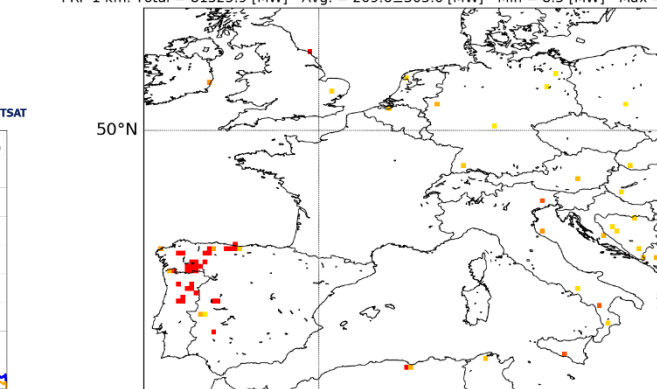
Sentinel-3 A+B SLSTR - Standard FRP MWIR [MW] - Night - 0.25 deg resolution - 15.08.2025

Total number 1 km hot-spots = 1317
FRP 1 km: Total = 35572.5 [MW] - Avg. = 27.0±61.6 [MW] - Min = 0.5 [MW] - Max = 877.2 [MW]



Sentinel-3 A+B SLSTR - Standard FRP MWIR [MW] - Day - 0.25 deg resolution - 15.08.2025

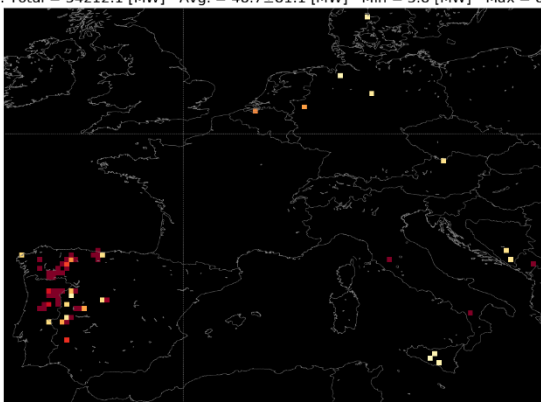
Total number 1 km hot-spots = 389
FRP 1 km: Total = 81525.9 [MW] - Avg. = 209.6±305.0 [MW] - Min = 8.5 [MW] - Max = 1852.2 [MW]



Terra MODIS - FRP MWIR [MW] - Night - 0.25 deg resolution - 15.08.2025

Total number 1 km hot-spots = 703

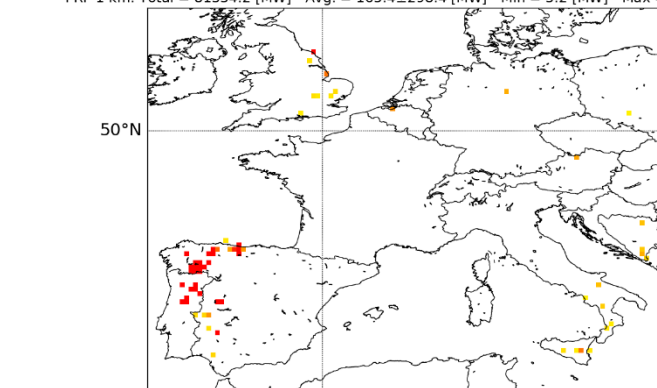
FRP 1 km: Total = 34212.1 [MW] - Avg. = 48.7±81.1 [MW] - Min = 3.8 [MW] - Max = 889.3 [MW]



Terra MODIS - FRP MWIR [MW] - Day - 0.25 deg resolution - 15.08.2025

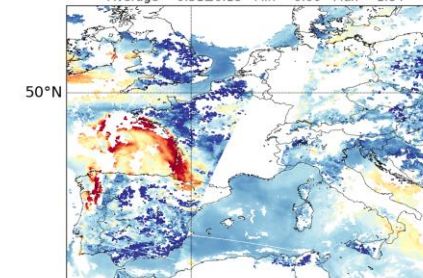
Total number 1 km hot-spots = 493

FRP 1 km: Total = 81534.2 [MW] - Avg. = 165.4±298.4 [MW] - Min = 5.2 [MW] - Max = 1709.2 [MW]



Sentinel-3 A+B SLSTR - AOD(550 nm) - Quality (Land + Ocean Q1 & 3) - 15.08.2025

9.5 km Resolution
Average = 0.31±0.18 - Min = 0.00 - Max = 1.84



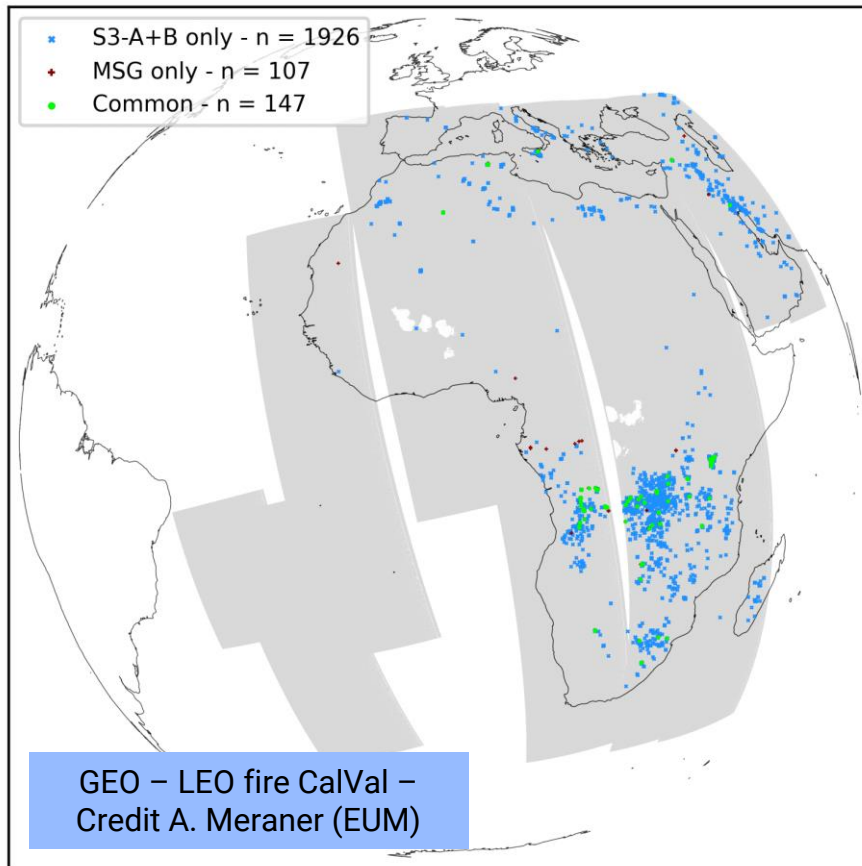
NRT S3 Aerosols Coll 3
(credit J. Chimot)

GEO-LEO match-up (history)

MSG SEVIRI FES (FRP-PIXEL) vs. Sentinel-3 A+B SLSTR

NRT FRP MWIR

04.07.2021 - Night



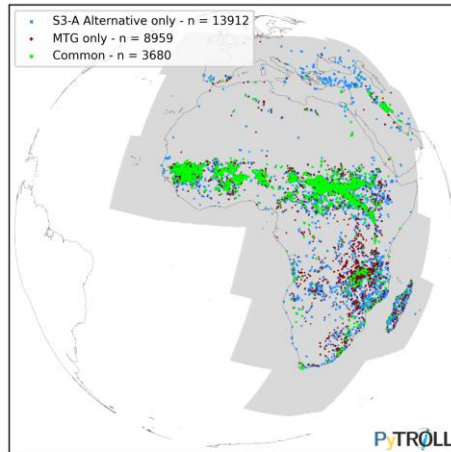
- GEO – LEO collocation methodology designed & implemented by A. Meraner (EUMETSAT) **since 2023**:
 - Satpy / Py troll - Stringent 1-to-1 pixel threshold.
- MSG vs. SLSTR Active Fire scores:
 - ~60% ($\pm 10\%$) MSG hot-spots common with SLSTR
 - ~9% SLSTR common with MSG
- MSG vs. MODIS Active Fire scores:
 - ~32% MSG hot-spots common with MODIS (Terra, Aqua)
 - ~23% MODIS (Terra, Aqua) common with MSG.
- S3 NRT FRP = higher Probability Of Detection than MODIS (MSG Reference).
- MODIS = higher Precision (MSG Reference) => OFRaP-CS3 higher probability of weak hot-spots.
 - Good - Further confidence needed.
- Warning: activation scores strongly vary per minimum fire threshold.

GEO-LEO match-up (evolution from SEVIRI to FCI)

MTG FCI FES (FRP-PIXEL) vs. Sentinel-3 A SLSTR Alternative

NRT FRP MWIR

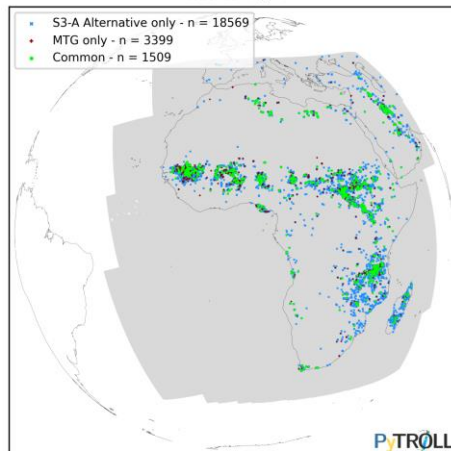
2025-11 Day



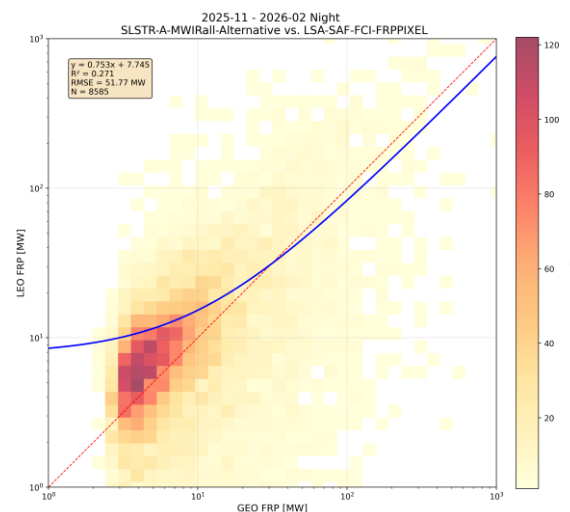
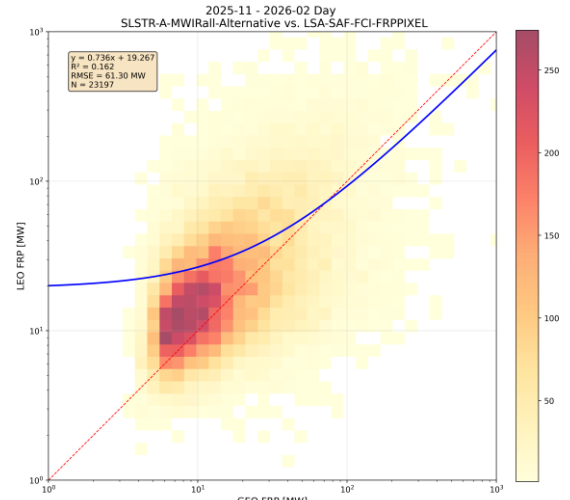
MTG FCI FES (FRP-PIXEL) vs. Sentinel-3 A SLSTR Alternative

NRT FRP MWIR

2025-11 Night



- GEO/LEO - daily maps: **S3 FRP NRT** vs. **MTG-I/FCI FRP**



- Motivated by the soon loss of MODIS Terra and natural limitations with MSG SEVIRI.

- Current results (4 months of inter-comparisons MTG):

S3 MWIR **Standard (Alternative)** FRP :Day: **10%** (**18%**) common with MTG/FCINight: **9%** (**7%**) common with MTG/FCI

- Like with SEVIRI, S3 NRT FRP detects a much higher number of fires (mostly small ones)

Additionally:

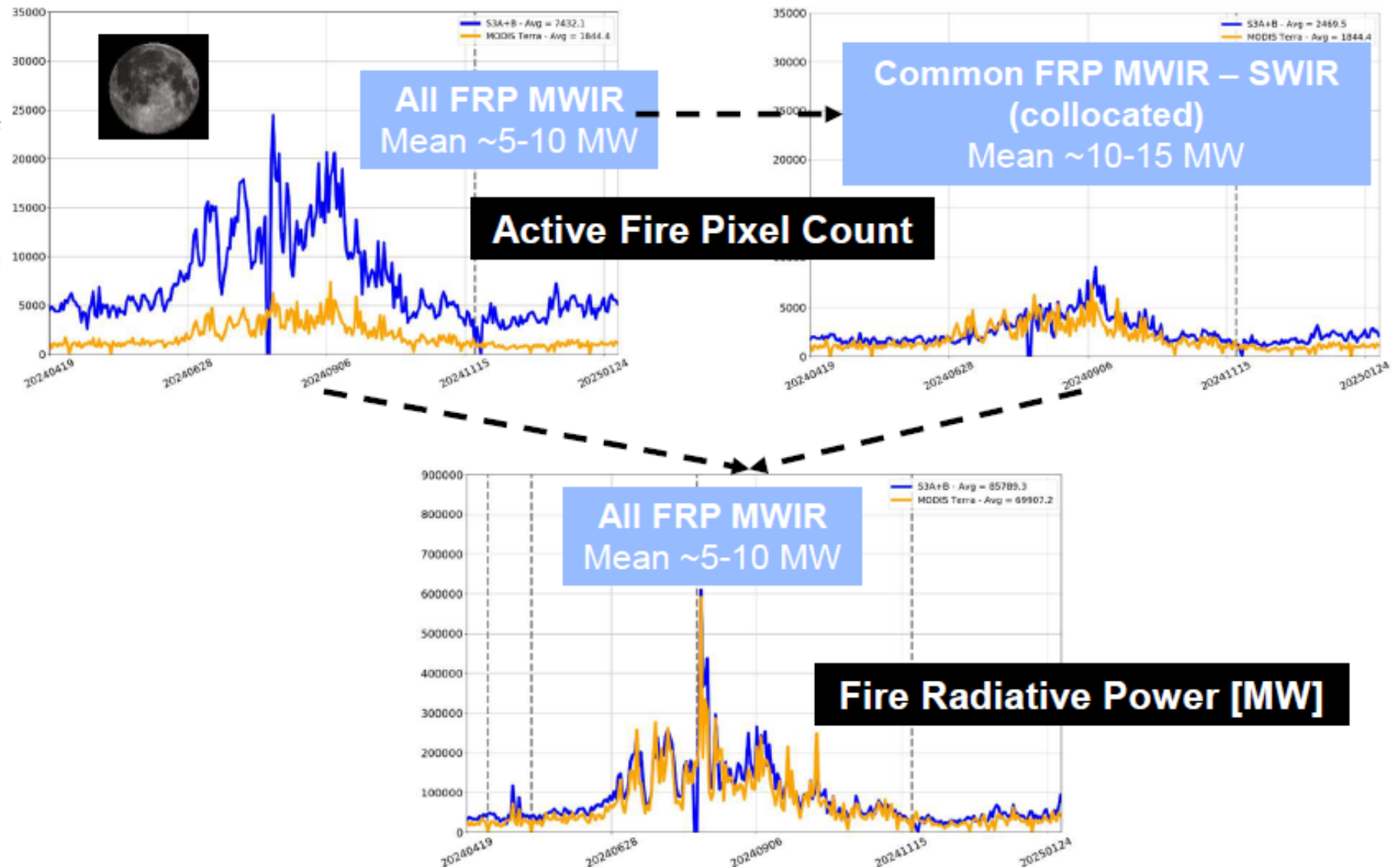
Mean Absolute Difference FRP: 19MW (Day) ; 7MW (Night)

- Under evolution with additional GEOs (GOES, HIMAWARI – Credits IPMA & ECMWF).

=> Replacing the daily S3 vs. MODIS Terra with S3 vs. “Global” GEO inter-comparison monitoring

Sensitivity of S3 NRT FRP processor towards small fires

- Night-Time Active fire vs. MODIS Terra:
 - S3 = Much higher number of active fire pixel counts.
 - S3 Mean FRP ~5-10 MW
 - MODIS Terra Mean FRP > 10 MW (with high pixel distortion).
- The vast majority of S3 new active fires => weakly radiative.
 - Confirmed based on S3 / MODIS Terra match up.
 - Independent verification with common S3 FRP MWIR vs. SWIR.
- Overall regional / global FRP is very close.





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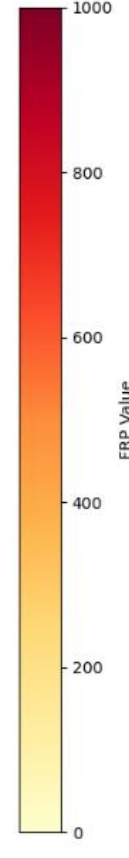
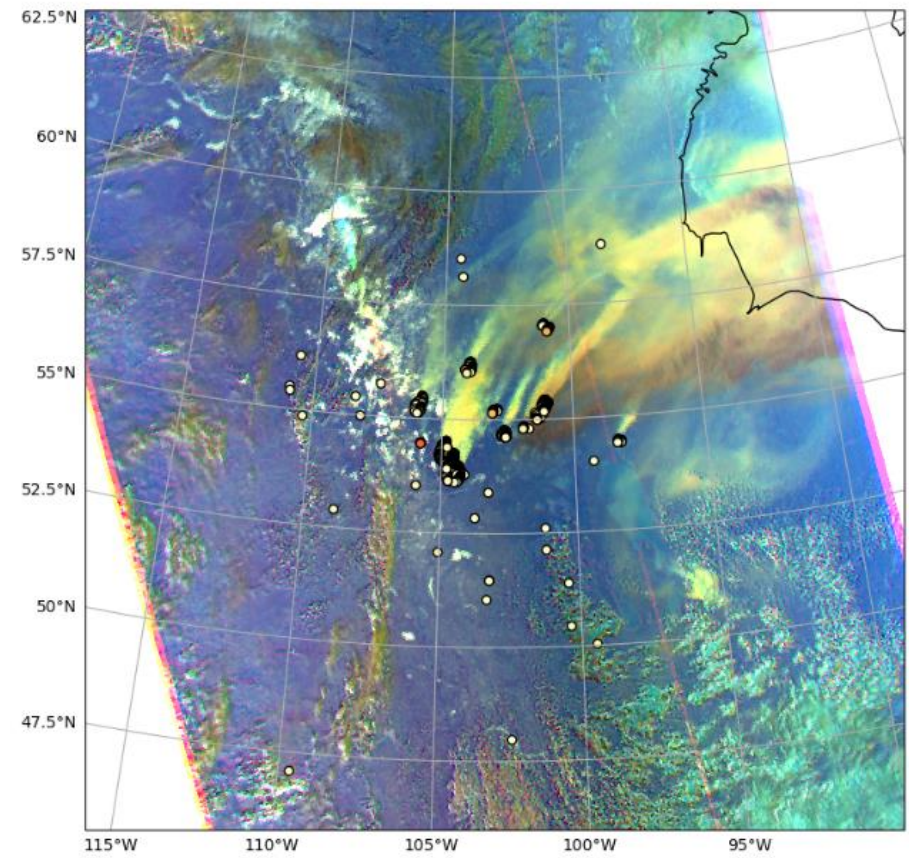
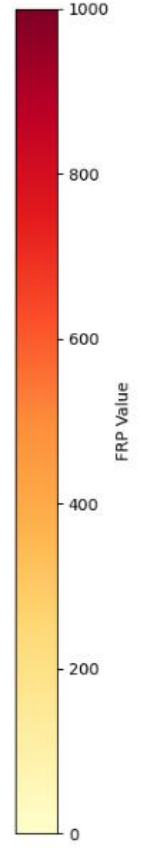
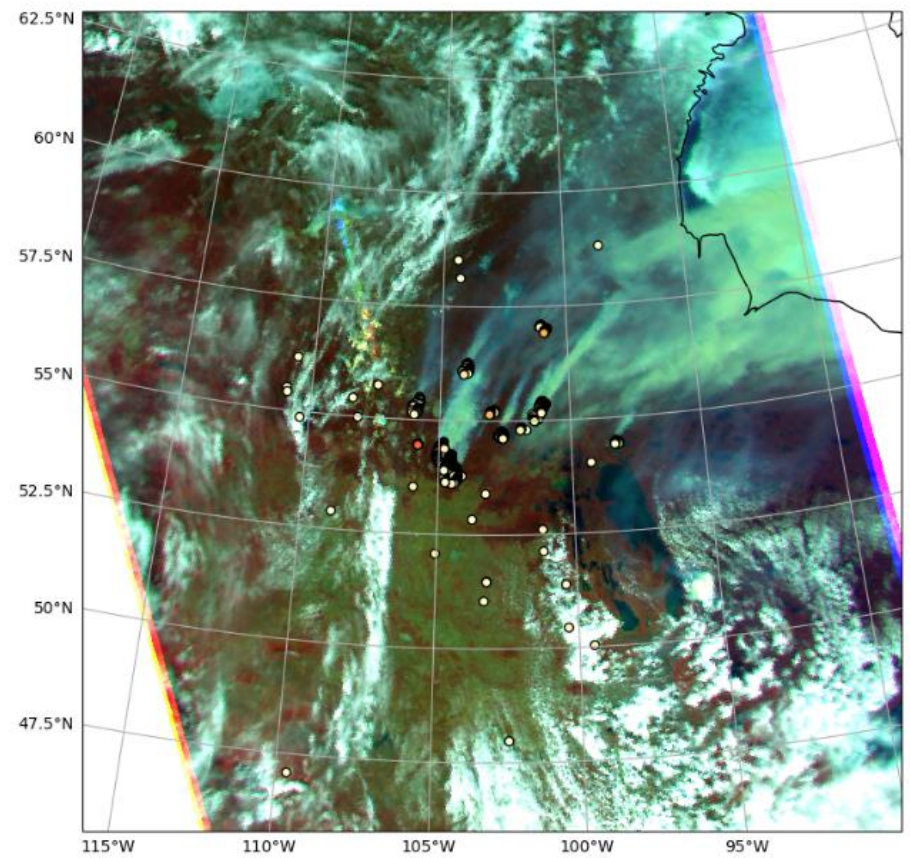


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New imagery quality analyses – Synergy FRP Polarimeters

Synergy Sentinel-3 NRT FRP with Polarimetry RGB (NASA Harp 2)



Canada wildfires 27th May 2025

Credits:
Pepe Philips,
Edouard Martins,
Bertrand Fougne,
Julien Chimot
(EUMETSAT)



Upcoming Collection 3.2 in a nutshell

- To be publicly **released in May 2026**
- Main evolutions in the Coll3.2:
 - **Further user-friendliness** of product with separation in 2 folders: “FRP” (fires only) + “FGE” (geodetic grid)
 - similar overall product size, but the “FRP-only” content is now 60-80% lighter than in Coll3.1
 - **Improved detection accuracy** based on advanced imagery analyses
 - Removal of remaining outliers in very high latitudes in summertime
 - Flagging of small bright reflective targets within the 1km-pixel (with use of the 500m VIS+SWIR channels)
 - Specification and implementation of confidence classes for user guidance
 - **Adaptation due to planned updates in SL1 product (new Baseline Collection 005 to be released May 2026)**
 - Vicarious calibration included
 - Change in granule duration (from 5-8min to 3min)

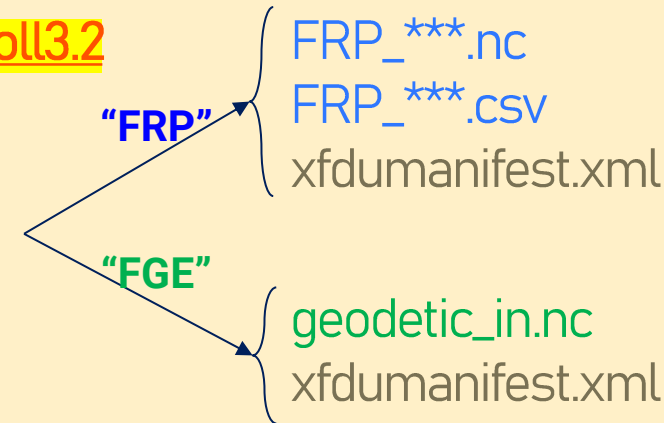


Upcoming Collection 3.2 – New format

CURRENTLY in Coll3.1



SOON with Coll3.2



Creation of the csv files since the release of Coll3.0 in July 2024 (after thorough user survey)

Change in product duration of granule (due to update in SL1 BC 005)

Coll3.1: between 5 and 8 minutes

Coll3.2: permanent fixed 3 minutes

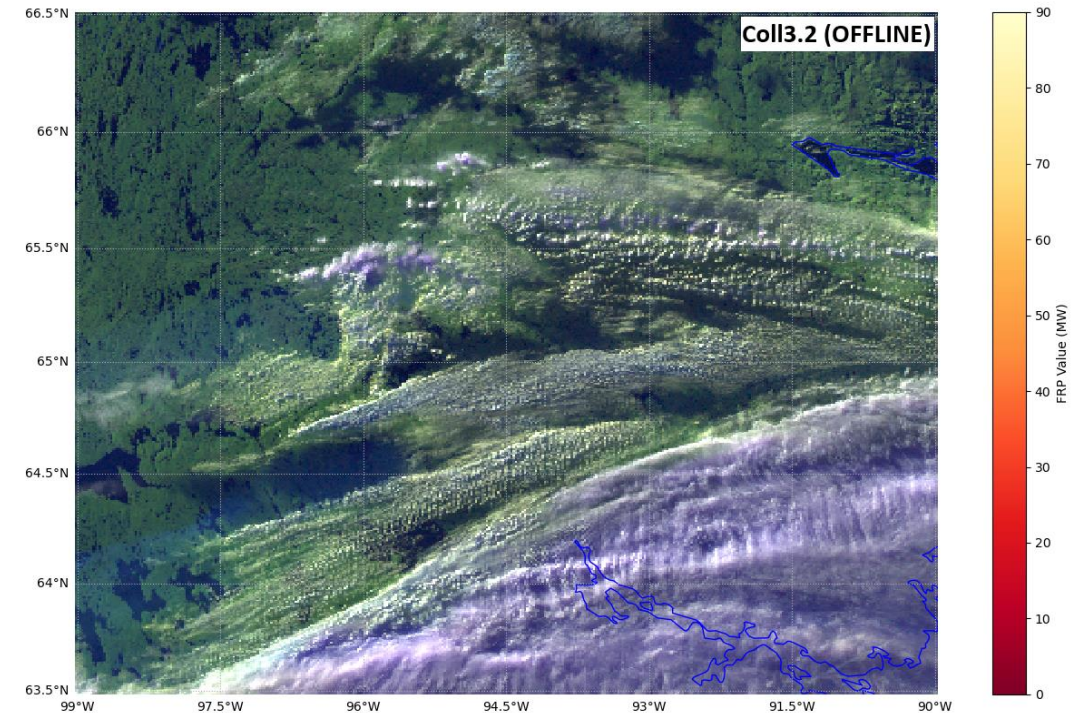
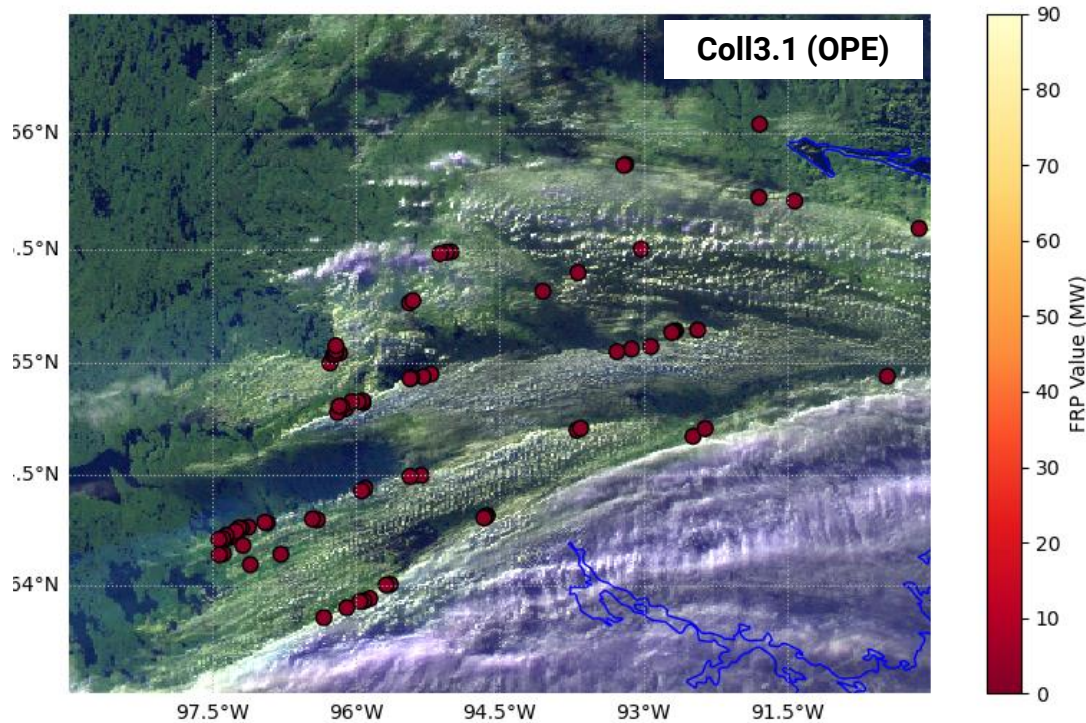
Creation and provision of a **DAB (Daily Aggregated Burning) Fires Area dataset** – 1 csv file per day

Contact *E. Martins* or *J. Chimot* for accessing the data + credentials of EUMETSAT ftp server

Upcoming Collection 3.2 – Improved Daytime (1/3)

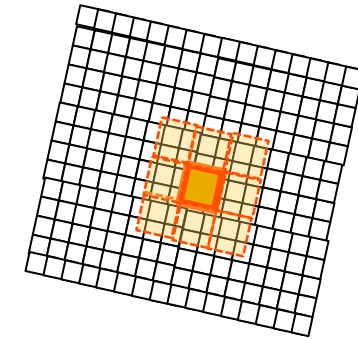
Outlier residuals within the night-time detection algorithm branch

- Apparent hot MWIR signals caused by elevated clouds in twilight zones (e.g. end of July, Canada)
 - Such targets display bright signal during raking-light conditions (very high Solar Zenith Angle)
 - Benefits of using Red (S2) and/or the cirrus (S4) bands (available during these conditions)
- ➔ Simple absolute S2 and/or S4 tests allow their removals



Upcoming Collection 3.2 – Improved Daytime (2/3)

- **Use of subpixel information within the 1km MWIR IFOV between the *_an* and *_in* grids**
 - Reuse/adaptation of the near-neighbour module developed for Coll2.1
 - Use of tests+thresholds related to cloud and other bright targets (i.e., solar panels) to overcome the known false alarms in the Daytime MWIR branches
 - Raising to **True** the pixels the flag related to cloud edges and to solar panels



black cells = 500m image grid (S1→S6)
orange cells = 1km image grid (S7→S9; F1)

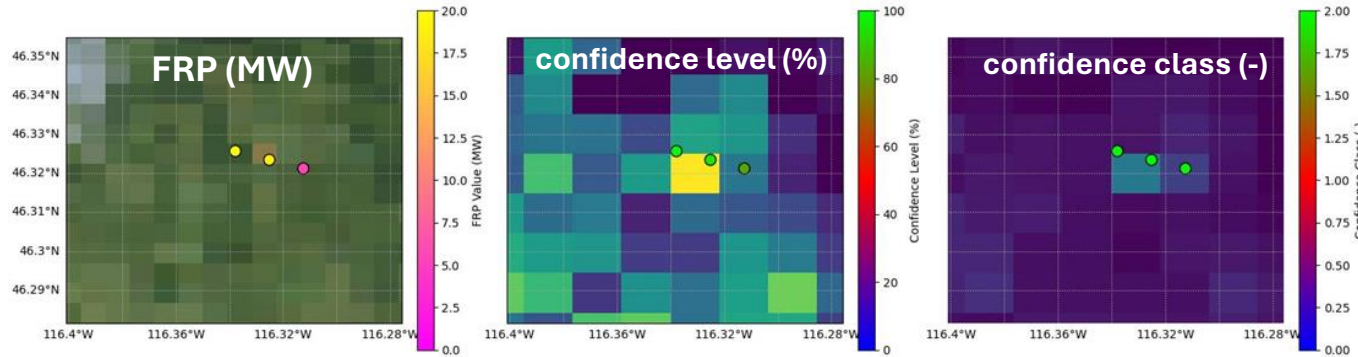
Use of same tests/thresholds for detection of bright reflective targets (*ATBD VIIRS 375m FRP, Schroeder & Giglio 2016*)

- **Revision of confidence levels** (based on the original ATBD, *Wooster et al. 2020*) and **creation of confidence classes** (same thresholds 0%/30%/80% than in ATBD MODIS)

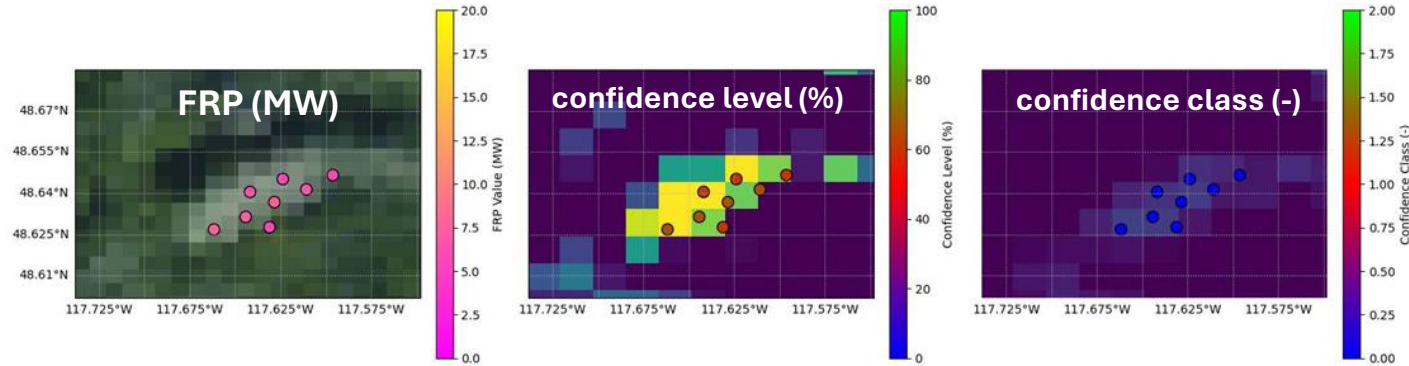
'Lower' confidence (=0)	if confidence_level < 30%
'Nominal' confidence (=1)	if 30% < confidence_level < 80%
'Higher' confidence (=2)	if confidence level > 80%



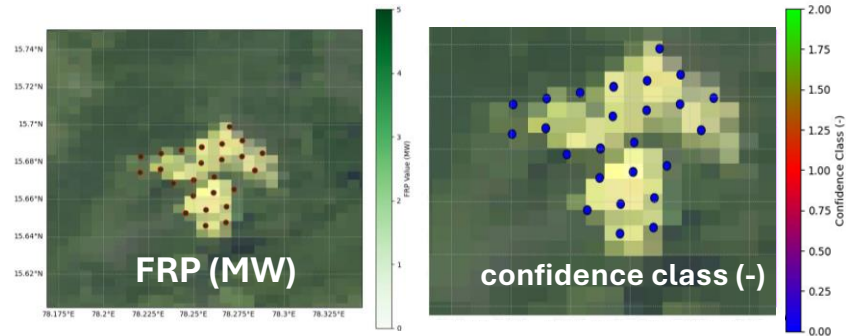
Upcoming Collection 3.2 – Improved Daytime (3/3)



Classified as
“HIGHER confidence”



Classified as
“LOWER confidence”



Classified as
“LOWER confidence”

Towards Ultra Fast FRP



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Intensive support to user exploitation: CAMS, CEMS, Google, NOAA, NASA Firms, Australia Bureau Meteorology, NRC, SMHI, etc...

Sentinel-3 NRT L2 FRP
EC EFFIS / GWIS viewer 2.0 portals

Additionally: multiple user requests addressed to EUMETSAT to optimize further the timeliness of the Sentinel-3 NRT L2 fire system:

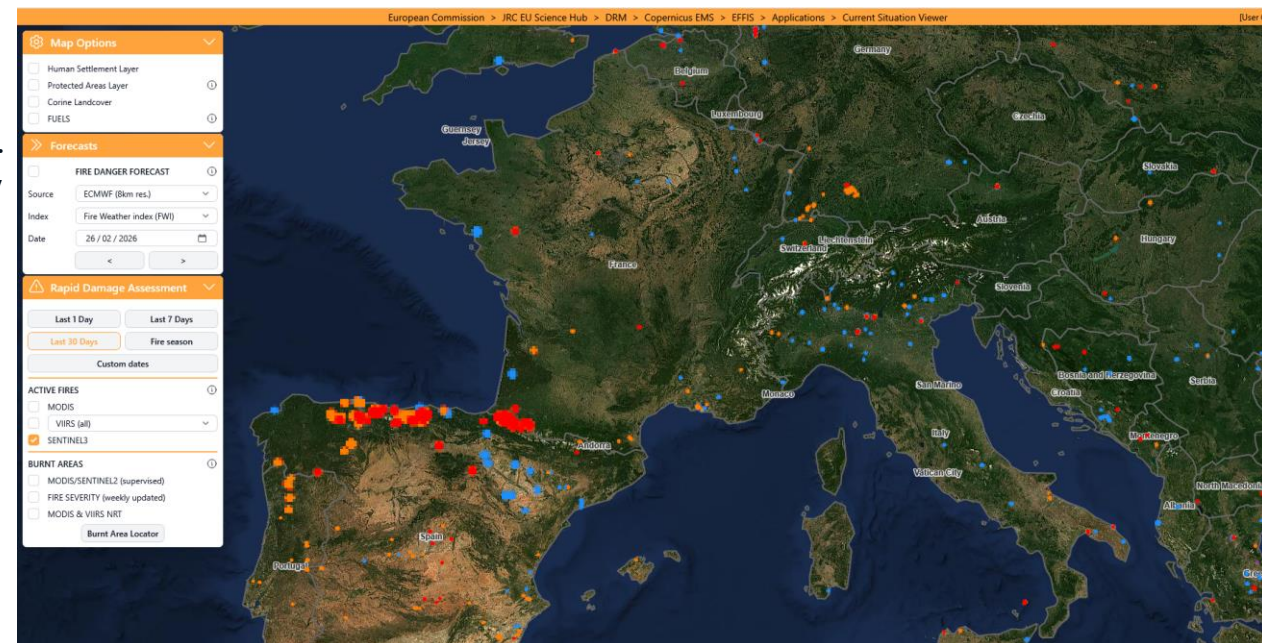
- EUMETSAT Future Focus wildfire workshop in 2024 (follow-up in November 2026).
- Member states from Copernicus Programme Committee meetings: e.g. Sweden / SMHI.
- EC / JRC request letter received in October 2025.

Objectives:

- **Fast:** < 2h30 – global coverage
- **Ultra Fast:** < 30 mins (threshold), < 15 mins (goal)
– regional coverage: Europe, Mediterranean basin...

Technical solutions being considered at EUMETSAT:

- 1) **Direct broadcast:** Identification of dedicated local ground-based antenna(s) (e.g. EARS). Feasibility under assessment.
- 2) **New OPERational Processor:** Major evolution of the Sentinel-3 NRT processing chain → reducing processing latency



Emergency Management



EUMETSAT



Copernicus
Europe's eyes on Earth

*Credits to: Alfredo Branco, Fernando Sedano, Elena Roglia, Tadas Nikonovas (JRC)
Edouard Martins, Daria Malik, Jagjeet Nain, Oscar Henriquez, Julien Chimot (EUMETSAT)*

Outcome & perspectives



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Major evolutions in Coll3.2 of FRP NRT → release in ~May 2026

- Enhanced user-friendliness (FRP and FGEodetic separated products)
- Improving detection accuracy: Solar panels, cloud edges, clouds in twilight, fire confidence classes
- All technical documentations + webpages to be updated by April 2026
- L1 calibration update + change in granule duration (3minutes), with noticed positive impact on S3 FRP NRT

Ongoing quality monitoring with current Coll3.1 and future Coll3.2...

- **LEO/LEO** (MODIS/Terra FRP... later this year VIIRS FRP)
- **LEO/GEO** (ex: MSG/SEVIRI since 2023; first results with MTG/FCI)

Constant/regular user interaction with agencies/institutions

Full-time mission Reprocessing of S3 NRT FRP (Coll3.2) to happen and being publicly released before Q2 2027

S3C Commissioning under preparation

Request received at EUMETSAT for providing a solution to improve the timeliness of the FRP NRT product

(Objective in the long term: towards 30min “threshold” or 15min “goal”)