



## Sentinel-3 Product Notice – SLSTR Fire Radiative Power products

<b>Mission</b>	Sentinel-3A & Sentinel-3B	
<b>Sensor</b>	SLSTR-A & SLSTR-B	
<b>Product</b>	<ul style="list-style-type: none"> <li>Level 2: SL_2_FRP at NTC</li> </ul>	
<b>Product Notice ID</b>	S3.PN-SLSTR-FRP.03	
<b>Issue/Rev Date</b>	28/02/2022	
<b>Version</b>	1.0	
<b>Preparation</b>	This Product Notice was prepared by the S3 Mission Performance Centre and by ESA experts	
<b>Approval</b>	ESA Mission Management	

### Summary

This Product Notice addresses both Sentinel-3A and -3B SLSTR Fire Radiative Power (FRP) processing baselines deployed on 28/02/2022. It is applicable to Non-Time Critical (NTC) timeliness.

It corresponds to the public release of SL\_2 FRP products, made on the 28<sup>th</sup> of February 2022.

The Notice describes the Level-1B current status, the processing baseline, the product quality and known limitations for both SL\_FRP-A and SL\_FRP-B.



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### Processing Baselines

<b>Processing Baseline</b>	<ul style="list-style-type: none"><li>Processing Baseline ID : FRP_NTC.004.07.00</li></ul>
<b>IPFs version</b>	<ul style="list-style-type: none"><li>SL_2_FRP IPF version 01.07</li><li>SL_1 IPF version: 06.19</li><li>PUG version: 3.44</li></ul>

### Current Operational Processing Baselines

<b>IPF</b>	<b>IPF Version</b>	<b>Into operations since</b>
S3A & S3B SL_2_FRP	01.07	<b>Land Centres:</b> NTC mode: 28/02/2022 09:05 UTC
S3A & S3B SL_1	06.19	<b>Land Centres:</b> NTC mode: 28/02/2022 09:05 UTC
PUG	3.44	<b>Land Centres:</b> NTC mode: 28/02/2022 09:05 UTC



## Details of the changes and impacts

This updated FRP processor includes two main evolutions. First, to complete the daytime detection included in the previous FRP algorithm, the specific case of S7-saturated area has been analysed and a dedicated fire detection algorithm included in this processor version. Secondly, the SWIR detection has been reviewed and improved to provide accurate results over nighttime products.

### **Fire detection over Land saturated area:**

To cope with the saturation level on S7 radiances, especially over daytime, a combined “brightness temperature dataset has been created internally and used for fire detection. This dataset is formed by first copying S7 measurements. Then, over each pixel associated with a saturated S7 brightness temperatures (i.e., superior to 311 K), the S7 value is replaced by the F1 brightness temperature. In addition, the same replacement is also performed for each pixel in the surrounding 11 ×11 pixel window when S7 brightness temperature and the difference between S7 and S8 are above certain thresholds (respectively 300K and 10K). Note also that specific test is excluding F1 pixels affected by the down-scan anomaly phenomena.

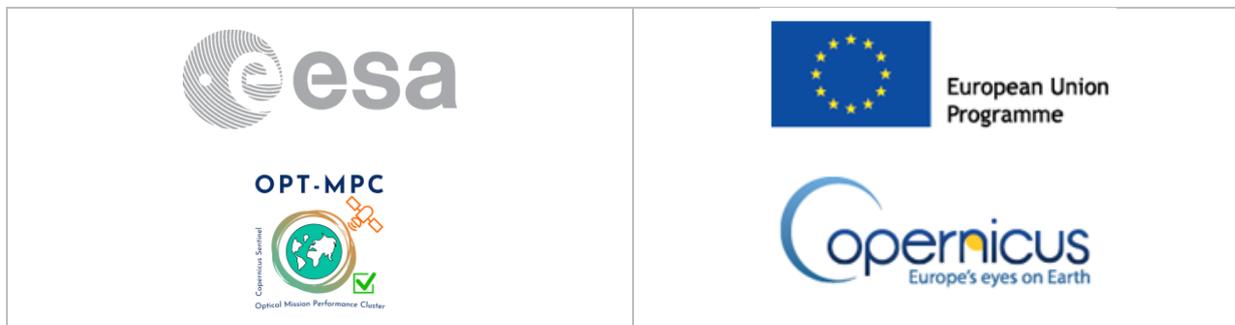
The fire detection and confirmation approach is then applied on this combined radiometric dataset, similarly to the daytime non-saturated and nighttime cases, but with appropriate thresholds.

Note that, on a contrary to the previous processing baseline, the MWIR detection is now only performed over land.

### **Fire detection using SWIR radiances:**

To ensure the performance of the fire detection based on SWIR radiances, it has been decided to restrict this approach to the night-time product, over both land and oceanic areas. The SWIR detection is performed using both SLSTR S5 at 1.6 μm and S6 at 2.25 μm channels. Tests are performed directly over the 500m resolution and provided in a separate file, called FRP\_an or FRP\_bn depending on the selected stripe (Note that the nominal configuration has been defined selecting only A stripe). These tests are using the fact that, during nighttime, SWIR channel signals should essentially be very close to zero over ambient temperature surfaces and that fires emit significantly at these wavelengths.

To link both detection (using MWIR and SWIR measurements), a clustering approach is performed between both resolutions, 500m and 1 km grid. Any confirmed SWIR fire is projected on the 1 km grid and, if possible, SWIR fire clusters are matched with corresponding MWIR fire clusters. A FRP\_MWIR value is then derived, based on the matching distribution.



## Status of the Processing Baseline

The current processing baseline for SLSTR-A FRP and SLSTR-B FRP products is v3.03. The baseline was deployed in the Land processing centres on 28/02/2022 for SLSTR-A and for SLSTR-B.

The quality status of the baseline products is as follows:

### Geometric Calibration

- SLSTR-A and SLSTR-B nadir and oblique view geolocation accuracy meet the mission requirements (0.5 pixel as per S3 MRTD, 2011).
- The estimated geometric validation for SLSTR-A and SLSTR-B is within 0.1 pixel in nadir view along and across track and in oblique view across track.
  - Smaller offset (still within requirements) is observed in oblique view along track (~0.2 pix) for both satellites.

### TIR Radiometric Calibration

- SLSTR-A: TIR radiometric accuracy meets the mission requirements (S3 MRTD, 2011).
- SLSTR-B: TIR radiometric accuracy is under evaluation. Early results presented at the SLSTR technical In-Orbit Commissioning Review (IOCR) suggest that the calibration is compliant for the mission requirements above 250K (S3 MRTD, 2011).

### VIS/SWIR Radiometric Calibration Information

SLSTR-A/B: All solar channels (S1-S6) have been undergoing a vicarious calibration assessment to quantify their radiometric calibration adjustment. Recent analysis of vicarious calibration results over desert sites performed by RAL, CNES, Rayference and University of Arizona have determined new and consistent radiometric deviations wrt. common reference sensors (MERIS, MODIS). Consequently, these have been used to provide a first-order radiometric corrections which are provided in the below tables (restricted to S5 and S6 - complete tables can be found in SLSTR L1 product notice). As current radiances in the L1B product remain uncorrected of these radiometric calibration adjustments, the calibration factors associated with S5 and S6 radiances have been included as configurable parameters in the FRP algorithm. They are applied to SWIR radiances and their associated detection thresholds.

	S5 – Nadir view	S6 – Nadir view	S5 – Oblique view	S6 – Oblique view
Correction	1.11	1.13	1.04	1.07
Uncertainty	0.02	0.02	0.03	0.05



## Flags

Several flags are internally processed inside the SLSTR L2 FRP algorithm/software and are not derived from SLSTR L1B products:

- The cloud masking considered in the FRP processing is based on an internal algorithm radiometry test and is different from the SLSTR L1 masking – for one reason because of the need to minimise the chances that areas of smoke are masked as cloud.
- The surface classification is derived from the Global Land Cover 2000 map.
- The sun glint risk is also internally re-evaluated and the results can differ from the one included in the SLSTR L1B Product. This internal sunglint detection test works well in most cases and has been improved to take into account saturation on S2 and/or S3 radiances. In addition, specific tests have been added to detect solar panels and other reflective surfaces, which can cause similar glint effects and need to be treated as false alarms.

## Known product quality limitations

The SLSTR FRP products are considered mature enough to be released, and intercomparisons against near-contemporaneous measurements from other sensors have demonstrated their general quality. However, some elements should still be considered with caution. Specifically the following issues remain under investigation and/or development;

- Very frequent saturation of the S7 channel over active fire pixels means that the F1 channel must often be used instead to accurately measure MIR waveband spectral radiances, but the F1 and S7 channels are not perfectly co-located. Hence the algorithm includes the strategy of clustering spatially contiguous active fire pixels into individual fires (each composed of a cluster of active fire pixels) to cope with this fact. There is a switch within the algorithm that defines whether the active fire pixel FRP retrievals within each individual fire are all calculated using the F1 data, or whether those fires that contain only unsaturated S7 pixels still have their per-pixel FRPs retrieved using the S7 data (these options are termed F1\_ON or F1\_OFF respectively). After a period of testing, intercomparison and evaluation against independent measurements, the first situation (F1\_ON) has been shown to deliver better product performance and is the one implemented to produce the operational NTC FRP products.
- As the AF pixel detection “confidence” parameter was not yet properly calibrated for use with SLSTR data, this value has been suppressed from the FRP products. The product does however include an estimate of the uncertainty on the FRP retrievals made using the MIR band signals.
- There are some rare instances where the F1 channel shows very high brightness temperatures that are not representative of real environmental conditions (generally downscan of very cold clouds). A specific test has been included to avoid false active fire detections and a dedicated flag - F1\_downscan – included in the FRP\_flag parameter.



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### Products Availability

- Copernicus Open Access Hub (<https://scihub.copernicus.eu/>), NRT and NTC
- Copernicus Online Data Access (<https://coda.eumetsat.int/>), NRT and NTC
- EUMETCast (<https://eoportal.eumetsat.int/>), NRT
- EUMETSAT Data Centre (<https://eoportal.eumetsat.int/>), NRT and NTC
- Other

### Any other useful information

- None

### User Support

- Questions about SLSTR products can be asked to the Sentinel-3 User Support desk at:
  - [eosupport@copernicus.esa.int](mailto:eosupport@copernicus.esa.int)

### References

- SLSTR L1 Product Notice
  - S3.PN.SLSTR-L1.09, v1.0 dated on 20/01/2022
- Product Data Format Specification – Sentinel-3 SLSTR Product Data Format Specification - Level 2 Fire products, Ref: S3MPC.ACR.FRP.003, Issue: 1.4, Date: 2 December 2021  
<https://sentinel.esa.int/web/sentinel/user-guides/sentinel-3-slstr/document-library>

### Static ADFs



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### S3A

- S3\_SL\_2\_CFM\_AX\_20160216T000000\_20991231T235959\_20190930T120000\_\_\_\_\_MPC\_O\_AL\_002.SEN3
- S3\_SL\_2\_PLFMAX\_20160216T000000\_20991231T235959\_20190930T120000\_\_\_\_\_MPC\_O\_AL\_002.SEN3
- S3A\_SL\_2\_FRPTAX\_20160216T000000\_20991231T235959\_20211201T120000\_\_\_\_\_MPC\_O\_AL\_004.SEN3
- S3A\_SL\_2\_FXPAAX\_20160216T000000\_20991231T235959\_20211201T120000\_\_\_\_\_MPC\_O\_AL\_003.SEN3
- S3A\_SL\_2\_PCPFAX\_20160216T000000\_20991231T235959\_20211201T120000\_\_\_\_\_MPC\_O\_AL\_005.SEN3
- S3A\_SL\_2\_S6N\_AX\_20160216T000000\_20991231T235959\_20190930T120000\_\_\_\_\_MPC\_O\_AL\_002.SEN3
- S3A\_SL\_2\_SXPAAX\_20160216T000000\_20991231T235959\_20190930T120000\_\_\_\_\_MPC\_O\_AL\_002.SEN3
- S3A\_SL\_1\_N\_F1AX\_20160216T000000\_20991231T235959\_20170324T120000\_\_\_\_\_MPC\_O\_AL\_006.SEN3
- S3A\_SL\_1\_N\_S7AX\_20160216T000000\_20991231T235959\_20170324T120000\_\_\_\_\_MPC\_O\_AL\_006.SEN3
- S3A\_SL\_1\_N\_S8AX\_20160216T000000\_20991231T235959\_20170324T120000\_\_\_\_\_MPC\_O\_AL\_006.SEN3
- S3A\_SL\_2\_S7N\_AX\_20000101T000000\_20991231T235959\_20151214T120000\_\_\_\_\_MPC\_O\_AL\_001.SEN3
- S3A\_SL\_2\_F1N\_AX\_20000101T000000\_20991231T235959\_20151214T120000\_\_\_\_\_MPC\_O\_AL\_001.SEN3

### S3B

- S3\_SL\_2\_CFM\_AX\_20160216T000000\_20991231T235959\_20190930T120000\_\_\_\_\_MPC\_O\_AL\_002.SEN3
- S3\_SL\_2\_PLFMAX\_20160216T000000\_20991231T235959\_20190930T120000\_\_\_\_\_MPC\_O\_AL\_002.SEN3
- S3B\_SL\_2\_FRPTAX\_20180425T000000\_20991231T235959\_20211201T120000\_\_\_\_\_MPC\_O\_AL\_003.SEN3
- S3B\_SL\_2\_FXPAAX\_20180425T000000\_20991231T235959\_20211201T120000\_\_\_\_\_MPC\_O\_AL\_002.SEN3
- S3B\_SL\_2\_PCPFAX\_20180425T000000\_20991231T235959\_20211201T120000\_\_\_\_\_MPC\_O\_AL\_004.SEN3
- S3B\_SL\_2\_S6N\_AX\_20180425T000000\_20991231T235959\_20190930T120000\_\_\_\_\_MPC\_O\_AL\_001.SEN3
- S3B\_SL\_2\_SXPAAX\_20180425T000000\_20991231T235959\_20190930T120000\_\_\_\_\_MPC\_O\_AL\_001.SEN3
- S3B\_SL\_1\_N\_F1AX\_20180425T000000\_20991231T235959\_20181002T120000\_\_\_\_\_MPC\_O\_AL\_002.SEN3
- S3B\_SL\_1\_N\_S7AX\_20180425T000000\_20991231T235959\_20190912T120000\_\_\_\_\_MPC\_O\_AL\_003.SEN3
- S3B\_SL\_1\_N\_S8AX\_20180425T000000\_20991231T235959\_20180409T120000\_\_\_\_\_MPC\_O\_AL\_001.SEN3
- S3B\_SL\_2\_S7N\_AX\_20180425T000000\_20991231T235959\_20180409T120000\_\_\_\_\_MPC\_O\_AL\_001.SEN3
- S3B\_SL\_2\_F1N\_AX\_20180425T000000\_20991231T235959\_20180409T120000\_\_\_\_\_MPC\_O\_AL\_001.SEN3

**End of the Product Notice**