TERRASCOPE SENTINEL-3

ALGORITHM THEORETICAL BASE DOCUMENT (ATBD)

Sentinel-3 Land Surface Temperature daily and 10-daily composites

Reference: ***Terrascope Sentinel-3 LST composites Algorithm Theoretical Base Document***
DOI:
Authors: Carolien Toté, Lieve Van den Heuvel
Version: 1.0
Date: 19/11/2025

DOCUMENT CONTROL

Signatures

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Change record

Release	Date	Updates	Approved by
1.0	19/11/2025	Initial version	Jurgen Everaerts

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LIST OF ACRONYMS

ACRONYM	EXPLANATION
AATSR	Advanced Along Track Scanning Radiometer
ATSR	Along Track Scanning Radiometer
ATBD	Algorithm Theoretical Base Document
CLMS	Copernicus Land Monitoring Service
COG	Cloud-Optimized GeoTIFF
DEM	Digital Elevation Model
DN	Digital Number
EO	Earth Observation
ESA	European Space Agency
GDAL	Geospatial Data Abstraction Library
GEOTIFF	Geospatial Tagged Image File Format
GIS	Geographical Information System
GRD	Ground Range Detected
IW	Interferometric Wide Swath
L2	Level 2
L3	Level3
LST	Land Surface Temperature
LSTunc	Land Surface Temperature uncertainty
LUT	Lookup table
MERIS	MEdium Resolution Imaging Spectrometer
MODIS	MODerate Resolution Imaging Spectroradiometer
NRT	Near-real time
NTC	Non-time critical
OGC	Open Geospatial Consortium
OPT-MPC	Optical Mission Performance Cluster
PDF	Product Distribution Facility
PDU	Product Dissemination Unit
PROBA-V	Project for Onboard Autonomy - Vegetation
S1	1-day composite
S10	10-daily composite
S3A/B	Sentinel-3A/B
SAR	Synthetic Aperture RADAR
SL_2_LST	SLSTR Level 2 LST product
SLC	Single Look Complex
SLSTR	Sea and Land Surface Temperature Radiometer
SNAP	Sentinel Application Platform
SPOT	Satellite Pour l'Observation de Terre
SRTM	Shuttle RADAR Topography Mission
STAC	SpatioTemporal Asset Catalogs
SYN	Synergy
V	Version
VGT	Vegetation
WGS	World Geodetic System

1. Introduction

1.1. Terrascope explained

Terrascope is the Belgian platform for Copernicus Sentinel, PROBA-V and SPOT-VEGETATION satellite data, products, and services. It provides easy, full, free and open access to all users without restrictions. This allows non-specialist users to explore the wealth of remote sensing information and build value-added products and services.

The following data are included:

- Sentinel-1 SAR data (sigma0 and coherence) over Belgium and its surroundings
- Sentinel-2 multispectral data over Europe and parts of Africa
- Sentinel-3 multispectral Synergy (SYN) – Vegetation (VGT) and thermal Land Surface Temperature (LST) data
- Sentinel-5P atmospheric composition data
- The SPOT-VEGETATION archive
- The PROBA-V archive

Users have the possibility to build derived information products to their own specification, using the Terrascope processing cluster through provided virtual machines or notebooks, and via OpenEO. This eliminates the need for data download (and consequential storage costs), because the cluster holds all the data in a directly accessible, analysis-ready format. Integration of data or products in your own application is facilitated through catalog (STAC) and Open Geospatial Consortium (OGC) web services.

Terrascope is user centered, so any suggestions for new or enhanced functionality are welcome. Feel free to contact us: info@terrascope.be.

1.2. Scope of Document

This ATBD (Algorithm Theoretical Base Document) describes the origin and generation of the Sentinel-3 (S3) Level-3 Land Surface Temperature (LST) product.

The document is organised as follows:

- Section 2 provides an overview of the input data needed for the processing workflow.
- Section 3 explains the data available to users.
- Section 4 provides a detailed description of the different processing algorithms.
- Section 5 justifies the overall workflow with a quality assessment.

1.3. Description

Land Surface Temperature (LST) is the radiative skin temperature of the land surface and can be measured by satellite instruments, such as the Sea and Land Surface Temperature Radiometer (SLSTR) sensor onboard Sentinel-3. SLSTR is designed to retrieve global Land Surface Temperature to an accuracy of less than 1 K (Ghent et al., 2024).

The Terrascope Sentinel-3 (S3) Level 3 (L3) Land Surface Temperature (LST) composite products consist of daily and 10-daily LST composites on a fixed 1°/112 grid, like the regular latitude/longitude 'Plate carée' grid that was used for SPOT/Vegetation and PROBA-V.

Only day-time composite products are delivered, starting from S3 Sea and Land Surface Temperature Radiometer (SLSTR) Level 2 (L2) non-time critical (NTC) LST products as available through the Copernicus Data Space Ecosystem and Terrascope.

Table 1.1: Summary of main characteristics of different Terrascope versions until V100.

Version	Main characteristics
V100	• Initial version

1.4. Feature added value/use case

Currently, there are no multi-day composites of S3-SLSTR LST available for users in close to NRT timeliness (based on latest available Level 2 NTC input products, with timeliness up to 30 days, but usually available 48-72 hours after acquisition).

The benefit of providing Sentinel-3 LST composites on the regular 1/112° (1 km) PROBA-V grid, with the same temporal resolution as the CLMS global biophysical variable products (i.e., 3 composites per month) and projected on a similar grid, is that combined use of biophysical variables and LST for e.g. drought monitoring is simplified. In addition, the Terrascope products are provided (almost) in near-real time (in contrast to e.g. ESA CCI LST).

Through the Optical Mission Performance Cluster (OPT-MPC), a limited dataset is made available of daily and monthly composites of clear-sky SLSTR LST per platform (S3A/S3B), generated by the University of Leicester. The data is stored in an equal-angle longitude-latitude global grid, with a spatial resolution of 0.05°. Both day-time and night-time composites are available, but only for the time range January/2018-March/2022 (for S3A) or March/2019-March/2022 (for S3B).

With the ESA CCI LST project (former GlobTemperature), a consistent long-term LST CDR of over 20 years from 1995 to 2020 for ATSR-2 through to SLSTR is created, by bridging and filling the gap between MERIS/AATSR and Sentinel-3/SLSTR. See key documents.

- There is a dataset of 1-day LST composites (Day/Night) available at 0.05° spatial resolution (v2.00) up to the end of 2020. Data can be downloaded from: https://gws-access.jasmin.ac.uk/public/esacci_lst/.
- There is a dataset of 1-day and monthly LST composites (Day/Night) available at 0.01° spatial resolution (v3.00) up to the end of 2020. Data can be downloaded from: https://data.ceda.ac.uk/neodc/esacci/land_surface_temperature/data.

The CLMS LST product is based on geostationary satellites, with a spatial resolution of 5/112°, see https://land.copernicus.eu/global/products/lst.

2. Input data

2.1. General

Sentinel-3 SLSTR Level2 Land Surface Temperature products at full resolution (i.e. around 1 km) are used as input to generate the daily and 10-daily composite products. The SL_2_LST product contains LST from the SLSTR instrument at a spatial resolution of 1 km calculated using a split-window approach[1]. S-3 SLSTR L2 LST products are distributed in Product Dissemination Units (PDUs).

Only 3' PDUs are processed to generate the Terrascope LST composite products. Until 02/05/2020 S-3A based NTC products were full pole to pole orbit files. Since 03/05/2020, the S-3A PDUs are 3' frames[2]. S-3B SLSTR L2 LST products are all distributed as 3' PDUs. Only products starting from 03/05/2020 are processed in a systematic way.

For each input **S3*_SL_2_LST** product, the following bands are used: **LST**, **LST_uncertainty** (LST uncertainty estimates), and several layers provided for the SLSTR instrument nadir view, i.e. the **bayes_in** and **cloud_in** cloud masks, and **solar_zenith_tn** and **sat_zenith_tn** geometry layers:

- LST contains LST estimates, saved as int16, scaled DN [-32767, 32767], corresponding to physical values between [224.466, 355.534] Kelvin, using scaling factor 0.002 and offset 290.0
- LST_uncertainty contains estimated LST uncertainties, saved as int16, scaled DN [0, 4000], corresponding to physical values in the range [0, 8], using scaling factor 0.002
- The bayes_in band contains the result of the probabilistic cloud test, which has improved performance since 23/10/2020.
- Cloud_in is based on threshold-based cloud tests.
- The solar_zenith_tn (solar zenith angle of the SLSTR nadir view) is used to distinguish day from night-time observations.
- The sat_zenith_tn (satellite zenith angle of the SLSTR nadir view) is used to give preference to near-nadir observations.

2.2. Data availability

SLSTR-A SL_2_LST is available from 05/07/2017, and SLSTR-B SL_2_LST available from 26/02/2019. However, since only 3' PDUs are processed (see above), Terrascope daily and 10-daily composite products are only available from 01/05/2020 onwards.

[1] https://sentinel.esa.int/documents/247904/4598082/Sentinel-3-SLSTR-Land-Handbook.pdf
[2] https://sentinels.copernicus.eu/web/sentinel/-/new-time-duration-for-slstr-l2-ntc-user-products

3. Output

3.1. Data characteristics

The daily and 10-daily composite products have following characteristics:

- Spatial coverage and resolution:
  - global (85°N-65°S; 180°W-180°E)
  - resolution 1°/112, corresponding to about 1 km at the equator
  - Geographic Lat/Lon (WGS84) 'Plate carrée' grid.
  - Products are distributed as 10° x 10° tiles (3360 x 3360 pixels) named XxxYyy (Figure 1).
  - Only tiles covering (at least some) land surface are processed.
- Periodicity:
  - S1: daily composite product combining day-time observations, with separated products for S3A and S3B.
  - S10: 10-daily (1-10, 11-20, 21-end), i.e. 36 dekads per year, combining the S1 (daily) composite products. For multi-day compositing, S3A and S3B S1 products are combined.

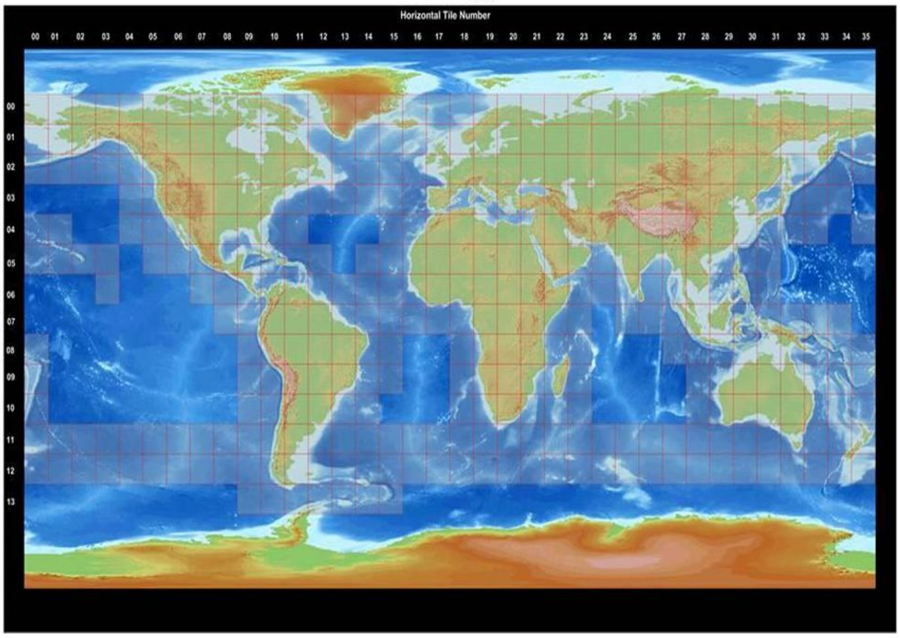

Figure 1: 10° x 10°tiling grid for distribution of Terrascope Sentinel-3 LST composite products

The LST and LSTunc output data are stored as int16 (to reduce file size) in Cloud Optimized Geotiff (COG) format, with separate files for:

- LST: land surface temperature
- LSTunc: land surface temperature uncertainty

Valid data ranges and scaling factors are specified in Table 2.

Table 2: DN and physical ranges and scaling factors for LST and LSTunc

Layer	NoData Value	DN range	Physical range	Scale	Offset
LST	-32768	[-32767, 32767]	[224.466, 335.534] K	0.002	290
LSTunc	-32768	[0, 4000]	[0, 8]	0.002	0

The physical value in Kelvin can be defined by using the following formula:

Physical Value = Scale * Digital Number + Offset,

with scale and offset as defined in Table 2. The NoData Value, Scale and Offset are stored in the COG metadata.

3.2. Product layers

All Terrascope Sentinel-3 LST are stored in either the **COG/S3_LST_S1_1KM** (daily products) or **COG/S3_LST_S10_1KM** (10-daily products) collection.

In the Terrascope Virtual Machine environment, this data can be found in these folders:
/data/MTDA/TERRASCOPE_Sentinel3/COG/S3_LST_S1_1KM/<Year>/<Year><Month><Day>/
/data/MTDA/TERRASCOPE_Sentinel3/COG/S3_LST_S10_1KM/<Year>/<Year><Month><Day>/

For every S1 product, three files are present:

- The LST image product itself
- An image that contains the uncertainties of the LST product (LSTunc)
- A text file holding the list of S3 SLSTR L2 LST input files used to generate the S1 product

The S1 file name is constructed as follows:
<platform>_LST_3_S1_<tile>_<date>_1KM_<product_type>_<product_version>.tif
and
<platform>_LST_3_S1_<tile>_<date>_1KM_<product_type>_<product_version>_input_files.txt

For every S10 product, two files are present:

- The LST image product itself
- An image that contains the uncertainties of the LST product (LSTunc)

The S10 file name is constructed as follows:
<platform>_LST_3_S10_<tile>_<date>_1KM_<product_type>_<product_version>.tif

Table 3: naming elements for LST products

Template	Description
platform	S3A or S3B
tile	X<xx>Y<yy> with xx: 00-35 and yy :00-13 A tile is 10° high in latitude and 10° wide in longitude, numbering in latitude (Y) is North to South, starting at +75° North for the top left corner to 55° South numbering is longitude (X) is West to East, starting at 180° West for the top left corner to 170° East
date	yyyymmdd
product_type	LST, LSTunc
Version	V100

Examples:

S3_LST_3_S1_X12Y11_20220202_1KM_LST_V100.tif
S3_LST_3_S1_X12Y11_20220202_1KM_LSTunc_V100.tif
S3_LST_3_S1_X12Y11_20220202_1KM_LST_V100_input_files.txt

and

S3_LST_3_S10_X12Y11_20220201_1KM_LST_V100.tif
S3_LST_3_S10_X12Y11_20220201_1KM_LSTunc_V100.tif

3.3. Product version

Terrascope products are produced in a controlled way. Every product has a version indicator, consistent with the Semantic Versioning 2.0.0 protocols (https://semver.org/). The version indicator has three digits: XYZ.

- X is 0 during prototyping and pre-operational use. X is 1 for the first operational setup, and increments when results are no longer backward compatible (i.e. any further processing will have to be adapted to deal with e.g. format changes, value scaling, etc.).
- Y is reset to 0 with an X increment. Y increments when functionality is added, but backward compatibility is guaranteed (e.g. when a different approach is taken for atmospheric or geometric correction).
- Z is reset to 0 when Y increments. Z increments when the software is patched (bug fixed) without any functional changes.

The current Terrascope Sentinel-3 LST composites workflow version is V100.

Whenever X or Y changes, the impact of the updates will be reported. Users are informed about version changes through the Terrascope newsletter (to subscribe: https://terrascope.be/en/stay-informed).

3.4. Product data access

The Terrascope S3 LST composite products can be visualized on the Terrascope viewer available at http://viewer.terrascope.be.

The Terrascope S3 LST composite products can be accessed through:

- Catalog services: STAC
- Web services: Web Map Service (WMS) and Web Map Tile Service (WMTS):
  Protocols for downloading images and integrating them into GIS software
- Notebooks (login required): https://notebooks.terrascope.be/hub/login
  Programming environment to quickly access and edit data
- Virtual Machines (VM) (login required): https://terrascope.be/en/form/vm
  External computer used to view data and process it in the cloud
- OpenEO API (login required): https://openeo.org/documentation/1.0/python/
  Python API to automate satellite data processing in the cloud

The details of each of these access points are described on https://docs.terrascope.be/

4. Methodology

4.1. Overview

An overview of the processing workflow is shown in Figure 2. In a first step, Sentinel-3 SLSTR L2 LST input products and bands are selected, and projected to the regular 1°/112 grid, using a SNAP GPT command. This yields a temporary dataset of gridded and tiled L2 LST, translating the following layers from the input data (see §2.1) LST, LST_uncertainty, cloud mask (based on bayes_in and confidence_in) and geometry layers (sat_zenith_tn, solar_zenith_tn, longitude_tx, latitude_tx).

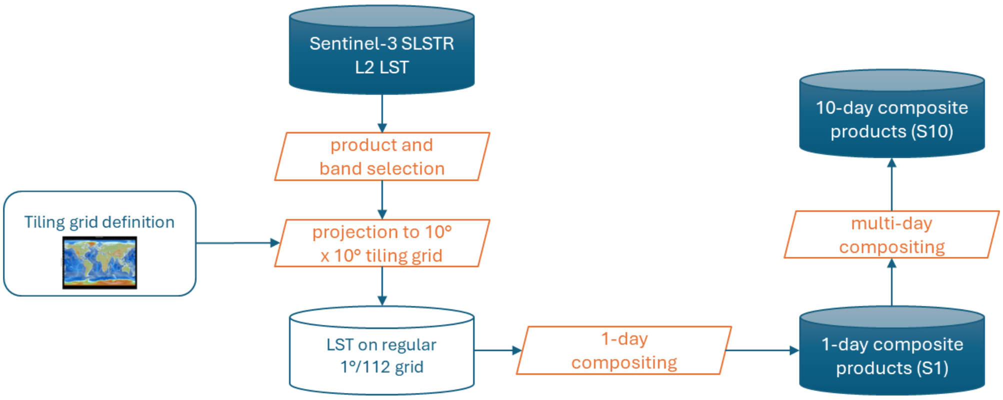

Figure 2: Terrascope LST Composites processing workflow overview

Daily composite products (S1) are generated from this temporary tiled dataset by selecting the LST input and associated LST_uncertainty with the minimum viewing zenith angle (i.e. closest to nadir view). Cloudy observations or observations with LST_uncertainty larger than 1 K are discarded. Observations from different platforms/sensors are not combined in the 1-day compositing step.

In the multi-day compositing step to generate 10-day composite products (S10), the mean LST is calculated from all valid S1 products in the compositing period (i.e. days 1-10, days 11-20, and days 21-end of the month), combining S1 products from different Sentinel-3 sensors.

$$LST_{mean} = \frac{1}{n}\sum_{i=1}^{n} LST_i$$

The LSTunc is propagated using the following formula:

$$\Delta LST_{mean} = \frac{1}{n}\sqrt{\Delta LST_{i=1}{}^2 + \Delta LST_{i=2}{}^2 + \cdots + \Delta LST_{i=n}{}^2}$$

4.2. Limitations

The main limitations of the Terrascope S1 and S10 LST composites are related to (i) limitations of the input data and the compositing algorithm; (ii) the length of the time series; and (iii) the limited quality information. This is described in more detail in the following paragraphs.

i. The temporal compositing algorithm is based on observation selection with lowest VZA (for S1) and mean value of daily composites (for S10). Masking of input Level 2 LST is done on the basic cloud mask and an uncertainty threshold. The latter has not been evaluated in detail, but it seems unlikely that uncertainty values above 1 K will be ever observed in the input product. Regarding the former, undetected clouds will lead to a negative bias in the LST. This means that artefacts in or underperformance of the input cloud mask will lead to artefacts in the daily and 10-daily composite products. An example is shown in Figure 3. This can be solved by revisiting the compositing algorithm, e.g. including outlier screening and removal and/or considering the use of the median instead of the mean value for the 10-day composites.

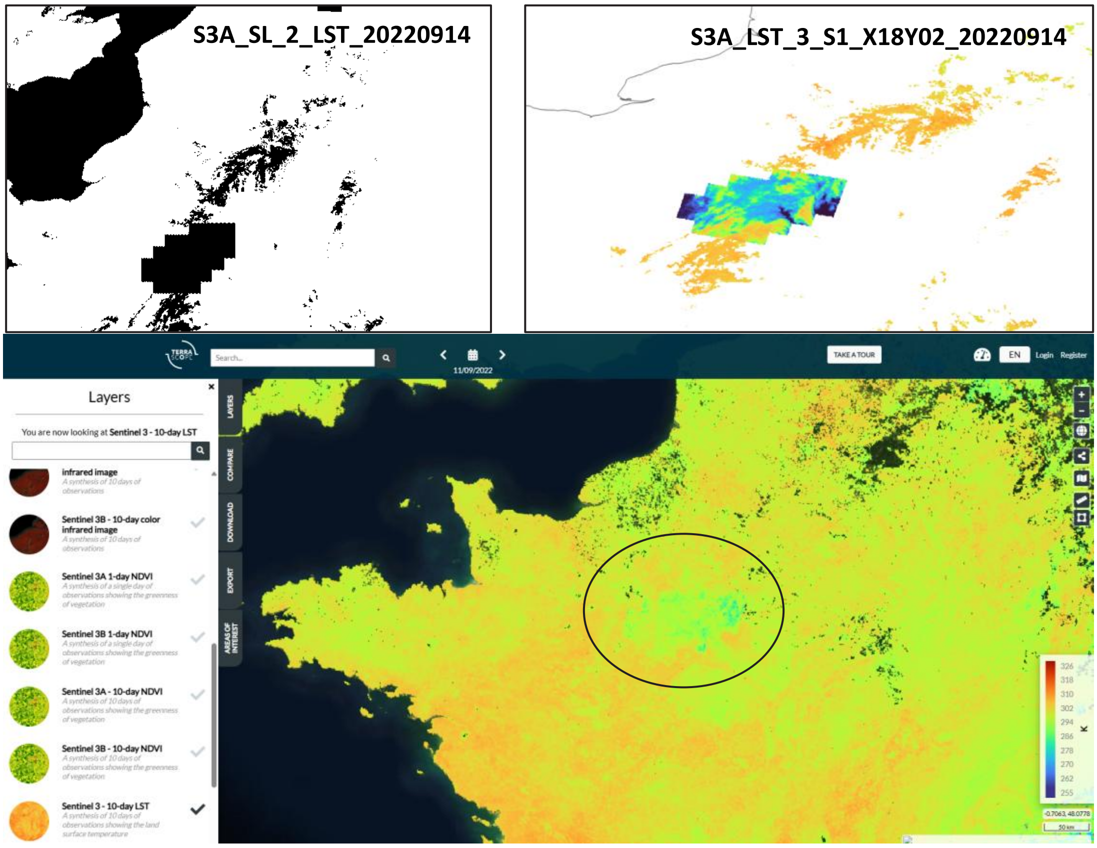

Figure 3: Example over Northern France of artefacts in the S3A_SL_2_LST cloud mask for 14/09/2022 (top left) propagating through S1 (top right) and S10 (bottom)

ii. Due to limitations of the processing structure, only PDUs of 3' length are processed. Until 02/05/2020 S3A based NTC products were full pole to pole orbit files, and therefore products are only generated from 03/05/2020 onwards, although Sentinel-3 input is available since 19/04/2016 (S3A) and 09/05/2018 (S3B).

iii. Other than the LST uncertainty layer, that is propagated from the input SL_2_LST products, no quality information is available in the S1 and S10 composite products. It could be interesting to include other layers that allow interpretation of the quality of the composite products, e.g. a layer with the number of valid Level 2 input observations taken into consideration for the composite product, or a layer that contains the standard deviation of the input values for S10 mean compositing.

5. Quality assessment

5.1. Quality of the input data

Accuracy of LST retrievals is influenced by emissivity variability, that increases for larger viewing angles and in regions of high topographic variance, and by atmospheric effects, such as the presence of clouds or aerosols (Ghent et al., 2024). The performance of Sentinel-3 L2 Land Surface Temperature (SL_2_LST), that is used as input for the Terrascope composite products, is routinely assessed by the OPTical Mission Performance Cluster (OPT-MPC) and the results of validation against in situ observations are regularly reported (see publications on the SLSTR Document Library[3]). Summarizing from the 2024 Annual Performance Report[4]: overall, daytime Sentinel-3 LST measurements tend to exhibit some bias, with several stations exceeding the mission requirements (±1 K), particularly at high temperatures. For Sentinel-3A, 42% of the stations remain within the requirement. For Sentinel-3B, 33% of the stations meet the requirement. Some stations continue to show persistent biases, particularly at high temperatures. Trends exceeding 1 K/decade were observed in several cases, highlighting the need for continued monitoring to confirm their long-term stability. These variations may be influenced by factors such as instrument drift, changes in cloud masking, or local site conditions. Additionally, seasonality effects were evident at multiple stations, with larger positive biases typically occurring in spring and summer.

Intercomparison between the Sentinel-3 Level 2 LST (SL_2_LST) product and the operational MODerate Resolution Imaging Spectroradiometer (MODIS) MOD11A1 product indicates overall good agreement (Li et al., 2023). In a study over agricultural landscapes in the U.S. Corn Belt, SL_2_LST is reported to overestimate daytime LST (Li et al., 2021). Similar biases were found over a rice paddy area in Valencia, Spain (Pérez-Planells et al., 2021). Comparison of the operational LST product validation to equivalent validation for the SLSTR LST product from the ESA Climate Change Initiative Land Surface Temperature (CCI LST) was done by Ghent et al. (2024). The results indicated that the CCI LST products sensors meet the daytime 1 K accuracy requirements, whereas the SL_2_LST products are slightly higher than this 1 K requirement. This discrepancy is related to several evolutions that have been made in the CCI LST product compared with the SL_2_LST product, including (i) an improved database of reference states; (ii) dynamic auxiliary data for fractional vegetation; (iii) dynamic biome data; and (iv) improvements in the cloud detection scheme. Enhanced features used in the development of the CCI LST products could be considered for operational SL_2_LST processing, but it should be noted however that CCI LST data is not available in near-real time.

[3] https://sentiwiki.copernicus.eu/web/document-library#Library-S3-SLSTR
[4] https://sentiwiki.copernicus.eu/__attachments/1681931/OMPC.ACR.APR.007%20-%20S3%20SLSTR%20Annual%20Performance%20Report%202024%20-%201.1.pdf

5.2. Verification of the algorithm implementation

The algorithm implementation is verified by plotting L2 LST inputs, S1 composites and S10 composites over October/2025 over LANDVAL (Martínez-Sánchez et al., 2024) sites. An example for October/2025 over a LANDVAL site near Bordeaux (France) is shown in Figure 4.

The top plot shows all Level 2 LST inputs from both S3A (in blue) and S3B (in orange) with their associated uncertainty. Inputs which are clouded or have LST uncertainty larger than 1 K are masked and discarded from further processing. The middle plot shows the daily composite products (S1), generated from the Level 2 LST inputs by selecting the LST input (and associated uncertainty) with the lowest viewing zenith angle. Finally, the bottom plot shows the S10 product after multi-day compositing, based on the mean LST calculated from all valid S1 products in each compositing period.

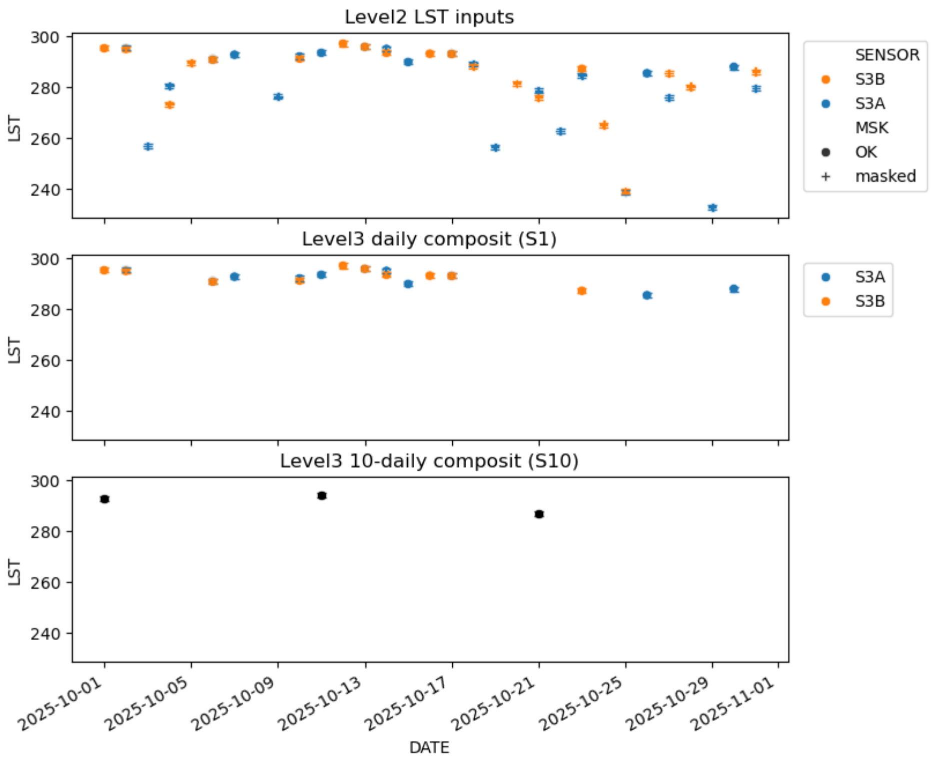

Figure 4: Sentinel-2 SLSTR Level 2 LST (top), derived Level 3 daily composites (middle) and 10-daily composites (bottom) over a LANDVAL site located East of Bordeaux, France (44.896°N, -0.036°E)

5.3. S3A vs S3B

With two Sentinel-3 satellites in orbit, the revisit time is less than one day for the SLSTR instruments onboard S3A and S3B. This means that per day multiple observations are available. In order to evaluate the consistency between LST derived from S3A and S3B, daily S1 composites are compared over the LANDVAL sites (Martínez-Sánchez et al., 2024) for the period Januari-December 2024.

Geometric Mean Regression analysis shows very high correlation between S3A LST and S3B LST S1 composite products (R^2=0.98), but there is some bias, with slightly lower LST measured by S3B compared to S3A (mean bias of 1.4 K). Differences between S3A and S3B LST performance were also reported by the OPT-MPC (see §5.1).

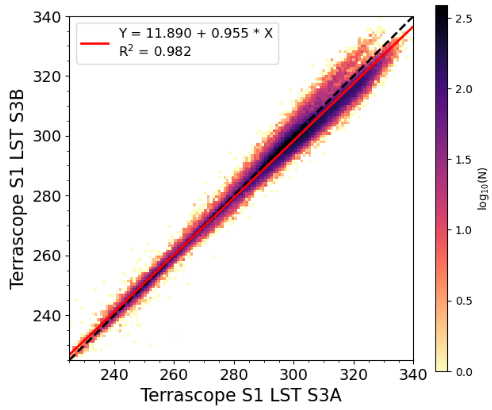

Figure 5: Geometric Mean Regression between S1 LST composites derived from S3A (X-axis) and S3B (Y-axis) over the LANDVAL sites for the year 2024

5.4. Comparison with ESA CCI LST

ESA CCI LST provides a dataset of 1-day and monthly LST composites (Day/Night) at 0.01° spatial resolution (v3.00). Products are available for 2016-2020 (S3A) and 2018-2020 (S3B). Since the Terrascope 1-day composite products are available since May 2020, the intercomparison focuses on the period May-December 2020.

5.4.1. Visual comparison

Visual comparison between the Terrascope daily composite products and the ESA CCI daily LST composites is done for a 10°x10° tile over the Iberian Peninsula for a few dates in June resp. December 2020 (Figure 6 and Figure 7). In general, the maps show large agreement, except for the fact that larger gaps are observed in the ESA CCI product, where in some cases (but not always) the Terrascope S1 product shows rather low LST values compared to the surrounding areas. The masking in the Terrascope daily compositing is done solely on the standard cloud mask that is provided with the SL_2_LST input product, while in the ESA CCI LST product additional threshold-based techniques have been used to detect omitted clouds, e.g. thin cirrus or low-level fog[5]. This results in higher product completeness for the Terrascope S1 products compared to the ESA CCI daily LST. Sometimes artefacts (e.g. PDU boundaries) are visible in the ESA CCI daily LST (e.g. S3A product of 20200203 or S3B product of 20201203), while the Terrascope S1 products in these cases looks more complete.

[5] ESA CCI Land Surface Temperature Algorithm Theoretical Basis Document available at https://admin.climate.esa.int/documents/1711/LST-CCI-D2.2-ATBD_-_i3r0_-_Algorithm_Theoretical_Basis_Document.pdf

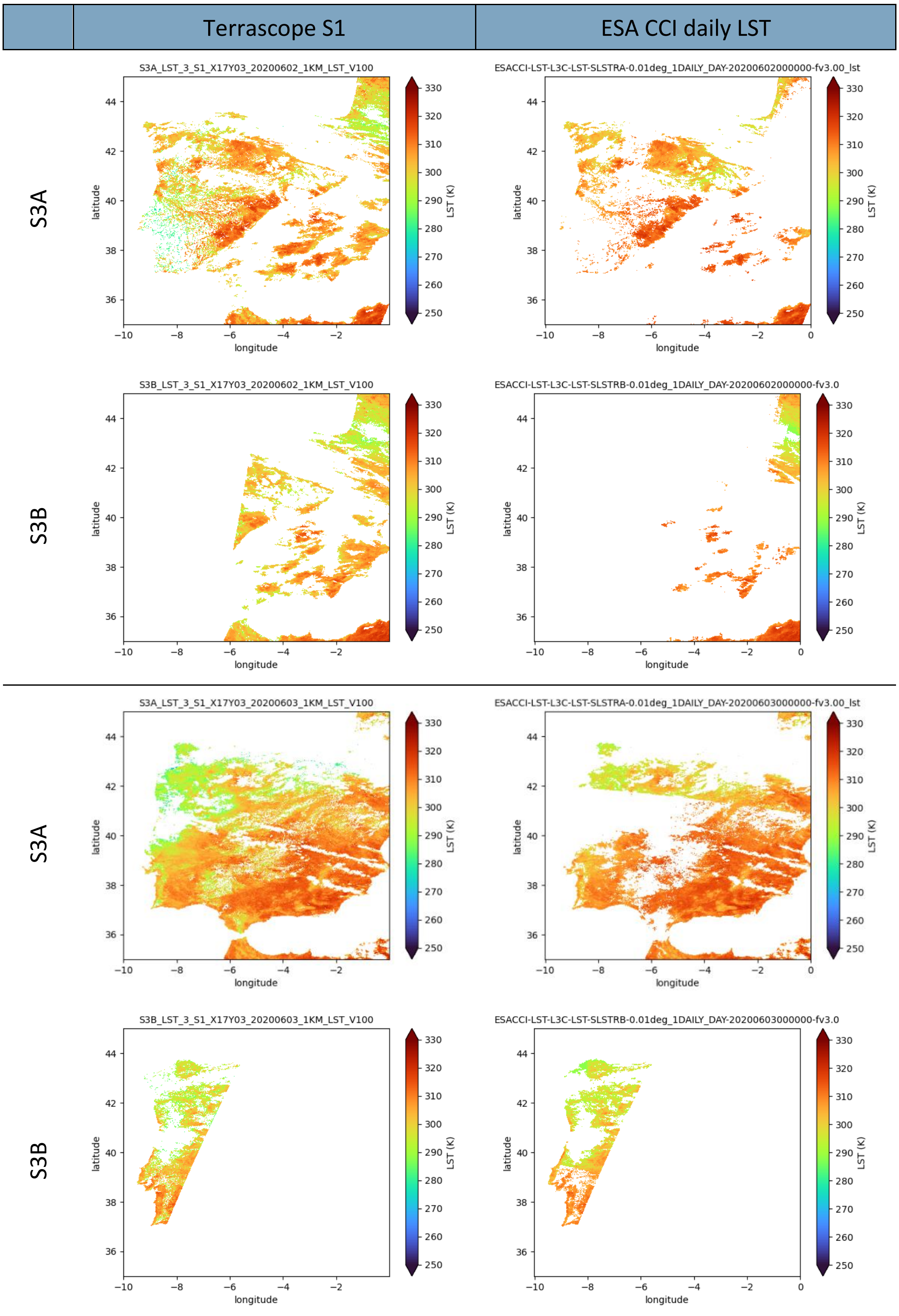

Figure 6: Visual comparison of Terrascope S3A S1 LST composites (left) with ESA CCI LST daily composites (right) over the Iberian Peninsula for 2 and 3 June 2020

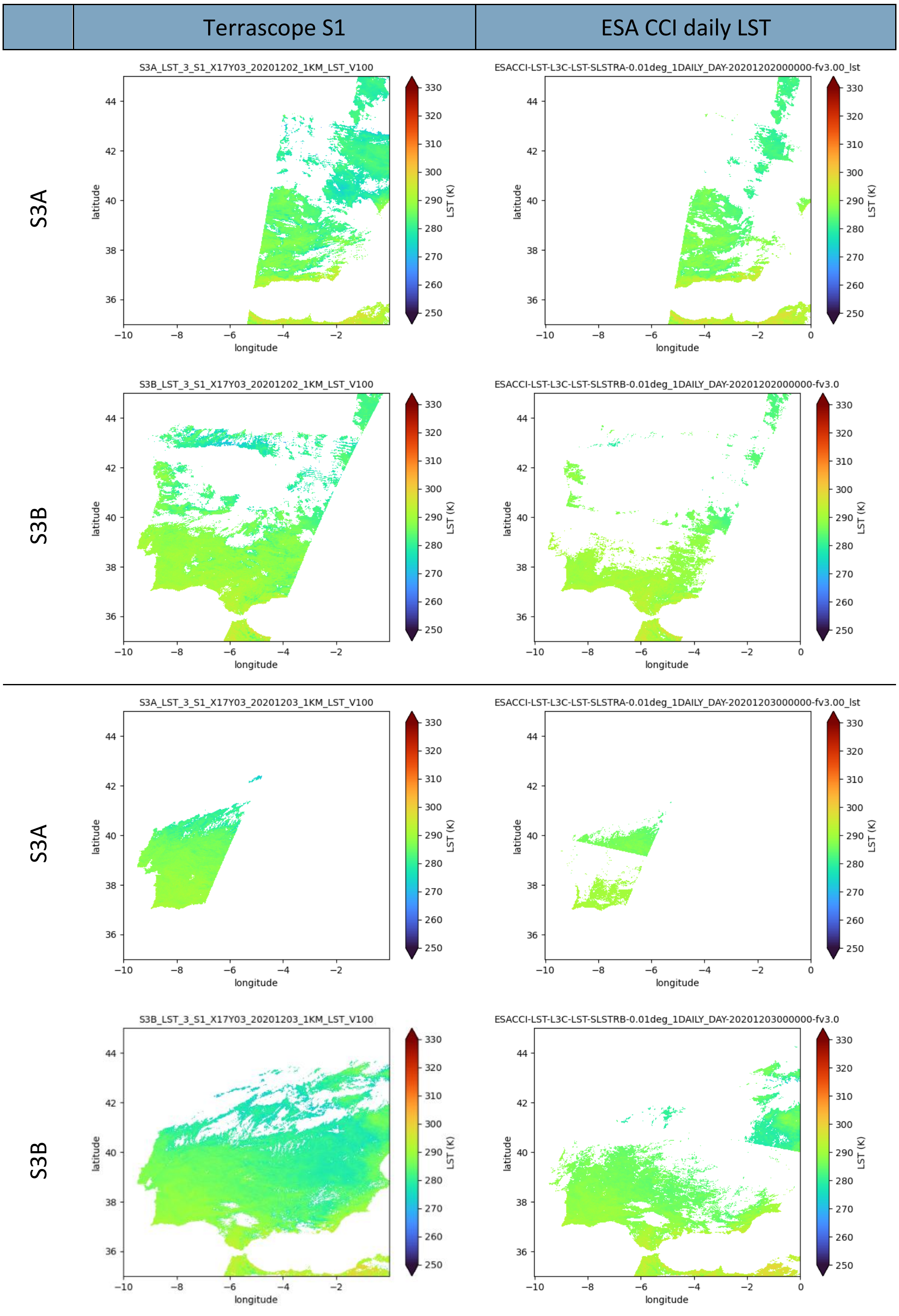

Figure 7: Visual comparison of Terrascope S3A S1 LST composites (left) with ESA CCI LST daily composites (right) over the Iberian Peninsula for 2 and 3 December 2020

5.4.2. Statistical comparison

Statistical comparison is done through Geometric Mean Regression (GMR). The GMR model is used to identify the (linear) relationship between two datasets of remote sensing measurements, with both datasets subject to noise, by minimizing the sum of the products of the vertical and horizontal distances (errors on Y and X). The coefficient of determination (R^2) indicates agreement or covariation between two datasets with respect to the linear regression model, summarizing the total data variation explained by this linear regression model.

As shown in Figure 8, the agreement between the Terrascope S1 LST product and the ESA CCI daily LST product is very high, both for S3A and S3B, with $R^2 = 0.99$ and regression lines very close to the 1:1 line. This means that there is no systematic bias between both products. The very small unsystematic bias is related to small differences in the LST retrieval algorithm (different auxiliary data and retrieval coefficients) and differences in the daily compositing algorithm, with more stringent cloud screening in the ESA CCI LST products (Ghent et al., 2024).

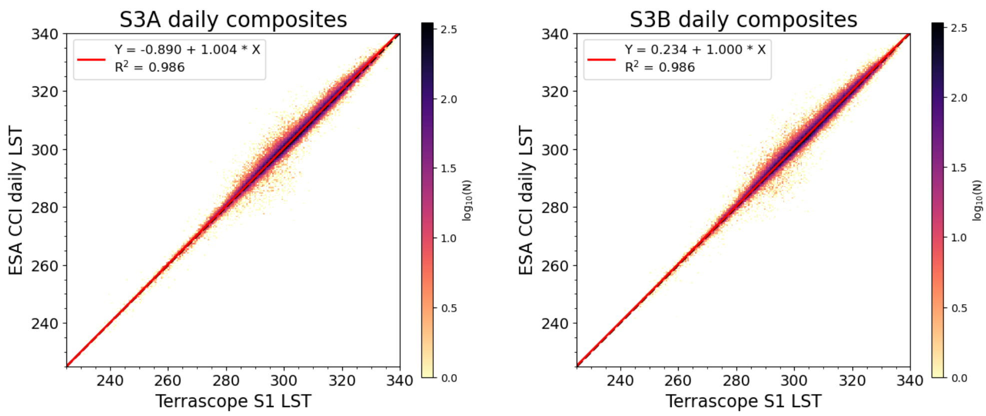

Figure 8: GMR between Terrascope S1 LST and ESA CCI daily LST for S3A (left) and S3B (right) over the period 3 May 2020 – 31 December 2020.

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